Biofuels Development and Land Use changes in West Africa

Jean-Claude Legoupil, François Ruf

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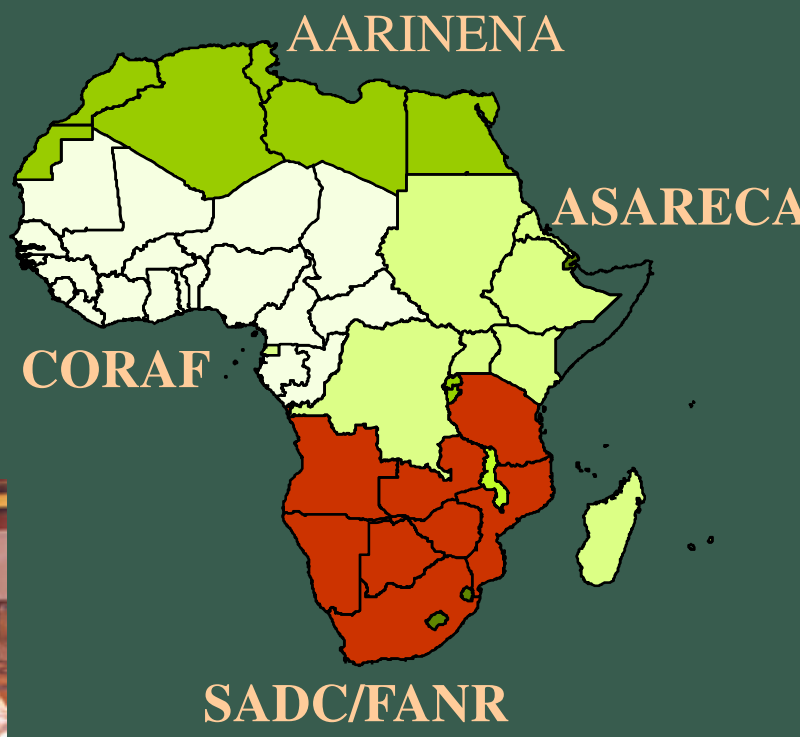
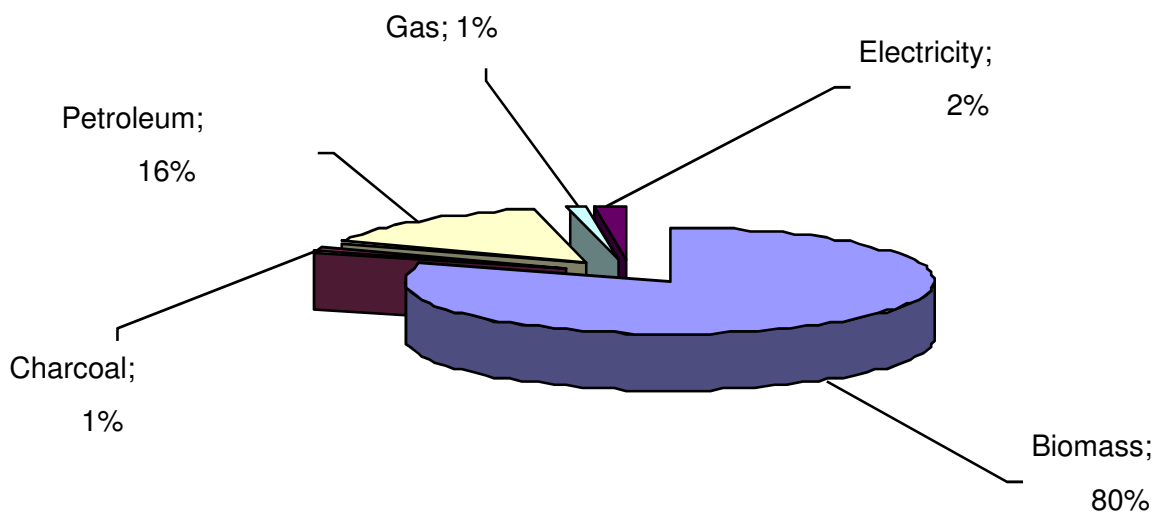
The Forum for Agricultural Research in Africa (FARA)

