# TROPICAL FORESTS AND CLIMATE CHANGE: FROM FACTS TO ECOPOLITICS

## IMPLEMENTATION OF A FORESTY PROJECT FOR CLIMATE CHANGE MITIGATION

# II. CASE STUDIES

***Joint FNS-GAIA post-master module***
***« Tropical forests and climate change »***

***Montpellier, February 15-16, 2018***

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# EcoMakala

| | |
|---|---|
| **Title** | EcoMakala – Supply the population of Goma with sustainable wood-energy |
| **Sectoral scope** | Afforestation/Reforestation |
| **Place** | Democratic Republic of Congo (North Kivu) |
| **Area** | 5 390 ha |
| **Project participants** | WWF (WWF Belgium, WWF DRC, WWF ESARPO…) |
| **Status** | CDM process in stand by (draft PDD) |
| **Methodology** | AR-AMS001 |
| **Volume** | n. c. *(20-25 ktCO2e/year according to our estimations)* |
| **Crediting period** | 20 years (2007-2027) |

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# Oceanium

| | |
|---|---|
| **Title** | Oceanium mangrove restoration project |
| **Sectoral scope** | Afforestation |
| **Place** | Senegal (Saloum and Casamance) |
| **Area** | 1 700 ha |
| **Project participants** | Océanium (PDD/project host), Danone/Orbéo (buyers) |
| **Status** | Registered |
| **Methodology** | AR-AMS0003: Afforestation and reforestation project activities implemented on wetlands (Small Scale) |
| **Volume** | 2,7 ktCO2e/year |
| **Crediting period** | 30 years (2008-2038) |

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# PRODUMA

| | |
|---|---|
| **Title** | PRODUMA - Programme de développement durable de la production de mangrove en Guinée Maritime |
| **Sectoral scope** | Energy industries – Renewable energy |
| **Place** | Guinea Conakry (Maritime Guinea) |
| **Area** | About 108 600 ha of mangrove - 400 households |
| **Project participants** | Univers-Sel (NGO based in Guérande, France) and ADAM (Guinean NGO) |
| **Status** | Non engaged in the CDM process |
| **Methodology** | *CDM*: EB 56 - Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories<br>*Gold Standard*: Methodology for improved cook-stoves and kitchen regimes |
| **Volume** | 2 to 4,6 ktCO2e/year |
| **Crediting period** | 10 years (2010-2020) |

# EcoMakala

# EcoMakala

1. Project description

   *Source: EcoMakala / EU-project final evaluation (SalvaTerra, 2013)*

2. Socio-economic impacts

3. Environmental impacts

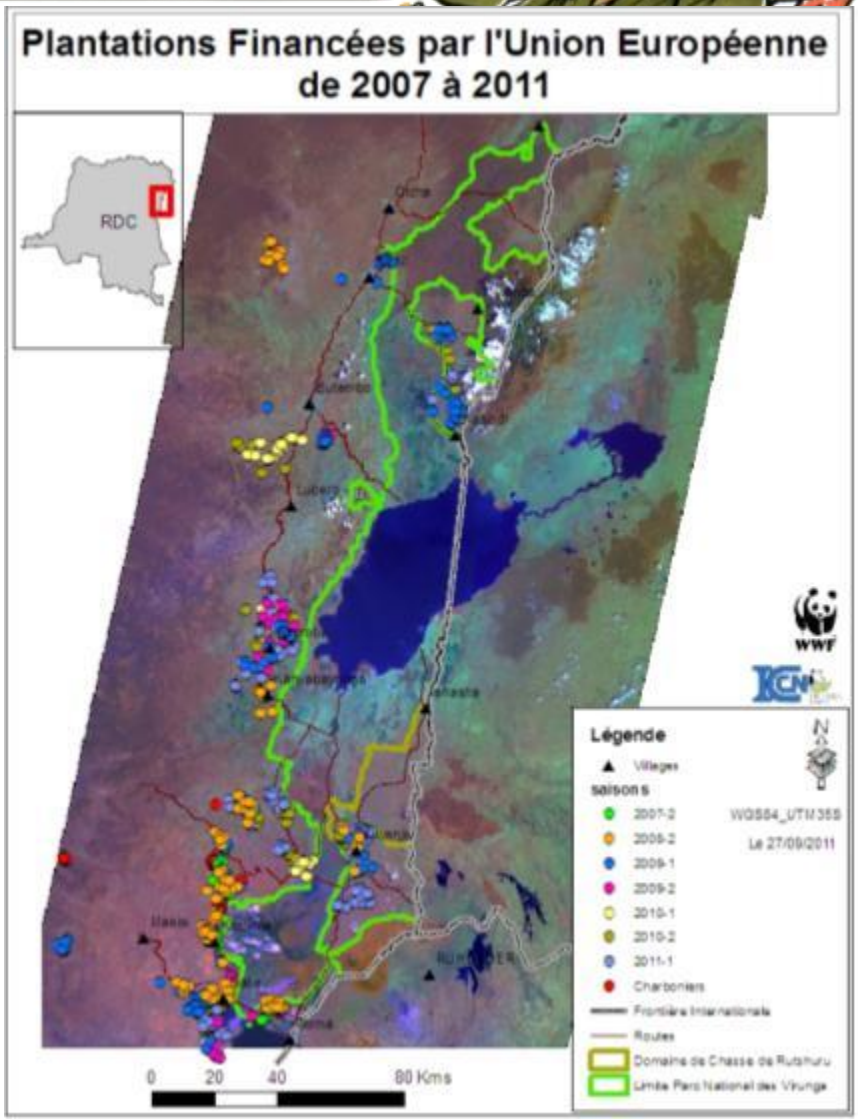
4. Prospects

# Context

- North Kivu, DRCongo.


# Context


Kikura
Beni
Butembo
Chanj
A 109
Lubero
Parc National
Des Virunga
Tayna Nature Reserve
Bingi
N2
Rukungiri
Bwindi Impenetrable
National Park
Kisoro
Masisi
N2
Butaro
Ruhengeri
Kivuye
Sake
Goma
Ruhondo
Gatonde
Rubavu
Nyakabanda


Plantations Financées par l'Union Européenne
de 2007 à 2011
RDC
Légende
Villages
saisons
2007-2
2008-2
2009-1
2009-2
2010-1
2010-2
2011-1
Charbonniers
Frontière Internationale
Routes
0
20
40
80 Kms

# Context

- North Kivu :
  - A « Province » in DRC
  - Poverty rate : 73% in 2005
  - Around 6.3 M inhabitants (+3.5%/yr)
  - **Various ethnies** : *Wanande, Bambuda, Balese, Watalinga, Batwa, Bapere, Batwa, Hutu, Tutsi, Hunde, Nyanga, Batembo, Bakusu, Bakano, Bakumu, Bahunde…*
  - Main activities :
    - **Agriculture**
    - **Mining**
    - **Logging**
    - **Charcoal production (« makala »)**
  - Particularity : Volcanic area

J. Maurice

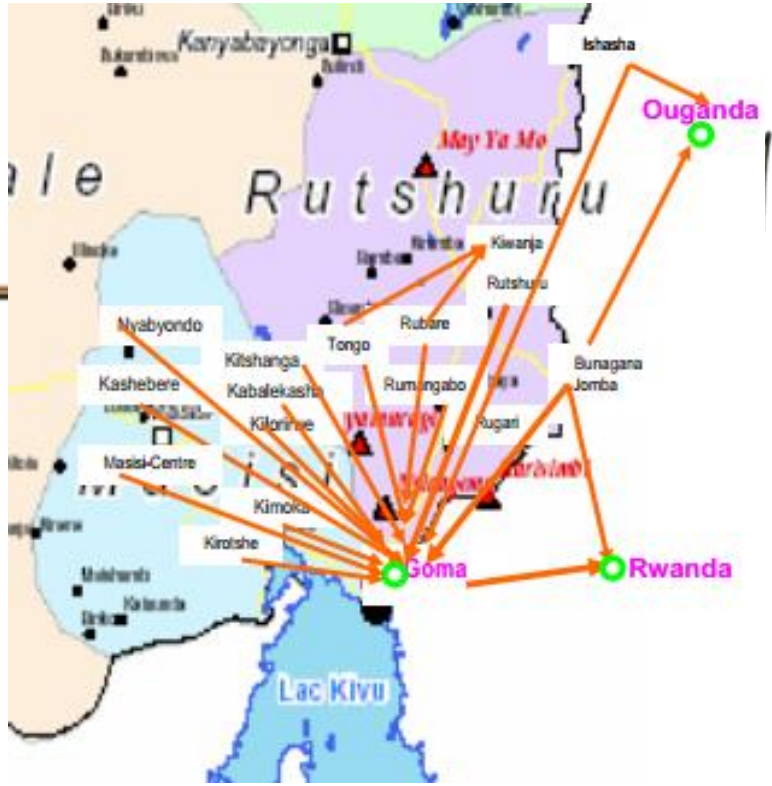
# Context

- North Kivu : a complex situation
  - « **The African World War** » since 1990's : successive cycles of war/peace. **Refugees camps.**
  - **Geologically,** maybe the richest region in the world (gold, coltan, wolframite, cassitérite… « *conflict minerals* »). Illegal mining involve militia groups and local/foreign leaders.
  - **Biodiversity** hotspot
  - Very good **soil fertility**
  - **Very strong land tenure conflicts**
  - Absence of State power: traditional chiefs (« Mwami ») and local/foreign leaders control the area.
  - **High corruption levels**

Global witness

# Context

- Goma, capital city of North Kivu :
  - High demography (1 M inhabitants)
  - At the border between DRC and Rwanda
  - 60 000 tons/year of charcoal consumed
  - Charcoal mainly from the Virungas National Park (ViNP) (see ➔)




Aide et action pour la paix

Goma and the Nyiragongo volcano

Jojo.au.congo.over-blog.com

# Context

- The Virungas National Park :
  - Oldest Protected Area in Africa (1925)
  - **An extraordinary biodiversity :** 50% of mammals species and 66% of birds species known in DRC
  - Various endemic species (*Albertine rift valley*)
  - Threatened by **agriculture** (slash and burn) and **charcoal production**

*Gorilla beringei graueri*

*Gorilla beringei beringei*

*Mixed forests*

# Context



http://www.youtube.com/watch?v=woU6VXTBWZ4

# Context

- Artisanal charcoal production :
  - Subsistance activity
  - Low efficiency (yields around 10%)
  - High impacts on forests

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J.C. Balolebwami

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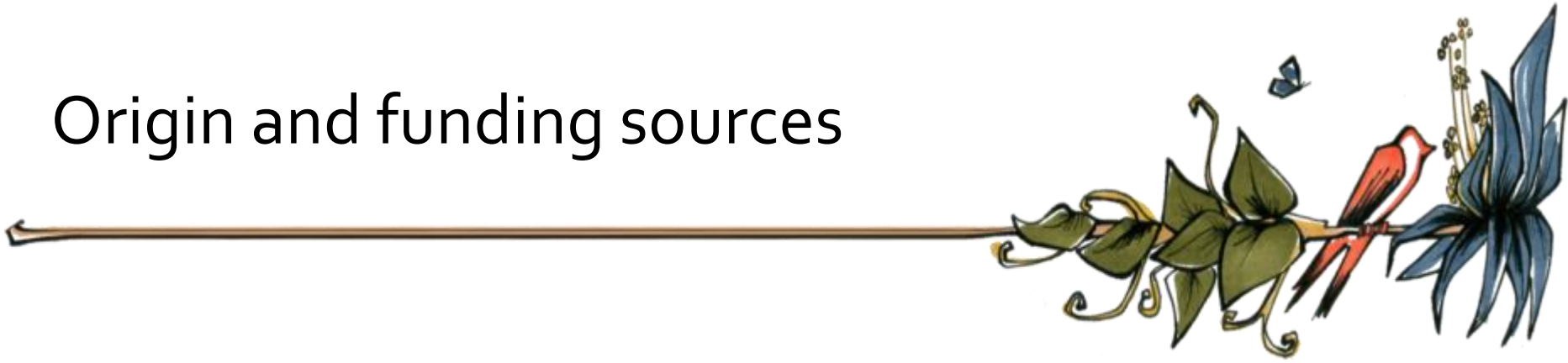
# Logical framework

- Main objective : support small-scale forest plantations around the Virungas National Park to increase the quantity of legal charcoal in Goma and reduce the pressure on forest ecosystems.

