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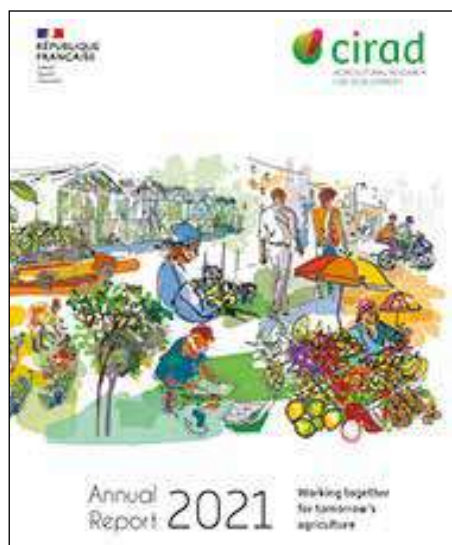


AGRICULTURAL RESEARCH
FOR DEVELOPMENT



Annual
Report 2021

Working together
for tomorrow's
agriculture



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EDITO

For engaged, high-level research

Élisabeth Claverie de Saint Martin,
CIRAD CEO

World Conservation Congress, COP26, New Africa-France Summit, United Nations Food Systems Summit, etc., etc. 2021 was a year rich in international events, which was far from a foregone conclusion after 2020, marked by Covid and lockdowns. Despite the circumstances, CIRAD played an active role in a range of events. Alongside our partners from tropical and Mediterranean countries, we made ourselves heard on many issues.

A visible presence on the global stage

CIRAD excelled itself in the field of health in 2021, among other things with the development in Réunion of the RunCov screening test, an economical method for field use that resulted from our plant and animal health research activities. In terms of biodiversity, as a member of the International Union for the Conservation of nature (IUCN), CIRAD took part in the World Conservation Congress, co-organizing a range of events. The topics covered included cultivated biodiversity as a lever for sustainable, resilient farming systems; management of protected areas; and One Health, all of which are close to our hearts at CIRAD. This was a chance for us to present and debate the research we do with our partners in tropical and Mediterranean countries, and to take part in drafting the 148 resolutions and recommendations adopted. Agriculture, forests and soils are both victims of and solutions to a range of issues, and must be included in any actions aimed at reducing the effects of

climate change, and we raised this still largely overlooked topic at COP26. Lastly, in terms of agroecology and sustainable food systems, we were very active in building coalitions, for instance the Agroecology Transformative Partnership Platform (TPP), led by several R&D organizations including CIRAD, alongside the 48th Plenary of the Committee on World Food Security (CFS).

Research, training, and ambitious partnerships

Relations between science and society are a major concern for CIRAD, a targeted research organization with a remit for research with and for society. We have produced a position paper on the topic that has been adopted by our Board of Trustees. It will allow us to focus more on this aspect in our approaches and operations. As regards training, in addition to sustained activity all year round, the agreement signed with Institut Agro and the creation of the POLLENIS research unit have laid the foundations for an ambitious policy backed by long-term collaborations and synergies.

Despite the pandemic, we have been determined to maintain a presence on the ground, alongside our partners: 97 staff members left for new or ongoing overseas assignments in 2021. As of the end of November, 280 new contracts had been signed, for amounts ranging between € 364 000 and € 37 567 000. Within CIRAD, the various social partners have now signed a work from home agreement, which will modernize how

we work and ensure better quality of work life. The tools adopted during the pandemic have also allowed us to reduce our carbon footprint long term.

Greater recognition and visibility

On a national level, 2021 was marked by visits from our supervisory ministers, to inaugurate advanced infrastructures that also represent a human and scientific commitment on the part of CIRAD as a whole: MESRI* in Réunion, for the inauguration of 3P, and MEAE** in Montpellier, for that of the Abiophen greenhouse and the ARCAD building. In July, the audit report from the Haut conseil à l'évaluation de la recherche et de l'enseignement supérieur (HCERES), which was very positive in terms of both our results and our prospects, recognized our impact culture and the originality of our strategic position.

A leader in Europe

The overall legacy from 2021 was therefore positive, and 2022 is also looking good for CIRAD. In terms of partnerships, I-Site MUSE has been extended for five years, the sign of a positive local dynamic. With the French Presidency of the Council of the European Union, CIRAD will be striving even harder to be a leader in Europe as regards the Green Deal, to serve as a reference in terms of impact, to promote innovation pathways and to conduct engaged, top-level research.

* French Ministry of Higher Education, Research and Innovation

** French Ministry for Europe and Foreign Affairs

2021 HIGHLIGHTS

January



PREZODE, joining forces to prevent future pandemics

The PREZODE initiative, aimed at preventing emerging zoonotic risks and pandemics, was launched at the One Planet Summit on 11 January. PREZODE, which was initiated by CIRAD, INRAE and IRD, was built under the aegis of France, in consultation with around ten other research organizations in France, Germany and the Netherlands.



Mariam Sow

© S. Lewicki, CIRAD

Agroecology in the spotlight at the One Planet Summit

The summit was marked by the announcement of a new coalition, the International Agroecological Movement for Africa (IAM Africa), to which CIRAD has signed up, and by a contribution from ENDA PRONAT Executive Secretary Mariam Sow, who is on the CIRAD Board of Trustees, who addressed world leaders from CIRAD's Dakar office.

February

Thierry Lefrançois appointed to the French Scientific Council on Covid-19

Thierry Lefrançois, a specialist in health networks and integrated approaches at CIRAD is the first veterinarian on the council, which was set up to inform public policy decisions on the management of the health crisis.



© F. Durouau

Precious pulses

A not-to-be-missed event for scientists, experts, farmers, policymakers and professionals, the *Rencontres francophones sur les légumineuses*, was held on 24 and 25 February. It was organized by Terres Inovia and Terres Univia, CIRAD and INRAE, with the aim of creating synergies between French-speaking countries, to build a joint vision.



Pulses include a wide range of plants



G. Trébut © CIRAD

March



Ecoffee R&D, for reduced pesticide levels in coffee

The Ecoffee R&D initiative associates coffee firms and research organizations, with the aim of reducing pesticide use in conventional coffee growing. An international audit to assess practices in Brazil, Mexico, Nicaragua and Vietnam marked the launch of the initiative.

April

BioStar, bioenergy for SMEs in West Africa

The BioStar project was officially launched on Thursday 15 April at Joseph Ki-Zerbo University in Ouagadougou. It aims to contribute to energy and food security in West Africa by developing an innovative bioenergy sector and meeting the needs of agrifood processing SMEs. BioStar is being co-funded for five years by the European Union DeSIRA programme and the Agence française de développement.



May

Serge Morand appointed member of the One Health High-Level Expert Panel

Serge Morand, a health ecologist at CNRS on secondment to CIRAD in Thailand, was appointed on 27 May as one of the 26 international members of a high-level expert panel on the One Health approach. CIRAD has already worked extensively on this topic, and contributed to the emergence of the panel, created jointly by the WHO, FAO, OIE and UNEP.



PR

Hydropolis sets sail

22 April saw the launch of an ambitious building and partnership project due to become operational in 2022. The new water science campus, Hydropolis, involving researchers from CIRAD's G-EAU research unit, among others, is intended to foster cooperation between businesses and research teams.



PlantAlliance, a public-private consortium to drive agroecological innovation

28 public and private research organizations working in plant science, plant breeding and connected technologies (including CIRAD) have created PlantAlliance. The purpose of this consortium is to increase the pace of innovations in genetics, genomics and the breeding of new varieties as a main driver for the development of innovative agroecological cropping systems.



A. Rival © CIRAD

Periurban market gardening in Ouagadougou, Burkina Faso



Small-scale irrigation but big hopes, thanks to IRRINN

The IRRINN project, to intensify agricultural production by scaling up innovative, adapted irrigation practices and technologies, was launched in Burkina Faso in March. The aim is to enable a larger number of producers to benefit from customized "small-scale" irrigation systems. IRRINN is coordinated by CIRAD, and funded by the European Union under the DeSIRA programme.

2021 HIGHLIGHTS

June

Launch of the FAIR Sahel project

The official ceremony to launch the FAIR Sahel project, coordinated by CIRAD, was held on 15 June in Ouagadougou under the presidency of the Ministry of Higher Education, Scientific Research and Innovation of Burkina Faso.

FAIR Sahel aims to intensify agriculture in an ecologically friendly way, to make farms in the Sahel more resilient.

It is co-funded for four years by the European Union DeSIRA programme and the *Agence française de développement*.



Millet © R. Belmin, CIRAD

July

A first for studies of crop pathogenic bacteria

In an article published on 29 July in *PLoS Pathogens*, scientists from CIRAD, from the French Muséum national d'Histoire naturelle (MNHN) and from the Mauritius Herbarium retraced the evolutionary history of a bacterium infecting citrus in the Indian Ocean, comparing an ancient genome from a herbarium to those of its modern counterparts. This paves the way for using ancient herbaria to trace the evolutionary history of crop pathogenic bacteria.

Tens of ancient herbaria were studied worldwide. Here, the Smithsonian Institution in the United States



© L. Gagnevin, CIRAD

September



© D. Bazile, CIRAD

The IUCN Congress in Marseille allowed scientists to share their messages with politicians and representatives of IUCN members



Agricultural research at the IUCN World Conservation Congress

The World Conservation Congress organized by the members of the IUCN, including CIRAD, closed its doors on 10 September. It called for a raft of transformations including building long-term agricultural research partnerships, stepping up dialogue between scientists and policymakers, and continuing to work for greater impact.



E. Malézieux © CIRAD

Lychees for sale on a market in Madagascar



CIRAD's commitment to food system transformation at the United Nations Summit

The United Nations Food Systems Summit was held in New York on 23 September. This "People's and solutions summit" was one of the highlights of 2021, and aimed to drive real change across all sectors, from production to consumption. CIRAD and its partners were actively involved in its preparation, calling for territory-based solutions designed by and for local actors.

October

French sustainable cocoa initiative

On 5 October, the French Secretary of State for Biodiversity, Bérangère Abba, the Syndicat du Chocolat (French chocolate trade union), CIRAD, NGOs and retailers signed joint and decisive commitments towards sustainable cocoa, with the participation of the Minister Delegate for Foreign Trade and Economic Attractiveness, Franck Riester.



Pile of cocoa pods and tool used to open them, Ecuador



© CIRAD

Partnerships in the spotlight at the Montpellier Global Days and the New Africa-France Summit

More than 3000 participants from Africa and France attended the New Africa-France Summit in Montpellier on 8 October 2021. The day marked the culmination of the Montpellier Global Days organized by Montpellier University of Excellence and its partners from 4 to 7 October, at which a range of talks and meetings bore witness to the strength and importance of partnerships for training, research and innovation.



November

CIRAD at COP26

Along with its partners, CIRAD was involved in several side events at COP26 in Glasgow from 31 October to 12 November. It called for agriculture, forests and soils, which are both victims and solutions, to be given a place in actions aimed at mitigating climate change.

Launch of the *Sustenta e Inova* project, for sustainable farming practices in the Brazilian Amazon

Sustenta e Inova was launched on 11 November in Belém-Pará. It is co-funded by the European Union and jointly coordinated by CIRAD and several partners. The aim is to promote sustainable land use in the Brazilian Amazon, in order to preserve biodiversity and manage natural resources.

Inauguration of the Plant Protection Platform (3P) in Réunion

Frédérique Vidal, French Minister of Higher Education, Research and Innovation, Béatrice Sigismeu, Vice-President of the Réunion Regional Council, Stéfano Dijoux, Deputy Mayor of Saint-Pierre de La Réunion, and CIRAD CEO Élisabeth Claverie de Saint Martin inaugurated the new buildings at the Plant Protection Platform in Saint-Pierre on 22 November.

L to R: B. Sigismeu, É. Claverie de Saint Martin, S. Dijoux, F. Vidal and É. Jeuffrault, CIRAD Regional Director for Réunion



© CIRAD

December



© K. Zerouali, IRD

Valérie Verdier and Élisabeth Claverie de Saint Martin



A new IRD-CIRAD framework agreement

On 14 December, CIRAD CEO Élisabeth Claverie de Saint Martin and IRD Chair Valérie Verdier signed a new five-year framework agreement between the two organizations. The agreement reaffirms the similarity of the issues on which they are working with a view to achieving the SDGs, and their shared priorities for action, notably to benefit young people.

Photography serving science



© D. Delebecque, CIRAD

CIRAD researcher and photographer Raphael Belmin, who provided the texts and photos for the "African agroecology in motion" exhibition, received a special mention from the judges of the Racines Sud association's *Prix de l'expatriation 2021*. The judges congratulated him on "his use of photography to explore new ways of generating knowledge and bridging the gap between the world of research and civil society".

Exhibition on line (in French): bit.ly/34ovB9C


2021 PORTFOLIO

AbioPhen, a greenhouse to study plant responses to climate change

The AbioPhen greenhouse, inaugurated in October 2021, is a high-tech ecophysiology facility. Climate parameters can be fully controlled in its six glass compartments and four growth chambers. This advanced infrastructure will serve to study how plants react to future climate conditions.

claire.billot@cirad.fr

© C. Cornu, CIRAD




Produced in Vietnam, Văn Yên cinnamon
(which has a GI) stands out for its slightly
sweet-spicy flavour and aroma
© V. Bonneaud, CIRAD

Geographical indications serve economic viability and natural and cultural heritage

Reconciling economic viability and the protection of natural and cultural heritage through a territory-based approach to food systems: this is the proposal made by the 158 participants in the independent dialogue on geographical indications (GIs) organized in May by CIRAD and FAO.

claire.mongin-bernard@cirad.fr • delphine.marie-vivien@cirad.fr

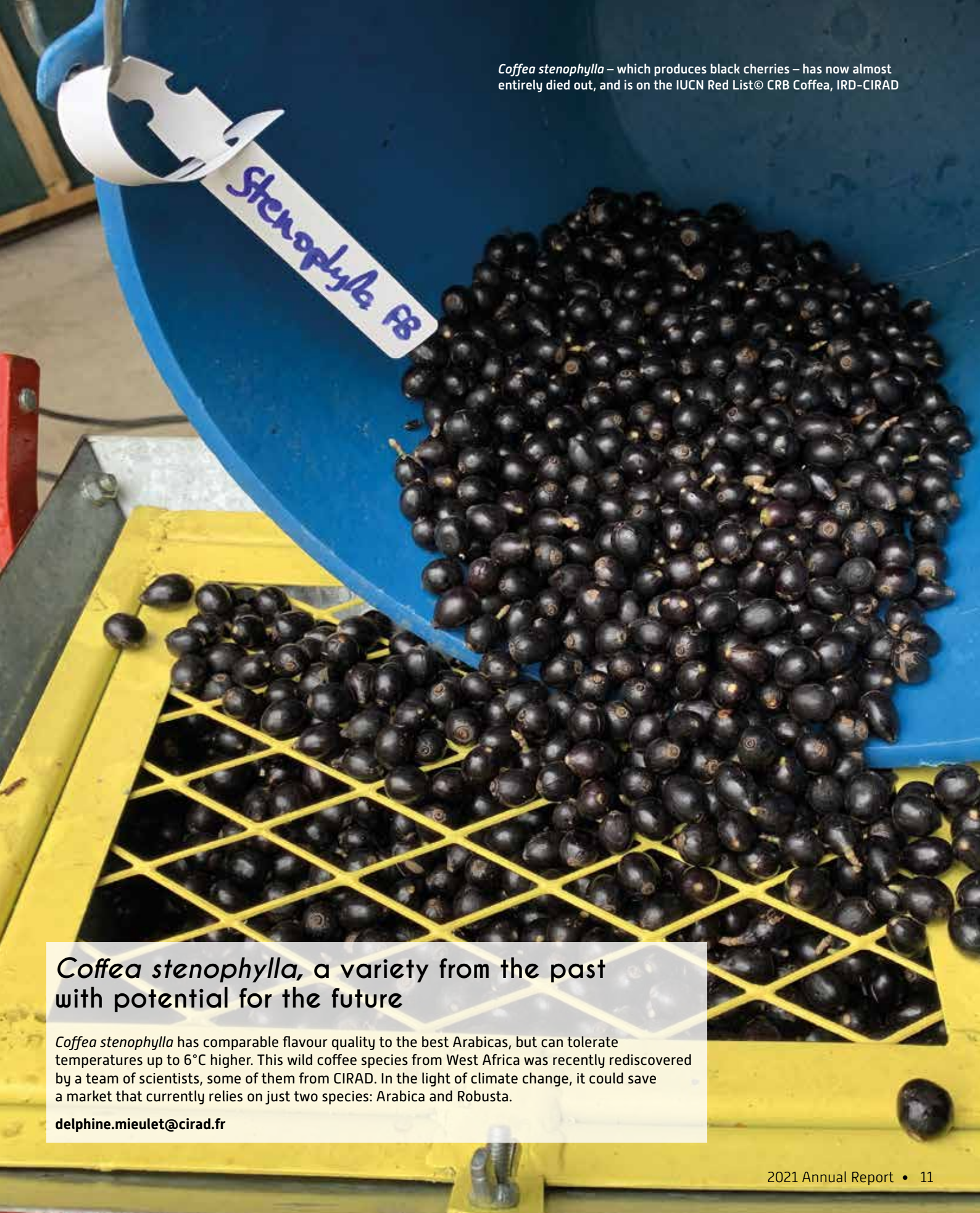
A large number of yellow desert locusts are shown on a sandy, reddish-brown ground. The locusts are densely packed in some areas, particularly in the foreground and middle ground, where they appear to be mating or swarming. They have a bright yellow color with some darker markings on their wings and bodies. The background shows more locusts scattered across the sand, extending towards the horizon. The overall scene depicts a massive infestation of these insects in a desert environment.