5 Networking Support functions

- Advocacy and resource mobilization for agricultural research
- Access to knowledge & technologies
- Regional Policy & Markets
- Capacity Strengthening
- Partnerships & Strategic Alliances

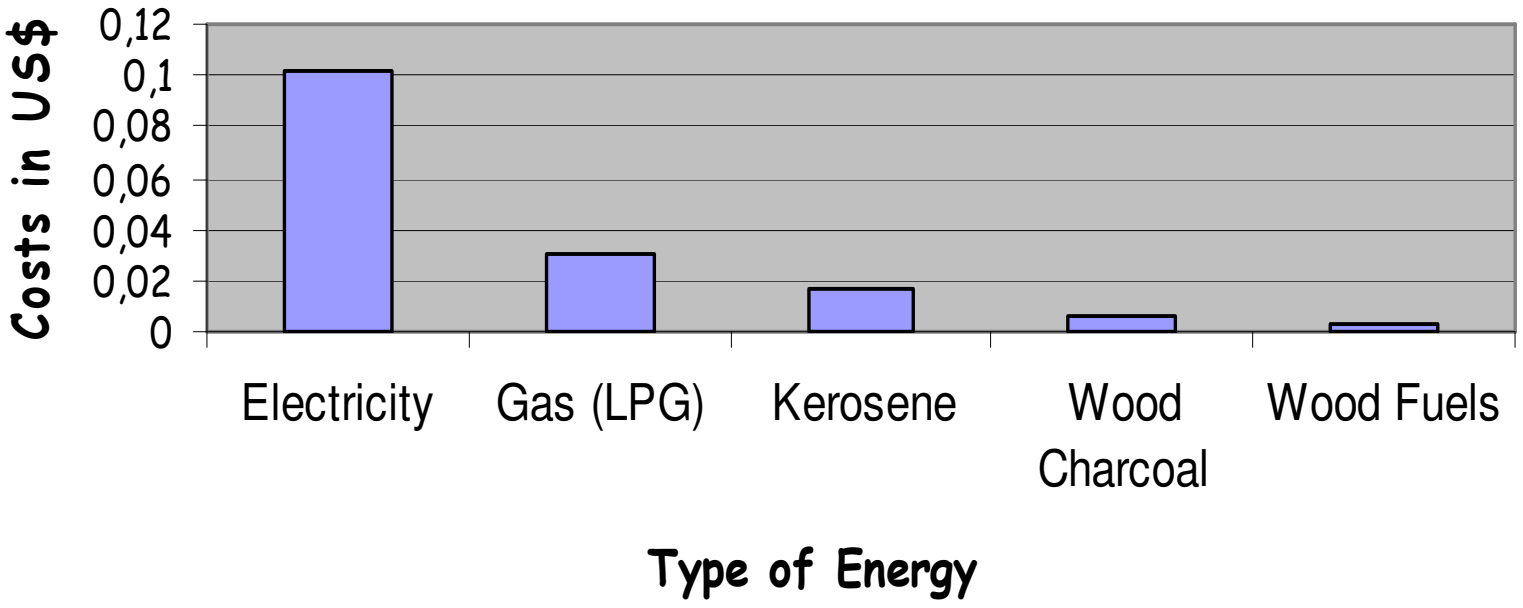


Energy Demand in sub-Saharan Africa



Energy Demand in sub-Saharan Africa

Prices of different forms of Energy (in Chad)
in US$ for 1 Mega Joule (World Bank 1998)



Energy Demand in sub-Saharan Africa

Energy Demand in sub-Saharan Africa

Wood Charcoal Trade along road (Ghana 2008)

Energy Demand in sub-Saharan Africa

Why Biofuels ?