- Specific objectives :
  - Create sustainable alternatives to illegal logging through private plantations,
  - Strengthen local capacities to produce and commercialize legal charcoal,
  - Develop a technical compendium on reforestation techniques in the project area (R&D),
  - Set up a« rotative equity » fund to sustain the project's activities,
  - **Experiment CDM and REDD+ activities**

# Origin and funding sources



- 1987 – 2005 : « WWF PEVi-Kacheche project », a reforestation project started by WWF-ESARPO (10 million trees produced and mostly distributed for free).
- 2002 : WWF Belgium supports the reforestation component, technically and financially.
- 2006 : a funding request is introduced to ACP-EU Energy Facility *(African Caribbean Pacific - European Commission Energy Facility)* for 2.4 M€, in which 0.6 M€ financed by WWF Belgium (through Kellog's/WWF Sweden).
- Other sources of funds : *International Fertilizer Development Center*, WWF Sweden/*Swedish International Development Cooperation Agency*)

# Project activities

- **Promote forestry plantations :**
  - Local associations (49 ASBL representing almost 3000 planters) selection, training and contracting
  - « large scale planters » (> 10ha, 29 planters) selection and contracting
  - Identification of reforestation sites
  - Support the installation of forest nurseries…
  - …and their management by the associations
  - Support the installation and maintenance of plantations
  - Plantation monitoring (GIS database + field control)
  - Communication campaign
  - Site productivity assessment
  - …

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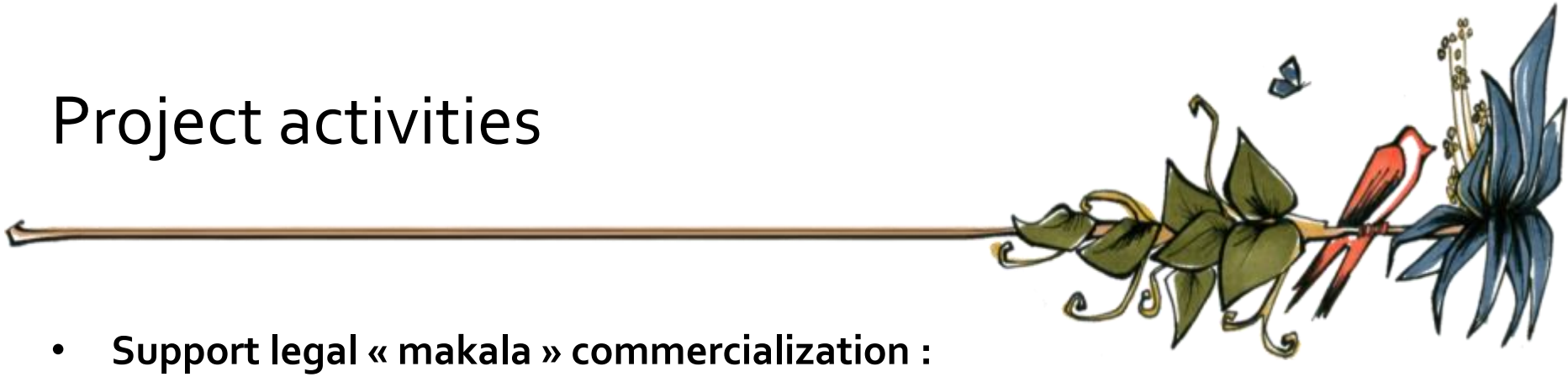
# Project activities

Eucalyptus sp.  in nursery (J. Maurice)

*Eucalyptus saligna : 80% of total plantations.*

*Photos: J.Maurice*

# Project activities



- **Support legal « makala » commercialization :**
  - Analysis of the local wood-energy sector (fluxes, stakeholders, prices, origin…)
  - Organization of the commercialization
  - Improvement of carbonization techniques

- **Support R&D experiments:**
  - Carbon sequestration measurements
  - Productivity tests on indigenous fast growing species

- **CDM certification** :
  - PIN + DNA Letter of non objection (July 2011)
  - Technical training of staff
  - Monitoring framework almost ready
  - PDD started but not finalised
  - *Environmental and socio-economic impact assessment (see next page)*

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# EcoMakala

1. Project description

2. Socio-economic impacts

   *Source: EcoMakala Socio-economic Assessment (ONFI, 2012)*

3. Environmental impacts

4. Prospects

# PDD requirements

- The PDD should describe the socio-economic impacts that the project activity may have in the area (including employment, livelihoods, food security…).
- The description should include both positive and negative impacts of the project activity.

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# Terms of references

- Socio-economic analysis to characterize the project area (baseline) :
  - obtain information on local land-use, economic activities, land tenure systems, resources…
  - Identify the relevant stakeholders and describe their socio-economic environment,

- Analyze potential positive or negative socio-economic impacts,
- Identify potential alternatives or ways to improve the project if necessary,
- Recommendations to mitigate or suppress the negative socio-economic impacts identified

**How ? ➔ Literature review and household survey.**

# Household survey

- Step 1: survey questionnaire + sampling plan
- Step 2 : recruitment of  local investigators
- Step 3: inform villages about the survey
- Step 4: training of local investigators (16 for 1856 questionnaires)
  - Objective  and principles of the survey
  - Questionnaire review
  - Risks  linked to the survey (bias, security…)
  - Field test: participative cartography (land-use systems)
  - Repartition of investigation areas among investigators
- Step 5: survey + monitoring by local expert
- Step 6: data codification + analysis + reporting
- Step 7 : local restitution (villages)

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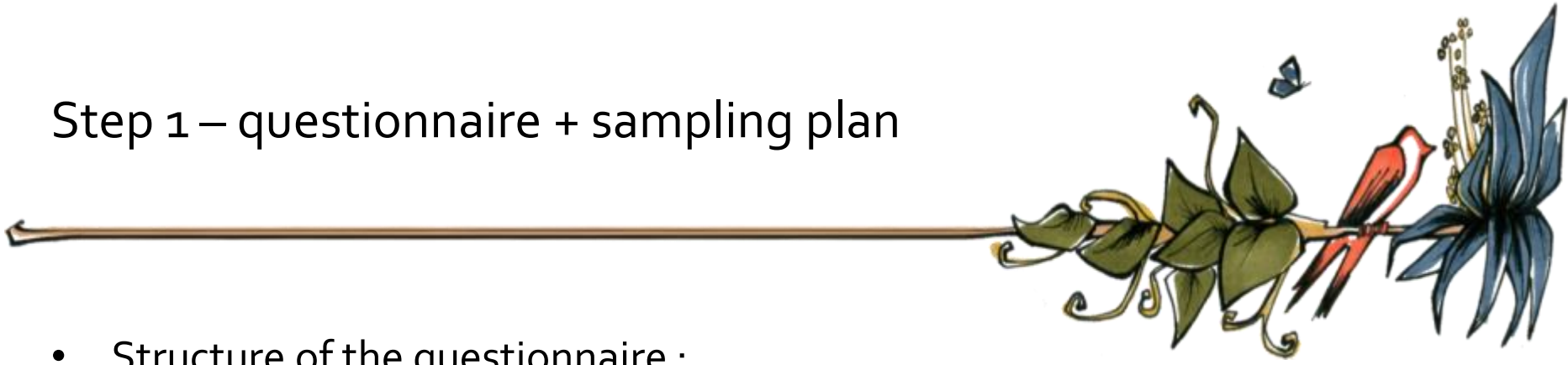
# Step 1 – questionnaire + sampling plan



- Structure of the questionnaire :
  - A. Identity of investigator + interviewed people
  - B. Description of the village (households) and land tenure system
  - C. Land use systems (agriculture, cattle ranching and forestry)
  - D. Use of natural resources (wood, NLFP, plants + fisheries)
  - E. Local infrastructures and services (health, education, water, energy)
  - F. Culture and religion
  - G. Participation in the Ecomakala project

  - A = used for codification
  - B to F = **Baseline**
  - G = **Perception of the project**

# Step 2 – recruitment of local investigators
# Step 3 – inform villages about the survey
# Step 4 – training of local investigators



- **Local experts** are key-partners in such surveys.
- Easy to find investigators with experience in the region because a lot of socio-economic surveys have been done in North Kivu (by humanitarian organisations)
- Villages (chiefs + households) must be **informed prior to the investigation**. Explain the reasons of the survey, to establish **trust** and show respect.

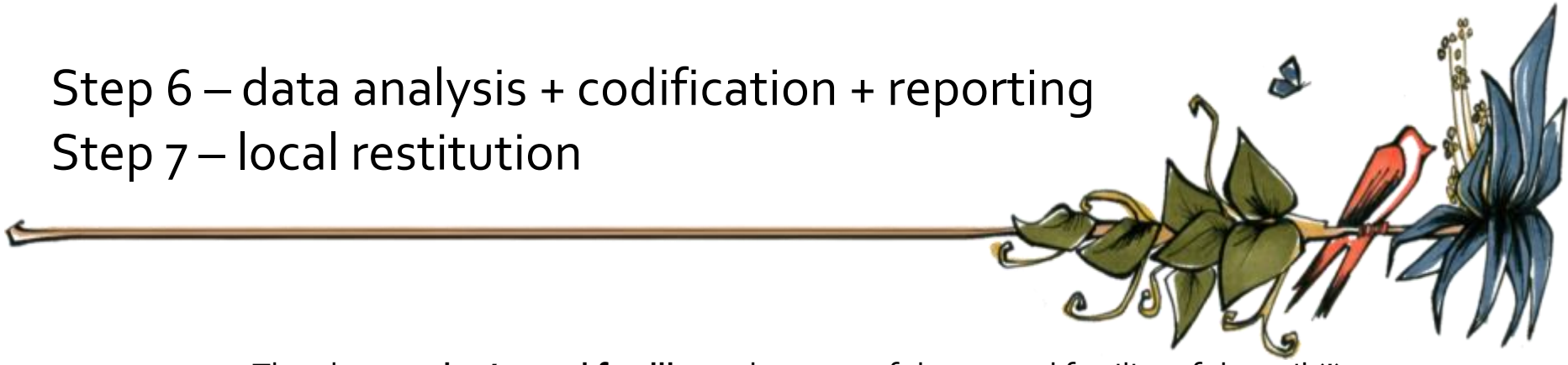
# Step 5 – Survey + monitoring by local expert


Participative cartography to identify the land-use systems in the village

# Step 6 – data analysis + codification + reporting
# Step 7 – local restitution

- Results :
  - Stakeholders cartography : local associations, individuals, local leaders and customary authorities, administrative authorities, hunters and soldiers…
  - Example of results :
    - 36% of the households produce charcoal in the project area
    - Men are involved in charcoal production in 90% of the cases (men alone: 66%)
    - Women are involved in woodfuel collection in 95% of the cases (women alone : 21%)
    - Most producers declare that the charcoal production is controlled by the army rebels who give authorizations to enter the Virunga National Park
    - 56 % of forest plantations are realised on agricultural fields, 33% on fallows

# Step 6 – data analysis + codification + reporting
# Step 7 – local restitution



- The planters **don't need fertilizers,** because of the natural fertility of the soil (!)
- In 72% of the cases**, the final objective is to commercialise wood products** (either wood energy or sawnwood and wood sticks).
- The main risk identified by the planters are **bush fires.**
- The main crops are **cassava** (48.5%), **beans** (24.5%), maize (10%), bananas (4.2%), potatoes (2%) and sweet potatoes (0.7%).
- 51.5 % of the population investigated practice cattle ranching. But in the northern region (Beni), most animal proteins come from hunting, the % of cattle producers is lower.
- Only 5% of houses built with baked bricks and 2% with cement (70% are adobe houses).
- And more…

- **But some limits :**
  - **Land use conflicts** : people do not speak freely about these conflicts (50% the person investigated declare having conflicts affecting their land, but it might be underestimated).

