Tropical forests and climate change

0-deforestation products
Rationale and a case study from Ivory Coast

GEEFT/BB 2022-2023 – December 15th, 2022

Presented by David COMBAZ

Associate expert in agriculture, forestry and climate change at SalvaTerra

d.combaz@salvaterra.fr

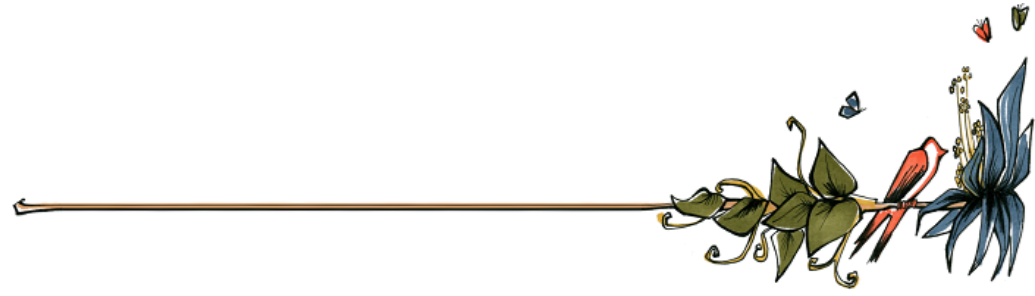# Producing 0 deforestation cocoa and palm oil in Ivory Coast: WHY AND HOW?

Summary

1. **Forest and agriculture in Ivory Coast: Dangerous liaisons**

2. Zero deforestation commitments

3. Forest mapping and stratification

4. Cocoa traceability

5. Sustainable intensification trials for cocoa cultivation

Agriculture, the basis of "Ivorian miracle"

Ivorian agriculture in the 2000s:

- 2/3 of the Ivorian workforce, 600 000 farms in the cocoa and coffee sectors
- 40% of the export incomes and 20% of GDP for coffee and cocoa
- 45% of the world cocoa production

- Agriculture is one of the four pillars to make Côte d'Ivoire become a new industrialized country by 2025 (PND, 2012)

- Objective of 9% of annual growth in agricultural sector, especially with 7.6% of annual growth for cash crop – firstly cocoa (NAIP, 2010)

The Ivorian forest disappears

- A small-scale and extensive agriculture
  - For example, in 2001, 2.9% farmers used seeds / improved seedlings and 4.5% used fertilizers (NAS, 2001)
- A similar situation in the cocoa sector
  - In 2007 17% used improved seedlings and 12% fertilizers (Ruf & Agkpo, 2008)
- Low yields
  - (500 t / ha of cocoa, 4 times less than in station)
  - Reduction of fallow periods from 20 to 5 years on average since 1960 (Halle & Bruzon, 2006)
- Forest soils are sought for fertility
  - about 200 000 ha deforested/ year (+ wooded forest fallows)
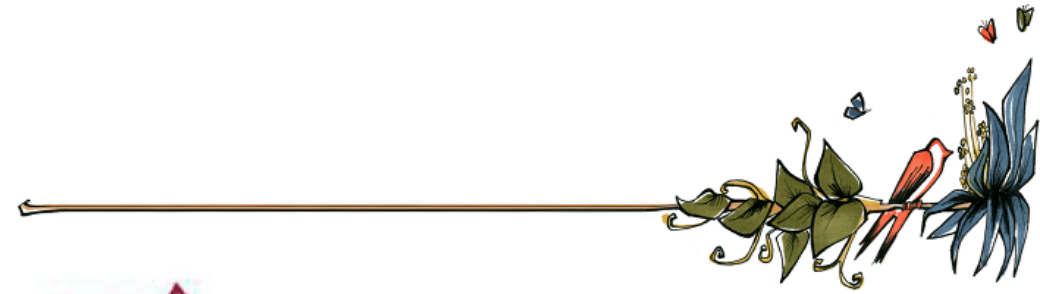 - 40 000 ha deforested / year for the cocoa (Salvaterra, 2013)
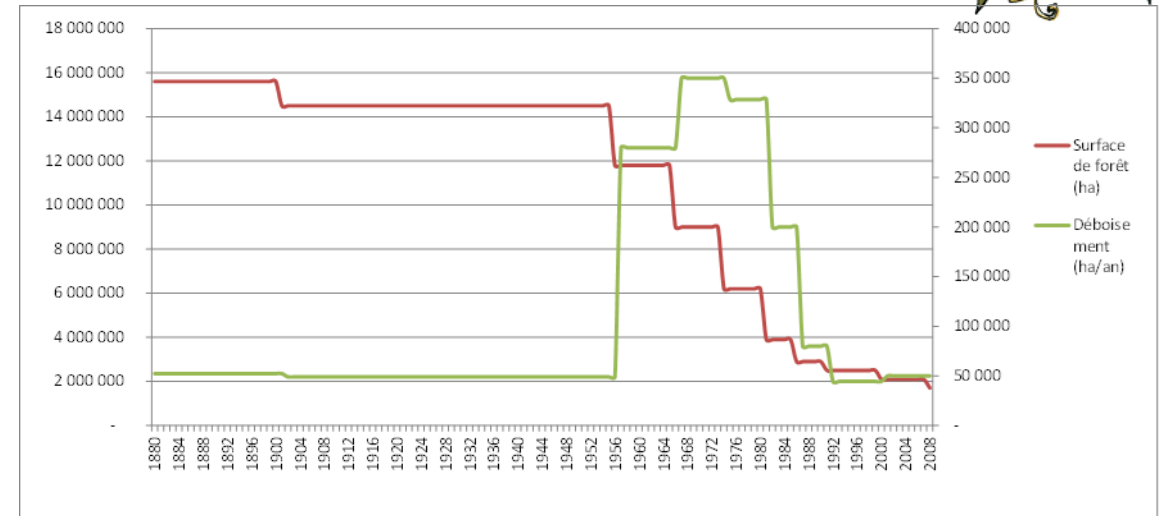
90% of forests have disappeared since 1880

With a **peak** between the 50s and 80s
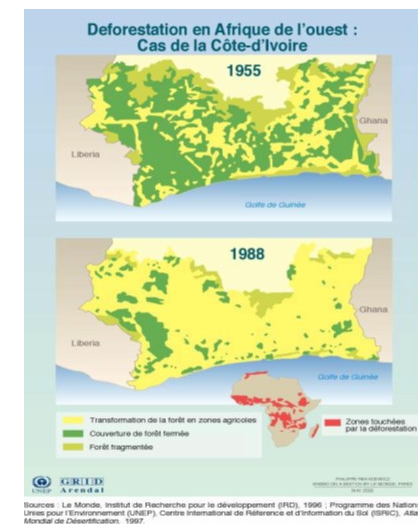
Many certifications schemes...

Many environmental and social certifications: UTZ (cocoa), Rainforest Alliance (cocoa and palm oil), RSPO (palm oil), Max Havelaar (cocoa), ESR / ECOCERT (cocoa), etc.

- Certification is **widespread** among producers: 207 producers and many UTZ certified Ivorian traders

- Sometimes **anecdotic**: only 1 company of certified cocoa ESR/ECOCERT
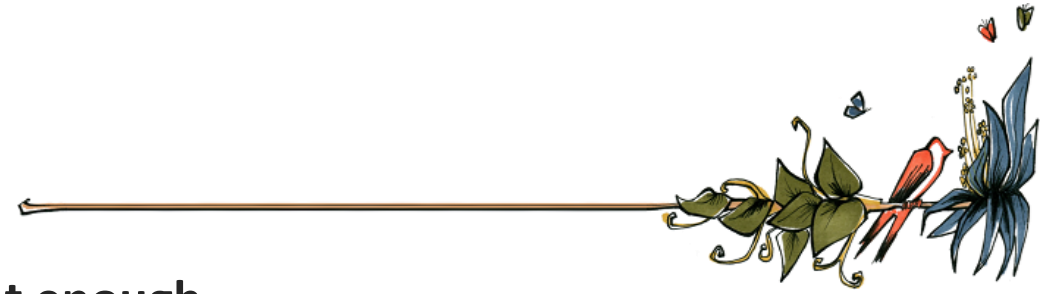
The fight against deforestation is implicitly considered

For example:
- Obligation to have over 12 (UTZ) or 12-18 (RA) trees/ha in cocoa plots,
- Prohibition to plant palm trees in primary forests, included in " High Conservation Value Forest "(RSPO)

For what results?

