Ficus Natalensis Agroforestry System

Uganda - Okusimba emituba n'ebimera

Ficus natalensis based agroforestry system protects crops on windy hill slopes facing Lake Victoria and reduce runoff towards the meandering Kagera River Valley.

Ficus natalensis is traditionally scattered in crop fields as a land management practice in central and south-western Uganda. The improved technology designed through community participation involves planting lines of Ficus natalensis along the contour at an interval that enables the tree to provide shade to young crops without depriving them of sunshine. When planted together with coffee trees or in banana plantations, the tall Ficus tree forms the top storey that protects the crop from the hot sun.
The main purpose of Ficus based agroforestry is to protect the soil from erosion. Within 3 to 5 years the Ficus tree forms a deep root system that stabilizes the soil. In addition, it drops leaves which quickly decay to provide both soil cover and manure thereby increasing the fertility of the soil. The trees provide firewood, fodder for livestock and bark cloth which can be used domestically or sold to supplement household income. They also act as wind breaks.
Ficus Natalensis is propagated using cuttings from young branches which are planted vertically 6 m apart along a contour. Propagation material is readily available and cheap, making the technology inexpensive to establish. Any annual or perennial crop can be inter-cropped with Ficus spp. provided the tree canopy is managed well. The tree is quite robust and can attain heights of over 20m, with a very extensive canopy if left to grow. Pruning raises its canopy to the desired height above the ground. In its early stages, fencing is required to protect the tree from damage by livestock. Within 12 to 18 months, however, the tree is established enough to withstand browsing. Only simple tools like hoes and garden forks for digging holes/pits are essential for establishment of the technology. The implementation of the technology on steep slopes (> 50%) is not possible without other supportive SLM interventions, in Rakai these include construction of stone lines and mulch application.
The pruned branches of Ficus natalensis are used as fuel wood when dry. Therefore scarcity of fuel wood may lead to over-harvesting of branches and destroying the canopy. Nonetheless, the tree regenerates quickly with the coming of the rains. Ficus tree can live for a hundred years.

left: Young coffee seedlings growing under the protective canopy of Ficus spp. (Photo: Charles L Malingu)
right: The watershed technologies of agroforestry and stone lines has created a plantation out of wasteland in 3 rain seasons (Photo: Charles L Malingu)

Location: Uganda
Region: Rakai District (Kijonjo Parish)
Technology area: 0.06 km^2
Conservation measure: vegetative
Stage of intervention: mitigation / reduction of land degradation
Origin: Developed externally / introduced through project, recent (<10 years ago)
Land use type:
Mixed: Agroforestry
Climate: subhumid, tropics
WOCAT database reference: T_UGA016en
Related approach: Community development approach (A_UGA009en)
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Classification

Land use problems:

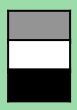
- Severe deforestation as trees were cut down for firewood, charcoal, timber and for agricultural use; Overgrazing (expert's point of view)
Prolonged dry weather, destructive rainstorms and declining soil fertility (land user's point of view)

Land use	Climate	Degradation	Conservation measure
Agroforestry rainfed	subhumid	Soil erosion by water: loss of topsoil / surface erosion, Biological degradation: reduction of vegetation cover, quantity / biomass decline	vegetative: Tree and shrub cover

Stage of intervention

Prevention
Mitigation / Reduction
Rehabilitation

Origin



Land users initiative: traditional (>50 years ago)
Experiments / Research
Externally introduced: recent (<10 years ago)

Level of technical knowledge

Agricultural advisor
Land user

Main causes of land degradation:
Direct causes - Human induced: soil management, crop management (annual, perennial, tree/shrub), deforestation / removal of natural vegetation (incl. forest fires), over-exploitation of vegetation for domestic use
Indirect causes: poverty / wealth, education, access to knowledge and support services

Main technical functions:

- control of raindrop splash
- control of dispersed runoff: impede / retard
- improvement of ground cover
- stabilisation of soil (eg by tree roots against land slides)
- reduction in wind speed
- spatial arrangement and diversification of land use

Secondary technical functions:

- increase in organic matter
- increase of infiltration
- increase / maintain water stored in soil
- sediment retention / trapping, sediment harvesting

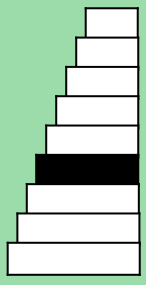
Environment

Natural Environment

Average annual rainfall (mm)

> 4000 mm
3000-4000 mm
2000-3000 mm
1500-2000 mm
1000-1500 mm
750-1000 mm
500-750 mm
250-500 mm
< 250 mm

Altitude (m a.s.l.)

