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INSTITUT DES SCIENCES ET INDUSTRIES DU VIVANT ET DE L'ENVIRONNEMENT
PARIS INSTITUTE OF TECHNOLOGY FOR LIFE, FOOD AND ENVIRONMENTAL SCIENCES

FOREAIM

"Protecting forests acting on farms"

Study practices, uses and representations of stakeholders in the forest to develop strategies for restoration in the Mabira Forest Reserve, central Uganda

Cécile HERVO

Work of master' degree
Diploma of forest Ingenior
Feature : Rural and Tropical Forestry

15th promotion (2005-2007)
Directrice de mémoire : Nicole SIBELET
Maître de stage : John TABUTI
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Year: October 2007
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ABSTRACT:

Foreaim European project aims at the restoration of the degraded forests of Eastern Africa and Madagascar, by ameliorating the incomes of the rural inhabitants through seven work-package. The work-package 1 corresponds in search of practices, uses and representations linked to the tree and the forest. The present study tries to present the different stakeholders as well as representations, the levels of dependency and possible resolutions for forest restoration. In collaboration with CIRAD and the University of Makerere, this job was performed around Mabira Forest Reserve, located between two biggest cities of Uganda near the lake Victoria. It is based on a socio-economic survey by interviews and a forest inventory.

First of all, there were studied the lawful system, positive and customary, linked to the tree in farms and the forest. It was shown that the boundary of the forest was not subjected to large attacks of agricultural cleaning and that deterioration was more diffuse (charcoal, disappearing of overexploited species).

Then, we were approached the practices of the farmers linked to planting trees on farms The forests' use by the enclaves' inhabitants depended on the size of the land, on their incomes and on the distance between the forest and their house. It was possible to define three main types of farmers: the big wood-self-sufficient landowners, owners with a partial dependence on the forest, and the small owners depending broadly on the forest. Other threats influenced the forest, the urban coal consumer and the industrial project of deforestation.

An inventory, accomplished near the places of interviews displayed another form of representation, pointed out that the forest remains dense on important sectors (600 stems / hectare and 30 m^2 / hectare on average) but that degradation was visible in the form of invasive species (e.g. *Broussonetia papiriféra*).

Thanks to these different factors, it was possible to determine the levels of dependency of the stakeholders, their uses and the impact on the forest Then it was given some suggestions to understand the reasonings of different types of stakeholders, in the subsequent act to restore Mabira forest.

Key words:

Forests – Degradation – Restoration – Perception – Farmer – Diversity – Typology – Forest inventory – Dependence

RÉSUMÉ :

Le projet européen Foreaim vise la restauration des forêts dégradées d'Afrique de l'Est et de Madagascar, en améliorant les revenus des riverains ruraux aux travers de sept volets. Le volet 1 correspond à la recherche des pratiques usages et représentations liés à l'arbre et la forêt. La présente étude cherche à décrire les différents acteurs ainsi que les représentations, les niveaux de dépendance et les solutions envisageables pour la restauration forestière. En collaboration avec le CIRAD et l'Université ce travail a été effectué autour de la réserve forestière de Mabira, située entre deux grandes villes d'Ouganda près du lac Victoria. Il se base sur une enquête socio-économique par interview et un inventaire forestier.

Tout d'abord, sont étudiés les dispositifs légaux, positifs, coutumiers liés à l'arbre dans les exploitations agricoles et la forêt. Il est montré que les limites de la forêt ne subissent plus d'attaques de défrichement agricole et que la dégradation est plus diffuse (charbon de bois, disparition d'essences surexploitées).

Ensuite, sont abordées les pratiques des exploitants agricoles liées à la plantation d'arbres dans les fermes. L'utilisation de la forêt par les riverains dépend de la taille du foncier, de leurs revenus et de leur éloignement de la forêt. Il est possible de définir trois principaux types d'exploitants ; les grands propriétaires autosuffisant en bois, les propriétaires ayant une dépendance partielle à la forêt, et les petits propriétaires dépendant largement de la forêt. D'autres menaces pèsent sur la forêt, l'urbanisation croissante consommatrice de charbon et des projets industriels de déforestation à d'autre fin.

Un inventaire réalisé près des lieux d'interview expose une autre forme de représentation, indique que la forêt reste dense sur des secteurs important (600 tiges / ha et 30 m² / ha en moyenne) mais que la dégradation est visible sous la forme d'espèces invasives (par ex *Broussonetia papiriféra*).

