Des systèmes agroforestiers sur les versants nord dans les Mornes à Léogâne (Hanspeter Liniger)

Agro-silvo-pastoralisme on north facing slopes (Haiti)

Ti forè (engl.: little forest)

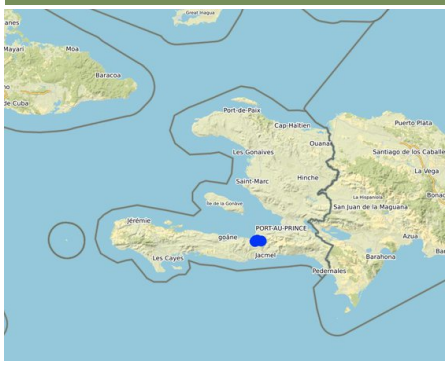
DESCRIPTION

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.

Agroforestry systems in Haiti are traditional land use practices characterised by a multi-storey arrangement of tall native trees, fruit species at various heights and a range of perennial and annual crops below. In Léogâne, large agroforestry systems are reduced to areas on less sun-exposed and more humid north-facing slopes. They are often agro-silvo-pastoralist systems, since while land users take their animals into small forests for grazing, their cattle also feed on old banana stems. In return, animal manure fertilizes the soil. In order to implement this technology, land users plant fruit trees and cash crops in the understorey of conserved, mature trees, e.g. Samanea saman, a popular tree for agroforestry, as its characteristic umbrella shape protects the crops underneath from sun damage. The most common crops used for agroforestry in Léogâne are yam, mango, breadfruit, banana, pomelo and papaya. This system also provides an excellent environment for the cash crops of coffee and cacao. There is no particular layout in which agroforestry systems are established, but the trees and crops are equally distributed. For maintenance, land users remove weeds that compete with the crops, replace old trees/ crops with new ones (e.g. coffee bushed are replaced every 20 years) and distribute the banana suckers (lateral shoot that emerges from the soil usually near the parent plant).

Agroforestry systems combine economy with ecology. They enable the cultivation of edible products while at the same time conserving natural resources. In contrast to weeded/ ploughed crops (predominately found on sunnier and drier south-facing slopes), agroforestry mitigates soil erosion when applied on slopes. The vegetation cover hinders soil compaction and improves rainwater infiltration. Therefore, agroforestry reduces runoff, replenishes groundwater and improves the quantity and quality of springs. Moreover, agroforestry protects villages and cropland downstream from floods, landslides and siltation. Land users appreciate this technology for its great diversity of products, year-round harvest and the income of cash crops. However, land users are often troubled by the time required before receiving benefits from the first harvest from the trees. This is often the hindering factor for out-scaling this technology.

LOCATION



Location: Léogâne, Département d'Ouest, Haiti

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites

- -72.59102, 18.39474
- -72.64129, 18.39852
- -72.64047, 18.40198
- -72.65365, 18.39821
- -72.63619, 18.39858
- -72.66942, 18.38859

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
- [x] 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
- ✓ reduce risk of disasters
- 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-silvopastoralism

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 altilis)

Is crop rotation practiced? No

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

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

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/ gullying, 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, Hg: change in groundwater/aquifer level, Hp: decline of surface water quality

SLM group

- agroforestry

SLM measures

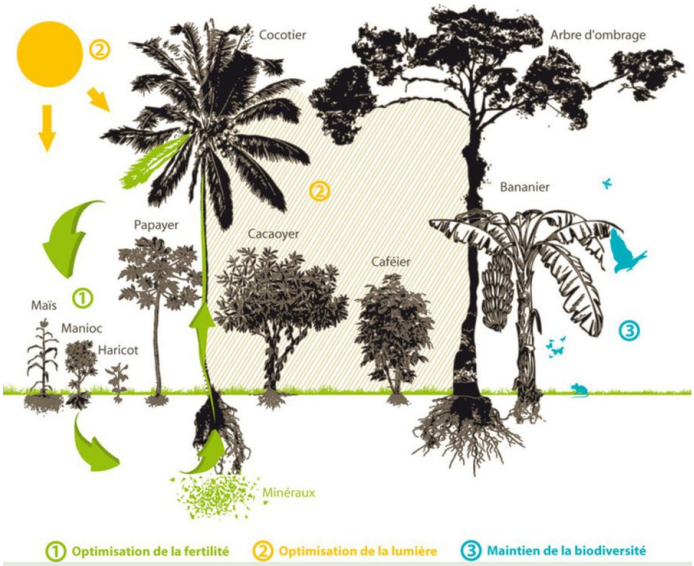
- improved ground/ vegetation cover
- ecosystem-based disaster risk reduction

vegetative measures - V1: Tree and shrub cover

management measures - M1: Change of land use type

TECHNICAL DRAWING

Technical specifications
If possible, land users profit from groups of existing large trees (eg 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.



