STATE OF PROTECTED AREAS IN CENTRAL AFRICA 2020

State of Protected Areas 2020

The State of Protected Areas 2020 is a publication produced under the Central Africa Forest Observatory (OFAC), a specialized unit of the Central African Forests Commission (COMIFAC).

http://www.observatoire-comifac.net

This publication was produced with funding from the Organization of African, Caribbean and Pacific States (OACPS) and the European Union (EU) through the BIOPAMA and RIOFAC programs, and GIZ through the COMIFAC support program. Its content is the sole responsibility of COMIFAC/OFAC and does not necessarily reflect the views of the EU or OACPS.

Unless otherwise noted, administrative boundaries and map layouts are for illustrative purposes only and do not imply official endorsement. Unless otherwise indicated, the data, analyses and conclusions presented in this book are those of the respective authors.

Desired citation: Doumenge C., Palla F., Itsoua Madzous G-L. (Eds.), 2021. State of Protected Areas in Central Africa 2020. OFAC-COMIFAC, Yaounde, Cameroon & IUCN, Gland, Switzerland: 400 p.

COMIFAC: Central African Forests Commission

COMIFAC is an international organisation recognised for its role in the subregional integration of conservation and sustainable and coordinated management of forest ecosystems. It is responsible for the orientation, harmonization and monitoring of forestry and environmental policies in Central Africa. COMIFAC emerged from the commitments made in March 1999 by the Heads of State of Central Africa in the "Yaoundé Declaration". It brings together ten member countries of the subregion that share a common natural heritage. Its legal framework is governed by the February 2005 treaty: "Treaty on the Conservation and Sustainable Management of Forest Ecosystems in Central Africa and to establish the Central African Forests Commission". COMIFAC's Convergence Plan defines the shared ten-year intervention strategies of Central African States and development partners in the field of conservation and sustainable management of forest and savanna ecosystems. A second edition of this plan, covering the period 2015-2025, now exists.

Web site: www.comifac.org

OFAC: Central Africa Forest Observatory

OFAC is a specialised unit of COMIFAC, in charge of coordinating the Forest Observatory, in relation with the COMIFAC National Coordination committees and in collaboration with all of the partners producing and disseminating information on the forests and ecosystems of Central Africa. OFAC is responsible for coordinating the collection and editing of data, the analysis of results and the dissemination of information to target groups through the Observatory's website and various publications. OFAC thus provides the subregion and its partners with essential tools for steering and sharing knowledge for better governance and sustainable management of forest ecosystems. The unit contributes to the organization and dissemination of information within the Congo Basin Forest Partnership (CBFP). It benefits from a support project financed by the European Union and the BIOPAMA program (IUCN and JRC).

Website: www.observatoire-comifac.net

IUCN : International Union for Conservation of Nature

IUCN is a membership Union composed of both government and civil society organisations. It harnesses the experience, resources and reach of its more than 1,400 Member organisations and the input of more than 18,000 experts. IUCN is the global authority on the status of the natural world and the measures needed to safeguard it.

Website: www.iucn.org

Weyrich S.A., Neufchâteau, Belgium. ISBN 978-2-87489-597-5
Legal deposit n° D/2021/8631/25

STATE OF PROTECTED AREAS IN CENTRAL AFRICA 2020

DEDICATION

The State of Protected Areas in Central Africa 2020 wishes to pay special tribute to the conservation actors who passed away between 2015 and 2020 by dedicating this book to them.

In memory of **Martin HEGA**
Martin HEGA, the former Director of the WCS Gabon *Monts de Cristal* Project, worked for the SWM-CIRAD sustainable wildlife management project until his death on Tuesday, 28 July 2020. He leaves behind the memory of someone who was deeply committed to the conservation of nature for over twenty years, with a genuine interest in people, especially rural communities. He initiated and contributed to many conservation, awareness-raising and capacity-building activities for biodiversity management stakeholders in the field. Since 2016, he was one of the senior coaches in the process of assessing protected area management effectiveness using the IMET tool. Thank you, Martin, for your commitment to the biodiversity of Central Africa. We will not forget you.

Let us also remember all those colleagues devoted to the protection of biodiversity who died while carrying out their duties.

Name	Year of death
CONGO	
ROBEYST Jana	2017
CAR	
FINE David	2017
Shaun	2017
MBENGA Ponce Pilate	2017
SANON Régis	2018
AKO Tolieton	2018
YAMALE Arsène	2020
YADJIME Laurent	2020
MBOYO Etienne	2018
EQUATORIAL GUINEA	
ETEZE Severino Evina	2019
BOKESA Joaquín	2019
GABON	
MOUANDJA MOUNYENGUILA Fridolin	2018
RWANDA	
GYONGY Krisztián “Kris”	2017
CAMEROON	
DIEUL DIEUL Simon Pierre	2017
NGONGO Bruce Danny	2017
NGOZO Martin	2017
AMPOAN KANGA Patrice Emmanuel	2017
ITAMOUNA René Martin	
AWUNGE Ngoe Robert	2018

Name	Year of death
DRC	
AGOYO MBIKOYO	2015
KPIONYESLINANI Jean-Marie	2015
ISHARA BIRINDURA Easter	2016
DJUMA ADALU Uweko	2016
GADA MIGIFULOYO André	2016
KIMBESA MUHINDO Anselme	2016
KIZA VUNABANDI Jean-Claude	2016
SEBINYENZI BAVUKIRAHE Yacinthe	2016
MULONGA MULEGALEGA Fidèle	2016
MUMBERE MUVESEVESE Venant	2016
MAGOMBO Justin	2016
SUNGUDIKPIO NDINGBA Richard	2016
ANIGOBE BAGALE Rigobert	2016
TSAGO MATIKULI Dieudonné	2016
BYAMUNGU MYAZIRO Oscar	2016
SUKAMATE LUSENGO Jacques	2016
JANKOVIC Matúš	2017
KOMBI KAMBAL Jules	2017
MUNGANGA NZONGA Jacques	2017
MUHARYIRWA Patrick Prince	2017
BWAMBALE NYAMIKENGE	2017
KATU MUMBERE	2017
KASEREKA MWANA Zaire	2017
MERIKO ARI Joël	2017
BOLIMOLA AFOKAO Gérome	2017

Name	Year of death
DRC	
NALOLA BUTINDA Tims	2017
MATABARO Anselme	2017
MACHONGANNI Célestin	2017
GUKIYA NGBEKUSA Léopold	2018
KISEMBO N’SINGA Patrick	2018
SUDI KOKO	2018
ANTOPO Seleman	2018
LOKANA TINGITI	2018
PALUKU SYAIRA Charles	2018
PALUKU MALYANI Jonas	2018
MUSUBAO FIKIRINI Pacifique	2018
ADAMOU Philippe	2018
KAMATHE MULWAHALI Kachenge	2018
BIRIKO NZABAKURIKIZA Faustin	2018
POSOPOSI MOUKOTO	2018
KAKULE MULMEWA Barthelemie	2018
KASEREKA Prince Théodore	2018
KARONKAYO BYAMUNGU Jean de Dieu	2018
KASUMBANA Jean Luc	2018
KANANINA SIBOMANANA Jean-Luc	
ILA MURANDA Emmanuel	
MASIKA BARAKA Rachel	
KIBWALWE KIBANDA Simon	

List compiled from the https://www.internationalrangers.org/meet-our-rangers/ website and information collected from national directorates and agencies in charge of protected areas.

SUMMARY

LIST OF CONTRIBUTORS

Editorial Committee

President:
ITSOUA MADZOUS Gervais-Ludovic (COMIFAC)
Members:
JOMHA DJOSSI Donald (OFAC), **DOUMENGE Charles** (CIRAD), **MERCERON Tanya** (IUCN), **MOKPIDIE Damase** (OFAC), **NSOM ZAMO Annie-Claude** (UNESCO), **PALLA Florence** (OFAC), **WAITKUWAIT Wolf Ekkehard** (GIZ), **ZOGNOU Théophile** (TNS)

Coordinators

PALLA Florence (OFAC-COMIFAC)
DOUMENGE Charles (CIRAD)

Scientific editors

DOUMENGE Charles (CIRAD), **PALLA Florence** & **ITSOUA MADZOUS Gervais-Ludovic** (OFAC & COMIFAC)

Authors

ABWE Ekwoge, Central Africa Program, San Diego Zoo Global, USA & WCS, Ebo Forest Research Project, Yaounde, Cameroon
AGNANGOYE Jean-Pierre, Independent consultant, Libreville, Gabon
ARRANZ Luis, WWF, Dzanga-Sangha Protected Areas, Bayanga, CAR
BARSKE Julia, WWF, Berlin, Germany
BAYOL Nicolas, FRMi, Mauguio, France
BIGOMBE LOGO Patrice, CERAD, Yaounde, Cameroon
BLEU Deblondet D., ECOFAC 6 Regional Technical Assistance Office, Libreville, Gabon
BOBO Kadiri Serge, University of Dschang, FASA, Dschang, Cameroon
BOKIKA-NGAWOLO Jean-Christophe, Mbou-Mon-Tour, DRC
BREUER Thomas, WWF, Berlin, Germany
BREUMIER Paloma, FRMi, PIREDD Mai-Ndombé Project, Nioki, DRC
BRNCIC Terry M., WCS, Brazzaville, Congo
BROOKS A., WWF Tigers Alive
BRUGIERE David, BRL Ingénierie, Nimes, France
BUHENDWA Germaine, ICCN, Bukavu, DRC
DE CHASSEY Esther, APN, Congo
DEGUIGNET Marine, IUCN, Gland, Switzerland (formerly UNEP-WCMC, Cambridge, UK)
DESSARD Hélène, CIRAD, Montpellier, France
DE WACHTER Pauwel, WWF, DRC
DE WINTER Jan, DFS Deutsche Forstservice, Feldkirchen, Germany
DISSONDET Baudelaire, WCS, Pointe-Noire, Congo
DOUMENGE Charles, CIRAD, Montpellier, France
EDÉ Antoine, APN, Brazzaville, Congo
EPANDA Manfred, Independent consultant, Yaounde, Cameroon (formerly AWF, Yaounde, Cameroon)
GAMI Norbert, Consultant anthropologist, Brazzaville, Congo
GANDINI Gustavo, FIGET, Libreville, Gabon and Milan, Italy
HAKIZUMWAMI Elie, WRI, Kinshasa, DRC
HEDWIG Daniela, The Elephant Listening Project, Cornell University, New York, USA
HERBINGER Ilka, WWF, Berlin, Germany
HOUDMONT Pierre, UCL, Leuven, Belgium
HUCHON Jean, Delegation of the European Union, Cotonou, Benin (formerly Delegation of the European Union, Libreville, Gabon)
IGUNZI Félix, ICCN, Bukavu, DRC
ITSOUA MADZOUS Gervais-Ludovic, COMIFAC, Yaounde, Cameroon
IZQUIERDO Pablo, WWF-Norway, Oslo, Norway
JIAGHO Rémi Evaliste, University of Yaounde I, Cameroon (formerly IUCN, Yaounde, Cameroon)
JOHNSON OGOULA Christian, ANPN, Libreville, Gabon
JOMHA DJOSSI Donald, OFAC-COMIFAC, Yaounde, Cameroon
JUNGERS Quentin, OFAC-COMIFAC, RIOFAC Project, Kinshasa, DRC
KAKULÉ Pierre, Tayna Nature Reserve, DRC
KAMGANG Serge Alexis, Garoua Wildlife College, Garoua, Cameroon
KANDZA Vidrige H., AJSEC, Sombo, Congo
KLENAST Ivonne, The Elephant Listening Project, Cornell University, New York, USA
LAZARO Cristina, UNEP-WCMC, Cambridge, UK
MAGANGA Pierre Brice, WWF, Gabon
MALIBANGAR Aline, CBSP - PIMS3447 project, UNDP, Yaounde, Cameroon
MANGUE EBANG Gasparo Lutero, INDEFOR-AP, Malabo, Equatorial Guinea
MASI Shelly, MNHN, Paris, France
MAVINGA Franck, WWF, Bayanga, CAR
MAYEN NDIONG Bertille, GIZ, Abidjan, Côte d'Ivoire (formerly GIZ, BSB Yamoussa, Garoua, Cameroon)
MBAYI MWADIANVITA Christian, PIREDD Plateaux Project, WWF, Kinshasa, DRC
METSIO SIENNE J., GIZ Regional Support for COMIFAC, Yaounde, Cameroon
MICHEL Baudoin, ERAIFT & APN, Kinshasa, DRC and University of Liege, Belgium
MILANDOU Carine, CNIAF, Brazzaville, Congo
MOKPIDIE Damas, COMIFAC, Yaounde, Cameroon
NARAT Victor, CNRS, Paris, France
NGAMA Steeve, IRAF-CENAREST & ANPN, Libreville, Gabon
NGOGA Télesphore, RDB, Kigali, Rwanda
NJING SHEI Wilson, GIZ Regional Support for COMIFAC, Yaounde, Cameroon
NKE NDIH Jean, CREDPAA, Yaounde, Cameroon
NKOLO Martial, GIZ Regional Support for COMIFAC, Yaounde, Cameroon
NSOM ZAMO Annie-Claude, UNESCO, Yaounde, Cameroon
NZIGIYMPA Leonidas, Conservation and Community of Change, Bujumbura, Burundi

NZITA NGANGA Maxime, ECOFAC 6 Regional Technical Assistance Office, Libreville, Gabon
OKOUYI OKOUYI Joseph, IRET-CENAREST & FIGET, Libreville, Gabon
OMASOMBO Valentin, Mbou-Mon-Tour, DRC
ONOTIANG Mapeine F., Independent lawyer, Yaounde, Cameroon (formerly COMIFAC, Yaounde, Cameroon)
OUISSIKA Chérubins-Brice, CNIAF, Brazzaville, Congo
OYO Pierre, Independent consultant, Brazzaville, Congo
PADOU Lambert, APDS, Bayanga, CAR
PALLA Florence, OFAC-COMIFAC, RIOFAC Project, Yaounde, Cameroon
PAMONGUI Gervais, APDS, Bayanga, CAR
PAOLINI Carlo, Independent consultant, Poppi, Italy
POLIWA Rémy, Independent consultant, Boissy-Saint-Leger, France
PONGUI Brice-Séverin, MDDEFE-WRI-OSFAC project, Brazzaville, Congo
PROCES Pierre, ECOFAC 6 Regional Technical Assistance Office, Libreville, Gabon
ROGGERI Paolo, JRC, European Commission, Ispra, Italy
SALIFOU Mahamadou, DFS BSB Yamoussa support project, Garoua, Cameroon
SAUGET Marie, Milpa Communication, Grenoble, France
SCHOLTE Paul, GIZ, Abidjan, Côte d'Ivoire (formerly GIZ, Yaounde, Cameroon)
STEPHAN Claudia, Mbeli Bai Study, WCS, Brazzaville, Congo
TABUNA Honoré, CEEAC, Libreville, Gabon
TAKOUGANG Nadège, GIZ Regional Support for COMIFAC, Yaounde, Cameroon
TATI Guillaume, ESI-Congo & GSAC Alliance, Congo
TCHOUMBA Georges Belmond, WWF, Central Africa Regional Forest Program, Yaounde, Cameroon
TELFER Paul, CCC, Congo
TIBADELSCHI Paolo, WWF-Norway, Oslo, Norway
VANGU LUTETE Clément, UC-PIF, Kinshasa, DRC
VINCENT Claire, UNEP-WCMC, Cambridge, UK
WAITKUWAIT Wolf Ekkehard, GIZ Regional Support for COMIFAC, Yaounde, Cameroon
WALIWA Nestor, Directorate of Wildlife and Protected Areas, Bangui, CAR
WELBY Patrick, Okapi Fund, Brussels, Belgium (formerly Okapi Fund-DRC, Kinshasa, DRC)
ZOGNOU Théophile, Sangha Tri-national Foundation, Yaounde, Cameroon

Proofreading
SAUGET Marie (Milpa Communication), **BIGOMBE LOGO Patrice** (CERAD), **BOBO KADIRI Serge** (University of Dschang), **HAKIZUMWAMI Elie** (WRI)

Editorial assistance
MBA BIZO Télesphore (Independent consultant, Yaounde, Cameroon) and **SAUGET Marie** (Milpa Communication)

Translation
DELOBEL Grace (Freelance translator, Claret, France) and **NOAH Faustin** (Freelance translator, Yaounde, Cameroon)

Design and layout
BONNET Hélène (Studio 9, Montpellier, France)

Maps
JUNGERS Quentin & **MATOKO Grâce** (OFAC-COMIFAC)

Iconographic research
DOUMENGE Charles (CIRAD), **PALLA Florence** (OFAC-COMIFAC) and **SAUGET Marie** (Milpa Communication)

Photo credits
APN (40, 241)
S. Assoignons/WCS (13 down-right, 375)
M. Bellosta (51, 62-63, 87)
D. Bleu/AT ECOFAC 6 (229)
T. Breuer/WCS (49, 188, 195, 208, 218)
A. Brink (19, 52, 94, 98-99, 138, 142, 306, 323, 372, 376,399)
T. Brncic/WCS (201)
COMIFAC (118 inlay)
H. Dessard/CIRAD (293)
C. Doumenge (56, 311, 322)
C. Doumenge/CIRAD (9, 13 up-left, 22, 39, 67, 97, 191, 262, 281, 294, 299, 332, 336, 338, 341, 346, 355, 359, 360, 361, 363, 366, 368, 384)
C. Doumenge/IUCN (13 up-right, 13 down-left, 259)
G. Dubois (13 middle-right, 28, 125, 130-131, 137, 178, 185, 254, 268, 291, 319, 358)
M. Epanda (231, 367)
FIGET (327)
E. Forni/CIRAD (248-249, 257, 267)
C. Garai/ABC & Lola ya Bonobo (13 middle-left)
V. Gond/CIRAD (252, 264, 272, 280, 289)
E. Hakizumwami (206)
A. Howard/CCC (cover, 308-309, 320, 333, 344)
J. Huchon (220-221)
F. Igunzi/ICCN-RNI (278, 290)
D. Jomha Djossi/OFAC-COMIFAC (2, 46, 133, 162)
V. Kandza/AJESEC (92, 174-175, 181, 182, 197, 202, 205)
Z. Labuschagne/WCS (387)
D. Louppe/Cirad (238)
F. Maisels/WCS (186)
B. Mayen (71, 84, 93, 148, 156, 159)
V. Narat (34)
K. de Nobrega/WCS (83, 352-353, 365)
L. Nzigiyimpa (140, 155)
N. Ortega (44, 47, 80, 324, 325, 396)
R. Peltier/Cirad (230, 243, 244)
N. Radford/WCS (370)
D. Santiago Garcia (55)
P. Scholte (16-17, 60, 68, 74, 90, 102, 106, 109, 112, 117, 118, 121, 122, 129, 335, 345)
S. Schumann (312)

Printing
Weyrich S.A., Neufchâteau, Belgium

ACRONYMS AND ABREVIATIONS

ACDG: African Conservation Development Group
ACF: Africa Conservation Fund
ACFAP: *Agence Congolaise de la Faune et des Aires Protégées* (in English: Congolese agency for wildlife and protected areas; Congo)
ADIH: *Action pour le Développement Intégral des Humains* (in English: Action for the Integral Development of Humans; CAR)
AFD: *Agence Française de Développement* (in English: French Development Agency; France)
AfDB: African Development Bank
AJSEC: *Association des Jeunes pour l'éducation et la Sauvegarde des Eléphants au Congo* (in English: Youth association for education and the safeguard of elephant in Congo; Congo)
AMV: Africa Mining Vision
ANPN: *Agence Nationale de Préservation de la Nature* (in English: National Agency for the Preservation of Nature, previously National Agency for National Parks; Gabon)
APDS: *Aires Protégées de Dzanga-Sangha* (in English: Dzangha-Sangha Protected Areas; CAR)
APN: African Parks Network (South Africa)
ART: Architecture for REDD+ Transactions
ASBABUK: *Association Sanguia Baka Buma'a Kpodé* (Cameron)
ASSD: Association for Surveillance and Sustainable Development
AWF: African Wildlife Foundation
BACUDA: Bagyeli's Cultural and Development Association (Cameroon)
BIOPAMA: Biodiversity and Protected Area Management program
BMU: *Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit* (in English: Federal Ministry of the Environment; Germany)
BNS: Basic Necessities Survey
BRICS: Brazil, Russia, India, China and South Africa
BRLi: *Bas-Rhône Languedoc Ingénierie* (France)
BSB: *Binational Séna-Oura – Bouba-Ndjida* (Cameroon-Chad)
CAFE: Consortium of African Funds for the Environment
CAFI: Central African Forest Initiative
CAR: Central African Republic
CAWHFI: Central Africa World Heritage Forest Initiative
CBD: Convention on Biological Diversity
CBFP: Congo Basin Forest Partnership
CCC: Congo Conservation Company
CEEAC: *Communauté Économique des États de l'Afrique centrale* (in English: Economic community of Central African states)
CEI: Calls for Expression of Interest
CEMAC: *Communauté Economique et Monétaire d'Afrique Centrale* (in English: Central African Economic and Monetary Community)
CENAREST: *Centre National de la Recherche Scientifique et Technologique* (in English: National center for scientific and technological research; Gabon)
CERBE: *Centre de Ressources de la Biodiversité et de l'Écotourisme* (in English: Biodiversity and Ecotourism Resource Center; Congo)
CIRAD: *Centre de Coopération Internationale en Recherche Agronomique pour le Développement* (in English: Center for international cooperation in agricultural research for development; France)
CITES: Convention on International Trade in Endangered Species of wild fauna and flora
CLD: Comité Local de Développement (in English: Local Development Committee ; DRC)
COAST: Collaborative Actions for Sustainable Tourism (Cameroon)
CoCo-Congo: *Coalition pour la Conservation au Congo* (in English: Community Conservation-Congo ; DRC)
Co-m: Co-management
COMIFAC: *Commission des Forêts d'Afrique Centrale* (in English: Central African Forests Commission)
COMILOG: *Compagnie Minière de l'Ogooué* (in English: Ogooue mining company; Gabon)
COP: Conference Of the Parties
COTCO: Cameroon Oil Transportation Company
COVAREF: *Comité de Valorisation des Ressources Fauniques* (in English: Wildlife resources valuation committee; Cameroon)
Covid-19: Coronavirus disease 2019
CSO: Civil Society Organization
CSR: Corporate Social Responsibility
DAS: Domain Awareness System
DFAP: *Direction de la Faune et des Aires Protégées* (in English: Directorate of Wildlife and Protected Areas; Cameroon and Gabon)
DFC: *Domaine Faunique Communautaire* (in English: Community fauna estate; CAR)
DFID: Department For International Development (UK)
DM: Delegated Management
DOPA: Digital Observatory for Protected Areas
DRC: Democratic Republic of the Congo
DSS: Decision Support System
EAC: East African Community
ECA: Economic Commission for Africa
ECOFAC*: Programme régional de conservation et de valorisation des Ecosystèmes Forestiers d'Afrique centrale* (in English: Central African Forest Ecosystems program)
EDC: *Electricité du Cameroun* (in English: Cameroon Electricity Company; France)
EDF: *Electricité de France* (in English: French Electricity Company; Cameroon)
EEZ: Exclusive Economic Zone
EIA: Environmental Impact Assessment
EITI: Extractive Industries Transparency Initiative
EoH: Enhancing our Heritage
ERP: Emission Reduction Programs
ESI: Endangered Species International
EU: European Union

FAO: United Nations Food and Agriculture Organization

FCFA: *Franc de la Communauté Financière Africaine* (West Africa) or *Franc de la Coopération Financière en Afrique centrale* (Central Africa) (in English: African Financial Community Franc or Franc of Financial Cooperation in Central Africa)

FCPF: Forest Carbon Partnership Facility

FEDEC: *Fondation pour l'Environnement et le Développement au Cameroun* (in English: Foundation for the Environment and Development in Cameroon; Cameroon)

FFEM: *Fonds Français pour l'Environnement Mondial* (in English: French Global Environment Facility; France)

FGIS: *Fonds Gabonais d'Investissement Stratégique* (in English: Gabonese Strategic Investment Fund; Gabon)

FIGET: *Fondation Internationale Gabon Eco-tourisme - Giuseppe Vassallo* (in English: Gabon Ecotourism International Foundation - Giuseppe Vassallo; Gabon)

FIP: Forest Investment Program

FLEGT: Forest Law Enforcement, Governance and Trade

FMU: Forest Management Unit

FONAREDD: *Fonds national REDD* (in English: REDD National Fund; DRC)

FPIC: Free, Informed and Prior Consent

FRA: Forest Resources Assessment of FAO

FREL: Forest Reference Emission Level

FRMi: *Forêts Ressources Management international* (in English: Forests Resources Management International; France)

FSC: Forest Stewardship Council

GAPA: Governance Assessment for Protected and conserved Areas

GCF: Green Climate Fund

GD-PAME: Global Database on Protected Areas Management Effectiveness

GDP: Gross Domestic Product

GEF: Global Environment Facility

GIZ: *Deutsche Gesellschaft für Internationale Zusammenarbeit* (in English: German Agency for International Cooperation; Germany)

GSAC: *Alliance pour la conservation des Grands Singes en Afrique Centrale* (in English: Alliance for the Conservation of Great Apes in Central Africa)

HCVF: High Conservation Value Forest

HELP: *Habitat* Écologique *et Liberté des Primates* (in English: Ecological habitat and freedom of primates; Congo)

IBA: Important Bird Area

ICCN: *Institut Congolais pour la Conservation de la Nature* (in English: Congolese institute for nature conservation; DRC)

ICMM: International Council on Mining and Metals

IDA: International Development Association

IDAK: *Investissement Durable au Katanga* (in English: Sustainable investment in Katanga; DRC)

IFC: International Finance Corporation

IFL: Intact Forest Landscape

IHDI: Inequality-adjusted Human Development Index

IIED: International Institute for Environment and Development (UK)

IMET: Integrated Management Effectiveness Tool

IPACC: Indigenous Peoples of Africa Coordinating Committee

IPCC: Intergovernmental Panel on Climate Change

IRAF: *Institut de Recherches Agronomiques et Forestières* (in English: Agricultural and forestry research institute; Gabon)

IRET: *Institut de Recherches en Ecologie Tropicale* (in English: Tropical Ecology Research Institute; Gabon)

IT: Information Technology

ITTO: International Tropical Timber Organization

IUCN: International Union for Conservation of Nature

JICA: Japan International Cooperation Agency (Japan)

KfW: *Kreditanstalt für Wiederaufbau* (in English: German Credit Institution for Reconstruction; Germany)

LCFC: Local Community Forest Concessions (DRC)

LMC: Local Management Committee

LNG: Liquefied Natural Gas

LPG: Liquefied Petroleum Gas

LRA: Lord's Resistance Army (Uganda)

MEFCP: *Ministère des Eaux, Forêts, Chasse et Pêche* (in English: Ministry of Water, Forests, Hunting and Fishing; CAR)

MEFDDE: *Ministère de l'Économie Forestière, du Développement Durable et de l'Environnement* (in English: Ministry of Forest Economy, Sustainable Development and Environment; Congo)

METT: Management Effectiveness Tracking Tool

MICE: Meetings, Incentives, Conferencing, Exhibitions

MINFOF: *Ministère des Forêts et de la Faune* (in English: Ministry of Forests and Wildlife; Cameroon)

Mio: Million

MMT: Mbou-Mon-Tour (DRC)

MOOC: Massive Open Online Course

NDC: Nationally Determined Contributions

NGO: Non Governmental Organization

NIAP: National Ivory Action Plan

NRMC: Natural Resource Management Committee

NRMP: Natural Resource Management Plan

NSSFPA/CBD: National Strategy for Sustainable Financing of Protected Areas for the Conservation of Biodiversity (Cameroon)

NTFP: Non-Timber Forest Product

OBAPAC: *Observatoire de la Biodiversité et des Aires Protégées d'Afrique Centrale* (in English: Observatory of Biodiversity and Protected Areas of Central Africa)

OECM: Other Effective area-based Conservation Measure

OFAC: *Observatoire des Forêts d'Afrique Centrale* (in English: Central African forest observatory)

OPEC: Organization of Petroleum Exporting Countries

PA-BAT: Protected Areas-Benefits Assessment Tool

PALF: Projet d'appui à l'Application de la Loi sur la Faune sauvage (in English: Project for the Application of Law for Fauna)

PAME: Protected Areas Management Effectiveness

PAMETT: Protected Area Management Effectiveness Tracking Tool

PAP: Priority Action Plan

PCI: Principles, Criteria and Indicators

PDAC: *Projet d'appui au Développement de l'Agriculture Commerciale* (in English: Commercial Agriculture Development Support Project; Congo)

PDEAC: *Programme de Développement de l'Écotourisme en Afrique centrale* (in English: Programme for the Development of Ecotourism in Central Africa)

PES: Payments for Environmental Services

PIREDD: *Programme Intégré de Réduction des Émissions dues à la Déforestation et à la Dégradation forestière* (in English: REDD Integrated Programme; RDC)

PMC: Participatory Management Contracts

PME: Planning-Monitoring-Evaluation

PNNN: *Parc National de Noubalé-Ndoki* (in English: Nouabale-Ndoki National Park; Congo)

PNOK: *Parc National d'Odzala-Kokoua* (in English: Odzala-Kokoua National Park; Congo)

PPP: Public-Private Partnership

PROGRAM: *Protectrice des Grands singes de la Moukalaba* (in English: Protector of the Great Apes of the Moukalaba; Gabon)

PSD: Public Services Delegation

PSIMT: *Plan Stratégique Indicatif à Moyen Terme* (in English: Medium-Term Indicative Strategic Plan)

PSR: Pressure-State-Response

RAPAC: *Réseaux des Aires Protégées d'Afrique Centrale* (in English: Network of Central African Protected Areas)

RAPPAM: Rapid Assessment and Prioritization of Protected Areas Management

RCLT: *Réserve Communautaire du Lac Télé* (in English: Lake Tele Community Reserve; Congo)

RDB: Rwanda Development Board (Rwanda)

REA: Reciprocal Environmental Agreements

REDD: Reducing Emissions from Deforestation and forest Degradation

REMA: Rwanda Environmental Management Authority (Rwanda)

RFI: *Radio France Internationale* (France)

RGT: *Réserve de Gorilles de Tayna* (in English: Tayna Gorilla Reserve; RDC)

RIL: Reduced-Impact Logging

RNCE: *Réserve Naturelle et Culturelle de l'Ennedi* (in English: Ennedi Natural and Cultural Reserve; Chad)

RSPO: Roundtable for Sustainable Palm Oil

SAGE: Site-level Assessment of Governance and Equity

SAKIMA: *Société Aurifère du Kivu et du Maniema* (in English: Gold Company of Kivu and Maniema; DRC)

SAPA: Social Assessment for Protected and conserved Areas

SDG: Sustainable Development Goals

SEM: *Société Equatoriale des Mines* (in English: Equatorial Mining Company; Gabon)

SEVAC: *Système de l'Économie Verte en Afrique Centrale* (in English: Green Economy System in Central Africa)

SGAPFS: *Sous-Groupe de travail sur les Aires Protégées et la Faune Sauvage de la COMIFAC* (in English: Sub-working group on protected areas and wildlife of COMIFAC)

SMA: *Société des Missions Africaines* (in English: Society of African missions)

SMART: Spatial Monitoring And Reporting Tool

SNH: *Société Nationale des Hydrocarbures* (in English: National Hydrocarbons Company; Cameroon)

SODEPAL: *Société d'Exploitation du Parc de la Lékédi* (in English: Lekedi parc exploitation society; Gabon)

SOMINKI: *Société Minière et Industrielle du Kivu* (in English: Mining and Industrial Company of Kivu; DRC)

SONAMINES: *Société Nationale des Mines* (in English: National Mining Company; Cameroon)

SOPA-CA: State of Protected Areas in Central Africa

STP: Sao Tome and Principe

SWOT: Strengths, Weaknesses, Opportunities and Threats

TLU: Tropical Livestock Unit

TNS: *Tri-National de la Sangha* (in English: Sangha Tri-National; Cameroon, CAR, Congo)

TREES: The REDD+ Environmental Excellence Standard

TRIDOM: Tri-national Dja-Odzala-Minkebe (Cameroon, Congo, Gabon)

UK: United Kingdom

UN: United Nations

UNCDD: United Nations Convention to Combat Desertification

UNDP: United Nations Development Programme

UNDRIP: United Nations Declaration on the Rights of Indigenous Peoples

UNEP: United Nations Environment Program

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNFCC: United Nations Framework Convention on Climate Change

UNWTO: United Nations World Tourism Organization

USA: United States of America

USAID: United States Agency for International Development (USA)

USFWS: United States Fish and Wildlife Service (USA)

UTO: *Unité Technique Opérationnelle* (in English: Technical Operational Units; Cameroon)

VF: Virunga Foundation

VIP: Very Important Person

WB: World Bank

WCBR: Wamba Committee for Bonobo Research

WCS: Wildlife Conservation Society (USA)

WDPA: World Database on Protected Areas

WRI: World Resources Institute

WWC: Wittenberg Weiner Consulting

WWF: World Wide Fund for Nature

ZCV: *Zone de Chasse Villageoise* (in English: Village hunting zone; CAR)

ZIC: *Zone d'Intérêt Cynégétique* (in English: Zones of hunting interest; Cameroon)

ZIC-C: *Zone d'Intérêt Cynégétique Communale* (in English: Communal ZIC; Cameroon)

ZIC-GC: *Zone d'Intérêt Cynégétique à Gestion Communautaire* (in English: Community-managed ZIC; Cameroon)

INTRODUCTION

The second edition of the *State of Protected Areas in Central Africa 2020* takes a close look at the protected areas of COMIFAC member countries. COMIFAC is one of the world's largest networks working to protect biodiversity and combat climate change. This book helps to sound the alarm about the risks and dangers facing the planet, but also covers numerous initiatives essential for the well-being of people within their environment.

Central Africa is a land of diversity, one marked by diverse climates, soils, landscapes, ecosystems, fauna and flora. The home of the Congo Basin, Central Africa also is a land of extremes. Not only is the Congo Basin the second largest continuous tropical forest track in the world, it also is the site of the world's largest complex of swamp forests and peat bogs. But this land, one which has nurtured generations of Africans, is facing mounting pressures.

Worldwide, 2019 was the second hottest year on record, just 0.04 °C cooler than 2016. Moreover, the decade 2010-2019 was the warmest ever recorded. Central Africa for the most part escaped the massive fires that ravaged the Amazon, Southeast Asia and Australia in 2019-2020, but this may not be the case in the future. The subregion has not been spared from global warming. Savannas and dry forests already have been weakened and attacked by fires, and pasturelands are no longer green, leaving animals hungry. Livestock farmers are forced to venture into protected areas for water and fresh grass for their herds.

Ecosystems in the countries of Central Africa are becoming increasingly degraded due to intensifying anthropogenic pressures driven in particular by population growth and demand from international markets. Natural ecosystems are exposed to wildlife poaching, an expansion of transhumant pastoralism, an increase in mining permits, industrial agriculture and family farming, the exploitation of wood (timber, fuel wood), conflicts over land, and the list goes on.

In this constantly changing context, where international and local challenges are closely intertwined, protected areas are one of the most effective management tools for slowing biodiversity loss, mitigating the impact of climate change, and helping ecosystems and human communities adapt to change. Some countries have already understood this and have developed land-use plans that include national protected area networks capable of playing this triple ecological, social and economic role that is the backbone of sustainable development.

State of Protected Areas in Central Africa 2020 illustrates the subregion's contribution to safeguarding the quality of life of current and future generations. The book describes creative initiatives and approaches to biodiversity management. It calls for the meaningful participation of local communities and indigenous peoples in the management of protected areas. It suggests solutions facilitating the peaceful coexistence of humans and large wildlife. With a determination based on lessons learned, it suggests approaches and practices for the wise use of natural resources.

This book aims to offer guidelines for discussion and action to support countries in the subregion as they embark on the road to economic development. To be efficient and sustainable, this development must be based on a universal adherence to the principles of respect for the environment and social equity. It is the only way to prevent poverty and war.

The opportunistic granting of industrial resource exploitation permits on locations known to be part of protected areas is undermining the fulfilment of national and international commitments regarding biodiversity conservation. The construction of major infrastructure without prior environmental and social impact studies can no longer be accepted. A proliferation of armed gangs, poor treatment of eco-guards, illegal activities of a few local residents and

endemic poverty is contributing to wildlife crime through poaching, which is nonetheless preventable. Corruption is encouraging illegal logging, the trafficking of wildlife by-products and non-timber forest products, etc.

It is a question, here and now, of taking a radical change in direction. The pattern of complaints, tensions and conflicts must be abandoned in favor of a new paradigm, one of collaboration and partnership between protected area managers and every stakeholder who uses, protects and manages biodiversity and natural resources, whether pastures or forests, farmland or woodland, mines or elephants... The book in your hands aims to encourage the coordination of sectoral activities at the territory and regional landscape level, the strengthening and improvement of conservation practices and local community involvement in biodiversity conservation and management, as well as the training and capacity building of stakeholders and the adoption of flexible, learning-by-doing approaches to environmental management.

It is up to all of us to make this a reality. Each of us, at our own individual level of decision making and action, can contribute to the emergence of this new paradigm.

Let us therefore remain committed to rescuing these endangered environments and the species inhabiting them in order to achieve a real ecological transition.

Minister of Forestry and Wildlife
Republic of Cameroon
Current Chairman of COMIFAC

Jules Doret NDONGO

FOREWORD

The year 2020 marked a decisive moment in the conservation of nature, as the world took stock of progress under the Strategic Plan for Biodiversity 2011-2020 and negotiated the new Global Biodiversity Framework for the post-2020 period. The publication of this valuable report is an important step in a long process that began at the 5th IUCN World Parks Congress in Durban in 2003.

During the implementation of the Strategic Plan for Biodiversity 2011-2020, governments and other stakeholders made considerable progress towards achieving several key objectives of Aichi Target 11 relating to protected areas.

This State of Protected Areas report, made possible by the BIOPAMA program through funding from the European Union and the Organisation of African, Caribbean and Pacific States, documents this progress and illustrates it with numerous case studies from Central Africa. It also shows how protected area systems are a key component in the region's conservation strategy, without which biodiversity loss would have been much greater.

The report makes a significant contribution to assessing the current status of the many factors that contribute to the success of protected area systems. It examines the progress made in meeting national and global goals, and measures this against reliable standards of effectiveness. It also provides a diagnosis of what is missing, where the gaps are and how to address them through targeted capacity building.

As Nelson Mandela said at the IUCN World Parks Congress in Durban, "*We know that the key to a sustainable future for protected areas lies in developing partnerships. It is only through alliances and partnerships that protected areas can be adapted to the needs of society.*" Understanding and documenting the relevance of protected areas to the needs of societies is one of the main contributions of this report.

With increasing population pressure and associated natural resources consumption, there are few places in the world where investment in effective governance and management is not required to address threats and maintain ecosystem integrity. By establishing a valuable baseline against which future progress can be measured, such a report contributes to regional and global baseline information systems, as well as to partnerships that will support better informed decision-making at national and global levels. In this regard, it will help to target the areas of intervention and investment needed to improve both the governance and management of protected areas, and to support the effectiveness of these systems as a foundation, not only for life on land and life under water, but also for the human development goals essential to the future of our planet.

Enjoy your reading!

Aliou FAYE

IUCN Regional Director – Central and West Africa


Comment vous pouvez les aider
Ne jamais...
...acheter
...brouiller
...garder
...jeter
...conduire
Soyez gentils avec ces doux géants !

PREFACE

F. Palla, L. Itsoua-Madzous & C. Doumenge

Planning and managing protected areas require knowledge about the status of these areas and the issues affecting them. In 2015, the first edition of the State of Protected Areas in Central Africa (SOPA-CA) provided an up-to-date assessment of national and subregional networks. This summary report was prepared by the Central African Forest Observatory (OFAC), under the auspices of the Central African Forests Commission (COMIFAC). The preparation of SOPA 2015 was funded by the European Union through the RIOFAC project and the BIOPAMA-IUCN program, the Network of Central African Protected Areas (RAPAC) through the OBAPAC project (Observatory of Biodiversity and Protected Areas of Central Africa), and the German Agency for International Cooperation through the GIZ COMIFAC support project. Produced by a multinational group of Central African protected area experts, SOPA 2015 focused on presenting each country's protected area network, both with regard to the types of protected areas as well as their size and distribution. This was complemented by summary analyses of various themes (legislation, institutions, governance, support projects, socio-economic issues).

Following the success of SOPA 2015, many institutions voiced a desire to improve and rapidly update this publication. The momentum created by the production of the first edition led to the development of the second, which explores in more detail various themes related to biodiversity conservation and protected area governance and management. SOPA 2020, the volume you are now holding in your hands, completes and updates the inventory of the subregion's protected area networks, but also breaks new ground by delving deeply into certain themes that were either only briefly discussed (governance, tourism, etc.) or not mentioned at all (human-elephant conflicts, mining and oil industry, etc.) in the first volume. These themes were discussed and approved in 2018 during a meeting of protected area specialists held in Douala.

The objective of SOPA 2020 is to contribute to a more effective use of approaches and tools for collecting and analysing data on protected area management in Central Africa. It aims to provide an overview of their importance with regard to global changes, but also to situate protected areas within national and regional territories. In keeping with the perspective of sustainable development in Central Africa, this geographical placement also must include the communities living in these territories. It is this much needed dual integration of protected areas that has guided the authors throughout the book.

This document is intended to be used by administrations in charge of protected areas, policy makers, technical and financial partners, research institutions, Civil Society Organizations (CSOs) and anyone else interested in biodiversity conservation in Central Africa. Special emphasis is placed on up-to-date and harmonized data and analysis to inform policy makers and managers. It does not claim to be exhaustive, and could not cover all relevant topics related to protected areas. Its objectives are to help build collective intelligence on the subject of protected areas and to stimulate new analyses and syntheses relevant to and sought by conservation and sustainable development actors.

SOPA 2020 consists of nine thematic chapters. The first provides an overview of the situation of Central African protected areas in 2020 (Chapter 1). The eight other chapters are organized in two sections. Whenever possible, the chapters are based on experiences and case studies in and around protected areas in the subregion. The first section focuses on the "Governance of protected areas in Central Africa". It presents the actors involved in protected area governance and some of the dynamics underway. This section has three chapters; the first provides

a general overview of protected area governance (Chapter 2) which is complemented by a specific chapter (Chapter 3) on Public-Private Partnerships (PPP). The section's final chapter (Chapter 4) introduces the importance of information for decision making and management effectiveness, subjects that are too often neglected. The second section focuses on "Sustainable development and protected areas in Central Africa". It offers insight into the conflicts undermining the sustainable development of Central African protected areas, and proposes possible solutions. This section has five chapters that address issues considered important by specialists: human-elephant conflict (Chapter 5), transhumance and protected areas (Chapter 6), extractive industries and protected areas (Chapter 7), ecotourism (Chapter 8) and climate change (Chapter 9). To reach a wide audience, the book is being published in French and English.

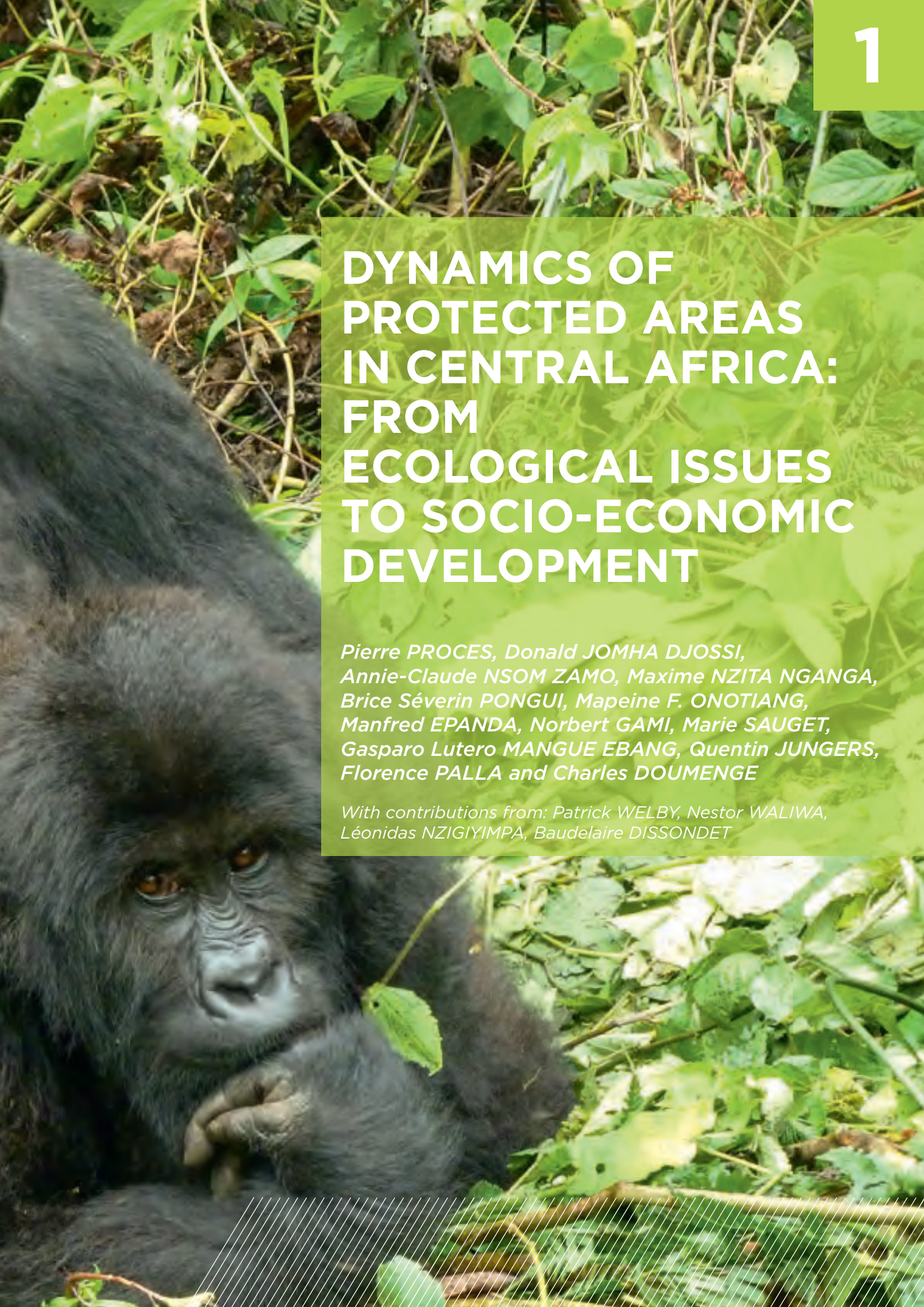
The process of developing SOPA 2020 involved diverse actors from the North and South, representing OFAC, COMIFAC, government institutions in Central African countries, donors, the private sector, conservation NGOs, researchers and members of civil society. For this second edition, the process was launched in September 2018 and an Editorial Committee was set up and chaired by the Deputy Executive Secretary of COMIFAC. Workshops were held successively from May 2019 to November 2020, both face-to-face and online, during which the members of the said committee defined and validated the content of the present document and the topics that were to be addressed, and then transmitted instructions and guidelines to the prospective authors. These workshops also provided an opportunity to discuss the texts with their authors as the process moved along.

SOPA 2020 has been developed through a collaborative approach involving different stakeholders, including conservation experts, researchers and technical partners in the conservation field. Different authors volunteered to write the thematic chapters, with one or two lead authors coordinating the work of each group. In the course of the drafting process, some authors withdrew and others joined certain thematic groups. It should be noted that the Covid-19 epidemic made it impossible to hold joint writing workshops, as was originally planned, and the disruptions caused by the pandemic affected the availability of some authors and the progress of the project. To ensure the consistency of the document and to expedite the process, the additional services of editors, reviewers and proofreaders were indispensable.

The difficulties encountered during the preparation of this document, in an exceptional health context, made it possible to identify the points to be improved to facilitate the production of future editions. Without going into detail, the need for the various co-authors of the chapters to work remotely significantly limited the timely production of this document. It also hindered the desired synergy and collaboration between partners who did not all know each other at the outset. Moreover, administrative considerations made it necessary to work in parallel on the production of the texts, their translation and their joint layout, in both the French and English versions. The overlapping of these different production phases also further complicated the work, especially in terms of coordination. Despite the difficulties encountered, the authors and all of the stakeholders involved demonstrated their willingness to share their knowledge and experience to contribute to the final document.

The contributions of the many authors as well as the contributors and reviewers have resulted in a document that we hope will live up to the expectations raised.

We would like to thank everyone who participated in this wonderful adventure – without you, SOPA 2020 would not be possible. Thank you all.



1

DYNAMICS OF PROTECTED AREAS IN CENTRAL AFRICA: FROM ECOLOGICAL ISSUES TO SOCIO-ECONOMIC DEVELOPMENT

Pierre PROCES, Donald JOMHA DJOSSI, Annie-Claude NSOM ZAMO, Maxime NZITA NGANGA, Brice Séverin PONGUI, Mapeine F. ONOTIANG, Manfred EPANDA, Norbert GAMI, Marie SAUGET, Gasparo Lutero MANGUE EBANG, Quentin JUNGERS, Florence PALLA and Charles DOUMENGE

With contributions from: Patrick WELBY, Nestor WALIWA, Léonidas NZIGIYIMPA, Baudelaire DISSONDET

Central Africa is a priority region for biodiversity conservation due to its exceptional heritage and high level of endemism (Colyn & Deleporte, 2004; Brooks *et al.*, 2011; Dagalier *et al.*, 2019). Its ecosystems have the value of a common good for both current generations, including the 40 million people who benefit from the natural resources they provide, and future ones (Nasi *et al.*, 2011; Hiol Hiol *et al.*, 2014; FAO, 2016). The social and cultural functions performed by these ecosystems are so essential that their alteration, let alone disappearance, would have consequences for the quality of life of populations at local, national and global levels.

As is the case in the rest of the world, biodiversity in the subregion is threatened, particularly through poaching (better organized and equipped), deforestation and the expansion of shifting agriculture, and so-called "development" activities (mining, urban expansion, etc.; Abernethy *et al.*, 2016). This impact of anthropogenic activities on nature is unprecedented; the total mass of man-made materials (concrete, steel, asphalt, etc.) is increasing everywhere, and surpassed that of global biomass (total mass of all living organisms) in 2020. Unfortunately, this phenomenon has not reached its peak, since projects predict that this anthropogenic mass will at the least double by 2040 (Elhacham *et al.*, 2020).

Nevertheless, biodiversity conservation and sustainable environmental management could increase resilience and reduce the vulnerability of human societies to climate change (de Wasseige *et al.*, 2015; Seddon *et al.*, 2019; see Chapter 9 of this book). In Africa, this change will be characterized by increasingly frequent droughts and increased variability in rainfall patterns (de Wasseige *et al.*, 2015; IPBES, 2019). To check the loss of biodiversity, it is estimated that a minimum of 30% of the Earth's surface must be protected through conservation measures, including 10% under strong protection (CDB, 2019; Hannah *et al.*, 2020).

The expansion of protected area networks in Central Africa since the 20th century is an encouraging development. However, integrating environmental and biodiversity conservation issues into the emergence strategies of governments in the subregion will be challenging, particularly as the economic context is darkening. The decline in the price of oil per barrel since late 2018, coupled with the global health crisis stemming from Covid-19, have led to a deteriorating economic situation. The subregion has not been spared from this global phenomenon as macroeconomic forecasts for 2020 indicate a growth rate of between –2.5% and –4.3% (BAD, 2020).

This situation is prompting governments to accelerate oil extraction and diversify national economies, especially toward mining and forestry industries. While some forestry industry actors are implementing more sustainable practices, this is not yet the case for many industrial actors (see Chapter 7). The development of agribusiness also is being considered by decision-makers, generally to the detriment of diversified agriculture. Yet agroecology and agroforestry could provide avenues for sustainable development, in contrast to conventional industrial approaches (Torquebiau, 2007; Meynard, 2017).

National economies need to shift toward sustainable and environmentally-friendly sectors. This change of course will not be possible without the support of everyone involved, including foreigners (such as China), who are playing an increasingly important role in diverse key economic sectors.

The development of a greener economy should provide new opportunities for rural communities, which still rely heavily on subsistence slash-and-burn agriculture. This is the main driver of deforestation in Central Africa (Gillet *et al.*, 2016; Karsenty, 2020), a deforestation which is likely to be exacerbated by the projected demographic growth. The subregion's population, currently estimated at approximately 185 million inhabitants (BAD, 2020), should more than double by 2050 (OFAC, n.d).

While changes in agricultural practices are indispensable, protected areas also can play an important role in this paradigm shift and contribute to the economic diversification of Central Africa. In addition to their fundamental role in maintaining

rainfall, supporting agricultural systems and combating climate change (see Chapter 9), opportunities for economic activities exist in ecotourism (see Chapter 8) and in the development of Non-Timber Forest Product (NTFP) industries. Protected areas are now the backbone of policies and strategies for biodiversity conservation and sustainable management. Over the past decade, the global protected area network has increased steadily, both on land and at sea, including in Central Africa (Doumenge *et al.*, 2015a; UNEP-WCMC, 2018). This increase has helped mitigate the effects of climate change and the accelerating rate of species extinction (WWF, 2020; IPBES, 2019).

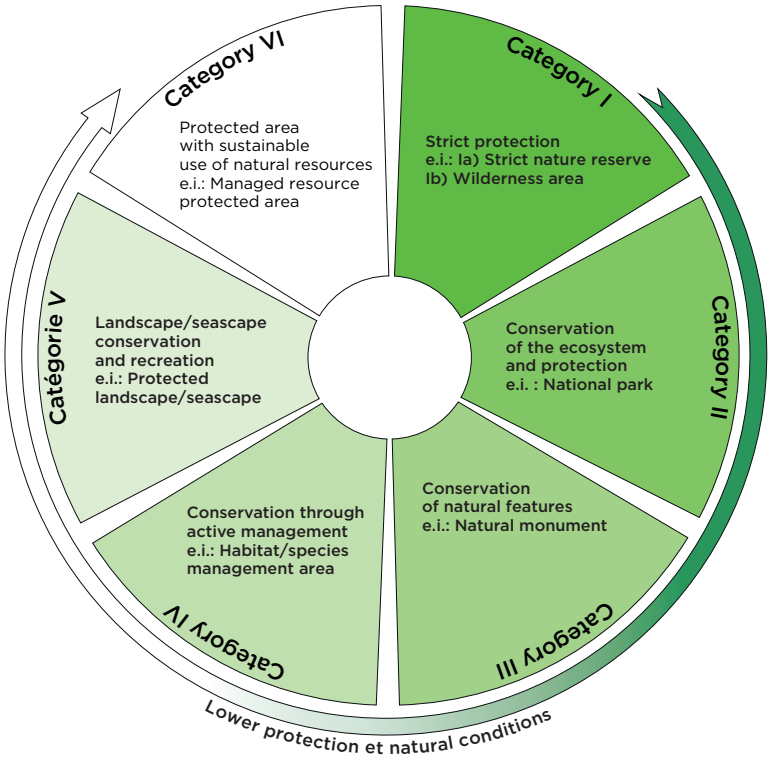
Some progress has been made in the implementation of the Strategic Plan for Biodiversity 2011-2020, but it remains insufficient (CDB, 2020). Protected areas will be at the heart of the negotiations of the new post-2020 global biodiversity framework to be discussed at the 15th Conference of the Parties of the Convention on Biological Diversity (COP15-CBD). One of the key measures is to protect at least 30% of the world's land and marine areas, with at least 10% under so-called "strict" protection (CDB, 2019). How can Central African protected areas contribute to this new global dynamic of biodiversity protection and preservation of ecological balances? And how are protected area managers in the subregion responding to some of the challenges facing them? This Chapter attempts to answer this twofold question; other more detailed answers also are provided in the thematic chapters of this book.

1. Central African protected areas in 2020

1.1 Nationally classified protected areas

The International Union for Conservation of Nature (IUCN) defines a protected area as "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to ensure the long-term conservation of nature and its associated ecosystem services and cultural values" (Dudley, 2008). This definition covers a wide range of territories and encompasses diverse management statuses and types, grouped into six categories (Figure 1). It also includes a wide range of governance forms which are presented and discussed in Chapters 2 and 3.

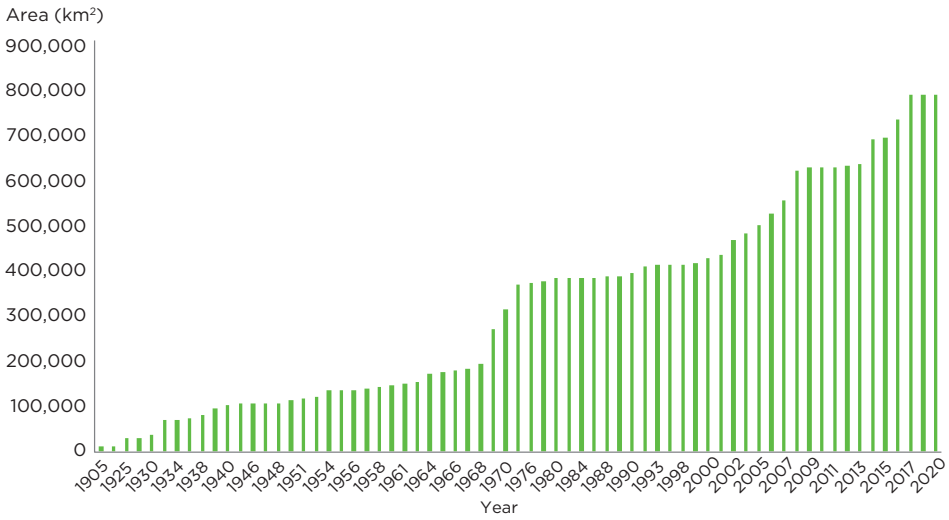
Figure 1 – The six IUCN protected area management categories



Source: adapted from Dudley (2008)

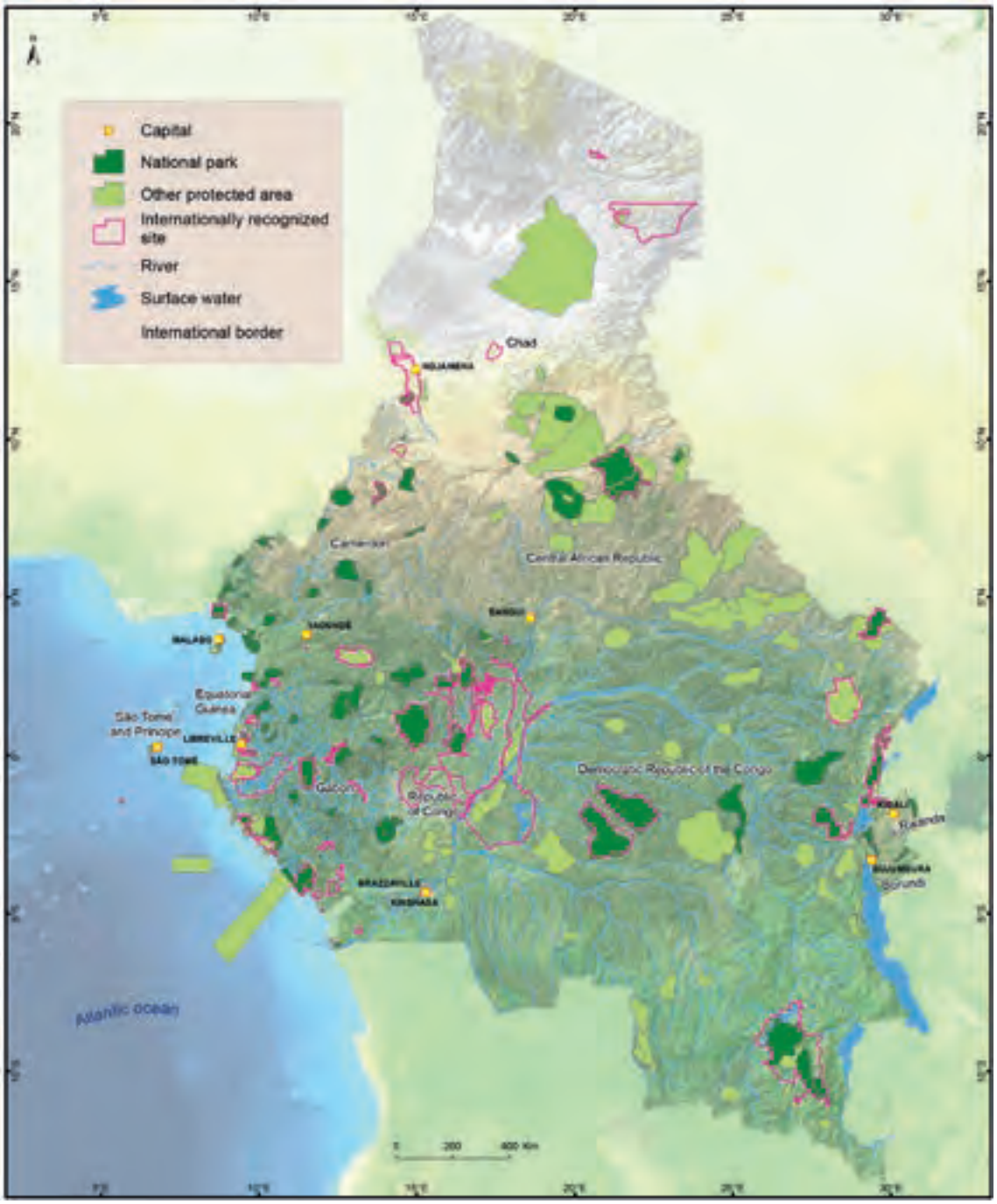
In Central Africa, the number and size of protected areas increased particularly during the 1930s, and again from the late 1960s to the mid-1970s (Doumenge *et al.*, 2015b; Figure 2). There also was a significant jump following the Rio Convention and the launch of the ECOFAC (Central African Forest Ecosystems) program. The subregional network currently includes 206 protected areas covering about 799,000 km², all categories combined, or 14.8% of the land area and 5% of the marine exclusive economic zone (EEZ) of Central African countries (Figure 3; Annex 1).

Figure 2 – Evolution of the Central African protected area network since the beginning of the 20th century



Note: This includes all protected areas, both terrestrial and marine, classified under national laws and recognised by WDPA.
Source: Central African Forest Observatory (OFAC)

Figure 3 – Spatial distribution of protected areas in Central Africa



Note: International sites include World Heritage sites, Ramsar sites and biosphere reserves. Source: OFAC

Approximately 50% of these protected areas were set up during the first twenty years of the 21st century (both in terms of number and size; Figure 2), with 20% of these established during the UN Decade on Biodiversity 2011-2020. This reflects the governments' commitment to developing the Central African protected area network and achieving the Aichi Targets (see box). This commitment has been demonstrated in particular through the ECOFAC program, which is celebrating its 30th anniversary. This program has contributed to the classification of many protected areas in the subregion, such as Obo (Sao Tome and Principe) and Monte Alen (Equatorial Guinea) national parks, and the reclassification and extension of Lope (Gabon) and Odzala-Kokoua (Congo) national parks.

The Aichi Targets in relation to Central African protected areas

The Aichi Targets, or "Strategic Plan for Biodiversity 2011-2020", were adopted in October 2010 by the signatories of the CBD. The eleventh target aims to establish, by 2020, networks of protected areas or other conservation measures at the scale of territories covering at least 17% of terrestrial and 10% of marine and coastal areas. This target concerns both increasing the number of protected areas and improving their effectiveness in protecting biodiversity (CDB, 2011).

Depending on the conservation areas considered, the Aichi Target for terrestrial protected areas is either met by a small number of countries (Equatorial Guinea, CAR and Sao Tome and Principe) or by the majority of them (Figure 4). In fact, if only protected areas classified by the countries according to national laws and recognized by the World Database on Protected Areas (WDPA) are considered, only the three countries mentioned meet the Aichi criteria. On the other hand, if internationally recognized sites (World Heritage sites, Ramsar sites, biosphere reserves) as well as other types of protected areas recognized by States are considered, Burundi and Rwanda alone remain well below the 17% target.

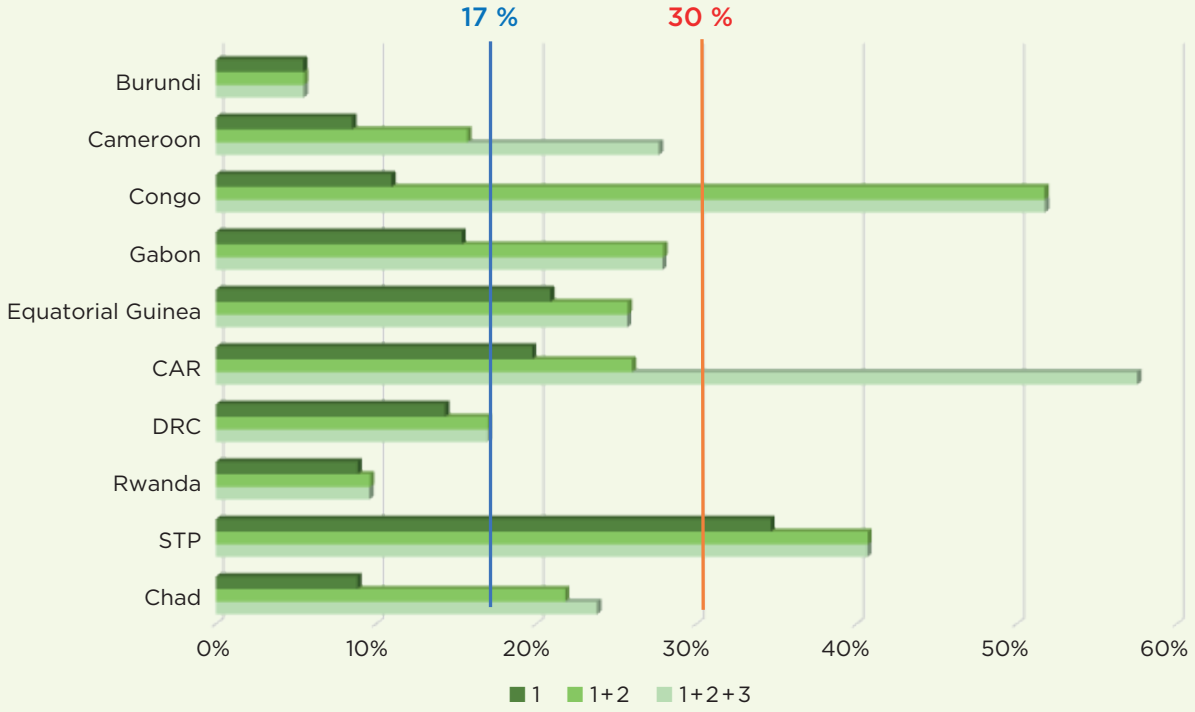
Moreover, some countries have already surpassed the target under negotiation of 30% of the territory under protected area status (Congo, CAR, Sao Tome and Principe). Cameroon, Gabon and Equatorial Guinea are not far away, making Central Africa an exemplary region for terrestrial biodiversity conservation – at least on paper. It will be difficult for two countries, Burundi and Rwanda, which have some of the highest rural population densities on the African continent, to meet these targets.

To measure progress in meeting these international objectives, prior work consequently is required to define what is considered a "protected area" with concrete and verifiable criteria. This will allow the same parameters to be used and will curtail possible political considerations

in the outcome of States' progress toward the stated goals. The IUCN approach of classifying protected areas into globally accepted management categories is sometimes difficult to put into practice due to highly variable national classifications and special political interests. While such harmonization may be difficult at the global level, it is recommended that common frameworks be put in place at the subregional level to reduce disparities.

The elements presented in this box raise a number of questions that will be discussed later in this section. It includes a more detailed analysis of protected area connectivity and management effectiveness, and the consideration of measures involving the outskirts of protected areas that could contribute to the achievement of the Aichi Targets (see sections 1.4 and 2.3).

Figure 4 – Percentage of terrestrial protected areas in relation to the national surface area



Notes: 1. National protected areas: protected areas classified by States according to national laws and recognized by the WDPA; 2. International protected areas: protected areas listed under the World Heritage and Ramsar conventions or part of the biosphere reserve network; 3. Other national protected areas: protected areas recognized as such by States but not recognized by the WDPA, such as Zones of Hunting Interest (ZIC).
Source: OFAC

In Central Africa, the three most common categories of protected areas are national parks (category II), species conservation areas (category IV, wildlife reserves or similar), and protected areas where sustainable use of biodiversity is allowed (category VI, various types of hunting areas; Table 1). While national parks in savanna ecosystems often are relatively old, most forest parks are recent (Doumenge *et al.*, 2015b). This is the case, for example, of the 13 national parks in Gabon, created in 2002, and of most forest parks in Cameroon.

Categories IV and VI include protected areas that are often vast, especially in savanna zones, to protect sufficient populations of large wildlife. Most of the hunting estates (from the French *domaine de chasse*, category VI), particularly in the Democratic

Republic of the Congo (DRC), Gabon and Congo, were created explicitly for the sustainable exploitation of large fauna and sport hunting. However, as this activity is currently closed in these countries, these areas are considered, and even managed, as wildlife reserves (category IV; see box section 1.3). The difference between these two types of protected areas is therefore difficult to establish in the absence of detailed knowledge of each protected area. The figures presented should be considered instead as a whole: over half of the protected areas and nearly three quarters of the surface area represent territories with a protection status that can accommodate certain forms of sustainable use of biodiversity (non-industrial and for the benefit of contracted operators or rural communities).

Table 1 – Distribution of protected areas in Central Africa according to IUCN categories

IUCN category	Number of protected areas		Size of protected areas	
		%	km²	%
I	3	1.5	1,375	0.2
II	76	36.9	209,196	26.2
III	5	2.4	465	0.1
IV	77	37.4	363,452	45.5
V	3	1.5	362	0.1
VI	42	20.4	223,959	28.0
Total	**206**	**100.0**	**798,809**	**100.0**

Notes: These are national protected areas (marine and terrestrial). These statistics may differ from those officially reported by countries due to differences in the way protected areas are categorized. Source: OFAC

Over the last five years, the most notable development in Central Africa has been the increase in the number of marine protected areas, which complement the network of terrestrial protected areas in the subregion (Figure 3). While this effort by coastal States is to be welcomed, only 5% of EEZs are protected, well below the 10% of marine and coastal areas set by the Aichi Targets. The first marine areas were created in the 1990s, although tentative efforts to implement conservation measures in marine areas began in Gabon as early as the 1960s. By 2017, nine marine parks and associated buffer zones had been created in this country, as well as 11 aquatic reserves. In line with this initiative, Gabon has committed to protecting 30% of its marine territories by 2030.

It should be recalled that it is currently impossible to specify the exact number or size of protected areas in Central Africa. National statistics and the status of protected areas are not always known precisely. One revealing example is that of DRC's hunting estates and reserves, most of which were created during colonial times. The texts creating these estates and reserves are not all available, and their inventory, which is being carried out by the *Institut Congolais pour la Conservation de la Nature* (ICCN), has not yet been made available to OFAC.

Furthermore, the global definition of protected areas provided by IUCN is not always sufficient to determine what is considered a protected area under the laws of each country. The legal framework in many Central African countries does not provide a very precise definition of the term "protected area", which hinders the full use of national efforts to achieve Aichi Target 11. We will return to this question in the following sections.

1.2 Protected areas with international status

Among the areas dedicated to conservation, two refer to international conventions: World Heritage sites, and wetlands of international importance known as "Ramsar sites". These sites are proposed by countries to be included in the relevant lists managed by UNESCO (United Nations Educational, Scientific and Cultural Organization) and the Ramsar Convention Secretariat.

A third case concerns biosphere reserves, an international network of reserves run by UNESCO's Man and the Biosphere program.

These international sites occupy more than 600,000 km², or 11.2% of the subregion's land area (Table 2). Only 22% of this total has official protection status under national laws and are included in national protected area networks (Figure 3). This is the case, for example, of the largest Ramsar site in the subregion, straddling Congo and DRC.

Table 2 – Central African protected areas under international status or agreement

International status	Number of sites	Surface area (km²)
World Heritage	13	135,343
Ramsar	51	425,459
Biosphere Reserves	13	45,729
Total	**77**	**606,531**

Source: OFAC

The designation of an area under an international label does not impose any particular regulatory protection. Nevertheless, States undertake to report to the secretariats of the conventions to which they adhere on the conservation of the ecological characteristics of the sites for which they have obtained the designation. For example, the Ramsar Convention provides in Article 3.2 (§4.3.7) that each Contracting Party "shall arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference. Information on such changes shall be passed without delay" to the secretariat of the convention. The national reports submitted by the contracting parties show that the two conventions – World Heritage and Ramsar – often have played a crucial role in preventing or halting activities that could have negatively affected sites critical for biodiversity conservation.

Thus, although most of these sites do not have a high level of protection, governments have stronger protection obligations on these territories than on "ordinary" lands. Therefore, these areas could, in the same way as conventional protected areas, be capitalized on in the efforts made by States to meet their global commitments, particularly Aichi Target 11 (see box in section 1.1). With this in mind, some countries have already included these internationally designated protected areas within their protected area network.

1.3 Other areas involved

Each State has its own "conservation vocabulary" and classifications may vary depending on the institution in charge of protected areas. For example, what is called a hunting estate (in French, *domaine de chasse*) in Chad corresponds to a ZIC (zone of hunting interest, from the French *Zone d'Intérêt Cynégétique*) in Cameroon, which also are found in CAR (see box). While some of these hunting areas have been degraded and their reclassification to other land uses could be an option, others still contain significant biodiversity or play a role in the countries' ecological framework. Their classification in IUCN categories IV to VI (or even II) could then be fully justified. As a result, these areas could contribute to the achievement of Aichi Target 11 and could even allow some countries in the subregion to reach the 30% target for protected areas, which will be discussed at the next COP-15 (CDB, 2019; see box section 1.1).

Other forms of protection can also contribute to achieving the Aichi Targets. This is the case of buffer zones, on the outskirts of protected areas, which can benefit from special status, as in Congo. In this country, buffer zones are considered protected areas and can be included in the protected area network.

Some countries also have developed other legal tools to protect the environment. For example, Congo's new forest code provides for two categories of forests: protection forests, with the "main purpose of guaranteeing the maintenance of a permanent

Trophy hunting areas in Central Africa: IUCN category VI?

P. Scholte, GIZ-Côte d'Ivoire

Central African countries have large areas devoted to trophy hunting (Table 3 and Figure 5). In Cameroon, CAR and Chad, these hunting areas (referred to by their French acronym, ZIC) cover 12%, 32% and 2% of the national territory respectively, equivalent to almost 90% of the combined area of all other protected area categories in the first two countries (Figure 4).

While there are differing opinions on this matter (Cooney *et al.*, 2017), from a conservation perspective, hunting areas are important for biodiversity conservation due both to their immense size and the role they play in maintaining natural environments and large mammal populations. The success of certain ZICs is due to the efforts private hunting company staff, who at least partially monitor these territories (Scholte & Iyah, 2016). The management of these hunting areas is subject to specifications; a quota of animals that can be hunted is set each year by the Minister of Forestry and Wildlife. In addition, wildlife assessments are conducted in them every five years (Booth and Chardonnet, 2015; Roulet, 2007).

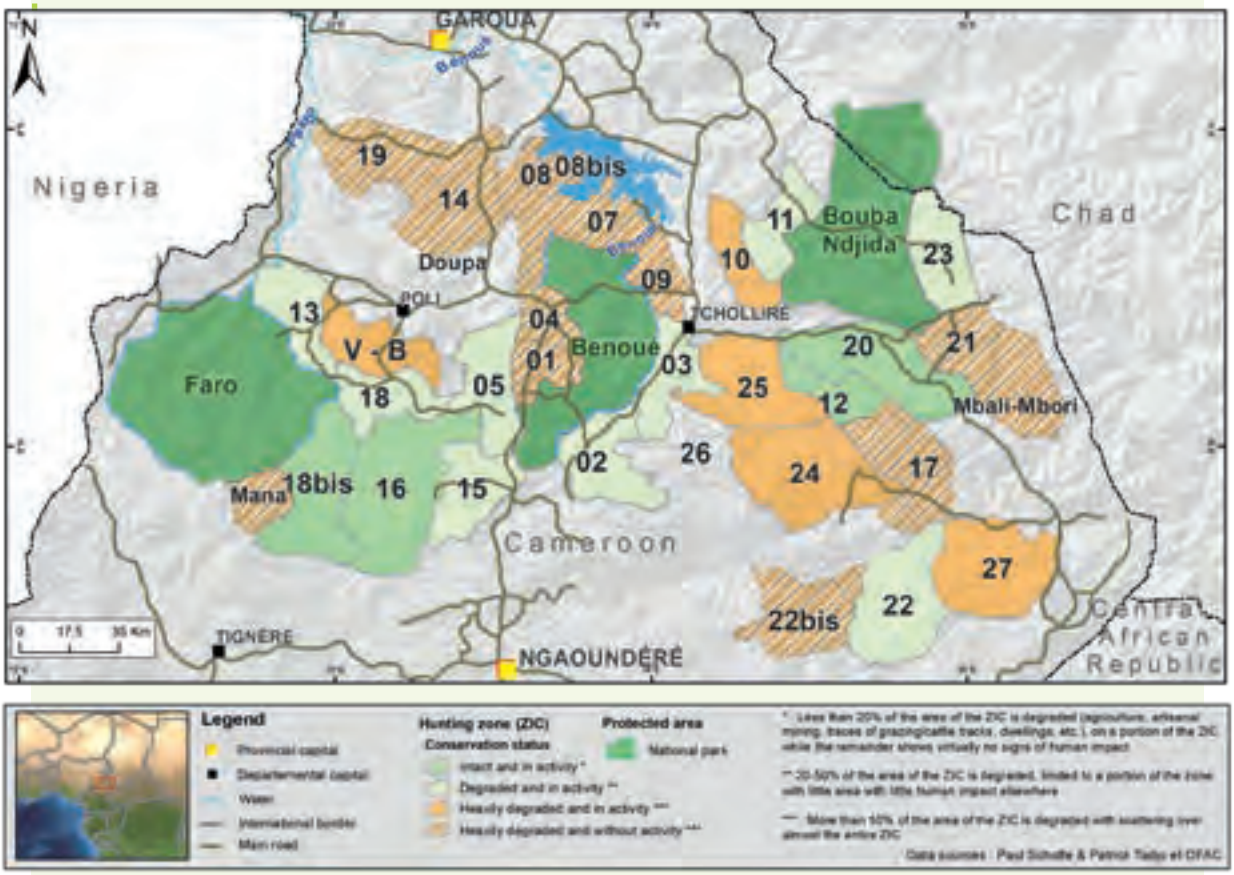
One of the difficulties in classifying hunting areas as protected areas is the diversity of their status, governance and management (see also Table 5, Chapter 2). For example, CAR and Cameroon have not included their hunting areas in the WDPA, while Chad has included some of them. Congo, Gabon and DRC also have included their hunting estates in their lists of protected areas; in the absence of game tourism, their management is not fundamentally different from a wildlife reserve (IUCN category IV).

In Cameroon, private hunting areas and community and communal hunting areas are considered protected areas under the law, but they have not been included in the global database of protected areas (UNEP-WCMC, 2017). Nevertheless, in official publications such as those of the Ministry of Forests and Wildlife (MINFOF, 2017), the country presents hunting areas alongside national parks and wildlife reserves as "more or less recognized by the IUCN classification", and assumes that they contribute to the achievement of Aichi Target 11.

The IUCN classification includes category VI, whose main objective is "to protect natural ecosystems and use natural resources sustainably, where conservation and sustainable use can be mutually beneficial" (Dudley, 2008). Following the example of Zambia and Tanzania, which have suggested the inclusion of their trophy hunting areas in this category, Central African hunting areas also could be included in this same category (Shafer, 2015; Booth & Chardonnet, 2015). Nevertheless, those in favor and those against hunting areas continue to disagree on this question.

Currently, hunting areas are declining overall, due to increased operational costs from agricultural encroachment and poaching, as well as reduced profits (decline in the trophy hunting market). Efforts currently are underway to organize a structured transition to other land uses for areas where hunting operations have ceased. Hunting companies with economic and ecological potential also are being supported to stop agricultural encroachment. This would allow countries to reclassify non-operational hunting areas to other land uses (pastoralism, reforestation, etc.) and some could be maintained in the protected area system.

Figure 5 - Distribution of hunting areas in the North region of Cameroon



Sources: P. Scholte and OFAC

Table 3 – Importance of hunting areas in countries where hunting tourism is active

Country / Designation	Number	Surface area (km²)
Cameroon [1]		
Zone of hunting interest (ZIC)	45	41,597
Community-managed ZIC (ZIC-GC)	26	15,352
CAR [2]		
Village hunting zone (ZCV)	12	34,287
Community wildlife estate (DFC)	6	4,186
Leased hunting sector	70	157,594
Leased hunting zone	1	450
Chad		
Hunting estate	8	25,714
TOTAL	**168**	**279,179**

Notes:
[1] of which 32 in the North (in savanna, 14 active) and 38 in the South (in forest, all active);
[2] of which 79 in the North-West (in savanna, some active) and 10 in the South-West (in forest, none active).
Source: OFAC, Roulet *et al.* (2008), Lescuyer *et al.* (2016), UNEP-WCMC & IUCN (2021)

forest cover for the conservation of fragile soils, springs or watercourses and sacred forests", as well as natural conservation forests, with the "main purpose of ensuring the sustainability of forest species, the protection of the habitat of fauna and flora or the preservation of landscapes" (Congo, 2020). In DRC, the status conservation forestry concession has been established, in particular to meet certain expectations related to Reducing Emissions from Deforestation and Forest Degradation (REDD+; see section 4).

Provisions also exist for the creation of community forests, or even for the creation of local community forestry concessions (in DRC; Vermeulen & Karsenty, 2015). The main objective of these provisions is to enable rural communities to secure control over forest areas for their own benefit, in theory in a sustainable manner. However, some of these provisions are being used by rural communities to create conservation areas without jumping through the hoops of protected area management agencies. This is the case in DRC with the association *Mbou Mon Tour*, which has led the project to create the Mbali River community forestry concession (bringing together six villages), intended for the conservation of bonobos and their habitat (see Chapter 2). This example is not an isolated case and could, in the long run, lead to a set of territories with a primary conservation vocation, which would complement the "classic" network of protected areas.

These different examples show that from different pieces of legislation (forestry laws, wildlife and conservation laws), it is possible to set up spaces for biodiversity conservation (see also Doumenge *et al.*, 2015b). However, all of these elements raise the question of the effectiveness of the management of these territories with regard to conservation objectives and the application of laws (Wabiwa Betoko & de Hoog, 2021). Another question mentioned earlier concerns the harmonization of approaches and designations between countries. A shared, expanded and harmonized frame of reference would be desirable.

However, the efforts made to increase the number of protected areas should not absolve the States of their environmental responsibilities outside protected areas, meaning in 70 to 83% of the territories, depending on the objectives set. The question is no longer to pit strong protection zones against weak protection zones (Denhez, 2020), but to develop territorial projects where hotspots of high biodiversity value are connected through a network of ecological corridors supporting socio-economic activities that respect the environment.

Overall, there is an urgent need to consider other concepts, such as IUCN's Other Effective area-based Conservation Measures (OECM). Biodiversity conservation strategies cannot stop at the borders of protected areas. They must cover

all territories and all socio-economic activities. Thus, under certain conditions, certified forestry concessions under sustainable management make it possible to maintain a forest framework that is fundamental for maintaining biodiversity and associated ecosystem services (Lhoest *et al.*, 2020). They are not protected areas, but they can contribute to maintaining functional ecosystems and play a role in the connectivity of protected areas. In terms of maintaining the living fabric of our planet, management status alone is not the only important factor, but also the proximity of human settlements and effective territorial management.

2. Protection of biodiversity

2.1. A diversity of biomes

Central Africa extends from the Sahara Desert to the Congolese rainforests and Zambezi open forests (*miombo*), and from coastal mangrove forests to the mountain forests of the Albertine Rift (Table 4 and Figure 6). It is crossed by a climatic gradient characterized by mean annual rainfall ranging from 250 mm to 10,000 mm (Doumenge *et al.*, 2015a). Although the aquatic biomes also are very diverse (freshwater and marine biomes), the following section focuses on the protection of terrestrial ones.

Only 17% of the total area of these terrestrial biomes is protected, either under national status or as a result of international recognition (Table 4). This average masks highly variable degrees of protection; without going into detail here, some small biomes, such as mangroves and low mountain vegetation, are relatively well protected, while others, for example, arid zones and flooded savannas, are not.

Mangroves contribute to the protection of coastlines, notably by reducing marine erosion and by participating in the cycle of nutrients in coastal environments. They host many spawning grounds required for productive and sustainable fisheries. In addition, they produce basic goods for communities living in their vicinity (harvesting bivalve molluscs, firewood, salt, etc.). However, they are under pressure due to infrastructure development for industrial needs and coastal urbanization, overexploitation of fuelwood and colonization by invasive species (FAO, 2017).

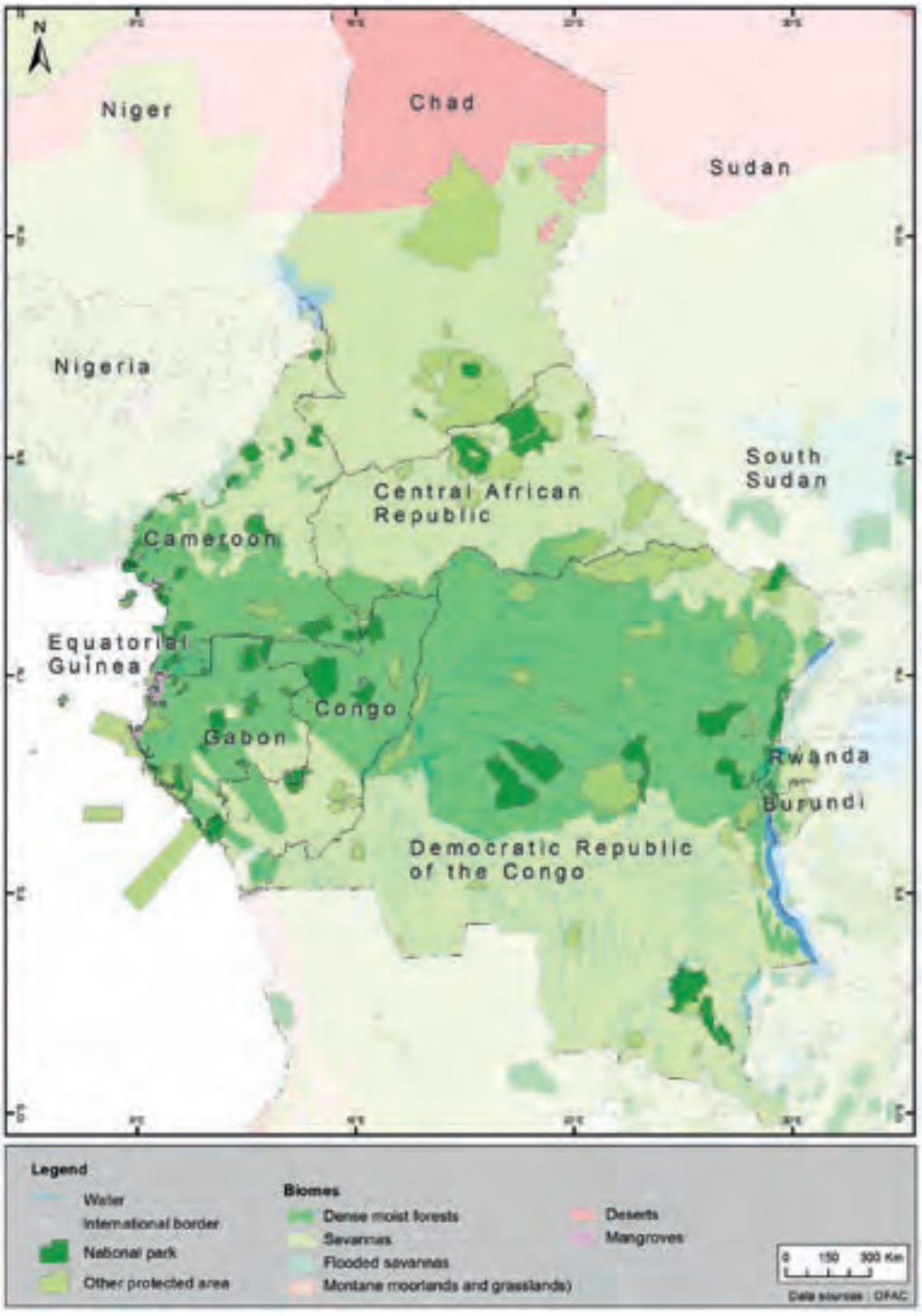
Although the legal and institutional frameworks for mangrove management and exploitation remain insufficient for their protection in Central African countries, Cameroon hopes that all mangroves will have conservation status by 2025 (Nchoutpouen *et al.*, 2017). The figures presented here are therefore likely to evolve according to the dynamics of the countries in terms of the conservation and creation of protected areas.

Table 4 – Importance of protected areas for the conservation of Central African terrestrial biomes

Terrestrial biome	Area occupied by the biome in Central Africa (km²)	Area covered by protected areas[3] (km²)	Proportion of the biome protected (%)
Deserts and dry shrubby thickets	516,620	33,438	6.5
Flooded savannas	12,806	179	1.4
Mangroves	8,441	5,761	68.2
Mountain meadows and thickets	1,328	2,018	56.0
Tropical and subtropical savannas[1]	2,869,909	460,669	16.1
Dense humid tropical and subtropical forests[2]	1,929,171	407,056	21.1
Total	**5,338,275**	**909,120**	**17.0**

Notes: [1] Including open forests; [2] Including mountain forests; [3] Protected areas included here are those under national conservation status as well as World Heritage sites, Ramsar sites and biosphere reserves. Sources: WWF (2012) and WPDA (2020)

Figure 6 – Geographical distribution of protected areas in the terrestrial biomes of Central Africa



Source: OFAC

Among the biomes present in the subregion, tropical rainforests are the most iconic. These forests are at the heart of important international climate change issues due to the carbon stocks they contain (Marquant *et al.*, 2015; see Chapter 9). They also are irreplaceable reservoirs of biodiversity, hosting species characteristic of Central Africa, such as various endemic Fabaceae-Caesalpinioideae and the moabi (*Baillonella toxisperma*), a majestic Sapotaceae and the unique representative of the genus *Baillonella*.

For example, barely 15% of the moabi's range is included in nationally classified protected areas (77,977 / 517,479 km²; Figure 7). This tree, endemic to Central Atlantic Africa, was once more widespread. It is currently on the IUCN Red List of vulnerable species (White, 1998). Maintaining its populations is not only important for its genetic diversity and regeneration capacities, which guarantee sustainable exploitation, but also because it has an economic value for many human populations (cultural, culinary and medicinal uses). In addition, its fruits are eaten by animals such as the forest elephant (*Loxodonta cyclotis*) and great apes, which also are on the IUCN Red List (see section 2.2).

Figure 7 – Protected areas and range of moabi in Central Africa

Source: OFAC

2.2. Rich but threatened animal diversity

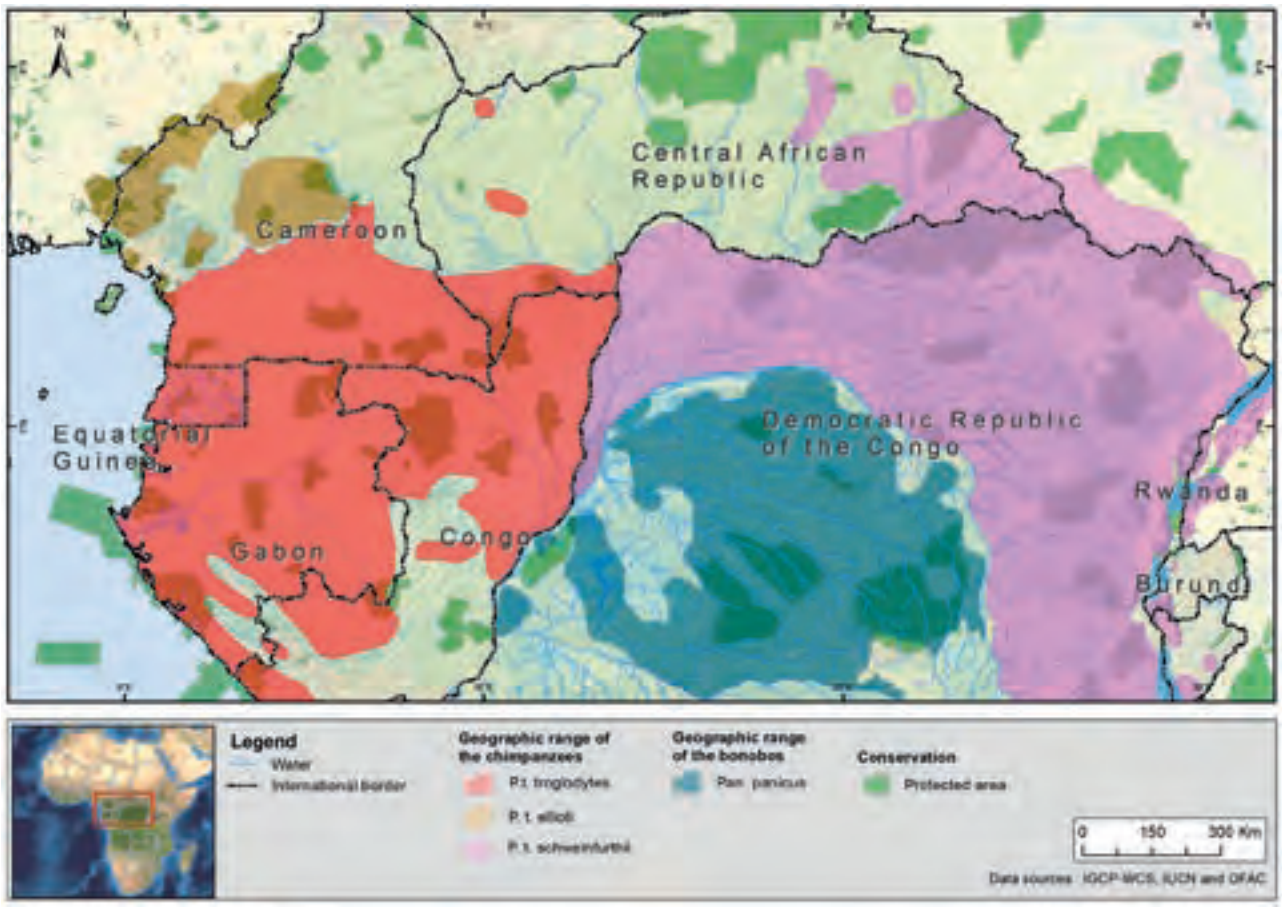
In terms of wildlife, the subregion is home to iconic animals, including the great apes. The largest existing populations are found here, belonging to the genera *Pan* (chimpanzees and bonobos) and *Gorilla* (gorillas). Both are our closest relatives but also irreplaceable species for maintaining ecological balances; their largely frugivorous diet and large body mass give them a crucial role in forest dynamics as seed dispersers (Haurez, 2015).

However, ape populations face several threats, including poaching and habitat destruction. Despite the protection measures that are being taken, all of the species are on the IUCN Red List, the list of species threatened with extinction (see box).

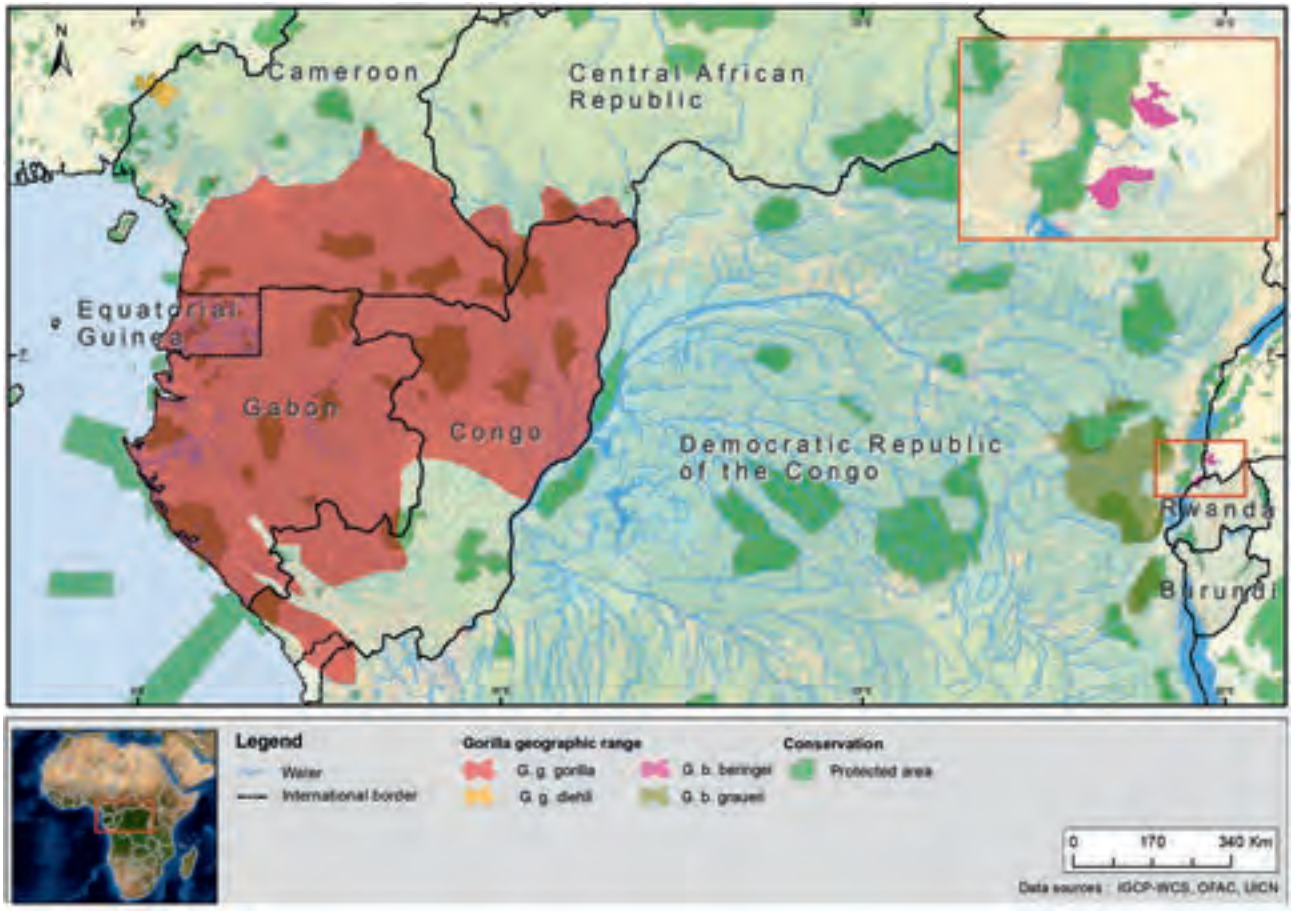
Protected areas play an important role in protecting these great apes and many other species. However, this protection varies greatly depending on the species or subspecies under consideration. For example, only 15% of the range of the Central African chimpanzee and the western lowland gorilla is officially protected (Figure 8 and Table 6). These species are still fairly widespread, but are under severe pressure and their protection needs to be improved.

In contrast, over 98% of the mountain gorilla's range is protected. This species is endemic to the Albertine Rift, and is distributed over a very limited area surrounded by agricultural land and very high human population densities. Nonetheless, the remaining mountain gorilla populations are almost entirely included in protected areas, whose management effectiveness has been improved significantly in recent years. These populations, close to extinction a few years ago, are now increasing. The positive effect of well-managed protected areas on this threatened species is particularly noteworthy, providing a very concrete illustration of the importance of protected areas in the conservation of an iconic species, one which is the basis of a flourishing ecotourism industry (see Chapter 8).

Figure 8 – Protected areas and ranges of great apes in Central Africa



8a - Chimpanzee and Bonobo



8b - Gorillas

Note: Only nationally classified protected areas included in WDPA are considered here.
Sources: IGCP-WCS, IUCN and OFAC

Table 5 – Importance of protected areas for the conservation of Central African great apes

Taxon	Range (km²)	Range within protected areas	
		(km²)	(% of range)
Elliot's Chimpanzee *(P. t. ellioti)*	90,329	31,345	34.7
Central Chimpanzee *(P. t. troglodytes)*	713,386	107,998	15.1
Eastern Chimpanzee *(P. t. schweinfurthii)*	982,190	161,970	16.5
Bonobo *(Pan paniscus)*	416,301	73,405	17.6
Cross River Gorilla *(G. g. diehli)*	3,674	1,540	41.9
Western Lowland Gorilla *(G. g. gorilla)*	690,027	104,715	15.2
Eastern Gorilla *(G. b. graueri)*	48,195	16265	33.7
Mountain Gorilla *(G. b. beringei)*	789	775	98.2

Notes: The figures presented are for the entire range of the species and subspecies. Only nationally classified protected areas included in the WDPA are included. Sources: IGCP-WCS, IUCN and OFAC

Status of the great apes in Central Africa

E. Abwe, San Diego Zoo Global & WCS

Populations of all great apes have declined in recent decades (Table 6), mainly due to habitat loss and fragmentation (Tyukavina *et al.*, 2018), disease (i.e., Ebola; Walsh *et al.*, 2003), hunting and the bushmeat trade (Williamson, 2018), but also the pet trade, which can result in the death of adults at the time of capture. The situation is such that all great apes are listed in Appendix 1 of the IUCN Red List (Ancrenaz *et al.*, 2018).

The conservation issues surrounding these animals are critical and many measures have been taken to stop this dynamic. Internationally, governments have ratified the Agreement for the Conservation of Gorillas and their Habitats (Gorilla Agreement), which came into force in 2008. Outside of government initiatives, protection programs also have been created, overseen by international organizations such as IUCN (e.g., the Bonobo Conservation Strategy 2012-2022).

Protected areas are an important tool for the protection of great apes, where they are subject to enhanced protection. In particular, the presence of eco-guards on the ground is an effective measure to deter and control poaching activities (UICN, 2014). Awareness-raising actions implemented in certain protected areas are also fundamental, such as those initiated in the Lossi sanctuary (Congo), along with an experiment in habituating gorillas to humans (see box in Chapter 2). They sometimes lead to the creation of local associations, as is the case in the Ebo forest in Cameroon, with the *Club des amis des gorilles*, or in DRC, with the *Groupe d'appui pour la conservation des écosystèmes de Basanku et Bolomba*.

Despite all of these initiatives, the protection of great apes in Central Africa remains a major issue. In addition to all of the threats mentioned above, there also are problems associated with armed conflicts, economic opportunities for local communities, etc. The role of protected areas can be improved through a number of means, including better law enforcement (UICN, 2014) and the creation of buffer zones around protected areas, especially where they are surrounded by "a mosaic of forest types, habitats and areas used by humans" (Morgan & Sanz, 2007).

Status of the great apes in Central Africa

Table 6 – Status of great ape populations in Central Africa

Taxon	Number	Date of last assessment	Category (according to Annex 1 of the IUCN Red List)
Elliot's Chimpanzee *Pan troglodytes ellioti*	6,000 to 9,000	Nov. 2015	In danger of extinction
Central Chimpanzee *Pan troglodytes troglodytes*	Approximately 140,000	Jan. 2016	In danger of extinction
Eastern Chimpanzee *Pan troglodytes schweinfurthii*	181,000 to 256,000	March 2016	In danger of extinction
Bonobo *Pan paniscus*	15,000 to 20,000	March 2016	In danger of extinction
Cross River Gorilla *Gorilla gorilla dielhi*	250 to 300	Jan. 2016	Critically endangered
Western Lowland Gorilla *Gorilla gorilla gorilla*	316,000	Jan. 2016	Critically endangered
Eastern Gorilla *Gorilla beringei graueri*	3,800	Aug. 2018	Critically endangered
Mountain Gorilla *Gorilla beringei beringei*	1,000	Aug. 2018	In danger of extinction

Sources: Oates *et al.*, 2016; Maisels *et al.*, 2016 and 2018; Plumptre *et al.*, 2016 and 2019; Fruth *et al.*, 2016; Bergl *et al.*, 2016

Another animal species that plays a major role in forest dynamics is the forest elephant. Wildlife inventories conducted by the World Wide Fund for Nature (WWF) between 2008 and 2016 revealed a 66% drop in their populations (Thouless *et al.*, 2016; WWF, 2017). Their protection requires both an improvement in protected area networks, the identification of migration corridors and the improvement of forest connectivity between protected areas (see section 2.3). It also requires improved management of human-elephant conflict and the widespread implementation of measures to promote cohabitation with forest elephants (see Chapter 5).

While the presence of protected areas is necessary to officially allocate portions of territory to the protection of biodiversity, this is not always sufficient in the face of certain pressures (large-scale poaching with weapons of war, etc.), especially when the management of these protected areas does not benefit from the desired investment. The disappearance of the last northern white rhinos (*Ceratotherium simum cottoni*) in Garamba Park is a clear example. The death of the last male individual in 2018 destroyed any hope of saving the species, at least in a natural manner.

When protected areas are degraded, reintroduction options are available to restore balanced, rich and diverse populations. However, such reintroductions are only desirable – and possible – if these protected areas are managed effectively. Recent initiatives, such as the reintroduction of lions (*Panthera leo*) in Akagera National Park (Rwanda) and attempts to introduce several species of oryx (*Oryx spp.*) in the Ouadi Rimé-Ouadi Achim Wildlife Reserve (Chad), show encouraging results.

With regard to the oceans, measures to protect marine biodiversity are very recent in Central Africa. Ocean environments, in general and in the Gulf of Guinea in particular, are subjected to strong pressures such as uncontrolled fishing, coastal erosion, oil exploitation, pollution, and the effects of climate change (Failler *et al.*, 2019). As an example, about 20% of the world's tuna and tuna-like species fisheries operate in Gabonese territorial waters (Sea Shepherd,

2016 in Ndjambou *et al.*, 2019). It is also in these waters that nearly 10% of the world's humpback whales (*Megaptera novaengliae*) come to breed, which recently has become the focus of tourism activities.

In 1981, the Convention for Cooperation in the Protection and Development of the Marine Environment and Coastal Environment of the Western, Central and Southern African Region (or Abidjan Convention) was adopted. Article 11 of this convention provides for the creation of "specially protected areas". The network of Central African marine protected areas has only been substantially deployed since 2017, mainly in Gabonese territorial waters. However, the marine ecosystems which are currently protected do not represent their diversity; Gabon having the only marine protected area on the high seas (UICN, 2015b).

The development of a network of marine protected areas, designed on coherent geographical scales from the point of view of ecosystems, and benefiting from sufficient human and material financial resources for their proper functioning, is therefore an important lever for the conservation of the marine and coastal wealth of Central Africa. The Blue Gabon program aims to strengthen the protection of the marine environment with the establishment of 20 marine protected areas, representing 26% of the national territorial waters (National Geographic, 2017). This initiative should encourage other coastal countries in the subregion to contribute more effectively to the protection of marine environments and species, within the framework of the strategic work program on marine protected areas (UICN, n.d.).

2.3. Protected areas and ecological networks

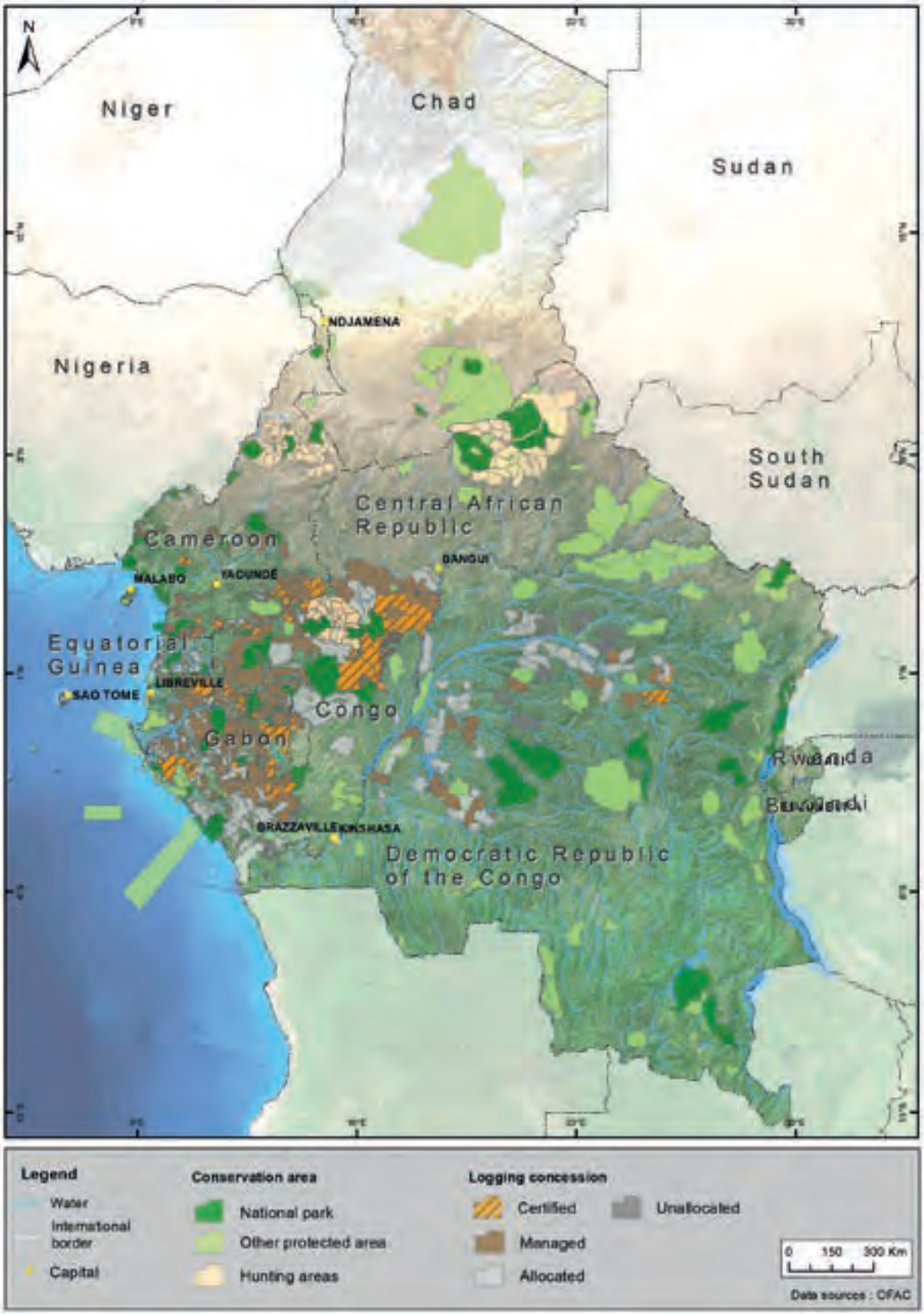
Effective protection of biodiversity requires respect for the biology and needs of its constituent species. Certain species, such as savanna (L. *africana*) and forest elephants, require vast territories to survive. The main task is to allow the natural movements of populations (migrations, access to food sources...) but also genetic mixing, which is essential for the maintenance and adaptation of animal and plant species (Triplet *et al.*, 2020).

The effectiveness of each protected area must be considered on the scale of larger ecological networks, including other protected areas, but also other territories allowing a continuity of natural or semi-natural ecosystems within this territorial mesh (Funwi-Gabga *et al.*, 2014). Other areas, such as ZICs (see box section 1.3) and managed and certified forestry concessions, can contribute to this connectivity and to the protection of animal and plant species (Figure 9). Indeed, these economic activities require healthy environments in order to maintain populations of desired species – both animal and plant – and thus, indirectly, their habitats. The ZICs of the savannas of Cameroon and CAR, and the other protected areas of these two countries and of Chad, thus make it possible to create vast, functional ecological complexes in the savanna zones. The ZICs in southern Cameroon also could strengthen connectivity between the national parks in the Sangha Trinational complex, which straddles the borders of Cameroon, Congo and Gabon.

Forestry concessions account for 36% of the total area of great ape priority conservation zones and 14% of the forest elephant's range. These concessions, when under sustainable management and certification, also allow the maintenance of a forest framework that is vital for the maintenance of forest biodiversity and associated ecosystem services (Van Vliet *et al.*, 2017; Lhoest *et al.*, 2020). Wildlife erosion in these concessions is indeed less significant than in forestry concessions without management plans (Karsenty & Gourlet-Fleury, 2016).

Effective conservation policies therefore need to take into account the multiplicity of land uses, particularly the areas inhabited by species that are subject to conservation or sustainable management measures, both within and outside protected areas (Morgan & Sanz, 2007). This means developing multi-sectoral land-use plans, including, in particular, the use of wood, hunting, agriculture and the mining and oil industries with conservation activities (see also Chapter 7). Improving the connectivity of protected area networks and maintaining functional ecological webs are promoted through the Aichi Targets. They require coordinated actions at different scales and between different socio-economic sectors so that the conservation measures adopted are coherent and correspond as closely as possible to both species biology and ecosystem functioning.

Figure 9 – Connectivity of protected areas



Note: Only nationally classified protected areas included in WDPA are considered here. Source: OFAC

3. Continually evolving legislation

Governments have a range of tools at their disposal to combat biodiversity loss. All Central African countries have ratified various international agreements and conventions that provide a general framework for actions and policies promoting better coexistence between humanity and the rest of the living world. However, it is national legislation that has the force of law above all else. Moreover, to be effective, such legislation must be enforced by all stakeholders, not just protected area managers.

Since 2015 and the first State of Protected Areas (Doumenge *et al.*, 2015a), a number of new pieces of legislation have been enacted or revised. This is the case, for example, of the law of 8 July 2020 concerning the forestry code in Congo, which introduced the notion of "ecological damage" that the State is likely to suffer as a result of actions against forest ecosystems. One of the changes observed in forest management also concerns conservation forest concessions, which DRC has set up (see box). This type of concession can complement the network of protected areas in the subregion (see section 1.3), provided that the laws and regulations are respected and that the objectives and management of these concessions allow for effective biodiversity protection (which may not always be the case; Wabiwa Betoko & de Hoog, 2021). However, this offers new opportunities for biodiversity protection and raises questions about the inclusion of this type of land use in the global database of protected areas.

The level of protection provided for in the texts varies greatly according to the type of ecosystems and threats identified on the wild fauna and flora. Since 2017, a decree designates ICCN as the management body of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in DRC. This facilitated the development of a National Ivory Action Plan (NIAP) 2016-2017, with a focus on protecting elephants, which are subject to intensive poaching both in the country and in neighboring countries that serve as a platform for the sale or resale of ivory (Nkoke, 2017).

Nevertheless, while these texts are relatively effective in sustainably preserving wild flora and fauna, including the natural habitats on which they depend, they suffer from some imperfections that are amplified by corruption, poverty and other socio-cultural obstacles. In the event of threats or serious damage to biodiversity, the creation of a protection tool and its implementation thus generally remain the sole responsibility of the government; other stakeholders are at best consulted and rarely involved.

Conservation forest concessions

Biodiversity management in forest concessions has undergone significant changes since the 1990s. In addition to the conservation zones allowed in Forest Management Units (FMUs), as established in most forestry codes (protection or conservation series), another category of forestry concession is gradually emerging: the conservation forest concession.

This type of concession was established in DRC by Decree No. 011/27 of 20 May 2011, which set out the specific rules of attribution. This innovative text allows any person who meets the requirements to obtain the right to use the forest by valorizing its environmental services (such as REDD+ projects), excluding any extractive exploitation of its resources and without prejudice to the exercise of forest use rights by local populations and the initial or desired ecological balance of the forest.

This category of forest concession provides a complementary tool to protected areas, which can be used to develop a "soft" approach to protect and value biodiversity. It would be interesting if it were explicitly enshrined in the laws of other countries so that certain forest concessions, initially allocated for industrial exploitation, could be converted into conservation concessions with, at the core, a REDD+ style project.

When imposed and enforced, penalties for offenses against wild fauna and flora, including their natural habitat (detention, monetary fines, etc.) are not always a sufficient deterrent for offenders or their sponsors. Some countries, such as Gabon, have tackled this problem head-on, with the support of non-governmental organizations such as Conservation Justice (2021). The low level of justiciability (RADE, 2020) is attributable to the lack of monitoring and control bodies and, above all, of judicial bodies with jurisdiction over wildlife crime and related issues. One solution would be to rely on "legal indicators" of the effectiveness of national and regional wildlife management legislation.

As some texts are difficult to apply, the contribution of scientific data and information to the development of legal texts in the biodiversity sector should be strengthened. This is a major challenge for the next few years, for genuine applicability and especially for the importance of environmental jurisdiction. The aim is to strengthen the development of environmental law and its effectiveness at both national and regional levels (RADE, 2020).

Only five member countries of the Central African Forest Commission (COMIFAC) have ratified the revised Maputo Convention on the Conservation of Nature and Natural Resources, which entered into force on 23 July 2016. This Convention provides, alongside obligations to protect natural habitats, their fauna and flora, actions relating to the preservation and restoration of these natural habitats. Protected areas are thus particularly concerned.

The subregional agreement on forest control in Central Africa, signed in 2008, is not limited to logging; it commits member States to strengthening subregional cooperation for the protection of wildlife, including the fight against poaching. Above all, it is an incentive for the signatory States to share strategies and operational means to fight poaching in the context of transboundary protected areas. However, the implementation of this important agreement is still in its infancy. Subregional capacity-building workshops for wildlife law enforcement officers (with representatives from the judiciary, forestry, customs and police) should improve the situation.

Furthermore, the revised Treaty establishing the Economic Community of Central African States (CEEAC), which came into force in 2020, commits States to greater cooperation in the areas of the environment, natural resources and biodiversity than was the case under the 1983 Treaty. However, even though organized wildlife crime is increasing in the subregion, there is still no regional unification of legislation on wildlife and protected areas, as the priorities of CEEAC member States end with the harmonization of national policies.

Various COMIFAC directives, notably those on environmental and social impact studies in forest areas, and on the participation of local and indigenous populations and NGOs in the sustainable management of Central African forests, also apply to protected areas. Although not legally binding, they are a source of obligations for States and individuals alike and should be reflected in national legislation.

Despite some institutional reforms, protected areas and conservation forests are not spared from overlapping uses of natural ecosystems (see, for example, Chapter 7). This indicates that coordination between the various government services involved can remain tricky. Despite this, protected areas are gradually becoming the subject of a coordinated approach among government departments and local authorities, rather than being seen as a sectoral issue. The implementation of the principles of integrated land-use planning should, in this respect, help to promote new synergies between administrations.

4. The management of protected areas under question

The data presented in section 1 show that most Central African countries have or will be able to achieve Aichi Target 11 (17% of territories classified as protected areas) – at least on land – or even the 30% target under negotiation. It is all a question of knowing which "conservation areas" are being taken into account. The diversity of legal statutes in effect allows a diversity of governance and management systems. This makes it possible to adapt management objectives to each specific situation, from strict conservation areas to areas where natural resources may be used in a sustainable manner, allowing the maintenance of green (vegetation) and blue (water) frameworks over vast territories.

Since the 1990s, the protected area networks of the countries in the subregion have expanded and now better cover the entire spectrum of biodiversity. Although the forest (in some regions) and large fauna (in general) are under significant pressure, the ecological frameworks (forests and savannas, aquatic ecosystems, etc.) often remain, allowing biodiversity to be dispersed (see section 2).

In fact, the question that arises is not so much the size of the protected area network as the effectiveness of its management. Although a comprehensive assessment of this issue is warranted, it is beyond the scope of this document. However, a few observations can be made in order to set out certain elements of the debate.

Protected area management "is about what is done to achieve given objectives" (Borrini-Feyerabend, 2014). Despite the considerable progress that has been made, and the use of various tools to measure

management effectiveness (see Chapter 4), Central African countries are facing significant challenges in this domain. With the exception of Rwanda and, to a lesser extent, Gabon, very little government funding is allocated to protected areas. International development assistance partially compensates for these financial deficiencies (Doumenge *et al.*, 2015a; Liboum *et al.*, 2019). However, a paradigm shift is needed to place protected areas – and biodiversity – in a more central place in development policies, and to strengthen the financial and human resources required for effective protected area management.

Effective protected area management depends on many factors, including legal status, clear management and conservation objectives, the type of governance (see Chapter 2), human resources, budgets, current legislation (including in other sectors), the ecological and socio-economic context (presence of nearby communities, industrial projects, etc.), and so on. All of these elements must be taken into account in protected area management plans, which are strategic tools essential for the management of the sites. These plans must extend over several years and be reviewed at the end of this period for possible improvements. They must then be translated into annual management plans, business plans and other operational documents.

The 2015 edition of the State of Protected Areas in Central Africa carried out an initial country-by-country review of the status of protected area management plans in the subregion (Doumenge *et al.*, 2015a). Since 2016, the IMET (Integrated Management Effectiveness Tool) assessments conducted, while covering only a sample of protected areas, nevertheless have noted a failure to produce new or updated management plans. On the contrary, there are an increasing number of development plans that have not been updated. This could be one reason for the decline in management effectiveness in many protected areas.

Moreover, the production of management plans appears to be motivated by a government administrative need and is not fully embraced by managers. Many development plans are not based on useful or up-to-date information. Their quality is insufficient to effectively guide management actions, and they do not make it possible to achieve the objectives set, which are themselves often imprecise. Without questioning the usefulness of this planning tool, it is becoming increasingly important to question the quality of the documents produced.

IMET assessments conducted by the Central African Forest Observatory (OFAC) in partnership with national administrations indicate that although some protected areas have a management plan, few are actually used to meet management needs. There are several reasons for this: 1) the lack of clarity in the definition of the management vision and objectives, 2) the paucity of basic information on values and threats, making it impossible to establish a reference level for the state of conservation, 3) the absence of a framework for monitoring and self-evaluation of the results of the implementation of the said plan, based on results indicators. Some of these issues are addressed in Chapter 4, in particular the need for regularly updated information for more effective protected area management.

While management effectiveness requires clear and verifiable objectives, human skills and available equipment and funding also are crucial for success. These conditions are significantly improved under Public-Private Partnerships (PPP), as is the resulting management performance (see Chapter 3).

Cameroon has not implemented a PPP, but has chosen to use an external consultancy firm (BRLi, *Bas-Rhône Languedoc Ingénierie*) to assist with change and to address structural deficits in the protected area sector. In this country, management by large territories has been instituted through Technical Operational Units (referred to by their French acronym, UTOs), including protected areas, ZICs, forestry concessions, etc. These UTOs were set up gradually starting in 2000 to facilitate coordination between all stakeholders and to operationalize a more integrated and participatory management of natural resources. Their evaluation showed that this means of managing large territories was relevant, but the structure and functioning of UTOs needed to be reconsidered to take better account of intersectoral complexity on the ground (see box).

This support process (2016 to 2019) allowed the Directorate of Wildlife and Protected Areas (DFAP) and, more broadly, the Ministry of Forests and Wildlife (MINFOF), to identify and define a new strategic approach for the wildlife and protected areas sector,

and to clarify its positioning in the national land-use policy. A strategy for renewing the protected areas network development plan was presented. It should enable DFAP to promote an ecosystem approach and the collaborative management of protected area complexes based on a sustainable land-use planning approach at the landscape level.

Ultimately, these UTOs should become decentralized regional hubs for the development of the rural economy through the sustainable use of natural resources around protected areas. Their overhaul provides for greater involvement of civil society (NGOs) and the private sector (concessionaires and leaseholders), including through the development of non-profit PPPs for protected areas. Territory projects developed in these UTOs also will require greater synergy and dialogue between all stakeholders (government authorities, technical and financial partners, civil society, etc.) at the scale of the entire landscape. In the absence of national-scale land-use planning, this land-use planning by large area, which is more decentralized, can make it possible to strengthen the effectiveness of sustainable development and biodiversity conservation strategies.

Many indigenous peoples and local communities are impacted by the existence of protected areas, particularly through limitations on access to certain natural resources or, on the contrary, through the development of new activities or jobs (see section 6 of this chapter and Chapter 8). At present, many

The broad objectives for the overhaul of UTOs in Cameroon

M. Salifou, independent consultant & J. De Winter, DFS Deutsche Forstservice

The revision of the protected area network management plan in Cameroon has made it possible to define several major orientations in the overhaul of the UTOs. Each should incorporate a new governance entity and a set of protocols for collaborating with other institutional actors in key sectors influencing wildlife and protected area management (forest management, agro-industry, etc.). This experimentation will initially take place in only ten UTOs (Figure 10). These new governance entities will coordinate various sectoral interventions and involve the private sector in the form of partnerships created with the decentralized administration.

In order to promote multi-sectoral integration, a *Groupement d'intérêt public* (GIP – a public interest grouping with a formal legal status) will be created for each UTO. This group will be mandated within the framework of a non-profit PPP and will be able to delegate part of the implementation of programs to third parties, including certain non-sovereign missions to the private sector and civil society (specialized NGOs). These public interest groups also will be empowered to establish specific regulations, which are essential for better coordination of the stakeholders.

To improve their financial autonomy, the UTOs will be able to seek or generate funding that complements public budget allocations and revenue generated by their development. This could be done through trust funds or payments for environmental services. Any donation should be placed in a single protected area/UTO or even for a specific theme. Finally, the revision of the management strategy provides for facilitating the establishment of PPPs by promoting a non-profit approach to their involvement in the management of the protected areas concerned.

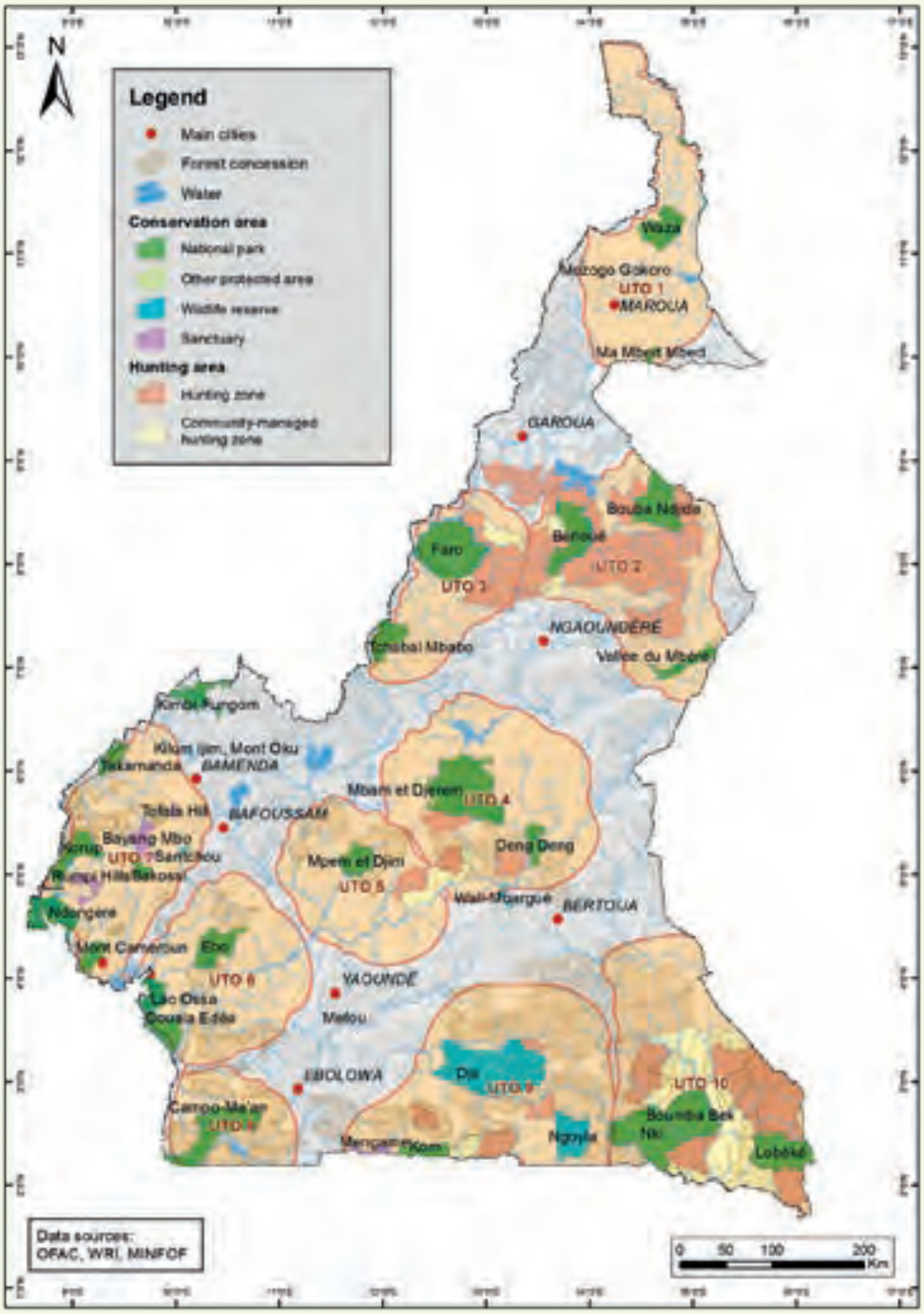
The framework plan for the overhaul of UTOs, drawn up for the period 2020-2035, is based on these major guidelines and includes, at the level of each renovated UTO, the following lines:

- establishment of a governance entity,
- intersectoral coordination,
- sustainable financing and equitable benefit sharing,

Broad objectives for the overhaul of UTOs in Cameroon

– creation of zoning, amenities and infrastructure,
– development of biodiversity protection and monitoring of the status of biodiversity and impacts,
– development of tourism,
– follow-up, communication and increased visibility.

Figure 10 – Overview of the network of ten Cameroonian UTOs after their overhaul



Sources: WRI (2013) & MINFOF (2014)

protected area management initiatives aim to consider the well-being and rights of these populations more thoroughly in order for conservation actions to be better accepted and effective. A shift from conflictual relations to real collaboration requires an understanding of the needs of each stakeholder as well as the development of a culture of transparency, which guarantees a minimum of mutual trust and joint decisions accepted by all actors.

It is in this context that mechanisms such as Free, Informed and Prior Consent (FPIC) must be put in place (see box). This type of mechanism would be interesting to develop more systematically in Central African protected areas to strengthen the capacities of all governance actors (including rural communities) and to promote "good governance" as well as more effective management.

5. Funding

To be effective, protected areas need long-term financial support. Increasing this financial support, for the protected areas and for the development of their peripheries, is obviously a central question because it remains today insufficient. Public funding is far below what is needed and the shortfall is partly met by international public funding (Calas, 2020; see also Chapter 9), as well as by many private donors. The emergence of PPPs also is an important element (see Chapter 3).

According to the platform dedicated to identifying initiatives in the forest/environment sector developed by OFAC that has been operational since 2016, the total amount of funding committed to the biodiversity sector for the period 2015-2029 is approximately US$3.1 billion. It is important to note that the figures used in these accounts are taken from project documents, contracts or audits, and they do not necessarily reflect the amounts actually spent on the implementation of these initiatives; in addition, there are various funds that could not be accounted for.

Among the different international, bilateral and multilateral donors that are financing themes related to biodiversity conservation, the European Union (EU) is by far the largest (Figure 12). It contributes 68% of the total funding recorded for the subregion.

DRC's protected areas have been receiving financial support in recent years, reflecting changes needed to preserve biodiversity more effectively. These changes are seen in the alignment of ICCN's recently adopted community conservation strategy with that of some official development assistance donors, and in the determination to ensure long-term support for the costly management of conservation. Several trust funds have been created (including the one for Virunga National Park, an emblematic protected area in DRC).

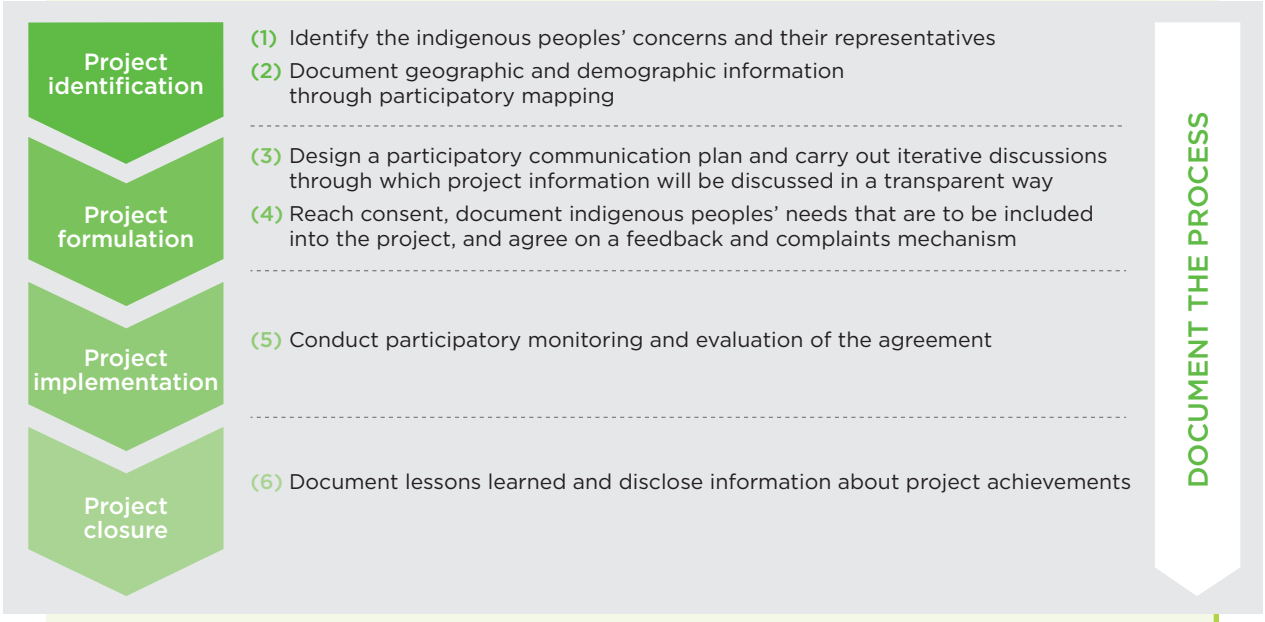
FPIC for indigenous peoples and local communities

W. E. Waitkuwait, M. Nkolo, J. Metsio Sienne, N. Takougang and W. Njing Shei, GIZ-Cameroon

FPIC is enshrined in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP, Article 10) and the CBD. This approach requires that all stakeholders, and in particular indigenous peoples and local communities, be given the opportunity to express their opinion on any development project that is expected to have impacts on their way of life and well-being. This notably involves communicating relevant information to these populations. This approach is a factor of good governance, allowing, in particular, to better integrate the needs and rights of these peoples in all conservation and development projects. COMIFAC has included the FPIC approach in its guidelines for the participation of local people in forest management (COMIFAC, 2015). At the national level, this approach is also described in detail in a number of tools, such as the Guide for Consultation of Indigenous Peoples for FPIC and Participation, in Congo, and the Procedure Manual for Obtaining Free, Prior and Informed Consent in the Framework of REDD+ Initiatives in Cameroon.

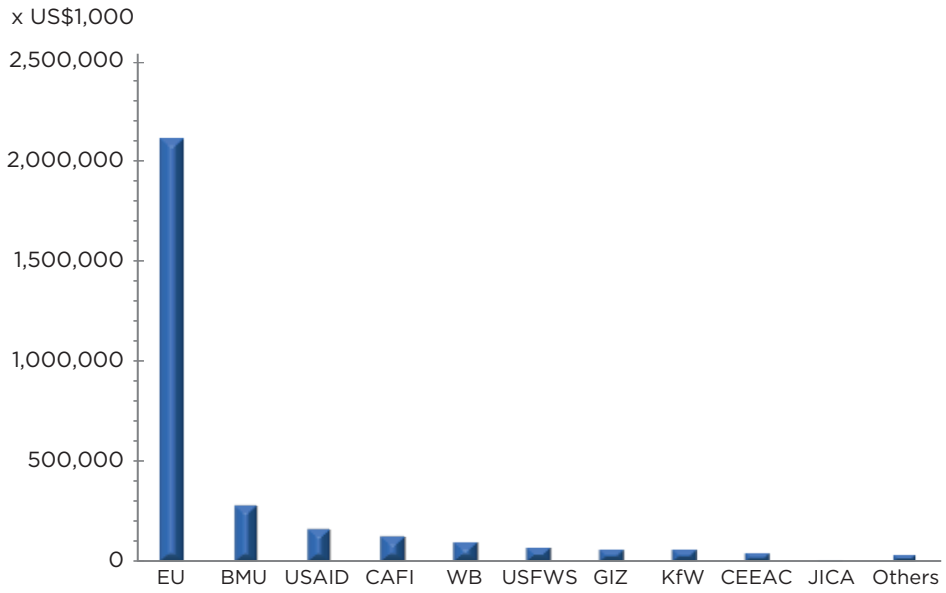
To facilitate the implementation of the COMIFAC guidelines, German cooperation is supporting the development of a FPIC toolkit, which will serve as a subregional reference. This toolkit takes into account the guidance provided by international guides that describe several stages of FPIC (Figure 11). It also aims to build on existing knowledge by including activities such as the relocation of villages within Sena Oura National Park and the process of revising the management plan for Lobeke National Park in Cameroon. The application of FPIC is not limited to the establishment of protected areas. It also is important for those involved in governance, in the development or review of management plans, to identify those aspects of management where FPIC will be required.

Figure 11 – Diagram of the six key steps to be considered when following the FPIC approach



Source: FAO (2017)

Figure 12 – Donor funding for conservation in Central Africa for the period 2015 to 2029



BMU: Federal Ministry of the Environment (Germany); CAFI: Central African Forest Initiative; CEEAC: Economic Community of Central African States; EU: European Union; GIZ: German Agency for International Cooperation; JICA: Japan International Cooperation Agency; KfW: German Credit Institution for Reconstruction; USAID: United States Agency for International Development; USFWS: United States Fish and Wildlife Service; WB: World Bank. Source: OFAC.

The Okapi Fund, a founding member of CAFE (Consortium of African Funds for the Environment), was established back in 2013 but did not actually become operational until 2019. By the end of the same year, the first two endowments of the fund were released, from KfW (*Kreditanstalt für Wiederaufbau*) and the Global Environment Facility (GEF), via the World Bank, amounting to €14 million and US$7.4 million, respectively. The Okapi Fund plans its first interventions in 2022. These will benefit Kahuzi-Biega and Garamba National Parks, two World Heritage sites placed by UNESCO on the list of endangered sites.

International institutions such as UNESCO encourage States and their specialized agencies, as well as public and private donors, to contribute to trust funds, rather than financing projects with a limited implementation period and whose successive

cycles do not guarantee the necessary continuity of support. These conservation trust funds are widely deployed on the African continent. They are used as fundraising and management tools under REDD+ strategies and to directly support certain protected areas (Spergel & Wells, 2010; CFA, 2014). This is the case of the Sangha Trinational Foundation and the Okapi Fund for Nature Conservation. The CAFE is seeing its membership increase year after year.

These international financial instruments help to increase and secure long-term financing, but they are not free of flaws. As they are aligned with carbon and/or financial markets, they depend on complex processes that can generate uncertainty (Lapeyre, 2017). They also tend to shift the centers of decision-making outside countries (to stock markets or carbon markets), to decrease the importance of national administrations and to increase that of certain intermediaries (such as international NGOs) in negotiations and decision-making (Méral *et al.*, 2009).

Other innovations such as PPP contracts and Participatory Management Contracts (PMCs) are also becoming more widespread. In the long term, the task is to set up actions corresponding to national policies and priorities, with the support of professional partners capable of providing needed technical and financial support. To our knowledge, half a dozen PPPs and PMCs have been concluded with ICCN since 2005 in DRC.

In conclusion, it should be emphasized that any conservation financing strategy must involve a range of mechanisms that complement each other. These different funding instruments need to be mobilized at various scales, from local (a site) to national, or even subregional (Gobin & Landreau, 2017).

6. Local and indigenous communities and protected areas in Central Africa: reducing conflicts, enhancing opportunities

The reconciliation of environmental and socio-economic issues within the framework of national and local development plans is a major challenge for the creation and management of protected areas. The current approach is based on a new paradigm: "Conservation as a lever for development, security and resilience". This means no longer considering protected areas only within the strict limits of their perimeters, but rather considering the entire matrix of the landscapes that surround them and all of the social, economic and environmental issues that are at stake.