- Africa's contribution to GHG emissions is not really important (3%). Nevertheless contribution to reduce this rate is an objective as the continent is very vulnerable to the impacts of climate change

- Africa plays an important role in the capture of carbon and the fact that it is loosing its rainforests faster than Brazil is an important concern

The Johannesburg World Summit on Sustainable Development (WSSD) in 2002 has proposed a commitment of each country to meet 10% of its national energy supply from renewable energies

Overview of the most relevant liquid Biofuels

One tonne of **sugar cane** can produce around 100 liters of alcohol and 350 kg bagasse which on burning produces direct energy of which 60% is necessary to process alcohol. Average sugar cane yield can vary from 60 t/ha to more than 100 t/ha (6,000-10,000 liters alcohol per ha).

The alcohol production from **Cassava roots** depends on the starch (carbohydrate) content. Roots at 30% starch content will produce around 250 liters of alcohol (96%) per tonne of root. Cassava has one of the highest rates of CO2 fixation.

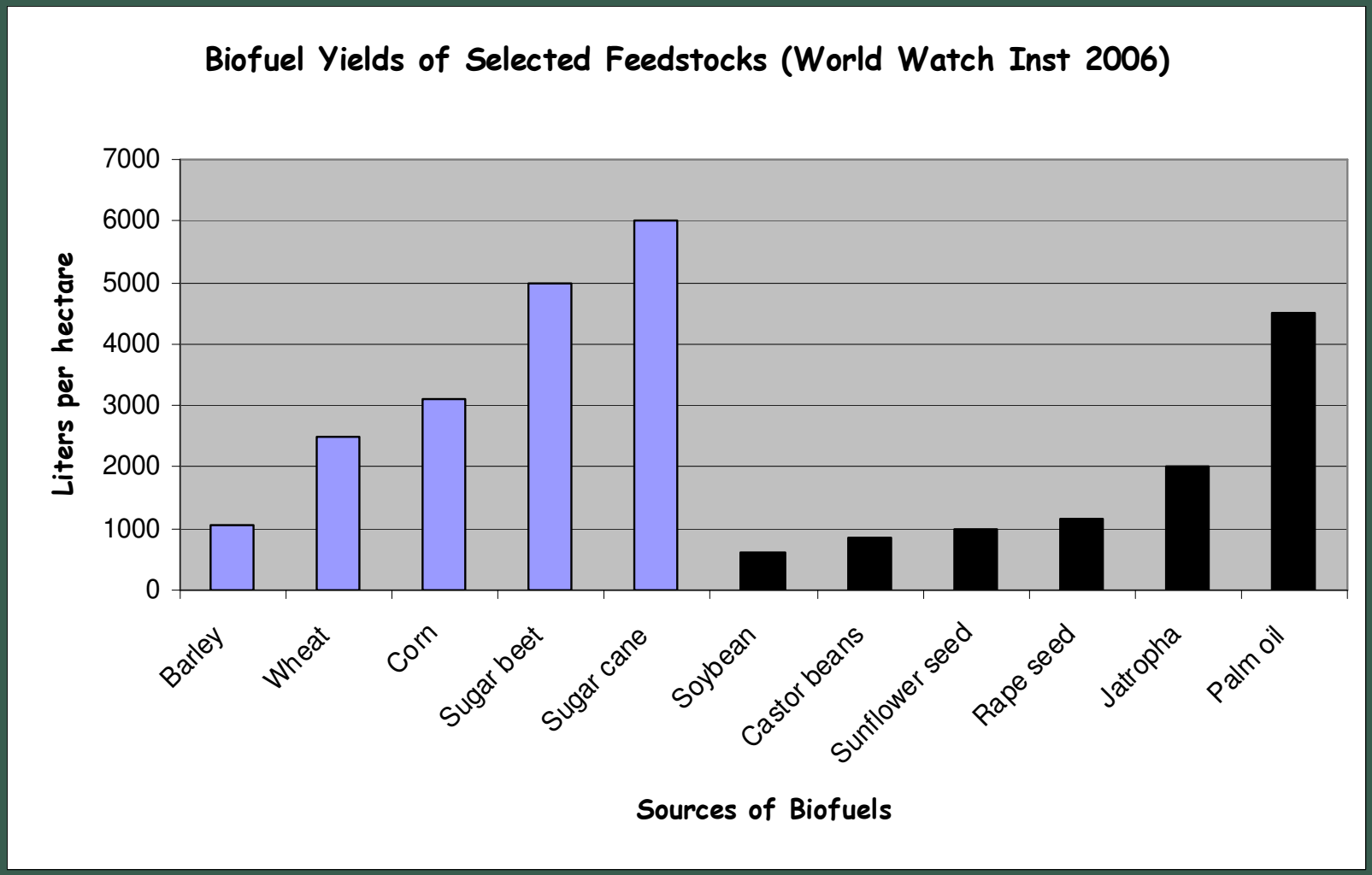
Overview of the most relevant liquid Biofuels

