Agro-silvo-pastoralisme on north facing slopes (Haiti)  
Ti foré (engl.: little forest)

**DESCRIPTION**

Agroforestry is a way of incorporating agricultural land combining trees and crops and / or livestock. The technology increases and diversifies production, generating social, economic and environmental benefits. In addition, planted around houses, trees offer hurricane protection.

In Léogâne, agroforestry systems can be found in home gardens for subsistence and on the northern slopes where it is wetter. They are often agro-silvo-pastoralist systems, since it includes animal production: For example when land users take their cattle into these small forests and give them old banana trunks to eat. The animal excrement fertilizes the soil.

The objective of agroforestry is the cultivation of edible products while preserving natural resources and reconciling economy with ecology. In contrast to weeded/ploughed crops, agroforestry does not accelerate soil erosion when applied on slopes and benefits the water regime. Rainwater can better infiltrate, reducing runoff and replenishing groundwater. If applied in watersheds, agroforestry systems not only protect springs, but also villages and cropland downstream.

Agroforestry systems initiate by planting different fruit trees in the home garden. However, land users often profit from the shade of remaining trees of the abundant vegetation that once covered the country and plant fruit trees and cash crops in the understory. Samanea saman, for instance, is a tree that is quite popular for agroforestry; its shape is comparable to an umbrella and protects the crops underneath from the burning sun. The crops most used for agroforestry in Léogâne are banana, coffee, cocoa, pomelo and yam. There is no particular system in which they are established, but they are equally distributed in a forest or field. For maintenance they pull out noxious weeds that compete with the crops, harvest the products and replant if necessary.

Agroforestry has the potential to improve the quantity and quality of springs, stabilise the soil with deep rooted trees, reduce the risk of flooding to downstream areas and offer protection of settlements against hurricanes. Land users appreciate that this technology offers a great diversity of products and year round harvest. Coffee and cocoa, for example, are cash crops and can substantially increase their income. What is not preferred by land users is the time it takes to receive benefits from the first harvest in agroforestry systems.

**LOCATION**

- Location: Léogâne, Département d'Ouest, Haiti
- No. of Technology sites analysed: 2-10 sites
- Spread of the Technology: evenly spread over an area (approx. 0.1-1 km2)
- In a permanently protected area?: No
- Date of implementation: more than 50 years ago (traditional)

**Type of introduction**

- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- through projects/ external interventions
The combination of agroforestry with livestock makes the soil more fertile. (Joana Eichenberger)

Agroforestry offers good soil cover. (Joana Eichenberger)

### CLASSIFICATION OF THE TECHNOLOGY

**Main purpose**
- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- ✓ conserve ecosystem
- ✓ protect a watershed/ downstream areas – in combination with other Technologies
- ✓ preserve/ improve biodiversity
- ✓ adapt to climate change/ extremes and its impacts
- ✓ mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

**Land use**

Land use mixed within the same land unit: Yes - Agro-silvo-pastoralism

- **Cropland**
  - Annual cropping: root/tuber crops - sweet potatoes, yams, taro/cocoyam, other
  - Perennial (non-woody) cropping: banana/plantain/abaca
  - Tree and shrub cropping: avocado, cacao, coffee, shade grown, mango, mangosteen, guava, papaya, pomelo, breadfruit (artocarpus altillis)

- **Grazing land**
  - Cattle and goats are brought into the forest, tied to a tree or pole and fed with old banana trunks
  - Animal type: cattle - dairy, cattle - non-dairy beef, goats

- **Is integrated crop-livestock management practiced?** Yes

- **Products and services:** meat, milk

- **Forest/ woodlands**
  - (Semi-)natural forests/ woodlands: subtropical humid forest natural vegetation, tropical rain forest natural vegetation. Management: Selective felling, Non-wood forest use
  - Tree types (deciduous): n.a.