**Environmental, social and economical progresses are real, but not enough**

- **For forests: most certifications do not guarantee the absence of deforestation.**
  - for example, the RSPO, does not explicitly prohibit the conversion of high carbon stock areas and requires a national interpretation of the HCV concept to make it become an effective tool against deforestation

- **For consumers: certifications schemes are often incomprehensible** and guide marginally consumer purchases
  - (for example : 244 criteria for ESR)

- **For economic operators**: **considerable difficulties and reduced ambitions**.
  - long discussions on collective standards hinder rapid and ambitious initiatives (consensual agreements on lowest common denominator),
  - Implementation difficulties: how to trace and manage certified and non-certified production among scattered smallholders?

Some questioned certifications, for example, the RSPO:

"It is unfortunately no longer possible for producers or users of palm oil to ensure that they are acting responsibly simply by producing or using Certified Sustainable Palm Oil" (WWF, 2013)

"Only primary forests are protected: 20% of the deforestation in Indonesia from 2009 to 2011 was caused by RSPO members ... The RSPO has failed to adapt to new market dynamics" (Greenpeace, 2015)

Summary
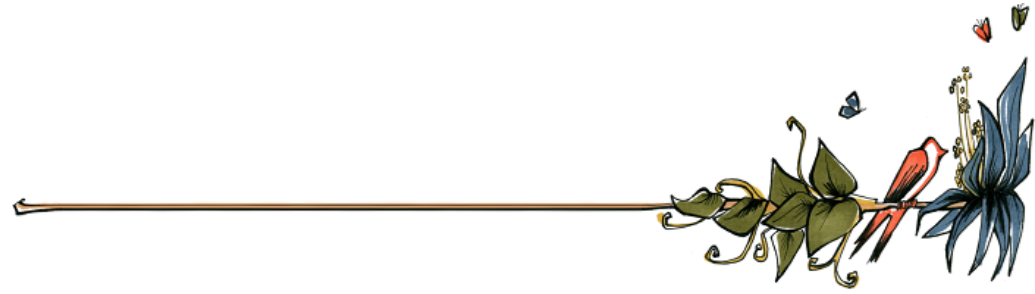
1. Forest and agriculture in Ivory Coast: Dangerous liaisons

2. **Zero deforestation commitments**

3. Forest mapping and stratification

4. Cocoa traceability

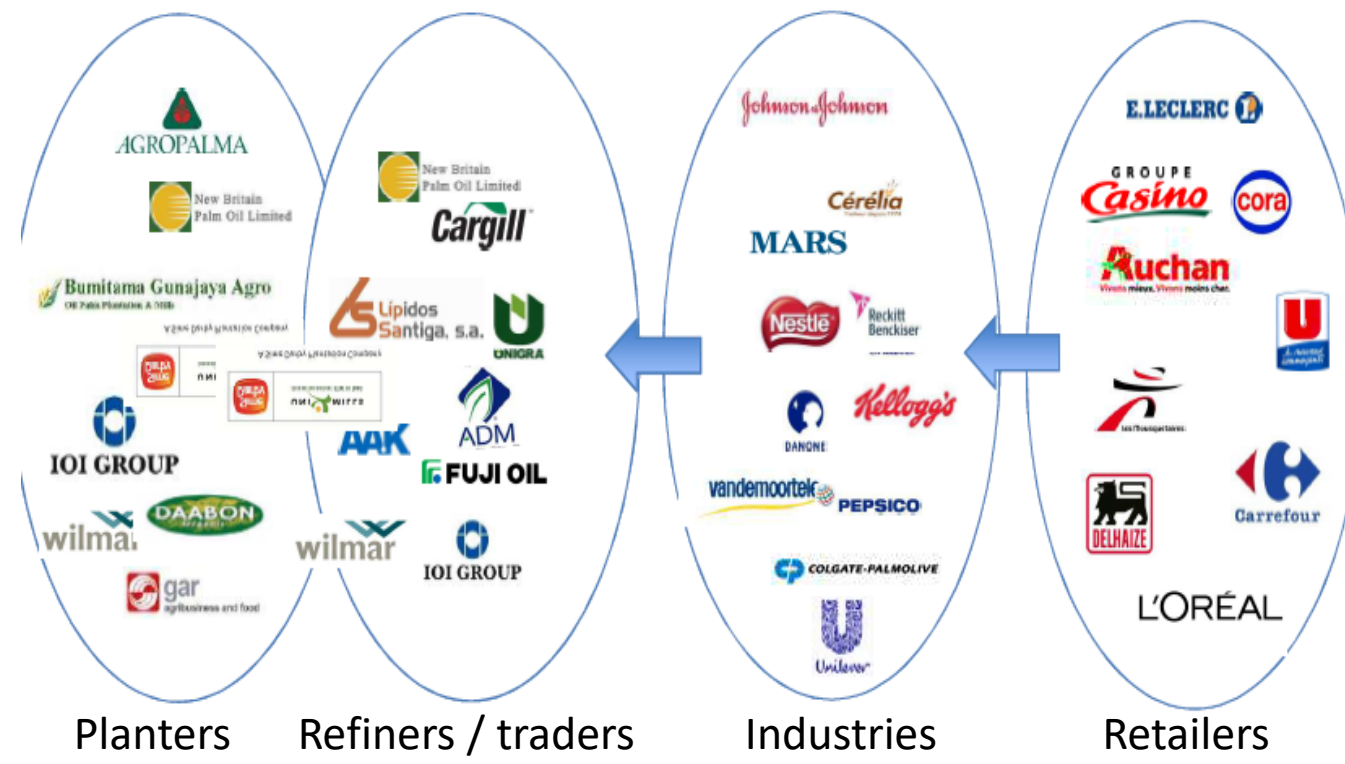5. Sustainable intensification trials for cocoa cultivation

# Strong media pressure leads to action

Oil palm: a recent but large-scale movement

Many companies made 0-deforestation commitments:

Planters   Refiners / traders   Industries   Retailers

"Early movers": GAR (Indonesia, 14% of the world market) in February 2011 and WILMAR (Indonesia, 43% of the global market) and **27 Govts (Including IC) and 34 companies** signed the UN Declaration to **stop deforestation by 2020** (NY, September 2014)

70% of world volumes concerned
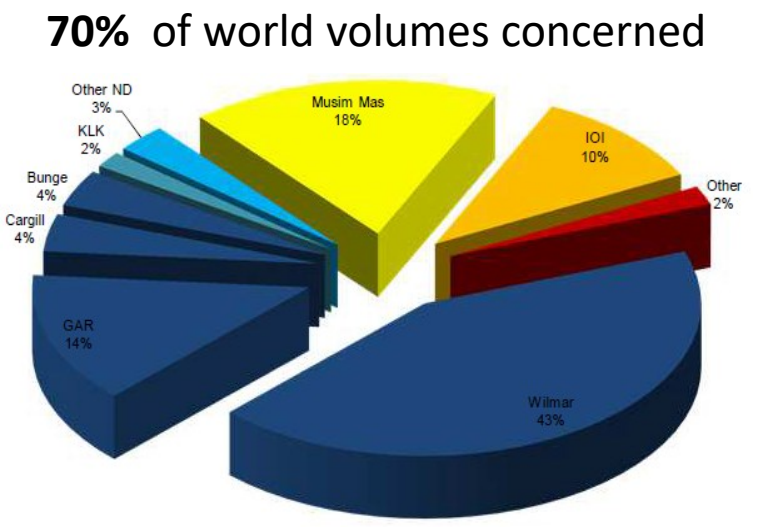
"O deforestation" in practice

1. **Forest inventory and HCS mapping**: assess and rank forests according to their carbon stocks, and identify High Carbon Stock forest vs non-HCS

2. **Define arable and protected areas according** to the HCS forest map, and additional criteria (biodiversity, connectivity, FPIC, etc.)