Sweet Sorghum is a plant with high sugar content. Sweet sorghum is very drought and heat tolerant and is suitable for arid regions. New hybrid varieties can reach 5 t/ha grains and 45 t/ha for cane (grains + stalks). Ethanol productivity is estimated at 40 l/t of millable cane yield (1800 liters alcohol per hectare).

African Oil palms. The fruit comprises an oily, fleshy outer layer (pericarp) with a single seed (kernel) also rich in oil. annual production averages 10 tonnes of fruit, which yields 4000 liters of pericarp oil and 250 liters of high quality kernel oil

The Euphorbia tirucalli, (Pencil tree). is an unarmed shrub or small tree with succulent branchlets with white latex. The hydrocarbon molecules in the Euphorbia latex have a size distribution very much like those in petroleum. After removing the water, we get a crude oil void of sulfur. Oil production can vary between 3,000 to 16,000 liters per hectare (20-100 barrels/ha) depending on cropping conditions.

Jatropha Curcas L. (Physic nut). The plant is adapted to extreme growing conditions. Jatropha seeds contain of 35% oil. Seed production is depending on cropping conditions and climates. Yield of 4-6 tonnes of seeds per hectare is an average and oil production is about 1800 liters per hectare.


Biofuel Yields of Selected Feedstocks (World Watch Inst 2006)
Liters per hectare
7000
6000
5000
4000
3000
2000
1000
0
Barley
Wheat
Corn
Sugar beet
Sugar cane
Soybean
Castor beans
Sunflower seed
Rape seed
Jatropha
Palm oil
Sources of Biofuels

Would Biofuel crops threaten food security?

Possible Positive Effects linked to Biofuels production

-The developed world's demand for Biofuels presents a great opportunity for African countries to produce more biofuel crops and exporting them.

- Higher commodity prices would put more money in the pockets of poor farmers.

- Biofuels will attract investment, which would benefit food production, accelerate rural development, and alleviate poverty and migration to the cities.

- Farmers and rural development will benefit of the market organization of an industrial crops (availability of inputs, production linked to markets…).

Possible Risks linked to Biofuels production

- Development programmes of biofuel crops will compete with food production and even the non food biofuels crops will compete for land and water.