# Main conclusions

- An overall **good perception** of the project within the population, although the concrete benefits will appear in the future (after wood harvesting).
- Some **fears** :
  - **To be « expropriated »** after several years. In local customs, planting a tree is a way of showing land ownership. As most of the planters do not have valid land tenure titles, they fear to lose the land they gave for the establishment of nurseries or community plantations…
- Some **expectations** :
  - **Extension** of the project (more areas, more people) + access to **credit**
  - More support to **improve carbonization** activities and **makala marketing**
  - More environmental awareness and communication
  - ***Explain the concept of carbon credits***

# Positive impacts

- Creation of local jobs, skilled labour
- Revenues increase (100 USD/ha/planter and 150 USD/ha/association)
  - *more Education and Health spending*
  - *House building improvement*
- Access to cash money and equity
- Creation of alternative sources of wood-energy
- Agricultural land diversification, valorization of marginal lands
- Local taxes for administrative authorities (in the long term)

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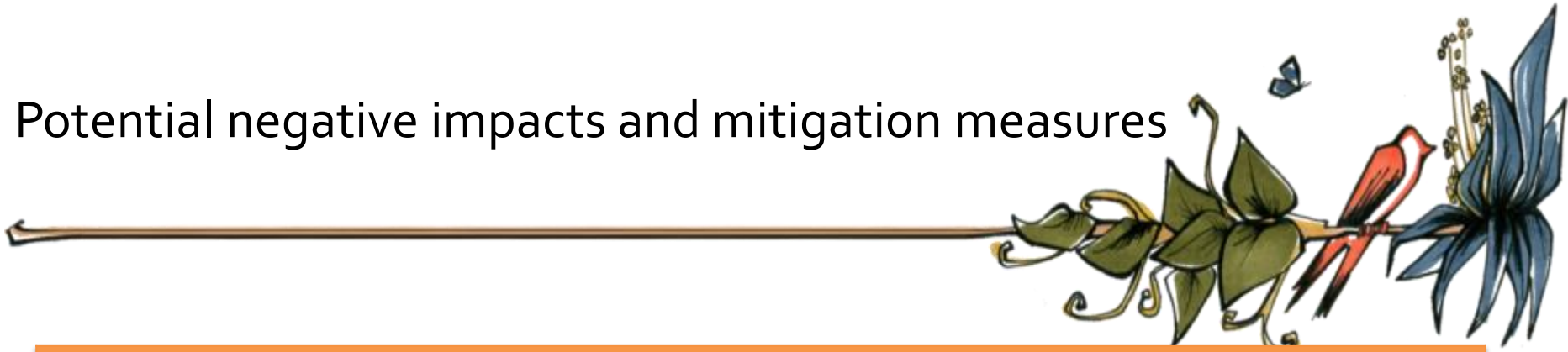
# Potential negative impacts and mitigation measures



| Potential impact | Level of impact | Measure taken | Complementary measure suggested |
|---|---|---|---|
| Land immobilisation in a context of food insecurity | Medium | Pre-audit to identify marginal lands<br>Final site identification made by planters | Introduce fruit trees and agroforestry techniques |
| Long term revenues vs. immediate needs | Medium | Short rotations (4 years / coppicing)<br>A % of the plantation cost is covered by the project | Propose alternatives to generate intermediary revenues (e.g. agroforestry) |
| Land appropriation by local leaders | Medium to high | Associations created to regroup and strengthen individual planters | Communication and avocacy with local authorities and Mwami. |

# EcoMakala

1. Project description

2. Socio-economic impacts

3. Environmental impacts

   *Source: Ecomakala Environmental assessment (ONFI, 2012)*

4. Prospects

# PDD requirements

- The PDD should describe **the likely impacts** of the project activity on natural and man-made environment in the area.
- The description should include both positive and negative impacts of the project activity.

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# Terms of references

- Environmental analysis to characterize the project area (**baseline**) :

- Analyze potential positive or negative environmental impacts,
- Identify potential alternatives or ways to improve the project if necessary,
- Recommendations to mitigate or suppress the negative environmental impacts identified

**How ? ➔ Literature review, land-use inventories and field observations (flora and wildlife).**

# Field assessment

- Step 1: Definition of the study area
- Step 2: Description of the biophysical environment (literature review + field survey)
- Step 3 : Project description + alternatives
- Step 4 : Initial status and possible evolution of the environment without the project
- Step 5: Identification of the potential project's impact on the environment
- Step 6 : Measures to suppress, prevent or mitigate the potential negative impacts

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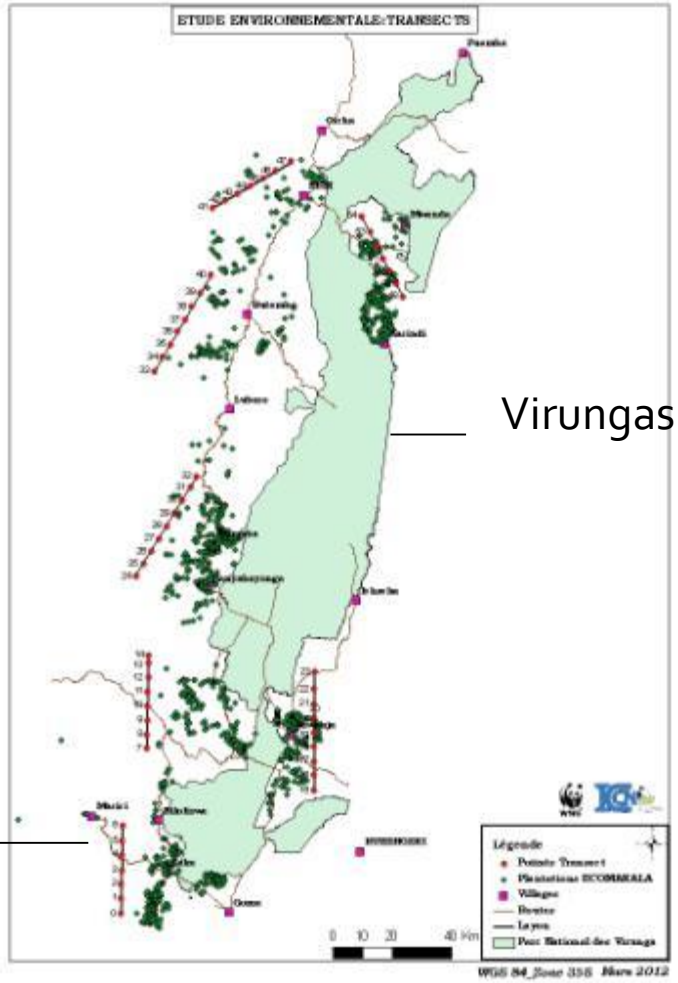
# Step 1: Definition of the study area

- Based on the project area map, 7 paths have been designed inside the project area in order to describe its flora , fauna and land-use

*Paths* *EcoMakala plantations*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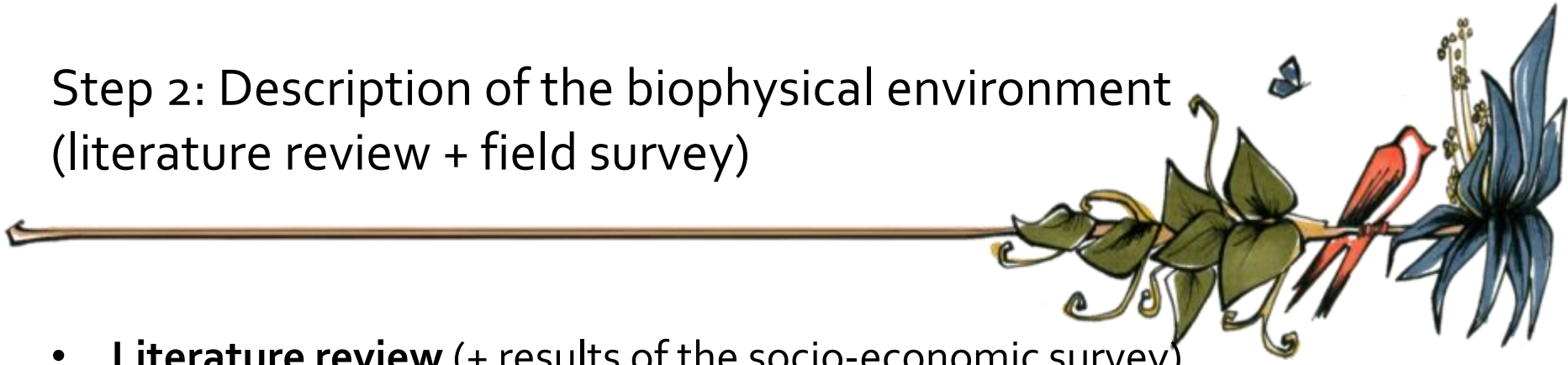
# Step 2: Description of the biophysical environment (literature review + field survey)



- **Literature review** (+ results of the socio-economic survey)
  - Climate
  - Geology and soils
  - Hydrology and hydrograpy
  - Description of terrestrial ecosystems
  - Deforestation rates, local dynamics
  - Natural resources
  - Wildlife
- **Field survey** (to complement the literature review + survey)
  - Flora/Land use inventory
  - Fauna observations
  - … close to the plantations, but not inside (baseline).

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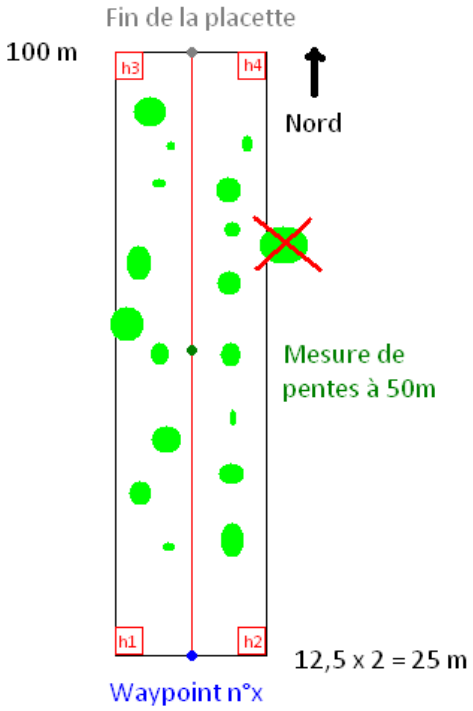
# Step 2: Description of the biophysical environment (literature review + field survey)

- Field survey :
  - Design a sampling scheme + inventory protocol + inventory sheet




**Inventaires floristiques et de relevés botaniques pour la réalisation de l'étude environnementale du projet Ecomakala, Province du Nord Kivu.**

Fiche d'inventaire

A. Informations générales :

| N° du GPS : | | Date : | | Heure : | : | Territoire : | |
|---|---|---|---|---|---|---|---|
| N° de la placette : | | Coordonnées : | | Nom du rédacteur : | | | |

B. Informations sur la placette : Cocher les cases correspondantes

☐ Inventaire valide
☐ Inventaire invalide : préciser ci-dessous la raison de l'invalidité.

Ex : champ cultivé, village, plan d'eau, zones marécageuses, zone incendiée…

☐ La placette mesure 100 m.
☐ La placette ne mesure pas 100 m : indiquer ci-dessous la raison et la longueur réelle

1) raison :
2) longueur réelle (remarque : avant correction de pente) :

E. Relevés botaniques des espèces herbacées dominantes sur les sous-placettes
% : taux de recouvrement de l'espèce (au jugé)
Indiquer le nom scientifique des herbacées dominantes dont le taux de recouvrement est > 25% !

| h1 (SO) | | h2 (SE) | |
|---|---|---|---|
| Espèces dominantes | % | Espèces dominantes | % |
| *Nom scientifique* | *> 25%* | | |

| h3 (NO) | | h4 (NE) | |
|---|---|---|---|
| Espèces dominantes | % | Espèces dominantes | % |
| | | | |

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# Step 2: Description of the biophysical environment (literature review + field survey)

- Field survey :
  - Recruit and train staff on the field



Nota bene : make sure that the team has adequate equipment (GPS, suunto, compass, tape…)

# Step 2: Description of the biophysical environment (literature review + field survey)


→ Be ready to explain your work to local observers !