One of the factors hindering the achievement of the objectives assigned to protected areas is in effect the state of conflict that has long prevailed and still prevails between managers and local and indigenous communities. Local and indigenous communities

refer to all populations organized on the basis of customs and traditions, united by ties of solidarity and kinship that underpin their cohesion and ensure their reproduction in space and time, and who live or reside around, within or near protected areas, exercising customary use rights (COMIFAC, 2015).

The daily lives of these communities and their way of life remain very much linked to the use of natural resources, which provide them with what they need for food, health, aesthetics, construction and handicrafts, energy, agricultural and livestock activities, and spiritual and leisure activities (Gami, 1999 & 2010; Stolton *et al.*, 2015). These resources also have a financial value. Their trade on local, national and even international markets contributes significantly to generating income for all of the actors involved in the various commodity chains, including those who harvest them but also those who process, transport, export and sell them (FAO, 2016).

Access to and use of natural resources and places of identity therefore involve issues of survival, authority, power and enrichment for managers, communities, private sector representatives and NGOs. Protected areas are struggling to establish themselves as drivers of economic development in the areas where they are located, and many of them have become "pantries surrounded by hunger" (Sournia, 1990). This situation is due to several mechanisms, such as: a glaring lack of planning for national development and the sharing of national wealth; impoverished rural populations, partly displaced from the protected territory and who express their determination to exploit it; productive systems – in particular agricultural systems – that are not very productive combined with population growth; and external economic operators, individual or organized as a company, who come to carry out activities in and around the protected areas.

6.1 The origin of conflicts

Different kinds of situations crystallize conflicts around protected areas. They can be linked to the very creation of the protected areas, which often is accompanied by the forced displacement of communities, as well as the plundering of their natural resources. In particular, protected areas are the site of tensions around access to wildlife, from which the communities are excluded (Clarke *et al.*, 2019).

However, activities such as agriculture, hunting and infrastructure construction projects continue to encroach on protected areas, with consequences on their integrity. This encroachment is a consequence of the communities' poverty, as well as of their resistance to the creation of protected areas (Lewis, 1996).

Another type of conflict is becoming increasingly important on the outskirts of some protected areas, namely that between humans and wildlife that approach villages and devastate crops (UICN, 2015a). This issue is discussed in detail in Chapter 5.

The territories around protected areas also are affected by conflicts related to access to land. The inadequate management of land issues is mainly due to a lack of knowledge on the part of land-use planners of the complexity of local dynamics of natural resource exploitation (Binot & Joiris, 2007).

These conflicts are exacerbated by other factors, such as the prevailing insecurity in the subregion and in neighboring countries, and the abusive behavior of some eco-guards toward local and indigenous communities. Cases of physical abuse, torture, confiscation of fresh meat, extrajudicial executions and destruction of property have been reported by human rights organizations.

6.2 From conflict to collaboration

The recognition that the exclusion of local and indigenous communities from protected areas was ineffective has led States to seek a management approach that would allow for effective biodiversity conservation and the economic development of stakeholders (Moukouya *et al.*, 2015). This approach was at the heart of the ECOFAC program as well as, more recently, that of the PPPs signed between States and various partners (see Chapter 3).

Before establishing a protected area, an obvious first step would be to gather information about the people who live there and how they live, and to receive their consent (see box section 4), to ensure that conservation restrictions do not threaten their traditional livelihood activities. However, as a study of 34 protected areas has shown (Pyhälä *et al.*, 2016), this is almost never done in most Central African countries, or if it is, it is carried out incompletely.

Yet the conservation paradigm has evolved over time, notably with the adoption of the CBD in 1992, in which biodiversity conservation and sustainable use are asserted as inseparable (Adam, 2012). Local and indigenous communities must be, along with other actors, including the State and conservation NGOs, at the heart of their management. Their involvement is motivated by the fact that over many generations they have developed a body of knowledge that has enabled them to live and nourish themselves from the forest and its biodiversity while preserving its productive capacities (FAO, 2016).

Even if this is not yet sufficiently realized on the ground, functional changes have been made in the definition of the management objectives of protected areas, with a view to contributing to the strengthening of the link between conservation and natural resource use. The establishment of the IUCN protected area categories, for example (see Figure 1), refers to different conceptions of the place of humans in environmental protection policies (Héritier & Laslaz, 2008).

The operationalization of the community participatory approach in the creation and management of protected areas translates into interventions at two levels: the revision of regulatory frameworks and the development of initiatives that operationalize participatory approaches. However, each country's legislation and management objectives provide different opportunities for the participation of local communities. In Cameroon, for example, memoranda of understanding between local communities and MINFOF make it possible to specify the forms of collaboration and define the rights and duties of each party (see box).

Fighting lawbreaking and poaching are other important concerns of protected area managers. More participatory management could enable official managers to be more effective while also allowing local and indigenous communities to partially reclaim management of their hunting territories.

Despite these advantages, participatory monitoring remains very underdeveloped, or even non-existent (Gabon, Burundi and Equatorial Guinea) and is limited to very specific sites in CAR (Dzanga-Sangha Protected Areas, referred to by the French acronym APDS) and Congo (Lake Tele). Within the framework of the CAWHFI (Central African World Heritage Forest Initiative) project, awareness-raising and the integration of communities in APDS monitoring committees have thus encouraged local populations to oppose the armed groups active in CAR and to prevent them from penetrating into the protected areas. Countries such as Cameroon and DRC also have set up village monitoring committees (known as COVAREF or *Comités de Valorisation des Ressources Fauniques*) and farmer-forest committees.

Memoranda of understanding between local communities and conservation authorities in Cameroon

P. Bigombe-Logo, CERAD

In Cameroon, human rights-based conservation is growing. Under the facilitation of WWF-Cameroon, memoranda were signed between indigenous peoples and the conservation services of some protected areas. These documents define the commitments of each party in the management of the protected area, including the modalities for exercising the communities' use rights.

The Campo-Ma'an National Park memorandum was signed in 2011, following several years of negotiation. Park managers and the Bagyeli indigenous people agreed on several points: 1) the necessary participation of local and indigenous communities in the sustainable management of the park's forests and the conservation of its biological diversity, 2) the promotion of and respect for FPIC principles in negotiations with the Bagyeli for the co-management of the park, and 3) the recognition and enjoyment of their use rights for their survival. It in effect has been accepted that resource harvesting can be sustainable and does not pose a serious threat to the maintenance of biodiversity.

An agreement also was signed in 2018 concerning the Ngoyla Wildlife Reserve. This agreement determines the access of the indigenous Baka people to certain resources of the reserve, notably NTFPs, partially protected animals and those used in cultural rites, and resources resulting from fishing activities (subject to authorization by MINFOF). Also described is the association of the Baka with certain management activities (ecological monitoring, ecotourism, surveillance, etc.), and their controlled presence within the restricted access zone of the reserve. In return, they pledge to denounce any practice contrary to the prescriptions of the reserve's management plan, to break off any collaboration with actors involved in illegal activities within the reserve and its surrounding areas (poaching, illegal mining and illegal logging) and to harvest NTFPs in a sustainable manner.

In the same vein, MINFOF signed a memorandum in 2019 with an association of indigenous Baka peoples from Moloundou, ASBABUK (*Association Sanguia Baka Buma'a Kpodé*), regarding the national parks of Lobeke, Nki and Boumba-Bek. Among the points that ASBABUK has committed to respect are its involvement in the implementation and monitoring of the execution of the activities included in the action plan, the management and sustainable use of natural resources, as well as the sensitization of the community to these practices, the designation of their representatives in strategic, technical and communication activities related to the development of the parks and the respect of the framework of their traditional activities in the parks concerned, etc. The conservation services have pledged to facilitate this community's access to resource areas in the parks concerned, to rely as much as possible on the labor and/or expertise of the Baka in the implementation of park development activities, to facilitate the setting up of frameworks for consultation and discussion between the public authorities, the communities, NGOs and other development partners, to follow up on the relevant complaints made by the Baka, etc.

The signing of these memoranda marks a definite evolution in the relationship between indigenous "Pygmy" peoples and protected areas in Cameroon. If they are effectively implemented, monitored and evaluated, with the genuine participation of all stakeholders, as provided for in their respective texts, they will contribute to laying the foundations for the progressive improvement of relations between indigenous peoples and protected areas in Central Africa.

In the Dja Faunal Reserve in Cameroon, local residents have organized themselves into vigilance committees, under the impetus of the NGO African Wildlife Foundation (AWF), to support the conservation of this protected area. These committees were established by decision of the administrative authority and received logistical support funded by the ECOFAC 6 program. The information provided by these committees led to the seizure of weapons, ammunition and poached meat in the reserve, as well as to the arrest of several poachers (Epanda *et al.*, 2019).

Such approaches are beneficial in that they allow, through the analysis of the information collected, a better knowledge of the presence of armed groups from other parts of the country or from neighboring countries. They also make it possible to concentrate patrols in the most sensitive crime areas and to be more efficient in the organization of these patrols. This ultimately allows better management of material and human resources.

These different initiatives have the advantage of involving and empowering communities against external aggression, particularly poaching and illegal exploitation of timber resources. They also allow these communities to benefit from additional financial income (in the form of salaries) and thus to be able to meet their families' daily needs.

Despite the promising results of these oversight committees, they still face difficulties. These are related to, among other things, death threats made by poachers who are arrested, cases of complicity between some committee members and poachers, a lack of legal coverage and non-responsiveness of the government – which leads to discouragement – and a lack of adequate equipment (Epanda *et al.*, 2019).

It also should be noted that these participatory monitoring initiatives must grapple with a continuing lack of recognition in existing regulations. The question of responsibilities, as well as the support of the communities involved, remains problematic and is not always very clear.

To protect their wildlife resources, Central African countries nevertheless have adopted increasingly dissuasive laws and ratified several international conventions, including CITES (Ngeh *et al.*, 2018). These regulations vary from one country to another, but the objective is the same everywhere, namely to prevent and punish offenses. Violations are supposed to be brought to the attention of the competent authorities, in this case the judicial authorities, for processing and decision. Unfortunately, cases are not always brought before courts and tribunals and, when they are, are not always sanctioned by a judgment (in DRC, for example, out of the 35 cases registered between January 2016 and March 2018, only three judgments were rendered; Ngeh *et al.*, 2018).

To reverse this trend, one of the main strategies is to strengthen law enforcement, which involves closer monitoring of procedures, from investigations and operations, to convictions and enforcement, particularly at the local level (Henson *et al.*, 2017). The capacities of local and indigenous communities

that are partners in the fight against poaching are being strengthened through training workshops organized through several projects. The aim of the Project for the Application of Law for Fauna (PALF) is to improve the level of wildlife law enforcement in Central Africa, particularly in Cameroon, Congo, Gabon and CAR. It is being put in place for a period of four years (2018-2022) and one of the main expected outcomes is the establishment of clearer enforcement mechanisms and their effective implementation in the subregion (OFAC, 2019).

6.3 Toward greater control of development activities

While conflicts still exist between local and indigenous communities and protected area managers, the involvement of these communities in management is now considered good practice (Vermeulen & Triplet, 2009). It is based on the economic assumption that if communities are involved in conservation activities and find in them economic benefits, they will be motivated to conserve biodiversity and conflicts with protected areas will decrease.

In the development projects implemented in Central African protected areas, income-generating activities focus on the promotion of alternatives in natural resource management (NTFPs, agroforestry), beekeeping, domestic animal husbandry, sharing of benefits from conservation and tourism (see Chapter 8). Among the initiatives implemented, some focus on developing NTFPs, which local and indigenous communities use both for their own needs and as sources of income and employment. NTFPs include plants for food, medicine and crafts (fruits, nuts, mushrooms, fibers, bark, etc.), as well as animals and their by-products (game, honey, etc.).

As the management and exploitation of NTFPs remains artisanal and part of the informal sector, these products still do not contribute sufficiently to the sustainable development process. Projects are set up to support communities, in order to assist them in structuring development sectors.

A project on the outskirts of the Dja Faunal Reserve has supported the structuring of the 15 most commercialized NTFP value chains in Cameroon. This has improved their commercial value, so that the beneficiary populations, and in particular women, can earn the income necessary for their development. As a result of this work, the prices per kilogram of the NTFPs concerned have increased considerably, as the processing of raw products has led to an increase in the value added. With regard to protected areas, this initiative also has enabled the development of reforestation capacities of local and indigenous communities through the establishment of local tree nurseries. The signing of reciprocal environmental agreements (REAs) between the groups involved in the project also committed them to stop supporting poaching activities.

The 2016-2020 phase of the CAWHFI project also enabled the implementation of several actions in the different parks involved:

- *Nouabale Ndoki National Park (Congo):* members of local and indigenous communities have been recruited to participate in park management (contractual and seasonal). The communities from which they come also have received training to monitor the management of social infrastructure built by the park management body in Makao and Bomassa (dispensaries, schools and water supply), and to carry out beekeeping and farming activities in order to diversify their sources of income (Unesco, 2019);
- *Lobeke National Park (Cameroon):* a plan to secure the use rights of the community living on the outskirts of the park was adopted, along with a set of actions to be carried out over a four-year period, with the support of various organizations. The signing of a memorandum of understanding between the communities and MINFOF focused on the respect of their rights, including access to forest resources and the practice of their customs and practices (Unesco, 2019);
- *APDS (CAR):* ecotourism and monitoring activities have strengthened the capacities of local and indigenous communities in mastering the concept of ecotourism, in the efficient administration of the management committees of community-managed hunting areas (ZIC-GC), as well as in communicating ecological and cultural values to tourists. Other initiatives also have been launched for some time by WWF to empower rural people and strengthen local development (see box).

The APDS complex and indigenous and local communities

F. Mavinga, WWF-CAR and J. Barske, WWF-Germany

The APDS complex was created in 1990 to promote local development of impoverished populations while ensuring wildlife conservation. Managers have paid particular attention to the well-being of local communities and have developed a number of actions to benefit them.

These actions can be grouped under five headings:

– **strengthening indigenous culture:** the international organization OrigiNations has supported the creation of a group of indigenous youth who are contributing to the intergenerational protection and promotion of their cultural and natural heritage, as well as to the active defense of their rights;

– **informing about the rights and duties of citizens:** a Human Rights Center was created by the local organization *Maison de l'enfant et de la femme Pygmées* and by the Indigenous Peoples of Africa Coordinating Committee (IPACC). The Center works with the local population (particularly the BaAka), providing various forms of support: legal assistance and support for conflict resolution, awareness-raising and training on human rights in general and on the rights of indigenous peoples in particular, assistance in obtaining birth certificates to enable them to access government services, the right to vote and stand for election, freedom of movement, etc. The Center also informs and trains local civil and administrative authorities, as well as law enforcement officers, eco-guards, etc. on indigenous rights;

– **improving the education system:** the park manager, in partnership with *Action pour le Développement Intégral des Humains* (ADIH) and the Society of African Missions (SMA), has supported the construction of two school hostels to enable BaAka children and youth in the villages to attend secondary school;

– **improving the health system:** again in partnership with ADIH and SMA, the strategy is to strengthen the existing rural health centers and to set up a mobile unit to: 1) facilitate access to health care and preventive health education for the most marginalized BaAka communities, 2) organize continuous surveillance of human-animal transmissible diseases through a field laboratory, an employee health program, animal carcass surveillance, and regular observations of primates habituated to close contact with humans. WWF is also involved in health care and education, as well as in the promotion of human rights and indigenous peoples, in collaboration with MINFOF and local partners;

– **promote communication and awareness:** a community radio station was set up in 2011 in Bayanga (*Radio Ndjoku*), in collaboration with *Radio France Internationale* (RFI) to contribute to the peaceful coexistence of communities (awareness-raising programs on human rights principles and environmental and social issues).

In addition to these actions, tourism has been the focus of a development strategy, allowing the local population to benefit from 40% of tourism revenues (see also Chapter 8).

All of these actions promote greater involvement of local and indigenous communities in the management of protected areas and the creation of a dynamic that contributes to conservation activities by reducing conflicts. They also strengthen their skills in specific areas of activity and promote stable and regular sources of income, improving their quality of life and reducing pressures on protected areas.

Conclusion

Protected area networks in Central Africa have been greatly expanded since the beginning of the 20th century, both on land and at sea. This increase is in line with national and regional nature conservation policies, but also a more global dynamic, reflected at the international level through the Aichi Targets and, more recently, the 30x30 objective (30% of protected areas by 2030) that will be negotiated at the next CBD Conference of the Parties.

If protected areas classified by States under national laws and recognized by the WDPA alone are considered, only a few countries have achieved the Aichi Target. However, if we add the protected areas with an international status (World Heritage, Ramsar, biosphere reserves), most countries have reached this objective and several are approaching the 30x30 objective.

Moreover, when other national protected areas, ones not recognized by the world database of protected areas (such as certain zones of hunting interest and forest reserves), are taken into account, Central Africa can legitimately claim to be well on the way to rapidly achieving this 30x30 objective. However, in order to agree on the territories taken into account for the validation of these objectives, international efforts must be made to develop a common frame of reference to recognize and categorize all those spaces that can be considered to be protected areas.

The maintenance of functional biodiversity on a global scale cannot ignore the role that certain areas dedicated to the sustainable use of wildlife and forest resources can play in maintaining a functional green and blue frameworks. The role of some ZICs and managed and certified forest concessions may indeed be important in strengthening the connectivity of protected area networks.

The inclusion of these types of land use could open a new discussion in which Central Africa can offer its experience. This also means not only discussing a purely accounting objective of 30% of the territories under more or less strong protection, but also emphasizing the reality of management on the ground and the effectiveness of management of all of these territories, whether they are conventional protected areas or other priority land uses. It is on this point of management effectiveness that the main discussions of the CBD should focus.

On the other hand, it would seem misguided to consider the effectiveness of protected area networks outside their context. The issues of network connectivity and the separation or overlapping of land uses must be considered within the framework of multi-sectoral land use planning. In Central Africa, few countries have set up a land-use planning policy worthy of the name; this is one of the major projects ahead.

The richness of the subregion does not only lie in its biodiversity, nor in its landscapes. It is also rich in human diversity which it is essential to take into account. In the history of protected areas, these peoples often have been excluded from decision-making, even though their survival is often dependent on the use of natural resources. This has been the source of numerous conflicts between managers and local communities, and may have exacerbated the latter's precarious situations. Today, a new paradigm is emerging, calling for the integration of these populations into the management of protected areas. Several examples have been presented in this chapter and others are discussed in the following chapters.

This more inclusive approach will make it possible to highlight local knowledge, but also to leverage the know-how of national and international partners through the PPPs being developed in the subregion. It also will make it possible to rely on new paradigms (eco-development, eco-security, green economy), making it possible to mitigate the pressures on biodiversity while promoting more sustainable development.

Conservation policies must therefore be aligned with development needs in a region that is aiming for economic growth of between 6 and 8% by 2035, and this within an unprecedented health context that makes the future of protected area management uncertain. Listening to and taking into account the needs of rural communities, helping them to develop their skills, participating in the financing of sustainable agricultural sectors, mobilizing nature-based solutions such as agroforestry, etc., are all avenues that governments and their partners can explore and which will have beneficial repercussions on environmental protection. Beyond the achievement of the Aichi Targets or the 30x30 objective, the Central African protected area network only can have a real positive impact on the environment if its managers make it part of territorial connectivity and succeed in putting humans back at the heart of their environment.

Bibliography

Abernethy K., Maisels F. & White L.J., 2016. Environmental issues in Central Africa. *Annual Review Environment Resources* 41(1) :1–36.

Adam S., 2012. Un modèle et son revers : la cogestion des réserves de biosphère de Waza et de la Bénoué dans le Nord-Cameroun. Géographie. Université du Maine

ncrenaz M., Cheyne S., Humle T., Rawson B., Robbins M. & Williamson L., 2018. Socioécologie des grands singes.

BAD, 2020. Perspectives économiques en Afrique centrale 2020 - Faire face à la pandémie de COVID-19.

Binot A. & Joiris D.V-J., 2007. Règles d'accès et gestion des ressources pour les acteurs des périphéries d'aires protégées. *VertigO*, Hors-série 4. DOI : https://doi.org/10.4000/vertigo.759

Booth, V. and P. Chardonnet 2015. Guidelines for improving the administration of sustainable hunting in sub-Saharan Africa. FAO and IGF.

Borrini-Feyerabend G., Bueno P., Hay-Edie T., Lang B., Rastogi A & Sandwith T., 2014. Lexique sur la gouvernance des aires protégées et conservées. Congrès Mondial des Parcs 2014 UICN, Gland, Suisse.

Brooks E.G.E., Allen D.J. & Darwall W.R.T., 2011. The status and distribution of freshwater biodiversity in Central Africa. IIUCN, Gland, Switzerland and Cambridge, UK : 126 p.

Calas, 2020. Synthèse de la conférence-débat 16 octobre 2020, Webinaire CIRAD.

CDB, 2020. Perspectives mondiales de la diversité biologique 5. Secrétariat de la CDB, Montréal, Canada : 208 p.

CDB, 2019. Avant-projet du cadre mondial de la biodiversité pour l'après-2020. Secrétariat de la CDB, Montréal, Canada. CBD/WG2020/2/3 : 14 p.

CDB, 2011. Plan stratégique pour la diversité biologique 2011-2020 et les Objectifs d'Aïchi. https://www.cbd.int/doc/strategic-plan/2011-2020/Aichi-Targets-FR.pdf

CFA, 2014. Le financement durable des aires protégées : fonds fiduciaires pour la conservation et financement de projet. Avantages comparatifs. Conservation Finance Alliance : 41 p.

Clarke C., Perram A., Nounah S., Nsioh M., Nsonkali C-J., Mabaya R., 2019. À l'intérieur et autour des aires protégées du Cameroun : une analyse basée sur les droits des accords d'accès et d'utilisation des ressources entre les peuples autochtones et l'État. Forest Peoples Program, UK : 14p.

Colyn M. & Deleporte P., 2004. Biogeographic analysis of Central African forest guenons. *In*: Glenn M.E. & Cords M. (Eds.), The Guenons: diversity and adaptation in African monkeys. Developments in primatology: progress and prospects. Springer, Boston, MA. : 61-78.

COMIFAC, 2015. Directives sous-régionales sur la participation des populations locales et autochtones et des ONG à la gestion durable des forêts d'Afrique centrale. Édition 2, 2015 – 2025. Série Politique n°7, COMIFAC, Yaoundé, Cameroun : 52 p.

Congo, 2020. Loi n° 33-2020 du 8 juillet 2020 portant code forestier. Brazzaville, République du Congo : 54 p.

Conservation Justice, 2021. 47 trafiquants de faune arrêtés au Gabon grâce à Conservation Justice en 2020. https://www.conservation-justice.org/fr/47-trafiquants-de-faune-arretes-au-gabon-grace-a-conservation-justice-en-2020/

Cooney R., Freese C., Dublin H., *et al.*, 2017. The baby and the bathwater: trophy hunting, conservation and rural livelihoods. *Unasylva* 68 : 3-16.

Dagallier L.-P.M.J., Janssens S.B., Dauby G. *et al.*, 2019. Cradles and museums of generic plant diversity across tropical Africa. *New Phytologist* 225 : 2196–2213.

Denhez, F., 2020. Les aires protégées peuvent-elles sauver la biodiversité au XXIe siècle ? À quoi servent les aires protégées ? Compte-rendu : Journée FRB 2020.

de Wasseige C., Tadoum M., Eba'a Atyi R. & Doumenge C. (Eds.), 2015. Les forêts du bassin du Congo - Forêts et changements climatiques. Weyrich Ed., Neufchâteau, Belgique : 128 p.

Doumenge C., Palla F., Scholte P., Hiol Hiol F. & Larzillière A. (Eds.), 2015a. Aires protégées d'Afrique centrale – État 2015. OFAC, Kinshasa, République démocratique du Congo et Yaoundé, Cameroun : 256 p.

Doumenge C., Billand A., Palla F. & Scholte P., 2015b. Les aires protégées du cœur de l'Afrique. *In* : Doumenge C., Palla F., Scholte P., Hiol Hiol F. & Larzillière A. (Eds.), Aires protégées d'Afrique centrale – État 2015. OFAC, Kinshasa, République démocratique du Congo et Yaoundé, Cameroun : 10-15.

Dudley, 2008. Lignes directrices pour l'application des catégories de gestion aux aires protégées. Gland. Suisse. UICN. X +96pp.

Elhacham E., Ben-Uri L., Grozovki J. *et al.*, 2020 Global human-made mass exceeds all living biomass. *Nature* 588, 442–444. https://doi.org/10.1038/s41586-020-3010-5

Epanda M-A., Mukam F-A., Bacha T. *et al.*, 2019. Linkings local people's perception of wildlife and conservation to livehood and poaching alleviation. A case study of the Dja biosphere reserve, Cameroon. DOI : https://doi.org/10.1016/j.actao.2019.04.006

Failler P., Touron-Gardic G., Sadio O. & Traore M.-S., 2019. Menaces sur les aires marines protégées en Afrique de l'Ouest : de la pêche non contrôlée aux changements climatiques. *Mondes en développement* 187 **:** 137-157.

FAO, 2017. La gestion communautaire des écosystèmes de mangroves en Afrique centrale : enjeux et perspectives. Forum sous-régional. Douala.

FAO, 2016. Vivre et se nourrir de la forêt en Afrique centrale. Rome. Italie.

Fruth B. *et al.*, 2016. *Pan paniscus* (errata version published in 2016). The IUCN Red List of Threatened Species 2016. https://www.iucnredlist.org/species/15932/102331567

Funwi-Gabga *et al.*, 2014. Situation des grands singes en Afrique et en Asie. *In* : La planète des grands singes : les industries extractives et la conservation des grands singes . Arcus Foundation : 229-237.

Gami N., 2010. Communautés locales et gestion des aires protégées. *Le Flamboyant* 66/67 : 2-5.

Gami, N., 1999. Les activités humaines dans les terroirs coutumiers face aux plans d'aménagement des aires protégées : le cas du parc national d'Odzala au Nord du Congo-Brazzaville. *In* : L'homme et la forêt tropicale. SHE/Édition de Bergier : 467-476.

Gobin C. & Landreau B., 2017. Innover pour financer la conservation de la nature en Afrique de l'Ouest et en Méditerranée. Mava, Gland, Suisse : 43 p.

Gillet P., Vermeulen C., Feintrenie F., Dessard H. & Garcia C., 2016. Quelles sont les causes de la déforestation dans le bassin du Congo ? Synthèse bibliographique et études de cas. *Biotechnol. Agron. Soc. Environ.* 20(2) : 183-194.

Hannah L., Roehrdanz P.R., Marquet P.A., *et al.*, 2020. 30% land conservation and climate action reduces tropical extinction risk by more than 50%. *Ecography* 43: 943–953.

Haurez B., 2015. Rôle du gorille des plaines de l'Ouest (*Gorilla gorilla gorilla*) dans la régénération des forêts denses humides et interaction avec l'exploitation sélective de bois d'œuvre. Thèse de doctorat, Université de Liège, Belgique.

Henson D-W., Malpas R-C., D'Udine F-A-C., 2017. Application des lois sur les espèces sauvages dans les aires protégées d'Afrique sub-saharienne. Évaluation des bonnes pratiques. Document occasionnel de la Commission de sauvegarde des espèces de l'UICN n°58. Cambridge, Royaum-Uni et Gland, Suisse : UICN. Xxiv + 68 pp. doi.org/10.2305/IUCN.CH.2017.SSC-OP.58.fr

Héritier S. & Laslaz L., 2008. Les parcs nationaux dans le monde. Protection, gestion et développement durable. ELLIPSES : 328 p.

Hiol Hiol F., Kemeuez V-A. & Konsala S., 2014. Les espaces forestiers des savanes et steppes d'Afrique centrale. *In* : de Wasseige C., Flynn J., Louppe D., Hiol Hiol F. & Mayaux P. (Eds.), Les forêts du Bassin du Congo – État des forêts 2013. Weyrich, Belgique : 165-183.

IPBES, 2019. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES secretariat, Bonn, Germany. 56 p.

Karsenty A., 2020. Géopolitique des forêts d'Afrique centrale. *Hérodote* 179 : 108-129.

Karsenty A. & Gourlet-Fleury S., 2016. Quelle efficacité environnementale des plans d'aménagement des concessions forestières ? DP-FAC, CIRAD, Montpellier, France : 4 p.

Lapeyre R., 2017. Financements innovants des aires protégées en Afrique : où est l'innovation ? https://ideas4development.org/aires-protegees-afrique-biodiversite/

Lescuyer G., Poufoun J.N., Defo L., Bastin D. & Scholte P., 2016. Does trophy hunting remain a profitable business model for conserving biodiversity in Cameroon? *International Forestry Review* 18 (S1) : 108-118. http://www.cifor.org/publications/pdf_files/articles/ALescuyer1602.pdf

Lewis C., 1996. Managing conflicts in protected areas. IUCN, Gland, Switzerland, and Cambridge, UK : xii + 100 p.

Lhoest S., Fonteyn D., Daïnou K., *et al.*, 2020. Conservation value of tropical forests: Distance to human settlements matters more than management in Central Africa. *Biological Conservation*. doi.org/10.1016/j.biocon.2019.108351

Liboum M., Guizol P., Awono A., Jungers Q., Pokem D.S.D. & Sonwa D.J., 2019. Flux financiers internationaux en faveur de la protection de la nature et de la gestion durable des forêts en Afrique centrale. *OFAC Brief* 3 : 8 p.

Maisels F., Strindberg S., Breuer T., Greer D., Jeffery K. & Stokes E., 2018. *Gorilla gorilla* ssp. *gorilla* (amended version of 2016 assessment). *The IUCN Red List of Threatened Species* 2018: e.T9406A136251508. https://dx.doi.org/10.2305

Maisels F. *et al.*, 2016. *Pan troglodytes* ssp. *troglodytes* (errata version published in 2016). The IUCN Red List of Threatened Species 2016. https://www.iucnredlist.org/species/15936/102332276

Marquant B. *et al.,* 2015. Importance des forêts d'Afrique centrale. *In* : de Wasseige C., Tadoum M., Eba'a Atyi R., Doumenge C. (Eds.), Les forêts du Bassin du Congo – Forêts et changements climatiques. Weyrich.Neufchâteu, Belgique..

Méral P., Froger G., Andriamahefazafy F. & Rabearisoa A., 2009. Le financement des aires protégées à Madagascar : de nouvelles modalités. *In* : Aubertin C. & Rodary E. (Eds.), Aires protégées, espaces durables ? IRD, Bondy, France : 135-154.

Meynard J.-M., 2017. L'agroécologie, un nouveau rapport aux savoirs et à l'innovation. *Oilseeds & fats Cops and Lipids* 24(3). DOI:10.1051/ocl/2017021

Ministère des Forêts et de la Faune (MINFOF) 2017. Secteur Forestier et Faunique du Cameroun. Faits et Chiffres 2017. http://pfbc-cbfp.org/actualites/items/Faits-chiffres.html

Moukouya P., Kasali J-L., Diamouangana J. *et al.*, 2015. Gestion participative des aires protégées au Congo, mythe ou réalité : cas de la réserve communautaire du Lac Télé. *Tropicultura* : 24-32.

Morgan D. & Sanz CM., 2007. Lignes directrices pour de meilleures pratiques en matière de réduction de l'impact de l'exploitation forestière commerciale sur les grands singes d'Afrique centrale. Gland. Suisse : Groupe de spécialistes des primates de la CSE de l'Union mondiale pour la nature : 40 p.

Nasi R., Billand A. & Van Vliet N., 2011. Empty forests, empty stomachs : bushmeats and livehoods in Congo and Amazonia Basins. *International Forestry Review* : 335-368.

National Geographic, 2017. Le Gabon crée la plus grande réserve océanique d'Afrique pour protéger la biodiversité marine. https://www.nationalgeographic.fr/environnement/2017/06/le-gabon-cree-la-plus-grande-reserve-oceanique-dafrique-pour-proteger-la

Nchoutpouen C., Asseng Zé A., Moudingo J.H. & Maloueki L. (Eds), 2017. Rapport final du forum sous-régional sur la gestion communautaire des écosystèmes de mangroves en Afrique centrale. Douala, 14-16 juin 2017. COMIFAC, Yaoundé, Cameroun : 70 p.

Ngeh C-P., Shabani A-N., Mabita M-C., Djamba K-E., 2018. La répression des crimes fauniques en RDC : comment améliorer les poursuites judiciaires ? TRAFFIC. Yaoundé, Cameroun et Cambridge, UK.

Nkoke S.C., Lagrot J.F., Ringuet S. & Milliken T., 2017. Ivory Markets in Central Africa – Market Surveys in Cameroon, Central African Republic, Congo, Democratic Republic of the Congo and Gabon: 2007, 2009, 2014/2015. TRAFFIC, Yaoundé, Cameroon and Cambridge, UK.

Oates J.-F. *et al*., 2016. *Pan troglodytes* ssp. *ellioti.* The IUCN Red List of Threatened Species 2016. https://www.iucnredlist.org/species/40014/17990330

OFAC, 2019. Renforcement de l'application de la loi sur la faune et la flore en Afrique centrale. https://www.observatoire-comifac.net/info/project/782/publish

OFAC, s.d. Démographie et développement. https://www.observatoire-comifac.net/africa/context_human

Plumptre A., Robbins M.M. & Williamson E.A., 2019. *Gorilla beringei*. The IUCN Red List of Threatened Species 2019: e.T39994A115576640

Plumptre A. *et al*., 2016. *Pan troglodytes* ssp. *schweinfurthii* (errata version published in 2016). The IUCN Red List of Threatened Species 2016. https://www.iucnredlist.org/species/15937/102329417

Pyhälä A., Osuna Orozco A. & Counsell S., 2016. Aires protégées dans le Bassin du Congo : un échec pour les peuples et la biodiversité ? The Rainforest foundation, UK : 55-60.

RADE, 2020. La protection de l'environnement par les juridictions africaines : avancées nationales et régionales. *Revue Afr. Droit Environ*. 5 : 230 p.

Roulet, P.A. 2007. La gestion communautaire de la faune sauvage comme facteur de reconsidération de la privatisation et de la marchandisation des ressources naturelles ? Le cas du tourisme cynégétique en Afrique Sub-Saharienne. *Afrique Contemporaine* 222: 129–147.

Roulet P.A., Mamang-Kanga J.P., Ndallot J., Ndomba D.L. & Nakou P., 2008. Le Tourisme cynégétique en République centrafricaine. Rapport pour Ambassade de France, Bangui, RCA.

Saura *et al.*, 2018. Protected area connectivity: Shortfalls in global targets and country-level priorities. European Commission, Joint Research Centre (JRC), , Ispra, Italy.

Scholte P. & Iyah E., 2016. Declining population of the Vulnerable common hippopotamus *Hippopotamus amphibius* in Bénoué National Park, Cameroon (1976–2013): the importance of conservation presence. *Oryx* 50: 506 – 513. http://pfbc-cbfp.org/news_en/items/Scholte-al.html

Sea Shepherd, 2016 *In* Ndjambou L.E., Lembe A.-J. & Nyinguema Ndong L.-C., 2019. Gestion des espaces maritimes et enjeux halieutiques en Afrique centrale : le cas du Gabon. https://journals.openedition.org/espacepolitique/7668#quotation

Seddon N., Sengupta S., García-Espinosa M., Hauler I., Herr D. & Rivzi A.R., 2019. Nature-based Solutions in Nationally Determined Contributions: Synthesis and recommendations for enhancing climate ambition and action by 2020. IUCN, Gland, Switzerland and University of Oxford, UK.

Shafer, C.L. 2015. Cautionary thoughts on IUCN protected area management categories V–VI. *Global Ecology and Conservation* 3: 331–348.

Spergel B. & Wells M., 2010. Les fonds fiduciaires pour la conservation comme modèles pour le financement national de la REDD+. *In* : Angelsen A. (Ed.), Réaliser la REDD+. Options stratégiques et politiques nationales. Cifor, Bogo, Indonésie : 75-84.

Stolton S., Dudley N., Avcıoğlu Çokçalışkan B. *et al.*, 2015. Values and benefits of protected areas. *In*. G. L. Worboys,M. Lockwood, A. Kothari, S. Feary and I. Pulsford (Eds). Protected Area Governance and Management. ANU Press, Canberra, Autraslia : 145-168.

Sournia S., 1990. Les aires de conservation en Afrique francophone : aujourd'hui et demain, Espaces à protéger ou espaces à partager ? *Cahiers d'Outre-Mer* 42 (172). DOI: 10.3406/caoum.1990.3361

Thouless C.R. *et al*., 2016. African Elephant status report 2016: an update from the African Elephant database.

Torquebiau E., 2007. L'agroforesterie : des arbres et des champs. L'Harmattan, Paris : 156 p.

Triplet P., Kpidiba B.K., Houehounha Dodé H.M., 2020. Aires protégées. Créer, gérer, évaluer des aires protégées.

Tyukavina A., Hansen M. C., Potapov P. , Parker D., Okpa C., Stehman S. V., Kommareddy I., Turubanova S., 2018. Congo Basin forest loss dominated by increasing smallholder clearing. Sci. Adv. 4, eaat2993

UICN, 2017. 2017 Cetacean Red List Update. https://iucn-csg.org/2017-cetacean-red-list-update/

UICN, 2015a. Résultats et effets des grands projets de conservation sur les aires protégées en Afrique du Centre et de l'Ouest. UICN/PACO, Nairobi, Kenya.

UICN, 2015b. État de référence du dispositif de conservation marine et côtière en Afrique centrale. Vers un plan de travail stratégique sur les aires marines protégées en Afrique centrale. Rapport 2015 Phase 2.

UICN, 2014. Plan d'action régional pour la conservation des gorilles de plaine de l'Ouest et des chimpanzés d'Afrique centrale 2015–2025. Groupe de spécialistes des primates de la CSE/UICN, Gland, Suisse : 60 p.

UICN, n.d. État de référence AMP AC. https://www.iucn.org/fr/r%C3%A9gions/afrique-centrale-et-occidentale/notre-travail/programme-for%C3%AAt-paco/programme-for%C3%AAts/d%C3%A9veloppement-du-m%C3%A9canisme-d%E2%80%99observation-du-littoral-ouest-africain/etat-de-r%C3%A9f%C3%A9rence-amp-ac

UNEP-WCMC, 2018. Liste des Nations Unies des aires protégées 2018 Supplément sur l'efficacité de la gestion des aires protégées. UNEP-WCMC : Cambridge, Royaume-Uni.

UNEP-WCMC & IUCN, 2021. Protected Planet: The World Database on Protected Areas (WDPA). UNEP-WCMC, Cambridge, U.-K. & IUCN, Gland, Switzerland. www.protectedplanet.net

UNESCO, 2019. Rapport d'activités du projet CAWHFI (Initiative pour le patrimoine mondial forestier d'Afrique centrale). Yaoundé, Cameroun : 60 p.

Van Vliet N., Nguinguiri J.-C., Cornelis D. & Le Bel S. (Eds), 2017., 2017. Communautés locales et utilisation durable de la faune en Afrique centrale. FAO/CIFOR/CIRAD, Libreville – Bogor -Montpellier.

Vermeulen C. & Karsenty A., 2015. Les concessions forestières des communautés locales : une avancée potentielle pour la foresterie sociale en RDC. *In* : Marysse S. & Omasombo J. (Eds.), Conjonctures Congolaises 2014. Politiques, territoires et ressources naturelles : changements et continuités. L'Harmattan, Paris, *Cahiers Africains* 86 : 97-112.

Vermeulen C. & Triplet P., 2009. Améliorer la participation des populations locales à la gestion des aires protégées. In : Triplet P. (Ed.), Manuel de gestion des aires protégées d'Afrique francophone : 228-232 .

Wabiwa Betoko I. & de Hoog A., 2021. La Belgique en Forêt Congolaise : Est-ce le Grand Retour? Greenpeace. https://www.greenpeace.org/africa/fr/communiques-de-presse/13848/la-belgique-en-foret-congolaise-est-ce-le-grand-retour/

Williamson L., 2018. Un schéma de catégorisation du braconnage. 57 : 21-22.

White L., 1998. *Baillonella toxisperma*. The IUCN Red List of Threatened Species 1998. https://www.iucnredlist.org/species/33039/9752397

WWF, 2012. Terrestrial ecoregions of the world. https://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world

Almond R.E.A., Grooten M. & Petersen T. (Eds), 2020. Living Planet Report - 2020: Bending the curve of biodiversity loss. WWF, Gland, Suisse.

Annex 1 – National protected area networks in Central Africa

Country	Terrestrial protected areas			Marine protected areas		
	Number	Area (km²)	Proportion of land (%)	Number	Area (km²)	Proportion of EEZ (%)
Burundi						
National protected areas	15	1,519	5.5			
International protected areas	4	785	2.8			
Cameroon						
National protected areas	31	40,519	8.5	+	+	+
International protected areas	12	34,154	7.2			
Congo						
National protected areas	15	38,893	11.4	+	+	+
International protected areas	17	140,599	41.1			
Gabon						
National protected areas	20	41,133	15.3	20	52,759	26.0
International protected areas	11	35,288	13.2			
Equatorial Guinea						
National protected areas	13	5,860	20.9	+	+	+
International protected areas	3	1,360	4.9			
CAR						
National protected areas	17	123,143	17.8			
International protected areas	6	38,820	6.2			
DRC						
National protected areas	55	335,851	14.3	1	216	13.4
International protected areas	12	190,619	8.1			
Rwanda						
National protected areas	4	2,337	8.9			
International protected areas	2	167	0.6			
Sao Tome and Principe						
National protected areas	2	347	34.7	+	+	+
International protected areas	2	61	6.1			
Chad						
National protected areas	13	156,206	12.2			
International protected areas	8	155,124	12.1			

Note 1: National protected areas: protected areas classified by States according to national laws and recognized by the WDPA; International protected areas: protected areas listed under the World Heritage and Ramsar conventions or part of the biosphere reserve network. These two categories partly overlap as some of the international protected areas also have national status. These overlaps have not been specified here.
Note 2: There are some mixed protected areas (terrestrial and marine) but these are counted in the terrestrial category because of the small extension of the protected coastal areas.
+ : small areas of protected coastal zones.
Source: OFAC

2

GOVERNANCE OF PROTECTED AREAS IN CENTRAL AFRICA: AN EVOLVING PROCESS

Bertille MAYEN NDIONG, Patrice BIGOMBE LOGO, Kadiri Serge BOBO and Paul SCHOLTE
With contributions from: Théophile ZOGNOU, Elie HAKIZUMWAMI, Wolf Ekkehard WAITKUWAIT, Léonidas NZIGIYIMPA, Marie SAUGET

Geopolitical borders were carved into the African landscape, forming the basis on which "modern" economic and social systems have gradually developed at the expense of traditional natural resource governance systems. The process related to the creation of protected areas has not taken this reality into account, thus carrying within itself the seeds of separation between humans and nature (Monpetit, 2013). Consequently, rural communities often have been excluded from the decision-making processes and the management of protected areas as well as the resources they relied on to survive. From being the managers of their environment, most local inhabitants have been relegated to the status of observers. Meanwhile, state, private and non-governmental actors exercised their rights over these lands. Over time, protected areas have been created and, with them, new institutions.

Despite the continued growth of protected area networks in Central Africa, as well as efforts to improve the performance of these protected areas, they do not always achieve the objectives set out. Poaching and other anthropogenic pressures continue. To respond effectively to these challenges, it is key to improve the governance of protected areas. While "good governance" – one that is shared, transparent, and effective – is a vital factor in the management effectiveness of protected areas, its absence can yield mixed results, even though significant financial, human and material resources are mobilized.

Good governance cannot be decreed, it is an evolving process involving knowledge, practices and standards that must be adapted to each context. What is the situation in Central African protected areas? Does their governance encourage effective inclusive participation of all stakeholders? By effective inclusive participation, we mean that government institutions, local communities, the private sector and civil society are involved in decision-making processes in a manner that is transparent and accountable to all relevant stakeholders.

This chapter aims to show that the governance of protected areas in Central Africa is undergoing a profound change, while also at a crossroads between consolidation and continuous improvement in some countries, and hesitation and resistance in others. The chapter provides an overview of the governance of protected areas in the subregion and the changes that have occurred over the past 30 years and concludes with recommendations for policy makers and protected area managers.

1. Protected area governance: concepts and definitions

Governance "is about who decides what is done and how those decisions are made" (Borrini-Feyerabend, 2014b). It is "the interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken and whether citizens or other stakeholders have their say" (Graham & Plumptre, 2003).

Governance:

- is neither a system of rules nor an activity, but rather a process;
- is not based on domination, but rather on trade-off;
- is not formalized, but is based on continuous interplay;
- involves both private and public actors (Smouts, 1998 in Nguinguiri, 2003).

Governance includes formal institutions and regimes with enforceable powers, as well as informal arrangements that people and institutions have agreed upon or perceive to be in their interest (Battistella *et al.*, 2012). There is no silver bullet model of protected area governance. Rather, it is a multidimensional concept that depends on a number of site-specific factors, including:

- land tenure security as a prerequisite for the success of land and natural resource governance,
- considering the diverse stakeholders, and their objectives, interests and concerns,
- the specific context of the protected area: environmental, socio-economic, institutional and political (Franks, 2018).

The International Union for Conservation of Nature (IUCN) characterizes protected areas according to four governance types (Borrini-Fayerabend, 2014a) which are determined based on the actors who hold power in decision-making (Table 1). These governance types can be applied to different types of management (Dudley, 2008). Governance and management are indeed two different and yet complementary concepts, the latter falling under "what is done to achieve the given objectives" (Borrini-Feyerabend, 2014b).

Table 1 - Types of protected area governance considered by IUCN

Public	Shared	Private	Community
Governance by the government, acting at several levels	Shared governance involving the participation of multiple rights holders	Governance by individuals or private organizations	Governance by indigenous peoples and/or local communities

Source: Borrini-Feyerabend *et al.* (2014a)

IUCN also proposes key principles for good governance, including:

- the **inclusion** of all stakeholders in decision-making, which implies a democratic dimension;
- **subsidiarity**, which promotes a "bottom-up" approach, so that collective decision-making is not disconnected from those who must comply with it;
- **transparency** in the sharing of information about decisions with all stakeholders; and
- **accountability** of decision makers to impacted and affected stakeholders (Lausche, 2012).

The analysis of governance therefore calls on official norms, actors, power play, and refers to the political, administrative and legal environment that facilitates or hinders good protected area management. It also outlines the legitimacy of decision-makers, the free and informed participation of key stakeholders in the decision-making process, and the inclusion of the views of rights-holders.

2. Policy framework for protected area governance

2.1 International conventions

The creation of protected areas is enshrined in Article 8 of the Convention on Biological Diversity (CBD), relating to in situ biodiversity conservation. In Central Africa, the Yaounde Declaration (1999) is one of the important milestones for the development of protected areas in the subregion; it is supported by the United Nations General Assembly resolution 54/214, which acknowledged the Declaration and called on the international community to support Central African countries in their forest development efforts. On 5 February 2005, the Treaty on the Sustainable Management of Forest Ecosystems in Central Africa reiterated these commitments, while integrating cooperation agreements and conventions.

These international texts are the bedrock of cooperation and exchange between the States of the subregion for better conservation of biodiversity and sustainable natural resource use. They serve as an overall framework for national protected area governance strategies, policies and programs, and include consideration of indigenous peoples and local communities. Improving the protection of biodiversity indeed requires the support of the stakeholders who directly depend on it and recognition of their traditional knowledge, while contributing to their well-being.

2.2 Intergovernmental agreements

These agreements are legal instruments signed between government representatives to establish and manage protected areas in a collaborative manner. They therefore mainly are aimed at protected areas whose governance type is "governance by government" (see section 4.2.1). The memoranda of understanding specify the management modalities for each of the areas selected for cooperation.

This is the case, for example, with the Cameroon-Congo-Central African Republic (CAR) cooperation agreement and the agreement on the free movement of personnel relating to Sangha Tri-National (TNS;

COMIFAC, 2000 & 2005), the BSB Yamoussa Agreement for the Cameroon-Chad binational complex, and the Tripartite Anti-Poaching Agreement for the Cameroon-CAR-Chad area. The implementation of these agreements is sometimes an uphill battle (see the box below on the BSB Yamoussa Agreement).

In practice, the application of these agreements is sometimes difficult, due in particular to considerations of sovereignty, but also to questions of territorial control (Ngoufo, 2013) and administrative inconsistencies, which limit the effectiveness of joint actions. In addition to these challenges, there is the question of the financial, human and material resources required for their implementation. Lastly, as each country has its own conservation and protected area laws, governance and management arrangements may differ, requiring efforts on the part of all concerned to reach a consensus.

2.3 National laws

Many traditional and modern political systems in Africa operate side by side, yet this has not yet led to a profound or sustainable mutual transformation (Kwesi, 2007). Customary law and traditional techniques for the management and protection of ecosystems and/or natural resources are part of the intangible cultural heritage of COMIFAC (Central African Forests Commission) countries. The sidelining of legal heritage on the basis of "non-Western legal cultures" remains a burning issue in the governance of protected areas in the COMIFAC area (Zognou, 2020).

From a legal perspective, the creation and management of protected areas are governed by laws that vary between countries, ranging from ministerial decisions (in the case of certain protected areas in Cameroon), to presidential decrees (in the case of Congo), to laws

Challenges in the operationalization of two international agreements concerning BSB Yamoussa

The BSB (Binational Sena-Oura - Bouba-Ndjida) Yamoussa Complex was established by the governments of Cameroon and Chad on 2 August 2011 with the signing of the agreement for the creation and joint management of the complex. It is one of the seven transboundary initiatives carried out under the lead of COMIFAC, as part of the implementation of the convergence plan for the conservation and sustainable management of Central African ecosystems.

Following major massacres of elephants in the BSB complex, the COMIFAC Council of Ministers held in N'djaména (Chad) on June 6, 2012, highlighted the importance of transboundary anti-poaching operations for the sustainable development of biodiversity in the northern part of the subregion. To this end, a roadmap for the operationalization of the BSB Agreement was developed. In addition, Cameroon, CAR and Chad signed a tripartite transboundary anti-poaching cooperation agreement in N'djamena on 8 November due to the need to develop national strategies, intensify anti-poaching efforts in each country, develop and implement a joint strategy associated with a transboundary anti-poaching action plan for the three countries.

However, it took eight years after the signing of the BSB Agreement, and six years after the signing of the transboundary anti-poaching agreement, for the very first inter-ministerial oversight body meeting of these two agreements to take place. The supervisory and arbitration committees of both agreements met in December 2019 to facilitate the operationalization of the said agreements. At the regional and provincial level, the binational and tripartite planning and implementation committees met four times between 2014 and 2017. Nonetheless, their resolutions and recommendations were not fully implemented.

(in the case of CAR and Chad) or ordinances (in the Democratic Republic of the Congo - DRC). In addition, there are differences in the processes for preparing laws and in their degree of precision (distribution of responsibilities, designation of posts to be created, determination of the origin and extent of funding, etc.).

Conflicts of jurisdiction also are critical in determining the effectiveness of legal instruments for the protection of protected areas. This is the case, for example, in Cameroon, where several ministries are involved in environmental protection: the Ministry of Environment, the Ministry of Forestry and Wildlife, the Ministry of Water and Energy and the Ministry of Tourism. This multi-layered institutional structure reinforces the lack of transparency in decision-making. It is combined with what can be termed as the " government by deceit" that makes all decisions potentially overruled or reversed depending on the interests of the stakeholders involved (Ongolo & Badoux, 2017).

Over the years, changes have occurred at the legislative and legal levels. In particular, land use has long suffered from legal uncertainty due to an overlap of various laws. In order to deal with the conflicts generated, Congo has recognized the customary land rights of local communities under certain conditions, and those of indigenous populations in an inalienable and perpetual manner. In DRC, on the other hand, property rights remain with the State, and land use can be subject to concessions.

With respect to customary use rights in the private domain of the State, such as a protected area, DRC and Congo have varying regulations. In DRC, concerning forests classified for conservation purposes, Article 16 of the Forestry Code states that local communities can only exercise their use rights in certain areas. In Congo, on the other hand, the consideration of use rights is specific to each type of protected area: in strict nature reserves, all hunting, fishing, or grazing activities are prohibited, whereas these use rights are arranged in wildlife sanctuaries and declared hunting areas (Van Vliet *et al.*, 2017).

To sum up, within the different countries of Central Africa, each country has its own laws. Governance systems are very diverse and not very transparent. Efforts to include all stakeholders in decision-making also differ, as these populations are often sidelined in protected area governance.

3. Actors with conflicting and intertwined interests

3.1 Protected area governance stakeholders

The governance of a protected area should be based on multi-stakeholder engagement that involves all key stakeholders. Since the Rio Conference in 1992, there has been a veritable explosion of new actors in the environmental field, including protected areas (Table 2). The multiplicity and superposition of (sub) regional organizations in Africa ought to play an integrative role, but all too often this creates an overlap and the coordination of actions becomes complex (Kakdeu, 2015).

In Central Africa, the implementation of a regional dynamic instigated by CEEAC (Economic Community of Central African States), COMIFAC and the Congo Basin Forest Partnership (CBFP) should, however, enable interconnection rather than integration, which would be more efficient in the management of protected areas (Ares *et al.*, 2016). Progress has been made in this direction, although actors often continue to prioritize their own private preserves and interests over open and mutually beneficial cooperation.

Table 2 – Typology of protected area governance actors

Actors	Description
Local communities	Rights holders and interest holders: communities within/around the protected area, represented through existing local leadership arrangements.
Private actors	Non-state actors with a significant interest in the socioeconomic impacts of the protected area and any associated conservation and development activities.
Organizations	Non Governmental Organizations (NGOs) or private sector organizations, whether for-profit or not, that help to ensure the sharing of costs and benefits to mitigate social conflicts.
Local government services	Stakeholders and actors from decentralized government services or decentralized authorities to whom society attributes legal or customary rights to land, water and natural resources.
Government	National agencies including conservation and environmental authorities acting as protected area managers by government agencies.

Source: adapted from Frank & Small (2016).

The Economic Commission for Africa (ECA) urges governments to play a leading role to ensure that the natural resources of their countries are exploited for the benefit of their citizens in a sustainable manner (ECA, 2012). The State is indeed the primary actor in promoting the governance of protected areas. In addition to dedicated ministries and specialized government agencies (such as the *Institut Congolais pour la Conservation de la Nature* - ICCN, in DRC), various other ministries (agriculture, animal resources, mining, defense and security, education) may collaborate – or not – on biodiversity conservation.

At a more local level, the regions, departments, urban and rural municipalities, conservation services of protected areas and declared hunting areas can be involved in governance, along with the ministries in charge of the environment, water and forests and any other sectoral administration concerned. Decentralization has been institutionalized, to a greater or lesser extent, in most Central African countries.

Technical and financial partners, including the African Parks Network (APN), the Wildlife Conservation Society (WCS), IUCN, the World Wide Fund for Nature (WWF), the European Union and the German cooperation agency are supporting various projects and programs at national and regional levels. This support can take different forms, such as grants to local communities for the development of economic activities, assistance to managers, or the organization of consultation mechanisms with local communities, etc. (UICN-PACO, 2015a).

The term "Organizations" in Table 2 refers to any grouping, association or movement formed by individuals or legal entities for profit or non-profit purposes (Bettati & Dupuy, 1986; Merle, 1982). These include NGOs and ecological associations that contribute to the protection of natural resources. Among these associations is the Tayna Gorilla Reserve (RGT), an association that manages the nature reserve of the same name in DRC (see box in section 4.1).

In addition to the conservation of natural resources, some NGOs are involved in defending human rights or the rights of indigenous peoples. By being involved in governance and decision-making, these NGOs have the opportunity to make their demands and needs heard. They also ensure the application of governance principles and the respect of international commitments made by governments. It should also be noted that, they are increasingly involved in the preparation of international documents.

In terms of the private sector's role, this is manifested by the presence of private operators, such as hunting or fishing concessionaires, managers of tourism infrastructure and other authorized economic activities, etc. Thanks to their ability to mobilize financial resources, they ensure the operation and long-term maintenance of associated economic activities.

The plurality of actors generally means a plurality of "representational configurations" and we can therefore see the emergence of power games and influence peddling within governance. In practical terms, the outcomes of governance systems are closely linked to the skills of the members of the management team, who are responsible for adapting a formal framework to a local context that has its own rules, in order to achieve the management objectives of the protected area.

On the one hand, the strict application of official regulations, often in an authoritarian manner, only leads to the exacerbation of conflicts (and even to violence and more or less arbitrary arrests). Non-inclusive management of protected areas, which can involve systematic repression of local residents, may be effective in the short term. However, it does not help to create an enabling environment for their governance in the long term, let alone better protect biological resources. On the other hand, acquiescing to little deals and monetizing compromises invariably lead to the joint corruption of stakeholders. Negotiating and sharing power appears to be the most effective and rewarding solution for all actors (Nguinguiri, 2003).

3.2 Tools to facilitate governance change in protected areas

Studies were carried out in two protected areas in Cameroon and one in Chad using the SAPA (Social Assessment for Protected Areas) methodology; this tool is presented in Chapter 4. These studies analyze the negative and positive impacts

of the protected areas on local actors. In Benoue National Park (Cameroon), local communities' perceptions of the impact of the protected area on their well-being were used to develop, together with key stakeholders, solutions to the problems of protected area governance.

The analysis also identified the level of interest and influence of each stakeholder group, including those who have little influence on decision-making related to the protected area (women, youth, minorities, migrants), but who should have more influence for the sake of equity and effectiveness in conservation. The analysis, extended to the two protected areas of BSB Yamoussa (Bouba Ndjida and Sena Oura National Parks), assessed certain aspects of governance as well as the perceptions of the various stakeholders, such as respect for the rights of communities, transparency of the process and circulation of information, as well as participation in decision-making (Table 3).

Table 3 - SAPA assessment of governance by local communities in three protected areas

Protected area	Sena Oura (Chad)	Bouba Ndjida (Cameroon)	Benoue (Cameroon)
Type of governance	By the government and shared	By the government and shared	By the government
Established	By the government at the initiative of the communities	Unilaterally by the government	Unilaterally by the government
Management mode	Operational co-management structure	Non-operational co-management structure	Existence of co-management
Governance indicators			
Respect for the rights of the rights holders	2.25	0.43	0.38
Participation in the decision-making process	1.29	0.51	0.77
Transparency and information	1.55	0.87	0.76
Impact mitigation	0.02	0.38	0.11

Note: Governance indicators were assessed on the basis of a survey of households living on the outskirts of protected areas.

The SAPA methodology has helped to improve the quality of the information collected and the ownership of the process by the communities who also wish to take their destiny into their own hands. Consultation of all the stakeholders, including conservation services and local communities, is particularly useful for sharing costs and benefits, disseminating information, promoting dialogue and shared reflection. The importance of a transparent flow of information (who gets what) also was emphasized.

In addition to SAPA, other assessment tools include IMET (Integrated Management Effectiveness Tool) and the Site-level Assessment of Governance and Equity (SAGE; see Chapter 4). One of the lessons learned from the use of these tools is the importance of clear identification and participation of all stakeholders. Only then can negotiations lead to the development and joint validation of solutions to the problems encountered in the governance of protected areas.

In general, the more effective the participation of local communities in decision-making processes, the better their input into the development of policies relevant to their own development and accountability. It also appears that programs intended to strengthen the governance of protected areas in order for them to gradually become autonomous (economic, social, ecological and institutional sustainability), should be designed to operate for approximately ten years rather than the three years planned for most projects (UICN-PACO, 2012).

4. Modes of governance: four categories and options for adaptation

4.1. Status of the governance of protected areas in Central Africa

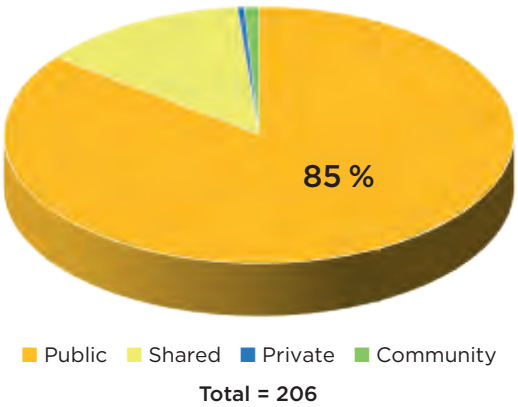
Since 1990, the governance of protected areas in the subregion has been undergoing profound changes (Table 4 and Figure 1). Although centralized public governance remains the dominant model, it has evolved significantly. In 1990, most countries managed protected areas through a government department. Taking its lead from DRC, a pioneer in this field (1934), several countries have created a state institution with independent management (institute, agency, office): Rwanda (1973), Burundi (1980), Gabon (2002), Equatorial Guinea (2002) and Congo (2012). Currently, the large majority of protected areas are managed by an agency (Figure 2).

Table 4 - Number of protected areas by governance category in Central Africa between 1990 and 2020

Year	Public		Shared		Private	Community
	Ministry	Agency	PPP	Communities		
1990	64	58	0	0	0	0
2020	69	117	26	3	1	2

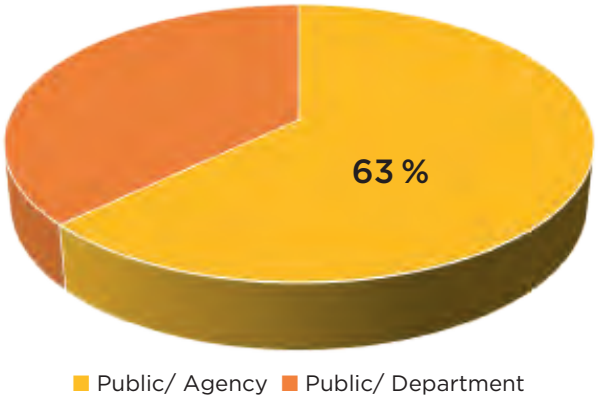
Source: OFAC.

Figure 1 - Distribution of Central African protected areas by governance category in 2020



Source: OFAC.

Figure 2 - Distribution of public governance of protected areas between government departments and agencies

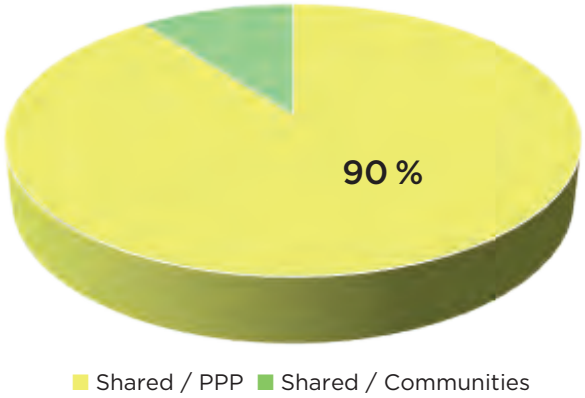


Source: OFAC.

In some cases, private non-profit organizations specialized in protected area management can support public institutions (see Chapter 3). The State, although responsible, receives support (technical and financial) from other actors, or even shares governance and delegates to them all or part of the daily management of certain protected areas.

Overall, for the past several years there has been a gradient of transfer of responsibilities from the public to the private partner, which can take several forms, including shared governance. The governance of protected areas can be shared between the State and local communities or with private partners (in the form of Public-Private Partnerships - PPP). This form of governance has expanded significantly and is the dominant form in the subregion (Figure 3). DRC has been a PPP pioneer since 2005, with the signing of two agreements for Garamba and Virunga National Parks. At the end of 2020, 14 PPP contracts were in operation and a fifteenth is under negotiation (see Chapter 3), concerning more than 20 protected areas; these PPPs are on a non-profit basis.

Figure 3 - Distribution of shared governance of protected areas between private parties (PPPs) and communities



Source: OFAC.

The sole example of private governance of a protected area seems to be the Lekedi Park in Gabon. The park, which is currently a hunting estate, is managed by a private company, the *Société d'Exploitation du Parc de la Lékédi* (SODEPAL), a subsidiary of the *Compagnie Minière de l'Ogooué* (COMILOG). It was created to maintain economic activity in the Bakoumba region after the cable car that transported manganese to the Congo stopped operating.

Tayna Nature Reserve (DRC)

P. Kakule, Tayna Nature Reserve

Born out of a desire to protect nature, the animals (including gorillas), but also the human inhabitants who depend on natural resources for their survival, Tayna Nature Reserve was created in 1998 on the initiative of the future chief conservation officer of the reserve and two traditional chiefs.

The first phase of the project was conducted in collaboration with the bami, community leaders. Through interviews, surveys and workshops, an inventory of the population's expectations and needs for the reserve was drawn up. Local communities articulated several conditions for the creation of this reserve, including its appropriation by the population and the possibility of acting for the protection of protected species, poverty reduction (thanks to the implementation of development projects, the construction of primary schools, etc.) and the integration of Tayna into the international network of protected areas.

The management of the reserve was entrusted to the Tayna Gorilla Reserve Association (RGT), created by customary chiefs and landowners in 2002. The management model chosen is a community-based management system. The board of directors of the association is made up of local chiefs, bringing together the 21 "landed" chiefs, and reports to the College of Founders, the final decision-maker. In the field, the RGT's actions are carried out by the technical team led by a coordinator. This team consists of about 60 agents spread over different sites, with technical support from ICCN.

Local authorities, such as the political-administrative and customary authorities of the Lubero territory, were involved from the onset and participated in drafting the reserve's management plan with government partners. In the beginning, this authority contributed to easing up some of the tensions that had arisen between some local leaders and project managers.

Tayna Reserve is recognized by the Congolese government as a protected area, on par with a national park. ICCN has a say in the planning of the reserve's activities, and management is entrusted to local communities. The regulations governing the reserve were designed by the stakeholders, namely local communities, traditional chiefs, political-administrative authorities, provincial representatives of government services, ICCN and project managers.

The demarcation of the reserve, done with the communities, was conducted in parallel with the RGT's implementation of support activities for various community structures in the areas of health, assistance to vulnerable people, rehabilitation of agricultural feeder roads, etc. Since the start of the Tayna project, community education and awareness-raising activities have been among the driving forces behind the development of this protected area. The objective is to achieve a better understanding and acceptance of the reserve by local communities. Tayna Community Radio and Television is an example, with two stations broadcasting environmental education programs. Another example is the establishment in 2003 of the *Université de conservation de la nature et développement de Kasugho*, which is responsible for training the daughters and sons of the land in community conservation and integrated conservation development.

Uncertain funding is negatively affecting the reserve's operations, with funding gaps sometimes leads to the abandonment of certain projects, as was the case for the micro-hydro power station. Other threats to the reserve include illegal fishing and hunting, the influence of local leaders on the population for not respecting signed protocols, the looting or destruction of equipment (including radio stations), and the political exploitation of the reserve's activities by local actors. Nevertheless, over the years, RGT has demonstrated the value of its community-based system and has gained the confidence of the government, international conservation organizations (including Dian Fossey Gorilla Fund International) and private organizations, which have provided support for the development of the reserve's actions, as well as from local communities.

Currently, the only two protected areas that appear to be under community-based governance are Tayna (see box) and Kisimba Ikobo Nature Reserves, in DRC. Since the late 1980s and early 1990s, community-based forest management has been promoted in several Central African countries (Cameroon, Gabon, DRC, etc.), with varying degrees of success (Julve *et al.*, 2007), as well as the involvement of local populations in the management of protected areas (Nguinguiri, 2004). Twenty years down the line, only a few protected areas can claim community governance or shared governance between the government and rural communities (Table 4 and Figures 1 and 3).

However, the situation is somewhat more nuanced. Without being formally called community governance, alternative models nonetheless are emerging, paving way for greater consideration and involvement of indigenous peoples and local communities in the governance and management of protected areas. It is mainly a matter of shared governance with local communities, and include the Lossi Gorilla Sanctuary in Congo, the Iyondje Bonobo Community Reserve and the Sankuru Nature Reserve in DRC. In other cases, such as the Lake Tele Reserve in Congo, governance is officially in the hands of the public authority, but an entire set of structures and procedures have been put in place to effectively involve local communities in decision-making (see boxes in section 4.2). All of this is a first step towards officially shared governance, or even governance that could eventually be delegated to rural communities.

The assessment made here corresponds mainly to terrestrial protected areas, which were the first historical models established. Marine protected areas, which are more recent, also have appeared in Central Africa since the end of the 1990s. While the governance of terrestrial protected areas is evolving towards more inclusive models, marine protected areas are all under public governance, thus limiting the possible participation of users of the maritime space.

4.2. The most common types of governance in Central Africa

4.2.1. Governance by government

Public governance of protected areas has changed significantly over the past few decades. As noted above, a majority of countries have moved from "ministry management" to "agency management". The creation of independent agencies is supposed to make protected area management more efficient, in particular with regard to finances, but also to give more confidence to donors due to a more transparent use of funds. At present, these institutions have an

improved capacity to mobilize funding, as well as better transparency and accountability. Nevertheless, in the absence of specific studies, it remains difficult to evaluate precisely the pros and cons of the two forms of public governance.

It should be noted here that these two forms of public governance remain centralized forms. Despite the decentralization processes that have been underway for several years in most countries, the governance of protected areas does not seem to be following this trend. To our knowledge, the only case of management by a decentralized state entity is the Obô de Principe Park, which is managed under the supervision of the regional government. Other territories may be moving towards decentralization, such as the Technical Operational Units (referred to by the French acronym, UTOs) set up in Cameroon, with a more or less established form of local governance (see Chapter 1), or rare cases of small protected areas created by local governments (Anonymous, 2019).

Centralized public governance traces back to the colonial era, which featured centralized management and policies that, among other things, excluded indigenous peoples and local communities from natural resource management as they were perceived to be a risk to the resources that the colonists exploited or wished to preserve. Traditional rights of ownership and management of territories that existed prior to the creation of protected areas were not taken into account. This historical form of governance often favors legal and institutional tools of repression and eviction of populations. As a result, conflicts between conservation officers and local communities are recurrent (see Chapter 1). However, this conflictual situation is not inevitable and it is possible to establish more inclusive governance. Some Central African countries have chosen to adopt a government-led governance system that still leaves room for consultation, aiming to better integrate communities and improve management efficiency. This is notably the case in DRC and Congo, although actions towards better shared governance also are being undertaken elsewhere.

In some cases, managers have established mechanisms for conflict resolution and collaboration with local communities, as in Nyungwe National Park in Rwanda. The administration there promotes environmental information and education, develops joint mechanisms for managing conflicts between communities and the park (illegal activities and animals leaving the park), and allocates 10% of the income generated from tourism in the park to socioeconomic projects chosen jointly by district representatives, park officers and sector officers. Consultation frameworks between the administration and the communities have been set up to provide adequate responses to conflicts arising from illegal activities in the protected area. Park authorities maintain partnerships with local organizations as well as private investors to establish performance contracts related to the implementation of projects that preserve the integrity of the park (Hakizumwami, 2016). Although under the jurisdiction of the State, the welfare of local communities is part of the conservation actions. Since October 2020, Nyungwe Park has switched to a new mode of governance, under a PPP contract with the NGO African Parks, which is committed to continuing these actions.

Elsewhere, administrations and their partners are going even further in sharing governance. Like all Congolese protected areas, the Lake Tele Community Reserve is, by law, under the responsibility of ACFAP (*Agence Congolaise de la Faune et des Aires Protégées*), under the supervision of the Ministry of Forest Economy, Sustainable Development and Environment (French acronym, MEFDDE). The government and WCS signed a memorandum of understanding in 2008 to allow WCS to support the management of the reserve. This management was supposed to involve local communities, notably through management committees (PAPACO, 2011; see box). This approach of co-construction of local consultation and governance bodies should eventually lead to better shared governance, the terms of which have yet to be legally validated. In 2020, the State, in conjunction with the private sector, initiated a new phase in the management of the reserve. The aim is to establish integrated community conservation of the peatland ecosystems and promote ecotourism in the area; the project is financed by the Global Environment Facility (GEF) via the World Bank and the United Nations Environment Program (UNEP).

Lake Tele Community Reserve: local community participation in question

N. Gami, Consultant anthropologist & P. Oyo, Independent consultant

Lake Tele Community Reserve (known by its French acronym RCLT), created in 2001 (decree n° 2001-220 of 10 May 2001) in Congo, covers an area of 4,389 km^2. It consists mainly of marshy and floodable forests and savannas and dry land. RCLT is included in the national list of sites under the Ramsar Convention on Wetlands of International Importance. Currently, it is part of the Lake Tele - Lake Tumba (DRC) landscape, a peatland area sequestering nearly 30 billion tons of carbon (Dargie *et al.*, 2017).

The head of RCLT is a conservation officer appointed by the Minister of Forest Economy (article 9 of the decree creating the reserve). The reserve is formally administered by a management committee and by the same officer (Article 6). WCS provides technical and financial support to the stakeholders in the management of the reserve. Unfortunately, the management committee has never met. To introduce a participatory character to RCLT's governance and management, managers set up three levels of organization:

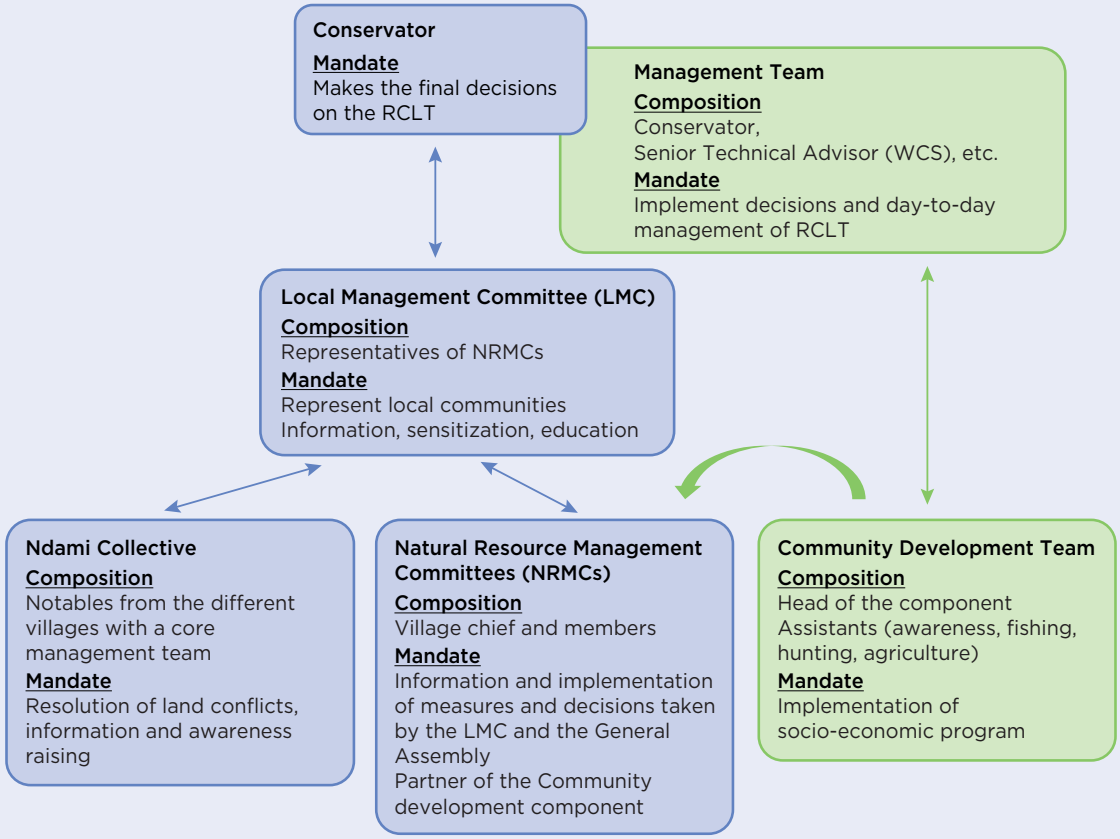
1. the **Local Management Committee** (LMC), which aims to represent the communities in the management of the reserve, and to inform, educate, communicate and disseminate information on natural resource management. The LMC is composed of people elected by the members of the Natural Resource Management Committees (NRMCs) in each village (Figure 4);
2. the ***Ndami* Collective** (*ndamis* are notables, or traditional authorities), which works in agreement with the management unit of the reserve to inform communities (such as raising awareness about savanna fires) and, above all, in the resolution of conflicts related to land tenure and good natural resource management. The members of the collective are elected according to the customary rules of the sociocultural groups living in and around the reserve, mainly the Bomitaba. This collective is not formalized administratively, but is highly respected by the inhabitants of the villages concerned;
3. The **RCLT Community Development Team**, composed of several WCS officers, working in harmony with the LMC, the *Ndamis* and the NRMCs. The members of this team helped to organize the NRMCs and the LMC and facilitated understanding of their respective missions. This team facilitates the *Ndami* Collective's missions in the field and helps the NRMC, the LMC and the *Ndami* to discuss issues related to the proper management of natural resources, particularly fisheries (responsible fishing). The team also supported fishing communities in the development and validation by various political partners (Prefect, sub-Prefect) of a framework for the development and management of wetlands.

These governance bodies were set up by reserve managers to fill the gaps in the creation decree, particularly Article 8, which excludes the communities from the management committee. According to this decree, only the conservation officer appointed by the Government has decision-making powers. Local communities only have a consultative role through the LMC, which also is the body that transmits decisions to the NRMCs or conveys their concerns. The management plan for the reserve, once validated by national authorities, will integrate the recommendation on the modification of the said decree, formalizing community governance bodies such as the LMC and the *Ndami* Collective and their roles in decision-making.

Lake Tele Community Reserve: local community participation in question

Twenty years after its publication, the decree that established the RCLT is no longer adapted to the current governance context. This text must be modified to adapt to the evolution of management and conservation concerns by including the participation of local communities in decision-making on the reserve, which is real and recognized by all parties. The practice-based approach set up by the managers, outside the traditional institutional framework but validated by the authorities concerned, currently allows local communities to participate in decision-making on the management of the RCLT through the LMC (natural resources). The modification of the creation decree must validate this shared governance, which is already effective in the field.

Figure 4 – Organization of the current governance of the Lake Télé Community Reserve



4.2.2 Shared governance and delegation of authority

Shared governance in the form of PPPs was promoted in the 1990s by the World Bank. Included in axis 5 of the COMIFAC Convergence Plan (2015-2025), this form of governance involves a larger number of actors (public and private sectors, civil society, technical and financial partners, etc.) and is a guarantee of its ownership by all stakeholders and a major asset for its success. PPPs could be a solution to some governance problems, which stem from: (i) failure to secure government operating budgets for protected areas; (ii) weak capacity of protected areas to mobilize funding at multiple levels; (iii) worsening threats and pressures on biodiversity; (iv) weak attractiveness and

economic valuation of protected areas; and (v) limitations of external funding related to program cycles (Agnangoye, 2015; Gami, 2016).

As mentioned in Chapter 3, PPP contracts can be broken down into several types, corresponding to different degrees of involvement of the private partner: from governance and management that remain the responsibility of the administration (with technical and financial support from the private partner), to sharing governance and operational management between partners, and to delegating management to the private partner under shared governance. It seems that delegation of governance to the private partner is in no case the norm; it remains, at the minimum, shared.

PPPs currently represent about 12% of protected area governance in Central Africa (Table 4 and Figure 1). A detailed presentation and discussion of PPPs is provided in Chapter 3; only a few specific cases will be noted here. Following the positive results achieved by the partnership established at Odzala-Kokoua National Park (see box), Congo extended this initiative to Nouabale-Ndoki National Park working with WCS (including the creation of the Nouabale-Ndoki Foundation based on the model of the Odzala-Kokoua Foundation). Another agreement is underway with the NGO *Noé* for Conkouati-Douli National Park.

The Odzala-Kokoua Foundation's governance model allows local communities to make their voices heard and to participate in decision-making (Figure 5). However, this form of governance, concentrated in a few "hands", raises questions of both representativeness and social acceptance. Indeed, in local cultures, decisions are still often made out in the open, in full view of everyone. Furthermore, the fact that only two people, although elected, represent more than 70 associations and several thousand inhabitants implies the establishment of a relationship of trust between the representatives and the inhabitants. This requires good communication, but also the appropriation and development of a certain democratic culture which is not always evident in these societies (Cogels, 2008). Nevertheless, experiences such as that of Odzala-Kokoua contribute to this democratic learning and provide lessons for other partnership governance projects.

PPP: the example of Odzala-Kokoua National Park (Congo)

N. Gami, Consultant anthropologist

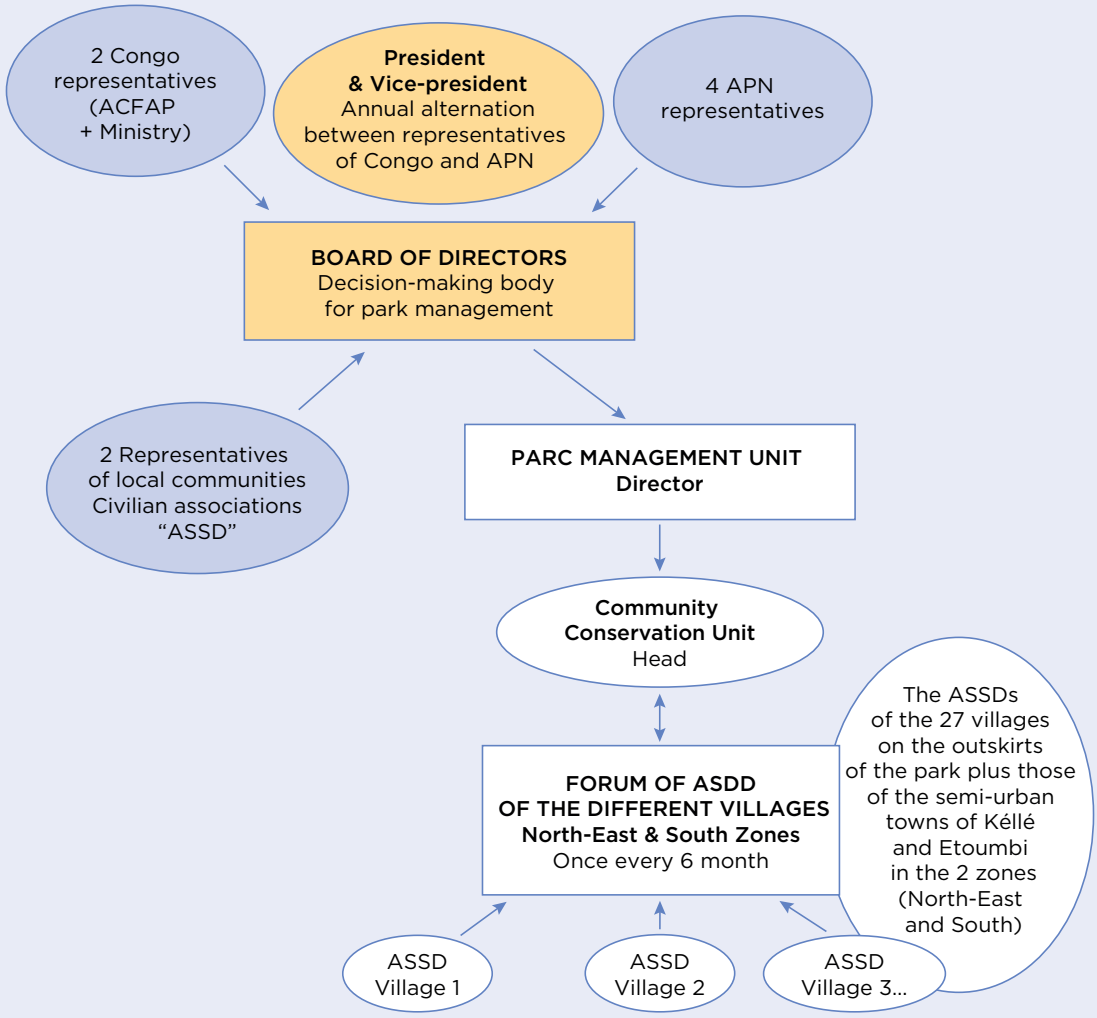
Odzala-Kokoua National Park (known by its French acronym PNOK), which was established on 13 April 1935, is one of the earliest protected areas in Congo, and has been a biosphere reserve since 1977. To improve the park's governance and the effectiveness of its management, the Congolese government, through the MEFDDE, signed a PPP agreement in 2010 with APN for the management of PNOK over a 25-year period. APN aims to contribute to the government's efforts regarding the social and economic development of local communities and the development of income-generating activities, but also in activities likely to contribute to the conservation and sustainable management of the park's natural resources.

The Odzala-Kokoua Foundation was created to provide funding and management of the park. At the end of 2020, its Board of Directors was made up of representatives of the Ministry, APN and the local communities. The communities living on the outskirts of the park are organized in each village into an Association for Surveillance and Sustainable Development (ASSD), officially recognized by the Congolese authorities (including the sub-prefectures of Mbomo, Etoumbi, Kellé and Makoua). These ASSDs elect two people to represent them on the Foundation's Board of Directors (Figure 5). These representatives are elected democratically at the general assemblies of the village associations after everyone has campaigned. The communities can now have a voice in the management of

the park and participate in discussions on the selection and funding of micro development projects in the various "villages."

Two information exchange platforms, called "fora", bring together the representatives of the 71 ASSDs after each board meeting to exchange information and record complaints and advice. After each forum, the two community representatives convey the complaints of the communities to the Board of Directors and participate in other discussions regarding park management. This partnership approach has made it possible to improve the participation of the various stakeholders, in particular the local communities, in park management and the development of tourism. Indeed, APN works with the Platner Foundation through the Congo Conservation Company (CCC), which has tourism concessions in the park. CCC develops lodges, works with tour operators around the world, and provides training and capacity building for young men and women from local communities in the tourism business. Another benefit for the communities is earning a share of the income generated by tourism and its use in community micro-projects. Nevertheless, communities still require support in the formulation of projects of community interest to make the best use of their share of tourism revenues, with a view to improving their living conditions.

Figure 5 – Decision-making and management bodies of Odzala-Kokoua Park



Among the benefits brought by the implementation of shared governance, there is a reduction in the workload between actors, an increase in the skills of the various stakeholders, and a sharing and understanding of each other's perspectives, etc. In terms more directly of conservation, synergy between government representatives and local stakeholders can help create alliances to address unsustainable exploitation of natural resources by entities outside the protected area (Borrini-Fayerabend *et al.*, 2010). However, this assumes that parties involved can get to know each other, work together, and develop a shared vision for the future of the protected area.

Among the protected areas under official shared governance between the State and rural communities, the Lossi Gorilla Sanctuary is a precursor in Central Africa (see box). It is the first protected area created by official decree at the request of local communities - the Mboko Allengui communities. Under Congolese law, as in other countries, the administration in charge of protected areas (ACFAP) holds the governance and management power. The decree provides for a form of partnership (to be defined) with the communities, which could theoretically allow for shared governance. However, the communities are only involved in governance at the pleasure of the administration. This creates an asymmetrical relationship between the two partners from the outset, which can hinder collaboration; nevertheless, these challenges could be overcome if the official authority is proactive in sharing governance.

Elsewhere, particularly in DRC, local communities also have been behind the emergence of protected areas, such as the Yiondje Bonobo Community Reserve, which came into existence in 2012 after several years of work. As in the case of Lossi, the government conservation agency (ICCN) is the official manager. However, collaborative governance was set up thanks to *La Forêt des Bonobos* Association, created by and for the communities. This association also is supported by two international organizations, the African Wildlife Foundation (AWF) and the Wamba Committee for Bonobo Research (WCBR). Another shared governance reserve, Sankuru Nature Reserve, the largest bonobo reserve in DRC, continues to experience heavy deforestation that is endangering the closest relative to humans. These problems appear to be a result of insufficient support and participation on the part of local communities as well as unresolved land conflicts (Volckhausen, 2019).

In the Luki (DRC) and Dimonika (Congo) biosphere reserves, WWF promoted the establishment of shared governance systems. This process has lasted several years and has demonstrated the importance of a protocol to which all stakeholders

Lossi Gorilla Sanctuary (Congo): current governance

N. Gami, Consultant anthropologist

An original and innovative story

In northern Congo spanning 350 km², the Lossi Gorilla Sanctuary lies in the south of the Odzala-Kokoua National Park. Between 1992 and 1997, a lowland gorilla (*Gorilla gorilla gorilla*) habituation experiment took place, supported by Central African Forest Ecosystems program (ECOFAC), funded by the European Union (Gami, 2003).

The site chosen covers clan lands of the Mboko Alengui communities. These have a very strong sense of land ownership, managed by the rights holders. Hence, rules based on customary law set out the terms of inheritance or land appropriation by individuals. The gorilla habituation pilot experiment, in interaction with foreign researchers and with the support of an anthropologist, led to the creation in Congo, for the first time, of a protected area at the request of the local community owning the land (1996).

This local community is explicitly involved in the management of the gorilla sanctuary, including decision making and the sharing of revenues generated by ecotourism. The modalities of participation - a first in Congo - are specified in Decree No. 2001-222 of 10 May 2001, establishing the sanctuary (Articles 3 and 11). Article 11 stipulates in particular: "A memorandum of understanding sets out the forms of involvement of the local community, the partnership model to be put in place and the nature of the benefits derived by the village communities in the management of the sanctuary".

What has become of this pilot experiment in the Congo?

Unfortunately, following the devastating effects of the Ebola epidemics, the communities now feel abandoned. Indeed, in December 2001, the first Ebola hemorrhagic fever epidemic in the Congo broke out in the Districts of Mbomo and Kellé. Several more outbreaks followed until 2005, resulting in the deaths of more than 80 local people, as well as gorillas and chimpanzees (OMS, 2021). These outbreaks led to the loss of the habituated gorilla group, which was named "Apollo". This group was the sanctuary's main tourism attraction, bringing in significant revenue for the communities.

Following these epidemics, the support needed to sustain this pilot experience disappeared. The primatology researchers left the area and moved to the outskirts of the sanctuary, and the financial support that the project initially received dried up. A government-appointed conservation officer oversees the Sanctuary, but there is a serious lack of financial and logistical resources to revitalize the site. And shared governance is at a standstill.

The Lossi Sanctuary is a good example of the lack of long-term vision and support needed for the establishment of shared, or even community, governance of some protected areas in Central Africa. This sanctuary needs to be revitalized through financial and technical support to restore the confidence of the Mboko Alengui community and enable them to reclaim the future of the site. While a minimum of financial resources is required, support to local communities is particularly important in terms of institutions, governance, management and planning, the resumption of the habituation of gorilla groups and the revival of tourism activities. The community cannot face all of these challenges alone.

adhere. These experiences have led WWF to develop a guide for managers and policy makers to help them develop shared governance systems in protected areas (WWF, 2013).

One of the main expected outcomes of all these shared local governance projects is a change in the behavior of local communities, leading to greater acceptance of conservation actions and protected areas; shared governance of natural resources can be more effective than governance that excludes rural communities (Kairu *et al.*, 2021). However, this objective faces several difficulties, including the expectation of tangible benefits that would enable communities to escape the extreme poverty in which they are trapped. Moreover, in many cases, the populations concerned take a wait and see approach at best. Resistance to proposed changes is frequent, and generally only a few leaders support them.

The forms of shared governance that have been set up in the subregion in recent years can be seen as an opportunity to collaborate and strengthen the skills of those sharing the responsibility, namely local communities. The Lossi experience, as well as other similar experiences that followed, shows that the inclusion of communities requires, in particular, time and support in terms of training and management (preparing even a simple management plan or a business plan cannot be improvised). Special support in terms of the sustainable development of the protected area's biodiversity also is needed, whether this involve ecotourism (see Chapter 8), the development of ecosystem services (carbon, watershed protection) or the use of certain natural resources (when this is tolerated). In too many cases, communities are being led to believe that they can expect benefits from the establishment of protected areas, but they are not being provided with the means or support to realize these expectations.

These obstacles can only be overcome with medium to long-term institutionalized support from the State and development partners (planning, organization, legal recognition, law enforcement, information and training, etc.). Governance and local development projects cannot be considered without a link to national planning for sustainable development and land use, nor without support from national structures. Devolution of responsibilities cannot mean abandonment; structural reforms cannot "rest on the shoulders of farmers alone" (Joiris & Bigombé Logo, 2008).

4.2.3 Private governance

Private governance is the granting of "control" and/or "ownership" of protected areas to private entities or individuals (see section 3.1). In Central Africa, land is generally collectively owned, and it is the State's responsibility to delegate governance. These private actors may include individuals or conservation NGOs, who purchase and privatize land for natural resource conservation. These actors also may have financial interests in these protected areas. They can effectively develop ecotourism activities but also benefit from taxes and fees related to their land (Fouth *et al,* 2017).

In the subregion, the only protected area under private governance is Lekedi Park (see section 4.1), but small areas also may be linked to this form of governance, such as arboretums created by private initiatives (in Burundi, for example). Apart from protected areas stricto sensu, hunting zones, dedicated to the sustainable exploitation of large fauna through sport hunting, make it possible to examine models of private governance - or those that are close to it - and to draw lessons from them for the benefit of protected areas (Table 5). Indeed, ZICs (the French acronym for *Zones d'Intérêt Cynégétique*, or zones of hunting interest) are a crucial element in the development of the large fauna management network, especially in Cameroon and CAR (see Chapter 1).

These ZICs are usually leased by private parties, often expatriate individuals or companies, or even by rural communities. While the governance of these ZICs is legally a matter of "shared governance" with the government, it is often de facto privatized. Indeed, apart from the specifications formulated by the public party, the private party often has a great deal of room of leeway at the decision-making level.

Generally speaking, private governance is seen by some protected area managers as a source of problems, insofar as field experiences have shown, particularly in North Cameroon, that some private operators often do not respect their terms of reference. Moreover, this mixture of control and ownership leaves much open to interpretation (Calaque, 2017).

Table 5 - Governance and management of hunting areas in Central Africa

Country	Type of governance or management	Mode (denomination)	Features	Strengths	Weaknesses	Source
Cameroon, North	Shared governance [1] of hunting	Private (ZIC)	5-year lease, renewable. Specifications are limited to payments and instructions on many of the infrastructures (roads and buildings). "The leaseholder must manage the area as a good environmentalist, with the constant objective of finding the right trophy to satisfy the clients while preserving and maintaining the wildlife capital at an optimal level."	High level of investment thanks to the long leasing period (>>5 years). Autonomy of management with the possibility of a good quality of management.	Little control over the quality of management. Image of "little white king" Terms of reference that do not include other land uses (ecosystem services such as carbon credit, other forms of tourism, etc.). Majority of areas (heavily) degraded (see map chapter 1).	Lescuyer *et al.*, 2016 [2]
	Shared governance	Communal (ZIC-C)	Management contracted out to the private sector.	See above (private mode)	Areas with high human pressure, very marginal in terms of wildlife potential, highly degraded (see map chapter 1)	
	Shared governance	Community (ZIC-GC)	Almost all of them without activity (see map chapter 1).	Diversification of the image.		
Cameroon, South	Delegated hunting management	Private (ZIC)	Hunting activity is superimposed on forestry, the real managers of the area being the forestry companies.	This is a secondary activity, which also explains its viability, as the management of the area is the responsibility of the forestry companies.	Presence of the leaseholder ≤3 months per year.	Lescuyer *et al.* 2016 [2], MINFOF 2012
	Delegated hunting management	Community (ZIC-GC)		Good image of the communities. Areas with some wildlife potential.	Virtually no wildlife management	
Congo	Delegated hunting management	Private (DC)	The forestry industry is the dominant activity in the area.			UNEP-WCMC & IUCN 2021

Country	Type of governance or management	Mode (denomination)	Features	Strengths	Weaknesses	Source
Gabon	Delegated hunting management	Private (DC)	Sport hunting closed			UNEP-WCMC & IUCN 2021
CAR, North/East	Shared governance	Private (ZC)	At present, almost all are inactive. Recent decline in wildlife potential.	Large areas. Potential to open up to other land uses (ecosystem services, vision tourism, etc.)	Little control over the quality of management. Image of "little white king". Need to open up to other land uses (ecosystem services such as carbon credit, other forms of tourism, etc.). Level of degradation.	Roulet *et al.* 2008 [2]
	Shared governance	Community (ZCV)	Majority not active. Recently reduced wildlife potential. Governed by a tripartite memorandum of understanding (State, community, hunting guide), valid for 10 years.	Areas near national parks. Before the crisis (2013) with some economic potential (>140,000 €/year).	Slowness in opening up to other land uses (ecosystem services such as carbon credit, other forms of tourism, etc.). Despite the potential before the crisis, management costs far exceeded the benefits. Level of degradation.	Roulet *et al.*2008 [2], Bouche *et al.* 2009
CAR, South/West	Delegated hunting management	Private (ZC)	The forestry industry is the dominant activity in the area. Presence of the leaseholder ≤3 months per year.		Little wildlife management.	Roulet *et al.* 2008 [2]
	Delegated hunting management	Community (ZCV)	Same for private.		Little wildlife management.	Roulet *et al.* 2008 [2]
DRC	Delegated hunting management	Private (DC)	Large area, ICCN data (2021) suggest even more sites (27), however inactive. Overlaps with other land uses.		High level of degradation with little wildlife potential	ICCN 2021 UNEP-WCMC & IUCN 2021
Chad	Delegated hunting management	Private (DC)	Large areas with relatively low wildlife density	Wildlife potential, integration with Greater Zakouma	Little control over the quality of management.	UNEP-WCMC & IUCN 2021

DC: hunting estate (from the French *Domaine de Chasse*); ZC: hunting zone (*Zone Cynégétique*); ZCV: village hunting zone (*Zone Cynégétique Villageoise*); ZIC: zone of hunting interest (*Zone d'Intérêt Cynégétique*); ZIC-C: communal ZIC (*Zone d'Intérêt Cynégétique-Communale*); ZIC-GC: community managed ZIC (*Zone d'Intérêt Cynégétique-Gestion Communautaire*). French acronyms have been kept as they are widely used in the countries.

[1]: Shared governance means, in fact, freedom of decision making on the part of the lease holder. This is mainly due to the duration of the lease, which is generally very long (>> 5-10 years) and the absence of the State in the vicinity. This gives the lease holder a large flexibility in decision making that goes beyond the mere responsibility of management itself.

[2]: The hunting areas in Cameroon and CAR, unlike those of Congo, Gabon and DRC, are not included in the World Database of Protected Areas (WDPA; UNEP-WCMC & IUCN, 2021).

Mbou-Mon-Tour: an example of community biodiversity governance in DRC

V. Omasombo and J.-C. Bokika-Ngawolo, MMT, V. Narat, CNRS

The Congolese NGO Mbou-Mon-Tour (MMT) operates mainly in the North Bateke chiefdom, Bolobo Territory, Mai-Ndombe Province (DRC). Following local observations of dwindling animal resources, this NGO was created in 1997, initially as a development NGO, to set up alternative subsistence activities. In 2001, MMT focused on the conservation of an emblematic species: the bonobo (*Pan paniscus*), whose presence was confirmed in 2005 by WWF.

The initiators of the project were villagers who either were from the area originally or were living there. After experiencing a great deal of criticism and mistrust from various "classic" conservation actors, MMT gradually succeeded in becoming a key player by proposing an innovative model for the conservation of bonobos in DRC and, more generally, of great apes in Central Africa.

It quickly became apparent that the local communities were not in favor of creating a reserve or of extending the Tumba-Lediima reserve, as they wished to prevent the area from becoming a classified forest under the Congolese forestry code and being shifted to central governance. In order to be able to create a community conservation area, MMT relied on the Congolese forestry code, and in particular article 22, which stipulates: *"A local community may, at its request, obtain as a forest concession all or part of the protected forests among those usually owned by custom"*. The objective of creating this "forest concession" was community biodiversity conservation and not artisanal timber exploitation, as is often proposed for the creation of community forests.

The creation process lasted approximately ten years, in parallel with the progress made in the production of regulatory texts relating to the modalities of allocation and management of Local Community Forest Concessions (LCFC). The decree setting out the terms and conditions of allocation was signed in 2014, and the ministerial order specifying the terms and conditions management was signed in 2016. In 2017, the Governor of the Mai-Ndombe Province signed the decrees granting the status of "LCFCs for bonobo conservation" to six villages in the area, collectively named the Mbali River LCFCs, for a total area of 18 km^2 instead of the 500 km^2 originally requested.

The boundaries, management rules and major orientations of these LCFCs were defined by the villagers themselves at a general assembly. Participatory community governance was established, and in 2020 the inhabitants of the villages concerned elected the members of the three governance bodies from among their population. The Management Committee is the executive and technical body in charge of the daily management of the Mbali River LCFC, in accordance with the resolutions and orientations of the General Assembly to which it reports. The Monitoring Committee is responsible for monitoring and evaluating the management activities of the forest concession. The Committee of Elders is the body for consultation, prevention and settlement of conflicts related to the management, use and operation of the concession and the sharing of the resulting benefits. Prior to the establishment of these committees, MMT brought together traditional chiefs and representatives of the local population to define the rules of management, in accordance with legal requirements and in respect of local customs and practices.

Following this initiative, several neighboring villages have asked MMT to replicate the process. This could lead to a national network of LCFCs promoting the conservation of bonobos and biodiversity in general.

How in effect can it be ensured that the private partner, who has different interests from those of the government, will be able to play its role as a "good" manager of large wildlife and the environment in which they live, while developing a profitable economic activity? This question mirrors one raised previously in forestry, which has given rise to legislation on sustainable forestry and third-party certification (Lescuyer, 2006).

The objectives of ZICs, and especially community-managed ZICs, concern the development of sport hunting and a better distribution of revenues related to this activity (Van Vliet *et al.*, 2017). In Cameroon, the adoption of participatory management as a strong focus of forest policy has led to the establishment of a number of pilot community-management initiatives. Notwithstanding the relatively complex process of creating community-managed ZICs, their establishment has had the advantage, particularly in southern Cameroon, of providing communities with a better structure for wildlife and income management, of encouraging the consideration of minorities and aspects related to female representation in wildlife management, of facilitating their awareness of the challenges of sustainable wildlife management, and of generating tangible financial benefits within the communities, which are used for the implementation of development projects. However, this initiative has weaknesses, such as the low capacity for monitoring and community ownership in the implementation of micro-projects (supply of animal proteins, aquaculture, beekeeping, etc.), the low level of collective action (individualism is still high) and the lack of transparency in the management of the benefits.

4.2.4 Governance by indigenous peoples and local communities

Introduced in the 1980s, this type of governance advocates a participatory approach to biodiversity conservation and raises the issue of the real power granted to local and indigenous populations. These communities may have different profiles, for example they may be sedentary or mobile, with customary and/or legal rights over the area concerned. The holding of rights, responsibility and authority by communities, through agreed rules, in effect can be quite complex. Multi-level governance, coupled with the political instability found in many Central African countries, also constitutes a major obstacle to the effective involvement of local communities alongside other conservation actors.

However, there are several examples of individuals, social groups and communities working together for the sustainable use of natural resources (Nianogo, 2010). In 2020, two protected areas benefited from community governance: Tayna (see box in section 4.1) and Kisimba Ikobo, both in DRC. However, other conservation initiatives are being developed through community forestry, which allows governance and management of forests to be assigned to rural communities. Using these legal provisions, various forests are being or have been conceded to communities for conservation and enhancement of forest ecosystem services, in Cameroon but especially in DRC. This is the case of the Mbali River forest, developed by the NGO Mbou-Mon-Tour (see box). This type of initiative, driven from the outset by the rural communities themselves, can inspire the creation of community-based protected areas.

5. Challenges related to the implementation of protected area governance in Central Africa

To tackle biodiversity loss in Central Africa, reforms are needed to improve the governance of protected areas (Zognou, 2020; COMIFAC-JICA, 2020). As we have seen, this governance is evolving, with an increasing mobilization of technical and financial partners through PPPs and a timid sharing of responsibilities with rural communities.

Biodiversity conservation cannot be managed in a disembodied way, and it involves a multitude of situations that must be managed on a case-by-case basis and the inclusion of local stakeholders (Boissière & Doumenge, 2008; Borrini-Feyerabend *et al.*, 2014a). However, very often, strict conservation is the main management tool and governance remains in the hands of centralized state entities. Highly centralized institutions want to maintain their power over territories and resources; they often are reluctant to decentralize and devolve governance. This reflects an apparent gap between the rhetoric of participatory management and the reality of governance in many protected areas (Petursson & Vedeld, 2017).

Paradoxically, any policy of decentralization and devolution of responsibilities also requires a strong central power. However, this power must be exercised in other ways, by setting a legal and regulatory framework, by specifying the main principles of sustainable development and the framework for land use planning, by supporting local actors and by playing its role of monitoring-evaluation-sanction, etc. On the other hand, the legal status of protected areas and their ecological importance must be considered. Indeed, it could be quite possible that the State retains governance and management responsibility for protected areas of national interest (such as national parks), but favors the devolution of responsibilities for protected areas of more local interest or with a conservation status allowing the exploitation of natural resources by local communities (protected areas in categories IV and VI of the IUCN classification, for example).

The development of PPPs allows weak states to meet their national and international commitments by injecting more technical and financial resources into protected area management. Private partners have understood that it is necessary to guarantee the application of laws but also to set up mechanisms allowing local communities to benefit from the resources of protected areas (financial and other). However, this support should, on the one hand, enable public services to strengthen their skills and operating capacities and, on the other hand, facilitate the devolution of certain responsibilities to local communities. The ultimate objective is to strengthen the skills, capacities and responsibilities of national actors in the long term (COMIFAC, n.d.; see also Chapter 3).

The training of protected area managers also is an important issue, as it largely determines the effectiveness of management and its ability to adapt to contexts. Significant efforts are still required to overhaul staff training and to make it more consistent with environmental and social conditions and to the responsibilities of the various job positions. In addition, there is a need to improve working conditions to attract and retain staff.

In Central Africa, public service managers are, for the most part, engineers or technical staff of water, forests and hunting departments. Their capacity to use protected area management tools still need to be improved with regard to the development of management plans and business plans, monitoring the implementation of management plans, assessing management effectiveness, fundraising, partnership development, management (staff, equipment, finances), monitoring of bio-ecological indicators, etc. This situation is exacerbated by a lack of teachers specializing in the management of wildlife and protected areas.

Web-based MOOCs (Massive Open Online Courses), such as those offered by IUCN (UICN-PAPACO, 2021), are important complements to traditional training, but they do not replace on-the-job training. Similarly, specialized training programs offered by universities and engineering schools do not offer enough internships to students, which would allow them to gain experience in the field and discover their future profession in a more concrete manner (UICN-PACO, 2015b). Moreover, the training of these state managers does not yet include enough social sciences or the teaching of facilitation and participatory management tools.

The greater involvement of rural and indigenous communities in the governance and management of protected areas also requires appropriate teaching. In particular, these lessons must be more widely co-constructed with the learners and integrate their own knowledge and skills. Even more than for managers in administrations, continuous training and regular support programs are needed, which requires training to be imagined in a totally different way from the basic training that is usually offered.

6. Proposals to improve the governance of Central African protected areas

6.1 The need for appropriate and operational legislation

The legal framework for the governance of protected areas dates back to the colonial period (Bigombe Logo *et al.*, 2020). Various founding texts (London Treaty of 1900, 1947 decree regulating hunting, etc.) established the sovereignty of the colonial State over wildlife management and the consecration of protected areas, in the modern sense of the term (Kamto, 1991), as instruments for the preservation of species and the conservation of biological diversity. After independence, the Central African States adopted legislation which, although new, was still largely inherited from these old texts.

The Rio Summit in 1992 and the holding of several World Parks Congresses have created favorable conditions for the integration and participation of populations and civil society in the governance of protected areas. These texts reaffirm the sovereignty of States in the management of protected areas, while strictly regulating the rights granted to biodiversity conservation organizations and to local and indigenous populations: conditions of collaboration for protected area management, recognition of customary use rights, participation in the governance protected area institutions, etc.

Currently, these structural schemes are revealing their limitations (Nguiffo & Talla, 2010), as we have seen in the case of the Lake Télé Reserve. On the one hand, they are failing to halt the decline of wildlife, continued poaching and the erosion of biodiversity. On the other hand, they do not allow protected areas to respond effectively to the legitimate expectations of States and local communities. This situation can be explained by several factors, such as the increase in populations (notably migrations) on the edges or in protected areas, the advisory and non-decisional role attributed to certain organizations from indigenous populations and local communities, and the conflicts that still persist between certain communities and managers.

The effective governance of protected areas in Central Africa therefore requires a thorough overhaul, with revision and adaptation of the related legal framework. This process must promote and fine tune the framework for shared governance of protected areas between States, biodiversity conservation organizations, civil society and local and indigenous populations. Among other things, the reform should translate into the implementation of simplified and coherent statute laws and by-laws that are customized and operational. This new approach must include the recognition of traditional legal heritage, the development of an approach to biodiversity conservation based on the respect for human rights, and the revamping of the regional institutional coordination of protected areas management in the subregion. In the context of the implementation of shared governance or governance by indigenous peoples and local communities, it is important to ensure that all representative bodies of these populations acquire a legal status so that their participation is formally recorded in the statutes of the protected area.

6.2 Respect for human rights and an increased role for communities in the governance of protected areas

This approach is based on the premise that incorporating internationally recognized human rights into biodiversity conservation programs and activities is a solid foundation for effective biodiversity conservation outcomes (Campese *et al.*, 2009). It is an approach that challenges the structural conflict between protected areas and local and indigenous communities (Greiber *et al.*, 2009). It makes local and indigenous communities the key actors and ultimate beneficiaries of biodiversity conservation.

This inclusive conservation is promoted and supported today by the Conservation and Human Rights Initiative, the Secretariat of the UN Convention on Biological Diversity and the GEF-7, as an alternative to the classic model of conservation versus people.

The human rights referred to here are standards that aim to protect people from serious political, legal, social and other abuses. It is essential to ensure that these rights (Table 6), whether fundamental, procedural or customary, are systematically taken into account whenever they may be affected, either in relation to conservation objectives or in the event of tensions or conflicts between "rights holders" and "duty bearers" in biodiversity conservation activities.

Table 6 - Human rights affected by biodiversity conservation

Fundamental rights
Life
Health
Adequate standard of living including food
Water
Development
Practice of own culture
Work
Property
Self-determination and use of natural resources
Procedural rights
Information
Participation
Access to justice and redress

The rights of indigenous peoples
Traditional lands, territories and resources
Self-determination
Land and resource management
Development and equitable benefit sharing
Traditional knowledge and indigenous heritage
Compensation
Emerging issues
Environmental rights (intergenerational)
Protection against forced evictions
Access to land/basic resources
Free, Prior and Informed Consent (FPIC)

Source: adapted from Greiber *et al.* (2009).

In order progress further, indigenous people and local communities must become aware of their rights and, in parallel, of the challenges of protected area conservation. These populations need to know their rights better so that they can make their voices heard. This will allow them to become actors of change for the implementation of governance where they would be able to play a full role. In addition, environmental and conservation awareness helps to improve the dialogue between conservationists and rural communities, and ideally to build acceptance of the need for a protected area. In the long run, this may have the effect of limiting conflicts between managers and these populations.

6.3 Rebuilding institutional coordination at all territorial levels

The improvement of the governance of protected areas also requires the reorganization of the regional institutional coordination of the Central African protected area network. Better coordination of the work of the various cooperation actors involved in protected area complexes (often transboundary) is a guarantee of efficiency and success. For example, in the case of the BSB Yamoussa Complex, the two protected areas concerned (Bouba-Ndjida and Sena Oura) have a different type of governance (shared; see section 3.2) from that of the complex itself (state). Faced with such a situation, transboundary cooperation and coordination are needed to achieve the objectives of each protected area at the individual level and the complex at the binational level.

A wide range of actors are involved in the governance and management of protected areas. This abundance of actors, if not well synergized, can reduce the effectiveness of regional cooperation actions due to redundant or contradictory actions. The establishment and/or strengthening of consultation and coordination frameworks at various levels (meetings, sharing of experiences, legal agreements, etc.) is essential to better coordinate actions, harmonize interventions and seek synergy between all stakeholders.

Administrative decentralization, which is a slow but necessary process for integrated natural resource management, is still in its infancy in the subregion and needs active support from regional actors; the same applies to the devolution of responsibilities to the right territorial level, from local to national. The establishment of decentralized territorial authorities and the empowerment of local actors (communities, etc.) should make it possible to avoid duplication of efforts by encouraging a search for complementarity and by orienting interventions according to the defined objectives. This would allow for a progressive empowerment of local actors in the management of protected areas, the harmonization of interventions and approaches, and the optimization of the mobilization of human, technical and financial resources.

6.4 Stakeholder support

As we have seen previously, technical, material, financial and human support over the medium-long term is key to setting up a governance that is better shared between various stakeholders. Project-based programming spanning three to five years is not adapted to this need and is even counterproductive. Public planning, cooperation agreements, actions to support rural communities, etc., must be programmed over a minimum of ten years. Supporting the establishment of a community-based protected area or the involvement of indigenous populations in the shared management of a protected area cannot be considered in the context of short projects. Governments and supporting financial institutions need to reform their procedures, while maintaining adaptive guidance based on regular assessments.

Another element that we have mentioned concerns training. In order to facilitate the evolution of protected area governance towards more equity and justice, the development of training, whether through workshops, internships, or short courses for example, must be considered. The training courses dedicated to future protected area managers, whether they are university courses or not (for example, short MOOC-style courses or other types), can be improved in a number of ways. It appears that new graduates lack practical experience and knowledge of the field, knowledge of how to manage the budgets they will be responsible for and understanding of relations with other stakeholders. Moreover, the involvement of rural actors, who are often poorly trained or even illiterate (but in possession of incomparable knowledge

and skills), requires an in-depth rethinking of the training system so that it becomes more participatory and applied, with a carefully planned pedagogical progression, adapted to local contexts (see the description of the Tayna reserve initiative in section 4.1). Finally, continuous training targeted to the needs of managers and other personnel must be implemented, along with plans to help skills progress.

7. Conclusion

In Central Africa, we have seen that the governance systems of protected areas are complex, based on complex interactions between institutional structures and actors with divergent and overlapping interests and norms. Over the past thirty years, these systems have evolved significantly, although in different ways. Public governance is now leaning more towards governance by an independent agency rather than a ministerial department. Shared governance has developed but mainly in the framework of public-private partnerships with international organizations. The sharing of responsibilities with local communities is being tested in various sites but is still in its infancy. Finally, one protected area with private governance and two with community governance were identified.

Thus, the governance of protected areas in the subregion is undergoing profound change. Central Africa is now at a crossroads in finding the right governance model reflecting the realities of the variety of human and ecological contexts. Although there is still a long way to go, in some cases it is increasing welfare and social equity for people and significantly reducing threats and pressures on protected areas.

What appears to be a fundamental condition today is the pursuit of reforms within governance systems so that they match local contexts. Given the considerable weight of traditional customs and practices and the esteem in which the institution of traditional chieftaincy is held, as well as the dogma of religion within communities bordering protected areas, it is desirable that reform action be put in place to make traditional norms more compatible with the requirements of modern governance of protected areas (Bigombe Logo, 2012; Kwesi, 2007).

Since the 1990s, international institutions such as the World Bank have been encouraging the establishment of governance systems that include all stakeholders (notably shared governance). In reality, shared governance was developed in the PPP framework with international actors, but has been slow to take shape with rural communities. Despite the commitments made by governments, many protected areas are still under government governance (85%),or have government representatives on their governance body (almost 100%). Cameroon, CAR, Sao Tome and Principe and Chad only have protected areas whose governance is a centralized state model (ministry); the other countries have switched to a governance by agency model.

However, the growth of shared private and community governance systems is involving a greater number of actors and constitutes a step towards the better integration of protected areas in multi-actor territorial management. Shared governance can be observed within ZICs and involves private actors but also communities and decentralized administrations. Private governance as such remains almost non-existent (except, in fact, in some ZICs), which is a major difference with southern Africa, for example (Bauer *et al.* 2020). As for community governance of protected areas, it is slowly emerging, particularly in DRC and Congo, which are pioneers in this regard.

Whether the model in question is one of shared governance or governance by indigenous peoples and local communities, models that include these communities hold the greatest potential for positive impacts on natural resource conservation and on the well-being of people. By taking their needs and rights into account, the risks of conflicts between these communities and protected areas are limited. When local communities become actors in the governance and management of protected areas, other governance actors can benefit from their know-how and their hands-on knowledge of the natural environment and its specific characteristics.

It is not enough to engage in dialogue with the local communities. It is essential to give legitimacy to their voice by supporting them in the development of the skills they need to participate in the protected area governance, to officially recognize their status as rights holders, and to give them a role in the decision-making process. As we have seen in this chapter, many protected areas are currently moving in this direction, but none has proven yet to propose a sufficiently successful system in terms of effective local communities' involvement. Enabling these communities to participate effectively in the governance and decision making of protected areas that are part of their living environment continues to be a major challenge for the countries of Central Africa.

Bibliography

Agnangoye J-P., 2015. Expériences de gestion des aires protégées en mode partenariat public-privé (PPP) : leçons apprises en Afrique centrale. Présentation aux JAP5 du RAPAC, Yaoundé, Cameroun.

Anonyme, 2019. La province de l'Équateur signe un partenariat avec une association pour gérer la réserve communautaire des Bonobo à Basankusu. Radio Okapi. https://www.radiookapi.net/2019/05/13/actualite/societe/la-province-de-lequateur-signe-un-partenariat-avec-une-association-pour

Ares M., Boulanger E. & Deblock C., 2016. Intégration ou interconnexion ?. *Revue Interventions économiques* 55. http://journals.openedition.org/interventionseconomiques/2895

Battistella D., Petiteville F., Smouts M.C. & Vennesson P., 2012. Dictionnaire des Relations Internationales. Troisième édition. Dalloz, Paris : 572 p.

Bauer H. Chardonnet B., Scholte P., *et al.*, 2020. Consider divergent regional perspectives to enhance wildlife conservation across Africa. *Nature Ecol. Evol.* 5 : 149-152.

Bettati M. & Dupuy P.M. (Eds.), 1986. Les ONG et le droit international. *Politique étrangère* 51(3) : 818-819.

Bigombe Logo P., 2012. La valorisation des connaissances traditionnelles et locales dans l'aménagement forestier et la conservation de la biodiversité en Afrique centrale. *In* : Villeneuve C. (Eds.). Forêts et humains : une communauté de destins. Pièges et opportunités de l'économie verte pour le développement durable et l'éradication de la pauvreté. Institut de l'Energie et de l'Environnement (IEPF), OIF et UQAC. : 19-24.

Bigombe Logo P., Sinang J.J. & Zo'obo Y., 2020. Les racines coloniales de la gestion des ressources forestières et fauniques au Cameroun. *In* : Batibonak P.R. (Ed.), Indépendances inachevées en Afrique. Les chemins de la reconquête. Éditions Monange, Yaoundé, Cameroun : 167-192.

Boissière M. & Doumenge C., 2008. Entre marginalisation et démagogie : quelle place reste-t-il pour les communautés locales dans les aires protégées ? *Les Cahiers d'Outre-Mer* 244 : 459-488.

Borrini-Feyerabend G. *et al.*, 2010. En Gouvernance Partagée ! Un guide pratique pour les aires marines protégées en Afrique de l'Ouest. PRCM, UICN & CEESP, Dakar, Sénégal.

Borrini-Feyerabend G., Dudley N., Jaeger T., Lassen B., Broome N.P., Phillips A. & Sandwith T., 2014a. Gouvernance des aires protégées : de la compréhension à l'action. Coll. Lignes directrices sur les meilleures pratiques pour les aires protégées 20, UICN, Gland, Suisse : 123 p.

Borrini-Feyerabend G., Bueno P., Hay-Edie T., Lang B., Rastogi A & Sandwith T., 2014b. Lexique sur la gouvernance des aires protégées et conservées. Congrès Mondial des Parcs 2014 UICN, Gland, Suisse.

Bouche P., Bache A.Z, Yakata M., Chendra A. & Nzapa Beti R., 2009. Les zones cynégétiques villageoises du Nord de la République centrafricaine, 15 ans déjà. https://ecofaune.org/IMG/pdf/bouche_zcv_15_ans_2009.pdf

Calaque R., 2017. Gouvernance des aires protégées en Afrique centrale : concepts pour améliorer la légitimité et l'efficacité des aires protégées, OFAC, RAPAC, COMIFAC.

Campese J., Sunderland T., Greiber T. & Oviedo G., 2009. Rights-based approaches. Exploring issues and opportunities for conservation. IUCN & CIFOR, Bogor, Indonesia : 334 p.

Cogels S., 2008. Le lien entre gouvernance environnementale et gestion participative est-il viable ? Critique d'un modèle projectif incluant le secteur privé : cas d'un projet d'exploitation minière au Katanga. *In* : Arnoldussen D., Binot A., Joiris D.V. & Trefon T. (Eds.), Gouvernance et environnement en Afrique centrale : le modèle participatif en question. Musée Royal de l'Afrique centrale, Tervuren, Belgique : 39-50.

CEA, 2012. L'économie verte dans le contexte du développement durable et de l'élimination de la pauvreté : Quelles sont les implications pour l'Afrique ? Commission Economique pour l'Afrique, Addis Abeba, Ethiopie. http://hdl.handle.net/10855/21117

COMIFAC, 2005. Protocole d'accord pour la circulation du personnel TNS. Ministres en charge des forêts du Cameroun, du Congo et de RCA : 4 p.

COMIFAC, 2000. Accord de coopération entre les gouvernements de la République du Cameroun, de la République centrafricaine et de la République du Congo relatif à la mise en place du Tri-national de la Sangha. Ministres en charge des forêts du Cameroun, du Congo et de RCA : 10 p.

COMIFAC, s.d. Directives sous-régionales sur la participation des populations locales et autochtones et des ONG à la gestion durable des forêts d'Afrique centrale. COMIFAC, Yaoundé, Cameroun. Série Politique 3 : 45 p.

COMIFAC-JICA., 2020. Guide de gestion collaborative des aires protégées transfrontalières au travers de la valorisation des Produits Forestiers Non Ligneux. COMIFAC-JICA, Yaoundé, Cameroun.

Dargie G.C., Lewis S.L., Lawson I.T., Mitchard E.T.A, Page S.E., Bocko Y.E. & Ifo S.A., 2017. Age, extent and carbon storage of the central Congo Basin peatland complex. *Nature* 542 : 86-103.

Dudley, 2008. Lignes directrices pour l'application des catégories de gestion aux aires protégées. UICN, Gland, Suisse : X + 96 p.

Fouth D., Nkolo M. & Scholte P., 2017. Analyse des modèles de gouvernance des aires protégées et autres aires de conservation. Expériences pratiques des projets/programmes de la GIZ en Afrique. GIZ, Kinshasa, RDC : 53 p.

Franks P., 2018. Analyse des modèles de gouvernance des aires protégées non étatiques au Kenya. IIED, UICN-PACO.

Franks P. & Small R., 2016. Évaluation sociale pour les aires protégées (SAPA). Guide méthodologique à l'intention des facilitateurs SAPA. IIED, Londres.

Gami N., 2016. Le partenariat public-privé (PPP) dans les aires protégées du Bassin du Congo. L'exemple du parc national d'Odzala-Kokoua en République du Congo. *In* : Buttoud, G. & Nguinguiri J-C., La gestion inclusive des forêts d'Afrique centrale. Passer de la participation au partage des pouvoirs. FAO, Libreville, Gabon & CIFOR, Bogor, Indonésie : 35-44.

Gami N., 2003. Le sanctuaire de Gorilles de Lossi (Congo). Les leçons d'une démarche participative. Cirad, Libreville, Gabon. Série Forafri 23 : 82 p.

Graham J.B. & Plumptre T., 2003. Governance principles for protected areas in the 21st century. A discussion paper. Institute on Governance, Canada Parks and Canadian Agency for International Development, Ottawa.

Greiber T., Janki M., Orellana M., Savaresi A. & Shelton D., 2009. Conservation with Justice. A Rights-based Approach. IUCN, Gland, Switzerland : 115 p.

Hakizumwami E., 2016. Rapport de mission d'échange d'expérience sur la gouvernance et la valorisation des aires protégées forestières au Rwanda. UICN-PACO.

ICCN, 2021. Domaines de chasse. Kinshas, RDC. https://www.iccnrdc.org/chasse.html

Joiris D.V. & Bigombé Logo P., 2008. Dynamiques participatives et développement local dans la bassin congolais. Des rendez-vous manqués ? *In* : Arnoldussen D., Binot A., Joiris D.V. & Trefon T. (Eds.), Gouvernance et environnement en Afrique centrale : le modèle participatif en question. Musée Royal de l'Afrique centrale, Tervuren, Belgique : 21-37.

Julve C., Vandenhaute M., Vermeulen C., Castadot B., Ekobeck H. & Delvingt W., 2007. Séduisante théorie, douloureuse pratique : la foresterie communautaire camerounaise en butte à sa propre législation. *Parcs et Réserves* 62(2) : 18-24.

Kairu A., Kotut K., Mbeche R. & Kairo J., 2021. Participatory forestry improves mangrove forest management in Kenya. *International Forestry Review* 23(1) : .

Kamto, 1991. Les conventions régionales sur la conservation de la nature et des ressources naturelles en Afrique et leur mise en œuvre. *Revue juridique de l'environnement* 4 : 417-442. https://www.persee.fr/doc/rjenv_0397-0299_1991_num_16_4_2739

Kakdeu L-M., 2015. Les organisations sous régionales freinent l'intégration africaine. Libre Afrique. Un regard alternatif sur le continent. Atlas Economic Research Foundation. www.LibreAfrique.org

Kwesi J., 2007. Intégrer les autorités traditionnelles dans les systèmes de gouvernement démocratique : le défi de la réforme de la dualité. Colloque IRG/ARGA de Bamako, Mali.

Lausche B., 2012. Lignes directrices pour la législation des aires protégées. UICN, Gland, Suisse : 406 p.

Lescuyer G., Poufoun J.N., Defo L., Bastin D. & Scholte P., 2016. Does trophy hunting remain a profitable business model for conserving biodiversity in Cameroon? *International Forestry Review* 18 (S1) : 108-118.

Lescuyer G., 2006. Des critères de bonne gestion forestière à la certification des concessions : le Bassin du Congo au centre des débats. in "Exploitation et gestion durable des forêts en Afrique centrale". D.Ezzine de Blas, R.Nasi, J.C.Nguinguiri (Eds.), L'Harmattan, Paris, 369-88

Merle M., 1982. Sociologie de relations internationales. Troisème édition. *Politique étrangère* 47(4) : 1042-1044.

MINFOF, 2012. Mise en place des territoires de chasse gérés par les communautés. Capitalisation des expériences de l'UTO Sud-Est. République du Cameroun, Ministère des forêts et de la faune.

Monpetit S., 2013. Les aires protégées transfrontalières : au-delà de la conservation de la biodiversité. Sherbrooke, Canada.

Nianogo A., 2010. Preface. *In* : Borrini-Feyerabend G., Chatelain C., Hosh G. *et al*. Gouvernance Partagée ! Un guide pratique pour les aires marines protégées en Afrique de l'Ouest. PRCM, UICN & CEESP, Dakar, Sénégal.

Nguiffo S.A. & Talla M., 2010. La législation relative à la faune sauvage au Cameroun : entre usages locaux et perception légale. *Unasylva* 236 (61) : 14-18.

Nguinguiri J.-C., 2004. Gouvernance des aires protégées dans le Bassin du Congo : principes et pratiques. International Symposium Tropical Forests in a Changing Global Context, Brussels, 8-9 November, 2004. Royal Academy of Overseas Sciences & Unesco,: 127-137.

Nguinguiri J.C., 2003. Gouvernance des aires protégées : l'importance des « normes pratiques » de régulation de la gestion locale pour la faisabilité des réformes dans le bassin du Congo. *Bulletin de l'APAD*.

Ngoufo R., 2013. Etude sur la capitalisation des expériences d'aires protégées transfrontalières en Afrique centrale. COMIFAC, Yaoundé, Cameroun : 42 p.

OMS, 2021. Fièvre hémorragique à virus Ebola au Congo. https://www.who.int/countries/cog/areas/ebola/fr/ (accédé le 13/01/2021)

Ongolo S. & Badoux M., 2017. Gouverner par la ruse. L'État camerounais face aux exigences internationales de conservation de la biodiversité. *In* : Compagnon D. *et al.* (Eds.), Les politiques de biodiversité. Presses de Sciences Po (P.F.N.S.P.) « Académique » : 127-147.

PAPACO, 2011. Réserve communautaire du Lac Télé. UICN, Programme Aires Protégées d'Afrique et Conservation (PAPACO). https://papaco.org/fr/wp-content/uploads/2015/07/METT-Reserve-communautaire-Lac-Tele.pdf

Petursson J.G. & Vedeld P., 2017. Rhetoric and reality in protected area governance: Institutional change under different conservation discourses in Mount Elgon National Park, Uganda. *Ecological Economics* 131 : 166–177.

Roulet P.A., Mamang-Kanga J.P., Ndallot J., Ndomba D.L. & Nakou P., 2008. Le Tourisme cynégétique en République centrafricaine. Rapport Ambassade de France, Bangui, RCA.

UICN-PACO, 2012. Acteurs et gouvernance des aires protégées d'Afrique de l'Ouest : quelle contribution à la conservation ? UICN-PACO, Ouagadougou, Burkina Faso : 171 p.

UICN-PACO, 2015a. Gouvernance efficace des ressources naturelles et lutte contre la pauvreté : Rapport annul 2014. UICN-PACO, Ouagadougou, Burkina Faso : 44 p.

UICN-PACO, 2015b. UICN-PACO, Ouagadougou, Burkina Faso : 52 p.

UICN-PAPACO, 2021. MOOC Conservation. https://mooc-conservation.org/

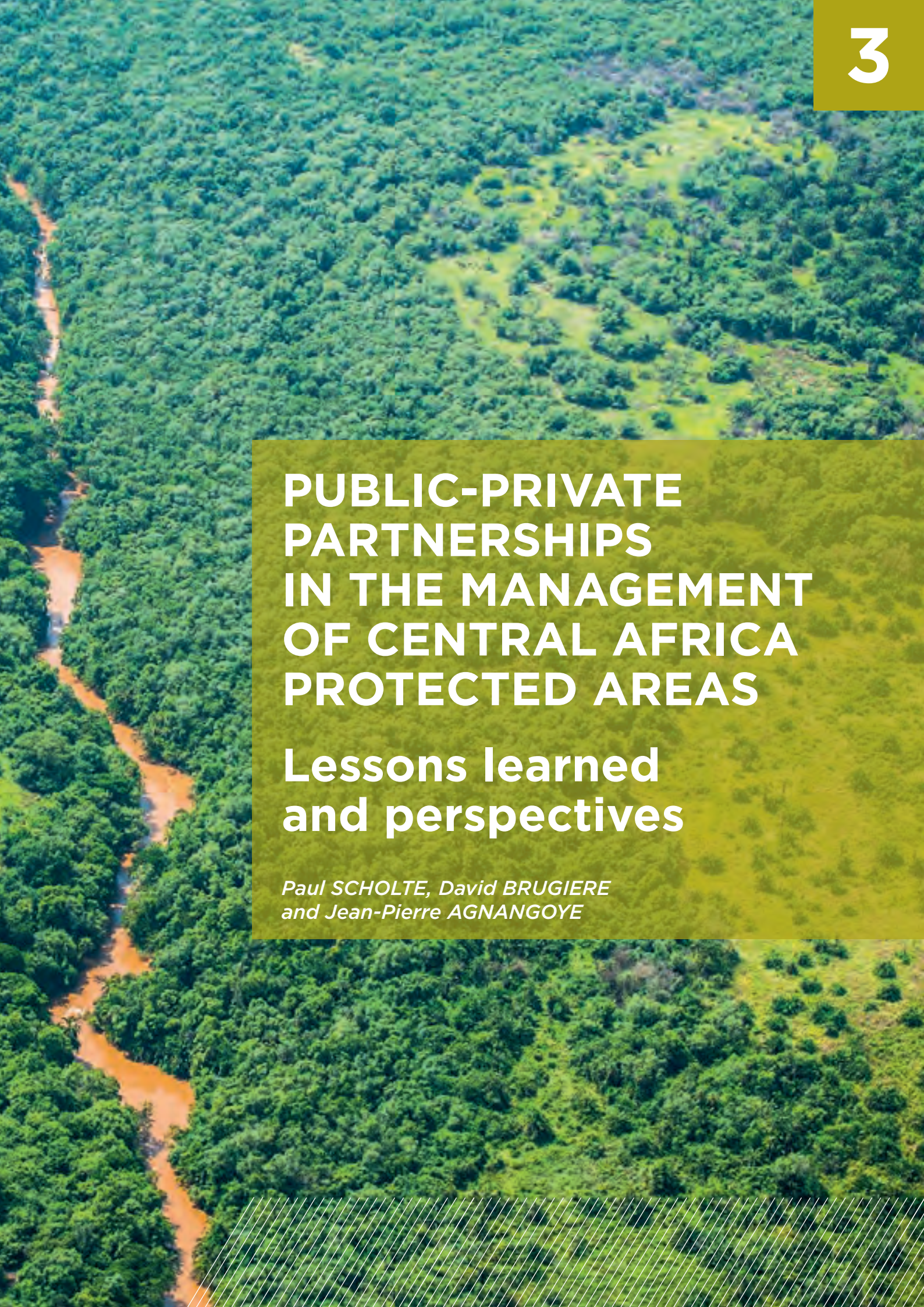
UNEP-WCMC & IUCN, 2021. Protected Planet: The World Database on Protected Areas (WDPA). UNEP-WCMC, Cambridge, U.-K. & IUCN. www.protectedplanet.net

Van Vliet N., Nguinguiri J.-C., Cornelis D. & Le Bel S. (Eds.), 2017. Communautés locales et utilisation durable de la faune en Afrique centrale. FAO, Libreville, Gabon, Cifor, Bogor, Indonésie & CIRAD, Montpellier, France.

Volckhausen T., 2019. Les mesures de conservation des bonobos entravées par la déforestation et les violations des droits humains. *Mongabay*. https://fr.mongabay.com/2019/12/les-mesures-de-conservation-des-bonobos-entravees-par-la-deforestation-et-les-violations-des-droits-humains/

WWF, 2013. Gestion participative des ressources naturelles dans les réserves de biosphère. L'expérience du WWF dans les réserves de Luki, Yangambi (RDC) et Dimonika (République du Congo). https://wwf.be/assets/Uploads/Images/PROJECTS/LUKI/Guide-de-gestion-participative-des-aires-protegees-en-RDC-259916.pdf

Zognou T., 2020. Vers une gouvernance efficace des aires protégées dans l'espace COMIFAC. COMIFAC, Yaoundé, Cameroun.



3

PUBLIC-PRIVATE PARTNERSHIPS IN THE MANAGEMENT OF CENTRAL AFRICA PROTECTED AREAS

Lessons learned and perspectives

Paul SCHOLTE, David BRUGIERE and Jean-Pierre AGNANGOYE

Wildlife populations in protected areas have long remained relatively stable in Central Africa (Scholte, 2011). This situation is rapidly changing, and Central Africa is now confronted with declining and even collapsing wildlife populations. Since the 1980s, most of the dry savanna protected areas have lost 80% of their antelope populations, with declines in the sub-humid savanna protected areas occurring since the 1990s (Plumptre *et al.*, 2007; Scholte, 2013). Lions have gone extinct in over 60% of protected areas in West and Central Africa over the last forty years (Brugière *et al.*, 2016). Long-term surveys of forest wildlife show more recent rapid declines: for example, forest elephant populations that have dropped by 60% between 2002 and 2011, including in protected areas (Maisels *et al.*, 2013). Amongst several underlying drivers or root causes of these changes, we earlier identified: 1) poor incentives, including wildlife laws, regulations, conflicts and corruption, which limit investing in wildlife conservation, and 2) chronic underfunding, most Central African protected areas running on an estimated 10% of the necessary funds (Balmford *et al.*, 2003; Norton-Griffiths, 2007; Scholte, 2011; Scholte *et al.*, 2018).

Partnerships with private organizations have been suggested to be a means to address the root causes, i.e., "poor incentives" and "underfunding", as not-for-profit organizations generally are distinguished by their technical expertise and credibility in the eyes of international funding agencies compared to often highly centralized bureaucratic governmental organizations (Hatchwell, 2014; Saporiti, 2006; Baghai *et al.*, 2018; Scholte *et al.*, 2018). Since the early 2000s, protected area authorities in some 12 countries in sub-Saharan Africa have delegated park management to international non-governmental private partners. While Malawi and Zambia led the way in Southern Africa to adopt such partnerships, Central African countries hesitated to embrace delegated management to help restore their parks. Delegated management has long been perceived as "allowing foreigners to take over our national parks". Doubts about its feasibility and desirability continues to reign amongst protected areas authorities in Central African countries, such as Cameroon and Gabon.

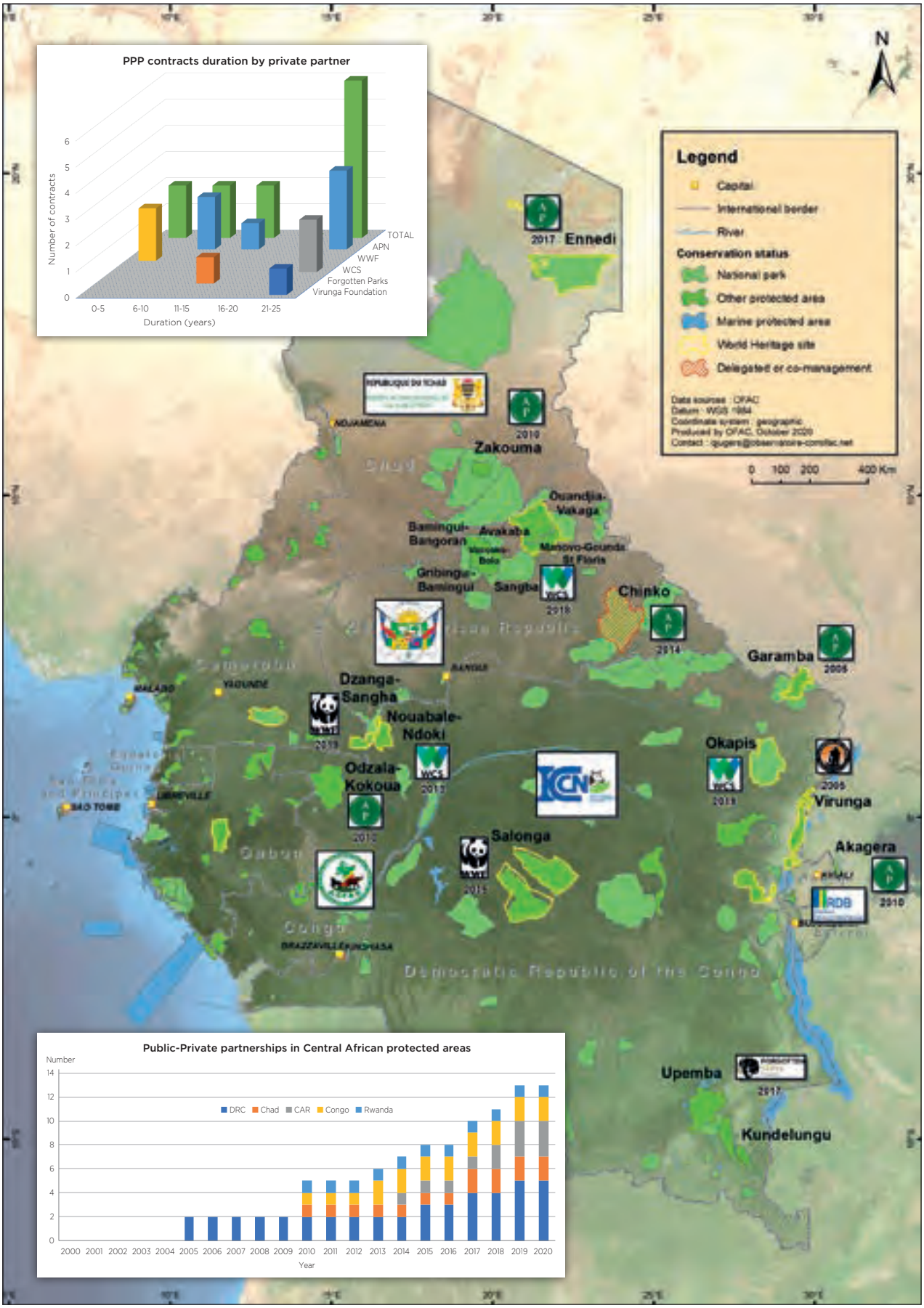
In 2005, the Democratic Republic of the Congo (DRC) took the lead in Central Africa, contracting African Parks Network (APN) for the management of Garamba National Park and Virunga Foundation for the management of Virunga National Park. Since 2010, the DRC has been joined by an increasing number of Central African countries, such as Chad, Rwanda, Congo and Central African Republic (CAR), which have initiated Public-Private Partnerships (PPP) (Figure 1). As of July 2020, 13 partnerships have been contracted (the 14th at Nyungwe National Park in Rwanda is imminent), managing a total area of c. 205,000 km^2, the size of Senegal. The presently concluded contracts will allow, pending further studies and developments, this area to increase to c. 306,000 km^2.