New prospects for controlling desert locust invasions

A new discovery: at the point of swarming, females move away from males to avoid being harassed, and do not join them until a few hours before egg laying, to fertilize their eggs. This discovery could significantly improve control operations, for instance by targeting female-biased groups carrying eggs.

The article was published in PNAS on 11 October, by the Japan International Research Center for Agricultural Sciences (JIRCAS), in collaboration with the Centre national de lutte antiacridienne in Mauritania (CNLA), CIRAD and the Centre national de lutte antiacridienne in Morocco (CNLAA).

cyril.piou@cirad.fr



Coffea stenophylla – which produces black cherries – has now almost entirely died out, and is on the IUCN Red List© CRB Coffea, IRD-CIRAD

Coffea stenophylla, a variety from the past with potential for the future

Coffea stenophylla has comparable flavour quality to the best Arabicas, but can tolerate temperatures up to 6°C higher. This wild coffee species from West Africa was recently rediscovered by a team of scientists, some of them from CIRAD. In the light of climate change, it could save a market that currently relies on just two species: Arabica and Robusta.

delphine.mieulet@cirad.fr

A new report proposes avenues to make protected areas in Central Africa more effective

Central Africa currently has more than 200 protected areas, a figure that has doubled in the past 20 years. According to a new report entitled “State of protected areas in Central Africa: 2020”, Central Africa is close to meeting the international targets for protected areas. However, those areas are often poorly run and their management could be improved.

charles.doumenge@cirad.fr



Elephants in the Béli swamp clearing,
Nouabale-Ndoki National Park,
Republic of the Congo
© C. Doumenge, CIRAD



Bringing science and policy closer together, to build healthy, sustainable food systems

Fostering dialogue between science and policy was the topic for a webinar organized by MUSE-Montpellier University of Excellence and its members and partners (University of Montpellier, CIRAD, INRAE, IRD) in February 2021. The event was part of the run-up to the United Nations Food Systems Summit in New York in September 2021.

patrick.caron@cirad.fr

Focus on Africa



The New Africa–France Summit in Montpellier on 8 October 2021 brought together more than 3000 participants from Africa, France and other European countries. It was the culmination of the Montpellier Global Days organized by Montpellier University of Excellence and its members, including CIRAD. The week was filled with talks and meetings that bore witness to the strength and importance of partnerships for training, research and innovation. This is an ideal time to focus on CIRAD’s activities in Africa, in 2021 and in future.



Foreword

by Philippe Petithuguenin,
Director General in charge of Research and Strategy

CIRAD has a long history of working with African agricultural research (research centres and universities), a history that began with the merger of the former “institutes” to form CIRAD in 1984. That collaboration, which is the cornerstone of CIRAD’s geographical strategy, is characterized by a dual commitment, both day to day, since it relies on CIRAD researchers working on the ground within partner organizations in Africa, often for several years, and long term, notably via the thirteen permanent platforms in partnership for research and training [dPs]*.

In Africa, where our work particularly focuses on agroecological intensification of agro-silvo-pastoral systems, CIRAD has partnerships centring on the following six topics, which steer and structure our targeted research:

- helping farming systems in the global South adapt to climate change;
- engineering agroecological transitions;
- supporting the transition to more sustainable, inclusive food systems;
- preserving biodiversity as a lever of development and resilience;
- promoting territory-based approaches to leverage sustainable, inclusive development;
- proposing an integrated animal, plant and ecosystem health approach, in connection with public health.

Backed by the various members of the thirteen dPs and CIRAD’s six regional offices covering the entire continent, those partnerships and topics form the core of almost 150 research, innovation support and training projects. Since development is clearly impossible without building skills, CIRAD is working with African universities to provide education and training, notably at Masters and PhD level, either on its own or with other French organizations such as MUSE, Institut Agro and the Agreenium alliance.

This “Focus on Africa” special report bears witness to that commitment, and allows our partners to express themselves. They shed light on a range of key operations in 2021, some of which were reported and discussed at the New Africa-France Summit and the Montpellier Global Days. The five interviews illustrate CIRAD’s five main remits:

- to generate new, relevant knowledge recognized by our peers;
- to build partnerships;
- to help draft appropriate public policies;
- to build our partners’ research capacity by means of training;
- to support innovation processes and generate impact.

They provide a glimpse of CIRAD’s commitment to the continent, via the contributors’ original opinions, for which we are most grateful.

* Of the 21 dPs of which CIRAD is a founding partner, 13 involve both CIRAD and African partners.

Full list at:
<https://bit.ly/3pBqURg>





Publications

Bienvenu H.K. Amani, a young researcher whose career has skyrocketed thanks to spatial modelling

Having an article published in a prestigious, world-famous journal is the holy grail for any researcher. This is precisely what has happened to Bienvenu Amani, a talented young researcher doing his PhD at CIRAD. He looks back over our fruitful collaboration.

Bienvenu Hyppolite Amani is a PhD student at Jean Lorougnon Guédé University in Daloa (Ivory Coast). In the course of his thesis work at CIRAD, he developed a method for modelling the reconstitution of forest ecosystems. Those models were recently applied on a large scale, and the results have been published in the journal *Science*.



How and where did you first come across CIRAD?

Jean Lorougnon Guédé University was contacted in late 2017 by Professor Justin Kassi from Félix Houphouët-Boigny University in Abidjan and CIRAD's Dr Bruno Hérault, who were looking for a student to work on the DynRecSE project focusing on the dynamics of the reconstitution of ecosystem services. I was just finishing my Masters in agriculture and forestry, and met Bruno Hérault to talk about applying for a PhD grant. After a test and an interview, he put me forward for an AMRUGE-CI 2 grant, an Ivory-Coast France partnership research capacity-building instrument. I was one of the 23 recipients of a grant.

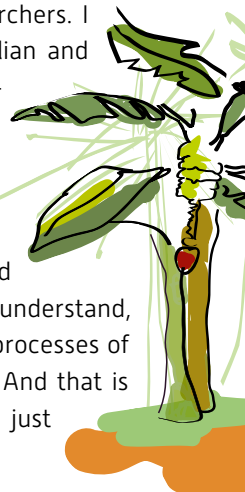
How did that meeting help you with your work, and eventually to publish?

At the end of 2018, I began working on my thesis on the dynamics of reconstitution after cropping in tropical forest systems. I began with a four-month stay at CIRAD in French Guiana, during which I followed the "Tropical Ecology" Masters course and learned about analysis tools and basic forest system dynamics modelling with the ECOFOG joint research unit (UMR). When I returned to Ivory Coast, I began field work, with the help of Bruno Hérault and Karidia Traoré, my thesis supervisor, a lecturer at Jean Lorougnon Guédé University. I succeeded in developing models of the pathways by which biodiversity is reconstituted and of forest composition. I published an initial article as lead author – *The potential of secondary forests to restore biodiversity in the lost forests of semi-deciduous West Africa* – in the journal *Biological Conservation* in April 2021.

Those models caught the attention of foreign researchers working on tropical secondary forest dynamics within the 2ndFor network. They invited me for a working visit to IDIV in Leipzig, Germany. The Covid crisis unfortunately got in on the act, and we had to work remotely, but the methodology I developed in Ivory Coast was adapted to be rolled out on a larger scale, across the tropics. It was this model that served as the basis for the work published in *Science*.

What have you drawn from your collaboration with CIRAD?

It has opened a lot of doors for me. In particular, my time at UMR ECOFOG in French Guiana and with the Forests and Societies research unit at CIRAD in mainland France allowed me to meet a lot of talented, really friendly researchers. I now work almost every day with Dutch, Brazilian and German researchers, on topics of shared interest. CIRAD allowed me to build a skillset I could never have imagined when I started on my thesis: data management with the R software, model development using Stan, spatial modelling, etc. I am now continuing with my PhD and feel I'm halfway there, but well-equipped to understand, analyse, interpret and pinpoint the underlying processes of forest ecosystem reconstitution in the tropics. And that is already a huge step forward for a researcher just starting out in his career. ■



CIRAD - IRAD

A multi-faceted scientific and institutional partnership

CIRAD and Cameroon's Institut de recherche agricole pour le développement (IRAD) have been partners for a long time. Their fruitful collaboration is founded on frequent exchanges on shared research topics, reciprocal visits and longer stays by researchers, and coordination of a platform in partnership for research and training (dP). We talk to Eunice Ndo, joint coordinator of dP Agroforesterie.



Eunice Golda Danièle Ndo is a senior researcher at IRAD, Cameroon. She specializes in plant epidemiology, and works on diseases of fruit species. She is also joint coordinator of the Agroforestry Systems in Central Cameroon platform in partnership for research and training (dP Agroforesterie) and heads IRAD's Mbalmayo agricultural research centre, which covers its operational structures in the centre, South and East of the country.

How and when did you come across CIRAD?

My first encounter with CIRAD dates back to 2004. I had been

a junior researcher at IRAD since 2002, and was working to build a sub-project within the programme to strengthen agricultural research partnerships in Cameroon (Reparac), implemented jointly with CIRAD. The project our team submitted, aimed at boosting fruit production in terms of both quantity and quality in Cameroon, was selected for funding. In 2007, I was given a grant to fund an eight-week stay in Montpellier, to meet my future thesis supervisors at CIRAD and register for my thesis at Montpellier SupAgro. That visit was the start of many collaborations.

What form does the partnership between CIRAD and your organization take? What are its main strengths and weaknesses?

Cooperation between the research sector in Cameroon and CIRAD, which has been built

on shared, mutually beneficial topics, centres on scientific and institutional partnerships. The scientific component is what prompted cooperation between IRAD and CIRAD. Regular exchanges between scientific managers at our two organizations, notably during missions and other meetings, have served to organize cooperation on several topics. Within the framework of past projects conducted jointly by our organizations, several CIRAD researchers have spent time in Cameroon, assigned to IRAD. As part of the platform in partnership for research and training on Agroforestry Systems in Central Africa (dP Agroforesterie), working on sustainable intensification of agroforestry systems in Cameroon, IRAD and particularly CIRAD are driving the construction and implementation of operations. And CIRAD researchers have organized several capacity-building sessions for junior researchers and teachers from Cameroon.

On an institutional level, a series of discussion meetings have enabled CIRAD and IRAD to reflect on the content and practical details of an institutional partnership (missions to Cameroon by managers from CIRAD, missions to France by managers from IRAD). Each year, IRAD's Director General and his closest

colleagues travel to Paris for the International Agricultural Show, where a meeting is held with CIRAD management.

One of the main strengths of our partnership is that it has always allowed junior researchers (several PhD students) to get involved and build their skills. The weaknesses include a lack of commitment on the part of certain partners when it comes to defining strategy, and the fact that priority is still sometimes given to topics with funding from major donors, which are not always those that most concern countries in the global South.

What was the partnership's main achievement in 2021?

In 2021, within dP Agroforesterie, four training workshops were organized for junior researchers and teachers from the dP member organizations, each with around fifteen participants. They covered the following topics: scientific writing and promotion of results; assessment of agroforestry systems; gathering and statistical processing of data from surveys and agricultural experiments; and a seminar for students from the dP on presenting current or past thesis work (PhD or Masters). ■



From a local to a regional level, achievements and challenges of dP PPZS

With more than twenty years of collaboration with CIRAD under her belt, the Senegalese researcher Astou Camara is coordinator of the PPZS platform in partnership for research and training [dP]. She talks passionately and frankly about the platform, its achievements, and the challenges it faces in the coming years.



Astou Camara, a sociologist, is head of the macro-economic analysis unit at the Institut sénégalais de recherches agricoles (ISRA) in Dakar (Senegal). She is coordinator of the PPZS platform in partnership for research and training.



How did you first come across CIRAD, and how did you become PPZS coordinator?

I first met some CIRAD researchers in 2000; I was doing my BSc and they were looking for students. PPZS had just been set up. I contributed to its initial work on the dynamics of pastoral systems in Senegal. Since then, we have never stopped working together. To begin with, I wanted to be an engineer, but my work with CIRAD encouraged me to become a researcher, and it was within PPZS that I did my thesis, supervised by CIRAD and INRA. I was then recruited by the Institut sénégalais de recherches agricoles (ISRA), and continued to work within PPZS, of which ISRA is a founder member. I have been PPZS coordinator since February 2018.

How has dP PPZS contributed in the past and how is it still contributing to public decision making in Senegal and on a regional level?

While for CIRAD, PPZS is a platform in partnership, in statutory terms, it is a scientific interest group covered by an agreement that is renewed by its member organizations every four years. For me, PPZS is primarily a research collective in which CIRAD, which was behind its creation, plays a key role. It is also a collective to which Senegalese national organizations are very attached, like ISRA, which hosts it and provides it with both financial and human resources. However, although other organizations are now heavily involved, if CIRAD were to pull out of PPZS now, the platform would not survive. The fact that local partners have not truly taken the platform on board stems, I think, from the basic position it has taken. Pastoralism is not a priority for the Senegalese government, which is more concerned with crops such as groundnut, millet, rice, etc. On a national level, transhumant pastoral systems – which are the heart of PPZS – do not fit in with the government's wish to modernize farming.

Nevertheless, PPZS has achieved some notable results. The fact that research teams have looked at the issue and produced scientific evidence has fuelled the arguments available to producer groups and helped pastoralism to become recognized. Leading bodies such as the World Bank have shown an interest. The

Bank has been funding major regional programmes to support pastoralism in the Sahel, such as PRAPS 1 and 2, since 2013. PPZS participates in top-level regional meetings on pastoralism, contributing on a range of topics such as peaceful transhumance. It recently took part in a foresight exercise on the future for transhumant livestock rearing in coastal countries, supported by the FAO, in which Swiss aid bodies have also expressed an interest.

PPZS celebrated its 20th anniversary in June 2020. It has been a shining example in terms of training: every year since its creation, it has received and trained around ten PhD or Masters students. I am one of the many beneficiaries. Researchers from PPZS also participate in doctoral schools, a number of Masters courses, etc.

What are the prospects for PPZS, as of 2021?