# Step 2: Description of the biophysical environment (literature review + field survey)

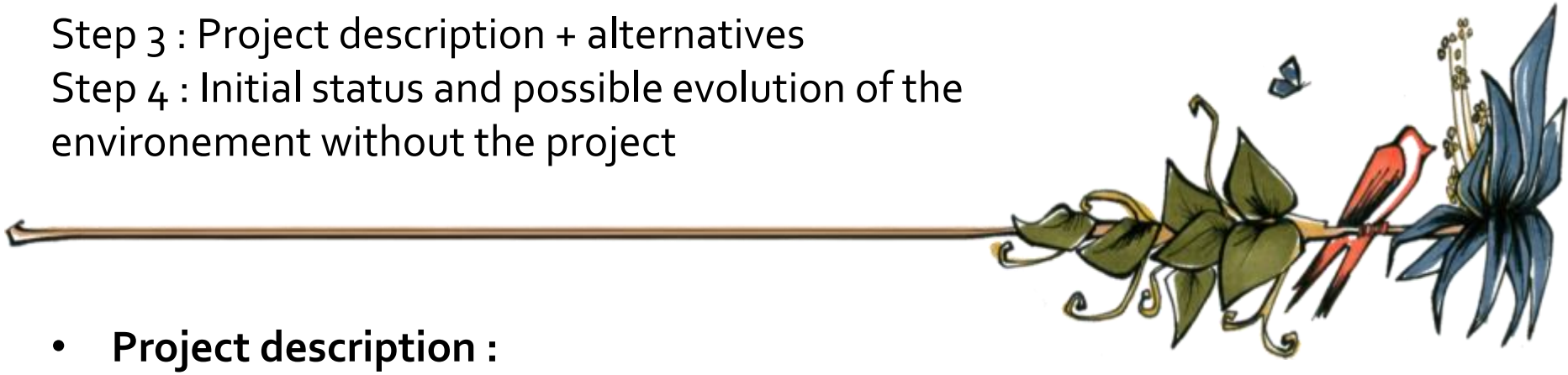
- Field survey :
  - Codify and analyze the data
  - Analyze the results

Annexe 4 : Données d'inventaires floristiques et d'observations faunistiques

TRANSECT NORD (MUTWANGA- KASINDI) Territoire de Beni

| Date | N° de G.P.S | N° du Placette (waypoint) | Coordonnées Géographiques ////////////// ////////////// | Alt (m) | EPE (m) | Heures | Si invalide : Raison d'Invalidité: | Appareil Photo | N° de Photo | Nom du Rédacteur |
|---|---|---|---|---|---|---|---|---|---|---|
| 10/04/2012 | Stéphane | 48-3 | Noo.21155° E029.74986° | 2016 | ±8 | 12 :53 | Cfr fiche d'inventaire N°48-3 | Stéphane | 0034 | Vhosi |
| 07/04/2012 | Stéphane | 48-4 | Noo.21989° Eo29.74649° | 1885 | ±3 | 12 :10 | Cfr fiche d'inventaire N°48-4 | Stéphane | 0021 | Vhosi |
| 06/04/2012 | Stéphane | 49-0 | Noo.22708° E029.74104° | 1581 | ±3 | 13 :13 | C'est une zone incendiée avec des champs cultivés | Stéphane | 0015 | Vhosi |
| 06/04/2012 | Stéphane | 49-2 | Noo.24141° E029.73277° | 1220 | ±3 | 11 :50 | Présence de champ cultivé de caféier, bananier … | Stéphane | 0014 | Vhosi |
| 06/04/2012 | Stéphane | 49-3 | Noo.24976° E029.72934° | 1147 | ±3 | 10:44 | Camps militaire dans la cité de Lume | Stéphane | 0013 | Vhosi |
| 06/04/2012 | Stéphane | 49-4 | Noo.25770° E029.72514° | 1085 | ±3 | 10 :00 | C'est la cité de Lume | Stéphane | 0012 | Vhosi |
| 06/04/2012 | Stéphane | 50-0 | Noo .26596° Eo29.72149° | 1047 | ±3 | 9 :09 | Présence de champ cultivé de palmier, bananier | Stéphane | 0011 | Vhosi |
| 00/04/2012 | Stéphane | 50-1 | Noo .27381° | 1030 | ±3 | 15 :58 | Présence de champ cultivé | Stéphane | 0027 | Vhosi |

Step 3 : Project description + alternatives
Step 4 : Initial status and possible evolution of the environement without the project



- **Project description :**
  - Global and specific environmental objectives
  - Localisation and access
  - Technical specifications
    - Species : *Eucalyptus saligna* and other sp., *Grevillea robusta*, *Acacia mearnsii*…
    - Silviculture adopted : short rotation coppice
    - Plantation technique : simple hole x medium density (1100 t/ha)
    - Maintenance technique : manual
    - Forest production objectives
      - Wood sticks after 3 years, wood energy after 4 years (at least 60% of total volume), sawn-wood after 5 years
    - Expected productivity per species :
      - *Acacia mearnsii* (30 – 45 m3/ha/an – VERY fertile areas), *Senna siamea* (10-12 m3/ha/an)
    - Planification of areas to be reforested
    - Etc.
  - Local infrastructures (nurseries)

Step 3 : Project description + alternatives
Step 4 : Initial status and possible evolution of the environement without the project

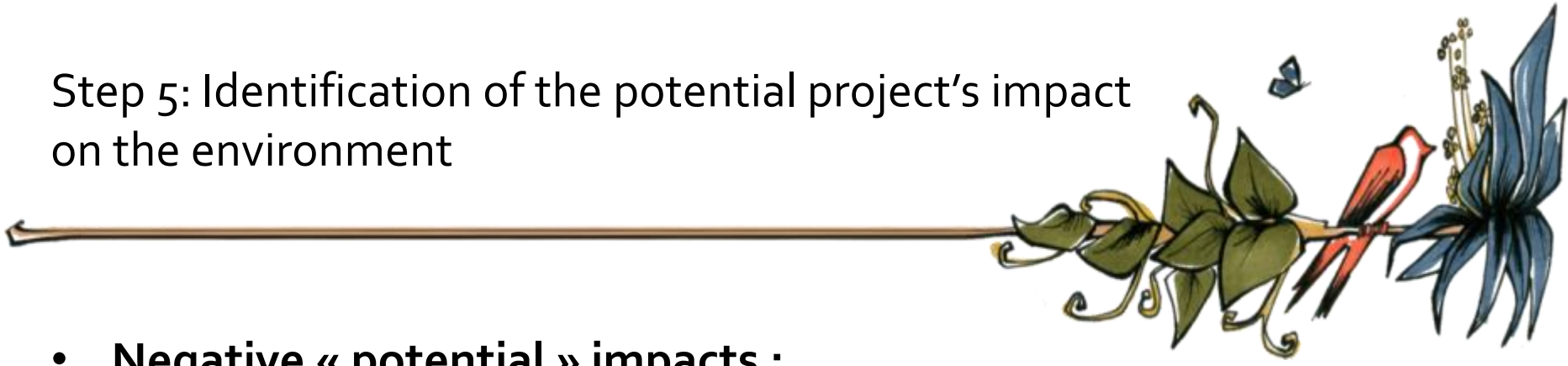
- **Alternatives:**
  - Large scale reforestation?
    - Reducing poverty = working with SSC farmers
    - LSC plantations = food security ?
      - Not adapted to local conditions
  - Intensive forest management ?
    - No economies of scale possible (fragmented plantations, no infrastructures)
    - Herbicides might endangered natural resources
      - Not adapted to local conditions
  - Technical Genetic improvement (selection)
    - Good solution to replace the seed lots that have shown bad results (some *Cedrela odorata* and *Cedrula cerulata* notably)
  - Diversification of species (80% of *Eucalyptus saligna*)
    - Good growth but medium quality charcoal
    - Exploitation of young Euc. plantations show possible mineralomass exportations…

# Step 5: Identification of the potential project's impact on the environment

- **Positive « potential » impacts** :
  - Soil restructuration
  - Soil fertility improvement (with Leguminous species)
  - Water quality improvement
  - Reduction of erosion
  - Creation of new habits for fauna
  - Creation of wood and NLFP sources
  - Carbon sequestration
  - …

➔ *It is mainly a qualitative assessment… there is no monitoring of such impacts*

# Step 5: Identification of the potential project's impact on the environment



- **Negative « potential » impacts :**
  - Risk of erosion if the plantations are exploited too intensively (especially on high slopes)
  - Risk of soil acidification under Eucalyptus plantations
  - Risk of mineralomass exportation with fast growing species harvested too early
  - Risk of increase pressure on water sources with high-demanding species like Eucalyptus
  - Phytosanitary risks (80% of *Eucalyptus saligna*).
  - Risk of pollution due to fertilizers and herbicides (banned by the project, but some planters might use them)
  - Risk of encroachment by exotic, invasive species (*Acacia mearnsii*).

# Step 6 : Measures to suppress, prevent or mitigate the potential negative impacts

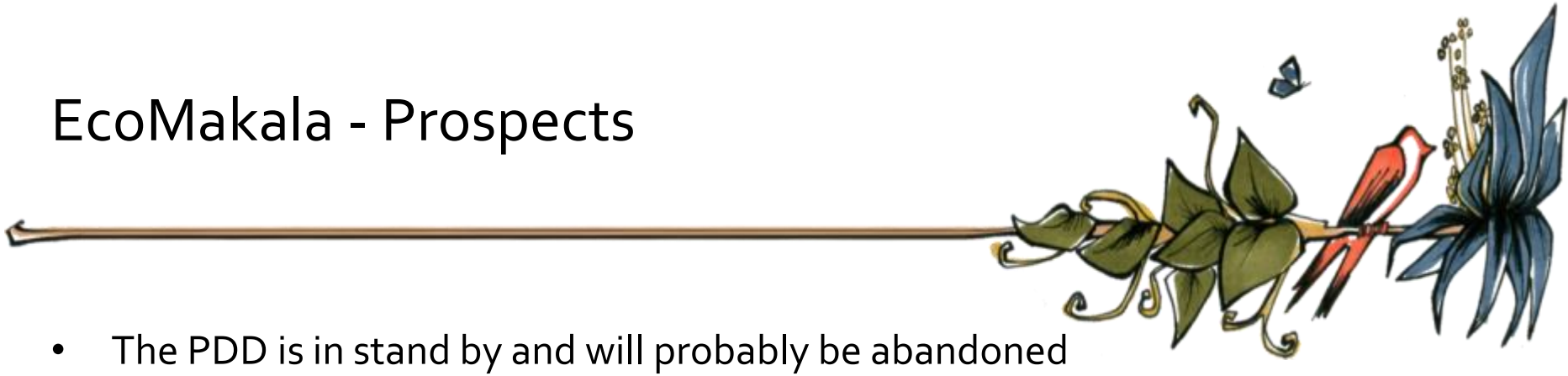
*NB: low level impacts not treated here*

| Potential impact | Level of impact | Measure taken | Complementary measure suggested |
|---|---|---|---|
| Erosion on slopes after intense harvest | Important | Harvest limited to 1 tree on 3<br>Obligation of results over 90% of the plantation (forest cover) | No mechanization (if any) if slope > 15%<br>Harvest on slopes by « patches » (mosaic)<br>More control on harvest sites |
| Acidification | Medium to important | Area limited to 2ha , tests to find alternative species | Quantify the phenomenon and establish recommendations<br>Authorize the mix of species (Eucalyptus x Leguminous). |
| Mineralomass exportation | Medium to important | No measure. | *Same as above.* |
| Pressure on water sources | Important | Interdiction to reforest close to a water course (20 m) | Strict control. Participative monitoring to detect any changes. Use alternative species. |
| Phytosanitary crisis | Medium | Mix of Euc. Species intrabloc is authorized (max 3) | Phytosanitary monitoring plan + capacity building to identify pests and diseases. |

# EcoMakala

1. Project description
2. Socio-economic impacts
3. Environmental impacts
4. Prospects

# EcoMakala - Prospects



- The PDD is in stand by and will probably be abandoned
  - Too complex ? Not enough funds ? Registration issues ?
- The project is now entering into a new stage :
  - Geographically integrated « Ecomakala+ » pilot project, funded by CBFF, integrating :
    - Forest plantations
    - Improved cookstoves
    - Fight against illegal logging in the Virungas National Park
    - Land tenure conflicts mediation
    - Land use planning
    - Agricultural intensification
    - Agroforestry (cacao under shade)
- New challenges arise :
  - Definition of the project area, reference area and leakage area ; analysis of deforestation/forest degradation factors (not only charcoal), methodology, benefit sharing mechanism…

# PRODUMA

# PRODUMA

1. Context
2. Activities
3. Eligibility to carbon certification
4. Methodological issues
5. Conclusion

# Guinea (Conakry)

# A devastated economy

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| GNP (G$) | 2,94 | 2,82 | 4,21 | 3,78 | 4,10 |
| GNP/inhab. ($) | 319 | 300 | 438 | 384 | 407 |
| Growth (%) | 3 | 2,5 | 1,8 | 4,9 | - 0,3 |
| Inflation (%) | nd | nd | nd | 18,4 | 4,7 |
| Emissions de GHG emissions per inhab. Per year (teCO2) | 0,1 | 0,1 | 0,1 | nd | nd |

Human Development Index: 0,34 (156$^{th}$ country of 169 (UNEP, 2010)

# A political hope

Sékou Touré
1958-1984

Lansana Conté
1984-2008

Dadis Camara
2008-2010

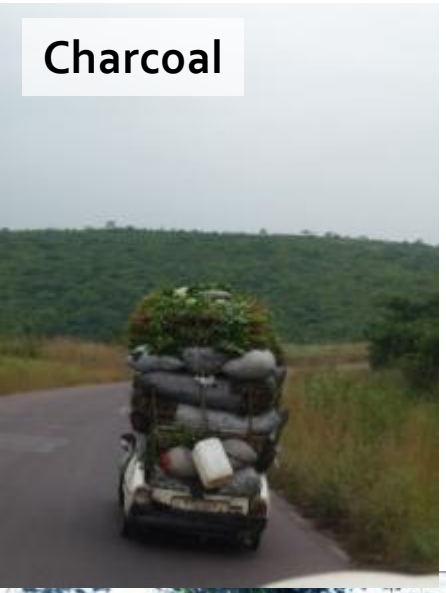
Sékouba Konaté
2010

Alpha Condé
2010-now

60 years of dictatorship

Election of Alpha CONDE in 2010. First free national election held in Guinea since it gained independence in 1958.