A decade after their start, reviews of PPP experiences have started to appear, with Southern African countries taking the lead (Nyirenda & Nkhata, 2013). However, our understanding of the efficiency of such partnerships and of how law enforcement, normally an exclusive governmental responsibility, needs to be handled, remains poor (Hatchwell, 2014).

In Central Africa, DRC has been particularly active in discussing the experiences it developed during the first years of delegated management. These discussions figured prominently at the annually held CoCo-Congo (Community Conservation Congo) conference in 2013-2015, where the *Institut Congolais pour la Conservation de la Nature* (ICCN), the protected areas authority, met up with its partners to discuss ongoing topics.

In 2014, regional discussions were initiated by the Network of Central African Protected Areas (RAPAC) in Douala, Cameroon. The Central African Forests Commission (COMIFAC) joined to organize exchanges at a subregional level in Central Africa,

Figure 1 – Public-private partnerships in the management of Central Africa protected areas



aiming at learning from delegated management experiences, with a training on PPP and protected areas. In November 2016, alongside the 16th meeting of the Congo Basin Forest Partnership (CBFP) held in Kigali (Rwanda), RAPAC brought various stakeholders of the subregion together to share views on delegated management of protected areas. In October 2017, actors involved in the management of Deng Deng National Park (created as an offset of a hydroelectric scheme), in close collaboration with the hydroelectric company, organized a national meeting to keep Cameroonian authorities informed about experiences with delegated management.

In December 2017, the Sub-working group on protected areas and wildlife (SGAPFS) of COMIFAC took the initiative to develop "Best practices for the management of protected areas through public-private partnerships in Central Africa". This process incorporated two workshops (December 2017 in Libreville, and April 2018 in Douala) resulting in guidelines that were further developed, published and adopted by COMIFAC's Board of Ministers in July 2019 (COMIFAC, 2018).

Alongside these initiatives, we collected details on Central African protected areas partnerships, compiled external evaluations from the partnerships and tried to draw further lessons. This allowed a first comparison with protected areas partnerships elsewhere in Africa, highlighting regional differences and possible solutions (Scholte *et al.*, 2018).

The present chapter builds on these PPP review initiatives, presents new data on partnership contracts, and provides subsequent insights that may assist the further development of these partnerships. It thereby provides an overview of partnership experiences and allows to draw lessons from this form of management as it applies to the specific ecological and socio-economic context of Central Africa. This should lead to a deeper understanding of delegated management and allow governmental bodies to be in a better position to take informed decisions on possible delegated management of one or more of its protected areas. And, should they do so, prepare themselves accordingly.

We start off reviewing the differences between management and governance (section 1). Our focus subsequently turns to defining the different possible types of management. We provide, in the form of a map, charts and tables, an overview of the 13 management agreements thus far contracted, and emphasize the sensitive issues of how law enforcement has been undertaken under such partnerships as well as how funding is being dealt with (section 2). In the following section (3), we provide an analysis of experiences with delegated management by using evaluations of these partnership contracts and the SWOT method (Strengths, Weaknesses, Opportunities and Threats) from the point of view of (governmental) experts and delegated management specialists with different backgrounds and affiliations. In the last section (4), we explore improved practices and models in which the COMIFAC guide on best-practices plays a central role. In addition, other PPP initiatives are discussed, especially in outsourcing tourism operations in national parks. We end this chapter with a number of conclusions and recommendations for the further development of PPPs.

1. Management types of protected areas

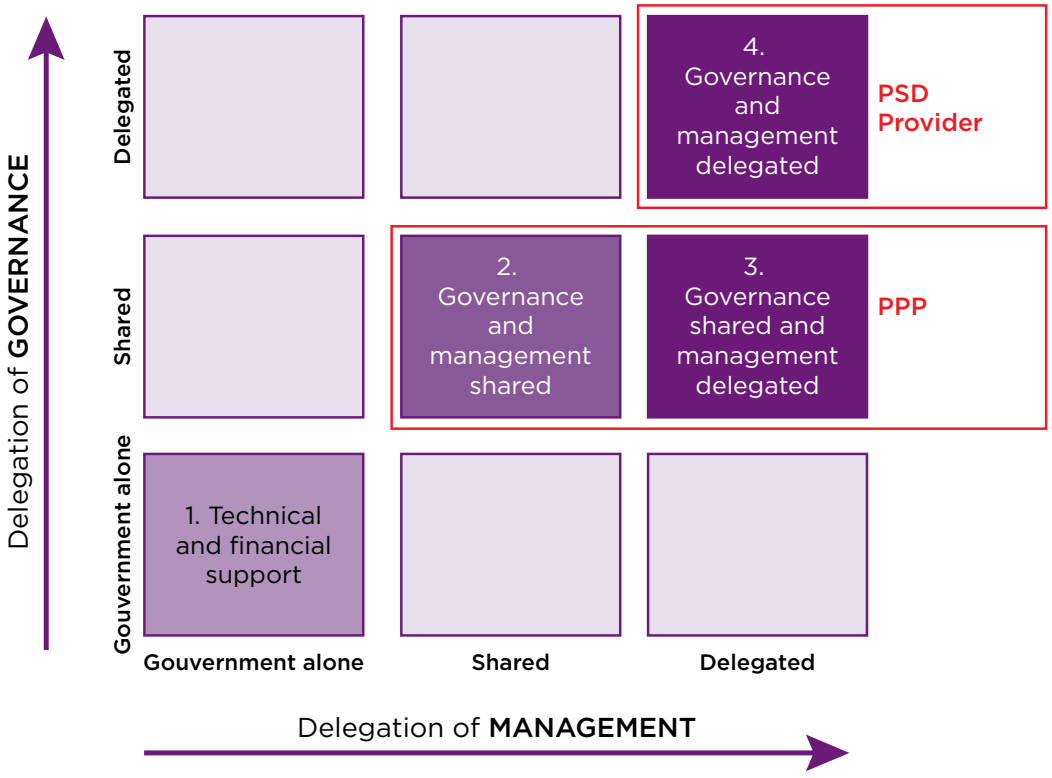
1.1 Sovereignty, ownership, governance and management

We concentrate in this chapter on partnerships that delegate operational management of a protected areas to a private partner, and generally share governance between the public and private partners. Before discussing these differences, it is important to keep in mind the overarching dimensions of sovereignty and ownership which concern all protected areas. Each country is sovereign in its legislation that all, including management and governance bodies, have to comply with, be it under private or state management, governance or ownership. Ownership of all protected areas in Central Africa lies, to the best of our knowledge, with the State. The State may be represented by the ministry in charge of wildlife or a dissolved body such as an "agency" or "office" in charge of protected areas.

In Chapter 2, the governance of protected areas in Central Africa was presented, and we refer back to it for specific details. For our discussion about PPP management modes, we refer to the framework provided in Figure 2. There are three variations of governance and management arrangements, namely:

1. Strategic governance and operational management are shared between the public partner and the private partner;
2. Strategic governance is shared between the public partner and the private partner and operational management is delegated to the private partner. This is the main partnership mode considered in this chapter;
3. Strategic governance and operational management are delegated to the private partner.

Figure 2 – Modes of strategic governance and operational management



Source: adapted from Baghai (2016).
PPP: Public-Private Partnership; PSD: Public Services Delegation

1.2 Management modes of Central African protected areas

The following four management modes have been identified in Central African protected areas (COMIFAC, 2018):

a. Public management by a department of the ministry responsible for biodiversity conservation and protected areas management. This is the mode that historically prevailed in all Central African countries, and which remains in place in Burundi, Cameroon, CAR and Sao Tome and Principe;

b. Management by an agency, a specialized technical body of the supervising ministry with a certain degree of administrative and financial autonomy. Historically, DRC was the first country in Central Africa to adopt this type of institution with the establishment in 1975 of what is now named ICCN. Rwanda followed, and more recently Gabon, Congo and Equatorial Guinea have set up national agencies;

c. Community management, a rare mode of management in Central Africa from a formal standpoint, limited to a few isolated cases, such as the Tayna Nature Reserve (DRC) and the Lac Tele Community Reserve (Congo);

d. Public-private partnership management, which began developing in 2005 in DRC, followed by Congo, Rwanda, Chad, and most recently CAR (Figure 1).

All Central African protected areas are under public governance, community or shared. The absence of protected areas under private governance is striking considering that this category is widespread and even growing in Southern and Eastern Africa (Bond *et al.*, 2004). This is largely linked to the nature of the land tenure: in Spanish (Equatorial Guinea) and French-speaking Central African countries, private land ownership rights are very restrictive. Unlike several countries in English-speaking areas (South Africa, Namibia, Kenya), there are no large private properties which have been converted, all or in part, into a protected area by their owners.

It should be noted that several management modes may be found within the same country and in the same protected area category. The exception is the combination of the "public management" and "management by an agency" modes as they are mutually exclusive within the same protected area category. In Rwanda, for example, the management of national parks is the responsibility of the Rwanda Development Board (RDB). RDB directly manages Volcanoes National Park under the "management by an agency" mode, however, it subcontracts the management of Akagera National Park to African Parks Network under the "PPP management" mode. Meanwhile the management of wetlands, including a Ramsar site (Rugezi Marsh), is supervised by the Rwanda Environmental Management Authority (REMA) under the "management by an agency" mode. In Gabon, the *Agence Nationale de Préservation de la Nature* (ANPN) manages the national parks under the "management by an agency" mode while the *Direction de la Faune et des Aires Protégées* (DFAP) under the Ministry of Water and Forests oversees other types of protected areas managed under a "public management" mode.

Central African protected areas have a long history of "project" style technical assistance, traditionally in combination with the "public management" mode. Nonetheless, the three other management modes also have received assistance from projects, which sometimes makes it difficult to distinguish the difference between management modes, especially the "PPP management" mode.

1.3 Public-private partnership management mode

Public-private partnerships constitute an ordering and procurement mechanism. They differ from conventional practices in terms of the planning and execution of works and provision of public services due to the strong involvement of various institutions or organizations from the private sector (in the broad sense including private companies, foundations, NGOs, etc.). This involvement occurs through the whole or partial delegation of the responsibility of the government as contracting authority to a private entity, which may take place in various ways (see Figure 2).

In general, one speaks of PPP when the public and private sectors collaborate under a contract to carry out infrastructure projects such as roads, railways, hospitals, schools, etc. (SETYM International, 2012). These projects are subject to the signing of long-term

contracts between a public authority and a private sector company. One of the distinguishing features of this management mode is the transfer to the private partner of certain risks associated with the project, in particular its design, construction, management and operation and maintenance. The private partner commits, in terms of outputs and performance, to carry out the project in question. Furthermore, the private partner seeks to obtain the required funding. In return, the public partner agrees to pay a renumeration to the private partner. This renumeration must reflect the performance of the services effectively rendered.

Long-term technical assistance and public-private partnership: what is the difference?

A large number of Central African protected areas receive support from technical and financial partners in the form of projects. A "project" is a kind of financial assistance that is defined in time and space and targets specific actions laid out in a "project document". These projects generally are implemented by technical partners – Non Governmental Organizations (NGOs) or consulting firms – which deploy a team of technical assistants who provide support to the government employees managing the protected area.

While the duration of the projects is generally relatively short (3-4 years), the technical partners nonetheless can manage to secure a series of funding which enables them to provide long-term technical and financial support. For example, two NGOs, the World Wide Fund for Nature (WWF) and the Wildlife Conservation Society (WCS) respectively have provided uninterrupted support to the protected areas of Dzanga-Sangha (CAR) and Nouabale-Ndoki (Congo) since the areas were established (in 1990 and 1993, respectively). These two NGOs recently negotiated to change their support from the project form to a PPP arrangement, and contracts were signed to this end in 2013 (WCS) and 2019 (WWF).

What difference does this make compared to long-term technical assistance? First, the contract establishes official governance and operational management entities in the protected areas that did not necessarily exist previously. Through the contract, the State then formally delegates part of its prerogatives to the private partner. This mainly concerns two domains: i) management of protected area staff (including government employees), which passes under the direct authority of a director representing the private partner; and ii) securing long-term funding, which becomes the sole responsibility of the private partner. The last point is crucial: given the inefficiencies of Central African States in terms of financial governance, it is expected that the credibility of the private partner will lead to substantial private and public funding and that this partner will ensure efficient and transparent management.

It should be acknowledged that in the case of long-term technical assistance, the private partner already de facto provides and manages most of a protected areas' funding, and also sets up forms of shared governance of the protected area through one or several project steering committees, for example. In this case, the real novelty is above all the transfer of the responsibility of the protected area's entire staff to the private partner.

In general, three key elements constitute a PPP:

- There is a contractual document between the public and private partners that clearly defines the roles, responsibilities and commitments of the two parties;
- The public partner delegates to the private partner all or part of its prerogatives, in particular the management of the protected area's staff (including government employees);
- The private partner provides or raises funding and manages the funds necessary for the operational management of the protected area (investment and operations).

The efficiency of this type of partnership has been the main reason for the model's application to protected areas which have been underfunded and deprived of investments for a long time. However, the PPPs currently in place in Central Africa are all not-for-profit. Any revenue from the partnership is first invested in the protected area before being used to potentially provide support to communities on the outskirts of the protected area or the public partner (case of DRC).

This management mode requires more in-depth preparation and planning than conventional management modes, and the appropriate management of the procurement stage. This approach makes it possible to stimulate competition between candidates. However, the use of competitive procedures is not yet common in PPPs applied to Central African protected areas. Indeed, all PPPs currently in place were concluded through single source negotiation processes and not calls for tenders.

Examples include the case of APN for Akagera National Park in Rwanda, Zakouma National Park in Chad, Chinko Nature Reserve in CAR, Garamba National Park in DRC, and Odzala National Park in Congo (Figure 1). At present, two contracts are being prepared following a call for tenders, Nyungwe National Park (in Rwanda) with APN and Conkouati-Douli National Park (in Congo) with *Noé* (a French NGO registered in Congo). Unfortunately, their contract negotiations were delayed due to the Covid-19 pandemic.

1.4 Public-private partnership, delegated management or co-management?

Studies focussing on public-private partnerships for the management of protected areas often seek to establish a typology based on different criteria (governance arrangements, operational management, financing, etc.). The terms "delegated management" and "co-management" thus appear often to distinguish the degree of collaboration between the two partners. Co-management is supposed to represent a model where responsibility is more balanced between the two partners. In practice, it has proven difficult to make a distinction between these two models.

Baghai *et al.* (2018) note that in the delegated management model, the governance structure is characterized by a majority of members appointed by the private partner. The latter also appoints the senior officials of the operational management entity and has full responsibility for the operational management of the protected area. In the

co-management model, the sharing of authority is more balanced and the State retains its sovereign missions: anti-poaching operations are directed by the public authority which has the power to hire and dismiss its agents, while the partner can do the same with its own contract staff.

On the basis of these two definitions, the aforementioned authors consider that the protected areas of Virunga and Salonga in DRC, and Dzanga-Sangha in CAR, fall under co-management, while the protected areas of Akagera and Nyungwe (Rwanda), Garamba (DRC), Chinko (CAR), Zakouma (Chad), Nouabale-Ndoki and Odzala-Kokoua (Congo) fall under delegated management. Yet when the partnership agreements are examined in detail, this categorization no longer appears clear. While it is true that in Salonga and Virunga those responsible for combatting poaching are appointed by the public authority, this is also the case in Garamba (under delegated management), but is not the case in Dzanga-Sangha (nonetheless also under co-management), Akagera or Nyungwe. In terms of the composition of governance entities, the criterion of having the majority of representatives appointed by the private partner for delegated management mode appears to be verified overall; however, this is also the case for Dzanga-Sangha, which is nevertheless under co-management.

Overall, in the co-management model, the public partner is more present and the key positions of operational management fall within the public authority's domain, in particular police operations, for which it is responsible under the law. In fact, there is a gradient between co-management and delegated management regarding the transfer of responsibility from the public partner to the private partner which can take several forms. As a result, it is not always easy to assign a protected area to a particular model, as was recognized by Baghai *et al.* (2018).

The "co-management" versus "delegated management" debate is not just a semantic one. In countries where public opinion is very sensitive to the transfer of responsibilities from the public to the private sector, even conditionally, the State will always prefer a co-management agreement regardless of whether in practice all operational management operations of the protected area are carried out by the private partner.

2. Public-private partnership initiatives in Central Africa

2.1 Background

African Parks Network pioneered the implementation of delegated management partnerships in Africa and holds the largest number of contracts with governments of the subregion (6/13 contracts currently and soon 7/14 with Nyungwe) (see Figure 1). This organization has established medium-term partnerships in DRC and Chad, and long-term partnerships in CAR, Rwanda and Congo.

Wildlife Conservation Society is an international NGO that has been engaged in the management of Central African protected areas since the end of the 1980s. In 2013, it started working under a PPP in Nouabale-Ndoki (Congo), a park in which it has been providing technical assistance since 1993. WCS has signed two new contracts: i) in 2018 in CAR (protected areas in the north), where its presence is new; and ii) in 2019 in DRC for the wildlife reserve in Okapis where it has been present for many years.

World Wide Fund for Nature, a conservation NGO, has long dominated the Central African conservation landscape. It recently entered into two PPPs: one relating to Salonga National Park, in DRC (since 2015), and the second relating to the Dzanga-Sangha complex of protected areas (a national park and a special reserve) in CAR, where the organization has operated since the 1980s. WWF is characterized by what is called co-management contracts (Annex 1), with few differences from delegated management but with extremely short contract durations (Figure 1).

Two other organizations are involved in PPP management arrangements. These are: Forgotten Parks in DRC (since 2017) and *Noé* in Conkouati-Douli National Park in Congo (finalization of negotiations underway in 2020).

2.2 Public-private partnerships and law enforcement

Law enforcement is the task of protected area managers that has generally been seen as incompatible with delegated management and has been

considered to be the exclusive responsibility of the State in Central Africa. However, there has increasingly been an effort to bring together the "best of both worlds" by having staff with governmental contracts in the parks' organigrams. They are thereby allowed to wear arms and verbalize people while being under the management of the private partner. We examined the PPP contracts in our possession to reflect the diversity of possibilities to organize law enforcement under this model, and presented schematically how the various partnerships have dealt with this issue (see Table 1). Note that this presentation is schematic and reflects our own interpretation. We also added other forms of management, i.e., lease, as applied by trophy hunting enterprises (see also section 4).

Table 1 – Protected areas with delegated, co-management and lease agreements in Central Africa: law enforcement details

Country	Protected Area	Private Agency	Management type	Law enforcement role				Collaboration with armed forces	Notes
				Private partner personnel		State contracted detached			
				Managers	Guards	Managers	Guards		
Cameroon	Hunting zones	Individuals/ companies	Lease	+	++	-	-	+/-	Role of private partner has not been formalized, but tolerated
CAR									
	Chinko	APN	DM	++	++	-	-		
	North CAR	APN	DM						
Chad	Ennedi	APN	DM						
	Zakouma	APN	DM	+/-	-	+	++	+	Deputy director with state contract
Congo	Nouabalé-Ndoki	WCS	DM	-	-	+	++	+/-	Head of anti-poaching with state contract
	Odzala	APN	DM						
DRC	Garamba	APN	DM	+/-	-	+	++	+/-	Head of anti-poaching with state contract
	Salonga	WWF	Co-m						
	Upemba-Kundelunga	Forgotten Parks	DM	++			++		Park director with state and private partner contract
	Virunga	VF	DM	++	-	++	++	+/-	
Rwanda	Akagera	APN	DM	+/-	--	+	++	+	Head of anti-poaching with state contract

Notes: The contracts that we have not been able to see (Okapi, DRC) are not included.

Abbreviations: APN: African Parks Network; VF: Virunga Foundation; WCS: Wildlife Conservation Society; WWF: World Wide Fund for Nature; DM: Delegated Management; Co-m: Co-management.

++: dominant; +: common; +/-: fair; -: limited; --: none, based on interpretations from the authors. If nothing indicated, no information was available.

2.3. The crucial role of funding in public-private partnerships

Eight (out of 13) of the Central African delegated management contracts (see section 2.1.) presently in implementation explicitly mention financing on a park with management in their titles (see Appendix 2). In half of the delegated management contracts that have been analysed, raising funds is explicitly expected from the private partner, and its non-fulfilment, generally over two years, could be a reason to dissolve the contract. With exception of

Akagera National Park (Rwanda), all other Central African protected areas depend on international funding for more than 90% of their budgets.

In Table 2, we estimate the relative importance of the different public, private or revenue sources. Where available, we indicate the amounts of protected area management funding based on the major funding sources (see unpublished references in Appendix 2). The mean funding of parks that are the subject of "mature" partnerships is US$640/km^2, or US$800/km^2 if the two extremes (Odzala and Akagera) are not included. This is lower than the US$1,200/km^2 reported as the mean funding of African parks under delegated management (Baghai *et al.*, 2018). APN's 2016 annual report, comparable with the figures presented, suggests an overall mean of US$520/km^2 (60,000 km^2 divided by the funding available of US$31.2 million), an amount that declined to US$439/km^2 in 2018 due to the inclusion of the vast Ennedi landscape (105,000 km^2 divided by funding of US$46.1 million).

These figures are an order of magnitude of the budgets available to state-managed protected areas. These state budgets are often drawn from different sources and composed of investments, personnel costs and operation costs, each through different budget and ministerial lines. Investments for example pass through the ministry of public works, personnel costs through the ministry of public services and operational budget through the ministry in charge of protected areas. Only the latter is directly available to the protected area managers. The few data available to us suggest that the budgets are generally less than US$50/km^2. In the case of project-supported state managed protected areas, operational budgets may of course be higher. The available funding for parks in partnerships under development, only US$90/km^2, reflects the ambitious size of the parks (15,000 – 40,000 km^2) and highlights the need to develop fundraising mechanisms.

Table 2 – Estimated funding to protected areas with delegated and co- management arrangements in Central Africa and their sources

Country	Protected Area	Area (km²)	Public sources (1, 3)				Private sources (1, 3)
			EU Mio €	GER Mio €	US Mio US$	Nat. Mio US$	Conservation partner network
Delegated Management under development							
CAR	Chinko	15,027	++ 1	-	++	--	-
CAR	North-East (4)	40,724	++ 1.4	--		--	
Chad	Ennedi	24,412	++ 1	--	--	--	+
DRC	Salonga	33,618	++ 3.5	-		-	+
DRC	Upemba-Kundelungu	24,600	+ 0.6	+			
Total		138,381					
Well-established Delegated Management							
CAR	Dzangha-Sangha	1,220 + 3,159	--	+ 1	+ 0.5	+/-	++
Chad	Zakouma	3,100	++ 2	--	-	+ (military)	-
Congo	Nouabale-Ndoki	4,230	--	+ 0.8	+ 0.5	-	+
	Odzala	14,330	++ 1.2	--	++ 1.2	-	+
DRC	Garamba (5)	5,133	++ 4.1	-- +		-	-
	Virunga	7,880	++ 3.1	--	+ 0.5	-	-
Rwanda	Akagera	1,122	--	--	--	+ 0.25	-
Total		**40,272**					
Total without Odzala		25,942					
Total without Odzala and fenced Akagera		24,820					

APN: African Park Network; EU: European Union public funds; GER: German public funds (through KfW); Nat.: National public funds; VF: Virunga Foundation; US: United States public funds (esp. US Fish and Wildlife Service); WCS: Wildlife Conservation Society; WWF: World Wide Fund for nature. CAR: Central African Republic; DRC: Democratic Republic of the Congo

++: dominant; +: important; +/-: medium; - : limited; --: none.

Where available, amounts of funding have been added as illustration. Budgets are therefore tentative and minimum values only.

Mio: Million

Private sources (1, 3)	Park revenues (2, 3)	Investment prior to contractualisation	Budget per park (Mio $)	Budget ($/km²)
Others, foundation and lotteries Mio US$				
+?	--		4.0	266
	+ hunting zones		1.7	42
+	--		1.2	49
	-		4.8	143
			1.0	41
			12.7	92
+	+	Trustfund with 54 Mio € (esp.GER)	2.4	548
+	+/-	Continued EU funding > 30 years	2.4	774
+ 1.8	-	Trustfund with 54 Mio € (esp. GER)	3.7	879
+	+		3.0?	209?
+	+		5.4	1052
+	+		6.0	761
+	++ 2.0 Mio $	National public investment in electric fence (2.8 Mio $)	2.8	2496
			25,7	**638**
			22,7	875
			19,9	802

1. Sources: Amounts committed, recalculated to annual based on funding cycle of generally 5 years: EU: Action Plans 11th European Development Fund (2018-2022), Chad, DRC, Regional; US: US Fish and Wildlife Service, call for proposals 2018, see unpublished references for details.

2. Akagera: net income in 2019 (APN annual report, 2019).

3. € / $ = 1.2

4. The area corresponds to those zones considered as priority in the CAR-WCS contract, excluding several of the surrounding hunting zones formally included

5. The amounts mentioned here only concern Garamba National Park (5,133 km²), although part of the budget is also used for the management of the 3 surrounding hunting zones (9,663 km²).

3. Are public-private partnerships the panacea for Central African protected areas?

3.1 Strengths, weaknesses, opportunities and threats of PPP in Central Africa

After reviewing independent evaluation reports of ongoing experiences in Central Africa (Brugière, 2016; Lauginie, 2017) and the conclusions of the sub-regional workshop to capitalize on lessons learned that was organized by COMIFAC and RAPAC on 4-6 December 2017 in Libreville (Gabon), the main Strengths and Weaknesses, Opportunities and Threats (SWOT) of PPPs were identified (Table 3).

3.2 Public-private partnerships in Central Africa: lessons learned concerning the critical conditions for success

The first PPPs developed in Central Africa have now been in existence for some 15 years (see Figure 1). Some, notably those funded by technical and financial partners, in particular the European Union, have undergone formal independent evaluations. This is notably the case for Odzala-Kokoua National Park in 2016 (Brugière, 2016) and Zakouma National Park in 2017 (Lauginie, 2017; Table 4). These evaluations aimed to measure the results achieved and the fulfilment of commitments included in the contractual agreement signed by the two participating parties. These assessment exercises, combined with workshops and working meetings dedicated to PPPs over the past few years, have made it possible to better understand the operating difficulties encountered by certain PPPs in Central Africa. They also make it possible to identify the conditions critical for the success of a public-private partnership. In sum, it appears that there are four key conditions, explained in detail below, which must be combined for a PPP to function correctly. These conditions facilitate the achievement of expected results, both operationally (protection of biodiversity) and in terms of the governance and effective management of a protected area.

3.2.1 Clarity of the partnership agreement

Due to a lack of experience, the first partnership agreements drawn up between States and private partners in Central Africa left room for a certain margin of interpretation, especially in terms of the two parties' commitments. One point in particular has generated many problems: staff recruitment. When the management of a protected area is delegated to a private partner, the latter generally finds a team already in place; they are government employees (civil servants or contract workers) or sometimes project contract workers. The

Table 3 – Analysis of the Strengths, Weaknesses, Opportunities and Threats of PPPs in Central Africa

Strengths	Weaknesses
1. Partners make mutual long-term commitments to the benefit of the protected areas concerned; also improved governance. 2. Increased professionalism in operational management (improved management of funds and equipment; transparency and accountability in their use) and staff management, and increased effectiveness of the management of protected areas. 3. Provision and securing of new long-term funding for operations, necessary investments, maintenance of infrastructure and equipment. 4. Protected areas continue to operate, securing jobs, improvement in the working and living conditions of staff. 5. Significant contributions to community development (in financial terms). 6. Independence and neutrality of the private partner to deal with threats on the protected area. 7. Strengthening conservation status, boosting the image and better promotion of protected areas (tourism and ecosystem services).	1. Lack of a legal framework in most countries and the public partner's poor understanding of the basic principles governing PPPs. 2. Incorrect interpretation and confusion of roles in the implementation of PPP project management contracts. 3. Appointment by States of inappropriate individuals to governance bodies (Board of Directors) and operational management of the protected area (protected area management unit). 4. Poor communication between the private partner and the public partner (lack of transparency), generating conflicts of jurisdiction and interpretation in the implementation of certain clauses of the contracts. 5. Funding mobilized based mainly on short-term projects and programs. 6. Lack of predefined objective indicators for assessing the performance achieved under the framework of current PPP agreements. 7. Inadequate training of government employees and others which makes an exit strategy difficult.
Opportunities	**Threats**
1. Credibility and confidence in relation to financial partners. 2. Diversification of funding sources. 3. Facilitated access to better professional capabilities on the market. 4. Work at the national, sub-regional and international level. 5. Capacity building and transfer of skills to the benefit of national managers. 6. Increased integration of protected areas in the local and national socio-economic context. 7. PPPs can serve as stabilizing factors, especially in areas undergoing political instability and war.	1. Lack of a suitable legal framework for PPP in countries with the exception of DRC and Rwanda. 2. Rejection of the PPP model by the public partner due to low involvement in decision-making, lack of ownership and lack of institutional benefits (fear of losing some prerogatives, fear of losing sources of power and income). 3. Lack of long-term financial mechanisms, as well as projects and programs. 4. Lack of communication and transparency, which leads the public partner to take a dim view of closer relations between the private partner and donors, in particular concerning the attribution and management of government subsidies. 5. Practices perceived as "discriminatory" (differences in treatment between national and international staff) and weak national capacity building policy. 6. PPPs may further weaken the States, especially if national capabilities are not developed and in the absence of plans for the evolution of PPPs (for example, transferring delegated management to a partner) or even exiting PPPs.

Table 4 – Protected areas with delegated management agreements in Central Africa: details on evaluations[1,2]

Country	Protected Area	Agency	Evaluation Period	Evaluation types	Law enforcement/ Protection	Management & Infrastructure	Biodiversity conservation / Research & monitoring	Community development/Economic impact	Fundraising/ Sustainable funding	Authors[3]
Chad	Zakouma	APN	2010-2017	SWOT[4]						
				Partnership[5]	0.8	1.0	0.4	0.4	0.6 / 0.2	d'Huart (2013)
				EU project[6]	0.8	0.8	0.2	0.2	0.6 / 0.0	Lauginie (2017)
Congo	Odzala-Kokoua	APN	2010-2016	SWOT						d'Huart (2013)
				Partnership	0.8	0.8	0.8	0.4	0.4	Brugière (2016)
DRC	Garamba	APN	2005-2013	SWOT						d'Huart (2013)
	Virunga	ACF	2005-2012	Internal[7]	0.8	0.6	0.4	0.6	0.8	Internal (2012)
			2005-2013	SWOT						d'Huart (2013)
Rwanda	Akagera	APN	2010-2015	Partnership	1.0 (5/5)	0.91 (10/11)	0.31 (4/13)	0.58 (3.5/6)	0.75 (3/4)	Goodman (2015)

Scores indicated on a scale from 0 to 1.0, the degree of attaining the programmed / expected activities[2]

1. Although all contracts prescribe evaluations, we have only been able to obtain five evaluation reports, plus one SWOT analysis of the partnerships of Zakouma, Odzala-Kokoua and Virunga (d'Huart, 2013).

2. Assessments are interpreted by the authors of this chapter based on evaluation reports. Goodman (2015) scores, based on number of planned activities implemented as indicated by the figures in brackets, were recalculated to 1.0 – 0.0 (max – min) score. The other evaluations lacked such quantitative assessments, and interpretations should be taken with caution.

3. All evaluations were commissioned by the European Union, except Akagera (APN) and Virunga 2012 (auto-evaluation).

4. SWOT: Qualitative evaluation that categorizes findings according to Strengths, Weaknesses, Opportunities and Threats.

5. Partnership, evaluation on contract between public and private partner.

6. Project, evaluation for the funding partner.

7. Internal, by private partner team.

ACF: Africa Conservation Fund, presently Virunga Fund; APN: African Parks Network.

usual procedure is that the private partner carries out an assessment of the quality of this workforce, keeping the agents considered suitable and returning the others to the State. Other people are then recruited to complete the team. Indeed, these recruitments can occur at any time during the operation of the partnership contract when a post becomes vacant. Experience has shown that a poor definition of staff (managers and senior technicians) recruitment processes has generated considerable tensions between stakeholders.

Partnership agreements should therefore describe in detail the methods to be used to recruit staff assigned to the management of the protected area. For senior management personnel, international calls for applications are desirable, and for middle management personnel, national calls for applications are recommended. In both cases, the principal of a short list of the three best candidates to be interviewed should be observed. The partnership agreement must specify the identity of the person (or team) who will conduct the interviews and make the final selection. The most operational system leaves the responsibility for implementing the selection process to the private partner, and the issuance of a no objection notice for senior managers to the State.

3.2.2 Confidence and communication

The success of a public-private partnership relies greatly on the development of a trust-based relationship between the two partners. This cannot develop without close and intense communication, especially during the first years of the PPP's operation, allowing the two partners to get to know each other. Procedures for internal and external communications and exchanges (formal and informal) must be defined in the partnership agreement. Meetings of the Board of Directors (or of any governance entity bringing together the two partners) are critical opportunities for discussion and communication. They help to build a solid relationship of trust. Some PPPs have been set up in French-speaking Africa in a context of mistrust or have stirred much debate, with the State being accused of privatizing a public good and the private partner suspected of doing business at the expense of the community. A communication policy vis-à-vis the general public and civil society must be rapidly developed by the two partners working in collaboration. In particular, it must explain in a fully transparent manner the mode of operation of the partnership, its governance and the costs and benefits of the approach.

3.2.3 Private partner: compliance with accountability obligations

The terms and conditions of the private partner's accountability to the State must be clearly defined in the partnership agreement. It appears that when new PPPs first began operating in Central Africa, some private partners may have considered the protected area under their management as a private territory. The accountability obligations were limited to submitting contract activity reports. The latter were important but vastly inadequate in terms of accountability.

The private partner should not forget that its role goes far beyond that of a simple service provider whose accountability obligations are limited to those described in the partnership agreement. As it manages a public good of national (and often international) importance, one whose ecosystem services go well beyond the limits of the protected area, the private partner has an important duty of accountability, chiefly to the State. Even if it is not contractually obligated to be accountable to society as a whole, the private partner must communicate with society so that its actions are understood and accepted. Nonetheless, it cannot necessarily communicate all information to the general public because some information could compromise the effectiveness of its actions (fighting poaching, for example). It is in effect up to the two partners, the State and the private partner, to define the communication policy (contents, format, messages, targets, etc.).

3.2.4 Public partner: no interference in operational management

The management of protected areas has historically been a sovereign domain in Central Africa: it is the State which creates parks and reserves, and it is the State which ensures their management. The delegation of management to a private entity, even if this entity has a public utility or non-profit status, is a very recent phenomenon. To some extent, it clashes with a political culture that remains very interventionist. In certain PPPs, the State wanted to influence decisions taken by the private partner for the protected area's

Experience of the African Parks Network: conditions favoring the sound and effective success of public-private partnerships

B. Michel, APN

African Parks Network, a South African NGO established in 2000, has been developing public-private partnerships in nine countries of sub-Saharan Africa and 16 parks for the past 20 years. These parks cover approximately 105,000 km^2. In 2018, APN employed 4,804 staff and paid US$10.2 million in wages. APN's 2019 budget is US$71 million. The NGO is developing partnerships based on the principle of the three "M's" (mandate, money, management):

– "Mandate": it is a strong mandate. It includes complete responsibility and accountability;

– "Money": this assume full responsibility for funding and financial management;

– "Management": this refers to efficient and effective management combining firm implementation of the law and strong community ties.

While the principle of the three "M's" is essential in partnership negotiations between APN and governments in sub-Saharan Africa, how it plays out is adapted to the context of the partner country and its institutional culture. Three institutional arrangements were developed among the 16 ongoing partnerships:

1. The creation of a mixed enterprise which brings together two shareholders, notably APN and the partner government (case of Akagera National Park in Rwanda);
2. The creation of a foundation including two founding members, in this case APN and the partner government (case of the Odzala Foundation in Congo);
3. Direct management of the protected area by a Board of Directors coupled with an obligation to represent both partners (case of Zakouma in Chad, Chinko in CAR, etc.).

Over the 20 years of APN's operations, the implementation conditions essential for success and the achievement of expected results have emerged. They include:

– Ongoing and effective support for the partnership from the country's government and administration;

– Active involvement of the two partners, notably with regard to transparent communication, including during crisis situations (security incidents, poaching or political upheavals);

– Constant and unfailing accountability of the manager;

– Considerable community support and peaceful and suitable communications with local authorities;

– A common vision of medium and long-term objectives shared by the two partners and involving the training of national managers and meaningful capacity-building at all levels.

An absolute prerequisite for the success of a PPP is the willingness of both partners to commit themselves to and share a common vision of the protected area's future. Going against the adage "No will, no way" is therefore a necessary condition for the success of the partnership. It requires a real embrace of the concepts and a certain "maturing" of the implementation of PPPs. Twenty years of experience in managing partnerships has shown that, more often than not, what is needed is patience and above all getting the two partners to learn from each other.

operational management (for example, the process of drawing up the management plan or the implementation of anti-poaching activities). This situation created misunderstanding and tension on both sides.

It is therefore recommended that the State refrain from interfering in the day-to-day operational management of the protected area as long as the partnership agreement fully delegates this to the private partner. On the other hand, during meetings of the governance entity of the protected area (for example, the Board of Directors), the State is fully entitled to discuss with the private partner the operational management modalities and request that certain concerns be taken into account. However, once decisions are taken, the State must let the private partner assume full responsibility for their implementation.

Even after fifteen years of existence, PPPs are still a fairly new model in Central Africa and remain uncommon in many countries (Figure 1). The learning stage has thus not yet been completed, either by the private partners or the State. The experiences underway are rich in lessons for building a balanced contractual relationship between the two partners with a view to delivering sustainable results in terms of protecting biodiversity.

4. What type of public-private partnerships for Central Africa?

4.1 Sub-regional guide on best-practices for the management of protected areas through PPPs

For several years, national institutions in charge of managing protected areas have asked sub-regional organizations (RAPAC, COMIFAC) for their support to better understand and adopt PPPs. The positive results achieved in the initial experiments, and the difficulties and weaknesses identified in the first evaluations undertaken, have continued to stimulate growing interest in the mechanism.

A sub-regional guide to best-practices for the management of protected areas through PPPs (available only in French, *Guide sous-régional des bonnes pratiques pour la gestion des aires protégées en mode Partenariat Public-Privé*) (COMIFAC, 2018), was drawn up at the initiative of COMIFAC and RAPAC with support from GIZ, the German Agency for International Cooperation. This guide is the first attempt to respond to the difficulties encountered and the questions related to the adoption and implementation of

this management arrangement in Central Africa. It targets decision-makers in charge of protected areas in countries covered by COMIFAC to help them make informed decisions regarding the adoption of PPP within protected areas and in preparing related tender documents. The guide can be used to better assess the relevance and opportunities offered by PPPs to guarantee the long-term funding and smooth operations of protected areas.

The guide aims to provide points to consider in the preparation of tender documents and negotiation files and to prepare partnership contracts. It also helps to focus the attention of decision-makers and stakeholders on a few gaps and weaknesses that should be avoided in each of the four phases of the development process of a PPP project.

Depending on the approach and the type of governance adopted by the two parties, responsibilities are clearly divided between the State and the private partner and are laid down in the contract. The guide provides directions and guidance on determining the duration of a contract and arrangements for sharing the revenue generated. It also explains the sharing and transfer of risk, the responsibility for law enforcement and other aspects of the relationship between the public and private partners in the management of the protected area.

The four phases of the development process of a PPP protected area management project must be identified and their implementation must be carefully prepared.

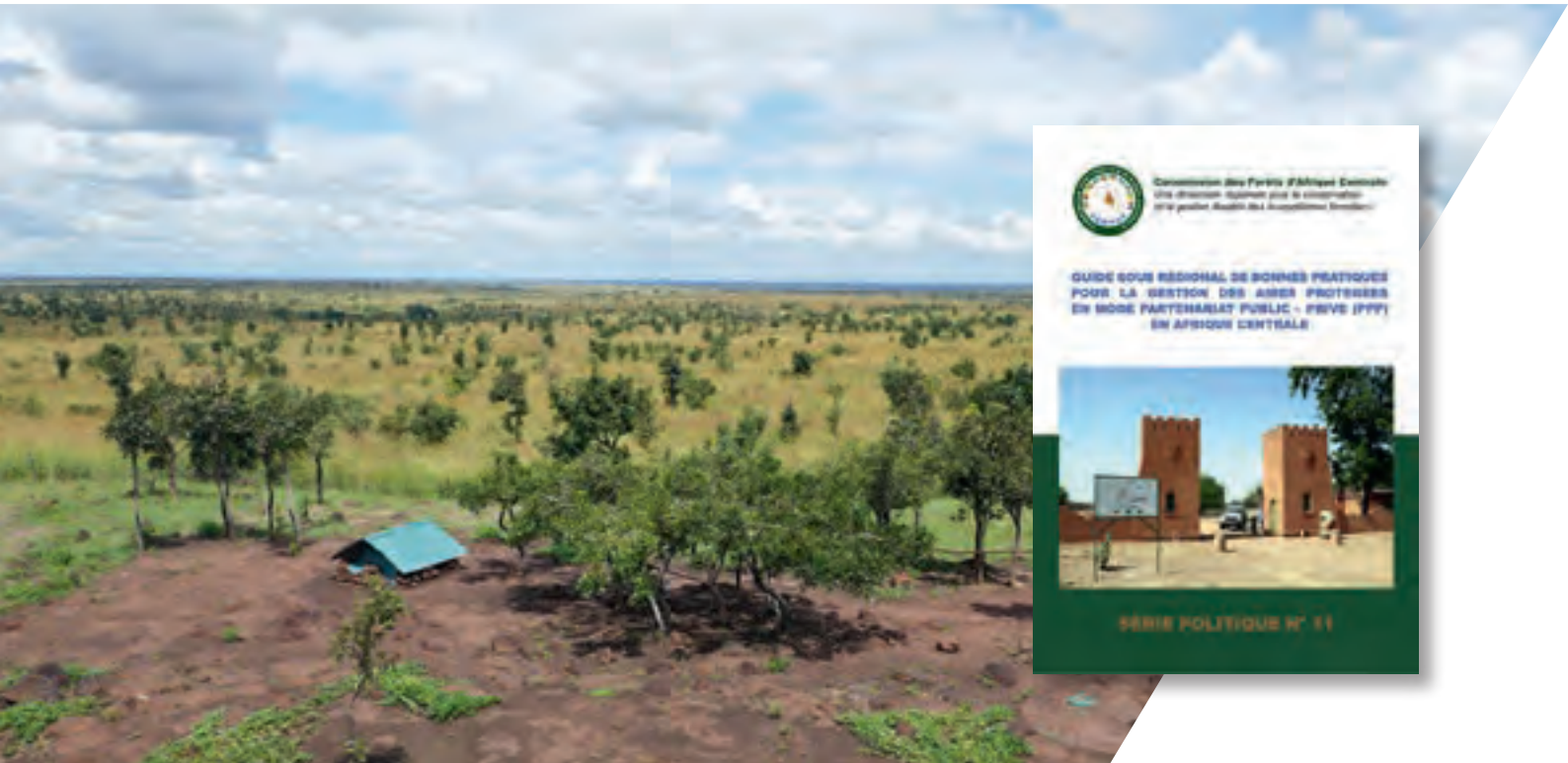
4.1.1 Project identification and preparation phase

The satisfactory implementation of a PPP project for the management of a protected area fundamentally depends on the correct conduct of the initial project identification and preparation phase. This phase should allow each of the partners in general, and in this case the public partner, to answer certain key questions. At this point the task is to clearly determine the motivations, objectives and main expected outcomes, as well as the skills and resources required from the private partner for their achievement.

The protected areas in the national network likely to be the subject of a PPP contract must be identified. This is the first task which the government must tackle before undertaking any other step.

The next priority is to establish an inventory of the protected area to provide reference elements and to determine objective performance assessment criteria to be used in the implementation of the partnership contract. During this phase, the choice must be made clearly on the most suitable governance model (shared or delegated) and on the designation of the appropriate operational management entity (delegated operational management or co-management; see Figure 2).

Lastly, it is necessary to develop specifications tailored to each protected area likely to be the subject of a contract. This will be validated by the competent authority after consulting with all parties interested in making relevant additions and improvements.



The following key points must be considered in particular:

- The nature of the commitments that the private partner will have to assume;
- The type of governance proposed;
- The scope and limits of the delegated powers;
- The terms of payment for services and/or allocation of revenue generated by developing the potential of the sites;
- The duration of the contract and assessment and review arrangements.

4.1.2 Contract formalization phase

The main reference documents for drafting the contract are:

- The texts establishing and governing the organization and operations of the protected area, in accordance with national legislation;
- The tender or restricted consultation file prepared by the public partner which, for this purpose and following a standard model, proposes a draft contract adapted to the specific conditions of the protected area concerned;
- The technical and financial proposal submitted by the private partner.

The guide proposes contents that could be used in for-profit and not-for-profit partnership contracts.

4.1.3 Public-private partnership implementation phase

The main features of the implementation of PPP projects are:

- An implementation, through a long-term contract, primarily aimed at providing services;
- An obligation for the private partner to provide results and not resources;
- The transfer to the private partner of certain risks associated with the project, in particular its design, construction, management or operation, maintenance and financing;
- Recourse to private funding which assumes a transfer of certain financial risks to the private sector.

Implementation is the phase which effectively determines the success or failure of the project based on the right (or wrong) formulations, understandings, interpretations and observations of the clauses of the contract.

4.1.4 Monitoring and evaluation phase

Given the long duration of the contracts (up to 25 years), monitoring and evaluation are critical for PPPs. This involves carrying out periodic monitoring and evaluation of actions and results to assess the need to review, reframe or, in extreme cases, terminate agreements. A certain number of good monitoring-evaluation practices are laid out in the guide.

4.2 Capacity building of staff at the national level

In tandem with the 16th meeting of the CBFP, RAPAC organized a meeting with actors and various PPP stakeholders in the sub-region in November 2016. Among the recommendations resulting from this meeting is one relating to "promoting public-private partnership as a transitional (and not permanent) model aimed, among other things, at developing national human and material resources ready to take over the management of the protected area".

Although there continues to be divergent opinions regarding the efficiency and feasibility of delegated management, there is a consensus that these partnerships should contribute to capacity building of national personnel (Baghai *et al.*, 2018; Scholte *et al.*, 2018). Does delegated management supplant the State or build its capacities? The evaluation by the European Commission (2014) of delegated management initiatives in DRC concluded that, apart from undeniable strengths, weaknesses include the limited ownership by the protected area authority. The private partner is expected to provide administrative and technical capacities to access and use the funding according to required standards. Raising capacities of national personnel and institutions is hereby critical. Although the recent delegated management contracts (Table 1) pay generally more attention to capacity building, the described expected efforts of the private party remain vague and difficult to monitor and measure. An exception is Rwanda, which has set a ceiling on the number of expatriate staff: four for the management of Akagera National Park, and three for each lodge.

4.3 Towards other types of partnerships

At present, delegated management holds a monopoly on PPPs. This may be understandable where private partners have initiated conservation activities in the area, as is the case with WWF in Dzangha-Sangha protected area (CAR) and WCS in Nouabale-Ndoki National Park (Congo). However, we wonder if this should automatically continue as partnerships mature and protected areas become more developed. In this respect, Garamba National Park is an example where its first delegated management contract in 2005 totalled seven pages, which tripled to 24 in 2016, with increased expectations within the DRC.

Some other types of partnerships may also be considered, depending on responsibilities handled to the private partner or economic activity considered (Table 5). These other types of contracts and economic models (Roulet, 2004 or Yasuda, 2012 on sport hunting, for example) will not be detailed here but they might offer other opportunities for conservation through economic activities, which differ substantially from non-profit PPPs discussed in this chapter.

Deng Deng National Park in Cameroon: towards a new type of funding mechanism

Deng Deng National Park in Cameroon was established in 2010 on 6,820 km². Its creation was part of the environmental compensation for the construction of Lom Pangar dam, which destroyed approximately 6,000 km² of dense rainforest. This park is home to a wide range of wildlife, notably the northernmost population of lowland gorillas. It has received material support, in particular from *Électricité du Cameroun* (EDC), a public hydro-electric company responsible for the dam. It also has received technical implementation assistance from WCS (2008-2012), followed by the BRLi-SFAB consultancy firm (2014-2018) with funding from the French Development Agency (AFD).

The park is expected to soon benefit from an unprecedented financing mechanism in the sub-region: the hydropower operators benefiting from the Lom Pangar dam must pay a royalty (called "water rights") to EDC. The legal text establishing these water rights stipulates that "a part should be devoted to the rehabilitation and management of Deng Deng National Park". Studies are underway to clarify the payment mechanisms of water rights.

Cameroon has not yet developed PPP arrangements for its protected areas, although this is mentioned as a priority in its forest-wildlife sub-sector strategy and legal provisions exist on this subject. Interest in this type of partnership was renewed during the national technical workshop on PPPs organized on 20 October 2017 in Yaounde (with AFD funding). In response to this interest, it was proposed that Deng Deng National Park be a pilot PPP site at the national level due to the existence of a sustainable funding mechanism facilitating the identification and operations of a private partner. The latter is expected to be recruited through a call for tenders. A project financed by AFD and the French Global Environment Facility (FFEM) should start soon to facilitate the establishment of this PPP.

In view of the number of dams scheduled to be built on the rivers of Central Africa on the one hand, and the development of legal compensation mechanisms for environmental damage on the other, the pilot case of Deng Deng National Park will be of remarkable interest at the sub-regional scale.

Table 5 – Other public-private partnership initiatives in protected areas in Central Africa

Country	Protected area (Number)	Area covered (km^2)	Agency	Contract duration (year)	Subject	Process
Cameroon	Hunting zones (24)	23,847	Individuals / companies	Automatically renewable (5)	Commercial PPP for hunting enterprises	
CAR	Hunting zones, majority no longer operational	3,100,000	Individuals / companies			
Cameroon	Campo-Ma'an	NR	AWF		Tourism investments (lodge) and subsequent management	Public offer
Cameroon	Deng Deng	6,820	EDC			See box on Deng Deng
Congo	Odzala-Kokoua NP	NR	Congo Conservation Company		Wilderness safari ceded operations to Congo Conservation Company, sponsored by the Plattner Foundation	
Rwanda	Akagera NP, Magashi	NR	APN and Wilderness Safari		Tented lodge	Investment funding from Buffett Foundation through APN

APN: African Parks Network; AWF: African Wildlife Foundation; CAR: Central African Republic; EDC: *Électricité du Cameroun*; NP: National Park; NR: Not Relevant; PPP: Public-Private Partnership

5. Conclusions and recommendations

5.1 Conclusions

Since the establishment of the contracts for Garamba and Virunga National Parks in 2005, public-private partnerships have become an important tool for the management of protected areas in Central Africa. The six contracts that reached the end of their terms were all extended, unlike in other African countries, notably Ethiopia.

African Parks Network dominated the PPP landscape in Central Africa in the early years and remains an important actor, holding six of the 13 PPP contracts which are active in the sub-region. WWF and WCS, which also have been very present in this region for decades through the provision of technical assistance, have recently converted their historic collaboration in certain protected areas into PPPs, which testifies to the interest in this model. Furthermore, new actors are gradually emerging, such as Forgotten Parks (in DRC) and more recently *Noé* (in negotiations for two PPPs in Chad and Congo).

Since the first partnership contracts were signed in 2005, major changes have resulted in a second generation of contracts. This evolution notably includes greater ownership by governments, which have formulated increasingly detailed expectations. The example of the Garamba contract is instructive. In 2005, it only contained seven pages without specific expectations; in 2016, the contract had extended to 24 pages and included specific targets.

To strengthen the appropriation of PPPs by governments, COMIFAC has developed a guide to best-practices for the management of protected areas through PPPs (available in French, *Guide Sous-Régional de Bonnes Pratiques pour la Gestion des Aires Protégées en Mode Partenariat Public-Privé PPP en Afrique Centrale*). The guide focuses on the preparation of tender documents to draw the attention of decision-makers to the gaps and weaknesses to be avoided in each of the four phases of the development process of a PPP project.

The diversification of PPPs in Central Africa, moving beyond the "total" delegated management model, remains tentative. A type of co-management model is gradually emerging where roles and responsibilities are more shared by the two actors.

5.2 Recommendations

The establishment of PPPs should preferably take the form of a call for tenders open to national and international organizations. Allocation through single source negotiations should remain the exception. A standard tender document is available in the guide to best practices for the management of protected areas through PPPs proposed by COMIFAC (2018).

It is crucial to be able to make management contracts accessible to the public "upon reasonable request". Only contracts concluded with APN and WWF were made available to us, which makes the learning process difficult. Furthermore, this lack of transparency is easily interpreted as a desire to conceal something.

In contracts, the clauses relating to the responsibility of the two partners in the management of protected area administrative and field staff (recruitment, promotion, changes in posts, sanctions, dismissals, etc.) must be very clear so as not to leave room for interpretation. This in particular concerns government employees seconded to the private partner, whose management requires close collaboration between the two partners.

The clauses relating to procedures for communication between the two partners must be detailed in the contracts. It is recommended that, in addition to key events in the governance of the agreements (for example, meetings of the Board of Directors), flexible and partly informal arrangements for exchanges and communications be put in place between the two partners. This is particularly important during the first years of the partnership when the two partners are gradually getting to know and trust each other.

Almost all contracts include regular evaluations, often in a five-year time frame. Unfortunately, this provision often has not been fulfilled and when evaluations are conducted, they have been hindered by a lack of operational plans as they were supposed to be drafted on the basis of these contracts that allow tracking contractual actions and other obligations. We recommend a stricter application of the possibilities that (independent) evaluations offer.

Capacity building, considered to be amongst the most important part of the partnerships, has, to our knowledge, never been systematically evaluated. Part of the ongoing frustration with PPPs is the large number of expatriate staff in some of the contracted parks. The impression is that few partnerships have developed systematic capacity building programs, although recently some initiatives have been taken (e.g., in Garamba National Park).

Until now, PPPs were established between States and NGOs. It would be interesting to test this model with local authorities. Following a more or less generalized decentralization process in Central Africa, they are required to take on increasing responsibilities in terms of environmental management. Their expertise in this area is generally very limited and the establishment of a PPP would be a good way for them to assume their responsibilities while improving their expertise through collaboration with an experienced partner.

Bibliography

References cited in the text

Baghai M., 2016. Of Parks and Partnerships. A Review of collaborative approaches to improving management of Africa's State Protected Areas. MSc Thesis, Oxford University, UK.

Baghai M., Miller J.R.B., Blanken L.J., Dublin H.T., Fitzgerald K.H., Gandiwag P., Laurenson K., Milanzi J., Nelson A. & Lindsey P., 2018. Models for the collaborative management of Africa's protected areas. *Biological Conservation* 218: 73-82.

Balmford A., Gaston K.J., Blyth S., James A. & Kapos V., 2003. Global variation in terrestrial conservation costs, conservation benefits, and unmet conservation needs. *Proceedings of the National Academy of Science* 100: 1046-1050.

Brugière D., 2016. Evaluation 2011-2015 de l'Accord de Partenariat pour la Gestion du Parc national d'Odzala-Kokoua, République du Congo. Rapport BRLI Ingénierie, Nimes, France.

Brugière D., Chardonnet B. & Scholte P., 2016. Large-scale extinction of large carnivores (lion *Panthera leo*, cheetah *Acinonyx jubatus* and wild dog *Lycaon pictus* in protected areas of West and Central Africa. *Tropical Conservation Science* 8 : 513-527.

COMIFAC, 2018. Guide Sous-Regional de Bonnes Pratiques pour la Gestion des Aires Protégées en Mode Partenariat Public-Privé PPP en Afrique Centrale. COMIFAC, Série Politique 11. https://www.comifac.org/documents/autres-publications/

European Commission, 2014. Évaluation de la coopération de l'Union Européenne avec la République Démocratique du Congo 2008-2013. Rapport, Union Européenne, Kinshasa, RDC.

Goodman P.S., 2016. Akagera National Park Management Performance Review for the period 2010 to 2015. Report.

Hatchwell M., 2014. Public-private partnerships as a management option for protected areas. *Animal Conservation 17*: 3-4.

Lauginie F., 2017. Evaluation à mi-parcours externe de l'Accord décennal de Partenariat Public-Privé (PPP) entre le Gouvernement de la République du Tchad et African Parks Network (APN) au titre de la délégation de gestion du Parc national de Zakouma (PNZ) et de sa périphérieRapport Particip Gmbh et ETI Consulting.

Maisels F., Strindberg S., Blake S. *et al.*, 2013. Devastating decline of forest elephants in central Africa. *PLoS ONE* 8: e59469.

Norton-Griffiths M., 2007. How many wildebeest do you need? *World Economy* 8: 41–64.

Nyirenda V.R. & Nkhata B.A., 2013. Collaborative Governance and Benefit Sharing in Liuwa Plain National Park, Western Zambia. *Parks* 19(1): 103-114.

Plumptre A.J., Kujirakwinja D., Treves A., Owiunji I. & Rainer H., 2007. Transboundary conservation in the Greater Virunga Landscape: its importance for landscape species. *Biological Conservation* 134: 279-287.

Roulet P.-A., 2004. Chasseur blanc, cœur noir ? La chasse sportive en Afrique centrale. Thèse doctorat, Univ. Orléans, France : 563 p.

Saporiti N., 2006. Managing National Parks. How Public-Private-Partnerships can Aid conservation. The World Bank Group. Public Policy for the private sector. Note N*o*. 309, World Bank, Washington DC, USA.

Scholte P., 2013. Population trends of antelopes in Waza National Park (Cameroon) show escalating effects of poaching and livestock intrusion. *African Journal of Ecology* 52: 370-374.

Scholte P., 2011. Towards understanding large mammal population declines in Africa's protected areas: a West-Central African perspective. *Tropical Conservation Science* 4(1): 1-11.

Scholte P., Agnangoye J.P., Chardonnet B., Eloma H.P., Nchoutpouen C. & Ngoga T., 2018. A Central African perspective on delegated management of protected areas. *Tropical Conservation Science* 11: 1-10.

SETYM international, 2012. Document du module de formation sur les partenariats public-privé 2012-2013. Document non publié.

Yasuda A., 2012. Is sport hunting a breakthrough wildlife conservation strategy for Africa? *Field Actions Science Report* 6: 1-8. http://journals.openedition.org/factsreports/1362

Additional references

African Parks Network, 2019. Annual report 2018. https://www.africanparks.org/sites/default/files/uploads/resources/2019-06/AFRICAN%20PARKS%20-%202018%20Annual%20Report%20-%20Full%20-%2005062019%20-%20Digital_0.pdf

African Parks Network, 2020. Annual report 2019. https://www.africanparks.org/sites/default/files/uploads/resources/2020-06/AFRICAN%20PARKS%20-%202019%20Annual%20Report%20-%20WEB%20READY%20v4%20-%20Low%20Res.pdf

Akagera National Park, 2018. January 2018 monthly report.

d'Huart, J.-P., 2013. Avancement des partenariats public-privé existants dans les Parcs Nationaux de la Garamba et des Virunga (R.C. Congo), d'Odzala-Kokoua (République. du Congo) et de Zakouma (République. du Tchad). Analyses des forces et des faiblesses des PPP et piste d'amélioration et de renforcement. Rapport AGRECO, Bruxelles.

EPEC, 2015. The Guide to Guidance How to Prepare, Procure and Deliver PPP Projects. European PPP Expertise Centre.

Fondation Tri-Sangha, 2018. Annual Report 2017. http://www.fondationtns.org/dev/wp-content/uploads/2018/05/RAPPORT-ANNUEL-FTNS-2017-ENG-LD-print.pdf

Lescuyer G., Poufoun J.N., Defo L, Bastin D. & Scholte P., 2016. Does trophy hunting remain a profitable business model for conserving biodiversity in Cameroon? Int. Forestry Review 18 (S1): 108-118. http://www.cifor.org/publications/pdf_files/articles/ALescuyer1602.pdf

Union Européenne, 2015. Annexe de la décision de la Commission relative au programme d'action annuel 2015 en faveur de la République Démocratique du Congo à financer sur le 11e Fonds Européen de développement. Document relatif à l'action pour le programme Environnement et agriculture durable pour la sauvegarde des sites biologiques prioritaires de la République démocratique du Congo. http://ec.europa.eu/transparency/regdoc/rep/3/2015/FR/3-2015-6758-FR-F1-1-ANNEX-2.PDF

Union Européenne, 2016a. Annexe 2 de la décision de la Commission relative au programme d'action annuel 2016 en faveur de la République du Tchad à financer sur le 11e Fonds Européen de développement. Document relatif à l'action pour le programme d'appui à la gestion concertée des aires protégées et écosystèmes fragiles du Tchad (APEF) URL : https://ec.europa.eu/europeaid/sites/devco/files/ad-2-aap-chad-2016_fr.pdf

Union Européenne, 2016b. Annexe relative au programme d'action annuel 2016 en faveur de la région Afrique centrale à financer sur le 11e Fonds Européen de Développement. Document relatif à l'action pour Programme d'Appui pour la préservation de la biodiversité et les écosystèmes fragiles – phase 6 (ECOFAC6). https://ec.europa.eu/europeaid/sites/devco/files/ad-3-central-africa-2016_fr.pdf

U.S. Fish and Wildlife Service, 2018. Central Africa Regional Program Catalog of Federal Domestic Assistance (CFDA) Number: 15-651. Funding Opportunity Number: F18AS00060. Notice of Funding Opportunity and Application Instructions.https://www.fws.gov/international/pdf/FY18-AFR-NOFO.pdf

Zakouma National Park, 2018. January 2018 monthly report.

APPENDICES

Appendix 1 – Protected areas with delegated or co-management agreements in Central Africa: generalities

Country	Protected Area	Area (km²)	Category IUCN	World Heritage Site	Partner
CAR	Chinko	15,027 18,392 (2)	VI	no	Chinko project + APN APN
	Dzangha-Sanga	1,220 / 3,159	II VI	yes	WWF
	North-east Protected area complex	40,724 / 113,898 (3)	I + II + IV Hunting zones (VI)	yes	WCS
Tchad	Ennedi	24,412	V	yes	APN
	Zakouma NP + Siniaka Minia WR + Bahr Salamat WR	3,100 4,643 + 20,950	II + IV	no	APN
Congo	Nouabale-Ndoki NP	4,230	II	yes	WCS
	Odzala-Kokoua NP	14,330	II	no	APN
DRC	Garamba NP + HZ	5,133 9,663	II Hunting zones	yes	APN
	Okapi	13,700	IV	yes	WCS
	Salonga NP	33,618	II	yes	WWF
	Upemba NP - Kundelungu NP	24,600 ?	II, IV, Hunting zones	no	Forgotten Parks
	Virunga NP	7,880	II	yes	VF
Rwanda	Akagera NP	1,122	II	no	APN
	Nyungwe NP	1,019	II	no	APN

Protected areas: HZ: Hunting Zone; NP: National Park; WR: Wildlife Reserve

Partner: APN: African Parks Network; VF: Virunga Foundation; WCS: Wildlife Conservation Society; WWF: World Wide Fund for Nature;

Management Type: Co-m: Co-management; DM: Delegated management

1. Indicated are all signed contracts, the newer ones superseding the older ones (Chinko, Garamba, Virunga, Zakouma) as indicated.

2. The 18,392 km² area is to be enlarged, pending 'three years of studies' with all neighboring hunting zones totaling 17,819 km² and 'following a change in status of other hunting zones' an additional 9,990 km² that would bring the total at 46,201 km².

Type	Contract since (1)	Contract duration (year)	Management body name	Governance oversight	Notes
DM	2014 2020	50 25	Chinko project Directorate-General	Board of Directors	Part of the area (made up of hunting concessions) to be upgraded in a national park within 3 years (2)
Co-m	2019	5	Management unit	Monitoring committee	Contract after > 30 years of support
DM	2018	25	Direction	Board of Directors	
DM	2017	15	Direction	Board of Directors	Reserve Naturelle et Culturelle de l'Ennedi created on the 6th of February 2019
DM	2010 2017	20 10	Direction	Board of Directors	
DM	2013	25	Foundation	Board of Directors	
DM	2010	25	Foundation	Board of Directors	
DM	2005 2011 2016	5 3 10	Direction (Foundation considered)	Board of Directors	2011 contract not seen, said to be linked to EU-WB funding
DM?	2019				Contract not seen
Co-m	2015	3	Management unit (Foundation considered)	Steering committee	Contract after > 10 years of support
DM	2017	15	Management committee		Consultatif Comité de coordination du Site,
DM	2005 2011 2015	? 10 25	Management committee	Board of Directors	2005 contract not seen
DM	2010	20	Non-profit business	Board	
DM	2020?	?	?	?	Contract under negotiation, not seen

3. The area (40,724 km²) corresponds to those zones considered as priority in the CAR-WCS contract, i.e. Manovo-Gounda-St.Floris NP, Bamingui-Bangoran NP, Vassoko-Bollo Strict Nature Reserve and Koukourou-Bamingui Faunal Reserve and Zone Pilote Sangba, 'with increasing efficiency and funding' this will be enlarged to a total of c. 67,769 or 'potentially, after evaluation', to 113,898 km².

Appendix 2 – Delegated and Co-management Contracts

CAR

Chinko

Accord de partenariat entre le Ministère de l'Economie Forestière, Environnement et Tourisme et le Projet Chinko pour la gestion et le financement de la Zone de protection du Chinko République Centrafricaine (2014). Signed: for the Government of the Central African Republic, the Minister of Forest Economy, Environment and Tourism Hyancinthe Touhouye; for the Chinko Project, Executive Director David Simpson.

*Accord de Partenariat entre le Gouvernement de la République Centrafricaine représenté par le Ministère des Eaux, Forêts, Chasse et P*êche (MEFCP) et *African Parks Network pour la gestion et le financement de l'aire de conservation de Chinko (2020).* Signed: for the Government, Minister Amit Idris; for African Parks Network, Peter Fearnhead.

North-East

Accord de partenariat entre la République Centrafricaine représenté par le Ministère des Eaux, Forêts, Chasse et Pêche et lla Wildlife Conservation Society (WCS) pour la gestion et le financement du complexe des Aires Protégées du Nord-Est de la République Centrafricaine et son paysage fonctionnel (2018). Signed: for the Government, Minister Lambert Lissane-Moukove; for WCS, Dr. Hon G. Robinson.

Dzanga-Sangha

Accord de cogestion pour la gouvernance et le financement des Aires Protégées de Dzangha-Sangha (APDS) entre le gouvernement de la République Centrafricaine représenté par le Ministre des Eaux, Forêts, Chasse et Pêche (MEFCP) et le Fonds Mondial pour la Nature (WWF-international). Signed: for WWF Marc Languy, Director for Central Africa; for the Central African Republic, S.E. Lambert Lissane-Moukove, Minister of Water, Forests, Hunting and Fishing.

CHAD

Zakouma

Accord de Partenariat entre le Gouvernement de la République du Tchad et African Parks Network (APN) pour la gestion et le financement du Parc National de Zakouma (2010). Signed: for the Government of the Republic of Chad, the Minister of Environment and Fishery Resources Hassan Terap; for African Parks Network, Countries Director Jean Marc Froment.

Accord de Partenariat entre le Gouvernement de la République du Tchad et African Parks Network (APN) pour la gestion et le financement du Parc National de Zakouma et son Grand Ecosystème Fonctionnel (2017). Signed: for the Government of the Republic of Chad, represented by the Minister in charge of protected areas Ahmat Mbodou Mahamat; for African Parks Network, Peter Fernhead, Chairman and CEO.

Ennedi

Accord de Partenariat entre le Gouvernement de la République du Tchad et African Parks Network (APN) pour l'appui à la création puis la gestion et le financement de la réserve naturelle et culturelle de l'Ennedi (RNCE). Signed: for the Government, Minister of the Environment and Fisheries Dr. Ahmat Mbodou Mahamat; for African Parks Network, the Director of Operations Baudouin Michel.

CONGO

Odzala-Kokoua

Accord de Partenariat pour la gestion et le financement du Parc National d'Odzala-Kokoua République du Congo (2010). Signed: for African Parks Network, Executive Director Peter Fearnhead; for the Republic of Congo, Minister of Forest Economy, Sustainable Development and the Environment Henri Djombo.

Avenant no. 1. Accord de Partenariat entre le Gouvernement de la République du Congo et African Parks Network du 14 November 2010 Relatif à la gestion du Parc National d'Odzala-Kokoua en mode partenariat public-privé (2017). Signed: for African Parks Network, Executive Director Peter Fearnhead; for the Republic of Congo, Minister of Forest Economy, Sustainable Development and the Environment Rosalie Matondo.

Nouabale-Ndoki

Accord de Partenariat pour la gestion durable et le financement du Parc National de Nouabalé Ndoki, Répu-

blique du Congo (2013). Signed: James Deutsch, WCS Africa Program Director; for the Government, the Minister of Forest Economy and Sustainable Development Henri Djombo.

DRC

Garamba

Contrat de Gestion entre l'Institut Congolais pour la Conservation de la Nature et African Parks Network, Kinshasa (2005). Signed: for African Parks Foundation, Paul van Vlissingen; for Congolese Institute for Nature Conservation (ICCN), Dr. Cosma Wilungula Balongelwa.

Contrat de Gestion du Parc National de la Garamba entre l'Institut Congolais pour la Conservation de la Nature et African Parks Network (2016). Signed: for African Parks Network, Peter Fearnhead; for ICCN, Dr. Cosma Wilungula Balongelwa.

Virunga

Contrat de Gestion entre l'Institut Congolais pour la Conservation de la Nature et L'Africa Conservation Fund (UK) (2011). Signed: for Africa Conservation Fund-UK (United-Kingdom), Jan Blonde Nielsen and S.E. Francois Xavier de Donnea; for ICCN, Dr. Cosma Wilungula Balongelwa and Yves Mobanda Yogo.

Contrat de Gestion entre l'Institut Congolais pour la Conservation de la Nature et la Virunga Foundation (2015). Signed: for Virunga Foundation, Mr. Francois Xavier de Donnea and Mr. Jan Blonde Nielsen; for ICCN, Dr. Cosma Wilungula Balongelwa.

Salonga

Protocole d'Accord spécifique définissant les modalités de Cogestion du Parc National de la Salonga entre l'Institution Congolais pour la Conservation de la Nature et le World Wide Fund for Nature (2015). Signed: for WWF, Jean Claude Muhindo; for ICCN, Dr. Cosma Wilungula Balongelwa.

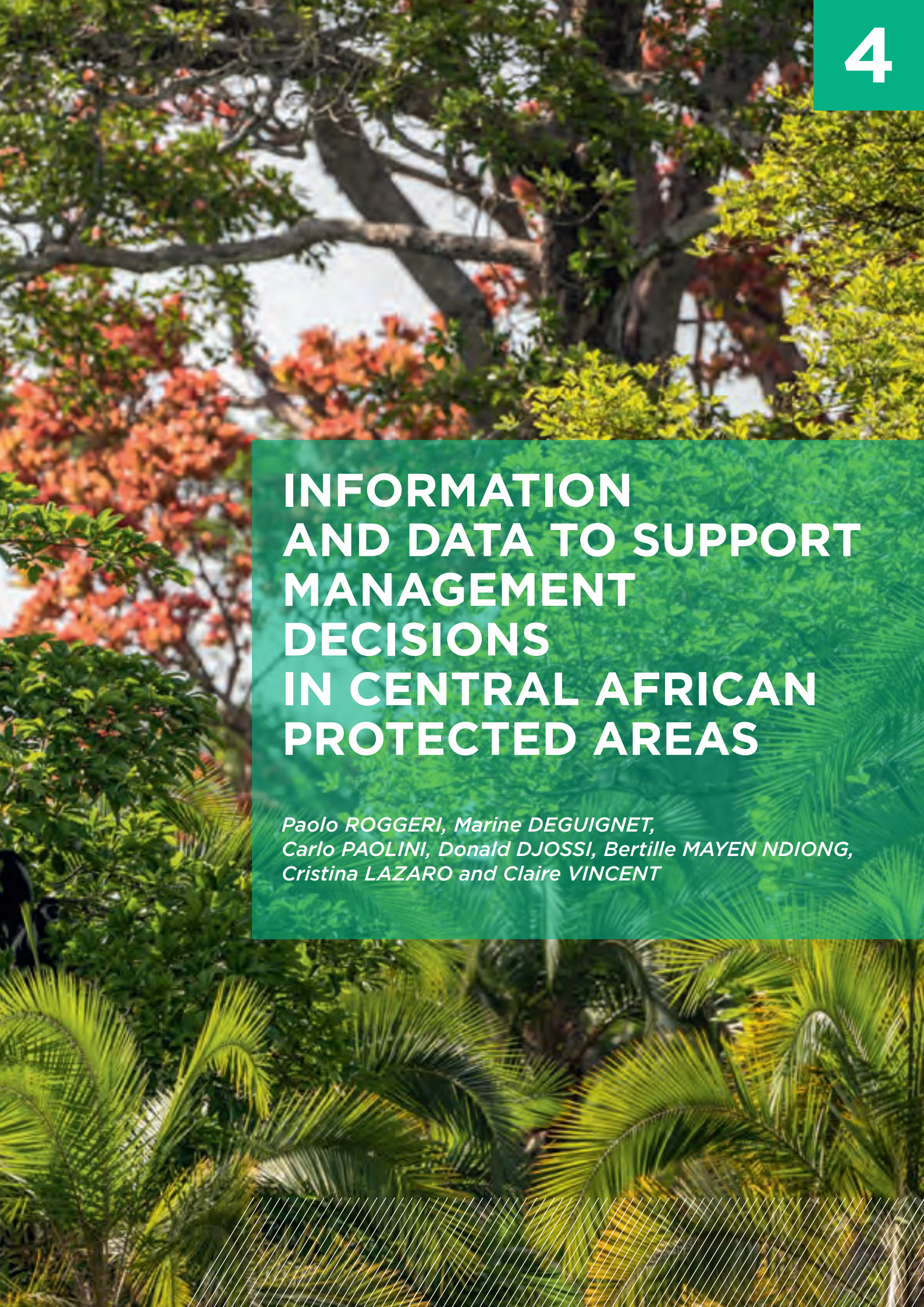
Upemba-Kundelungu

Contrat de Gestion du complexe Upemba-Kundelungu (CUK) entre l'Institut Congolais pour la Conservation de la Nature et Forgotten Parks Foundation (2017). Signed: for Forgotten Parks Foundation, Dr Peter Blomeyer; for ICCN, Dr. Cosma Wilungula Balongelwa.

RWANDA

Akagera

Public Private Partnership Agreement between The Rwanda Development Board and the African Parks Network relating to the Management and Financing of Akagera National Park (2010). Signed: for African Parks Network, Peter Fearnhead; for Rwanda Development Board, John Gara.



4

INFORMATION AND DATA TO SUPPORT MANAGEMENT DECISIONS IN CENTRAL AFRICAN PROTECTED AREAS

Paolo ROGGERI, Marine DEGUIGNET, Carlo PAOLINI, Donald DJOSSI, Bertille MAYEN NDIONG, Cristina LAZARO and Claire VINCENT

Biodiversity conservation is a major challenge for policymakers in Central African countries. In a context of chronic underfunding, information plays a crucial role in ensuring the effectiveness of interventions and investments. The use of information is vital for a number of reasons: information supports all decisions related to planning and management, it helps to target and calibrate the efforts that need to be made, and it allows the impact of actions undertaken to be measured. Nonetheless, far too little attention and resources are devoted to information collection and information management.

> **Information** can be considered as the resolution of uncertainty. The concept of information has different meanings in different contexts. In our case, information is associated with data linked to understanding conceptual and concrete elements. The more an element is uncertain, the more information is needed to resolve this uncertainty and to find a viable solution.

The very usefulness of having priority information for the management and governance of protected areas is sometimes questioned. Many managers still see data collection as an unnecessary activity that diverts resources from more important actions. Yet insufficient information negatively impacts the quality of planning, the identification of intervention priorities and, ultimately, the outcomes of actions undertaken.

This situation is mainly due to two factors. On the one hand, there is a vicious circle in protected areas. A lack of information makes management more complicated, leading managers to work in a reactive mode, responding to problems as they happen rather than taking a proactive approach with a long-term perspective. On the other hand, we still have in the frame of support projects in Central Africa insufficient dialogue between protected area managers and information producers (experts, groups of specialists, biodiversity observatories, networks, etc.). The former are not always able to clearly identify their information needs. The latter, in the absence of guidance from managers and real benchmarks, are unable to focus their efforts on producing information that could be directly useful in achieving desired outcomes in the field.

This undermines planning, monitoring, and evaluation capacities, reduces the ability to identify management objectives and complicates decision-making. A clear vision of conservation objectives makes it possible to better develop the rationale behind an intervention and to formulate sound medium and long-term work programs at the level of both specific sites and protected area networks. The more management is proactive and adaptive, the more information needs will be targeted and reduced, and the more resources can be directed towards achieving conservation objectives rather than resolving short-term problems.

Adopting a proactive approach requires the mobilization and use of data. It is therefore essential to invest in training protected area managers in the collection, production, management and use of data and information, using new technologies, statistics, analysis, interpretation, etc., directly or with the support of partners.

This chapter proposes a set of possible solutions for both information producers and users (protected area managers and policymakers) to strengthen their capacities and levels of interaction and to improve the production, interpretation and use of information.

How to read this chapter?

This chapter is intended for anyone interested in increasing their knowledge of best practices in information management to support decision-making related to biodiversity, especially protected areas. It discusses the importance of having accurate baseline data and of developing systems to collect and manage this data for their easy analysis and processing in view of informing decision-making processes.

The chapter has two parts. The first part, consisting of sections 1 and 2, emphasizes the importance of relying on targeted information to effectively conserve biodiversity (Annex 1 provides a set of

general information on data collection), and discusses the status of information use for decision-making in Central Africa. The second part, covering sections 3 to 7, focuses on the principles of information management and use to support decision-making. It describes the main tools that are available and used in the subregion (see Annex 2 for detailed descriptions), as well as the analyses that can be derived from them. It also illustrates the importance and role of the Central African Forest Observatory (referred to by its French acronym, OFAC) in supporting protected areas and national services in their strategic activities and daily work. Lastly, this part emphasizes how important it is for different actors, and notably national administrations, to share information and promote the role and work of OFAC.

While it is recommended to read the entire chapter, it also is possible to concentrate on either the first or second part, or simply on specific topics of primary interest to the reader.

Note for the reader

In the absence of targeted, in-depth and comprehensive studies in Central Africa on the subject under discussion, the various findings reported are based mainly on the experience gained during IMET (Integrated Management Effectiveness Tool) campaigns conducted in the region (Paolini & COMIFAC, 2020; Paolini *et al.*, 2020), as well as on the personal experience of the authors and of various resource persons.

1. Importance of an action-oriented information system

Biodiversity conservation plays a crucial role in maintaining the balance of ecosystems for the economies of countries in the Central African subregion and for the many people who directly depend on natural resources for their livelihoods. Over recent decades, there has been a significant acceleration in biodiversity loss, including within protected areas. A growing number of species, both animal and plant, are subject to mounting pressures and are facing an increasing loss of their habitats and ecosystems.

Protected areas play a major role in this fight against biodiversity loss. However, protected areas also are facing increasing pressures (Table 1). In response, national governments, sometimes with the support of the international community, are developing action plans relying on information and on technical and financial resources, which are often insufficient or irregular.

Table 1 – Main threats in Central African protected areas

Fragmentation and destruction of natural environments	Urban growth
	Expansion of subsistence farming
	Illegal harvesting of wood (fuel, timber)
	Bush fires
	Illegal mining
Overexploition of wildlife species	Overfishing
	Deforestation
	Poaching
Introduction of invasive exotice species	Fire ants
	Water hyacinth
	Rats and cats on islands
Pollution	Industrial
	Agricultural
	Urban
Climate change	Direct and/or indirect effect on biodiversity
	Failure to demonstrate the importance of protected areas in the fight against climate change
Poor governance	Lack of institutions and procedures for fair conflict resolution
	Weak management capacity
	Failure to enforce relevant legislation
	Absence of a participative management framework
Inadequate conservation actions	Conservation actions that are not relevant, targeted or effective
	Lack of planning based on reliable and up-to-date data and information

Sources: adapted from Paolini et al. (2020) and Jacquemot (2018).

Larger than elephants!

Adapted from the European Commission (2016)

The development of the strategy, "Larger than Elephants" (European Commission, 2016), as the European Union's contribution to a strategic approach to wildlife conservation in Africa, was time-consuming because the information needed to take stock of the situation and make proposals was not available in a format that could be used immediately. Therefore, information from very diverse sources had to be sought, organized, summarized and illustrated in order to develop this strategy.

In the future, such national or regional approaches should be easier to develop relying on previous inventories, observed trends, future perspectives and the desired vision. If relevant information is not organized and structured, the formulation of strategies will continue to require considerable efforts and will remain short on information, and therefore will be insufficiently precise.

Under these conditions, biodiversity conservation strategies must be relevant and targeted. They also must be implemented effectively, and be monitored to ensure their effectiveness and enable them to evolve over time in response to changes on the ground.

Conservation objectives are not always up to date. Their wording may be generic or imprecise, or they may not anticipate changes over time due to a lack of monitoring indicators or specific objectives. Under these conditions, it is difficult to make operational recommendations and to intervene effectively. Even when these objectives (or targets) are identified correctly or are associated with monitoring indicators, there may be gaps in knowledge regarding the nature and extent of the problem, making it difficult to identify reference baselines.

In Central Africa, a large amount of data exists, but it is difficult to access to this data and the information that can be drawn from it. These data are not always comparable or regularly updated, and they are rarely quantified or organized in a structured or useable database. This situation is confusing for decision-makers who struggle to "filter" this information. Despite the apparent abundance of information, a wide gap often remains between the level of "critical knowledge" (what is needed and can be used to intervene in an effective and targeted manner) and what is actually known about the reality on the ground. Also, it is worth distinguishing "information" from "practical knowledge" while managing Central African protected areas.

Elephants and Zakouma National Park

Adapted from Paolini (2009).

Between 2002 and 2010, 95% of the elephants in Zakouma National Park (Chad), representing nearly 4,000 animals, were slaughtered by poachers for their ivory tusks. A lack of information had created the impression that the significant increase in the park's elephant population during the 2000s was due to the park's effective management. In reality, while the number of elephants inside the park had risen during this period, this was due to pressure from poachers across the region driving elephants towards areas of refuge like Zakouma Park. The increase of animals inside the protected area thus masked widespread poaching, which was taking place at a scale that went far beyond the park itself.

Within the park, the elephant population also was being inadequately monitored due to the animals' seasonal migration outside the park during the rainy season. More comprehensive information about these elephant populations in the subregion, and the monitoring of elephants during their migrations before 2000, could have made it possible to better understand the evolution of poaching activities and to organize a response better adapted to the actual situation.

Today, from the 500 surviving individuals, the elephant population is growing. The park managers know exactly where they live and have been able to adopt more effective planning measures. The monitoring and management of large mammals takes place not only inside the park, but also outside the protected area in collaboration with local communities.

Three conclusions can be drawn from this experience: 1) the 4,000 elephants killed between 2002 and 2010 came not only from Zakouma Park but also from neighboring countries (Cameroon and Central African Republic); 2) the losses could have been limited through a proactive approach formulated on the basis of information from several sites, shared between countries, and regional collaboration; and 3) the resources invested in the protection and restoration of the surviving elephant population of «Zakouma Park/subregion» are considerably higher than the costs of management based on preventive information.

In the management of protected areas, the **information** needed for informed decision-making concerns the status and changing trends of key elements that we wish to preserve. **Practical knowledge**, based on one's own experiences and what one believes one knows, has its own value, but it is neither targeted nor systematized (very qualitative).

To define appropriate responses to the problems posed, decision-makers and field actors must have access to critical information that enables them to orient and prioritize their interventions. Regional observatories such as OFAC can play an important role in compiling, organizing and facilitating access to this data and information for everyone. They also can help to identify critical gaps in knowledge and to formulate actions to be taken by promoting a quantified "objectives-indicators-benchmarks" approach.

Information is not only fed through the collection of data; this data must be shared, analyzed, and used for planning and decision-making. Today, these aspects continue to receive insufficient attention. Sharing data helps to define a vision that is both broader and more accurate, enabling countries to achieve better levels of understanding. It also provides an immediate return in terms of capacity building and improved effectiveness in the implementation of conservation policies. For further information on data collection and management, please refer to Annex 1.

"Sentinel" indicators

OFAC (*Observatoire des Forêts d'Afrique Centrale*), a regional observatory (www.observatoire-comifac.net/), can provide a sentinel indicator and/or alert service to monitor pressures on and threats to biodiversity. Sentinel and alert indicators are a type of "substitute" indicator that can take the place of indicators in logical frameworks and Planning-Monitoring-Evaluation (PME) systems of projects and activities. This type of indicator is not used to measure the outcome of an activity, but rather as a signal to indicate an important change in a key element within a complex system. They therefore should be easy to collect and communicate, and signal the need for more in-depth analysis and investigation. Sentinel indicators support adaptive and proactive project management, and are not tied to a fixed objective.

Sentinel indicators are used to monitor key elements of a system in order to monitor and provide information about relationships of mutual influence between different actors and their context. Unlike performance indicators, which are used to measure changes leading towards a desired condition or expected results, sentinel and early warning indicators are used to signal changes within the system in which a project is operating. A distinction may be made between **sentinel indicators**, which enable long-term monitoring of contextual factors, and **alert indicators**, which are collected more regularly and can indicate an immediate need to adapt management or to conduct an in-depth analysis of a situation.

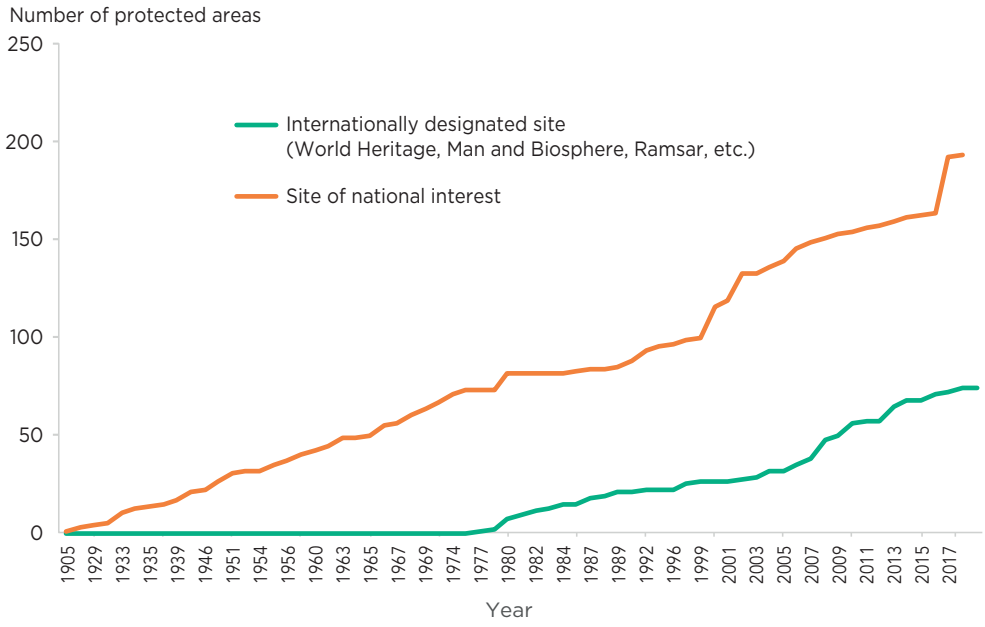
For example, in relation to the Covid-19 pandemic, it would be possible at an operational level to use sentinel indicators to monitor closely and regularly the evolution of forest cover and habitat integrity which, if degraded, could facilitate virus spread, or monitor bushmeat markets, etc. Sentinel indicators can provide important information for the management of protected areas, including aspects that may be more strongly impacted by the consequences of the pandemic and by restrictive measures adopted by different governments. This includes, for example, increased poaching in relation to a drop in tourism and reduced national funding for conservation sectors and sites.

2. Status of data collection and processing in the management of Central African protected areas

2.1 Insufficient consideration of core data in the creation of Central African protected areas

The creation of protected areas in Francophone Africa can be traced to three historical periods: between 1930 and 1950 during the colonial era, between 1960 and 1990 following independence, and since 1990, after the Rio Conference (Figure 1). The creation of protected areas in the region took place in a wide variety of contexts, responding to clear conservation goals or aiming to meet international commitments. However, these initiatives have not always relied on baseline data enabling a better understanding of the ecological wealth of these areas and their importance for the human societies living in them. A textbook example was the creation of certain forest parks in the Democratic Republic of the Congo (DRC) in the 1970s after a simple flyover in a plane. Furthermore, the creation of a considerable number of protected areas over a very short period of time was not followed up with the support or resources needed for their management.

Figure 1 – Evolution of protected areas in Central Africa



Note: sites with a "proposed" status and a value of "0" for the designated year were excluded from the analyses.
Source: WDPA (2020).

While the progress measured in relation to Aichi Biodiversity Target 11 in the Convention on Biological Diversity (CBD) testifies to the efforts being made by Central African countries to achieve this target (Mengue-Medou, 2002; Deguinet *et al.*, 2018), the expansion of protected areas nonetheless does not always explicitly refer to clear conservation priorities. According to the management guidelines for protected areas prepared by IUCN (International Union for Conservation of Nature), all protected areas should be established with a precise conservation objective. Basic information also must be available to characterize this objective and to define the targeted results (e.g., protection of a habitat or a rare species), the actions to be carried out and the mode of management. The importance of being able to have up-to-date and quality data to characterize the situation on the ground and identify the best sites and the best management options is obvious. Unfortunately, this has not always been the case, and various protected areas in Central Africa, regardless of when they were established, do not have, or can no longer find, the basic information justifying their creation (Thomas & Middleton, 2011).

Nevertheless, it must be recognized that in general, even without objective or in-depth information, the creation of protected areas has relied on technical notes and/or information, sometimes oral or experts accounts, which have led to more in-depth investigations and the decision to put the territory in question under protection (as in, for example, the case of Odzala-Kokoua National Park in Congo). Some approaches, such as IUCN's identification of critical sites for forest conservation, the Important Bird Areas (IBAs) compiled by Birdlife International, or the creation of Gabon's network of national parks, have been based on more or less detailed studies, with a greater emphasis on knowledge related to biodiversity than socioeconomic interests (IUCN, 1989; Fishpool & Evans, 2001; Doumenge *et al.*, 2003a and b).

The systems now used to collect, manage and process data on protected areas in Central Africa have evolved considerably. Nonetheless, the lack of infrastructure and insufficient support in terms of capacity building of protected area management actors remain significant. Consequently, managers are not always able to keep on top of changes in tools used for data monitoring, processing and analysis.

Data analysis is a process of inspecting, cleaning, processing and modelling data in order to highlight information that enables a better understanding of the situation, suggests conclusions, and facilitates decision-making.

Data processing refers to a series of processes that extract information or produce knowledge from raw data.

Based on feedback from assessments of the management effectiveness of protected areas generated by the IMET tool since 2015, it appears that a small number of protected areas are using and promoting such approaches and tools to improve planning and management (Paolini & COMIFAC, 2020). This trend is more noticeable in protected areas receiving external technical support under large conservation programs or which are part of Public-Private Partnership (PPP) governance

systems. However, these programs are time-limited and their objectives rarely fit into a comprehensive intervention logic that takes into account the protection of values and human well-being.

At the national level, the process of collecting and centralizing information varies widely in the countries covered by COMIFAC (*Commission des Forêts d'Afrique Centrale*), and often is oriented towards administrative or surveillance information rather than ecological or socioeconomic monitoring. Only a few countries, such as Cameroon, Gabon, Congo and DRC, have a data centralization and processing unit within the institutions in charge of protected area management, which allow these institutions to have detailed information on the protected areas that they manage.

2.2 Description of the current situation

Data on protected areas and biodiversity are collected by national conservation services in partnership with other national and international actors. Due to their often extremely limited resources and the mounting number of threats faced, their operational objectives focus on preventing situations from further deteriorating by adopting an approach that is more reactive than proactive, and which does not consider critical underlying factors. In practice, management often boils down to a routine activity far removed from an approach based on factual data and analysis.

At present, it is clear that a regional database does not yet exist which lists all of the efforts to assess management effectiveness that have been carried out in the different countries and the different protected areas of Central Africa. This is certainly an initiative that should be set up with OFAC's support. Over the past five years (2015-2020), multiple assessments of the effectiveness of protected area management have been carried out using the IMET tool (Paolini *et al.*, 2020). According to feedback from past experiences (IMET campaigns, Sub-working group on protected areas and wildlife (SGAPFS) of COMIFAC, experiences of resource persons), it seems that all too often there are "rudderless navigation" situations where management plans, annual action plans, and even anti-poaching activities are developed or implemented without essential knowledge about the context of intervention of protected areas and their peripheries.

Overall, the efforts of field partners to share, secure and centralize the data collected for future use remain insufficient. A significant number of actors in the field, data generators and data collectors (operators in charge of PPPs, non governmental organizations (NGOs), research institutes) work outside the IUCN framework of the Global Database on Protected Areas Management Effectiveness (GD-PAME). Some have adopted their own approaches. Others are unwilling to share their data, either because they have an eye on future publications, or due to the sensitivity of certain information, or to avoid provoking conflict or criticism.

Even today, once a program is completed, some partners leave the site taking with them much of the data and information generated during their period

The importance of accurate and up-to-date conservation objectives

IMET analyses carried out in 2015-2016 in some one hundred Central African protected areas have sometimes highlighted extreme situations with regard to planning-monitoring-evaluation systems. During the planning analysis, one national park reported objectives from a management plan that were over 20 years old. If the management team of the park in question continues to take actions to achieve objectives defined on the basis of an inventory made over 20 years ago, there is a strong risk that it will be out of step with the current situation of the protected area, which will call into question the effectiveness of the actions undertaken.
To reduce the risks of biodiversity loss, managers must: 1) identify clear, achievable and up-to-date management objectives, and 2) adopt a results-oriented PME approach.

of support. Many of the protected areas in the region are permanent research laboratories for many of the international agencies and research centers located there, with the permission of the research ministries. Research activities producing massive amounts of data are regularly conducted by students completing master's theses and PhD dissertations.

A problem found repeatedly in Central Africa is that this mass of information is not used for management, and the research carried out does not meet management needs. Unfortunately, no coordination yet exists between research actors and the ministries in charge of research and technical supervision which could ensure that the results obtained are centralized in order to formulate conservation and operational management strategies. Yet making such information available is essential to help define baseline situations and to be able to monitor trends in the field. The failure to secure data and a lack of synergy between different actors are the reasons why each time new initiatives are set up, the first task that must be undertaken is to establish the baseline situation, which sometimes requires considerable financial resources.

In protected areas which have a significant quantity and quality of information, these data are sometimes inconsistent or sectoral, often very dispersed, and sometimes stored in private computers. However, it is important to emphasize that there are numerous examples of good information management in the subregion. Experience has shown that better information management facilitates effective protected area management, one that is more results-oriented and, most importantly, enables management objectives and results to be achieved even when financial and human resources are limited.

It is also interesting to note that, in general, problems related to the management of protected areas are rarely addressed in an integrated manner despite the close links between various issues and the intervention context. The management of natural resources is influenced by the institutional context, the threats and pressures faced by these areas, the goods and services rendered to human societies, climate change, and so on.

2.3 Main constraints

Several difficulties may arise when implementing a sustainable data collection system. Table 2 shows the most recurrent.

3. The challenges of information management for decision-making

When collecting data and managing information, protected area managers and experts face many challenges and constraints, including the following: funding availability, prioritization of the collection(s) needed to fill gaps in critical information, availability

Table 2 – Main constraints related to implementing sustainable data collection systems

Main constraints	Associated issues
Insufficient financial and logistical resources	The establishment of long-term systems for collecting and processing data requires substantial financial resources.
Weak staff capacities in the field and in central services	There have been significant technological advances in collection, storage and analysis tools. Certain phenomena observed in protected areas require sophisticated tools to be able to quantify them. Although these tools exist, staff are not sufficiently trained in their use.
Inadequate staffing levels	The staff available is often insufficient to guarantee the proper functioning of the planning, coordination, monitoring and evaluation processes, or to guarantee the proper implementation of field activities, an inherent part of management.
Institutional instability	Administrative staff posted to sites are subject to particularly rapid rotations. In addition, the departure of an individual is rarely anticipated and not at all prepared. Beyond the direct impacts on operation, these departures often result in the loss of data collected during the person's stay at his or her post because the use of personal computers is frequent and centralized data storage systems are rarely set up or updated.
Politicians' limited interest in conservation	For example, investments in operations like research and information gathering are very low. Politicians generally are unaware of the benefits that conservation actions can provide.
Difficulty in managing and using available data	The problem of using, developing and exploiting data in the management of protected areas remains vast. The shortage of national and regional biodiversity experts and the limited use of structured collection tools linked to a centralized database for the processing, analysis and interpretation of data constitute real bottlenecks. These activities are mainly carried out by experts who often do so independently, without direct collaboration with protected area staff.

of resources and materials, staff skills, logistics organization, Information Technology (IT) support for data recording and data transfer, and even data archiving at the central level or in the reference database. Despite the efforts made, given the increasing decline in biodiversity, the results achieved have been mixed. Coordinated action, based on a better knowledge of the contexts of intervention and the establishment of effective surveillance and monitoring systems, is essential to improve the situation on the ground. Investments to strengthen the capacities of key actors responsible for data analysis are also needed to provide accessible, organized and usable data and information.

The smooth and transparent flow of data, and the potential to easily analyze and compare data, are critical elements for adjusting and informing actions in the field. The constitution of such an information system would make it possible to establish indispensable links between the planning, monitoring and evaluation of actions, ensuring an approach and responses consistent with the reality on the ground.

Another important issue involves the practical difficulties encountered when the status of specific situations (particular themes, assets, or threats) needs to be represented by compiling different types of information coming from different sources, origins and periods,

and on different scales. This exercise is nonetheless necessary to provide decision-makers – ideally with the support of technical and statistical analysis tools – with thematic and visual summaries (Decision Support Systems, or DSS). These summaries must reflect the reality on the ground, simplify the identification of the current situation, and allow desired future conditions to be formulated in order to calibrate the interventions.

These summarizing efforts, as well as the establishment of well-structured databases, are decisive elements for the effective management of protected areas. They allow various actors to see more clearly and save national officials, experts and donors from having to undertake extensive research to find the information necessary for decision-making.

4. From data collection to data storage

Targeted data collection based on the management objectives of each protected area promotes proactive and adaptive management focused on results.

4.1 What questions are we trying to answer?

The information sought must always be oriented towards decision support and the achievement of well-defined objectives and results, both on an individual protected area and its peripheries and on an entire network. Each protected area site and network is characterized by its own conservation priorities, each with specific underlying questions that data collection must help answer to confirm or reject initial hypotheses. Decision-makers must be informed about the situation in the field, the implementation status of strategies (or management plans) and, more generally, the state of biodiversity conservation in their reference site, country or region.

With respect to this objective, it is important to be able to have a structured information system that can offer a transparent view of the vital information actually available on different themes and on protected area management issues.

At the national level, the overall framework for intervention is usually the CBD and the national biodiversity conservation strategy. It is essential to facilitate the monitoring of their implementation through efficiency and performance indicators.

> **Vital information** is the information that is crucial or truly important for decision-making. It is the information that enables decision-makers to avoid drowning in a sea of excess information, only a small portion of which is relevant or directly useful for decision-making. An efficient information system should enable decision-makers to access a dashboard and instruments that allow them to easily assess and make decisions about a situation.

For each **priority management objective** identified (for example, the conservation of animal or plant species, of habitats, of ecosystem services, etc.), monitoring specific indicators and related reference levels will allow decision-makers to visualize the gap between the actual situation and the target situation. When these indicators are unavailable, specific work should be initiated with the supervisory authorities to formulate them (or reformulate them if necessary). For each of the national priorities selected, a basic inventory must be available or, at the least, the capacity to assess (as much as possible on the basis of quantitative information) the level of knowledge of the situation on the ground.

4.2 Archiving and storing data

Data collected must be archived and stored in computerized databases at both the site level and national and regional levels. These databases should be suitably organized to enable further data processing, support analyses and facilitate the adoption of result-oriented approaches. These same data should be able to be updated regularly.

One of the main challenges is archiving data collected in the field (for example, during research campaigns, anti-poaching patrols, territory inspections, ecological monitoring and monitoring-evaluation exercises). Data collected using digital tools (for example, smartphones, iPads, Cybertracker, IMET Offline, laptop computers and tablets) must be transferred to the central system of the protected area, either remotely if the data collection tools are able to do so, otherwise as soon

as the teams return to the home base. The same holds true for data noted on paper or in specific collection forms which must be quickly entered and saved in the central system. The rapid transfer of field data makes it possible on the one hand to use the information in real time and, on the other, to limit the risk of losing information collected through the accumulation of an unmanageable backlog or the deterioration of the equipment itself.

Data archiving refers to the transfer of data to the protected area's central system or to a higher level.

Data storage refers to the manner by which different information collected is archived and therefore organized in the databases of the central system of the protected areas or at a higher level.

Storing the data collected requires the database to be organized so that the data can be further processed as easily as possible. The organization of databases at different management levels (protected area, provincial or regional office, central service, etc.) must be the same, or at least be sufficiently compatible for data to be easily transferred from the site to higher levels. It must enable all information relating to the same theme (for example, the same protected species or the same threat) to be easily visualized and extracted, thereby facilitating an overview of the situation in the field and the level of knowledge (surveys, inventories, studies, patrol reports), and allowing a better identification of critical information gaps.

When protected areas and national services have been able to equip themselves with digital information systems, the ways data are stored had to be adapted. Indeed, they are generally designed to facilitate the storage of information for consultation and visualization purposes rather than for the purpose of actually processing and extracting data to produce analysis reports and support decision-making.

Furthermore, there is a lack of synergy and pooling of efforts between the operators of national monitoring systems and those of OFAC's regional system, which limits the emergence of a comprehensive perspective. It is therefore useful to strengthen the interoperability and articulation between databases and to favor systems which, thanks to a structure in different thematic modules, support and facilitate processing and analysis processes.

Three key criteria should guide data collection, and particularly the choice of data collection tools and instruments: quantification, comparability, and change of scale. Tools and information systems following these principles exist and are used in Central Africa, including, for example, the IMET tool, whose database offers "advanced" data processing capacities (OFAC, 2020).

Quantification: need to quantify data as accurately as possible. This element is critical to supply reference data and develop work plans that are as accurate as possible.

Comparability: possibility to compare the situation and performance of different protected areas regarding specific aspects.

Scaling up: the ability to perform analyses at the level of protected area systems (national, regional or ecosystem) based on information on individual protected areas.

It also is critical to clearly define the procedures and modalities for the **transmission of information** both at the local level and to higher levels (e.g., national agency or service responsible for protected areas, OFAC). The definition of the data transmission system and the roles of each within it, and rigorous adherence to these procedures and modalities, form the basis of effective information management.

4.3 Responses to the main challenges related to information management

The main challenges related to the continuous updating of information on protected areas are, beyond essential financial resources, the total absence of standards for data transmission systems and for clear workflow within protected areas and between these areas and the administrations concerned. In practice, managers face a wide range of difficulties and problems when collecting and managing data (technical, logistical, financial, equipment, organization, training, data transmission, computer connections, etc.).

Some general recommendations are proposed in Table 3. They aim to improve information management within conservation sites and at the central level. However, to achieve meaningful results, each of these recommendations requires strong political will and backing.

Table 3 – Recommendations for improved information management

Recommendations	
Formalize and document	In administrations, it is important to formalize and document the procedures for processing information on biodiversity through guidelines and to have these applied at the central level and on the sites.
Centralization and management of data at the site level, creation of data management units at the central level	At the site level, this means ensuring the monitoring and centralization of data. At the central level, the task is to create and ensure the correct functioning of a data collection and management support unit to work transversally with other units. The mission of this unit would be to compile, centralize, harmonize and produce analyses contributing to the preparation of state of conservation reports (monitoring and evaluation).
Structure and promote the interoperability of databases	This means establishing well-structured and interoperable databases in protected areas with monitoring systems at different scales (up to national and Central African levels).
Favor field observations	There is an urgent need to promote data collection that is oriented and based on simple field observations instead of always waiting for in-depth studies by experts in a specific field.
Monitor the state of biodiversity	Periodic reports transmitted to the headquarters level should be centralized. Reports should integrate aspects of monitoring the state of biodiversity and not be limited only to the description and listing of activities carried out.
Make the data collected accessible	Full access to the data collected, and the possibility to visualize them and use the information derived from them, must be guaranteed to all decision-makers, managers and operators in the field, both at the level of each site and at national and regional levels (observation bodies such as OFAC). This will ensure better staff involvement in the understanding and interpretation of situations and thus ensure a constant improvement in the quality of conservation actions.

4.4 Main data collection tools in protected areas

The technological advances of our era have facilitated a significant change in the way data are collected. The tools available are increasingly powerful, efficient, versatile, easy to use, connected, affordable and widespread. The new models offer more and more interoperability and potential, especially in terms of autonomy (batteries) and archiving or storing information (data, images, maps, etc.). Although more traditional tools such as fact sheets, patrol reports and expert studies continue to be widely used, numerous other methods now exist to collect data in protected areas.

Depending on the themes or aspects targeted (ecological monitoring, fighting poaching, governance, social surveys, management efficiency, tourism, etc.), there are different systems and structured collection methods that are more or less articulated and complex, most supported by one or more specific tools.

Among the ecological monitoring tools, we can cite the various monitoring software developed for Cybertracker, a portable device for collecting data in the field that was widely used in Central Africa in the 2000s. Other computer applications also are available to facilitate animal censuses and flora and fauna inventories.

Among the tools supporting law enforcement and the fight against poaching, we may cite SMART (Spatial Monitoring And Reporting Tool). This is a monitoring and reporting tool which aims to collect and archive conservation data with a particular focus on patrol activities. It helps to promote better decision-making and the more effective organization and deployment of patrols (SMART, 2019). DAS (Domain Awareness System) is another tool that provides a set of applications recording in real time the positions of radios, vehicles, and aircraft and animal sensors. The tool is intended to help managers make immediate tactical decisions to effectively deploy the necessary resources. An IMET module focused on fighting poaching also is being developed and currently is being tested in several Central African protected areas.

In terms of social surveys, beyond traditional survey forms, managers can access some very specific tools such as BNS (Basic Necessities Survey, adapted by WCS, Wildlife Conservation Society, to conservation contexts; Davies, 2020), PA-BAT (Protected Areas-Benefits Assessment Tool; Dudley & Stolton, 2009) and METT (Management Effectiveness Tracking Tool; Stolton & Dudley, 2016). IIED (International Institute for Environment and Development) also has developed a consolidated approach supported by an IT tool called SAPA (Social Assessment for Protected and conserved Areas; Franks & Small, 2016), which is intended to assess the social impacts – positive or negative – of protected areas and any related conservation or development activity.

Widely used and recognized systems do not yet exist for the assessment of governance. However, several tools are currently under development or are being tested in the field. These include GAPA (Governance Assessment for Protected and conserved Areas, Frank & Booker 2018), SAGE (Site-level Assessment of Governance and Equity), and the IMET module for assessing the governance of ecosystem services which is currently being tested in some protected areas in the subregion.

Tools for assessing the management effectiveness of protected areas deserve particular attention given their importance for supporting sound protected area management. Over 70 methods and tools are listed in the GD-PAME. Among those most used in the field, including in Central Africa, we may mention the following:

- EoH (Enhancing our Heritage), which was specifically designed for UNESCO (United Nations Educational, Scientific and Cultural Organization) to assess the management effectiveness of World Heritage sites;
- RAPPAM (Rapid Assessment and Prioritization of Protected Areas Management), developed by IUCN, which helps to compare the management effectiveness of different protected areas;
- METT, which allows a rapid assessment of the management effectiveness of a given protected area but which is not suitable for inter-site comparisons like RAPPAM;
- IMET, which is specifically designed to support decision-making by managers.

Among these tools, the integrated tools combine elements for monitoring management effectiveness, governance, and social assessment. This is the case for IMET and IUCN's Green List of protected areas. These tools are particularly interesting insofar as they allow a much more comprehensive view of a situation and, therefore, directly and effectively support decision-making processes through a planning-monitoring-evaluation approach.

Annex 2 includes a comparative table presenting the main tools commonly used in the subregion. A brief presentation of each tool is complemented by a discussion of its usefulness and main advantages and disadvantages. A map showing the dissemination of these tools in the different countries of Central Africa also is provided. Table 4 presents the use of these tools in Central African countries.

Two examples of integrated results-oriented tools to support decision-making

IUCN Green List of protected and conserved areas: this list is an IUCN initiative to identify and highlight protected areas which are achieving good conservation results and that are effectively managed and equitably governed. It is a certification program and the first global standard for best conservation practices.

IMET: this instrument provides managers elements and tools from different approaches and methods in an integrated package on the same platform. Although initially designed to monitor management effectiveness, IMET offers the possibility of addressing different themes and aspects of management and governance while still supporting planning-monitoring-evaluation processes. It accompanies managers in an analytical approach which, working from an inventory, makes it possible to assess the management effectiveness of a protected area and to determine the management changes needed to achieve the conditions desired. Thanks to an integrated monitoring and evaluation process, managers can periodically fine-tune the planning of their actions based on actual changes observed in the field.

Table 4 – Current status of the use of decision-support tools for the effective management of protected areas in the COMIFAC area

Pays	METT	RAPPAM	EoH	GAPA	IMET	Green list	SAGE	SAPA	SMART	IBA
Cameroon	✔	✔	✔		✔		✔	✔	✔	✔
Gabon	✔	✔			✔			✔	✔	
Equatorial Guinea	✔	✔							✔	
Burundi	✔	✔			✔				✔	✔
Central African Republic	✔	✔	✔							✔
Democratic Republic of the Congo	✔	✔			✔				✔	✔
Congo	✔	✔	✔						✔	✔
Rwanda										
Sao Tome and Principe										
Chad		✔			✔		✔	✔	✔	✔
Total	7	8	3	0	5	0	2	3	7	6

Source: GD-PAME database, June 2020.

Importance of integrating different tools and methods of analysis

When assessing and analyzing field situations, it is possible to achieve important outputs by using several approaches and tools or by relying on integrated approaches. These results would be difficult to achieve if only one empirical approach or a single tool was used.
For example, during an IMET training program held in Bolivia, national managers wanted to begin a threat analysis exercise with a brainstorming session. The exercise was repeated several times using the «threat calculator» employed in IMET. The comparative analysis made it possible to identify three threats which had not been highlighted previously, one of which, concerning overgrazing in community-managed areas, was particularly important.

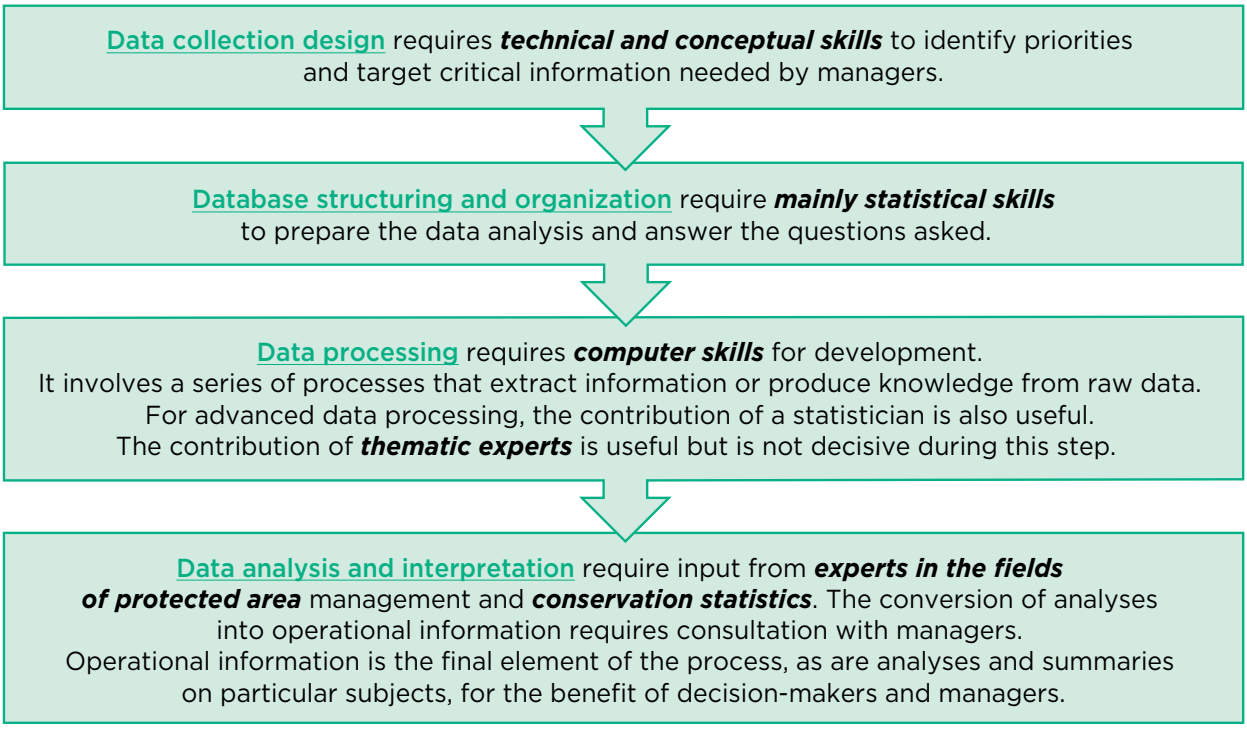
5. Data processing and analysis

5.1 Required skills

Information management is a complex process that calls for a range of skills and requires the involvement of thematic experts, protected area management experts, IT experts and statisticians (Figure 2). Every national administration and regional monitoring agency should invest heavily in capacity building and ongoing training for the planning, management, monitoring and evaluation of the institution itself.

It should be remembered here that statistics is a powerful tool that can greatly contribute to conservation. At present, there are few, if any, national services that rely on specialized statistical staff for monitoring and evaluation, at least in the field of conservation.

Figure 2 – Different stages of information management and required skills

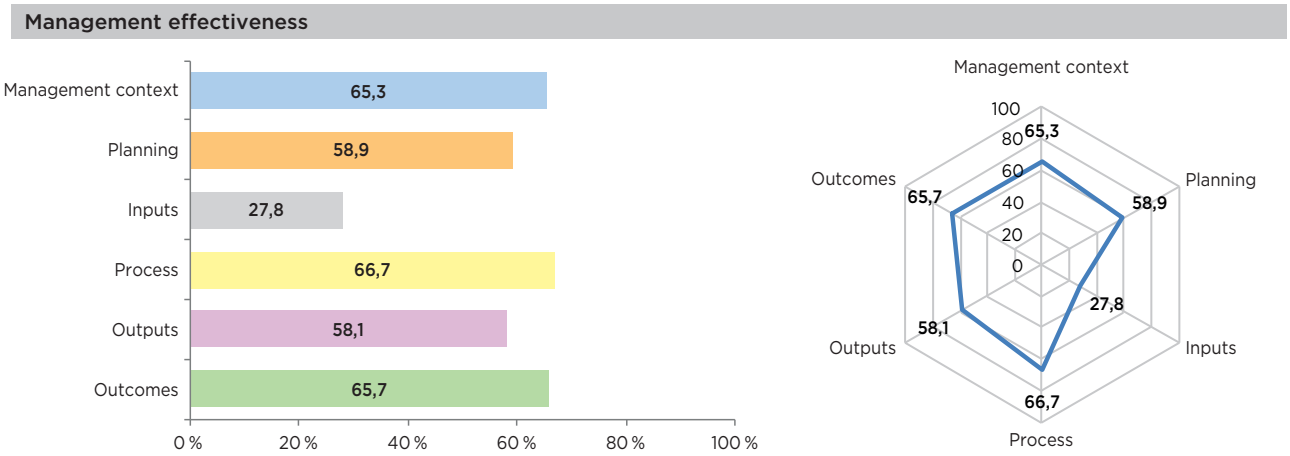


A **decision-support system (DSS)** is an information system which supports decision-making activities within organizations. These systems serve the management, operations, and planning levels of an organization, and support decision-making related to issues that can evolve rapidly.

5.2 Some of the possible analyses

Statistical analysis processes make it possible to study large amounts of data and identify the most interesting features. The success of this approach in recent years is largely due to graphical representations used in decision-support systems that are easy to understand and that "speak" to both policymakers and managers. These visual representations highlight relationships that are difficult to grasp through the direct observation of data tables, relying on the objective depiction of the phenomenon analyzed. Figure 3 presents an example of a decision-support graph from an IMET analysis in the form of a bar chart (on the left) and a radar chart (on the right).

Figure 3 – Visualization of the results of an IMET analysis for supporting decision processes



Source: BIOPAMA (2018)

Protected Areas Management Effectiveness (PAME) assessments

Like most PAME tools, IMET organizes the different elements of the analysis around the six steps of the protected areas management cycle (Hockings et. al, 2018):

- 1. Management context
- 2. Planning
- 3. Inputs
- 4. Process
- 5. Outputs
- 6. Outcomes

The score achieved by each element can be visualized along a scale of 0 to 100, in the form of histograms and radar charts which allow one to synthetize the outcomes of the PAME assessment undertaken. The visualization tools are used to support the reflection underpinning decision-making. They are not meant for a numerical evaluation of the protected area.

The boundaries of the marine section of Mayumba National Park (Gabon)

From Paolini et al. (2020).

The first IMET analyses undertaken in Gabon made it possible to understand the potential of the DSS underlying the design of the tool. Mayumba National Park, on the coast of Gabon, had demonstrated important progress in terms of achieving management objectives. It therefore needed to set new objectives and revise its management plan. Only the marine section of the park showed lower achievement values, which were clearly demonstrated by the graphic representations (radar charts and histograms) of the DSS part of IMET.

The park's director was responsible for reporting the results to officials of the *Agence Nationale de Préservation de la Nature* (ANPN) in Libreville. The presentation of the management effectiveness immediately drew the attention of officials to the difficulties of achieving the assigned objectives in the park's marine section due to the need to refine the park's boundaries.

The changes in the classified area's boundaries requested by the park were approved the following month. The DDS enabled the director of Mayumba Park to present the situation and the difficulties to be addressed in a simple, organized and comparative manner, which allowed him to garner the attention and support of his superiors needed to obtain the changes requested and to guarantee better management of the park.

Among the many possibilities for further analysis and use of the information generated by processing data collected, we would like to draw attention to the following three types.

Analysis at the level of protected area systems

The possibility of carrying out analyses at the level of protected area systems as a whole, whether at the level of landscapes or major biomes, as well as at the national or at the regional level, undeniably offers great added value. This scaling up of the analysis makes it possible to formulate more effective responses to questions that arise at the level of the entire system considered. However, this change of scale is only possible if the analysis is based on information that is quantified and can be compared, and in Central Africa, as in other regions, this is rarely the case.

This type of analysis is feasible only in the presence of databases which are structured in the same way, and depends heavily on the willingness of national administrations to share their data. In Burundi, for example, this work made it possible to revise the national biodiversity conservation strategy and to make the case for funding needs based on well-documented analyses and proposals.

These comparative analyses at the levels mentioned above facilitate dialogue with the international community and donors. They are crucial when deciding whether, where and how to finance conservation projects.

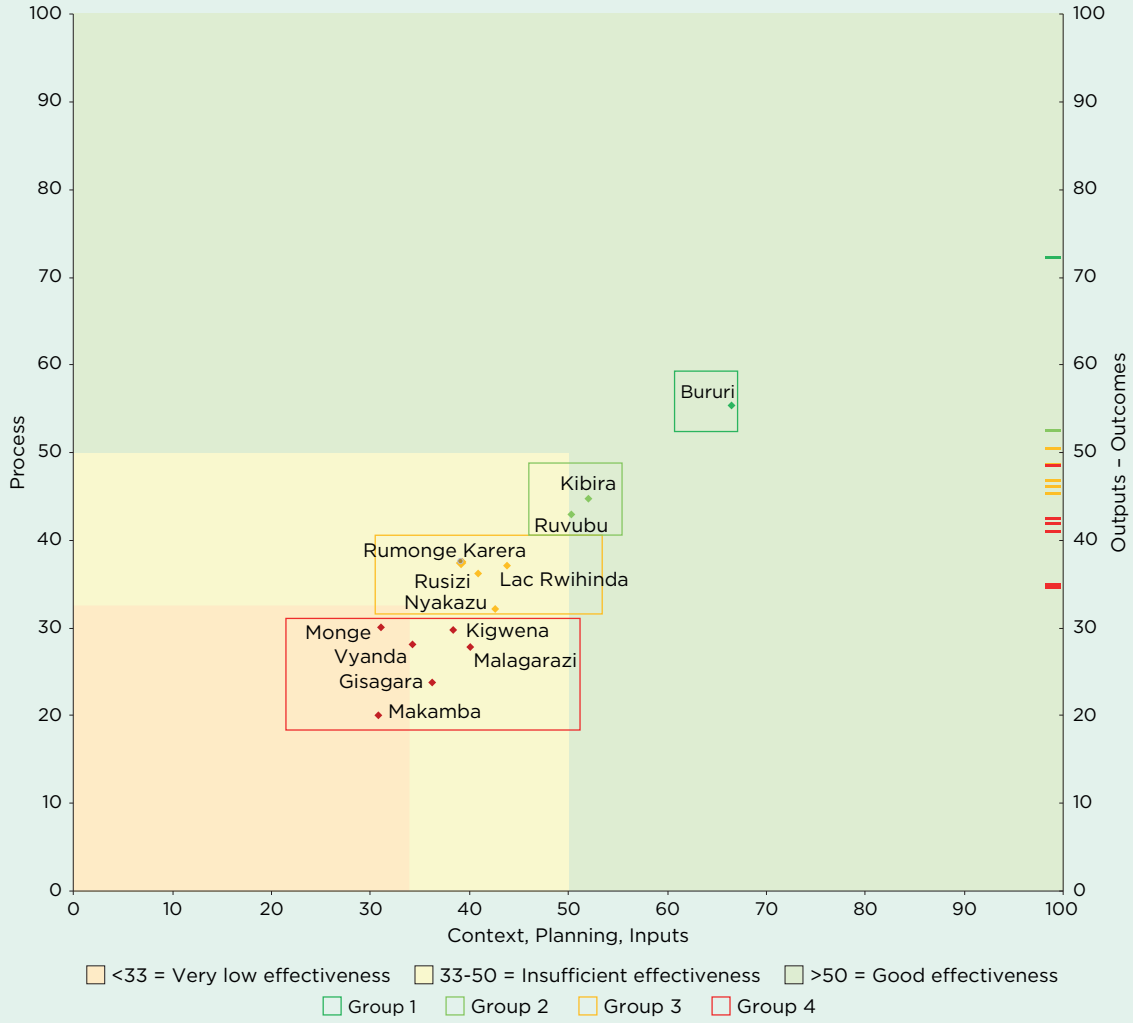
This facilitates the monitoring of countries' implementation of international commitments and makes it easier to prepare reports for the CBD or other agencies. Examples include monitoring Sustainable Development Goals (SDGs), commitments made under the United Nations Framework Convention on Climate Change (UNFCCC) such as Nationally Determined Contributions (NDC) to reduce emissions at the national level and adapt to the effects of climate change, etc.

Justifying the importance of the benefits of protected areas can open up opportunities to diversify funding sources for the effective management of protected areas. The work carried out following IMET exercises conducted on a set of 38 protected areas in the protected area networks of Burundi, Gabon, Cameroon, Republic of Congo and Chad has shown the potential of such an approach (Paolini *et al.*, 2020; COMIFAC, 2020).

Scaling up of analysis in the IMET tool

The analysis at scales higher than that of a site uses a technical model developed by the BIOPAMA program (Biodiversity and Protected Area Management Programme). Through statistical analysis, the model organizes and structures information in order to procure new aggregated data for a set of protected areas. It is then possible to establish operational indicators for a network or for each protected area. Comparisons between protected areas also make it possible to draw parallels and facilitate the formulation of strategic and operational solutions.

Figure 4 – Example of a graphical representation of the grouping of sites in a network of protected areas (Burundi)



Source: BIOPAMA (2018). Note 1: The terms "Context, Planning, Inputs, Process, Outputs and Outcomes" refer to the six steps of the management cycle of protected areas (see the text box associated with Figure 3). Note 2: on each axis, the elements of the management cycle are scored between 0 and 100. The third axis "Outputs – Outcomes" is independent from the two others. Each protected area is materialized by a colored dot..

The technical model proposes a scaling up of analysis based on several elements:

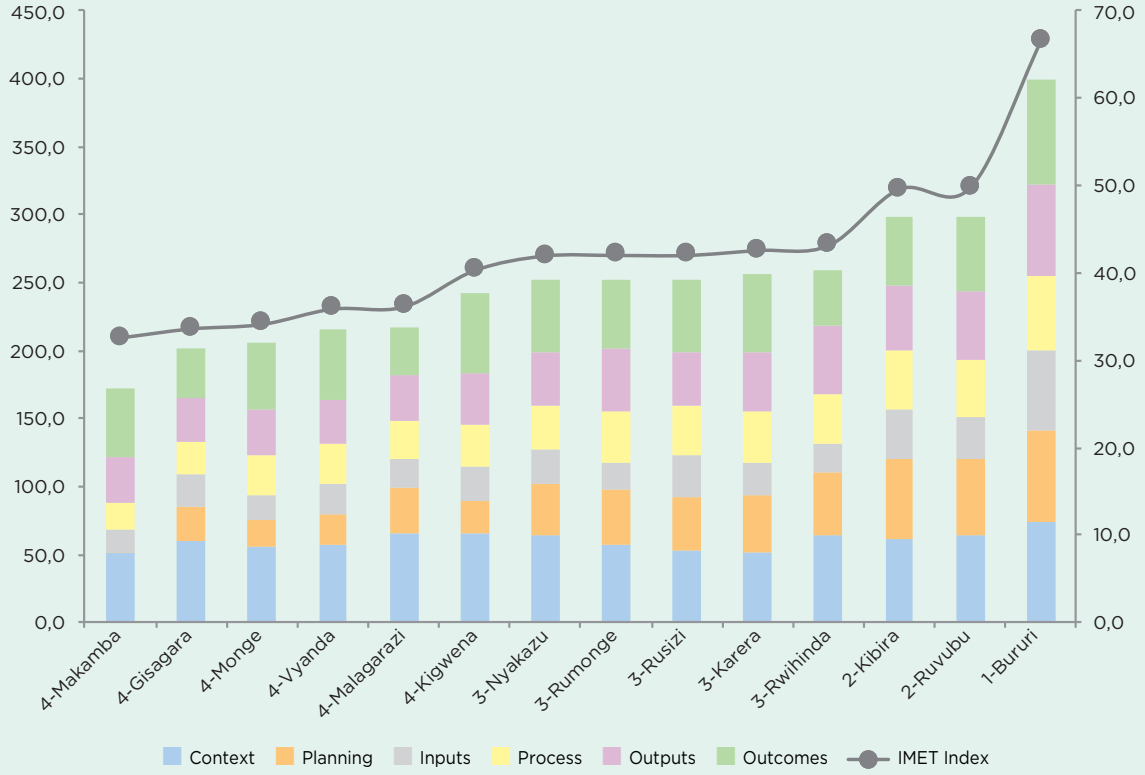
1. **clustering**, to identify protected areas with sufficiently similar (homogeneous) scores in the six different elements of the management cycle (see Figure 4);

2. **ranking**, against targeted benchmarks for the management cycle elements or indicators;
3. the **IMET index**, which is proposed to provide an assessment of the overall performance of each protected area (an example of the demonstration of the IMET index is shown in Figure 5);
4. **calculation of the average** to define the average in relation to IMET scores for numerous elements of analysis;
5. **cross-analysis**, which makes it easier to appreciate and quantify the discrepancies between the scores of groups of indicators that are supposed to be functionally linked to each other;
6. **quantification of indicators of non-response** to IMET questions, to determine the propensity of protected area staff to avoid answering certain questions or to provide answers perceived as difficult;
7. **technical analysis**, to support biodiversity conservation from an operational point of view and to augment the effectiveness of natural resource management and conservation efforts based on the values recorded for the indicators of the IMET tool.

It is important to note that in the scaling up, statistical and technical analyses are functionally integrated in order to make it easier to develop proposals related to:

- mitigating threats and building on strengths;
- identification of operational priorities;
- required improvements in management and governance policies.

Figure 5 - Example of a graphical representation of the IMET index to visualize the results of the scaling up analysis of Burundi's protected areas network



Source: BIOPAMA (2018). Note 1: The IMET synthetic index is evaluated between 0 and 100 (maximum level which can be achieved by each histogram). It refers to the average of the indexes as presented in Figure 3 and in the associated text box. The relative contribution of each element is represented by a different color. Note 2: the figures associated with each protected area refer to the groups of protected areas identified in Figure 4.

Answering specific conservation questions

A well-designed and organized information system can provide more insight into the situation relating to a specific problem, linked for example to a species, habitat, ecosystem service or any other element. Table 5 presents an example of an approach to consider the management of a species based on long-term objectives.

Better understand specific situations

In a protected area in Bolivia, the analysis of «External constraints and supports» easily revealed that one of the four communities participating on the national park's management committee had a strongly negative attitude. The protected area's management team did not seem to consider this to be much of problem as co-management could be ensured through the existing majority (three communities out of four).
However, interactions between the park management team and the IMET facilitators supporting them in the evaluation of the management effectiveness of the protected enabled a more in-depth analysis of the problem and the reasons for divergence. This joint reflection made it possible to propose initiatives aiming for a more balanced and higher quality governance of the protected area, taking into account all of the communities involved in management.

Table 5 – Example of long-term management of the elephant population in a protected area

Status	Actions	Results	Effects	Impact	Objective
Year zero The elephant population estimated to be about 500 individuals, decreasing and in danger of extinction 	Anti-poaching patrols	Control of 90% of the park area	• Decrease in cases of slaughtered animals • Better community-park co-management of large wildlife • Better knowledge about elephant population management • Suppression of acts of poaching (slaughter and illegal trade)	**Year +6** The elephant population has increased from 2 to 6%, i.e., approximately 510 to 530 individuals after 6 years of intervention 	**Future years** The viable elephant population is approximately 700 to 950 and more after 18-20 years 
	Raising awareness and responsibility of actors	Information on illegal activities from external actors			
	Management of human/elephant conflicts	Decreased conflicts			
	Strengthening and application of laws	Poaching cases brought to court			
	Monitoring and biomonitoring	Sufficient knowledge of distribution, trends and migration			

Source: Paolini *et al.* (2015)

By defining specific search criteria, IMET evaluation summary tables and radar diagrams (see Figure 3) render it easier to compare protected areas. An example of a comparative table is presented below; it focuses on certain elements measuring the importance of the protected areas in the Burundi national network (Table 6).

Table 6 – Comparison of the values obtained by Burundi's protected areas in the six sub-indicators of the IMET "value and importance" indicator

Protected area	Governance	Classifications	Key species	Habitats	Climate change	Ecosystem services
1-Bururi	62.5	66.7	86.7	75.8	66.7	57.0
2-Kibira	30.3	88.9	61.9	74.4	80.0	41.8
2-Ruvubu	27.8	66.7	66.7	66.7	60.0	55.7
3-Karera	11.1	66.7	33.3	66.7	0.0	55.0
3-Rwihinda	25.0	66.7	68.4	66.7	51.9	61.4
3-Nyakazu	18.2	66.7	56.8	60.3	26.7	39.7
3-Rumonge	25.0	66.7	66.7	50.0	26.7	14.8
3-Rusizi	36.4	41.7	33.3	33.3	29.6	38.3
4-Gisagara	5.6	66.7	47.6	63.0	37.0	49.3
4-Kigwena	5.6	66.7	66.7	66.7	25.0	45.0
4-Makamba	6.1	66.7	60.0	66.7	10.0	48.2
4-Malagarazi	7.4	68.1	66.7	66.7	23.8	45.2
4-Monge	5.6	66.7	50.0	66.7	18.5	51.1
4-Vyanda	6.7	73.2	47.6	66.7	20.0	40.1

The value of each indicator is estimated between 0 and 100: 0 1-32 33-50 51-100. Note: the values associated with each protected area refer to the groups of protected areas identified in Figure 4. Source: BIOPAMA (2018)

Planning-monitoring-evaluation approach

Conservation actions must be increasingly results-oriented, linking planning, monitoring and evaluation with the outcomes of interventions. The quality and targeting of field actions must be improved by establishing clear links between past, present and future initiatives and the long-term objectives of the protected area.

The adoption of the PME process requires the collection of information to be targeted on the effects and outcomes sought. Monitoring and evaluation focused on conservation targets facilitate the extraction of relevant information on past and current activities which can serve as a basis for the development of programs, reorientation of activities and planning for the future. This approach also promotes the establishment of a functional flow of information between protected areas and information providers such as observatories, groups of specialists, experts, conservation networks, NGOs, etc.

6. Role of a regional observatory

The role of a regional observatory for biodiversity conservation in Central Africa is decisive in more ways than one. First of all, it facilitates access to information for a wide range of users and helps fill information gaps and select information essential for planning and management. In particular, it provides policymakers and managers with dashboards for monitoring the situation on the ground and the level of implementation of the various objectives of the national conservation strategies. The presence of such an observatory makes it possible to support the work of decision-makers by developing visualization tools that facilitate decision-making (DSS), by producing specific analyses, by facilitating interaction with groups of experts for the formulation of operational recommendations, by promoting the harmonization of approaches and by offering an overall vision.

Value added of information coming from digital observatories

The analysis of the "intervention context" in Moukalaba-Doudou National Park, in Gabon, noted that the most important conservation elements were, for the most part, correctly listed in the planning document, but that their prioritization in terms of management had not been specified. With the help of the list of species recorded in the protected area and the indicators from the IUCN Red List available on the DOPA Explorer website of the Digital Observatory for Protected Areas (https://dopa-explorer. jrc.ec.europa.eu/dopa_explorer), it was possible to refine the intervention priorities. The analysis demonstrated that certain assets did not received the attention which they were due and did not benefit from sufficient conservation efforts in relation to the selected intervention priorities. The exercise finally made it possible to correctly identify the conservation actions to be carried out for each of the main «assets» of the protected area.

A regional observatory also interacts with countries and supports them in processing, analyzing and interpreting data. It provides various actors not only all of the information available, but also all of the tools that could facilitate their work. When an observatory is staffed with individuals who are skilled in statistics, it can even support countries in their efforts to adopt monitoring and information management tools. In this respect, it plays a vital role in human capacity building. It also plays a specific and decisive role in supporting countries to develop national information systems that are able to interact with the regional system.

Central Africa Forest Observatory (OFAC)

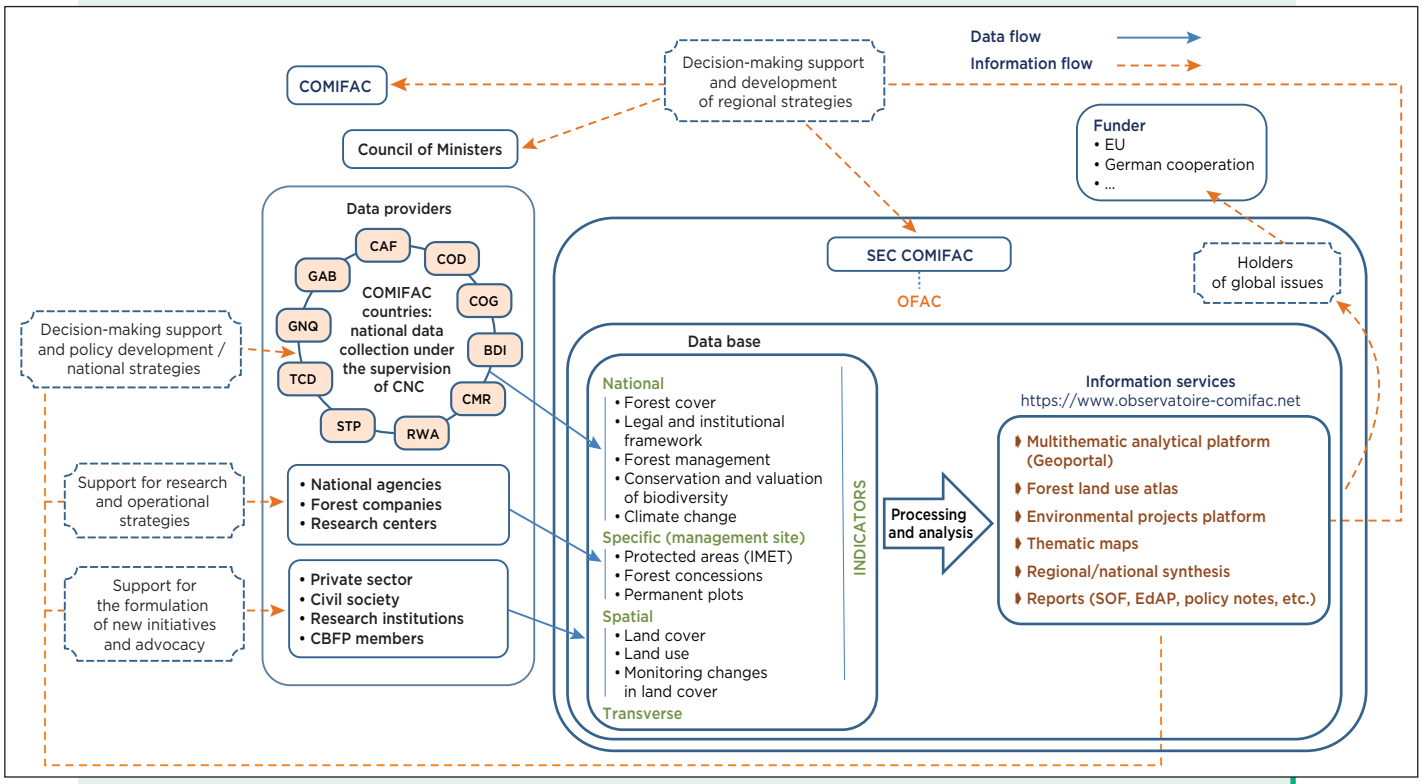
OFAC's mission is to ensure the availability of information to support the sustainable management of forest ecosystems in Central Africa. The observatory, supported by diverse partners, has set up several systems to collect and manage environmental data at different scales of intervention.

At the national level, OFAC conducts annual campaigns to collect reference data in its 10 member states. These indicators, which are defined in a concerted and participatory manner, are chosen according to their relevance, the nature of the variables and the possibility of obtaining information on them. They are regularly reviewed to take into account new emerging themes, and to facilitate synergies with other international mechanisms for collecting environmental data (for example, FAO's Forest Resources Assessment (FRA) and the biannual campaigns of the International Tropical Timber Organization (ITTO).

The information available at the level of management sites is collected by different actors using different collection tools which are most often their own. These data are sometimes sensitive and must be analyzed in a very precise context.

OFAC's information system brings together these different processes by ensuring that the mechanisms for collecting, storing, processing and disseminating information meet the requirements of confidentiality, harmonization, security, interactivity and exchange, making it possible to capitalize on this information at other levels but also at the site level.

Figure 6 – Flow of data and information between OFAC and its partners



The main constraints to the proper functioning of a regional observatory like OFAC concern the availability of the necessary resources in terms of staff (skills and profiles), infrastructure and funding, but also the need to interact openly with each country. To achieve the shared objectives of increasing "useful knowledge" and facilitating the emergence of an overall regional vision, it is essential that countries share the information which they have and that they adhere to the approach advocated by a regional observatory. Countries must simultaneously rely on the observatory's services and value its role for their own benefit and that of the region as a whole.