3. **Pilot and replicate improved farming practices** to produce more at constant area

4. **Implement traceability schemes** to allow only 0 deforestation products into the supply chain

5. **Monitor, evaluate and communicate** results at large-scale to make the approach credible

HIGH CARBON STOCK (HCS) IN TROPICAL FORESTS — GREENPEACE

CONCLUSION ➔ private approach ≠ collective certification. As a company, **contribute to fight against deforestation** and **strengthen its competitiveness**:

"Those suppliers who are the first to have affordable traceable solutions concretely available on the market will very likely see their market share increase among committed brands" (TFT, 2014)
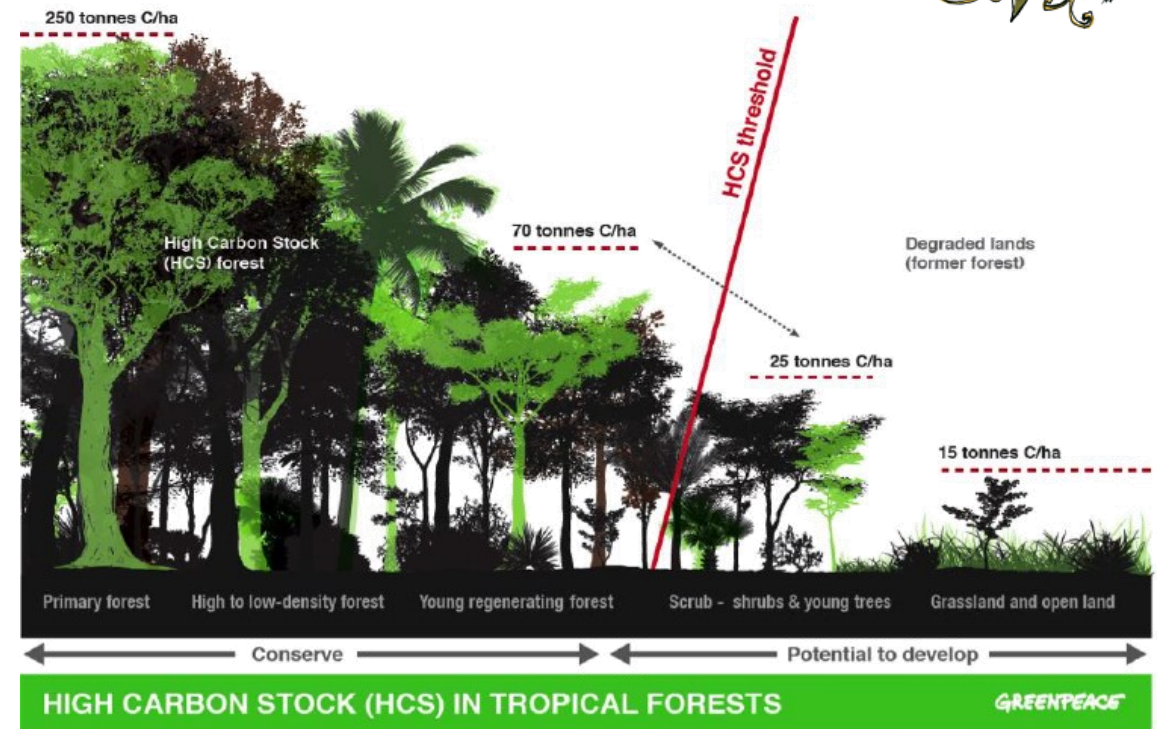
What about cocoa production?

For corporations :   Recent ads (Mondelēz, Cargill, etc.) but little action in the field

For the government of Ivory coast:

- Aim to increase the forest cover to 20% by 2020, from 10-13% currently, especially by controlling the expansion of cocoa fields (Forest Code, 2014)

- Development of a national cocoa sustainability standard, as part of Quality-Quantity-Growth program (2QC, 2014)

- Presidential statement at the New York Climate Summit "Ivory Coast will produce zero deforestation cocoa by 2017 (2014)

Main obstacles:

- **Less experience** than in the oil palm sector, difficulties due to the fragmentation of the supply side (many smallholders)

- **An agreement is needed on the concept** (gross vs. net deforestation?

BUT there is an opportunity to seize for the IC, world leader of the cocoa market!

Gross vs. net deforestation?

E.g.: How to reduce deforestation from 100 ha/year to 70 ha/year?
- **Gross deforestation**: reduce deforestation by 30 ha/year
- **Net deforestation**: reduce deforestation by 10 ha/year and reforest 20 ha/year (offset mechanism)

Which one is best?

- **For a company: gross deforestation**
  - Individual and ambitious approach
  - More credible for consumers, hence a favored access to markets

- **For the government: net deforestation**
  - Collective approach, allows to involve more operators with accessible targets

Is it achievable? Examples from Ghana and Liberia

Scenario	Total Invested (in USD$)	Tenor (Years)	Net Cash Flow[1]	Carbon Revenue	Productivity Range[2]
East BAU	$0	N/A	$20,469	$0	300 - 370 kg/ha
E. Inputs	$487[3]	1-4[3]	$46,621	$0	370 - 770 kg/ha
E. Rehabilitate	$3,079	25	$70,287	$0	0 – 1,100 kg/ha
E. Integrated	$2,800	25	$49,734	$768	0 – 880 kg/ha

Cocoa   Palm Oil

Scenario	Total Invested (in USD$)	Tenor (Years)	Net Cash Flow[1]	Carbon Revenue	Productivity Range[2]
East BAU	$0	N/A	$11,523	$0	4.5 – 5.5 tons/ha
E. Inputs	$1,000[3]	1-3[3]	$22,741	$0	5.5 – 11 tons/ha
E. Rehabilitate	$3,081	25	$38,268	$0	0 – 16 tons/ha
E. Integrated	$2,537	25	$23,645	$1,162	0 – 11 tons/ha

➔ **In Ghana:** ITK "**rehabilitation**"(sustainable fertilization + renewal) and "**Integration**" (sustainable fertilization + renewal + reforestation) are **more profitable than** ITK « **Business As Usual**" and **reduce/store more carbon**, with **moderate investments** *(Source: Proforest - Tea Prince's Rainforest Project, 2012)*