# Drivers of an important forest degradation




- Poverty
- Demographic pressure
- Bad governance

**7,2 Mha in 1990 …**
**6,5 Mha in 2010**
**➔ -10% in 20 years**



# PRODUMA

1. Context
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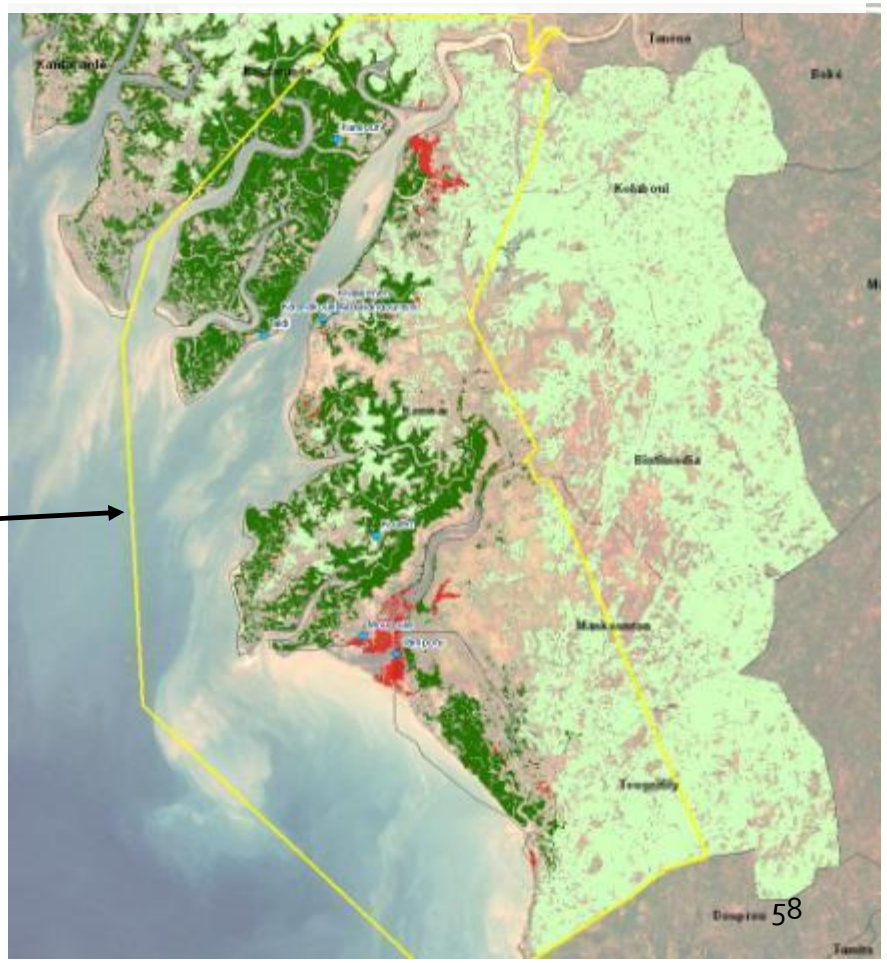
# Solar salt production

Ignigenous salt production

Solar salt production

# Extension of a previous project

PRODUMA: Programme de développement durable de la production de mangrove en Guinée Maritime

# Process

Scraping of the salty soil

# Process

Piling

# Process

Filtering with seawater

# Process

Filtrate recuperation

# Process

Spreading on tarps

# Process

Collecting salt

# Support campaigns to solar salt production

Bins to boil water: ignigenous salt production

| Zones | Coyah | | | Koba (Barifaniah/Kito) | | | Benty | | | Totaux | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Années** | **2008** | **2009** | **2010** | **2008** | **2009** | **2010** | **2008** | **2009** | **2010** | **2008** | **2009** | **2010** |
| Unités familiales (UF) | 130 | 249 | 119 | 112 | 167 | 75 | 164 | 216 | 40 | 406 | 632 | 234 |
| Panis (P) | 192 | 469 | 163 | 95 | 139 | 47 | 21 | 2 | 1 | 308 | 610 | 211 |
| Indice P / UF | 1,5 | 1,9 | 1,4 | 0,8 | 0,8 | 0,6 | 0,1 | 0,01 | 0,02 | 0,8 | 1 | 0,9 |
| Cristallisoirs (C) | 701 | 814 | 367 | 589 | 1125 | 529 | 1090 | 1469 | 199 | 2380 | 3408 | 1095 |
| Indice C / UF | 5,3 | 3,3 | 3,1 | 5,2 | 6,7 | 7 | 6,7 | 6,8 | 5 | 5,9 | 5,4 | 4,7 |

Tarps: solar salt production

# What is the link with the CDM ?

Univers-Sel had the idea to conduct a study to assess the relevance of using carbon finance to support its program to promote solar salt production.

This idea was proposed to the Climate subsidiary of *Caisse des Dépôts et Consignations* (CDC-Climat), which has offered financial support.

# PRODUMA

1. Context
2. Activities
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# Available methodologies

**CDM – Executive Board I.E./Version 03**
Sectoral Scope: 01 EB 56
**Indicative simplified baseline and monitoring methodologies**
**for selected small-scale CDM project activity categories**
**TYPE I - RENEWABLE ENERGY PROJECTS**
***I.E.Switch from non-renewable biomass for thermal applications by the user***

- ***Activity eligibility***: OK, mentions solar energy
- ***Small-scale (<15 kteCO2/an)***: OK (see calculations later)
- ***No double counting***: No, zero CDM project in Guinea. Another project being developed (improved cookstoves by Bolivia Inti Sud Soleil), but project areas are disjoints.
- ***Project boundaries***: No possibility to consider the Coyah II project area.

**Gold standard**
**Methodology for improved cook-stoves and kitchen regimes**
**V.02 – 08/02/2010**

**No VCS methodology**

# Eligibility

**Additionality**

Solar salt production seems more profitable than ignigenous production, with low investments -> no investment barrier (or impossible to prove without data)

Technology / common practices barriers: bins and campaign costs advanced by traders, producers' hands are tied.

**Non-renewability of the biomass**

Bring evidence of :

- Increased collection time and distance → Cheap survey
- Resources degradation → Literature
- Increased prices → No data
- Suggesting a change in practice scarcity → Expensive survey

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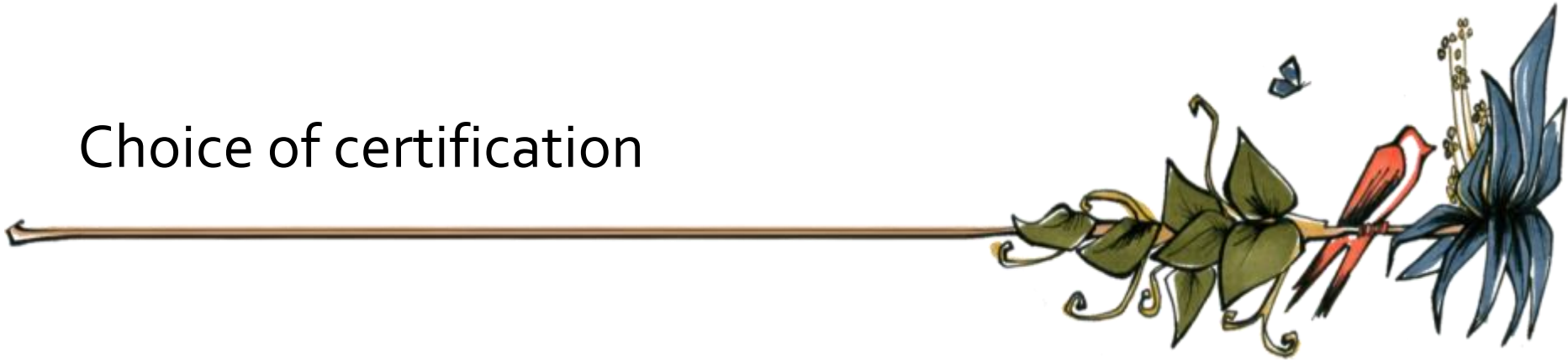
# Choice of certification



Through the application of these methodologies, four possibilities:

(i) CDM certification with the CDM methodology

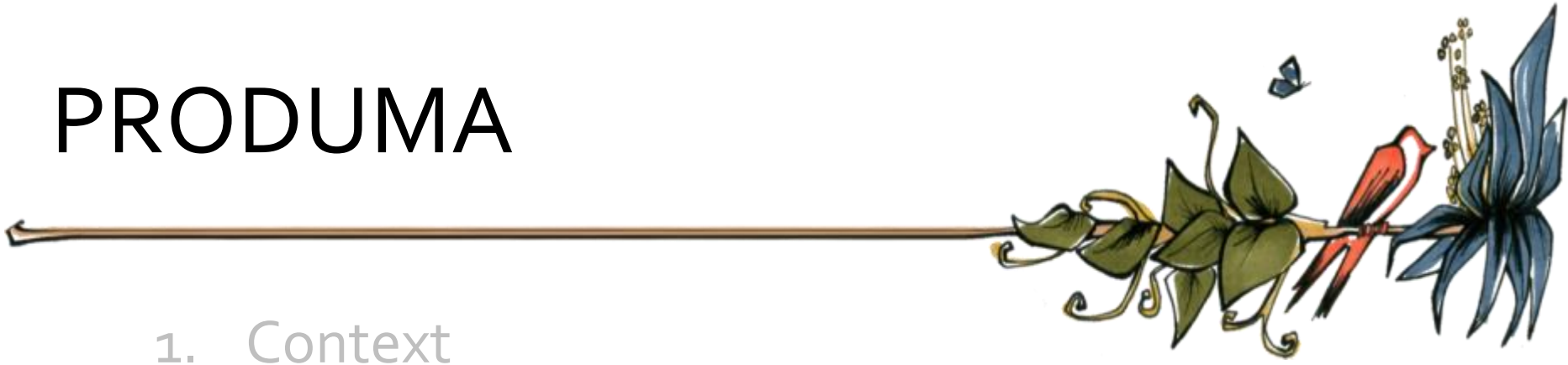
(ii) CDM and Gold Standard double certification with the CDM methodology

(iii) Verified Carbon Standard certification with the CDM methodology

(iv) Gold Standard certification with the Gold Standard methodology

The study focused on the calculations of emission reductions of the project according to the different methodologies and their valorization according to different certification

# PRODUMA



1. Context
2. Activities
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# Non-renewability rate (fNRB)

Basis for the calculation of emission reductions

$$fNRB = NRB / (NRB + DRB)$$

***Non renewable woody biomass (NRB)***

Wood is cut by households, salt producers and fish smokers. One can estimate these populations and their consumptions.

NRB = consumption – DRB

***Demonstrably Renewable woody Biomass (DRB)***

Easy for mangroves (satellite imagery, growth known) -> 153 400 m3/year.

Difficult for other forests (no data) -> estimations based on IPCC default values.

Two estimations: a conservative one and a realistic one

- **Non-renewability rate between 36% and 62%**

# Emission reductions

$$ER = B * f_{NRB} * NCV_{biomass} * EF_{fossilfuel}$$

**B**: 5 400 tons of wood saved (3t of wood per tarp * 1800 tarp)

$f_{NRB}$: 36% (conservative) to 62% (realistic) of the wood consumption is non-renewable

$NCV_{biomass}$ : calorific net value of wood: 0,018 TJ/ton

$EF_{fossilfuel}$ : emission factor for non-renewable energy

CDM methodology: value for kerosene: 71,5 tCO2e/TJ -> 1,287 tCO2e/t wood

GS methodology: value for woodfuel: 1,696 tCO2e/t wood

**Choosing the GS methodology instead of the CDM methodology allow to generate 32% additional credits !**

In ten years, between 20 000 (conservative fNRB, CDM methodo) to 46 000 (realistic fNRB, GS methodo) ktCO2e avoided (emissions of 4000 - 9000 French people during in one year).

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# Leakage

If producers and fish smokers non supported by the project increase their wood consumption because of a better availability of the resources, due to the project.

If producers supported continue to use bins.