7. Preliminary considerations for an action plan

It is often said that information is power. In the field of conservation, information can be viewed by a protected area manager as "the power to protect the area and its associated assets". However, to what extent can we become good conservation managers by finding and using good information? How can "good information" give us the power to move in the right direction? Here are a few answers that could be given to these questions:

- information makes it possible to know the assets and wealth that we need to manage;
- it allows us to stay a step ahead of threats and opportunities, and to take a proactive approach;
- it strengthens the validity of our intervention because it favors the adoption of innovative, flexible and adaptive management in terms of conservation;
- it makes management effective and efficient because it is results-oriented;
- it makes it possible to consider and make suitable decisions in real time.

Despite all of these advantages, some protected area managers do not use information correctly. As something which can be stored, analyzed and used to better achieve objectives which have been set, information has enabled the transformation and evolution of various activity sectors in the world today. Although it could play the same role in conservation, some protected area managers seem to tend to overlook its importance.

One of the main reasons for this attitude is that we believe that our knowledge and experience match the information we need to manage. This confusion between necessary information and acquired knowledge does not exist in other fields of intervention where, to the contrary, knowledge is reinforced at the same time that available information is sought and used.

Research and information management require sustainable resources and significant capacity on the part of staff involved in the management of a protected area. However, these resources are generally insufficient and capacity building is often limited to anti-poaching activities.

Several factors should be considered for the better use of information in conservation:

- managers must understand that the knowledge-experience they have acquired can and must be enriched with new information necessary for results-oriented management;
- it is a mistake to think that information management involves taking resources away from "priority" management activities. First of all, investing in the collection and analysis of information is necessary for better informed decision-making; it is a priority that must be assumed as such. Second, investing in research and analysis of the information already available, in synergy with the different actors and using existing information systems, does not require excessive efforts in terms of time, and even less in terms of money. A lot information is often already available and can be generated without any kind of special contribution being requested from management sites by website operators or observatories such as OFAC. The issue of what resources are available or are to be mobilized must be analyzed above all with the objective of exploiting or rendering usable the information that is already available rather than generating new information. OFAC, with the support of analysts and specialists in digital data processing, could play the role of facilitator to make the available scientific information more accessible and usable;
- the use of data collection and analysis tools such as IMET and SMART must be expanded. These tools are designed to collet, store, analyze and directly use calibrated information to support management at the site level. They are a powerful means to improve

decision-making within the reach of managers. Here again OFAC can play an important role by securing data storage, supporting data analysis, and combining data coming from different sources. OFAC also can transmit to managers structured data which respond to management needs and priorities. Consultation and harmonization work between the parties is required to better define the type of priority information essential for management;

- protected area staff must be trained in the use of information management tools and in the interpretation of data and information for planning and decision-making purposes.

Ultimately, considering the many external and internal factors affecting the conservation of protected areas and the management of natural resources in general, it is essential to define and implement a strategy aimed at promoting a coordinated effort by the various actors to fill critical information gaps and promote a results-oriented approach. OFAC has an important role to play in the promotion and refinement of an information strategy in the subregion.

In order to launch discussions for the preparation of an information strategy at the level of the COMIFAC area, some basic principles can already be set out. To improve the management of conservation sites and of the impact of human interventions, it is essential to:

1. recognize the contribution of information to the effective, proactive and targeted management of protected areas and the overall environment;

2. make the most of the knowledge and experience of field actors by combining these with information produced by scientists and other data providers;

3. orient the collection of data and knowledge around well-targeted management objectives in a results-oriented management framework;

4. develop synergies and design coordinated data collection approaches by promoting more direct involvement of managers in identifying and formulating information needs;

5. ensure better use of the information available by facilitating access and effective use for operational purposes. It also involves promoting collaboration in the interpretation of data between managers, scientists and other stakeholders in order to encourage all possible synergy with existing actors and programs;

6. guarantee, with the support of observatories (in particular OFAC), the use of instruments such as IMET and SMART, which allow the information available at the site level to be used through its analysis and translation into targeted operational indications;

7. promote information sharing and transparency;

8. use information to lobby for the mobilization of resources needed for effective management of protected areas.

Conclusion

Information plays a crucial role in protected area management and biodiversity conservation. However, for its potential to be fully exploited and for managers and policy makers to achieve their goals and reverse current trends, a change in culture is needed. Data providers, managers and researchers must pull together and establish a dialogue that can ensure a continuous flow of information between all stakeholders. This could generate a virtuous circle to better guide research and the collection of critical information, supporting better planning that will enable actions in the field to be better targeted. These are the foundations of a proactive and results-oriented approach, based on informed and effective decision-making.

To do so, it is essential to be able to rely on user-friendly information systems, easy to access and search, based on well-structured databases from which information can be easily extracted. Above all, these databases must help to better present the reality on the ground. Through the analysis of this information, it will then be possible to formulate the most appropriate operational recommendations possible with regard to the actions and strategies to be implemented at the site, country and subregional levels. While qualitative information can be useful for decision-making, the use of quantitative information should be improved. The latter allows for a simpler and finer representation of the situation as well as the comparison, scaling and repetition of assessments. The process should encourage a better use of information by enhancing the information that already exists, but also promote the collection and search for essential information that will enable better targeted interventions.

The capacity to analyze the information available and formulate operational recommendations is without doubt a critical component in the chain of information processing in which investments will be essential. Human capacity building is undoubtedly one of the priorities for intervention. OFAC can and should play a central role in the region in the management, analysis and flow of information, as well as in capacity building, facilitating better coordination between different intervention levels and by supporting countries in their efforts to formulate priorities and policies.

However, all of this alone is not enough. Countries need to recognize and support the principles of data sharing and transparency, rendering data accessible to all stakeholders, of course while respecting the limitations imposed by sensitivity and security concerns. This sharing would benefit above all the countries themselves by enabling them to solicit both actors in the field and scientists. The resulting transparency and objective regional vision would facilitate dialogue and reciprocal trust between countries and donors, contributing to a greater mobilization of resources for conservation.

Bibliography

References cited within the text

Bellinger G., Castro D. & Mills A., 2019. Data, information, knowledge, and wisdom. http://www.systems-thinking.org/dikw/dikw.htm

BID-REX, 2019. Better data, better decisions: increasing the impact of biodiversity. Interreg Europe.

BIOPAMA, 2018. Analyse des aires protégées du Burundi. Rapport BIOPAMA. https://www.biopama.org/sites/default/files/inline-files/Analyse des AP Burundi.pdf

COMIFAC, 2020. Réseau d'aires protégées de la République du Congo : Analyse et conclusions - Rapport d'analyse sur la base des évaluations IMET, Version provisoire.

Commission Européenne, 2016. *Au-delà des éléphants. Éléments d'une approche stratégique de l'UE pour la conservation de la nature en Afrique – Analyse régionale*. Office des publications de l'Union européenne, Luxembourg : 496 p. https://ec.europa.eu/europeaid/au-dela-des-elephants-elements-dune-approche-strategique-de-lue-pour-la-conservation-de-la-nature-1_fr

Davies R., 2020. Basic Necessities Survey, including version adapted by Wildlife Conservation Society for use in conservation context. https://mande.co.uk/special-issues/the-basic-necessities-survey/

Deguignet M., Bingham H.C., Burgess N.D. & Kingston N. (eds.), 2018. Liste des Nations Unies des aires protégées 2018. Supplément sur l'efficacité de la gestion des aires protégées. UNEP-WCMC, Cambridge, Royaume-Uni : 62 p. https://wdpa.s3.amazonaws.com/UN_List_2018/2018%20List%20of%20Protected%20Areas_FR.pdf

Doumenge C., Fomete Nembot T., Tchanou Z., Micha Ondo V., Ona Nze N., Bourobou Bourobou H. & Ngoye A., 2003b. Conservation de la biodiversité forestière en Afrique centrale atlantique. III – Gestion et priorités d'investissement dans les sites critiques. *Bois Forêts Tropiques* 277 : 53-67.

Doumenge C., Ndinga A., Fomete Nembot T., Tchanou Z., Micha Ondo V., Ona Nze N., Bourobou Bourobou H. & Ngoye A., 2003a. Conservation de la biodiversité forestière en Afrique centrale atlantique. II – Identification d'un réseau de sites critiques. *Bois Forêts Tropiques* 276 : 43-58.

Dudley N. and & Stolton S., 2009. The Protected Areas Benefits Assessment Tool. A methodology. WWF : 43 p. https://d2ouvy59p0dg6k.cloudfront.net/downloads/pa_bat_final_english.pdf

Fishpool L.D.C. & Evans M.I., 2001. Important Bird Areas in Africa and Associated Islands: Priority Sites for Conservation. BirdLife Conservation Series 11. Newburry and BirdLife International, Cambridge, U.-K.

Franks P. & Booker F., 2018. Governance Assessment for Protected and Conserved Areas (GAPA): Early experience of a multi-stakeholder methodology for enhancing equity and effectiveness. IIED Working Paper, IIED, London.

Franks P. & Small R., 2016. Évaluation sociale pour les aires protégées (SAPA). Guide méthodologique à l'intention des facilitateurs SAPA. IIED, Londres.

Jacquemot P., 2018. Quel avenir pour les aires protégées africaines. WillAgri : 20 p.

Mengue-Medou C., 2002. Les aires protégées en Afrique : perspectives pour leur conservation. https://www.researchgate.net/publication/30439081_Les_aires_protegees_en_Afrique_perspectives_pour_leur_conservation

Natural Capital Coalition, 2019. Data use in natural capital assessments. Assessing challenges and identifying solutions. Full report.

OFAC, 2020. Aires protégées (IMET). https://www.observatoire-comifac.net/monitoring_system/imet

Paolini C., 2009. Conservation and rational use of ecosystems Sudano-Sahelian – Phase II.

Paolini C., Rakotobe D. & Jomha Djossi D., 2015. Mallette pédagogique pour effectuer la mission de coaching d'amélioration de la gestion des aires protégées et le développement du système d'information de l'observatoire des aires protégées et de la biodiversité du programme BIOPAMA (COMIT). UICN, Gland, Suisse : 128 p. [Paolini C. & Rakotobe D., 2020. COMIT – Utiliser IMET pour évaluer et améliorer l'efficacite de gestion des aires protégées. UICN, Gland, Suisse : 104 p.]

Paolini C. & COMIFAC, 2020. Réseau d'aires protégées d'Afrique centrale - Rapport d'analyse basé sur les évaluations IMET. Rapport de synthèse.

Paolini C., Bialowolski, P. & COMIFAC, 2020. Réseau d'aires protégées du Gabon : Analyse et conclusions - Rapport d'analyse sur la base sur les évaluations IMET.

SMART, 2019. SMART Mobile Data Collection Handbook. SMART Training Taskforce. Version 1.1 2019-10.

Stolton S. & Dudley N., 2016. METT Handbook: A guide to using the Management Effectiveness Tracking Tool (METT). WWF-UK, Woking.

Thomas L. & Middleton J., 2011. Lignes directrices pour la planification de la gestion des aires protégées. UICN, Gland, Suisse: x + 67 p. https://portals.iucn.org/library/sites/library/files/documents/PAG-010-Fr.pdf

UICN, 1989. La conservation des écosystèmes forestiers d'Afrique centrale. UICN, Gland, Suisse et Cambridge, Royaume-Uni : viii + 124 p.

Additional references

Coad L., Leverington F., Knights K., Geldmann J., Eassom A., Kapos V., Kingston N., de Lima M., Zamora C., Cuardros I., Nolte C., Burgess N.D. & Hockings M., 2015. Measuring impact of protected area management interventions: current and future use of the Global Database of Protected Area Management Effectiveness.

Doumenge C., Palla F., Scholte P., Hiol Hiol F. & Larzillière A. (Eds.), 2015. Aires protégées d'Afrique centrale – État 2015. OFAC, Kinshasa, République Démocratique du Congo et Yaoundé, Cameroun : 256 p.

Hockings M., Stolton S., Leverington F., Dudley N., Valentine P. & Courrau J., 2008, Evaluating Effectiveness, A framework for assessing management effectiveness of protected areas. 2nd edition.

Leverington F., Lemos Costa K., Courrau J., Pavese H., Nolte C., Marr M., Coad L., Burgess N., Bomhard B. & Hockings M., 2010a. Management effectiveness evaluation in protected areas – a global study, 2nd edition.

Leverington F., Lemos Costa K., Pavese H., Lisle A. & Hockings M., 2010b. A Global Analysis of Protected Area Management Effectiveness.

Leverington F., Hockings M. & Lemos Costa K., 2008. Management effectiveness evaluation in protected areas – a global study.

Mallon D.P, Hoffmann M., Grainger M.J., Hibert F., Van Vliet N., Mcgowan P.J.K., 2015. Analyse de situation de l'UICN concernant la faune terrestre et d'eau douce en Afrique centrale et de l'Ouest. Doc. occasionnel Commission de sauvegarde des espèces de l'UICN 54. UICN, Gland, Suisse et Cambridge, Royaume-Uni : x + 162 p.

Rakotobe D. & Regnaut S., 2016. COMIT – BIOPAMA Campaign 2016. Capacity development for protected areas managers. IUCN.

RAPAC, 2016. Développement des capacités d'évaluation de l'efficacité de gestion des aires protégées d'Afrique Centrale – Évaluation de 40 aires protégées – PAMETT. Rapport final.

Triplet P., 2009. Manuel de gestion des aires protégées d'Afrique francophone.

UNEP-WCMC, 2016. The State of Biodiversity in Africa. A mid-term review of progress towards the Aichi Biodiversity Targets. UNEP-WCMC, Cambridge, UK : 94 p.

Annexes

Annex 1. General considerations regarding data collection

What is meant by "data collection"?

Data collection refers to the systematic approach of bringing together and measuring information from a variety of sources in order to gain a complete and accurate view of a domain of interest. Collecting data allows a person, organization, or business to answer relevant questions, assess results, and better anticipate future probabilities and trends.

Table 7 – Basic principles for data collection

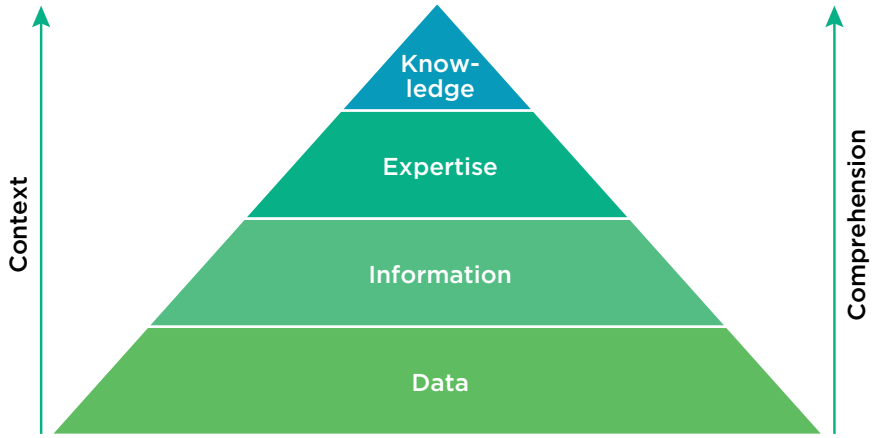
Systemic approach	which is done methodically and proceeds in a predetermined order
Measure	seek to know, or determine a quantity by means of a measurement
Come from various sources	different sources, different data producers, or different types of data, that can contribute to updating the same subject
Obtain a comprehensive and accurate view	the information sought must be focused on filling a lack of critical information and must be as complete and quantified as possible
Allows answers to relevant questions	all data collection must be done with the objective of answering one or more specific, previously defined question(s)
Allows results to be assessed	the data collected are the basis of all analysis and interpretation processes and are therefore the basis of all decision-making
Allows better anticipation of future trends	understanding the problem and the dynamics underlying it allow predictions to be made and response / adaptation strategies to be identified

Data collection should be undertaken by following a certain number principles presented in Table 7. On the one hand, data collection involves research and the compilation of information that is already available (bibliographic research and retrieval of information from experts or specialized institutions), and, on the other, the collection of new relevant data in relation to the field of interest or the question asked.

Accessibility of data and information: data ownership and visualization

The data-information-knowledge-wisdom/learning hierarchy (Figure 7; Bellinger *et al.*, 2019) shows that data, information, knowledge and learning are interrelated concepts. This implies that decisions – whether they affect the management of a protected area or the definition of a national conservation strategy – will only be sufficiently justified and sound if they are based on relevant and sufficient data and information.

Figure 7 – From data to knowledge



Source: modified from BID-REX (2019).

Challenges

Despite the amounts of data available, the challenges and difficulties that exist generally lead to inefficient data flows from the data collection process to the decision-making stage (BID-REX, 2019). These difficulties or obstacles can be regrouped into four categories following the classification proposed by Natural Capital Coalition (2019), and are presented in Table 8.

Table 8 – Main difficulties related to data management

Type of difficulty	Associated issues
Accessibility of data This refers to the ease with which users can find and use data	This difficulty refers to the formatting, cost and ownership of data. The challenges are related to: • the availability of data: a number of factors may complicate users' access to data, such as: – how the data is formatted: data available in incompatible formats or where the process of formatting data for compatibility is time consuming, – restrictions on licenses, costs and ownership by third parties: in some cases, it may be difficult to access datasets due to confidentiality issues or because the payment of a royalty or a license is required; • the volume and complexity of data: users may have access to a dataset but this requires significant investments in time and resources which can be difficult to manage.
Data infrastructure This refers to the need to support organizations which produce, provide and manage data	This difficulty refers to measurement protocols, standards and guidance documents, as well as software. The challenges are related to: • weak governance: the lack of good governance of data (management, policies, standards, etc.) can undermine the quality of data, • volume of data: this can exceed the capacity of the available management systems and analysis capabilities, • standards and advice on how to use data: their absence can lead to poor quality data and incorrect analyses.
Data quality This is crucial for data to be reliable	This difficulty refers to the comprehensiveness, accuracy, and consistency of the data, as well as their availability to answer questions raised. The challenges are related to: • incomplete data: in many cases, data are not available at the scale, accuracy or frequency required for the evaluation, • robustness of the data: depending on the robustness of the evaluation and the type of output required, data may need to come from authoritative sources and be highly credible.
Capacity building This refers to the ability of the actors involved in all phases to use the data.	This difficulty refers to the lack of capacity to understand the data and use it wisely. The challenges are related to: • identifying and solving problems with data, • filling gaps and uncertainties in datasets, • using new technologies and streamlining efforts, • understanding the limitations of data in decision-making.

Recommendations

Possible solutions to the challenges presented in the preceding paragraph are proposed below (BIDREX, 2019; Natural Capital Coalition, 2019).

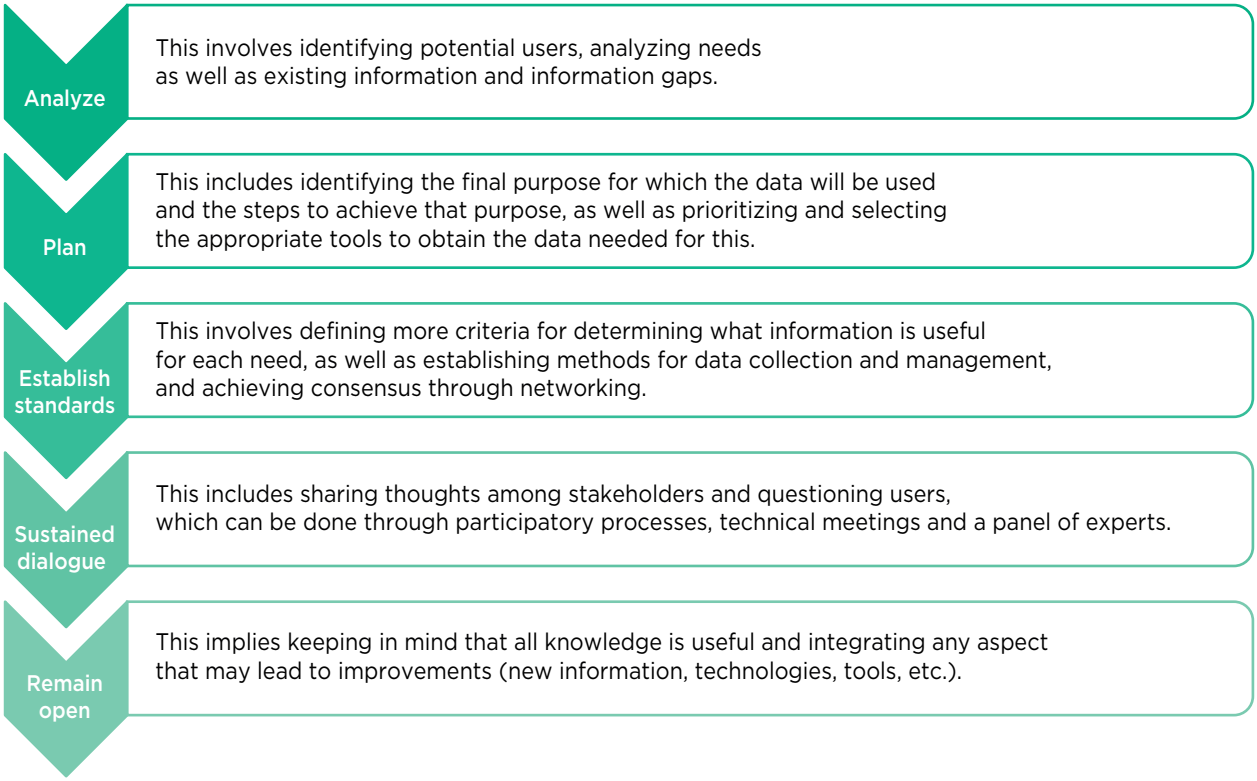
- Make data sets open-access without compromising their robustness and, where possible, adopt approaches that allow free access to the data. Communicate the benefits of sharing data to all stakeholders.
- Communicate basic licensing requirements to data providers to facilitate access rights.
- Establish an in-house protocol for data collection and management. Create policies to ensure ethical access and use of data. Establish standards and guidelines for quality assurance and data verification.

- Use new technologies and new information systems. Automate data management processes. Use custom-built systems to manage large volumes of data and ensure efficiency.
- Provide more guidance on the use of data, data interpretations and issues related to data quality and data management.
- Use internal and external resources when data quality is not guaranteed at the source (e.g., consultants, interdepartmental collaboration, etc.) to ensure data quality.
- Invest to fill gaps in key data and/or explore the use of technologies or models to fill these gaps.
- Provide capacity building and training - throughout the data chain - from data collectors to data users and analysts. Ensure that data limitations and uncertainties are well understood and taken into account in decision-making.
- Work with partners (other organizations and the general public) because this can help build community and provide a network of support.

Best practices

Sometimes the data used may not have been produced specifically for the primary purpose under study (they may have been produced or derived from other related processes). To ensure that the information is appropriate for the target objective, reflection is needed about the data needs and intended uses. This can be undertaken by considering five main elements (Figure 8; BID-REX, 2019).

Figure 8 – Main elements to consider in data collection



Annex 2. Contributions of decision-support tools in protected area strategy development, planning, monitoring & evaluation, and management

How can we make the right decisions for the effective management of Central African protected areas in a changing and complex context?

What types of tools and methodologies can be relied on to address the management and governance challenges facing the managers of protected areas in Central Africa? Which tools could help us identify concrete courses of action and feasible solutions? How do these decision-support tools help the managers of our protected areas?

In general, decision-support tools, especially tools for assessing the management effectiveness of protected areas, enable protected area managers and their partners to: (i) measure the performance of a protected area (or of a protected area network) in relation to its conservation objectives; (ii) make decisions to improve this performance and facilitate the evolution of the protected area context; (iii) in so doing, improve the achievement of objectives; and lastly (iv) be able to be accountable to all partners involved in the management of protected areas.[1] The choice of a specific tool depends on the scale at which the protected area manager wishes to work and the level of precision s/he expects from results and analyses. Considering the array of tools used in Central Africa, this document lists the most widely used tools in terms of their usefulness, user type and application framework.

1. https://papaco.org/fr/evaluations/

Table 9 – Overview of the main tools used in Central Africa for decision support

	SMART	IBA	IMET	METT	RAPPAM	EoH	SAPA	SAGE	GAPA	Green list
General information										
Context of application	PA	PA	PA	PA	PA	Assets to conserve	Social impact of conservation measures	PA + periphery Governance and equity of conservation measures	Governance and equity of conservation measures	PA + reference context
Approximate period when the tool began to be used in Central Africa	2005	2001	2015	2002	2008	2010	2019	2019	Not yet used	Not yet used
Level of dissemination of the tool in Central Africa	High	Low	Medium	High	Low	Low	Low	Low	None	None
Ease of use of the tool	Medium	Forte	Medium	High	Medium	Medium	Low	Low	Low	Low
Time required for implementation	Long	Short	Medium	Short	Medium	Medium	Long	Long	Long	Long
Flexibility of the tool in collecting information to better reflect the specific features of the PA considered	Medium	Medium	High	Low	Medium	Medium	Medium	Medium	Medium	Medium
Fundamentally quantitative evaluation	YES	NO	YES	NO	NO	NO	NO	NO	NO	YES
Fundamentally qualitative evaluation	NO	YES	NO	YES	YES	YES	YES	YES	YES	YES
Adaptability of the tool for multiple uses in PA management (themes and applications)	Medium	Low	High	Low	High	High	High	High	High	High
Possibility of inserting information on the intervention context	Low	Medium	High	Low	Medium	Medium	Medium	Medium	Medium	Low

	SMART	IBA	IMET	METT	RAPPAM	EoH	SAPA	SAGE	GAPA	Green list
General information										
Level of objectivity in the attribution of values, estimated on the basis of: 1) openness to stakeholder participation, 2) number of elements considered and 3) range of the assessment scale	Medium	Medium	High	Medium	Medium	High	High	High	High	High
Information on the content										
The tool considers elements related to the following themes:										
1. Climate change	NO	NO	YES	Medium	Medium	NO	NO	NO	NO	YES
2. Ecosystem services	NO	NO	YES	NO	NO	NO	NO	NO	NO	YES
3. Anti-poaching	YES	YES	YES	YES	YES	YES	NO	NO	NO	YES
4. Ecological monitoring	YES	Medium	YES	Medium	Medium	YES	NO	NO	NO	YES
5. Marine Protected Areas	NO	YES	YES	NO	NO	YES	NO	NO	NO	YES
6. Governance	NO	NO	Medium	NO	YES	YES	YES	YES	YES	YES
7. Social dimension	NO	NO	Medium	Medium	YES	YES	YES	YES	YES	YES
8. Participatory management and local communities	NO	NO	Medium	Medium	YES	YES	YES	YES	YES	YES
Respect for the succession of elements of the management cycle	Low	Low	High	Medium	Medium	Medium	Low	Low	Low	Medium
Services and products provided										
Tool supporting the results-oriented approach	YES	Medium	YES	Medium	Medium	YES	YES	YES	YES	YES
Tool that integrates a database	YES	NO	YES	NO	NO	NO	NO	NO	NO	YES
Possibility of integrating information into a database supporting the results-oriented approach	YES	Medium	YES	Medium	Medium	Low	Low	Low	Low	YES
Possibility of carrying out analyses of the entire PA (multi-theme)	Medium	Medium	YES	Medium	NO	YES	NO	NO	NO	YES
Possibility of changing the scale of analysis	YES	Medium	YES	Low	YES	Low	Low	Low	Low	YES
Operational support in monitoring key conservation elements	YES	Medium	YES	Medium	Medium	Medium	NO	NO	NO	YES
Support for planning	YES	Medium	YES	Medium	YES	YES	YES	YES	YES	YES
Contributes to capacity building	YES	Medium	YES	Medium	NO	YES	YES	YES	YES	YES

Note: this table is compiled based on the authors' personal experience and knowledge and reflects their opinion only.

PA: Protected Area. Response level: Low Medium High

Tableau 10 – Outils d'aide à la décision utilisés en Afrique centrale pour évaluer et améliorer l'efficacité de gestion et la gouvernance des aires protégées

Tool	Objective targeted by the tool	Advantages	Disadvantages
SMART **(Spatial Monitoring and Reporting Tool)** smartconservationtools.org	The spatial monitoring and reporting tool is designed to: (i) improve anti-poaching efforts in a protected area, (ii) ensure effective monitoring of law enforcement in protected areas and conservation zones, (iii) conduct ecological monitoring, and (iv) understand the level of pressures and threats to the protected area. SMART facilitates the collection, storage, and analysis of data on patrol efforts, and the extraction, transfer, and sharing of data with key actors. The tool helps to create and maintain a flow of information between eco-guard teams, protected area managers and their partners, as well as data managers and users. The SMART approach helps to significantly improve the protection of wildlife and their habitats. SMART is a combination of patrol efforts, ecological monitoring, monitoring the application of the law, and monitoring management measures to improve the protection of protected areas, control threats and pressures, and inform decision-making.	The SMART approach is applicable in all protected areas and is implemented by patrol teams to protect wildlife and natural ecosystems. It contributes effectively to the protection of protected areas as well as biodiversity as a whole. SMART is the protected area manager's ideal software. The tool makes it possible to: i) work towards better law enforcement to reduce threats to wildlife and natural resources; ii) motivate field teams through a system of bonuses adapted to the performance of eco-guards, and iii) have a database through the systematic collection of data during patrols, and data storage and analysis upon return from patrols.	The use of SMART and the establishment of a patrol database alone will not improve the protection of a protected area. The use of SMART must be combined with effective law enforcement and the provision of sufficient multifaceted resources to the protected area. Adaptive patrol management requires: (i) additional resources; (ii) qualified staff in the fields of IT, team management, data processing and analysis. The evaluation of feedback mechanisms between managers and eco-guards is an important element that must not be neglected in the process.
IBA **(Important Bird Areas)** https://rris.biopama.org/node/18654	BirdLife International has developed this global framework to identify and monitor the conservation status, threats and protection actions in IBAs. IBAs are places of international importance for birds and, therefore, for biodiversity conservation. The tool aims to identify, monitor and protect essential sites for birds and biodiversity. It has a threat calculator, a record sheet to specify the status of bird populations and a record sheet of actions in progress. The designation of a site as an IBA is made on the basis of one of the following criteria: i) it regularly hosts a species that is endangered at the country level; ii) it hosts a species that is endemic or has a restricted range; iii) it hosts an avian community representative of a biome; iv) it constitutes a gathering area hosting a number of birds representing at least 1% of the national, continental or global population, whether for nesting, migrating or wintering.	BirdLife provides a standard "Pressure-State-Response" (PSR) framework as a management approach. PSR is simple, flexible and practical enough to be implemented effectively on a wide range of sites. The framework enables the compilation of data at national, regional and global levels for better monitoring of BirdLife partnerships. It enables the identification of conservation actions to be undertaken and key partners for achieving the objectives set. Through this conservation plan, it is easier to mobilize human resources and to help obtain the financial and material resources needed to implement the selected activities.	The designation of an IBA has no legal implications because it works above all to encourage decision-makers and tourism promoters to respect the heritage value of the site. However, the prestige of an IBA label often brings legal protection and facilitates ecotourism. The ZICO monitoring tool can be used to feed databases but these are not always accessible to protected area managers.

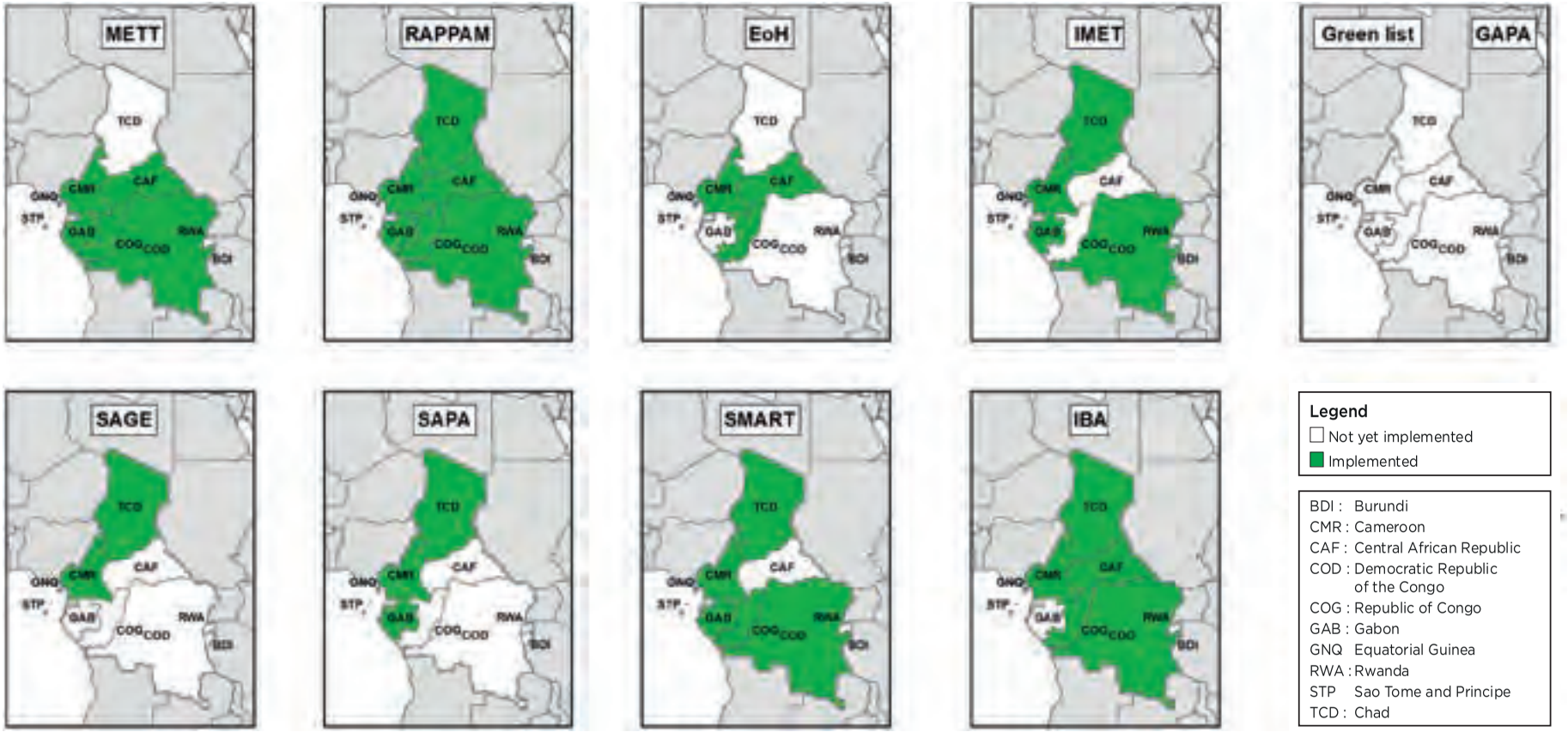
Tool	Objective targeted by the tool	Advantages	Disadvantages
IMET **(Integrated Management Effectiveness Tool)** https://rris.biopama.org/node/18643	The main objective of IMET is to support the planning, monitoring and evaluation of protected areas to improve management and ensure the achievement of conservation objectives. It is designed to build the capacity of protected area managers to adopt a results-oriented approach. Although IMET assessments include the assessment of protected area management effectiveness, the scope of the tool is much broader than some of the methods in the Global Database on Protected Area Management Effectiveness (GD-PAME). IMET is a participatory and program-based approach that relies on the results of the analysis of adaptive management of protected areas. It provides a comprehensive set of decision-support tools for protected area managers, organizations and biodiversity conservation agencies. The tool covers all elements of the protected area management cycle. The results of the assessment are visualized in real time, which facilitates exchanges between the different stakeholders for participatory decision-making.	IMET exercises are carried out with the support of facilitators, "IMET Coaches". The assessment is based on a database that allows functional links to be established between different management levels: from the site to the landscape and ecosystem, or from the site to the national and regional network of protected areas. The tool is adapted for the manager and his/her partners who wish to obtain a complete inventory of the intervention context and management of a protected area or a network of protected areas. IMET makes it possible to adapt to the specificities of the protected area. The visualization of analyses and scores through the graphs automatically generated by the tool can support decision-making. In the absence of a development and management plan, the tool facilitates the planning of activities and helps provide guidance for the revision of work and management plans.	The tool is intended for centralized data collection and helps improve management efforts and reporting on protected areas. IMET should not be used to compare protected areas but rather to assess the specific features of each. While including elements that allow an initial assessment of governance and social impacts, the tool – in its current state – is not meant to be used specifically to assess these aspects. If required, it would be useful to conduct more in-depth studies using tools such as SAPA and SAGE (see below for a brief presentation of these tools). It should be noted that an IMET module for assessing the governance of ecosystem services has been developed and is currently being tested in Central Africa.
METT **(Management Effectiveness Tracking Tool)** https://rris.biopama.org/node/18647	A tool for measuring the performance of a protected area in relation to community development actions, METT allows for a rapid assessment of the effectiveness of a protected area's management. The different versions of METT allow managers and their partners to identify needs, constraints, trends, strengths, weaknesses and priority actions to improve the management effectiveness of a protected area. The tool is used by donors to obtain an inventory of the state of the protected area and to monitor and evaluate conservation objectives. When carried out on a regular basis, METT makes it possible to monitor improvements and setbacks with a view to defining management priorities. Advanced METT+ covers other important aspects that are not in the traditional METT version, notably climate change. RAPAC (Réseau des Aires Protégées d'Afrique Centrale) has used METT under the name PAMETT (Protected Area Management Effectiveness Tracking Tool), which has been used widely in Central Africa. To measure progress and correct management actions on an ongoing basis, the assessment should be repeated annually.	Easy to use by managers themselves, METT provides sufficient information to identify the main management issues that need to be communicated to decision-makers. It is useful for protected area managers who would like to carry out a rapid assessment of individual sites without the need for additional studies or research. The tool consists of a series of forms to be filled in by the user (whether an expert or not) that have a relatively simple interface and are easy to understand. Indicators on assets, habitats and species are filled in during discussions and do not necessarily need to be well documented.	The assessments are relatively superficial and should not be the only basis for improving the management effectiveness of protected areas. The quality of the assessment is directly related to how it is carried out. If the method is not properly applied, the assessment can easily be biased, leading to results that are not comparable from year to year. The scoring method for each criterion (scores from 0 to 3) makes it difficult to assess the evolution of different situations over time and does not allow a comparison of the management effectiveness between different protected areas. The absence of a database does not ensure complete standardization of the tool for comparable analyses over time.

Tool	Objective targeted by the tool	Advantages	Disadvantages
RAPPAM **(Rapid Assessment and Prioritization of Protected Area Management)** https://rris.biopama.org/node/18645	Designed for large-scale comparisons across many protected areas, the tool provides policy makers and managers with a relatively quick and easy method to identify key trends and issues that need to be addressed to improve management effectiveness in a given protected area system or group of protected areas. RAPPAM is a decision support tool for setting priorities and allocating resources throughout the system to improve management. It represents a first step in the identification of management priorities for a network of protected areas, whether at the national or regional level. It highlights gaps or obstacles in legislation and policies for urgent action, particularly for IUCN category I-IV protected areas.	RAPPAM is implemented by protected area managers but is more useful to policy makers and stakeholders as a decision support tool for an entire protected area network. Participatory evaluation is carried out in the framework of discussions with stakeholders, which makes it possible for decision-makers to define strategic interventions to improve the management of the entire protected area system. When a protected area network needs to be rapidly assessed, it is recommended in the case of an initial assessment to prioritize the key management issues which require attention.	The tool is more useful for a network of protected areas. An isolated assessment at the level of a single protected area reduces the relevance of the analyses, which are meant to be comparative. The protected areas evaluated should have similar objectives. If the objectives vary, the evaluation should be divided into different "sub-evaluations", otherwise the results may be inaccurate. The method relies on questionnaires that include definitions of terms and details on key concepts, hence the need for reliable data to produce credible reports.
EoH **(Enhancing our Heritage)** https://rris.biopama.org/node/18648	Although developed for World Heritage sites, the tool can be used in all protected areas. The tool makes it possible to: i) identify gaps in the management of the protected area; ii) explore appropriate solutions based on the values and objectives for the establishment and management of the protected area; iii) identify threats to the assets of the protected area; iv) develop and implement a system for the monitoring and evaluation of the management effectiveness of the protected area.	User-friendly and flexible, the tool helps managers identify the main values that contribute to the conservation of heritage assets, the respect of the protected area's management objectives and the evaluation of management effectiveness in achieving these objectives. The tool is very useful for managers of protected areas who wish to carry out a complete assessment or to analyze in more detail certain aspects of the management of their site according to a particular objective.	The compilation of the tool is lengthy and essentially qualitative and not quantitative in nature, which makes it difficult to compare two successive exercises. The tool does not allow the multitude of information collected during the assessment to be inserted into a database that would allow it to be processed. This is unfortunate because the information collected is very complete and could be very useful in filling in gaps in governance and management. It would be desirable to have a database for monitoring and comparative analyses that would allow for changes in scale and the monitoring of developments over time.

Tool	Objective targeted by the tool	Advantages	Disadvantages
SAPA **(Social Assessment for Protected and conserved Areas)** https://www.iied.org/assessing-social-impacts-protected-conserved-areas-sapa	Within the framework of poverty reduction for communities living in and around protected areas, SAPA enables the assessment of the positive and negative social impacts of protected areas on the well-being of these communities. The process includes a self-assessment using a combination of community workshops, a household survey, and stakeholder workshops, all conducted by a SAPA facilitation team. It is intended to help managers increase and share more equitably the social benefits (positive impacts) of conservation and reduce the negative social impacts. The community stakeholder workshop also helps to develop an action plan in a participatory manner to bring about positive change regarding stumbling blocks identified during the assessment.	The SAPA process is carried out with the help of community SAPA facilitators in collaboration with protected area managers, neighboring communities and key stakeholders. The diagnosis of the positive and negative impacts of the protected area on local and indigenous communities is done in a participatory manner, which promotes the joint search for appropriate solutions to reduce negative social impacts and improve social dialogue between different actors.	SAPA is useful for protected areas with human communities living in and around them. The method is more applicable for individual protected areas, but it can be adapted for the needs of protected area networks. It should be noted that where local communities exist, their support is the key to success in co-managing protected area resources. SAPA sheds light on the population-protected area relationship. The approach focuses on social aspects.
SAGE **(Site-level Assessment of Governance and Equity)** https://www.iied.org/site-level-assessment-governance-equity-sage	SAGE is a method used to assess the governance and equity of measures to conserve biodiversity, ecosystem services and other actions to support conservation, such as cost-benefit sharing programs. SAGE has two objectives. The first is to enable actors at the site level to improve governance and equity in their daily work to conserve biodiversity and preserve the environment. The second is to generate information for actors at higher levels to monitor the effective management of protected areas, improve governance and produce national reports. Initially developed for protected areas, its use has been extended to other sites and conservation areas for sustainable natural resource management. The assessment is based on a framework of 10 principles of effective and equitable governance in line with IUCN protected area governance principles. It is generally not recommended to use the full set of 10 principles because experience has shown that summarizing the findings will take more than a full day's work and participants may lose interest in the proceedings.	Supervised by SAGE facilitators, site-level actors and rights holders conduct the assessment themselves in close collaboration with protected area conservation services. This allows the key actors to appropriate the process as they participate in identifying and prioritizing problems, and preparing actions to be taken to improve governance of the protected area. The SAGE exercise would not be considered credible if the following «basic principles» are absent from the assessment of equity and governance: equity, respect for actors, participation of all stakeholders in the decision-making process, transparency, responsibility or accountability, and sharing of costs and benefits.	Before starting the SAGE process, it is important to verify the feasibility of its use on the proposed conservation site. Five key conditions must be met for a SAGE assessment to produce reliable results and improve the equity and governance of the site: (i) the area's management and governance systems have been operating for at least 2 years (i.e., the assessment is based on concrete experience); ii) there is a low risk that the assessment will lead to conflicts between or within different groups of actors; iii) all key actors are willing to commit themselves to the assessment; iv) the lead facilitator must be independent and considered to be neutral by all actors; v) key actors commit to supporting short and medium-term actions in response to the assessment's results.

Tool	Objective targeted by the tool	Advantages	Disadvantages
GAPA **(Governance Assessment for Protected and conserved Areas)** https://pubs.iied.org/17632IIED/	GAPA is an assessment tool designed for the managers of protected areas and their key players. It helps to identify the strengths and challenges of the governance of a protected area, and aims to promote robust and equitable governance. The evaluation framework is based on IUCN governance principles. GAPA is suitable for all types of protected areas, and allows biodiversity conservation and local development to be covered. To conduct an in-depth analysis of specific points, the actors and managers of the protected area select five or six principles to focus on from 11 governance principles. The collection of data on the status of the protected area in terms of good governance is achieved by combining several actions, namely: the consultation of key stakeholders, the organization of target groups, and conducting surveys/interviews and workshops. The results of the assessment enable the preparation of the action plan and are validated by the stakeholders.	The tool has three main elements: the principles of good governance, the assessment process, and a set of methods and tools. GAPA is comparable to a health check-up that shows the strengths and challenges of the governance of a protected area, enabling the identification of the problems to be solved. It renders possible a diagnosis of the protected area to understand the underlying causes of gaps in governance. This in turn renders it possible to identify the actions likely to improve the situation and to establish a baseline to monitor changes in governance over time.	The multi-stakeholder GAPA approach involves the active participation of key stakeholders in: i) designing the assessment process, ii) analyzing and validating the results, and iii) preparing the action plan. This is essential for the transparency, ownership and credibility of the results. The assessment has six stages: preparation, framing, information, data collection, governance assessment and action plan. The four key people facilitating the process should be experienced: the GAPA Facilitator, the Animator, the Host, and the Rapporteur. The Facilitator must be competent, neutral and impartial. The tool has not yet been used in Central Africa; it has been used in Southern/Eastern Africa (Kenya, Uganda, Zambia, etc.).
Green List (IUCN) https://www.iucn.org/theme/protected-areas/our-work/iucn-green-list-protected-and-conserved-areas/global-standard	The Green List is a process that includes several tools for assessing the management effectiveness of a protected area and an external evaluation of its performance. It aims to provide international recognition of the quality of protected area management. This certification process defines quality criteria that encourage managers to make efforts to better manage protected areas and achieve conservation objectives. The Green List serves to label protected areas that are effectively managed and equitably governed. The method is based on a unique and comprehensive verification process that gives independence and credibility to the evaluation process and its results.	The certification application process is conducted by the protected area manager with stakeholders, independent experts, mentors (similar to IMET coaches) and independent assessors. Ideal for individual protected areas, the certification process also can be adapted to protected area networks that wish to be eligible for the «Green List» label. Green List certification is based on internationally recognized quality standards. The tool relies on the COMPASS data base, whose access is restricted to the global community of the Green List.	The standards for defining best practices are ambitious. Developed to help achieve, among other objectives, target 11 of the Convention on Biological Diversity (CBD), the Green List includes an independent mechanism for verifying the protected area's performance (as opposed to a self-assessment). The certification process is long and can be expensive. It takes place in successive stages and the cost is borne entirely by the protected area.

Figure 9 – Main tools used in Central Africa to support decision-making



5

HUMANS AND FOREST ELEPHANTS IN CENTRAL AFRICA: CONFLICT AND CO-EXISTENCE IN AND AROUND PROTECTED AREAS

Thomas BREUER, Steeve NGAMA

Human-wildlife conflicts are ancient, but they are posing an increasing challenge for conservation managers across Africa (Lamarque *et al.*, 2009; Nyhus, 2016; Shaffer *et al.*, 2019). Human-wildlife conflicts can lead to a loss of biodiversity and a substantial decline in human well-being, most often for people living near protected areas (Thirgood *et al.*, 2005). Avoiding or solving these conflicts are key issues for both protected area and wildlife managers.

> Conservation conflicts can be defined as "situations that occur when two or more parties with strongly held opinions clash over conservation objectives and when one party is perceived to assert its interests at the expense of another" (Redpath *et al.*, 2013).

Conflicts and human-wildlife interactions include three frames. The first consists of (illegal) human activities involving wildlife (resource use) that lead to wildlife population disturbance and decline, and in the worst case, to species extinction. This is driven by an overall increase in the human population, particularly in sub-Saharan Africa, and an increasing need for land. These issues are addressed by conservation managers in their daily work, as well as by anti-poaching measures, law enforcement efforts, and work with stakeholders to mitigate habitat loss and fragmentation, and to eliminate retaliatory killing of wildlife.

The second frame consists of conflict arising from wildlife behavior directed at people and their belongings with negative outcomes for people, their health and their livelihoods. This type of conflict usually involves crop raiding and livestock predation. The third frame consists of conflicts between people over conservation, an often ignored but particularly important component of human-wildlife conflict. This includes conflicts of interest, conflicts over beliefs and values, interpersonal conflicts, and conflicts over information. Thorough knowledge of all three frames and their underlying drivers is crucial to identify intervention priorities (Redpath *et al.*, 2013, 2015; Baynham-Herd *et al.*, 2018, 2020).

Our current knowledge of human-wildlife conflict in Central Africa remains limited. Most studies have focused on the savanna region of Southern and East Africa (particularly related to savanna elephants, *Loxodonta africana*, and large carnivores) from which lessons can be learned (Hoare, 2015; Pooley *et al.*, 2017; Fraser-Celin *et al.*, 2018; Shaffer *et al.*, 2019). Nonetheless, human-wildlife conflict in Central Africa has occurred in both savanna and forest ecosystems for centuries.

Many species are involved in human-wildlife conflict in Central African savanna and forest ecosystems. Conflicts involving elephants (Tchamba, 1995, 1996; Granados & Weladji, 2012; Tchamba & Foguekem, 2012), buffaloes (*Syncerus caffer*) and baboons (*Papio anubis*) raiding crops, and predation on livestock by lions (*Panthera leo*) and other large carnivores (Van Bommel *et al.*, 2007; Bauer *et al.*, 2010) have been documented in the Sudanian and other savanna ecosystems (Bauer, 2003; Weladji & Tchamba, 2003; Bobo & Weladji, 2011).

For example, after the 1994 genocide in Rwanda, a large portion of Akagera National Park was given to Rwandans upon repatriation as they needed land on which to cultivate crops for their livelihoods and pasture their cows. Buffaloes and lions posed a serious threat to humans and their cattle. The loss of just one cow could mean severe economic pain in the surrounding communities, and many responded by hunting or poisoning the park's wildlife until some species were eradicated altogether. Lions, which numbered more than 300 before the 1990s, disappeared (Moran, 2019). Likewise, the decrease in the number of lions in the national parks of the northern area of the Central African Republic (CAR) is largely due to their systematic slaughter by nomadic herders who enter the parks with their herds during the dry season (Chardonnet, 2002). Even today, illegal persecution, including through poisoning, shooting and trapping, is the greatest threat to the survival of predators (Muruthi, 2005).

Primates also cause widespread damage in wood plantations by debarking and uprooting seedlings. Baboons are expert in raiding crops such as potatoes, sorghum and bananas. They can even chew sorghum stalks to extract the juice. Baboons also venture into

gardens, steal food from lodges and campsites, and can be a major nuisance in small towns if left unchecked. In Cameroon, the civet (*Civettictis civetta*) is a major predator, causing a decrease in livestock income of about 18% (Weladji & Tchamba, 2003). Smaller wildlife, particularly rodents, birds and insects, are often not the subject of intensive studies, but their crop raiding impact can be substantial (Arlet & Molleman, 2007). Although less common than crop damage, human death and/or injury is the most serious form of conflict between humans and wildlife. The hippopotamus (*Hippopotamus amphibius*) is widely believed to be responsible for more deaths than any of the large African wildlife. Yet despite the threat posed by human-wildlife conflict to the success of conservation projects and protected areas, conflict management is an understudied topic in Central Africa.

Protected area managers are experiencing increasing hostility from riverine communities, particularly farmers, who consider crop raiding as a major reason to dislike protected areas and wildlife conservation. These perceptions, coupled with negative impacts on livelihoods, could undermine current conservation efforts through a lack of support for, and a failure to apply, existing wildlife and protected area laws. This brings wildlife into direct conflict with human populations. In the extreme situation, human-wildlife conflict can act as a pretext for elephant poaching (Compaore *et al.*, 2020).

In this chapter, we discuss human-wildlife conflict issues around protected areas in Central Africa, with a particular emphasis on forest elephants (*Loxodonta cyclotis*). We describe conflicts that arise due to the presence of crop-raiding elephants within and around protected areas. Some other wildlife species, such as baboons, buffaloes, gorillas (*Gorilla gorilla*), and hippopotamus may pose similar problems. Other species also are likely to pose different types of conflicts, for example livestock predation by large carnivores such as lions and leopards (*Panthera pardus*), civet, etc. (Weladji & Tchamba, 2003), or spotted hyenas (*Crocuta crocuta*) around tourism camps and settlements. In this context, it is important to note that activities addressing various human-wildlife conflicts might involve completely different mitigation techniques (e.g., guarding and fencing related to livestock).

Since forest elephants are often mentioned as the number one conflict species in Central Africa, we believe that it is crucial to address this conflict, wherever it occurs. Measures to protect elephants increasingly have been applied in recent years to combat wildlife crime. While the impact of people on forest elephants (poaching, retaliatory killing, etc.) has dramatic impacts on elephant populations and the ecosystem (Breuer *et al.*, 2016; Poulsen *et al.*, 2018; Berzaghi *et al.*, 2019), we do not cover this wildlife crime aspect as it concerns a completely different set of law enforcement actors and activities. Instead, we address the implications of elephant conservation for people living with forest elephants and discuss how addressing human-elephant conflict should lead to co-existence of humans and elephants in Central Africa.

While our current knowledge of human-elephant conflict and its mitigation in Central Africa remains astonishingly limited (Naughton *et al.*, 1999; Nguinguiri *et al.*, 2017), many lessons can be learned from studies conducted on elephants in isolated protected areas with hard edges in West Africa (Barnes, 1999; Boafo *et al.*, 2004; Barnes *et al.*, 2005, 2015; Gunn *et al.*, 2014), as well as from general guidelines related to human-elephant conflict in Southern and East Africa as well as Asia (Hoare, 2000a, 2012, 2015; Nelson *et al.*, 2003; Dublin & Hoare, 2004; Lee & Graham, 2006; Parker *et al.*, 2007; Osei-Owusu, 2018; Gross, 2019; Shaffer *et al.*, 2019).

The conflict situation and potential mitigation measures differ according to the intactness of the landscape, which can be put into three broad categories:

1. **Isolated protected areas:** elephants primarily range inside protected areas and from time to time move out of them, for example to raid crops on land surrounding the protected area. There is often a hard edge between the protected area border and the surrounding land which is largely due to the fact of encroachment by people resulting in the isolation of "island" protected areas. This situation is particularly found in many protected areas in West Africa, but can also be remarkably similar for human settlements that are located within protected areas;
2. **Large relatively intact forest landscape and protected area networks:** forest elephants move freely within these relatively intact landscapes and

occur both inside and outside protected areas. In this context, protected areas are often falsely blamed for being responsible for conflict, whereas stakeholders (e.g., logging companies) responsible for wildlife management in the land outside of protected areas are not doing enough to address the conflict. This category is applicable to the largest intact landscapes in Western Equatorial Africa and is largely relevant to wide-ranging species, such as elephants, migratory herbivores, and large carnivores;

3. **Human dominated multi-use landscapes, dominated by agricultural land and large commercial plantations:** such situations are increasingly occurring in Central Africa (Asaha & Deakin, 2016). Here, elephants are rare, and there is a conflict of interest between farmers and those who wish to protect the remaining elephant populations.

Furthermore, it should be noted that many human-wildlife conflict studies and manuals mainly concentrate on mitigation measures. However, these technical activities only treat the symptoms of the problem (Barnes, 2002; Dublin & Hoare, 2004; Hoare, 2015; Gross, 2019). The conflict lies at various levels, and different activities going beyond mitigation are needed to address conflict issues among stakeholders and the underlying and deep-rooted causes of conflict in order to transform conflict into co-existence (Madden & McQuinn, 2014, 2017; Nyhus, 2016; Frank *et al.*, 2019).

In the following, we cover three objectives and provide various recent case studies related to human-forest elephant conflict. First, we briefly summarize the history and current situation of human-elephant conflict in Central Africa. We next describe the types of human-elephant conflict and discuss the impacts on human livelihoods. Finally, we propose a holistic approach to addressing human-elephant conflict that integrates both biological and social science methods to the complex issues of human-elephant conflict. We briefly describe several components of such a holistic approach to human-wildlife conflict which will help to prevent future conflicts and mitigate existing conflicts using cost-effective techniques. Such an integrated approach allows the inclusion of qualitative data using sociological methods such as participant observation, which has been proven to provide more insights into the various dimensions of the conflict. We advocate for increased elephant tolerance and human-elephant co-existence within conservation landscapes, as well as for more mitigation methods where elephants are compressed into small protected areas.

1. Historical and current patterns of human-forest elephant conflict in Central Africa

Relatively little is documented about the history of human-elephant conflict in Central Africa despite its occurrence since pre-colonial times (Barnes, 1996; Lahm, 1996). Elephants have been hunted for tusks, meat, fat, and bones throughout their range. The killing of elephants by the Baka and Aka tribes was a widespread cultural tradition (Agam & Barkai, 2018) and is still an important part of their cultural heritage (Tsuru, 1998). However, the colonial ivory trade resulted in the removal of millions of forest elephants and many of the large tuskers (Poulsen *et al.*, 2018).

In the past, human-elephant conflict may have existed, but it was likely to be of little concern – even in the largest palm oil (*Elaeis guineensis*) or rubber (*Hevea brasiliensis*) plantations – as elephants were simply shot when they approached fields. Elephants likely avoided human settlements, resulting in little human-elephant conflict. Furthermore, local people were regularly resettled along roads and to urban centers both before and after the colonial period. This resulted in huge remote forests (with large tracks of secondary forest that are preferred by forest elephants) with very few people and very limited access (large areas of Southern Cameroon, Gabon and Northern Congo) that contained large elephant populations residing at high densities (e.g., Minkébé forest in Northeast Gabon).

Poaching for ivory was common but occasional. Sport hunting was performed by expatriate employees of logging companies and other industries. Forest elephants were often killed when they approached villages, and therefore they largely ranged far away from villages in remote and inaccessible forests. In contrast, people in today's Democratic Republic of Congo (DRC) have been forced to exploit the forest for natural products, particularly wild rubber and palm oil; this likely has had a negative impact on the abundance and distribution of forest elephants and consequently human-elephant conflict.

With the creation of many protected areas in the 1990s and increasing measures of conservation, forest elephants eventually returned close to human settlements and started raiding crops in the villages where they were well protected. Around these villages, protection measures were relatively well implemented due to the presence of conservation actors. Consequently, forest elephants started to range even closer to human settlements, where they felt safe and where crops were easily accessible. Complaints of human-elephant conflict have been increasing ever since. Today, forest elephants still occur in relatively moderate numbers in the dense rain forests of Gabon, Congo, and Southeast Cameroon, as well as in and around Salonga National Park in the DRC (Maisels *et al.*, 2013). Most other populations are fragmented and have undergone dramatic declines due to commercial poaching for ivory, which has caused a population decline of over 60% (and in some sites even over 80%) over the last decade (Maisels *et al.*, 2013; N'Goran *et al.*, 2016; Poulsen *et al.*, 2017).

Historically, the largest landscapes had exceptionally low human population densities with relatively intact forests where forest elephants could roam freely. However, this has changed rapidly over recent decades due to the expansion of commercial logging, mining activities and development corridors (Edwards *et al.*, 2014; Laurance *et al.*, 2015; Kleinschroth *et al.*, 2019). The development of infrastructure and roads, and encroachment from people coming from outside these landscapes, has led to a mixture of people of varying origins and socio-economic backgrounds, and an intensification of farming, more sedentary settlements, and shorter fallow periods. This has further resulted in the expansion of farming activities around traditional settlements, and along new roads, particularly in the DRC (Laporte *et al.*, 2007; Kleinschroth *et al.*, 2015, 2019; Tyukavina *et al.*, 2018). This increased cultivation combined with forest conversion is causing an expansion of agricultural areas into forest elephant habitats (Kleinschroth & Healey, 2017; Tyukavina *et al.*, 2018), and consequently an increased potential for human-elephant conflicts (Breuer *et al.*, 2016).

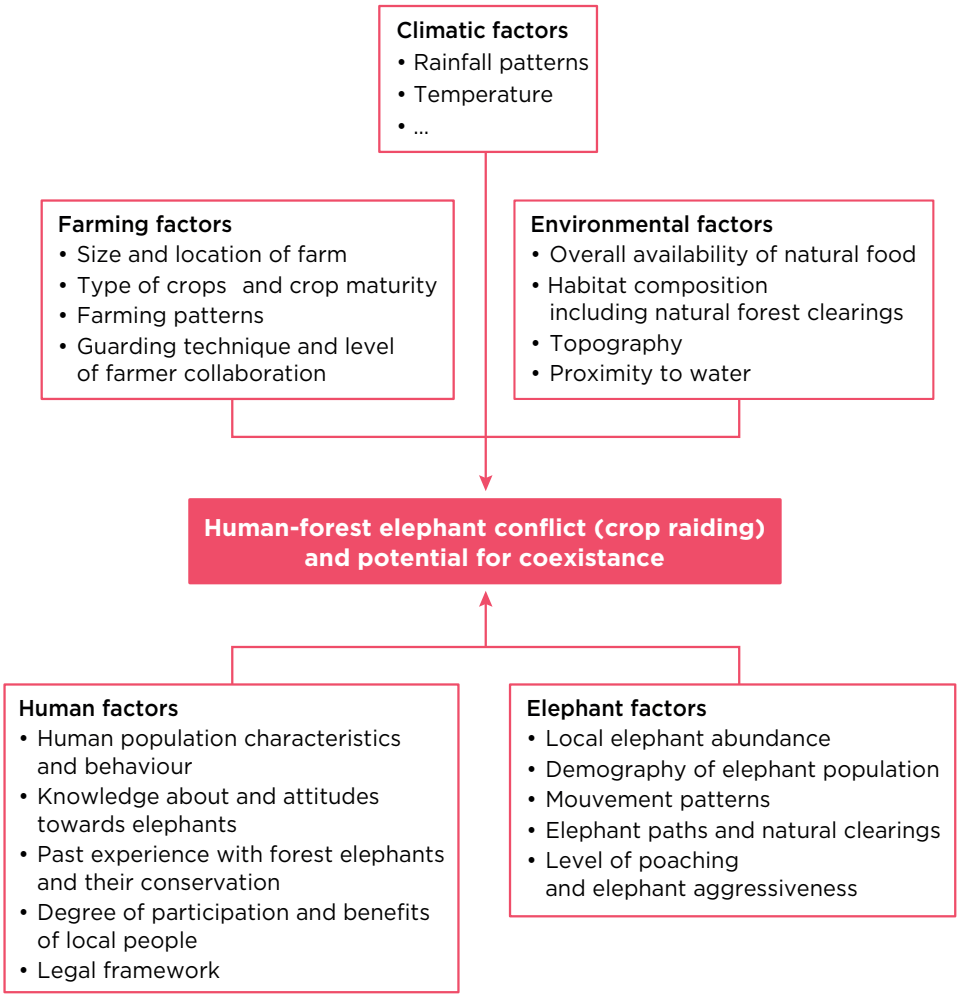
In addition to a dramatic reduction in the number of forest elephants, there are other far-reaching consequences of anthropogenic impacts. Forest elephants avoid areas of high poaching intensity and take refuge in areas where they feel safe (with no poaching), leading to locally high forest elephant

abundance (which is rather a compression), and potentially high crop raiding impacts. Furthermore, elephants that have witnessed the killing of their conspecifics and have grown up without larger tuskers might lose fear and show increased aggression. Similarly, poaching has led to more demographic and behavioral changes of forest elephants that are likely to increase human-elephant conflict throughout the region (Breuer *et al.*, 2016).

We realize that much progress has been made in recent years to combat elephant poaching, including the prevention of poaching events, the arrests of organized poaching gangs and the punishment of traffickers and middlemen. However, it is important to understand that forest elephants have extremely slow population growth rates (Turkalo *et al.*, 2017), and the apparent increase in conflict is thus not due to a sudden increase in the local forest elephant populations. Rather, the continuous immigration and expansion of people into forest lands, the increase of the density of the last elephant populations repelled in these forest tracks, the lack of effective mitigation methods, and potentially an increase in so-called problem elephants, are among the main reasons behind the increasing conflict.

In summary, a diversity of factors must be considered when dealing with human-elephant conflicts, including elephant and human populations' dynamics and behavior, as well as environmental factors (Figure 1). Climate change has been particularly overlooked, as it seems that the fruiting of natural forest trees seems to have fallen dramatically during the past 30 years, which may have pushed elephants "out of the wood" (Bush *et al.*, 2020).

Figure 1 - Factors contributing to human-forest elephant conflict (crop raiding) and potential for co-existence in Central Africa



2. Types of human-elephant conflict and impact on livelihoods

Elephants and people compete for space, water and food. Rural human population growth results in an expansion of agricultural land and a reduction of forest elephant habitat. Due to their large body size, enormous nutritional needs (up to 450 kg of food per day), and wide-ranging behavior, forest elephants regularly come into conflict with humans (Fritz, 2017). Elephants are particularly notorious crop raiders, and their ability to destroy an entire year's worth of crops in a single visit can threaten a farmer's livelihood. Elephants are messy eaters and can easily destroy around one hectare of crops in a few raids. When we address conflict due to forest elephants, it is therefore important to know that a single elephant can cause huge damage. Thus, it is not surprising that forest elephants are considered among the top-ranking crop-raiding species, which likely leads to declining tolerance for elephants in rural communities (Naughton-Treves & Treves, 2005).

In addition to damaging crops, they destroy food stores and water sources, and sometimes threaten human life. Impacts can be either direct (crop loss, property destruction, injury, etc.) or more hidden, such as the opportunity costs of added expenditures and workload (Hoare, 2000a; Hill, 2004; Jadhav & Barua, 2012; Walker, 2012; Barua *et al.*, 2013; Gladman *et al.*, 2020; Salerno *et al.*, 2020).

Another way to categorize these costs is to split them into tangible and intangible categories (Kansky & Knight, 2014). Tangible costs are financial losses such as infrastructure and harvests damages, whereas intangible costs are non-monetary, temporally delayed, and often psychological in nature (fear, stress, sleep-deprivation or in the extreme case grief over a death). To be successful, a human-elephant conflict program must consider both monetary and intangible costs as they are likely to have different types of influence on peoples' perceptions and levels of tolerance for co-existence. Here we briefly describe some of the major impacts that forest elephants can have on people and their livelihoods.

2.1 Crop raiding

Crop raiding is often mentioned as being responsible for the largest (monetary) impact of human-wildlife conflict on human livelihoods (Naughton *et al.*, 1999; Mackenzie & Ahabyona, 2012; Hill, 2018). In Central Africa, it predominantly impacts individually managed smallholder farms using slash-and-burn practices (Lahm, 1996; Madzou, 1999; Naughton *et al.*, 1999; Boukoulou *et al.*, 2012a; Eyebe *et al.*, 2012; Fairet, 2012; Walker, 2012; Inogwabini *et al.*, 2014; Nsonsi *et al.*, 2017). Crop raiding is likely to have occurred ever since the existence of agriculture in Africa. Most people

in Central Africa practice smallholder agriculture and shifting cultivation (land is cultivated for around two years and then allowed to lie fallow for 5-20 years), primarily of root crops such as cassava, yams and cocoyam, banana/plantain trees, and occasional ground nuts. Farming is typically practiced using slash-and-burn practices on private family plots managed by native smallholders. Cultivation in re-growing secondary forests of umbrella trees (*Musanga cecropiodes)* is often preferred because these are easier to clear than old and mature forest.

Crop raiding decreases agricultural productivity, can lead to the abandonment of fields, and hinders efforts to reduce poverty as rural incomes often depend on small-scale farming and are rarely compensated (Mackenzie & Ahabyona, 2012; Walker, 2012; Hill, 2018). Farmers whose entire livelihoods depend on agriculture are often the most vulnerable. Causing on average a crop loss of over 25%, crop raiding can have severe consequences on both family food supplies and household income (Fairet, 2012; Walker, 2010, 2012). Few people have the financial means to ensure field protection. The need to protect fields overnight exposes guards to mosquito-borne disease, stress, and lack of sleep. Thus, crop raiding can have many negative side-effects and increase vulnerability (e.g., lack of funds for mitigation measures). The extent of the crop loss is therefore likely to influence people's perception of forest elephants.

2.2 Infrastructure destruction

Elephants also occasionally destroy infrastructure. Destruction of property occurs when elephants break into houses while looking for salt, soap, bread or even toilet paper. Forest elephants even destroy small-scale alcohol breweries or accidentally fishing nets and dugout canoes (Nsonsi *et al.*, 2018).

Forest elephants destroy not only the property of local communities but also tourism and research camp infrastructure. At Mbeli Bai, in the Nouabale-Ndoki National Park, one single large musth bull terrorized researchers and regularly destroyed boardwalks over the swamp and the tourism facilities. The same bull destroyed the tourism dining room multiple times, and even removed mattresses from tourism bungalows which did stand on four high concrete posts. Years later, another younger bull regularly entered the same camp and due to his aggressive behavior, the tourism activities had to be closed. Similar problems occur at other research and tourism camps.

2.3 Competition for natural resources, access restriction, injury and killing of people

Forest elephants compete for wild foods such as wild mangos (*Irvingia spp.*), and many other fleshy fruits such as *bambu* (*Chrysophyllum lacourtianum*)

and moabi (*Baillonella toxisperma*) that have an important value for local livelihoods and on local and regional markets. Most of these larger trees are connected via elephant paths. Elephants harvest these fruits from the ground or bump their heads against the tree trunks with force (Maisels *et al.*, 2002). Forest elephants therefore directly compete with local gatherers for these fruits and also come into contact with people when looking for trees growing naturally in the vicinity of settlements, such as palm trees.

Forest elephants are dangerous to people. Aggressive encounters with elephants in the dense rain forest are common. Physical aggression and charges are not uncommon. Biomonitoring and ranger teams are regularly charged by forest elephants, and several people have been wounded or killed. Thus, walking in a forest elephant habitat is becoming more and more dangerous, making it necessary to be prepared for potential aggressive encounters. Heightened aggression both in the short and long term is likely to be a consequence of poaching (Breuer *et al.*, 2016). For example, we witnessed an elephant bull that had been extremely peaceful and regularly frequented the park headquarters become very aggressive after a poaching event in a nearby forest clearing. Researchers and tourists have been killed by hyper aggressive male elephants and elephant mothers protecting their young offspring.

Forest elephants can also be dangerous to people when approaching settlements. When elephants lose fear, they come near people and become destructive (see above). Elephants can prevent people from passing and might actively charge people. This can substantially compromise conservation efforts. In order to anticipate any aggressive behavior, it is strongly recommended that people be aware of the risks of charging elephants and understand their body language.

2.4 Opportunity costs

Human-elephant conflict also generates opportunity costs, poor health and poor nutritional status (Fairet, 2012; Walker, 2012; Barua *et al.*, 2013; Gladman *et al.*, 2020). Staying up overnight to protect crops leads to an increased workload, lack of sleep and more stress, lower health and a rising fear of elephant. Children might not be able to attend school if they must work overnight to protect the farms or if an elephant blocks the roads and prevents them from passing. Conflict events may thus affect people for years after they occur. We will see below that such intangible costs strongly influence tolerance for co-existing with wildlife.

2.5 Price increase and standard of living

Crop raiding can also have secondary impacts on people not involved in the farming sector as prices of cash crops can be higher in remote villages where local production cannot meet demand for staple foods (Fairet, 2012; Walker, 2012). For example in Northern Congo, cassava had to be imported (despite being subsidized by a nearby conservation project), and the price was up to 25% higher in villages where elephants had destroyed almost all crops (Nsonsi, n.d.).

3. Finding solutions to human-elephant conflict

Measures to address human-wildlife conflict are diverse and address different elements of the conflict. They include practical solutions dealing with the symptoms of the conflict (e.g., impact mitigation measures to reduce crop loss and ensure income safety) or addressing previously unresolved social issues underlying the conflict (e.g., issues in relationships between stakeholders) or even deep-rooted values and social beliefs (including addressing past traumata). They range from activities that aim to prevent human-wildlife conflict before it occurs to mitigation measures that aim to reduce the impacts of human-wildlife conflict after it occurs (Nelson *et al.*, 2003; Redpath *et al.*, 2013; Nyhus, 2016; Young *et al.*, 2016a; König *et al.*, 2020). Thus, in the case of elephants, it is not only crucial that we fully understand the ecology of forest elephant behavior to modify their behavior (Mumby & Plotnik, 2018), we also need to acquire a clear understanding of the human dimension of the conflict (Dickman, 2010; Bennett *et al.*, 2017a; Hill, 2017; Wallace & Hill, 2017; Gross, 2019; Shaffer *et al.*, 2019).

Unfortunately, human-wildlife approaches are rarely systematically included in conservation and protected area management projects in Central Africa

(Naughton *et al.*, 1999; Hoare, 2012, 2015; Nguinguiri *et al.*, 2017; Gross, 2019; Shaffer *et al.*, 2019). Most measures addressing human-elephant conflict have been applied in isolation, and holistic approaches are rare because they are not often included in the design of programs and/or there is a lack of funding. To our knowledge, the specific problem of crop raiding has never been addressed in full, even where conservation projects in the Central Africa have been running for several decades. Where human-elephant activities occur, conservationists often only aim to mitigate the visible impact of wildlife without considering the human dimension of the conflict. It is important to understand that a combination (and ideally the full range) of interventions needs to be deployed – there is no one-size-fits-all solution.

Implementing technical solutions that focus on physical and spatial measures (e.g., beehive fencing) in isolation and economic fixes (e.g., compensations) only address parts of the overall problem (see Figure 1). More importantly, the deeper-rooted reason for the conflict is not solved. Holistic landscape-based approaches aim to increase the willingness of local communities to tolerate and co-exist with wildlife conflict. They apply land-use planning, community conservation and participation using scenarios of climate change as well as increased population growth, immigration and agricultural expansion, more extractive industries, agroforestry, and increased fragmentation (Osborn & Parker, 2003; Dublin & Hoare, 2004; Walker, 2010; König *et al.*, 2020).

Conservationists and protected areas' managers in Central Africa must start to work on more long-term approaches applying land-use planning, understanding of stakeholders, increasing community participation and implementing co-existence activities that raise the level of tolerance of living with wildlife and try to accommodate forest elephants as a species within a shared landscape. Human-wildlife conflict must be addressed at various administrative levels (vertical integration) to elaborate the relevant intervention policy and the institutional links between local, regional and national entities (Hoare, 2015). A focus on shorter-term measures in the conflict zone will not lead to success.

Furthermore, any human-wildlife conflict program must build on local knowledge and a willingness to respect local realities (Treves *et al.*, 2006; Treves *et al.*, 2009; Young *et al.*, 2016a; Wallace & Hill, 2017; Branco *et al.*, 2019). An electric fence is no solution when financial means are lacking, and bee-fencing cannot be applied when local resistance against bees exists. Finally, any co-existence approach needs to respect the existing cultural relationships of people and elephants. We must include knowledge about the ethnobiology of a site to increase tolerance towards conflict species (Setchell *et al.*, 2017; Parathian *et al.*, 2018).

Conservation organizations jointly working with governmental offices in Central Africa can play a crucial role in the implementation of human-wildlife conflict projects. They often have the knowledge and staff capacity needed, and can raise funds to cover salaries of full-time employment for experts and the relevant operational budget and logistics. Given the wide-ranging nature of elephants, it will be important to collaborate with other stakeholders (logging and safari companies, and mining extractives) in the buffer zones of protected areas. WWF (World Wide Fund for nature) has developed a long-term and holistic human-wildlife conflict "SAFE" system (Brooks, 2015) that integrates a variety of measures to ensure that wildlife and people co-exist in harmony while protecting both wildlife habitats and people's assets (Appendix 1).

3.1 Understanding the conflict

A thorough understanding of all dimensions of the conflict is crucial for any human-wildlife conflict program to be successful (Hill, 2004, 2017; Dickman, 2010; Guerbois *et al.*, 2012; Redpath *et al.*, 2013; Kansky & Knight, 2014; Young *et al.*, 2016a; Wallace & Hill, 2017; Gross, 2019; König *et al.*, 2020). Only a few studies in Central Africa have systematically aimed to fully understand the diverse components of human-wildlife or elephant conflict and its underlying drivers (Nsonsi, n.d.; Walker, 2010; Crawford, 2012; Fairet, 2012). These include the biology of the conflict species and the ecological variables that might impact the conflict as well as the human techniques (e.g., crops planted, farming cycle, location of fields) that increase vulnerability to conflict animals. Rarely do human-wildlife conflict projects

investigate conflicts between people, even though the conflict with wildlife might often be a surrogate for a deeper-rooted social conflict.

Problems can be very site specific and depend on the socio-cultural context of the stakeholders as well as the ecological setting in the landscapes or around the concerned protected area. Furthermore, it is important to understand whether the human-elephant conflict concerns a larger portion of the human and elephant populations or just a few problem elephants or concerned farmers. Thus, understanding susceptibility to and determinants of human-elephant conflict requires a deeper knowledge of site-specific conflict patterns, especially crop raiding, which is likely to change over time as elephants quickly adapt to new situations. There are various dimensions of vulnerability, including biophysical, social and institutional components, and investigating these components together is likely to reveal a much better understanding than investigating a single factor on its own.

It is important to know that forest elephants have always been present in these landscapes. They have not been re-introduced, nor have they been forced out of protected areas due to growth in the elephant population. It is a misconception that more signs of human-elephant conflict are due to an increasing forest elephant population resulting from successful law enforcement activities as forest elephants show slow population recovery (Turkalo *et al.*, 2017). Conflict between elephants and people arises due to the expansion of human settlements and slash-and-burn agriculturel, which are encroaching on elephant habitats, and to elephants moving to areas where they feel safe. Increasing habitat loss and fragmentation due to development of linear infrastructure, expansion of human settlements and people's need for land, agriculture and pastures are resulting in a serious increase in human-wildlife conflict zones throughout the continent (Kleinschroth *et al.*, 2019).

Poaching has worsened the situation on various levels. For example, conflicts are exacerbated due to the phenomenon of compression into protected areas and the loss of fear of humans due to local high levels of protection, and the attraction of elephants to secondary forest with its dense understory (Nchanji & Lawson, 1998; Naughton *et al.*, 1999; Naughton-Treves & Treves, 2005; Breuer *et al.*, 2016). Given the anthropogenic impacts on forest elephants, the killing of larger older tuskers with the resulting loss of ecological knowledge, heightened aggression and increased exploratory behavior of younger males combined with increased compression and fragmentation, it is very likely that human-elephant conflict is going to severely increase in the future, despite an overall decline in forest elephant numbers (Breuer *et al.*, 2016). This may be exaggerated by the deteriorating social context (e.g., increased poverty, civil and political instability, worsened governmental support, rapid population growth and land needs, but also rural exodus, etc.) in some Central African countries (e.g., social vulnerability). If local people feel that they are left alone to face these problems, a transformation from conflict to co-existence is unlikely to happen.

3.2 Perceptions and root causes affecting tolerance of co-existence with forest elephants

Conservation programs aiming to mitigate the impacts of human-wildlife conflict must understand the social dimensions of the conflict because human-wildlife conflict is often mainly about social conflicts between different human groups (Hill, 2004; Dickman, 2010; Hill, 2017; Wallace & Hill, 2017; Vucetich *et al.*, 2018). Negative impacts on livelihoods (and tangible costs) often are far less of a problem than the pervasive existence of negative perceptions among stakeholders (Hill, 2004; Webber *et al.*, 2007). Such data should take into account that the perception of conflict wildlife can differ between households and according to a variety of socio-economic factors such as gender, level of education, ethnicity, residency, dependency on farming and wealth (Naughton *et al.*, 1999; Hill, 2004; Naughton-Treves & Treves, 2005; Kansky & Knight, 2014; Nsonsi *et al.*, 2017, 2018).

3.2.1 Addressing lack of knowledge and considering local attitudes

First, it is important to understand that local people, and occasionally even members of wildlife authorities in Central Africa, have limited knowledge about the management of human-wildlife conflicts. Statements such as the "wildlife that come from the nearby protected area" often are incorrect because wildlife are not confined (in most cases) to protected areas and often have been living in the landscapes long before the establishment of human settlements and agriculture.

Next, the size and behavior of the crop-raiding species strongly influences perceptions; for example, attitudes towards elephants are often based on extreme damage events which contrast with the small persistent damage caused by smaller animals such as rodents or insects (Hill, 2004; Naughton-Treves & Treves, 2005; Oerke, 2006; Arlet & Molleman, 2007).

As a result, attitudes towards wildlife are controversial (Lee & Graham, 2006): on the one hand, wildlife such as elephants, gorillas and lions can be viewed as icons and flagship species for conservation. When conservationists and people in the Western world argue about the importance of forest elephants, they use terminology such as forest engineers, ecosystem services, and seed dispersers (Blake *et al.*, 2009; Poulsen *et al.*, 2018). They regard wildlife with affection and admiration and highlight their role as tourism magnets. Local people often do not understand the link between wildlife presence and ecological services as these concepts are complex. For example, it was recently demonstrated that elephants have a positive effect on soil fertility with important implications for local agricultural practices (Sitters *et al.*, 2020).

On the other hand, local people see wildlife quite differently and judge them as dangerous and pests that damage their property (Hill, 1998). For example, in Northern Congo, negative attitudes towards forest elephants were largely associated with farming activity, lack of benefits from the conservation project and past conflicts with wildlife law enforcement (Nsonsi *et al.*, 2017, 2018). Only occasionally do local stakeholders have positive attitudes towards wildlife, particularly among indigenous people (Köhler, 2005). Even

where positive benefits of wildlife exist, interactions with wildlife are framed negatively. Complaints expressed by local farmers can make human-elephant conflict a highly political issue between protected area managers and local communities. This is intensified due to a widespread lack of understanding about the role of each conservation actor.

Understanding perceptions of wildlife and the prevalent conservation conflict matters and needs to inform wildlife tolerance and co-existence strategies and the implementation of management responses (Nsonsi *et al.*, 2017, 2018; Vasudev *et al.*, 2020). When addressing human-wildlife conflict, it is therefore important to understand who the different stakeholders are, what their interests are, and what types of conflict exist between them.

3.2.2 Lack of participation and ownership of wildlife and protected areas

Perceptions might also reflect underlying issues of wildlife ownership, differences in benefit sharing and stakeholder involvement as well as power differentials between different human groups (institutional vulnerability). Overall, protected area management in Central Africa reflects a top-down conservation strategy in which locals are mostly excluded from decision making. However, authorities in charge of managing protected areas in Central Africa have limited technical skills and financial means. International Non Governmental Organizations (NGOs, including foreign staff) therefore often take over much of the daily work on the ground in collaboration with the government. Given this strong presence of NGOs, locals consider them as the owners of wildlife and the management body of protected areas. This is further exacerbated by so-called Public-Private Partnerships (PPP) in which NGOs take over the management body of a protected area (Hatchwell, 2014).

Conflicts between local people and protected area managers are common around national parks. This is due to a lack of local community participation in the management of protected areas, and occasionally poor relationships between local people and protected area managers (Lambini *et al.*, 2019). Correspondingly, local people often have hostile attitudes towards wildlife authorities and the concept of protected areas (West *et al.*, 2006). When local people feel that there is a lack of transparency in decision making, or think that there are unequal power dynamics, a lack of trust is often manifested (Peterson *et al.*, 2010; Stern & Coleman, 2015; Young *et al.*, 2016a).

For example, in Northern Congo and coastal Gabon, many stakeholders expressed confusion about the ownership of wildlife, some even stating that elephants belong to the "Western" people who only care about conservation and not about people's livelihoods (Fairet, 2012; Nsonsi *et al.*, 2017). Local resistance to conservation agendas might lead to increased complaints about human-wildlife conflict. Consequently, this can result in political maneuvering and the use of conflict language, such as "pests" or "problem animals", a lack of trust, and communication barriers. When farmers are unsatisfied with conservation narratives that are against their interests, they might express their anger, deception and lack of empowerment by complaining about elephants. Raising concerns about conflict can occasionally be an attempt by local people to receive financial support where compensation occurs.

3.2.3 Underlying conflict and past unresolved incidents of human-wildlife conflict

Aggressive wildlife behavior events remain in people's memories. Perceptions can reflect past conflictual events and not necessarily current conflict. Negative perceptions towards wildlife can result from past confrontations with wildlife laws (e.g., with rangers) and consequently some wildlife species, in particular forest elephants, are perceived as the main conflict species (Fairet, 2012; Nsonsi *et al.*, 2018).

Sometimes local people, including farmers, even threaten conservationists and park managers because wildlife destroyed their properties, including fields. For instance, if an elephant kills a farmer near a protected area, this may result in a massive protest against the protected area's administration, sometime resulting in the burning of staff offices and cars. Clearly, such deep-rooted attitudes and political manipulation have often been ignored in local conservation projects. Indeed, intangible costs have been identified as having a much larger impact on tolerance of living with wildlife like elephants and buffaloes than the perceived monetary costs or lack of benefits from their conservation.

3.2.4 Other social and cultural conflicts

There are also conflicts between farmers. For instance, some farmers accuse their neighbors of witchcraft and of transforming themselves into elephants to destroy their plantations because, by chance, an elephant feeds in one field and leaves the neighboring fields untouched (Nsonsi, n.d.). The owner of the destroyed field takes a negative view of the luckier ones.

Perceptions are likely to differ due to people's ethnic and residency background (Parathian *et al.*, 2018). Clearly pygmies, who have a strong spiritual link to elephants, have different attitudes than Bantus (Köhler, 2005). Many Bantu tribes believe that elephants are totems of the Aka/Baka pygmies who want to punish them by annihilating their efforts in the agricultural sector. And more importantly, immigrants are likely to show less tolerance compared to people that have grown up with elephants living nearby.

Thus, an understanding of the perceptions of those who are affected by the conflict is crucial as their beliefs are likely to influence their behavior (Nsonsi *et al.*, 2018). Such a knowledge gain will help to frame conflict mitigation strategies.

3.3 Susceptibility to wildlife crop raiding

Understanding factors influencing crop consumption by wildlife is important to design crop protection methods (Naughton-Treves, 1998; Sitati *et al.*, 2003; Jackson *et al.*, 2008; Graham *et al.*, 2010; Songhurst & Coulson, 2014). Crop raiding behavior is likely different due to differences in wildlife habitats (e.g., availability of water, location of fruiting patterns). For instance, there are differences between elephants species (e.g., savanna elephants move in large herds while forest elephants tend to form small groups; Fishlock *et al.*, 2008; Schuttler *et al.*, 2012; Schuttler *et al.*, 2014; Turkalo *et al.*, 2013; Fishlock & Turkalo, 2015; Mills *et al.*, 2018; Beirne *et al.*, 2020; Brand *et al.*, 2020), and differences in farming patterns (mainly small-scale farms in forest areas compared to larger fields in the savannas). In addition, it is important to realize that each location has its own set of factors affecting the spatial and temporal pattern and intensity of crop raiding, and hence the different options available to mitigate the conflict. While there is a deepened understanding of some of the factors affecting the vulnerability of farms to crop-raiding elephants in savanna ecosystems, little is known about forest elephants.

A variety of factors are likely to affect susceptibility to crop raiding (Sitati, Walpole & Leader-Williams, 2005; Graham *et al.*, 2010; Guerbois *et al.*, 2012; Goswami *et al.*, 2015; Wilson *et al.*, 2015; Gross *et al.*, 2018). They are related to the behavior of crop-raiding elephants (Osborn, 2004; Chiyo & Cochrane, 2005; Rode *et al.*, 2006; Chiyo *et al.*, 2011; Chiyo *et al.*, 2012; Gunn *et al.*, 2014), natural features (biophysical: e.g., density of elephants, proximity to natural habitat and feeding sites, rainfall, topography, availability of wild fruits, etc.) as well as intrinsic features of the farms (crop species, stage of ripening of crops, farm size and location, cultivation cycles of local farmers, effectiveness of farm protection measures, etc.) (Barnes *et al.*, 1995; Barnes *et al.*, 2005; Lahm, 1996; Nchanji & Lawson, 1998; Osborn, 2003; Boafo *et al.*, 2004; Chiyo *et al.*, 2005; Kofi Sam *et al.*, 2005; Gross *et al.*, 2018; Snyder *et al.*, 2020).

The biophysical vulnerability to crop raiding patterns in Central African forested areas is poorly understood and shows many site-specific patterns. Thus, to predict these patterns, we need to understand why and when forest elephants raid crops. Various hypotheses have been proposed that remain largely untested. There are many short-term studies aiming to understand crop raiding patterns within Central Africa (Nsonsi, n.d.; Lahm, 1996; Kamiss & Turkalo, 1999; Madzou, 1999; Ongognongo *et al.*, 2006; Walpole & Linkie, 2007; Boukoulou *et al.*, 2012b; Eyebe *et al.*, 2012; Fairet, 2012; Inogwabini *et al.*, 2014; Ngama *et al.*, 2019).

Certainly, as confirmed in many studies, the maturity of crops has a strong impact on the occurrence of raids. When crops are ripe, they attract animals due to their high nutritional value. Crop type is undoubtedly also an important factor impacting raids. Among the preferred crops are maize, bananas and cassava, but also sugarcane, sweet potatoes and rice. Crops may also provide additional benefits to wildlife, such as the provision of rare nutrients.

The location, size and vegetation around a field (see fruiting trees above) are also important predictors

of elephant crop raids. In Central Africa, it appears that the scattered pattern of planting due to low quality soil, far away from the village, also creates more opportunities for crop-raiding by wildlife. If farmers open their fields in a nearby elephant habitat, these fields will be more vulnerable.

It therefore is important to understand how elephants move through the forest and which factors influence their distribution and abundance in the absence of anthropogenic activities (e.g., habitat types, understory composition and canopy closure, proximity to natural forest clearings or other salt licks, seasonal concentration of fruiting trees; existence of elephant paths; Ngama *et al.*, 2019; Beirne *et al.*, 2020). In a recent study in Gabon, researchers found that the presence of wild fruiting trees near farms increased the occurrence of crop damage, particularly when those trees were bearing ripe fruits (Ngama *et al.*, 2019).

Fields are also more difficult to guard if they are far from a village. For instance, elephants largely raid crops during the night or when people are absent. Smaller fields are often more vulnerable than larger ones. The general lack of organized, team-based mitigation strategies exacerbates the situation.

Patterns found in savanna elephants (e.g., rainfall) are likely not to be the same for forest elephants because water is overall abundant with some notably seasonal exceptions (Blake, 2002). Nevertheless, peaks in crops raiding occur more often in the wet season at some sites when forage quality is low and when elephants appear to be ranging closer to cultivated areas, although other studies could not find any seasonal difference. However, traditional farming is determined by the rainfall season. Researchers also found higher susceptibility to crop raiding when fields were located near permanent water points at some sites, but not at other ones. Interestingly, elephants do not raid crops grown on steeply sloping fields, thus providing further conflict mitigation options (Ngama *et al.*, 2019).

Furthermore, there are likely to be large inter-individual, age and sex differences, and the reasons for crop raiding might additionally vary not only between sites but also between individuals of the same elephant population, as seen in savanna elephants (Chiyo *et al.*, 2011, 2012). The extent to which the different social system of forest elephants, with much smaller groups, influences conflict patterns is unknown. There is limited site-specific information on ranging patterns of forest elephants, particularly on the usage of elephant paths, natural forest clearing, or other high elephant value forests. Unfortunately, our baseline knowledge about elephant habitat use and movements is predominantly determined by individual movement patterns (Blake, 2002; Momont *et al.*, 2015; Mills *et al.*, 2018; Beirne *et al.,* 2020; Molina-Vacas *et al.*, 2020) or from large landscape surveys (Clark *et al.*, 2009; Stokes *et al.*, 2010).

Finally, human activities are likely to modify raiding patterns. Clearly, human activities (poaching, linear infrastructure, road traffic), strongly impact population-wide-elephant distribution (Laurance *et al.*, 2006; Stokes *et al.*, 2010; Yackulic *et al.*, 2011). Forest elephants avoid areas of high-poaching intensity and take refuge in secure areas, leading to locally high forest elephant abundance and intensified crop raiding near villages where elephants feel safe (Breuer *et al.*, 2016). However, the degree of impact remains to be studied. Additionally, forest elephants appear to be attracted to secondary forest and there might be a link between logging disturbance and increased levels of crop-raiding incidents. Therefore, natural and anthropogenic factors work in combination.

3.4 Monitoring the conflict, its impacts and the effectiveness of conflict management interventions

Despite the multitude of review articles on human-wildlife conflict, the existence of many different human-wildlife conflict manuals (Nelson *et al.*, 2003; Parker *et al.*, 2007; Walpole & Linkie, 2007; Fernando *et al.*, 2008; Osei-Owusu & Bakker, 2008; WWF, 2008; Lamarque *et al.*, 2009; Osei-Owusu, 2018), and the availability of online resource pages, there is a paucity of data on the effectiveness of conflict management measures in Central Africa. This contrasts with other regions in Africa and Asia, where mitigation measures have been studied in detail (Davies *et al.*, 2011; Gunaryadi *et al.*, 2017; Branco *et al.*, 2019; Scheijen *et al.*, 2019) and occasionally have succeeded in reducing the conflict to tolerable levels. However, mitigation measures in isolation will not be successful and must be integrated into larger

human-elephant co-existence programs (see below) as all negative impacts of the conflict can never be eliminated. We briefly present a few important monitoring questions and tools.

Monitoring must take place at different levels with baselines and follow-up monitoring of project success of prevention and mitigation strategies (Pozo *et al.*, 2017). Various questions about human-elephant conflict need to be answered, most notably: reports by farmers themselves have been shown to overestimate the real impact of damage by crop-raiding species; so what is the exact amount of crop-raiding by forest elephants and how does it compare to less visible species (such as rodents)? How effective are mitigation methods in reducing tangible costs? How can we measure and monitor intangible costs to better address them? How does crop-raiding and trampling damage impact the harvest in palm oil or agroforestry plantations (e.g., African oil palm, safou (*Dacryodes edulis*), kola nut (*Cola spp.*), etc.)?

Standardized data collection protocols have been developed for savanna elephants that have been used to quantify the impact of crop raiding (Hoare, 1999, 2000b; Parker *et al.*, 2007). However, it has been extremely challenging to confirm whether reported (or perceived) impacts reflect real impacts because of the time required for wildlife managers to confirm raids. Therefore, more participative and real-time documentation has been recommended. For example, community-based monitoring of crop raiding using mobile devices has been used in Southern Africa and is being tested in Central Africa (Angoran, 2016; Le Bel *et al.*, 2016; Nguinguiri *et al.*, 2017). To put such systems in place, local data collectors must be trained and supervised over several years.

More innovative methods, such as camera traps, can help to determine raiding patterns (timing and location) and age and sex patterns of crop-raiding elephants (Smit *et al.*, 2017; Ngama *et al.*, 2018). Combined with the mapping of forest elephant hot spots (e.g., fruiting trees, natural forest clearings and other licks along large elephant paths), such data can help to identify high conflict zones which can then be integrated into a larger human-elephant co-existence approach and land-use plan with the aim to increase the acceptance of elephants on community land (see below). The involvement of local communities is crucial for the development

of participative community action plans, which are currently being developed in several countries of Central Africa. Furthermore, data on human-wildlife conflict must be linked to detailed information on wildlife demography, distribution, movement patterns and human activities.

We need to integrate social sciences and methodologies (interview, community engagement, focus groups, etc.) into human-wildlife conflict programs to gather information on people's perceptions and drivers of negative attitudes to wildlife (Hill, 1998; Hartter, 2009; Nsonsi *et al.*, 2017, 2018; Vasudev *et al.*, 2020). This also includes qualitative data which can be exploratory and comparative in their approach, the use of different analytical methods, and the involvement of both natural and social scientists (Bennett *et al.*, 2017a and b; Setchell *et al.*, 2017). How do people value the proposed mitigation strategies and how are people's perceptions changing in relation to mitigation success or increased participation?

3.5 Legal framework for elephant conservation and human-elephant conflict in Central Africa

Central African countries do not share the same laws and have different engagements when it comes to activities related to elephant conservation and human-elephant conflict (Breuer *et al.*, 2015). Activities that fall under such legislation include, for example, reactive actions such as translocations, killing of problem animals, compensation and insurance, but also land-use planning. Within a country, there are often multiple laws from different sectors (environment, forest, wildlife, agriculture) that must be considered when dealing with human-wildlife conflict.

Few countries have detailed laws providing a legal framework of dealing with wildlife conflict animals and compensations. For instance, Rwanda enacted a law on the compensation of damage caused by wildlife (Law N°26/2011 of 27/07/2011) and established the Special Guarantee Fund for accidents and damage caused by vehicles and wildlife (Law N°52/2011 of 14/12/2011).

Elephants are totally protected in all Central African countries. But the killing of elephants, for example for trophy hunting, is allowed in some countries. Trophy hunting has unknown consequences on elephant populations, particularly when large tuskers are removed (as there is often a minimum size of tusks to be allowed to be hunted).

Most national and regional strategies and action plans to assist in the conservation of forest elephants are largely outdated and date back to 2005 (IUCN, 2015). National action plans are important, however, to obtain political support. Guidelines do exist to elaborate national elephant plans and are currently being used to elaborate more national action plans in Central Africa. They have been more recently updated in some countries (e.g., Gabon, Congo, etc.). The elaboration of national strategies and action plans is often less of a challenge than the implementation of the activities recommended. This is due to a lack of political will and conflicts of interest, particularly with other ministries, and a lack of funding to roll out human-wildlife conflict programs. Gabon is one exception with a detailed plan in human-elephant conflict that is put into practice (ANPN, 2016).

3.6 Changing agricultural patterns

One of the most effective deterrence to elephant damage is the modification of traditional agricultural patterns. This concerns the location of fields, planting alternative – unpalatable – crops (Gross *et al.*, 2016), and potentially changing the planting style (e.g., moving from slash-and-burn to regularly fertilized fields). However, more research is needed to evaluate whether changing farming practices can be an option. Overall, planting in wildlife habitats should be avoided; if needed, farms must be relocated out of wildlife habitats and away from paths or potentially attractive features such as natural fruiting trees. The closer the farms are located to the settlement, the easier it is to guard them. Scattered small fields within wildlife habitats will lead to increased crop raiding compared to large communal fields with straight edges. Fields should be grouped together and a collaborative effort to guard them must be set up. Working together buffers the individual damage done to a single farmer. Establishing teams that guard the fields will also allow farmers to concentrate their efforts on farming and not guarding (see Table 1).

Table 1 – Some conditions which encourage or deter elephant intrusions into farms

Most favoring conditions	Most deterring conditions
Farms far from villages	Farms near villages
Farms located in elephant corridors and preferred habitat	Setting farms far from elephant corridors and preferred habitat
Setting farms in areas where elephants go to collect food	Avoiding setting farms in areas where elephants go to collect food
Leaving standing trees whose fruits are eaten by elephants	Avoiding standing trees whose fruits are eaten by elephants
Setting patchy farm areas in the forest	Grouping farms
Setting farms near swamps used by elephants	Setting farms away from swamps used by elephants
Setting plantations in flat areas	Setting plantations in steep fields
Ignoring animals, their usefulness, and neglecting the specificities of elephant behavior	Making efforts to obtain knowledge on forest elephant behavior and their usefulness (e.g. use elephant's feces to fertilize crops)

However, farmers might argue that the location of farms further away from villages is a result of soil-depletion. Farmers need to have a thorough understanding of the growing conditions (soil, water, climate, topography, etc.) of various crops. Particularly, research into the impact of different farming practices (with or without slash-and-burn and usage of fertilizers) on soil nutrition of farms is needed to understand the suitability of these modified practices.

Changing to alternative crops might not be easy, and farmers need to be convinced that there is a market for their alternative crops. Often local people state that they are willing to plant crops that elephant do not raid (unpalatable crops). However, local people remain highly reliant on basic foods, such as cassava, tubers and bananas. Imports of these staple foods might be an option. Alternative crops should either be consumable, or the farmers should be able to easily sell them. The list of proposed alternative crops is long and includes, for example, chili (*Capsicum* sp.), tea (*Camellia sinensis*), tobacco (*Nicotiana tabacum*), cacao (*Theobroma cacao*), medicinal or aromatic plants, vegetable gardens (near houses) and many more (Barnes *et al.*, 1995; Gross *et al.*, 2016). If these crops only provide low income (and need high financial and technical investment), it is unlikely that farmers will change to them. Furthermore, when changing to alternative crops that elephants do not eat, crop-raiding by other wildlife species might still occur.

If alternative crops are used as a buffer zone, the buffer zone must be wide enough (several kilometers) and should contain only unpalatable crops. However, trampling damage might still occur, particularly when the buffer zone is not wide enough. Lastly, the technical skills and efforts to plant, cultivate and harvest these alternative crops should be comparable to the typical low-input agriculture that is widespread in Central Africa. If not, increased capacity building and support is needed to make them competitive with common crops.

3.7 Alternative activities and benefits from wildlife conservation

Alternative activities to agriculture might include handcrafts, beekeeping, ecotourism benefits, harvesting of non-timber forest products, and payments for ecosystem services (Wright *et al.*, 2016; Wicander & Coad, 2018). These income generating activities often are conducted not as an alternative but as a complement to farming activities. Ideally benefits should be linked to wildlife conservation or related activities, but this is overall challenging.

Some argue that natural resource use (e.g., trophy hunting, ecotourism, timber and non-timber forest product usage) can positively influence local attitudes and perceptions of resource users. More research is needed to establish links between distribution of revenue and conservation activities.

Improving livelihoods through human-elephant conflict mitigation through agroforestry and beekeeping in Northern Republic of Congo

V. H. Kandza, AJSEC

Problem statement and objective

Conflict over elephant conservation is common in Northern Congo. In the Likouala Department, east and north of the Nouabale-Ndoki National Park (PNNN), forest elephant poaching is extremely prevalent. Nevertheless, forest elephants come into conflict with people, and impact human livelihoods, particularly through crop raiding. Mitigation measures are largely absent. The *Association des Jeunes pour l'éducation et la Sauvegarde des Éléphants au Congo* (AJSEC) therefore initiated a human-elephant conflict project aiming to: 1) provide alternative income opportunities for local and indigenous communities with an emphasis on elephant poachers; 2) test various mitigation methods around a permanent agroforestry plot, most notably beehives; and 3) provide access to environmental education and awareness-raising information related to forest elephants.

Approach

The project was conducted between the logging town of Thanry-Congo and the local village of Makao-Linganga in the northeast of PNNN. After consultation meetings with village authorities and elders, the chief of the village selected 15 young hunters, nine Bayaka (indigenous or foragers) and six Bantus (farmers). This selection was based on specific criteria such as courage, good knowledge of the forest (knowing trees species useful for elephants, knowing fruit availability season). Therefore, training and working with these young men also allowed the project to collect more detailed information about elephant poaching in the area. This information made it possible to define a new strategy through awareness and the promotion of agroforestry activities as a new alternative income and food supply opportunity. AJSEC taught the young hunters new methods to grow crops and manage beehives, including diverse species to be grown and specific methods to increase production. Women were employed to harvest the crops and to sell the excess harvest to nearby towns. Additionally, AJSEC emphasized the urgency and the fundamental need to protect forest elephants and enhance biodiversity, including their ecological value for forest regeneration.

Equipment and farming technique

This sustainable agricultural approach made it possible to grow many different plant species (e.g., manioc, pineapple, bananas, trees) and set up beehives in the same area to produce food and honey for a long period. Nine species of crops and nine trees species have been cultivated. Surrounding the cultivated land, 80 beehives have been placed. Plants, tubers and seeds were bought in Brazzaville and transported to the project area. Basic equipment was provided to famers, including wheelbarrows, shovels, hoes, rakes, machetes, a chainsaw and an outboard motor. They also constructed a small storage house. The first part of the project (cleaning the land) was finalised at the end of July 2019. This was followed by the installation of the beehives and the planting of crops and trees species between August and September 2019. The first harvest of tomatoes and vegetables occurred in October 2019. Thereafter, the harvest of different crops species will continue until December 2020. The harvest of different fruits species will start around September 2020.

3.8 Preventing and mitigating impacts in the conflict zone

The aspect of prevention and mitigation of human-wildlife conflict has been the subject of many manuals and tools (Nelson *et al.*, 2003; Osei-Owusu & Bakker, 2008; Gross, 2019). Again, it is important to emphasize that prevention and mitigation methods should be used in combination and with flexibility at different spatial scales as elephants quickly become accustomed to these mitigation methods. Unfortunately, there is a paucity of monitoring data on the effectiveness of these measures, particularly in Central Africa. Most often they are applied in isolation from other important tools of human-wildlife conflict. However, a set of tools (e.g., toolbox) should be provided (Hoare, 2015; Nguinguiri *et al.*, 2017; Shaffer *et al.*, 2019; Snyder & Rentsch, 2020) so that they can be applied in combination or rotated as wildlife – especially elephants – can quickly learn to overcome a single tool used in isolation. Ideally, a mixture of both passive (e.g., fencing) and active (e.g., guarding) interventions should be applied.

Traditionally, the use of mitigation strategies has been relatively uncommon in Central Africa; even basic guarding is not done regularly (Barnes, 1996; Lahm, 1996; Walker, 2010; Fairet, 2012; Nsonsi *et al.*, 2018). Despite a willingness to apply prevention and mitigation measures, existing strategies where they exist are often inadequate and ineffective. Furthermore, the lack of trust in wildlife authorities makes farmers reluctant to apply proposed prevention and mitigation methods. Most often prevention and mitigation measures are implemented by individual farmers, but there is a clear need for cooperation and sharing of responsibilities.

The involvement of local people in the development of prevention and mitigation strategies is crucial to the success of all sustainable prevention and mitigation measures and should therefore be based on local knowledge and be specific to the species and area concerned (Snyder & Rentsch, 2020). Such measures emphasize existing positive aspects of human-wildlife relationships. When tools are simple and creative, their long-term usage and success is much higher than when they are based on external and expensive ideas.

New prevention and mitigation techniques are emerging, ranging from guarding, repelling, fencing and many more. Many different methods have recently been summarized in the FAO (United Nations Food and Agriculture Organization) and CIRAD (*Centre de Coopération Internationale en Recherche Agronomique pour le Développement*) human-wildlife conflict toolbox (FAO *et al.*, 2014). Only a selection of some of the more recent applications is presented here as case studies (Angoran, 2016; Nguinguiri *et al.*, 2017).

Many of these deterrence tools and mitigation techniques have been applied in Central African countries but most of them are not well documented (Nsonsi, n.d.; Madzou, 1999; Ongognongo *et al.*, 2006; Walker, 2010; Fairet, 2012; Ngama *et al.*, 2016, 2018; Nsonsi *et al.*, 2018). There is a clear need for detailed species-specific information of the success of mitigation tools in different local situations. If deterrents are coupled with tangible benefits (e.g., honey in the case of beehives or pepper in the case of chili-pepper fences or bombs), communities are more likely to become engaged over the long term, thereby increasing the likelihood of human-wildlife co-existence (Hedges & Gunaryadi, 2010; Le Bel, 2015; King *et al.*, 2017; Branco *et al.*, 2019).

We can draw some conclusions and formulate recommendations on these mitigation methods based on the factors impacting vulnerability to crop raiding. For example, we know that crop raiding (not trampling damage) is not random and takes place when crops are ripening, thus most mitigation efforts (e.g., guarding) should take place when the likelihood of raids is highest (e.g., when crops are ripening). Please note that other wildlife might raid crops during other periods of the crop growth cycle.

Recently, the application of mitigation measures, particularly the use of bees and chili to deter elephants, has been conducted in Gabon on fruiting trees. When testing the use of beehives, even though elephants could adjust their feeding strategies to overcome the bee threat by feeding at night, bees have been found able to recruit more fighters and grow their colonies. The ability of bees to defend hives from elephants depends on multiple environmental factors. For that, farmers need to manage their beehives to reach an optimum level enabling bees to effectively deter elephants and produce honey. This includes protecting beehives against predators, which is not an easy task.

A Human-Wildlife Conflict Mitigation Toolkit for Central Africa

S. Ngama, IRAF-CENAREST and T. Breuer, WWF Germany

Content of the toolkit

Based on the lack of information on methods to mitigate human-wildlife conflict in Central Africa and the need of the *Commission des Forêts d'Afrique Centrale* (COMIFAC) and the *Réseau des Aires Protégées d'Afrique Centrale* (RAPAC) to provide tools to conservation practitioners, a Human-Wildlife Conflict Mitigation Toolkit (FAO *et al.*, 2014) has been developed by FAO, CIRAD, Awely and various partners (Le Bel *et al.*, 2016; Nguinguiri *et al.*, 2017). The toolkit is a device which includes five documents gathered in a canvas bag:

- 1. A **Wildlife Book** presenting the 17 animal taxa occurring in Central Africa that come in conflict with people;
- 2. A **Conflict Booklet** presenting the five main types of impact caused by animals, consequences on communities and introducing ways of human-wildlife co-existence;
- 3. The **Solution Book** bringing together various practical solutions planned to (i) prevent conflicts, (ii) block access to wildlife, (iii) repel wildlife and (iv) remove the most dangerous animals;
- 4. The **Law Book** introducing the national legislation related to wildlife protection in Cameroon, Gabon, and Central African Republic;
- 5. The **Evaluation Notebook** offering a monitoring and evaluation strategy for human-wildlife conflict.

An application in Gabon

In Gabon, some trials have been performed, all focused on human-elephant conflict. FAO promoted this tool in collaboration with CIRAD, the Ministry in Charge of Wildlife and the NGO *Fruitière Numérique*. They organized a capacity-building session to train local artisans on the manufacture and use of low-cost pepper dispensers as a repellent method. ANPN tested the

efficiency of chili bullets and straps in different parks and obtained mixed results for chili bullets and better crop protection effects with chili straps. The *Institut de Recherches Agronomiques et Forestières* of the *Centre National de la Recherche Scientifique et Technologique* (IRAF-CENAREST) started to assess the use of beehives in the Gamba complex of protected areas with satisfactory results.

To monitor the use of the toolkit, KoBoCollect, an Android application, offers an interesting alternative for collecting and transmitting information in real time. The NGO WCS (Wildlife Conservation Society) assessed the use of the KoBoCollect tool in *Monts de Cristal* National Park and obtained satisfactory results. However, local communities mostly do not use Android smartphones.

Lessons learned

Obviously, the FAO toolkit still needs to be spread among the farmers who most need it and solutions need to be adapted according to site specificities. A lack of effective tools and low technical capacity are significant issues for the staff of protected areas and wildlife services who are supposed to assist farmers in addressing human-wildlife conflict. COMIFAC, RAPAC and the respective national agencies should be involved either via the implementation of national strategies or through monitoring activities.

The lack of on the ground activities and funds to implement the toolkit remain a further challenge. In that regard, the toolkit needs further improvement. For example, it would be useful to include a community training book and/or books of solutions according to each animal species in conflict with people. Standing alone, the toolbox cannot simply be applied. It is also clear that it needs to be fully adapted to any local context. In this regard, it is important to provide more in-depth details related to rainforest wildlife, as many of the examples are only useful for the savanna ecosystem and link to other sources of information.

We strongly recommend that other tools are needed to complement this mitigation toolkit, as improvement of tolerance and human-wildlife co-existence needs to be achieved, and this requires a holistic approach.

Web link: https://ur-forets-societes.cirad.fr/outils/boite-a-outil-bo-chf

When using beehives, it is important to take all safety measures and evaluate where to place hives. African bees are known for their aggressiveness and the risk they pose to human health. Using beehives will benefit both humans and elephant conservation if properly managed and maintained.

As a biological strategy, the use of beehives presents many challenges including: i) parasites and diseases which diminish honey production and could also have a negative effect on the efficiency of beehives as elephant deterrents; ii) bee stings which could discourage people from practicing beekeeping; iii) the inability to maintain beehives at the optimum activity level could lead to a failure of the hive to deter elephants. Given these challenges, people must master beekeeping and be properly trained to successfully use beehives, and more research is necessary to test the ability of hives to deter elephants in plantations.

Use of chili pepper to mitigate human-elephant conflict in the Gamba Complex, Southeast Gabon

S. Ngama, IRAF-CENAREST

Problem statement

To prevent elephant damage on crops, the use of chili is promoted under different forms (unpalatable crop, burning bricks, chili guns, chili bombs, chili bullets, etc.) as a non-lethal method. As the Gamba complex, in Southeast Gabon, is one of the human-elephant conflict hotspots, low tech devices using chili to keep elephants away from fruiting mango trees were tested. In this experiment, we were particularly interested to understand how forest elephants react to devices using chili pepper as a deterrent based on sequential camera trap photos (Ngama *et al.*, 2018).

Approach

The experimental approach consisted in using three different simple devices, which could target three different elephant senses: 1) bottles filled with the chili pepper concentrate, and hung on mango trees to release the smell of chili in order to disturb and then prevent elephants from collecting and eating mango fruits; 2) bottles filled with chili pepper hung on wired fences to reach the elephant's face and eyes in order to prevent them from entering an area; 3) chili pepper concentrate coated onto mango fruits to force elephants to collect and eat chili pepper, or avoid and leave mango fruits.

Results and lessons learned

The chili pepper device that resulted in splashing concentrate on the elephant's face proved to be the most effective at deterring elephants. Surprisingly, chili pepper concentrate directly applied to mango fruits did not deter elephants from eating the fruits, although it caused discomfort. To make effective deterrent devices with chili pepper, results from this trial suggest focusing on exploring practices to reach elephants' faces with the least, safest quantity of chili pepper with a sufficiently strong painful deterrent effect. Eye exposure to chili pepper produces intense tearing. This might explain why even at the first device the elephants reversed while challenging the chili fence. The young elephant that received chili pepper in its face never came again in contact with the fence and no more contact events were recorded there.

These results also explain why failures have been recorded in other places in Gabon where chili pepper guns have been used. When elephants are approaching a crop field, it requires courage for guarding people to target the animal face. Moreover, as elephants mostly raid on crops during night times, this is obviously too difficult, even impossible to locate, target and reach it face.

Permanent and mobile fences can be used for fencing as a mitigation option. Mobile fences are suitable for small farms, particularly farms which are mobile due to slash-and-burn practices. Fencing might be particularly useful around permanent fields or even around villages, but also potentially around the island protected areas. An electrical fence has been established around Akagera National Park in Rwanda, and a stone wall fence system is practiced around Virunga National Park in DRC and Volcano National Park in Rwanda to prevent wildlife from moving out of the protected area.

Practical human-elephant conflict mitigation: lessons learned from first test to beehives in Gabon

S. Ngama, IRAF-CENAREST

Context

The use of beehives to protect plantations has successfully reduced elephant damage on crops in many savanna areas throughout Africa (King *et al.*, 2009, 2011, 2017; Goodier & King, 2017; Branco *et al.*, 2019; Scheijen *et al.*, 2019). Beekeeping has the additional advantage of producing honey, potentially diversifying and increasing the livelihoods of local farmers. While promising, this method needs further research because no comparable work has been conducted on forest elephants or with *Apis mellifera adansonii*, the only species of African honey bee in Central Africa. The trials presented here had two objectives: (1) experimentally examining whether the presence of the African honey bee species present in Central Africa deters forest elephants from feeding on fruit trees; (2) assessing whether local communities could adopt the strategy on using beehives to both protect their crops and enhance their livelihoods (Ngama *et al.*, 2016).

Methods and results

We conducted trials with local people to adopt modern beekeeping around Monts de Cristal National Park and in the Gamba Complex. Ten villages were involved, and residents were sensitized on the importance of bees and modern beekeeping. Technical, financial and human limitations were considered by setting trials according to available resources. Thus, fruit trees were used to set beehives (two beehives per tree) instead of plantations which would require more material (about hundred beehives per site). The trial involved governmental agencies (IRAF-CENAREST, ANPN), local companies (Colas-Gabon, Shell-Gabon) and non-governmental actors (WCS, Smithsonian Institution).

The trials did not allow a direct assessment of human-elephant conflict. Yet about 150 people were trained on beekeeping with twenty of them receiving beekeeping equipment in Monts de Cristal National Park. Most of the people trained adopted modern beekeeping. Results from the Gamba Complex showed that beehives colonized by *Apis* bees can be effective elephant deterrents, but people must actively manage hives to maintain bee colonies at the optimum activity level which enables bee colonies to deter elephants and produce honey.

Lessons learned

Beekeeping is a promising initiative to reduce human-elephant conflict and enhance local people´s livelihoods in Central Africa and supports conservation activities. For that, we must transfer the necessary knowledge and technologies to local people. Modern beekeeping has many advantages: 1) benefits for the preservation of local wild bee colonies, as modern beekeeping prevents traditional honey harvests leading to the destruction of wild bee colonies, 2) benefits for agriculture production through pollination, 3) protection of sites against elephants, 4) may generate additional revenues.

Akagera Park electric fence to mitigate human-wildlife conflict

E. Hakizumwami, Independent consultant

Context

Founded in 1934, Akagera National Park once covered over 2,500 km^2. In 1997 it was reduced in size by close to 50% to provide land for refugees. Unfortunately, wildlife such as buffaloes, elephants, hippos (*Hippopotamus amphibius*), wild pigs and baboons (*Papio* sp.) were raiding crops and farmers had problems holding them down.

Solution

In 2013, the Rwanda Development Board (RDB) inaugurated an electric fence to reduce human-wildlife conflict in the area and to bring to an end life, crop and livestock losses due to animals straying from the park. Officials hope that it will also end poaching, which has led to the loss of some animal species. The fence was commissioned by the Government of Rwanda and cost over US$2.5 million.

It stretches along 120 km on the southern and western boundary of the park. It has 1.8 m high-line of metallic posts with 8 horizontal electrified wires. The posts support a mesh to allow higher resistance and the passage of small animals like rodents. The fence is powered with solar energy. Nine fence attendants' houses have been built, spaced approximately 20 km apart, which also serve as bases for the solar equipment. Akagera Management Company currently has 42 fence attendants patrolling the entire fence line on a daily basis.

Results

The fence is substantially reducing human-wildlife conflict on the boundary of the park while helping to reduce incidents of poaching inside the park. The establishment of the fence also marked an important step towards the re-introduction of lions (*Panthera leo*) and black rhinos (*Diceros bicornis*) into Akagera. The fence is reducing crop and livestock losses, which previously had led to food shortages in the districts neighbouring the park.

Piloting an electric fence design for mitigating elephant crop raiding in Northern Congo

T. M. Brncic, WCS Congo.

Problem statement and tested solution

Forest elephants regularly range around the village of Bomassa, around the Nouabale-Ndoki National Park. People are unable to successfully farm without an effective method of protecting their fields. Previous attempts at mitigation included cable fences with chili grease, burning chili bricks, beehive fences, and night guarding with a gun (to fire in the air), all with limited success and lack continued use by the community (Madzou, 1999; Ongognongo, 2006; Nsonsi, n.d.). Following the successful implementation of two solar-powered electric fences to protect research camps in PNNN against persistent elephant raids, WCS piloted a 4-ha community agriculture project to evaluate the potential benefits of this system to prevent crop-raiding by elephants. The fence was installed in June 2019. The design includes 85 cm-long flexible electrified barbs. These barbs aim to prevent elephants from touching the trees or breaking the wire with their non-conductive tusks. In order to avoid theft of materials, a custom-built cage was welded and planted in a cement base to house the equipment. Live large trees (>25 cm

diameter where possible) were used as posts to avoid financial and labor costs of installing and maintaining posts, and to make it difficult for elephants to push them over. The fence was electrified on the day of installation and has remained on at all times since. Fifteen camera traps were installed around the field to evaluate elephants' responses over time.

Installation and maintenance costs

Fixed costs (approximately US$1,550) are one-off installation costs (e.g., fence charger, solar battery, solar panel, ground rods, airfreight of materials, etc.) that are the same whether the fence is 200 m or 50 km long. Per-meter costs are dependent on the final length of the fence (e.g. wire, insulators, and labor to clear the fence line) : in this case US$2.3/m. The maintenance costs included a participant hired by the community at US$50 per month to check the fence daily for faults and make minor repairs when necessary. Extra labor was hired on one occasion to cut back vegetation outside the fence line and several times to remove tree falls (approx. US$100 in the first year). The replacement costs for the entire system would likely be incurred after 5-10 years. In total, in the first year, installation costs were approximately US$3,450, with US$700 of maintenance costs for 825 m of fence protecting approximately 4 ha of agricultural land. Assuming a 5-year equipment life, the total cost per year would be US$1,390 (US$350/ha) and thus US$23/yr or just over US$2/month/participant.

Involvement of communities

Request for participation by community members was high and the land was divided into 59 small plots of 25 m x 25 m for 58 families. Participants took responsibility for helping set up the fence, clearing, planting and weeding their own plots. Most participants gathered for one hour each week to rake the fence line and agreed to contribute 1,000 FCFA per month to hire a community member to check the fence daily, and save for repairs. Families with more limited financial means contributed to the weekly sweeping.

Preliminary results

As of May 2020, there have been zero elephant incursions or damage inside the trial plot. All elephants who received a shock immediately fled. Participants have already harvested maize, peanuts, manioc leaves and some manioc tubers. Consequently, several participants declared they would be willing to increase their monthly contribution if necessary. Many participants have requested an expansion of the project, indicating that they would ideally like to farm 3-4 times as much area and would be willing to increase their monthly contribution accordingly.

Solar-powered electrical fencing around parts of protected areas is also now being applied successfully in Gabon (Avomo Ndong, 2017) and Northern Congo. However, in general, such measures are too expensive, difficult to maintain and likely largely ineffective within a larger landscape when there is a lack of strong financial and political community and governmental commitments. However, it should be clear that, most often, fencing only solves human-wildlife conflict locally as it shifts problems elsewhere.

Most successful crop harvests throughout the region are performed by local farmers implementing a mix of locally based methods and actively guarding their fields. To achieve these results, they use both acoustic and visual systems such as beating empty barrels and putting fires around farms to chase away elephant raiders. However, these measures are not viable in the long-term as they are time consuming and require the continual presence of farmers.

Furthermore, elephants quickly get used to such techniques. A better understanding of the usage of the environment by forest elephants might help to find solutions. For example, mitigation strategies could use steep slopes as an elephant deterrent, but implementation of the strategy would differ at small and large scales (Ngama *et al.*, 2019). At the small scale, the most effective strategy might be to incorporate topography with other deterrents such as encircling fields on steep slopes with wire fences. Such methods could be easily implemented by local farmers themselves. However, on flat terrain where hillsides do not exist, dirt walls could be built around fields, mimicking the skid trail walls that were effective in deterring elephants. More details about the potential and practicality of using steep fields as an elephant deterrent could be found in the mentioned literature.

3.9 Compensations and insurance schemes

Compensation is a payment to "compensate" a monetary loss of property (crops, infrastructure, livestock, etc.) as a direct result of a wildlife conflict (Nyhus *et al.*, 2003, 2005; Ravenelle & Nyhus, 2017). Compensation payments might be related to species-specific schemes (e.g., elephants, large carnivores, etc.) or related to any activity (e.g., crop raiding). Generally speaking, compensation for losses has not been very successful in practice (Nsonsi, n.d.; Morrison *et al.*, 2009; Fairet, 2012; Hoare, 2012, 2015; Barua *et al.*, 2013; Shaffer *et al.*, 2019; Umuziranenge, 2019). However, many locals state compensation as a priority. Wherever they occur in Central Africa, national compensation schemes appear to be largely ineffective. Compensations are cumbersome and slow to administer, insufficient and are often delayed for months and occasionally even years. Mostly, public funds are not enough to cover all compensation claims. There are various flaws that include: slow administration, so that people must wait for a long time before receiving a payment; unfair payments, as most often only a fraction of the actual value of the loss is paid and payments might be given to some but not all claimants.

Insurance system for crop damage caused by animals in Odzala-Kokoua National Park

A. Edé, APN

Assessment of the problem and the solution tested

In the Republic of the Congo, the State is supposed to pay compensation for damage caused by protected wildlife (Decree No. 06/970 of 1986). However, this system is not working in the field. Faced with the distress of rural communities, the managers of Odzala-Kokoua National Park decided to set up an insurance scheme to help the people who were most affected and depended on their fields for their livelihoods. This system was not, however, intended to replace the role of the State, which remains responsible for crop compensation payments.

An insurance fund was created with the support of partners such as the European Union, and thanks to members who pay a membership fee of 2,500 FCFA/ha/year (about US$4/ha/year) to insure their fields. When there is damage, policyholders notify park managers, who come to draw up a damage report. Compensation is calculated proportionally in relation to several parameters: the damage (based on Decree 06/970), the state of the fields, and the farmer's monitoring efforts. Policyholders are then compensated twice a year.

Following difficulties encountered during the first four years of operation, a new insurance program was set up. It is no longer based on Decree 06/970, which had a compensation scale that was outdated and unsuitable, and it defines more appropriate and simplified compensation rules. The maximum payment (200,000 FCFA/ha) is reached when the sum of the devastated areas is equal to or surpasses 25% of the field size; below that, the policyholder is compensated according to the severity of the damage, up to a maximum of 100,000 FCFA/ha.

Results and lessons learned

This insurance scheme provides monetary compensation for damage while seeking to encourage the most appropriate behavior. However, it faces many problems. First, it is not financially self-sufficient. Second, to register the reports, significant human resources and means of transportation are required. This insurance system also can have perverse effects and encourage communities to not protect their fields. Furthermore, communities do not necessarily understand the complicated insurance process, particularly the calculation of payments. This renders the process opaque and raises the possibility of corruption, misuse of funds and tribalism, and policyholders sometimes accuse the management team of being involved in such practices. Lastly, the reaction of communities may not be commensurate with the actual damage, and some villages may complain that they have not been sufficiently compensated compared to other villages.

To overcome these problems, the following is needed: 1) effective awareness-raising about how the insurance system works with the support of government officials; 2) a capacity to rapidly record damage reports; 3) the use of a standard damage assessment method that has been approved by members; 4) the use of a simple compensation system that is understood by the majority of members and which they can follow up with receipts of damage reports provided by the management team; and 5) the system must encourage practices to resolve human-wildlife conflict and be able to guarantee the amount of compensation. Without all of these parameters, it is highly likely that the insurance system will have a negative impact on human-wildlife relations around protected areas. If misunderstood, this system also could reduce community support for conservation.

Compensations are difficult to manage, particularly over large landscapes, since it is often impossible to attribute a loss (e.g., crop raiding) to a specific species. Often wildlife and/or agriculture authorities are not reliable and come late when signs of damage are no longer visible. Obviously, they are open to considerable abuse and fraudulent claims or blatant corruption. Illiterate farmers have difficulties submitting claims. Some studies point out that representatives from the agricultural ministry are notoriously absent in the field, do not use accurate assessment methods and that claims are not processed for years and most of them are not paid. When they are paid out to some (not all), this might cause resentment or social problems among recipients.

Since they do not tackle the underlying causes of human-wildlife conflict, compensations can result in sloppy livestock and crop protection practices and do not promote co-existence. Some authors even argue that at worst compensations exacerbate human-wildlife conflicts. In the worst case, compensations might have the unintended consequence of subsidizing agricultural expansion and might increase the conflict between people when only a few, and not all people, receive compensations. Finally, compensation and efforts to address tangible costs might have little impact on farmers' tolerance to co-exist with elephants, particularly when intangible costs influence tolerance levels more than tangible costs.

To overcome these challenges, various locally managed insurance schemes have emerged (Morrison *et al.*, 2009; Chen *et al.*, 2013; Wilson-Holt & Steele, 2019). To improve the effectiveness of compensation schemes, clear guidelines must be elaborated that address the conditions of payments. The administrative burden should be kept to a minimum to allow quick payments, and the system should be flexible to include new rules. A monitoring scheme must be in place that allows time effective validation of claims. Payments should reflect levels of losses and should be made within a short timeframe after verification of the damage/loss.

Damage and losses must by verified through systematic and proven methods to avoid mistakes and subjectivity, and to raise confidence in compensation decisions. Lastly, a certain level of local ownership is needed to reduce abuse. More recently, community-based micro-insurance systems have been introduced around protected areas in Central Africa.

3.10 Killing of problem animals and translocations

The killing and translocation of problem elephants are far more challenging to carry out than other response measures and are therefore only considered after all other measures have failed (Fernando *et al.*, 2012; Hoare, 2015; Shaffer *et al.*, 2019). This is because of the heavy logistics involved and the difficulty to efficiently target the real problem animals.

Performing killings or translocations of problem animals are risky activities which require the intervention of specialized teams and heavy logistics. Moreover, they only relocate the issue rather than solving it. Transferring problem animals to other locations will surely transfer the issue to that new location, and is thus futile. In addition, the killing of problem elephants has always been reported as being a useless strategy in mitigating human-elephant conflict. Retaliation killings of problem elephants usually do not target the right animals. After a crop raiding event, the animal(s) responsible usually move far away from the site, and it is impossible to be 100% sure that the real problem animal has been identified and targeted. When group of elephants is involved, it is even more difficult to identify the right problem elephant.

3.11 Transforming the conflict by increasing tolerance through awareness and community engagement

It is important to recognize that it is crucial not only to mitigate the conflict, but also more importantly to change human behavior to achieve human-wildlife co-existence (Madden & McQuinn, 2014, 2017; Frank, 2016; Kansky *et al.*, 2016; Nyhus, 2016; Frank *et al.*, 2019), and human-elephant co-existence in particular (Hoare & Du Toit, 1999; Guerbois *et al.*, 2013; Gross, 2019; Shaffer *et al.*, 2019). Co-existence can be defined as "a dynamic but sustainable state in which humans and wildlife co-adapt to live in shared landscapes governed by effective institutions that ensure long-term wildlife population persistence, social legitimacy, and

tolerable levels of risk" (König *et al.*, 2020). The participation and engagement of local communities is crucial for any human-wildlife conflict approach and the success of such a transformation process (Madden, 2004; Treves *et al.*, 2006, 2009).

Tolerance in the context of human-wildlife conflict can be defined as the ability of an individual to absorb the potential or actual costs of living with wildlife. To increase tolerance, we first need a complete understanding of the factors impacting tolerance. Recent research findings are demonstrating that tangible (monetary) costs have little impact on people's attitudes. Intangible costs, on the other hand, seem to be driving tolerance for co-existence with wildlife (Saif *et al.*, 2020).

Various activities can help to increase local tolerance, ranging from knowledge increase, reducing intangible costs, and increasing intangible benefits. Essentially, awareness raising should aim to revert hostility and increase levels of tolerance and pro-conservation behavior (Espinosa & Jacobson, 2012). Where forest elephants occur, it is important to provide knowledge on their natural behavior and their historic distribution. Raising community awareness of the conflict and the ecological role of wildlife in general and of elephants is crucial to increase tolerance among local people, whether they reside around an isolated protected area or within an intact landscape with free-ranging forest elephants.

Helping people to understand historical and current distribution will help to raise understanding of the danger (and associated tangible costs) of establishing new farms in elephant habitats and will lower expectations of mitigation strategies. This knowledge gain might be particularly relevant for recent immigrants who have not experienced long-term co-existence with elephants, for example on the danger of close encounters with elephants to reduce life-threatening contact with elephants in the forest and around farms. Awareness raising can happen from a young age, for example in rural schools or in nature clubs (Breuer & Mavinga, 2010), but also with targeted focus group discussions, such as meetings with farmers, local natural resource use communities and underrepresented groups such as women and minorities. Finally, informal and formal leaders, including local, regional and national decision-makers, must be particularly informed.

Next, activities can aim to reduce the costs of living with wildlife. Above, we have described various prevention and mitigation activities that can potentially reduce the monetary costs of co-existence, particularly when they are based on strong community support and are combined with alternative income-generating activities that are likely to be successful (beehives and chili pepper). To reduce intangible costs, various activities such as the creation of specialized teams might ultimately lead to increased tolerance, which include collective management of risks and income-generating activities. Farmers will have enough sleep and can focus their efforts on farming activities. Thus, to achieve such attitude changes and encourage co-existence, it is crucial that local communities are involved from

the start of a human-wildlife project. This would also concern increased ownership for wildlife and protected area management through participation in decision making. Engagement is only possible when local communities take ownership of the project and help to develop and decide relevant interventions.

Ideally, locally led conflict resolution committees made up of local stakeholders should be created instead of inactive national wildlife and protected area authorities. Such committees can help to share knowledge, identify strategies to change perceptions, and principally help to manage natural resources in a sustainable way by pooling their resources. Potential solutions can be based on existing positive interactions with and attitudes towards elephants. Similarly, when compensations or insurance systems are based on local ownership and local financial contributions, there is a much better chance that they will be accepted among the local stakeholders.

3.12 Integrated landscape management

Human-wildlife conflict must be addressed at various spatial scales. Land-use planning helps to address the causes of the conflict and goes beyond treatment of the symptoms (mitigation strategies, compensations, etc.). A landscape-based approach (some of them transboundary) has been promoted in Central Africa where people and wildlife share resources (Angu *et al.*, 2011). Integrating human-wildlife conflict programs into such an approach is considered as one of the greatest long-term activities to increase human-elephant co-existence (Osborn & Parker, 2003; Dublin & Hoare, 2004; Walker, 2010; Fairet, 2012). Such an exercise will involve the input of many stakeholders with the aim to protect key forest elephant habitats and natural resources while simultaneously considering people's needs for space to secure their livelihoods. Protecting key areas for elephants, creating buffer zones, and investing in alternative land uses can be some of the successful solutions.

Large landscapes will allow natural movements of forest elephants, allowing them to use more space which will reduce locally high elephant numbers and potentially extreme conflict zones. Identification and creation of wildlife corridors between high density zones, such as protected areas or high conservation value forest within logging concessions, is of crucial importance in this land-use exercise. This planning concerns elephants that move out of isolated protected areas and come into conflict with riverine communities and farms in the vicinity of the protected area border. In that case, land-use planning including wide buffer zones (e.g., planted with unpalatable crops such as medical herbs or chili) can be an option. For example, a buffer zone with forest plantations (eucalyptus and acacia) and tea plantations has been set up around Nyungwe National Park in Rwanda.

Taking into consideration elephant needs within a landscape is much more challenging as we have little understanding about their seasonal movements. Detailed knowledge on wildlife behavior (where available) needs to be included in such planning and zoning exercises as in the case of savanna elephants (Graham *et al.*, 2009; Granados *et al.*, 2012; Bastille-Rousseau *et al.*, 2020; Snyder *et al.*, 2020). For example, we must consider the wide-ranging nature of forest elephants and particularly the explorative behavior of younger male elephants.

Settlements and farms should not be created along known elephant paths, close to natural forest clearings (*bais*) and salt licks and should not disturb migration corridors to seasonal available fruiting trees. Any planning should model how potential habitat changes and losses of high conservation value forest impact forest elephant distribution.

The success of any planning exercise will be based on a government's commitment. Too often, we have seen that existing land-use plans are not respected and are not included in legislation and policy. Despite the existence of inter-ministerial exchange committees, the different ministries often do not consult each other, resulting in land use overlaps; mining concessions are overlapping with protected areas and/or large oil palm or timber concessions are attributed without consultation of relevant stakeholders (Javelle, 2012; Schwartz *et al.*, 2012). Improvement of the legal framework related to land-use planning and reforms is currently taking place in some and is starting in other Central Africa countries. This is particularly important as Central Africa is undergoing rapid changes due to major development corridors, and the building of infrastructure for mining and timber operations, as well as large scale agricultural and palm oil production in the near future.

5. Conclusion

Human-wildlife conflict is undoubtedly one of the main threats to conservation in Central Africa, along with the destruction of habitats and the commercial hunting of wildlife to supply markets with bushmeat. It is a real challenge for governments, wildlife managers, conservation and development organizations and local communities.

Human-elephant conflict has long existed, and sometimes is the result of human encroachment into elephant habitats. It is not, as is often mistakenly stated, due to a natural increase in elephant populations. These are only increasing when the last remaining elephants that have not been exterminated are pushed back into areas where they feel less threatened by poaching.

Conflict can have substantial monetary and non-monetary costs and mitigation measures are often absent or ineffective. Addressing this conservation challenge is very complex, and has a strong emotional and political dimension as the conflict is the outcome of a combination of human and elephant behaviors as well as social aspects related to human-human relationships where the elephant becomes a symbol of the overall conservation conflict.

Given the fact that overall, the conflict arises due to encroachment of people into former wildlife habitats such as elephant migration corridors, it is impossible to expect that wildlife will disappear, and the conflict cannot be mitigated to zero levels. Instead, people should try to get used to co-existing as much as possible with wildlife. To achieve co-existence where conflict occurs, a holistic human-wildlife conflict program needs to be set up that integrates social and biological sciences. Such a program should look beyond simple impact mitigation measures and aim to understand the various dimensions of the conflict. Protected area managers in Central Africa are encouraged to set up holistic approaches such a "SAFE" system, which can be beneficial for the overall acceptance of their conservation work (see Appendix 1).

Beyond elephants, the success of human-wildlife conflict management also will require the characterization of agricultural activities and local strategies for the control of other animals known to be crop pests in the surroundings of protected areas (buffaloes, baboons, carnivores, rodents, etc.). Although much is being done by COMIFAC and some national agencies and partners to address this issue, much remains to be done in order to cover equally different types of ecosystems (rainforests, dry forests and woodlands, as well as savannas) and different key species involved in human-wildlife conflicts.

Bibliography

Agam A. & Barkai R., 2018. Elephant and mammoth hunting during the Paleolithic: a review of the relevant archaeological, ethnographic and ethno-historical records. *Quaternary* 1: 3.

Angoran E.J., 2016. Human-Wildlife conflict management toolbox: feedback from the field test in Crystal Mountain national park (Gabon). *Nature & Faune* 30(2): 89–92.

Angu K., Tchamou N. & Yanggen D. (Eds.), 2011. Landscape-Scale conservation in the Congo Basin: lessons learned from the Central African Regional Program for the Environment (CARPE). IUCN, Gland, Switzerland.

ANPN., 2016. Projet de gestion de la faune et des conflits homme-élephant dans le sud du Gabon : Cadre fonctionnel pour la réduction des impacts sociaux potentiels dus à la restriction potentielle d'accès aux ressources naturelles dans les parcs nationaux de Waka, de Moukalaba-Doudou, de Loango et de Mayumba. ANPN, Libreville, Gabon.

Arlet M.E. & Molleman F., 2007. Rodents damage crops more than wildlife in subsistence agriculture on the northern periphery of Dja Reserve, Cameroon. *International Journal of Pest Management* 53: 237–243.

Asaha S. & Deakin L., 2016. Land-use change and its influence on rural livelihoods, food security and biodiversity conservation in the Southwest region of Cameroon. *In* : Deakin L., Kshatriya M. & Sunderland T. (Eds.), Agrarian change in tropical landscapes. CIFOR, Bogor, Indonesia: 54-90.

Avomo Ndong S.S., 2017. Human-wildlife conflict and ecotourism: comparing Pongara and Ivindo National Parks in Gabon. Master thesis, University of Oregon, USA: 155 p.

Barnes R.F.W., 1996. The conflict between humans and elephants in the Central African forests. *Mammal Review* 26: 67–80.

Barnes R.F.W., 1999. Is there a future for elephants in West Africa? *Mammal Review* 29: 175–199.

Barnes R.F.W., 2002. Treating crop-raiding elephants with Aspirin. *Pachyderm* 33: 96–99.

Barnes R.F.W., Azika S. & Asamoah-Boateng B., 1995. Timber, cocoa, and crop-raiding elephants: a preliminary study from southern Ghana. *Pachyderm* 19: 33–38.

Barnes R.F.W., Hema E.M., Nandjui A., Manford M., Dubiure U.-F., Danquah E.K.A. & Boafo Y., 2005. Risk of crop raiding by elephants around the Kakum Conservation Area, Ghana. *Pachyderm* 39: 19–25.

Barnes R.F.W.W., Danquah E., Hema E.M., Dubiure U.-F., Manford M., Nandjui A. & Boafo Y., 2015. Retrospective versus prospective designs for studies of crop raiding by elephants. *Pachyderm* 1: 44–50.

Barua M., Bhagwat S.A. & Jadhav S., 2013. The hidden dimensions of human–wildlife conflict: Health impacts, opportunity and transaction costs. *Biological Conservation* 157: 309–316.

Bastille-Rousseau G., Wall J., Douglas-Hamilton I., Lesowapir B., Loloju B., Mwangi N. & Wittemyer G., 2020. Landscape-scale habitat response of African elephants shows strong selection for foraging opportunities in a human dominated ecosystem. *Ecography* 43: 149–160.

Bauer H., 2003. Local perceptions of Waza National Park, northern Cameroon. *Environmental Conservation* 30: 175–181.