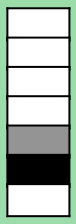


> 4000
3000-4000
2500-3000
2000-2500
1500-2000
1000-1500
500-1000
100-500
<100

Landform

plateau / plains
ridges
mountain slopes
hill slopes
footslopes
valley floors

Slope (%)



flat
gentle
moderate
rolling
hilly
steep
very steep

Soil depth (cm)

0-20
20-50
50-80
80-120
>120

Growing season(s): 120 days (February to May), 120 days (September to December)
Soil texture: coarse / light (sandy)
Soil fertility: medium
Topsoil organic matter: medium (1-3%)
Soil drainage/infiltration: good

Soil water storage capacity: low
Ground water table: 5 - 50 m
Availability of surface water: poor / none
Water quality: poor drinking water
Biodiversity: medium

Tolerant of climatic extremes: temperature increase, seasonal rainfall increase, seasonal rainfall decrease, wind storms / dust storms, droughts / dry spells, decreasing length of growing period

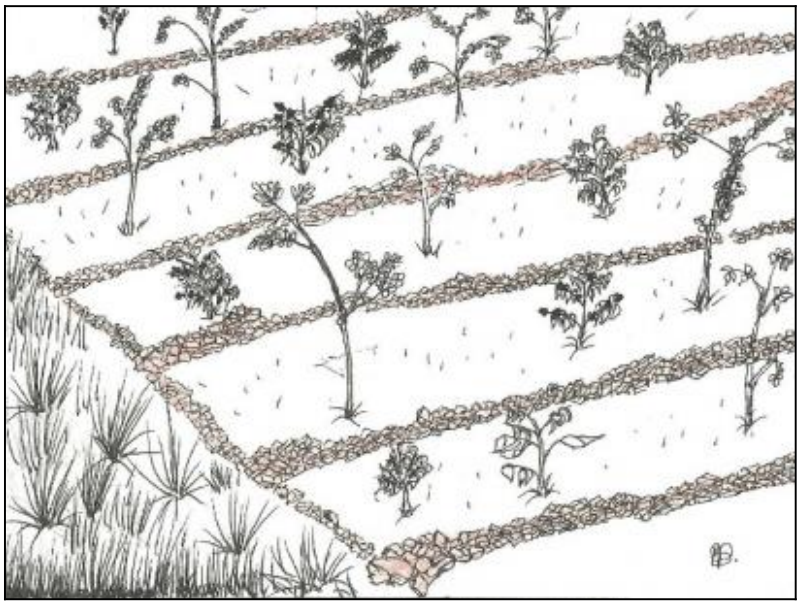
Human Environment

Mixed per household (ha)

<0.5
0.5-1
1-2
2-5
5-15
15-50
50-100
100-500
500-1,000
1,000-10,000
>10,000

Land user: Individual / household, Small scale land users, common / average land users, men and women
Population density: 100-200 persons/km2
Annual population growth: 1% - 2%
Land ownership: individual, not titled
Land use rights: individual
Water use rights: open access (unorganised) (Most land users have access to untittled land and have open access to water.)
Relative level of wealth: average, which represents 63% of the land users; 34% of the total area is owned by average land users

Importance of off-farm income: less than 10% of all income: There is a difference in income levels between those who have implemented the technology and those who have not.
Access to service and infrastructure: low: technical assistance, employment (eg off-farm), energy, financial services; moderate: health, education, roads & transport, drinking water and sanitation; high: market
Market orientation: subsistence (self-supply)



Technical drawing

A diagram showing Ficus spp. trees planted to provide shade to coffee trees. (Byonabye Proscovia)

Implementation activities, inputs and costs

Establishment activities

-
- Sourcing planting materials
- Making pits
- Planting cuttings
- Spot weeding

Establishment inputs and costs per ha

Inputs	Costs (US$)	% met by land user
Labour	76.00	100%
Equipment		
- machine use	14.00	100%
Agricultural		
- seedlings	30.00	100%
TOTAL	**120.00**	**100.00%**

Maintenance/recurrent activities

- Spot weeding
- Pruning
- Removing and processing the bark into bark cloth

Maintenance/recurrent inputs and costs per ha per year

Inputs	Costs (US$)	% met by land user
Labour	30.00	100%
Equipment		
- machine use	8.00	100%
Agricultural		
- seedlings	0.00	0%
TOTAL	**38.00**	**100.00%**

Remarks:
The most important factor affecting cost is labor to transport the bulky stem cuttings to the site. However, Ficus Natalensis is easy to establish and is durable (over 100 years) depending on management. It is extremely hardy and when it grows to 50cm to 100cm stem diameter it can be used for timber or to make dugout canoes. Establishment costs are easily recovered.
The costs were calculated for wind breaks and optimum canopy after establishment. Calculations were done in December 2013, considering activities of the previous (September-November) wet season.