Its current activities and its prospects look promising. Let's hope that the various partners will adopt it more wholeheartedly. There are several ways of going about this: by co-constructing strategy with partners on a more equal footing; by promoting CIRAD's partner organizations more effectively when communicating about the platform on a global level; and by ensuring more effective advocacy, to strengthen the link between research and public policy in Senegal. ■

Pastoralism and drylands in West Africa

The PPZS platform in partnership for research and training [dP] is working towards sustainable pastoral livestock production that is better integrated into national economies and articulated with other production systems in dry zones. To this end, it is coordinating scientific partnership and knowledge generation in the field of pastoral livestock rearing, knowledge that is particularly useful for policymakers and pastoral and agropastoral communities on various levels. The platform associates four organizations: CIRAD, which is currently in charge of its coordination, and three Senegalese partners: the Centre de suivi écologique (CSE), the Institut sénégalais de recherches agricoles (ISRA) and Cheikh Anta Diop University (UCAD).

Training

From skills to international multi-stakeholder networks, long-lasting connections

Lucrèce Nlend Nkott, a 29-year-old researcher from Cameroon, did her thesis at CIRAD. Why CIRAD? What was special about the supervision provided and what doors has it opened? We hear her feedback.

Lucrèce Nlend Nkott, an economist, is a junior researcher from Cameroon. She defended her thesis at Institut Agro Montpellier in July 2021.

How and when did you come across CIRAD?

Before I arrived in Montpellier in 2016 for a Masters in development economics at Institut Agro, I obtained a degree in agro-economic engineering from the University of Dschang in Cameroon. That was where I first heard of CIRAD, which had sent representatives to recruit interns. And it was a six-month internship on cocoa certification in Cameroon as part of my Masters course that allowed me to work with CIRAD for the first time. I then passed the entrance examination for doctoral school, and was chosen to produce a thesis on the institutions and bodies governing varietal innovation in Burkina Faso and Madagascar, supervised by Ludovic

Temple from CIRAD's Innovation research unit. I defended my thesis on 1 July 2021.

What role did CIRAD play?

A financial one, first and foremost, as I received funding for my thesis from two projects (GeneRice and CoEx) funded by Agropolis Fondation. That enabled me to spend six months in Burkina Faso and another six in Madagascar, to gather data. In addition to that support, CIRAD really helped me to network, as I was able to meet and talk to researchers whose work I had read. I also met researchers in the Netherlands. This collaboration opened my eyes to other ways of doing research and showed me the merits of practical research for development, in association with

stakeholders on the ground, combining theoretical and empirical work. In practical terms, I contributed to two inter-institutional (research, NGOs, public sector) policy briefs on genome editing on upland rice in Madagascar and the seed sector in Burkina Faso*. During my two periods in the field, we organized stakeholder forums to bring together various groups of players.

As a junior researcher, what are your plans for the near future?

Just after I defended my thesis, I did an analysis for CIFOR-ICRAF of stakeholder networks in the cocoa sector in Cameroon. Having worked with producers during my engineering activities, I like working with a range of stakeholders. My thesis demonstrated that having everyone work separately is not very efficient. As a junior researcher, I came across some very different realities. In Madagascar in particular, women play a very important role in leadership, particularly in the research sector, and I did not feel discriminated against. In Burkina Faso, on the other hand, it is men who hold the

power, but I was lucky enough to work with a respected female researcher, Evelynne Compaoré, which made things easier. In fact, it was in my own country, Cameroon, that I encountered the greatest reservations as regards working with a young woman. As for the future, I am open to the idea of working overseas, but I would prefer to work in Africa, as it's the continent I know best. Working with CIRAD has been very fulfilling in human terms, and I would really like to carry on doing so. If you look at my research topics, you will always come across CIRAD, so the link between us is definitely not about to be broken. ■

* Temple L., Razanakoto O., Razafimahatratra M.H., Nlend Nkott A.L., Ramanitrinizaka F. N. Ai. 2021. *Gouvernance des conditions sociétales d'évaluation de plantes de riz génétiquement éditées à Madagascar*. Montpellier: CIRAD, 11 p. <https://agritrop.cirad.fr/598571/>

Sawadogo-Compaore E.M.F.W., Temple L., Ouédraogo S., Zongo Al., Soulama S. 2020. *Renouveler la gouvernance du secteur semencier au Burkina Faso pour un développement inclusif*. Ouagadougou: ISA, Information pour la sécurité alimentaire, 4 p. <https://agritrop.cirad.fr/595543/>





Leila Ben Amor Mathieu, a sociologist specializing in the media, leads the Human Development Team at the EU Delegation in Abuja (Nigeria). The team is in charge of cooperation activities in terms of education, social protection and social safety nets (hence environment and agriculture), nutrition, and health.

Innovation and impact

The European Union, a very engaged donor: the case of the LIDISKI project (Nigeria)

CIRAD's partners in Africa also include donors. One example is the European Union, which is funding the LIDISKI project in Nigeria. We talk to Leila Ben Amor Mathieu, Human Development Team Lead at the EU Delegation in Nigeria.

Why is the EU funding the LIDISKI project, and how is the project combining innovation and impact?

The European Union sees animal health as a priority for Africa, particularly given its potential to alleviate poverty. Supporting animal vaccination through this type of project is one way of guaranteeing livestock health and improving farmer incomes, with the broader aim of alleviating poverty, which is what the sector I work in is striving to do. The LIDISKI project was designed as a close partnership between veterinarians on the ground and research organizations, to make sure that practitioners would take its activities on board. The way in which it is organized makes its implementation both efficient and effective, which is a vital factor for impact. I attended one of its reporting workshops, and saw that the veterinarians involved were really satisfied with their relations with CIRAD, which is really important. The close links within the project between the Nigerian partner organization, CIRAD and players on the ground are a sign of the project being implemented consensually, with stakeholders playing a full role.

What can you tell us about the relationship between the EU and CIRAD regarding this project?

Right from the outset of the project, we have had a great relationship with CIRAD, whose expertise we really appreciate. One of the things we like most is CIRAD's constant efforts to communicate, which have made project monitoring quick and easy. Our project manager and the people in charge of implementing the project are on the same wavelength when it comes to project operations. At the delegation, we have a lot of projects and partners, and those partners generally restrict themselves to submitting reports and other contractual documents. In the case of LIDISKI, we feel as if we know the project well, because we are invited to its workshops and party to a regular flow of information about the project. Moreover, the project fully respects our criteria regarding visibility, transparency and reporting. This is a source of great satisfaction for us.

What is special about working with CIRAD?

CIRAD is one of our many partners, I wouldn't say there was anything entirely specific. At the EU, we have rules, operating methods and assessment criteria that outline our relations with our implementing partners. In theory, we should therefore have the same sort of relationship with every partner, within that set framework. However,

that doesn't mean that the way in which our partnerships operate on a daily basis doesn't vary depending on the organizations involved. In the case of this project, we have an easy relationship, and I hope this will continue and that the project will continue to build veterinary capacity in Nigeria. Things are looking good. My team appreciates the expertise demonstrated at the project workshops. Moreover, the Covid-19 crisis has proved how robust CIRAD is: it has managed to continue its work while respecting the health regulations applicable in Nigeria (number of people per workshop, etc.). The project's Nigerian partners are very grateful that CIRAD has remained present and continued student and researcher exchanges despite the crisis. ■



LIDISKI, guaranteeing food security in rural zones, via technological innovations that are sustainable in climate terms

The LIDISKI (Livestock Disease Surveillance Knowledge Integration) project, funded by the EU, is a four-year project (2020-2023) being implemented by a consortium led by CIRAD, the National Veterinary Research Institute (NVRI), IZSVE in Italy, and Ikore. It aims to use knowledge gathered from players in the animal health sector to build tools and expertise for use in establishing sustainable surveillance and control strategies against livestock diseases, particularly Newcastle disease (ND) in poultry and peste des petits ruminants (PPR). In supporting this sector, LIDISKI is helping to boost food security and improve the quality of life of farmers and livestock owners in Nigeria.

Scientific research as a development driver



In the light of the challenges posed by sustainable development in the global South in the current demographic, climate, environmental and social context, CIRAD and its partners are convinced that there is a growing need for knowledge and innovations. To tackle those challenges and ensure that it is capable, through science, of helping societies in the global South to make a range of unprecedented transitions, CIRAD has identified six priority research topics.

Each of those topics relates to a major research issue shared with our partners in the global South, on which CIRAD has chosen to work collectively, in an integrated, multidisciplinary way, so as to reinvent, diversify and broaden its scientific and partnership-based output.



Biological inputs

Steady growth in Latin America ■

Several Latin American countries are increasingly active in the production of biological inputs. Some are supporting this with incentive programmes and changes to their regulations, albeit without breaking with industrial agricultural production models. The latest issue of *Perspective** examines these trends.

In Latin America, public policies are increasingly designed to encourage the use of alternatives to agrochemicals (pesticides and fertilizers). However, this promotion of biological inputs, or bioinputs, does not break with industrial agricultural production models. Instead, the States are seeking to foster coexistence between chemical and biological inputs in the context of a transition towards the bioeconomy.

Multinational agrochemical companies have invested in the bioinputs sector through numerous buyouts of national companies. They are thereby establishing themselves on this emerging technology frontier, enjoying high growth on South American markets. However, farmers' groups are a step ahead of public action with the on-farm production of bioinputs. Brazil is a frontrunner in this dynamic. Since the mid-2010s, a network of large farms, both conventional and organic, has been formed at the federal level to encourage the on-farm production of microorganisms for fertilization or plant health. These dynamics pose certain problems for the State and for the booming bioinputs industry. Industrialists want to guarantee the intellectual property of their microbial strains and are exerting pressure to prohibit on-farm reproduction of microorganisms derived from their commercial products, a practice they class as "biopiracy".

In France and Europe, on-farm production of microorganisms is currently totally or almost totally non-existent. However, there is growing interest in biocontrol, in agroecology, and in

the reappropriation by farmers of certain activities in terms of technology design and use. Close attention must therefore be paid to current innovations in South America and to the way in which they are helping to renew relations between farmers, agricultural research and the inputs industry.

* *Perspective*, the CIRAD policy brief, has been published since 2009, primarily in English and French, with certain issues in Spanish or Portuguese. Authors use their scientific results to suggest new lines of debate and action on issues of strategic importance for countries in the global South.

All issues of *Perspective* :
<https://revues.cirad.fr/index.php/perspective>



Biological inputs, or bioinputs, include both biofertilizers and pest and disease biocontrol products



A. Rival © CIRAD

In Vietnam, farmed ducks eat the pests that attack rice paddies

Agroecology, a bulwark against viral zoonoses ■

A study published by researchers from CIRAD in *Science of the Total Environment* indicates that agroecological crop protection reduces the risks of the emergence of viral zoonoses. At the interface between human, animal and ecosystem health, viral zoonoses – such as Covid-19 – are transmitted either by arthropod vectors, such as mosquitoes, or by vertebrate reservoirs, crop pests, or pest predators. This review of scientific articles establishing the actual or potential impacts of different crop protection techniques on the emergence of viral zoonoses has helped to identify a clear trend: conventional crop protection practices, using pesticides and inputs, ultimately increase the risks of virus emergence, whereas agroecological crop protection reduces those risks.

alain.ratnadass@cirad.fr

VIABILITY

The keys to an agroecological transition in Africa

Unloading manure at a composting site
in Madagascar



© T. Raharison, CSDM

The possibility of transforming African agriculture on a large scale by means of agroecological practices is still under debate, despite many success stories. The three-year Viability project, launched in 2021 and coordinated by CIRAD and ICRAF, set out to document the viability of such practices in nine African countries. Its initial results show the advantages and drawbacks of agroecology, such as improved food security or, conversely, its labour-intensiveness.

It is the first project to be implemented within the framework of the Agroecology Transformative Partnership Platform (TPP). The platform, launched by France and CGIAR in 2021, is intended to transform food systems and to spearhead the agroecological transition.

nadine.andrieu@cirad.fr

Viability is funded by the French Ministry for Europe and Foreign Affairs

Agroecological transitions

All news items on this topic



Boost-AE, a platform to speed up the agroecological transition

Boost-AE is a collaborative platform to enable knowledge sharing and bring together agroecology players worldwide. This CIRAD initiative is a multi-partner forum to facilitate agroecological transitions in tropical and Mediterranean regions. Boost-AE is backed by an interactive, collaborative website that allows public- and private-sector players in the agroecological transition to make themselves known and find future partners. Relational mapping is used to visualize and understand who is doing what, where and since when. A collaborative document base contains the outputs of scientific or development projects and many other resources: reports, books, practical guides, videos, etc. Boost-AE also has the advantage of a powerful search engine.

nadine.andrieu@cirad.fr

Find out more: <https://boost.cirad.fr/fr/1/home.html>





CoEx

When smallholders shape biodiversity

The CoEx project, which ended in May 2021, set out to describe seed systems in West Africa, with a view to building more effective, fairer public policy. We look back at the main results.

Public policies are struggling to accompany farmers' organizations in their access to and management of seed. How do smallholder farmers source seeds, how do they use them and for what purposes? Coordinated by CIRAD and financed by Agropolis Fondation, the CoEx project looked at these questions for more than four years, studying the different crops grown in Burkina Faso, Mali, Niger and Senegal. Eleven research laboratories and seven farmers' organizations were involved, mobilizing several scientific disciplines. The first focal area of the CoEx project highlighted the different seed strategies at the local level. In West Africa, the diversity of seed management practices translates into a multitude of "standards", whether legally formalized or not. One part of the project focused on these legal and economic aspects, with the ultimate goal of aligning this multitude of rules and practices and ensuring maximum stakeholder participation in decision-making. Possible modes of collaboration between research and farmers' organizations were also studied.

selim.louafi@cirad.fr • mathieu.thomas@cirad.fr



© R. Belmin, CIRAD

A smallholder sowing his field
in the Mboro region, Senegal

Learn about the CoEx project in five minutes
(in French):
<https://youtu.be/FDfkC4Xic70>



The CoEx project was funded by Agropolis Fondation.

Preventing pandemics: what progress has been made worldwide?

In July 2020, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) assembled a panel of experts to look at the scientific evidence of the origin of Covid-19 and come up with solutions to prevent future pandemics. One of the causes identified by the experts was over-exploitation of nature, and one of the solutions the rollout of One Health approaches encompassing environmental health. A year on, a few weeks ahead of the IUCN World Conservation Congress in Marseille from 3 to 11 September, Serge Morand (CNRS-CIRAD) and Claire Lajaunie (INSERM) looked back at what could be drawn from the experts' report and the progress made since, in an article published in *One Earth*.



Cattle farm in the Mucheni region, Zimbabwe (SWM Programme)

© Brent Stirton - Getty Images for FAO, CIFOR, CIRAD, WCS



Biodiversity

All news items on this topic



Adansonia suarezensis
baobab stand in northern Madagascar.
The species could disappear from
the island by 2100 due to the increase
in seasonality in the tropics

© C. Cornu, CIRAD

See the results of the study
in a video:

[https://www.youtube.com/
watch?v=eFu1lMY1R88](https://www.youtube.com/watch?v=eFu1lMY1R88)



Climate change

Madagascar's baobabs are in danger

According to a study published in *Global Change Biology*, four of the seven baobab species found in Madagascar could disappear by 2100. For three of them, the cause is the increase in seasonality, in other words climate variations in the course of the year.