Bauer H., De Iongh H. & Sogbohossou E., 2010. Assessment and mitigation of human-lion conflict in West and Central Africa. *Mammalia* 74: 363–367.

Baynham-Herd Z., Redpath S., Bunnefeld N. & Keane A. 2020. Predicting intervention priorities for wildlife conflicts. *Conservation Biology* 34: 232–243.

Baynham-Herd Z., Redpath S., Bunnefeld N., Molony T. & Keane A., 2018. Conservation conflicts: Behavioural threats, frames, and intervention recommendations. *Biological Conservation* 222: 1801–188.

Beirne C., Meier A.C., Brumagin G., Jasperse-Sjolander L., Lewis M., Masseloux J., Myers K., Fay M., Okouyi J., White L.J.T. & Poulsen J.R., 2020. Climatic and resource determinants of forest elephant movements. *Frontiers in Ecology and Evolution* (early view).

Bennett N.J., Roth R., Klain S.C., Chan K., Christie P., Clark D.A., Cullman G., Curran D., Durbin T.J., Epstein G., Greenberg A., Nelson M.P., Sandlos J., Stedman R., Teel T.L., Thomas R., Veríssimo D. & Wyborn C., 2017a. Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biological Conservation* 205: 93-108.

Bennett N.J., Roth R., Klain S.C., Chan K.M.A., Clark D.A., Cullman G., Epstein G., Nelson M.P., Stedman R., Teel T.L., Thomas R.E.W., Wyborn C., Curran D., Greenberg A., Sandlos J. & Veríssimo D., 2017b. Mainstreaming the social sciences in conservation. *Conservation Biology* 31: 56–66.

Berzaghi F., Longo M., Ciais P., Blake S., Bretagnolle F., Vieira S., Scaranello M., Scarascia-Mugnozza G. & Doughty C.E., 2019. Carbon stocks in central African forests enhanced by elephant disturbance. *Nature Geoscience* 12(2): 725–729.

Blake S., 2002. *The ecology of forest elephant distribution and its implications for conservation*. PhD Dissertation, University of Edinburgh, Edinburgh, U.K.: xii + 308 p.

Blake S., Deem S.L., Mossimbo E., Maisels F. & Walsh P.D., 2009. Forest elephants: tree planters of the Congo. *Biotropica* 41: 459–468.

Boafo Y., Dubiure U.-F., Danquah E.K.A., Manford M., Nandjui A., Hema E.M., Barnes R.F.W. & Bailey B., 2004. Long-term management of crop raiding by elephants around Kakum Conservation Area in southern Ghana. *Pachyderm* 37: 68–72.

Bobo K.S. & Weladji R.B., 2011. Wildlife and land use conflicts in the Mbam and Djerem conservation region, Cameroon: status and mitigation measures. *Human Dimension of Wildlife* 16: 445–457.

Boukoulou H., Mbete P., Mbete R., Ngokaka C., Akouango F., Klaid Rhaysaint Excelh B. & Vouidibio J., 2012. Conflit Homme/Eléphant : étude de cas dans le village Miélékouka au nord du Parc national d'Odzala Kokoua (Congo). *Journal of Applied Bioscience* 50: 3478–3484.

Branco P.S., Merkle J.A., Pringle R.M., King L., Tindall T., Stalmans M. & Long R.A., 2019. An experimental test of community-based strategies for mitigating human–wildlife conflict around protected areas. *Conservation Letters* 13(1): e12679.

Brand C.M., Johnson M.B., Parker L.D., Maldonado J.E., Korte L., Vanthomme H., Alonso A., Ruiz-Lopez M.J., Wells C.P. & Ting N., 2020. Abundance, density, and social structure of African forest elephants (*Loxodonta cyclotis*) in a human-modified landscape in southwestern Gabon. *PLoS One* 15: e0231832.

Breuer T., Bout N., Fishlock V. & Maisels F., 2015. Protecting bais and elephants: law enforcement and anti-poaching. *In* : Fisklock V. & Breuer T. (Eds.), Studying forest elephants.. Neuer Sportverlag, Stutgard, Germany: 72-83.

Breuer T., Maisels F. & Fishlock V., 2016. The consequences of poaching and anthropogenic change for forest elephants. *Conservation Biology* 30: 1019–1026.

Breuer T. & Mavinga F.B., 2010. Education for the conservation of great apes and other wildlife in Northern Congo - The importance of nature clubs. *American Journal of Primatology* 72: 454–461.

Brooks A., 2019. SAFE System approach to Human-Wildlife Conflict Management. WWF Tigers Alive, WWF International, Gland, Switzerland.

Bush E.R., Whytock R.C., Bahaa-el-din L., Bourgeois S., Bunnefeld N., Cardoso A.W., Dikangadissi J.T., Dimbonda P., Dimoto E., Edzang Ndong J., Jeffery K.J., Lehmann D., Makaga L., Momboua B., Momont L.R.W., Tutin C.E.G., White L.J.T., Whittaker A. & Abernethy K., 2020. Long-term collapse in fruit availability threatens Central African forest megafauna. Science, 0.1126/science.abc7791.

Chardonnet P. (Ed.), 2002. Conservation of the African Lion : contribution to a status survey. International Foundation for the Conservation of Wildlife, Paris, France & Conservation Force, USA: 171 p.

Chen S., Yi Z.F., Campos-Arceiz A., Chen M.Y. & Webb E.L., 2013. Developing a spatially-explicit, sustainable and risk-based insurance scheme to mitigate human-wildlife conflict. *Biological Conservation* 168: 31–39.

Chiyo P.I. & Cochrane E.P., 2005. Population structure and behaviour of crop-raiding elephants in Kibale National Park, Uganda. *African Journal of Ecology* 43: 233–241.

Chiyo P.I., Cochrane E.P., Naughton L. & Basuta G.I., 2005. Temporal patterns of crop raiding by elephants: A response to changes in forage quality or crop availability? *African Journal of Ecology* 43: 48–55.

Chiyo P.I., Moss C.J. & Alberts S.C., 2012. The influence of life history milestones and association networks on crop-raiding behavior in male african elephants. *PLoS One* 7: e31382.

Chiyo P.I., Moss C.J., Archie E.A., Hollister-Smith J.A. & Alberts S.C., 2011. Using molecular and observational techniques to estimate the number and raiding patterns of crop-raiding elephants. *Journal of Applied Ecology* 48: 788–796.

Clark C.J., Poulsen J.R., Malonga R. & Elkan P.W., 2009. Logging concessions can extend the conservation estate for central African tropical forests. *Conservation Biology* 23: 1281–1293.

Compaore A., Sirima D., Hema E.M., Doamba B., Ajong S.N., Di Vittorio M. & Luiselli L., 2020. Correlation between increased human-elephant conflict and poaching of elephants in Burkina Faso (West Africa). *European Journal of Wildlife Research* 66: 24.

Crawford A., 2012. Conflict-sensitive conservation in Nyungwe National Park: conflict analysis. International Institute for Sustainable Development, Winnipeg, Manitoba, Canada.

Davies T.E., Wilson S., Hazarika N., Chakrabarty J., Das D., Hodgson D.J. & Zimmermann A., 2011. Effectiveness of intervention methods against crop-raiding elephants. *Conservation Letters* 4: 346–354.

Dickman A.J., 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. *Animal Conservation* 13: 458–466.

Dublin H.T. & Hoare R.E., 2004. Searching for solutions: the evolution of an integrated approach to understanding and mitigating human–elephant conflict in Africa. *Human Dimensions of Wildlife* 9: 271–278.

Edwards D.P., Sloan S., Weng L., Dirks P., Sayer J. & Laurance W.F., 2014. Mining and the African environment. *Conservation Letters* 7: 302–311.

Espinosa S. & Jacobson S.K., 2012. Human-wildlife conflict and environmental educatione evaluating a community program to protect the Andean Bear in Ecuador. *Journal of Environmental Education* 43: 55–65.

Eyebe A.J., Dkamela G.P. & Endamana D., 2012. Overview of human wildlife conflict in Cameroon. Poverty and Conservation Learning Group Discussion Paper No 5. IIED.

Fairet E.M.M., 2012. Vulnerability to crop-raiding: an interdisciplinary investigation in Loango National Park. PhD Thesis, Faculty of Social Sciences and Health, Department of Anthropology, Durham University, U.K..

FAO, CIRAD & Awely, 2014. Boîte à outil d'atténuation des conflits homme-faune. FAO, Libreville, Gabon, CIRAD, Montpellier, France & Awely, Orléans, France. https://ur-forets-societes.cirad.fr/outils/boite-a-outil-bo-chf

Fernando P., Kumar A.M., Williams C.A., Wikramanayake E., Aziz T. & Singh S.M., 2008. Review of human-elephant conflict mitigation measures practiced in South Asia. WWF International, Gland, Switzerland.

Fernando P., Leimgruber P., Prasad T. & Pastorini J., 2012. Problem-elephant translocation: translocating the problem and the elephant? *PLoS One* 7: e50917.

Fishlock V., Lee P.C. & Breuer T., 2008. Quantifying forest elephant social structure in Central African bai environments. *Pachyderm* 44: 17–26.

Fishlock V. & Turkalo V., 2015. Studying elephant behaviour at bais. *In* : Fishlock, V. & Breuer, T. (Eds.), Studying forest elephants. Neuer Sportverlag, Stuttgart, Germany: 106-117.

Frank B., 2016. Human–Wildlife conflicts and the need to include tolerance and coexistence: an introductory comment. *Society and Natural Resources* 29: 738–743.

Frank B., Glikman J.A. & Marchini S. (Eds.), 2019. Human-Wildlife Interactions: Turning Conflict into Coexistence. Cambridge University Press, Cambridge, U.K..

Fraser-Celin V.L., Hovorka A.J. & Silver J.J., 2018. Human conflict over wildlife: exploring social constructions of African wild dogs (*Lycaon pictus*) in Botswana. *Human Dimensions of Wildlife* 23: 341–358.

Fritz H., 2017. Long-term field studies of elephants: understanding the ecology and conservation of a long-lived ecosystem engineer. *Journal of Mammalogy* 98: 603–611.

Gladman T., Redpath S.M., Vedeld P.O., van Eeden L., Pascual U., Sherren K. & Murata C., 2020. Non-material costs of wildlife conservation to local people and their implications for conservation interventions. *Biological Conservation* 246: [108578].

Goswami V.R., Medhi K., Nichols J.D. & Oli M.K., 2015. Mechanistic understanding of human-wildlife conflict through a novel application of dynamic occupancy models. *Conservation Biology* 29: 1100–1110.

Graham M.D., Douglas-Hamilton I., Adams W.M. & Lee P.C., 2009. The movement of African elephants in a human-dominated land-use mosaic. *Animal Conservation* 12: 445–455.

Graham M.D., Notter B., Adams W.M., Lee P.C. & Ochieng T.N., 2010. Patterns of crop-raiding elephants, *Loxodonta africana*, in Laikipia, Kenya, and the management of human–elephant conflict. *Systematics and Biodiversity* 8: 435–445.

Granados A., Weladji R. & Loomis M., 2012. Movement and occurrence of two elephant herds in a human-dominated landscape, the Bénoué Wildlife Conservation Area, Cameroon. *Tropical Conservation Science* 5: 150–162.

Granados A. & Weladji R.B., 2012. Human-Elephant Conflict Around Bénoué National Park, Cameroon: Influence on Local Attitudes and Implications for Conservation. *Human Dimensions of Wildlife* 17: 77–90.

Gross E.M., Lahkar B.P., Subedi N., Nyirenda V.R., Lichtenfeld L.L. & Jakoby O., 2018. Seasonality, crop type and crop phenology influence crop damage by wildlife herbivores in Africa and Asia. *Biodiversity and Conservation* 27: 2029–2050.

Gross E.M., McRobb R. & Gross J., 2016. Cultivating alternative crops reduces crop losses due to African elephants. *Journal of Pest Science* 89: 497–506.

Gross E.V., 2019. *Tackling routes to coexistence Human-elephant conflict in sub-Saharan Africa*. GIZ, Bonn, Germany.

Guerbois C., Chapanda E. & Fritz H., 2012. Combining multi-scale socio-ecological approaches to understand the susceptibility of subsistence farmers to elephant crop raiding on the edge of a protected area. *Journal of Applied Ecology* 49: 1149–1158.

Guerbois C., Dufour A.B., Mtare G. & Fritz H., 2013. Insights for integrated conservation from attitudes of people toward protected areas near Hwange National Park, Zimbabwe. *Conservation Biology* 27: 844–855.

Gunaryadi D., Sugiyo & Hedges S., 2017. Community-based human-elephant conflict mitigation: The value of an evidence-based approach in promoting the uptake of effective methods. *PLoS One* 12: e0173742.

Gunn J., Hawkins D., Barnes R.F.W., Mofulu F., Grant R.A. & Norton G.W., 2014. The influence of lunar cycles on crop-raiding elephants; evidence for risk avoidance. *African Journal of Ecology* 52: 129–137.

Hartter J., 2009. Attitudes of rural communities toward wetlands and forest fragments around Kibale National Park, Uganda. *Human Dimensions of Wildlife* 14: 433–447.

Hatchwell M., 2014. Public-private partnerships as a management option for protected areas. *Animal Conservation* 17: 3–4.

Hedges S. & Gunaryadi D., 2010. Reducing human–elephant conflict: do chilies help deter elephants from entering crop fields? *Oryx* 44: 139–146.

Hill C.M., 1998. Conflicting attitudes towards elephants around the Budongo Forest Reserve, Uganda. *Environmental Conservation* 25: 244–250.

Hill C.M., 2004. Farmers' perspectives of conflict at the wildlife–agriculture boundary: some lessons learned from African subsistence farmers. *Human Dimensions of Wildlife* 9: 279–286.

Hill C.M., 2017. Understanding human-wildlife interventions. *In*: Hill C.M., Webber A.D. & Priston N.E.C. (Eds.), Understanding conflicts about wildlife: a biosocial approach. Berghahn Books, New York, USA and Oxford, U.K.: 1-14.

Hill C.M., 2018. Crop foraging, crop losses, and crop raiding. *Annual Review of Anthropology* 47: 377–394.

Hoare R., 1999. A training package for enumerators of elephant damage. IUCN African Elephant Specialist Group Report.

Hoare R., 2000a. African elephants and humans in conflict: the outlook for co-existence. *Oryx* 34: 34–38.

Hoare R.E., 2000b. Data collection and analysis protocol for Human-Elephant conflicts situation in Africa. A document prepared for the IUCN African Elephant Specialist Group's Human-Elephant Conflict working group. IUCN and WWF International, Gland, Switzerland: 41 p.

Hoare R., 2012. Lessons from 15 years of human elephant conflict mitigation: management considerations involving biological, physical and governance issues in Africa. *Pachyderm* 51: 60–74.

Hoare R., 2015. Lessons from 20 years of human–elephant conflict mitigation in Africa. *Human Dimensions of Wildlife* 20: 289–295.

Hoare R.E. & Du Toit J.T., 1999. Coexistence between people and elephants in African savannas. *Conservation Biology* 13: 633–639.

Inogwabini B.-I., Mbende L., Bakanza A. & Bokika J.C., 2014. Crop-damaging by elephants at Malebo, Democratic Republic of Congo: ecological correlates and financial implications for conservation programs. *Pachyderm* 54: 59–65.

IUCN., 2015. Central African elephant conservation strategy. IUCN SSC African Elephant Specialist Group: 40 p.

Jackson T.P., Mosojane S., Ferreira S.M. & van Aarde R.J., 2008. Solutions for elephant *Loxodonta africana* crop raiding in northern Botswana: moving away from symptomatic approaches. *Oryx* 42: 83–91.

Jadhav S. & Barua M., 2012. The Elephant vanishes: impact of human-elephant conflict on people's wellbeing. *Health Place* 18: 1356–1365.

Javelle A.G., 2012. Managing Land for Mining and Conservation in the Democratic Republic of Congo. WRI, Washington DC.

Kamiss A. & Turkalo A., 1999. Elephant Crop Raiding in the Dzanga-Sangha Reserve, Central African Republic. GIZ & WCS, Bangui, CAR.

Kansky R., Kidd M. & Knight A.T., 2016. A wildlife tolerance model and case study for understanding human wildlife conflicts. *Biological Conservation* 201: 137–145.

Kansky R. & Knight A.T., 2014. Key factors driving attitudes towards large mammals in conflict with humans. *Biological Conservation* 179: 93–105.

King L.E., Lala F., Nzumu H., Mwambingu E. & Douglas-Hamilton I., 2017. Beehive fences as a multidimensional conflict-mitigation tool for farmers coexisting with elephants. *Conservation Biology* 31: 743–752.

Kleinschroth F., Gourlet-Fleury S., Sist P., Mortier F. & Healey J.R., 2015. Legacy of logging roads in the Congo Basin: How persistent are the scars in forest cover? *Ecosphere* 6(4): 1-17.

Kleinschroth F. & Healey J.R., 2017. Impacts of logging roads on tropical forests. *Biotropica* 49: 620–635.

Kleinschroth F., Laporte N., Laurance W.F., Goetz S.J. & Ghazoul J., 2019. Road expansion and persistence in forests of the Congo Basin. *Nature Sustainability* 2: 628–634.

Kofi Sam M., Danquah E.K.A., Oppong S.K. & Ashie E.A., 2005. Nature and extent of human-elephant conflict in Bia Conservation Area, Ghana. *Pachyderm* 38: 49–58.

Köhler A., 2005. Of apes and men: Baka and Bantu attitudes to wildlife and the making of eco-goodies and baddies. *Conservation and Society* 3: 407–435.

König H.J., Kiffner C., Kramer-Schadt S., Fürst C., Keuling O. & Ford A.T., 2020. Human-wildlife coexistence in a changing world. *Conservation Biology* (early view).

Lahm S.A., 1996. A nationwide survey of crop-raiding by elephants and other species in Gabon. *Pachyderm* 21: 69–77.

Lamarque F., Anderson J., Fergusson R., Lagrange M., Osei-Owusu Y. & Bakker L., 2009. Human-wildlife conflict in Africa. Causes, consequences and management strategies. FAO Forest Paper.

Lambini C.K., Bayer J., Beyer T., Engelbrecht K., Hokan M., Kiewitt Y., Mielich N. & Stöbesand H., 2019. Conflicts, participation and co-management in protected areas: A case study of Lobéké National Park, Cameroon. SLE Publication Series (S279), Berlin.

Laporte N.T., Stabach J.A., Grosch R., Lin T.S. & Goetz S.J., 2007. Expansion of industrial logging in Central Africa. *Science* 316(5830): 1451.

Laurance W.F., Croes B.M., Tchignoumba L., Lahm S.A., Alonso A., Lee M.E., Campbell P. & Ondzeano C., 2006. Impacts of roads and hunting on Central African rainforest mammals. *Conservation Biology* 20: 1251–1261.

Laurance W.F., Sloan S., Weng L. & Sayer J.A., 2015. Estimating the environmental costs of Africa's massive "development corridors". *Current Biology* 25: 3202–3208.

Le Bel S., 2015. Repelling elephants with a chilli pepper gas dispenser: Field tests and practical use in Mozambique, Zambia and Zimbabwe from 2009 to 2013. *Pachyderm* 56: 87–96.

Le Bel S., Chavernac D. & Stansfield F., 2016. Promoting a mobile data collection system to improve HWC incident recording: a simple and handy solution for controlling problem animals in Southern Africa. *In* : Angelici F.M. (Ed.), Problematic wildlife: a cross-disciplinary approach. Springer, Stutgart, Germany & New York, USA: 395-411.

Lee P.C. & Graham M.D., 2006. African Elephants *Loxodonta africana* and human-elephant interactions: implications for conservation. *International Zoo Yearbook* 40: 9–19.

Mackenzie C.A. & Ahabyona P., 2012. Elephants in the garden: financial and social costs of crop raiding. *Ecological Economics* 75: 72–82.

Madden F., 2004. Creating coexistence between humans and wildlife: global perspectives on local efforts to address Human–Wildlife conflict. *Human Dimensions of Wildlife* 9: 247–257.

Madden F. & McQuinn B., 2014. Conservation's blind spot: The case for conflict transformation in wildlife conservation. *Biological Conservation* 178: 97–106.

Madden F. & McQuinn B., 2017. Conservation conflict transformation: Addressing the missing link in conservation. *In* : Hill C.M., Webber A.D. & Priston N.E.C. (Eds.), Understanding Conflicts about Wildlife: a biosocial approach. Berghahn Books, New York, USA and Oxford, U.K.: 170-193.

Madzou Y., 1999. Situation conflictuelle des éléphants à Bomassa: un défi pour la gestion de la zone périphérique du Parc National de Nouabalé-Ndoki, Nord Congo. WCS, Bomassa, Congo.

Maisels F., Blake S. & Turkalo A., 2002. Wild forest elephants shake down fruit and leaves from trees. *Pachyderm* 33: 88–90.

Maisels F., Strindberg S., Blake S., *et al.*, 2013. Devastating decline of forest elephants in central Africa. *PLoS One* 8: e59469.

Mills E.C., Poulsen J.R., Fay M.J., Morkel P., Clark C.J., Meier A., Beirne C. & White L.J.T., 2018. Forest elephant movement and habitat use in a tropical forest-grassland mosaic in Gabon. *PLoS One* 13: e0199387.

Molina-Vacas G., Muñoz-Mas R., Martínez-Capel F., Rodriguez-Teijeiro J.D. & Le Fohlic G., 2020. Movement patterns of forest elephants (*Loxodonta cyclotis* Matschie, 1900) in the Odzala-Kokoua National Park, Republic of Congo. *African Journal of Ecology* 58: 23–33.

Momont L., Breuer T. & Schuttler S., 2015. Forest elephant ranging and habitat use. *In* : Fishlock V. & Breuer T. (Eds.), Studying forest elephants.. Neuer Sportverlag, Stuttgart, Germany: 132-139.

Moran B., 2019. Akagera National Park, Rwanda. National Geographic. https://www.nationalgeographic.com/environment/2019/05/akagera-national-park-rwanda-conservation/

Morrison K., Victurine R. & Mishra C., 2009. Lessons learned, opportunities and innovations in Human Wildlife conflict compensation and insurance schemes. WCS TransLinks Programme.

Mumby H.S. & Plotnik J.M., 2018. Taking the elephants' perspective: Remembering elephant behavior, cognition and ecology in human-elephant conflict mitigation. *Frontiers in Ecology and Evolution* 6: 122.

Muruthi P., 2005. Human wildlife conflict: lessons learned from AWF's African heartlands. African Wildlife Foundation, Washington DC, USA.

N'Goran K.P., Nzooh Dongmo Z.L. & Le-Duc Y.S., 2016. The status of forest elephant and great apes in Central Africa priority sites. WWF Biomonitoring report, Yaounde, Cameroon.

Naughton-Treves L., 1998. Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology* 12: 156–168.

Naughton-Treves L. & Treves A., 2005. Socio-ecological factors shaping local support for wildlife: crop-raiding by elephants and other wildlife in Africa. *In* : Woodroffe R., Thirgood S. & Rabinowitz A. (Eds.), People and wildlife: conflict or coexistence?.. Cambridge University Press, Cambridge, U.K.: 252-277.

Naughton J., Rose R. & Treves A., 1999. The social dimensions of human-elephant conflict in Africa: a literature review and case studies from Uganda and Cameroon. Gland, Switzerland.

Nchanji A.C. & Lawson D.P., 1998. A survey of elephant crop damage around the Banyang-Mbo wildlife sanctuary, 1993-1996. WCS, Yaounde, Cameroon.

Nelson A., Bidwell P. & Sillero-zubiri C., 2003. A review of human-elephant conflict management strategies. People and Wildlife, Wild CRU and Born Free Foundation Partnership.

Ngama S., Bindelle J., Poulsen J.R., Hornick J.L., Linden A., Korte L., Doucet J.L. & Vermeulen C., 2019. Do topography and fruit presence influence occurrence and intensity of crop-raiding by forest elephants (*Loxodonta africana cyclotis*)? *PLoS One* 14: e0213971.

Ngama S., Korte L., Bindelle J., Vermeulen C. & Poulsen J.R., 2016. How bees deter elephants: beehive trials with forest elephants (*Loxodonta africana cyclotis*) in Gabon. *PLoS One* 11: e0155690.

Ngama S., Korte L., Johnson M., Vermeulen C. & Bindelle J., 2018. Camera traps to study the forest elephant's (*Loxodonta cyclotis*) response to chili pepper repellent devices in Gamba, Gabon. *Nature Conservation Research* 3: 26–35.

Nguinguiri J.C., Czudek R., Larrubia C.J., Ilama L., Le Bel S., Angoran E.J., Trébuchon J.-F. & Cornelis D., 2017. Managing human-wildlife conflicts in central and southern Africa. *Unasylva* 68: 39–44.

Nsonsi F. (n.d.). Développement d'un modèle de gestion durable et intégrée du conflit Homme-Eléphant à la périphérie du Parc National de Nouabalé-Ndoki. University of Kinshasa, DRC.

Nsonsi F., Heymans J.-C., Diamouangana J. & Breuer T., 2017. Attitudes towards forest Elephant conservation around a protected area in Northern Congo. *Conservation and Society* 15: 59–73.

Nsonsi F., Heymans J.-C., Diamouangana J., Mavinga F.B. & Breuer T., 2018. Perceived human-elephant conflict and its impact for elephant conservation in northern Congo. *African Journal of Ecology* 56: 208–215.

Nyhus P., Fischer H., Madden F. & Osofsky S., 2003. Taking the bite out of wildlife damage. The challenges of wildlife compensation schemes. *Conservation in Practice* 4: 37–43.

Nyhus P.J., 2016. Human–Wildlife conflict and coexistence. *Annual Review of Environment and Resources* 41: 143–171.

Nyhus P.J., Osofsky S.A., Ferraro P., Madden F. & Fischer H., 2005. Bearing the costs of human–wildlife conflict: the challenges of compensation schemes. *In*: Woodroffe R., Thirgood S. & Rabinowitz A. (Eds.), People and Wildlife, Conflict or Co-existence? . Cambridge University Press, Cambridge, U.K.: 107-121.

Oerke E.C., 2006. Crop losses to pests. *Journal of Agricultural Science* 144: 31–43.

Ongognongo B., Ekoutouba D.B. & Stokes E.J., 2006. Conflit homme-éléphant dans la périphérie du Parc National de Nouabalé-Ndoki au nord Congo: evaluation des méthodes de lutte contre la dévastation des champs de manioc par les éléphants dans le village de Bomassa. WCS, Bomassa, Congo.

Osborn F.V., 2004. Seasonal variation of feeding patterns and food selection by crop-raiding elephants in Zimbabwe. *African Journal of Ecology* 42: 322–327.

Osborn F.V. & Parker G.E., 2003. Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. *Oryx* 37: 80–84.

Osborn F.V., 2003. Seasonal influence of rainfall and crops on home range expansion by bull elephants. *Pachyderm* 35: 53–59.

Osei-Owusu Y., 2018. Technical manual: Human-wildlife conflict - elephants. UNEP African Elephant Fund and Conservation Alliance International.

Osei-Owusu Y. & Bakker L., 2008. FAO Conflit Homme-Animal: Eléphant Manuel Technique. FAO, Rome.

Parathian H.E., McLennan M.R., Hill C.M., Frazão-Moreira A. & Hockings K.J., 2018. Breaking through disciplinary barriers: Human–Wildlife interactions and multispecies ethnography. *International Journal of Primatology* 39: 749–775.

Parker G.E., Osborn F.V., Hoare R.E. & Niskanen L.S., 2007. Human-elephant conflict mitigation: a training course for community-based approaches in Africa - participant's manual Assessment. Livingstone, Zambia and Nairboi, Kenya.

Peterson M.N., Birckhead J.L., Leong K., Peterson M.J. & Peterson T.R., 2010. Rearticulating the myth of human-wildlife conflict. *Conservation Letters* 3: 74–82.

Pooley S., Barua M., Beinart W., Dickman A., Holmes G., Lorimer J., Loveridge A.J., Macdonald D.W., Marvin G., Redpath S., Sillero-Zubiri C., Zimmermann A. & Milner-Gulland E.J., 2017. An interdisciplinary review of current and future approaches to improving human–predator relations. *Conservation Biology* 31: 513–523.

Poulsen J.R., Koerner S.E., Moore S., Medjibe V.P., Blake S., Clark C.J., Akou M.E., Fay M., Meier A., Okouyi J., Rosin C. & White L.J.T., 2017. Poaching empties critical Central African wilderness of forest elephants. *Current in Biology* 27: 134–135.

Poulsen J.R., Rosin C., Meier A., Mills E., Nuñez C.L., Koerner S.E., Blanchard E., Callejas J., Moore S. & Sowers M., 2018. Ecological consequences of forest elephant declines for Afrotropical forests. *Conservation Biology* 32: 559–567.

Pozo R.A., Coulson T., McCulloch G., Stronza A.L. & Songhurst A.C., 2017. Determining baselines for human-elephant conflict: A matter of time. *PLoS One* 12: e0178840.

Ravenelle J. & Nyhus P.J., 2017. Global patterns and trends in human–wildlife conflict compensation. *Conservation Biology* 31: 1247–1256.

Redpath S.M., Gutiérrez R.J., Wood K.A. & Young J.C. (Eds.), 2015. Conflicts in conservation - navigating towards solutions. Cambridge University Press, Cambridge, U.K..

Redpath S.M., Young J., Evely A., Adams W.M., Sutherland W.J., Whitehouse A., Amar A., Lambert R.A., Linnell J.D.C., Watt A. & Gutiérrez R.J., 2013. Understanding and managing conservation conflicts. *Trends in Ecology and Evolution* 28: 100–109.

Rode K.D., Chiyo P.I., Chapman C.A. & McDowell L.R., 2006. Nutritional ecology of elephants in Kibale National Park, Uganda, and its relationship with crop-raiding behaviour. *Journal of Tropical Ecology* 22: 441–449.

Saif O., Kansky R., Palash A., Kidd M. & Knight A.T., 2020. Costs of coexistence: understanding the drivers of tolerance towards Asian elephants *Elephas maximus* in rural Bangladesh. *Oryx* (early view).

Salerno J., Bailey K., Gaugham A.E., Stevenes F.R., Hilton T., Cassidy L., Drake M.D., Pricope N.G. & Hartter J., 2020. Wildlife impacts and vunberable livelihoods in a transfrontier conservation landscape. *Conservation Biology* (early view).

Scheijen C.P.J., Richards S.A., Smit J., Jones T. & Nowak K., 2019. Efficacy of beehive fences as barriers to African elephants: A case study in Tanzania. *Oryx* 53: 92–99.

Schuttler S.G., Blake S. & Eggert L.S., 2012. Movement patterns and spatial relationships among African forest elephants. *Biotropica* 44: 445–448.

Schuttler S.G., Philbrick J.A., Jeffery K.J. & Eggert L.S., 2014. Fine-scale genetic structure and cryptic associations reveal evidence of kin-based sociality in the African forest elephant. *PLoS One* 9: e88074.

Schwartz B., Hoyte D. & Nguiffo H.S., 2012. Emerging Trends in Land-Use Conflicts in Cameroon: Overlapping Natural Resource Permits Threaten Protected Areas and Foreign Direct Investment. WWF CARPO, Yaounde, Cameroun.

Setchell J.M., Fairet E., Shutt K., Waters S. & Bell S., 2017. Biosocial Conservation: Integrating Biological and Ethnographic Methods to Study Human–Primate Interactions. *International Journal of Primatology* 38: 401–426.

Shaffer L.J., Khadka K.K., Van Den Hoek J. & Naithani K.J., 2019. Human-elephant conflict: A review of current management strategies and future directions. *Frontiers in Ecology and Evolution* 6: 235.

Sitati N.W., Walpole M.J. & Leader-Williams N., 2005. Factors affecting susceptibility of farms to crop raiding by African elephants: using a predictive model to mitigate conflict. *Journal of Applied Ecology* 42: 1175–1182.

Sitati N.W., Walpole M.J., Smith R.J. & Leader-Williams N., 2003. Predicting spatial aspects of human-elephant conflict. *Journal of Applied Ecology* 40: 667–677.

Sitters J., Kimuyu D.M., Young T.P., Claeys P. & Olde Venterink H., 2020. Negative effects of cattle on soil carbon and nutrient pools reversed by megaherbivores. *Nature Sustainability* 3: 360–366.

Smit J., Pozo R.A., Cusack J.J., Nowak K. & Jones T., 2017. Using camera traps to study the age–sex structure and behaviour of crop-using elephants *Loxodonta africana* in Udzungwa Mountains National Park, Tanzania. *Oryx* 53: 368–376.

Snyder K.D., Mneney P., Benjamin B., Mkilindi P. & Mbise N., 2020. Seasonal and spatial vulnerability to agricultural damage by elephants in the western Serengeti, Tanzania. *Oryx* (early view).

Snyder K.D. & Rentsch D., 2020. Rethinking assessment of success of mitigation strategies for elephant-induced crop raiding. *Conservation Biology* (early view).

Songhurst A. & Coulson T., 2014. Exploring the effects of spatial autocorrelation when identifying key drivers of wildlife crop-raiding. *Ecology and Evolution* 4(5): 582-593.

Stern M.J. & Coleman K.J., 2015. The multidimensionality of trust: Applications in collaborative natural resource management. *Society and Natural Resources* 28: 117–132.

Stokes E.J., Strindberg S., Bakabana P.C., Elkan P.W., Iyenguet F.C., Madzoké B., Malanda G.A.F., Mowawa B.S., Moukoumbou C., Ouakabadio F.K. & Rainey H.J., 2010. Monitoring great ape and elephant abundance at large spatial scales: measuring effectiveness of a conservation landscape. *PLoS One* 5: e10294.

Tchamba M. & Foguekem D., 2012. Human Elephant conflict in the Waza-Logone region of Northern Cameroon: an assessment of management effectiveness. *Tropicultura* 30: 79–87.

Tchamba M.N., 1995. The problem elephants of Kaele: a challenge for elephant conservation in northern Cameroon. *Pachyderm* 19: 26–32.

Tchamba M.N., 1996. History and present status of the human/elephant conflict in the Waza-Logone region, Cameroon, West Africa. *Biological Conservaion* 75: 35–41.

Thirgood S., Woodroffe R. & Rabinowitz A., 2005. The impact of human–wildlife conflict on human lives and livelihoods. *In*: Woodroffe R., Thirgood S. & Rabinowitz A. (Eds.), People and Wildlife, Conflict or Co-existence? Cambridge University Press, Cambridge, U.K.: 13-26.

Treves A., Wallace R.B., Naughton-Treves L. & Morales A., 2006. Co-managing human–wildlife conflicts: a review. *Human Dimensions of Wildlife* 11: 383–396.

Treves A., Wallace R.B. & White S., 2009. Participatory planning of interventions to mitigate human-wildlife conflicts. *Conservation Biology* 23: 1577–1587.

Tsuru D., 1998. Diversity of ritual spirit performances among the Baka pygmies in southeastern Cameroon. *African Study Monographs Suppl.* 25: 47–84.

Turkalo A.K., Wrege P.H. & Wittemyer G., 2013. Long-Term monitoring of dzanga bai forest elephants: Forest clearing use patterns. *PLoS One* 8: e85154.

Turkalo A.K., Wrege P.H. & Wittemyer G., 2017. Slow intrinsic growth rate in forest elephants indicates recovery from poaching will require decades. *Journal of Applied Ecology* 54: 153–159.

Tyukavina A., Hansen M.C., Potapov P., Parker D., Okpa C., Stehman S. V., Kommareddy I. & Turubanova S., 2018. Congo Basin forest loss dominated by increasing smallholder clearing. *Science Advances* 4(11): eaat2993.

Umuziranenge G., 2019. Community Perceptions of Human-wildlife Conflicts and the Compensation Scheme Around Nyungwe National Park (Rwanda). *International Journal of Natural Resource Ecology and Management* 4: 188–197.

Van Bommel L., Bij De Vaate M.D., De Boer W.F. & De Iongh H.H., 2007. Factors affecting livestock predation by lions in Cameroon. *African Journal of Ecology* 45: 490–498.

Vasudev D., Goswami V.R., Hait P., Sharma P., Joshi B., Karpate Y. & Prasad P.K., 2020. Conservation opportunities and challenges emerge from assessing nuanced stakeholder attitudes towards the Asian elephant in tea estates of Assam, Northeast India. *Global Ecology Conservation* 22: e00936.

Vucetich J.A., Burnham D., Macdonald E.A., Bruskotter J.T., Marchini S., Zimmermann A. & Macdonald D.W., 2018. Just conservation: what is it and should we pursue it? *Biological Conservation* 221: 23–33.

Walker K.L., 2010. Moving away from prescriptive pachyderm palliatives : toward an integrated assessment of farmer-elephant conflict in Gabon. PhD, University of Michigan, USA: 127 p.

Walker K.L., 2012. Labor costs and crop protection from wildlife predation: the case of elephants in Gabon. *Agricultural Economics* 43: 61–73.

Wallace G.E. & Hill C.M., 2017. Engaging farmers and understanding their behaviour to develop effective deterrents to crop damage by wildlife. *In*: Hill C.M., Webber A.D. & Priston N.E.C. (Eds.), Understanding Conflicts about Wildlife: A Biosocial Approach.. Berghahn Books, New York, USA and Oxford, U.K.: 170-193.

Walpole M. & Linkie M. (Eds), 2007. Mitigating Human-Elephant Conflict: Case Studies from Africa and Asia. Fauna and Flora International, Cambridge, U.K..

Webber A.D., Hill C.M. & Reynolds V., 2007. Assessing the failure of a community-based human-wildlife conflict mitigation project in Budongo Forest Reserve, Uganda. *Oryx* 41: 177–184.

Weladji R.B. & Tchamba M.N., 2003. Conflict between people and protected areas within the Bénoué Wildlife Conservation Area, North Cameroon. *Oryx* 37: 72–79.

West P., Igoe J. & Brockington D., 2006. Parks and peoples: the social impact of protected areas. *Annual Review of Anthropology* 35: 251–277.

Wicander S. & Coad L., 2018. Can the provision of alternative livelihoods reduce the impact of wild mMeat hunting in West and Central Africa? *Conservation and Society* 16: 441–458.

Wilson-Holt O. & Steele P., 2019. Human–wildlife conflict and insurance. Can insurance reduce the costs of living with wildlife? IIED Discussion Paper, London.

Wilson S., Davies T.E., Hazarika N. & Zimmermann A., 2015. Understanding spatial and temporal patterns of human-elephant conflict in Assam, India. *Oryx* 49: 140–149.

Wright J.H., Hill N.A.O., Roe D., Rowcliffe J.M., Kümpel N.F., Day M., Booker F. & Milner-Gulland E.J., 2016. Reframing the concept of alternative livelihoods. *Conservation Biology* 30: 7–13.

WWF, 2008. Common Ground Solutions for reducing the human, economic and conservation costs of human wildlife conflict. WWF International, Gland, Switzerland.

Yackulic C.B., Strindberg S., Maisels F. & Blake S., 2011. The spatial structure of hunter access determines the local abundance of forest elephants (*Loxodonta africana cyclotis*). *Ecological Applications* 21: 1296–1307.

Young J.C., Marzano M., White R.M., McCracken D.I., Redpath S.M., Carss, D.N., Quine C.P. & Watt A.D., 2010. The emergence of biodiversity conflicts from biodiversity impacts: Characteristics and management strategies. *Biodiversity Conservation* 19: 3973–3990.

Young J.C., Thompson D.B.A., Moore P., MacGugan A., Watt A., Redpath S.M. & Stephens P., 2016a. A conflict management tool for conservation agencies. *Journal of Applied Ecology* 53: 705–711.

Young J.C., Searle K., Butler A., Simmons P., Watt A.D. & Jordan A., 2016b. The role of trust in the resolution of conservation conflicts. *Biological Conservation* 195: 196–202.

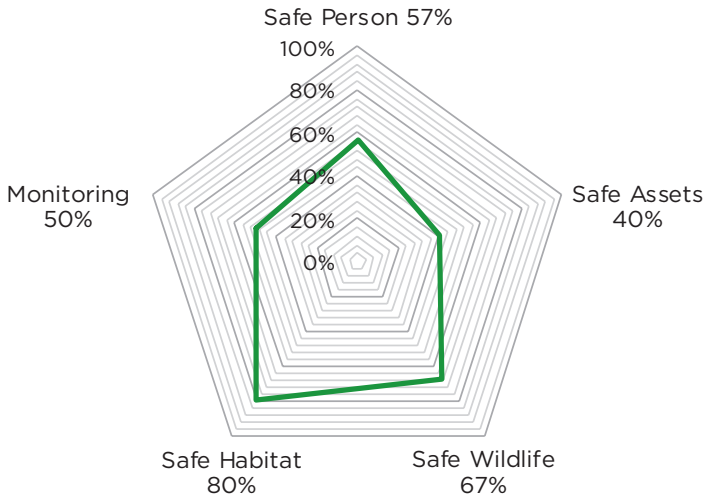
APPENDICES

Appendix 1 – The SAFE approach

A. Brooks, WWF Tigers Alive

The SAFE Approach to human-wildlife conflict is results-focused and delivered through five Strategic Outcomes: safe person, safe assets, safe wildlife, safe habitat, and effective monitoring (Brooks, 2019; Figure 2). Using lessons from global transport safety systems, this is a paradigm shift away from existing approaches to human-wildlife conflict globally. Calls are often made within human-wildlife conflict strategies to "resolve" and "mitigate" conflict, though these only address part of the problem and at only specific times of a conflict event.

Figure 2 – Example of a SAFE baseline at a site



Background and justification for the approach

Current approaches to human-wildlife conflict management are insufficient to tackle the dynamic, emotive and complex challenge of minimizing and managing human-wildlife conflict. Current approaches suffer from three critical weaknesses: 1) they have an isolated focus on the symptoms of conflict; 2) they lack coherent long-term direction; 3) there is no basis to measure progress and impact.

An isolated focus on the symptoms of conflict

Current approaches are site and context specific and are the result of many years of trial and error and are variously successful but result in minimal impact. They are readily grouped into six conflict elements: Policy, Prevention, Mitigation, Understanding the Conflict, Response and Monitoring.

While each action has served a valuable function at each site, in isolation, the actions: i) merely address symptoms of a dynamic challenge; ii) require constant fundraising; iii) do not address drivers of conflict; iv) can misdirect community and project focus onto conflict when it may only represent a relatively small component of what a community needs; v) have limited ability to impact on human progress and wildlife conservation in that area.

The lack of coherent long-term goals and direction

The current approach of dealing with symptoms is demonstrably weak as it does not coalesce around desired long-term goals nor thrust in any strategic direction that fosters co-existence into the future. Compensation, insurance schemes, or fencing for example, are merely dealing with the "current state" of a changing (social, climatic and ecological) context in an area. The actions are fundamentally limited in their ability to build a "better" future for people and wildlife in that space.

Without a coherent long-term direction that accounts for people, their assets, wildlife and their habitat, human-wildlife conflict actions are: i) having little impact on the drivers of conflict; ii) are often demonstrating false success by displacing the conflict; iii) can perpetuate the continuation of incompatible projects that only exacerbate conflict in that area (for example, where successful species recovery projects are pitted against successful small holder agroforestry expansion projects).

The lack of a basis to measure progress and impact

The focus on symptoms of conflict and the "current state" means that human-wildlife conflict actions only measure against the progress of these actions; e.g. the number of reported conflict incidents, the number of straying animals, the number of compensation claims made or the distance of electric fence installed. There is no ability to measure progress toward a "desired state" of co-existence nor to demonstrate wise investment.

The lack of a long-term goal means there is: i) no impetus to capture a baseline and therefore nothing to measure progress and impact against; ii) a lack of foundation for a long-term commitment; iii) a lack of ability to report at completion on the impact of the interventions; iv) ultimately a weak ability to argue for stronger regulatory and policy foundations in government to mainstream human-wildlife conflict.

Principles of SAFE

A SAFE approach to human-wildlife conflict provides a **holistic** view of the conflict in its entirety. It is **inclusive** in that it encompasses all the interactions between the people, their land, their livelihoods, decision-makers, commercial and government interests, and wildlife. It is **forgiving** as it accommodates human error and the "wildness" of the species involved. The SAFE System approach has four guiding principles:

1. it recognizes that all wildlife is wild, and conflict will occur. When conflicts occur however, the interventions across the system should ensure that the impact of an incident does not exceed the limits of community tolerance and does not result in retaliatory killing;
2. it stresses that individuals, communities, leaders and the public involved in the design of the system need to accept and share responsibility for the safety of the system, and those that use the system must accept responsibility for complying with the rules and constraints of the system;
3. it aligns conflict management decisions with wider development plans and processes that contribute to economic, human and environmental goals;
4. it guides interventions to meet the minimum standards and long-term goals, rather than setting specific targets.

How SAFE is delivered

A SAFE strategy and approach can be delivered through a cyclical stepwise approach (Figure 3):

Step 1. Capture existing human-wildlife conflict data and trends: local managers compile any existing information on human-wildlife conflict locally regardless if it is porous or robust. This data is used to guide the development of a stakeholder workshop.

Step 2. Managers lead a stakeholder Rapid Assessment workshop in the landscape. The outputs from the workshop are: a SAFE Baseline, a report on coverage of the six elements (Figure 4), a human-wildlife conflict monitoring plan, and actions to manage human-wildlife conflict.

Step 3. Development of the SAFE Strategy. Managers use the information and results gleaned from the Rapid Assessment workshop to formulate the strategy.

Step 4. The strategy is implemented across the site and with contribution by relevant stakeholders.

Step 5. The strategy is monitored over time, and data is collated, and trends reported back to the site. After an agreed period (e.g. 2 years), the cycle begins again with a new Rapid Assessment to assess progress and change.

Figure 3 – SAFE main steps

Figure 4 – The six elements of conflict

Implementation of a SAFE strategy should continue in the long-term and not be considered a project with a start and end date. Over time, the local human-wildlife conflict context under a SAFE system will gradually remove all the immediate risk areas and become safer for each outcome area.

6

TRANSHUMANT PASTORALISM AND PROTECTED AREAS IN CENTRAL AFRICA: FROM CONFLICT TO PEACEFUL COEXISTENCE

Jean HUCHON, Rémi Evaliste JIAGHO, Deblondet D. BLEU and Manfred EPANDA

Today, management plans for protected areas are taking into account challenges affecting their peripheries. Their effectiveness depends on it. In the Sudano-Sahelian zone, conservation officers can no longer ignore problems related to transhumance and the dynamics of pastoralism. Protected areas in Chad and the Far North Region of Cameroon have faced these issues for some time. They are now also affecting other protected areas located further south. These include the national parks of Bouba-Ndjida, Benoue and Faro in Cameroon, the complexes of protected areas in the northeast and the Chinko region of the Central African Republic (CAR), and Garamba National Park and Bili-Uere Hunting Estate in the Democratic Republic of the Congo (DRC).

While transhumant pastoralism has been practiced for many years in these areas, the expanded network and strengthened management measures of protected areas – known as "paper parks" – have focused attention on the question of the coexistence of protected areas and transhumance.

In 2019, the N'Djamena conference made it possible to include this topic in the policy agenda of Central African regional institutions. However, the linking of transhumance, poaching, illegal trafficking and the movement of armed groups steered discussions towards a security approach to transhumance. Conservation officers of protected areas cannot effectively manage such an approach alone as they have neither the means nor a mandate to deal with security issues.

This chapter attempts to explore the interface between protected areas and transhumance, a form of pastoralism. It highlights the broad elements needed for understanding this issue while emphasizing the fact that the way it is expressed varies depending on the specific characteristics of each site and protected area.

Pastoralism contributes significantly to the Gross Domestic Product (GDP) of Central African states. It is a complex production system characterized by mobility that can take many forms depending on the environment. It is currently subject to heavy pressures, both short-term and structural, and the way that pastoralism evolves will dramatically change the management of protected areas in the long run.

Protected areas are confronted with this challenge in various ways depending on their location along transhumance routes. How then can the management of protected areas be adapted to transhumance? All stakeholders agree that there is a need to test new approaches to cohabitation that are tailored to the specific features of each site.

1. Transhumant pastoralism in Central Africa

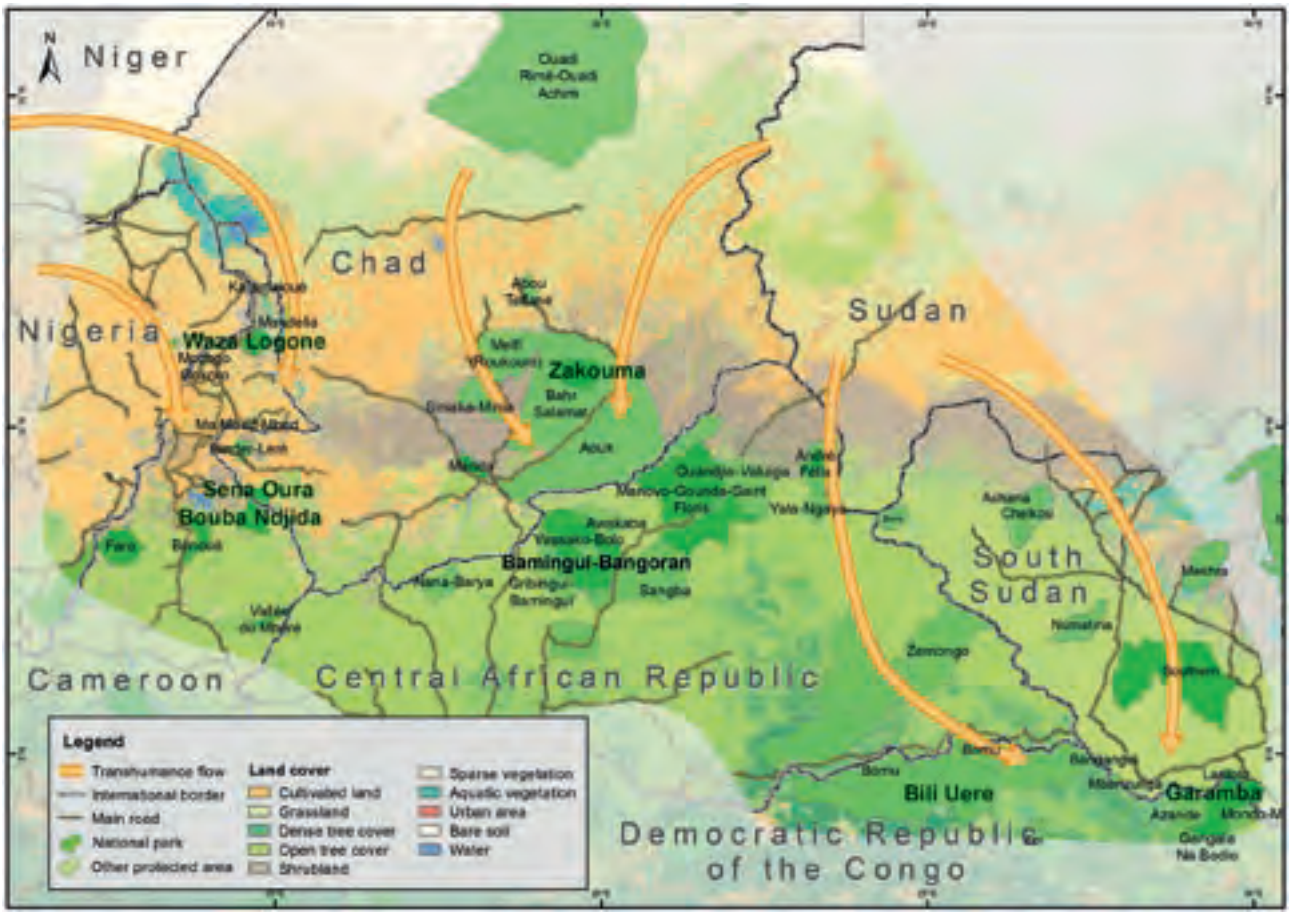
Transhumant pastoralism is a key economic sector and a complex production system.

1.1 A key economic sector

Pastoralism is a major economic, political and social sector in Central African countries such as Chad, CAR, Cameroon, and DRC (Figure 1). Transhumant pastoralism is not a new phenomenon in Central Africa. Since the mid-18th century, groups of pastoralists from Sudan and Uganda crossed through high-altitude wetlands in what is now DRC. The same is true of pastoralist groups from Niger and northern Nigeria who spend the better part of the dry season in the Logone floodplain. Sudano-Sahelian pastoralists have travelled within and outside CAR since the start of the 20th century.

Today, pastoralism is a key economic activity in countries such as Cameroon, Chad and CAR. In 2012, it represented 35% of agricultural GDP and 5.85% of total GDP in the Central African Economic and Monetary Community (CEMAC) region (CENUA, 2012). According to the United Nations Food and Agriculture Organization (FAO), the member states of the Economic Community of

Figure 1 – Area of expansion of transhumant pastoralism in Central Africa



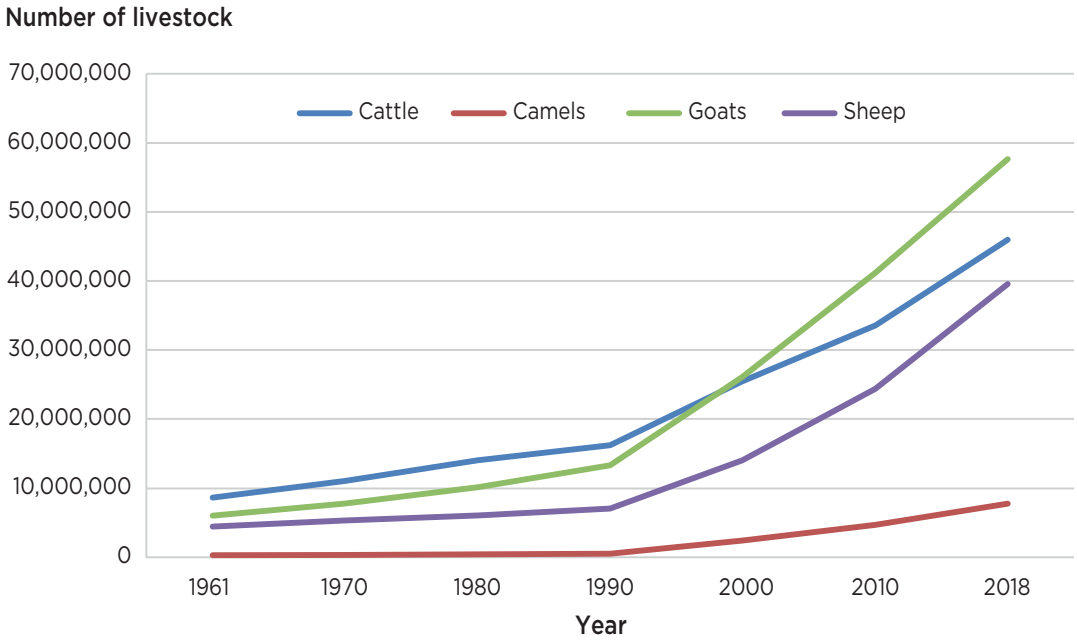
Central African States (CEEAC) are home to around 46 million cattle, 7 million camels, 57 million goats and 39 million sheep (FAO, 2020). Although the reliability of data related to this sector is debatable, the studies available indicate a strong growth in livestock since the 1990s (Figure 2).

In Chad, according to the 2017-2021 National Livestock Development Plan, this sector accounts for between 30 to 50% of the country's exports (excluding oil). Annual income flows are estimated to be around 140 billion FCFA and the added value at 210 billion FCFA. The size of the national herd is estimated to be over 20 million heads and transhumant pastoralism accounts for 80% of Chad's livestock production. Livestock production involves nearly 40% of the working population and indirectly benefits 70% of the country's rural population (CNUCED, 2019). Similarly, this sector has always played a prominent role in CAR's economy: before the 2013 crisis, it contributed up to 18% of the national GDP, or 60 billion FCFA in absolute value, and more than three billion FCFA in export earnings (FAO, 2018). In Cameroon, this contribution to national GDP is thought to be at least 9%; in 2016, the GDP of the livestock and hunting sector was estimated at 226.8 billion FCFA (République du Cameroun, 2011 and 2017). These figures demonstrate the economic strength of the sector for Central Africa and consequently the stakes it represents for the countries and their governments.

1.2 A complex production system characterized by mobility

Pastoral systems manage 80% of Central African livestock and are characterized by animal mobility. These production systems make the most of the seasonal availability of pastures and limit risks associated with climate uncertainty which are specific to Sahelian environments. They involve the regular movements of herds between "fixed points": seasonal pastures, water points (wells, boreholes, ponds, etc.),

Figure 2 – Evolution of livestock in Central Africa from 1961 to 2018



Source: FAO (2020).

villages and markets. These movements are usually predictable because pastoralists and their herds generally follow the same paths in the same season each year to reach pastures which are known to them. Depending on the case, these movements may be either pendular (moving from one point to another with a return by the same path) or circular (following a loop bringing them back to their starting point), but are rarely random (OCDE, 2014). Several factors contribute to determining the movements: environmental conditions of the areas travelled across, accessibility of resources, herd composition and type of animals (dromedaries, cattle, goats, mixed), presence of markets, existence of borders along the path, security climate, system of alliance and social agreements, etc. These are all elements that, combined together, precisely determine the direction of the movements.

The composition of the herd is the primary factor dictating the type of transhumance. Depending on the type of animal (cattle, goats or dromedaries), pastoralists must calculate the distance to cover between two water points. Cattle and small ruminants rarely move more than 30 km per day. Likewise, the nature of the water points, which are shaped by soil characteristics, in a given area greatly determine the pace of movement and the direction of the path chosen by the pastoralist. Pastoralists guiding large cattle herds avoid wells and boreholes where animals cannot drink quickly, and favor stages between ponds.

As stated above, pastoralists take into account many other elements to define each stage of their itinerary in a very specific way (Figure 3). They also know that the journeys planned can change significantly during the transhumance depending on the state of the water points, the vagaries of ecological conditions, the various problems encountered, etc.

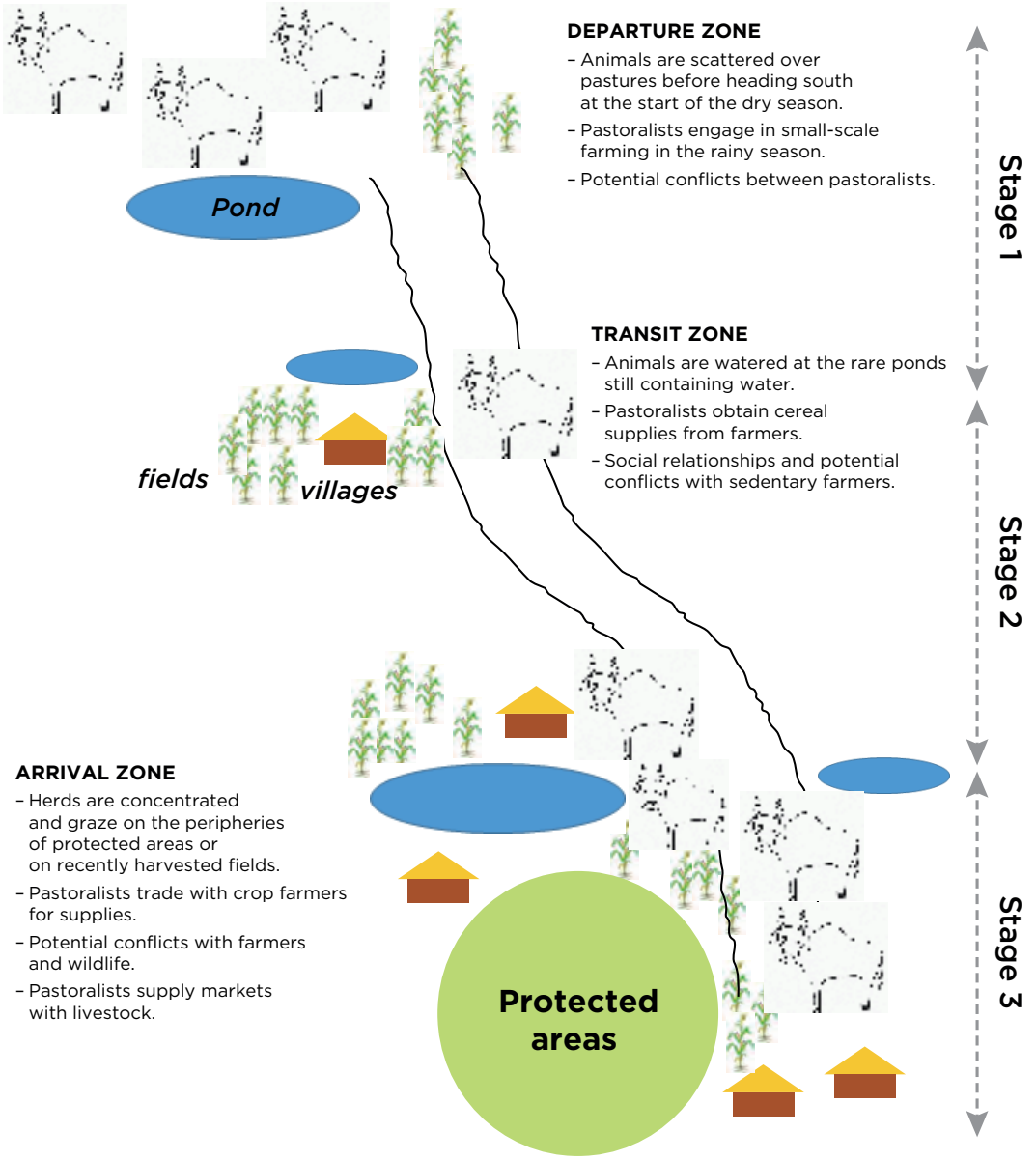
Transhumance generally begins shortly before the start of the dry season. The overall direction is from the north to the south (Figure 3). Transhumant pastoralists tend to prefer itineraries that enable them to reach their host destination as quickly as possible. The return north begins before the arrival of the first rains. The pace of the descent and return depends on known constraints along the path (for example, river crossings and harvest periods blocking the corridors). The stages are carefully chosen based on information collected from informants and the pastoralist's personal experience. Over the past 10 years, improved telephone network coverage in pastoral regions has considerably changed the practices of pastoralists, enabling them to remotely assess

the resources available in the destination areas. The information collected also covers trade terms (market information systems), border crossing points, health and safety situation, etc.

Pastoralists also adjust their movements according to alliances that they may have made during past transhumance seasons. These complex alliances, struck at different scales (tribe, lineage, reciprocity system), can involve other groups of pastoralists or sedentary farmers. These alliance systems render it possible to regulate herd movements at the level of each stage making up the overall transhumance route. In theory, they make it possible to coordinate and monitor the schedule of pastoralists' departures on transhumance, as well as to regulate flows through critical areas. They provide information about farming calendars along the planned routes so that the pastoralists remain alert and go around fields located along the routes. Alliance systems also are responsible for deterring a huge influx of herds, authorizing access to local resources and facilitating the dispersion of animals over seasonal grazing lands to reduce pressure on certain resources.

Ultimately, each pastoralist practices a distinctive form of pastoralism which is based on the composition of his or her herd, the seasonal availability and

Figure 3 – Transhumance routes and stages



accessibility of resources, and his or her information networks and effective alliances. Consequently, any attempt to classify pastoralism is inevitably simplistic. Nonetheless, four major types of pastoralism can be distinguished:

- **Nomadism**, which describes a mode of operating with the continuous, unpredictable movement of all members of a family or a group. Certain Peul groups may be viewed as practicing nomadism. They began their movements from the Cameroon border starting in the 1920s, and from western Chad in the 1990s. Since then, their migrations have led them into eastern CAR and northeastern DRC.
- **Long-distance transhumance**, which favors long journeys to and from a destination. In eastern Chad, those practicing this kind of pastoralism leave their home areas in the middle of the country at the end of the rainy season to head south towards the border with CAR, where they spend the dry season. They prefer to move in stages from pond to pond, rapidly descending south en masse, avoiding the risk of floods or, to the contrary, ponds drying out early. At the end of the dry season, the animals return north to their home territories. These seasonal transhumance journeys can cover distances of up to 1,500 km.
- **Medium-distance transhumance** involves shorter movements, on territories circumscribed by watering points or campsites where the pastoralists' families live on a permanent basis. The herds are smaller. The range of their movements varies greatly depending on the characteristics of the sites and seasons.
- **Agropastoral livestock farming**, or **semi-transhumance**, is the type of pastoralism most widely practiced today by the majority of agropastoralists. Daily movements covering a few kilometers enable nearby pasturelands to be grazed. Only some family members are mobile on a seasonal basis, the remainder engage in sedentary agriculture.

1.3 Constraints and changes in contemporary pastoralism

To accurately determine how the interface between pastoralism and protected areas is evolving, it is important to understand the global pressures and changes currently affecting pastoralism, including climate change, insecurity, agricultural policies and market integration, and population growth. These will continue to have a long-term impact on transhumance. These pressures, which are both short-term and structural, are determining transhumant pastoralists' current behavior and the evolution of transhumance routes. They explain in part the problems encountered in the management of protected areas.

1.3.1 Climate uncertainty

Since the 1970s, the Lake Chad basin has been experiencing a drought marked by reduced rainfall, a southward shift in isohyetes of about 200 km and increased temperatures (UICN & CBLT, 2007). Since the 1990s, there has been an overall trend towards resumed rainfall in the Sudano-Sahelian zone. This dynamic is nonetheless related more to the intensity of rainfall events than to a prolongation of the rainy season. Furthermore, intermittent droughts have been occurring more frequently in recent years.

Under these uncertain climate conditions, pastoralists are extending, reducing and modifying their routes. Over the past 20 years, Chadian long-distance transhumance pastoralists have been venturing ever further south in search of pastures that remain viable late in the season (Figure 4). This phenomenon is not only due to climate uncertainty. It also is due to an overall increase in herd sizes, which is driving the search for new pasture land. Climate uncertainty thus must be considered alongside other factors, such as improved animal and human health (lower mortality rate for those under 15 years, more adults, thus the need for more animals).

While many pastoralists return to their home territories at the season's end, some groups also set up semi-permanent camps on the new pastureland and leave a few family members there. The latter wind up settling down and engaging in small-scale farming. They then organize the movements of their animals over shorter distances around these new anchor points. The combination of livestock and crop production is a common diversification and risk-mitigation strategy related to climate hazards. It also is a strategy implemented by crop farmers who invest in livestock and whose animals are added to those of the transhumant pastoralists during the dry season.

Figure 4 - Evolution of the main transhumance routes between 1970 and 1990

Source: FAO (2012).

1.3.2 The burden of insecurity

Deadly cattle raids have long been carried out periodically between groups of transhumant pastoralists to gain access to pastures or strategic water points. Conflicts with farmers are likewise recurrent. However, over the past few years, insecurity is leaving an increasing mark on pastoral areas in CAR, eastern Chad, and northern Nigeria (Bonnet, 2013).

In fragile states, transhumant pastoralists are regularly subject to abuse from rebel groups. This abuse includes the payment of taxes, livestock theft, kidnappings and ransom demands. In response, transhumant pastoralists are tending to arm themselves to protect their livestock and their families. They sometimes opt to regroup their herds *en masse* and join forces to guard the animals, limit their movements on certain stages, or on the contrary accelerate to pass certain areas at risk. Some also put themselves under the protection of rebel groups in exchange for in-kind payments to facilitate their passage and access territories under rebel control. This mechanism has been essentially institutionalized in northeastern CAR through a well-established system of taxation and rights of passage laid down by the rebels. Pastoralists are required to provide services to the rebels and thus sometimes become their allies against their will.

This militarization of transhumance reinforces feelings of insecurity and instability. The recent spread of firearms among transhumant pastoralists is raising the specter of arms trafficking and the wide-

A map of transhumance routes redrawn by insecurity

Insecurity is increasingly manifest along all of the transhumance routes of the Sudanian region in Central Africa, and is without doubt the main contributor to the recent redrawing of the general map of transhumance. Three major crises have directly affected the organization of transhumance in Central Africa over the last 20 years.

In the 2000s, the Darfur crisis forced pastoralists in eastern Chad to abandon their traditional transhumance routes, which had become too dangerous along the border with Sudan. They shifted westward onto other, lesser known transhumance corridors on which they had weaker social relationships with sedentary villages (Bonnet, 2013). Numerous local conflicts between pastoralists and farmers thus multiplied along the new routes lying east of Zakouma National Park.

The crisis in CAR began in 2013. It again altered the map of transhumance routes in a broader manner. Until then, a large community of Peul pastoralists had occupied western CAR. Under pressure from Anti-Balaka militia groups, this region has been virtually emptied of cattle, with pastoralists taking refuge in Cameroon or in eastern CAR. The latter region was under the control of the Seleka rebels, who are friendlier to the Peul. Large herds thus arrived in southeastern CAR. In the northeastern part of the country along the border with Chad, tensions flared under the combined effect of the northward movement of pastoralists from CAR (seeking to flee the political crisis in their country) and the southward descent of Chadian pastoralists (following poor rainfall).

The security crisis in northern Nigeria has led to the closure of the border with Chad. It therefore affected the cross-border flows of Chadian pastoralists who had to change their routes to reach large Nigerian markets. They have managed by following more secure but longer routes via Cameroon and particularly Niger. To cope with the security risk, some transhumant pastoralists have been forced to settle permanently or semi-permanently south of the Logone plain (Cameroon). These constraints limiting access the largest consumer market in West Africa, and the absence of other commercial outlets, are some of the explanatory factors for the explosion in cattle numbers that currently can be observed in Chad. Insecurity in southern Libya also is affecting traditional camelid trade exchanges.

spread renting of arms to criminals and rebels, which is further increasing demand among pastoralists. To avoid rebellion movements, herders are heading towards remote border areas which are vast, marginalized territories where there is little central government control. In CAR, large herds are thus sometimes escorted by armed herders equipped with modern communication equipment. They move across areas considered to be virtual "gray zones" but which also host certain emblematic protected areas.

1.3.3 The impact of trade and socioeconomic inequality

As for all of Africa, globalization has strongly affected pastoralist communities. As a result, pastoral practices, such as transhumance, have changed substantially over the last 30 years. The development of urban markets and access to basic services, and the improvement of communication technologies, have opened the door to new opportunities. Since the 1990s, the flows of cattle from Chad and northern Cameroon to major urban markets have grown steadily. Herds most often head towards Nigeria.

The prices of animals are generally set according to the terms of trade with agricultural products. Pastoralists have long benefited from relatively stable terms of trade favorable to their activity. Today, speculation, price volatility and the substitution of local products by imported products are causing price instability. Depending on the geographic area, the price relationship between livestock products and agricultural products has even changed to the detriment of pastoralists. Pastoralists must sell more to generate the same amount of income that they earned previously. For some pastoralists, the size of their household's herd is decreasing at the very moment that they should have more animals to ensure the survival of their family units in the medium term.

In both Chad and Cameroon, a gradual transfer of livestock is taking place, from the smallest and poorest pastoralists to the wealthiest ones. Rich transhumant pastoralists benefit from the protection of national economic and political environments thanks to their lucrative activities. Well-connected politically, they even are creating private enclosures on rangelands. On the one hand, for the smallest and poorest pastoralists, this situation further limits their productivity and capacity to increase the size of their herds, and they fall back on areas that are sometimes ill-suited for livestock. They thereby contribute to destroying wild-

life habitats. On the other hand, the overall herd size of wealthy pastoralists developing "entreprenurial" pastoralism is increasing exponentially, involving new practices that do not include the historical, cultural, social and societal features of pastoralism, and which are considered to be the main causes of local conflicts and the destruction of wildlife habitats.

1.3.4 Pastoral areas on the fringes of agricultural development

Despite considerable social, economic and political progress, transhumant pastoralists generally are subject to a certain degree of cultural and spatial isolation. In pastoralist regions, human development indicators remain poor, and the provision of public services is limited. Basic services are largely inaccessible for transhumant pastoralists. The remote conditions of pastoralist regions often justify a low-level of government investment. Furthermore, decision makers promoting territorial development programs have long overlooked transhumant communities. Mobility is often perceived to be an obstacle to the organization of space. Pastoral systems continue to be described as "traditional". The "multi-scale" character of transhumant livestock systems (dispersion of production spaces and marketing spaces) confers on them a reputation of being systems that are difficult to control (Harchies *et al.*, 2007). As a result, public territorial development initiatives rarely consider the dynamics of transhumant pastoralists' use of space (Binot *et al.*, 2006).

A question to consider is whether the agricultural policies for agro-industry development implemented between 1990 and 2000 also had a significant impact on transhumant pastoral systems. Pastoral land used on a seasonal basis was considerably reduced in favor of other, more intensive agricultural uses (dry season sorghum, locally known as berbere, and cotton). Agricultural intensification programs, increased areas under cultivation and improvements in agricultural techniques (for example, irrigation, extension of cotton crops) have sometimes directly influenced the rise in conflicts between farmers and pastoralists.

Traditional pastoral institutions, which are responsible for managing shared use rights and resolving local conflicts, have not always been able to respond to the new challenges. Under these circumstances, they have sometimes lost their legitimacy in the eyes of some pastoralists. The latter have adapted their production practices, in particular their mobility, to take into account changes in agricultural calendars. Nevertheless, transhumance corridors skirting around these agricultural areas are generally heavily frequented and become bottlenecks at the end of the dry season. Certain strategic areas are experiencing increasingly dense concentrations of livestock. This is notably the case around certain protected areas in North Cameroon.

1.3.5 Demographic impact

Pastoralism also is facing other challenges which are much more internal. One in particular is the population growth of pastoralist communities.

Since the middle of the 20th century, the population in the Sahel has more than tripled. Following a similar dynamic, the current population growth in pastoral areas is 2.5 to 3.5% per year. The populations who depend on pastoralism may thus double every 25 to 35 years (African Union, 2010). The impact of this growth will affect the entire Sudanian region in the years to come.

Pastoral societies will be unable to absorb the population overflow in the long term. The number of livestock, even if rising sharply, will not be sufficient to support an excessively large population. Currently, numerous young people from pastoralist households already must leave pastoralism to find other means of emancipation and subsistence. Some take up farming, pick up a trade or join the government if they have a sufficient level of education. They thereby put an end to their mobility. They nonetheless remain culturally linked to pastoralism, and still invest some of their income in the purchase of livestock. They keep the animals near their camps or on the outskirts of the urban centers where they live and work.

The owners in questions do not practice transhumance, but their animals join those of transhumant pastoralists and other agropastoralists on the pasturelands during the dry season. Once their herds have reached a certain size, some owners, who may be businessmen or government bureaucrats, hire young herders to escort their animals to more remote pasturelands. When traveling, these young herders do not always respect the boundaries of transhumance corridors or the management rules governed by and negotiated with local institutions and state authorities. These situations are often at the root of major local conflicts when the animals destroy farmers' fields.

Other young pastoralists are not thriving and are limiting themselves to small holdings. They suffer from a lack of alliances needed to access strategic areas. They are then sometimes obliged to engage in activities such as cutting down trees to produce and sell wood charcoal, etc. Some become poachers or turn to activities involving the illegal collection and use of natural resources. These young people from pastoral communities also have a tendency to join gangs and rebel groups. They help to maintain the climate of insecurity that is now beginning to characterize the outskirts of the most remote protected areas where bandits and rebel groups take refuge. This was notably the case of Faro National Park in Cameroon several years ago. The involvement of young pastoralists in this phenomenon testifies to a complex crisis in pastoral societies, one fueled by intergenerational tensions, a lack of interest on the part of governments in these mobile populations, increasing impoverishment and growing insecurity in pastoral regions.

2. The pastoralism - protected areas interface

Previously fairly contained, the pastoralism - protected area interface is now becoming an urgent problem on the peripheries of protected areas, within buffer zones and over larger expanses of territory such as Greater Zakouma. These peripheries are simultaneously wildlife habitat zones, arable land for farmers and rangeland areas for pastoralists. These overlapping uses are increasing the risk of conflict over access to natural resources between pastoralists and farmers and between pastoralists and conservation officers. Depending on the location, the analysis of the challenges may be different. In some cases, a reduction in livestock numbers may be identified as the priority while in others it may be the control of agricultural dynamics or even directly security issues. However, proposals for action consistently identify the need to integrate transhumant pastoralism into the management of protected areas in order to mitigate local conflicts likely to affect wildlife habitats. This approach also requires an understanding of the challenges which exist at the scale of transhumance territories and regions when cross-border transhumance is involved.

2.1 Each site faces very specific challenges

The challenges of the pastoralism-protected area interface can vary depending on the sites and the areas surrounding them, their ecological features, geographic location, neighboring communities, political and socioeconomic organization, type of pastoralism practiced, etc. However, in most cases, they reflect conflictual relationships between pastoralists, farmers and conservation officers around questions of access to resources, wildlife habitat degradation and poaching.

To cope with these situations, most recommended measures seek to closely integrate biodiversity conservation and local development in the peripheries of protected areas, especially since these outlying areas are characterized by the extreme poverty of the people living in them.

The cases of Waza National Park, the Greater Zakouma ecosystem and the Bili-Uere - Garamba - Chinko landscape present diverse problems and proposed solutions.

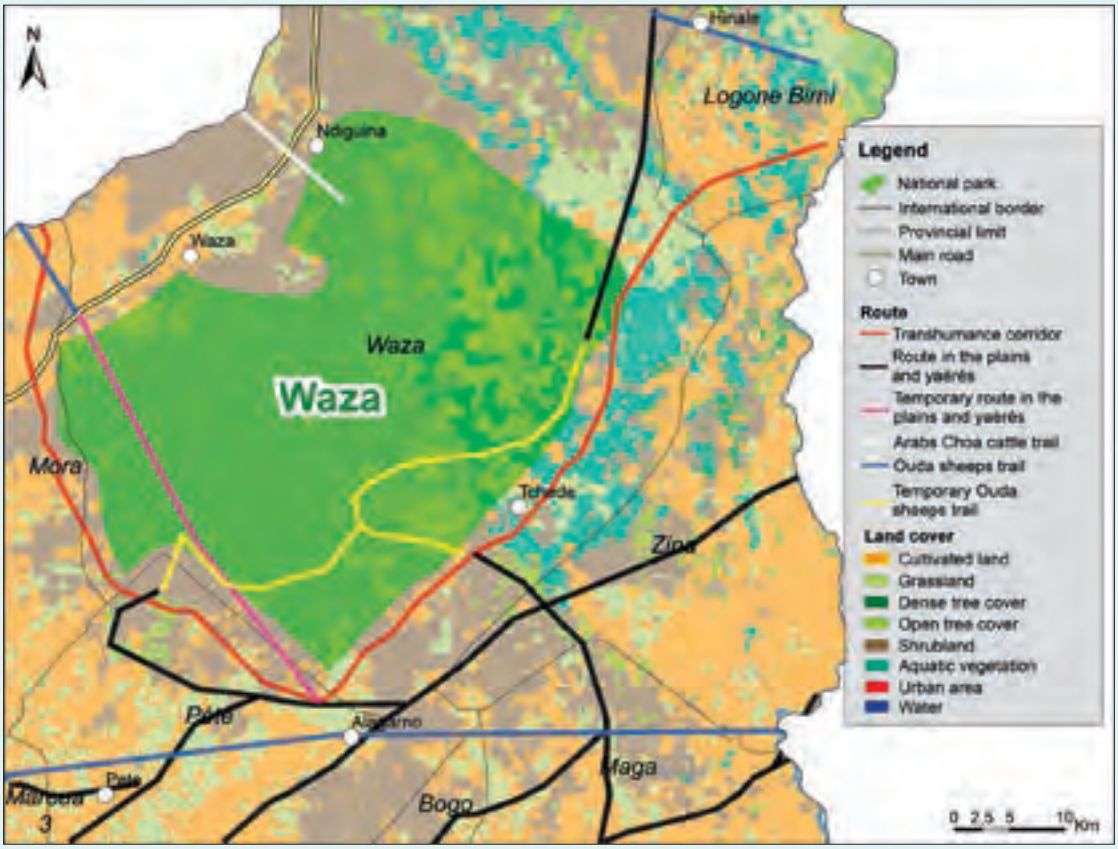
Waza National Park (Cameroon): immense concentrations of livestock

The Far North region of Cameroon is a genuine crossroads of trade routes and cultures. Pastoralists, their herds and wildlife have peacefully coexisted for a long time on the pastureland of the Waza-Logone flood plain. Each year, transhumant pastoralists move in with their herds for the dry season, maintaining strong social and economic ties with local communities. Some pastoralists gradually have established their families and part of their herds on former grazing areas that were attributed to them by traditional local authorities. These families started to grow a few crops. The areas reserved exclusively for herds were then reduced considerably.
Against this backdrop of land pressure, traditional authorities today appear to be calling into question the rules regulating access to grazing land. Pastoralists are being forced to renegotiate the sites that they sometimes have used for several generations. To avoid being dispossessed, land-use must be permanently visible in a landscape. Consequently, pastoralists who have become agropastoralists tend to extend their cultivated areas at the expense of pasture land, thereby affirming their rights over the land (Kossoumna Liba'A, 2018). Livestock are then pushed back and concentrated on the few savannas remaining available. The increase in livestock on these areas leads to over-grazing and bush fires. Conflicts with local communities, farmers, sedentary pastoralists, transhumant pastoralists and wildlife now occur on a daily basis over access to water points and increasingly scarce grazing land.

Waza National Park (Cameroon): immense concentrations of livestock

Figure 5 indicates the presence of transhumance routes along the edges and even inside Waza National Park.

Figure 5 – Pastoral routes around Waza National Park



From January to July, the massive arrival of herds from the north poses a heightened threat to the ecosystem. During this period, over 100,000 heads of cattle may be found on the Waza-Logone flood plain alone. The movements in question increase the risk of over-grazing, land compaction and soil degradation. The livestock carrying capacity is often more than surpassed. It hovers around 17.5 Tropical Livestock Units (TLU) per hectare (Jiagho, 2018). At the end of the 1990s, it was estimated to be between 8 and 10 TLU per hectare (UICN & CBLT, 2007).

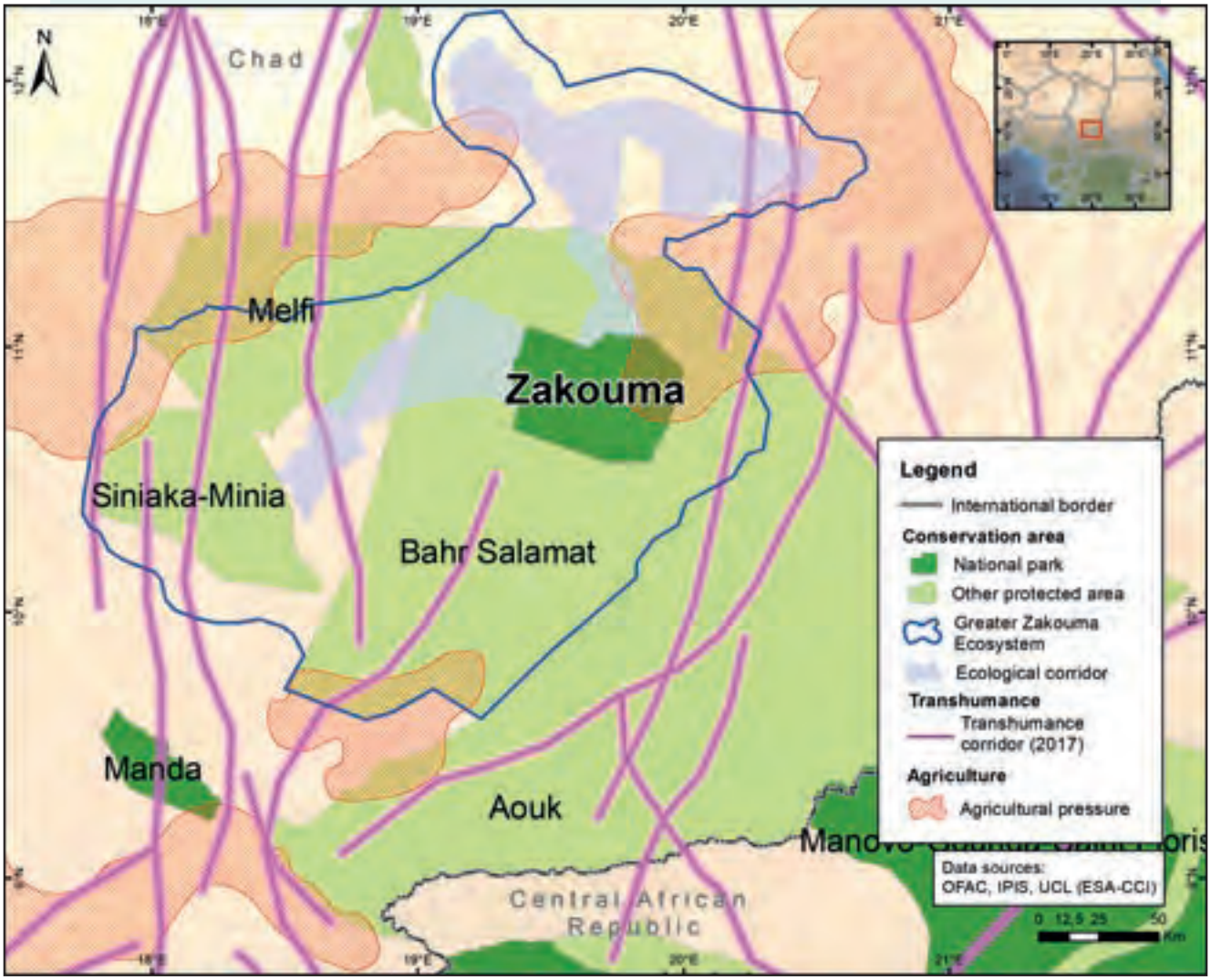
Furthermore, pastoralists and their herds are increasingly extending their stay past July when the first rains are slow to fall. Pastoralists can establish themselves for periods lasting over six months, notably to the east of Waza National Park, a flood-prone area where there are perennial ponds. Many pastoralists establish themselves in an even more permanent manner.

For their part, local agropastoralists are intensifying their investments in livestock. They are mostly goat farmers, and supplement their animals' feed with woody forage. This sometimes leads to the uncontrolled cutting of the woody resource. It is estimated that 478 ha of forest cover is disappearing on average each year from the areas surrounding Waza National Park (Jiagho *et al.*, 2016). The natural habitat is thus being modified in an alarming manner. Wildlife are being affected and conflicts are deepening between conservation services and transhumant pastoralists. This state of affairs is disturbing wildlife conservation actions in Waza National Park.

Greater Zakouma (Chad): strong expansion of the agriculture sector

The Greater Zakouma Functional Ecosystem (Figure 6) spans approximately 25,000 km². It includes wildlife habitat areas, some of which are classed as protected areas, and others which are occupied by sedentary and mobile human communities. Due to the multiplicity of actors involved and the shared uses of resources, cohabitation between farmers, pastoralists and wildlife is a constant challenge. The region is notably characterized by very strong dynamics between corridors allowing the movement of wildlife, mainly elephants and large antelopes, the agriculture colonization front and the pastoralists' transhumance routes. These different ways of using the land frequently overlap in both space and time. Areas of vegetation stretch out on both sides of the park's boundaries. These areas allow wildlife to pursue their seasonal migrations outside the park. During the rainy season, elephants are found to the north and southeast of the park. In recent years, the management of the national park has improved significantly. Numerous large mammals have returned. In the areas surrounding

Figure 6 – Agricultural colonization and transhumance routes across the entire Greater Zakouma Functional Ecosystem



the park, this dynamic is beginning to generate conflicts with local communities. Damage to farmers' crops and carnivore attacks on domestic livestock are increasing. They are causing a certain degree of antagonism between park officials and farming communities, who may seek reprisal through poaching.

The Zakouma area serves as a bread basket for Chad due to its cereal production, which is among the highest in the country (notably that of dry season sorghum, locally known as *berbéré*). The expansion of *berbéré* crops is the major cause of deforestation in the areas around the park and is the main threat to wildlife conservation. Once used to graze animals and gather food, the savannas are now deforested. In the areas where vegetation still appears "intact", diverse landscape markers signal the limits of fallow land that are recognized by everyone and are socially appropriate. These areas with fluctuating boundaries and land rights that are well-established at the village level are subject to ongoing local renegotiations (Binot, 2011).

The area hosts transhumant pastoralists who descend from the north each year at the end of the rainy season (October-November). They establish themselves in the plains neighboring the park with their tens of thousands of cattle. Some of these pastoralists only stay a few days before resuming their journey in CAR, sometimes travelling all the way down to southeastern CAR. Pastoralists practicing medium-distance transhumance stay for the duration of the dry season. Their herds make the most of the end of the *berbéré* harvest. Some pastoralist families establish themselves more permanently and engage in small-scale farming. Sedentary farmers also are investing in livestock to diversify their income. There has been a significant growth in cattle livestock, and agro-sylvi-pastoral farming systems are increasing in number. There is heavy pressure around the transhumance corridors when thousands of heads of cattle throng together in the peripheral area. Animal movements are becoming more complicated. The transhumance corridors are reduced and sometimes completely obstructed by crops while access to important areas of mixed uses is very difficult due to the extension of farming activities.

The advance of the agriculture front on the savannas and the pastoralism area constituted by transhumance corridors, and the growth in livestock numbers stemming from transhumant pastoralists settling in more permanently and from investments in livestock by farming inhabitants, are the main causes of the degradation of wildlife resources. These dynamics are behind the increase in conflicts between pastoralists and farmers, between pastoralists themselves, and more generally between people and wildlife (destruction of crops by pests and attacks on livestock by wild animals, slaughter of animals for trade).

Numerous studies have been conducted in Zakouma National Park to better understand the dynamics at play, the diversity of stakeholders, their respective strategies, and the short and medium-term issues (political, food, economic, energy, sociocultural) involving natural resources. This has led to the development of a landscape approach to address questions regarding conservation, farming and livestock. This involves shifting to an approach seeking to integrate the park and its vital ranges for large wildlife into the development of surrounding territories through the application of an inclusive land-use plan. In particular, the establishment of the Greater Zakouma Functional Ecosystem should enable conservation efforts to be expanded by integrating the role of local communities.

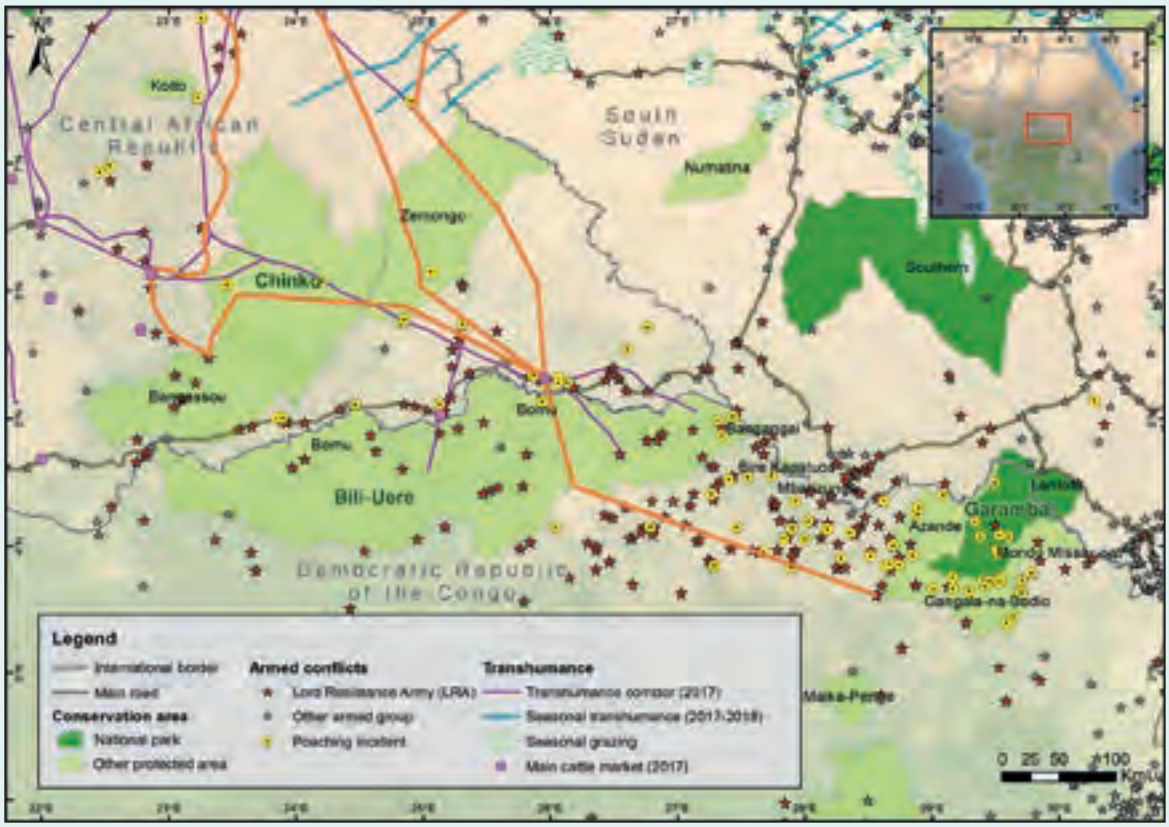
Bili-Uere – Garamba – Chinko landscape (DRC and CAR): the insecurity in question

This landscape includes the Garamba complexes (Garamba National Park and three game reserves: the Bili-Uere hunting estate and the Bomu reserves in DRC, and the Chinko reserve in CAR). This isolated and sparsely populated region (2.9 habitants/km^2) straddles the border between DRC and CAR and lies close to South Sudan (Figure 7). It is populated by farming communities and transhumant pastoralists. Neither government has controlled the territory for the past 20 years, and the virtual absence of public services has facilitated the establishment of several armed groups like the Lord's Resistance Army (LRA). These well-equipped groups actively engage in large-scale poaching (Ondoua *et al.*, 2017).

Several groups of transhumant pastoralists move through the region on a seasonal basis: Arabs (from Chad and Sudan) and Peul (Fulani and Bororo, divided into several clans which are more or less independent from each other). The latter are from regions lying along both sides of the CAR-Cameroon border. They began their slow migration towards eastern CAR in the 1920s. Their movements accelerated in the direction of DRC in the early 2000s due to diverse factors, including a series of droughts, repressive political events, shifting fronts of insecurity following civil wars in DRC and Sudan, and economic opportunities that sometimes opened up around protected areas and refugee camps.

In DRC, local farming communities accuse these transhumant pastoralists of collaborating with armed groups and major poachers, sharing information and food with them. In fact, large

Figure 7 – Conservation, insecurity, and cross-border transhumance: challenges of the cross-border area between CAR, DRC and South Sudan



Bili-Uere - Garamba - Chinko landscape (DRC and CAR): the insecurity in question

poachers frequently use the paths and tracks followed by transhumant herds. By doing so, they can consistently avoid densely populated areas and centres. To cope with the threat of insecurity, transhumant pastoralists are sometimes pushed to arm themselves. This state of affairs leads local populations to identify the pastoralists with the rebels and large poachers.

In CAR, the transhumant pastoralists arrive each year from the northeast and settle down in the Chinko area from December to May. These pastoralists are armed to protect their animals from rebel groups circulating along their route. Most are shepherds employed by rich elites living in Darfur. While the cohabitation with the Chinko reserve may appear to be more peaceful than in DRC, it is sometimes difficult to distinguish the pastoralists from large poachers and rebel groups. This confusion can again accentuate the climate of fear and insecurity among local communities.

The passage of herds near the protected areas raises several problems for the managers of these spaces. The herds threaten natural wildlife habitats and the pastoralists sometimes hunt intensively when passing through.

Under the effect of climate change and growing insecurity in DRC and CAR, the movements of transhumant pastoralists are going to intensify in these isolated regions where the governments exercise little territorial control. Existing laws have been poorly adapted to the situation for a very long time. They appear totally inadequate for regulating the passage of herds on both sides of the borders. The transhumant pastoralists are both victims and perpetrators of insecurity. Investments to secure the transhumance routes, notably the water points and improved market access, appear today as the best solution. The objective is to reduce conflicts between communities and establish a sustainable use of resources in keeping with conservation goals.

2.2 Integrating transhumant pastoralism into the management of protected area peripheries

2.2.1. Promote the landscape approach for the integrated management of protected areas

Protected area integration can be defined as: "the process of ensuring that the design and management of protected areas, corridors and the surrounding matrix fosters a connected, functional ecological network." It also may be defined as the integration of the values, impacts and dependencies of the biodiversity and ecosystem functions and services provided by protected areas into key sectors, such as agriculture, fisheries, forestry, mining, energy, tourism, transportation, education and health (CBD, 2018). The integration of protected areas and conservation areas into landscapes is thus an essential factor for the sustainability and effectiveness of conservation measures fostering connectivity. Land users should be included in the establishment and management of protected areas, and new types of protected areas and conservation areas should be developed that allow an occupation and use of land that are in line with conservation objectives. The establishment of protected areas which integrate the human communities residing in the peripheries of protected areas and stricter conservation areas (such as national parks) would help improve connectivity by creating transition zones between protected areas and the rest of the matrix, which would promote integration into the landscape. Initiatives related to connectivity must take into consideration the conservation of private lands to be successful at the landscape scale. Incentive measures could be implemented to facilitate community cooperation aimed at maintaining particular assets in the transition areas. For example, payment strategies for ecological services (carbon sinks, minimum payment for water filtration, water containment, etc.) could be proposed to cover the

expected costs of services and to reinforce integration by recognizing the value obtained.

Community mobilization and participation in conservation planning are essential for the integration of protected areas and conservation areas into the landscape. To strengthen residents' sense of belonging and their willingness to play an active role in achieving conservation objectives, a charter could be drawn up in collaboration with all stakeholders who may voluntarily adhere to the charter, which would confirm their commitment for a fixed period, with the option to renew their participation. This would attest to the communities' intention to carry out land projects, including a vision for territory development planning and conservation. Provincial laws on protected areas and territorial development planning could govern these charters.

2.2.2 Promote land-use plans which take into account the spatial logic specific to transhumance

On the same territory around a protected area, several types of transhumance may be interacting. Each type of transhumance can have a different relationship with space and time. Depending on their production practices, long-distance transhumant pastoralists, agropastoralists and neo-pastoralists (whose herds are managed by hired shepherds) each have different interests. The same holds true for the other actors in a territory, such as protected area and wildlife managers, farmers, mine operators, administrative staff, etc.

This overlapping between transhumant pastoralists' mobility and other users' relationship with space, coupled with security issues, represents a source of conflict. Designing an approach that takes into account all types of mobility and the uses of all stakeholders also is essential for setting up the peaceful management of transhumance around protected areas.

In this regard, land-use plans are interesting tools. This is particularly true because their development follows a process that is meant to be inclusive in order to account for the complexity of power games between stakeholders. The approach should highlight:

- The **diversity** of actors, the absence or weak involvement of certain stakeholders, their spatial logics, their relationships with the land, and the allocation of land and its uses.
- Seasonal **mobility**, which is a key component to the local dynamics of natural resource use.
- The **interdependence** of actors and of crop production systems and transhumant livestock systems. The two systems follow different spatial logics in terms of rights of access to resources, but their practices are complementary. They are the result of negotiations guided by well-established sociopolitical mechanisms. The pastoral and crop farming communities can be ethnically distinct but are generally economically complementary and socially integrated (Huchon, 2018).

Beyond enabling a wealth of information to be collected about local territories, the process of

developing a land-use plan helps to strengthen the resilience of rural communities. This is a critical element for avoiding human-animal conflicts. The delineation and recognition of specific spaces thus aim to secure resources (wildlife and rangeland) as much as the legitimacy of actors (seasonal transhumant pastoralists, for example) as "rightful claimants" to the space, particularly in contexts with strong land pressure (Binot *et al.*, 2006). This is why it is important to ensure that:

- The plans address the two spatial logics (securing resources and actors' legitimacy), without which the local complementarities between crop farming and pastoralism risk being destabilized.
- Transhumant pastoralists and farmers are considered in the same way and are involved in the development of these plans, although it is always more difficult to involve the former as their presence is seasonal and their legitimate institutions are not always represented locally on the sites (because they often reside in the territories where they spend the rainy season).
- Plans are the subject of discussion at the local and regional level (of transhumance routes) because mobility is organized at the scale of a transhumance route.
- Discussions do not only involve "artificial" groups, formed solely for the needs of a project. The consideration of conflicts of interest related to land management may initially prove to be problematic. Nonetheless, it makes it possible to include certain customary authorities whose views otherwise could subsequently become sources of roadblocks or conflict.
- Efforts are made to move beyond the stage of the simple participation of local populations, and in particular of transhumant populations. The roles and responsibilities of each must be defined and actors in the system of governance also should be involved.

One should keep in mind that these land-use plans must above all be negotiation tools that can evolve. In particular, they can make it possible to prioritize investments and infrastructure and to set objectives for these multi-user spaces. Above all, they offer a broader picture of local development, transhumance corridors and ecological corridors, water points (location, type of structures, ponds or boreholes) and their functionality according to the types of users, forage production sites (type of forage according to users), checkpoints for veterinary services and security, etc. At a later stage, the construction of new infrastructure for pastoral purposes (pastoral stations, ponds, corridors, cattle markets, vaccination yards and mixed health care supplies, etc.) enables the dialogue to be continued with all of the stakeholders and to orient transhumance routes on a given territory.

Depending on the case, these plans can potentially establish a consensual demarcation of the boundaries of protected areas that all actors understand. The process of defining these then can facilitate the effectiveness of surveillance measures, strengthen the capacities of wildlife managers in terms of information, logistics and the use of technological tools, and allow them to adapt to emerging threats.

2.2.3 Think on the scale of transhumance routes

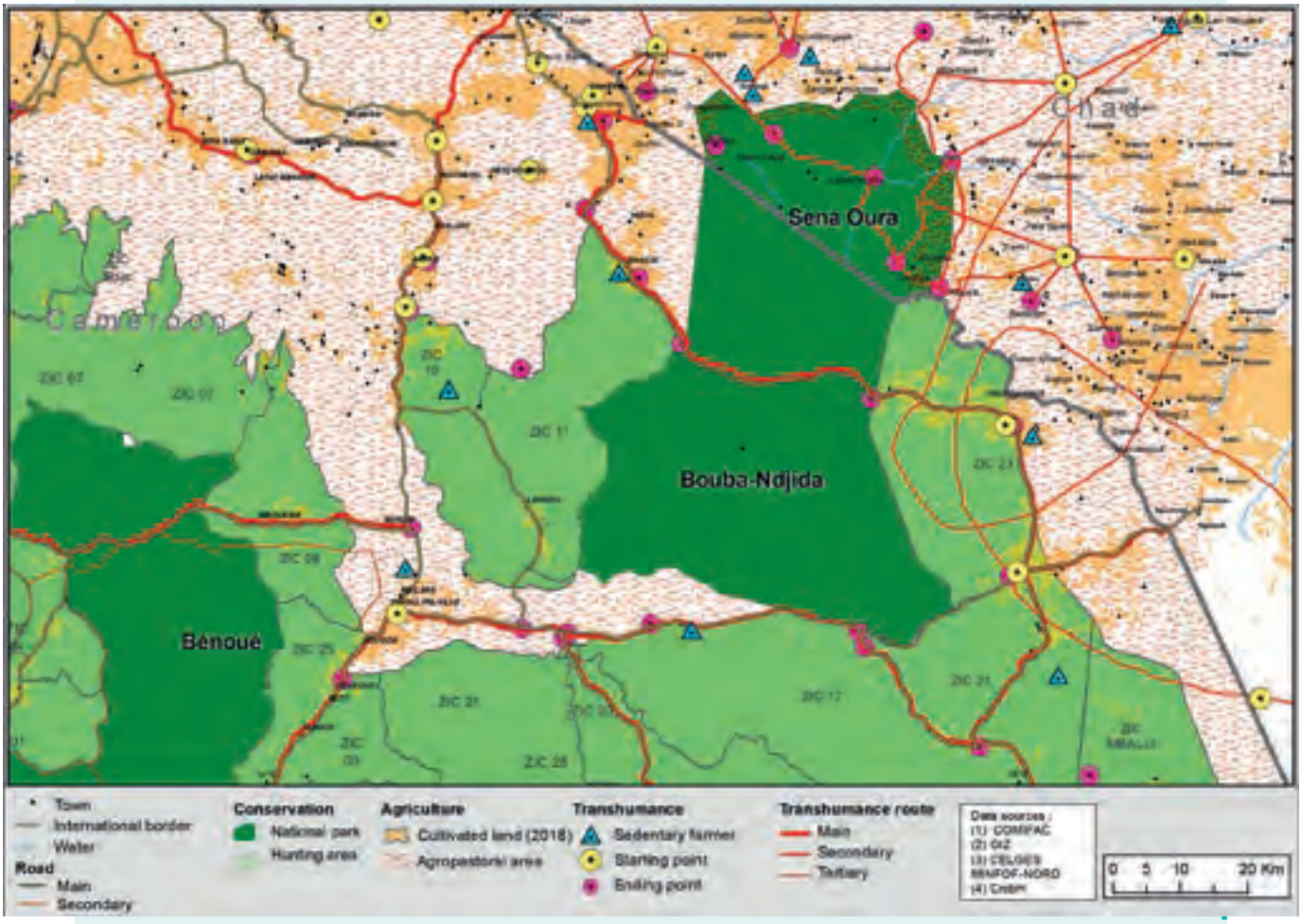
To better grasp the complexity of interactions between a protected area and transhumance, it is important to understand the specific functioning of the different livestock farming systems operating on the outskirts of the protected area concerned. The analysis of the spatial dimensions of transhumance is an essential prerequisite for establishing a constructive dialogue between the managers of protected areas and pastoralists, which then makes it possible to precisely identify the determinants of pastoralists' actions and the role of the protected area and its periphery in their lives.

To do so, it is vital to consider several interlocking levels. The first level covers the set of routes that lead to the protected area in question, from the pastoralists' departure point to the dry season pastures targeted (Figure 3). The second level designates the stages of the transhumance route, before and after the protected area (departure point, rapid travel area without permanent water points, transit area and arrival area, depending on the position of the protected area along the route). Lastly, the local level is that of the area directly around the protected area, with its pastures and water points, that hosts transhumant pastoralists who are passing through or stay there.

The binational Sena-Oura - Bouba-Ndjida (BSB) Yamoussa complex: better understanding transhumance to target management priorities.

The BSB Yamoussa complex, established in August 2011 through a partnership agreement between Chad and Cameroon, is an ecological ensemble composed of two key protected areas (figure 8): (i) Sena-Oura National Park in Chad and Bouba-Ndjida National Park in Cameroon. The BSB Yamoussa complex is surrounded by several zones of hunting interest (referred to below by their French acronym, ZIC) in Cameroon and a peripheral area in Chad. These two protected areas are under multiple and intensifying external pressures generating agro-sylvo-pastoral conflicts linked to an intensification of migration, the gradual encroachment of agropastoral activities, the development of mining activities (uncontrolled gold mining), conflictual management of transhumance and an escalation of poaching. The rapid advance of the agricultural front in particular is increasing the difficulties involved in moving transhumant herds and is heightening the risk of multi-faceted land conflicts. The vast majority of BSB is covered by infertile land unsuitable for agriculture. At the end of the dry season, water becomes scarce. The rivers, called locally *mayo*, are dried out and pastures are degraded. Access to water, even more than pastures, is the major problem for both livestock and wildlife.

Figure 8 – Transhumance and land occupation in BSB Yamoussa area



The binational Sena-Oura - Bouba-Ndjida (BSB) Yamoussa complex

Since 2014, several studies undertaken under the framework to resolve the issue of transhumance in Cameroon (North and Far North) made it possible to identify the spatial, social, economic, technical and political dimensions of transhumance in the area.

Exclusively nomadic Peuls form a very small minority. Most transhumant pastoralists make seasonal movements without crossing borders. Most are crop-livestock farmers or agropastoralists. The herds, with 40 to 60 heads, are shepherded by herdsmen from the Garoua area in the north. Cross-border seasonal transhumance between Chad, Cameroon and Nigeria also exists, most often practiced by young hired herdsmen. Herds moving from Chad towards Cameroon are larger than those coming from Nigeria, or those which are from Cameroon and moving towards Chad. In principle, everyone knows the major transhumance corridors defined by a decree from the ministry in charge of livestock. Small and medium transhumance corridors are determined by more local and customary practices. Transhumant pastoralists complain that crop fields are spilling over onto these corridors.

These preparatory studies made it possible to now build elements for a consultation process involving the different actors, reconcile points of view, and guide future interventions in the cross-border context of the BSB Yamoussa complex on the basis of a genuine involvement of local communities. It turns out that the local populations recognize the importance of protected areas, particularly their capacity to slow down the development of the agricultural front. They nonetheless are advocating for an increase in land allocated to crop and livestock farming. In other words, they accept the parks, but are less tolerant of the ZIC surrounding the parks. The issue of ZICs will therefore be a priority for support action in the park peripheries.

Setting up a mechanism to prevent and manage conflicts related to transhumance should enable the establishment of constructive dialogue and positive relationships between the managers of the protected areas and the users of the BSB space, and ensure the sustainable use of goods and services provided by the natural environments.

This step of understanding the route in its entirety makes it possible to assess the strategies of different types of transhumant pastoralists. It enables an understanding of how pastoralists consider the periphery of a protected area within the broader context of the entire route: an essential area after a rapid movement with the herds, a transit area, a final destination, etc. Depending on the position of the protected area on the transhumance routes, management issues may be different as the animals' needs and the pastoralists' objectives will not necessary be the same. The measures to implement at the local level by the manager of the protected area could then be different depending on the situation.

2.2.4 Consider the role of transhumant pastoralists in the management of insecurity

Overall, transhumant pastoralism helps to make the most of vast remote areas, ensuring a human presence in isolated regions within countries facing major security challenges (OCDE, 2014). It is an essential line of defense against insecurity by the occupation of the space. The relationship between herd mobility and security can, however, work both ways (COMIFAC & GIZ, 2019). Pastoralists often are the first victims of rebel groups and bandits involved in large-scale poaching. Pastoralists try to avoid confrontations with these groups, but they can also be led to support poachers' operations, directly or indirectly, by hiding arms or providing information.

Under these conditions, the managers of protected areas have every reason to maintain constructive relationships with transhumant pastoralists, who can prove to be valuable sources of information about large-scale poaching networks. Depending on the context, this can be undertaken in different ways, one example being the development of basic services for transhumant pastoralists in the peripheries of protected areas.

Managers of protected areas must position themselves at the heart of development and security issues as territory actors alongside other sociopolitical actors. Defending the benefits of transhumant pastoralism to state authorities and local political leaders could then be a means to gain the confidence of pastoralist community leaders, develop constructive relations with pastoralists and ensure their support in the fight against large-scale poaching.

2.2.5 Maps and trade networks

All too frequently, maps made for the management of protected areas focus strictly on the management of parks and their peripheries. However, the problems of large-scale poaching and transhumance cannot be resolved solely at the local scale or only within the boundaries of a protected area. Significant efforts thus must be made to establish maps which integrate protected areas and other types of land use, including transhumance territories on the scale of transhumant routes. Used for decades, major transhumance routes often are part of the landscape and are widely recognizable. On the most problematic sites, several projects also have delineated the boundaries of the main corridors where animals pass through. The tracks are sometimes approved by government administrations, and may even be marked. This work already has been launched in Chad (Almy Bahaim project) and in West Africa.

Regional observation and information mechanisms also should be developed on issues common to biodiversity conservation and transhumance management. The development of exchange networks between managers of protected areas affected by transhumance and security and pastoral development actors could be a good way to break down barriers separating themes. Such networks also could be used to supply statistical databases useful for the overall management of interfaces between transhumance territories and protected areas and/or their peripheral areas, mark the most problematic routes, and define guidelines for the review of legislation on abandoned or overcrowded transhumance routes, or on parks that exist only on paper.

2.2.6 Support customary institutions and local diplomacy initiatives

The traditional institutions managing herd movements are facing significant structural constraints. For example, their ability to respond to the challenges of climate change and insecurity is generally limited. As a result, they are losing some of their legitimacy, and many pastoralists and new herd owners are turning their backs on their authority. Yet support for these traditional institutions and other suitable consultation frameworks is essential for understanding and implementing agreements and alliances involving

the shared and sensible use of natural resources. Support given to these institutions by the managers of protected areas encourages local diplomacy and promotes inclusive agreements.

For example, in the context of Faro National Park in Cameroon, these initiatives have facilitated the establishment of agreements on mobility and the assessment of the carrying capacity on the busiest grazing areas, and influenced the perception of the stakeholders concerned. Support for the Network of Transhumant Associations of Greater Faro, led by the *Lamido* of Tchamba (a traditional Peul chief), is enabling diverse actors to discuss and negotiate different questions related to the management of pastoral mobility around the national park. On both sides of the border between Cameroon and Nigeria, all those directly concerned were already linked traditionally, but alliance systems were losing their legitimacy. With the *Lamido's* support, this network made it possible to rekindle interest across transhumant communities as a whole, and to include other issues in local debates, such as combating insecurity (the park had become a refuge for hostage takers and highway bandits) and the protection of natural resources.

Traditional institutions also can be strengthened by becoming integrated into broader collaboration platforms. The Actors Forum from Faro is another example of a multi-stakeholder and multi-sectoral platform. It brings together all of the parties involved in the management of the territories surrounding Faro National Park, the *Lamido* and local authorities, as well as the army, security and law enforcement forces, park managers and the private sector active in the greater Faro area. Here, transhumant pastoralists and other actors have come together in the interest of conservation. They identify together solutions to problems arising from the shared use of resources and space. These consultation frameworks help actors to reach agreements and align their interests, and consider the mobility and the territorialization of transhumance in a peaceful manner by including the interests of the management of protected areas and their peripheries.

Within these consultation frameworks, the role of each participant is based on local sociopolitical relationships specific to each society, whether the society be highly or loosely structured. The circumstances and the manner by which actors interact are not the same from one site to another, in the *Lamidat* of Tchamba (Faro) or isolated areas of CAR and DRC. Each site has its own dynamics, with its own actors' logics and inter and intra-actor relationships on the peripheries of protected areas. Given the new challenges, population pressure and pace of pastoralist communities' generational renewal, the adaptability of traditional institutions should be analyzed. These institutions must be able to respond to the aspirations of new generations of pastoralists in terms of governance, services and representation. They must be able to base their legitimacy on notably new management skills, and on their ability to engage in dialogue with government authorities (Huchon, 2018).

Finally, particular attention must be paid to eventual political and economic interference from figures with close connections to central or local government authorities. Impunity and weak local governance can quickly wipe out any results achieved by actors on the ground. Lobbying at the central level for the fair enforcement of laws must be carried out in parallel to work in the field.

2.2.7 Facilitate the integration of agropastoralists and younger generations

It was mentioned earlier that in response to drought and insecurity, many pastoralists have left their home regions and settled in other areas that are more favorable for their livestock. Although they sometimes have been settled for dozens of years on these new territories, their integration into local communities often remains tenuous. There may be a great deal of tension on certain sites long after these former transhumant pastoralists have settled down on them. Dealt with in terms of identity, or even instrumentalized by a few political leaders in national debates strongly marked by ethnicity, these tensions can give rise to violent clashes, as can be observed in Nigeria and East Africa.

In the interest of pacification, special attention must therefore be paid to the integration of transhumant populations into host communities. This is a point raised regularly by pastoral development projects. Social programs implemented on the outskirts of protected areas should pay keen attention to this integration, notably through non-discriminatory access to health and education services, the promotion of inter-community social events, etc.

The implementation of support programs (for example, education, literacy, and professional training) targeting young people from pastoralist communities in particular can make it possible to work on long-term trends. Integrating young pastoralists into conservation programs also can be an opportunity because their knowledge of the environment can contribute considerably to conservation efforts.

2.2.8 Support cross-border agreements

Several bilateral initiatives and agreements relating to the creation and concerted management of cross-border complexes of protected areas already exist in Central Africa. These include the 2011 cross-border collaboration agreement between Cameroon and Chad for the Bouba-Ndjida (in Cameroon) - Sena-Oura (in Chad) complex, reinforced by a tri-national agreement between Cameroon, Chad and CAR in 2013. The subregion also has a plan of extreme urgency to fight poaching and an emergency plan to fight poaching (savannas component).

Despite these integrative processes initiated by regional institutions such as CEEAC, COMIFAC (Central African Forests Commission) and RAPAC

(Network of Central African Protected Areas), policies and strategies are not being concretely applied in the field. This is mainly the result of institutional factors and a lack of land-use plans. The "protected areas - transhumance" issue finds itself at the crossroads of the prerogatives of several ministries. It is difficult to activate synergies without major collective decisions and above all without a shared objective.

The 2019 N'Djamena conference made it possible to put these issues on the regional political agenda. However, discussions were very focused on issues of security, control and the creation of corridors and cross-border protected area complexes for wildlife protection. The N'Djamena initiative needs to be strengthened and the debate broadened by integrating the territorial logics of transhumant pastoralists more deeply into the discussions. The task is to link local territories, encompassing protected areas and their peripheries, to the territories experienced by transhumant pastoralists. Beyond intergovernmental agreements, innovation also must take place through the implementation of collaborative approaches at the scale of transhumance routes.

In the short term, this involves supporting cross-border dialogue initiatives to define a regional and integrated vision of transhumance-protected area interfaces in Central Africa. This step is a prerequisite for the regulation of cross-border transhumance and the establishment of frameworks for concerted action to capitalize on past transhumance movements, prepare for future ones, and make an inventory of the investment needs for improving relations between these two forms of occupation of space.

Conclusion: current lessons and future prospects

The treatment of transhumant pastoralism in the peripheries of protected areas is today a core concern of protected area managers in the Sudano-Sahelian region. The actions taken by managers in this domain undoubtedly remain too limited. Human factors (cultural, historical, social and societal, economic) in particular should be better integrated into their vision of pastoralism and territorial development. However, it should be remembered that, contrary to what can be seen in East Africa, logistical issues also often continue to severely limit, from a technical and financial point of view, the development of effective actions in favor of pastoralists making use of remote and sparsely populated areas.

Compared to what is happening in East and West Africa, knowledge about transhumance in Central Africa remains weak with regard to recent transformations and future challenges. Considerable efforts are still needed to better understand the evolution of the spatial, ecological and socioeconomic dynamics specific to pastoralism in the region, notably in response to climate change and insecurity which are affecting large portions of the territories that transhumant pastoralists travel through. These efforts are without doubt a prerequisite for any large-scale operation to address the issue of protected area peripheries. The task is to focus on better understanding the internal power relations specific to pastoralist groups whose social systems, despite appearances, are often highly structured. Socio-political studies on transhumant groups should serve as a lever to integrate transhumant pastoralists into political consultation processes and to improve the effectiveness of the interventions of protected area managers. Political questions must be considered to tackle the phenomena of increasing conflicts, instrumentalization and the rise of jihadism in particular.

Finally, special attention could be given to lessons learned from the creation of protected areas in the Sahelian zone, such as those of the Ouadi Rime-Ouadi Achim and Binder-Lere reserves in Chad. The socioeconomic issues of pastoralism and the ecological concerns of conservation are closely linked. Here, support for the pastoral economy is a means to guarantee the safeguarding of the exceptional ecological characteristics of these wildlife sanctuaries. Improved cohabitation between wildlife and transhumant pastoralism on the outskirts of protected areas could be achieved by safeguarding the mobility of transhuman pastoralists across their entire transhumance routes.

Bibliography

References cited within the text

African Union, 2010. Policy, Framework for Pastoralism in Africa: Securing, Protecting and Improving the Lives, Livelihoods and Rights of Pastoralist Communities. African Union, Department of Rural Economy and Agriculture, Addis Ababa, Ethiopia : 38 p.

Binot H.A., Castel V. & Caron A., 2006. L'interface faune-bétail en Afrique de l'Ouest. *Sécheresse* 17 (1-2) : 349-361.

Binot H.A., 2011. L'intégration des riverains d'aires protégées aux démarches de conservation de la faune sauvage d'Afrique centrale : l'obstacle posé par les pratiques des projets. *Bulletin de l'Association de Géographes Français* 88 (4) : 432-443.

Bonnet B., 2013. Vulnérabilité pastorale et politique publiques de sécurisation de la mobilité pastorale au Sahel. *Mondes en développement* 164 (4) : 71-91.

CBD, 2018. Décision 14/8 adoptée par la Conférence des Parties à la Convention sur la diversité biologique : Aires protégées et autres mesures de conservation efficaces par zone.

CENUA, 2012. Bétail, viande, poisson : comment mieux les vendre en Afrique centrale. *Echo d'Afrique centrale* 27 : 7-9.

COMIFAC & GIZ, 2019. Note conceptuelle, session thématique 3. Conférence internationale des Ministres en charge de la défense, de la sécurité et des aires protégées sur la lutte contre le braconnage et autres activités criminelles transfrontalières. N'Djamena, Tchad, 23-25 janvier 2019.

CNUCED, 2019. Examen de la politique d'investissement : Tchad. Commission des Nations Unies pour le Commerce et le Développement, Genève.

FAO, 2012. Système d'information sur le pastoralisme au Sahel : Atlas des évolutions des systèmes pastoraux au Sahel 1970-2012. CIRAD, FAO.

FAO, 2018. Stratégie d'appui à la résilience – Renforcement des moyens d'existence agropastoraux 2018-2023, République centrafricaine. Rome.

FAO, 2020. FAOSTAT. http://www.fao.org/faostat/en/#home (accédé : janvier 2020).

Harchies M., Binot A. & Wolff E., 2007. Impacts mutuels de la conservation et de l'élevage transhumants sur l'occupation des sols et les ressources environnementales ». *VertigO*, Hors-série 4. http://journals.openedition.org/vertigo/808

Huchon J., 2018. Conflits politiques ou politisation des conflits liés au pastoralisme. *Grain de sel* 73-74. http://www.inter-reseaux.org/IMG/pdf/gds73-74_conflits_p12-14.pdf.

Jiagho R., 2018. Flore et végétation ligneuse à la périphérie du Parc National de Waza (Cameroun) : Dynamiques et implications pour une meilleure gestion. Thèse de doctorat, Université du Mans, France et Université de Yaoundé I, Cameroun.

Jiagho E.R., Zapfack L., Kabelong Banoho L.P.R., Tsayem-Demaze M., Corbonnois J. & Tchawa P., 2016. Diversité de la flore ligneuse à la périphérie du Parc national de Waza (Cameroun) *Vertigo* 16(1). http://vertigo.revues.org/17249 ; DOI : 10.4000/vertigo.17249 (consulté 17/05/2016)

Kossoumna Liba'A N., 2018. Revue des expériences de reconnaissance et sécurisation foncière des communautés Nord Cameroun. Rapport projet LandCam, CED, RELUFA, IIED, UE.

Krätli S., Monimart M., Jalloh B., Swift J. & Hesse C., 2014. Accompagner la mobilité pastorale au Tchad: Construction d'un modèle innovant d'intervention pour le développement. *Afrique contemporaine* 249(1) : 69-82. doi:10.3917/afco.249.0069.

OCDE, 2014. Un atlas du Sahara-Sahel : géographie, économie et insécurité. Éditions OCDE, Paris.

Ondoua O.G., Moundjim B.E., Marindo J.C.M., Usongo L. & Williamson L., 2017. An Assessment of Poaching and wildlife trafficking in the Garamba-Bili-Chinko Transboundary Landscape. TRAFFIC Report.

République du Cameroun, 2011. Ministère de l'Élevage, des Pêches et des Industries Animales: Document de stratégie du sous-secteur élevage, pêche et industries animales du Cameroun.

République du Cameroun, 2017. Institut National de la Statistique. Annuaire statistique du Cameroun, Edition 2017. Chapitre 14: Élevage et pêche. UICN & CBLT, 2007. Plan de gestion de la plaine d'inondation de Waza Logone. Document produit dans le cadre des Projets Pilotes UICN-CBLT. UICN. Maroua, Cameroun.

Additional references

African Union, 2007. Report on the migrations of Mbororo nomadic pastoralists by the fact-finding mission dispatched to the DRC, CAR and Cameroon. African Union, Peace and security council, Addis Ababa, Ethiopia.

Agence Française de Développement, 2014. Sécuriser la mobilité pastorale au Sahel. Questions de développement : synthèse des études et recherches de l'AFD n°10, Paris.

Ankogui-Mpoko G-F. & Vircoulon T., 2018. La transhumance en Centrafrique : une analyse multidimensionnelle. Rapport du fonds Bekou, UE.

Barrier B., Weber J., Dury S., Hamadou O. & Seignobos C., 2003. Les enjeux du développement agricole dans le Grand Nord du Cameroun : 10 p.

Bénard C. & Guibert B., 2009. Sécuriser le pastoralisme pour préserver la paix. Almy Bahaim au Tchad oriental. IRAM, Agritchad, Burgeap, Agence Française de Développement.

Betabelet JR., Maïna Ababa AM. & Tidjani I., 2015. Élevage bovin et conflits en Centrafrique. *Les Cahiers d'Outre-Mer* 272 : 463-608.

Binot A., Joiris DV. & Hanon L., 2010. L'échec de la sécurisation foncière dans les aires protégées. *In* Bigombe-Logo P. &, Joiris DV. (Coord), *Gestion participative des forêts d'Afrique centrale*. Ed. QUAE, Collection Synthèse.

Bonnet B., Banzhaf M., Giraud PN. & Issa M., 2004. Analyse des impacts économiques, sociaux et environnementaux des projets d'hydraulique pastorale financé par l'AFD au Tchad. Rapport IRAM, Paris : 160 p.

Carayol R., 2017. En Afrique, le spectre d'un djihad peul. *Le Monde diplomatique* 758 (5) : 6.

Chauvin E. & Seignobos C., 2013. L'imbroglio centrafricain. État, rebelles et bandits. *Afrique contemporaine* 248 (4) : 119-148.

COMIFAC & GIZ, 2020. Construction d'un dialogue sur la transhumance dans le BSB Yamoussa, Tome I – IV. COMIFAC, GIZ, Yaoundé, Cameroun : 176 p.

Convers A., Chaibou I., Binot A., Dulieu D. 2008. La gestion de la transhumance dans la zone d'influence du parc régional du W par le programme Ecopas. *VertigO*, Hors-série 4. http://journals.openedition.org/vertigo/761 (consulté 17/09/2019)

De Bruijn M., 2018. La radicalisation, symptôme d'une crise de la jeunesse pastorale ? *Grain de sel,* n°73-74.

De Vries L., 2018., Navigating violence and exclusion: The Mbororo's claim to the Central African Republic's margins. Sociology of Development and Change Group, Wageningen University, Netherlands, Geoforum. https://doi.org/10.1016/j.geoforum.2018.03.014

Gonin A., 2016. Les éleveurs face à la territorialisation des brousses repenser le foncier pastoral en Afrique de l'ouest. *Annales de géographie* 2 (707).

Huchon J., 2009. La reconquête de l'espace pastoral comme solution à la pauvreté : les projets de restocking dans le Nord-Ouest du Kenya. *In* Duteurtre, G. & Faye, *Élevage : richesse des pauvres*. Éditions Quæ.

International Crisis Group, 2018. Tchad: désamorcer les tensions dans la bande sahélienne. Rapport Afrique 266.

International Crisis Group, 2017. Herders against Farmers: Nigeria's Expanding Deadly Conflict. Africa Report 252.

International Crisis Group, 2014. Afrique centrale : les défis sécuritaires du pastoralisme Rapport Afrique 215.

Kabelong B., 2013. Influences des activités anthropiques sur la ressource ligneuse dans la périphérie du Parc national de Waza. Mémoire Master professionnel en Sciences forestières. Université de Yaoundé I, Cameroun.

Kagoné H., Toutain B., Dulieu D., Houinato M., Boureima A., Nocker U., 2006. Pastoralisme et aires protégées en Afrique de l'Ouest : du conflit a la gestion concertée de la transhumance transfrontalière dans la région du parc régional W (Bénin, Burkina Faso, Niger). *Bulletin of Animal Health and Production in Africa* 54(1).

Lombard L., 2016b. Threat economies and armed conservation in north-eastern Central African Republic. *Geoforum* 69, 218–226. http://dx.doi.org/10.1016/j.geoforum.2015.08.010.

Luizza M., 2017. Le pastoralisme transhumant en Afrique centrale : nouveaux impacts sur la conservation et la sécurité. USFWS, Division de la conservation internationale, Rapport technique.

Ndiaye P., Lecomte P., 2016. La gestion durable des parcours dans le Sahel : Stratégies, Pratiques, Gouvernance et Promotion : note de cadrage. Projet régional d'appui à la transhumance au Sahel, PRAPS Coordination régionale.

Office International des Migrations, 2014. Les dimensions migratoires de la crise en République centrafricaine, considérations à court, moyen et long terme. Department of Operations and Emergencies Geneva, Switzerland.

République du Tchad, 2008. Ministère de l'élevage et des ressources animales. Plan National de Développement de l'Élevage 2009-2016.

Richard D., Alary V., Corniaux C., Duteurtre G., Lhoste P., 2019. Dynamique des élevages pastoraux et agropastoraux en Afrique intertropicale. Ed. Quæ, CTA, Presses agronomiques de Gembloux. Collection Agricultures tropicales en poche.

Schouten P. & Kalessop, SP., 2017. Laissez piller : l'économie politique des barrières routières en République centrafricaine. Danish Institute for International Studies, Anvers/Bangui.

Seignobos C., 2011. Le phénomène Zargina dans le Nord du Cameroun. *Afrique Contemporaine* 3 : 35–59. http://dx.doi.org/10.3917/afco.239.0035.

Seignobos C., 2010. Une négociation foncière introuvable ? L'exemple du Mayo-Rey dans le nord du Cameroun. *Annales de géographie* 676.

Sounon Kon'De ALS., Lesse P., Ickowicz A., Messad S., Houinato M. & Mensah G.A., 2019. Évolutions des systèmes d'élevage bovin au nord-ouest du Bénin. *Bulletin de la Recherche Agronomique du Bénin* (BRAB), Numéro Spécial Interdisciplinaire.

Tidjani I., 2015. Étude socio-anthropologique des populations pastorales de la République centrafricaine en lien avec la crise sécuritaire de 2013-2014. Catholic Relief Services, Bangui.

7

EXTRACTIVE INDUSTRIES AND PROTECTED AREAS IN CENTRAL AFRICA: FOR BETTER OR FOR WORSE?

Georges Belmond TCHOUMBA, Paolo TIBALDESCHI, Pablo IZQUIERDO, Annie-Claude NSOM ZAMO, Patrice BIGOMBE LOGO and Charles DOUMENGE
With contributions from: Pauwel DE WACHTER, Pierre Brice MAGANGA, Wolf Ekkehard WAITKUWAIT

The countries of Central Africa are distinguished by the abundance of both their biodiversity and natural resources, particularly minerals, gas and oil. This dual wealth could offer extraordinary opportunities for development if it is governed wisely and revenues are shared equitably (Maréchal, 2013). The economic growth and emergence plans drawn up by the States rely mainly on the exploitation of mineral resources. While mining and oil industries can be sources of employment (albeit generally modest) and wealth, they also can cause substantial environmental and socioeconomic damage (Carbonnier, 2013; Maréchal, 2013; Noiraud *et al.*, 2017; Chuhan-Pole *et al.*, 2020). However, this damage can be mitigated, and there also are potential opportunities for investments in biodiversity protection.

Countries in the subregion grew by an average of 5.8% between 2001-2012, compared to 3.0% between 1990-2000, enabling Central Africa to record the second highest growth rate in Africa over this period (BAD, 2013). This performance generated a surge of optimism regarding their economic development prospects. Unfortunately, the anticipated upturn was short-lived, with growth rates dropping to 1.1% in 2017, rising slightly to 2.2% in 2018 (BAD, 2019), only to be followed by the crisis induced by the Covid-19 pandemic that began in early 2020 (BAD, 2020). This weak performance is largely due to limited local processing capacities for raw materials, which are mostly exported unprocessed, thereby reducing the value added of these products. Similarly, fluctuations in the price of raw materials on the international market contribute to the vulnerability of economies based on the export of these raw materials, including minerals. Most of the major mining projects, particularly iron ore exploitation, also have not yet materialized due to the fall in ore prices on the international market, a phenomenon linked to increased iron production in other regions of the world.

At the same time, Central African countries shelter important and, in many ways, unique biodiversity (Billand, 2012; Maréchal *et al.*, 2014; Doumenge *et al.*, 2015). This biodiversity take a considerable part in national economies. For example, the forests of the Congo Basin contribute 18% of GDP in the Central African Republic (CAR) and 20% of foreign exchange earnings in Cameroon (Tieguhong & Ndoye, 2007). To ensure the *in situ* protection of this biodiversity, numerous protected areas were created, over which diverse and often antagonistic economic interests are now competing.

Protected areas contain not only a wealth of biodiversity, but also subsoil that can be important reservoirs of mineral resources (minerals, oil, and gas). These resources are coveted by multinational firms as well as small-scale prospectors. In Gabon, for example, the Gamba Complex of Protected Areas contains a wide diversity of habitats and species as well as the country's largest onshore oil reserves (Dallmeier *et al.*, 2006). Oil reserves also have been found in other protected areas, including Virunga National Park and Salonga National Park in the Democratic Republic of the Congo (DRC), two of the most important protected areas in Central Africa. Virunga hosts the richest biodiversity of all the protected areas in the subregion (Plumptre *et al.*, 2017), while Salonga is the largest forest park in Africa and one of the very first in the world.

In Cameroon – but this holds true in other countries as well – national strategies for the management of mining and forest resources show that sector-specific laws contain clear contradictions regarding forest land use (Schwartz *et al.*, 2012). Overlapping industrial mining claims, forest titles, and protected areas are common throughout Central Africa (Doumenge *et al.*, 2016; Noiraud *et al.*, 2017). Artisanal mining, such as gold panning and diamond mining, also is widespread throughout the subregion and occurs extensively in protected areas. While this activity is a source of income for local communities, it has significant impacts on forest cover and poses a threat to conservation (Messina & Feintrenie, 2014).

The activities of extractive industries are, a priori, incompatible with the conservation objectives assigned to protected areas. To exploit subsurface resources, the topsoil and all that it contains must be stripped away. Furthermore, the transportation of mineral commodities requires transportation infrastructure to be constructed, which also drives deforestation, forest fragmentation, land degradation and biodiversity loss. In light of the economic importance of extractive industries, but also the commitments made by States to protect biodiversity (as a global public good, to benefit from a healthy environment and to support their economic activities; Aveling, 2009), how can the socioeconomic imperatives facing governments be reconciled with environmental considerations? In other words, to what extent can the exploitation of mineral resources be combined with the vital need to safeguard the environment and society?

This is the core issue addressed by this chapter, and one which also involves the following questions:

- what is the current situation of oil and mining extractive industries in Central Africa?
- how and to what extent do they impact protected areas and natural ecosystems?
- how can a harmonious and mutually beneficial cohabitation be ensured between, on the one hand, the conservation of natural environments and their biodiversity and, on the other, the exploitation of mining resources, in the broadest sense of the term (minerals, oil and gas)?

1. Extractive industries, development and conservation

The mining, gas and oil potential of African countries in general, and those of Central Africa in particular, is very rich and varied (oil, copper, manganese, iron, diamond, cobalt, coltan, etc.). Mining in the subregion is benefiting from favorable conditions, notably the sustained rise in the prices of certain minerals and an explosion in demand from China, India and other emerging economies driven by their rapid growth.

Environmental impacts

Industries generate environmental and socioeconomic impacts that need to be characterized and managed. In terms of environmental impacts, one can distinguish:

– **direct impacts**, caused by the extraction activity and which occur at the same time and in the same place (degradation of plant cover, soil and groundwater pollution, etc., on the operating site);

– **indirect impacts**, caused by the extraction activity but which occur later or further away from the site (long distance pollution of the water table or atmosphere, decline in human health, dwindling wildlife, etc.). These impacts are nevertheless reasonably predictable;

– **cumulative impacts**, which result from the incremental impact of the extraction activity on top of past or present activities. They also are reasonably predictable;

– **major changes** in local economies, culture, infrastructure use, employment, or human migration that may be generated by extraction and transportation activities and which are more difficult to characterize and quantify. In particular, mining projects attract traders and a range of hunters and small-scale farmers and fuelwood producers, drawn by the increased availability of cash and opportunities arising from the food and fuelwood needs of the people living around the mine.

The exploration and extraction of oil, gas and minerals involve high levels of uncertainty with regard to the resources hidden below the ground, heavy initial investments and long exploration and project development phases. Extraction activities also require specialized techniques and significant investments. Consequently, the sector is dominated by large multinational companies with vertically integrated value chains. It is characterized by high profits that fluctuate according to international market prices and extraction costs.

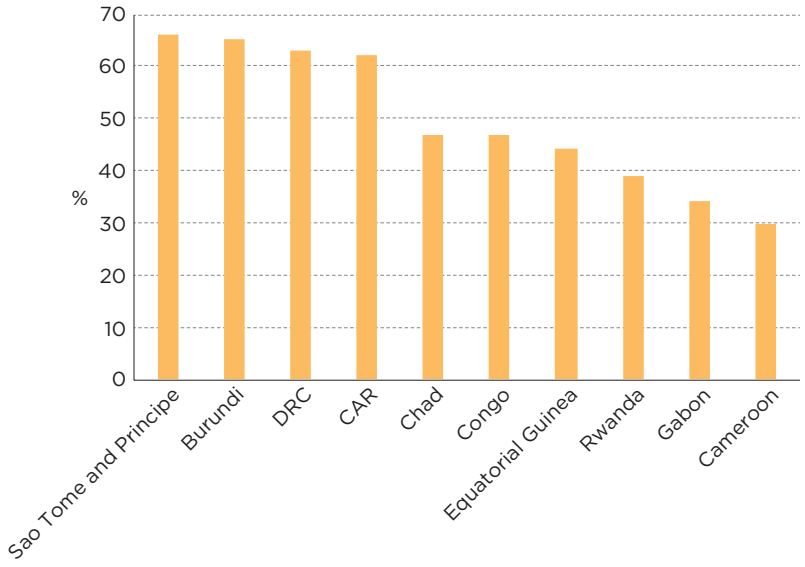
Given the importance of the sector to the continent, in 2009 the African Union adopted a general framework for the development of mining resources called the Africa Mining Vision (AMV), complemented in 2011 by an action plan (Union Africaine *et al.*, 2011). AMV recommends improving the conditions for negotiating mining contracts, paying more attention to the environment, and ensuring the best use of natural resources and the development of African skills. Unfortunately, the implementation of AMV at the national level has been slow to materialize. AMV remains insufficiently understood by governments, as well as the private sector and civil society, even though this action framework promotes the creation of local value and the fight against tax evasion (Ushie, 2017).

In contrast, an analysis of recently initiated reforms of mining codes in Central African countries indicates that the codes are oriented toward intensifying mining and oil exploration, reducing administrative procedures, increasing tax incentives and increasing the share of revenue going to the government. This approach neglects or slightly downplays the question of the impact of mining operations on the environment, as well as on the income and well-being of local communities and residents.

C. Rosellini emphasized as early as 2005 (p. 137), "The main issue for the oil-producing countries in Central Africa is the maximization of their oil resources for the development and well-being of the population". While some countries are able to make better use of their natural resource endowment, others have mediocre growth rates, despite their abundant underground wealth. The economies of Gabon, Congo, Equatorial Guinea, and DRC are largely based on extractive resources (85 to 95% of exports by value: OEC, 2020). While the top three have higher GDP per capita than other Central African countries (Figure 1), they do not always rank better than their neighbors in terms of poverty rates or the Inequality-adjusted Human Development Index (IHDI; Atlasocio, 2020a and b; Index Mundi, 2020e). DRC's economy is

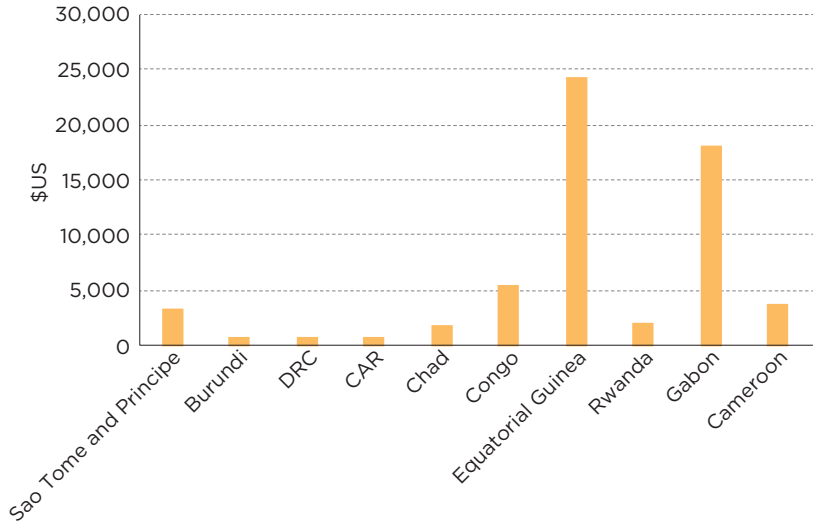
based largely on mining, but the country is one of the poorest in the world. Revenues from mineral resources frequently widen the gap between rich and poor (Noiraud *et al.*, 2017). This is what some authors have called the "curse of natural resources" (Sachs & Warner, 1995). In contrast, Cameroon, whose economy is not very dependent on mining or oil, and whose GDP per capita is lower than those of the three countries mentioned above, nevertheless has the lowest proportion of people living below the poverty line in the subregion. This is likely due to the greater diversification of its economy, a better distribution of national wealth and higher reinvestment in the country.