- **Products and services:** Fruits and nuts, Other forest products, Grazing/ browsing, Nature conservation/ protection, Protection against natural hazards

### Purpose related to land degradation

- ✓ prevent land degradation
- ✓ reduce land degradation
- ✓ restore/ rehabilitate severely degraded land
- ✓ adapt to land degradation
- ✓ not applicable

### Degradation addressed

- **soil erosion by water** - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gully, Wm: mass movements/ landslides, Wo: offsite degradation effects
- **biological degradation** - Bc: reduction of vegetation cover, Bh: loss of habitats, Bq: quantity/ biomass decline, Bs: quality and species composition/ diversity decline, Bl: loss of soil life
- **water degradation** - Ha: aridification, Hs: change in quantity of surface water, Hp: change in groundwater/aquifer level

### Water supply

- ✓ rainfed
- ✓ mixed rainfed-irrigated
- ✓ full irrigation

### SLM group

- agroforestry

### SLM measures

Wocat SLM Technologies

Agro-silvo-pastoralisme on north facing slopes
If possible, land users profit from groups of existing large trees (e.g., Samanea Saman) to grow coffee, bananas, pomelo, yam, etc. underneath. An agroforestry system optimizes light, provides rich and abundant organic matter, and contributes greatly to maintaining the balance of the ecosystem. When applied on slopes, agroforestry systems are able to conserve soil. The deep roots of large trees stabilize the soil and allow better infiltration of water.

**ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS**

**Calculation of inputs and costs**
- Costs are calculated: per Technology area (size and area unit: 0.5ha)
- Currency used for cost calculation: HTG
- Exchange rate (to USD): 1 USD = 62.0 HTG
- Average wage cost of hired labour per day: 200

**Most important factors affecting the costs**
The price of seeds: If some seeds from the last harvest are kept, there is no need to buy (many) new ones the next season. The price of the seeds varies seasonally. At the time of the harvest prices are low, and in March (beginning of the planting season), they are higher. By planting crops that regrow every season or trees with a long economic life, money can be saved on the cost of seeds. If the land users take care of their tools, they can last up to 6 years.

**Establishment activities**
1. Plant fruit/forest trees around the house, if there are already some, all the better. (Timing/ frequency: March / April (before big rainy season))
2. Plant crops between the trees (Timing/ frequency: March / April (before big rainy season))

**Establishment inputs and costs (per 0.5ha)**

<table>
<thead>
<tr>
<th>Specify input</th>
<th>Unit</th>
<th>Quantity</th>
<th>Costs per Unit (HTG)</th>
<th>Total costs per input (HTG)</th>
<th>% of costs borne by land users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour person-days</td>
<td></td>
<td>10.0</td>
<td>200.0</td>
<td>2000.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoe pieces</td>
<td></td>
<td>1.0</td>
<td>5.0</td>
<td>5.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Pickaxe pieces</td>
<td></td>
<td>1.0</td>
<td>5.0</td>
<td>5.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Machete pieces</td>
<td></td>
<td>1.0</td>
<td>5.0</td>
<td>5.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Plant material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana tree cutting</td>
<td></td>
<td>10.0</td>
<td>75.0</td>
<td>750.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Cacao tree seeds milk powder tin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee tree seeds milk powder tin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coconut tree cutting</td>
<td></td>
<td>3.0</td>
<td>500.0</td>
<td>1500.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Mango tree cutting</td>
<td></td>
<td>1.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Papaya tree cutting</td>
<td></td>
<td>3.0</td>
<td>30.0</td>
<td>90.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee for labourers cup</td>
<td></td>
<td>10.0</td>
<td>25.0</td>
<td>250.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Total costs for establishment of the Technology in USD**

4'955.0

79.92
Maintenance activities
1. Weeding during the first 2 years (Timing/ frequency: First 2x a year and after 2 years only when necessary (about 1 once a year))
2. Harvest (Timing/ frequency: throughout the year)
3. Cut banana trunks to give cattle (Timing/ frequency: throughout the year)
4. Plant new fruit trees (Timing/ frequency: March / April, frequency depends on the plant)

Maintenance inputs and costs (per 0.5ha)