**Monitoring of 5 fish smokers and 5 producers non supported**

**Monitoring of 69 producers supported by PRODUMA**

# PRODUMA

1. Context
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# Comparison of the certifications

**CDM**:

- Need to get a letter of non-objection -> important risk
- Low carbon benefits

**VCS**:

- No letter of non-objection but low price for credits

**CDM+GS**:

- Need to get a letter of non-objection
- Carbon benefits slightly higher than for CDM only

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# Comparison of the certifications

**GS**:

- GS "Passport" to develop in addition to PDD (16 k €)
- No letter of non-objection
- Costs of monitoring, validation, verification, registration are substantially the same as for the CDM, VCS or CDM + GS
- Methodology almost identical to CDM but can use the emission factor of wood instead of the kerosene -> 30% additional credits
- GS > VCS and potentially> CDM

Results: Net Present Value = 112 to 310 k€ and Internal Rate of Return = 41% to 77%

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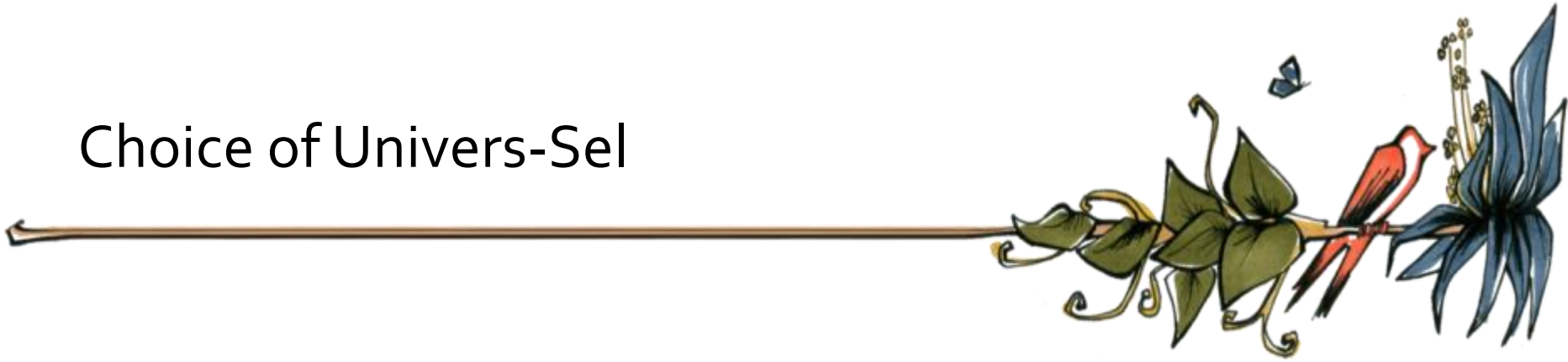
# Choice of Univers-Sel



Univers-Sel finally decided not to engage considering unethical the use of carbon credits

# Océanium

# Océanium

1. Project presentation

2. Monitoring plan

OCEANIUM
DAKAR

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# The project presented by its developers



http://www.dailymotion.com/video/xdtc78_restauration-of-mangroves-senegal-2_news

# Complements

The project developed basic material for the approved methodology:

AR-AM0014: Afforestation and reforestation of degraded mangrove habitat

***Particularities***:

- Very simple plantation technique, very low costs (0,025€/tree, all inclusive!)
- Project led by Océanium, with very good communication and lobbying skills. Its director, Haïdar El Ali, was considered by the newspaper *Le Monde* in the hundred most influent ecologists in the world, and became Minister of Ecology in April 2012.
- Important participation of the population and efficient vulgarization tools.

# Plantation guide

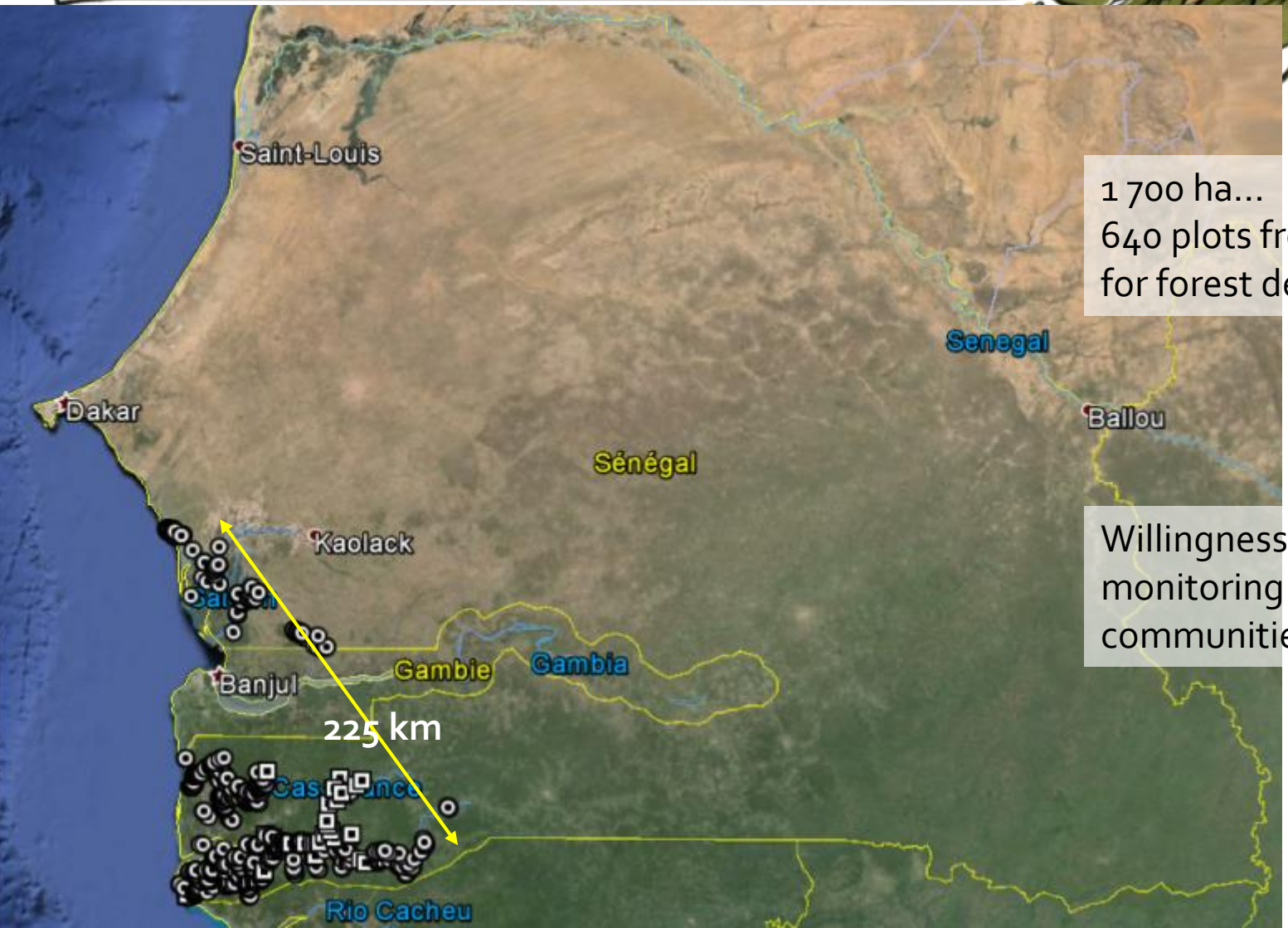

www.oceaniumdakar.org/IMG/pdf/bd_guide_technique_reboisement_mangrove.pdf

# Océanium

1. Project presentation

2. Monitoring plan

# A complex monitoring




1 700 ha…
640 plots from 0,5 (minimum for forest definition) to 28 ha

Willingness to participatory monitoring involving communities

# Project boundaries (1/3)

| For afforestation and reforestation project activities - Host Party's selected single minimum: | | | Host Party's minimum selected values for A/R project activities include: | |
|---|---|---|---|---|
| A single minimum tree crown cover value between 10 and 30 per cent | A single minimum land area value between 0,05 and 1 hectare | A single minimum tree height value between 2 and 5 metres | Palm trees | Bamboos |
| 30 | 0.5 | 2 | | |

Every plantations considered for the carbon project is > 0,5 ha and >30% tree cover, but due to mortality, some can go down under these thresholds.

Each plot has to be checked before each monitoring campaign.

The non-forest plots have to be replanted or extracted from the calculations (0tCO2e/ha).

# Project boundaries (2/3)

How to check 640 plots?

Remote sensing is sometimes possible but not always:

# Project boundaries (3/3)

How to check 640 plots?

Other solutions:

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# Stratification

The proposed stratification was based on:

- The ecological quality of the sites (good/medium), depending on the quality of the soil (mud/sand) the natural presence of mangrove and the observed stock growth

- The plantation density

5 stratum:

| Quality | Density |
|---|---|
| All | Null (100% mortality) |
| Good | Low |
| Good | High |
| Medium | Low |
| Medium | High |

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# Sampling (1/2)

Tool to calculate the number of sample plots : *Calculation of the number of sample plots for measurements within A/R CDM project activities.*

If only 1 stratum:

$$n = \frac{N \times t_{VAL}^2 \times s^2}{N \times E^2 + tVAL^2 \times s^2}$$

n: Number of sample plots required

N: Project area / Plot area

$t_{VAL}$: Two-sided Student's t-value, at infinite degrees of freedom, for the required confidence level (95% for the methodology)

s: Estimated standard deviation of biomass stock

E: Acceptable margin of error (10% for the methodology)

- To know « s », a pre-sampling is needed. > 10 plots per stratum

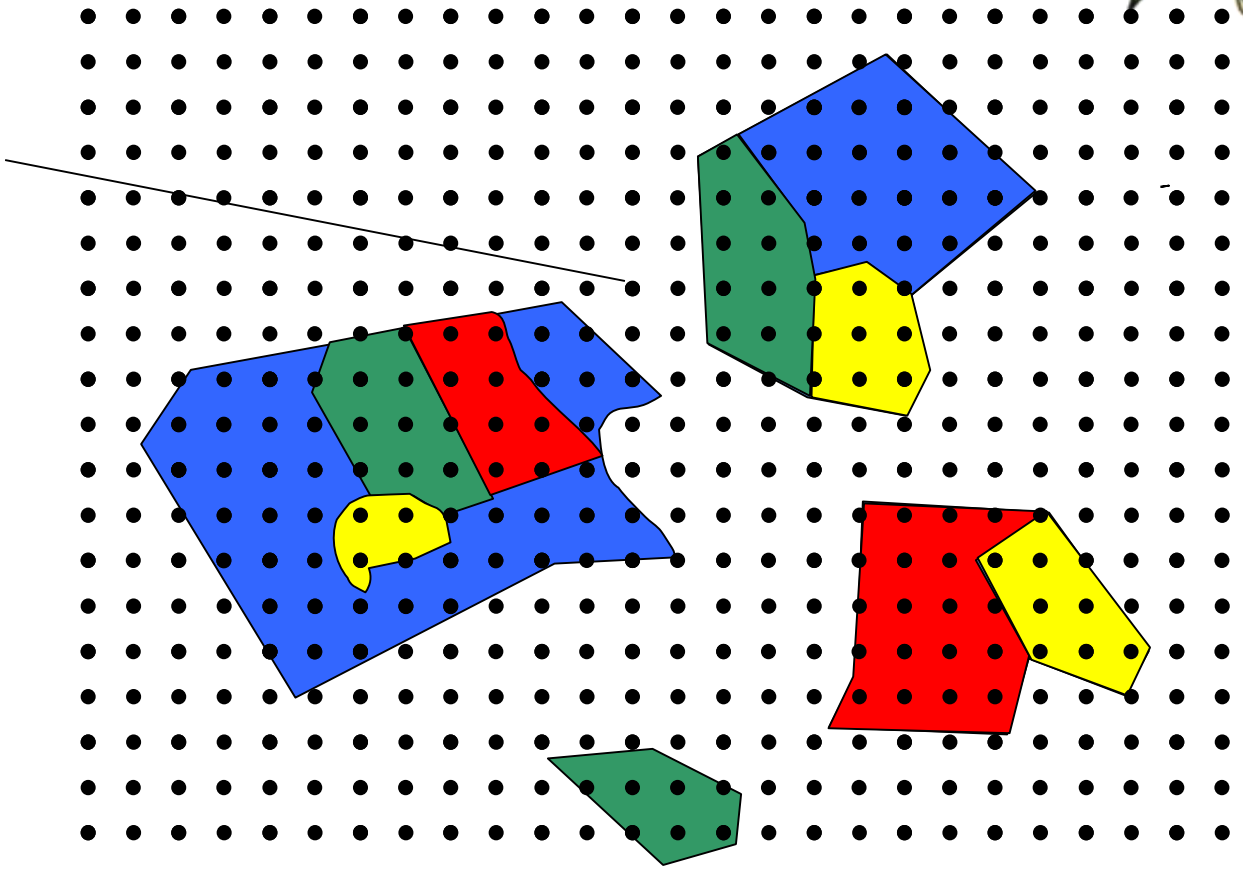
The plot size is set according to the tree density per hectare estimated for a mature plantation. The objective is that the plots contain an average of 10 to 15 trees.