Of the eight baobab species known in the world, six are endemic to Madagascar. Three of them are particularly sensitive to temperature variations over the year. They are distributed throughout the northern part of the island, close to the Equator. In order to adapt to the increase in temperature seasonality, these species should in theory migrate further north, towards the Equator. However, the terrestrial limits of the island of Madagascar would prevent the dispersal of these species in this direction, and would lead to their probable extinction. The article

– published by a team of researchers from CIRAD, the University of Picardy in France, FOFIFA in Madagascar and the University of Santa Catarina in Brazil – builds on a database covering the entire island, derived from field surveys conducted by teams from CIRAD and FOFIFA since the early 2000s. Although anticipation of and adaptation to climate change are necessary, these new findings show that the most important thing is to minimize this change by limiting greenhouse gas emissions in the atmosphere.

ghislain.vieilledent@cirad.fr

220 million ha of tropical rainforest have been lost since 1990

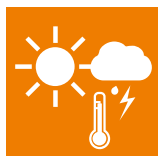
A team of scientists from the Joint Research Centre (JRC), CIRAD, CIFOR and INPE published groundbreaking work in the March issue of the journal *Science Advances*: 30 years of satellite data on disturbances in tropical forest cover throughout the world. The maps provided show the evolution of deforestation and forest degradation since 1990 with an unprecedented degree of accuracy. The study reveals that deforestation has been largely underestimated by previous studies, in particular on the African continent. In Africa, the deforestation associated with slash-and-burn agriculture forms a patchwork of small but numerous areas, which makes it more difficult to detect by satellite. On a global level, 17% of tropical rainforests have disappeared in favour of agriculture and other land uses since 1990.

ghislain.vieilledent@cirad.fr

Since 1990, 17% of tropical rainforests have disappeared
in favour of agriculture and other land uses



© V. Cond, CIRAD



Climate change

Agroecological transitions

Food systems

Albedo

Reassessing carbon sequestration practices

Albedo is the capacity of the soil to reflect or absorb solar radiation. It conditions land surface temperatures. What do we know about the linkages between albedo, climate change and soil carbon storage? A workshop reviewed the current knowledge on this question.

Biomass carbon sequestration techniques alter the capacity of soil surfaces to reflect solar radiation. These aspects are under-researched, even though they could limit – or even reverse – the positive climate effects of certain agricultural practices. If ignored, biogeophysical effects can result in sub-optimal or even counter-productive climate change mitigation policies. Soil carbon sequestration practices need to be reassessed in view of biogeophysical effects, and this must be done in detail on a local level, as the effects are very context-specific: climate, soil type, species, etc. For example, the application of biochar – a charcoal of plant origin – on light surfaces significantly reduces the albedo and increases land temperature. Biochar contributes to carbon storage and reduces emissions of nitrous oxide (N₂O), a powerful greenhouse gas, but this climate benefit declines by 30% when we consider albedo. The practice can nevertheless be improved in order to reduce this negative effect, by applying biochar on dark surfaces, to crops under permanent cover, burying it, or even mixing it with white clay or lime to lighten it.



© R. Cardinael, CIRAD

Albedo measurements will be taken in Zimbabwe in conservation and conventional agriculture plots managed by the International Maize and Wheat Improvement Center (CIMMYT)

At a virtual workshop organized by CIRAD and the CLAND Convergence Institute, more than 300 scientists from 52 countries met to share and discuss the latest knowledge on the subject.

remi.cardinael@cirad.fr

Taking account of food security in targets to reduce methane emissions



© R. Carayol

Methane is a potent greenhouse gas arising from the production of milk, meat, eggs and rice. Stabilizing the climate will require global methane emission cuts of 24-47% by 2050, compared with 2010. A new study has looked at the consequences for food security of various ways of determining fair national targets for methane emissions by 2050. It set out to demonstrate the implications for food production, the land area available for CO₂ offsetting and issues of international equity. For instance, to satisfy national emissions constraints, Brazil and Ireland could maintain some milk and beef exports, but India would have to reduce its production of livestock and rice to only 30% of national calorie and protein requirements.

remi.prudhomme@cirad.fr

Cattle farming is a major methane emitter

For a sustainable and resilient rubber sector in Southeast Asia



The Agence française de développement (AFD) has awarded CIRAD a 1.5 million-euro grant for the FORSEA regional project (FOrecasting impacts of climate change and workforce availability on natural Rubber commodity chain in South-East Asia). The project will be implemented with a consortium of partners in Cambodia, Thailand and Vietnam.



Harvesting latex from rubber trees

I. Vagneron © CIRAD

Central Africa

The region's forests are highly vulnerable to climate change

An international study coordinated by researchers from IRD and CIRAD reveals the composition of the tropical forests of Central Africa and their vulnerability to the increased pressure from climate change and human activity expected in the coming decades.

Central Africa is home to the world's second-largest area of dense tropical rainforest. This major reservoir of biodiversity stretches out over five main countries: Cameroon, the Central African Republic, the Democratic Republic of Congo, Gabon, and the Republic of Congo. It provides numerous ecosystem services, such as regulating exchange cycles between the earth and the atmosphere, and helps to ensure food supply for local populations. Due to the threats from climate change and demographic pressure expected in Africa by the end of the 21st century, the protection and sustainable management of these forests is a challenge for policymakers. It requires better knowledge of these ecosystems, in particular their composition and vulnerability to the changes under way. Using an exceptional dataset – an inventory of more than 6 million trees in the above five countries – researchers have produced the first continuous maps of the floristic and functional composition of these forests, allowing them to identify the most vulnerable areas. The results were published in the journal *Nature*.

sylvie.gourlet-fleury@cirad.fr

Central Africa is home to the world's second-largest area of dense tropical rainforest, stretching over five main countries: Cameroon, the Central African Republic, the Democratic Republic of Congo, Gabon, and the Republic of Congo

Climate change

All news items on this topic



E. Forni, CIRAD



Food systems



Agroecological transitions



Climate change

Transforming agrifood systems

Food systems lie at the crossroads between the major challenges for humanity. Based on its several decades of experience in tropical and Mediterranean countries, CIRAD is calling for a far-reaching transformation of those systems. In 2021, the year of the United Nations Food Systems Summit, a team from CIRAD published a position paper setting out the five priorities if it is to contribute to that transformation, from developing and rolling out innovative agricultural production and food processing technology and practices to supporting multi-stakeholder governance.

arlene.alpha@cirad.fr



© A. Bichard

Sustainability

Diagnoses and debates to fuel action

What levers could be used to improve food systems? The European Union, FAO and CIRAD have joined forces to make rapid diagnoses of food systems in more than forty countries. The first results were obtained in Burkina Faso.

The Food System Assessment (FSA) project set out to conduct national food system diagnoses to support policymakers working to make food systems more sustainable and resilient. In all, 47 countries have signed up. A “sustainable” food system meets four criteria: it ensures food and nutrition security and health; it provides jobs and contributes to GDP; it reduces inequality between territories and between the players involved in it; and it preserves natural resources. The diagnoses, based on qualitative and quantitative data and using a participatory approach, contributed to the runup to the United Nations Food Systems Summit. The first brief in the series, “Catalysing the transformation of sustainable food systems: Early Insight – Burkina Faso”, highlighted four levers for action: diversifying diets to fight malnutrition, supporting family farming, reducing inequality between territories, and transforming agricultural production practices.

ninon.sirdey@cirad.fr

helene.david-benz@cirad.fr

claire.orbell@cirad.fr



Tintilou market, Burkina Faso

Combining tradition and modernity to build inclusive, sustainable food systems

The number of people living in cities in Africa, Southeast Asia and Latin America is forecast to grow by about 25% by 2050. As a result, urban food systems in these regions will have to tackle food, health, social and environmental challenges. Running counter to an outdated idea that “traditional systems” are backward in relation to “modern systems”, an international team of researchers coordinated by CIRAD has characterized six types of urban food systems specific to cities in the global South, and identified five levers for action centring on initiatives with moderate use of energy and capital.

paule.moustier@cirad.fr



A. Rival © CIRAD

Moramanga market, Madagascar

Mobile street food seller, Jakarta, Indonesia

From farm to dustbin

Food waste accounts for 10% of global GHG emissions

Some 30 to 40% of the food produced worldwide is either lost or wasted. That total accounts for 10% of global greenhouse gas (GHG) emissions. This vital issue, which was everywhere at the United Nations Food Summit, is a common thread in several CIRAD research projects.

Food loss and waste is one of the key issues flagged up by a multi-stakeholder process to prepare for the United Nations Food Summit on 23 September 2021. It is also a key element in CIRAD's strategy. Our projects cover postharvest losses and food wastage, as well as waste food recycling, from farm to dustbin.



© Eberhard, Adobe Stock

Three projects stand out in this field.

- SAFOODS (based in Dakar and Ziguinchor in Senegal and Yamoussoukro and Abidjan in Ivory Coast) set out to assess the climate-related constraints on fruit and vegetable food systems, and to work with value chain stakeholders to build innovations. Based on the diets of urban consumers, SAFOODS is working to map food chains and identify where waste and loss occur and the critical points where climate change may threaten food chains, and collaborating with local players to build solutions to the weak spots identified.
- BioStar is working to improve energy supplies to agrifood processing SMEs in West Africa, by recycling their waste to produce heat, mechanical power and/or electricity. The project will enable agrifood SMEs to set up in rural areas, near agricultural production sites. It will create rural jobs and above all reduce postharvest losses.
- Lastly, MARIGO set out to develop agroecological periurban market gardening chains in Ivory Coast, to guarantee healthy, sustainable production in a context of climate change. It includes a specific component on reducing vegetable losses in terms of both quantity and quality. For instance, developing accessible, innovative postharvest technology will help extend the shelf life of vegetables on local markets.

sandrine.dury@cirad.fr



Food systems

All news items on this topic





One Health

CAZCOM

Working towards autonomous national animal disease surveillance

Two years after its launch, it is time to take stock for the CAZCOM project, aimed at building animal disease surveillance capacity in Zimbabwe. The balance is highly positive, offering promising prospects for a follow-up project to step up previous actions.

A fully equipped, operational molecular biology laboratory of international calibre within the Faculty of Veterinary Science at the University of Zimbabwe, 200 technicians, engineers and researchers trained, seven Masters students supervised and a new research project to step up the actions begun by CAZCOM. Those few figures sum up the achievements of this project aimed at building animal surveillance capacity in Zimbabwe. At the same time, links with national veterinary services have been strengthened and collaborations with international research institutions are underway, along with the development of partnerships with the private sector. CAZCOM was completed in late 2021, and is now being supplemented and intensified by the PACMAN programme, to train even more staff members in diagnostic techniques and to turn the molecular biology laboratory into a true biotechnology platform. This will help to speed up response times for health actions from several months to just a few days during epizootic events.

CAZCOM was funded by the French Ministry for Europe and Foreign Affairs, via the French Embassy in Zimbabwe.

Video:

https://youtu.be/v5A_2oJocTI



© A. Jimu

Taking a blood sample from a cow as part of the CAZCOM project in Zimbabwe

One Health

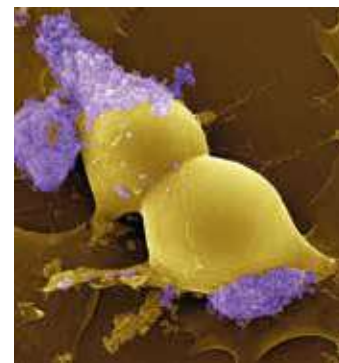
All news items on this topic



Boosting immunity to tackle antibiotic resistance

Two scientists from CIRAD have identified virulence proteins for a whole family of bacteria. The goal of this research is to build on new immunotherapies aimed at boosting the cellular pathways attacked, rather than destroying the bacteria with antibiotics. The focus is on the fight against antibiotic resistance, a growing global problem. Working on ways to strengthen the immunity of host cells serves to avoid the selection pressure exerted by the use of antibiotics. That pressure results in the mutation of certain bacteria, which then become resistant to antibiotics.

damien.meyer@cirad.fr



© D. Meyer, CIRAD

Ehrlichia ruminantium bacteria (purple) infecting a bovine aortic endothelial cell in the process of division

Probing the past to predict the future

Centuries-old herbaria have vast potential for retracing the evolutionary history of crop pathogenic bacteria. Two articles published in 2021 showed that an understanding of those bacteria is a prerequisite for improving our ability to predict the dynamics of both current and future diseases.

Researchers from CIRAD in Réunion and the Muséum national d'Histoire naturelle (MNHN) had already demonstrated – by working with the Mauritius Herbarium to retrace the evolutionary history of a bacterium infecting citrus in the Indian Ocean – that it is possible to use historical herbaria to trace the



© L. Gagnevin, CIRAD

Researchers have studied tens of ancient herbaria worldwide. Here, the Smithsonian Institution in the United States

evolution of pathogenic bacteria that affect crops. They have now repeated the exploit for a virus that causes a serious cassava disease. By sequencing small interfering RNAs from a 1928 cassava specimen, the researchers were able to rebuild almost the entire genome of one of the viral agents that cause African Cassava Mosaic Virus (ACMV). They were then able to estimate the speed at which the virus evolved, and to date the existence of the ancestor shared by all African isolates to the 1850s or thereabouts. *"This estimate predates those made solely using contemporary specimens isolated in the field by more than a hundred years. It is more consistent with historical records, since the oldest descriptions of the disease date back to 1894 in Tanzania"*, said CIRAD's Adrien Rieux, lead author of the article published in the journal *Nature – Scientific Reports*. Thousands of specimens in herbaria held by natural history museums all over the world have yet to be explored, and DNA analysis techniques are continuing to evolve rapidly, offering some exciting new research possibilities.

lionel.gagnevin@cirad.fr • adrien.rioux@cirad.fr

In Gabon, kinship systems affect the spread of various cassava viruses



© M. Delêtre

Cassava mosaic disease (CMD) is one of the most important crop virus diseases in Africa. In a study published on 23 July 2021 in the journal *Nature Communications*, a team of researchers from the National University of Galway (NUIG) and CIRAD looked at how the social factors that govern cassava variety exchanges between communities also influence the spread of the virus variants that cause CMD. The study showed that viral diversity was much greater in communities that actively exchanged cassava cuttings.

jean-michel.lett@cirad.fr

Woman planting cassava cuttings infected by mosaic disease (Gabon, 2004)

Pinpointing the risks and zones of infectious disease emergence in Southeast Asia

In a study published in *Microbiome* on 21 January, an international research team revealed the viromes, in other words the genetic material (DNA or RNA) of the viruses carried, of more than thirty species of rodents and insect eaters in Southeast Asia. This is a major step forward, which provides a clearer picture of the diversity of those viruses. Comparing virus ecology information and farming practices in a given territory allows researchers to pinpoint areas with a higher risk of disease emergence. The wide range of viruses discovered is cause for concern, in view of the current trend towards farming wild animal species in the region.

Many crop pests, such as rodents, carry viruses. Crop protection practices are therefore a major link in the disease emergence chain



© V. Herbreteau, ANR



Territory-based approaches



Agroecological transitions



Climate change

T2GS

When rural communities (re)invent groundwater management

The T2GS project is studying and assessing several local groundwater management initiatives. These collective initiatives are a source of inspiration to address the overexploitation of aquifers.

The Transformations to Groundwater Sustainability (T2GS) project is studying and assessing local initiatives within rural communities aimed at establishing common rules for access to water, preserving the resource and ensuring its equitable sharing. After a year and a half of fieldwork among rural communities in Algeria, India, Morocco, Peru, Tanzania and Zimbabwe, the scientists have presented their first findings. The solutions are not to be found in the individual control of water use, or in an increase in water supply, but in the collective management of groundwater resources. One of the challenges of T2GS is to erase the boundary between scientific knowledge and that of local people, with a view to mutual enrichment. The project is also highlighting the importance of transdisciplinarity in research. While hydrology is necessary to work on access to groundwater, alone it is not enough to design fair and sustainable governance systems.

marcel.kuper@cirad.fr



© R. Belmin, CIRAD

Sustainable use of groundwater depends on collective management of the resource

T2GS has financial support from the Agence nationale de la recherche (ANR).

The land acquisition race is not over yet

The Land Matrix, an international initiative set up to monitor land acquisitions, of which CIRAD is a member, recorded 1865 transactions between 2000 and 2020, for a total area of 33 million hectares. That staggering total is comparable in size to Italy or the Philippines. Expanding agricultural production on the acquired land is a threat to rural livelihoods and natural habitats. Although progress has been made in terms of land governance, there is an evident lack of policy implementation in this area. In a new report, the Land Matrix analyses the impacts of large-scale land acquisitions ten years after the surge, and raises the alarm, as the current signals point to a probable new rush.

ward.anseeuw@cirad.fr

Land acquired as an investment in the Sahel © J. Bourgoïn, CIRAD



Territory-based approaches

All news items on this topic

SERTÕES

Integrating water management, agriculture and energy efficiency to fight climate change

The Sertões project aims to pinpoint levers for the agroecological transition and to co-construct new local modes of governance for both water supplies and rural zones in Ceará state, Brazil.