Grâce à ces différents facteurs, il a été possible de déterminer les niveaux de dépendance des acteurs, de leurs utilisations et de la dégradation de la forêt. Puis il est émis des suggestions permettant de comprendre les raisonnements des différents types d'acteurs, et pour dans la suite, agir à restaurer la forêt de Mabira.

Mots clés :

Forêts – Dégradation – Restauration – Représentations –Exploitants agricoles –Diversité – Typologie – Inventaire forestier– Dépendance

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Follow gratitude go first of all villagers who greeted me in their village to show me their lives. One thought for Adera, which opened me the doors of his village.

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LISTE OF ACRONYMES

C/P : chairperson

CFM : Collaborative Forest Management

CIRAD : Centre de Coopération Internationale en Recherche Agronomique pour le Développement

FAO : Food and Agricultural Organization

FOREAIM : FOrest Restoration in Eastern Africa, Indian ocean islands and Madagascar

LC's : Local councils

MAFICO : MAbira Forest Integrated Community Organization

MWLE : Ministry of Water, Lands and Environment

NAADS : National Agricultural Advisory Services

NEMA : National Environment Management Authority

NFA : National Forestry Authority

NFP : National Forest Plan

NFTPA : National Forestry and Tree Planting Act

NGO : Non Government Organization

NWFP (PFNL) : Non Wood Forest Product (Produits Forestier Non Ligneux)

OIBT : Organisation International des Bois Tropicaux

SCOUL : Sugar Corporation of Uganda Limited

UNEP : United Nations Environment Program

INTRODUCTION

The rainforest and its disappearing make the object of numerous international debates in recent years. First studied by the scientific world, the problem of the environmental degradation entered the sphere of policy and civil society. Environmental protection and its restoration in case of deterioration became obligatory conditions in all project of development. The sustainable forest management was asked more and more often through developments at forest services for. But deforestation figures was still rising.

In Uganda forests covered only 24 % of the territory and disappear at rate of 2 % per year according to FAO. Besides their disappearing, many forests were degraded by various uses. During the presidency – dictatorship of Idi Amin, forests were declared free zone, where agriculture was allowed. Many encroachments have therefore taken place in the course of this period. In 1980, the new government of Museveni decided displacement of populations. But the harm was done, because figures speak about more than a third of the rainforest was deteriorated. Nowadays the Ugandan population was 85 % to a rural population and more than 90 % of the population use the firewood or the charcoal as energy. A broad proportion of the population depends on forest resources for its basic needs: food security, wood and non-wood products, spiritual and cultural role. But these roles are partly fulfiled by the forest and partly by numerous planted trees on farms, reducing pressure so on the forest.

European project FOrest Restoration in Eastern Africa, Indian Ocean Islands and Madagascar (FOREAIM) has emerged from this context It seeks to limit deterioration of forest and to develop new strategies of restoration, adapted to local context. To achieve it, the project was seeking a multi-disciplinary view of situation.

Inscribed in this plan, study introduced here was conducted place in three village enclaves of the Mabira Forest Reserve. This degraded natural forest is located 60 km east from Kampala. Study tried to understand representations and uses of the different stakeholders, to determine their level of dependence on forest. On the other hand, study examined strategies which allow to reduce this dependence and constraints which prevent these strategies to be more developed.

After a presentation of the context of study, problems will be detailed. As a result the choice of methods used to answer it. Results will be presented in form of typology of stakeholders and of their forest uses. Finally the representations of degradation and restoration will be presented and worked out ways of restoration.

1. AN EUROPEAN PROJECT TO RESTORE A FOREST

1.1. THE FOREST: A GLOBAL CHALLENGE

Global issue, the forests were a large wood supply, the "green lung" of the planet, a reserve of genetic resources (rainforests would contain about 80 % of worldwide biodiversity of the Earth), a way to protect soil and hydrographic network, they were also the living place of the "forests people", that is about 1,5 billion individuals.

In the course of the twentieth century, many people focused on the forest, because the human interventions on the forest seem to become more and more important and concern with their destructive effects.

First studied by scientists for the species diversity and variability, the forest is now in the center of attention of policies and civil society, through numerous forest international conventions. This attention is aimed at protecting it from threats which influence her.