- 2000 trees/ha -> a plot of 100 m² contains 20 trees

# Sampling (2/2)

Plots are automaticaly localized under GIS (random square mesh sampling)

Random point



Change the mesh until the number of plots is **OK**

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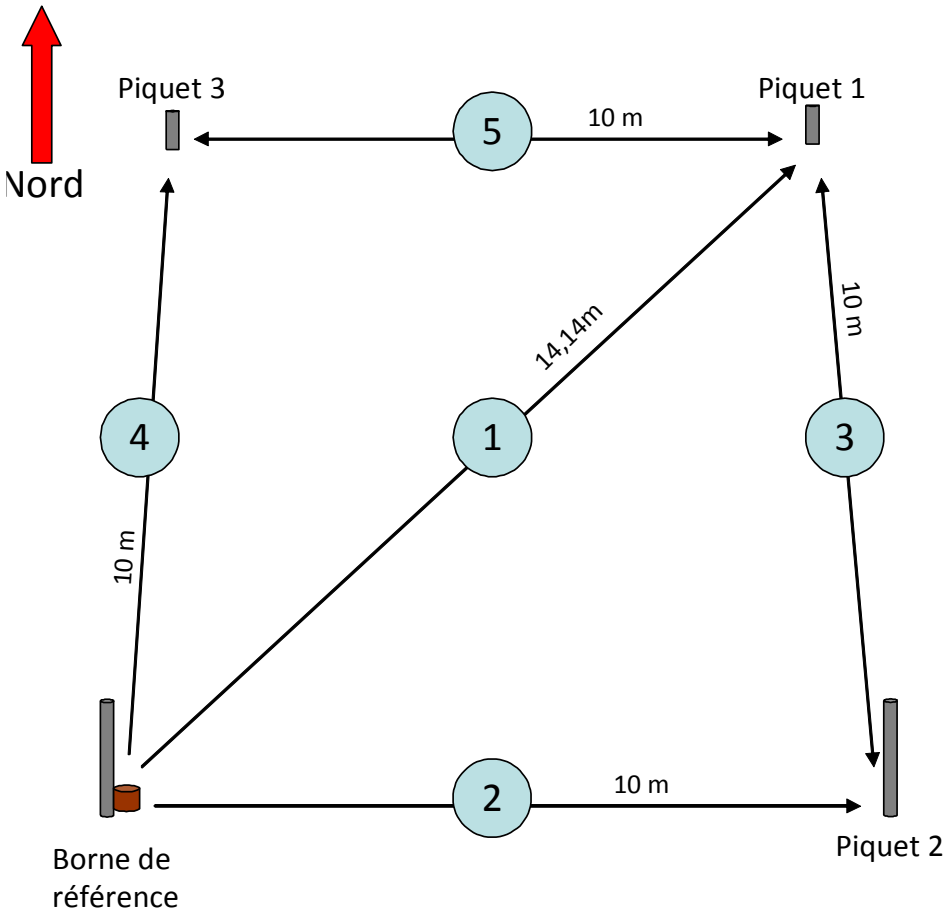
# Plots installation (1/2)

Permanent plots (required by the methodology)

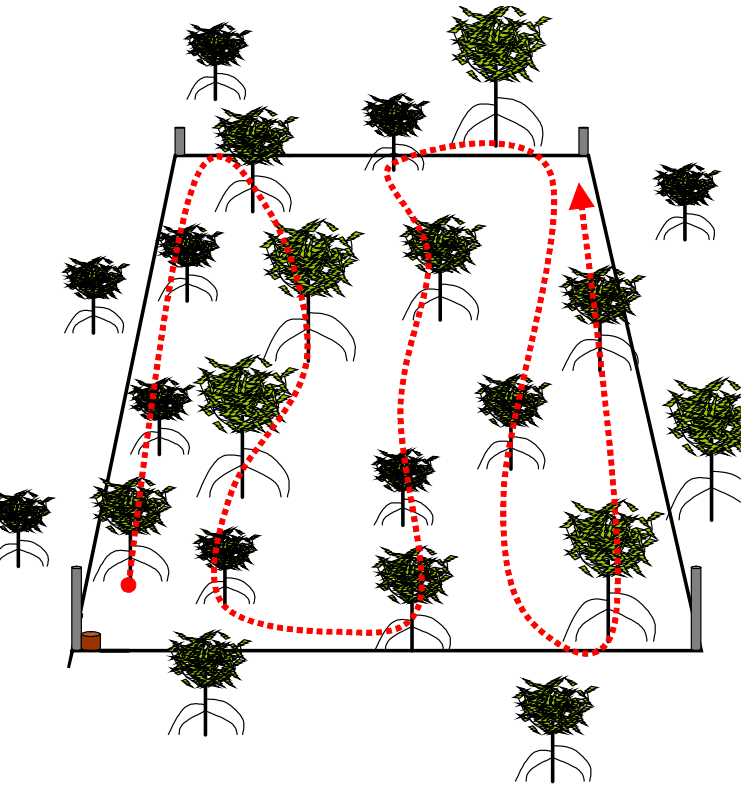
# Plots installation (1/2)




Step 1: find the place (geographic coordinates given by the GIS after sampling)

Step 2: Install the plot… but not anyhow ! Everyone trying to reinstall the plot (in particular the DOE) must find exactly the same trees in it.

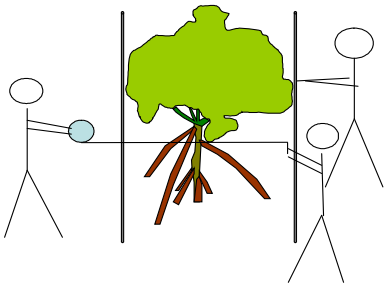
# Measures



Each trees must be measured

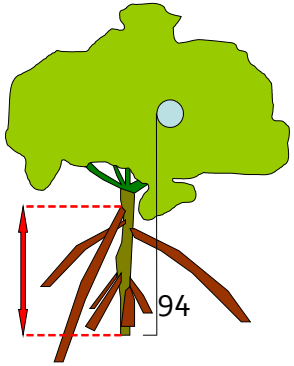
Measures depend based on allometric equations

1. Maximal diameter of the crown



2. Circumference of the stem at the insertion of the lower branch alive

3. Height from the ground to the insertion of the highest living root



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# Allometric equations (1/2)


Few allometric equation for *Rhizophora spp* in Africa.

The use of an inappropriate equation is the main source of error in the estimation of biomass (Day Jr. et al. 1987).

72 plants collected in 42 plots, from 1 to 24 years old, in various ecological situations.

Separation of leaves, fruits, branches and roots

Weighing in situ and after drying

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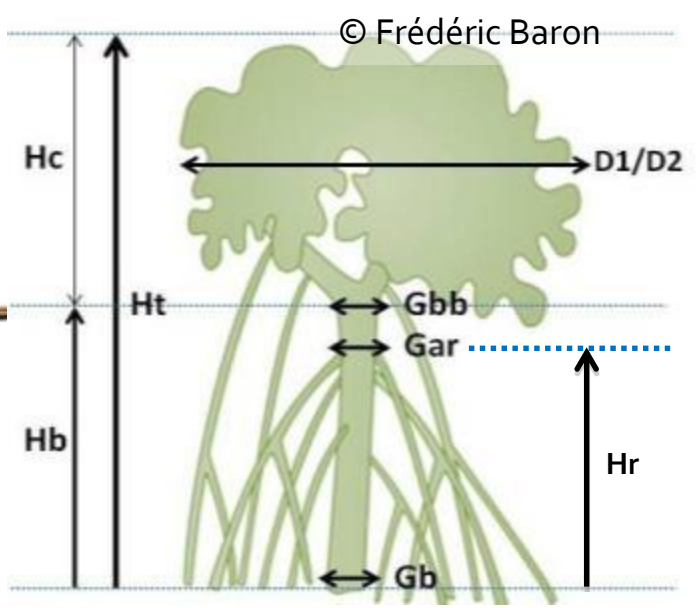
# Allometric equations (2/2)




Measurement of a large number of dendrometric parameters.

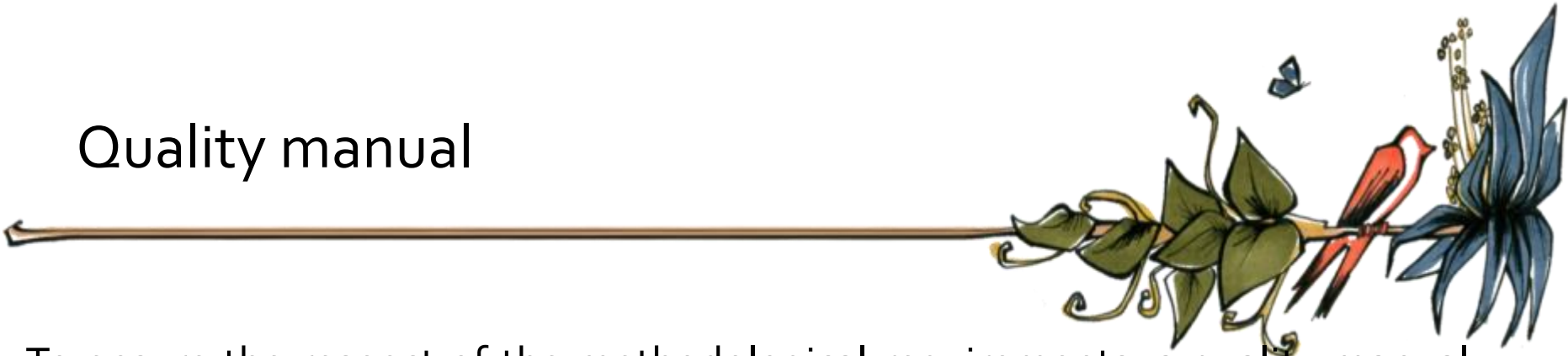
Multiple linear regressions to link the above-ground biomass to the dendrometric parameters

| Model | b | c | d | $R^2$ | AIC* | RSE** | Erreur relative |
|---|---|---|---|---|---|---|---|
| (1) $\ln(BA) = b.\ln(D1)^3 + c.\ln(Gbb)$ | 0,030 | 0,848 | | 0,9969 | 42,97 | 0,038 | 5,77% |
| (2) $\ln(BA) = b.\ln(D1)^2 + c.\ln(Gb) + d.\ln(Gbb)$ | 0,195 | -0,323 | 0,918 | 0,9969 | 45,58 | 0,038 | 5,79% |
| (3) $\ln(BA) = b.\ln(D1)^2 + c.\ln(Ht) + d.\ln(Hc)$ | 0,210 | 0,819 | -0,415 | 0,9962 | 57,34 | 0,042 | 6,33% |
| (4) $\ln(BA) = b.\ln(Gbb)^3 + c.\ln(D1)$ | 0,039 | 0,732 | | 0,9961 | 59,86 | 0,043 | 6,50% |
| (5) $\ln(BA) = b.\ln(D1)^2 + c.\ln(Ht)$ | 0,221 | 0,394 | | 0,9960 | 60,41 | 0,043 | 6,53% |
| (6) $\ln(BA) = b.\ln(Ht)^2 + c.\ln(D1) + d.\ln(Hc)$ | 0,197 | 1,172 | -0,788 | 0,9960 | 61,79 | 0,043 | 6,54% |
| (7) $\ln(BA) = b.\ln(D1)^2 + c.\ln(Gb)$ | 0,247 | 0,298 | | 0,9960 | 61,99 | 0,044 | 6,61% |
| (8) $\ln(BA) = b.\ln((D1^2).Gbb) + c.\ln(Gb)$ | 0,901 | -1,210 | | 0,9955 | 68,63 | 0,046 | 6,93% |
| (9) $\ln(BA) = b.\ln(D1)^3 + c.\ln(Ht)$ | 0,030 | 0,754 | | 0,9955 | 69,94 | 0,046 | 6,99% |
| (10) $\ln(BA) = b.\ln(D1)^2 + c.\ln(Hc)$ | 0,237 | 0,358 | | 0,9954 | 69,28 | 0,046 | 7,01% |
| (11) $\ln(BA) = b.\ln(Gbb)^3 + c.\ln(Hc)$ | 0,053 | 0,504 | | 0,9947 | 79,15 | 0,050 | 7,53% |
| (12) $\ln(BA) = b.\ln(Gbb)^2 + c.\ln(Hc) + d.\ln(Gb)$ | 0,326 | 0,577 | -0,466 | 0,9942 | 86,81 | 0,052 | 7,84% |
| (13) $\ln(BA) = b.\ln(Hc)^2 + c.\ln(D1)$ | -0,143 | 1,780 | | 0,9928 | 102,07 | 0,058 | 8,78% |
| (14) $\ln(BA) = b.\ln(Gbb)^2$ | 0,347 | | | 0,9927 | 101,49 | 0,059 | 8,88% |
| (15) $\ln(BA) = b.\ln(Gb)^3 + c.\ln(D1)$ | -0,184 | 2,260 | | 0,9921 | 109,14 | 0,061 | 9,24% |
| (16) $\ln(BA) = b.\ln(Hc) + c.\ln(Gb) + d.\ln(Gbb)$ | 0,701 | -1,873 | 2,765 | 0,9906 | 120,37 | 0,066 | 10,00% |
| (17) $\ln(BA) = b.\ln(Gb) + c + c.\ln(Gbb)$ | -1,566 | 3,152 | | 0,9883 | 136,34 | 0,074 | 11,23% |

* Akaike Information Criterion
** Residual Standard-error of Estimate

The equation to use is chosen depending on its statistical robustness and practical aspects concerning measurement

# Quality manual



To ensure the respect of the methodological requirements, a quality manual was developed, detailing:

- Organization and responsibilities,
- Procedures for all the monitoring steps, including data encoding, analysis, control and storage,
- Procedure to control and correct each step of the process,
- Memo sheets accompagning procedures,
- Field forms,
- Internal auditing and efficiency improvement process,
- Documents storage,,
- Quality manual diffusion and revision procedures.