<table>
<thead>
<tr>
<th>Specify input</th>
<th>Unit</th>
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<th>Costs per Unit (HTG)</th>
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<tr>
<td>Labour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour for maintenance</td>
<td>person-days</td>
<td>50.0</td>
<td>200.0</td>
<td>10000.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machete</td>
<td>pieces</td>
<td>1.0</td>
<td>5.0</td>
<td>5.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Hoe</td>
<td>pieces</td>
<td>1.0</td>
<td>5.0</td>
<td>5.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Pickaxe</td>
<td>pieces</td>
<td>1.0</td>
<td>5.0</td>
<td>5.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Plant material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cacao tree (economic lifetime +/- 20yrs)</td>
<td>milk powder tin</td>
<td>0.5</td>
<td>500.0</td>
<td>250.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Coffee tree (economic lifetime +/- 20yrs)</td>
<td>milk powder tin</td>
<td>0.5</td>
<td>500.0</td>
<td>250.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Papaya tree (economic lifetime +/- 4yrs)</td>
<td>cutting</td>
<td>3.0</td>
<td>30.0</td>
<td>9.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Coconut tree (economic lifetime +/- 15-60yrs)</td>
<td>cutting</td>
<td>3.0</td>
<td>500.0</td>
<td>1500.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Mango tree (economic lifetime &gt;100yrs)</td>
<td>cutting</td>
<td>1.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Total costs for maintenance of the Technology: **12'205.0**
Total costs for maintenance of the Technology in USD: **196.85**

**NATURAL ENVIRONMENT**

**Average annual rainfall**
- < 250 mm
- 251-500 mm
- 501-750 mm
- 751-1,000 mm
- ✓ 1,001-1,500 mm
- 1,501-2,000 mm
- 2,001-3,000 mm
- 3,001-4,000 mm
- > 4,000 mm

**Agro-climatic zone**
- humid
- semi-arid
- dry
- arid

**Specifications on climate**
- Léogâne has a tropical climate with a rainy season ranging from April to November (with two peaks in April-May and August-October) and a dry season from the end of November to March. The relative decrease in rainfall in June and July is called the “mid-summer drought”. Due to climate change, the rainy season tends to start later than it used to. Mean annual temperature: 25-27°C

**Slope**
- flat (0-2%)
- gentle (3-5%)
- moderate (6-10%)
- rolling (11-15%)
- hilly (16-30%)
- ✓ steep (31-60%)
- very steep (>60%)

**Landforms**
- plateau/plains
- ridges
- mountain slopes
- hill slopes
- foot slopes
- valley floors

**Altitude**
- 0-100 m a.s.l.
- ✓ 101-500 m a.s.l.
- 501-1,000 m a.s.l.
- 1,001-1,500 m a.s.l.
- 1,501-2,000 m a.s.l.
- 2,001-2,500 m a.s.l.
- 2,501-3,000 m a.s.l.
- 3,001-4,000 m a.s.l.
- > 4,000 m a.s.l.

**Technology is applied in**
- ✓ convex situations
- ✓ concave situations
- ✓ not relevant

** Soil depth**
- ✓ very shallow (0-20 cm)
- shallow (21-50 cm)
- moderately deep (51-80 cm)
- deep (81-120 cm)
- very deep (> 120 cm)

**Soil texture (topsoil)**
- ✓ coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

**Soil texture (> 20 cm below surface)**
- ✓ coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

**Topsoil organic matter content**
- ✓ high (>3%)
- medium (1-3%)
- low (<1%)

**Groundwater table**
- ✓ on surface
- < 5 m
- 5-50 m
- > 50 m

**Availability of surface water**
- excess
- ✓ good
- medium
- poor/ none

**Water quality (untreated)**
- ✓ good drinking water
- poor drinking water
- ✓ for agricultural use only (irrigation)
- unusable

**Water quality refers to: both ground and surface water**

**Is salinity a problem?**
- Yes
- ✓ No

**Occurrence of flooding**
- Yes
- ✓ No

**Species diversity**
- ✓ high
- ✓ medium
- low

**Habitat diversity**
- ✓ high
- ✓ medium
- low

**CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY**

**Market orientation**
- ✓ subsistence (self-supply)

**Off-farm income**
- ✓ less than 10% of all income

**Relative level of wealth**
- ✓ very poor

**Level of mechanization**
- ✓ manual work
### Mixed (subsistence/commercial) or commercial/market
- Poor
- Average
- Rich
- Very rich

### Animal traction
- Mechanized/motorized

### Sedentary or nomadic
- Sedentary
- Semi-nomadic
- Nomadic

### Individuals or groups
- Individual/household
- Groups/community
- Cooperative
- Employee (company, government)

### Gender
- Women
- Men

### Age
- Children
- Youth
- Middle-aged
- Elderly

### Area used per household
- < 0.5 ha
- 0.5-1 ha
- 1-2 ha
- 2-5 ha
- 5-15 ha
- 15-50 ha
- 50-100 ha
- 100-500 ha
- 500-1000 ha
- 1,000-10,000 ha
- > 10,000 ha