➔ **In Liberia:** *"Establish a public-private coalition with multinational companies committed to ambitious **zero deforestation policies**, **only allowing companies adhering to such policies to do business in Liberia**" (Source: MoU Liberia / Norway, 2014)*
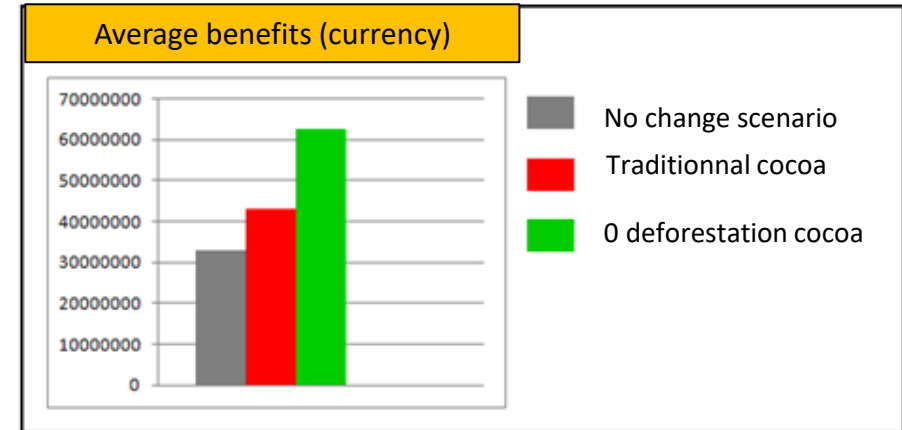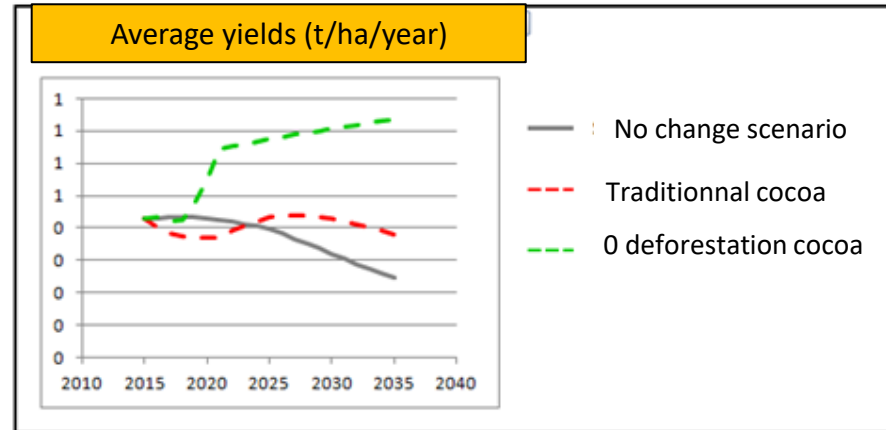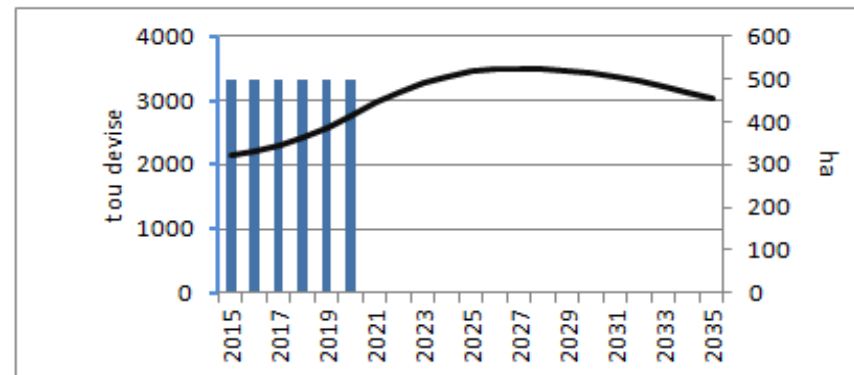
And in Ivory Coast?

To produce the same volume:

- 0 deforestation, improved ITK requires 5,000 ha of arable land

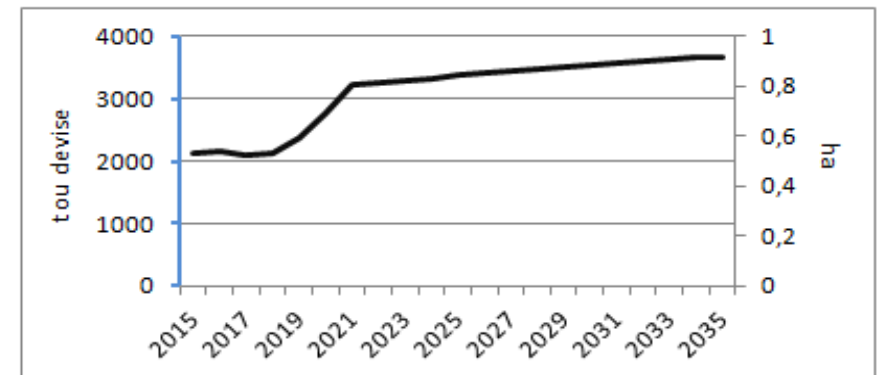- BAU ITK requires 5,000 ha + 3,000 ha of converted land

Source: Salvaterra - EFI, 2013

Average yields (t/ha/year)

- No change scenario
- Traditionnal cocoa
- 0 deforestation cocoa

Average benefits (currency)

- No change scenario
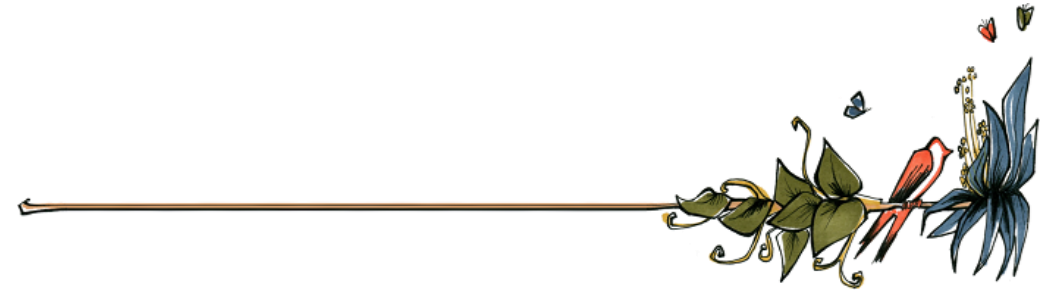- Traditionnal cocoa
- 0 deforestation cocoa

Traditionnal cocoa

0 deforestation cocoa

Actions to implement:

Overall objective : Support two operators (Cocoa & Oil palm) to commit to 0 deforestation and help the Government to agree on a sustainability standard for cocoa.

Steps to follow:

1. **Identify partner operators**
2. **Define a 0 deforestation agreement** : objectives, activities, resources, schedule, monitoring & evaluation (operator + SalvaTerra, CN-REDD and independent observer)
3. **Implement** the agreement:
   1. HCS forest mapping on a pilot production basin and
   2. Definition of an alternative ITK to intensify the production
4. **Quantify** the benefits, including **carbon** and **socio-economic** improvements
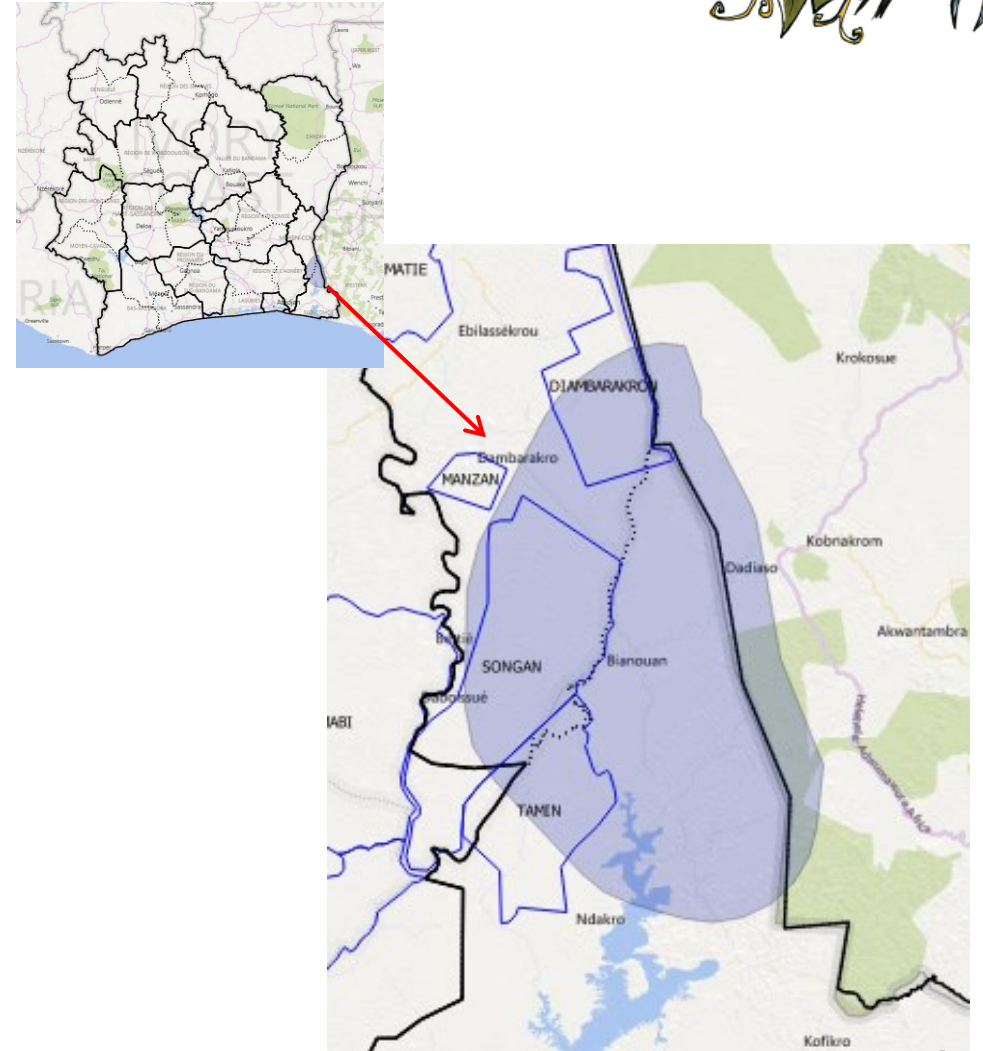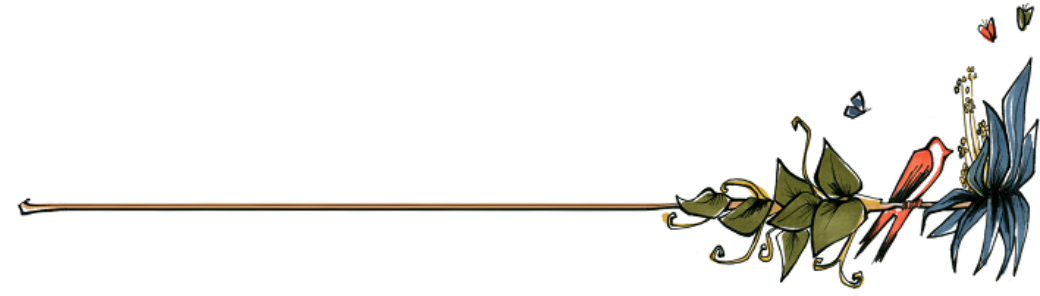
Summary
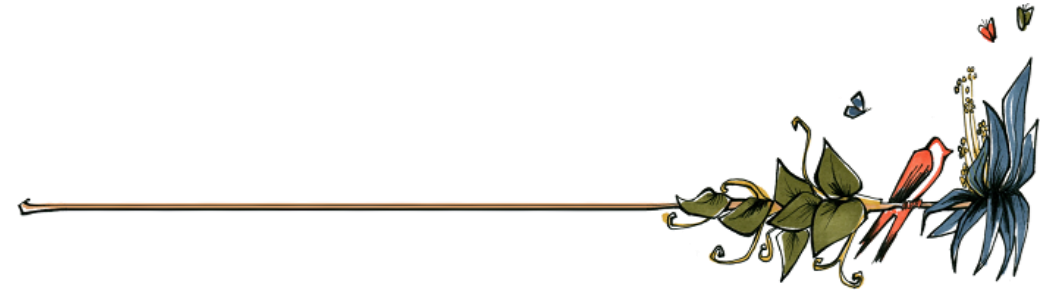
1. Forest and agriculture in Ivory Coast: Dangerous liaisons

2. Zero deforestation commitments

3. **Forest mapping and stratification**

4. Cocoa traceability

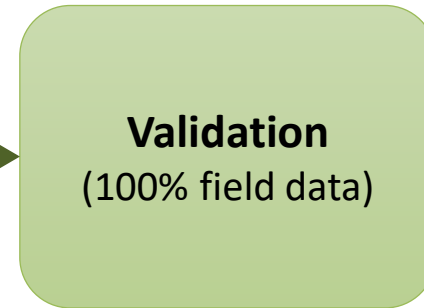5. Sustainable intensification trials for cocoa cultivation

The pilot area

- Selected among different production basins in agreement with the industrial and the government

- Nearby the Songan classified forest in the old cocoa belt, in the South East

- 1,249,000 ha, close to Bianouan town, between the Bia river and Ghana

- Fully covered by SPOT 6/7 pictures (1.5 m) and partially by Pleiades pictures (0.5 m)

Methodology

November 2015

April 2016

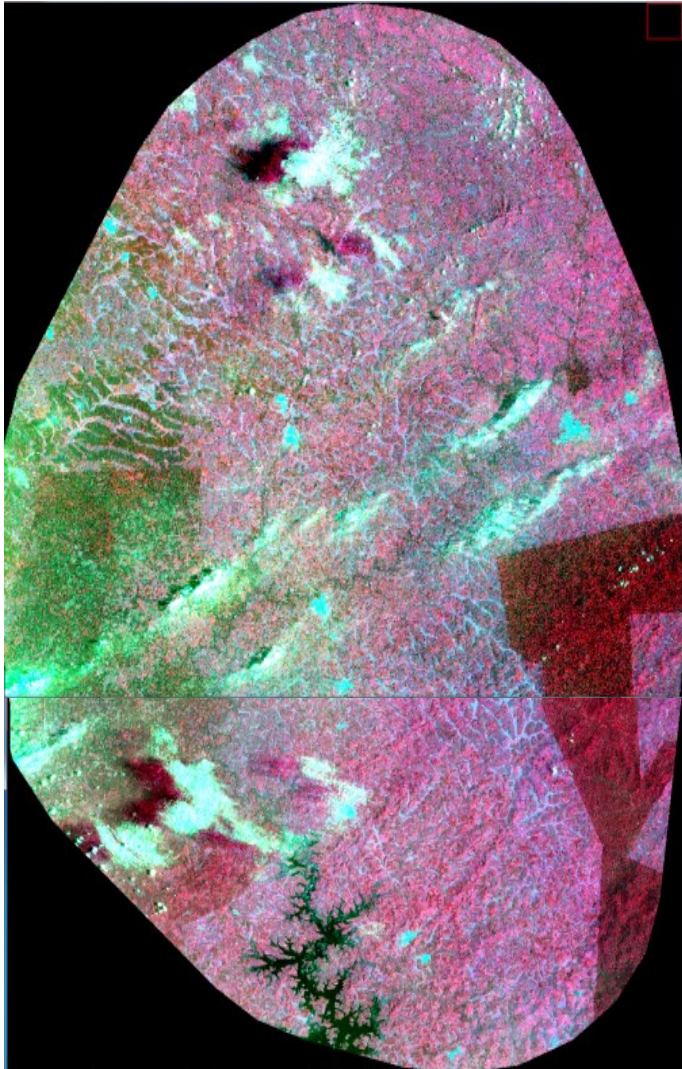| Image preprocessing | → | **Strata characterization** (reconnaissance mission) | → | **Interpretation** | → | **Validation** (100% field data) | → |

Vegetal strata identified and described

LULUCF map produced

LULUCF map validated

Step 1: Preprocessing the pictures

- **December and January 2014** (dry season) **orthorectified and cloudless** SPOT 6 pictures

- **Radiometric calibrations aim to** make the application of specific treatments easier: Principal Component Analysis (PCA), vegetation indices

- **Panchromatic and multispectral bands fusion**: resolution melioration from 6 to 1.5 m

- **Delimitation of the area of interest** by cutting of the provided pictures

- **Isolation of cloudy areas** to limit the visual pollution on the polygon interest

SPOT 6/7 pictures made available by Airbus for Salvaterra

Step 2: Strata characterization

Field mission : crucial in the absence of ancillary data (maps, agricultural statistical data, aerial pictures), etc.