Figure 1 – Poverty and economic wealth in Central Africa



a) Percentage of total population below the national poverty line (2020)

Note: Of the 184 countries ranked, those in Central Africa are all among the 50 countries with the highest proportion of poor people in the world, including four in the top ten (Sao Tome and Principe, Burundi, DRC, CAR). Source: Index Mundi (2020e).



b) GDP/capita at purchasing power parity in current US$ (2017)

Note: Of the 197 countries ranked, CAR, Burundi and DRC are ranked 197, 196 and 195 respectively. Most of the countries in the subregion are among the 50 countries with the lowest GDP per capita in the world, except for Equatorial Guinea, Gabon and Congo. Source: Atlasocio (2020a).

Other authors contest the existence of this so-called "universal curse" of natural resources (Alexeev & Conrad, 2009; Brunnschweiler & Bulte, 2008; Davis & Tilton, 2005). A more detailed analysis of the phenomenon reveals certain factors, in particular historical, institutional and resource concentration (large deposits with high potential added value), which may or may not sustain this paradox of national wealth alongside substantial poverty (Philippot, 2009; Carbonnier, 2013; Tcheta-Bamba & Kodila-Tedika, 2018). The fact remains that many Central African countries, despite their extensive natural resources and surges in growth when oil and mineral prices rise, have not been able to convert their underground wealth into harmonious and sustainable development for their people.

The main causes are inadequate legislative and institutional frameworks, weak and poorly enforced environmental and social standards, a lack of transparency and governance principles, and a still incipient freedom of expression and debate. An additional factor is a propensity to favor very large mining projects over smaller ones (Hilson, 2019). Under these conditions, mineral resources cease to be a godsend and become a curse. Mineral exploitation can generate different types of negative externalities, including struggles to capture resource rents and political instability, rising costs of living, social dislocation, environmental pollution, pressure on other limited natural resources, and so on (Carbonnier, 2013; Noiraud *et al.*, 2017; Chuhan-Pole *et al.*, 2020).

Nonetheless, some twenty African countries have adopted the Extractive Industries Transparency Initiative (EITI) standards. This initiative aims to promote more inclusive, transparent and accountable management of mineral resources by improving governance systems, making information about mining and drilling available to the public and building greater trust among stakeholders. Although many improvements are still needed, EITI has led to some progress in transparency in the sector in Central Africa (Cameroon, Congo, DRC, Chad; ITIE, 2020a). The organization has praised Congo's recent progress in implementing the EITI standard for oil activities, including the establishment of an oil and gas cadastre system available on the internet (ITIE, 2020b; Ministère des Hydrocarbure, 2021).

Current mining codes incorporate environmental protection requirements by requiring prior environmental and social impact studies, as well as environmental and social management plans designed to mitigate and potentially repair the harmful effects of extractive industries. This is the case of Gabon, which revised its mining code extensively in 2019. Although it is considered to be more favorable to investors, it requires mining and oil companies to carry out an impact study approved by the two ministries concerned (the Ministry of Environmental Protection and Natural Resources, Forestry and the Sea and the Ministry of Mines and Industry) before any exploration or exploitation operation. The code also has instituted the requirement to contribute

1-5% of revenues to two funds to finance Corporate Social Responsibility (CSR) projects: the Industrial Responsibility Fund and the Social Responsibility Fund (DGT, 2020a).

One also should note that a number of financial institutions impose ecological requirements for the projects that they finance which go beyond national legal requirements (Equator Principles, International Finance Corporation (IFC) performance standards, etc.). When applied correctly, these requirements can reduce the ecological impact of mining projects. Certain standards emphasize the "no net loss of biodiversity" target. This requires biodiversity offsets but does not sufficiently take into account indirect and cumulative impacts of mining (which are often more significant than direct impacts).

Within the framework of these laws and standards, measures to avoid, reduce and offset impacts must be put in place to ensure that extractive activities are compatible with nature conservation requirements. At the political and institutional level, governments must ensure good cooperation and coordination between various public services (for example, the ministries in charge of mines, forests, the environment or agriculture). They also must build an operational synergy between government services, the private sector and any other stakeholder (in particular associations and Non Governmental Organizations - NGOs). For their part, extractive industry operators must implement the best operational practices compatible with the protection of nature and biological diversity.

Avoid – Reduce – Offset

Adapted from: Alligand *et al.* (2018)

In order to ensure that all activities and projects, whether these involve mining or, for example, infrastructure, are consistent with sustainable development principles and with the objective of causing no net loss of biodiversity, project holders and industrialists must implement the 'avoid-reduce-offset' sequence of actions.

1. Avoid: this consists of modifying a particular project or activity to remove a negative impact that the project or activity could generate. When the impacts are too great and the activity incompatible with sustainable development principles, the project may be cancelled.

2. Reduce: this consists of reducing a project's negative impacts on the environment, whether these impacts are permanent or temporary, take place in the present or future, or occur in exploration, installation or operational phases. Reduction measures can achieve several outcomes; they can reduce the impact's duration, intensity, scope, or a combination of these.

3. Offset: this consists of compensating for any significant direct or indirect negative effects generated by a project that could not be avoided or sufficiently reduced. Compensation measures must make it possible to preserve and, if possible, improve the quality of an environment. They include measures to restore degraded sites and compensate for residual damage to ensure, at a minimum, that there is no net loss of biodiversity. If possible, a net gain in biodiversity should be sought.

The order of the sequence also reflects a hierarchy: avoid > reduce > offset. Avoidance is the only action able to guarantee that an environment is not degraded; it must be promoted and applied from the earliest stages of project preparation, and can lead to the cancellation of a project. Impact reduction measures then should be implemented over the entire duration of a project. Offsetting, on the other hand, should only be used as a last resort, when all impacts that could not be avoided or sufficiently reduced must be remedied.

Despite some advances, progress in this area remains too sluggish (Noiraud *et al.*, 2017; Ushie, 2017). Governments and private companies are delaying changes in their practices and civil society is struggling to make its voice heard. In Central Africa, mining and oil exploitation is not yet an engine for sustainable development.

Some mining claims – for exploration and exploitation – are located on the outskirts of protected areas or encroach on their boundaries. They simultaneously represent a major source of multiple threats to the environment and a powerful lever for socioeconomic development. The risks and impacts of extractive industries on a protected area are linked to the relative location of the extractive activity, namely within the protected area or on its outskirts.

When extractive industries set up near protected areas, they generate many environmental and social impacts directly related to extraction and transportation activities (deforestation, soil degradation, pollution, etc.; Noiraud *et al.*, 2017). Indirect impacts also develop due to a significant influx of job seekers and their families and people attracted by the increased cash flows circulating around the mines. This invariably leads to increased poaching and cutting of wood for construction timber and charcoal production, as well as an extension of areas used for agriculture (Noiraud *et al.*, 2017; Voundi *et al.*, 2019).

The most drastic impact is related to the direct degradation or even downgrading of protected areas due to an overlap with exploration or mining claims (Qin *et al.*, 2019). In all countries of the subregion, the ministries in charge of mines and energy and the mining companies – which are multi-million-dollar enterprises – have much greater clout in negotiations than the ministries responsible for the environment and protected areas, not to mention civil society. In addition, struggles over power and turf between departments lead to anarchic and uncoordinated decision-making between the various ministries. To be convinced of this, one need only listen to a former DRC Minister of Mines, who stated loudly and clearly, "The law allows us to explore in any part of the country" (De Souza, 2019). This translates into decisions to overlap land uses that can lead to land use conflicts, usually to the detriment of local actors and ecological balances (Doumenge *et al.*, 2016; Noiraud *et al.*, 2017).

When governments must make a decision, this falls most often in favor of mining and oil extraction rather than protecting biodiversity and the provision of ecosystem services, even for protected areas listed as World Heritage sites (Qin *et al.*, 2019). In some cases, biodiversity is damaged, or a protected area loses part of its territory; in other cases, the protected area is simply downgraded outright (Rabanal *et al.*, 2010; Edwards *et al.*, 2014).

Against a backdrop of neoliberal capitalism, biodiversity conservation often is considered subordinate to its exploitation, and biodiversity conservation is not considered to be a sustainable development pillar on par with the economic and social pillars (MacKenzie *et al.*, 2017). While a shift in the balance has been initiated through mechanisms such as AMV, EITI standards and the Equator Principles, this remains insufficient. Incoherent public policies, a lack of transparency and corruption often favor opaque decision-making by the departments in charge of mines and energy.

In a country like DRC, the industrial mining sector has become slightly more transparent with, in particular, the introduction of a mining cadastre system accessible on the internet (Cadastre minier, 2020), but the oil sector remains very opaque. This is demonstrated by the pressures on Salonga and Virunga National Parks (Mupfuni & Malungu, 2018; De Souza, 2019; Qin *et al.*, 2019). The case of Virunga National Park is a good illustration. In the late 2000s, the Congolese government awarded production-sharing contracts to oil companies (Total, Soco), covering a large part of the park's area. After intense campaigning by national and international NGOs and organizations such as UNESCO (United Nations Educational, Scientific and Cultural Organization), Total rapidly withdrew from the project, and Soco eventually announced that it would stop operations in June 2014. However, it recently was reported that the Congolese government signed a tentative agreement to reallocate Soco's license to another oil company.

Case studies like that of Virunga Park show that international extractive companies and governments can be influenced by NGO campaigns and pressure from international bodies (such as the World Bank or UNESCO). However, in the absence of transparent

and coherent multisectoral policies, the actors with the least amount of financial and human capital, and the economic sectors which are the weakest, remain under intense pressure from private political and financial interests. Against this backdrop, protected areas continue to be subjected to strong recurring pressures, even when they are critically important to national networks, both in terms of biodiversity protection and ecosystem services provided to human populations (Qin *et al.*, 2019).

Nevertheless, it has sometimes been possible to achieve a balance, at least in part, between oil exploitation, local development and conservation. In particular, the identification of key elements of biodiversity and the implementation of monitoring systems make it possible to minimize certain impacts of exploitation operations. This is the case with Shell Gabon's oil operations from the 1960s until 2017 in the Gamba Complex of Protected Areas (Dallmeier *et al.*, 2006). With support from organizations such as the Smithsonian Institution, Shell developed a biodiversity action plan that identified particularly important or vulnerable habitats and priority species, and described how to manage impacts and risks related to biodiversity. This plan was integrated into Shell Gabon's environmental management system and translated into operational procedures. These procedures included, among other measures, reducing the width and number of roads built, stricter speed controls on these roads, limiting the size of rigs and favoring the use of existing rigs in drilling operations, and banning hunting, fishing and the transportation of game meat and weapons (Moussotsi Ikapi, 2016). However, as Shell Gabon has now handed over its shares in the onshore operation to Assala Energy (Shell, 2017), all of these gains could be lost if Assala Energy's environmental policy does not sufficiently embrace this legacy. Assala Energy's website is notably silent with regard to environmental standards (Assala Energy, 2021).

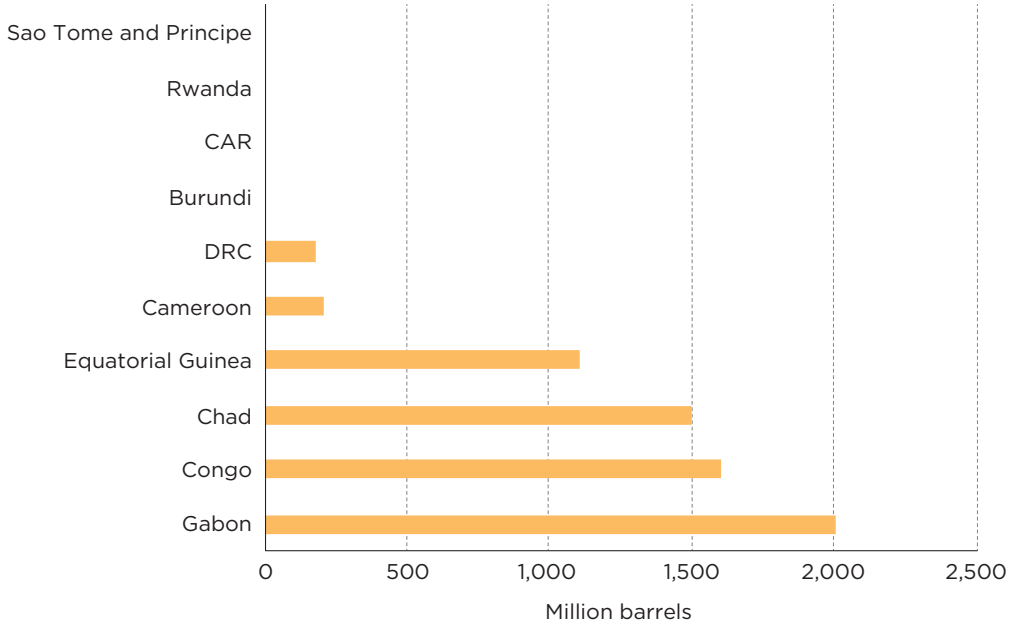
When energy or mining projects cause substantial environmental impacts, compensatory measures also can be implemented to mitigate these impacts. This is the case, for example, in Cameroon, where the construction of the oil pipeline between Chad and Cameroon led to the destruction of vast areas of forest along the path of the pipeline. Two national parks, Mbam and Djerem and Campo-Ma'an (the latter including a former wildlife reserve), were established to compensate for this damage.

2. The specific situation of certain mineral resources in Central Africa

2.1 Oil

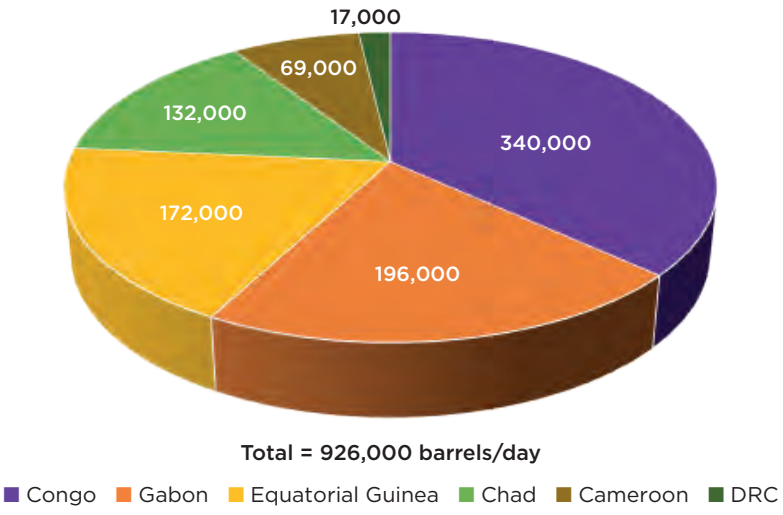
Central Africa is located in the Gulf of Guinea oil arc. With 6.58 billion barrels of proven oil reserves in 2020 (Figure 2a; Index Mundi, 2020a), the area is one of the oil-producing powerhouses in sub-Saharan Africa, ranking third behind Nigeria and Angola, with an output of 926,000 barrels/day (Figure 2b). The Central African Economic and Monetary Community (CEMAC) estimated oil production at 45.9 million tons in 2019 (Mbadi, 2020), including 17.4 million tons for Congo (about 37%), 10.9 for Gabon, 8.2 for Equatorial Guinea, and 6.7 for Chad (BP, 2020).

Figure 2 – Oil reserves and production in Central Africa



a) Proven reserves of crude oil (2020)

Source: Index Mundi (2020a).



b) Oil production (2019)

Source: Index Mundi (2020b).

The economies of several countries in the subregion are heavily dependent on oil resources. For example, crude oil exports in 2019 accounted for 67.5% of Gabon's total exports, 73.6% of those of Chad, 64.1% of Congo, 68.5% of Equatorial Guinea, and 38.3% of Cameroon (OEC, 2020). In 2020, the crisis triggered by the coronavirus epidemic led to a drop in prices that may prove to be catastrophic for growth and government revenues, although the decrease in government revenues could be offset, at least in part, by increased production (Mbadi, 2020). Although prices have been rising since the end of November 2020, pointing to a better year in 2021, they remain relatively unstable, dependent on both the recovery of the global economy and negotiations between producing countries (Aufrand, 2021).

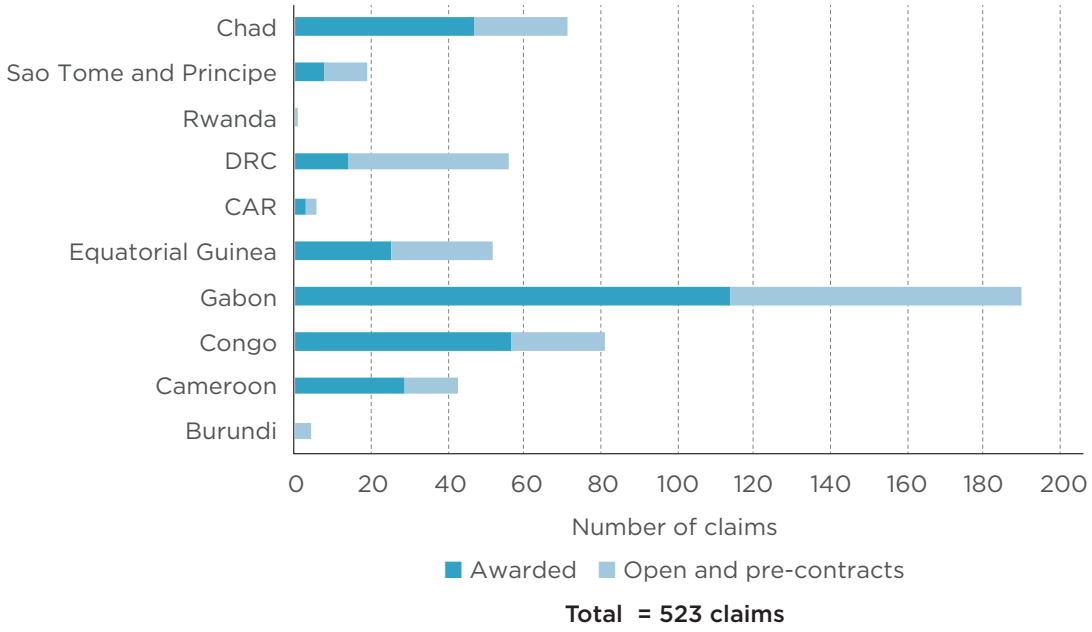
Across all of Central Africa, the oil and gas claims that have been granted or are open and in the process of being contracted amount to approximately 520 claims, and currently cover nearly 2,590,000 km^2 (Figure 3). These numbers refer mainly to oil (and oil and gas) claims, with gas-only claims representing a very small minority. Of this total, almost 297 claims have been awarded that cover an area of almost 920,000 km^2. Many awarded claims are in the exploration phase, and most of the claims in the exploitation phase are offshore.

With the notable exception of Chad, a landlocked country, and a few onshore fields in Gabon, most of the oil produced in Central Africa comes from offshore reserves. The oil is relatively easy to produce and safe from potential security issues, unlike oil produced onshore. Offshore production has the advantage of limiting potentially conflictual interactions between companies and local communities, allowing production to be protected from social and civil unrest. In the Congo, for example, oil production was not affected by the 1997-1999 civil war because the fields were located offshore, far from the conflict zones.

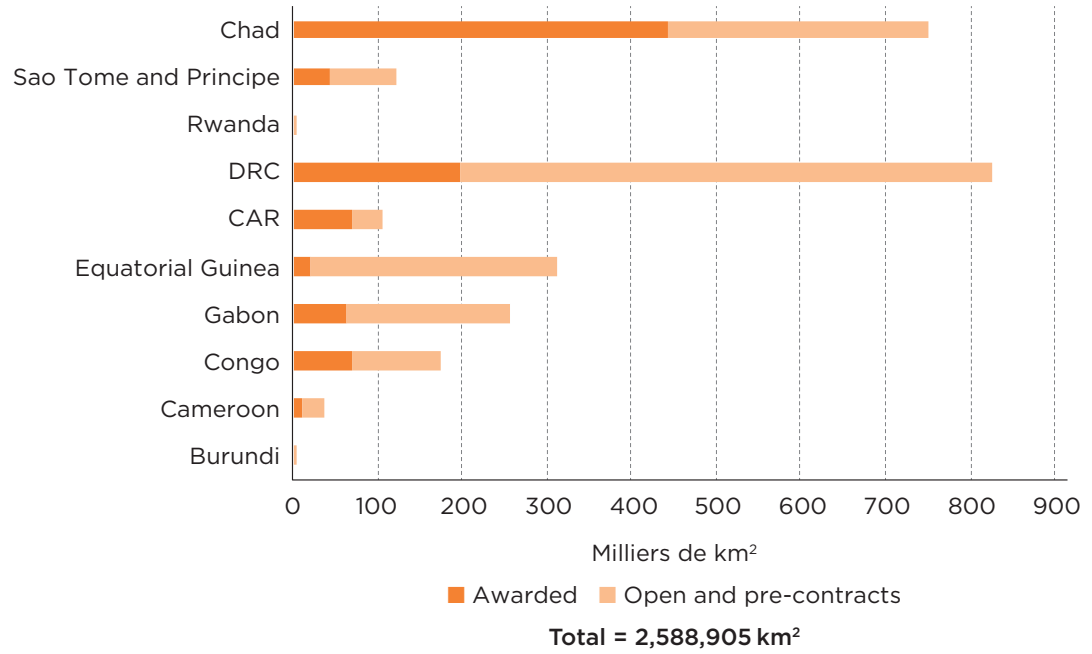
Thus far, this oil operations setup has limited interactions with protected areas. However, two new elements should be considered. First, in 2017 Gabon created the largest network of marine reserves in Africa, covering more than 50,000 km^2 (UNEP-WCMC & IUCN, 2020). This suggests that there will be significant interactions in the future between protected areas and oil exploitation, due to both the existing, largely offshore activity and new, recently identified marine deposits (Mbadinga, 2018). The current or foreseeable impacts of these extractive activities must be controlled and reduced as much as possible (pollution and traffic, in particular).

The second element to bear in mind is that the relatively limited nature of onshore oil exploitation

Figure 3 - Oil and gas claims awarded or open and under contract in Central Africa (2020)



a) Number of claims per country



b) Surface area by country

Awarded: operated (exploration and exploitation); Open and pre-contracts: under negotiation, pre-award, application, open. Source: WWF-SIGHT

activity could change overnight with the discovery and development of oil fields in the Central Congo Basin, either in Congo or in DRC. In Congo, two oil companies have reported the characteristics of the first onshore deposit discovered in the Cuvette region, situated in the north of the country, which could allow a fourfold increase in national production (Anon., 2020a).

Despite its economic importance, the oil industry in Central Africa has had only a limited impact on other sectors (Carbonnier, 2013). The management of oil revenues still lacks transparency, despite some sporadic

progress in relation to EITI (ITIE, 2020a and b). Foreign companies are driving oil operations through a framework of concession and production-sharing contracts established with the States.

States in the subregion seem increasing aware that it would be in their interest to diversify their partners. This diversification could be a way to access better dividends through competition between oil operators. Furthermore, it allows countries to escape from a quasi-monopolistic situation that has to date benefited their traditional partners. This is partly the basis for the relationships that are developing with new countries, especially with BRICS (Brazil, Russia, India, China and South Africa).

The sector has been experiencing extensive upheaval for several years, with legislative changes and, in some cases, the replacement of major traditional companies – and industry leaders – by other, medium-sized operators or by Asian state-owned companies or their subsidiaries (Augé, 2018; DGT, 2020b; Le Bec, 2020b). These oil companies are constantly adapting their portfolio of exploitable reserves by focusing on high-value areas and reducing operating costs. These costs are higher offshore than onshore, which could herald a major shift in exploitation on the continent depending on price levels, oil deposits, and political and security situations.

Medium-sized companies often operate with limited budgets and may not be very sensitive to environmental issues (Le Bec, 2020a). States will therefore have a decisive role to play in regard to both these social and environmental subjects and global energy strategies. This is the case in Gabon, for example, where the industry heavyweights Total and Shell have been replaced by two medium-sized companies, Perenco and Assala Energy; in a few years, these two may become the largest oil producers in the country (Le Bec, 2020a and b). However, these companies are not very transparent and are much less concerned about social and environmental issues than top tier companies. Tensions are still running high between supporters of unbridled exploitation of natural resources and those advocating for economic diversification and the sustainable development of the country. However, the transition initiated by some of the major companies, reinforced by the crisis induced by the Covid-19 pandemic, may offer opportunities for agreements between stakeholders and encourage the evolution of these medium-sized companies (reduction of their production, reduction of their environmental footprint, transition to renewable energy; Marot, 2020).

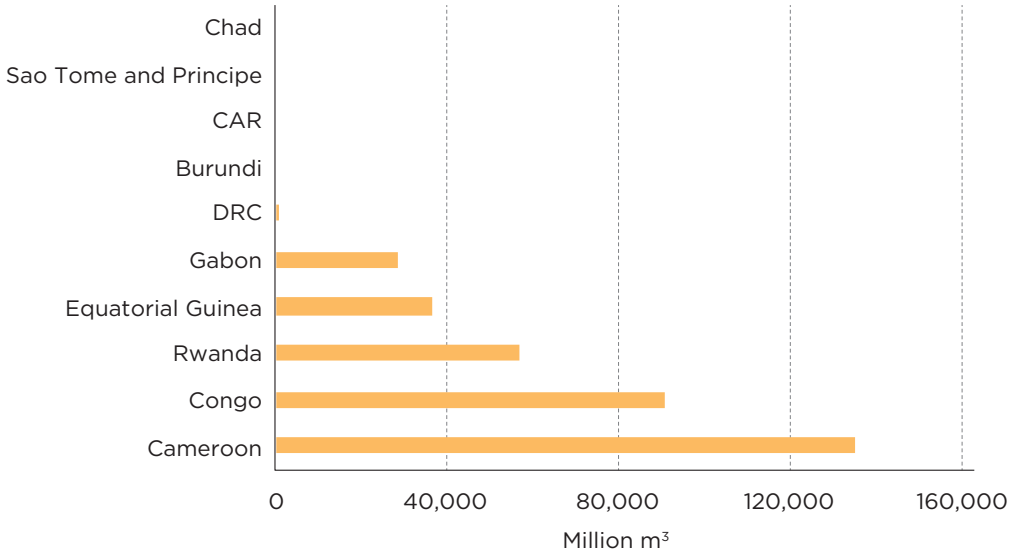
2.2 Natural gas

The countries of Central Africa have a long coastline. As with oil, the offshore exploitation of natural gas has allowed impacts on terrestrial ecosystems and protected areas to be limited; its impact on marine protected areas needs to be studied.

Natural gas reserves in the subregion were estimated to be equal to 348.5 billion m^3 in 2020 (Figure 4a; Index Mundi, 2020c). Production was 8.8 billion m^3 in 2019 (Figure 4b; Index Mundi, 2020d). Equatorial Guinea is the main producer of natural gas, with production of about 6.1-6.6 million m^3 depending on the source (70% of the regional total), or 21,000 barrels/day of Liquefied Natural Gas (LNG) in 2019 (Index Mundi, 2020d; BP, 2020).

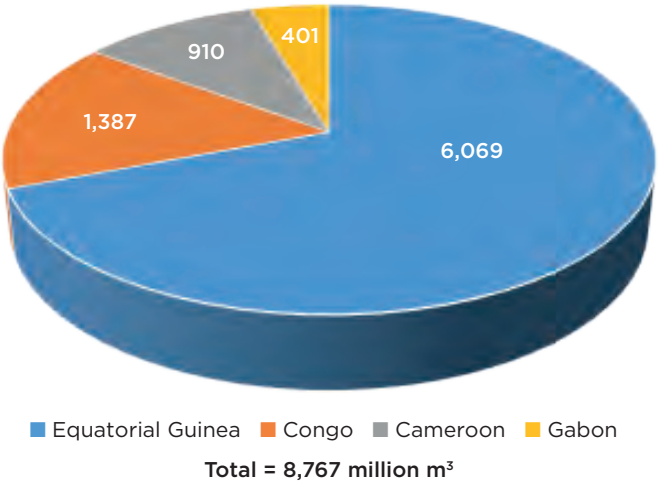
Production and the discovery of new oil fields in Equatorial Guinea are unlikely to offset the reduced natural output from wells, which has been declining since the late 2000s (BP, 2020). However, the contribution of natural gas exploitation to the country's hydrocarbon production is greater than in the past. Gas sales account for about 20% of Equatorial Guinea's export revenues (OEC, 2020). Gas, in addition to oil, should be able to maintain the country's attractiveness and its strategic position in the race for energy supplies. However, the development of this activity is severely hampered by a lack of infrastructure and technology, as is true elsewhere in the region. Equatorial Guinea is now working to develop its entire petrochemical value chain, and is collaborating with the private sector to create a highly developed and vertically integrated domestic industry. In March 2014, construction began on an offshore gas compression platform located 32 km north of Bioko Island, on the Alba B331 field. The American company Noble Energy intends to start an offshore LNG project in 2021, which includes the construction of a 65 km long pipeline (De Souza, 2020 and 2021). The country also is developing multiple partnerships and contacts in this field with Central African and West African countries with the aim of creating a regional Gulf of Guinea gas company.

Figure 4 – Gas reserves and production in Central Africa



a) Proven natural gas reserves (2020)

Source: Index Mundi (2020c)



Total = 8,767 million m³

b) Gas production (millions of m³/year; 2019)

Source: Index Mundi (2020d)

Congo produced about 7,000 barrels/day of LNG in 2019 (BP, 2020). The country's proven natural gas reserves are the fifth largest in sub-Saharan Africa. However, a lack of infrastructure and appropriate technologies is affecting commercialization. A small part of the gas generated by oil production is transformed into LPG (Liquefied Petroleum Gas), but most continues to be reinjected into oil wells, flared or dissipated into the atmosphere, as is still too often the case in many countries.

In Cameroon, a gas reserve was discovered in the Rio del Rey offshore basin, not far from Bakassi Peninsula. Cameroon began exporting LNG in 2018, but LNG and LPG production also supplies the domestic market for the sale of home gas cylinders to the general public. The country's priority now is to supply the local market with gas to meet domestic demand. The *Société Nationale des Hydrocarbures* (SNH) also supplies natural gas to the Kribi thermal power plant for electricity generation (Anon., 2019a). The increase in local LPG supply will be accompanied by a reduction in the substantial government subsidies in the energy sector. A new gas code was enacted in 2012 to promote this sector and facilitate this project.

Gabon announced in mid-2013 a promising discovery of gas condensates (a liquid mixture of hydrocarbons) during its first ultra-deep exploratory drilling on the Diaba exploration permit. Ninety percent of the gas produced during the oil operations is flared, vented or reinjected into the oil extraction wells. Natural gas resources currently are exploited by Perenco on two fields, Ganga and Ozangue, which supply the thermal power plants of Libreville and Port-Gentil (DGT, 2020b). The company recently reiterated its commitment to further develop the gas sector in the country; facilities for LPG production serving the domestic market are expected to be built in *Ogooué Maritime* province (Ngoma, 2020).

Lastly, Rwanda's intention to enter this production sector should be noted, with an agreement signed in 2019 between Gasmeth Energy and the Rwandan government for the recovery of methane from Lake Kivu. This agreement includes the construction of a gas extraction, processing and compression plant (De Souza, 2021). This operation will make it possible to secure the shores of the lake by preventing the formation of toxic gas bubbles. Most importantly, it will provide domestic gas for cooking, reducing dependence on wood and charcoal in the most densely populated region in Africa.

2.3 Minerals

2.3.1 General presentation of the sector

Central Africa has extensive and varied mineral resources (copper, cobalt, manganese, nickel, iron, uranium, gold, lead, zinc, diamonds, rutile, barite, rare earths) and non-mineral resources (precious stones, phosphates and coal). Unlike oil, whose potential resources are linked to large sedimentary basins, most of the subregion's mineral resources are located in ancient Archean and Proterozoic land forming a broad halo surrounding the Central Congo Basin (Milesi *et al.*, 2006; Edwards *et al.*, 2014; Noiraud *et al.*, 2017). Some large mining areas stand out from the rest, such as the Katanga copper belt in southern DRC, large diamond-rich areas in CAR and southern DRC, very rich iron deposits on the border between Cameroon, Gabon and Congo, and an extensive swathe of land in eastern DRC with an abundance of tin and various minerals.

For most countries in the subregion, developing the mining industry is a national priority. However, this sector is not represented in the exports of Sao Tome and Principe or Equatorial Guinea, and Cameroon only exports some gold and refined aluminum, which contribute 9% and 2% of exports respectively (OEC, 2020). The mining sector accounts for 20-30% percent of exports from Gabon, Chad, Congo, and CAR (20%, 21%, 25%, and almost 29% of exports by value, respectively; OEC, 2020), but the nature of the sector varies from country to country: manganese mining and processing in Gabon; gold mining in Chad and CAR, as well as diamonds in CAR (with a high proportion of quality gems); and copper mining and processing in Congo, which inaugurated a polymetal refining plant in 2019 (Kombo, 2021).

Nevertheless, DRC is "the" mining country in the region. The mining sector contributed 91% of the country's total exports in 2019, chiefly copper and cobalt, but also many other minerals in addition to diamonds (mainly for industrial use) and gold; the

latter two productions constitute 3.5% of official exports in value (OEC, 2020). Finally, mineral exports account for just over 45% and 55% of Rwanda's and Burundi's exports, respectively, mostly gold but also other minerals (niobium, tantalum, vanadium, tin, tungsten, etc., accounting for about 10% of exports).

These figures demonstrate, if proof were needed, the importance of the mining sector and the national and international stakes involved. The sector is strongly influenced by global economic and geostrategic issues due to the involvement of large international companies and the supply needs of major economic powers that influence the markets. This raises questions about the provenance of Burundi and Rwanda's mining output, which is likely to be partly – or in some cases largely – sourced from DRC (Noiraud *et al.*, 2017); much of the exploitation of gold and coltan, for example, is informal and illegal (Lopez *et al.*, 2017; Smith, 2020).

Mining in Central Africa is carried out on both an industrial scale, through large multinational companies, and an artisanal scale (Noiraud *et al.*, 2017). For example, approximately 12 million people are estimated to be involved in artisanal mining and exploration in Africa. Their total number in Central Africa is not known precisely, but depending on the source, it is estimated that there are between 1.5 and several million diggers in DRC alone, and approximately 50,000 in CAR (AMDC, 2017; DGT, 2020d). These figures remain very approximate due to the difficulties involved in counting these people, who often live in isolated territories and/or outside the law; this is, for example, largely the case in North and South Kivu, in eastern DRC (De Failly, 2013). In some regions, these small-scale diggers increasingly are being joined by Korean, Chinese, or national entrepreneurs with some capital, who practice semi-mechanized, "semi-industrial" exploitation (as is the case in eastern Cameroon; Voundi *et al.*, 2019).

Gold, diamonds, tin, tantalum (coltan), and other such minerals are mainly exploited by artisanal miners because this type of exploitation does not require large investments or infrastructure. This is the case for gold mining, which has developed considerably in the Tri-national Dja-Odzala-Minkebe (TRIDOM) area on the borders of Congo, Gabon and Cameroon, which also contains extensive reserves of excellent quality iron. Most of these artisanal miners have had little or no education, and barely make a living from the activity. They often are poorly or not at all organized, and do not hold mining titles (De Failly, 2013).

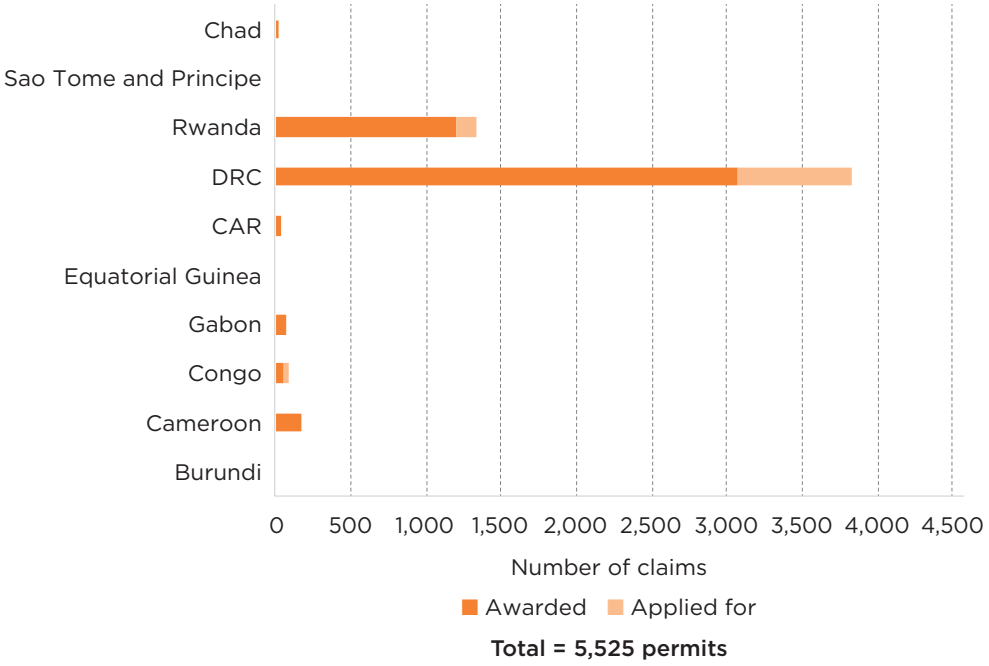
Consequently, the sector is falling prey to urban elites with little concern for social or environmental impacts, and even to armed groups who view mining as an easy way to obtain funds to buy weapons. In many cases, and in the absence of effective rule of law, the mining sector is too often "shaped by smuggling" (Lopez *et al.*, 2017; Smith, 2020). All of this has harmful effects on the environment, including on endangered species such as gorillas (Boekhout van Solinge, 2008). Moreover, this situation leads to numerous human rights abuses, such as child labor, forced labor and sexual abuse (Reed & Miranda, 2007; HCDH, 2010; De Failly, 2013; Edwards *et al.*, 2014; AMDC, 2017). Eastern DRC has been the scene of slavery-like practices, rape, and mass killings for several decades in connection with the exploitation of coltan and other mineral ores. The electronics industry has an unquenchable thirst for these ores, which are used in our cell phones and miniaturized electronic devices (Sutherland, 2011; Anon., 2020b).

2.3.2 Brief overview of mining

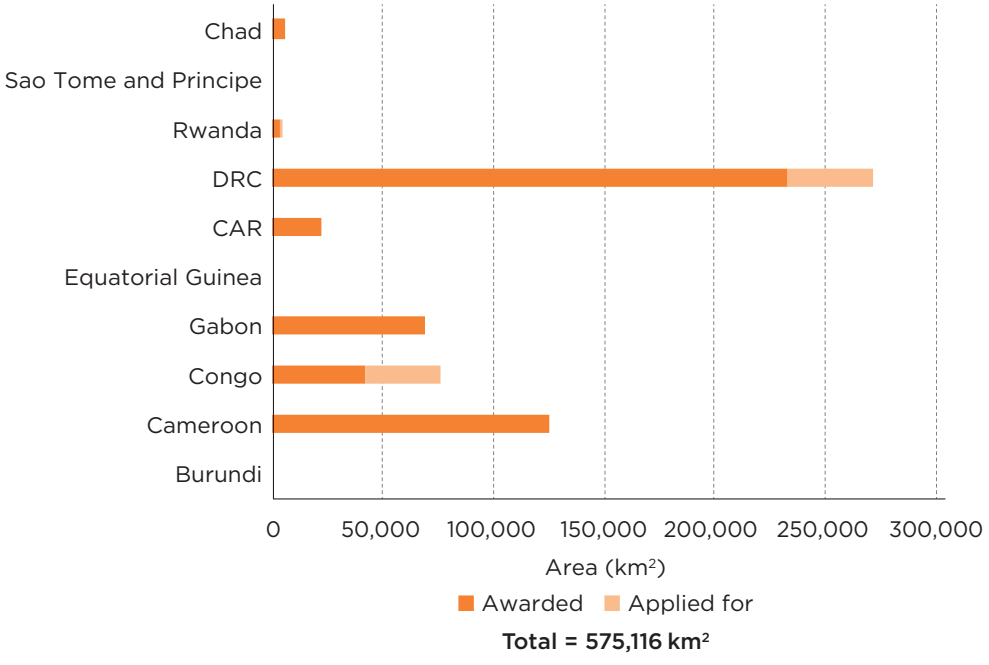
Across all of Central Africa, the mining claims that have been granted or applied for currently occupy slightly over 10% of the land surface, or more than 575,000 km^2, for a total of over 5,500 permits. At present, the majority are claims that have been granted, with nearly 4,600 claims covering more than 502,000 km^2 (Figure 5). Naturally, the situation varies greatly from one country to another; DRC is unsurprisingly in the lead with more than 3,800 permits covering over 270,000 km^2. Rwanda, second in terms of the number of permits (over 1,300), has the smallest surface area allocated (approximately 4,300 km^2), which is due to the small size of the country. In contrast, Cameroon is second in terms of area covered by granted claims, but has only issued 165 permits for an area exceeding 125,000 km^2.

The mining industry forms the core of DRC's economy (DGT, 2020e). Its industrial mining sector is the oldest and most developed in the subregion, contributing nearly 21% to the national budget and 17.8% to GDP in 2016 (DRC & World Bank, 2016).

Figure 5 – Mining claims granted and applied for in Central Africa (2020)



a) Number of claims per country



b) Surface area by country

Source: WWF-SIGHT

Despite this long history, the overall mineral potential of DRC is not well known (Hund *et al.*, 2013). Available information indicates a serious potential for gold, iron, diamonds, potassium, manganese, phosphate and oil sands, lithium, uranium, etc. Industrial production of copper and cobalt is sourced from the copper belt in the southeast of the country. This production is significant, with DRC the fifth largest producer of copper and the top producer of cobalt in the world. The industrial mining sector is dominated heavily by Chinese companies; Gécamines, the main Congolese player, is no longer a mining operator but owns shares in many foreign-owned companies (DGT, 2020d). The two main challenges facing

operators are electricity shortages and the dilapidated state of land infrastructure, which severely limits the transportation of mining commodities (DGT, 2020c). In addition, mining companies are sometimes forced to suspend operations due to volatile security situations in some regions (Anon., 2019b).

It should be noted that gold and certain minerals such as coltan are mainly mined in an artisanal manner in DRC. In fact, many of these minerals are mined illegally and leave the country without being accounted for and without the miners paying the government taxes on them (DGT, 2020d; Smith, 2020). The high level of exports of gold and some minerals from Burundi, Rwanda and Uganda owe much to DRC. In the case of Rwanda, the country has put in place a land use planning and cadastral system that has made it possible to legalize and organize mining much more efficiently compared to other countries in the subregion (Warnest *et al.*, 2012; Lehman *et al.*, 2017). The large number of registered permits, relative to the small size of the country, is indicative of this (see Figure 3a).

Gabon also has been recognized as a mining country for about half a century. The country is located in the "heart of the Congo Craton", and has exploited industrial deposits of uranium and manganese for decades. It also has extensive iron and gold deposits. Growing demand for non-renewable mineral resources is one of the greatest threats to sustainable development. However, this trend is affected by the instability of prices on the world market. The prices of certain minerals such as iron indeed have fallen drastically since 2009 (Anon., 2014). Consequently, many exploration projects begun in 2005 in Gabon, Congo and Cameroon following an upturn in global iron prices ultimately were not implemented.

In Congo, vast potash deposits have been under study for several years (Kouilou region, on the country's Atlantic coast). They have shown great potential and a high return on investment, and exploitation could begin soon (Caslin, 2018). These deposits will undoubtedly lead to heavy environmental impacts in southern Congo. Quite recently, semi-industrial gold mining by Chinese operators has developed very rapidly in the Congo section of the TRIDOM interzone, causing considerable environmental impacts (water pollution) and presenting strong competition to artisanal gold miners (Noiraud *et al.*, 2017).

3. Are extractive industries a danger for protected areas and biodiversity conservation?

3.1 Pressure from extractive industries on protected areas

Many oil and mining, industrial, semi-industrial and/or artisanal operations are located near or straddle protected areas. When operating, these mining and oil claims put considerable pressure on natural resources within and near protected areas.

By their very nature, mining operations cause significant direct damage to the environment through soil stripping and the chemical pollution of soils and waterways, destroying aquatic biodiversity in the process (Noiraud *et al.*, 2017; Voundi *et al.*, 2019). These activities also are likely to damage human and animal health through heavy metal pollution, as is the case in Katanga, DRC (Kahilu Mutshma *et al.*, 2015; Mateso, 2016). All of these risks and damage could be mitigated if laws governing mining and rules of good governance were strictly enforced. Unfortunately, the mining sector in many Central African countries is plagued by institutions which have been subverted to serve the elites, corruption, a lack of transparency, poor revenue redistribution and low societal participation (Philippot, 2009).

One should note that with regard to the impact of extractive industries on protected areas, the construction of mineral transportation infrastructure (mining sites, roads, railroads, pipelines, etc.), and migratory flows involving workers, job seekers and their families, generally exert tremendous pressure on natural resources (deforestation, poaching, etc.) that surpasses the direct impact of the exploitation itself (Reed & Miranda, 2007; Noiraud *et al.*, 2017). Hunting pressure is mainly focused on protected areas because they remain wildlife reservoirs and they are not, for many reasons, always managed effectively.

As mentioned earlier, mining projects attract poor populations. These communities generally do not benefit from the mining projects; they are there to feed and supply mining centers and camps with various materials such as hunting meat, charcoal and various forest products. All of this generally results in a degradation of living conditions and the environment (Voundi *et al.*, 2019; Chuhan-Pole *et al.*, 2020).

Numerous NGO reports and scientific studies also denounce the human rights violations associated with mining (HCDH, 2010; CREF, 2015). The mining sector has been known to have close links to armed groups and accept practices of enslavement and pauperization when the interests of a few key actors are at stake. Gold mining and coltan exploitation in eastern DRC are clear examples (Le Billon & Hocquard, 2007). Human misery and insecurity are two essential ingredients for the uncontrolled exploitation of natural resources, including biodiversity. Protected areas are paying the price.

Under these conditions, if governments strengthen protected area conservation and management measures, and mining operators implement environmental and social management plans effectively and efficiently, the effects of these multiple pressures can be mitigated. However, there remains significant room for improvement in the systematic implementation of environmental impact assessments and the application of the avoid-reduce-offset sequence at all stages of mining projects (Cigorogo *et al.*, 2020). The mining sector still generates significant environmental and social impacts that could be avoided or minimized.

3.2 Land use planning in question

The problem posed by claims granted to extractive industries that overlap protected areas reflects the pre-eminence of one land use over another. It is primarily a land use planning issue (Doumenge *et al.*, 2016). Unfortunately, few Central African countries have implemented or plan to develop an integrated, participatory, transparent approach to spatial planning and land use. Constrained by a small geographic area and a very large population, Rwanda implemented a land tenure legalization system and a land use plan that were mainly intended to strengthen social peace and promote agricultural production (Ali *et al.*, 2014; Chigbu *et al.*, 2019; RNRA, 2020). However, the plan also made it possible to safeguard areas dedicated to biodiversity protection. Other countries, such as DRC, Cameroon and Gabon, have indicated an intention to implement land use plans, but the process of preparing these plans has barely begun.

Land use decisions involve weighing the value of biodiversity and the ecosystem services that biodiversity provides against the economic value of extractive activities. On the one hand, the importance of biodiversity and forests are rarely recognized and are systematically underestimated, including their contribution to maintaining ecological balances, combating climate change, the survival of the poorest and employment (see, for example, chapters 9 and 10 of this book). On the other hand, the large sums of money involved in large oil and mining projects are emphasized, although the social benefits delivered by multinationals often are not – or at least very inadequately – commensurate with the taxes and revenues they pay to States (Kolk & Lenfant, 2010; Noiraud *et al.*, 2017). In the vast majority of cases, mining revenues remain concentrated in just a few hands and the sector does not promote the development of diversified and stable economies, stifling in advance any attempt to develop a sustainable biodiversity economy.

All this creates an imbalance in decision-making that harms biodiversity and protected areas as well as rural communities. Given the economic importance of the extractive industries and the significant financial returns they can generate for companies, governments and certain political and administrative elites, protected areas run a high risk of being downgraded in favor of industry. This is all the more likely because protected areas are often perceived, by both governments and rural communities, as a constraint. Years of intensive conservation efforts consequently can be wiped out by the discovery of an economically valuable mineral substance inside a protected area.

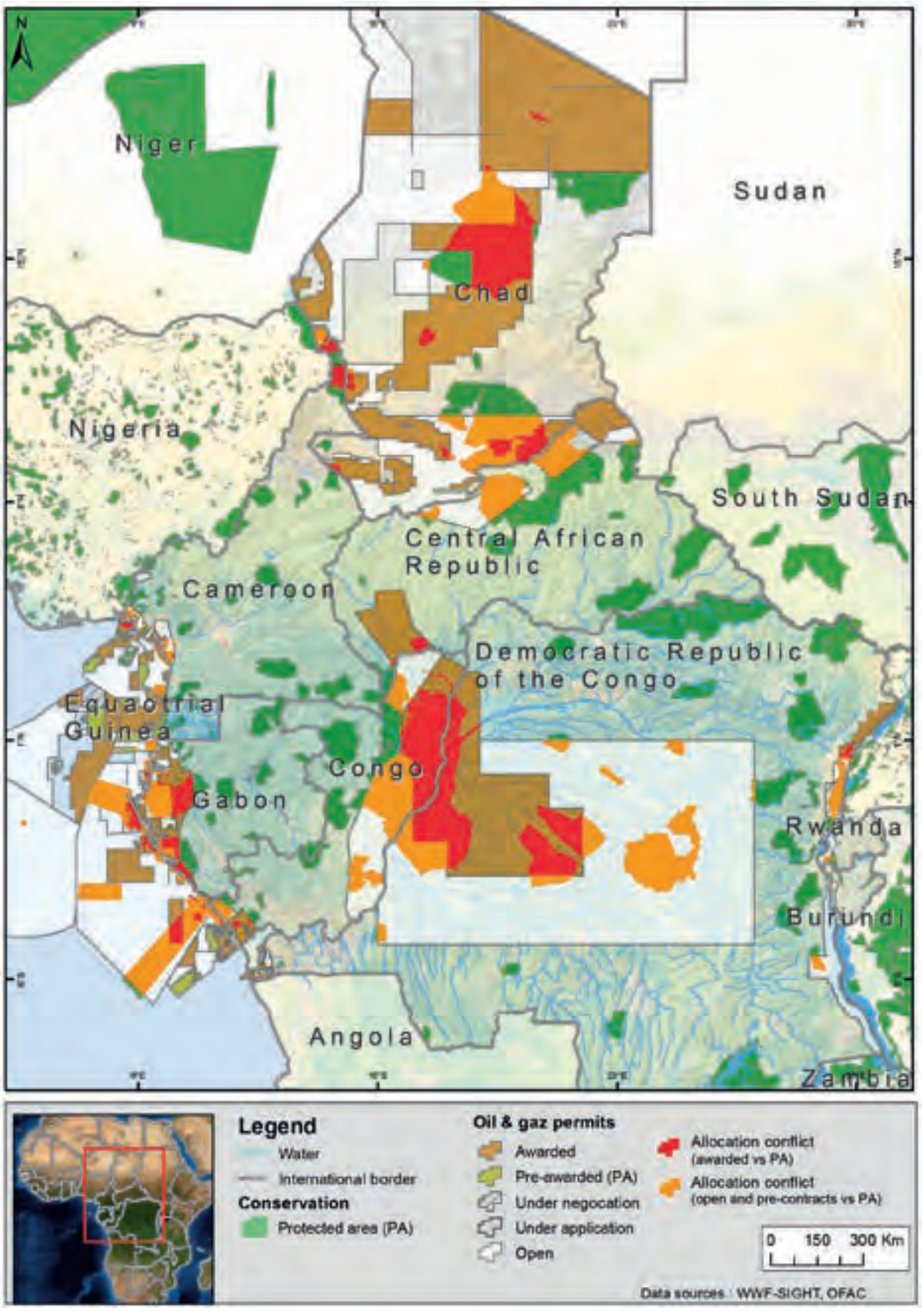
3.3 Overlap of oil and gas concessions and protected areas

About ten awarded oil (and more rarely gas) contracts overlap the network of Central African protected areas, covering an area of about 263,000 km^2, or 22.8% of the surface of protected areas in the subregion (Table 1 and Figures 6 and 7). These figures include both land and marine protected areas. The method that was used to carry out these assessments is detailed in Appendix 1. It should be noted that we considered both protected areas with national status and territories with international status, linked either to an international convention (World Heritage, Ramsar) or to an international network such as the biosphere reserve network.

In the offshore sector, the complete set of claims (granted, open or under pre-contract) cover the entire Exclusive Economic Zones (EEZ) of the countries along the Atlantic coast. Onshore, they are present in two large areas – the Central Congo Basin and the Chad Basin – but also in the coastal sedimentary basins and along the Albertine Rift (Figure 6). While currently oil production in the subregion is predominately offshore (except in Chad, and partially in Gabon), onshore exploration claims have increased significantly, raising the possibility of increased onshore production.

Depending on the country, the proportion of protected areas affected by claims operated by industrial companies (awarded) varies greatly, ranging from none to nearly 36% of national networks. Burundi, Equatorial Guinea and Rwanda have no conflicts between oil and gas claims and protected areas. In contrast, the protected area networks of Congo, Gabon, DRC and Chad are seriously threatened by these claims (Table 1).

Figure 6 - Spatial distribution of oil and gas claims overlapping with protected areas



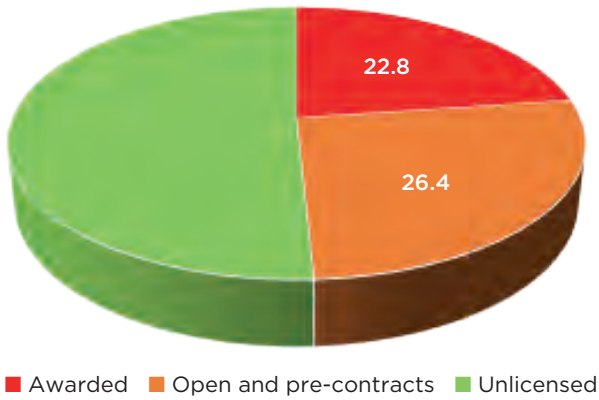
Source: WWF-SIGHT

Table 1 - Oil and gas claims overlapping protected areas

Territory	Type of claim	Claims overlapping protected areas		Protected areas impacted	
		Number	Area (km²)	Number	% area
Burundi	Awarded	0	0	0	0
	Open and pre-contracts	3	90	4	6.4
Cameroon	Awarded	7	6,345	7	9.3
	Open and pre-contracts	9	7,518	9	11.1
Congo	Awarded	8	44,622	11	25.2
	Open and pre-contracts	16	56,150	15	31.7
Gabon	Awarded	19	27,213	39	21.1
	Open and pre-contracts	19	62,171	40	48.2
Equatorial Guinea	Awarded	0	0	0	0
	Open and pre-contracts	12	1,664	10	24.2
CAR	Awarded	5	2,512	6	2.0
	Open and pre-contracts	9	22,732	12	17.9
DRC	Awarded	13	117,042	11	25.8
	Open and pre-contracts	22	104,220	20	23.0
Rwanda	Awarded	0	0	0	0
	Open and pre-contracts	1	437	1	15.8
Sao Tome and Principe	Awarded	0	0	0	0
	Open and pre-contracts	0	0	0	0
Chad	Awarded	6	65,116	9	35.7
	Open and pre-contracts	3	50,011	6	27.4
Central Africa	Awarded	10	262,850	83	22.8
	Open and pre-contracts	20	304,993	118	26.4

Awarded: operated (exploration and exploitation); Open and pre-contracts: under negotiation, pre-award, application, open. Source: WWF-SIGHT

Figure 7 - Proportion of the Central African protected area network impacted by oil and gas claims (%)



Awarded: operated (exploration and exploitation); Open and pre-contracts: under negotiation, pre-award, application, open. Unlicensed: no oil or gas claims. Source: WWF-SIGHT

Moreover, the projected allocation of new claims potentially threatens another quarter of the protected area network, bringing the total overlap to nearly half of the surface of protected areas in Central Africa (Figure 7). A large proportion of the protected areas in Congo, Gabon, DRC and Chad would be threatened (Table 1). Apart from Sao Tome and Principe, no country is spared.

Although under certain circumstances oil exploitation can considerably limit its environmental and social impacts, and even prove to be a key player in sustainable development, the environmental impacts of this exploitation could prove to be very negative, both on land and in the marine environment (Dallmeier *et al.*, 2016; Aghalino & Eyinla, 2017; Amarachi & Kabari, 2020). On land, the strongest potential impacts of oil exploitation can be expected in swamp forests, which are more easily subjected to pollution (Ite *et al.*, 2013). Everywhere, production and disposal infrastructure and indirect impacts will be significant, at least under current conditions. During the exploration phase, the destruction of forests also can cause significant impacts, particularly if the soil is fragile, as is the case in coastal sedimentary basins (Doumenge, 1992).

3.4 Overlap of mining concessions and protected areas

3.4.1 Central Africa

In Central Africa, at least for seven of the ten countries concerned, there are currently almost 4,590 awarded mining contracts covering an area of 502,150 km^2. These mining claims largely spare the Central Congo Basin (Figure 8). However, they do occupy extensive land in two major geographic zones: 1) the first encompasses the entire South Congo - Gabon - Cameroon axis, 2) the second occupies all of the landscape and ancient lands bordering the Congo Basin, mainly in the east (Albertine Rift) and south (Kasai and Katanga plateaus). These two large areas also are particularly rich in terms of biodiversity and endemism (Edwards *et al.*, 2014; Dagallier *et al.*, 2019).

Within this ensemble, 167 awarded claims overlap protected areas, covering just over 42,500 km^2, or 3.7% of Central Africa's protected areas (Table 2 and Figures 8 and 9). If mining claim applications are added, the total number of concessions overlapping protected areas covers 4.6% of their surface. While mining claims overlap a much smaller part of protected areas compared to oil permits, it should be noted that the impact of mines on biodiversity is often much greater than that of onshore oil wells, particularly when the latter observe appropriate measures (Reed & Miranda, 2007; Dallmeier *et al.*, 2016; Noiraud *et al.*, 2017). Moreover, it should be remembered that we are reporting here only official mining claims, and that illegal artisanal mining and semi-artisanal mining are widespread, causing a great deal of both ecological and social damage (De Failly, 2013; Edwards *et al.*, 2014). The specific situation in a few countries is presented below.

3.4.2 Cameroon

Currently, mining claims overlap more than 12,300 km² of protected area land in Cameroon, an area only slightly less than in DRC, for a much smaller number of permits (Table 2). These claims affect 18 protected areas. Contrary to what might be expected with improved land use planning, these figures have increased since 2012. At that time, the government had granted 30 mining exploration permits in 12 protected areas, covering approximately 9,400 km² (Schwartz *et al.*, 2012).

Most of the overlap areas involve prospecting mining permits (exploration). The main national parks affected are Lobeke, Boumba-Bek, Nki, Campo-Ma'an and, to a lesser extent, Korup, in the southern forest region. In the open woodlands and savannas of the north, Bouba-Njida and Benue parks are most affected. Also threatened are other sites that have not yet been classified but which are very important for the conservation of Cameroon's biodiversity, for example the Ngoyla-Mintom forest reserve and the Ebo forest.

Government representatives have wanted to substantially develop the mining sector for several years, as shown by the creation of SONAMINES (National Mining Company) in late 2020. This company's objectives will be to conduct mineral resource inventories in partnership with other actors, implement exploration and exploitation activities, ensure the restoration of sites after exploitation and obtain stakes in all companies with links to the mining sector (S.A., 2020).

However, these objectives have not yet been translated into operational industrial projects due to a number of unfavorable factors (drop in mineral prices, Covid-19, opaque governance, etc.). For example, the first major cobalt-nickel-manganese mining claim, held by the American company Geovic in southeast Cameroon (Nkamouna), still has not yet seen the light of day (Noiraud *et al.*, 2017; Anon., 2021).

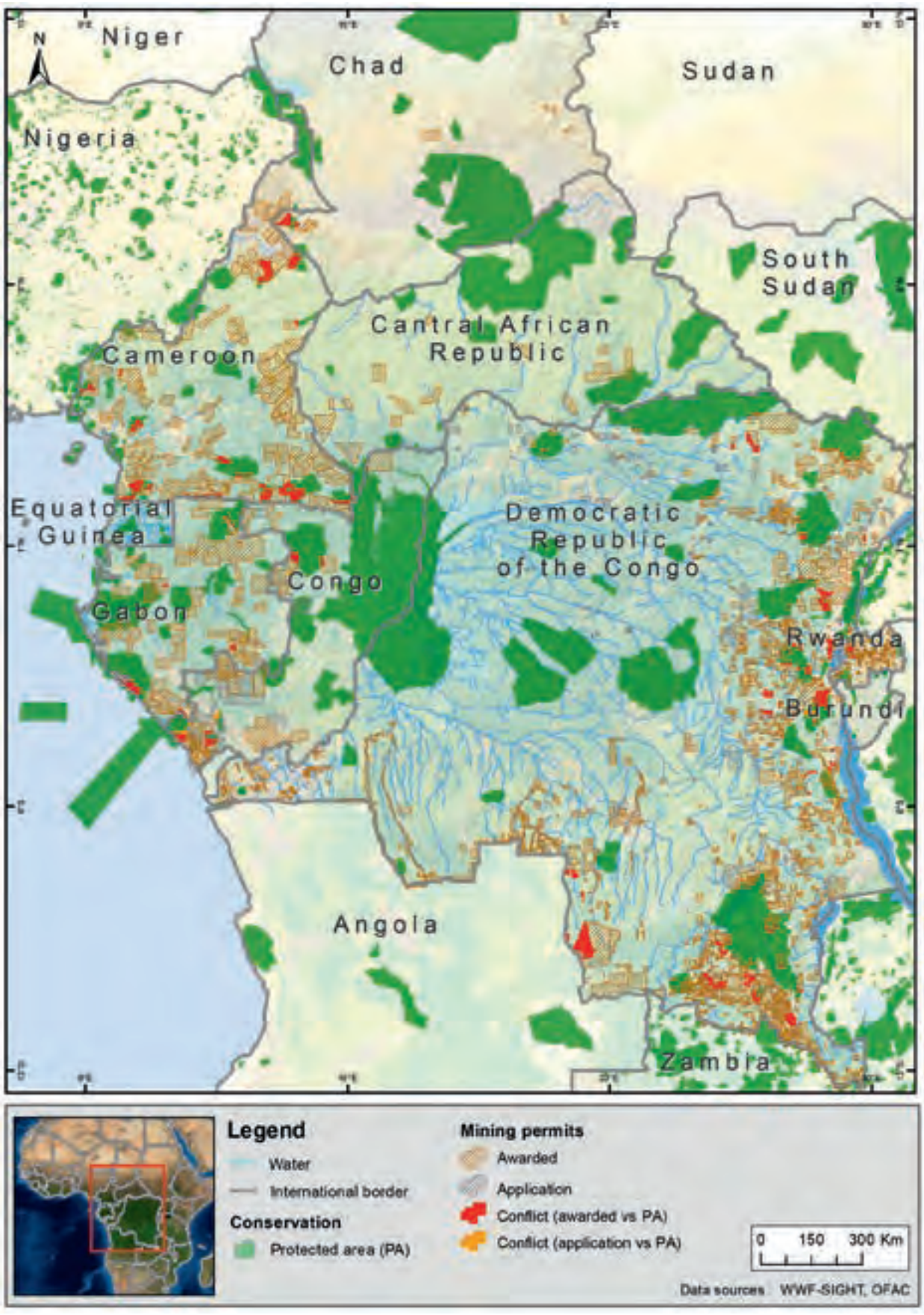
Another major undertaking intended to launch Cameroon's industrial mining activity is the Mbalam-Nabeba project, operated by Camiron and Sundance Resources to exploit vast iron ore deposits on the Cameroon-Congolese border. This project is associated with the construction of a railway to the port of Kribi (about 550 km). This will profoundly change the accessibility of southern Cameroon (and access to various protected areas), and also carries the risk of potential land use conflicts with other industrial forestry and agricultural projects (Noiraud *et al.*, 2017). As Sundance Resources was unable to start the Mbalam project, Cameroon reportedly decided to withdraw the permit and award it to a consortium of five Chinese state-owned companies; at the same time, the Congolese government also awarded the Nabeba permit to a new company (Mbodiam, 2021).

Before a mining claim is granted, the mining code requires prior approval from the relevant public authorities, which allow mining operations to be conducted in and around national parks and protected areas subject to international agreements. In 2012, an order by the minister in charge of mines prohibited illegal gold mining in protected areas in Cameroon, and made any gold mining activity in protected areas subject to prior authorization by the administrations in charge of mines, forests and wildlife, environment and nature protection (MINMIDT, 2012).

However, given the widespread presence of many artisanal gold miners in much of the country, from the south up to Adamaoua, including in protected areas, it has been difficult to enforce this ministerial order (Noiraud *et al.*, 2017). This is the case in the inter-zones of the TRIDOM landscape, both in Cameroon and Gabon. In Gabon, the government did, however, forcibly evacuate the gold mining camps that existed inside and around Minkébé National Park in 2011 and 2013 (Anon., 2013). Collaboration between the administrations in charge of mining, conservation services and even the military is necessary to clean up the artisanal mining sector, especially in protected areas.

In order to structure the artisanal sector and to promote the participation of national operators, Cameroon is trying to develop a semi-industrial mining sector with a low level of mechanization. This is the case for the mining of gold and semi-precious stones (Noiraud *et al.*, 2017). However, cohabitation between artisanal diggers and semi-mechanized Cameroonian companies, but also sometimes foreign companies (Korean, Chinese, South African, etc.), leads more often to conflictual relations than good integration (Voundi *et al.*, 2019); with sometimes very significant social and environmental impacts.

Figure 8 - Spatial distribution of mining claims overlapping with protected areas



Source: WWF-SIGHT

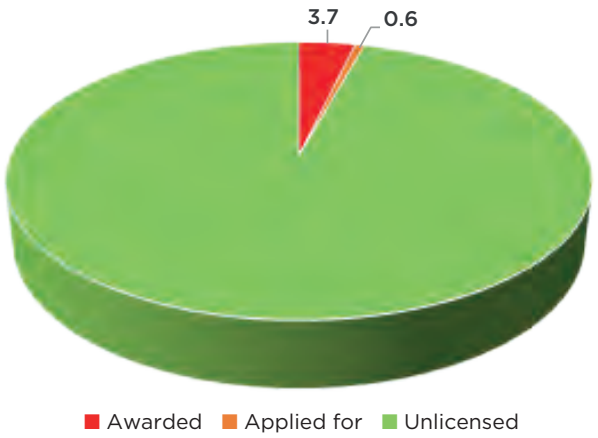
Table 2 - Mining claims overlapping protected areas

Territory	Type of claim	Claims overlapping protected areas		Protected areas impacted	
		Number	Area (km²)	Number	% area
Burundi	Awarded	-	-	-	-
	Applied for	-	-	-	-
Cameroon	Awarded	40	12,328	18	18.1
	Applied for	0	0	0	0
Congo	Awarded	34	7,166	14	4.0
	Applied for	17	5,894	9	3.3
Gabon	Awarded	24	7,918	14	6.1
	Applied for	1	1	1	0
Equatorial Guinea	Awarded	-	-	-	-
	Applied for	-	-	-	-
CAR	Awarded	4	855	3	0.7
	Applied for	0	0	0	0
DRC	Awarded	154	12,908	25	2.9
	Applied for	40	968	17	0.2
Rwanda	Awarded	13	11	4	0.4
	Applied for	1	0	1	0
Sao Tome and Principe	Awarded	-	-	-	-
	Applied for	-	-	-	-
Chad	Awarded	2	1,333	2	0.7
	Applied for	0	0	0	0
Central Africa	Awarded	167	42,520	80	3.7
	Applied for	35	6,863	28	0.6

- : lack of data

Source: WWF-SIGHT

Figure 9 - Proportion of the Central African protected area network impacted by mining claims (%)



Source: WWF-SIGHT

3.4.3 Gabon

Along with Sao Tome and Principe and Rwanda, where tourism in protected areas is very important economically, Gabon has established a coherent and effective protected area network able to contribute to the country's economic diversification (Doumenge *et al.*, 2015). Most mining claims are located outside or on the outskirts of protected areas. However, they impact a significant portion of protected areas: 24 mining claims overlap 14 protected areas, extending across nearly 8,000 km^2, or over 6% of the protected areas in question (Table 2).

However, apart from the long-standing manganese operation, there are very few active industrial claims; most are essentially prospecting permits (DGT, 2020a). An initial contract was awarded to a Chinese company for the exploitation of the Belinga iron mines, located in the north of the country on the outskirts of Minkebe National Park, but the license was returned to the public domain. The poor market

Zombe: a booming future village in the Itombwe Nature Reserve (DRC)

G. Buhendwa & F. Igunzi, ICCN

The Itombwe mountain range has long attracted the attention of naturalists and the international conservation community due to its diverse habitats and exceptionally rich fauna and flora (Doumenge & Schilter, 1997; Plumptre *et al.*, 2017). A protected area, named the "Itombwe Nature Reserve", was created there on 11 October 2006 through decree n°038/CAB/MIN/ECN-EF/2006. It is one of the most important sites for bird and primate conservation in Africa (Prigogine, 1985; De Failly & Bantu, 2010).

Itombwe Reserve has been facing many threats associated with human activities, including mining, for several years (Doumenge & Schilter, 1997; WWF, 2013). To the north of the reserve, industrial exploration sites have been granted to Banro Congo Mining, and toward the southwest, to Regal Bluent Mining (close to the outer limits of the reserve). Added to these are numerous artisanal mining sites scattered across the landscape. The quarry in Zombe is the most striking case.

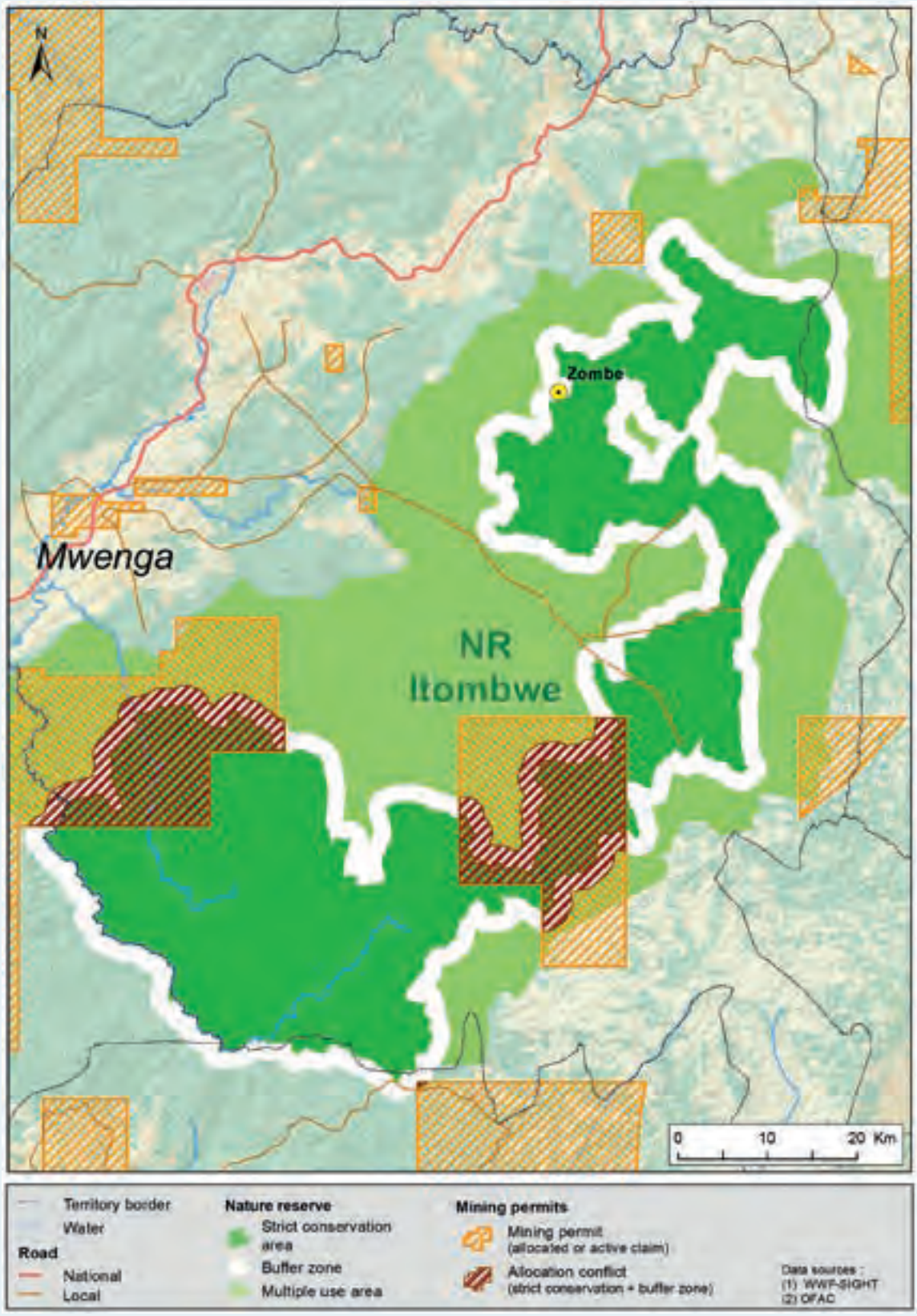
This quarry is located northwest of the reserve (Figure 10) and includes several artisanal cassiterite mines. It is equipped with a fair amount of infrastructure, which will enable it to soon become a new village inside the reserve. There is a Protestant chapel and a Catholic church, as well as a private dispensary providing primary health care to diggers. Much to the delight of the artisanal diggers, a market and numerous restaurants also are open for business.

The expansion of settlements around Zombe and the felling of trees for fuelwood are among the main threats to the biodiversity of the reserve in the Mulambozi area. With an estimated workforce of 3 1,250 artisanal diggers (according to the 2018 Quarry Management Committee report), demand for energy resources is very high. Apart from the tradition practice of the Basile chiefdom in Mwenga territory, which bans women from settling in the Zombe mine and living with men in order to build a real village, there are no other measures in place to curb this high demographic growth.

As noted by De Failly (2013), artisanal mining in South Kivu always has been characterized by a lack of structure, reflected in the weakness or absence of legal titles, collective organizations, shared governance, monitoring and evaluation, support for the sustainable management of natural resources, etc. This should be an issue of concern to all stakeholders working together for the sustainable management of Itombwe Nature Reserve's natural resources.

Zombe: a booming future village in the Itombwe Nature Reserve (DRC)

Figure 10 - Location of Zombe quarry in Itombwe Nature Reserve



performance of minerals, particularly iron, is delaying the exploitation of these deposits, which when mined are likely to pose social and environmental risks.

In effect, although the iron deposit itself is located outside Minkébé and Ivindo National Parks, strict environmental controls on the impacts (pollution, deforestation, poaching...) generated by the exploitation of the deposit would be required to avoid damaging the integrity of these protected areas. In order to supply the mine with electricity, the Chinese company had started to build a road and prepare a dam project at the level of the Kongou Falls, in Ivindo National Park. The park contains the finest network of rivers and waterfalls in Africa in a forested area, in particular Kongou Falls, and associated biodiversity that is unique in many ways (Simonet, 2007).

While the Belinga industrial iron mining case reveals the potential impacts of large mining projects, even when located outside the boundaries of protected areas, artisanal mining also poses threats (Noiraud *et al.*, 2017). Illegal gold mining in the TRIDOM landscape is commonplace; the Minkebe National Park already has suffered from this (Moukouangui Moukala, 2021). Although the government of Gabon is trying to formalize and legalize this sector, much remains to be done (see box on this topic in section 3.6).

3.4.4 DRC

As previously noted, DRC is "the" mining country in the subregion. Currently, 194 claims overlap protected areas, covering almost 14,000 km^2; these claims affect 3.1% of protected area land (Table 2). However, unlike Cameroon, these figures have been decreasing for several years. In 2017, overlaps affected about 11% of protected areas (Noiraud *et al.*, 2017).

DRC's economy is more heavily dependent on mining than any other country in the subregion, which can have dramatic social and environmental consequences. The exploitation of minerals is fueling serious social conflicts, particularly in the eastern part of the country (Reed & Miranda, 2007; De Failly, 2013; AMDC, 2017). Artisanal mining is developing extensively across the country's territory, inside and outside protected areas, with extremely limited possibilities for control. The environmental consequences are more damaging in the absence of any regulation.

Numerous mining exploration claims have been awarded around and within protected areas, such as the Okapi Wildlife Reserve and the national parks of Upemba, Virunga, and Maiko, among others; several of these protected areas are on the list of World Heritage sites. In Katanga, where copper and cobalt mining is the main industrial activity, mining claims cover a large part of protected areas, such as the Basse-Kondo game reserve and the Lufira Biosphere Reserve (Noiraud *et al.*, 2017). The high concentration of mining companies leads to significant degradation of soils and ecosystems (savannas, dry forests, hydrographic network) and even to the loss of agricultural land. In some cases, this mining also is leading to significant human health problems (Kahilu Mutshima *et al.*, 2015).

Quite recently, NGOs strongly denounced the government's desire to downgrade part of Virunga and Salonga National Parks – listed as World Heritage sites – in favor of oil exploitation (Mupfuni & Malungu, 2018). However, it is not only the oil industry that poses threats to protected areas (see section 3.1.2), but also the mining industry, particularly for gold, coltan and cassiterite. The NGOs fear

the devastating impacts of such a decision on the rich biological and cultural diversity of these parks.

The two protected areas most impacted (directly and indirectly) by mining claims are Kahuzi-Biega National Park (a World Heritage Site) and Itombwe Nature Reserve in South Kivu. The latter contains the largest area of dense mountain rainforest in Africa. In the first case, the company *Société Aurifère du Kivu et du Maniema* (SAKIMA) held mining claims for various minerals (gold, silver, tin, niobium, tantalum, tungsten) that expired in 2016 and 2017; however, these permits are still active on the mining registry site (Cadastre minier, 2020).

The situation in the Itombwe reserve is more problematic, with two large active mining sites (Twangiza and Namoya) operated by the Canadian company Banro, as well as several prospecting permits held by various companies, the most important of which also are those of Banro (gold, copper, tin, tantalum, niobium, cobalt, etc.; Banro Corporation, 2016; Noiraud *et al.*, 2017; Cadastre minier, 2020). In addition, people from rural areas are pouring into the area (WWF, 2013), succumbing to the lure of gold and cassiterite mining on former SOMINKI (*Société Minière et Industrielle du Kivu*) company sites. Security questions also are being raised due to the presence of armed groups who alternate between illegal mineral purchases and taxation and poaching (De Failly, 2013). The volatile security climate has forced Banro to cease operations several times (Anon., 2019b).

3.5 Overlap between extraction permits and intact forest landscapes

In addition to formal conservation through the creation of protected areas, the Intact Forest Landscape (IFL) concept has recently emerged in the conservation sector to designate a geographical unit with little disturbance whose protection appears to be absolutely necessary to maintain a forest's essential functions and services. An IFL is defined as being free of significant human activity or any sign of human-induced habitat fragmentation. This type of landscape must also be large enough (with an area of at least 500 km² and a minimum diameter of 10 km) to contain and sustain natural biotopes and viable populations of a wide range of taxa, as well as the ecological processes necessary for the evolution of biodiversity (Thies *et al.*, 2011).

Alongside protected areas, IFLs therefore appear to be an interesting tool to analyze forest cover (Potapov *et al.*, 2017). The emergence of the IFL concept and its technical definition respond to the need to define, implement and monitor policies related to landscape change and fragmentation at regional and global levels.

The total area of IFLs was estimated at nearly 840,000 km² in 2016, or 15.6% of the surface area of Central Africa (Table 3). Only six of the Congo Basin countries hold IFLs: Cameroon, Congo, Gabon, Equatorial Guinea, CAR and DRC; the latter country alone accounting for over 70% of the IFLs in the subregion (Figure 10).

Table 3 - Intact forest landscapes in Central Africa (2016)

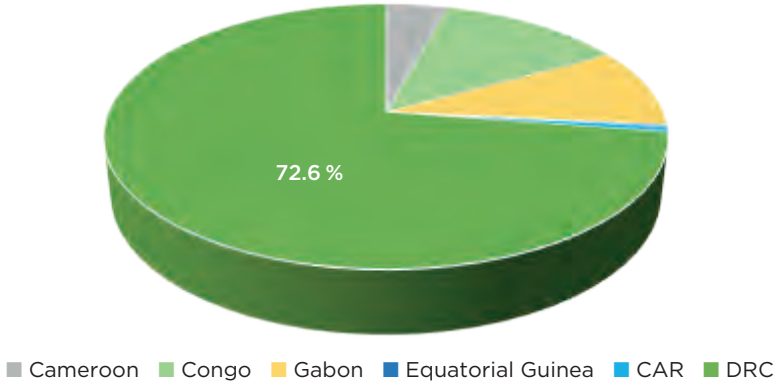
Territory	Country's surface area (km²)	Intact Forest Landscape	
		Area (km²)	% land area
Cameroon	466,040	35,612	7.6
Congo	341,732	106,475	31.2
Gabon	264,550	80,529	30.4
Equatorial Guinea	26,959	2,139	7.9
CAR	620,200	4,940	0.8
DCR	2,329,128	608,851	26.1
Central Africa	5,388,201	838,546	15.6

Note: Burundi, Rwanda, Sao Tome and Principe and Chad do not contain any IFLs (dense forests). Source: WWF-SIGHT

These intact forest landscapes include only dense evergreen or semi-deciduous rainforests; dry forests and tree savannas are not represented. Two major IFL areas are located in the following regions: 1) the Congo Basin, from the eastern foothills to the swamp and flood forests of the center of the basin (including

large areas of peatland), 2) the TRIDOM region, on the borders of Cameroon, Gabon and Congo. Another IFL region covers the highlands of central Gabon, from the Chaillu Mountains to the Crystal Mountains (Figure 10). The region consists of the hills bordering the Atlantic coast, from South Congo to Cameroon; the IFLs are very fragmented here. The IFLs in the Congo Basin cover certain protected areas and production forests, at least in part.

Figure 10 - Country distribution of intact forest landscapes in Central Africa

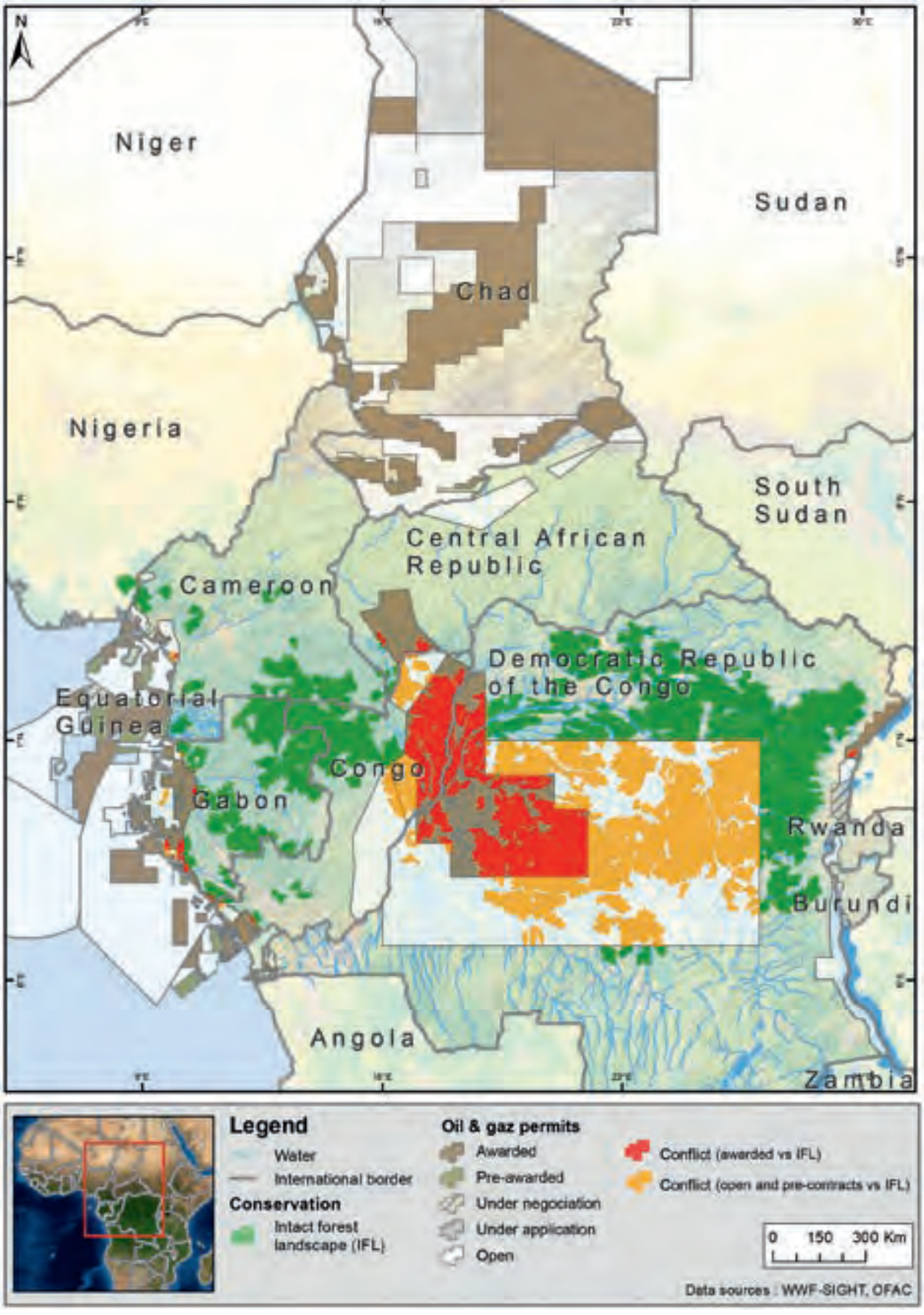


Source: WWF-SIGHT

The status of the oil and gas contracts overlapping IFLs is presented in Figure 11 and Table 4. Currently, 88 onshore oil and gas contracts overlap over 17% of the total area of Central African IFLs. Nearly 105,000 km² of IFLs are thus coveted by industry in DRC, and more than 36,000 km² in Congo, in the center of the Congo Basin. These claims directly threaten fragile ecosystems such as swamp and flood forests and the largest tracts of tropical forest peatlands in the world (Dargie *et al.*, 2019).

If open concessions and those in the process of being granted are added to these figures, these combined concessions occupy more than 50% of the territories hosting IFLs (Table 4 and Figure 12). The highest rates of overlap are found in DRC and Congo (57-58%); DRC also has the highest number of contracts awaiting allocation, clearly indicating the country's economic choices in favor of extractive industries. Moreover, the area of oil and gas claims which extend over protected areas has increased from 221,467 km² to 422,787 km² since 2018 (Grantham & Tibaldeschi, 2018), meaning it has nearly doubled in just a few years. Due to the potential negative environmental impacts that may occur if the projects go ahead, concerns about these choices therefore appear justified.

Figure 11 - Spatial distribution of oil and gas claims overlapping IFLs



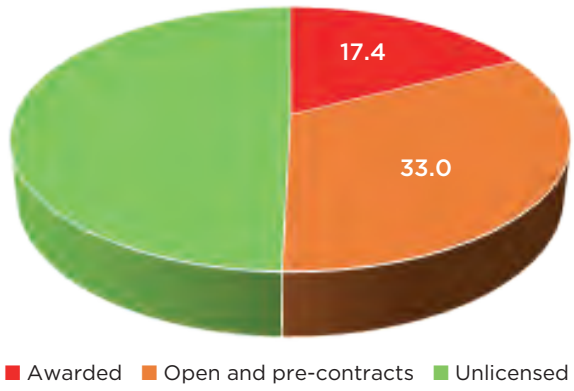
Source: WWF-SIGHT

Table 4 - Oil and gas claims overlapping IFLs

Territory	Type of claim	Claims overlapping IFL		IFL impacted
		Number	Area (km²)	% area
Cameroon	Awarded	1	81	0.2
	Open and pre-contracts	4	610	1.7
Congo	Awarded	14	36,326	34.1
	Open and pre-contracts	13	24,262	22.8
Gabon	Awarded	16	2,492	3.1
	Open and pre-contracts	10	1,860	2.3
Equatorial Guinea	Awarded	0	0	0
	Open and pre-contracts	0	0	0
CAR	Awarded	4	2,383	48.2
	Open and pre-contracts	0	0	0
DRC	Awarded	53	104,734	17.2
	Open and pre-contracts	152	250,039	41.1
Central Africa	Awarded	88	146,016	17.4
	Open and pre-contracts	179	276,771	33.0

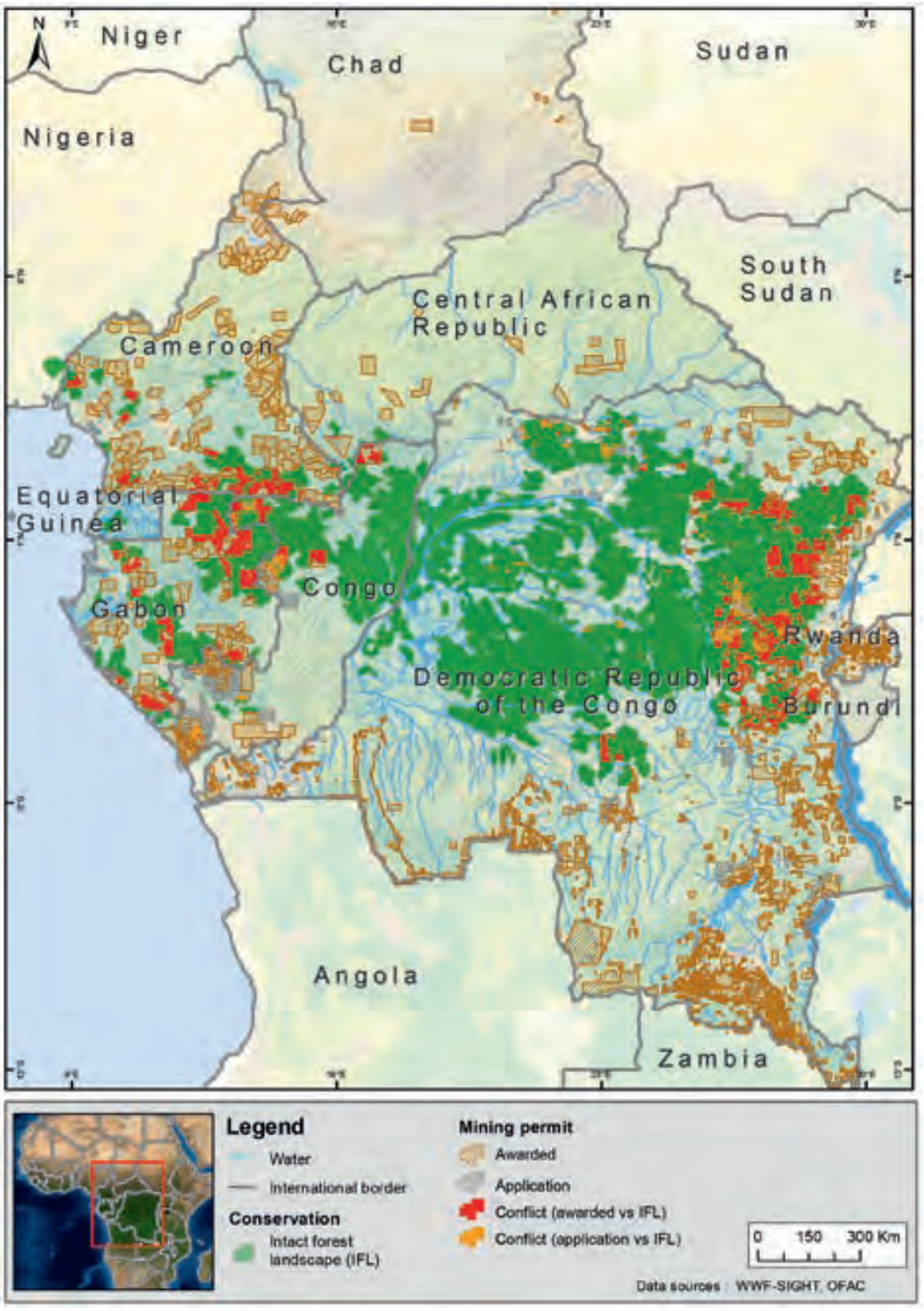
Source: WWF-SIGHT

Figure 12 - Proportion of IFLs impacted by oil and gas claims (%)



Awarded: operated (exploration and exploitation); Open and pre-contracts: under negotiation, pre-award, application, open. Unlicensed: no oil or gas contract. Source: WWF-SIGHT

Figure 13 - Spatial distribution of mining claims overlapping IFLs



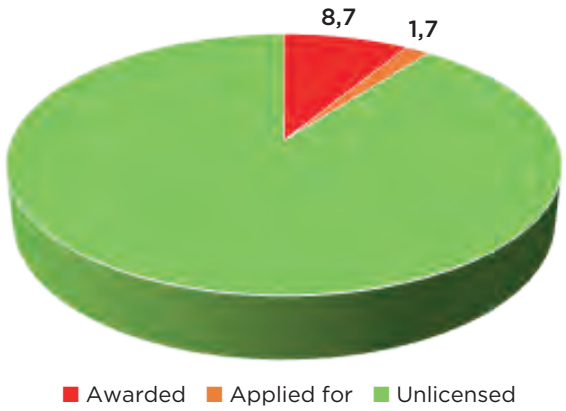
Source: WWF-SIGHT

Table 5 - Mining claims overlapping IFLs

Territory	Type of claim	Area of claims overlapping IFLs (km²)	IFLs impacted (% area)
Cameroon	Awarded	10,702	30.1
	Applied for	0	0
Congo	Awarded	9,565	9.0
	Applied for	5,644	5.3
Gabon	Awarded	21,411	26.6
	Applied for	0	0
Equatorial Guinea	Awarded	0	0
	Applied for	0	0
CAR	Awarded	20	0.4
	Applied for	0	0
DRC	Awarded	31,518	5.2
	Applied for	8,740	1.4
Central Africa	Awarded	73,216	8.7
	Applied for	14,384	1.7

Source: WWF-SIGHT

Figure 14 - Proportion of IFLs impacted by mining claims (%)



Source: WWF-SIGHT

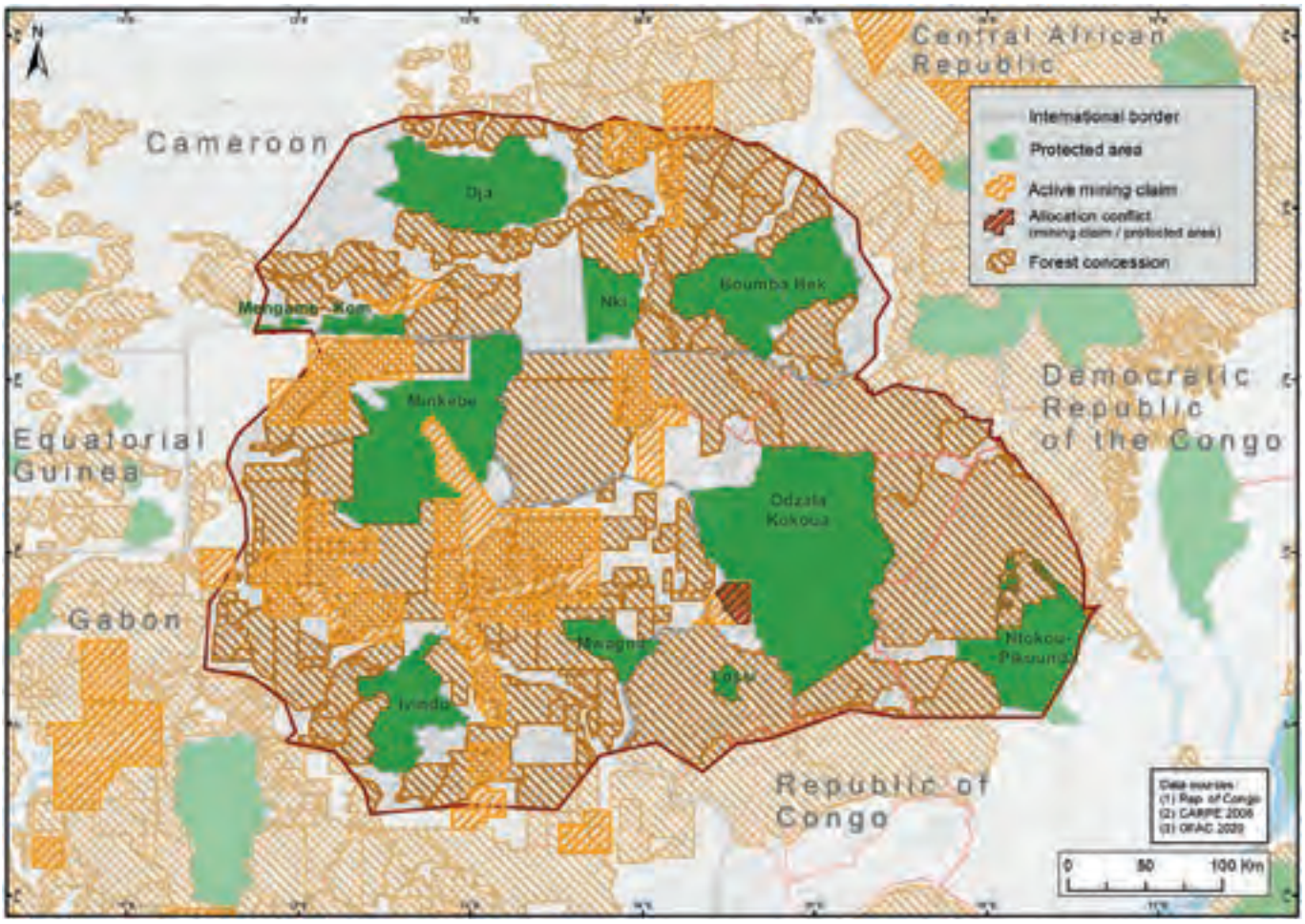
Mining titles officially granted to operators cover just under 9% of IFLs, over an area of about 73,000 km² (Table 5 and Figure 13). The situation obviously differs from one country to another, with DRC having nearly half of the overlap (in terms of surface area allocated). Cameroon and Gabon have the highest percentages of overlap, at 30% and 27% of IFLs, respectively (Table 5). When permits applied for are added to those already allocated, the total overlap reaches just over 10% of IFLs.

These figures are well below those for oil and gas claims (Figures 12 and 14), which may indicate a more favorable situation. Moreover, the areas involved have decreased in just a few years from 138,781 km² in 2018 (Grantham & Tibaldeschi, 2018) to 87,600 km² in 2020. However, these figures should be interpreted with caution as they reflect the situation of official claims, but do not capture the situation of illegal mining. As we have seen previously, illegal mining can be widespread in certain regions (Eastern DRC, TRIDOM, etc.).

Mining claims overlap only marginally with oil and gas contracts; when added up, the total area affected by extraction permits actually reaches more than 60% of IFLs. While oil claims could, in some cases, be managed to limit environmental impacts (Dallmeier *et al.*, 2006; Moussotsi Ikapi, 2016), there is considerable concern that this will not be the case in the Central Congo Basin or with mining claims. Certain up-and-coming oil companies may be less sensitive to environmental issues than some of the sector's leading players, and the risks of pollution are higher in wetland areas (Ite *et al.*, 2013; Le Bec, 2020a). Furthermore, much of the mining sector operates illegally and is largely unconcerned by the environmental and social impacts of extraction activities (Le Billon & Hocquard, 2007; Edwards *et al.*, 2014; Lopez *et al.*, 2017). The danger of deforestation and forest degradation remains very high.

Lastly, comparing extraction claims with IFLs as a whole is not sufficient because Central African forests are far from homogeneous, with some containing above-average biological richness or rare and endangered species. These forests are indeed very diverse, both in terms of plant and animal composition and functional composition (Fayole *et al.*, 2014; Gond *et al.*, 2016; Marshall *et al*, 2021). The regions most impacted by mining claims, such as eastern DRC and the Gabon-Cameroon region, are also the richest in biodiversity among Central African forests, and hold many endemic species (Edwards *et al.*, 2014; Dagallier *et al.*, 2019). The environmental impacts of mining activities may be more damaging in these regions than in some of the Congo Basin's terra firma forests.

Figure 14 – Overlap between mining, logging and protected areas in the TRIDOM landscape



Sources: OFAC and WWF-SIGHT.

3.6 TRIDOM forest landscape

The TRIDOM landscape (183,500 km²; Figure 14) is characterized by its rich biological diversity, with the largest forest elephant populations in Central Africa, low fragmentation and very low disturbance. IFLs cover 97% of the entire landscape. TRIDOM is known to be an important reservoir of iron ore, which is found in Cameroon, Gabon and Congo.

Exploratory work has shown that TRIDOM contains large amounts of high-quality iron ore deposits. It is only a matter of time before they are developed. Two major resource corridors are in sight: 1) a corridor linking the port of Lolabe (south of Kribi), via a 550 km railway to the Mbalam deposit (Cameroon) and a 70 km extension to Nabeba (Congo); 2) a large corridor that should link the Belinga deposit (Gabon) to the Gabonese coast. However, due to low market prices, the Mbalam-Nabeba project has not yet started; the governments of Cameroon and Congo are seeking buyers to replace the Australian company Sundance Resources (Mbodiam, 2021). The government of Cameroon also is seeking to raise funds for the railway, which will open up the south of the country to industrial activities, as the deepwater port south of Kribi already is operational, having been built with funding from China.

The cumulative impacts of the TRIDOM iron and gold deposits could be very significant. A coordinated mine-conservation-development approach is needed to plan measures for the survival of the complex as an interconnected landscape and to guide development activities. The major mining projects that have been initiated there are currently dormant. However, if these projects were implemented, the environmental and social impacts would be considerable, especially if the direct impacts of mining are added to those linked to the construction of transport infrastructure and to the significant flows of migrants seeking jobs and other economic opportunities. These negative impacts, if not properly managed and mitigated, are likely to threaten the very existence of this important landscape (WWF, 2018).

It is likely, however, that some large mining projects will apply the performance standards of the IFC, part of the World Bank Group; in particular Performance Standard 6 on biodiversity conservation and sustainable management of living natural resources (IFC, 2012). If the projects are partly financed by banks that adhere to the Equator Principles, this will be a requirement. These IFC standards highlight in particular the importance of habitats that are "critical" due to their high value in protecting rare or endangered species and ecosystems. Mining must avoid these habitats or can only operate in them under very specific conditions. TRIDOM and a major portion of the forests of Central Africa meet the definition of critical habitats because they contain threatened species (forest elephants, great apes, etc.) and because they are large-scale ecosystems associated with key evolutionary processes.

The iron ore mining project that was to be operated by Sundance Resources included a biodiversity offset through the conversion of Forest Management Unit (FMU) 10-034, located in the Ngoyla-Mintom forest in Cameroon, into a protected area. This FMU became the Ngoyla Wildlife Reserve in 2014 (Decree n° 2014/2383/PM). The project also included an offset of 2,000 km² in the TRIDOM interzone in Congo to strengthen conservation efforts between Minkebe National Park in Gabon and Odzala-Kokoua National Park in Congo. The project also was meant to provide support for anti-poaching activities. All this is on hold while waiting for new mining operators.

Mining development in TRIDOM will lead to immigration and the creation of new towns around the future mining sites (Nabeba, Avima, Mbalam, Belinga, etc.). These impacts could, in theory, be limited by the mining operation through a staff rotation system (fly in, fly out). Only the workers would be able to reside on the production sites while their families would remain in town (Yaounde, Brazzaville, Mintom, etc.).

Once the deposit is exhausted, it will be necessary to restore the site (as much as possible, as mountains of iron will be extracted) and to prevent new towns from being established in a formerly uninhabited area, as is the case with Avima Mountain in the far northwest of Congo. The development actions carried out by the mining project will focus on existing towns and villages, and not on a pioneer town with inhabitants coming from all over the world. In the present case, the question is mainly hypothetical since the projects,

after an exploratory phase, have not really started, providing a grace period to the rich natural resources of the landscape in the three countries concerned.

Artisanal gold panning is another important mining activity in the TRIDOM region. Several thousand people are engaged in gold panning or related activities (working as porters, gold buyers and small traders). Gold mining sites often are located deep in the forest and can have a significant impact on biodiversity, particularly the hunting of wildlife that thus far have been left relatively undisturbed. The supply chains serving mines are often used to transport bushmeat and ivory. The mining camps sometimes shelter poachers and/or ivory traders.

TRIDOM and TNS are under threat from artisanal and semi-industrial mining

The TRIDOM and Sangha Tri-National (TNS) transboundary complexes are under enormous pressure from illegal artisanal miners. In the southern part of the buffer zone of the Cameroon segment of TNS, three artisanal gold mining sites have been established and are operating with impunity. Similarly, illegal artisanal diamond mining is developing in the northern sector of the buffer zone of the CAR segment of TNS.

There also is considerable artisanal gold mining in the TRIDOM interzone in Congo, between the protected areas. It seems to have decreased in Gabon (Minkébé and periphery) following forceful action by the government. The area most affected is the Dja Faunal Reserve. The area around Ngoyla in Cameroon also has about 22 artisanal gold mining sites.

A new, semi-industrial gold mining sector, often involving Chinese operators, is furthermore rapidly devastating large areas of land, mining gold in an uncontrolled manner (and removing the gold that was the livelihood of artisanal gold miners) and heavily polluting rivers and springs. Despite government commitments to clean up the sector, a human and ecological disaster is underway.

The environmental impacts of these illegal practices are disastrous. They range from erosion to the diversion of watercourses through siltation (Tieguhong *et al.*, 2009). This activity generates several impacts, including deforestation and forest degradation, ecosystem pollution, poaching and fragmentation of wildlife habitats, alongside a deterioration in the living and working conditions of the gold miners.

Artisanal and semi-industrial gold mining needs to be effectively regulated and legalized to end the poaching associated with these mining sites and reduce pollution. This is particularly true of mercury pollution, the effects of which on human and ecosystem health in the TRIDOM cannot currently be assessed. It is also a question of encouraging and reserving gold mining activities for national citizens, under the framework of a reorganization of the gold sales channels controlled by the States.

In Gabon, the *Société Equatoriale des Mine*s (SEM), plans to support the creation of gold miner cooperatives. This state-owned enterprise was established a few years ago to oversee the development of the mining sector and manage government holdings in mining projects. SEM plans to assist, train and equip gold miners so that they can engage in an activity that will enable them to generate income over an extended period of time (Ondo Nzuey, 2019). If this initiative becomes a reality, it could make it possible to formalize this activity to a certain extent, and to integrate consideration of environmental concerns. However, if implemented, this experiment should be evaluated and its potential for extension to other areas examined.

The largest camp was the Minkebe gold camp in Gabon, which grew to hold 6,000 people before it was evacuated by the Gabonese army. The closure of this site in 2011 accelerated the opening of other sites on both sides of the Cameroon-Congo border. Several gold mining sites currently are active in Djoum, Mintom, Ngoyla and elsewhere. The survey conducted in some of these sites found that the gold miners came from across Cameroon but also from countries like CAR and Mali (Messina & Feintrenie, 2014).

All these activities have a significant impact on the environment and pose a threat to biodiversity conservation. Gold miners do not restore sites after extraction because, they say, "nature always finds a balance in the end". Nearly 90% of gold miners are unaware of the impact of their activities on the environment, even though the damage is sometimes quite visible, such as the blocking and disappearance of waterways.

A worrying and fairly recent phenomenon in the Congolese part of TRIDOM, in particular, concerns the emergence of semi-industrial gold mining by mainly Chinese operators. This activity results in significant pollution of waterways, and there are concerns about widespread long-term mercury pollution. These gold mines are furthermore rapidly removing the ore on which artisanal gold miners depend. These mining operations are carried out without prior impact studies and in locations close to protected areas.

4. Extractive industries and protected areas: is reconciliation possible?

This section explores the potential for extractive industries and biodiversity conservation to coexist in a mutually beneficial manner through the protection and sustainable use of biological resources in protected areas. The task is to see how the needs of economic development may be reconciled with those of environmental protection within a sustainable development approach.

Readers may wish to also consult the extensive literature on the oil and mining sectors and on improving their governance and extraction activities. Of note are several documents specifically addressing interactions between extractive industries, natural ecosystems and biodiversity conservation, which include a number of recommendations that remain valid today (Reed & Miranda, 2007; Schwartz *et al.*, 2012; Noiraud *et al.*, 2017).

4.1 Organizing and supporting the artisanal mining sector

A flourishing artisanal mining sector has developed illegally in nearly every country in Central Africa. Artisanal miners move into the forests, and often into protected areas, without authorization. They operate with impunity and cause significant environmental damage for which they are not held

accountable. Illegal artisanal mining thus has been identified as an important factor behind deforestation and "defaunation". It often is suspected of being involved in all kinds of trafficking, including that of ivory.

The case of TRIDOM, described in a box in this chapter, is a good example. In 2011, the government of Gabon summoned up the courage to expel from Minkebe National Park several thousand illegal gold miners whose very presence was threatening the survival of this protected area. However, repression is clearly not the only way to clean up the mining industry.

The first crucial step to improving this situation is the establishment of a legal framework that formalizes and rigorously controls the activity. This will ensure that those operating illegally inside protected areas are put out of action, and that those operating outside protected areas respect environmental and social standards. The ultimate goals are to reduce environmental impacts, improve the living conditions and earnings of miners, and ensure that national economies receive their due.

Various initiatives to improve governance and support the organization of the artisanal sector have been undertaken in recent years (Noiraud *et al.*, 2017; Ondo Nzuey, 2019). These include the establishment of dialogue platforms (particularly in DRC, with the support of GIZ, the German Agency for International Cooperation) and cooperatives. These initiatives highlight a global approach to mining issues, dialogue between stakeholders, better transparency in the sector and even joint decision-making. They should be pursued and adapted according to the specific contexts of each country and territorial level.

To do so, artisanal miners need to be accompanied and trained in less destructive and more profitable practices; sometimes, it may even be necessary to start with basic training so that they can learn to read and understand documents that concern them (De Failly, 2013). An increase in the organization and empowerment of artisanal miners is needed to lay the foundations for active artisanal mining alongside industrial mining, and to limit the social and environmental impacts observed today. This also implies providing artisanal miners with technical, financial and organizational support and guidance (e.g., organization into a professional association or cooperative). All of these new tasks are challenges for the public authorities overseeing mining, but they can be supported by various NGOs or by the private sector.

To keep artisanal mining clean, claims must not be granted inside protected areas and those on the outskirts of protected areas must be supervised carefully. In effect, artisanal miners alone cannot control and prevent poaching or the trafficking of ivory and trophies by workers or traders and transporters active in these gold mining sites.

A set of measures should be discussed, decreed and respected by the gold miners, even if it means closing a gold mining site. These measures include no trafficking in ivory, trophies or bushmeat, clarification of land and exploitation rights, a ban on subcontracting quarries, a ban on the use of mercury or other polluting materials, a ban on child labor, the official sale of minerals (primarily gold) through state-controlled channels and, if possible, reserving access to certain artisanal mining activities such as gold panning to nationals only.

4.2 Include protected areas and extractive industries in land use plans

Land use planning reflects a strategic vision of sustainable development through a more or less long-term planning of the use of land and available resources (Oyono *et al.*, 2014). It is the expression of a political will to place actions (national, regional or local) in a framework of spatial coherence. It is above all a deliberate public policy to try to act on the organization of space, i.e., on the relations that exist between the functioning of human economic and social systems and the structure of the space in which these systems operate.

With this in mind, it is important that extractive resources should not be explored or exploited on an ad hoc basis, but rather be subject to prior land use planning, which must be rigorously respected, and to the establishment of a framework for consultation and dialogue between the users of the land and its resources. This framework helps to prevent and manage potential land use conflicts. Land use planning also has the merit of being able to improve cooperation between sectors, and to provide a lasting solution to conflicting sets of rules, particularly between laws governing mining and those governing environmental protection and the management of protected areas.

For example, on the initiative and with the support of GIZ, a dialogue platform was created in the mining province of Katanga (DRC) named IDAK (Sustainable investment in Katanga). This platform aims to facilitate permanent dialogue between the public sector (provincial government, devolved administrations and decentralized administrations), the private sector (mining companies of all sizes and all sectors, federations or unions of artisanal cooperatives) and civil society. The platform is proving to be effective in terms of multi-stakeholder consultation, but is struggling to generate alone enough concrete and visible action on the ground (Noiraud *et al.*, 2017).

This intersectoral consultation must be effective both at the level of field decisions (at the level of the province, as in Katanga, or at the level of management units such as the Technical Operational Units, or UTOs, in Cameroon) but also at the level of the countries as a whole or even between countries. These consultations are necessary so that decisions can be taken at various decision-making levels that are shared and accepted by everyone involved. This must also be accompanied by the establishment of a transparent monitoring-evaluation-sanction system to ensure that decisions are implemented.

Consultation between stakeholders can be organized through more or less formal meetings or more informal discussions. It also can use tools for dialogue and the joint analysis of actions, such as role-playing. These can also be combined with modeling tools to highlight the consequences of decision-making, such as the MineSet tool. This array of dialogue and forecasting tools can not only help government departments, but also all mining sector stakeholders to interact with those in other sectors, including the environment, conservation and biodiversity management.

MineSet - Promoting consultation and decision-making on mining projects

H. Dessard, CIRAD

MineSet is a decision-support tool designed to facilitate consultation between different stakeholders concerned by the social and environmental impacts of mining projects in tropical forests (Redpath *et al.*, 2018). This tool was developed under the CoForSet project, which focused on ecological compensation schemes for extractive activities and the environmental impacts of these mechanisms (https://www.cofortips.org/).

MineSet is a board game where the dynamics of forestry, infrastructure and mining industries develop according to the decisions taken by the players, who manage forestry and mining concessions or protected areas. They discuss, negotiate, forge alliances and/or enter into conflict. Their decisions have environmental, social and economic consequences that are directly visible on the game board. Being able to visualize the direct, indirect and cumulative impacts of players' decisions often reveals to the players the unexpected consequences of their decisions, which may be more or less acceptable from an environmental and social perspective. Players can then review their initial strategy and re-examine the consequences of different individual or group actions.

As this "serious" game is quite flexible, it can easily be adapted to different contexts, including protected areas. It has been used successfully by the Forest Stewardship Council (FSC) in Central Africa to define regional indicators related to the management of intact forest landscapes within forest concessions. The negotiation process had been stalled by differences of opinion and misunderstanding between the social, environmental and economic chambers of the FSC. By exchanging roles, participants were able to better understand each other's concerns and return to the negotiating table to reach a consensus on a set of indicators.

This type of tool, when used with an experienced facilitator, is an excellent means for defusing conflicts, exploring strategies and developing scenarios before turning to formal discussions, and these discussions should prove to be better informed thanks to the experience acquired through the board game.

Most Central African countries are now part of this land use planning dynamic, even if they are not all at the same level of land use planning or development. They have recognized that there can be no sustainable development without designing and implementing land use plans.

For example, like many countries in the subregion, Cameroon has a master plan for land use and sustainable development. This document presents the orientations, objectives and expected results of a spatial, physical and environmental development vision. It is based on policy options, available natural resources, social dynamics, and the country's environmental, artistic and cultural heritage. This national plan is gradually being broken down into regional plans.

The conservation of natural wealth requires a territorial approach based on management at the scale of large landscapes that span entire complexes of protected areas and other areas under sustainable management. This approach is supported by the Central African Forests Commission (COMIFAC) and is being implemented in some countries through multi-stakeholder territory projects (such as the UTOs in Cameroon). In these landscapes, efforts must be grounded on the compatibility between different development sectors and between the different landscape and ecosystem spaces which host and surround the protected areas. This means taking into account the influence of every activity, looking beyond the exploitation and conservation sites alone,

and including the transportation routes of extracted commodities and assorted infrastructure (Reed & Miranda, 2007). This also means considering the overlapping of different uses when this is possible, as well as their spatial separation when not (zoning of the territory). Such a landscape level management approach must outline in detail management issues and objectives. It also must facilitate the emergence of a long-term vision and serve as a tool for understanding, guiding and monitoring the implementation of actions to be carried out in a concerted manner within these landscapes.

4.3 Exclude or strongly regulate oil and mining exploration and exploitation in protected areas

In protected areas, biodiversity conservation objectives take precedence over other management objectives. These may at times accommodate certain activities (possible overlapping of uses) or exclude them completely (separation of uses). For example, extractive activities are not permitted in International Union for Conservation of Nature (IUCN) Category I (strict nature reserves) or II (national parks) protected areas (Dudley, 2013). Many of the laws governing the management of Central African protected areas exclude human and industrial activities within these spaces.

In practice, however, these laws do not seem to apply to extractive activities (De Souza, 2019). There often is a strong temptation to downgrade protected areas for oil or mining and ignore their conservation objectives (Qin *et al.*, 2019). Various projects, such as oil exploitation in Virunga National Park (DRC), have been highly controversial and were eventually suspended; however, recurrent pressure from political-economic elites continues to be felt (Mupfuni & Malungu, 2018). Further south, the Itombwe Nature Reserve is still under attack from mining – both industrial and artisanal – and under pressure from exploration permits.

While exploitation operations may not seem compatible with protected areas, experience has shown that in some cases, when an oil company actually applies the most recent laws and operating standards, its environmental impacts can be controlled and its social impacts can be improved (Moussotsi Ikapi, 2016). IUCN protected area categories IV (habitat/species management area), V (protected landscape/seascape) and VI (protected area with sustainable use of natural resources) can accommodate economic activities provided that these activities are compatible with the primary objective of ecosystem and species conservation. This implies that the management of the extractive activity should be designed with a strict application of the avoid-reduce-offset sequence, and that the extractive

activity would be closely monitored and even terminated in case of non-compliance. In Central Africa, all these conditions are still far from being met and the precautionary principle must prevail: no exploration or exploitation operations in protected areas until these are proven safe.

These situations illustrate the fragility of the laws governing the management of biodiversity and the weakness of their application in the face of pressure from political and economic elites. They also reflect a lack of intersectoral consultation and incoherent national laws. Ultimately, a profound change in the system of governance and management of extractive industries is needed, meaning a shift from a profit-capture model to a cost-sharing and benefit-sharing model (Rosellini, 2005). Some progress clearly has been made (mining cadastres, participation in EITI by certain countries, etc.), but not enough to ensure transparency, controlled risk management and social equity in the governance of the extractive industries in the subregion.

It therefore seems necessary, within the framework of governmental consultation, to ensure that a ban on human activities, including industrial operations, be reaffirmed and strictly respected in category I to III protected areas, and that the principle of subordination to conservation objectives prevail in category IV to VI protected areas. In addition, the activities that are allowed on the outskirts of protected areas must be strictly monitored to prevent and limit environmental and social damage.

4.4 Changing how protected areas are perceived

Protected areas are widely perceived by some people in Central Africa as spaces that unnecessarily exclude human activities and do not generate any benefits for the communities living within or near them. Their importance in terms of providing free environmental services, combating the effects of climate change, and even developing sustainable economic sectors is insufficiently recognized by decision-makers at all levels (see, for example, Dudley & Stolton, 2010; Stolton *et al.*, 2015; chapters 8 and 9 of this book). Protected areas are then viewed as a source of frustration and are created only to satisfy the expectations of development partners.

With a few exceptions, governments therefore invest very little financial or human resources in protected area management. Too often, these areas are left to their own devices, vulnerable to poaching and trafficking of various kinds. And when these areas can offer immediate economic benefits, via other types of

uses such as extractive industries, which are directly accessible to political-economic elites, then the temptation to downgrade them is great (Qin *et al.*, 2019).

On the other hand, even when protected areas generate economic activities, local populations rarely enjoy the benefits. In general, a better redistribution of the benefits derived from these protected areas must be made systematic. This is the case in Rwanda, where Volcano, Akagera and Nyungwe National Parks bring in substantial foreign exchange and employ numerous people in management and tourism activities. Nyungwe Park, for example, is rich in gold, but mining is prohibited in favor of biodiversity conservation, ecosystem services (protection against erosion, maintenance of the microclimate and water supply for agriculture) and tourism.

The interface between industrial concessions and protected areas in the same landscape is currently marked by a lack of information exchange, communication, consultation and openness to participation. Actors and policy makers themselves often have little knowledge of the potential for sustainable and inclusive development of the different territories that make up the landscapes. They generally have little knowledge of the economic value of possible synergies between production and conservation areas due to the poor dissemination of conservation texts and to a lack of information flows between institutional actors and private sector operators.

In order to combat this misperception of protected areas by private sector companies and local communities, and therefore the lack of attention paid to them at the political level, knowledge must be better disseminated in society. Environmental education and information, professional training on biodiversity and its importance (supply of products and services to human societies), must be developed. In the forestry sector, the incorporation of new knowledge has made it possible to promote sustainable exploitation with dual environmental and socioeconomic benefits. There could be lessons to be learned from this for the extractive industries sector; the environmental and social aspects of mineral exploitation, and relationships with other sectors (including conservation), need to be better integrated and developed in professional curricula.

The viability of protected areas therefore will depend on local communities, operators and decision-makers becoming aware of the important benefits provided by these areas, the quality of their management and the economic and social benefits they can generate. Governments would be less likely to downgrade protected areas if they were convinced that they could contribute to national and local development. Protected areas also would have the support of local and indigenous communities who would see them as a tool to fight poverty.

However, this is not enough. It must be clearly stated that protected areas are not the source of rural poverty, nor are they able to resolve all problems. These are largely due to the lack of a fair redistribution of benefits gained from extractive industries, which are the main sources of wealth in most countries.

4.5 Integrating environmental concerns into the management of extractive industries

Broadly speaking, oil and mining projects in Central Africa are theoretically subject to environmental regulations, with requirements for preliminary environmental and social impact studies, accompanied by an environmental and social management plan. The avoid-reduce-offset approach is supposed to be applied at all levels of mining projects (see section 1 of this chapter). However, the weakness of governance in most countries of the subregion is not always conducive to the rigorous application of these legal and regulatory provisions. It is essential that this situation be remedied. First, all countries must join or re-join EITI and submit comprehensive reports on a regular basis.

Second, in addition to legal requirements, which often fall short of international standards, extractive industries must be part of a sustained improvement dynamic in the field, and internalize good practices with regard to taking biodiversity into account in their operations. They must comply with IFC standards and the Equator Principles. Supported by IUCN, the International Council on Mining and Metals (ICMM) also has developed a practical guide for extractive industries (ICMM, 2006). This guide, as its name suggests, provides mining operators with a set of tools, approaches and requirements that can help them minimize their footprint on biodiversity and thus improve their credibility with investors

and other stakeholders. This guide, which should be updated with regard to recent technological developments in the mining sector, could also inspire reforms of laws governing the exploration and exploitation of mines and metals.

The real challenge facing Central African countries is the need to conciliate a desire to promote economic development on the one hand with the preservation of the region's rich ecological and human heritage on the other. Governments must promote proactive policies that integrate environmental and social concerns into all extractive activities in order to encourage mining operations that truly contribute to the sustainable development of their countries. This also means that both effective incentive systems and credible control and penalty systems must be put in place.

4.6 Promoting public-private partnerships for biodiversity conservation

As noted above, the nature of extractive industries' operations can have very significant impacts on biodiversity and the environment overall. Through environmental management plans based on environmental and social impact studies, extractive industries commit to preventing, minimizing and repairing the damage they may cause to the environment during their operations (the avoid-reduce-offset sequence). Despite their possible willingness to do so, mining and oil companies do not always have either the capacity or experience to contribute to biodiversity conservation to an extent that could offset the negative impacts they may create.

It is therefore important to examine the possibility of promoting partnerships between extractive industries, governments and NGOs or private partners working in the field of conservation. This is the case of traditional organizations such as WWF (World Wide Fund for Nature), IUCN and WCS (Wildlife Conservation Society), and more recently established organizations such as African Parks Network (APN). This type of Public-Private Partnership (PPP) can effectively organize the contribution of extractive industries to protected area management and biodiversity conservation efforts through alliances between different stakeholders with complementary skills and responsibilities. The example of Shell in the Gamba protected area complex in Gabon is quite instructive in this regard (Dallmeier *et al.*, 2006; Moussotsi Ikapi, 2016).

This type of PPP also should be considered whenever a project has a significant impact on biodiversity, or indeed protected areas, and it is essential to implement compensatory measures. This is the case, for example, of the Chad-Cameroon pipeline, part of whose environmental impacts have been compensated through the establishment of a trust fund financed by the oil companies through the Cameroon Oil Transportation Company (COTCO). The funds collected notably make it possible to support the conservation of Mbam and Djerem and Campo-Ma'an National Parks through a partnership between private companies and the managers of these protected areas.

Such partnerships also could be extended to local and indigenous communities in a dynamic of broader collaboration. This would promote the transparency of the extractive industries, their optimal contribution to national economies, their societal responsibilities, the optimal management of biological resources and the protection of the environment, as well as the security of the rights and well-being of local and indigenous communities that may be impacted.

5. Conclusion

In Central Africa, although fluctuating commodity prices, particularly for oil and iron, and the Covid-19 epidemic have slowed the development of extractive industries in recent years, revenues from oil, gas and mining still form the bedrock of public finances. These industries provide the bulk of export revenues, and often have done so for several decades, as evidenced by the large number of mining, oil and gas contracts and the extent of the land which they occupy.

Extractive contracts currently cover 60% of Central Africa's protected area network and 60% of the subregion's intact forest landscapes. Moreover, oil and gas claims cover 100% of the maritime exclusive economic zones, whether or not these areas are classified as protected areas. Virtually the entire Chad Basin is covered by petroleum claims, as is the Central Congo Basin, including very fragile aquatic and

An example of compensation: the Chad-Cameroon oil pipeline project and protected areas

W. E. Waitkuwait, GIZ

The Foundation for the Environment and Development in Cameroon (FEDEC) was created in 2001 as part of the Environmental Management Plan for the Chad-Cameroon Pipeline Project. This pipeline allows oil to be transported from fields in southern Chad to Cameroon's Atlantic coast in the Kribi region. FEDEC manages a trust fund intended to pay some compensation for the project's adverse effects on the environment (ecological and social). Protected area managers and the private sector must work in partnership, led by the World Bank, the government of Cameroon and a consortium of oil companies involved in the pipeline development.

The funds are generated by compensation payments for project impacts by Exxon-Mobil, Chevron and Petronas, and made by COTCO, the company in charge of managing the pipeline. They are intended to finance the development and management of Mbam and Djerem and Campo-Ma'an National Parks, and to support sustainable agriculture and the improvement of education and health systems for the Bakola/Bagyeli indigenous peoples between Lolodorf and Kribi. COTCO has committed to financially support FEDEC for 28 years (the projected life of the pipeline) and has paid US$6 million to date. The credibility of the actions carried out on the ground is guaranteed by the World Bank. FEDEC was recognized as a public utility in 2001 and has an agreement with MINFOF (Ministry of forests and wildlife of Cameroon), allowing it to seek other investors and to work across Cameroon in favor of the environment and biodiversity. It has obtained MINFOF's agreement to intervene in two other parks, Deng Deng and Mbere Valley. It is looking for other investors interested in investing in these two parks.

In 2017, financial contributions to the various projects amounted to FCFA 58 million for the Campo-Ma'an park (beneficiary: African Wildlife Foundation (AWF), an NGO), FCFA 78 million for the Mbam and Djerem park (beneficiary: WCS, an NGO) and FCFA 56.5 million for support to local communities. FEDEC also receives ad hoc contributions from other donors on a project funding basis, including the Canadian High Commission in Yaounde (support for rural communities) and Granby Zoo (mobilization campaign for the construction of a gorilla health laboratory, gorilla habituation and support for local communities).

However, these contributions remain far below expectation, situated around 400-500 million FCFA/year per protected area to cover all of the expenses involved in implementing the management plans. A drop in the value of the US dollar, combined with difficulties in recovering investments, did not help to replenish the Foundation's coffers. This situation led FEDEC to draw from its capital in 2008, which raises the spectre that the mechanism may become unsustainable.

In this context, we note with regret that the Cameroon Government does not contribute to FEDEC's capital funds. Government participation in a trust fund would have the advantage of legitimizing the fund in the eyes of other potential donors, such as private sector companies that may be interested in biodiversity conservation. The current legal framework of FEDEC, like all trust funds operating in Cameroon today, also needs to be clarified. Legislation favoring foundations should be introduced, which would reassure potential investors.

peatland ecosystems. In addition, many of the rich and fragile ecosystems around the Central Congo Basin are in the grip of mining claims.

Their current and potential impact on biodiversity is considerable and could undermine conservation and sustainable development strategies in the subregion. While the local impact of oil wells may be relatively small, the overall direct and indirect impacts and socio-economic changes caused by extractive operations are often much larger. They must be better taken into account in all extractive projects.

Countries want to develop while reducing the environmental impact of human activities. To achieve this dual objective, human development must be decoupled from impacts on biodiversity and the physical environment, and from the indiscriminate exploitation of natural resources (Fischer-Kowalski *et al.*, 2011).

This last point requires deep societal changes leading toward more mineral-saving societies, technological innovation, and the development of alternative energy resources such as solar, hydraulic and wind energy. A country like Gabon, which is a member of OPEC (Organization of Petroleum Exporting Countries), can nonetheless be subject to purely commercial pressure from the most powerful countries in the organization, such as Saudi Arabia, to either open or close its oil taps. As we have seen, the national economy and the balance of state finances remain highly dependent on the oil sector, despite commendable attempts at economic diversification. For the sake of economic stability, but also for a more low-carbon development (contributing to the fight against climate change), it is in the country's interest to strengthen the diversification of the economy while using its oil resources sparingly.

This calls for overall policy, in particular energy policy, that is clear, stable, and consistent with sustainable development objectives, which must be explained to stakeholders. Tensions between governments, oil (and mining) companies, political partners, NGOs and civil society, all of whom have different interests at stake, must be resolved (Le Bec, 2020b). This requires: 1) the development of stakeholder consultation platforms (including representatives of protected areas and biodiversity conservation), 2) the systematization of multi-stakeholder land planning for sustainable development, 3) the application of internationally recognized environmental and social standards, and 4) the strengthening of the transparency and governance of the extractive sector.

It is therefore imperative for States to be aware of the need to approach these extractive industries in an integrated manner, promoting local industrialization and increasing fiscal resources while meeting the aspirations of their populations and the need for the conservation and sustainable management of biological resources and the ecosystem services that they provide. This means that States should implement sustainable development policies that promote better distribution of wealth. Even if some progress can be noted, the oil and mining sector still needs to demonstrate transparency, good governance and equity in the distribution of revenues (membership in EITI, accessibility of an up-to-date mining cadastre, transparent tax and revenue declarations, etc.).

The first point mentioned above – reducing the impacts of industrial activity – is of even more direct relevance to protected areas because they are under increasing pressure from industry, as we have seen throughout this chapter. In almost all Central African countries, many mining and oil exploration and exploitation claims border or overlap large areas of protected areas and intact forest landscapes. The exploitation of these underground resources therefore threatens the rich biological diversity within and around these protected areas. However, apart from gold mining and artisanal diamond production, large-scale industrial mining is still underdeveloped in most of the subregion. It is therefore still possible to avoid the mistakes of the past and to ensure that the future development of mining is environmentally and community-friendly.

While policies and legislation have changed significantly in recent years, particularly in terms of environmental and social standards, they are not sufficiently enforced on the ground. It is up to the States to ensure that environmental and social impact studies are carried out according to international standards and that mining and oil projects systematically implement the avoid-reduce-offset sequence. The government departments involved face significant challenges, particularly in terms of strengthening their expertise in these areas and their monitoring and intervention capabilities. Public-private style

partnerships could make it possible to remedy these shortcomings and promote the reconfiguration and operational expansion of public services.

Other partnerships could also be put in place to support States in the necessary formalization of artisanal mining. Attempts to establish cooperatives have been carried out in DRC, with insufficient success to date. Gabon also wants to move in this direction, but the needs are such (training, supervision, various forms of support; De Failly, 2013; Ondo Nzuey, 2019) that the public sector must enlist partners to help meet these needs.

Throughout this chapter, we have tried to show that it is possible for these two forms of land use – extractive concessions and protected areas – to coexist on the same territory if certain conditions are met. The management of natural and other public resources must be improved, adequate land use planning and development ensured, and intersectoral cooperation encouraged in the exploitation of the resources that the territory contains or shelters. It is also important that States make a strong commitment to prohibit mineral exploration and exploitation in protected areas, in accordance with the laws governing their management and with the international environmental agreements to which they are party. Similarly, the rigorous legal framework for mining and oil exploitation must be implemented as a priority on the outskirts of protected areas to guarantee the safeguarding and restoration of nature, as well as the well-being of local communities.

The challenges are certainly great, but a strong political will is likely to shift the tide in order to promote an economy that is more respectful of human life and societies, which will ensure economic development that integrates environmental concerns. Some countries seem to have made more progress than others. Regional coordination and the sharing of experiences and lessons learned therefore could give a regional dynamic a boost in the right direction.

Bibliography

References cited in the text

Aghalino S.O. & Eyinla B., 2017. Oil exploitation and marine pollution: evidence from the Niger Delta, Nigeria. *J. Human Ecology* 28(3) : 177-182.

Alexeev M. & Conrad R.F., 2009. The elusive course of oil. *Review of Economics and Statistics* 91(3) : 586-598.

Ali D.A., Deininger K. & Goldstein M., 2014. Environmental and gender impacts of land tenure regularization in Africa: Pilot evidence from Rwanda. *J. Development Economics* 110 : 262-275.

Alligand G., Hubert S., Legendre T., Millard F. & Müller A., 2018. Évaluation environnementale. Guide d'aide à la définition des mesures ERC. Commissariat Général au Développement Durable, La Défense, France : 133 p.

Amarachi P.O. & Kabari S., 2020. A review of the threat of oil exploitation to mangrove ecosystem: Insights from Niger Delta, Nigeria. *Global Ecology and Conservation* 22, e00961.

AMDC, 2017. Report on artisanal & small-scale mining in Africa. Selected countries policy profile review on ASM. Report, African Minerals Development Centre, Conakry, Guinea : 119 p.

Anon., 2021. Affaire GEOVIC: voici comment des camerounais ont fait perdre 55 milliards à l'État. *Cameroon Magazine*. https://www.cameroonmagazine.com/societe/affaire-geovic-voici-comment-des-camerounais-ont-fait-perdre-55-milliards-a-letat/ (accédé 30/01/2021)

Anon., 2020a. Congo-Brazzaville : découverte d'un premier gisement on-shore de pétrole. *Jeune Afrique*. https://www.jeuneafrique.com/815456/economie/congo-brazzaville-decouverte-dun-premier-gisement-onshore-de-petrole/ (accédé 19/10/2020)

Anon, 2020b. 44 organisations des droits humains plaident pour la protection du Dr Denis Mukwege – Prix Nobel de la paix 2018 – qui subit de graves menaces pour avoir dénoncé un massacre de civils à Kipupu dans le Territoire de Mwenga (Province du Sud-Kivu) en RD Congo. Protection International. https://protectioninternational.org/fr/nouvelles/rd-congo-pi-et-43-organisations-des-droits-humains-plaident-pour-la-protection-du-dr-denis (accédé 14/12/2020)

Anon., 2019a. Cameroun : la SNH double sa production de gaz domestique destinée au marché local. *Hydrocarbures*. https://www.agenceecofin.com/production/1112-71992-cameroun-la-snh-double-sa-production-de-gaz-domestique-destine-au-marche-local (accédé 19/10/2020)

Anon., 2019b. RDC – Or : la société minière Banro suspend ses activités dans quatre filiales. *Jeune Afrique & AFP*. https://www.jeuneafrique.com/836522/economie/rdc-or-la-societe-miniere-banro-suspend-ses-activites-dans-quatre-filiales/ (accédé 10/10/2020)

Anon., 2014. Les prix du minerai de fer à leurs plus bas niveaux depuis 2009. Boursorama & Thomson Reuters. https://www.boursorama.com/bourse/actualites/les-prix-du-minerai-de-fer-a-leurs-plus-bas-niveaux-depuis-2009-e0cbb1bcaf1105375f84be650a12cda0 (accédé, 10/10/2020)

Anon., 2013. Coups de feu à Minkébé : un mort et 34 orpailleurs aux arrêts. *Gabon Review*. http://www.bdpmodwoam.org/articles/2013/11/20/coups-de-feu-a-minkebe-un-mort-et-34-orpailleurs-aux-arrets/ (accédé 01/07/2020)

Assala Energy, 2021. https://www.assalaenergy.com/fr/ (10/02/2021)

Atlasocio, 2020a. Classement des États du monde par produit intérieur brut (PIB) par habitant à parité de pouvoir d'achat (PPA). https://atlasocio.com/classements/economie/pib/classement-États-par-produit-interieur-brut-par-habitant-parite-pouvoir-achat-monde.php (13/10/2020)

Atlasocio, 2020b. Classement des États du monde par indice de développement humain ajusté aux inégalités (IDHI). https://atlasocio.com/classements/economie/developpement/classement-États-par-indice-de-developpement-humain-ajuste-selon-les-inegalites-monde.php (13/10/2020)

Aufrand V., 2021. Pétrole WTI : les cours de pétrole marquent le pas après être remontés sous des résistances majeures. *IG Bank*. https://www.ig.com/fr-ch/marche-actualites-et-idees-de-trading/vente-wti-210311 (accédé 11/03/2021)

Augé B., 2018. L'exploration et la production pétrolière depuis 2014. Evolution des acteurs et de leurs stratégies. *Notes de l'Ifri* : 30 p.

Aveling C., 2009. La contribution de la biodiversité dans le maintien des produits et services forestiers. *In* : de Wasseige C., Devers D., de Marken P., Eba'a Atyi R., Nasi R. & Mayaux P. (Eds.), Les forêts du bassin du Congo. État des forêts 2008. Office de publication de l'Union Européenne, Luxembourg : 163-177.

BAD, 2020. Perspectives économiques en Afrique centrale 2020. Faire face à la pandémie de COVID-19. Banque Africaine de Développement. BAD, Abidjan, Côte d'Ivoire : 63 p.

BAD, 2019. Perspectives économiques en Afrique centrale 2019. Performances macroéconomiques et perspectives. Intégration régionale en Afrique centrale. Banque Africaine de Développement. BAD, Abidjan, Côte d'Ivoire : 52 p.

BAD, 2013. La transformation structurelle en Afrique centrale. Perspective historique et recommandations à moyen terme. BAD, Département régional Centre (ORCE), Revue thématique 2 : 11 p.

Banro Corporation, 2016. First mover in DRC with quality gold operations and high growth potential. Banro corporate presentation : 26 p.

Billand A., 2012. Biodiversité dans les forêts d'Afrique centrale : panorama des connaissances, principaux enjeux et mesures de conservation. *In* : de Wasseige C., de Marken P., Bayol N., Hiol Hiol F., Mayaux P., Desclée B., Nasi R., Billand A., Defourny P. & Eba'a Atyi R. (Eds.), Les forêts du bassin du Congo. État des forêts 2010. Office de publication de l'Union Européenne, Luxembourg : 63-94.