An action research project, Sertões, coordinated by CIRAD and due to run for three years, has been launched in Nordeste, the most impoverished region in Brazil and the most sensitive to climate change. It is the fruit of an almost 20-year partnership with the Meteorology and Water Resource Center of Ceará State (FUNCEME), and is intended to foster territory-based approaches that encompass the water, agricultural and energy sectors. CIRAD scientists will be coordinating a wide-ranging consultation programme, covering interlinked topics such as watersheds, hydrological systems and agricultural production. These exchanges of viewpoints on land and resource use are aimed at: analysing the impacts of climate change and the effects of public policy on the links between water, agriculture and energy; identifying agricultural development pathways that emit less greenhouse gas; and building the capacities of institutions in the water sector. The involvement of State decision-makers is one of the project's strengths.

julien.burte@cirad.fr • veronica.mitroi@cirad.fr

Sertões has financial support from the Agence française du développement (AFD).

The results of the project will be presented by AFD on the 2050 Pathways Platform.



Storing domestic water, Ceará, Brazil



© J. Burte, CIRAD

NIAYES 2040

What does the future hold for the Niayes region?



Harvesting potatoes in the Niayes
© C. Jahel, CIRAD

In Senegal, the Niayes region – the country's leading horticultural zone – faces a range of challenges: falling water tables, urban sprawl, pollution, and so on. What might it look like in 2040? The Niayes 2040 research project, which ended in 2021, built several possible change scenarios. The underlying aims were to fuel debate about the future, inform decisions, and demonstrate the possibility of steering territories towards a desired future. This foresight exercise was followed by several debriefing sessions and debates, involving a range of stakeholders. Those workshops pinpointed six plausible futures, and the pathways to them, which are summarized in a 12-minute video: "Six brèves histoires du futur".

robin.bourgeois@cirad.fr
cammille.jahel@cirad.fr

https://youtu.be/cyT6_H2M33k



Niayes 2040 has financial support from the Agence française de développement (AFD).

Training

The focus is on partnerships and decompartmentalization

In 2021 more than ever before, CIRAD's training operations were conducted in partnership. The launch of the POLLENIS joint research unit with Institut Agro is a prime example. Meanwhile, in Southeast Asia, the TALENT project has demonstrated the need to decompartmentalize training for plantation managers, to boost sustainability.



Interview with Magali Dufour, teaching and training officer at CIRAD

What were the 2021 highlights in terms of training at CIRAD?

One of the main events was the signing by Institut Agro Director General Anne-Lucie Wack and CIRAD CEO Élisabeth Clavier de Saint Martin of the framework

agreement between the two organizations to step up cooperation in the field of training. At the same ceremony, they also signed an agreement on the creation of a shared platform for teaching and training engineering in the global South, called POLLENIS. The first POLLENIS steering committee meeting was held in November, and the operational coordination unit is gradually taking shape. The aim is to work with partners in the global South to build more structuring projects and capitalize on the methods and resources generated as a result of projects.

With POLLENIS, we participated in drafting responses to a call for projects issued by the Agence nationale de la recherche (ANR) and the Agence française de développement (AFD) under their programme to boost partnerships with higher education in Africa. Two projects have received funding : PETTAL, in Senegal, in partnership with the University of Sine Saloum El Hadj Ibrahima Niass (USSEIN), aimed at promoting professional higher education firmly anchored

in territories, to support the agroecological transition within food systems; and the BIOVALOR project, in conjunction with the University of Abomey Calavi in Benin and the École nationale supérieure en agronomie et industries alimentaires (ENSAIA) at the University of Nancy, France. The latter project aims to boost an entrepreneurial approach, skills and culture within the agricultural higher education sector in Benin, by promoting levers for professional integration and the development of the bioeconomy.

In Montpellier, we also hosted an education steering committee meeting as part of the Erasmus+ Geomag project coordinated by the University of Carthage (Tunisia). The main aim of the project is to structure and optimize management of the sector and of agricultural areas and the environment in Tunisia by means of better use of geomatics. Eight universities in Tunisia and eight European organizations*, including CIRAD, are involved in the project. Within this framework, we took part in an analysis of training requirements and in the construction of training modules for existing Masters courses or continuing education.

The Agricultural training for plantain banana growers in Africa project (FABA) continued in 2021. A participatory workshop in Abidjan (Ivory Coast) in September brought together some fifty partners from Cameroon and Ivory Coast in the hope of determining training objectives and the resources required. The workshop, involving pro-

ducers, technicians and decision-makers, included a field trip to an agroecological plantation.

What are the prospects for 2022?

Our team will have a new recruit. A road map is being drafted for our Training Ambition. It will highlight the ramping up of POLLENIS, and the modernization of the e-learning platform thanks to funding from the Occitanie Regional Council. At the same time, we will be continuing to help CIRAD's various units and collectives, notably the platforms in partnership for research and training (dPs) and value

chains, with their training activities, in line with a Qualiopi-certified quality approach. The eventual aim is to roll out that approach to all our training activities. Lastly, on an institutional level, we will be working to strengthen our links with training organizations in both North and South, via our regional offices, while keeping a close watch on donors liable to fund training, to diversify our sources of funding. ■

* Notably CNAM, AgroParisTech, ENSG, the Romanian Space Agency and the University of Cordoba.

POLLENIS: how does it work?

The creation of the POLLENIS joint platform for training engineering in the global South follows on from a long line of joint training activities between Institut Agro (IA) and CIRAD. An official agreement was signed on 12 July 2021, and the shared platform marks the two organizations' shared desire to step up training operations and exploit their complementarities. POLLENIS associates three experts from IA and three from CIRAD, working to engineer teaching, training and skill-building activities in the global South that will strengthen the links between research-training-innovation and development. The intended field of training is extremely broad: higher education, professional training, diplomas, modules, teaching resources, and accreditation of training courses. POLLENIS works in addition to the other support services involved in project engineering. It has a triple role: to facilitate the building and implementation of projects with a training

component; to diversify partnerships; and to pool and capitalize on resources and tools. Its expertise is backed by the partners' sound experience of training on the ground in the global South, and their presence in territories based on a dense network (academia, universities, research, civil society, agriculture, etc.). The steering committee includes an equal number of representatives from both organizations, with the chair alternating between the two and currently held by CIRAD. This oversees the unit's operations on the one hand, which will be confirmed by a charter, and on the other, its thematic, geographical and partnership priorities, in line with the two organizations' strategies, including CIRAD's Training Ambition.

lucie.lemagnen@cirad.fr

Changing perspectives, training in sustainability

Plantation managers face a growing number of issues relating to sustainability. In Southeast Asia, the TALENT programme, coordinated by CIRAD and funded by AFD, has set out to raise awareness of those issues among plantation managers by means of training.

We talk to programme coordinator Alain Rival.



How did TALENT come about, and what are the aims?

I am a visiting lecturer at University Putra in Malaysia, and I realized that there was a disconnect between sustainability training and day-to-day teaching for future agricultural and forestry engineers. From the main global challenges to everyday practical aspects, sustainability issues are not directly addressed in teaching, and young agronomists are not always aware of their importance, or of current changes in their fields of work. However, major changes are indeed under way, and plantation managers are now responsible for sustainability. Their role encompasses every aspect of sustainability, whether economic, social or environmental. Even now, teaching is split between closed silos: soil science, terrestrial

and marine ecology, input and effluent management, etc. are all taught separately. This is what prompted the creation of the TALENT programme. It has 1.2 million euros of funding over five years from AFD, and covers four countries (Indonesia, Malaysia, Thailand and Vietnam) and several value chains: paper pulp, timber, oil palm and rubber. It has four target groups: agricultural science students, plantation managers, cooperative managers and bank executives involved in funding agricultural programmes.

What are the main innovations TALENT has brought?

Decompartamentalizing training, practice and theory is the first, and showing that raising awareness of sustainability is a continuous process that does not stop at the farm gate. Sus-

tainability in the world of tree crop plantations, in Asia and elsewhere, must be backed by a new way of managing landscapes in all their diversity: not just farms and managed forests, but preserved areas and zones in which crops and forests live side by side. If we want to improve practices, we need to raise awareness among and train each and every profession and stakeholder, both current and future. We hope that students, and people in continuing education, will change their perspective and eventually their day-to-day practices. ■

Further information:
talent-programme.org/

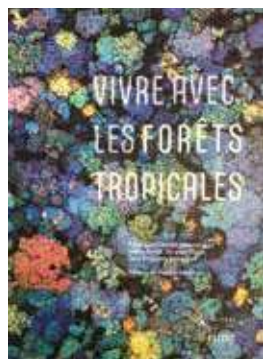


2021 PUBLICATIONS

Books for the general public

Living with tropical forests: a fresh look at relations between people and forests

Vivre avec les forêts tropicales is the result of 75 years of experience of forestry research, and was written by a group of more than 50 scientists from CIRAD's Forest and Societies research unit. It comprises portraits of and testimonials from people living with forests, and while it does not shy away from the current controversies surrounding conservation policies, it is a real invitation to travel.



Vivre avec les forêts tropicales.
P. Sist,
C. Doumenge,
V. Gond, J. Tassin,
J-F. Trébouchon
(eds).
Éditions MUSEO,
2021, 216 p.

The insects of the world, a tribute to a remarkable wealth of biodiversity

This insect "bible", the first such book in French about classification of the world's insects, provides new keys to identifying every order and most of the 1262 known families of insects. It is the fruit of 14 years' work by 52 authors of 14 nationalities, coordinated by Henri-Pierre Aberlenc, an entomologist from CIRAD, and also involved six other CIRAD researchers. Its 1800 or so pages and 5000 illustrations are intended for anyone at all interested in nature and the animal kingdom.

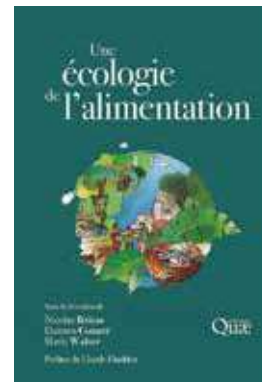
Les insectes du monde. Biodiversité, classification, clés de détermination des familles.
H-P. Aberlenc (coord.).
Éditions Quae and MUSEO, 2021, 1 876 p.



For ecology of food

Une écologie de l'alimentation falls somewhere between an expert essay and a narrative illustrated with examples from the four corners of the world, and marks the tenth anniversary of the UNESCO Chair in World Food Systems. It is intended for both professionals and members of the public interested in sustainable food issues. The concept of ecology of food serves to take a fresh look at the watchwords relating to sustainable food, with some surprises in store. It also aims to fuel citizen, public and private initiatives to transform food systems..

<https://doi.org/10.35690/978-2-7592-3353-3>



Une écologie de l'alimentation.
N. Bricas,
D. Conaré,
M. Walser.
Éditions Quae,
2021, 312 p.

Scientific works, studies and reviews

Zoonoses, diseases that link us with animals

Four specialists in zoonoses, including Serge Morand, an ecologist from CIRAD and the CNRS, have published a new book providing a clear, practical summary of the state of knowledge on these diseases that can be passed between humans and animals.

<https://doi.org/10.35690/978-2-7592-3271-0>

Les zoonoses : ces maladies qui nous lient aux animaux. G. Vourc'h, F. Moutou, S. Morand, E. Jourdain. Éditions Quae, 2021, 172 p.



Plant immunity and agroecological transition

This summary of current work on plant immunity was written by five plant disease specialists. Based on a profound understanding of immune defence mechanisms in plants, the authors, from CIRAD, INRAE and the CNRS, question the systematic use of pesticides. They call for an agroecological transition in terms of crop protection practices, to ensure resistant plants and environmentally friendly agriculture.

L'immunité des plantes : pour des cultures résistantes aux maladies. C. Lannou, D. Roby, V. Ravigné, M. Hannachi, B. Moury. Éditions Quae, 2021, 392 p.

2021 was a year rich in publications of various types, for CIRAD and its partners: books for the general public and coffee table books, scientific works, studies and reviews, as well as reports and co-publications.

A selection is shown below, and we invite you to find out more on our website (www.cirad.fr) and that of the publisher Éditions Quae, of which CIRAD is one of the founding members (www.quae.com).

Scientific works, studies and reviews

Agroecological transformation for sustainable food systems

This special issue of the *Dossiers d'Agropolis internationale* journal on agroecology was published to mark the United Nations Food Systems Summit. In it, scientists from CIRAD, CGIAR, INRAE and IRD share their expertise to support policymakers, extension services, NGOs and agricultural associations working to promote the agroecological transition.



Agroecological transformation for sustainable food systems. Dossier d'Agropolis internationale no. 26, France-CGIAR, Septembre 2021, 147 p.

The fight against deforestation

In a new study published by the Institut français des relations internationales (IFRI), CIRAD's Alain Karsenty gives a comprehensive overview of the causes of deforestation and the means of reversing this global trend. He makes five recommendations for global forest governance, with a view to the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP15).



Géopolitique des forêts du monde : quelles stratégies de lutte contre la déforestation ? A. Karsenty. Études de l'Ifri, IFRI, June 2021, 54 p.

Co-publications with the Food and Agriculture Organization of the United Nations (FAO)

Rural migration in sub-Saharan Africa under the microscope

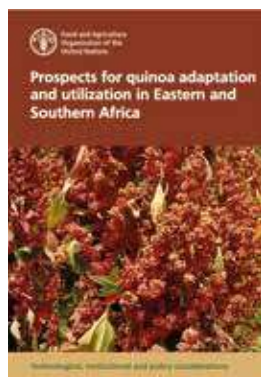
Sub-Saharan Africa has a long history of internal and international migratory movements. Those movements vary substantially across regions, and have evolved considerably over time. This working paper examines the dynamics and drivers of migration south of the Sahara. It is the result of a partnership between CIRAD and FAO, and was prepared by CIRAD in collaboration with the Centre for the Study of Governance Innovation (GovInn), South Africa, with financial support from FAO and CIRAD.



<https://doi.org/10.4060/ca7404en>

Rural migration in sub-Saharan Africa: patterns, drivers and relation to structural transformation. S. Mercandalli, B. Losch (eds.). M.N. Belebema, J.-F. Bélières, R. Bourgeois, M.F. Dinbabo, S. Fréguin-Gresh, C. Mensah, C.C. Nshimbi. Rome. FAO and CIRAD, 2019, 86 p.

What are the prospects for quinoa growing in Africa?

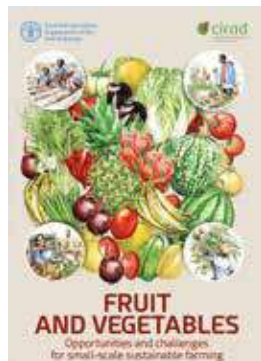


Didier Bazile, a researcher and quinoa expert from CIRAD, is a co-author of one of the first books on quinoa growing in Africa, published by FAO. It presents the key technological, institutional and policy considerations for the successful introduction, adaptation and utilization of quinoa on the continent.

<https://doi.org/10.4060/cb2351en>

Prospects for quinoa adaptation and utilization in Eastern and Southern Africa. Technological, institutional and policy considerations. M.F.A. Maliro, M.M. Abang, C. Mukankusi, M. Lung'aho, B. Fenta, S. Wanderi, R. Kapa, O.A. Okiro, E. Koma, C. Mwaba, M.M. Isse, D. Bazile. Addis Ababa, FAO, 2021, 54 p.

Moving ahead with sustainable fruit and vegetable production



On 20 September, FAO and CIRAD launched a major publication in support of the International Year of Fruits and Vegetables (2021). It covers the difficulties faced by small-scale fruit and vegetable producers and their opportunities for action, and aims to guide them when starting up or expanding their activity.

<https://doi.org/10.4060/cb4173en>

Fruit and vegetables. Opportunities and challenges for small-scale sustainable farming. FAO and CIRAD, 2021, 196 p.