- **Land-use census and characterization** according to the following criterias :
  - **Stucture** (number of layers, height, new growth, etc.)
  - **Phenology** (blossom, fructifcation, leaves, etc.)
  - **Ecological characteristics** (soil moisture, slope, altitude, human activities, etc.)

- **Identification/description** of **14 land use classes**

Step 2: Strata characterization

Perennial crops: 8 classes

- Falling of leaves on cocoa and rubber: strong spectral heterogeneity

- Mixed cultures: cocoa-rubber, cocoa-coffee, cocoa-coffee-palm, etc.

- Rubber and palm generally more easily to distinguish: monospecific crops

Oil palm plantation

Coffee plantation

Forest plantation (Teak)

Cocoa: 3 classes (shaded/full sun)

Rubber: 2 classes (mature/immature)

Step 2: Strata characterization

Forests and fallows: 5 classes

- Absence of primary forest in the study area

- Presence of mature perennial crops in the fallow 3 and 4

- Possible confusion between fallow 3 and 4 and cocoa plots

- Differentiation based on height, regrowth, presence of perennial crops

From secondary forest to fallow 5 (left to right)

Step 2: Strata characterization

Annual crops: 1 class

- Small and intercropping areas : yam, banana, corn, cassava, etc.
- Often confused with the very young fallows
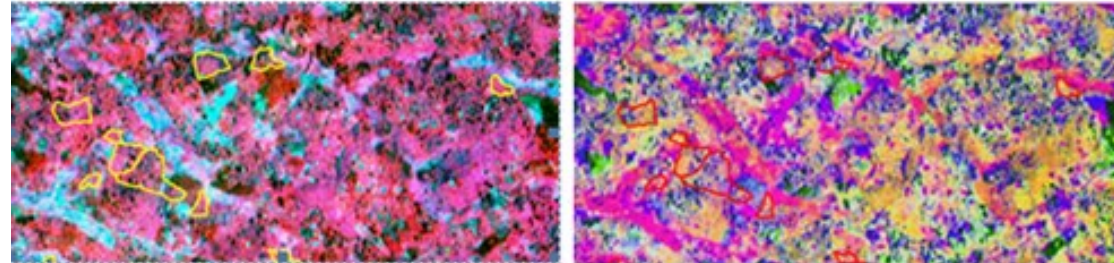- Often a transition to new cocoa plots
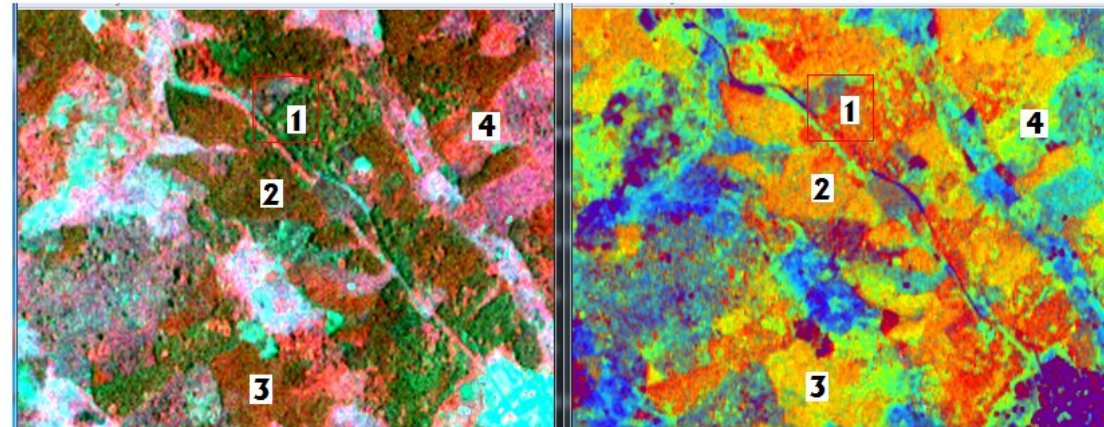
Step 3: Data processing and cartography

- **Most relevant pictures are processed**

- **Land-use are identified matching field information and spectral signatures**: **PCA**, **bands ratios** and **normalized difference vegetation index** (NDVI)

Colored composition of the raw layer (l.) and PCA1-PCA2-R / RIP colorful composition (r.)

RGB colored composition (l.) and RGB R / PIR PCA2-PCA3 colored composition of the raw layer (r.)



1 to 4: declining aged plots

Step 3: Data processing and cartography

Iterative approach to build and consolidate the land-use map:

- 272 training areas and 413 control points
- Supervised classification ("maximum likelihood" method)
- Separability test to reduce the number of classes
- Class grouping and delimitation, using of new training areas (Google Earth Pictures 2016)
- Confusion matrix to evaluate the validity of the results

Step 4: In-field validation
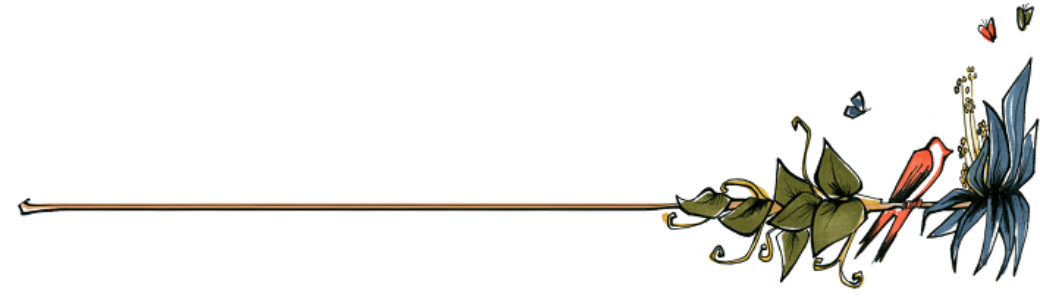
Validation mission:

- No ancillary datas: validation points are visited in the field

- Mission implemented with the CURAT and ten students from the University Felix Houphouet Boigny of Cocody