Boekhout van Solinge T., 2008. Crimes, conflicts and ecology in Africa. *In* : T. Sollund (Ed.), Global Harms: Ecological Crime and Speciesism. Nova Science Pub. : 13-35.

BP, 2020. BP statistical review of world energy, June 2020. http://www.bp.com/statisticalreview (accédé 19/10/2020)

Brunnschweiler C. & Bulte E., 2008. The resource curse revisited and revised: A tale of paradoxes and red herrings. *Journal of Environmental Economics and Management* 55(3) : 248-264.

Cadastre Minier, 2020. Portail du Cadastre minier de la RDC. Cadastre Minier, Kinshasa, RDC. Mise à jour : 10/08/2020. http://drclicences.cami.cd/fr/ (accédé 20/10/2020)

Carbonnier G., 2013. La malédiction des ressources naturelles et ses antidotes. Revue internationale et stratégique 91 : 38-48.

Caslin O., 2018. Congo – industries extractives : fertile potasse. *Jeune Afrique*. https://www.jeuneafrique.com/mag/622656/economie/congo-industries-extractives-fertile-potasse/ (accédé 14/10/2020)

Chigbu U.E., Ntihinyurwa P.D., De Vries W.T. & Ishimwe Ngenzi E., 2019. Why tenure responsive land-use planning matters: insights for land use consolidation for food security in Rwanda. *Int. J. Environmental Research and Public Health* 16 : 24 p.

Chuhan-Pole P., Dabalen A.L. & Land B.C., 2020. L'exploitation minière en Afrique. Les communautés locales en tirent-elles parti ? AFD, Paris & Banque Mondiale, Washington : 191 p.

Cigorogo J.R., Musibono E.D., Nsimanda I.C. & Ifuta N., 2020. Mise en œuvre du système d'études d'impact environnemental dans le secteur minier Congolais : une vision stratégique de développement durable ou une approche conceptuelle ? *IJLAS* 28(2) : 487-497.

CREF, 2015. La problématique de l'exploitation minière dans le Nord Kivu en RDC : situation actuelle et analyse sur les questions environnementales. *Bulletin WRM* 216 : 23-28. https://wrm.org.uy/fr/bulletins/numero-216/ (accédé 01/07/2020)

Dagallier L.-P.M.J., Janssens S.B., Dauby G. *et al.*, 2019. Cradles and museums of generic plant diversity across tropical Africa. *New Phytologist* 225 : 2196–2213.

Dallmeier F., Alonso A., Campbell P., Lee M.E., Buij R. & Pauwels O.S.G., 2006. Ecological indicators for the industrial corridor in the Gamba Complex of Protected Areas: a zone of high biodiversity value and oil exploration in southwest Gabon. *Bulletin of the Biological Society of Washington* 12: 243-252.

Dargie G.C., Lawson I.T., Rayden T.J., Miles L., Mitchard E.T.A., Page S.E., Bocko Y.E., Ifo S.A. & Lewis S.L., 2019. Congo Basin peatlands: threats and conservation priorities. *Mitig. Adapt. Strateg. Glob. Change* 24 : 669–686.

Davis G.A. & Tilton J.E., 2005. The resource curse. *Natural Resources Forum* 29(3) : 233-242.

De Failly D., 2013. Le secteur minier en RDC : quelle transformation pour quel développement ? *Politique étrangère* 2 : 113-123.

De Failly D. & Bantu J.-M., 2010. La forêt d'Itombwe : enjeux socio-économique et conservation de la nature en contexte Congolais. Terre citoyenne & Association des Populations des Montagnes du Monde : 25 p.

De Souza O., 2021. Les événements qui vont marquer le secteur pétrolier africain en 2021. *Hydrocarbures*. https://www.agenceecofin.com/dossier/2201-84403-les-evenements-qui-vont-marquer-le-secteur-petrolier-africain-en-2021 (accédé 08/03/2021)

De Souza O., 2020. Guinée équatoriale : Malgré la Covid-19, le champ gazier d'Alen entrera en service en 2021. *Hydrocarbures*. https://www.agenceecofin.com/gaz-naturel/1507-78582-guinee-equatoriale-malgre-la-covid-19-le-champ-gazier-d-alen-entrera-en-service-en-2021 (accédé 14/10/2020)

De Souza O., 2019. RDC : quand la quête de pétrole menace la préservation d'un patrimoine naturel exceptionnel. *Ecofin Hebdo*. https://www.agenceecofin.com/la-une-de-lhebdo/1312-72097-rdc-quand-la-quete-de-petrole-menace-la-preservation-d-un-patrimoine-naturel-exceptionnel (accédé 05/10/2020)

DGT, 2020a. Le secteur minier au Gabon. Direction Générale du Trésor, Ministère de l'Economie, des finances et de la relance, Paris, France. https://www.tresor.economie.gouv.fr/Pays/GA/le-secteur-minier-au-gabon (accédé 15/10/2020)

DGT, 2020b. Le secteur pétrolier au Gabon. Direction Générale du Trésor, Ministère de l'Economie, des finances et de la relance, Paris, France. https://www.tresor.economie.gouv.fr/Pays/GA/le-secteur-petrolier-au-gabon (accédé 15/10/2020)

DGT, 2020c. Les défis du secteur minier en RD Congo. Direction Générale du Trésor, Ambassade de France en RD Congo, Service économique, Kinshasa, RDC : 2 p.

DGT, 2020d. L'exploitation minière en RD Congo. Direction Générale du Trésor, Ambassade de France en RD Congo, Service économique, Kinshasa, RDC : 4 p.

DGT, 2020e. Le secteur minier en République Démocratique du Congo. Direction Générale du Trésor, Ministère de l'Economie, des finances et de la relance, Paris, France. https://www.tresor.economie.gouv.fr/Pays/CD/le-secteur-minier-en-rd-congo (accédé 15/10/2020)

Doumenge C. (Ed.), 1992. La Réserve de Conkouati : Congo. Le secteur sud-ouest. UICN, Gland, Suisse : IV + 231 p., 1 carte h.-t.

Doumenge C., Jungers Q., Halleux C., Bélanger L. & Scholte P., 2016. Conflits d'usage des terres dans les espaces ruraux du bassin du Congo : quelles régulations ? *In* : Pesche D., Imbernon J., Losch B. & Magrin G. (Eds.), Une nouvelle ruralité émergente. Regards croisés sur les transformations rurales africaines. Atlas pour le Programme Rural Futures du NEPAD. Seconde édition revue et augmentée. CIRAD, Montpellier, France & NEPAD : 50-51.

Doumenge C., Palla F., Scholte P., Hiol Hiol F. & Larzillière A. (Eds.), 2015. Aires protégées d'Afrique centrale – État 2015. OFAC, Kinshasa, République Démocratique du Congo et Yaoundé, Cameroun : 256 p.

Doumenge C. & Schilter C. (Eds.), 1997. Les Monts Itombwe. D'une enquête environnementale et socio-économique à la planification d'interventions au Zaïre. UICN, Brazzaville, Congo & IZCN, PIL et SIDEM, Bukavu, Zaïre : xii + 269 p.

Dudley N. (Ed.), 2013. Guidelines for applying protected area management categories. IUCN, Gland, Switzerland : x + 86 p.

Dudley N. & Stolton S., 2010. Arguments for Protected Areas. Multiple benefits for conservation and use. Routledge, London : 296 p.

Edwards D.P., Sloan S., Weng L., Dirks P., Sayer J. & Laurance W.F., 2014. Mining and the African environment. *Conservation Letters* 7(3) : 302–311.

Fayolle A., Swaine M.D., Bastin J.-F. *et al.*, 2014. Patterns of tree species composition across tropical African forests. *J. Biogeography* 41(12) : 2320-2331.

Fischer-Kowalski M., Swilling M., von Weizsäcker E.U. *et al.*, 2011. Decoupling natural resource use and environmental impacts from economic growth. A Report of the Working. Group on Decoupling to the International Resource Panel, UNEP, Nairobi, Kenya : 152 p.

Gond V., Cornu G., Viennois G. *et al.*, 2016. De l'arbre au satellite : comment cartographier la diversité des forêts tropicales d'Afrique Centrale ? *In* : Rakotoarisoa N.R., Blackmore S. & Riera B. (Eds.), Botanists of the twenty-first century: roles, challenges and opportunities. *Proc International conference "Botanists of the twenty-first century: roles, challenges and opportunities"*, September 2014, Paris, France. Unesco, Paris : 88-94.

Grantham H. & Tibaldeschi P., 2018. Assessing the potential threat of extractive industries to tropical intact forest landscapes. WWF, Oslo, Norvège : 54 p.

HCDH,2010. République démocratique du Congo 1993-2003. Rapport du Projet Mapping concernant les violations les plus graves des droits de l'homme et du droit international humanitaire commises entre mars 1993 et juin 2003 sur le territoire de la République démocratique du Congo. Haut-Commissariat des Nations Unies aux droits de l'homme : ix + 573 p.

Hilson G., 2019. Why is there a large-scale mining "bias" in sub-Saharan Africa? *Land Use Policy* 81: 852-861.

Hund K., Megevand C., Gomes E.P., Miranda M. & Reed E., 2013. Dynamiques de déforestation dans le bassin du Congo : Réconcilier la croissance économique et la protection de la forêt - Document de travail n ° 4, Exploitation minière. Deforestation trends in the Congo Basin, No. 4. Mining. World Bank, Washington DC.

ICMM, 2006. Good practice guidance for mining and biodiversity. ICMM, London, UK : 148 p.

IFC, 2012. Norme de performance 6. Conservation de la biodiversité et gestion durable des ressources naturelles vivantes. IFC, Washington D.C. : 11 p.

Index Mundi, 2020a. Pétrole - Réserves prouvées. https://www.indexmundi.com/map/?v=97&l=fr (accédé 15/02/2021)

Index Mundi, 2020b. Production pétrolière. https://www.indexmundi.com/map/?t=0&v=88&r=xx&l=fr (accédé 15/02/2021)

IndexMundi,2020c.Gaznaturel–Réservesprouvées.https://www.indexmundi.com/map/?t=0&v=98&r=xx&l=fr (accédé 15/02/2021)

Index Mundi, 2020d. Gaz naturel – Production. https://www.indexmundi.com/map/?t=0&v=136&r=xx&l=fr (accédé 15/02/2021)

Index Mundi, 2020e. Niveau de pauvreté - nombre d'habitants (%). https://www.indexmundi.com/map/?t=0&v=69&r=xx&l=fr (15/02/2021)

Ite A.E., Ibok U.J., Ite M.U. & Petters S.W., 2013. Petroleum exploration and production: past and present environmental issues in the Nigeria's Niger delta. *American Journal of Environmental Protection* 1(4) : 78-90.

ITIE, 2020a. Pays ITIE. https://eiti.org/fr/pays (accédé 15/10/2020)

ITIE, 2020b. République du Congo : de la déclaration au diagnostic. https://eiti.org/fr/news/republique-du-congo-declaration-au-diagnostic (accédé 15/10/2020)

Kahilu Mutshima C., Masengo Kindele J., Sony Tshimwanga J. & Kahadi Tshianzula P., 2015. De l'exploitation minière artisanale et son impact environnemental dans la ville de Kolwezi. Cas de la cité Gecamines de Kapata. *KAS Librairie Africaine d'Etudes Juridiques* 2(3) : 581-597.

Kolk A. & Lenfant F., 2010. MNC reporting on CSR and conflict in Central Africa. *J. Business Ethics*.

Kombo F., 2021. Mines : des résultats encourageants pour le complexe industriel de Soremi. *Les Dépêches de Brazzaville*. Agence d'information d'Afrique centrale. https://www.adiac-congo.com/content/mines-des-resultats-encourageants-pour-le-complexe-industriel-de-soremi-123566 (accédé 09/03/2021)

Le Bec C., 2020a. RDC, Tunisie, Gabon : le modèle de Perenco de plus en plus contesté. *Jeune Afrique*. https://www.jeuneafrique.com/1057569/economie/petrole-le-modele-du-franco-britannique-perenco-de-plus-en-plus-conteste/ (accédé 15/01/2021)

Le Bec C., 2020b. Gabon : le sauve-qui-peut des compagnies pétrolières. *Jeune Afrique*. https://www.jeuneafrique.com/1064995/economie/gabon-le-sauve-qui-peut-des-compagnies-petrolieres/ (accédé 15/01/2021)

Le Billon P. & Hocquard C., 2007. Filières industrielles et conflits armés : le cas du tantale dans la région des grands lacs. *Ecologie & Politique* 34 : 83-92.

Lehmann D., Brinkmann K., Diogo R.V.C & Buerkert A., 2017. Temporal and spatial changes of land use in rare metal mining areas of Rwanda. *Int. J. Mining, Reclamation and Environment* 31(8) : 519-529.

López E., Awawi A. & Salcedo-Albarán E., 2017. Trafficking of Coltan in the Democratic Republic of Congo. The Global Observatory of Transnational Criminal Networks, Research Paper 6 & VORTEX Working Papers 18 : 24 p.

MacKenzie C.A., Fuda R.K., Ryan S.J. & Hartter J., 2017. Drilling through conservation policy : oil exploration in Murchison Falls protected area, Uganda. *Conservation and Society* 15(3) : 322-333.

Marshall C.A.M., Wieringa J.J., Hawthorne W.D., 2021. An interpolated biogeographical framework for tropical Africa using plant species distributions and the physical environment. *J. Biogeography* 48 : 23–36.

Maréchal C., Cawoy V., Cocquyit C. *et al.*, 2014. Conservation et gestion de la biodiversité. *In* : de Wasseige C., Flynn J., Louppe D., Hiol Hiol F. & Mayaux P. (Eds.), Les forêts du bassin du Congo. État des forêts 2013. Weyrich, Belgique : 67-96.

Maréchal L., 2013. Le secteur minier est-il porteur de développement en Afrique ? *Cairn.Info* 2-2013 : 85-97.

Marot C., 2020. BP, Shell, Total… Pourquoi les majors accélèrent leur transition. https://www.jeuneafrique.com/mag/1033740/economie/bp-shell-total-pourquoi-les-majors-accelerent-leur-transition/ (09/03/2020)

Mateso M., 2016. RDC : pollution minière, les populations du Katanga en paient le prix fort. *France info*. https://www.francetvinfo.fr/monde/afrique/republique-democratique-du-congo/rdc-pollution-miniere-les-populations-du-katanga-en-paient-le-prix-fort_3063747.html (accédé 01/07/2020)

Mbadi O., 2020. En Afrique centrale, les producteurs de pétrole voient la vie en noir. *Jeune Afrique*. https://www.jeuneafrique.com/mag/913955/economie/en-afrique-centrale-les-producteurs-de-petrole-voient-la-vie-en-noir/ (accédé 14/10/2020)

Mbadinga F., 2018. Au Gabon, les découvertes de gisements pétroliers offshore se multiplient. *La Libreville*. https://lalibreville.com/gabon-decouvertes-de-gisements-petroliers-offshore-se-multiplient/ (accédé 19/10/2020)

Mbodiam B.R., 2021. Projet minier de Mbalam : courtisé par des avocats, Sundance privilégie une solution amiable au litige avec le Cameroun. *Investir au Cameroun*. https://www.investiraucameroun.com/mines/1203-16090-projet-minier-de-mbalam-courtise-par-des-avocats-sundance-privilegie-une-solution-amiable-au-litige-avec-le-cameroun (accédé 18/03/2021)

Messina J.P. & Feintrenie L., 2014. Exploitation minière en zone forestière au Cameroun. CRESA Forêt-Bois et CIRAD, Yaoundé, Cameroun : vi + 46p.

Milesi J.-P., Toteu S.F., Deschamps Y. *et al.*, 2006. An overview of the geology and major ore deposits of Central Africa: Explanatory note for the 1:4,000,000 map "Geology and major ore deposits of Central Africa". *J. African Earth Sciences* 44(4–5) : 571-595.

MINMIDT, 2012. Arrêté n°005550/MINMIDT/CAB/CJ du 12 du novembre 2012 portant interdiction des activités clandestines d'orpaillage dans les parcs fauniques et aires protégées du territoire national.

Ministère des Hydrocarbures, 2021. Congo Hydrocarbons Repository. https://congo-repo.revenuedev.org/map (accédé 15/02/2021)

Moukouangui Moukala M., 2021. Exploitation illégale de l'or : invasion massive des étrangers et destruction de l'environnement au Gabon. https://www.refletsgabon.com/2021/03/18/exploitation-illegale-dor-invasion-massive-des-etrangers-et-destructions-de-lenvironnement-au-gabon/ (18/03/2021)

Moussotsi Ikapi T., 2016. An oil and gas company operating in an area of high biodiversity - A model for sustainable development and social responsibility. SPE African Health, Safety, Security, Environment, and Social Responsibility Conference and Exhibition, Accra, Ghana, October 2016. https://doi.org/10.2118/183587-MS

Mupfuni S & Malungu A., 2018. Exploitation pétrolière à Virunga et à Salonga: révélations et dénonciations. *InfoCongo*. https://infocongo.org/fr/exploitation-petroliere-dans-les-parcs-des-virunga-et-salonga-revelations-et-denonciations/ (accédé 19/10/2020)

Ngoma C., 2020. Perenco Gabon se lance dans la production du gaz de pétrole liquéfié. *Direct Info*. https://directinfosgabon.com/perenco-gabon-se-lance-dans-la-production-du-gaz-de-petrole-liquefie/

Noiraud J-M., Noiraud A., Equipe JMN Consultant, Languy M., Nzita M., de Wachter P., Kalala D., Mubalama L. & Pelissier C., 2017. Industrie extractive : ses interactions avec la conservation et la gestion des écosystèmes en Afrique centrale. WWF Bureau Régional pour l'Afrique, Yaoundé, Cameroun : 134 p.

OEC, 2020. The Observatory of Economic Complexity. https://oec.world/en (accédé 08/02/2021)

Ondo Nzuey G., 2019. Orpaillage : bientôt des coopératives minières au Gabon. *The World News*. https://theworldnews.net/ga-news/orpaillage-bientot-des-cooperatives-minieres-au-gabon (accédé 20/10/2020).

Oyono P.R., Morelli T.L., Sayer J. *et al.*, 2014. Affectation et utilisation des terres forestières : évolutions actuelles, problèmes et perspectives. *In* : de Wasseige C., Flynn J., Louppe D., Hiol Hiol F. & Mayaux P. (Eds.), Les forêts du bassin du Congo. État des forêts 2013. Weyrich, Belgique : 215-240.

Philippot L.-M., 2009. Rente naturelle et institutions. Les ressources naturelles : une « malédiction institutionnelle » ? *CERDI, Etudes et Documents* E 2009.27 : 31 p.

Plumptre A.J., Davenport T.R.B., Behangana M. *et al.*, 2017. The biodiversity of the Albertine Rift. *Biol. Conserv.* 134 : 178-194.

Potapov P., Hansen M.C., Laestadius L. *et al.*, 2017. The last frontiers of wilderness: Tracking loss of intact forest landscapes from 2000 to 2013. *Science Advances* 3 : 13 p.

Prigogine A., 1985. Conservation of the avifauna of the forests of the albertine rift. *ICPB Technical Publication* 4 : 227-295.

Qin S., Golden Kroner R.E., Cook C., Tesfaw A.T., Braybrook R., Rodriguez C.M., Poelking C. & Mascia M.B., 2019. Protected area downgrading, downsizing, and degazettement as a threat to iconic protected areas. *Conservation Biology* 33(6) : 1275–1285.

Rabanal L.I., Kuehl H.S., Mundry R., Robbins M.M. & Boesch C., 2010. Oil prospecting and its impact on large rainforest mammals in Loango National Park, Gabon. *Biological Conservation* 143 : 1017–1024.

RDC & Banque Mondiale, 2016. Plan Stratégique de Développement du secteur minier (2016 – 2021) de la République Démocratique du Congo. Rapport R-2. Ministère des Mines, Kinshasa, RDC & Banque mondiale, Washington DC : 31 p.

Redpath S.M., Keane A., Andrén H. *et al.*, 2018. Games as tools to address conservation conflicts. *Trends in Ecology and Evolution* 33(6) : 415–26.

Reed E. & Miranda M., 2007. Assessment of the mining sector and infrastructure development in the Congo Basin region. WWF US report, Washington D.C. : 24 p.

RNRA, 2020. National land use planning portal. Rwanda Natural Resources Authority, Kigali, Rwanda. https://rwandalanduse.rnra.rw/index.php?id=2 (accédé 20/10/2020)

Rosellini C., 2005. La répartition de la rente pétrolière en Afrique centrale : enjeux et perspectives. *Afrique contemporaine* 4(216) : 125-138.

S.A., 2020. Le Cameroun crée une Société nationale des mines dont le capital peut être ouvert au secteur privé. *Investir au Cameroun*. https://www.investiraucameroun.com/mines/1512-15726-le-cameroun-cree-une-societe-nationale-des-mines-dont-le-capital-peut-etre-ouvert-au-secteur-prive (accédé 20/12/2020).

Sachs J.D. & Warner A.M., 1995. Natural resource abundance and economic growth. NBER Working paper series 5398. National Bureau of Economic Research, Cambridge, UK. 54p.

Schwartz B., Hoyle D. & Nguiffo S., 2012. *Tendances émergentes dans les conflits liés à l'utilisation des terres au Cameroun.* Rapport WWF, Yaoundé, Cameroun : 19 p.

Shell, 2017. Shell divests Gabon onshore interests. https://www.shell.com/media/news-and-media-releases/2017/shell-divests-gabon-onshore-interests.html (accédé 12/01/2021)

Simonet P., 2007. Les chutes de Kongou, une pomme de discorde. *RFI*. https://www1.rfi.fr/sciencefr/articles/095/article_59104.asp (15/03/2021)

Smith P., 2020. Ruée vers l'or africain (1/5) : en RDC, une « industrie » gangrenée par la contrebande. Jeune Afrique. https://www.jeuneafrique.com/1069095/economie/ruee-vers-lor-africain-1-5-en-rdc-une-industrie-gangrenee-par-la-contrebande/ (accédé 09/03/2021)

Stolton S., Dudley N., Avcıoğlu Çokçalışkan B. *et al.*, 2015. Values and benefits of protected areas. In Worboys G.L., Lockwood M., Kothari A., Feary S. & Pulsford I. (Eds.), Protected area governance and management. ANU Press, Canberra, Australia : 145–168.

Sutherland E., 2011. Coltan, the Congo and your cell phone. The connection between your mobile phone and human rights abuses in Africa. LINK Centre, University of the Witwatersrand, South Africa : 24 p.

Tcheta-Bamba A. & Kodila-Tedika O., 2018. Institutional conditions of the natural resource curse in Africa on economic performance. *MPRA Paper* 86511 : 26 p.

Thies C., Rosoman G., Cotter J. & Frignet J., 2011. Les paysages de forêts intactes. Etude de cas : le bassin du Congo. Greenpeace, Amsterdam, Pays-Bas : 15 p.

Tieguhong J.C., Ingram V. & Schure J., 2009. Impacts of artisanal gold and diamond mining on livelihoods and the environment in the Sangha Tri-National Park (TNS) landscape, Congo Basin. CIFOR, Yaoundé, Cameroun.

Tieguhong J.C. & Ndoye O., 2007. L'impact de l'exploitation du bois des concessions forestières sur la disponibilité des produits forestiers non ligneux dans le Bassin du Congo. FAO, Rome, Etude pilote sur les techniques d'exploitation forestière 23 : 38 p.

Union Africaine, BAD & CENUA, 2011. Préparer un avenir durable pour l'industrie extractive africaine: De la vision à l'action. Projet de plan d'action pour la mise en œuvre de la VMA. Conférence des Ministres chargés du développement des ressources minières de l'Union Africaine, Deuxième session ordinaire, Addis Abeba, Ethiopie, 12-16 décembre 2011. Union Africaine, BAD et CENUA : 51 p.

Ushie V., 2017. De l'aspiration à la réalité. Analyse de la Vision minière africaine. Oxfam GB, Oxford, Royaume-Uni, Note d'information Oxfam : 43 p.

UNEP-WCMC & IUCN, 2020. Protected Planet : The World Database of Protected Areas (WDPA). UNEP-WCMC and IUCN, Cambridge, UK. . ww.protectedplanet.net (accédé 01/07/2020)

Voundi E., Mbevo Fendoung P. & Essigue Emossi P., 2019. Analyse des mutations socio-environnementales induites par l'exploitation minière à Bétaré-Oya, Est-Cameroun. *VertigO* 19(1) : 1-29.

Warnest M., Sagashya D.G. & Nkurunziza E., 2012. Emerging in a changing climate – Sustainable land use management in Rwanda. FIG Working Week 2012, Knowing to manage the territory, protect the environment, evaluate the cultural heritage, Rome, Italy, 6-10 May 2012 : 14 p.

WWF, 2018. Assessing the potential threat of extractive industries to tropical intact forest landscapes. Rapport WWF-WCS-IFS : 53 p.

WWF, 2013. Exploitation minière artisanale dans la Réserve Naturelle d'Itombwe, RDC. Rapport d'activités et recommandations mises à jour. WWF International, Gland, Suisse : 108 p.

Additional references

Leach K., Brooks S.E. & Blyth S., 2016. Potential threat to areas of biodiversity importance from current and emerging oil and gas activities in Africa. UNEP World Conservation Monitoring Centre, Cambridge, U.K.

Johnson D., 2003. Les sables mouvants : l'exploitation du pétrole dans le Graben et le conflit congolais. Rapport, Pole Institute.

Ghazvinian J.H., 2007. Untapped: The Scramble for Africa's oil. Harcourt Ed., New York : 320 p.

Yates D.A., 2012. The scramble for African oil: oppression, corruption and war for control of Africa's natural resources. Pluto Press, London : 272 p.

Gond V., Verger G., Joubert P., Degarne N., Linarès S., Coppel A., Allo S. & Feintrenie L., 2014. Comment atténuer les impacts environnementaux de l'orpaillage illégal ? Retour d'expérience de l'observatoire de l'activité minière en Guyane française. *In* : Conférence internationale sur les initiatives de surveillance de la gouvernance des industries extractive en Afrique francophone, 22-23 août 2014, Yaoundé, Cameroun.

GRIP, 2014. Observatoire pluriannuel des enjeux sociopolitiques et sécuritaires en Afrique équatoriale et dans les îles du Golfe de Guinée. Géopolitique du pétrole dans l'espace CEEAC : L'enjeu des nouvelles politiques des hydrocarbures. Note n° 9, Louvain, Belgique : 24 p.

Halland H., Lokanc M. & Nair A., 2016. Le secteur des industries extractives : points essentiels à l'intention des économistes, des spécialistes des finances publiques et des responsables politiques. Banque mondiale, Washington DC : 145 p. DOI : 10.1596/978-1-4648-0493-9

Annex 1 - Methodology for assessing the impact of extractive concessions (mining, oil and gas) on key sensitive areas (protected areas and intact forest landscapes)

P. Tibaldeschi & P. Izquierdo, WWF-Norway

This study aims to identify and quantify the spatial overlap of extractive concessions (mining, oil and gas) with key environmentally sensitive areas (protected areas and intact forest landscapes) in Central Africa. The countries concerned include: Burundi, Cameroon, Chad, Congo, Gabon, Equatorial Guinea, CAR, DRC, Rwanda and Sao Tome and Principe.

The overlap between spatial, environmental and extractive datasets was defined using GIS analysis with the WWF-SIGHT platform developed by WWF. The coordinate system used was WGS 1984 Web Mercator Auxiliary Sphere. The layout of national borders of Central Africa were obtained from Open Stream maps.

Data defining the spatial location of mining concessions were obtained from the SNL Metals and Mining database (accessed on 02/12/2020). Data defining the spatial location of oil and gas concessions were obtained from the DrillingInfo database (accessed on 02/12/2020). Protected area locations and boundaries were defined using the IUCN/UNEP-WCMC World Database of Protected Areas (WDPA) (accessed 02/12/2020). Intact forest landscapes are those assessed in 2016.

The spatial overlap between these datasets as recorded by the GIS analysis was exported to MS Excel. The data were filtered. Any extractive activity that could be interpreted as having a limited or negligible impact on a protected area was excluded by applying the following filters:

oil and gas concessions

- exclusion of all concessions that expired before 01/12/2020. All oil and gas leases with no specified expiration date remained in the sample,
- differentiation between oil and gas concession contracts in operation (active or awarded, with a clearly identified concessionaire) and those not yet contracted, i.e., without a validated concessionaire or available for award, under bidding, pre-award or negotiation,
- deletion of all concessions closed due to force majeure;

mining concessions

- exclusion of all mining concessions that expired before 01/12/2020. All concessions with no specified expiration date remained in the sample,
- removal of all mining concessions that were neither in the process of being applied for nor awarded. The concessions awarded were differentiated from those for which the claim application is pending;

protected areas

- removal of any protected areas with a status of “Proposed” or “Not reported”, leaving only designated or listed protected areas, including international designations (World Heritage sites, Ramsar sites, biosphere reserves).

One problem we faced was the overlap of protected area surface areas where different

designations may cover the same spatial area (e.g., a national park and a World Heritage site). In addition, a single extractive concession may overlap several types of protected areas in the same zone, generating multiple records duplicating the zone where the overlaps occur. While this is an effective representation of the overlapping areas of the protected area network, it is potentially misleading and the figures cannot be directly compared to the size of the country, for example.

To solve this problem, the results take into account: 1) overlaps occurring within each protected area (keeping only one area where multiple protected area statuses overlap) and 2) overlaps occurring within concessions (keeping only one area where concession boundaries overlap).

The results were then combined to provide an assessment of the overlap of extractive activity with protected areas. Maps were generated using these filtered results.

8

ECOTOURISM AND PROTECTED AREAS IN CENTRAL AFRICA: A FUTURE IN COMMON

Charles DOUMENGE, Baudouin MICHEL, Rémy POLIWA, Thomas BREUER, Esther DE CHASSEY, Télesphore NGOGA and Luis ARRANZ
With contributions from: Honoré TABUNA, Christian JOHNSON OGOULA

Tourism has become an important industry worldwide, accounting for 10.3% of global GDP in 2019 (WTTC, 2020). It contributes significantly to the creation of jobs in some countries, especially for women, youth, migrant workers, rural communities and indigenous peoples (Kamga Kamdem *et al.*, 2020). It can drive other economic sectors such as agriculture, transport, construction, and telecommunications (WTTC, 2020). Tourism also is one of the main ways to both integrate protected areas into local and global economies and generate funding to cover, at least in part, their management costs (UICN-PACO, 2010; WTTC, 2019).

Before the crisis resulting from the Covid-19 pandemic, the global tourism industry was growing at a remarkable rate (WTTC, 2020). It accounted for 5.8% of all exports and 4.5% of global investments (Christie *et al.*, 2013). In 2020, however, Covid-19 halted this trend and tourism fell sharply around the world (UNWTO, 2020a & e; WTTC, 2021). Various recovery strategies are being considered, but it will not be possible to measure their effectiveness immediately. In the opinion of many experts, the sector may undergo profound change, with an increase in domestic tourism, tourism that is more oriented toward nature and open spaces, and tourism that is more responsible with regard to its impacts (Gössling *et al.*, 2020; UNWTO, 2020d; Bhammar *et al.*, 2021; Spenceley *et al.* 2021).

Africa, covering 22% of the Earth's surface, received about 4% of global international arrivals 10 years ago, when it held 15% of the world's population. Today, its share of international tourism has dropped to about 2%, while its population now represents about 19% of the global total (UICN-PACO, 2010; WTTC, 2020). The continent's overall lack of a reputation as a tourism destination, combined with a lack of tourism products, tourism culture, infrastructure, and accommodation capacity, account for this situation.

Nevertheless, some African countries, such as Morocco, Egypt and South Africa, have risen to the level of Asian and South American tourism countries (Table 1). In sub-Saharan Africa, South Africa is the main tourism destination, receiving over 10 million international tourists annually, and enjoying a very strong domestic tourism sector. In Kenya and Senegal, revenues from international tourism contributed 10-15% of exports. These revenues represented 67% of Cape Verde's total exports, only slightly less than for Sao Tome and Principe. For these countries, the sector is therefore an important source of foreign exchange and a vector of economic development (Cessou, 2021).

Table 1 – International arrivals and tourism revenue in some major tourism countries worldwide and in selected benchmark countries in Africa

Country	Arrivals (international tourists)[1]	Tourism revenue	
		(US$ million)[1]	(% of exports)[2]
Mexico	41,313,000	22,526	5
Indonesia	13,396,000	16,426	8
Morocco	12,289,000	7,782	21
Egypt	11,196,000	11,615	19
South Africa	10,472,105	8,944	9
Costa Rica	3,017,000	3,373	19
Kenya	1,931,000	1,072	15
Senegal	* 1,365,000	496	11

Sources: [1] Year 2018 except * 2017, UNWTO (2020a); [2] Year 2017, UNWTO (2020b).

Despite its considerable potential, particularly in nature and adventure tourism, ecotourism and cultural tourism, Central Africa is overall very underdeveloped as a tourism region (at the "pre-tourism" stage; Rieucau, 2001). As Viard (2008) noted, the subregion "is not yet considered a tourism destination as such". Only a few countries have begun to set up proactive tourism policies and strategies, such as Rwanda and Sao Tome and Principe, based notably on their protected area networks.

The subregion's protected areas may be a prime medium for the development of tourism activities, in particular ecotourism and wildlife viewing tourism. Tourism therefore could play an important role in biodiversity protection, providing opportunities for the socio-economic development of protected areas and economic justification for the protection of species and ecosystems (UICN-PACO, 2010; Mossaz *et al.*, 2015; Leung *et al.*, 2019; WTTC, 2019). Wildlife tourism directly accounted for US$120.1 billion of global GDP in 2018, more than five times the estimated value of illegal wildlife trafficking; when induced effects on other sectors are taken into account, the total economic contribution amounts to US$343.6 billion (WTTC, 2019). In Africa, wildlife viewing tourism accounts for one-third of tourism revenues.

This type of tourism is closely linked to seeing Africa's iconic large wildlife in protected areas (mega-herbivores and large carnivores, which have largely disappeared elsewhere). It is the basis for the development of tourism in many countries. This is the case in South Africa and Kenya; in the latter, wildlife viewing tourism generates about 70% of tourism revenues and accounts for over 10% of formal sector employment, mostly in protected areas (WTTC, 2019). In Central Africa, tourism development also has relied heavily on the existence of biodiversity and forests that remain largely intact, as well as particular species such as gorillas (Viard, 2008). Large trees and vast forests – and plants in general – are quietly attracting attention, and are expected to become increasingly popular features in the tourism landscape.

Protected areas are at the heart of tourism development projects in the subregion, and various partnerships have been formed in recent years, with the support of private operators, foundations and international NGOs. This chapter aims to take stock of some of these initiatives and to make this information available to as wide an audience as possible in order to promote the sustainable development of ecotourism in Central African protected areas.

1. Tourism in Central Africa

1.1 Macroeconomic overview

In 2017, Central Africa welcomed over 3,000,000 international visitors and generated nearly US$1 billion in revenue (Table 2; Kamga Kandem *et al.*, 2020). Arrivals and revenues have increased by over 380% since 2005 (from about 800,000 arrivals and US$262.2 million; Viard, 2008). Although the absolute numbers are still small on a global scale, this highlights the region's growth potential and recent dynamism.

These figures, although incomplete, illustrate widely differing situations depending on the country (Table 2). In Rwanda, Sao Tome and Principe and, to a lesser extent, Cameroon, the tourism sector as a whole has grown significantly and, for the first two countries, has become a pillar of the national economies. In other countries, the sector unfortunately has been scarcely developed: international arrivals (all visitors combined) remain below 300,000 visitors. Revenues contribute very little to exports or to GDP and employment. However, it should be noted that these figures should be interpreted with extreme caution given the weakness, if not the virtual non-existence, of tourism satellite accounts in most countries.

Table 2 - Importance of the tourism sector in Central African countries

Country	Arrivals (international tourists)	Tourism revenue (US$ million)	Tourism revenue (% of exports)	(% of GDP)	Contribution to employment (%)
Burundi	299,000	3	1	5.2	3.5
Cameroon	1,081,000	525	10	4.0	6.4
Congo	149,000	-	-	3.9	5.1
Gabon	269,000 *	-	-	2.9	2.6
Equatorial Guinea	-	-	-	-	-
CAR	107,000	-	-	6.6	4.6
DRC	232,000 *	6	1	1.8	1.4
Rwanda	1,000,000	438 [1]	31 [1]	12.7	12.3
Sao Tome and Principe	28,900	66	72	24.3	23.3
Chad	87,000	-	-	4.2	3.2

CAR: Central African Republic; DRC: Democratic Republic of the Congo.
[1]: US$498 million and 50% of exports in 2019 (RDB, 2020). - : no data.
Note: figures for the year 2017 except * (2016).
Sources: UNWTO (2019a & b, 2020a & b), Rwanda Chamber of Tourism (pers. com. 2019), Kamga Kamdem *et al.* (2020).

1.2 Strengths and weaknesses of the tourism sector in the subregion

Central Africa has a rich potential for nature-based tourism and ecotourism, both in terms of natural and cultural resources. It also benefits from significant international support in the protection of its natural heritage and the management of protected areas. The subregion also benefits from direct air links with various sending countries.

However, the tourism facilities on offer are not very developed, valued or professional. With the exception of Rwanda and Sao Tome and Principe, tourism remains a neglected sector in most national economies, which are mainly focused on extractive industries (mining, oil, forestry) and agriculture. Tourism development policies and strategies are just beginning to be formulated, and governments do not appear to be giving the attention needed to their implementation. This activity continues to face many obstacles, including red tape, complex visa requirements, poor infrastructure, insecurity and armed conflict, lack of specialized skills, lack of investment and an unfavorable business climate (Viard, 2008; Kimbu & Tichaawa, 2018; Kamga Kamdem *et al.*, 2020; Maisonneuve & Poliwa, 2020).

Rwanda has nevertheless managed to overcome these weaknesses and could inspire other countries in their respective efforts. The development of tourism in Rwanda is benefiting from an important natural potential that has been preserved in several protected areas despite heavy human pressure (rural population densities in the country are among the highest in Africa). Tourism in Rwanda is anchored in the national parks, particularly mountain gorilla tourism. The current success also is due to several factors, including the country's stability, proactive policy, efficient institutions, good international connections, development of road and hotel infrastructures, and effective communication campaigns. The creation of the Rwanda Development Board (RDB) has brought together support for private sector development (including facilitating business start-ups and fighting corruption), management and promotion of tourism activities and management of protected areas. In addition, the RDB has signed Public-Private Partnership (PPP) agreements with the South African NGO African Parks Network (APN), which has enabled the restoration of Akagera Park and the professionalization of the tourism sector on this site.

Elsewhere in the subregion, the arrival of nature tourism professionals and improved visitor reception facilities in certain protected areas are providing opportunities for the development and professionalization of the sector. Despite this, the weakness of the infrastructure, the lack of policies and strategies and the lack of an attractive legislative framework for tourism operators remain handicaps. In general, the political and institutional context is not yet conducive to the development of ecotourism.

2. Current and potential tourism

2.1 The land of the great apes

Africa is "the" continent of large fauna and the ideal place for wildlife tourism. Eastern and Southern Africa are world famous for the Big Five: lions (*Panthera leo*), leopards (*Panthera pardus*), savanna elephants (*Loxodonta africana*), rhinoceros (*Diceros bicornis* and *Ceratotherium simum*) and buffaloes (*Syncerus caffer*). These large mammals, feared and respected, still roam the savannas of Central Africa, but this image does not best reflect the situation in the subregion; the savanna elephant is highly endangered, the lion has become rare, and rhinoceros, exterminated by poaching, are being reintroduced (APN, 2019).

Beyond the Big Five, Central Africa needs to develop and advertise its own brand image. While the subregion contains both savannas and vast forests, it is the forests that could be the means to developing an original image – or trademark – of the destination (Devanne & Fortin, 2011). Gorillas are one of the subregion's iconic species and are already the subject of wildlife viewing tourism, which many visitors dream about (Virunga National Park, 2021c; Saiga, 2021; Visit Rwanda, 2021b). Moreover, Central Africa also is the cradle of the bonobo and home to two chimpanzee subspecies. These are the mammals which are the closest to the human species. Nowhere else can all of these species be found together in one region; Central Africa is truly "the land of the great apes".

Chimpanzee and bonobo habituation programs have only recently begun, and tourism to view these

two species in their natural environment is under development (Table 3). In contrast, gorilla tourism is well established in the Albertine Rift mountains, generating significant income; western gorilla tourism is more recent. In addition to these sites where great apes can be tracked in their natural environment, several initiatives have been developed in the subregion to host animals that have been poached, which also allow them to be seen in parks or in semi-liberty. These include bonobos in the *Lola ya bonobo* sanctuary (25 km from Kinshasa, DRC), chimpanzees in the HELP Congo (*Habitat Écologique et Liberté des Primates*) sanctuary in Conkouati-Douli National Park (Congo) or on Pongo Songo Island (Littoral region, Cameroon), and gorillas in the Lesio-Louna Gorilla Sanctuary (Congo).

Table 3 - Protected areas with great ape tourism in the wild (habituated animals)

Country	Western gorilla *(Gorilla gorilla)*	Eastern gorilla *(Gorilla beringei)*	Chimpanzee *(Pan troglodytes)*	Bonobo *(Pan paniscus)*
Cameroon	Campo-Ma'an			
Congo	Lossi, Nouabale-Ndoki and Mondika, Odzala-Kokoua		Nouabale-Ndoki	
Gabon	Loango, Moukalaba-Doudou			
CAR	Dzanga-Sangha			
DRC		Kahuzi-Biega, Virunga	Virunga	Mbali River Forest (Mai-Ndombe); Salonga
Rwanda		Volcanoes	Nyungwe	

Seeing a gorilla in the wild is a unique experience. While eastern gorilla tourism is well established, western lowland gorilla tourism could also act as a catalyst for the tourism sector in Central Africa, although developing lowland gorilla tourism is somewhat more challenging (see box on this subject). Gorillas accustomed to human presence can play an important role as ambassadors for conservation (Greer & Cipolletta, 2006). They also can promote: 1) increased political support and international awareness of conservation efforts for threatened species, 2) reduced poaching through constant monitoring of the home range of habituated groups, 3) increased support from donors and sponsors, 4) increased research to better understand the natural history of these charismatic mammals and to encourage research on other species in the same sites, and 5) increased employment and income generation opportunities in rural areas.

The reality of western lowland gorilla tourism

T. Breuer & I. Herbinger, WWF-Germany & S. Masi, MNHN

Mountain gorilla viewing tourism as a model?

In Rwanda, Uganda and DRC, wildlife viewing tourism of eastern gorillas, particularly of mountain gorillas (*Gorilla beringei beringei*), has been very successful. It has contributed substantially to the operating costs of protected areas, as well as the local and national economy of their range countries (Hatfield & Malleret-King 2007; Moyini & Uwimbabazi 2000; Nielsen & Spenceley 2011). The success of mountain gorilla-based tourism has attracted the attention of other Central African countries in the hope that similar revenue could be obtained from great ape-viewing tourism. However, western gorillas (*G. gorilla*) are not mountain gorillas, and lowland forests are not mountain forests.

Western lowland gorilla tourism is more challenging

Most western lowland gorilla tourism projects are the outcome of intensive long-term research programs (Blom *et al.*, 2004; Doran-Sheehy *et al.*, 2007). Lowland gorilla tourism with habituated groups has proven to be challenging and expensive. Complete habituation can take up to eight years, compared to two years for mountain gorillas (Blom *et al.*, 2004; Doran-Sheehy *et al.*, 2007).

While mountain gorilla groups leave clear traces on the herbaceous vegetation, lowland gorilla tracking requires skilled trackers to be able to find the same group every day in the understory of dense forests, especially during the dry season. Moreover, lowland gorillas have larger overlapping home ranges, and they usually live in smaller groups. This makes it crucial to follow them daily, but also makes it more difficult to track the same group of gorillas, which slows the habituation process (Bradley *et al.*, 2008). In addition, western gorillas are sympatric with forest elephants (*L. cyclotis*) throughout their home range. Elephants often are found in the same vegetation used by the gorillas or even near the same trees on which they feed, and can be dangerous when tourists are viewing the gorillas or traveling to and from habituated gorilla groups.

When habituating western lowland gorillas, habituation teams must be very close to the gorillas in order for the gorillas to see them. Due to the dense vegetation and flat topography, it may be necessary to approach as close as 10 meters from them before first contact. Gorilla reactions to such close proximity may then be more aggressive or last longer during the habituation process than with mountain gorillas. It therefore often takes longer to reach the stage where gorillas can be reliably observed without the risk of aggressive charges.

Investment and operating costs can run into the hundreds of thousands of US dollars (Greer & Cipolletta, 2006). Some projects fail to fully habituate lowland gorillas, even after several years of significant financial investment (French, 2009), and others have lost habituated groups due to disease outbreaks (Bermejo *et al.*, 2006). Due to the family structure of western lowland gorillas (one polygynous male), their habituation is also uncertain and represents a risky investment of time and money, as groups disintegrate after the death of the group's only silverback (Stokes *et al.*, 2003). This can negate all previous efforts and investments. In contrast, in multi-male mountain gorilla groups, one of the surviving males becomes the leader of the troop following the death of the dominant silverback (Robbins & Robbins, 2005).

Some recommendations

Developing a tourism project with western lowland gorillas will be more expensive and time consuming than one with mountain gorillas, and will require dedicated and skilled trackers. The habituation process should only be started once sufficient funding has been secured, over a sufficiently long period of time (at least five years), before opening the groups to tourist visits. This is essential to prevent projects from leaving the habituation area and poachers from killing the gorillas. Large groups with several females should also be selected as a priority. Habituation of a second group also is a good strategy to avoid the loss of the only habituated group if the silverback dies and the group disperses.

2.2 The need to diversify the tourism attractions on offer

Having a "flagship" tourist product is not enough: tourism thrives on the diversity of the offer. This diversity is necessary to: 1) arouse new desires in tourists, 2) provide them with varied and complementary experiences, and 3) keep them longer at each site or in the subregion. The diversification of the tourism offer must be considered at the scale of each site, but also at the scale of each country and of the subregion (see the cross-border tourism circuit proposed by the Congo Conservation Company; CCC, 2021). The subregion requires a strategy for diversifying the tourism offer at these different levels, which implies consultation and collaboration between tourism structures (ministries, receptive agencies, etc.).

Virunga National Park illustrates well the potential diversity of tourism offerings (see box). Not all of this potential currently is being developed, particularly due to security constraints (Balole-Bwami, 2018). Although other protected areas do not have Virunga's extensive geo-biodiversity, all of them have assets that could be used to gradually diversify their tourism offer. Central Africa is home to many rare and emblematic species, both animal and plant: gorillas, bonobos, okapi (*Okapia johnstoni*), grey-necked rockfowl (*Picathartes oreas*), humpback whales (*Megaptera novaeangliae*), leatherback turtles (*Dermochelys coriacea*), large trees such as the moabi (*Baillonella toxisperma*) and impressive lianas, and so on.

Searching for animals in the forest is difficult but can be a unique experience. However, where tracking is not possible, several protected areas have established wildlife viewing platforms in swampy clearings, locally known as *baï* (see box). The important knowledge that scientists have acquired about forest birds in a country like Gabon also has made it possible to develop bird tourism, a niche tourism sector that boosts the reputation of the subregion among naturalists and tourists in search of rarities.

The cultural potential of the subregion also is considerable, with many peoples whose traditions remain alive and which they would be proud to share (chieftaincies of the West Cameroonian Grassfields,

Virunga National Park: an example of potentially diversified tourism

Virunga National Park in DRC is the oldest park in Africa. It also is the richest in Central Africa in terms of landscape, ecosystems and species diversity (Delvingt *et al.*, 1990; Plumptre *et al.*, 2007). The Virunga Foundation manages the park through a PPP signed with the *Institut Congolais pour la Conservation de la Nature* (ICCN) for a period of 25 years (2015-2040). Its objectives are to support the protection of the park and to generate benefits for local communities living on the periphery (Parc national des Virunga, 2021a). It also manages tourism and its promotion.

The park's main tourism product is gorilla tourism, but other tours and activities are offered to visitors, increasing the park's attractions and promoting its tourism value (Table 4 and Figure 1). In addition to gorilla viewing, current activities include climbing Nyiragongo volcano and Ruwenzori Mountains, trips to Tchegera Island and visits to the Rumangabo chimpanzees. The tourism offer also can be complemented by activities on the outskirts of the park, which help to anchor tourism in the region as a whole. Projects to increase the ecotourism attractiveness of the park include the following priorities: further development of gorilla viewing tourism, walking and bird watching tours, chimpanzee watching, additional climbing trails on the active Nyiragongo and Nyamulagira volcanoes, etc.

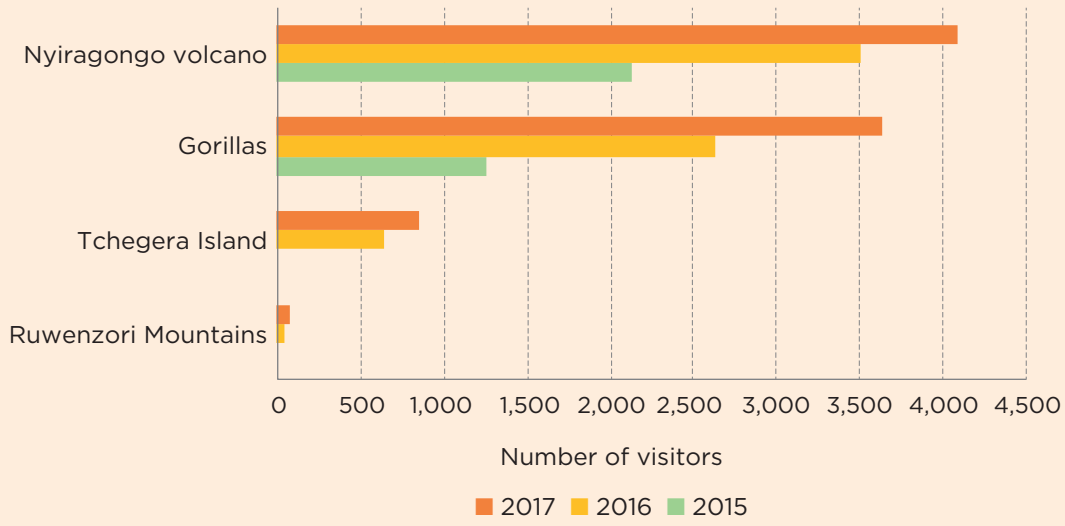
Virunga National Park: an example of potentially diversified tourism

Table 4 - Main current or potential tourism products in Virunga National Park

Park area	Tourism product	Park area	Tourism product
South	Mountain gorillas (Mikeno). Nyiragongo and Nyamulagira volcanoes and scientific tourism (vulcanology). Gas emission toward Tongo. Tshegera Island (Lake Kivu). Tongo chimpanzees. Senkwekwe Gorilla Sanctuary, Rumangabo. Chimpanzees (Rumangabo). Scientific tourism (primatology).	**North**	Eastern gorillas (Tshiaberimu). Climbing Mount Ruwenzori Large savanna mammals (Ishango). Walks on Lake Edward and the Semliki River. Sport fishing. Forest walk and canopy tour. Bird tourism and scientific tourism.
Center	Large savanna mammals. Sport fishing (Rutshuru River). Thermal waters (May-ya-moto). Mountain gorillas (Sarambwe). Walk on Lake Edward and the Rutshuru River. Scientific tourism (hydrobiology). Bird tourism and scientific tourism (Lulimbi). Balloon safari. Chimpanzees (Kinyonzo).	**Periphery**	Caves (Mikeno, Nyamabere, Lume, Mwenda). Thermal waters (Mutsora). Waterfalls (Nyahanga, Semliki). Folk dances. Culinary specialties. Religious sites (Muramba, Mount Mikeno, Tshiaberimu). Cultural site (Ishango) and scientific tourism (archaeology). Historical sites (Cyanzu, Kibati).

Source: from Balole-Bwami (2018).

Figure 1 - Visitors to the main tourism sites in Virunga National Park from 2015 to 2017



Source: Fondation Virunga.

the Teke people of Gabon and the two Congos, Aka and Baka Pygmies of the great forests, etc.). This cultural tourism, which could involve at least some protected areas, would make it possible for tourists to immerse themselves in the natural environment with the natives of these regions, the custodians of ancestral knowledge. However, this type of tourism is scarcely developed in the subregion (with the possible exception of certain regions in Cameroon); to do so, respect of the local populations must be ensured and numerous associated dangers avoided (Briedenhann & Wickens, 2007; Rodary, 2010).

Wildlife watching tourism from observation platforms overlooking forest clearings

T. Breuer, WWF-Germany, D. Hedwig & I. Kienast, Elephant Listening Project, Cornell University, C. Stephan, Mbeli Bai Study, WCS-Congo & C. Doumenge, CIRAD

What is a baï and where can tourists observe wildlife?

Baïs are natural clearings in tropical forests. There are many types, including large (up to 50 ha) permanently flooded marshy clearings, *baïs* on areas of bare soil dotted with extremely mineral rich mudholes, and small open areas (less than 1 ha) called *yangas* (Maisels & Breuer, 2015). Consequently, the fauna that visit these *baïs* varies enormously, as does their tourism potential. Grasses, water and salt attract a variety of animals, including gorillas, forest elephants (*L. cyclotis*), forest buffaloes (*S. caffer nanus*), bongos (*Tragelaphus eurycerос*) and birds (Breuer & Metsio Siena, 2015).

An exceptional set of clearings stretches from northeast Gabon to southeast Cameroon, CAR and North-Congo. Other swampy clearings also are present in DRC (such as in Salonga National Park), but the fauna is much rarer there due to heavy hunting activities. Wildlife observation towers have been built in Ivindo, Lobeke, Nki, Odzala-Kokoua, Dzanga-Sangha and Nouabale-Ndoki. The advantages of wildlife viewing on elevated platforms are the absence of long and tedious tracking, relative safety from large wildlife, better chances of seeing wildlife than in the forest, good elevated views, the possibility to spend the night on the mirador (a very different experience than in daytime), and easier viewing at dawn and dusk when animals are moving.

Meeting expectations

Wildlife viewing in *baïs* can nevertheless be difficult. The animals may be far away and not present in large numbers all year round or every day; moreover, they may only appear in the late afternoon when it is time to return to camp (Turkalo *et al.*, 2013; Gessner *et al.*, 2014). It can be difficult to endure the heat and the many insects on the platform, and walking in the forest around the miradors is not advisable as these areas are hotspots of animal activity and it would be dangerous.

Lastly, human activities in the vicinity (logging or mining) and poaching can lead to the disappearance or disruption of the animals' visiting patterns, reducing the possibilities of observation (Stephan *et al.*, 2020). This is the case for forest elephants, which become more nocturnal and suddenly leave the *baï* (Maisels *et al.*, 2015a). To diminish possible frustration, tourists should be aware that they are taking a once in a lifetime glimpse into the life of these large mammals in their natural habitats, and not in a controlled environment like a zoo. Many of these species are critically endangered and being able to see them, even from a distance or briefly, is a privilege.

Wildlife watching tourism from observation platforms overlooking forest clearings

Some good practices

Even on the miradors, visitors can be very intrusive and disturb wildlife. With increasing demand, it becomes necessary to put in place rules (no smoking or littering, speaking softly, etc.). The presence of tourists should be limited to the platform (if it exists) and the access road. Researchers also must be involved from the very beginning of the tourism activity (participation in the design of the activity, scientific mediation, training of guides, support for monitoring, etc.).

Baïs with existing research projects and tourism activities should be monitored and protected at all times (Breuer *et al.*, 2015; Maisels *et al.*, 2015b). Any new observation platform (especially those managed by communities) should only be built where monitoring teams can ensure protection and with a clear tourism development plan. Guidelines on best practices should be established, including for the mirador and any infrastructure construction (Metsio Siena *et al.*, 2015).

Any tourism program should realistically describe what can be expected in each *baï* so tourists have realistic expectations. Additional visitor packages can be created where possible (overnight stay at the *baï*, rental of viewing equipment, etc.). Lastly, *baïs* offer enormous potential for outreach and education; on some sites, it is possible to bring school groups or to allow VIPs to easily observe wildlife.

2.3 Infrastructure and services

2.3.1 National and regional infrastructure

The development of international tourism requires the existence of good air connections from the main sending countries (those that send international tourists). Generally speaking, Central African countries are fairly well connected to European countries, but not as well to Asian or American countries. In contrast, inter-African links are both complicated and chaotic. However, thanks to RwandAir, Rwanda has been able to establish reliable and regular connections with various countries including Nigeria, which provides more and more tourists to "the country of a thousand hills". This African market, which will grow with the emergence of wealthy and middle classes, can only develop if there are better air connections.

The development of regional and national ecotourism also requires improved links within Central Africa itself. In addition to air transport, road and rail links, which often are in poor condition or non-existent, also need to be improved. Within the framework of the major trans-African links, portions of roads have been repaired and tarmacked in Cameroon, Equatorial Guinea, Gabon, Congo, etc., but the entire network remains partially paved and poorly maintained. For example, access to Odzala-Kokoua National Park (Congo) from Brazzaville remains difficult, forcing the tourism operator, CCC, to fly tourists to the park by private plane from the city, heavily impacting the profitability of the activity. Access to Zakouma National Park in Chad, which is a long way from N'Djamena, also requires the use of charter companies. Only in small countries such as Sao Tome and Principe and Rwanda is road access to protected areas relatively easy, the latter having invested heavily in transport networks.

2.3.2 High-end initiatives: locomotives for protected area tourism?

In several countries of the subregion, the States have signed PPPs with private operators, foundations and NGOs for the management of protected areas as well as the development of ecotourism (see Chapter 3). Visitor facilities, logistics and tourism products on offer have thus been greatly improved on certain sites. Despite the difficulties, several professional tourism companies are beginning to establish themselves in Central Africa, making it possible to develop a higher quality, even luxury offer, which was lacking in the subregion.

The most dynamic area, and the first to attract high quality tourism operators, is the Albertine Rift with its mountain gorillas. While Virunga National Park has several camps and lodges, it is mainly in Rwanda that several private groups have invested in luxury accommodation and hospitality facilities (Wilderness Safaris, Governor's Camp, Mantis, etc.). Volcanoes National Park also offers a wide range of accommodation, from the most luxurious to the most basic, that can me*et all* expectations.

In the Congo Basin, large hotel chains are present and tend to be concentrated in major cities (such as the Radisson group), but they are uninterested in the ecotourism market. Companies specializing in this type of product are not yet well established in the region. The Congo Conservation Company is an exception, having operated in North-Congo for the past ten years in Odzala-Kokoua National Park (see box). It has set up several luxury camps and plans further investments over the next 20 years, including in Nouabale-Ndoki Park (Magoum, 2020). CCC also has established a partnership with Sangha Lodge in CAR, which already allows it to offer cross-border tourism products in Sangha Tri-National (TNS). It thus plans to play a driving role in the development of regional tourism, as desired by the countries (protocol for the circulation of tourists in TNS; COMIFAC, 2019).

Odzala-Kokoua National Park as a platform for developing regional tourism

P. Telfer, CCC

In 2011, the Congo Conservation Company partnered with Wilderness Safaris to build the first world-class safari camps in Central Africa. Wilderness Safaris is a leading African safari tour operator with over 38 years of experience, operating in ten countries and with over 40 camps. The company has provided Congo with a wealth of experience in the construction and operation of camps in southern and eastern Africa. With government support, the partners embarked on a three-site construction project in and around Odzala-Kokoua National Park. This was the first project of its kind in Central Africa.

At the start of this project, local expertise was limited and the technical skills required were unavailable in the country. The southern and eastern African experts mobilized did not have experience in the context of Francophone Africa. Technically, they were successful in building the infrastructure, but logistically and financially, many mistakes were made due to a lack of knowledge of local and national regulations and laws, including errors due to language barriers. Nonetheless, the lodges were built and opened in 2012, and CCC has been successfully developing its tourism activities in Congo for several years.

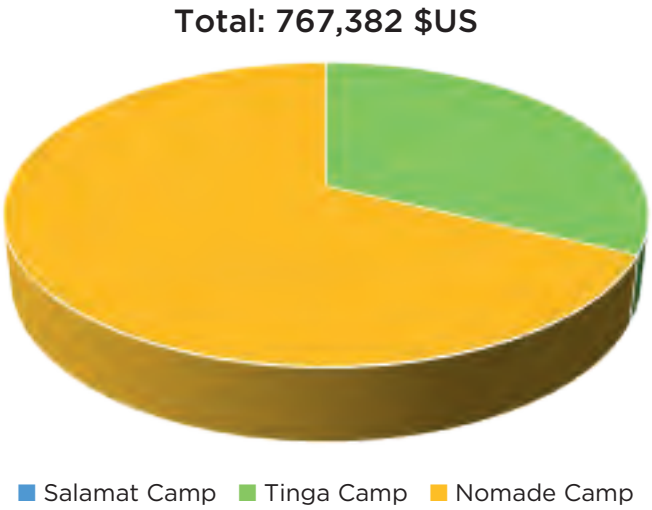
With the experience gained and the support of national government agencies, CCC has been able to overcome many of the earlier problems. One challenge has been to market a destination that was unknown and often associated with a negative or risky image. Difficulties in accessing the site (including obtaining visas and regional transport problems) have remained an obstacle to the competitiveness of tourism in Congo. Despite this, the international market has shown growing interest in the dense forests of Central Africa. For this reason, CCC has committed to expanding the destination, developing two new forest lodges (in Nouabale-Ndoki National Park) and establishing links with other regional destinations (such as Sangha Lodge in CAR). This provides the international tourism market with several safe, comfortable and awe-inspiring tours in the African rainforests.

CCC's goal is to develop tourism in the Congo Basin by offering visitors the opportunity to visit remote and unique forests. The planned investments in both countries will increase the tourism potential of the subregion, generating additional employment and tourism revenues. It will create a critical mass to demonstrate to other investors that tourism in the Congo Basin is a viable economic activity that should be undertaken. CCC is willing to make a long-term investment in the Congo Basin, contribute to the development of tourism, and take the risks needed to create a viable business model for the next 20 years. Creating a "Congo Basin" circuit and offering a variety of travel options will allow international visitors to consider tourism in Africa as a new destination, on par with other traditional markets.

Web link: https://congoconservation.travel/

Other companies specializing in ecotourism are setting up in Gabon, where several agreements have been signed with the African Conservation Development Group (ACDG) in Loango Park, and Luxury Green Resorts, a subsidiary of the *Fonds Gabonais d'Investissement Stratégique* (FGIS). The *Agence nationale de Préservation de la Nature* (ANPN) is collaborating with Luxury Green Resorts to develop high-end tourism services in some parks. This partnership has enabled the opening of an upscale lodge in Pongara National Park and several world-class camps (Akaka, Louri, Ndola) in Loango Park. This partnership thus is creating a real sustainable tourism product for "Destination Gabon". Operators such as APN also have developed infrastructure covering the full range of tourism services in Zakouma National Park (Chad), and will support the NGO *Noé*, which has just signed a PPP for the management of Conkouati-Douli National Park (South-Congo). In Zakouma, the luxury product offered (Nomad Camp and related services) generates about 70% of the park's tourism revenue; the low-end product is currently free for Chadians (Salamat Camp; Figure 2).

Figure 2 - Zakouma National Park tourism revenue in 2018 by level of service (%).



Notes: Salamat Camp – low-end (free); Tinga Camp - mid-range; Nomad Camp – high-end. Source: APN (2018).

2.3.3 The difficult development of small tourism service providers

Developing professional luxury tourism structures is necessary to promote the tourism value of protected areas and the emergence of a "Central Africa" destination. However, it alone will not better anchor protected areas in rural territories. Although high-end facilities hire local staff and train them, developing local skills, tourism is nourished by a diversity of services, from low to high-end. Rural communities will only be able to fully benefit from this dynamic if small structures are expanded.

These rural communities can become high-end operators, but this requires time and the support of qualified professionals. A community association owns a luxury lodge, Sabyinyo Silverback Lodge, on the edge of Volcanoes National Park in Rwanda. However, this lodge is managed by a private Kenyan tourism operator, Governor's Camp, which has entered into an agreement with the association through the African Wildlife Foundation (AWF). Since 2006, the lodge has generated over US$4 million for the community (AWF, 2021 and Governor's Camp, 2021).

The particular cases of the Akanda and Pongara parks in Gabon are interesting to mention because they are peri-urban parks. Akanda benefits from the diverse accommodations and restaurants available in the capital, Libreville. Meanwhile, Pongara benefits from the dynamics of the city's "seaside resort", Pointe-Denis, located on the other side of the Gabon estuary, with several lodges that range from mid-range to luxury style. Tourism in these two parks should benefit even more from this peri-urban dynamic, and offer forest or mangrove stay experiences for visitors from all walks of life. These peri-urban protected areas can play an important role in terms of environmental awareness and education.

Various small tourism operators already are working around Volcanoes National Park, as well as in cities that have potential for business and family travel (such as Libreville, which can leverage two peri-urban parks). Other small tourism structures requiring little investment also have emerged in Gabon within the framework of whale watching tourism, for which only a small boat is needed. However, these tourism structures (accommodation, catering, tourist operators) are not or are only marginally involved in tourism in protected areas. When they are, their skills and modes of operation are generally not in line with ecotourism standards.

Tourism activities in protected areas can be a means of enhancing skills and culture, providing income for surrounding rural communities and driving empowerment and emancipation. This could be the case, in particular, for indigenous peoples, who are often marginalized. If, despite a more favorable tourism environment, tourism activities involving the Bagyeli in the Kribi region continue to be dominated by other operators, the involvement of the Ba'Aka in the Dzanga-Sangha Protected Areas (APDS) suggest ways by which indigenous communities could be more involved (see boxes).

However, challenges remain to be overcome, including raising awareness of the role of rural communities in tourism activities that are new to them, increasing their responsibilities and strengthening their skills in tourism management (Tchindjiang & Etoga, 2014). The grip of the State and external private operators, and even international NGOs, on the design and decision-making processes related to tourism activities and land-use planning hinders the effective involvement of rural populations. While these national and international operators play a fundamental role, this role should evolve more toward one of support, supervision and oversight of local operators.

Creation of community-based tourist circuits as an opportunity for the development and empowerment of the Bakola-Bagyeli (Cameroon)

J. Nke Ndih, CREDPAA

The Bakola-Bagyeli Pygmy population, estimated at about five thousand souls, is found mainly in the South Region of Cameroon. The community's situation is very precarious for many reasons: domination by Bantu neighbors, logging, industrial agriculture, difficulties in accessing land, alcoholism, illiteracy, etc. Despite some support from civil society organizations, religious structures and some administrative services, the Bakola-Bagyeli people remain marginalized and extremely poor.

However, the development of tourism activities in the hinterland of the city of Kribi, a seaside resort but also an important logistics and industrial center, could help to find solutions to some of these problems. Several tourism hubs promoting Bakola-Bagyeli knowledge and culture have been identified: along the Atlantic coast (from Campo to Lobe Falls), the Ngovayang mountain range and the Bidou-Makoure region. The Bagyeli are not only «people of the forest» but also «people of the water». This region could host ecotourism and cultural, social and solidarity tourism, combining water, mountains and forest life.

The Bagyeli's Cultural and Development Association (BACUDA) received support from the Collaborative Actions for Sustainable Tourism (COAST) project between 2009 and 2014. This project trained local guides and created an interpretation circuit of the Bagyeli culture in the forests of Lobe Falls (COAST, 2014). Unfortunately, this type of action remains too ad hoc and does not sufficiently involve rural populations, including the Bagyeli, in their design and decision-making. This would require diverse actors to become more aware of the natural and cultural heritage of the region, sharing of responsibilities, strengthening the Bagyeli's skills in tourism and respect for their rights (Tchindjiang & Etoga, 2014).

All of the projects aim first to sedentarize the Bagyeli, and then to allow them to take charge of their lives. However, these projects, which are financed and designed by the partners, do not sufficiently take into account the Pygmies' way of life. The Pygmies are more concerned with their cultural identity than with the production of material goods. A community tourist circuit project should take into account these cultural aspects, to better embrace the Pygmies' nomadic lifestyle undertaken in small family units, for their needs to be fulfilled.

Involvement of local communities and indigenous peoples of Dzanga-Sangha protected areas in ecotourism (CAR)

G. Pamongui & L. Padou, APDS

Since 1992, ecotourism has been a strategy mobilized by the protected areas of Dzanga-Sangha (APDS) to improve the livelihoods of local and indigenous people by generating employment and income in order to strengthen links between conservation and neighboring communities (Blom, 2000). In addition to biodiversity-based tourism products (e.g., viewing wildlife species such as forest elephants, lowland gorillas, chimpanzees, bongos, buffaloes, giant forest hog – *Hylochoerus meinertzhageni*, etc.), APDS also offer exceptional cultural resources. Cultural tourism can thus provide visitors with a valuable opportunity to interact with local communities, including the Ba'Aka Pygmies and the Bilo. A range of community activities are focused on their traditional way of life and the appreciation of their cultures.

The aim is for visitors to encounter traditional cultures that still resist outside influence and to share experiences with these rural communities while immersed in the vast forest of the Congo Basin. Several sites have been identified and developed by local and indigenous communities with the technical and financial support of the park administration (liana bridge, visit to waterfalls, etc.). A range of activities are offered to visitors (net and crossbow hunting, dances and songs, storytelling evenings, discovery of medicinal plants, collecting honey and harvesting raffia palm wine, camping in the forest, etc.). In addition, there are other services that are more private than community-based, such as the rental of cars by local businesses and the manufacture and sale of art objects and handicrafts made from plant resources (necklaces, bracelets, etc.). These products, resulting from the traditional know-how of the Ba'Aka and Bilo, are sold at the craft center built by the APDS for this purpose.

The craft center also serves as a reception and tourist information center. Tourists are welcomed and put in contact with the communities providing the services. The communities are in charge of organizing the proposed activities. Trained local (Ba'Aka) tour guides and trackers, who work at the visitor center, accompany visitors around the park and reserve.

This approach allows local communities and indigenous peoples to participate and be actively involved in the implementation of activities following a partnership management model, where initiatives come from both the communities and the park administration. Ecotourism provides opportunities for local people to benefit in terms of revenue, employment and private investment. Through ecotourism, local communities receive additional direct and indirect income that contributes to improving their living conditions and encourages them to participate in conservation and sustainable natural resource management.

Two interesting sets of initiatives are those of FIGET (*Fondation Internationale Gabon Eco-tourisme – Giuseppe Vassallo*) in Ivindo National Park, and those in and outside protected areas carried out by local associations gathered under the GSAC Alliance (Alliance for the Conservation of Great Apes in Central Africa; see boxes). These initiatives are still very fragile and require financial, technical and professional support in the medium to long term. Their survival also depends on their ability to withstand tourism crises such as the global crisis in 2020 and 2021 (see section 5).

Another experience, in Gabon, sheds light on the difficulties of setting up tourism activities in rural areas of Central Africa. Between 2003 and 2006, the European Union funded a community-based ecotourism project in the Sette Cama region, south of Loango National Park. The project aimed to reduce poverty in this area through the development of ecotourism activities. It supported the establishment of a village cooperative, *Abietu-bi-Sette Cama*, enabling the community to actively participate in tourism and derive financial, educational and socio-professional benefits. The project trained nearly 45 people (hotel, restaurant, handicrafts, guiding) (Payen, 2012). However, a few years after the project ended, almost 75% of the local people originally involved had left the activity sector, with the number of direct jobs dropping from 39 to 9 between 2006 and 2012 (Payen, 2014).

The failure of this initiative was due in part to problems of accessibility and poor national infrastructure, rendering it difficult for visitors to reach the area. However, other reasons also must be considered such as: lack of communication and misunderstandings between local tourism actors, failure to take into account the expectations of rural communities, lack of knowledge and confusion of the roles of each actor, deficient logistics outside the control of rural communities, insufficient support over time for real ownership, lack of transparency, coordination and rebalancing of powers, and the absence of clear contracts between the parties to institutionalize the rights and duties of each stakeholder (Payen, 2012 and 2014). All these elements, both technical but especially socio-anthropological, must be taken into account in future community tourism support projects.

However, while community-based tourism has not yet taken off in Sette Cama, the above-mentioned project did train various people in several fields. These individuals have acquired skills that could either be put to good use elsewhere or serve as a basis for reviving the activity locally. This will only be possible if tourism governance is improved and better shared among all stakeholders, with or without the support of one or more private operators.

FIGET and ecotourism development in Ivindo National Park (Gabon)

G. Gandini, FIGET & J. Okouyi Okouyi, IRET-CENAREST and FIGET

History

FIGET is a foundation under Gabonese law that was created in Libreville in 2000 at the invitation of the Gabonese government. In 2001, the government made a 120 km² area available to the foundation for the development of ecotourism in what later became Ivindo National Park (established in 2002). Within the framework of tourism activities, which began in 2005, FIGET collaborates with several villages in the Makokou region (Loa-Loa, Melondo Milélé and Truhaya), IRET (*Institut de Recherches en Ecologie Tropicale*) and ANPN.

Activities

The foundation has built a small tourism facility at Kongou Falls. Totally integrated into the forest, it is composed of several bungalows with a total capacity of 12-14 beds. Several tourism itineraries are offered to visitors, allowing for a variety of activities and levels of physical difficulty. Guides from the villages lead tourists through the forest to discover its richness and the traditional uses of forest resources, including wildlife observation in *baïs* and a trekking circuit through the entire park.

FIGET and ecotourism development in Ivindo National Park (Gabon)

From 2014 to 2019, FIGET hosted between 90 and 120 tourists per year (except in 2016 due to internal organizational problems). Revenues have ranged between 20 and 30 million FCFA/year (between US$37,000 and US$55,000). Tourism activities ceased throughout 2020 due to the Covid-19 pandemic. FIGET also received regular financial support from the Trust the Forest foundation from 2005 to 2015.

For several years, tourism has been managed by local communities through a village cooperative. This activity represents an important source of income for these communities. It also provides funds for the State (park entrance), and allows external service providers to work, especially for the transport of tourists and the provision of meals.

Future prospects

FIGET's ecotourism project is one of the oldest tourism structures within the country's protected areas, in place for nearly 17 years. Tourism directly involves the local population of the park, which has taken over its management, in an original manner. The strong sense of ownership by the villages of the tourism activity has led to increased protection of the forest and wildlife. Since 2005, several hunters and former poachers have become tourist guides and have become the strongest defenders of the elephants and gorillas.

This initiative has demonstrated that a small, local reception facility can be set up in a protected area far from traditional tourist circuits and can contribute to rural development. However, an insufficient number of visitors and the fact that operations ceased in 2020 raises questions about its long-term survival. Contextual elements, beyond the control of FIGET and rural communities, also impact the economic viability of the activity, such as Gabon's limited development of tourism, the high cost of living, the absence of air transport between Libreville and Makokou, etc.

In order to be sustainable, this type of initiative must: 1) receive long-term support for local communities to fully take ownership of the activity (awareness, organization), 2) be professionalized to allow the emergence of small local tourism facilities (training), 3) benefit from the tourism dynamics developed by larger structures (partnerships, marketing), 4) benefit from an "insurance" allowing it to overcome crises like the one currently being experienced (support fund for small structures, for example).

Website: http://www.gabonrightroutes.org/

GSAC Alliance ecotourism initiatives

G. Tati, GSAC Alliance

GSAC Alliance is a young network of Central African civil society organizations working for the protection of great apes: gorillas, chimpanzees and bonobos. This network brings together several organizations in Central Africa. These organizations have been created by rural communities that operate in or around protected areas.
Ecotourism is seen by GSAC Alliance as one of the key responses to conservation issues in relation to community expectations. All of the sites have ecotourism potential, but to date only three ecotourism initiatives are operational.

Observing bonobos in Mai Ndombe (DRC)
Mbou-Mon-Tour (MMT) is a leading bonobo conservation association. Ecotourism activities have not yet been organized, although reception and accommodation facilities have been put in place. The association focuses its efforts on the protection and habituation of bonobos, as well as on securing their habitats. Three bonobo observation sites are operational. The number of tourists is still quite low, but the increase in attendance between 2018 (20 people) and 2019 (32 people) indicates that the site is starting to become known and is attractive; only 14 people visited the site in 2020 due to the Covid-19 epidemic, which also impacted the habituation work with the bonobos (reduction in the number of trackers and contact time).

Gorilla tourism in Moukalaba-Doudou Park (Gabon)
The PROGRAM (*Protectrice des Grands Singes de la Moukalaba*) community-based ecotourism approach was launched in 2014 and gradually consolidated up to 2016. The site received between 100 and 150 tourists per year, mostly from Gabon. Following technical restructuring between 2017 and 2018 (organization and capacity building of guides), the gorilla habituation program slowed down. During these two years, the number of visitors dropped drastically (to about 50 people/year). In 2019, habituation work with two groups of gorillas resumed (30 tourists registered), but in 2020 the Covid-19 pandemic led to the suspension of contact activities with the gorillas, which are vulnerable and susceptible to human disease agents. Today, three groups of gorillas are habituated or are in the process of being habituated: a group historically cared for by PROGRAM, a group habituated by IRET, and a group that has become familiar with the presence of humans by frequenting surrounding villages.

Tracking gorillas and chimpanzees in Mayombe forest (Congo)
This initiative was launched in 2015, in the Loaka area, about 150 km from Pointe-Noire. Ecotourism is being developed by the *Centre de Ressources de la Biodiversité et de l'Ecotourisme* (CERBE), a platform for the implementation of the actions carried out by the association ESI-Congo (Endangered Species International-Congo) in the town of Magne. ESI-Congo and the rural communities involved benefited from the assistance of the association *Azimut Voyages* and the company Ethicalia, based in France. Depending on the year, between 15 and 30 people visit the site. Expeditions into the forest are done in small groups of 4 to 6 tourists during stays that last from 4 to 10 days.

GSAC Alliance Ecotourism Initiatives

Perspectives

Most GSAC Alliance members intend to better promote ecotourism, but the development of this activity is being hindered by limited financial means and revenues which remain too low. The existing sites receive too few visitors and are only suitable for clients with low or average requirements in terms of services.

Among the many challenges facing GSAC members is the need to: (i) set up viable economic models that contribute to the development of communities while supporting conservation; (ii) build reception/accommodation facilities and organize activities that guarantee the safety of animals and people; (iii) draw up business plans; and (iv) transfer appropriate skills to actors from rural communities so that they can become professional.

Website: http://alliance-gsac.org/fr/

3. Ecotourism in Central African protected areas

3.1 Tourism revenue

Among the three countries that could be described as "tourism destinations" in Central Africa (Rwanda, Sao Tome and Principe, Cameroon), it is – unsurprisingly (see Table 2) – Rwanda that makes the most of its protected areas. The Rwandan parks alone attract considerably more tourists and revenues than any other country in the subregion (Table 5). Only the two parks in eastern DRC (Kahuzi-Biega and especially Virunga) benefit from both the attraction of eastern gorillas and the East African tourism dynamic.

Many protected areas in the subregion receive fewer than 100 visitors annually (numerous sites in Burundi, Cameroon, Congo, Gabon, Equatorial Guinea, DRC). These low numbers are due to a variety of factors, such as lack of commitment by the States, the remoteness and degraded state of transportation routes, the non-existence of reception and guide infrastructure and staff, non-existent marketing and even security problems (see paragraph 5). Often, only a small number of protected areas can be or are visited. Nlom *et al.* (2013) estimated that 5,200 tourists visited ten Cameroonian protected areas in 2012 (out of 28 protected areas surveyed at that time; Hiol Hiol *et al.*, 2015), including over 4,000 visitors to Waza and Mount Cameroon sites alone.

In most cases, the revenues generated by ecotourism – when there are revenues – are not yet sufficient to support a viable tourism sector (see the CCC, FIGET, and GSAC boxes) or contribute substantially to protected areas' management costs; the situation is similar to that described in the late 1990s (Wilkie & Carpenter, 1999; Blom, 2000). However, in several parks, tourism activities have become profitable and part of the operating costs are covered by the revenues generated, as in Zakouma National Park (APN, 2018b). Better still, in some protected areas, such as Virunga National Park and the parks of Rwanda, tourism is profitable and helps finance their operations and even that of other protected areas.

Since the beginning of 2000, the number of visitors to Rwanda's three parks has increased from 3,800 to over 110,000 tourists, and tourism revenues have jumped from US$300,000 to nearly US$29 million (Figure 3). Much of this revenue comes from the Volcanoes National Park and gorilla tourism (box and Table 6). A great number of visitors also enjoy the savannas and large wildlife in Akagera Park. The park welcomed more than 49,500 visitors in 2019, with record revenues of US$2.5 million; a new luxury lodge was opened that year, further increasing the park's appeal. These revenues allow 90% of the park's operations to be self-financed (APN, 2020).

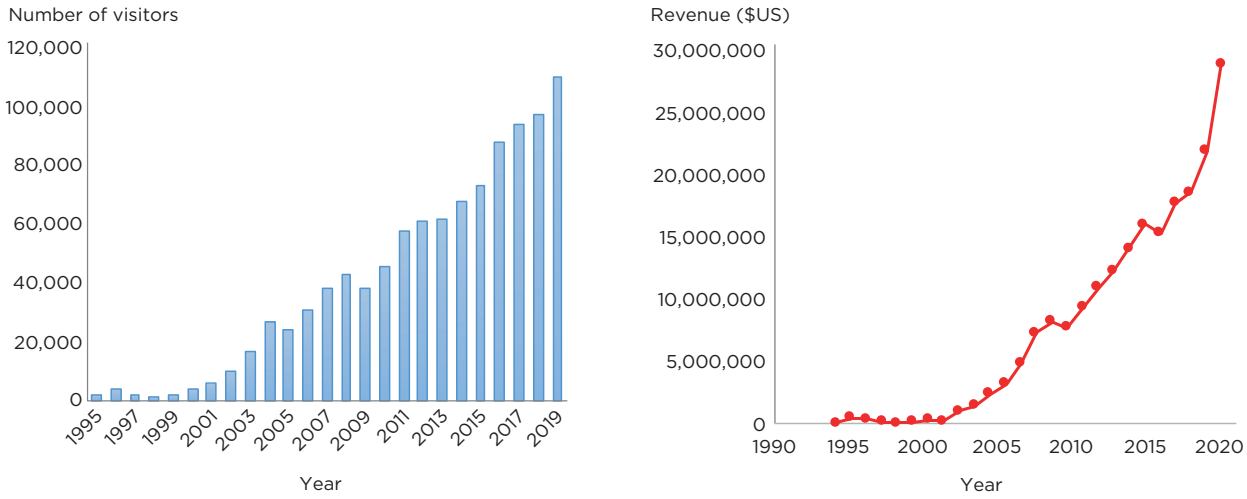
Table 5 - Recent tourism attendance and revenue in some Central African protected areas

Protected Area	Visitors	Revenue (US$)	Protected Area	Visitors	Revenue (US$)
Cameroon			**DRC**		
Waza	0	0	Garamba	0	0
Congo			Kahuzi-Biega	1,500	900,000
Odzala-Kokoua	205	680,800	Virunga	8,000	4,000,000
Gabon			**Rwanda**		
Ivindo	87	51,495	Akagera	44,066	2,000,000
Loango	600	739,176	Nyungwe	14,371	500,000
CAR			Volcanoes	36,000	17,200,000
APDS	415	196,504	**Chad**		
			Zakouma	3,890	767,382

Notes: figures corresponding to the year 2018 except Kahuzi-Biega, Virunga, Nuyngwe and Volcanoes (2017). Some figures are estimates as sources are not always accurate (Odzala-Kokoua) or they only concern some of the tourism operators (Ivindo, Loango). In some cases, a significant number of visitors were welcomed free of charge (Zakouma, for example). Sources: Ndayishimiye (2018), APN (2019 & 2018), Maisonneuve & Poliwa (2019), Okouyi Okouyi & Gandini (2020), Scholte (2021).

APN's strategy of securing Akagera Park, developing revenue from tourism and supporting surrounding rural communities is bearing fruit (APN, 2019 and 2020). The park's wildlife resources also have been restored with the reintroduction of lions and black rhinos. All of these elements, combined with the establishment of professional tourism management, the arrival of a luxury operator and effective marketing, have enabled the tourism business to grow significantly. This model is certainly not applicable everywhere in the same way, but it can provide food for thought for other protected areas in Central Africa. It is currently being replicated in certain sites, such as Zakouma Park and Odzala-Kokoua Park. Gabon is trying a similar approach which already has produced some interesting initial results in Loango National Park.

Figure 3 - Visitors and tourism revenues generated by Rwanda's national parks from 1994 to 2019



a) Annual number of visitors

(b) Annual revenue

Sources: RDB.

Gorilla tourism in Volcanoes National Park (Rwanda)

Tourism began in Volcanoes National Park in 1974, already with the intention to act for the conservation and the sustainable development of the human communities living around the park. The main attraction for visitors is the opportunity to enjoy an unforgettable experience with mountain gorillas in their natural environment.

Gorilla tourism is one of Rwanda's flagship tourism products (Visit Rwanda, 2021b and c). It is managed, as is all of Volcanoes National Park, by RDB. The activity is highly regulated: reservations must be made in advance (30% of clients book directly on the internet compared to 70% via a tour operator) and clients must respect a set of strict rules (Visit Rwanda, 2021a). Twelve gorilla families are currently visible to tourists, and six visitor permits can be issued per gorilla group daily. In 2018, 10 gorilla families were visible and the number of permits was limited to a maximum of 20,000 permits per year (Leung *et al.*, 2019); this maximum since was raised to just over 35,000 annual permits (Visit Rwanda, 2021b).

Fees have risen dramatically since the 1980s: from US$230 to US$375 in the 2000s, the rate for international visitors doubled a first time in 2012 (US$750) and a second time in 2017 (US$1,500). Up until 2017, the country had maintained different prices for international tourists, foreign tourists residing in Rwanda and national tourists; in 2017, the tariff was raised to US$1,500 for all, including nationals. As a temporary measure in response to the international tourism crisis caused by the Covid-19 pandemic, RDB introduced a new temporary fee schedule, effective from February to 31 May 2021, again differentiating between several categories of tourists: US$1,500 remains the fee for international tourists, US$500 for foreign residents and African Union nationals, and US$200 for Rwandans and East African Community (EAC) nationals.

Revenues from gorilla tourism directly amounted to more than US$19 million in 2018 (Table 6), not including all of the ancillary expenditures made by visitors (hotels and restaurants, other tourist activities, transport, guiding...). These revenues fell sharply in 2020 as a result of the Covid-19 pandemic, but the revival of tourism in early 2021 offers hope for a recovery (Visit Rwanda, 2021a).

Table 6 - Gorilla tourism in Volcanoes National Park

Year	Number of permits delivered	Revenue (US$million)
2016	22,219	15
2017	10,240	15.36
2018	15,132	19.2

Source: Bizimungu (2019) from RDB.

In a few favorable cases, tourism revenues could approach or even equal those of Volcanoes National Park. An assessment of the potential revenues from tourism of Virunga National Park showed that they could surpass US$10 million for visitor permits alone, and almost US$250 million if all items of expenditure by international tourists (transport, lodging, catering, various services, etc.; Balole-Bwami, 2018) were included. These estimates should be interpreted with caution as they represent a maximum potential, and do not consider any infrastructure, security or marketing constraints of the destination. However, they do highlight this potential and the knock-on effect of tourism on the economy as a whole.

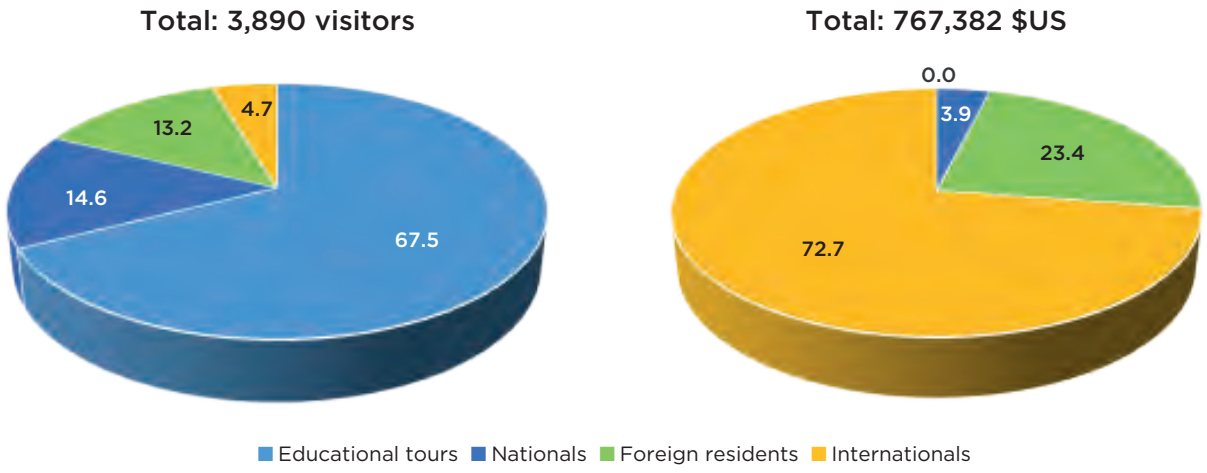
3.2 National versus international tourism

In addition to international tourism, and tourism by foreign residents, which are undeniable drivers for the growth of tourism in protected areas, the importance of national tourism must be noted. The first step is to make nationals aware of the richness of their natural heritage and its importance, both in terms of biodiversity and the ecosystem services it provides. It also involves demonstrating that this biodiversity is more valuable alive than dead. However, it also is a question of responding to the aspirations of increasing numbers of people in both urban and rural areas who wish to rediscover their natural heritage and enjoy nature with their families. The growth of urban populations and of middle and affluent classes in Africa is leading to a growing demand for recreation, reconnection with nature and encounters with natural heritage.

In several of the subregion's protected areas, environmental education programs are being set up in schools, in partnership with teachers, and visits are organized for schoolchildren (Garamba, Nouabalé-Ndoki, Zakouma, Akagera). More than 2,000 school children, 320 teachers and local leaders participated in environmental education sessions in Akagera Park in 2019 (APN, 2020), and over 500 school children visited Garamba Park in 2018 (APN, 2021).

Moreover, in some sites such as Zakouma Park, part of the tourism infrastructure is dedicated to national visitors. One of the park's three camps, Salamat Camp, is intended primarily for children and environmental education programs, particularly for the communities surrounding the protected area. Entry and access to the services of this camp are free for all Chadian citizens, which also encourages national tourism. The camp has safari vehicles that allow visits to the park to be organized under good conditions. This low-end infrastructure is fully funded by luxury tourism (Nomad Camp) and allows many Chadians to discover the park and its wildlife, with more than 80% of visitors being nationals (Figure 4a). However, some of these national visitors are shifting away from Salamat Camp to the mid-range camp (Tinga Camp), which accounts for about 4% of tourism revenues (Figure 4b). Although this figure remains low, it shows that there is a national demand.

Figure 4 - Tourism attendance and revenue in Zakouma National Park (Chad) in 2018



a) Types of visitors (%)

b) Revenue by type of visitor (%)

Source: APN (2018).

A study conducted in Cameroon a few years ago already noted this phenomenon (Nlom *et al.*, 2013). At that time, Waza National Park was the protected area receiving the highest number of tourists (Table 7). Even so, the number of visitors traveling across the entire country to Waza was 2.3 times less than those traveling to Mefou Wildlife Park, 45 km from Yaounde. And if these figures are compared with visits to the zoo-botanical gardens of Limbé (70 km from Douala) or Yaounde (Mvog-Betsi), the differences are even more important. These two semi-natural urban spaces see several tens of thousands of visitors per year: over 110,000 visitors, mainly Cameroonian, visited these two gardens in 2012; foreign visitors (residents and internationals) are few, although they constitute the majority of tourists visiting protected areas (Table 7). The case of Mefou Park is interesting because it is a wildlife park (with primates) located in a forest that could be classified as a protected area; 30% of its visitors are "national", including resident foreigners but also Cameroonians.

If only entrance fees are considered, the gardens of Mvog-Betsi and Limbé and Mefou parks were generating far more revenue than all of the protected areas at that time (approximately US$170,000 vs. US$65,000; Figure 5). However, if one looks at all tourism expenditures as a whole, the ratios are more balanced and even reversed (US$3.1 vs. US$3.9 million; Figure 6).

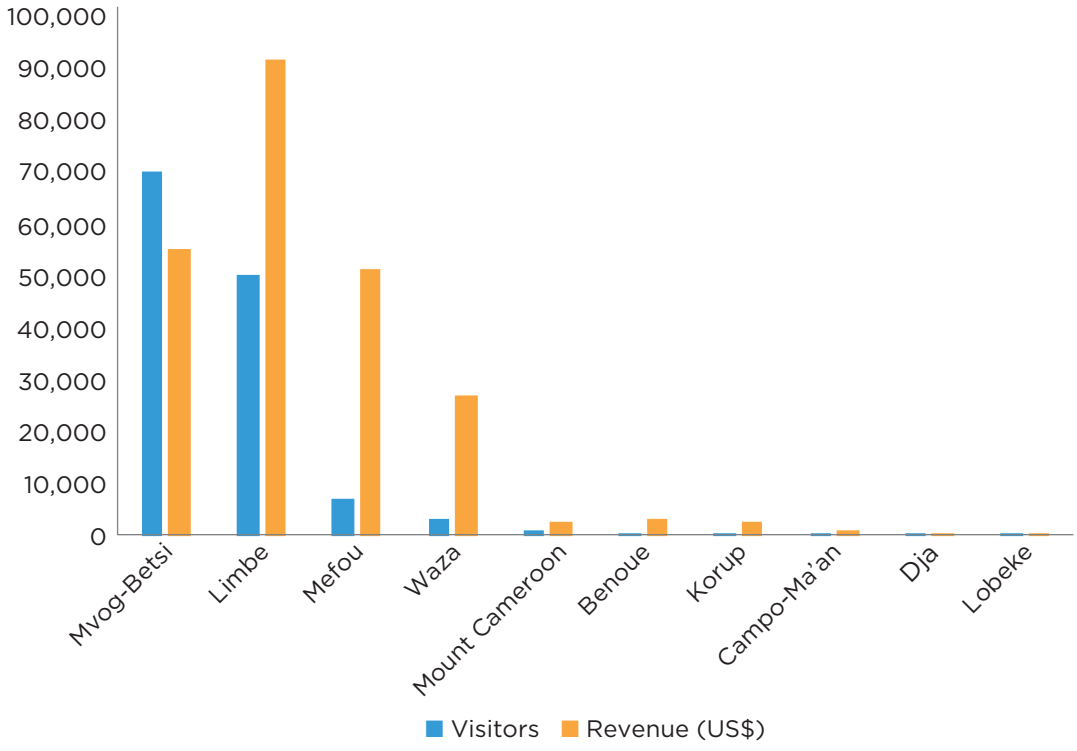
International ecotourism has the potential to grow substantially in the country, but in the absence of a real commitment from the State, it continues to stagnate. Since tourist numbers in protected areas have changed little since 2012, it is reasonable to say that currently, in Cameroon, national nature and wildlife viewing tourism (including resident foreigners but mostly Cameroonians) is far more important in terms of numbers than international tourism, and is almost as important as the latter in terms of revenue.

Table 7 – Visits to several tourist sites in Cameroon in 2012

Site	Visitors	Non-resident foreigners (%)
Mvog-Betsi [1]	69,985	1.2
Limbe [1]	50,372	7.8
Mefou [2]	6,800	70
Waza [3]	2,930	42
Mount Cameroon [3]	1,107	92
Benoue [3]	496	98
Korup [3]	218	53
Campo-Ma'an [3]	148	67
Dja [3]	82	70
Lobeke [3]	61	80

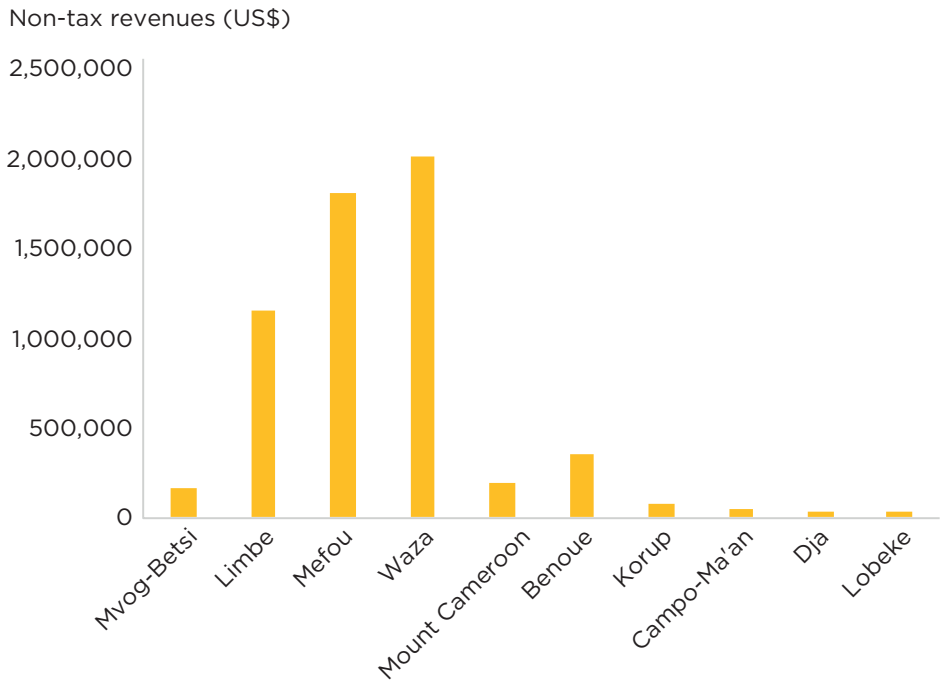
[1]: botanical and zoological gardens; [2]: wildlife parks in natural forests; [3]: protected areas in natural environments.
Source: Nlom *et al.* (2013)

Figure 5 – Visits and revenue at several sites in Cameroon in 2012



Note: revenues mainly are from entrance fees. Source: Nlom *et al.* (2013)

Figure 6 - Estimated non-tax revenues from several tourism sites in Cameroon in 2012



Note: estimated non-tax revenues concern all expenses related to tourism activity (accommodation, catering, guiding, transport, purchase of handicrafts...). Source: Nlom *et al.* (2013)

Beyond rising awareness about protecting nature, there also is a real demand for a national nature and vision tourism that has been largely underestimated until now, except in Rwanda. In this country, the administration and its partners have implemented a biodiversity awareness policy as well as an information and pricing policy for Rwandans. For the past 15 years, the country has been organizing a naming ceremony for young gorillas – called *Kwita Izina* – directly inspired by traditional Rwandan ceremonies, during which parents name their children in the presence of family and friends. This ceremony has over time become a national event for the celebration of nature (Visit Rwanda, 2021d). The country also has put in place a specific pricing policy for visiting the parks for nationals but also for African nationals, in particular those from the EAC (Visit Rwanda, 2021st). This program, called *Tembera U Rwanda*, has been in place since 2015 and is widely advertised (Ntirenganya, 2017; RDB, 2020). In 2018, over 44,000 tourists visited Akagera Park, half of whom were Rwandan nationals (NPC, 2021b).

3.3 Contribution of tourism to local development

Despite the many difficulties in involving rural communities in ecotourism, as discussed in section 2.3.3, the establishment of tourism operators can generate benefits for these communities, either at the community or individual level. In the APDS (see box in section 2.3.3), a total of FCFA 1,277 billion (or about US$2,344,000) was collected in direct revenue for 13,313 tourists from 1993 to 2019 despite the drastic reduction in bookings resulting from the military-political crises in CAR; tourist revenue has increased ninefold since the end of the 1990s (Blom, 2000)

Of this amount, over FCFA 53.32 million (just under US$98,000) was received directly by local communities and indigenous peoples through formalized community activities. This corresponds to about 4% of total revenues, as in 2018, when over FCFA 4 million (about US$7,500) was received by communities through cultural tourism activities (Table 8). In 2019, it is estimated that the APDS injected a total of about US$180,000 into the local economy (including community projects, service provision, salaries...). While these figures may seem relatively modest, even by the standards of some Central African protected areas (see Table 5), they are an invaluable source of income for these poor rural populations, who have no alternative sources of cash income apart from logging or mining.

Table 8 – Services and revenues of APDS in 2018

Service or fee	Revenue (FCFA)	Revenue (US$)
Park visit revenue	**12,907,965**	**23,686**
Elephant visit revenue	15,099,535	27,708
Gorilla tracking revenue	52,084,590	95,575
Mangabeys tracking revenue	1,267,425	2,326
Saline circuit revenue	550,200	1,010
Nature tourism revenues	**69,001,750**	**126,618**
Net hunting revenue	2,470,800	4,534
Crossbow hunting revenue	0	0
Plant collection revenue	353,700	649
Ba'aka cooking revenue	13,100	24
Ba'aka dance revenue	345,100	633
Bilo dance revenue	0	0
Sangha ride revenue	471,640	865
Hut building revenue	345,100	633
Tamtam on water revenue	0	0
Raffia palm wine revenue	117,940	216
Community tourism revenue	**4,117,380**	**7,555**
Total services	**86,027,095**	**157,860**
Administrative fees for filming	786,000	1,442
Administrative fees for researchers	2,832,875	5,198
Research and filming deposit	0	0
Doli lodge revenues	10,720,629	19,672
Sangha lodge revenues	6,720,000	12,331
Total fees	**21,059,504**	**38,644**
Grand total	**107,086,599**	**196,504**

1 FCFA = 0.001835 $US. Source: APDS.

Odzala National Park (Congo) injects about FCFA 15 million (US$27,000) per month into the local economy in the form of salaries and services, or about US$330,000 per year. In addition, part of the revenue generated by tourism supports community projects. In 2019, US$33,116 was allocated to the Odzala community development fund for agricultural diversification (planting cocoa and banana trees), support for small-scale livestock, infrastructure projects (construction of a community center and kindergarten, renovation of several schools, creation of a mobile clinic), and the delivery of medical equipment and supplies for health centers (APN, 2018, 2019 & 2020).

In the densely populated Rift Valley Mountain region, with its more developed tourism activities, the protected area that generates the most tourism revenue in DRC is Virunga National Park. Tourism revenue there was approximately US$4 million in 2017 (Table 5). This amount includes revenue from visitor permits, of which 50% goes to ICCN, 20% to park operations and 30% into a community fund. The latter supports small development projects, finances public lighting and supports small-scale entrepreneurship. In 2017, the budget of the community fund was US$458,566.

In Rwanda, it is estimated that nearly 142,000 jobs were created between 2018 and 2019 as a result of the growth of tourism in the country (Leung *et al.*, 2019). By law, 10% of revenues from tourism activities in protected areas must go to rural communities and are invested in community development projects. Between 2005 and 2017, over 600 projects (education, food security, health, basic infrastructure, access to drinking water, anti-erosion control, etc.; Nielsen & Spenceley, 2011) were funded for a total of US$4.4 million (RDB, 2018). Rendering tourism in Volcanoes Park valuable to surrounding communities seems to have promoted a recent decline in poaching in the park (Uwayo *et al.*, 2020). On the Akagera side, the community cooperative of independent guides also brought in nearly US$160,000 in 2018 (APD, 2019).

All of these elements suggest that Rwandan rural communities living on the outskirts of protected areas benefit substantially from tourism activities despite the high population density of the country. However, this momentum needs to be continued, especially for the poorest communities (Spenceley *et al.*, 2010; Sabuhoro *et al.*, 2017; Munanura *et al.*, 2020).

4. SWOT analysis of ecotourism in two Central African protected areas

APN has supported the management and protection of Odzala-Kokoua National Park (Congo) for several years. The site offers a particularly popular tourism experience with lowland gorilla viewing. Although these gorillas are more difficult to see than

Table 9 - SWOT analysis of tourism development in Odzala-Kokoua National Park

STRENGTHS	WEAKNESSES
• Unique and iconic wildlife experiences (western lowland gorillas, forest elephants, forest buffalo, bongo, birdlife). • Rare tourist experiences including habituated gorillas. • Diversity of waterways. • Products and activities available year round. • High-end tourist accommodation. • Friendliness of the staff. • Commitment to park conservation at all levels (heritage protection). • Transnational conservation (TRIDOM) and tourism development (countries, CCC) dynamic. • Major investments in infrastructure (roads, lodging, transport, surveillance posts, etc.) and staff training. • Multiple financial partners (EU, WWF, Sabine Plattner Foundation...). • Existence of a community development fund.	• Lower concentrations of species and more difficult to observe than some regional competitors (mountain gorillas). • Limited diversity of experiences currently available. • Lack of infrastructure and access to some areas of the park. • Cost and complexity of logistics (remoteness, poor roads, air transfers). • Costs and access to regular media exposure on international, regional and local markets. • Barriers due to low literacy and language (lack of English proficiency) in the park and in the country. • Challenge of aligning community expectations and needs with market development realities. • Limited availability of tourism skills in Congo. • Difficult to secure guides for more than one or two seasons. • Lack of a comprehensive national tourism development plan. • Administrative red tape. • High taxation.
OPPORTUNITIES	**THREATS**
• World famous Congo Basin forests: could be seen as the "Amazon of Africa". • A potentially emblematic destination for adventurous tourists or those aware of the protection of tropical forests and the sustainable development of the people who live there. • Significant opportunities to use the experience of researchers in tourism products. • Combining wildlife, nature and culture to give tourists a unique experience. • Potential to develop new attractions: river tourism, chimpanzee and other primate habituation, bird tourism. • A cultural wealth capable of creating additional opportunities for the development of tourism. • Existing experiences of community involvement to be developed. • Strengthening community resilience and reducing environmental pressure through sustainable tourism. • Tourism identified as a strategic pillar for the development of Congo. • Creation of a one-stop shop for tourism and transformation of the *Office de Promotion de l'Industrie Touristique* (OPIT) in 2019. • Development of local and foreign resident markets (low-end and mid-range) to diversify reception facilities without diluting the value of the offer for the international market.	• Regional reputation as a risky destination due to security problems and lack of knowledge about Congo (confusion with DRC). • Restrictions on travel that discourage visitors (visa applications, security checkpoints, etc.). • Undeveloped institutional framework (local and regional tourism organizations). • Difficulty in achieving coherence between tourism and protected areas due to the separation of responsibilities between ministries. • Lack of political will despite various announcements. • Very limited understanding of the benefits of tourism by politicians and citizens. • Lack of a tourism culture.

Table 10 – SWOT analysis of tourism development in Volcanoes National Park

STRENGTHS	WEAKNESSES
• One of the most visited parks in Rwanda. • An area reserved for tourism. • Reputation due to the presence of the mountain gorillas and the very good possibility of viewing for tourists. • A country that allows seeing the "Big Five" characteristic of the savannas and the legendary gorilla, characteristic of the dense Congolese forests. • Ecosystem diversity and important faunal and floristic endemism of the Albertine Rift. • A variety of tourism activities are possible, including mountain trekking. • Existence of a park and tourism management plan. • Stable, safe country with good health conditions. • Kigali is becoming better connected to various sending countries, thanks to a reliable airline. • The road network is in good condition and there are good connections between the park and the capital. • Gorilla viewing tourism that brings in significant revenue. • Tourism revenue sharing policy (10% of protected area revenues allocated to socio-economic development of surrounding communities; RDB, 2018). • Voluntary tourism development policy and strategy. • Well established cooperation between government, conservation NGOs and the private sector. • Capacity to invest in the park. • Direct and indirect job creation in conservation and development.	• Limited number of permits to visit the gorillas. • Mountainous environment that requires visitors to fit and healthy. • Image of the country still very much linked to the 1994 genocide and poverty. • Higher prices than some neighboring East African countries (overnight stays, packages...); in particular, high cost of visiting the gorillas. • Online offers and bookings are still not well developed or communicated. • The level of training has room for improvement, which hinders a wider professionalization of the sector. • RwandAir faces chronic deficits.
OPPORTUNITIES	**THREATS**
• Tangible benefits of the presence of tourism to local community members. • Visitor volume control: preservation of the visitor experience and reduction of wildlife disturbance. • System of incentives favoring local communities and to encourage their own valorization of natural resources (e.g., poachers who become tourist guides). • Study of the environmental economy of the park. • Establishment of health protection and early warning and response systems to contain epidemics (Ebola and others). • Study and promotion of cultural customs and traditions beneficial to gorilla conservation. • Creation of a raffle for the promotion of social tourism (gorilla visits at an affordable price). • Creation of a promotional gorilla season. • Wide range of accommodation and services, from low-end to top-of-the-range. • Opportunities for the development of cultural activities on the outskirts of the park, for the direct benefit of the communities. • Agreements with well-known football clubs to improve the country's image (Arsenal, Paris St. Germain).	• Very high human pressure: population densities among the highest in Africa (820 inhabitants/km^2 in some areas) and extremely poor farmers living around the park. • Poaching still exists in the park. • Possible political instability in the Albertine Rift region.

their mountain cousins, the park also has many other attractions, including wildlife viewing in swamp and savanna clearings (see Boxes 2.1 and 2.2; Table 9). In addition, a specialized company, CCC, has developed a high-end tourism facility and a variety of tourism products, including regional ones (see Box 2.3.2; Table 9). Significant international investment has enabled CCC to implement a long-term tourism development strategy and to overcome crises such as the global Covid-19 epidemic (see paragraph 5).

However, while there has been a significant increase in tourist numbers and revenue generated (Table 5), tourism in Odzala-Kokoua is not yet profitable. The activity remains very modest due to various constraints, both internal and external (Table 9). The most notable are the distance from the political (Brazzaville) and economic (Pointe-Noire) capitals, the poor state of road transport infrastructure, and the very high cost of air transport. Moreover, despite some good intentions (Maniongui & Nkounkou, 2019), Congo still sorely lacks a detailed and inclusive tourism action plan that integrates other economic sectors.

It is interesting to compare Odzala-Kokoua Park with Volcanoes National Park in Rwanda (Table 10). Tourism is incomparably more developed there compared to the protected areas of the Congo Basin (Table 5). This is primarily due to mountain gorillas, which are the major tourism attraction (see Box 3.1), but other tourism products also have been developed, such as hiking and cultural tourism (Baeriswyl, 2018). This success is due to the efforts made in the park itself (infrastructure, protection, tourism management, etc.), the fairly easy access to the park (good roads and relative proximity to Kigali), but also the policy implemented for several years by the Rwandan government to place tourism among the key economic sectors. Tourism is not considered separately from other economic sectors, but rather as a driving force for the development of the country as a whole. Rwanda also has taken a strong position in the business and conference tourism segment, with a very good MICE (Meetings, Incentive, Conferences, Events) ranking, which increases the attractiveness of the destination.

5. National and international crises and tourism

5.1 Safety and health impacts on tourism and protected areas

Before turning to the effects of the Covid-19 pandemic, which has been raging since the beginning of 2020 (UNWTO, 2020c), it should be noted that tourism is an economic activity that is particularly sensitive to the destination's image on the one hand, and the local security and health context on the other, as the two are linked. Many examples have shown that the number of visitors to a site drops drastically if there is a deterioration in the security situation. This unfortunately has repeatedly been the case in Virunga Park (DRC), but also in Cameroon's most famous park, Waza

Waza National Park: the impact of insecurity on tourism and conservation

P. Scholte, GIZ Côte d'Ivoire

Waza Park is located in the Sahelo-Sudanese savannas of Far North Cameroon and includes part of the Logone river floodplain. The park once was famous for its savanna elephants, which, with about 1,000 individuals concentrated around a few waterholes, guaranteed sightings during the dry season. Tens of thousands of kobs (*Kobus kob*) and korrigum antelopes (*Damaliscus lunatus korrigum*) in the floodplain, a large population of lions and Kordofan giraffes (*Giraffa camelopardalis antiquorum*), and rich birdlife made Waza the most visited park in Central Africa in the 1970s to 1990s (Scholte, 2005).

Promoted as an alternative to East African safaris, the number of visitors to the park increased rapidly in the 1970s and 1980s, contributing to a short-lived economic boom in Cameroon (Figure 7). From the late 1980s onwards, the country, under the influence of the structural adjustment program, cut back on government investment, leading to the deterioration of roads and the end of international flights to North Cameroon. This situation, compounded by growing political unrest in neighboring countries (Chad and Nigeria), led to a significant decline in visitors, which fluctuated around 3,000 per year for most of the 1990s and 2000s.

In the late 2000s, pastoralists fled in droves from the unrest caused by Boko Haram in Nigeria, causing an influx of livestock in and around Waza Park, increasing pressure on wildlife (Scholte, 2013). Decades of relative stability in North Cameroon came to a dramatic end with the kidnapping of French visitors in February 2013 (Preel, 2013). Visitor numbers plummeted only to regain slightly in the following tourist season (Figure 8). With the attack on a Chinese roadworkers' camp in the town of Waza in May 2014 (Anon., 2014), tourism ground to a complete halt. Waza was closed, opened only occasionally in 2019 and 2020 with respectively 10 and 11 visitors escorted by the armed forces. With the uncertainty of the Covid-19 crisis, the future of the park looks increasingly bleak.

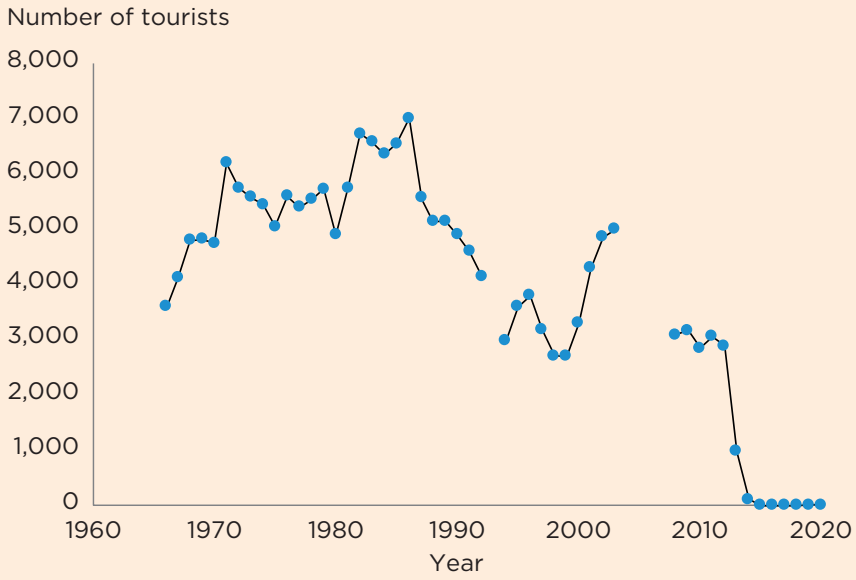
Tourism always has been crucial to Waza, with revenues from entrance fees equaling operating costs, although procedures put in place by the central government have discouraged more autonomous management. Many communities around Waza were involved in tourism-related activities, such as handicrafts, jobs at hotels, catering, escorting tourists, etc.. In villages such as Andirni, guiding tourists was the main source of income, resulting in a strong spirit of conservation that promotes the protection of the park to this day (Scholte, 2005). However, with the decline in tourism, conservation also has been affected. The lack of road maintenance since 2014 (with spiny *Acacia seyal* rapidly taking over the old tracks), has rendered surveillance and monitoring particularly difficult. The park's annual operating budgets, already low in 2015 (32 million FCFA, or about US$58,000), had fallen further to 8 million FCFA (US$15,000) by 2021. Although Waza has a reasonable number of guards (30), they no longer effectively control the park.

Recent observations (March 2021) point to increased human pressure, particularly in the floodplain of the park, and suggest a collapse of the kob and korrigum populations. Strikingly, local communities are calling for better protection of the park to prevent others from appropriating its resources (fish, grazing; Anon., 2021). Overall, species which have given Waza Park global importance, such as lion, korrigum and red-fronted gazelle *Eudorcas rufifrons,* face the risk of imminent loss (Tumenta *et al.* 2010; Scholte, 2013).

Although Boko Haram has seldom poached wildlife in the park (Kelly Pennaz *et al.*, 2018), the insecurity and resulting instability have had a devastating cascading influence, not unlike

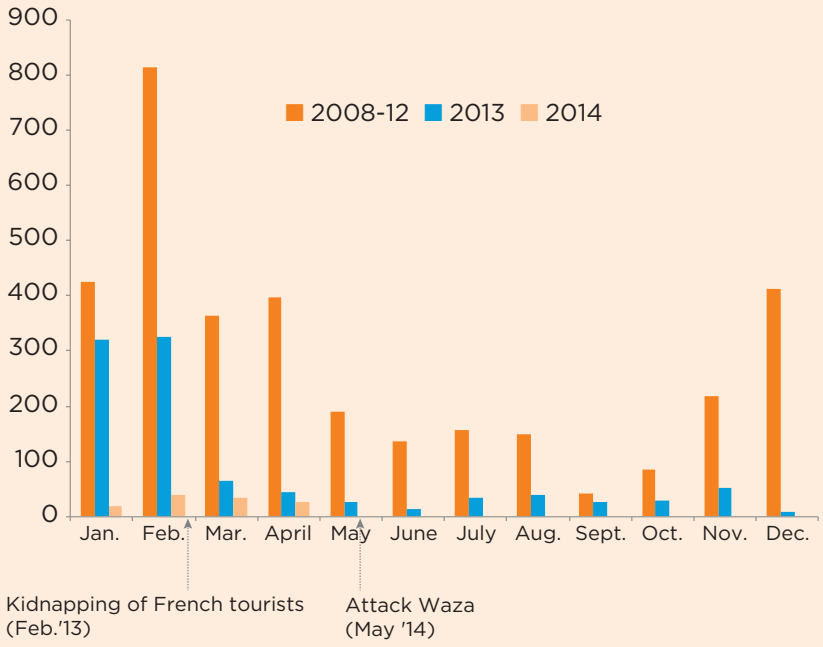
in other Central African parks such as Garamba (DRC). Given the amount of investment and effort required to restore effective management, it is difficult to see a future for Waza under the present management and governance set-up. The future might be brighter if Cameroon chooses to develop a PPP, as neighboring countries have done over the past decade, saving Garamba and several other protected areas (see Chapter 3).

Figure 7 – Tourist attendance in Waza National Park between 1966 and 2020



Source: adapted and updated from Scholte (2005).

Figure 8 – Drop in tourist numbers due to insecurity in Waza Park



Note: average monthly number of tourists over the period 2008-2012 compared to 2013 (abduction of French tourists in February) and 2014 (Waza camp attack in May).
Source: http://www.deselephantsetdeshommes.org/ and personal investigations.

National Park. This park was the flagship of Cameroonian protected areas in the 1970s and 1980s. It received up to nearly 7,000 tourists in 1986, and continued to receive between 3,000 and 5,000 visitors each year until 2012 (Figure 7 and 8). After that, the number of visits collapsed due to security problems, and today the park no longer receives any visitors (see box).

In addition to security, the emergence of epidemics such as Ebola, and even the prevalence of certain diseases (malaria, etc.), also are handicapping the subregion. The case of the Covid-19 pandemic is emblematic in this respect: it caused a collapse in international arrivals of about 73% globally and 63% in sub-Saharan Africa, with revenues cut in half overall (Gössling *et al.*, 2020; UNWTO, 2020d & e, 2021; WTTC, 2021). Countries with a more dynamic domestic tourism sector were slightly less affected than those solely dependent on international tourism. Worldwide, domestic tourism has fallen by about 45% in value while international tourism has fallen by over 69% (WTTC, 2021).

The measures taken to mitigate the Covid-19 pandemic have had a very significant direct impact on tourism, such as border closures, repeated lockdowns and curfews, the stopping of international air links, the closing of establishments (hotels, restaurants, etc.), etc. (UNWTO, 2020d). Gorilla tourism has had to be suspended due to the potential risks to the primates' health from coronavirus transmission to the gorillas (Fondation Virunga, 2020).

This has resulted in the loss of about 62 million direct and indirect jobs worldwide, including about 2 million in Africa (D'abzac, 2020; WTTC, 2021). In the TNS, parks have been forced to suspend many of their activities. Tourism has fallen sharply, with a loss of revenue of nearly FCFA 130 million (about US$233,000), with negative consequences on local communities (FTNS, 2020).

For protected areas, the impact of the pandemic goes far beyond the question of employment, leading to reduced funding, a reduction in the scope of management actions (restrictions on travel, difficulties in obtaining supplies, a reduction in surveillance, etc.) and an increase in human impacts (increased risk of poaching...; Kamga Kamdem *et al.*, 2020; Lindsey *et al.*, 2020; Waithaka, 2020; Spenceley *et al.*, 2021). One of the most important impacts is the likely decrease in revenue for protected area management and local communities, especially if cascading effects are likely to lead to a decrease in national and international funding for protected areas, or its redirection to the health sector or to address the financial crisis.

In Rwanda, an organized and proactive country, parks were open for part of the year, which helped to limit losses. A rigorous process was put in place and all visitors were required to present a negative Covid test, both immediately prior to and upon arrival at the parks. Gorilla tourism has been reopened, with revenues falling by less than in other countries, despite the drop in visits and lower rates for domestic visitors (Roberts, 2020).

5.2 Prospects for recovery

The effects of the Covid-19 pandemic on protected areas and tourism will be felt for several years to come. There are various calls for the tourism stakeholders to thoroughly reform the sector in order to foster resilience (Gössling *et al.*, 2020; UNWTO, 2020d). In particular, tourism ministers discussed the importance of initiating discussions on the coordination of health protocols on a global scale in order to facilitate the resumption of international travel while guaranteeing the safety of travelers and populations. They agreed on the need to strengthen exchanges with the private sector, support innovation and take ownership of the 2030 Agenda for Sustainable Development.

In the case of Central Africa, the subregion is facing a dual challenge: one linked to the Covid-19 epidemic, and one linked to the limited attractiveness and lack of organization of the subregion in the field of ecotourism (Rwanda being the exception). A number of structural measures should be taken to keep the sector afloat and enable it to grow. In the short term, fiscal and financial measures are needed, such as renegotiating bank and credit terms for existing tourism structures, if required with the support of the States in the form of bank guarantees (Kamga Kamdem *et al.*, 2020). While large international structures have the financial capacity to overcome the crisis, this is not the case for all of the small operators and service providers, which are often in the informal sector. However, it will not be possible to develop the tourism sector and, in particular, boost national tourism, without increased development of these small structures. The establishment of micro-credit capacities and the creation of professional support funds would make it possible to compensate – at least in part – for the absence of insurance or unemployment benefits. Other avenues for public funding of protected areas and ecotourism can be considered, such as the allocation of part of the revenues from tourist and airport taxes (Kamga Kamdem *et al.*, 2020).

More generally, it is the responsibility of States to develop integrated, sustainable and equitable tourism development policies, which must be based on three pillars: 1) strengthen the protection of heritage (natural and cultural), 2) provide a secure legal and economic environment for investors, and 3) allow for a better sharing of costs and benefits among stakeholders (Bhammar *et al.*, 2021; Spenceley *et al.*, 2021). The growth of ecotourism requires significant investments in infrastructure, facilitating the movement of tourists (visas on entry to countries or e-visas, free movement agreements for cross-border tourism, etc.) and training of staff at all levels. RAPAC published a handbook on ecotourism and community tourism a few years ago which remains relevant today (RAPAC, 2009).

Thanks to the increase of PPPs, some high-end tourism structures have been set up in protected areas of the subregion, which make it possible to launch the ecotourism dynamic. The States must accompany the process by ensuring that skills are strengthened and national operators developed, and by promoting consultation and synergy between all stakeholders in the sector (Viard, 2008; Kamga Kamdem *et al.*, 2020; Maisonneuve & Poliwa, 2020).

5.3 CEEAC and its partners on the front line

In 2015, the Heads of State of the Economic Community of Central African States (CEEAC) met in Ndjamena (Chad) and adopted several decisions aimed at developing and promoting the Green Economy System in Central Africa (SEVAC). Decision No. 35/CEEAC/CCEG/XVI/15 adopts sectoral programs for the development and promotion of the green economy, including the Programme for the Development of Ecotourism in Central Africa (PDEAC). The latter is associated with three other sectoral programs: the protected areas economic development program, the zoological parks economic program and the botanical gardens program. In the implementation of each sectoral program, an important place and role is reserved for technical and financial partners.

On 19 April 2017, CEEAC signed several memoranda with some partners, including the United Nations World Tourism Organization (UNWTO). The implementation of this agreement is included in the Medium-Term Indicative Strategic Plan (PSIMT) 2021-2025 and in the Priority Action Plan (PAP) 2021, adopted by the Heads of State (XVIII CEEAC Conference, November 2020, Libreville, Gabon).

The Environment, Natural Resources, Agriculture and Rural Development Department of CEEAC has thus made PDEAC's implementation a priority. The objective of this sectoral program is to develop the ecotourism economy in the subregion and to contribute to the diversification of the economies of the States, business development, job creation, regional integration and the well-being of communities living in the vicinity of the protected areas in rural areas. It is organized into five components:

- Component 1: development of policy, legal, fiscal and institutional frameworks to support ecotourism development,
- Component 2: development of the market and the products and services offered by the sector,
- Component 3: training and capacity building of stakeholders and ecotourism structures,
- Component 4: development of quality standards in the sector,
- Component 5: development and implementation of a subregional marketing and communication plan.

PDEAC aims to address some of the challenges facing the tourism sector, such as an appropriate legal, fiscal and investment framework, better targeted marketing, strengthening subregional skills and greater involvement of the private sector as well as of communities surrounding protected areas (Viard, 2008; Maisonneuve & Poliwa, 2019). It will build on the success of some protected areas that have benefited from private sector investment and expertise. This program will be financed by CEEAC (Fund for the Green Economy in Central Africa, Cooperation and Development Fund) and by various partners. It will be implemented with the support of UNWTO, within the framework of the above-mentioned memorandum.

6. Conclusion

Central Africa has all of the potential of an exceptional ecotourism destination, one that is unique in many ways. From the Atlantic Ocean to the Congo Basin and the Albertine Rift, the subregion is full of natural and cultural wonders. However, it is only recently that initiatives, often private, have made it possible to develop protected areas for tourism. While some countries have already forged a tourism image, such as Cameroon "Africa in miniature", Rwanda "the land of a thousand hills" and Sao Tome and Principe "the chocolate island", other countries have yet to create their own identity.

While each protected area also must identify its own product and brand image, Central Africa must develop a regional tourism identity, which will ensure synergy and increased attractiveness. When one speaks about the subregion, the great primates immediately leap to mind: Central Africa is "the land of the great apes".

Part of the subregion may be suitable for mass tourism, or at least for receiving large numbers of tourists (coastal or savanna regions), but this is not the case for the vast forest areas. Only tourism in small accompanied groups is possible. This, combined with the subregion's environmental and cultural wealth, is a further argument in favor of the development of ecotourism and community-based tourism. Central Africa must prioritize this type of tourism.

Following the example of Rwanda, the States are beginning to equip themselves with a certain number of legislative, human and operational means to supervise and boost their tourism sector. The legal and institutional framework still needs to be adapted to bring subregional and national ecotourism up to international standards. CEEAC could play a special role in providing leadership, regional synergy and support to countries.

High-end ecotourism already has established itself as a driver of tourism in Rwanda and in some protected areas in the subregion (Virunga in DRC, Odzala-Kokoua in Congo, Zakouma in Chad). These initiatives could stimulate the development of ecotourism in the subregion and enhance its reputation as an outstanding destination. The development of PPPs has proven effective in this area and could be extended to other sites. This requires investors who are willing to commit to the venture for 10 to 20 years until the activity becomes economically viable, especially in the Congo Basin. These investors will only commit themselves if the countries establish a secure and attractive business climate.

While it would be unrealistic to think that tourism alone will be able to support the investment and management costs of all of the protected areas, tourism already contributes to the partial or total financing of parks such as Akagera and Volcanoes, and indeed provides significant financial resources for other protected areas. Tourism also provides employment opportunities and helps finance community projects in very poor rural areas, thereby helping to anchor protected areas and tourism activity in rural territories.

However, promoting local development means encouraging and supporting the emergence of small local initiatives and reception facilities, agricultural and craft production for visitors, etc. This alone will make it possible to extend the range of tourists received and to promote national tourism, a means of better integrating protected areas into the human societies of the subregion. Small private and community operators have started to operate in the tourism sector, but they lack both professional skills and funding. It is up to the States and the major private operators to support and accompany them for a sufficient period of time, until they can become independent. The countries should thus encourage the creation of tourism development centers anchored in the territories, including the entire range of operators.

Tourism is both a promising and a fragile economic sector, vulnerable to political events and health crises such as Covid-19. In the absence of sectoral insurance and employment policies worthy of the name, States and private partners must set up tourism support funds and mutual insurance companies that enable the most fragile structures and communities to cope with these crises. This is essential for strengthening the resilience of the tourism sector and of protected areas in Central Africa.

Bibliography

Anon. 2021. Le braconnage s'intensifie dans le parc de Waza. *L'Oeil du Sahel*, 10 mars 2021. http://www.cameroon-info.net/article/cameroun-faune-le-parc-de-waza-extreme-nord-en-proie-a-une-recrudescence-des-activites-396159.html

Anon., 2014. Chinese camp hit near Boko Haram stronghold. *Aljazeera*. https://www.aljazeera.com/news/2014/5/17/chinese-camp-hit-near-boko-haram-stronghold

APN, 2021a. Garamba. République Démocratique du Congo. African Parks, Johannesbourg, Afrique du Sud. https://fr.africanparks.org/les-parcs/garamba (accédé 07/04/2021)

APN, 2021b. Akagera. Rwanda. African Parks, Johannesbourg, Afrique du Sud. https://fr.africanparks.org/les-parcs/akagera (accédé 07/04/2021)

APN, 2020. Quand l'espoir devient réalité. Rapport annuel 2019. African Parks, Johannesbourg, Afrique du Sud : 137 p.

APN, 2019. Réaliser la valeur des aires protégées. Rapport annuel 2018. African Parks, Johannesbourg, Afrique du Sud : 133 p.

APN, 2018a. Restauration. Le retour de la nature. Rapport annuel 2017. African Parks, Johannesbourg, Afrique du Sud : 113 p.

APN, 2018b. Parc national de Zakouma. Rapport tourisme, saison 2017-2018. Direction du parc national de Zakouma, African Parks, Tchad : 26 p.

AWF, 2021. Sustainable Tourism. AWF, Nairobi, Kenya. https://www.awf.org/community/sustainable-tourism (accédé 07/04/2021)

Baeriswyl D., 2018. Le Rwanda, 1 000 collines et 1 000 opportunités. Rapport Bachelor, Haute École de Gestion et de tourisme, Sierre, Suisse : 74 p.

Balole-Bwami E., 2018. Estimation de la valeur socio-économique du parc national des Virunga, République démocratique du Congo. Thèse de doctorat, ERAIFT, Université de Kinshasa, Kinshasa, RDC : 225 p.

Bhammar H., Li W., Moller Molina C.M., Hickey V., Pendry J. & Narain U., 2021. Framework for sustainable recovery of tourism in protected areas. *Sustainability* 13, 2798. doi.org/10.3390/su13052798Bermejo M., Rodríguez-Teijeiro J.D., Illera G., Barroso A., Vilà C. & Walsh P.D., 2006. Ebola outbreak killed 5000 gorillas. *Science* 314(5805), 1564.

Bizimungu J., 2019. Revenue from Gorilla tourism grows by 25%. The New Times, Kigali, Rwanda. https://www.newtimes.co.rw/news/revenue-gorilla-tourism-grows-25 (accédé : 25/02/2021)

Blom A., Cipolletta C., Brunsting A.M.H. & Prins H.H.T., 2004. Behavioral responses of gorillas to habituation in the Dzanga-Ndoki National Park, Central African Republic. *Int. J. Primatology* 25(1) : 179–196.

Bradley B.J., Doran-Sheehy D.M. & Vigilant L., 2008. Genetic identification of elusive animals: re-evaluating tracking and nesting data for wild western gorillas. *J. Zool.* 275(4) : 510–513.

Breuer T., Bout N., Fishlock V. & Maisels F., 2015. Protecting bais and elephants: law enforcement and anti-poaching. *In* : Fishlock V. & Breuer T. (Eds.), Studying forest elephants. Neuer Sportverlag, Stuttgart, Germany : 72-83.

Breuer T., & Metsio Sienne J., 2015. The history of bai research. *In* : Fishlock V. & Breuer T. (Eds.), Studying forest elephants. Neuer Sportverlag, Stuttgart, Germany : 14-23.

Briedenhann J. & Wickens E., 2007. Developing cultural tourism in South Africa: potential and pitfalls. *In* : Richards G. (Ed.), Cultural tourism : globalising the local - localising the global. Proc. ATLAS Expert Meeting Cultural Tourism: Globalising the local - localising the global, Barcelona, Spain, October 2004 : 47-60.

CCC, 2021. Découverte du basin du Congo. https://congoconservation.travel/discoveries/decouverte-du-bassin-du-congo/?lang=fr (accédé 10/02/2021)

Cessou S., 2021. Tourisme: saison blanche et sèche pour l'Afrique à cause du Covid-19. *RFI*. https://www.rfi.fr/fr/afrique/20210130-tourisme-saison-blanche-et-s%C3%A8che-pour-l-afrique-%C3%A0-cause-du-covid-19 (accédé 25/02/2021)

Christie I., Fernandes E., Messerli H. & Twining-Ward L., 2013. Tourism in Africa. Harnessing tourism for growth and improved livelihoods. World Bank, Washington DC : 248 p.

COAST, 2014. Tourisme côtier durable au Cameroun. Enseignements tirés à Kribi. Brochure projet COAST : 4 p.

Congo Conservation Company, 2021. Congo basin discovery. Congo Conservation Company, Congo & South-Africa. https://congoconservation.travel/discoveries/congo-basin-discovery/ (accédé 01/03/2021)

D'abzac E., 2020. Tourisme et voyages d'affaires en Afrique : pas de reprise avant plusieurs mois. *Déplacementspro.com*. https://www.deplacementspros.com/covid-19/tourisme-et-voyages-daffaires-en-afrique-pas-de-reprise-avant-plusieurs-mois (accédé 17/03/2021)

Devanne A.-S. & Fortin M.-J., 2011. Construire l'image d'une destination touristique dans un paysage en changement : défi d'articulation autour de l'éolien en Gaspésie (Canada). *Mondes du Tourisme* 4 : 61-76.

Delvingt W., Mankoto Ma Mbaelele & Lejoly J., 1990. Guide du Parc National des Virunga. Commission des Communautés Européennes, Bruxelles, Belgique : 191 p.

Doran-Sheehy D.M., Derby A.M., Greer D. & Mongo P., 2007. Habituation of western gorillas: the process and factors that influence it. *Amer. J. Primatology* 69(12) : 1354–1369.

French J., 2009. Can western lowland gorilla tourism become a viable tool for conservation in Gabon? Imperial College, London.

FTNS, 2020. Brief 2020. Fondation Tri-national de la Sangha, Yaoundé, Cameroun. https://mailchi.mp/6b6ed24a4c11/ftns-actu-002?e=39a77cecad (accédé 02/03/2021)

Gessner, J., Buchwald, R., & Wittemyer, G. (2014). Assessing species occurrence and species-specific use patterns of bais (forest clearings) in Central Africa with camera traps. *African Journal of Ecology* 52(1) : 59–68. https://doi.org/10.1111/aje.12084

Gössling S. Scott D. & Hall C.M., 2020. Pandemics, tourism and global change: a rapid assessment of COVID-19. *J. Sustainable Tourism* 29(1) : 1-20.

Governor's Camp, 2021. Sabyinyo Silverback Lodge. Gorvernor's Camp, Nairobi, Kenya. https://www.governorscamp.com/safari-camps/sabyinyo-silverback-lodge/ (accédé 07/04/2021)

Greer D. & Cipolletta C., 2006. Western gorilla tourism: lessons learned from Dzanga-Sangha. *Gorilla Journal* 33 : 16–19.

Hatfield R. & Malleret-King D., 2007. The economic value of the mountain gorilla protected forest (the Virungas and Bwindi Impenetrable National Park). Nairobi, Kenya.

Hiol Hiol F., Larzillière A., Palla F. & Scholte P., 2015. République du Cameroun. *In* : Doumenge C., Palla F., Scholte P., Hiol Hiol F. & Larzillière A. (Eds.), 2015. Aires protégées d'Afrique centrale – État 2015. OFAC, Kinshasa, République Démocratique du Congo et Yaoundé, Cameroun : 41-65.

Kamga Kamdem S.L., Marabé Ngar-Odjilo, Njamen B., Piga B., Poliwa R.C. & Tabapssi T., 2020. Le Covid-19 : impacts sur le tourisme en Afrique centrale et mesures de relance. RETAC, Yaoundé, Cameroun : 40 p.

Kelly Pennaz A., Ahmadou M., Moritz M. & Scholte P., 2018. Not seeing the cattle for the elephants: The implications of discursive linkages between Boko Haram and wildlife poaching in Waza National Park, Cameroon. *Conservation and Society* 16(2): 125-135. http://www.conservationandsociety.org/temp/ConservatSoc000-4386118_121101.pdf

Kimbu A.N. & Tichaawa M.T., 2018. Sustainable development goals and socio-economic development through tourism in Central Africa: myth or reality? *GeoJournal of Tourism and Geosites*, 23(3) : 780–796.

Leung Y.-F., Spenceley A., Hvenegaard G. & Buckley R. (Eds.), 2019. Gestion du tourisme et des visiteurs dans les aires protégées. Lignes directrices pour la durabilité. UICN, Gland, Suisse. Lignes directrices des meilleures pratiques dans les aires protégées 27 : xii + 120 p.

Lindsey P., Allan J., Brehony P. *et al.*, 2020. Conserving Africa's wildlife and wildlands through the COVID-19 crisis and beyond. *Nature Ecology & Evolution* 4 : 1300-1310.

Magoum I., 2020. Congo : 14 M$ de l'USAID pour développer l'écotourisme dans le parc de Nouabalé-Ndoki. *Afrik21*. www.afrik21.africa/congo-14-m-de-lusaid-pour-developper-lecotourisme-dans-le-parc-de-nouabale-ndoki/ (accédé 09/02/2021)

Maisels F. & Breuer T., 2015. What is a bai? *In* : Fishlock V. & Breuer T. (Eds.), Studying forest elephants. Neuer Sportverlag, Stuttgart, Germany : 12-13.

Maisels F., Fishlock V., Greenway K., Wittemyer G. & Breuer T., 2015a. Detecting threats and measuring change at bais: a monitoring framework. *In* : Fishlock V. & Breuer T. (Eds.), Studying forest elephants. Neuer Sportverlag, Stuttgart, Germany : 144-155.

Maisels F., Mbani O. A. & Bout N., 2015b. Assessing wildlife and human activity in and around a bai. *In* : Fishlock V. & Breuer T. (Eds.), Studying forest elephants. Neuer Sportverlag, Stuttgart, Germany : 46-62.

Maisonneuve N. & Poliwa R., 2019. Consolidation et réplication des succès écotouristiques dans les aires protégées d'Afrique sub-saharienne. Rapport final (version provisoire), Consortium COWI, PROSPECT C&S, Bruxelles, Belgique : 202 p.

Metsio Sienne J., Breuer T., Inkamba-Nkulu C., Mavinga F. B., Turkalo A. & Maisels F., 2015. Establishing a site: construction, facilities, health and behaviour. *In* : Fishlock V. & Breuer T. (Eds.), Studying forest elephants. Neuer Sportverlag, Stuttgart, Germany : 64-71.

Mossaz A., Buckley R.C. & Castley J.G., 2015. Ecotourism contributions to conservation of African big cats. *Journal for Nature Conservation* 28 : 112–118.

Moyini Y. & Uwimbabazi B., 2000. Analysis of the economic significance of gorilla tourism in Uganda. Nairobi, Kenya.

Munanura I.E., Backman K.F., Sabuhoro E. & Bernhard K.P., 2020. The potential of tourism benefits to reduce forest dependence behavior of impoverished residents adjacent to Volcanoes National Park in Rwanda. *Tourism Planning & Development* 17(5) : 475-496.

Ndayishimiye J., 2018. Infrastructures touristiques bien rémunérées au Rwanda : 438 millions USD en 2017, agriculture et industrie à la traîne. *Igihe*. https://fr.igihe.com/infrastructures-touristiques-bien-remunerees-au.html (accédé 10/03/2021)

Nielsen H. & Spenceley A., 2011. The success of tourism in Rwanda: gorillas and more. *In* : Chuhan-Pole P. & Angwafo M. (Eds.), Yes Africa can : success stories from a dynamic continent. The World Bank, Washington D.C. : 231-249.