Dynamic, revamped communication for greater visibility

Whether in terms of press relations, news items for the website or institutional communication in general, CIRAD's communication teams were particularly prolific in 2021. Their most notable achievements include the launch of a new website, an extended partnership with *The Conversation* and intense social media activity.

The production of new communication materials has meant revising some of the messages to be put across. This has been a collective undertaking, involving teams from across CIRAD, well beyond the Communication Office.

Almost 100 000 followers on social media!

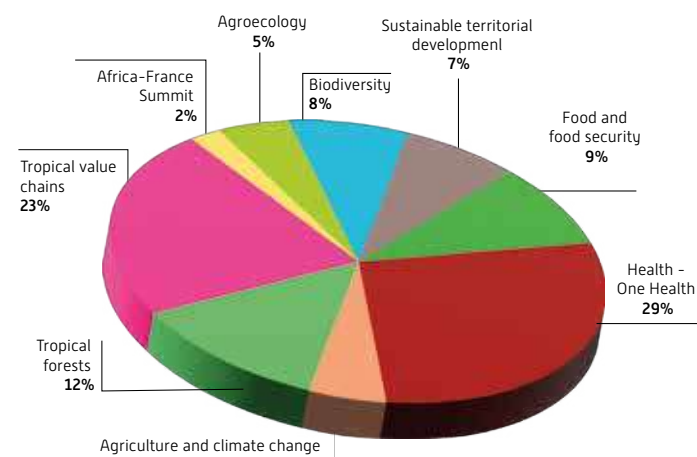
CIRAD is active on LinkedIn, Twitter, Facebook and YouTube. Our community of followers continued to grow in 2021, and currently stands at 93 380. Between 1 January and 31 December 2021, we attracted 15 906 new followers, a 20.4% increase on 2020. YouTube is the fastest-growing medium, with 35% more followers, followed by Facebook with +26%, LinkedIn +22% and Twitter +13%.

In the course of 2021, 1811 posts were shared on LinkedIn, Twitter and Facebook, 21.3% up on the previous year. Sixty-five videos were released on YouTube. Our posts triggered 4 197 312 impressions over the year, 15.5% up on 2020.

A busy year for press relations

With some 360 media requests, CIRAD was clearly visible in 2021. Sixty press releases resulted in 1100 press mentions (double the figure for 2020), and two press packs were compiled on topics CIRAD sees as crucial: emerging animal diseases and the Montpellier Global Days, ahead of the New Africa-France Summit. That event received extensive coverage, with 14 mentions in the French-speaking press, two programmes on RFI radio, an op-ed and an advertorial in *Jeune Afrique*, and two articles in the national press (*La Croix*, *La Tribune*). On a local level, the Summit gave rise to a report on the local France 3 TV station, an interview on France

Value chains, forests and the One Health topic account for more than half of online media mentions of CIRAD. Of those value chains, coffee was the subject of the most mentions.



Bleu Hérault radio, and several newspaper articles: three portraits in *La Gazette de Montpellier* and an interview in *La Marseillaise*. Our partnership with *The Conversation* resulted in 23 articles by our researchers on its website. The CIRAD Communication Office also supported filming of several documentaries and TV programmes.



© S. della Mussia, CIRAD

Institutional communication: revamped supports to boost visibility

The new website was launched in May 2021 in French and in June in English, after a two-year group effort. It was designed to be more user-friendly, thanks to its improved ergonomics and content tailored to each target user group. It offers specific entry points for different user categories, and has four main sections:

- Our activities, our impact
- CIRAD worldwide
- About us
- Work with us.

It also offers several specific spaces, notably devoted to press resources, the socioeconomic sector – with our Cirad'Innov solutions – and our regional offices. One major novelty is an interactive world map showing a selection of more than a hundred projects managed by CIRAD, providing a clearer picture of our global operations. The website is entirely responsive (it adapts to tablets and smartphones), and was developed in line with GDPR standards and accessibility regulations.



In the wake of the new website, CIRAD released a new institutional brochure. It comprises twelve pages with a wealth of illustrations and figures to tell donors, partners and the informed public about our activities. The most vital aspects of our organization – priority research topics, partnerships, innovation activities, impact culture, and training and skill-building operations – all feature in the document, with its new look in keeping with the new website. The brochure is available in English, French, Spanish and Portuguese. ■

Partnerships, a fundamental operating principle for CIRAD



From the beginning, partnerships have been in CIRAD's DNA. Along with scientific output, they are a vital lever for catalysing sustainable development, which CIRAD has always defended.

Over time, CIRAD has forged long-term, strong relationships with organizations in the global South. It has a global network of partners, and joint operations with more than 100 countries, via its twelve regional offices.

CIRAD has reaffirmed its commitment to Europe, by helping to build a range of initiatives and playing an active part in drafting policies for European cooperation, particularly with Africa.



From DeSIRA to Horizon Europe, CIRAD is at the heart of European partnerships

In early January 2021, the European Commission validated the list of projects to be funded following the third call for proposals under the DeSIRA programme (see box). In all, after three successive annual calls, the first of which was launched 2018, CIRAD is coordinating thirteen projects, with a total budget of 60 million euros.

That budget is provided by the DeSIRA programme and additional funding from several member States including France, via the Agence française de développement (AFD), Belgium, Germany, Luxembourg and Spain. CIRAD is also a partner in a further sixteen projects. To be chosen under the DeSIRA programme, projects must, by means of research and innovation, provide operational solutions to the challenges facing agricultural and food systems in non-EU countries. Those systems face major issues that have been further exacerbated by the Covid-19 pandemic: their economic, social and environmental sustainability is threatened, and their resilience to demographic shocks and climate change is increasingly limited.

Thirteen projects, multiple partnerships

The projects selected were prompted by requests from either EU delegations or EU member States. They are the result of close collaboration between European agricultural research organizations and national research, development, civil society and innovation partners in the target countries. The thirteen projects coordinated by CIRAD are thus built upon strong, wide-ranging partnerships with some forty research organizations in the global South, a dozen in the global North, a dozen NGOs and around ten farmers' organizations. In addition to five projects selected under the first DeSIRA call in 2018 (BIOSTAR, Cocoa4Future, FAIR, LIDISKI and IRINN, the first three of which have additional funding from AFD), four projects selected under the DeSIRA 2019 call began in 2021: ACCES, MAKIS, MARIGO and AMINATA. Lastly, four projects submitted under the DeSIRA

2020 call were validated in 2021: DINAMICC, RAIZ, Robusta in Uganda, and Terri4Sol (co-funded by AFD).

From one framework programme to another

2021 marked the transition between two EU framework programmes for research and innovation, with Horizon Europe replacing Horizon 2020 (H2020). Over the period from 2014-2020, H2020 centred on three pillars: excellent science, industrial leadership and societal challenges. Those objectives are also the core of the new Horizon Europe programme for 2021-2027, with 95.5 billion euros of funding for three main pillars: excellent science; global challenges and European industrial competitiveness; and innovative Europe. CIRAD teams are involved in a range of Horizon 2020 projects, including the new COMBAT project that CIRAD is coordinating with a consortium of 21 partners. That project, to combat animal trypanosomiasis, a parasitic disease transmitted by biting flies including the infamous tsetse, aims to support African livestock farmers affected by this scourge. Its implementation will be ensured by the strong presence of African partners in thirteen countries in which the disease is endemic, and by the direct engagement of FAO. However, the project has broader potential in that the disease is also at risk of being introduced into livestock farms (cattle, horses, etc.) in Europe due to globalization and environmental changes. The four-year COMBAT project has almost six million euros of funding from the H2020 programme. ■

DeSIRA, an initiative to strengthen research and innovation partnerships

The DeSIRA initiative (Development Smart Innovation through Research in Agriculture) is led by the European Commission Directorate General International Partnerships (DG INTPA, formerly DG DEVCO) and is co-funded by other organizations, such as national development agencies in Europe (including AFD), the Bill & Melinda Gates Foundation, etc. It intends to strengthen research partnerships (Europe and the global South), to promote innovation in support of the transformation of farming and food systems in response to global challenges (climate, biodiversity and food security).

Platforms in partnership for research and training

One road map, five ambitions

The road map for CIRAD's participation in the platforms in partnership for research and training (dPs), drafted as part of its 2019–2023 Scientific Partnership and Strategy Objectives (SPSO2) and inaugurated in 2021, centres on five essential ambitions.



Partnerships Officer Tanguy Lafarge presents those guidelines, which will steer the dPs' operations for the coming six years.

Why did we need a road map in 2021 and how was it produced?

The previous 2015–2020 road map was obsolete, so we needed a new action plan. This came at just the right time, as I was appointed Partnerships Officer in late 2019. The 30-odd-page document was drafted at the end of

2020, by means of an iterative process that took account of the views of CIRAD's governing bodies, such as its Science Council. It was submitted to our Board of Trustees in 2021.

What are the main outlines?

The road map begins with a detailed presentation of the principles behind the dPs and a critical analysis of the preceding period. It is then structured around five ambitions.

Ambition 1. To consolidate the existing dPs in terms of governance, leadership, and pooling of resources. Some of them have been sorely tested by the health crisis. Scientific leadership is particularly crucial in that it builds dPs' vision and guarantees both coherence and cohesion within the group, particularly by means of yearly physical meetings, whenever possible. CIRAD is playing a vital role in this, and provides incentive funding (690 000 euros in 2021) for the organization of scientific meetings, workshops, training, etc.

Ambition 2. To build diploma training modules. The dPs conduct research that is not sufficiently promoted within training courses. It is important to strengthen their cooperation with partner universities. Training courses are all the more important in that they serve to pass on the advanced scientific knowledge and innovative methods built by the dPs to students, and to attract the best students, who may either become researchers or benefit from research.

Ambition 3. To promote dialogue with beneficiaries. Each dP conducts research, builds innovations, and aims for impact. Promoting research results to civil society, policymakers and donors and understanding what civil society expects from research is one way of guaranteeing greater impact. To this end, the dPs must facilitate the organization of forums for debate between

researchers, players on the ground, policymakers, etc. The dPs are an appropriate way of mobilizing the ImpresS ex ante approach to build an impact pathway and structure its interactions with beneficiaries.

Ambition 4. To strengthen the links between the dPs. This could be done on a geographical basis via shared interdisciplinary projects (FAIR in West Africa, ASSET in Southeast Asia, etc.) and by organizing joint events such as the international conference on sustainable intensification in Dakar in November 2021. In terms of topics, this interconnection takes the form of global projects such as PREZODE, long-term pooling of facilities, organizing advanced scientific training, etc.

Ambition 5. To boost the network's visibility. This means encouraging every researcher involved in a dP to promote that dP to their contacts, including major global partners such as WUR or UC Davis, which are already members of MUSE. Major efforts are being made in terms of communication, with regularly updated dP websites, a growing presence on social media and plans for a newsletter. ■

tanguy.lafarge@cirad.fr

The dPs, a novel form of scientific partnership

CIRAD and its partners have been building platforms in partnership for research and training (dPs) since 2009. Those platforms are long-term alliances whose governance is shared, favouring the achievement of critical masses and interdisciplinarity. Shared research programming has resulted in a portfolio of projects, often funded following competitive calls for proposals.

The dPs in figures

21 dPs involving CIRAD

700 people, **123** of them provided by CIRAD

170 partner organizations

80 countries

2 international institutions

7 CGIAR centres

CIRAD and the SOWIT start-up: a win-win partnership



RR

SoYield is an app resulting from a promising partnership between a start-up – SOWIT – and CIRAD. It is a decision support tool that has proved capable of estimating mango yields in orchards in Ivory Coast and Senegal. Its launch will satisfy demand from players in fruit value chains in West Africa, while fuelling an enriched spatialized database for research purposes. The app is the result of CIRAD's PixFruit® expertise, and its development and transfer are being supported by the Cirad'Innov incubator.

We talk to SOWIT co-founder Hamza Bendahou.

What is SOWIT?

SOWIT is a Franco-African start-up specializing in precision agriculture, set up in 2018. Our aim is to help African farmers optimize their technical operations, from fertilization to estimating harvesting dates, through yield assessments. We offer two main types of expertise: agronomy expertise and data skills, using drones and satellite imaging.

And what about SoYield?

SoYield is an app that allows African mango producers to order yield estimates based on photos of their mango trees taken with their smartphone. The main aim is to help farmers optimize production, to make them less dependent on buyers. SoYield is designed to be user-friendly, meaning that it is tailored to the target producers in Ivory Coast and Senegal, where connections are unreliable and producers do not always have top-of-the-range smartphones or know much about digital agriculture tools. As things stand, producers can use the app even if

they are not connected, as the algorithm works off line: the producers take their photos and the data are sent once they are back on line. SoYield was tested successfully during the last mango season in the Niayes region in Senegal, and is due to be rolled out in Senegal and Ivory Coast in 2022. The app is free for smallholders, in line with our aim of bridging the digital divide on the continent. In addition to the service to producers, we are hoping to collate the data gathered to provide an overview of yields for a given crop across an entire production basin, or even several. Those data could eventually be used by countries to draft or steer agricultural policy, by financial institutions, or by development organizations.

What form has your partnership with CIRAD taken and how has it helped you?

It has allowed us to benefit from CIRAD's PixFruit® solution for estimating tropical fruit crop yields. In concrete terms, the innovation

project centring on mango yield estimation using smartphone images has been the subject of two theses supervised by CIRAD, several research projects and fundamental research operations over three years, to validate the proof of concept. As a start-up, we wouldn't have had the time or the means to build these new models. For our part, we brought the algorithms resulting from the research to a satisfactory degree of precision and operability, based on a mass comparison with "field reality" and user requirements. This should guarantee that the SoYield tool can be scaled up in accordance with the rules of good practice and rolled out internationally. Our partnership is the fruit of a long period of reflection after Hamza Rkha Chaham, who also co-founded SOWIT, met CIRAD's Emile Faye at the 2019 AgriNumA 2019 conference in Senegal. SoYield is a great example of shared development of an innovation, and puts SOWIT and CIRAD in the forefront as

regards fruit crop yield estimation.

What does the future hold for SoYield?

The main thing is to see SoYield being used by farmers, who will subsequently be able to make more money from their activity by knowing more about yields. After Senegal and Ivory Coast, we will be targeting other countries such as Nigeria and Egypt. With CIRAD, we are also looking at the possibilities of moving on to other crops than mango, depending on research and market interests. The overriding aim is to allow African farmers to intensify production sustainably. Citrus, cocoa and coffee are all interesting development prospects, on which our partnership could rapidly build. ■



Partnerships

Stronger collaborations and new agreements

January

AFD and CIRAD promise more than 10 million euros for projects on sustainable rural agricultural systems and territories in the global South

On 29 January, Michel Eddi, President Managing Director of CIRAD, and Rémy Rioux, Chief Executive Officer of the Agence Française de Développement (AFD), signed a financing framework agreement that marks an important milestone in their shared desire to strengthen their partnership for the development of sustainable rural agricultural systems and territories in the global South. On this occasion, three other agreements were signed, including one enabling AFD to co-finance EU DeSIRA projects and another aimed at fostering the development of geographical indications in Africa, the Caribbean and the Pacific.



From L to R:
Laurence Bretton-Moyet, Executive Director in charge of Strategy, Partnerships and Communication at AFD; Rémy Rioux, CEO of the AFD Group; Michel Eddi, President Managing Director of CIRAD; Philippe Lacoste, Director of Sustainable Development at the French Ministry for Europe and Foreign Affairs

February

CIRAD is heavily involved in the France-CGIAR Action Plan

France and the CGIAR System signed an ambitious action plan on 4 February 2021. The aim is to strengthen their partnership and institutional and scientific links in favour of research for agricultural and rural development in the global South. As a French public agricultural research for development operative, CIRAD will be heavily involved in the three topics covered by the plan: the agroecological transition; nutrition and sustainable food systems; and agriculture and climate change.