Matrix of confusion : objective of at least 80% of correct classification per class and of 85% for all the classes
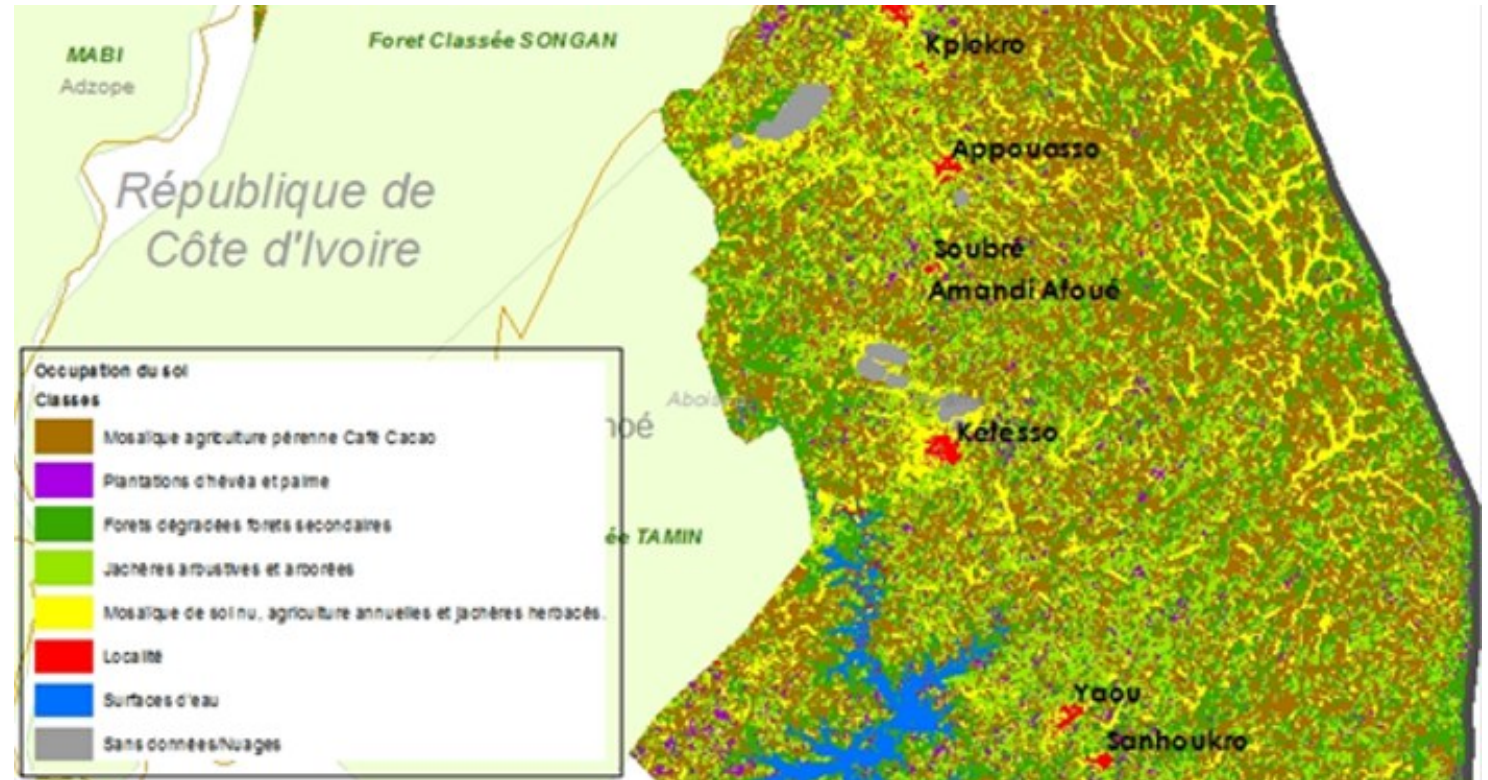
The final map

Very fragmented agricultural mosaic with high risks of classes confusion:

not very cost-effective, and not so adapted to the Ivorian context...

Remaining steps:
- Carbon stocks inventory by class
- Delimitation of HCS vs. non-HCS areas.

Summary

1. Forest and agriculture in Ivory Coast: Dangerous liaisons

2. Zero deforestation commitments

3. Forest mapping and stratification

4. **Cocoa traceability**

5. Sustainable intensification trials for cocoa cultivation
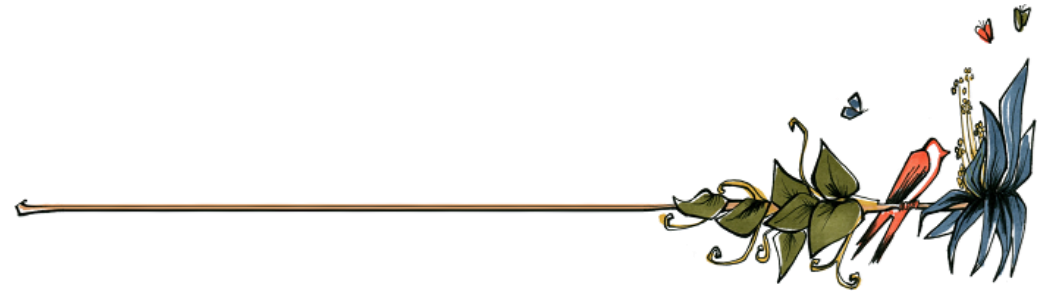
Cocoa markets in theory

A formerly State-controlled sector, with strong political and economic issues

- Farm prices are fixed by the state (1.5 €/kg)
- Sellers and buyers need to be State-authorized, at all levels
- Smallholder con only belong to one cooperative
- The creation of new cooperatives is subject to due diligence and control
- Traceability is ensured by monitoring documentation (receipts, purchase records, etc.)
- Traceability data is centralized in computers
- Unannounced controls of cooperatives, smallholders and transporters are realized by dedicated

Cocoa markets in practice
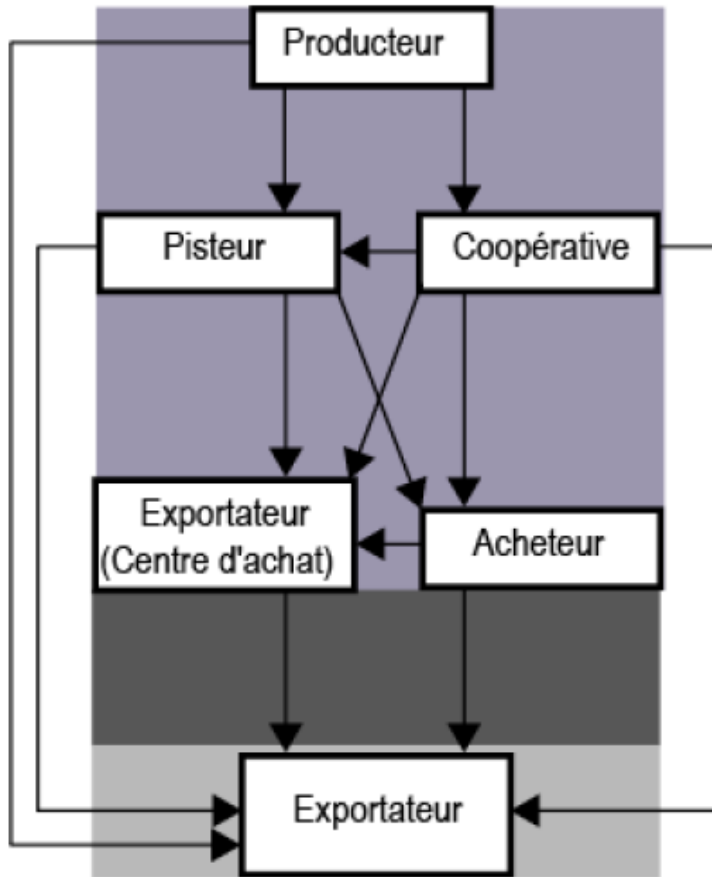
Sources: Ouattara, 2013

Multiple intermediaries and flows, very difficult to trace:

- An important share of trade occurs out of cooperatives
- Farmers sell to several cooperatives
- Cooperatives are purchasing to informal brokers
- Uncertain political will to implement control
- Growing environmental pressure: industrial compagnies adopt their own traceability tools, with inequal quality

Some insights from Bianouan region

- Purchases are done without prior verification of provenance

- Unstable cooperatives whose life expectancy is short (8 years)

- Some fictional cooperatives are only administrative entities

- Cocoa farmers often show little interest to their cooperative (unkown name), cumulate memberships or sale as "user"(without membership)

- Cooperatives leaders (often ex brokers) exercise on behalf of several cooperatives

- Only few controls on the field by national authorities

- Large-scale organized and facilitated purchase of cocoa from classified forests: production of false documents in cooperatives to "launder" cocoa

List of undifferentiated cooperative members and users

Farmer's purchase receipt : incomplete supplier identification

Cocoa is transported from classified forests by motorcycle, then loaded onto a boat and on 25t truck

How to improve traceability?