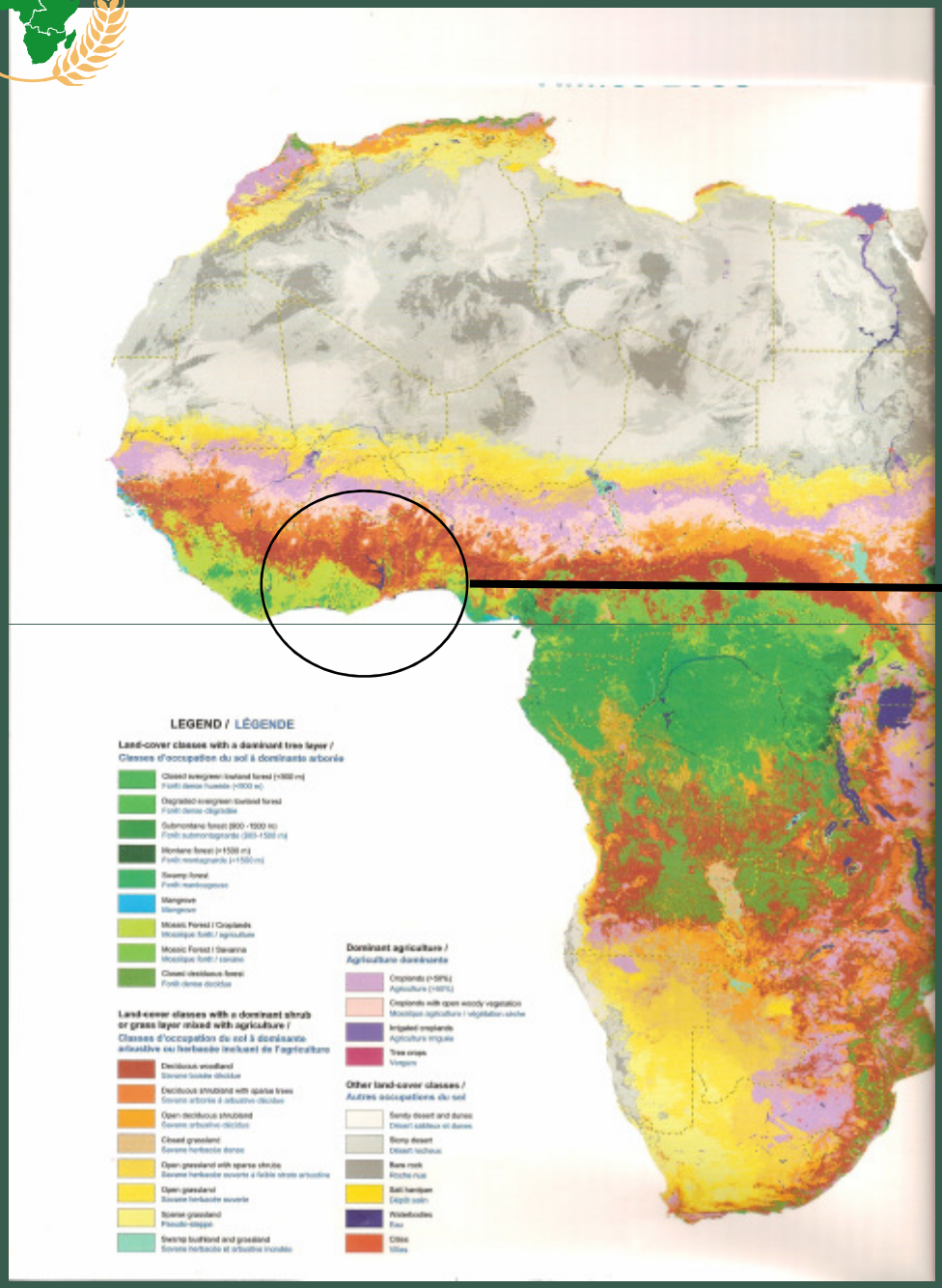
- In some place biofuel development (palm oil) is made at the expense of dwindling rainforests,

- Food prices will increase. Food insecure people would rise by over 16 million for every % increase in the real prices of staple foods".

- Biofuels production is likely to bring prosperity to the few who own the land and have the means to achieve large-scale production.

Research on improved technologies for Stoves, Engines, Domestic lights…

West Africa



What land use changes can we expect in the perspectives of biofuels development ?