June

A new partnership for more sustainable and equitable food systems

The Agroecology Transformative Partnership Platform, to promote agroecology as a way of transforming food systems, was launched on 3 June 2021 at a side event to the 48th Plenary of the Committee on World Food Security. This new global initiative aims to spearhead the transition to agroecology.

October

Africa-France scientific collaboration: toward a major joint study programme between African research bodies and agricultural universities, CIRAD and INRAE

On the sidelines of the New Africa-France Summit in Montpellier, Élisabeth Claverie de Saint Martin, CEO of CIRAD*, and Philippe Mauguin, Chair and CEO of INRAE, announced on 7 October that they are actively working together, with some 20 African agricultural research bodies, to develop a joint study, training and innovation programme. The programme will focus on the themes of agroecology, preserving natural resources, health, food security, developing territories and jobs.

*Élisabeth Claverie de Saint Martin took up the post of CEO on 16/06/2021.



From L to R:
Prisca Mugabe, Professor at the University of Zimbabwe; Elisabeth Claverie de Saint Martin, CEO of CIRAD; Astou Camara, Director of Macro Economic Analysis Office at the Institut Sénégalais de Recherches Agricoles (ISRA); Philippe Mauguin, CEO of INRAE

CIRAD signs the strategic memorandum of understanding between the partners in I-Site MUSE

On 8 October 2021, at the New Africa-France Summit, CIRAD signed the strategic memorandum of understanding between the partners in I-Site MUSE. The MOU formalizes the shared determination of the 16 I-Site member establishments to work together to structure its research, training through research, European and global strategy, and cooperation activities.

November

The Regional Platform for Agricultural Research for Development in the Indian Ocean framework agreement has been extended for three years

Jean-Baptiste Lemoyne, Secretary of State to the Minister for Europe and Foreign Affairs in charge of tourism, French citizens overseas and Francophonie; Vêlayoudom Marimoutou, Secretary General of the Indian Ocean Commission; Huguette Bello, Chair of the Regional Council; Adèle Odon, Réunion departmental councillor; and Élisabeth Claverie de Saint-Martin, CEO of CIRAD, have extended the Regional Platform for Agricultural Research for Development in the Indian Ocean (PRÉRAD-OI) framework agreement. The signing ceremony was held on 26 November 2021 in Saint-Denis (Réunion), during the extraordinary IOC Councillors Meeting.

Social responsibility at CIRAD



CIRAD is convinced that the social and environmental aspects of development transcend economics. It has put sustainable development firmly at the heart of its remit, and strives to set an example in terms of its practices and their impact. From responsible business travel to procurement procedures that promote the circular economy, through quality of work life and sustainable mass catering, it sees a range of social responsibility issues as levers for action.

Corporate social responsibility (CSR)

CIRAD, a responsible organization

Social and environmental responsibility, ethics, and so on... CIRAD made progress on CSR in a range of directions in 2021. That progress includes historic achievements such as signing a work from home agreement and obtaining substantial funding for more eco-friendly buildings. Here is an overview.

The year 2021 enabled CIRAD to pursue its commitment to greater social responsibility. This article highlights the most emblematic actions, but is not exhaustive.

Social responsibility: work from home agreement and action on gender equality

Talks between CIRAD and the unions have resulted in a work from home agreement (not related to Covid constraints). The agreement has a range of aims: improved quality of work life, better work-life balance, flexible but efficient working, and a smaller carbon footprint as regards individual travel. It was drafted with particular attention to the need to maintain the work collective and avoid any sort of isolation.

During 2021, CIRAD pursued implementation of its 2020-2023 gender equality action plan. In particular, the emphasis is on integrating gender issues into recruitment and career management instruments and procedures; on a guide to inclusive behaviour, in the aim of changing attitudes within the organization; on strengthening an in-house community of practice to build tools and methods for including gender in research content; and on drafting recommendations for greater consideration of gender equality when building and managing international partnerships. Principles and recommendations for inclusive communication have also been looked at, with the production of a practical guide and exchanges with an eminent linguist, Emeritus Professor Bernard Cerquiglini. Talks on a third in-house gender equality agree-

The work from home agreement negotiated in 2021 is notably intended to foster a better work-life balance



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ment have begun. The year 2021 was also marked by the appointment of Élisabeth Clavier de Saint Martin, CIRAD's first female CEO, who has expressed her commitment to fighting every possible form of sexual harassment and sexist behaviour. Sexual harassment officers have been appointed, and an initial online training session on policy in terms of gender-based violence and sexual harassment has been organized. The EU Gender-SMART programme, coordinated by CIRAD, has continued its activities and devoted its annual communication drive to the topic "Make equality bloom", covering a range of aspects relating to the development of an inclusive in-house culture.

Environmental responsibility, responsible procurement, and climate change



© R. Solesse, CIRAD

In 2021, CIRAD obtained public funding to allow it to invest more in making its installations more energy efficient. Shown here, the 3P platform in Réunion

CIRAD includes social and environmental provisions in its invitations to tender, when renewing contracts. It provides purchasing staff and prescribers with guidelines and tools to help them include those dispositions in their specifications.

In 2021, CIRAD obtained public funding to allow it to invest more in making its installations more energy efficient: 1.5 million euros under State recovery plans, for seven energy efficiency improvement operations on its sites in Occitanie, Réunion and Guadeloupe. Those operations will continue into 2022-2023. The Occitanie Regional Council and its 2021-2027 State-Region Planning Contract have also provided 6.1 million euros for CIRAD's



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plans to entirely redevelop its main site in Montpellier (Lavalette eco-site project), over the next ten years. In Réunion, the operation to renovate and extend the 3P scientific platform, primarily funded by the EU ERDF and scheduled for completion in mid-2022, is a large-scale eco-friendly building project.

More efficient, transparent and secure personal data management

In response to the growing number of issues surrounding personal data protection, CIRAD has extended its partnership with a consulting firm specializing in helping public- and private-sector structures comply with general data protection regulations (GDPR). The Data Protection Officer (DPO) is the main orchestrator in terms of compliance. His main tasks are to advise and inform CIRAD management and staff members as regards the relevant personal data protection regulations. The DPO also interacts with the CNIL, the French authority in charge of ensuring compliance with those regulations. He acts entirely independently, reports to general management, and works closely with the Head of Security of Information Systems (HSIS). The external support system, centring on a team comprising the DPO, a deputy DPO and an assistant DPO, was strengthened in early 2021 in response to a growing number of requests. In 2021, an awareness raising campaign served to train around a hundred staff members, and more than 200 requests for assistance were handled.

CIRAD has extended its partnership with a consulting firm specializing in compliance with GDPR



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The Responsible project, spearheading CSR at CIRAD

Work is continuing to draft a blueprint for social responsibility, a core element in our "Responsable" project. Communicating about our operations and discussing and sharing our priorities is a major part of that. For the first time, on 2 March 2021, we held an in-house event centring on social responsibility. The aim was to raise awareness of CIRAD's responsibility to society, publicize its commitments and actions, enable inspiring testimonials and discussions, and trigger collective debate (for instance on responsible business travel, quality of work life, and digital sobriety). Some 180 people took part remotely.

An initial social responsibility training course was organized in 2021. It was open to anyone interested in understanding the core elements of the concept and working to make it more collective and participatory. A workshop was held to discuss how to involve the community and build on collective intelligence, to sow the seeds of a CSR culture within CIRAD.

Partnerships with other higher education and research players are a key lever for the development of CIRAD's "Responsable" project. On 15 January 2021, we co-organized a symposium on responsible research and innovation, which was opened by Valérie Masson-Delmotte, Co-Chair of IPCC Working Group I. More than 3500 people took part in the symposium, which was the high point of our work with other organizations to build a framework for sustainable development and social responsibility. ■

cathy.grevesse@cirad.fr



Watch the video [in French]:
**Pour une recherche
et une innovation
responsables**



2021 Indicators

The indicators to monitor progress on the establishment's Scientific and Partnership Strategy Objectives were negotiated with the line ministries in 2019. Nine indicators were thus determined with a view to updating our Contractual Objectives:

Indicator 1 • Scientific output

Indicator 2 • Number of peer-reviewed articles, with or without impact factor, co-published with partners in the global South

Indicator 3 • Number of senior scientific staff members on assignment (by major geographical area)

Indicator 4 • Number of assignments undertaken by staff (in FTEs) by major geographical area (available from 2021)

Indicator 5 • Number of PhD students from the global South/total number of PhD students supervised by CIRAD researchers

Indicator 6 • Job structure – permanent contracts, fixed-term contracts, grant-funded PhD students –, number of FTEs [%]

Indicator 7 • Distribution of staff members by gender and category

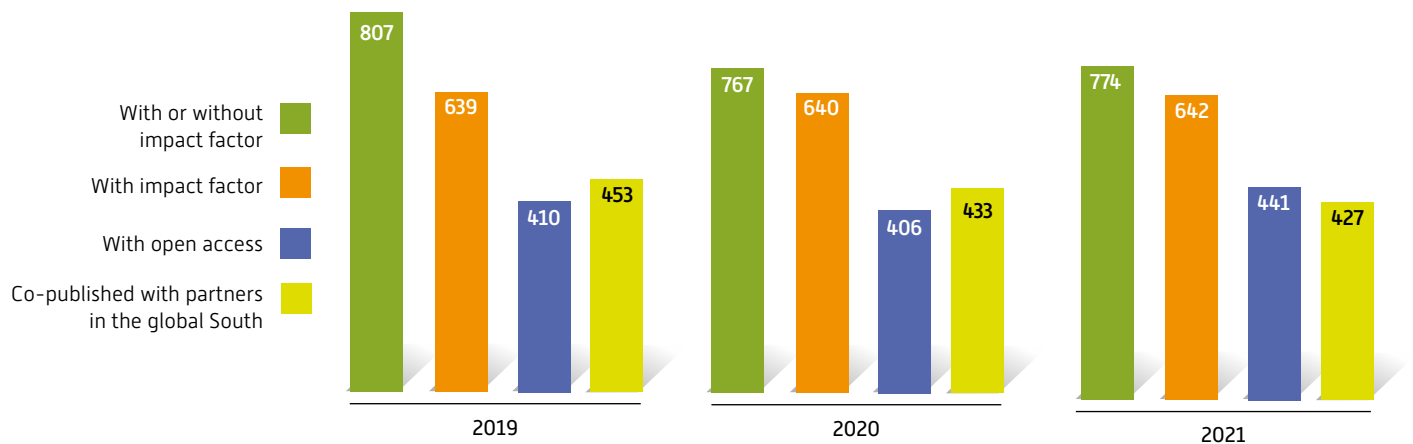
Indicator 8 • Orders registered for the year (DFI and turnover for project portfolio, M€) per type of donor

Indicator 9 • Results of contractual activity for the year (DFI and turnover, M€) per type of donor

THE SCIENCE AMBITION

CIRAD's scientific output has shown a constant increase in the number of articles published in journals with impact factor. Co-publications with partners in the global South still account for more than half of all CIRAD's publications. The notable increase in the proportion of open access articles, as well as in their consultation, is helping to strengthen the institutional policy on open science. The average number of downloads per publication from the Agritrop database, CIRAD's open archive platform, increased from 17 in 2019, to 21 in 2020 and 27 in 2021, illustrating the growing success of CIRAD's scientific output among its target audiences (<https://agritrop.cirad.fr>).

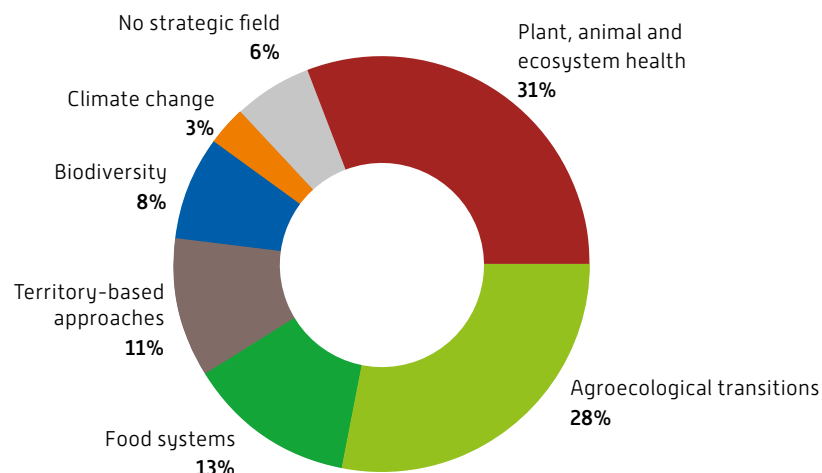
Number of peer-reviewed articles, with or without impact factor



Source: Agritrop. Dist – DGDRS

Breakdown of publications by research topic

In 2021 the breakdown of publications by priority research topic was similar to previous years, but with higher output for the topic Plant, animal and ecosystem health, in connection with the Covid-19 context.



THE PARTNERSHIP AMBITION

The geographical mobility of CIRAD staff (on long-term assignments supplementary to short trips) plays a key role at the heart of CIRAD’s mandate.

This mobility declined in 2020, mainly due to the Covid-19 context. In 2021, it improved again, with a 4% increase in the number of full-time equivalents (FTE), although the Covid-19 situation was still a problem. The majority of these postings concern sub-Saharan Africa and the consolidation of the French overseas regions for regional outreach.

Number of senior scientific staff members on assignment by major geographic area (in FTE)

Sub-Saharan Africa	106.32
North Africa	6.5
Asia	24.56
Oceania	1.00
South America	13.56
Central America and the Caribbean	8.25
North America	2.00
French overseas regions	126.14
Europe	6.02
TOTAL	294.34

Source: SIRH - DGDRD.

THE TRAINING AMBITION

The “Training in the South, with the South and for the South” ambition is one of the key changes in CIRAD’s current Strategic Vision. No development can be possible for a country without capacity building, which leads CIRAD to support and assist its partners through training in order to address their needs.

These diverse training programmes include academic training with supervision of PhD students and interns at different levels (bachelors, masters, engineers), and participation in tutorials and practical work sessions held by institutions in both the North and the South. They also include specific training programmes and sectoral workshops aimed at professionals, especially in the context of the platforms in partnership (dPs)

and hosting of partners within our infrastructures for specific training.

In 2021, CIRAD’s researchers overcame the difficulties arising from the pandemic thanks to a consolidated partnership and scientific strategy. They thus stepped up their supervision in both the North and the South and directed or contributed to the supervision of 412 PhD theses in total. CIRAD maintains its commitment to capacity building among its partners; 54% of the PhD students supervised in 2021 were from the global South. Moreover, special attention was given to the conditions for completing theses in the Covid-19 period, and PhD contracts were extended where necessary.

PhD students supervised by CIRAD in 2021



THE INNOVATION AND IMPACT AMBITION

Since 2010, CIRAD has been engaged in a culture of impact with its partners. Its scientific and methodological research supports critical thinking on the role of research and its contribution to long-term impact, focusing on actors' practice changes, behaviours and interactions. In 2021, the support and training schemes promoting the ImpresS method approaches and tools already developed by CIRAD (ex ante and monitoring-evaluation) were applied to 10 projects, three sectoral roadmaps and one platform in partnership.

In 2021, CIRAD strengthened its action with the socio-economic sector by launching the Cirad'Innov® brand. At CIRAD, innovation is co-constructed with the partners, who thus benefit from a sound scientific basis and from knowledge of the issues and challenges facing four major sectors of activity: food and food technologies; sustainable agriculture; livestock and animal health; and natural resources and territories. Through this approach, CIRAD also contributes to job creation in the global South.