Nlom J.H., Kana R. & Walde Z., 2013. L'écotourisme. *In* : Eba'a Atyi R., Lescuyer G., Ngouhouo Poufoun J. & Moulendè Fouda T. (Eds.), Étude de l'importance économique et sociale du secteur forestier et faunique au Cameroun. Cifor, Bogor, Indonésie : 189-209.

Ntirenganya E., 2017. Tembera U Rwanda: Domestic tourism drive making big gains. The New Times, Kigali, Rwanda. https://www.newtimes.co.rw/section/read/215535 (accédé 07/04/2021)

Okouyi Okouyi J. & Gandini G., 2020. Données touristiques 2014-2020 du site de Kongou (parc national de l'Ivindo). Com. pers.

OMT, 1998. Guide à l'intention des autorités locales. Développement du tourisme durable OMT-UNWTO, Madrid : 223 p.

Parc national des Virunga, 2021a. À propos du parc. https://virunga.org/fr/about/ (accédé 24/02/2021)

Parc national des Virunga, 2021b. L'Alliance Virunga. https://virunga.org/fr/alliance/ (accédé 24/02/2021)

Parc national des Virunga, 2021c. Trekking des gorilles. https://visit.virunga.org/fr/treks/mountain-gorilla-trek/ (accédé 24/02/2021)

Parc national des Virunga, 2020. Le Parc National des Virunga Suspend Temporairement le Tourisme des Gorilles de Montagne en Raison du Virus COVID-19. https://virunga.org/fr/news/virunga-national-park-temporarily-closes-mountain-gorilla-tourism-due-to-covid-19/ (accédé 16/10/2020)

Payen A., 2012. Tourisme communautaire dans les Suds : quelle implication des populations locales dans les aires protégées ? Cas du parc national de Loango, Gabon. Rapport Master, Univ. Paris 1 : 100 p.

Payen A., 2014. Les habitants : acteurs du développement dans les projets de mise en tourisme ? Cas du parc national de Loango au Gabon. *Via* 4-5. https://doi.org/10.4000/viatourism.892

Plumptre A.J., Davenport T.R.B., Behangana M. *et al.*, 2007. The biodiversity of the Albertine Rift. *Biological Conservation* 134 : 178-194.

Preel M., 2013. Sept touristes français enlevés par «un groupe de terroristes» au Cameroun. *Le Monde*. https://www.lemonde.fr/afrique/article/2013/02/19/cinq-a-sept-touristes-francais-enleves-dans-le-nord-du-cameroun_1835021_3212.html

RAPAC, 2009. Écotourisme et tourisme communautaire pour les aires protégées d'Afrique centrale – Manuel. RAPAC, Libreville, Gabon : 106 p.

RDB, 2020. Annual report 2019. RDB, Kigali, Rwanda : 53 p.

RDB, 2018. Rwanda tourist experience permit feed & reservation guidelines. January 2018. RDB, Kigali, Rwanda : 17 p.

Rieucau J., 2001. Biodiversité et écotourisme dans les pays du centre du golfe de Guinée. *Les Cahiers d'Outre-Mer* 216 : 417-452.

Right Routes, 2021. Itinéraire Langoué baï. FIGET, Libreville, Gabon & Fondation Trust the forest, Milan, Italie. http://www.gabonrightroutes.org/fr/itineraires/langoue-bai/ (accédé 15/02/2021)

Robbins A.M. & Robbins M.M., 2005. Fitness consequences of dispersal decisions for male mountain gorillas (*Gorilla beringei beringei*). *Behavioral Ecology and Sociobiology* 58(3) : 295–309.

Roberts S., 2020. Africa's year of zero: a special report on the future of wildlife tourism. *Financial Times*. https://www.ft.com/content/6a4f6c76-8a00-46ef-a645-23a5eda58825?FTCamp=engage/CAPI/webapp/Channel_Cision//B2B (accédé 01/12/2020)

Rodary E., 2010. Créer du lien social par le tourisme, une utopie soutenable ? *In* : Froger G. (Ed.), Tourisme durable dans les Suds ? P.LE. Peter Lang Ed., Bruxelle, Belgique. Ecopolis 11 : 37-47.

Sabuhoro E., Wright B., Munanura I.E., Nyonza Nyakabwa I. & Nibigira C., 2017. The potential of ecotourism opportunities to generate support for mountain gorilla conservation among local communities neighboring Volcanoes National Park in Rwanda. *J. Ecotourism*. https://doi.org/10.1080/14724049.2017.1280043

Saïga, 2021. À la recherche des gorilles de la forêt gabonaise Secret Planet, Lyon, France. https://www.saiga-voyage-nature.fr/fr/voyage/visualiser/les-gorilles-du-gabon

Scholte P., 2021. Fréquentation touristique 1966-2020 du parc national de Waza. Com. pers.

Scholte P., 2013. Population trends of antelopes in Waza National Park (Cameroon) show escalating effects of poaching and livestock intrusion. *African Journal of Ecology* 52 : 370-374.

Scholte P., 2005. Floodplain rehabilitation and the future of conservation & development. Adaptive management of success in Waza-Logone, Cameroon. Wageningen University and Research Centre, The Netherlands. *Tropical Resource Management Papers* 67 : 344 p. Http://hdl.handle.net/1887/4290 ; https://edepot.wur.nl/116462

Spenceley A., Habyalimana S., Tusabe R. & Mariza D., 2010. Benefits to the poor from gorilla tourism in Rwanda. *Development Southern Africa* 27(5) : 647-662.

Spenceley A., McCool S., Newsome D. *et al.*, 2021. Tourism in protected and conserved areas amid the Covid-19 pandemic. *Parks* 27 : 103-118.

Stephan C., Bahamboula J.J.D. & Brncic T.M., 2020. Responses to a poached conspecific in wild forest elephants (*Loxodonta africana cyclotis*). *Behaviour* 157(8–9), 823–833. https://doi.org/10.1163/1568539X-bja10025

Tchindjang M. & Etoga M.H., 2014. Les chutes de la Lobé, un patrimoine géoculturel exceptionnel sur la côte camerounaise entre tourisme durable et préservation des identités culturelles. *Via* 4-5. http://journals.openedition.org/viatourism/951

Tumenta P., Kok J., Van Rijssel J., Buij R., Croes B., Funston P., De Iongh H. & Udo de Haes H., 2010. Threat of rapid extermination of the lion (*Panthera leo leo*) in Waza National Park, Northern Cameroon. *African Journal of Ecology* 48: 888-894.

Turkalo A.K., Wrege P.H., & Wittemyer G., 2013. Long-Term monitoring of dzanga bai forest elephants: Forest clearing use patterns. *PLoS ONE* 8(12), e85154. https://doi.org/10.1371/journal.pone.0085154

UICN-PACO, 2010. Le tourisme dans les aires protégées d'Afrique de l'Ouest : quelle contribution à la conservation ? UICN-PACO, Ouagadougou, Burkina Faso : 109 p.

UNWTO, 2021. International Tourism and covid-19. UNWTO, Madrid, Spain. https://www.unwto.org/international-tourism-and-covid-19 (accédé 15/03/2021)

UNWTO, 2020a. International tourism down 65% in first half of 2020. *World Tourism Barometer* 18 (5) : 35 p.

UNWTO, 2020b. Country profile - Inbound tourism. https://www.unwto.org/country-profile-inbound-tourism (accédé : 24/09/2020)

UNWTO, 2020c. International travel plunges 70% in the first eight months of 2020. *World Tourism Barometer* 18 (6) : 35 p.

UNWTO, 2020d. Covid-19 and tourism. 2020: A year in review. UNWTO, Madrid, Spain : 18 p.

UNWTO, 2019a. Egypt: Country-specific: Basic indicators (Compendium) 2014 - 2018 (11.2019). https://www.e-unwto.org/doi/abs/10.5555/unwtotfb08180100201420182019 11 (accédé 23/09/2020)

UNWTO, 2020e. International tourism expected to decline over 70% in 2020, back to levels of 30 years ago. *World Tourism Barometer* 18(7) : 11 p. + 23 p. annexes.

UNWTO, 2019a. Cameroon: Country-specific: Basic indicators (Compendium) 2014 - 2018 (11.2019). https://www.e-unwto.org/doi/abs/10.5555/unwtotfb01200100201420182019 11 (accédé 23/09/2020)

UNWTO, 2019b. Sao Tome and Principe: Country-specific: Basic indicators (Compendium) 2014 - 2018 (01.2020). https://www.e-unwto.org/doi/abs/10.5555/unwtotfb06780100201420182020 01 (accédé 23/09/2020)

Uwayo P., Nsanzumukiza V.M., Maniragaba A., Nsabimana A.P. & Akimanizanye V., 2020. Contribution of former poachers for wildlife conservation in Rwanda Volcanoes National Park. J. *Geoscience Environment Protection* 8(4) : 47-56.

Viard E., 2008. Afrique centrale et tourisme. Réflexions autour du développement touristique. RAPAC, Libreville, Gabon : 22 p.

Visit Rwanda, 2021a. Rwanda reopens for tourism. RDB, Kigali, Rwanda. https://www.visitrwanda.com/rwanda-reopens/ (accédé 25/02/2021)

Visit Rwanda, 2021b. Gorilla tracking. RDB, Kigali, Rwanda. https://www.visitrwanda.com/interests/gorilla-tracking/ (accédé 26/02/2021)

Visit Rwanda, 2021c. Destinations. RDB, Kigali, Rwanda. https://www.visitrwanda.com/tourism/destinations/ (accédé 26/02/2021)

Visit Rwanda, 2021d. *Kwita Izina*. Rwanda's Gorilla Naming Ceremony. https://www.visitrwanda.com/kwita-izina/ (accédé 07/04/2021)

Visit Rwanda, 2021e. *Tembera U Rwanda*. Discover Rwanda. Dioscover Home. https://www.visitrwanda.com/discover-rwanda/ (accédé 07/04/2021)

Waithaka J., 2020. The impacts of Covid-19 pandemic on Africa's protected areas operations and programmes. IUCN-WCPA Paper : 44 p.

Wilkie D.S. & Carpenter J.F., 1999. Can nature tourism help finance protected areas in the Congo Basin? *Oryx* 33(4) : 332-338.

WTTC, 2021. Travel & tourism : economic impact 2021. WTTC, London : 2 p.

WTTC, 2020. Travel & tourism. Global economic impact & trends 2020. WTTC, London : 22 p.

WTTC, 2019. The economic impact of global wildlife tourism. Travel & tourism as an economic tool for the protection of wildlife – August 2019. WTTC, London : 29 p.

9

PROTECTED AREAS: A MAJOR ASSET IN THE FIGHT AGAINST CLIMATE CHANGE

Gervais-Ludovic ITSOUA MADZOUS, Serge Alexis KAMGANG, Damas MOKPIDIE and Charles DOUMENGE

With contributions from: Quentin JUNGERS, Pierre HOUDMONT and Deblondet D. BLEU

Although protected areas cover nearly 15.3% of the world's land area, including inland waters (Maxwell *et al.*, 2020), their role in fighting climate change remains insufficiently understood. They contribute substantially to optimizing carbon sequestration and storage by preventing deforestation and degradation of land and forest cover (Zapfack *et al.* 2013 and 2016; Noumi *et al.* 2018); the conservation of forests furthermore helps to maintain rainfall and regulate water flows and local and regional climates (Makarieva *et al.*, 2009; Nogherotto *et al.*, 2013; Bell *et al.*, 2015; De Wasseige *et al.*, 2015; Molina *et al.*, 2019). Protected areas also shelter many species of animals and plants and provide a range of ecosystem goods and services to human societies (Stolton *et al.*, 2015). Healthy, undisturbed ecosystems enhance resilience to the effects of climate change, and enable ecosystems and human populations to mitigate and adapt to these changes (De Wasseige *et al.*, 2015; Eba'a Atyi, *et al.*, 2015a).

Although they face multiple pressures, the overall health of natural ecosystems in Central Africa remains good. The Congo Basin forest is the second largest continuous tropical forest track after the Amazon. It contains one of the world's largest national forest parks, Salonga National Park, located in the Democratic Republic of the Congo (DRC). Protected areas in the subregion are home to unique biodiversity, one which remains rich, and highly diversified ecosystems (Doumenge *et al.*, 2015).

The dense humid forests of Central Africa contain the highest amount of biomass per unit area (418.3 ± 91.8 T/ha) of all tropical forests, and thus store significant amounts of carbon (Saatchi *et al.*, 2011; Slik *et al.*, 2013). They contribute substantially to climate equilibrium at local, regional and continental levels. Diverse models of the impacts of deforestation in the Congo Basin on the climate indicate a likely increase in ground temperatures and reduction in rainfall in many areas of Central Africa, and severe deforestation could potentially impact the climate of neighboring regions (Nogherotto *et al.*, 2013; Akkermans *et al.*, 2014; Bell *et al.*, 2015).

Unfortunately, these high Central African deforestation scenarios may not be as far off as they seem. Deforestation rates in West and Central Africa continue to increase, edging up to 0.59% per year, and sometimes even higher. DRC, for example, has one of the highest deforestation rates in the world (0.83% per year), ranking just behind Brazil and ahead of Indonesia in terms of net forest loss for the period 2010-2020 (all forests included, dry and humid; FAO, 2020).

Protected areas in Central Africa also are contending with considerable anthropogenic pressures that are now being exacerbated by the effects of climate change. They face multiple threats, including deforestation, the clearing of land for agriculture, the development of mining projects, and poaching. These are weakening the protected area network, leaving it more sensitive to climate change impacts.

Climate change is causing noticeable impacts on biodiversity and protected areas, with changes in the distribution of species alongside reductions in population sizes and even local extinctions (Davis & Shaw, 2001; Balanyá *et al.*, 2006; Bush *et al.*, 2020). Increased air temperatures, changes in rainfall patterns, and increased frequency and intensity of extreme climate events (droughts, floods, etc.) are all manifestations of climate change, ones with far-reaching consequences on animal and plant species and on ecosystems as a whole (Hartley *et al.*, 2007; Belle *et al.*, 2016).

The threats to these ecosystems and the protected areas they contain diminish their effectiveness in providing ecosystem services and hamper their role in conservation, thereby undermining the contribution of these protected areas to climate change mitigation and adaptation processes (Ndiaye & Ndiaye, 2013). Among the key elements to be considered in strategies deployed by protected area networks to cope with climate change, several elements are particularly important. These include the management

effectiveness and connectivity of protected areas in relation to the dispersal capacities and vulnerability of species (Belle *et al.*, 2016).

Aware of the importance of protected areas in combating the damaging effects of climate change, Central African countries have ratified a range of conventions, treaties and agreements to strengthen and implement mechanisms for the sustainable management of their protected areas. Examples include the implementation of the 2011-2020 Strategic Plan for Biological Diversity adopted by the signatory parties to the Convention on Biological Diversity (CBD), Aichi Target 11 and the Paris Agreement (2015). With the signing of the Paris Agreement, governments decided to strengthen the global response to climate change, with the aim of limiting the increase in global average temperature to below 2°C above pre-industrial levels.

To achieve this objective, as advised by the Intergovernmental Panel on Climate Change (IPCC; GIEC, 2018), various scientists recommend reducing global greenhouse gas emissions by 45% by 2030 and achieving neutral emissions (offset by capture) by 2070. Considerable international efforts will be required to achieve this as figures unfortunately reveal a sustained rise in emissions, including in the areas of agriculture, forestry, and more broadly, land use (Shukla *et al.*, 2019).

Although fossil fuel use and industrial processes account for nearly 80% of greenhouse gas emissions (GIEC, 2018), increasing attention is being paid to agriculture and forestry due to their combined climate change mitigation and adaptation potential. IPCC recently addressed the issue of land use and the measures to be implemented in this area, which include reducing deforestation, the reforestation and restoration of land and ecosystems, changing land management methods such as agroforestry, better fire management, long-term integration of organic coals in soils, and improving livestock management (Shukal *et al.*, 2019). All of these measures, combined with energy efficiency and an increase in the share of green energy in the energy mix, represent today the first steps toward sustainable development.

In the light of the above, particularly the combined challenges of climate change mitigation and adaptation and the importance of land management in this synergy, several questions deserve to be considered:

- Are Central African protected areas contributing to the fight against climate change?

- Are Central African protected areas vulnerable to climate change?
- What measures should be taken to enable protected areas to fully engage in the fight against climate change threats?
- What are the "climate finance" opportunities for Central African protected areas?

We will try to answer these questions over the course of this chapter.

1. Contribution of protected areas to the fight against climate change

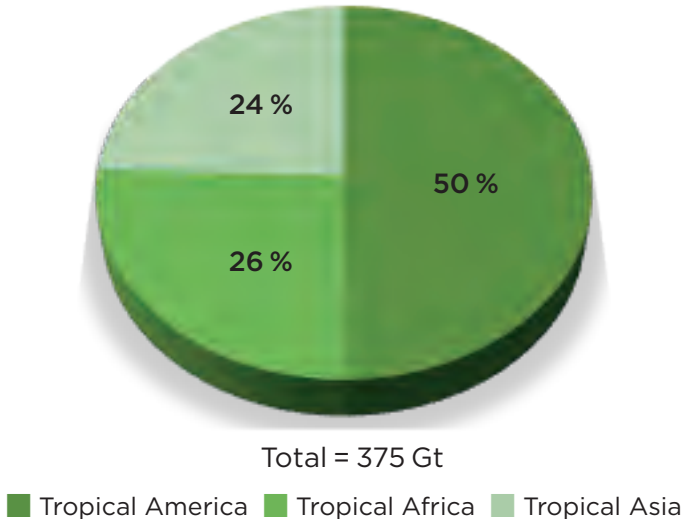
Global warming is presenting new challenges to the sustainable management of natural resource in protected areas. This is particularly due to the fact that protected areas are a "spatially static" management tool (the boundaries of protected areas are fixed) facing a "spatially dynamic" problem (climate variability, dispersion and adaptation of species). This problem can be addressed in part through more effective and adaptive management of protected areas. However, all this leads to an examination of the capacity of protected areas to serve as an important mechanism to combat climate change (Halpin, 1997; Heller & Zavaleta 2009). If managed effectively, protected areas can indeed play a major role in both adaptation and mitigation.

1.1 Mitigating climate change

The importance of Central African forests

African ecosystems play a significant role in climate change mitigation, storing just over one quarter of the 375 Gt of above-ground biomass in the intertropical zone (375×10^9 t, Avitabile *et al.*, 2016; Figure 1). The dense humid forests of Central Africa thus contain some of the highest above-ground biomass per unit area compared to Asian or American tropical forests: 418.3 ± 91.8 t/ha *vs.* 393.3 ± 109.3 and 287.8 ± 105.0 t/ha, respectively (Slik *et al.*, 2013; see also other references showing the variability of tree ecosystems: Baccini *et al.*, 2008; Saatchi *et al.*, 2011; Lewis *et al.*, 2013; Avitabile *et al.*, 2016).

Figure 1 – Above-ground biomass by continent in the intertropical zone

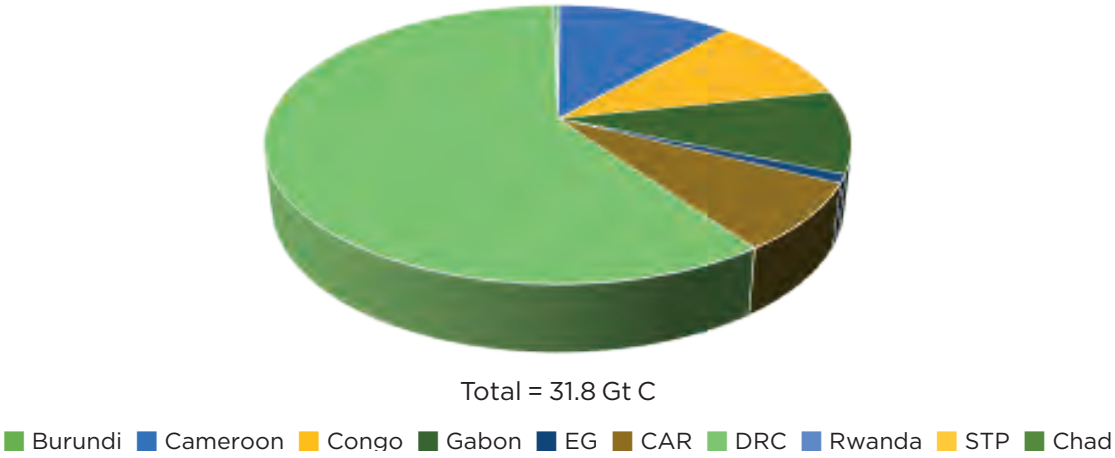


Source : Avitabile *et al.* (2016).

Central Africa alone holds more than 16% of intertropical above-ground carbon (Saatchi *et al.*, 2011). This percentage exceeds 20% of total carbon when soil organic carbon is considered, periodically flooded and swampy forests containing high amounts of both above-ground and below-ground carbon. These forests, in particular the vast expanses of peatlands in the Congo Basin, store 30.6 Gt of carbon in their soil, or the equivalent of the above-ground carbon stock of the entire Congo Basin (Dargie *et al.*, 2017; Ifo *et al.*, 2018). Unfortunately, they remain today very poorly protected (Dargie *et al.*, 2019).

In Central Africa, the above-ground carbon stock of ecosystems with tree cover greater than or equal to 10% is estimated to be about 31.8 Gt (Saatchi *et al.*, 2011). This carbon stock is very unevenly distributed between countries; due to its size and forest cover, DRC is in the lead, with nearly 60% of the subregion's above-ground carbon (Figure 2). The forested countries of Cameroon, Congo and Gabon also stock about 10%, and the Central African Republic (CAR) just slightly less. Rwanda and Burundi, on the other hand, are highly deforested but show good potential for land rehabilitation. This also is the case for Chad, a vast Sahelian country which does not stand out in the figure due to the difficulty of taking into account trees outside forests, but which has strong opportunities for afforestation.

Figure 2 – Above-ground carbon stocks by country in Central Africa



EG: Equatorial Guinea; CAR: Central African Republic; DRC: Democratic Republic of the Congo; STP: Sao Tome and Principe. Note 1: above-ground carbon stocks of ecosystems with tree cover ≥ 10%. Note 2: to convert carbon stocks into biomass stocks, doubling the former provides a fairly accurate estimate of the latter. Source: Saatchi et al. (2011).

By their very presence, these forests play a crucial role in regulating local and regional climates. They allow rainfall levels to be maintained up to several thousand kilometers inland; in contrast, rainfall decreases exponentially in deforested areas with distance from the sea (Makarieva *et al.*, 2009). Various simulations of deforestation in the Congo Basin have highlighted a likely overall rise in temperature (0.7 to 2 to 3 °C in the center of the basin) as well as a decrease in evapotranspiration and a drop in rainfall (Akkermans *et al.*, 2014; Bell *et al.*, 2015). These changes will not, however, be uniform. It is likely that the drop in rainfall will be greater in the western part of the basin (about −40%) than in the foothills of the Albertine Rift (about −10%), creating a climate anomaly dipole related, in particular, to the increase in horizontal winds from the Atlantic Ocean toward the rift (Bell *et al.*, 2015).

All of these changes will have repercussions beyond the Congo Basin itself through regional monsoon dynamics (Nogherotto *et al.*, 2013). From June to August, the monsoon could strengthen in West Africa, causing increased rainfall over the Sahel and decreased rainfall over the Guinean coast. From December to February, on the other hand, the African monsoon south of the Equator may strengthen, causing increased rainfall over this region. This further underscores the importance of considering all these phenomena at the regional and continental scale. Solidarity between countries, and the development of coordinated policies at the regional and continental level, including ones to develop a coherent forest and protected area network system, are vital.

Protected areas and carbon stocks

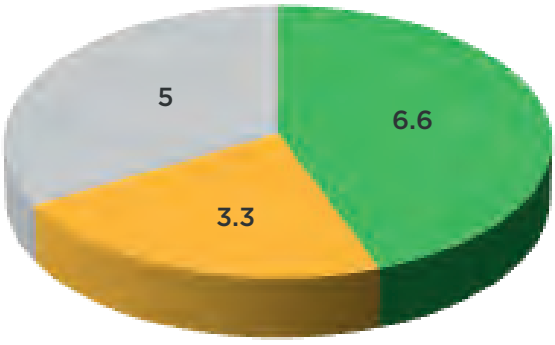
By combating deforestation and land degradation, protected areas contribute to the maintenance of carbon stocks and carbon capture, as well as to climate equilibrium (Lewis *et al.*, 2009; Makarieva *et al.*, 2009; Marquant *et al.*, 2015; Harris *et al.*, 2021). These protected areas were designed mainly to safeguard biodiversity from direct human

impacts, but they are equally capable of helping to fight climate change, beyond their primary role of protecting ecosystems.

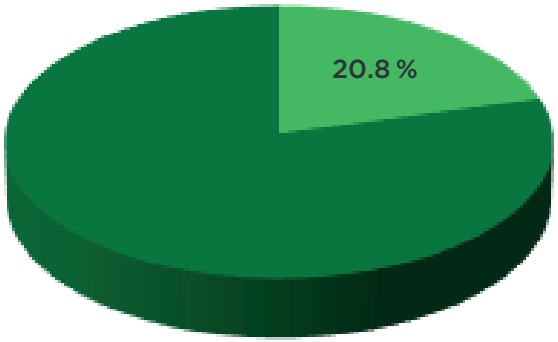
OFAC (*Observatoire des Forêts d'Afrique Centrale*) is currently assessing the carbon stocks conserved through the Central African protected area network. These protected areas extend over different biomes and contain a wide range of ecosystems. Some of these ecosystems, such as dense humid tropical and subtropical forests, store a significant amount of the world's carbon. An initial, very broad estimate indicates a total carbon stock of 14.9 Gt C for the ensemble of Central African protected areas, potentially representing three years of fossil fuel emissions of the United States. Above-ground carbon constitutes slightly less than 45% of this total (Figure 3a).

Protected areas cover approximately 17.6% of the land area of COMIFAC (*Commission des Forêts d'Afrique Centrale*) member countries (OFAC, 2020), yet they contain an estimated 20-25% of these countries' carbon stocks (Figure 3b). Salonga National Park, which is one of the world's largest tropical rainforest reserve, extending over 33,600 km², alone protects a stock exceeding 1.8 Gt C.

Figure 3 – Carbon stocks of the Central African protected area network



a) Distribution by reservoir (Gt C)



b) Importance in above-ground carbon storage in the subregion

Sources: OFAC (2020) and Saatchi *et al.* (2011).

Estimating the contribution of protected areas to the protection of carbon stocks in Central Africa

Q. Jungers, OFAC and P. Houdmont, UCL

Central African protected areas store large amounts of carbon but the size of these stocks has yet to be fully determined. This OFAC study is one of several currently underway to assess whether this ecosystem service could be used as a new instrument supporting the sustainable financing of protected areas.

To roughly estimate the total amounts of carbon stored in vegetation and soil in protected areas, OFAC compiled a set of available data on the main carbon reservoirs: above-ground carbon, below-ground carbon and soil organic carbon. The FAO GSOC map (2020) was used to obtain soil organic carbon data at a resolution of 1km. By applying a coefficient of 0.5 to the GLOBIOMASS map (ESA DUE, 2020), which lists all terrestrial above-ground biomass at a 100 m spatial resolution, the mass of dry matter was converted into above-ground carbon. Finally, multiplying the figures provided by this map by a root-stem coefficient provided by IPCC, and applied to all ecological zones present in Central Africa (FAO, 2012), provided the results for the remaining reservoir: below-ground carbon.

The distribution between the three reservoirs (Figure 3a) seems to indicate a significant contribution from above-ground biomass, particularly due to the presence of dense forests, and from soil organic carbon. Recent discoveries of carbon stored in Central African peatlands suggest that these magnitudes could be revised upwards (Dargie *et al.*, 2017). At this point, the results obtained for Central African protected areas must be considered as rough estimates. They indicate the order of magnitude of protected areas' importance in regard to carbon storage, but they will need to be clarified in the future.

These results, coupled with a fair price per ton of carbon, point to the emergence of a new tool for sustainable financing of protected areas in Central Africa, particularly forest protected areas. To do so, the potential of each protected area will need to be analyzed.

In some countries, such as Rwanda and Burundi, agricultural and livestock activities have reduced perennial above-ground carbon stocks. The remaining forests survive thanks only to the network of protected areas (Doumenge *et al.*, 2015). They nonetheless help to regulate local climates and protect watersheds and water supplies essential for human societies.

While these old-growth forests do contribute somewhat to carbon capture, the major carbon sinks are primarily secondary forests and areas located in forest-savanna ecotones (Lewis *et al.*, 2009; Baccini *et al.*, 2017; Harris *et al.*, 2021). A natural reforestation dynamic has been reported for several decades around the entire dense humid forests (Youta Happi *et al.*, 2003; Maley & Doumenge, 2012; Aleman *et al.*, 2017). Protected areas allow this reforestation dynamic to flourish.

Encouraging forest regeneration and the restoration of land in protected areas that have been impacted in the past by human activities also enables significant amounts of carbon to be stored. This requires looking beyond the boundaries of protected areas to understand their interactions with their surroundings. As part of a landscape management approach, the management of carbon stocks and flows in these surrounding areas can and should complement the role of the protected areas themselves. Indeed, both secondary forests and agricultural land can store significant amounts of carbon if the planting of useful trees and agroforestry are encouraged (Fongnzossie *et al.*, 2014). In addition to protected areas, numerous forestry concessions can, under sustainable management, both maintain a large amount of standing timber and help reduce carbon emissions (Eba'a Atyi *et al.*, 2015b).

Initiatives are underway across the subregion to integrate climate considerations into protected area programs, mitigate the effects of climate change and implement adaptation activities.

1.2 Climate change adaptation

Various climate models applied to Central Africa converge to predict an increase in atmospheric temperatures. This warming will probably be higher north and south of the dense humid forest block and in the savannas, and lower in the center (except in the case of massive deforestation). With regard to rainfall, predictions are less consistent, suggesting a slight increase in annual rainfall in some areas such as the Sahel, but, more importantly, more irregular rainfall patterns and an increase in the duration and intensity of dry periods (Tsalefac *et al.*, 2015).

Protected areas help to improve the resilience of ecosystems and human societies facing climate

change. Healthy vegetation, in particular forest vegetation, help to protect watersheds, prevent soil erosion, and maintain the sources and quality of water required for human activities (livestock farming, agriculture). The presence of forests in landscapes make it possible to recycle 30 to 50% of rainfall through evapotranspiration (Salati *et al.*, 1983). Apart from this local effect of forest cover, air masses that have circulated over forested areas can generate at least twice as much rain as those that have circulated over deforested areas (Makarieva & Gorshkov, 2010; Spracklen *et al.*, 2012), favoring greater crop and livestock production.

Natural ecosystems also provide shelter to pollinating insects (including bees), which are essential for agriculture. Moreover, these natural ecosystems supply products essential to human societies (food and medicinal plants, game, etc.). These products can be exploited in some protected areas provided they are set up for this purpose (e.g., International Union for Conservation of Nature-IUCN categories V and VI). Above all, these ecosystem goods and services provide human societies with essential resources in the event of poor harvests, food shortages and epidemics (Hopkins *et al.*, 2015).

The old-growth forests in Central Africa, which thus far have been able to tolerate climate fluctuations, will likely be able to withstand future changes (Maley *et al.*, 2018). These old-growth forests also are commonly ecosystems with high biodiversity, and even harbour many endemic species (Gonmadje *et al.*, 2011). They may also contain large amounts of carbon, although the relationships between increasing carbon stocks, increasing biodiversity and endemism may not always move in the same direction; these relationships also may vary depending on whether plant or animal biodiversity is being considered (Beaudrot *et al.*, 2016; Gonmadje *et al.*, 2017; Ifo *et al.*, 2018; Van de Perre *et al.*, 2018).

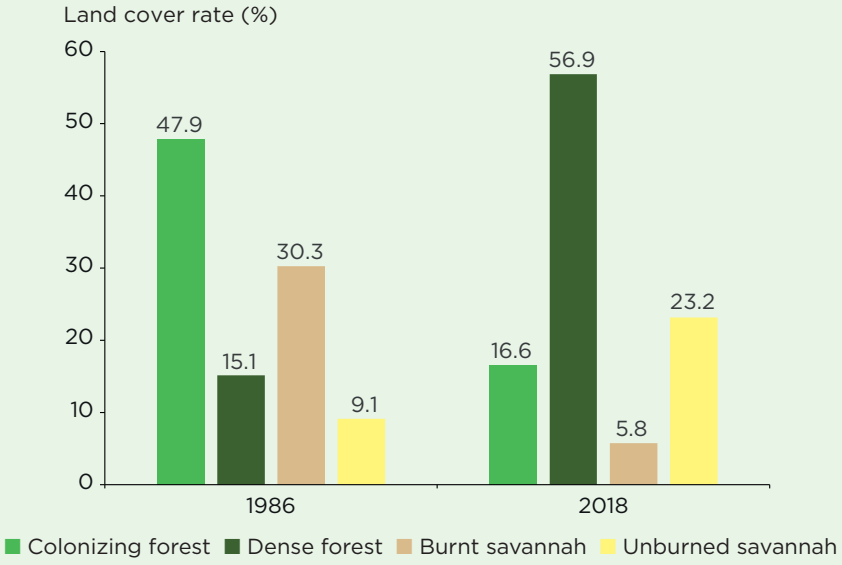
Overall, protected areas are essential tools for mitigating the impacts of climate change on ecosystems and human communities. They help maintain the integrity of ecosystems, buffer climatic fluctuations and reduce the impacts of extreme weather events that will increase in coming years (Hopkins *et al.*, 2015). Two elements may be highlighted here. First, the transboundary protected areas that have been established in Central Africa help to protect vast areas that are better able to maintain viable animal and plant populations, withstand climate change and mitigate its impacts. Second, the protected areas also can serve as barriers against uncontrolled fires, reducing their destructive effects, although very different strategies must be applied in forest and savanna areas (Nepstad *et al.*, 2006; Van Wilgen, 2009; Nelson & Chomitz, 2011).

Contribution of protected areas in the fight against climate change: the case of Mbam-and-Djerem National Park (Cameroon)

Mbam-and-Djerem National Park, situated in central Cameroon in a forest-savanna ecotone, is witnessing the forest reconquer the savanna (Youta Happi *et al.* 2003; Mitchard *et al.* 2009). The park extends over 4,165 km² (MINFOF, 2007) and is an essential component of Cameroon's protected area network. It was created in 2000 to compensate for the environmental impacts of the Chad-Cameroon oil pipeline.

Land cover dynamics within the park were assessed using Landsat satellite data (Figure 4). These data show a rate of advance of dense forest over savanna and young forests of about 40% between 1986 and 2018. In 1986, dense forests occupied just 15% of the territory, thirty years later, they covered 57% (Figure 2). This implies that a carbon stock is present and has grown considerably over this period (not estimated here).

Figure 4 – Evolution of different land cover classes between 1986 and 2018 in Mbam-and-Djerem National Park



Source: Kamgang *et al.* (2019).

Favorable environmental and climatic conditions, good soil conditions, low human population density and isolation are steering forest-savanna interface dynamics in the favor of the forest (Youta Happi *et al.*, 2003). This is true elsewhere in the central region of Cameroon, albeit to a varying extent. While dense forest is increasing inside the park, it has decreased over the past two decades in the areas around it (Fotso *et al.*, 2019).

Improved coordination between various actors, both within the park and in protected areas in general, would thus optimize climate change mitigation and adaptation. This involves taking into consideration carbon market scenarios when planning and implementing conservation activities. It also includes adapting protected area management to climate change in order to ensure the continued existence of biodiversity and ecosystem services. Deriving value from the carbon captured thanks to the advance of the forest would help to fund protected areas and improve the resilience of local communities to the effects of climate change.

2. Impacts of climate change on Central African protected areas

Increased air temperatures, changes in rainfall patterns, and increased frequency and intensity of extreme climate events (droughts, floods, etc.) are all signs of climate change. The threats to ecosystems and protected areas are reducing their ability to supply ecosystem services and are hampering their in situ conservation role.

2.1 Safeguarding ecological processes

The impacts of climate change on biodiversity in Central Africa are to a certain extent spread out. This leads to the need to develop appropriate methods to assess the vulnerability of species to the climate changes that are both underway and expected over the decades to come. To minimize global biodiversity losses, the species vulnerable to these changes must be identified (Pacifici *et al.*, 2015).

To assess threats to a species stemming from climate change, information on the species' vulnerability is required (i.e., the species' predisposition to be negatively affected by changes). This vulnerability depends on intrinsic and extrinsic factors, exposure to identified changes, sensitivity of the species to these changes and its adaptability (Williams *et al.*, 2008; Foden *et al.*, 2013; De Wasseige *et al.*, 2015: 57 and 58).

Although many studies have focused on the response of biodiversity to climate constraints, data on the mechanisms through which biodiversity adapts to climate change, and especially on the limits of this adaptability, remain patchy, and understanding of these mechanisms remains limited. Yet in order to consider how biodiversity may evolve in response to changes in the environment, a comprehensive overview is required (Lavorel *et al.*, 2017). A critical point concerns the speed of possible adaptive mechanisms and individual responses of species with respect to the time and space scales of disturbances.

Species' individual responses to climate change could cause cascading and feedback effects in biological systems, affecting ecosystem dynamics (Williams *et al.*, 2008; Ricard, 2014). The spatial reorganization of biodiversity, as well as changes in the phenology of species, are already causing the disruption of several biotic interactions (Parmesan, 2006) and could have important indirect effects on other species via food webs (Duffy, 2003; Schmitz *et al.*, 2003). The potential spread of invasive species, insect pests and pathogens may also affect ecosystems, and an increase in the frequency of pest infestations and diseases as a result of climate change already is apparent (Gitay *et al.*, 2002; Ricard, 2014; Biber-Freudenberger *et al.*, 2016).

2.2 Vulnerability of fauna

The vulnerability of wildlife to climate change, along with intensifying pressures from human activities, is causing the decline of biodiversity in protected areas. With changes already noticeable in the geographic distribution of diverse terrestrial and aquatic organisms in response to global warming, little information exists on the direct links between innate characteristics (including physiological traits, physiological tolerance limits and genetic diversity) and the vulnerability of species to climate change (Root *et al.*, 2003; Calosi *et al.*; 2008; Williams *et al.*, 2008; Pacoureau, 2018).

Over the past 100 years, the global average temperature has increased by approximately 0.714 ± 0.18 °C, and it is expected to continue to rise at a rapid rate (Pachauri & Reisinger, 2008; Welbergen *et al.*, 2008). During periods of rapid climate change, taxa which are unable to change their geographic range are at particular risk of extinction, especially if they cannot physiologically compensate for variations in the environment (Bradshaw & Holzapfel, 2001; Davis & Shaw, 2001; Balanyá *et al.*, 2006).

Although they may not disappear immediately, the populations of various species in Central Africa could decline sharply under the impact of extreme climate events. For example, sedentary antelopes and elephants could be sensitive to severe droughts (Maron *et al.*, 2015). Climate change will also alter the flowering and fruiting capacity of vegetation, with cascading effects on all of the species which depend on it (Butt *et al.*, 2015). This seems to be the case for forest elephants, whose health already has been impacted by a significant decrease in the plant species which they consume. Long-term studies

carried out in Lope National Park in Gabon have revealed a drastic drop of around 80% in the fruit production of plant species consumed by elephants between 1986 and 2018, and a decline of over 10% in the body condition of fruit-dependent elephants since 2008 (Bush *et al.*, 2020).

These in-depth studies concerning current and future changes in ecosystems and biodiversity are invaluable, but they remain rare and piecemeal. Certain models can partially compensate for these shortcomings, and seem to indicate that the Congo Basin could become unsuitable for mammals in the long term while the Atlantic side of Central Africa could prove to be an important refuge for mammalian biodiversity at the level of Africa (Thuiller *et al.*, 2006).

The effects of extreme temperatures on wildlife species highlight the complex ramifications of climate change on the behavior, demographics and survival of species. The physiological mechanisms underlying thermal tolerance limits and the capacity to adapt to these limits thus need to be better understood to predict the direct impact of global warming on wildlife diversity. This remains an area of research to be developed in the protected areas of Central Africa.

2.3 Vulnerability of flora

Climate change is now recognized as one of the major threats to the integrity of ecosystems around the world. In particular, climate change will affect biological diversity and the geographical distribution of habitats favorable to species, including useful and cultivated plant species (Parry *et al.*, 2007; Fandohan *et al.*, 2013; Eba Eba'a Atyi *et al.*, 2015a). Knowledge of the specific characteristics of the changes likely to impact species or their habitats is a key element in adaptation strategies (Heller & Zavaleta, 2009; Fandohan *et al.*, 2013). Climate change is an environmental issue

that deserves special attention in terms of planning agricultural production, diversification of agricultural production, and conservation of plant species.

In Africa, 25 to 42% of plant species could be threatened with extinction due to a loss of 81 to 97% of suitable habitats by 2085 (Solomon *et al.*, 2007). It is projected that 20 to 30% of plant species will face a greater risk of extinction if global warming exceeds 1.5°C to 2.5°C (Parry *et al.*, 2007; Busby *et al.*, 2012). This makes it all the more important to identify the areas that could allow vulnerable species to survive. To do so, both ecological modeling (Hulme *et al.*, 2001; Bell *et al.*, 2015; Tsalefack *et al.*, 2015; Tamoffo *et al.*, 2019) and paleoecology (Willis *et al.*, 2013) approaches are required. Knowledge of past changes in the climate and their effects on ecosystems has helped identify former forest refuge areas that could prefigure, at least to some extent, future forest refuges (Maley *et al.*, 2018). An understanding of these refuge areas is essential for preparing adaptation strategies and establishing effective protected area networks.

In the very short term, some studies carried out in Lope National Park (Gabon) have found that the fruiting of certain plant species has already begun to plummet (Bush *et al.*, 2020). The reproduction of many tree species depends on a slight drop in temperature during the dry season, one which no longer occurs when temperatures rise (Tutin & Fernandez, 1993). As discussed above, this in turn affects animal populations. This increase in temperature is therefore likely to lead to the depletion or even the eventual disappearance of these plant species due to reproductive collapse.

Moreover, drought also leads to a general increase in tree mortality, especially of larger trees and those with low density wood; this is already the case in the Amazon and Southeast Asia (Phillips *et al.*, 2010). More droughts favors the selection of the most drought-resistant species and induces changes in vegetation. This was demonstrated in a study conducted in Ghana in dense tropical forests following two decades of a drier climate (Fauset *et al.*, 2012). The authors found an increase in canopy, deciduous, intermediate light demanding, dry forest species (often very widespread), and a decrease in sub-canopy, shade-tolerant, evergreen species (often rarer and more localized). A similar, albeit less pronounced, phenomenon has been observed in the Amazon in most of the sites studied there (Esquivel-Muelbert *et al.*, 2019).

Woody forage vegetation in landscapes used by livestock farmers would also be more vulnerable due to the strong pressures this vegetation is already experiencing (Nyasimi *et al.*, 2015; Zakari *et al.*, 2017). Across most of Africa, this vegetation is now generally decreasing due to the constant decline in rainfall since the 1960s, an expansion of land under cultivation, livestock farming systems which often lead to the overexploitation of this resource and a rapidly increasing urban demand for wood (Onana & Devineau, 2002). Protected areas could thus play a significant role as a refuge for natural vegetation and associated wildlife, and as a source of diaspores and genetic material for the restoration of degraded landscapes.

2.4 Vulnerability of human populations

In the light of current global climate change, protected areas offer an exceptional opportunity for the conservation of biological resources and human livelihoods (Mansourian *et al.*, 2009). Once biodiversity begins to crumble, the human species is itself in danger. Protecting and managing these resources in a sustainable manner appears essential, and fighting for the preservation of forest ecosystems and wildlife is necessary to stave off the most common types of threats and to reflect on mitigation solutions (Ongolo & Karsenty, 2011).

Climate variability is posing a significant threat for African populations and communities. Some studies already have revealed that global climate change is occurring in a wide range of areas, affecting almost all human societies (Sutherst, 2004; Ouedraogo, 2010; Goujon & Magnan, 2018).

Agriculture plays an important role in African economies, but it is highly sensitive to climate conditions. Most studies have demonstrated that climate change is having a negative impact on the productivity of food crops in Africa. Although farmers have demonstrated their capacity to adapt to past climatic and environmental variations in the past, their ability to overcome future challenges will depend on their knowledge and the support policies implemented by governments (Challinor *et al.*, 2007).

Recent data cover certain aspects of climate change and human health, including infectious diseases (Chan *et al.*, 1999; Martens, 1999; Patz *et al.*, 2000) and vector-borne diseases (Sutherst, 1993; Gubler *et al.*, 2001). However, there continues to be a lack of in-depth quantitative studies on the many processes underway (Martens *et al.*, 1997; Chan *et al.*, 1999). This is due in part to the complexity of various indirect and feedback mechanisms which involve every aspect of global climate change. This implies a need to adopt a holistic approach to risk assessment and the management of vector-borne diseases (Wilson, 1995; Gratz, 1999).

Unfortunately, due to the current state of expertise and analytical data and the limited resources available to the scientific community, only isolated subsets of these changes have been considered in quantitative risk assessments despite the numerous interactions between the different drivers of change (Sutherst, 2004). It is nonetheless vital to assess the risks of potential changes in the status of vector-borne diseases in an evolving world. Various approaches also must be considered to adapt effectively to these changes. Table 1 highlights some environmental effects of climate change factors relevant to vector-borne diseases and their potential biological effects.

The impacts of climate change also seriously threaten development efforts and opportunities in Central Africa due to the subregion's dependence on natural resources, limited capacity to adapt, and high levels of poverty (Ouedraogo, 2010). Eradicating poverty in the region will require increased access to clean energy and better redistribution of wealth, in particular through appropriate policies and institutions (Eba'a Atyi *et al.*, 2015a).

Table 1 - Climate change factors relevant to vector-borne diseases and their potential biological effects

Driver of global change	Potential effects on vectors, pathogens and hosts environments	Potential effects on vectors, pathogens and hosts
Higher CO_2 concentration	Increased ambient temperature and plant biomass; range expansion of woody vegetation; longer plant growth season with humid microclimates	Increased longevity of vectors for the same rainfall and temperature through wetter microclimates, with possible range expansion of humid-zone vectors
Temperature increase (regional/temporal variation)	Expansion of warm climatic zones, with longer growing seasons, less extreme low temperatures and more frequent extreme high temperatures	Faster development of vectors and pathogens, with more generations per year; shorter lifetime of vectors at high temperatures, reduced low-temperature mortality of vectors, and range expansion of warm-climate vectors and pathogens
Precipitation	Factor too uncertain and regionally variable to be estimated but increase in frequency of extreme rainfall events	Altered patterns of breeding of mosquitoes, with more flushing of mosquito breeding sites with increased flooding
Urbanization	Increased human host density with poorer sanitation and water supply in numerous countries	Higher rate of disease transmission at the same vector density; more vector breeding sites
	Increased urban development in or near forests	Increased contact between humans and vectors in peri-urban forested areas
Deforestation	Increased human entry into forests and increased surface water in soils exposed by logging or agriculture	More vector breeding sites and more contact between humans and vectors
Irrigation and water storage	Increase of surface water, prevention of seasonal flooding	More vector breeding sites; reduced flushing of snails and mosquitoes
Intensification of agriculture	Increased land and vegetation disturbance and increased surface water; reduced biodiversity	Greater diversity of vector breeding sites, with reduced vector predation
Chemical pollution	Fertilizers, pesticides, herbicides and industrial toxins and endocrine disrupting chemicals	Altered human immune systems
Increased trade	Increase in the volume of goods shipped	Increased vector transport, leading to «homogenization» of vectors in receptive areas
Increased travel	Increased movement of people between North and South and East and West	Increased transfer of pathogens between endemic and disease-free regions, and increased visitor exposure to endemic regions

Source: from Sutherst (2004).

2.5 Vulnerability and adaptation of protected area networks

As discussed above, climate change will cause shifts in the climate niches of species. In response, these species will have to either evolve or move in order to adjust their spatial distribution. Current models also predict major changes in the composition of biological communities.

The management of protected areas is directly impacted by these ecological challenges. The impacts of climate change on biodiversity, both actual and potential, must be integrated into the way protected areas are managed. Assessing the vulnerability of biodiversity is the first step in the process of adapting these management methods. The pressure that climate change is exerting on the distribution of species underscores the need to set up conservation strategies at local, national and international scales to achieve conservation goals (Ricard, 2014).

At present, protected area managers in Central Africa have not yet clearly identified reference species (fauna and flora) or biological indicators that could enable us to accurately measure the vulnerability of species and protected area networks to climate change. As baseline data needed for decision-making are scarce and scattered, particular emphasis should be placed on scientific research as a major component in the implementation of programs and projects under REDD+/++ (Reducing Emissions from Deforestation and Forest Degradation, including the role of conservation and enhancement of forest carbon stocks), carbon markets and green economy mechanisms, among others.

For example, it would be interesting to measure, in the Central African protected area network, how extreme temperatures influence certain plants (phenology), the distribution, physiological responses and other adaptation mechanisms and behavioral changes (feeding, reproduction, gene flow, etc.) of sensitive wildlife groups (mammals, birds, amphibians, etc.), and to identify tolerance thresholds. Current ecological monitoring programs, where they exist, are not always relevant or sufficient to assess the vulnerability of species and protected areas to climate change. They deserve to be updated or redefined in order to provide decision-makers and managers with adequate information for informed decision-making in this regard. Climate change research should not only be diverse but also multi-disciplinary, collaborative and oriented toward understanding "cause and effect" relationships at the level of different taxonomic groups.

Ultimately, assessments of potential climate change impacts should be continued using diversified analytical tools in order to increase our confidence in

the results obtained and to provide more answers to the concerns of protected area managers in Central Africa. To this end, the use of global circulation models (Zakari *et al.*, 2017) and the vulnerability index developed by NatureServe to assess the vulnerability of species of interest seems promising (Gendreau, 2016; Young *et al.*, 2016).

3. Financing Central African protected areas in the fight against climate change

Although they play an undeniable role in the fight against climate change, protected areas in Central Africa also are suffering the effects of climate change (see sections 1 and 2 of this chapter). In an international context where decision-makers, scientists and other stakeholders recognize the relevance of nature-based solutions to today's environmental challenges, the role of protected areas remains insufficiently acknowledged. However, this role should and must be strengthened.

In addition to the various sources of funding available to protected areas (Joyeux & Gale, 2010), carbon could add value to biodiversity conservation activities. The value of carbon storage should be considered as one of the criteria for determining support for existing protected areas and the boundaries of new protected areas (Kemeuze, 2015). It is important to note that the capacity for carbon sequestration and storage increases rapidly when degraded areas have been restored. These elements may enable protected areas to potentially access funds allocated for both climate change mitigation and adaptation. For this, it is necessary to include in strategies concerning protected areas their carbon storage function and their key role in reducing emissions from deforestation and ecosystem degradation. This implies regularly evaluating these elements and adjusting the management of protected area networks, not only according to biodiversity conservation objectives, but also those of combating climate change.

The financing mobilized at the international level to combat climate change, as well as payment mechanisms for environmental services, could make it possible to improve and maintain the contribution made by Central African protected areas to fighting climate change. These protected areas suffer, however, from a chronic lack of financial resources for effective and efficient management, which hinders them from fully contributing to this fight.

Contributions to the financing of Central African protected areas, within the "green finance" framework, could consist of public funds (national and international), funds from donations or foundations and other Non Governmental Organizations (NGOs), or resources from the private sector (carbon market, funds made available within the framework of Corporate Social Responsibility (CSR), etc.). Currently, traditional funds, mobilized by States or, for example, within the framework of Global Environment Facility (GEF) funding or by certain NGOs and international organizations, fall well below the funding needs of African protected areas, particularly in Central Africa. An analysis of financial flows to tropical forests over the past 10 years reveals that the Congo Basin has received only 11.5% of international funds, compared to 54.5% for Southeast Asia and 34% for the Amazon (Liboum *et al.*, 2019).

3.1 Green finance and financing opportunities for protected areas

Projects in the Central African forest-environment sector – including those related to climate change – currently mobilize nearly US$2.3 billion in international funding; these are projects that were operational in 2020, regardless of their duration. Slightly less than half of these funds cover projects whose primary objective is to fight climate change (Figure 5a).

DRC accounts for the lion's share of these climate change mitigation and adaptation projects, with over 60% of international financing for the subregion (Figure 5b). DRC has in effect been chosen as one of the pilot countries worldwide to implement REDD+ and climate change policies. The country contains nearly half of the forests and about 60% of above-ground carbon in Central Africa (see Figure 2). DRC is one of the flagship countries for investments by CAFI (Central African Forest Initiative) and other donors in the fight against deforestation and climate change.

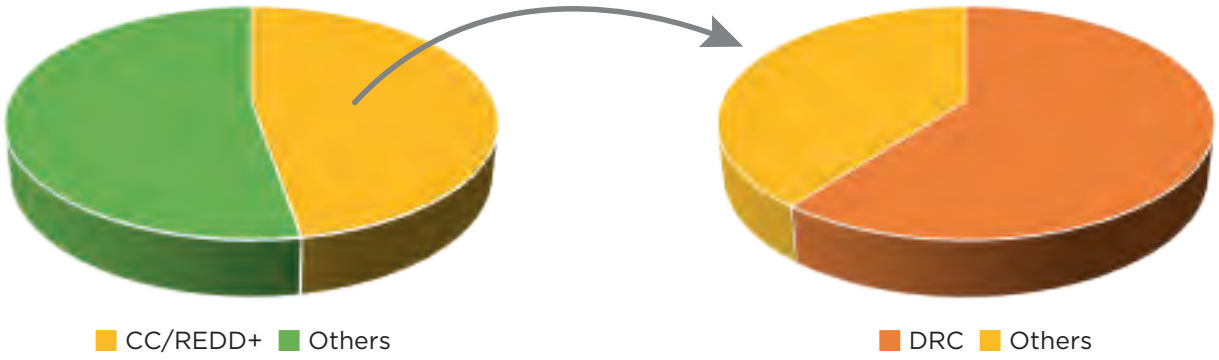
Analysis of "climate change/REDD+" financing: details on the method

The data presented here were compiled within the framework of OFAC. The following procedure was used:

1. an inventory was made of international financing focused primarily on climate change and REDD+. The following information was collected to describe each project or program: name of the project or program, country(ies) concerned, objectives, start and end dates, total financing, protected areas concerned or not;
2. only projects whose primary objective was clearly climate change and those active in 2020 were selected, regardless of their duration;
3. for multi-country projects, the total amount of funding was divided by the number of countries and the same proportion of funding was allocated to each country. In the absence of precise information on the distribution of funding by country, this provides an order of magnitude of funding for each country;
4. we compiled the relevant projects and programs identified from the OFAC analytical portal as of 17/12/2020 (https://www.observatoire-comifac.net/analytical_platform/projects/main), the bibliography, and websites such as that of the Green Climate Fund (GCF). For the latter, we have not taken into account preparatory activities (referred to as "Readiness");
5. the database was cleaned up by eliminating duplicates and arbitrating in favor of the official sites in case of contradictory data;
6. the exchange rate used was: € x 1.21741 = US$.

This method can and must be improved to obtain a more detailed picture of these funds and their allocations. Despite OFAC's establishment of an analytical platform, the collection and editing of data on international funding remains problematic (not to mention national funding, which remains very difficult to assess). Project managers struggle to respond to requests, and donors have not yet set up a procedure to automatically transfer information to OFAC, although this could be done easily. Some projects consequently have not yet been considered and, for those that have been, information on the allocation of funds (e.g., those allocated to protected areas) is not clearly detailed.

Figure 5 – International "climate change/REDD+" funding in Central Africa.



a) Importance of CC/REDD+ projects among international funding for the forest-environment sector

b) Importance of DRC-oriented funding among CC/REDD+ projects

CC: climate change; DRC: Democratic Republic of the Congo; REDD+: Reducing Emissions from Deforestation and Forest Degradation. Source: OFAC.

Although it is difficult to gain a comprehensive overview of these international projects, the funding data compiled by OFAC makes it possible to formulate an initial diagnosis of funding focused on climate change, REDD+ and protected areas. Other information also may be found in various publications produced by the observatory (Eba'a Atyi *et al.*, 2015a; Sonwa *et al.*, 2018; Liboum *et al.*, 2019).

In a desire to tackle environmental issues on a global scale while promoting sustainable development at the national level, the international community launched GEF in 1991. This fund subsequently became the most important financial mechanism of the conventions resulting from the 1992 Rio conference, namely the CBD, the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD). To date, the GEF has mobilized nearly US$25 billion in 4-year cycles. The most recent replenishment cycle (GEF-7), which closed in April 2018, mobilized US$4.1 billion, slightly less than the previous mobilization (GEF-6) of approximately US$4.5 billion.

The regional project, "Partnership for Biodiversity Conservation: Sustainable Financing of Protected Area Systems in the Congo Basin", was for example funded under GEF-4. This project aims to establish an environment conducive to the increased mobilization of funding for the protected areas system. Sustainable financing of protected areas in Central Africa would enable managers to have sufficient resources and integrate all of the management parameters of a protected area into their work, taking into account climate change monitoring in daily protected area management, including financing related studies. Through the project, financing strategies have been developed for protected areas in the six beneficiary countries, but their implementation has been severely hindered by the Covid-19 pandemic.

Again under the GEF, a new project could be started to better understand the impacts of climate change on Central African protected areas and to formulate mitigation measures. This project would make it possible to better address the needs identified in the second part of this chapter.

In response to growing concerns about climate change and sustainable development in the least developed countries, the 16th UNFCCC Conference of the Parties (COP 16), held in Cancun, Mexico, in 2011, launched the creation of a Green Climate Fund. This fund became operational four years later, with an initial capitalization of US$10.3 billion. It is now UNFCCC's primary financing mechanism. Its second replenishment phase, which closed in November 2019, mobilized over US$10 billion in additional funds (financing mobilized in September 2020; GCF, 2020b).

The GCF aims primarily to help developing countries tackle the challenges of adapting to the negative impacts of climate change and of reducing greenhouse gas emissions. It mainly finances direct actions

on the ground as part of the fight against climate change, in connection with the sectors of energy, agriculture, forest plantations and agroforestry, land use planning, green finance, etc. All developing countries, including those in Central Africa, may submit project proposals to the GCF at any time.

The current GCF project portfolio is valued at US$7.2 billion. Over 37% involve Africa through national or multinational projects, with US$2.7 billion earmarked for the continent. Africa is the priority region for the GCF; the other two priorities are small island states and least developed countries (GCF, 2020c). In the case of Africa, the bulk of this financing takes the form of public sector grants, although loans and some private investment also are involved.

Regional project for the sustainable financing of protected area systems in the Congo basin

A. Malibangar, UNDP

Six Central African countries (Cameroon, CAR, Congo, DRC, Equatorial Guinea, and Gabon), have secured US$8,181,818 in GEF funding for the implementation of a regional project "CBSP - Partnership for Biodiversity Conservation - Sustainable Financing of Protected Area Systems in the Congo Basin - PIMS3447". This five-year project was launched in 2017 and is managed by the United Nations Development Programme (UNDP).

Project objectives and components

The project's primary objective is to help address the challenge of funding protected areas at local, national and regional levels. It focuses on supporting the development of human resources, institutional frameworks and pilot mechanisms for the long-term financial sustainability of protected area systems and associated ecosystems in the six countries to bolster their conservation efforts.

The project is organized around inter-connected components contributing to the: (1) establishment and/or strengthening of legal, policy and institutional frameworks to support sustainable financing of protected areas at national and regional levels; (2) improvement of existing or innovative mechanisms for generating and sharing (disbursing) revenues in protected areas; and (3) strengthening and/or implementation of business plans and tools for the cost-effective management of protected areas and their associated ecosystems (at least two pilot sites per country), at the national level.

Current status

In 2021, the project is entering its final year. Considerable progress has been made in all six countries, including the development of the following in each country:

– a National Strategy for Sustainable Financing of Protected Areas for the Conservation of Biodiversity (NSSFPA/CBD) with an associated action plan (the periodicity of which varies from one country to another);

– a communications and resource mobilization strategy and plan for the implementation of the NSSFPA/CBD;

– two pilot sites designated by policy makers to serve as demonstration sites for the establishment of a sustainable funding mechanism in the future.

Regional project for the sustainable financing of protected area systems in the Congo basin

What challenges remain?

The unforeseen arrival of the global health and environmental crisis stemming from the Covid-19 pandemic impeded countries from beginning demonstration activities prior to the establishment of a potential sustainable financing mechanism in at least one pilot site. Virtually all component 3 activities have been restructured to contribute to the global response to Covid-19. This component will now focus on strengthening the resilience and sustainable livelihoods of local communities and indigenous peoples on the pilot sites to enhance joint biodiversity conservation and local development efforts. The project must still launch Calls for Expression of Interest (CEI) and calls for proposals for activities on sites in the six countries. However, their deployment is hampered by difficulties in moving around due to the current health crisis, security challenges in some countries, and the limited amount of time remaining before the end of the project, which is scheduled for November 2021. Activities will need to be prioritized, taking into account both the remaining available resources and the possible timelines of the disbursement of GEF funds in early 2021.

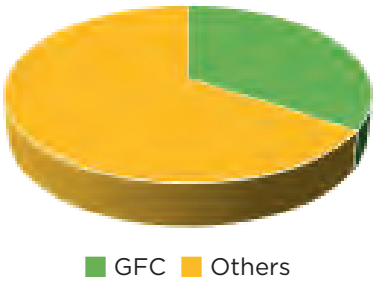
Website: www.financeapbassincongo.org
Twitter: @APbassinCongo
Facebook: https://www.facebook.com/financeAPbassincongo

The GCF accounts for about one third (Figure 6) of the international funding targeting climate change/REDD+ in Central Africa (see Figure 5a). Rwanda and, to a lesser extent, Cameroon, DRC and Burundi are the main beneficiaries of GCF-funded projects, particularly in the field of green energy such as solar energy (Figure 7; GCF, 2020a); no project specifically addresses protected areas. Only two projects cover the adaptation of rural populations to climate change and the management and restoration of ecosystems and forest resources, one in Rwanda (a project in the north of the country) and one in Cameroon and Chad (a cross-border project on the Niger River Basin).

As a GCF Delivery Partner, COMIFAC is among the beneficiaries of a Readiness regional programme aiming to establish a pipeline of projects that is required to set up a future REDD+ Catalytic Fund. A strategy also should be put in place to help Central African protected areas access this major global source of funding for climate action.

In view of accessing new financing, Central African countries have been active in REDD+ negotiations under the UNFCCC. The convention recognizes the role of conserving tropical forest ecosystems in fighting against greenhouse gas emissions produced by the forest sector. Furthermore, Article 5 of the Paris Agreement highlights all of the components of REDD+ (UNFCCC, 2015). It invites Parties to take measures to conserve and, where appropriate, strengthen sinks and reservoirs of greenhouse gases, including forests. It also invites them to take measures for the conservation and sustainable management of forests and to increase forest carbon stocks in developing nations. The provisions of Article 9 of this agreement further call on the international community to finance climate actions, notably by supporting country-led strategies and taking into account developing countries' needs and priorities.

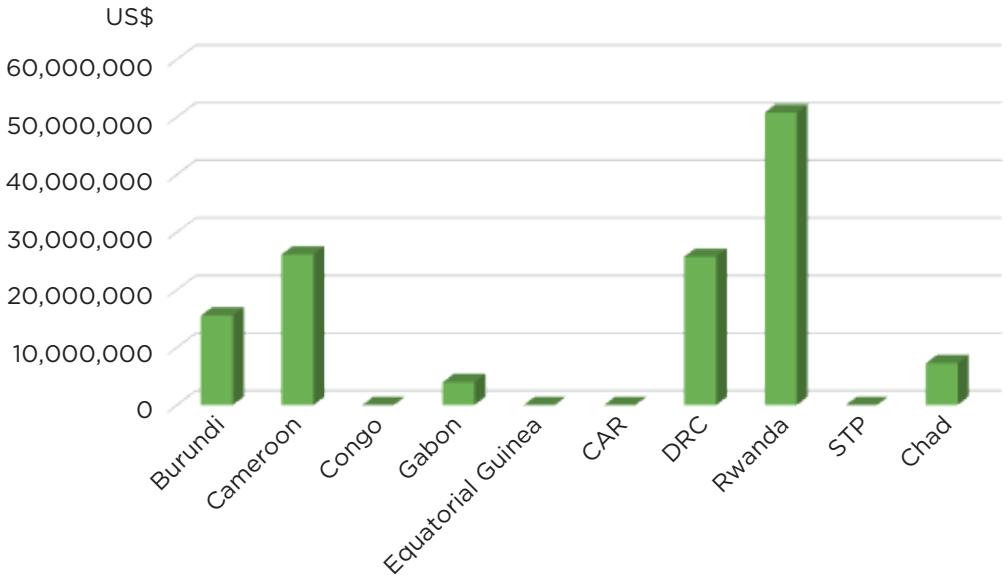
Figure 6 – GCF financing among "climate change/REDD+" projects in Central Africa



GCF: Green Climate Fund. Source: OFAC.

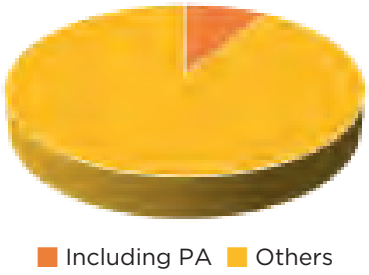
Currently, of the climate change/REDD+ projects being implemented in Central Africa, less than 9% (in terms of funding) concern protected areas (Figure 8), even though these areas play a major role in carbon sequestration and storage and in climate regulation through the protection of forests (see sections 1 and 2). Extending protected area networks and managing them efficiently are among the priorities of the convergence plan for the management of Central Africa forest ecosystems (COMIFAC, 2015), but climate financing continues to largely overlook this fact. The international communities' financial and technical support helps not only to maintain, but also to increase, the role of protected areas in combating climate change (see the insert on the Mbam-and-Djerem National Park in Cameroon in section 1.1).

Figure 7 – GCF financing per country in Central Africa in 2020



Source: GCF (2020a).

Figure 8 – The paltry share of financing covering actions for protected areas among the "climate change/REDD+" projects in Central Africa



Source: OFAC (2020).

3.2 The start of the mobilization of green finance by Central African countries

In addition to initiatives strictly related to the UNFCCC, some Central African countries (Cameroon, Congo, DRC) have engaged in the preparation of jurisdictional Emission Reduction Programs (ERPs) under the World Bank's Forest Carbon Partnership Facility (FCPF). Two programs have already been validated under the FCPF: the Mai-Ndombe ERP in DRC, and the Sangha and Likouala ERP in the Congo.

All of these programs identify biodiversity conservation as one of the "non-carbon benefits" among the expected outputs. Although conservation activities may receive REDD+ benefits, protected areas currently are not or are only marginally benefiting from REDD+. How these resources are delivered to conservation sites, and how they will contribute to improving their management, must be examined.

Mai-Ndombe Emission Reduction Program (RDC)

This program covers 123,000 km² and includes numerous activities, including the implementation of sustainable development plans and protection of High Conservation Value Forests (HCVF) in return for Payments for Environmental Services (PES). More specifically, it also includes support for: (i) the creation and operation of conservation concessions,

(ii) the conservation of local community forests, and (iii) the management of protected areas (FCPF, 2016).

It receives various types of funding:

- FCPF: emission reductions purchase and sale agreement; World Bank financing of US$55 million, future payments conditional on the reduction of greenhouse gas emissions;
- Integrated REDD+ Plateaux program (PIREDD Plateaux); World Bank financing for the Forest Investment Program (FIP), covering the former Plateaux district, of US$14.2 million (2016-2019);
- Integrated REDD+ Mai-Ndombe program; CAFI financing and World Bank implementation, mainly covering the former Mai-Ndombe district, of US$20 million (2018-2021);
- Mai-Ndombe Integrated REDD+ program, phase 2 (forthcoming), covering the entire province, of US$16 million (planned for 2022-2023);
- Additional GEF financing of US$6.21 million (2021-2022).

PIREDD Mai-Ndombe, the challenge of supporting development while preserving the forests of an entire province

C. Mbayi Mwadianvita, PIREDD Plateaux WWF, N. Bayol, & P. Breumier, FRMi, C. Vangu Lutete, CU FIP-DRC

Mai-Ndombe province was identified as a key province in the DRC in terms of REDD+ challenges for the following reasons: it is a forest province (forests cover 75% of the total area of the province) located close to Kinshasa (challenges related to the growing demand for fuelwood, timber, and food), and hosts endemic and endangered animal species such as the bonobo (*Pan paniscus*).

This province has thus benefited from REDD+ initiatives for several years with, in particular, a program to reduce greenhouse gas emissions included in the FCPF project portfolio and materialized by the signing of a purchase-sale contract for emission reductions between the Government of DRC and the World Bank Carbon Fund, for a value of US$55 million over five years. Payments will be linked to project performance, meaning to the difference between measured carbon emissions and emissions estimated in a baseline scenario without a project. A benefit sharing plan is currently being finalized. It defines the financing arrangements for the management of the program and for sharing revenues from the sale of emission reductions between the Mai-Ndombe provincial government, indigenous populations and local communities, as well as private operators who have developed their own "nested" projects.

To create an emission reduction dynamic, two Integrated REDD+ Programs successively have been financed since 2016, first in the former Plateaux District, by FIP (implemented by WWF, the World Wide Fund for Nature), then in the former Mai-Ndombe District, financed by CAFI/FONAREDD – National REDD+ Fund (implemented by FRMi - *Forêts Ressources Management International* and WWC - Wittenberg Weiner Consulting). Funding must be approved for this program to be continued until 2023. These Integrated REDD+ programs aim to meet two challenges: 1) ensure economic development to fight poverty, and 2) reduce carbon dioxide emissions compared to an established baseline scenario.

Activities aim to tackle the direct and indirect causes of deforestation and ecosystem degradation. They are based on land-use planning at different administrative and customary scales and on the creation of local governance structures for natural resources, the *Comités Locaux de Développement* (CLD: local development committees). Following a participatory approach, these CLDs develop Natural Resource Management Plans (NRMPs), planning land use, and then coordinate their implementation (Figure 9). The CLDs represent the local community in discussions with development partners, such as PIREDD Mai-Ndombe.

PIREDD Mai-Ndombe, the challenge of supporting development while preserving the forests...

Emission reduction efforts are based in particular on the development of agroforestry plantations of acacia or fruit trees associated with food crops in savanna areas (5,720 ha planned by the end of 2021), the development of palm oil plantations in savanna areas (2,060 ha), the protection of anthropic savannas against fires to allow their natural regeneration (9,670 ha to date), the improvement of agricultural practices in forested areas, and the use of forest areas for conservation within village territories (100,000 ha to date).

Although investments have been made by local communities, motivated by both the presence of project agents and PES payments, their adoption and long-term sustainability are not yet secured. The investments in question are in effect long-term investments (perennial crops) that have not yet become productive. The communities therefore are not yet convinced that they will yield economic benefits. Support for the communities involved should be continued until these investments have reached the end of their first production cycle.

Additional GEF funding (2021-2022) also will go to community forest management and the management of the Tumba-Lediima Reserve in order to focus on biodiversity aspects.

Figure 9 – Managed village lands within the framework of PIREDD Plateaux and Mai-Ndombe

Source: CU FIP-DRC.

Sangha-Likouala Emission Reduction Program (Congo)

The Sangha-Likouala ERP is located in the northern part of the Republic of the Congo (Figure 10). It extends over nearly 124,000 km^2, covered mainly by relatively intact dense humid forest. The contract is scheduled to be signed in January 2021.

The objectives of the program are to:

- reduce emissions by 9,013,440 te CO_2 from 2019 to 2023;
- enhance sustainable landscape management;
- improve and diversify local livelihoods;
- conserve biodiversity.

As part of the preparation of this program, Congo has finalized a range of specific tools: a sub-national Forest Reference Emission Level (FREL), REDD+ Principles, Criteria and Indicators (PCI) adapted to the ERP, a Reduced-Impact Logging (RIL) guide, a document specifying benefit-sharing options in the context of the implementation of the RIL, and additional studies on land use (CNREDD, 2019).

With initial funding of US$92.64 million, the financing plan for the program is as follows:

- guaranteed or committed investments that will target various program activities, including support from the GEF, International Development Association (IDA), IFP, the French Development Agency (AFD), the African Development Bank (AfDB), and the UK Department for International Development (DFID);
- the mobilization of additional investments, including through the CAFI initiative and the *Projet d'appui au Développement de l'Agriculture Commerciale* (PDAC), financed by the World Bank;
- private investments from interested companies;
- advance payment from the FCPF Carbon Fund for activities not covered by investment sources (FCPF, 2018).

Reducing emissions in North Congo: a multi-sectoral challenge

C. Milandou and C.-B. Ouissika, CNIAF

The Sangha-Likouala program plans to reduce carbon emissions while supporting sustainable landscape management and biodiversity conservation. The program area includes territories under various management and operating statuses (Figure 10):

– 17 forestry concessions covering 72,007 km^2 (including one which one is not in operation), assigned to ten companies;

– 13 mining exploration and research concessions assigned to 13 companies;

– 3 national parks and a nature reserve covering 26,701 km^2;

– several villages and towns (FCPF, 2018).

The planned intervention strategy combines sectoral and enabling activities (CNREDD, 2020). Sectoral activities fall under four main areas of intervention, within which efforts will be made to engage stakeholders to develop low-carbon practices that promote the protection of carbon stocks:

– **forest concessionaires** will be encouraged to apply RIL principles more systematically and to establish conservation series (non-logged areas);

– **agro-industrial** producers of sustainable palm oil will have to reduce emissions from deforestation in agricultural concessions, avoiding the conversion of HCVF. They will also be encouraged to move toward RSPO certification (the international standard of the Roundtable for Sustainable Palm Oil);

– **local communities and indigenous peoples** will be supported in (i) sustainable cocoa production through agroforestry systems in degraded forests, (ii) introduction of sustainable subsistence farming to increase agricultural productivity and crop diversification through agro-

forestry systems, (iii) the promotion of small producers sub-contracting from agro-industries on deforested areas within oil palm concessions, (iv) the sustainable use of Non-Timber Forest Products (NTFP) and (v) the provision of PES for individuals and communities protecting forests;

– **protected area managers** will be supported in improving site management and developing income-generating activities to benefit local communities and indigenous peoples;

– **mining companies** will be encouraged to contribute to the economic development of the region while minimizing their impact on the forest.

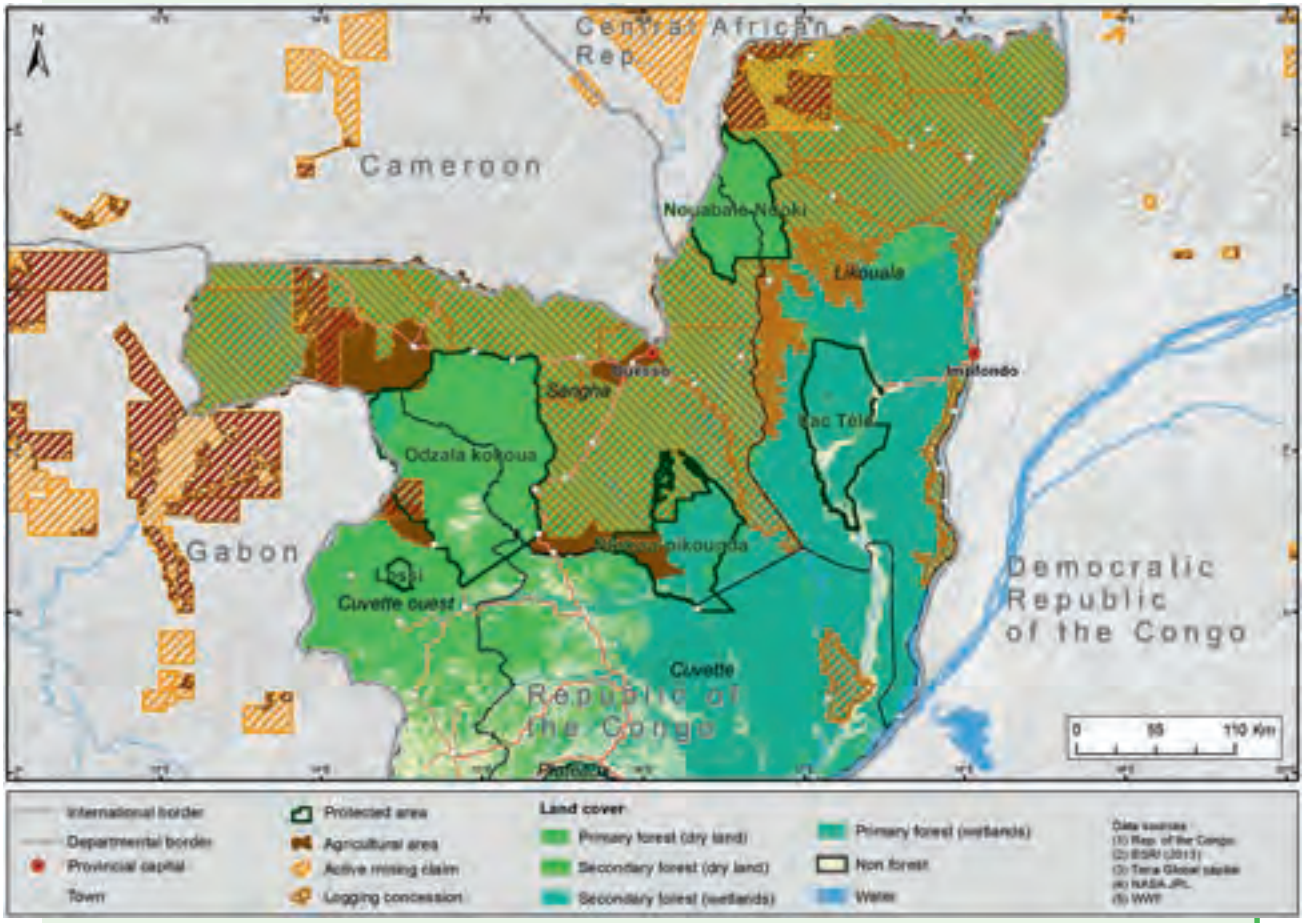
The enabling activities will include:

– improving governance, e.g., through capacity building of program partners and synergies with the Forest Law Enforcement, Governance and Trade (FLEGT) process;

– strengthening land use planning at local and national levels;

– improving livelihoods by developing agricultural value chains, e.g., for cocoa and palm oil.

Figure 10 – Spatial extent and land use of the Sangha-Likouala program



Source: FCPF (2018).

3.3 Payments for environmental services

Protected areas play an essential role in the provision of ecosystem services. However, despite their economic importance, few assessments of these services have been conducted in Central Africa. Under the Regional Project for Sustainable Financing of Protected Area Systems in the Congo Basin (see inset in section 3.1), financing strategies for the protected area systems in some countries of the subregion are being prepared under the aegis of COMIFAC. Payments for environmental services are identified in these strategies as one source of financing for protected areas.

Following the conclusion of a historic agreement between Gabon and Norway, this approach should be reinforced. Norway has committed to pay US$10, compared to US$5 on the current market, for each ton of certified carbon not emitted, based on the country's recent average emissions (2005-2014), with a maximum amount of US$150 million over ten years (CAFI, 2020). Gabon is thus the first country in Africa to receive payments for safeguarding its forest.

Gabon is receiving payments for protecting tropical forests

G.-L. Itsoua-Madzous, COMIFAC

Adapted from the addendum to the letter of intent Gabon-CAFI, September 2018

Gabon has the highest percentage (approximately 90%) of forest cover in Central Africa and a very low deforestation rate (FAO, 2020). While the country faces less pressure on its forests than its neighbors due to a lower demand for agricultural land, its voluntary commitment to fighting deforestation has made Gabon stand out. As early as the 1990s, Gabon introduced the sustainable management of forestry concessions, which cover most of the country's forests (Marquant *et al.*, 2015). Gabon also completely overhauled its protected areas network in 2002 by creating 13 national parks, one of which is listed under the World Heritage Convention (Doumenge *et al.*, 2015). The country furthermore has made significant progress in the sustainable management of its wood resources, banning all log exports as early as 2010 and deciding that all forestry concessions must be FSC-certified by 2022 (Forest Stewardship Council).

These measures offer the dual benefit of meeting socio-economic and environmental demands (Karsenty, 2020). They make it possible to protect forests and carbon stocks and reduce emissions generated by deforestation and logging. They also serve to reassure potential investors and donors about the country's credibility in meeting its commitments. These and other efforts led to the signing of a historic agreement with Norway in September 2018, through the CAFI initiative. This agreement involves a US$150 million payment intended to recognize the reduction of greenhouse gas emissions from deforestation and degradation and the absorption of carbon dioxide by Gabon's natural forests over a 10-year period (2016-2025). The agreement will reward both past performance – verified results since 2016 compared to the previous decade from 2005 to 2014 – and future outcomes, to be paid annually until 2025.

Third party certification

The parties are committed to a learning-by-doing approach and will jointly seek to adapt the partnership to global best practices. Gabon will seek to obtain ART (Architecture for REDD+ Transactions) certification for emission reductions and removals under this partnership.

Gabon is receiving payments for protecting tropical forests

ART's REDD+ environmental excellence standard, TREES (The REDD+ Environmental Excellence Standard; ART, 2020), does not yet include a robust method for crediting countries with high forest cover and historically low rates of deforestation such as Gabon. The Gabon-CAFI partnership intends to spearhead a new incentive approach for these countries and identify lessons to improve the TREES standard.

CAFI is ready to contribute up to US$150 million over 10 years

This contribution will depend on the results achieved by Gabon under the partnership. The CAFI initiative will guarantee a floor price of US$5/ton of carbon, with a maximum of US$75 million, for results achieved between 2016 and 2020, and up to an additional US$75 million for results achieved in 2021-2025. CAFI will also guarantee a floor price of US$10/ton for results certified by ART, subject to the maintenance of CAFI's overall financial commitment of US$150 million for the 2016-2025 period.

Gabon can accept this offer or sell its carbon credits to another buyer offering a higher price. The parties will seek to use the floor price to attract additional funding sources, in particular private buyers.

Gabon's climate commitments

Prior to the first payments, Gabon is, inter alia, expected to submit the following elements to the UNFCCC:

– a nationally determined contribution (NDC), confirming the provisions of the letter of intent signed with CAFI. In its new NDC, Gabon must seek to reduce its emissions by over 50% compared to 2005 by cutting forest sector emissions in half;

– a FREL or a forest reference level as provided for in the relevant decisions of the Conference of the Parties to the UNFCCC;

– a summary of information on how REDD+ safeguards are addressed and complied with, in accordance with relevant UNFCCC decisions.

By supporting national low-carbon investment frameworks and the land-use sector, the CAFI initiative has, among other things, committed to financing the expansion of Gabon's protected areas network by creating 4,000 km² of new forest protected areas in border regions currently open to logging. This is part of a wider package that includes a support programme for land use planning and forest monitoring.

3.4 Government funding and public-private partnerships

First, it should be noted that although the budgets allocated by the States often fall short of the funding needed by protected areas (Joyeux & Gale, 2010), this support nonetheless helps to maintain a minimum level of activity in a large number of Central African protected areas. This activity slows down deforestation and makes it possible to preserve the boundaries of protected areas, contributing to the conservation of existing carbon stocks (see section 1.1) and the maintenance of low emission rates by countries in the subregion.

It is clearly not enough, and in several protected areas, Public-Private Partnerships (PPP) have been established between governments and various partners. In most of these partnerships, the government expects the private partner to make a significant financial contribution (see Chapter 4). This funding can come from public, bilateral or multilateral donors, as well as from private foundations or specifically

created trust funds. All of these financial tools can be used to combat climate change and to help protected areas adapt to changes.

Furthermore, all countries in the subregion have regulations relating to the environment, Environmental Impact Assessments (EIA) and CSR. Funding from corporate social and environmental obligations can deliver co-benefits in the area of climate change mitigation and adaptation. For example, environmental compensation for the construction of the Chad-Cameroon pipeline supported the creation and management of the Mbam and Djerem National Park in Cameroon (see Chapter 8). Located in a region where forests are naturally expanding at the expense of savannas, the creation of this park makes it possible to increase the carbon stock present in Cameroon's protected areas (see inset in section 1.1 of this chapter).

For some large industrial and energy projects, compensating for the loss of carbon due to deforestation also is involved. This is the case for the Nachtigal dam construction project in Cameroon, located 64 km northeast of the capital, Yaounde. This project is being implemented by a consortium involving the Government of Cameroon, *Electricité de France* (EDF) and the International Finance Corporation (IFC, a subsidiary of the World Bank). The installed capacity is expected to be 420 MW, making it a major undertaking for the electrification of the country. However, this hydroelectric facility threatens a very rare endemic aquatic plant (*Ledermanniella sanagaensis*), which grows almost exclusively at the Nachtigal waterfalls (Takouleu, 2019). The project's environmental and social management plan must take into account the impacts on biodiversity. It provides for a compensation mechanism for the loss of forests caused by the construction of the dam, including a PES component. This PES component aims to compensate neighboring communities for their efforts to sustainable manage and restore their forests (Liboum *et al.*, 2019).

4. Opportunities and challenges

In Central Africa, the relationship between protected areas and climate change presents many challenges for support efforts. Commitments and initiatives are underway in the subregion, with the support of technical partners, to integrate climate considerations into programs involving protected areas and to mitigate the effects of climate change through adaptation activities.

4.1 Challenges of mobilizing funds for protected areas

Strengthening the importance of protected areas in political agendas

The main actions supported by the Global Climate Fund in Central Africa concern clean energy production projects (solar) and some land-use planning and reforestation projects (GCF, 2020a). These two sectors illustrate the key elements of strategies to fight climate change, with on the one hand the promotion of low-carbon development (low-carbon economies, deployment of "green" energies) and, on the other, carbon storage (maintaining and increasing stocks).

Protected areas are important land management tools that can be used to halt deforestation and the reduction of carbon stocks. They promote long-term carbon storage and increased stocks in areas where forests are regenerating. Moreover, protected areas make it possible to develop actions for the adaptation of human communities to climate change, as discussed earlier (section 1). Policy makers remain largely unaware of these different roles, which are not sufficiently considered in sustainable development and land-use planning policies. It is COMIFAC's task to act as an ambassador, with support from OFAC and all conservation partners.

To be socially acceptable, efforts to combat climate change must first be understood as necessary and useful for the development of countries and their inhabitants. This involves communicating to the general public, but also, in a more targeted manner, to policy makers and private operators. These efforts also must support the sustainable development of countries and contribute to poverty reduction (Eba'a Atyi *et al.*, 2015a and b; Reyniers *et al.*, 2016), including in landscapes where protected areas are located.

If fighting against climate change is to be effective, this concern also must be integrated into sectoral policies and requires improvements in intersectoral institutional coordination (energy, mining, forestry, agriculture, environment, etc.; Heller & Zavaleta, 2009). This will require major changes in decision-making and management mechanisms, often involving a complete break with current practices. Here again, COMIFAC, as a regional coordinating body in the fields of forestry and biodiversity conservation, must develop a proactive attitude to support governments in their intersectoral coordination efforts.

Developing confidence

How governments and institutions function are among the many factors contributing the success of projects and financial mechanisms (Joyeux & Gale, 2010; Karsenty & Ongolo, 2012). Some of these factors, which relate to governance and to institutions and practices, also ultimately refer to the relationships of trust that are necessary between the parties, first of all between donors and recipients, but more broadly, between all stakeholders. Three factors playing a role in the development of "climate" financing and financing for protected areas may be highlighted here:

- **1.** the government must respect the views and actively support the participation of stakeholders in the project, giving them a full role in discussions, decision-making and project implementation (stakeholders may be local communities, private actors, NGOs or associations; Reyniers *et al.*, 2016). It is not a question of necessarily agreeing about everything, but of leaving the door open for discussion and making decisions together;
- **2.** all stakeholders must feel that they really benefit from the projects and have an interest in the changes in practices that these projects are likely to bring about. For example, paying farmers to cut down less trees under a PES framework will not suffice if these same farmers do not find it worthwhile to intensify their farming practices or to plant trees that they will be able to exploit in a not-too-distant future (Bouyer *et al.*, 2013; Eba'a Atyi *et al.*, 2015b; Reyniers *et al.*, 2016). Not everyone will receive the same benefits from a project, but everyone should be able to derive benefits that are important to them. If one of the stakeholders feels cheated, mistrust will set in and the project will fail;
- **3.** governments must put in place institutions and legal and financial practices that donors and all stakeholders can trust. Concerns over the effective management and secure use of funds, along with the reliability and efficiency of monitoring and sanction mechanisms, are some of the sticking points in the development of international financing.

4.2 Putting in place and operationalizing a strategy to mobilize green finance for protected areas

Relying on domestic financing to attract other investment

Protected area networks are important both in supporting sustainable national development and in contributing to strategies for populations to cope with climate change. As such, governments have a duty to finance them, and there is hope that their investments will increase in the coming years, as can already be seen in countries such as Gabon (the beneficiary of a ground-breaking agreement with Norway) and Rwanda (a major GCF beneficiary, see Figure 7). This is expected to encourage international donors to provide more substantial support.

Considering the question from another angle, these protected areas play a role that goes beyond national borders, and they help to combat climate change, with their efforts benefiting countries that are sometimes located far from Central Africa. It is therefore appropriate that the international community contribute to their operations and effectiveness.

Under the aegis of COMIFAC, several countries in the subregion have begun a process of preparing national strategies for the sustainable financing of protected areas (see section 3.1). These documents will enable them to make better use of current sources of financing and to access financing that continues to be insufficiently tapped in Central Africa. This should, for example, make it possible to increase the contribution of the Green Climate Fund and mobilize a range of financial mechanisms other than the market mechanisms advocated by REDD+ (Eba'a Atyi *et al.*, 2015b).

Several obstacles to mobilizing additional funding for protected areas have been highlighted in the past, including the lower debt-carrying capacity of Central African countries compared to countries in the Americas or Asia. This translates into a lower financial volume as well as a higher proportion of grants relative to loans (Liboum *et al.*, 2019). However, several countries in the subregion have significant mining and energy resources and could easily reverse this trend.

It should be noted that the European Union provides greater support to Central African protected areas than protected areas in the other two tropical forest basins. Other countries traditionally had fewer political ties with the subregion and tend to make far greater financial contributions to the protection of the Amazon, for example. This is the case of Norway, although the situation is substantially changing with the support provided for several years to the DRC and the country's involvement in the CAFI program. As mentioned previously, Gabon has benefited from a unique agreement with Norway, which could inspire others (see section 3.3).

Another obstacle hindering increased international investment in Central Africa involves the risk that such investments may fail, one which is seen as being higher in the subregion than in other continents. To overcome this obstacle, the countries must present stronger projects. To be more convincing, they also must refine their NDCs and rely on more detailed analyses of the impacts of past actions and of future needs (Sonwa *et al.*, 2018; Liboum *et al.*, 2019). As of December 2020, Rwanda was the only country in the subregion to have submitted an updated NDC (Rwanda, 2020).

Documenting changes, planned actions and their impacts

As noted above, protected area planners and managers should have the latest scientific data on climate change and biodiversity in a form that is easy to access. It is equally important that countries set up permanent and transparent monitoring and evaluation mechanisms (Eba'a Atyi *et al.*, 2015a and b). These mechanisms must be able to provide information concerning management effectiveness on the ground, as well as a comprehensive overview of the evolution of protected area systems and the fight against climate change at the national scale.

There are two issues at stake here. One is to boost the confidence of potential donors (by monitoring and evaluating activities). Above all, however, it is a question of enabling protected area management institutions and their partners to manage the sites under their jurisdiction more effectively (with adequate information). Chapter 5 in this book delves deeply into the importance of information to support the management of protected areas. At the subregional level, OFAC should be at the forefront

of collecting and sharing information enabling effective monitoring and evaluation of protected areas and climate change. OFAC can make it possible to overcome certain obstacles to knowledge transfer between actors (Sufo Kankeu *et al.*, 2020), and promote both the transfer of knowledge and skills between countries and actors.

Potential for the establishment of secondary forests in CAR's protected areas

Adapted from RCA (2017)

CAR has 16 parks and reserves covering approximately 70,000 km², representing 11% of the country's territory. This protected area network is complemented by 46 hunting grounds, including 11 village hunting zones, bringing the total to 180,000 km², or 29% of the territory. To combat the effects of climate change in the country's northeast, the Government, supported by the World Resources Institute (WRI), has begun work to identify the potential for the growth of secondary forests in and around protected areas. These data will make it possible to better specify the baseline scenarios in the framework of NDC and REDD+ policies, carry out more precise monitoring, and enhance the potential of protected areas in the fight against climate change.

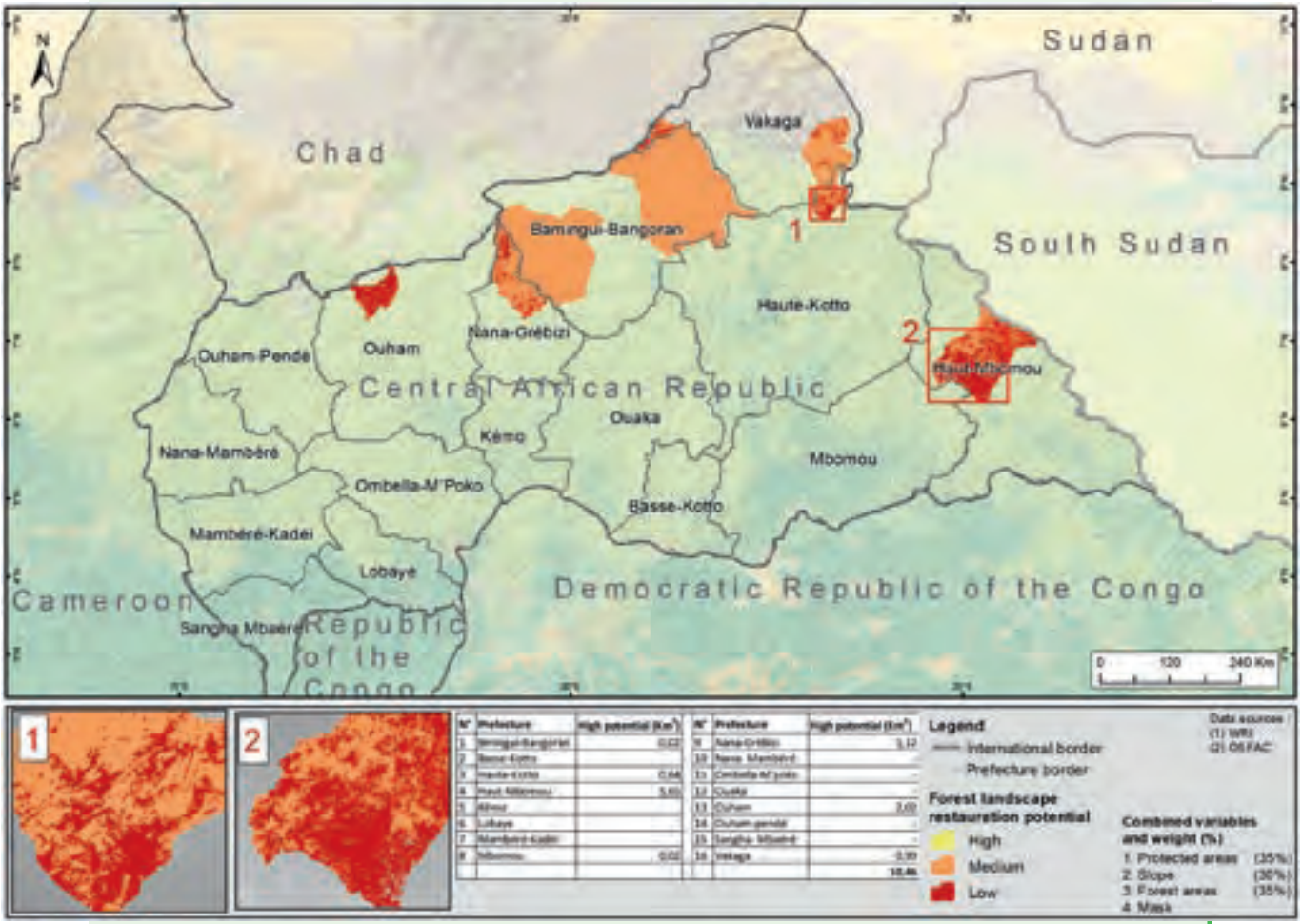
The results of this analysis estimated the potential for the restoration of forest landscapes and the establishment of secondary forests in protected areas at about 10,465 km² (medium potential) and 46,029 km² (high potential; Figure 11). In some protected areas, such as the national parks and strict nature reserves, only conservation activities are authorized, promoting an important natural regeneration dynamic (see inset in paragraph 1.1).

Potential for the establishment of secondary forests in CAR's protected areas

Elsewhere, in protected areas intended for both conservation and economic development (wildlife reserves, hunting estates or zones, biosphere reserves...), protection may be combined with active afforestation activities. This could include the development of practices such as assisted natural regeneration, as well as reforestation and agroforestry. This will particularly be the case in areas that have been degraded in the past, as well as on the outskirts and in the buffer zones of protected areas.

The information presented in Figure 11 takes into account both the ecological potential (more or less degraded forest areas, slopes) and the management category of protected areas. It must be combined with demographic, economic and social data to enable the managers of protected areas to better plan their conservation and reforestation activities, and to evaluate their effectiveness in the future.

Figure 11 – Potential for the establishment of secondary forests in CAR's protected areas



High potential: priority areas for restoration activities; medium potential: secondary areas for potential interventions; low potential: areas not conducive to restoration options and therefore not recommended for intervention. Source: RCA (2017).

Conclusions and prospects

African forests, mainly in Central Africa, store more than one quarter of the carbon in the intertropical zone. Protected areas play a significant role in protecting these carbon stocks, regulating local and regional climates, and providing ecosystem goods and services to human populations. Transboundary protected area complexes that have been set up in the subregion make it possible to protect vast areas in an ecological continuum capable of maintaining viable forest ecosystems and plant and animal populations.

Climate change predictions indicate a trend toward increasing global temperatures and a disruption of other parameters (rainfall, winds, etc.) with an increased frequency and intensity of extreme climate events (droughts, flooding, etc.). These changes will have negative impacts on protected areas in the region, jeopardizing the many services which they provide people, including in the fight against climate change.

Scientific studies undertaken to date in the subregion on ecological processes and the impacts of climate change remain scattered and limited, although they already have confirmed the vulnerability of protected areas to these changes. Protected areas are particularly well suited for long-term monitoring and analysis of ecological processes that are underlying and affected by climate change. This research should be not only diversified but multidisciplinary, collaborative and oriented toward understanding cause and effect relationships between different taxonomic groups.

Given the role played by protected areas in preserving the world's climate for the benefit of humanity, their protection and rational management should be a global priority in the context of "nature-based solutions" now advocated by the international community. Although a great deal of funding is currently being mobilized globally to fight climate change, Central African protected areas have been largely overlooked by projects and programs supported by climate finance.

The traditional funds mobilized, for example, within the GEF financing framework or by certain NGOs and international organizations, fall far short of protected areas' funding needs. REDD+ projects developed in the subregion, particularly in the DRC, have not yet met expectations despite the significant investments made. The projects need to be better anchored by promoting more participatory governance and by clarifying land tenure and local use rights (Reynier *et al.*, 2016). Other avenues also should be explored, such as the Gabon-CAFI agreement and greater use of the GCF.

To conclude, our analysis indicates that it is absolutely crucial to:

1. intensify the consideration of climate change in the day-to-day management of Central African protected areas. On one hand, the impacts of climate change in Central African protected areas need to be better understood, and measures for their mitigation identified; on the other, protected area managers need to be trained in these domains;

2. seize the opportunity offered by green finance to increase financial and technical resources to improve the management of protected areas in Central Africa through the development and implementation of a strategy to mobilize green finance in their favor.

COMIFAC should play a major role in the implementation of these actions with the help of its technical and financial partners.

Bibliography

References cited in the text

Akkermans T., Thiery W. & Van Lipzig N.P.M., 2014. The regional climate impact of a realistic future deforestation scenario in the Congo Basin. *J. Climate* 27 : 2714-2734.

Aleman J.C., Jarzyna M.A. & Staver A.C., 2017. Forest extent and deforestation in tropical Africa since 1900. *Nature*. https://doi.org/10.1038/s41559-017-0406-1

ART, 2020. The REDD+ Environmental Excellence Standard (TREES). ART Secretariat, Arlington, USA : 70 p.

Avitabile V., Herold M., Heuvelink G.B.M. *et al.*, 2016. An integrated pan-tropical biomass map using multiple reference datasets. *Global Change Biology* : 1406–1420.

Baccini A., Laporte N., Goetz S.J., Sun M. & Dong H., 2008. A first map of tropical Africa's above-ground biomass derived from satellite imagery. *Environ. Res. Lett.* 3 : 9 p. http://dx.doi.org/10.1088/1748-9326/3/4/045011

Baccini A., Walker W., Carvalho L., Farina M., Sulla-Menashe D. & Houghton R.A., 2017. Tropical forests are a net carbon source based on aboveground measurements of gain and loss. *Science*, 0.1126/science.aam5962.

Balanyá J., Oller J.M., Huey R.B., Gilchrist G.W. & Serra L., 2006. Global genetic change tracks global climate warming in *Drosophila subobscura*. *Science* 313 : 1773-1775.

Beaudrot L., Kroetz K., Alvarez-Loayza P., *et al.*, 2016. Limited carbon and biodiversity co-benefits for tropical forest mammals and birds. *Ecological Applications* 26(4) : 1098–1111.

Bell J.P., Tompkins A.M., Bouka-Biona C. & Sanda I.S., 2015. A process-based investigation into the impact of the Congo basin deforestation on surface climate. J. Geophys. Res. Atmos. 120 : 5721–5739.

Belle E.M.S., Burgess N.D., Misrachi M., *et al.*, 2016. Impacts du changement climatique sur la biodiversité et les aires protégées en Afrique de l'Ouest. Résumé des résultats du projet PARCC, Aires protégées résilientes au changement climatique en Afrique de l'Ouest. Rapport UNEP-WCMC, Cambridge, Royaume-Uni : 52 p.

Biber-Freudenberger L., Ziemacki J., Tonnang H.E.Z. & Borgemeister C., 2016. Future risks of pest species under changing climatic conditions. *PLoS ONE* 11(4) : e0153237. doi:10.1371/journal.pone.0153237

Bouyer O., Gachanja M., Pesti B., Fach E. & Gichu A., 2013. Carbon rights and benefit-sharing for REDD+ in Kenya. Kenya REDD+ analytical series, Issue #2. UN-REDD Program and Ministry of Environment, Water and Natural Resources.

Bradshaw W.E. & Holzapfel C.M., 2001. Genetic shift in photoperiodic response correlated with global warming. *PNAS* 98 : 14509-14511.

Busby J.W., Smith T.G., White K.L. & Strange S.M., 2012. Locating climate insecurity: Where are the most vulnerable places in Africa? *Climate change, human security and violent conflict* : 463-511. doi 10.1007/978-3-642-28626-1_23

Bush E.R., Whytock R.C., Bahaa-el-din L. *et al.*, 2020. Long-term collapse in fruit availability threatens Central African forest megafauna. *Science*. DOI: 10.1126/science.abc7791

Butt N., Seabrook L., Maron M. Law B.S., Dawson T.P., Suytus J. & McAlpine C.A., 2015. Cascading effects of climate extremes on vertebrate fauna through changes to low-latitude tree flowering and fruiting phenology. *Global Change Biology* 21 : 3267–3277.

CAFI, 2020. Gabon. Initiative pour la forêt de l'Afrique centrale. https://www.cafi.org/content/cafi/fr/home/partner-countries/gabon.html (accédé 07/11/2020)

Calosi, P., Bilton D.T., & Spicer J.I., 2008. Thermal tolerance, acclimatory capacity and vulnerability to global climate change. *Biology Letters* 4 : 99-102.

CCNUCC, 2015. Accord de Paris. Nations Unies, Paris : 26 p. https://unfccc.int/fr/process-and-meetings/l-accord-de-paris/qu-est-ce-que-l-accord-de-paris

CDB, 2013. Quick guides to the Aichi biodiversity targets. Secretariat, Convention on Biological Diversity, Montréal, Canada : 41 p.

Challinor A., Wheeler T., Garforth C., Craufurd P. & Kassam A., 2007. Assessing the vulnerability of food crop systems in Africa to climate change. *Climatic Change* 83 : 381–399.

Chan N.Y., Ebi K.L., Smith F., Wilson T.F. & Smith A.E., 1999. An integrated assessment framework for climate change and infectious diseases. *Environmental health perspectives* 107 : 329-337.

CNREDD, 2020. Plan de partage des bénéfices du Programme de Réduction des Émissions (ER-P) Sangha Likouala. Coordination Nationale REDD, Brazzaville, Congo : 5-7.

CNREDD, 2019. Rapport d'activités de l'année 2018. Coordination Nationale REDD, Brazzaville, Congo : 20 p.

COMIFAC, 2015. Plan de convergence pour la conservation et la gestion durable des écosystèmes forestiers d'Afrique centrale. Edition 2, 2015-2025. *COMIFAC Série politique* 7 : 42 p.

Dargie G.C., Lawson I.T., Rayden T.J., Miles L., Mitchard E.T.A., Page S.E., Bocko Y.E., Ifo S.A. & Lewis S.L., 2019. Congo Basin peatlands: threats and conservation priorities. *Mitig. Adapt. Strateg. Glob. Change* 24 : 669–686.

Dargie G.C., Lewis S.L., Lawson I.T., Mitchard E.T.A, Page S.E., Bocko Y.E. & Ifo S.A., 2017. Age, extent and carbon storage of the central Congo Basin peatland complex. *Nature* 542 : 86-103.

Davis M.B. &Shaw R.G., 2001. Range shifts and adaptive responses to Quaternary climate change. *Science* 292 : 673-679.

De Wasseige C., Marshall M., Mahé G. & Laraque A., 2015. Interactions entre les caractéristiques climatiques et les forêts. *In* : De Wasseige C., Tadoum M., Eba'a Atyi R. & Doumenge C. (Eds.), Les forêts du bassin du Congo. Forêts et changements climatiques. Weyrich, Neufchâteau, Belgique : 53-64.

Doumenge C., Palla F., Scholte P., Hiol Hiol F. & Larzillière A. (Eds.), 2015. Aires protégées d'Afrique centrale – État 2015. OFAC, Kinshasa, République Démocratique du Congo et Yaoundé, Cameroun : 256 p.

Duffy J.E., 2003. Biodiversity loss, trophic skew and ecosystem functioning. *Ecology Letters* 6 : 680-687.

Eba'a Atyi R., Loh Chia E. & Pérez-Terán A.S., 2015a. Vulnérabilité et adaptation des forêts et des communautés en Afrique centrale. *In* : De Wasseige C., Tadoum M., Eba'a Atyi R. & Doumenge C. (Eds.), Les forêts du bassin du Congo. Forêts et changements climatiques. Weyrich, Neufchâteau, Belgique : 65-77.

Eba'a Atyi R., Martius C., Schmidt L. & Hirsch F., 2015b. La forêt de l'Afrique centrale : une contribution accrue à l'atténuation du changement climatique. *In* : De Wasseige C., Tadoum M., Eba'a Atyi R. & Doumenge C. (Eds.), Les forêts du bassin du Congo. Forêts et changements climatiques. Weyrich, Neufchâteau, Belgique : 79-92.

ESA DUE, 2020. GLOBIOMASS. https://globbiomass.org/ (accédé 01/12/2020)

Esquivel-Muelbert A., Baker T.R., Dexter K.G., *et al.*, 2019. Compositional response of Amazon forests to climate change. *Glob. Change Biol.* 25 : 39–56.

FAO, 2020. Global Soil Partnership. http://www.fao.org/global-soil-partnership/pillars-action/4-information-and-data/global-soil-organic-carbon-gsoc-map/es/ (accédé : 01/12/2020).

FAO, 2012. Global ecological zones for FAO forest reporting: 2010 update. *FRA Working Paper 179*, FAO, Rome : 42 p.

Fandohan B., Gouwakinnou G.N., Fonton N.H., Sinsin B. & Liu J., 2013. Impact des changements climatiques sur la répartition géographique des aires favorables à la culture et à la conservation des fruitiers sous-utilisés : cas du tamarinier au Bénin. *BASE* 17(3) : 450-462.

FAO, 2020. Global Forest Resources Assessment 2020. Main report. FAO, Rome : 164 p.

Fauset S., Baker T.R., Lewis S.L., Feldpausch T.R., Affum-Baffoe K., Foli E.G., Hamer K.C. & Swaine M.D., 2012. Drought-induced shifts in the floristic and functional composition of tropical forests in Ghana. *Ecology Letters* 15 : 1120–1129.

FCPF, 2018. Programme de réduction des émissions dans la Sangha et le Likouala, République du Congo. Document de programme. FCPF, Fonds Carbone : 364 p.

FCPF, 2016. Programme de réduction des émissions du Maï-Ndombe, République démocratique du Congo. Document de programme. FCPF, Fonds Carbone : 350 p.

Foden W.B., Butchart S.H., Stuart S.N., Vié J.-C., Akçakaya H.R., Angulo A., DeVantier L.M., Gutsche A., Turak E. & Cao L., 2013. Identifying the world's most climate change vulnerable species: a systematic trait-based assessment of all birds, amphibians and corals. *PloS one* 8 : e65427.

Fongnzossie E.F., Sonwa D.J., Kemeuze V., Auzel P. & Nkongmeneck B.-A., 2014. Above-ground carbon assessment in the Kom-Mengamé forest conservation complex, South Cameroon: Exploring the potential of managing forests for biodiversity and carbon. *Natural Resources Forum* 38 : 220–232.

Fotso R., Fosso B. & Mbenda G.N., 2019. Évolution du couvert végétal du ParcNational de Mbam et Djérem et sa périphérie entre 2000-2018. Actes de la Conférence OSFACO, Des images satellites pour la gestion durable des territoires en Afrique, mars 2019, Cotonou, Bénin : 17 p.

GCF, 2020a. Projects & programmes. Areas of work. Green Climate Fund website. https://www.greenclimate.fund/countries (accédé : 07/11/2020)

GCF, 2020b. Green Climate Fund exceeds USD 10 billion replenishment mark. Green Climate Fund website. https://www.greenclimate.fund/news/green-climate-fund-exceeds-usd-10-billion-replenishment-mark (accédé : 07/11/2020)

Gendreau Y., 2016. La conservation dans le contexte des changements climatiques au Québec : analyses de vulnérabilité et stratégies d' adaptation. Thèse doctorat, Université du Québec à Rimouski, Canada : 167 p.

GFC, 2020c. Aperçu du GCF. Portefeuille de projets. Brochure, Green Climate Fund : 2 p.

GIEC, 2018. rapport spécial sur les conséquences d'un réchauffement planétaire de 1,5 °C (SR15)GIEC, Genève, Suisse : 400 p.

Gitay H., Suárez A., Watson R. & Dokken D., 2002. Les changements climatiques et la biodiversité. Document technique V du GIEC, CBD, WMO, PNUE.

Gonmadje C.F., Doumenge C., McKey D., Tchouto G.P.M., Sunderland T.C.H, Balinga M.P.B. & Sonké B., 2011. Tree diversity and conservation value of Ngovayang's lowland forests, Cameroon. *Biodiv. & Conserv.* 20 : 2627-2648.

Gonmadje C.F., Picard N., Gourlet-Fleury S., Réjou-Méchain M., Freycon V., Sunderland T., McKey D & Doumenge C., 2017. Altitudinal filtering of large tree species explains above-ground biomass variation in an Atlantic Central African rain forest. *Journal Tropical Ecology* 33 (2) : 143-154.

Goujon M. & Magnan A., 2018. Appréhender la vulnérabilité au changement climatique, du local au global. Regards croisés. Document de travail, FERDI & IDDRI, Paris : 19 p.

Gratz N.G., 1999. Emerging and resurging vector-borne diseases. *Annual Review of Entomology* 44 : 51-75.

Gubler D.J., Reiter P., Ebi K.L., Yap W., Nasci R. & Patz J.A., 2001. Climate variability and change in the United States: potential impacts on vector-and rodent-borne diseases. *Environmental health perspectives* 109 : 223-233.

Halpin P.N., 1997. Global climate change and natural area protection: management respponses and research directions. *Ecological Applications* 7(3) : 828–843.

Harris N.L., Gibbs D.A., Baccini A., et al., 2021. Global maps of twenty-first century forest carbon fluxes. *Nature Climate Change*. doi.org/10.1038/s41558-020-00976-6

Hartley A.J., Nelson A., Mayaux P. & Gregoire J.M., 2007. The assessment of African protected areas, Scientific and Technical Report. Office for Official Publications of the European Communities, Luxembourg : 77 p..

Heller N.E. & Zavaleta E.S., 2009. Biodiversity management in the face of climate change: a review of 22 years of recommendations. *Biological conservation* 142 : 14-32.

Hopkins A., McKellar R., Worboys G.L. & Good R., 2015. Climate change and protected areas. *In* : Worboys G.L., Lockwood M., Kothari A., Feary S. & Pulsford I. (Eds.), Protected area governance and management. ANU press, Camberra, Australia : 495-530.

Hulme M., Doherty R., Ngara T., New M. & Lister D., 2001. African climate change: 1900–2100. *Clim. Res.* 17 : 145–168.

Ifo S.A., Binsangou S., Ibocko Ngala L., Madingou M. & Cuni-Sanchez A., 2018. Seasonally flooded, and terra firme in northern Congo: Insights on their structure, diversity and biomass. *Afr. J. Ecol.* 57 : 92–103.

Joyeux C. & Gale J., 2010. Analyse des mécanismes de financement des aires marines protégées d'Afrique de l'Ouest. Proposition de renforcement de leur durabilité. Tome 3 – Le financement durable des aires protégées terrestres et marine : principes, mécanismes et expériences. Rapport UICN, The Environment and Development Group, Oxford, Royaume-Uni : 26 p.

Kamgang S.A., Bobo K.S., Gonder M.K. & Sinsin B., 2019. Chimpanzees (*Pan troglodytes ellioti* Matschie, 1914) in the forest transitions and mosaics ecosystems of the Mbam-Djerem National Park in Cameroon: Ecology and relations with local people. *In* : Kamgang S.A., Ph.D. Dissertation, University of Abomey-Calvi, Bénin : 24-39.

Karsenty A., 2020. Géopolitique des forêts d'Afrique centrale. *Hérodote* 179 : 108-129.

Karsenty A. & Ongolo S., 2012. Can "fragile states" decide to reduce their deforestation? The inappropriate use of the theory of incentives with respect to the REDD mechanism. *Forest Policy and Economics* 18 : 38–45.

Kemeuze, V., P. Mapongmetsem, D. Sonwa, E. Fongnzossie, and B. Nkongmeneck. 2015. Plant diversity and carbon stock in sacred groves of semi-arid areas of Cameroon: case study of Mandara mountains. *International Journal of Environment* 4:308-318.

Lavorel S., Lebreton J.-D. & Le Maho Y. (Eds.), 2017. Les mécanismes d'adaptation de la biodiversité aux changements climatiques et leurs limites. Rapport Académie des Sciences, Paris : 157p.

Lewis S.L., Sonké B., Sunderland T. *et al.*, 2013. Above-ground biomass and structure of 260 African tropical forests. *Phil. Trans. R. Soc. B* 368 : 20120295. http://dx.doi.org/10.1098/rstb.2012.0295

Lewis S.L., Lopez-Gonzalez G., Sonke B. *et al.*, 2009. Increasing carbon storage in intact African tropical forests. *Nature* 457 : 1003-1007.

Liboum M., Guizol P., Awono A., Jungers Q., Pokem D.S.D. & Sonwa D.J., 2019. Flux financiers internationaux en faveur de la protection de la nature et de la gestion durable des forêts en Afrique centrale. *OFAC Brief* 3 : 8 p.

Makarieva A.M. & Gorshkov V.G., 2010. The biotic pump: condensation, atmospheric dynamics and climate. Int. J. Water 5(4) : 365-385.

Makarieva A.M., Gorshkov V.G. & Li B.-L., 2009. Precipitation on land versus distance from the ocean: Evidence for a forest pump of atmospheric moisture. Ecological Complexity 6 : 302-307.

Maley J., Doumenge C., Giresse P., Mahé G., Philippon N., Hubau W., Lokonda M.O., Tshibamba J.M. & Chepstow-Lusty A., 2018. Late Holocene forest contraction and fragmentation in Central Africa. *Quaternary Research* 89: 43-59. doi.org/10.1017/qua.2017.97.

Maley J. & Doumenge C., 2012. The transgressive behaviour of the African rain forests during the two last millennia. *In* : Conference of the French Academy of Sciences, The impact of a major environmental crisis on species, populations and communities: the fragmentation of African forests at the end of the Holocene, 1-2 march 2012, Paris. Abstracts : 44-45 (poster).

Mansourian S., Belokurov A. & Stephenson P., 2009. Rôle des aires protégées forestières dans l'adaptation aux changements climatiques. *Unasylva* 60 : 63-69.

Maron M., McAlpine C.A., Watson J.E.M., Maxwell S. & Barnard P., 2015. Climate-induced resource bottlenecks exacerbate species vulnerability: a review. *Diversity Distrib.* 21 : 731–743.

Marquant B., Mosnier A., Bodin B., Dessard H., Feintrenie L., Molto Q., Gond V. & Bayol N., 2015. Importance des forêts d'Afrique centrale. *In* : De Wasseige C., Tadoum M., Eba'a Atyi R. & Doumenge C. (Eds.), Les forêts du bassin du Congo. Forêts et changements climatiques. Weyrich, Neufchâteau, Belgique : 17-35.

Martens P., 1999. How Will Climate Change Affect Human Health? The question poses a huge challenge to scientists. Yet the consequences of global warming of public health remain largely unexplored. *American scientist* 87 : 534-541.

Martens W., Jetten T.H. & Focks D.A., 1997. Sensitivity of malaria, schistosomiasis and dengue to global warming. *Climatic change* 35 : 145-156.

Maxwell S.L., Cazalis V., Dudley N. *et al.*, 2020. Area-based conservation in the twenty-first century. *Nature* 586 : 217-227.

MINFOF. 2007. Plan d'aménagement du Parc National du Mbam et Djerem et sa zone périphérique. 2007-2011.

Mitchard E. T. A., Saatchi S.S., Gerard F.F., Lewis S.L. & Meir P., 2009. Measuring Woody Encroachment along a Forest–Savanna Boundary in Central Africa. *Earth Interact*. 13(8) : 1–29.

Molina R.D., Salazar J.F., Martínez J.A., Villegas J.C. & Arias P.A., 2019. Forest-induced exponential growth of precipitation along climatological wind streamlines over the Amazon. *J. Geophysical Research Atmospheres* 124 : 1-11.

Ndiaye A. & Ndiaye P., 2013. Changement climatique, dégradation environnementale et quête d'utilisation des ressources naturelles: miracle ou mirage?

Nelson A. & Chomitz K.M., 2011. Effectiveness of strict vs. multiple use protected areas in reducing tropical forest fires: a global analysis using matching methods. *PLoS ONE* 6(8) : e22722. doi:10.1371/journal.pone.0022722.

Nepstad D., Schwartzman S., Bamberger B., Santilli M., Ray D., Schlesinger P., Lefebvre P., Alencar A., Prinz E., Fiske G. & Rolla A., 2006. Inhibition of Amazon Deforestation and Fire by Parks and Indigenous Lands. *Conservation Biology* 20(1) : 65–73.

Nogherotto R., Coppola E., Giorgi F. & Mariotti L., 2013. Impact of Congo Basin deforestation on the African monsoon. *Atmos. Sci. Let.* 14 : 45–51.

Noumi, N., L. Zapfack, & P. Pelbara. 2018. Afforestation/Reforestation Based on Gmelina Arborea (Verbenaceae) in Tropical Africa: Floristic and Structural Analysis, Carbon Storage and Economic Value (Cameroon). *Sustainability in Environment* 3:161.

Nyasimi M., Amwata D., Hove L., Kinyangi J. & Wamukoya G., 2015. L'agriculture intelligente face au climat. Quel impact pour l'Afrique ? CTA, Wageningen, Pays-Bas : 42 p.

OFAC, 2020. Observatoire des Forêts d'Afrique Centrale. www.observatoire-comifac.net (accédé 01/12/2020)

Onana J. & Devineau J.-L., 2002. *Afzelia africana* Smith ex Persoon dans le Nord-Cameroun. Etat actuel des peuplements et utilisation pastorale. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 55 : 39-45.

Ongolo S. & Karsenty A., 2011. La lutte contre la déforestation en Afrique centrale : victime de l'oubli du politique ? *Ecologie politique* : 71-80.

Ouedraogo N., 2010. Vulnérabilité et pauvreté énergétique, changement climatique et développement socio-économique de l'Afrique sub-saharienne. Congrès Mondial de l'Energie, Montréal, Canada, 12-16 septembre 2010 : 20 p.

Pachauri R.K. & Reisinger A., 2008. Bilan 2007 des changements climatiques: Rapport de synthèse. GIEC.

Pacifici M., Foden W.B., Visconti P., Watson J.E., Butchart S.H., Kovacs K.M., Scheffers B.R., Hole D.G., Martin T.G. & Akçakaya H.R., 2015. Assessing species vulnerability to climate change. *Nature climate change* 5 : 215-224.

Pacoureau N., 2018. Influence de la variabilité climatique, de l'abondance de proies, de la densité-dépendance et de l'hétérogénéité individuelle chez des prédateurs supérieurs longévifs : de l'individu à la population. Thèse Doctorat, Université de la Rochelle, France : 244 p.

Parmesan C., 2006. Ecological and evolutionary responses to recent climate change. *Annu.* Rev. *Ecol. Evol. Syst.* 37 : 637-669.

Parry M., Parry M.L., Canziani O., Palutikof J., Van der Linden P. & Hanson C., 2007. Climate change 2007 - Impacts, adaptation and vulnerability: Working group II contribution to the fourth assessment report of the IPCC. Cambridge University Press, U.-K.

Patz J.A., McGeehin M.A., Bernard S.M., Ebi K.L., Epstein P.R., Grambsch A., Gubler D.J., Reither P., Romieu I. & Rose J.B., 2000. The potential health impacts of climate variability and change for the United States: executive summary of the report of the health sector of the US National Assessment. *Environmental health perspectives* 108 : 367-376.

Phillips O. L., Van Der Heijden G., Lewis S. L. *et al.*, 2010. Drought-mortality relation-ships for tropical forests. *New Phytologist* 187 : 631–646.

RCA, 2017. La restauration des paysages forestiers en République centrafricaine : contexte et opportunités. République centrafricaine, Bangui : 71 p.

Reyniers C., Karsenty A. & Vermeulen C., 2016. Les paysans sans terre et REDD+ en RDC : les logiques locales face aux interventions internationales. *In* : Marysse S. & Omasombo Tshomda (Eds.), Conjonctures congolaises 2015 : entre incertitudes politiques et transformation économique. Ed. L'Harmattan, Paris : 199-226.

Ricard M., 2014. Vulnérabilité de la biodiversité des aires protégées du Québec aux changements climatiques. Université du Québec à Rimouski.

Root T.L., Price J.T., Hall K.R., Schneider S.H., Rosenzweig C. & Pounds J.A., 2003. Fingerprints of global warming on wild animals and plants. *Nature* 421 : 57-60.

Rwanda, 2020. Updated Nationally Determined Contribution, May 2020. Republic of Rwanda, Kigali : 84 p.

Saatchi S.S., Harris N.L., Brown S. *et al.*, 2011. Benchmark map of forest carbon stocks in tropical regions across three continents. *PNAS* 108(24) : 9899–9904.

Salati E., Lovejoy T.E. & Vose P.B., 1983. Precipitation and Water Recycling in Tropical Rain Forests with Special Reference to the Amazon Basin. *The Environmentalist* 3(1) : 67-71.

Schmitz O.J., Post E., Burns C.E. & Johnston K.M., 2003. Ecosystem responses to global climate change: moving beyond color mapping. *BioScience* 53 : 1199-1205.

Shukla P.R., Skea J., Slade R., Van Diemen R., Haughey E., Malley J., Pathak M. & Portugal Pereira J. (Eds.), 2019. Technical summary. *In* : Shukla P.R., Skea J., Calvo Buendia E., *et al.* (Eds.), Climate change and land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. IPCC, Geneva, Switzerland : 74 p.

Slik J.W.F., Paoli G., McGuire K. *et al.*, 2013. Large trees drive forest aboveground biomass variation in moist lowland forests across the tropics. *Global Ecol. Biogeogr.* 22 : 1261–1271.

Solomon S., Manning M., Marquis M. & Qin D., 2007. Climate change 2007-the physical science basis: Working group I contribution to the fourth assessment report of the IPCC. Cambridge University Press, U.-K.

Sonwa D.J., Guizol P., Itsoua Madzous G.L., Fobissié K. & Medjibé V., 2018. Contributions des pays d'Afrique centrale à la lutte contre le changement climatique. *OFAC Briefs* 2 : 4 p.

Spracklen D.V., Arnold S.R. & Taylor C.M., 2012. Observations of increased tropical rainfall preceded by air passage over forests. *Nature* 489 : 282-390.

Stolton S., Dudley N., Avcıoğlu Çokçalışkan B. *et al.*, 2015. Values and benefits of protected areas. *In* : Worboys G.L., Lockwood M., Kothari A., Feary S. & Pulsford I. (Eds.), Protected area governance and management. ANU Press, Canberra, Australia : 145-168.

Sufo Kankeu R., Tsayem Demaze M., Krott M., Sonwa D.J. & Ongolo S., 2020. Governing knowledge transfer for deforestation monitoring: Insights from REDD+ projects in the Congo Basin region. *Forest Policy and Economics*. doi.org/10.1016/j.forpol.2019.102081

Sutherst R.W., 2004. Global change and human vulnerability to vector-borne diseases. *Clinical microbiology reviews* 17 : 136-173.

Sutherst R.W., 1993. Arthropods as disease vectors in a changing environment. Environmental Change and Human Health. *Ciba Foundation Sym* 175 : 124-145.

Takouleu J.-M., 2019. Barrages : l'Afrique au défi de l'impact écologique des projets hydroélectrique. Afrik21. https://www.afrik21.africa/barrages-lafrique-au-defi-de-limpact-ecologique-des-projets-hydroelectriques/ (accédé 07/11/2020)

Tamoffo A.T., Moufouma-Okia W., Dosio A. *et al.*, 2019. Process-oriented assessment of RCA4 regional climate model projections over the Congo Basin under 1.5 °C and 2 °C global warming levels: Influence of regional moisture fluxes. *Climate Dynamics* 53 : 1911–1935.

Thuiller W., Broennimann O., Hughes G., Alkemade J.R.M., Midgley G.F. & Corsi F., 2006. Vulnerability of African mammals to anthropogenic climate change under conservative land transformation assumptions. *Global Change Biology* 12 : 424–440.

Tsalefac M., Hiol Hiol F., Mahé G. *et al.*, 2015. Climat de l'Afrique centrale : passé, présent et futur. *In* : De Wasseige C., Tadoum M., Eba'a Atyi R. & Doumenge C. (Eds.), Les forêts du bassin du Congo. Forêts et changements climatiques. Weyrich, Neufchâteau, Belgique : 37-52.

Tutin C.E.G. & Fernandez M., 1993. Relationships between mnimum temperature and fruit production in some tropical forest trees in Gabon. *J. Tropical Ecology* 9(2) : 241-248.

Van de Perre F., Willig M.R., Presley S.J., *et al.*, 2018. Reconciling biodiversity and carbon stock conservation in an Afrotropical forest landscape. *Science Advances* 4 : eaar6603.

Van Wilgen B.W, 2009. The evolution of fire management practices in savanna protected areas in South Africa. *South African Journal of Science* 105 : 343-349.

Welbergen J.A., Klose S.M., Markus N. & Eby P., 2008. Climate change and the effects of temperature extremes on Australian flying-foxes. *Proceedings of the Royal Society B* 275 : 419-425.

Williams S.E., Shoo L.P., Isaac J.L., Hoffmann A.A. & Langham G., 2008. Towards an integrated framework for assessing the vulnerability of species to climate change. *PLoS Biology* 6(12) : 2621-2626.

Willis K.J., Bennett K.D., Burrough S.L., Macias-Fauria M. & Tovar C., 2013. Determining the response of African biota to climate change: using the past to model the future. *Phil. Trans. R. Soc. B* 368 : 20120491. doi.org/10.1098/rstb.2012.0491

Wilson M.E., 1995. Travel and the emergence of infectious diseases. *Emerging Infectious Diseases* 1 : 39.

Young B., Byers E., Gravuer K., Hall K., Hammerson G. & Redder A., 2016. Guidelines for using the NatureServe climate change vulnerability index, Release 2.1. NatureServe, Arlington, USA : 65 p.

Youta Happi J., Bonvallot J., Hotyat M., Achoundong J.G., Dessay N., Guillet B., Peltre P., Schwartz D., Servant M. & Simmoneaux V., 2003. Bilan de la dynamique du contact forêt-savane en quarante ans (1950-1990) : dans la région du confluent du Mbam et du Kim, Centre-Cameroun. *In* : Froment A. & Guffroy J. (Eds.), Actes du colloque Peuplements anciens et actuels des forêts tropicales, Orléans, France. IRD, Paris : 211-218.

Zakari S., Arouna O., Toko I.I., Yabi I. & Tente B.A.H., 2017. Impact des changements climatiques sur la distribution de deux espèces ligneuses fourragères (*Khaya senegalensis* et *Afzelia africana*) dans le bassin versant de la Sota, Bénin. *Afrique Science* 13 : 1-14.

Zapfack L., Noiha Noumi V., Dziedjou Kwouossu P.J., Zemagho L. & Fomete Nembot T., 2013. Deforestation and carbon stocks in the surroundings of Lobéké National Park (Cameroon) in the Congo Basin. *Environment and Natural Resources Research* 3(2) : 78-86.

Zapfack, L., Noiha Noumi V. & Tabue M., 2016. Economic estimation of carbon storage and sequestration as ecosystem services of protected areas: a case study of Lobeke National Park. *Journal of Tropical Forest Science* : 406-415.

Additional references

Arnell A.P., Belle E. & Burgess N.D., 2014. Évaluation de la connectivité des aires protégées en Afrique de l'Ouest. Rapport UNEP-WCMC, Cambridge, Royaume-Uni.

Baker D. J., Hartley A.J., Burgess N.D., Butchart S.H.M., Carr J.A., Smith R.J., Belle E. & Willis S.G.,2015. Assessing climate change impacts for vertebrate fauna across the West African protected area network using regionally appropriate climate projections. *Diversity Distrib*. 21 : 991–1003.

Baker, D. et Willis, S.G. 2016. Impacts prévus du changement climatique sur la biodiversité dans les aires protégées d'Afrique de l'ouest. Rapport UNEP-WCMC, Cambridge, Royaume-Uni.

Carr J., 2015. Recommandations pour le suivi des espèces pour le site pilote transfrontalier du Parc national de Sena Oura (Tchad) et du Parc national de Bouba-Ndjidda (Cameroun). Rapport UNEP-WCMC, Cambridge, Royaume-Uni.

FAO, 2011. La situation des forêts dans le bassin amazonien, le bassin du Congo et l'Asie du Sud-Est. Rapport du Sommet des trois bassins forestiers tropicaux Brazzaville, République du Congo, 31 mai-3 juin 2011. FAO, Rome, Italie : 80 p.

Foden W.B. & Young B.E. (Eds.), 2016. IUCN SSC Guidelines for assessing species' vulnerability to climate change. Version 1.0. Occasional paper of the IUCN Species Survival Commission 59. Cambridge, UK and Gland, Switzerland : x + 114 p.

Geldmann J., Barnes M., Coad L., Craigie I.D., Hockings M. & Burgess N.D., 2013. Effectiveness of terrestrial protected areas in reducing habitat loss and population declines. *Biological conservation* 161 : 230-238.

Gross J.E., Woodley S., Welling L.A. & Watson J.E.M. (Eds.), 2016. Adapting to Climate Change: guidance for protected area managers and planners. *Best Practice Protected Area Guidelines Series* 24, IUCN, Gland, Switzerland : xviii + 129 p.

Masumbuko B. & Somda J. (Eds.), 2014. Analyse des liens existant entre le changement climatique, les aires protégées, et les communautés en Afrique de l'Ouest. Rapport UNEP-WCMC, Cambridge, Royaume-Uni.

Misrachi M. & Belle E., 2016. Lignes directrices pour les gestionnaires des aires protégées dans le cadre du changement climatique. Perspectives issues du projet PARCC Afrique de l'Ouest a utiliser conjointement avec les lignes directrices de l'UICN. Rapport UNEP-WCMC, Cambridge, Royaume-Uni : 34 p.

Schuette P., Namukonde N., Becker M.S., Watson F.G., Creel S., Chifunte C., Matandiko W., Millhouser P., Rosenblatt E. & Sanguinetti C., 2018. Boots on the ground: in defense of low-tech, inexpensive, and robust survey methods for Africa's under-funded protected areas. *Biodiversity and Conservation* 27 : 2173-2191.

Smith R., 2015. Analyse des carences et établissement de priorités géographiques pour la conservation en Afrique de l'Ouest. Rapport UNEP-WCMC, Cambridge, Royaume-Uni.

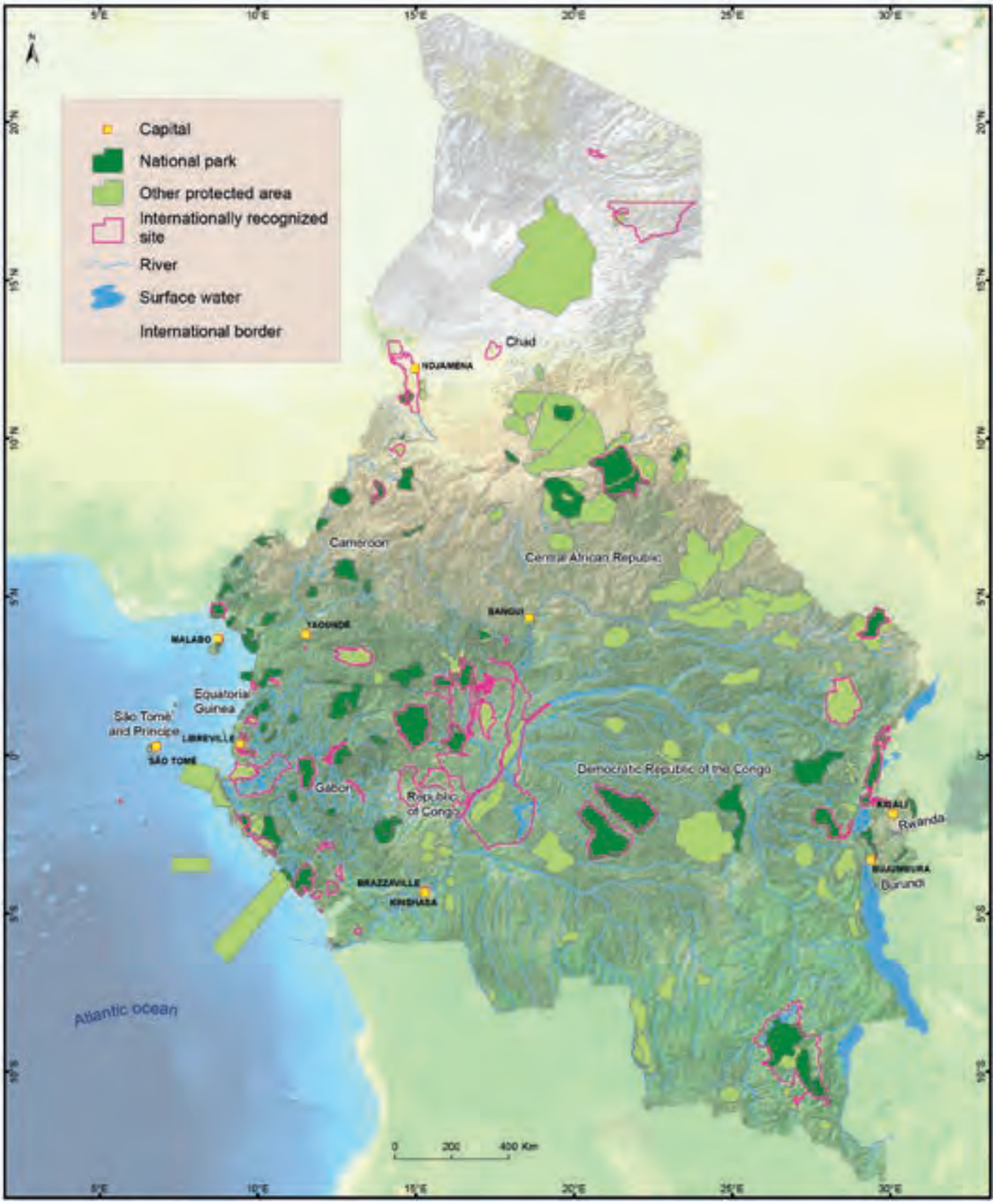
Willis S.G., Foden W., Baker D.J., Belle E., Burgess N.D., Carr J.A., Doswald N., Garcia R.A., Hartley A., Hof C., Newbold T., Rahbek C., Smith R.J., Visconti P., Young B.E. & Butchart S.H.M., 2015. Integrating climate change vulnerability assessments from species distribution models and trait-based approaches. *Biological Conservation* 190 : 167–178.


OK

National protected area networks in Central Africa

Country	Terrestrial protected areas			Marine protected areas		
	Number	Area (km²)	Proportion of land (%)	Number	Area (km²)	Proportion of EEZ (%)
Burundi						
National protected areas	15	1,519	5.5			
International protected areas	4	785	2.8			
Cameroon						
National protected areas	31	40,519	8.5	+	+	+
International protected areas	12	34,154	7.2			
Congo						
National protected areas	15	38,893	11.4	+	+	+
International protected areas	17	140,599	41.1			
Gabon						
National protected areas	20	41,133	15.3	20	52,759	26.0
International protected areas	11	35,288	13.2			
Equatorial Guinea						
National protected areas	13	5,860	20.9	+	+	+
International protected areas	3	1,360	4.9			
CAR						
National protected areas	17	123,143	17.8			
International protected areas	6	38,820	6.2			
DRC						
National protected areas	55	335,851	14.3	1	216	13.4
International protected areas	12	190,619	8.1			
Rwanda						
National protected areas	4	2,337	8.9			
International protected areas	2	167	0.6			
Sao Tome and Principe						
National protected areas	2	347	34.7	+	+	+
International protected areas	2	61	6.1			
Chad						
National protected areas	13	156,206	12.2			
International protected areas	8	155,124	12.1			

Note 1: National protected areas: protected areas classified by States according to national laws and recognized by the WDPA; International protected areas: protected areas listed under the World Heritage and Ramsar conventions or part of the biosphere reserve network. These two categories partly overlap as some of the international protected areas also have national status. These overlaps have not been specified here.
Note 2: There are some mixed protected areas (terrestrial and marine) but these are counted in the terrestrial category because of the small extension of the protected coastal areas.
+ : small areas of protected coastal zones.
Source: OFAC


Capital
National park
Other protected area
Internationally recognized site
River
Surface water
International border
Chad
NDJAMENA
Cameroon
Central African Republic
BANGUI
YAOUNDE
MALABO
Equatorial Guinea
São Tomé and Principe
LIBREVILLE
SÃO TOMÉ
Gabon
Republic of Congo
Democratic Republic of the Congo
BRAZZAVILLE
KINSHASA
KIGALI
Rwanda
BUJUMBURA
Burundi
Atlantic ocean
0 200 400 Km
5°E
10°E
15°E
20°E
25°E
30°E
20°N
15°N
10°N
5°N
0°
5°S
10°S

The State of Protected Areas in Central Africa 2020 places particular emphasis on updated data, allowing for a harmonized picture of the protected area network across the subregion. It shows, without ambiguity, that national networks and the subregional network have been strengthened considerably, but that they face many challenges. Detailed analyses, intended to inform decision-makers and managers, explore various themes barely touched upon in the previous volume (governance, ecotourism, etc.), or not addressed at all (human-elephant conflicts, transhumance, mining and oil industry, etc.). This document demonstrates the importance of protected areas for the sustainable development of Central Africa. It aims to contribute to a multisectoral dialogue and to the better integration of protected areas in national development strategies.