### Scale
- Small-scale
- Medium-scale
- Large-scale

### Land ownership
- State
- Company
- Communal/village group
- Individual, not titled
- Individual, titled

### Land use rights
- Open access (unorganized)
- Communal (organized)
- Leased
- Individual

### Access to services and infrastructure
- Health
- Education
- Technical assistance
- Employment (e.g., off-farm)
- Markets
- Energy
- Roads and transport
- Drinking water and sanitation
- Financial services
- None

### Socio-economic impacts
- Crop production
- Crop quality
- Risk of production failure
- Product diversity
- Production area (new land under cultivation/use)
- Drinking water availability
- Drinking water quality
- Expenses on agricultural inputs
- Farm income

### Socio-cultural impacts
- Food security/self-sufficiency
- SLM/land degradation knowledge

### Ecological impacts
- Water quantity
- Water quality
- Surface runoff
- Evaporation
- Soil moisture
- Soil cover
- Soil loss
- Soil accumulation
- Soil crusting/sealing
- Vegetation cover
- Biomass/above ground C
- Plant diversity
- Flood impacts
- Landslides/debris flows
- Drought impacts
- Impacts of cyclones, rain storms
- Emission of carbon and greenhouse gases
- Micro-climate

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**IMPACTS**

**Socio-economic impacts**
- Decreased
- Increased

**Socio-cultural impacts**
- Reduced
- Improved

**Ecological impacts**
- Decreased
- Increased
Off-site impacts

- Water availability (groundwater, springs): decreased
- Reliable and stable stream flows in dry season (incl. low flows): reduced
- Downstream flooding (undesired): increased
- Downstream siltation: reduced
- Buffering/filtering capacity (by soil, vegetation, wetlands): improved
- Damage on neighbours' fields: reduced
- Damage on public/private infrastructure: reduced

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs
- Short-term returns: very negative
- Long-term returns: very positive

Benefits compared with maintenance costs
- Short-term returns: very negative
- Long-term returns: very positive

CLIMATE CHANGE

- Climate-related extremes (disasters)
  - Tropical storm: not well at all
  - Local rainstorm: not well at all
  - Drought: not well at all
  - Landslide: not well at all

ADOPTION AND ADAPTATION

- Percentage of land users in the area who have adopted the Technology:
  - Single cases/experimental:
    - 1-10%
    - 11-50%
    - > 50%
- Of all those who have adopted the Technology, how many have done so without receiving material incentives?
  - 0-10%
  - 11-50%
  - 51-90%
  - 91-100%
- Has the Technology been modified recently to adapt to changing conditions?
  - Yes
  - No
- To which changing conditions?
  - Climatic change/extremes
  - Changing markets
  - Labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view
- Year-round production
- Diversity of production
- Increased income through cash crops (coffee, cocoa)

Strengths: compiler's or other key resource person's view
- Conservation of biodiversity
- Creation of microclimate
- CO2 sequestration
- Soil and water conservation
- Protecting homes against strong winds
- Protection of downstream areas from flooding and siltation

Weaknesses/disadvantages/risks: land user's view
- The first harvest is late.
  - This is a big challenge because land users in the area live from hand to mouth. This can be overcome by planting fruit or forest tree seedlings when implementing progressive terraces with vetiver hedges (see documented technology in WOCAT database). In this way, the land user can plant and harvest other crops while waiting for the trees to grow.

Weaknesses/disadvantages/risks: compiler's or other key resource person's view
- Difficult to convince land users because the benefits are rather in the long-term.
  - It's necessary to raise the land users' awareness on all the benefits of this technology.

REFERENCES

Compiler: Joana Eichenberger
Reviewer: Hanspeter Liniger
Date of documentation: Feb. 1, 2019
Last update: April 16, 2020
Resource persons
Jean Carls Dessin - SLM specialist
Laurore Dieufort - land user

Full description in the WOCAT database

Linked SLM data

Documentation was facilitated by
Institution
- Swiss Red Cross (Swiss Red Cross) - Switzerland
Project
- n.a.

Links to relevant information which is available online