Assessment

Impacts of the Technology

Production and socio-economic benefits

- +++ increased crop yield
- +++ increased wood production
- +++ reduced risk of production failure
- +++ increased farm income
- ++ increased production area
- ++ increased product diversification
- + diversification of income sources

Production and socio-economic disadvantages

- ++ increased labour constraints
- + loss of land

Socio-cultural benefits

- +++ improved conservation / erosion knowledge
- ++ improved food security / self sufficiency
- + improved cultural opportunities

Socio-cultural disadvantages

Ecological benefits

- +++ reduced surface runoff
- +++ reduced soil loss
- ++ increased soil moisture
- ++ reduced evaporation
- ++ reduced hazard towards adverse events
- ++ reduced wind velocity
- ++ improved soil cover
- ++ increased biomass above ground C
- ++ increased / maintained habitat diversity
- + increased plant diversity

Ecological disadvantages

- ++ Increased risk of lightening strikes
- + increased niches for pests

Off-site benefits

- +++ reduced damage on neighbours fields
- ++ reduced downstream flooding
- ++ reduced downstream siltation

Off-site disadvantages

Contribution to human well-being / livelihoods

++ The technology has improved availability of both food and fuel wood. Some products from trees used in agroforestry such as backcloth (Embugo - Luganda) are sold, diversifying household income.

Benefits /costs according to land user

Benefits compared with costs	short-term:	long-term:
Establishment	positive	positive
Maintenance / recurrent	very positive	very positive

The costs for both establishment and maintenance are a small fraction of the benefits accruing from the technology.

Acceptance / adoption:

100% of land user families (8 families; 100% of area) have implemented the technology voluntary. There is spontaneous adoption of the technology as it builds on traditional farming practices in the area.
There is strong trend towards (growing) spontaneous adoption of the technology. High demand for shade-grown coffee and bananas in addition to the highly valued bark cloth used in art and crafts has increased farmer appreciation.

Concluding statements

Strengths and → how to sustain/improve	Weaknesses and → how to overcome
Demand for wood fuel is high → Local bye laws should be enacted to control deforestation and encourage tree growing	Some tree species especially with short roots , compete with crops for nutrients. → Planting tree species with deep roots to avoid competition for nutrients.
It improves soil fertility-Ficus natalensis sheds leaves once every year, adding to soil humus. → More guidance should be given to the farmers for sustained spontaneous adoption of the technology	It is a home for weaver birds and caterpillars. → Use scarecrows and biological control.
It checks the speed of wind thereby protecting crops. → Other agricultural, ecological and social benefits could be explored in this scenic area facing the Kagera River where it enters Lake Victoria	The trees can hinder crops from light if canopy is dense → Prune periodically to enable other crops access to light
Stakes made from the Ficus branches can be used to grow climbing plants eg. passion fruits, yams as well as climbing beans → More tree planting should be encouraged	Some trees can fall especially during heavy and stormy rains, damaging plants and animals. → cutting excessive branches to reduce the load borne by trees.
Prevents soil erosion by checking raindrop splash, speed and amount of surface runoff and stabilizes the soil. → Because the ficus tree takes time to establish, other technologies such as trenches and grass strips could be used to reinforce it	Trees can attract lightening ,which destroys plants and animals. → Avoid putting animals under tall trees.
Ficus is used to provide backcloth that is sold for the making of Art and crafts and for cultural functions. → Management to accelerate healing of the bark within a shorter period should be investigated	
Trees shield crops from dangerous storms /rains and intense sunshine. → Encourage the spread of the canopy	
Ficus is good and attractive to birds and insects → Provision of material support in form of seedlings, farm tools for accelerated multiplication	
Ficus natalensis leaves are cut and fed to livestock like goats. → Encourage indeginous trees and growing fodder crops such as calliandra and nappier grass	