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# Staff training








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# Business case

# Introduction

- The objective of this section is to introduce basic financial concepts and to discuss their application in a CDM A/R project.

- This section illustrates that carbon credits have a low impact on project profitability (given current carbon prices) but can provide project developers with initial fundings through up-front payments (ERPA).

- The project described in this section is based on real A/R CDM projects but some features and figures mentioned are fictional due to confidentiality reasons. However, the conclusions are based on real situations.

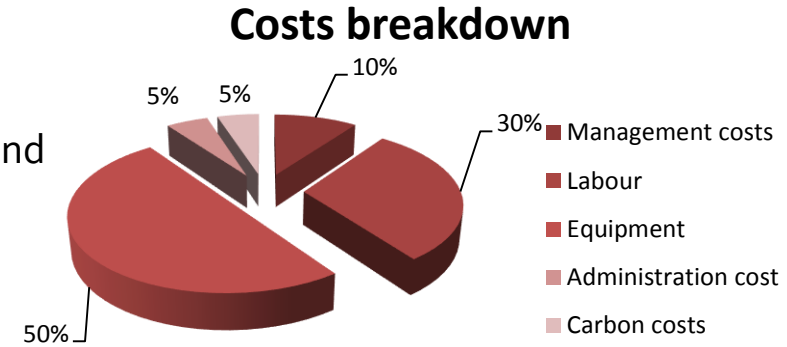
# Project description

- First, **a pilot agroforestry project** developed by a local agribusiness company
- Then, **with the support of private investors + technical and financial partners** (World Bank, carbon specialists, environmental and development NGOs…), decision made to **upscale the project.**
- Two financing options were chosen : **ERPA and debt** (private investors, assuming that selling carbon credits would cover the project costs)
- Difficulties arise:
  - Quantity of carbon sequestrated lower than expected
  - Prices of carbon credits far lower than expected : no profitability…
    - Investors not happy ☹
- But opportunities arise too :
  - Forest plantations can produce wood and other products too if well managed
  - After a few years, it seems that agricultural yields increase thanks to Leguminous trees
  - And the company is well connected to a huge market
    - Decision made to **review the business plan** to integrate all sources of revenues

# Costs

An entire **check-up** made by the company to understand its **costs items:**

- Labour needed per ha and per ton/m³ of final product (from nursery to markets)
- Small equipment: outfits, security equipment, furnitures…
- Gas, water, electricity, fuel, agricultural inputs…
- Management costs: overheads, administration costs…
- Rental costs: logistics (transport products to market), land
- Vehicles, buildings, computers, softwares
- *Carbon transaction costs* + technical assistance

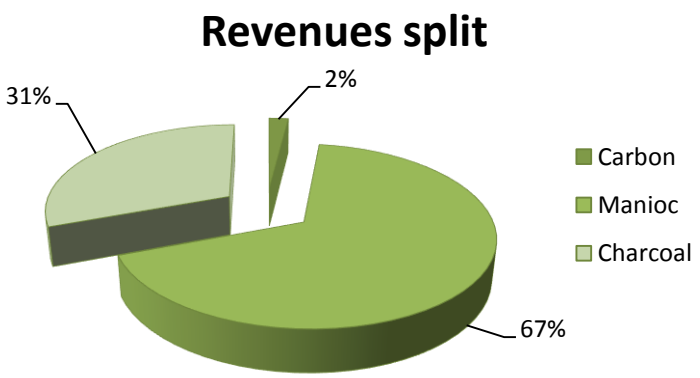



- A precise estimation of the company's **production costs** for a single ton of carbon.
- A more accurate vision of the company's total expenditures
- A sign of **transparency** addressed to investors
- A source of questions to **improve the business model** : *Should we rent or buy a tractor ? Should we internalize some carbon transaction costs ? Is our production cost below the international benchmark ? What is our gross margin ? Etc.*

# Revenues

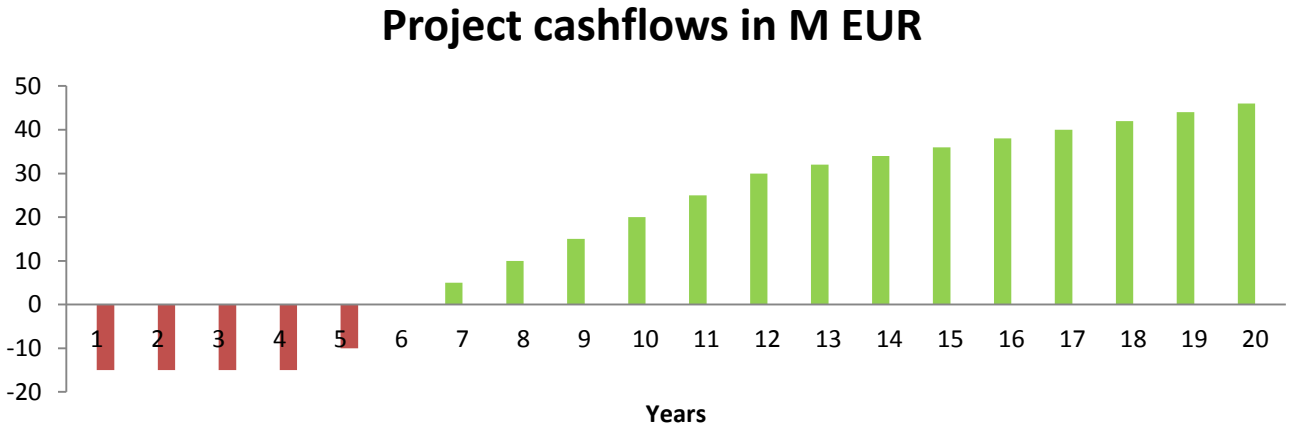
- The company realized that it could produce cassava flour and charcoal without jeopardizing the carbon sequestrated in plantations, if well managed (coppice rotation ensuring a constant C stock).
- **Assumptions** were made on :
  - Total production and agricultural/forestry yields, based on previous findings (pilot phase) and literature review on **local yields**,
  - **Prices** for carbon credits, cassava flour and charcoal, based on **market analysis** and literature review **on local markets**,

Other commodities than strictly carbon had to be included into the company's business model !



# Profitability (1/2)

- The company used two indicators to assess its profitability:
  - **Internal rate of return (IRR)** : the discount rate that makes the net present value (NPV) of all cash flows equal to zero.
  - The **NPV** is the cumulative sum of all annual cashflows (revenues minus costs, before taxes and debt interest) discounted over the project period. If NPV positive, project can be undertaken.




• IRR : 17% ☺

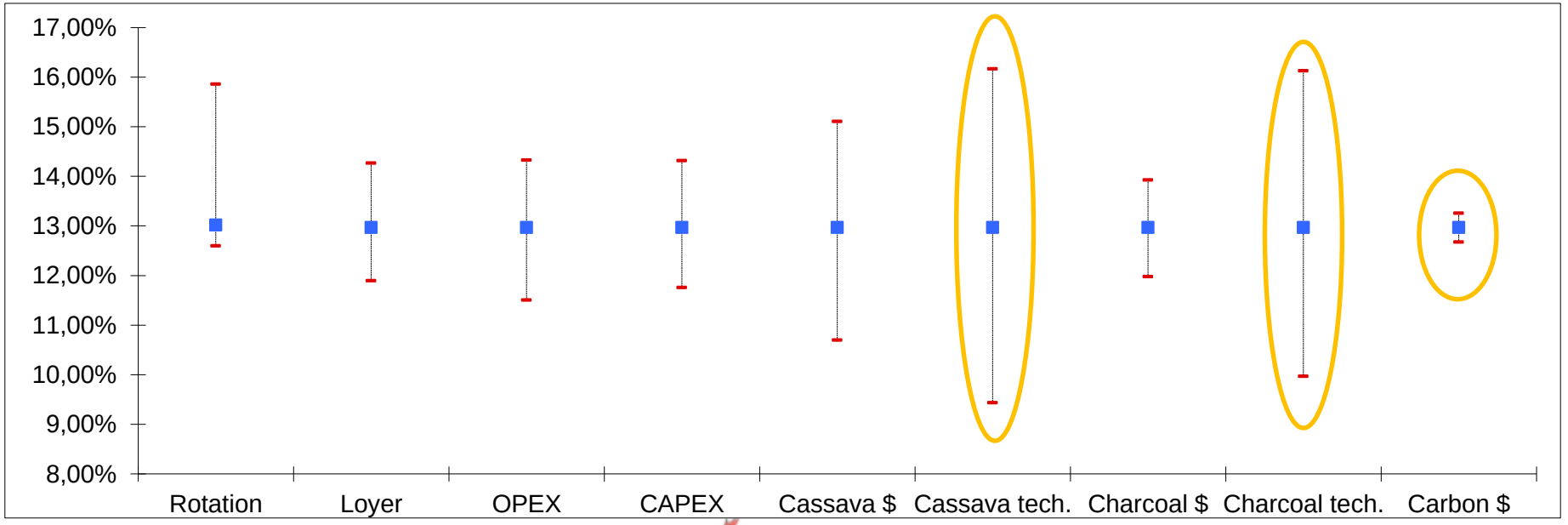
•VAN (9%) : 63.5 M EUR ☺
•VAN (20%) : -10 M EUR ☹

•*Test - VAN (17%) : ?*

The discount rate is subject to many discussions… So be careful when using NPV !

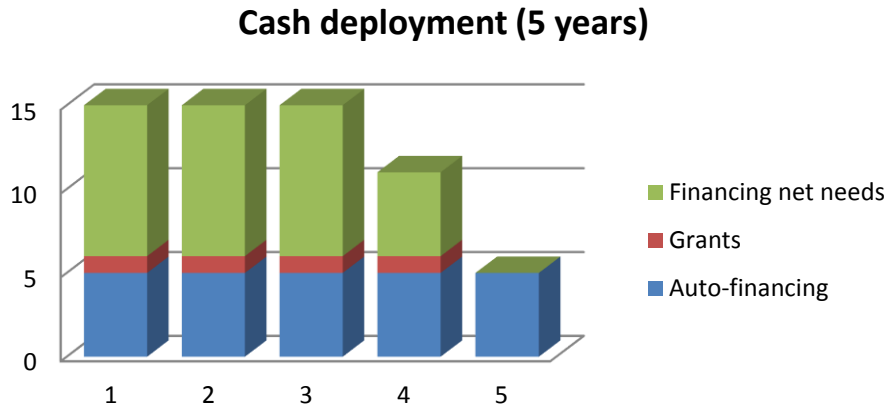
# Profitability (2/2)

- The investors had a clearer view on the project perspectives, but they asked for more:
  - *« What happens if the cassava flour prices crash ? If we find a technology to improve carbonisation efficiency ? Who will pay for the additional costs ? »*
- The company decided to go one step further and made a **sensitivity analysis on IRR :**



# Financing

- Ensured that its project was profitable, the company provided the investors with a **cash deployment profile** quantifying the amount of money needed to continue working:




- And a detailed **profit and losses balance sheet** (a consolidated summary of all expenses, revenues, indicators, etc. taking into account taxes, debt interest rates, etc.) so that the company could independantly review the business plan (**due diligence**)
- The company used this consolidated business plan to convince the current investors that **even with carbon, forestry projects are only profitable on the long term** and to find new investors.

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# Merci pour votre aimable attention !