Author: Ethiquable

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)

Specify input	Unit	Quantity	Costs per Unit (HTG)	Total costs per input (HTG)	% of costs borne by land users
Labour					
Labour	person-days	10.0	200.0	2000.0	100.0
Equipment					
Hoe	pieces	1.0	5.0	5.0	100.0
Pickaxe	pieces	1.0	5.0	5.0	100.0
Machete	pieces	1.0	5.0	5.0	100.0
Plant material					
Banana tree	cutting	10.0	75.0	750.0	100.0
Cacao tree seeds	milk powder tin	0.25	500.0	125.0	100.0
Coffee tree seeds	milk powder tin	0.25	500.0	125.0	100.0
Coconut tree	cutting	3.0	500.0	1500.0	100.0
Mango tree	cutting	1.0	100.0	100.0	100.0
Papaya tree	cutting	3.0	30.0	90.0	100.0
Other					
Coffee for labourers	cup	10.0	25.0	250.0	100.0
					11.0
Total costs for establishment of the Technology				**4'955.0**	
Total costs for establishment of the Technology in USD				*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)

Specify input	Unit	Quantity	Costs per Unit (HTG)	Total costs per input (HTG)	% of costs borne by land users
Labour					
Labour for maintenance	person-days	50.0	200.0	10000.0	100.0
Equipment					
Machete	pieces	1.0	5.0	5.0	100.0
Hoe	pieces	1.0	5.0	5.0	100.0
Pickaxe	pieces	1.0	5.0	5.0	100.0
Plant material					
Cacao tree (economic lifetime +/- 20yrs)	milk powder tin	0.5	500.0	250.0	100.0
Coffee tree (economic lifetime +/- 20yrs)	milk powder tin	0.5	500.0	250.0	100.0
Papaya tree (economic lifetime +/- 4yrs)	cutting	3.0	30.0	90.0	100.0
Coconut tree (economic lifetime +/- 15-60yrs)	cutting	3.0	500.0	1500.0	100.0
Mango tree (economic lifetime >100yrs)	cutting	1.0	100.0	100.0	100.0
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
- ☑ sub-humid
- ☐ semi-arid
- ☐ arid

Specifications on climate
he windward sides (north-facing slopes) receive more rain than the leeward sides.

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
- ☐ footslopes
- ☐ 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 (treatment required)
- ☐ 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

- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

- [ ] 10-50% of all income
- [ ] > 50% of all income

- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [x] youth
- [x] middle-aged
- [x] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [ ] small-scale
- [x] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [x] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [ ] individual

Water use rights
- [x] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	✓			good
education	poor	✓			good
technical assistance	poor	✓			good
employment (e.g. off-farm)	poor	✓			good
markets	poor		✓		good
energy	poor	✓			good
roads and transport	poor	✓			good
drinking water and sanitation	poor		✓		good
financial services	poor	✓			good
None	poor	✓			good

IMPACTS

Socio-economic impacts

Crop production	decreased						✓	increased
crop quality	decreased						✓	increased
risk of production failure	increased						✓	decreased
product diversity	decreased						✓	increased
production area (new land under cultivation/ use)	decreased				✓			increased
drinking water availability	decreased						✓	increased
drinking water quality	decreased						✓	increased
expenses on agricultural inputs	increased					✓		decreased
farm income	decreased						✓	increased

Socio-cultural impacts

food security/ self-sufficiency	reduced						✓	improved
SLM/ land degradation knowledge	reduced				✓			improved

Ecological impacts

water quantity	decreased							✓ increased
water quality	decreased						✓	increased
surface runoff	increased							✓ decreased
evaporation	increased						✓	decreased
soil moisture	decreased							✓ increased
soil cover	reduced							✓ improved
soil loss	increased							✓ decreased
soil accumulation	decreased				✓			increased
soil crusting/ sealing	increased							✓ reduced
vegetation cover	decreased							✓ increased
biomass/ above ground C	decreased							✓ increased
plant diversity	decreased						✓	increased
flood impacts	increased							✓ decreased
landslides/ debris flows	increased							✓ decreased
drought impacts	increased							✓ decreased
impacts of cyclones, rain storms	increased						✓	decreased
emission of carbon and greenhouse gases	increased							✓ decreased
micro-climate	worsened							✓ improved

Off-site impacts

water availability (groundwater, springs)	decreased	✓ increased
reliable and stable stream flows in dry season (incl. low flows)	reduced	✓ increased
downstream flooding (undesired)	increased	✓ reduced
downstream siltation	increased	✓ decreased
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	✓ improved
damage on neighbours' fields	increased	✓ reduced
damage on public/ private infrastructure	increased	✓ reduced

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	✓ very positive
Long-term returns	very negative	✓ very positive

Benefits compared with maintenance costs

Short-term returns	very negative	✓ very positive
Long-term returns	very negative	✓ very positive

CLIMATE CHANGE

Climate-related extremes (disasters)

tropical storm	not well at all	✓ very well
local rainstorm	not well at all	✓ very well
drought	not well at all	✓ very well
landslide	not well at all	✓ very well

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 → how to overcome

- 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 → how to overcome

- 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: June 16, 2020

Resource persons
Jean Carls Dessin - SLM specialist
Laurore Dieufort - land user

Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4328/

Linked SLM data
Cca: Unknown name https://qcat.wocat.net/en/wocat/cca/view/cca_4371/

Documentation was faciliated by
Institution
- Swiss Red Cross (Swiss Red Cross) - Switzerland

Project
- n.a.

Links to relevant information which is available online
- Ethicable (2013): Pourquoi nous soutenons l'agroforesterie.: http://www.ethiquable.coop/page-dactualites-mag/pourquoi-nous-soutenons-lagroforesterie