The situation was particularly worrying in the African continent, where 3 million hectares of rainforests have been wiped off the map between 1990 and 2005, that is 9% of its forest area (FAO, 2007b). Primary forests have been burned and biodiversity loosed. Deforestation has therefore continued despite sustained efforts to protect forests.

The World Bank imposed now constraints of environmental protection, so forest, to sign contract of help to developing countries.

In 2005 was held the workshop on the implementation of the restoration of the forest landscapes, uniting more than hundred experts. It was defined this notion. The restoration of the forest landscapes "aim to restore ecological integrity and improve productivity and economic value of degraded territories" (OIBT, 2005). So it is a means to respect international commitments concerning forests, biological diversity, climatic changes and changes in desert. It showed a good way to restore goods and services in degraded or deforested territories and to improve the livelihoods of those who live there. Experience has shown that, to succeed, the restoration of forested landscapes must start from the foundation, i.e. people who live in the this landscape and stakeholders who manage directly this landscape.

FOREAIM project registered in this context.

1.2. FOREAIM: A PROJECT OF MULTI-DISCIPLINARY RESTORATION

European FOREAIM project was situated in the current framework of natural heritage's protection by their sustainable uses, thanks to adoption of indigenous practices of management. Project was based on the definition of the sustainable development established during the Summit of the Earth in Rio of 1992. The project has intervened on landscape ladder in three African countries: Kenya, Madagascar and Uganda. Three European countries collaborate to bring technical help: Norway, France and Scotland. In the three African countries, the humid and sub-humid forest ecosystems were characterized as hard threatened by deforestation and degradation. The restoration of the forest has been placed as a priority objective to ensure a better livelihood in rural area, environmental benefits and development of the country in general.

The general objectives of the project was described in annex (Appendix 1). The project was based on a multi-disciplinary approach, which purposed to provide tools and strategies of management to local populations and local management organisms. These tools will allow to restore the degraded forest ecosystems, by understanding of deterioration and restoration mechanisms, while ensuring a positive impact for local populations, government, markets and lawful system.

The project was divided into 7 hardly interrelated components (Figure 1).