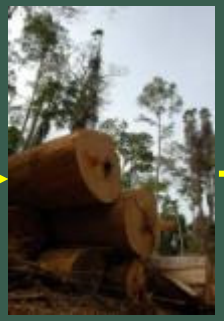
Actual land use (1)

Possible Biofuels crops

Savanna Zone

Forests Zone

Timber extraction



Slash & burn

Slash & burn

14%

76%

Oil Palm

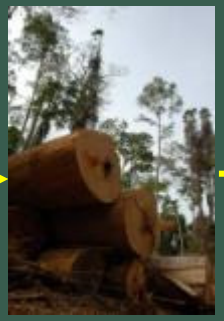
Rubber

84%

Actual land use (2)

Forests Zone

Timber extraction



Slash & burn

Slash & burn

14%

76%

Oil Palm

Rubber

84%

Actual land use (2)

Timber Extraction (1)

Timber Extraction (2)

Illegal Logging

Slash & Burn (1)

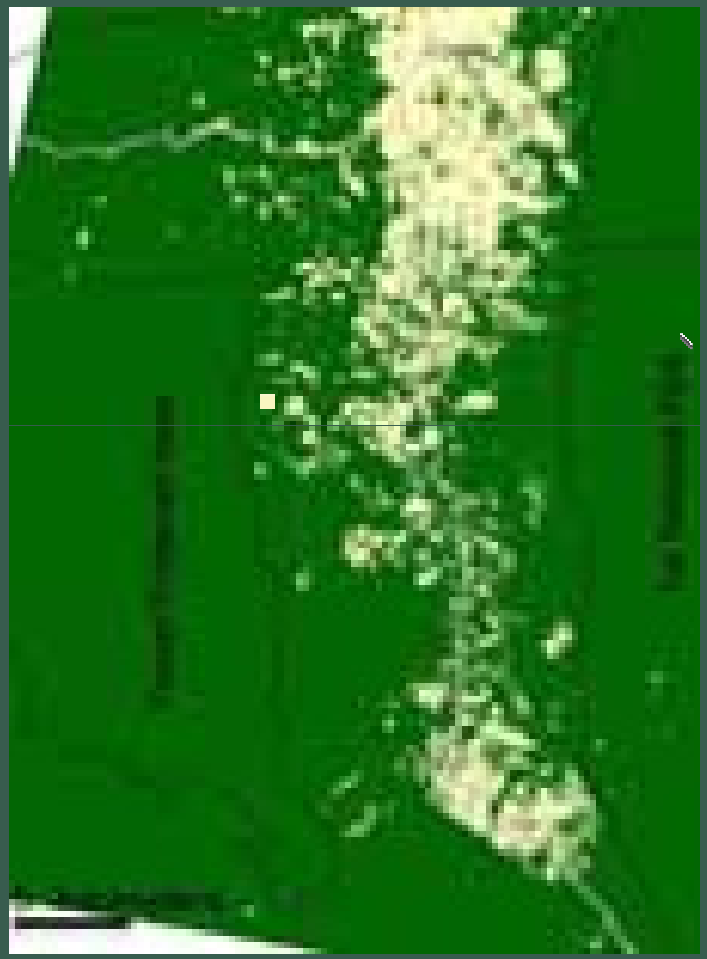
Slash & Burn

Wood Charcoal

Deforestation 1990-2006

Deforestation 1990-2006

Déforestation avant 1980



1980

2000

Forest

Deforestation

Plantation

Forest Exploitation Africa - Europe

Côte d'Ivoire: 320,000 km2, 18 million inhabitants		
Date	Forest areas	Agricultural area
1900	16,000,000 ha (50%)	?
1965	9,000,000 ha (28%)	1,900,000 ha (6%)
2004	2 – 6,500,000 ha ? (6-20%) ?	7,500000 ha (23%)

Ghana: 240,000 km2, 21 million inhabitants		
Date	Forest areas	Agricultural area
1900	9,000,000 ha (38%)	?
1965	4,000,000 ha (17%)	?
2004	1,500,000 ha ? (6%) ?	4-5,000,000 ha (20%)

Europe
Forests represent now around 15% of N.T. (Threatened by pollution)

Forests have been over exploited. There is a need for emergency measure to protect remaining forest & Reserves.