Different indicators confirmed these results in 2021:

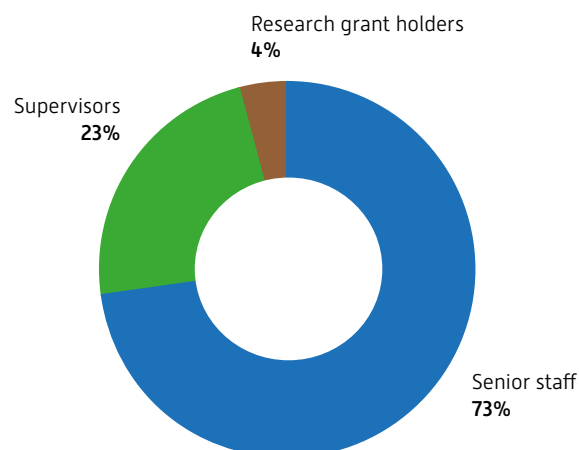
- The deployment of an innovation marketing strategy, with
 - 825 posts on the Cirad'Innov® LinkedIn accounts for each sector of activity, with 7000 followers in France, Africa, Asia and Latin America;
 - two events involving partner companies: Produrable and a side event at the New Africa France Summit;
 - a section on "Cirad'Innov® Solutions" and partnerships with companies on the new CIRAD website.
- A third of the projects (114) financed by CIRAD concern expertise, training, research collaborations and transfers enabling SMEs, start-ups, large corporations and local authorities to implement sustainable and appropriate solutions to the major challenges facing the tropical and Mediterranean sectors and territories.
- Fifteen projects are financed by the France Relance national "Corporate R&D" plan further to the Covid-19 pandemic, in collaboration with companies and enabling the recruitment of young researchers.

ALIGNING RESOURCES POLICY WITH THE SCIENTIFIC AND PARTNERSHIP STRATEGY

CIRAD has developed the skills needed for its scientific and geo-partnership strategy, with the recruitment of 105 permanent staff members in 2021.

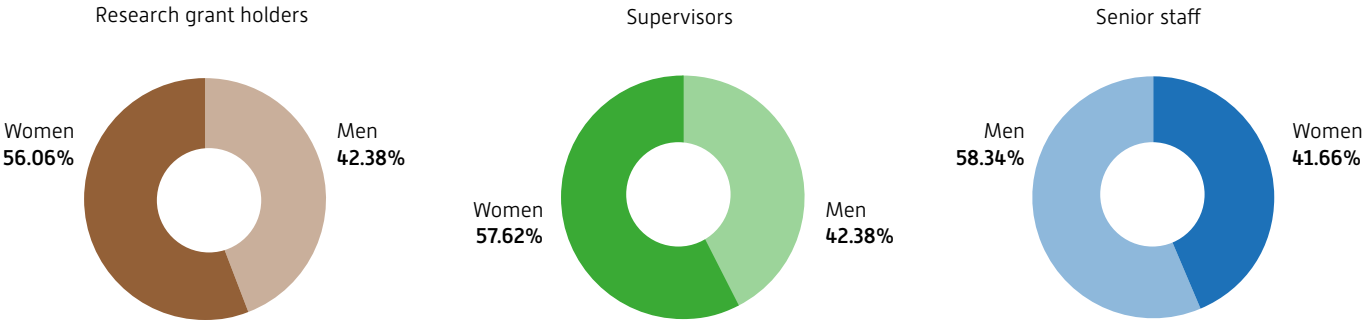
In 2021, the share of research grant holders (4% of CIRAD staff members) was almost at gender parity. Among supervisors, who make up a quarter of numbers, women are in the majority (57.6%). The number of senior staff is increasing further to the recruitment drive since 2019, with early signs of parity rebalancing. This progress towards parity is increasing (+1.3%), with different disparities according to jobs and categories.

Employment structure



Source: SIRH - DGDRD.

Distribution of staff members by gender and category

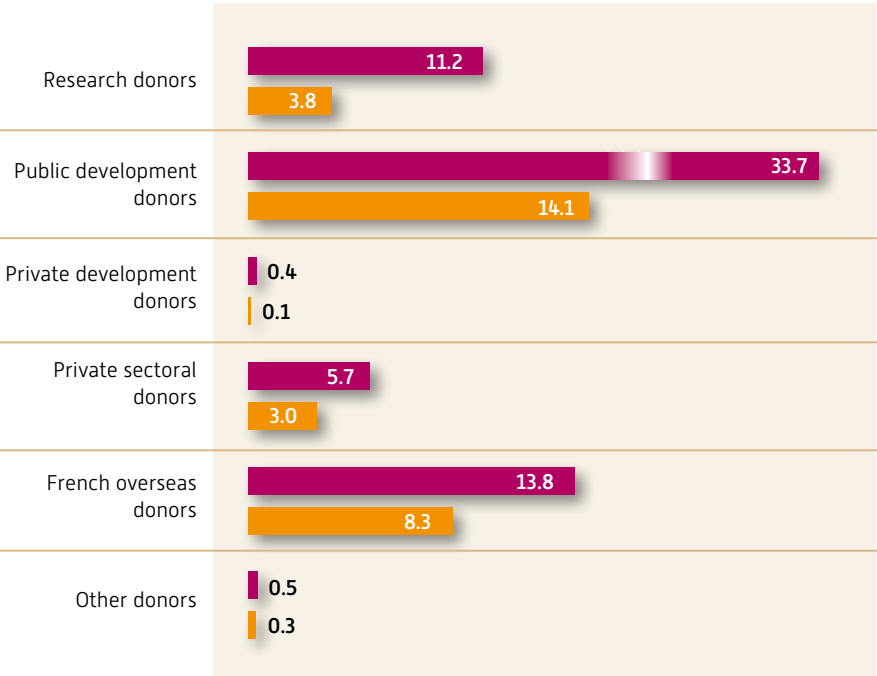


Source: SIRH - DGD RD.

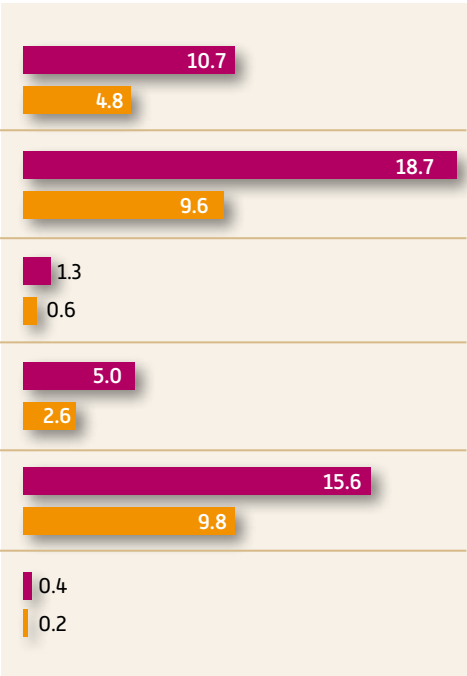
Orders registered, translated into turnover (65.2 million euros), remained very dynamic in 2021, with continued diversity of donors. Public development donors account for almost 34%, and French overseas donors 21%. Outputs show a turnover for 2021 of 51.6 million euros, which is a significant

increase compared to 2020, with considerable growth in contractual activity of 27.7 million euros. The contribution of public development donors and French overseas donors remains substantial.

Orders registered in 2021, in million euros



Results of contractual activity in 2021, in million euros



Source: SIRH - DGD RD

Turnover DFI

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UMR: Joint research unit • UPR: Internal research unit • US: Service unit

ÎLE-DE-FRANCE

42, rue Scheffer
75116 Paris - France
Tel.: +33 1 53 70 20 21
drif@cirad.fr

MONTPELLIER-OCCITANIE

Avenue Agropolis
TA 178/04
34398 Montpellier Cedex 5
France
Tel.: +33 4 67 61 49 34
dr-mo@cirad.fr

**MEDITERRANEAN
AND MIDDLE EAST**

Avenue Agropolis
TA 179/04
34398 Montpellier Cedex 5
France
Tel.: +33 4 67 61 49 47
denis.gautier@cirad.fr

**CONTINENTAL
SOUTHEAST ASIA**

Cité diplomatique de Van Phuc
Bureau 102, Bâtiment 2G
298 Kim Ma
Hanoi
Vietnam
Tel.: +844 37 34 67 75
francois.roger@cirad.fr

**FRENCH WEST INDIES,
FRENCH GUIANA AND CARIBBEAN**

Station de Neufchâteau
Sainte-Marie
97130 Capesterre-Belle-Eau
Guadeloupe
Tel.: +590 5 90 41 68 68
dir-reg.antilles-guyane@cirad.fr

**MEXICO,
CENTRAL AMERICA AND
ANDEAN COUNTRIES**

Carretera al Mar km 17
Vereda San Pablo
Cali
Colombia
Tel.: +57 316 4984309
philippe.vaast@cirad.f

**BRAZIL AND
SOUTHERN CONE
COUNTRIES**

Predio FINATEC
Campus Univ Darcy
Ribeiro
Caixa Postal 4522
CEP. 70842-970
Brasília-DF
Brazil
Tel.: +55 61 33 66 16 01
brasil-conesul@cirad.fr

**WEST AFRICA
DRY ZONE**

37, avenue Jean XXIII
BP 6189
Dakar-Étoile
Senegal
Tel.: +221 33 822 44 84
sylvie.lewicki@cirad.fr

**WEST AFRICA
FOREST AND
HUMID SAVANNAH**

Université
Houphouët-Boigny
Cocody, Bâtiment IRD
01 BP 6483
Abidjan
Ivory Coast
Tel.: +225 07 22 48 18 41
ciradci@aviso.ci

CENTRAL AFRICA

Rue Joseph Essono
Balla
BP 2572
Yaoundé
Cameroon
Tel.: + 237 222 21 25 41
cirad-cm@cirad.fr

**SOUTHERN AFRICA
AND MADAGASCAR**

Ampandrianomby
BP 853
Antananarivo 101
Madagascar
Tel.: +261 20 22 406 23
+231 32 07 235 95
dregion@cirad.mg

EAST AFRICA

C/o ICRAF,
United Nations Avenue
Gigiri - PO Box 30677
00100 Nairobi
Kenya
Tel.: +254 207 224 653 / 652
dr.afora@cirad.f

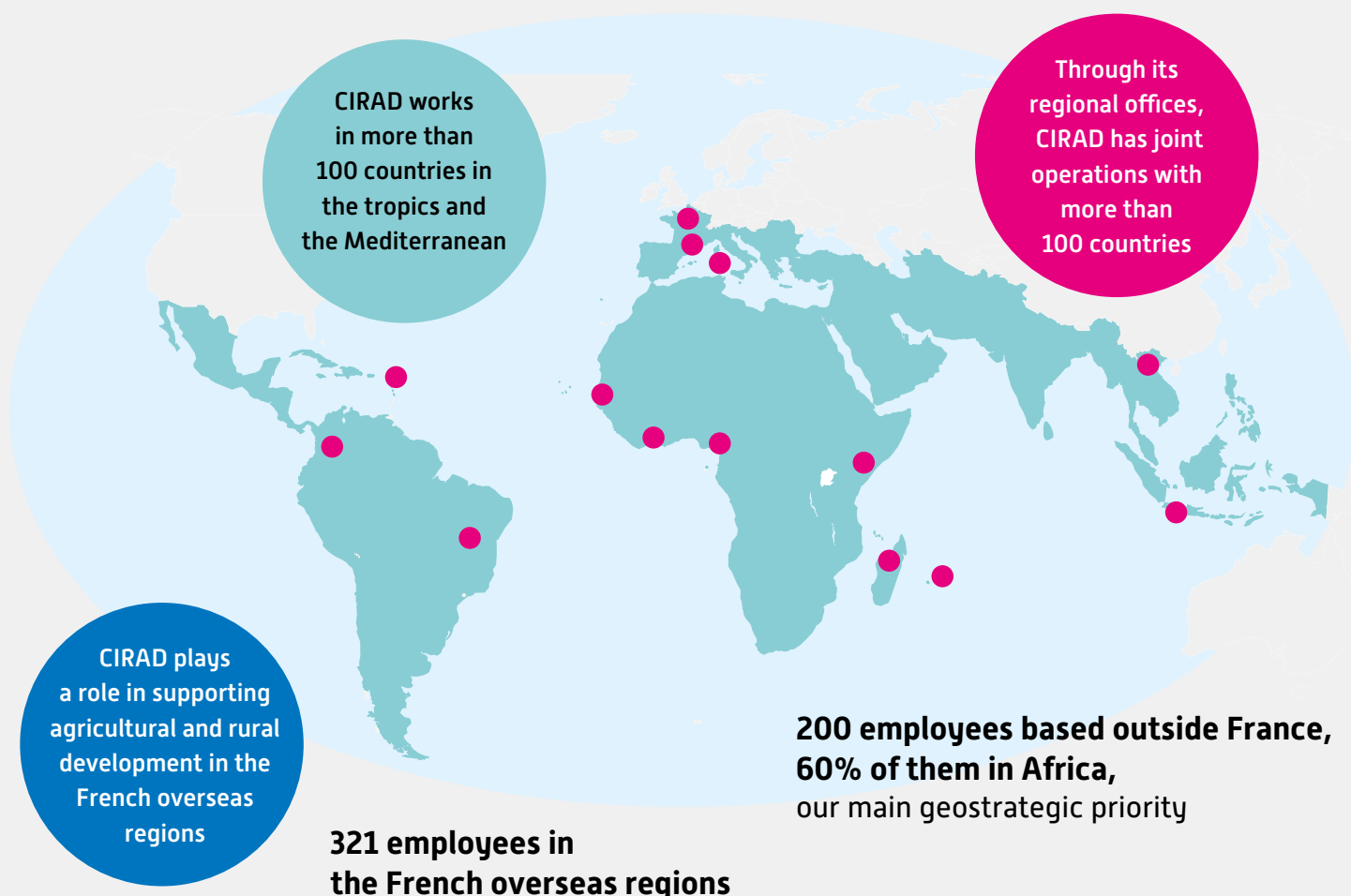
**RÉUNION,
MAYOTTE AND
INDIAN OCEAN
[EXC. MADAGASCAR]**

Station de La Bretagne
40 chemin de Grand Canal
CS 12014
97743 Saint-Denis Cedex 9
La Réunion
Tel.: +262 2 62 72 78 00
dir-reg.reunion@cirad.fr

**SOUTHEAST
ASIAN ISLANDS**

Graha Kapital 1
Jl. Kemang Raya n° 4
Jakarta 12730
Indonesia
Tel.: +62 21 71 98 641 / 642
cirad@idola.net.id

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Number of journal articles published*

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427	- co-published with partners in the global South;
441	- in open access.

* as of 15/02/2022

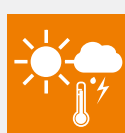
* Source: Agritrop, 2021 figures

Engaged science, to build resilient farming systems in a sustainable, inclusive world

CIRAD has **29 research units**,
split between **three scientific departments**

Six priority research topics
guide its targeted research operations

- Agroecological transitions
- Biodiversity
- Climate change
- Food systems
- One Health
- Territory-based approaches

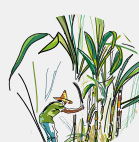
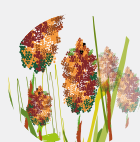


CIRAD's staff members work **in more than 40 scientific fields**



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Banana and plantain
Cocoa
Coconut
Coffee
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Dairy
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Fruit and vegetables
Oil palm
Rice
Roots and tubers
Rubber
Sorghum
Sugarcane



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including
**1140 scientific staff
members**, of whom
800
are researchers



CIRAD manages
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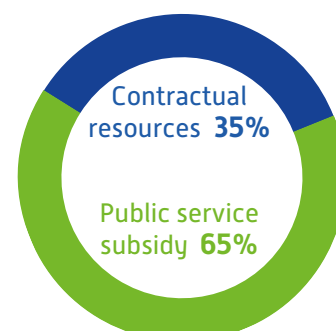
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It works with its partners to build knowledge and solutions for resilient farming systems in a more sustainable, inclusive world. It mobilizes science, innovation and training in order to achieve the Sustainable Development Goals. Its expertise supports the entire range of stakeholders, from producers to public policymakers, to foster biodiversity protection, agroecological transitions, food system sustainability, health (of plants, animals and ecosystems), sustainable development of rural territories, and their resilience to climate change.

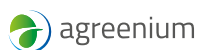
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AGRICULTURAL RESEARCH
FOR DEVELOPMENT

42, rue Scheffer
75116 Paris
France

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