Goal: transparent sourcing to prevent cocoa produced in HCS areas in the 0-deforestation supply chain

- Data base creation and management
  - Purchasing limited to geolocated and identified members before campaign
  - Updated and transparent farmers DB for every cooperative
  - Creation a national system of unique farmer code
- Control
  - Prior : during the creation of new cooperatives
  - Ongoing : regularly, at the office (e.g., annually) and unexpectedly, at the office (DB: theoretical flows), on the fields and on tracks (real flows)
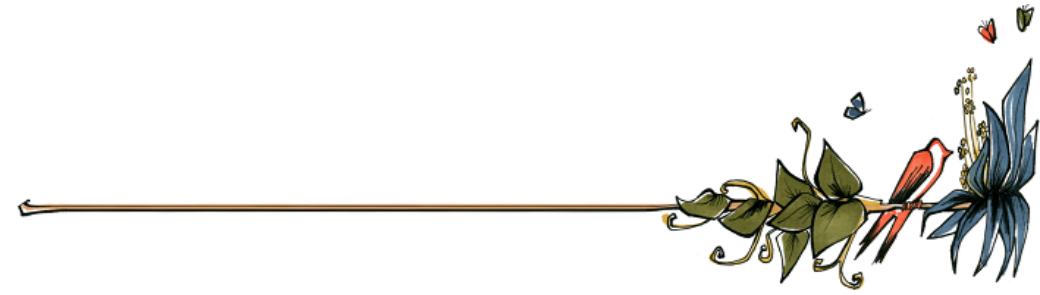
Summary

1. Forest and agriculture in Ivory Coast: Dangerous liaisons

2. Zero deforestation commitments

3. Forest mapping and stratification

4. Cocoa traceability

5. **Sustainable intensification trials for cocoa cultivation**
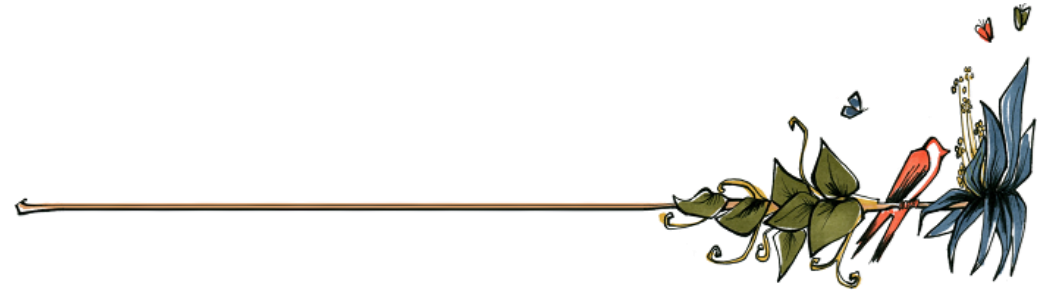
Cocoa: a forest crop

- Native from the rainforests of Latin America (hot and wet climates)

- 3 varieties :*Criollos, Trinaterios* and *Forasteros* (80% of the global market)

- Almost continuous harvest: between 0.3 t / ha (Venezuelan *Criollos*) and 4 t / ha (Indonesian *Forasteros*)

- Highly diversified farming systems, but 80% of the production comes from non-mechanized small farms

- 2 limiting factors: access to light and soil moisture... Maximum yield are reached in full sun exposure

- Many viral and fungal diseases, and pest → up to 50% of global losses

Ivorian Cocoa: unproductive and unsustainable

From a popularized model:

- An improved variety "Mercedes" with high potential yield (3 t / ha)
- A full sun production system after temporary shade
- Good agricultural practices (GAP) : pruning, application of fertilizers and plant protection treatments, appropriate densities and replacement of non-productive trees

To the reality of the plantations:

- Mix and little-productive varieties (Yield: 0.5 t / ha)
- Inadequate production systems, increasing the vulnerability of trees to drought and diseases (70% of full-sun systems)
- Unfollowed GAP : No pruning, absent or under-dosed fertilizer or plant protection treatments, aging orchards
- An alarming economical result : an average net margin of 0.37 € a day*!

*Calculated on a 25 year cycle for an average yield of 0.5 t / ha

Sustainable intensification initiatives in IC

- **Important stakes**: ageing plantations, global warming, Cocoa Swollen Shoot Virus (NB: incurable, transmitted mainly by cochineal)

- **Many initiatives**: by research centers (CNRA and ANADER) and industrial R&D (CARGILL, Mondelēz, CEMOI, NESTLE, etc.)

- **Mutual research subjects**: grafting (NB: forbidden at large scale), fertilization, agroforestry, etc.

- **Uncompleted and mixed results** and still agronomical doubts
  - Advantages and disadvantages of shading?
  - Organic and mineral fertilization needs?
  - Plant material for the Ivorian context?

Setting an experimentation system

- Tested factors : shade, fertilization (mineral and organic), plant material and pruning

- 3 tested ITK :
  - A – mixed cocoa in full sunlight
  - B – Mercedes cocoa in full sunligth   Based on an exhaustive review of
  - C – mixed cocoa in agroforestry   Ivorian and foreign experiences

- SMART indicators :
  - Socio-economic:
    - quantitative (cocoa yield and income, other income, operating costs, daily margin)
    - qualitative (work drudgery, cropping calendar)
  - Environmental:
    - biological activity of the soil (C / N, earthworm populations etc.),
    - carbon balance (avoided deforestation), etc.

Setting an experimentation system

Mother & Baby trials: a simple and bottom-up system

- 5 years trials with 100 famers monitored by 10 agents

- Mutual evaluation between agronomists and planters

- Easy access to experimental plots for independent observers

Agricultural system B :
Improved vegetal material (Mercedes), in full sun
(< 10 trees/ha)
Tested ITK : ITK1a et ITK1b

Same system

Agricultural system C :
Mix vegetal material, in agroforestery
(> 40 trees/ha)
Tested ITK : ITK2a et ITK2b

Same system

Agricultural system A :
Mix vegetal material, , in full sun
Tested ITK : ITK1a et ITK1b

Mother trials :
- 3 ITK (base, ITK1a et ITK1b)
- 4 repetitions / ITK
- Micro-plot of 0,25 ha
- 1 plot/bassin

Baby trials :
- 2 ITK (base, ITK1a ou ITK1b)
- No repetitions / ITK
- Micro-plot of 0,5 ha
- 32 plots /bassin

Base

Base

Base

Base
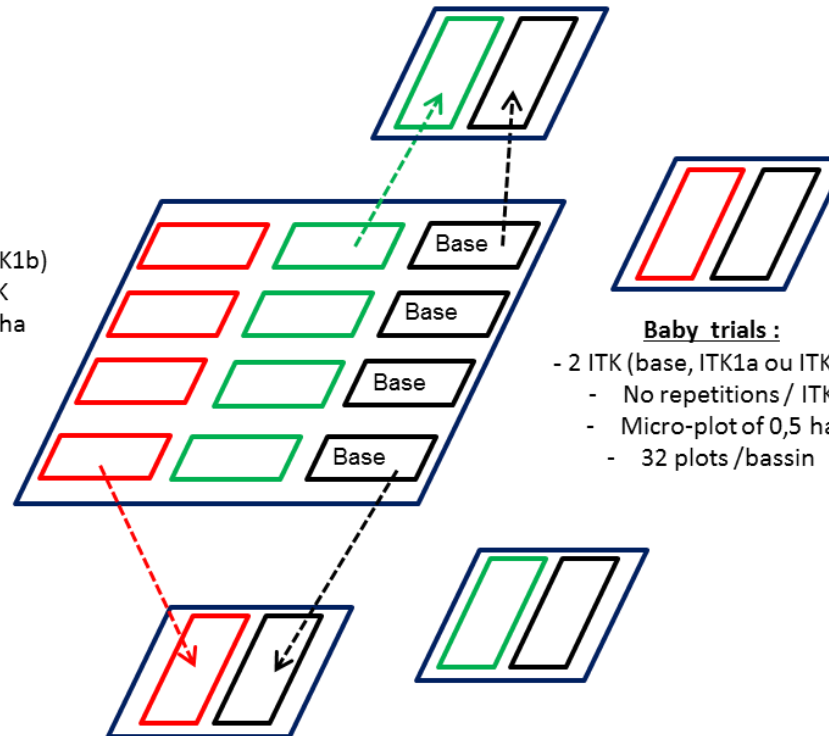
6 rue de Panama
75018 Paris | France
Email : info@salvaterra.fr
Tel : +33 6 88 13 66 35
www.salvaterra.fr

Thank you very much!