Rules are not enough to protect Forest.

Tangible benefits for local communities often in subsistence farming systems are necessary.

New cocoa management : Zero Shade and High Density Impact on Environment and Biodiversity

The End of a Cocoa Plantation
(Technical Difficulties to Re-Plant Cocoa after Cocoa)

Rubber is the champion of the diversification process

Oil palm is also and already a popular option of diversification

Diversification Strategies

Productivity Competitiveness	Small holder Plantation			
	Cocoa (poorly maintained)	Cocoa (well maintained)	Oil Palm	Rubber
Production (kg/ha)	400 Beans	900 Beans	8,000 Bunches	1,500 Dry latex
Producer price (US$/kg)	1.0	1.0	0.08	0.8
Gross Revenue (US$/ha)	400	900	640	1200
Net Revenue including labour costs (US$/ha)	170	500	240	840
Net Revenue excluding labour costs (US$/ha)	340	800	460	1020
Returns from labour (US$/day)	**6.0**	**8.0**	**8.7**	**15.7**

Farmers' Strategies – Crops Diversification - New Land Use

Crops Diversification is now a part of Farmers' Strategies.
The process of diversification is a reality which can be ignored

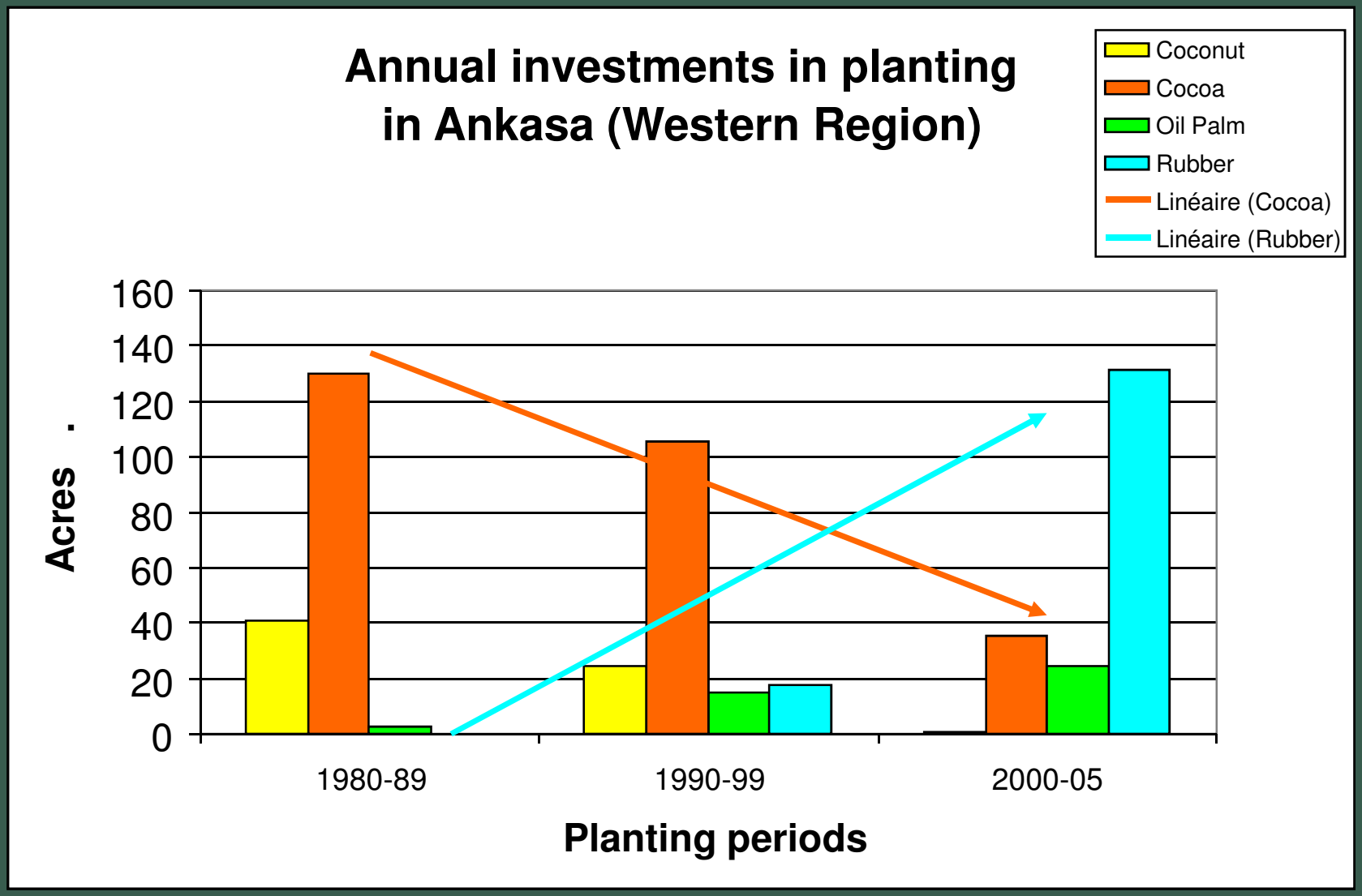
All new markets, **including Biofuels,** will create new opportunities to:

- support production,
- improve productivity and
- provide positive elements for environment rehabilitation.

Subsistence Farmers are practicing a mining agriculture.
To improve their situation is a social and economic objective.

Oil Palm demand is important and financially the crop is interesting.

Rubber is financially the most interesting crops, with a stable and regular production


Annual investments in planting in Ankasa (Western Region)
Coconut
Cocoa
Oil Palm
Rubber
Linéaire (Cocoa)
Linéaire (Rubber)
160
140
120
100
80
60
40
20
0
Acres
1980-89
1990-99
2000-05
Planting periods

Carbon Storage

CIRAD, Lamade E. & Bouillet J-P, 2005; National Resources of Canada, 2008.

Tree crop plantations are seen as « polluters »
since they : - need fertilizers, pesticides
- produce effluents from processing
- are planted in deforested areas considered as « Carbon sinks ».

When harvesting bunches and foliage biomass the Carbon storage is still of **2,5 ton of carbon per ha and per year**.

Higher than Forest ecosystems

Plantations of oil Palms could be of particular interest as their high biomass production and dynamic expansion make them a potentially important carbon sink .

Conclusion (1)

- In West Africa crops diversification and land use changes are realities and farmers' strategies take into consideration all new markets opportunities.

- In Humid zones Oil palm is clearly a part of the farmers' strategy for diversification. Most of the plantation development are mainly made in existing old cocoa plantations or in already degraded forestlands.

- Oil palm plantation has major potential for atmospheric CO2 sequestration with an annual carbon storage rate higher than forest ecosystems. Oil palm can be positively considered to rehabilitate degraded forestlands as well as "carbon sinks".

- Forest codes and legislation have been ineffective to protect forest & environment. Communities manage their natural resources on a sustainable way when they get back tangibles benefits.

Conclusion (2)

- Coercive measures are not efficient for Farmers into subsistence farming. Move those farmers into a commercial systems is a social & economic objective.

- Oil palm plantations offer smallholders interesting incomes.

- Biofuel market can offer new market in addition of traditional markets. New demands can lead to intensification of the productivity.

- In savanna zones Jatropha appears to be an attractive crop for smallholders' farming systems diversification.

Drivers for Biofuels crops development are diversification, new markets and income generation

Thank You