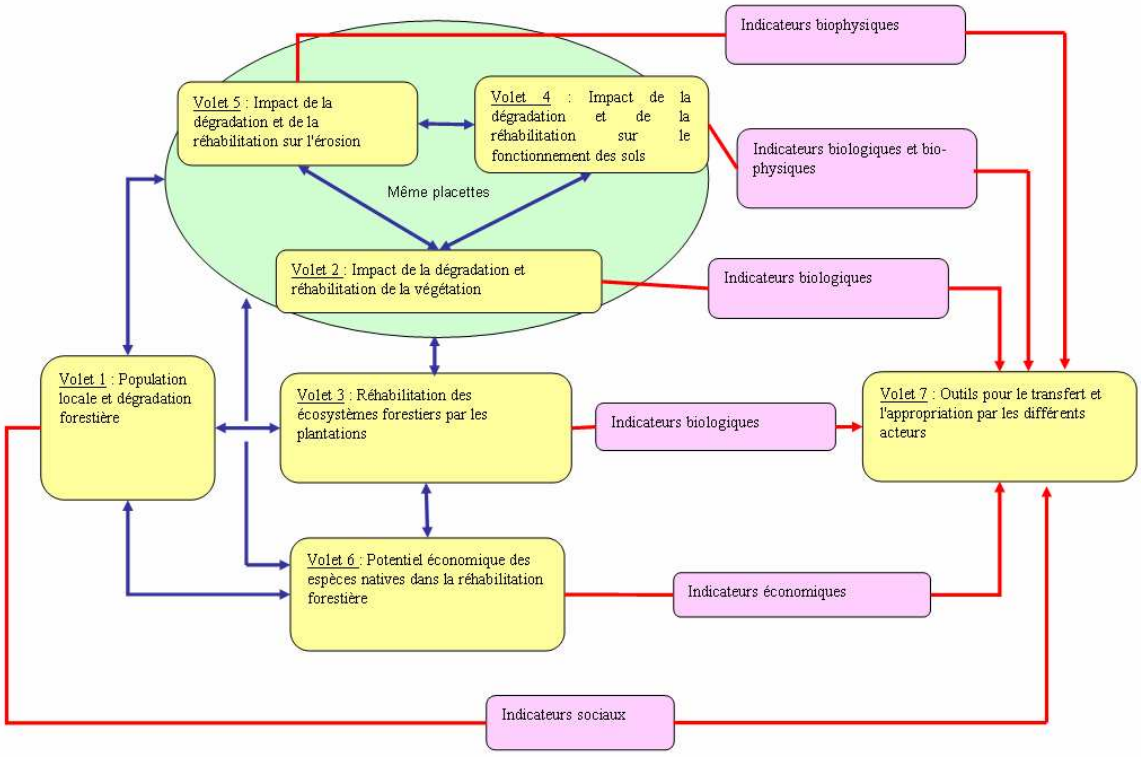

Figure 1 : Components of FOREAIM

This report was integrated in the work-package 1 " Valuation of traditional ecological knowledge, tree management practices, uses and economic dependency of local population on forests and tree based systems in the context of their degradation." Specific targets in each work-package have been documented in appendix (Appendix 1).

Under this stage, the work was performed in collaboration with Makerere University (Kampala, Uganda) and the Centre de coopération Internationale en Recherche Agronomique pour le Développement (CIRAD).

1.3. UGANDA: DOUBLE SPEECH ON THE FOREST

Uganda is spanning the Equator, in the West North of the Lake Victoria. It is characterized by a weak proportion of forest in comparison with his neighbors, with 24 % of its surface (Figure 2), of whom a large majority of private forest (70 %).

According to National Forestry and Tree Planting Act (NFTPA, (Parliament of Uganda, 2003)), the forest in Uganda is defined as a "land containing a vegetation association that is predominantly composed of trees of any size." Law adds that the forest is composed of the natural forests, of plantations and the forested ecosystems, defined as being: "any natural or semi-natural formation of vegetation whose dominant element is trees, with closed or partially closed canopy, together with the biotic and abiotic environment." (Appendix 2).

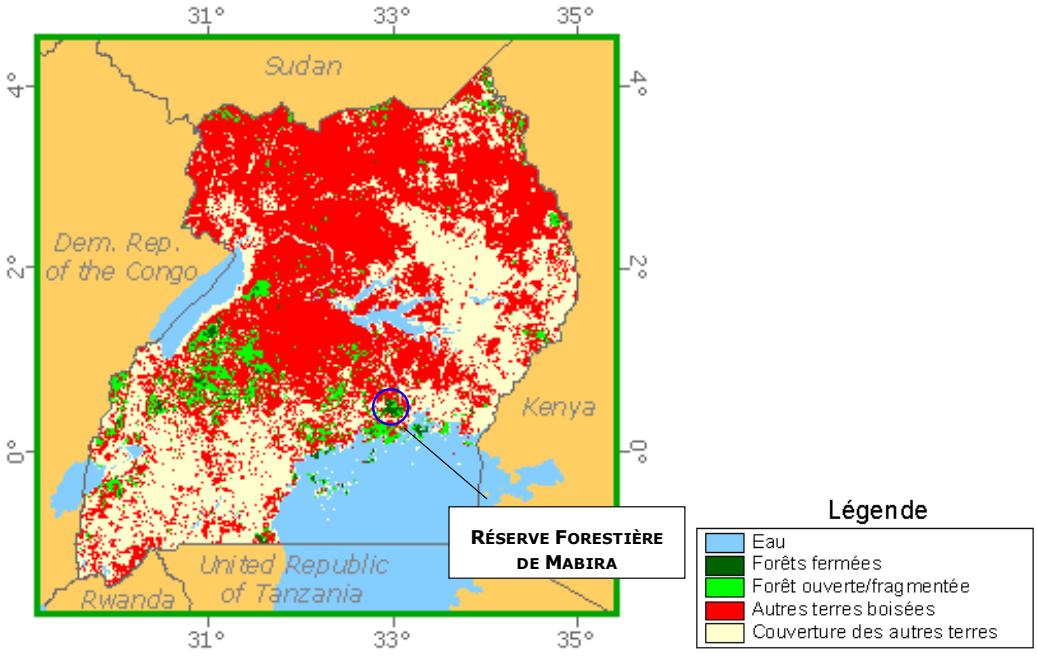

Figure 2 : Vegetal cover of Uganda

(Source :(FAO, 2007a))

In 1998, the new Constitution included a clause on forest management and particularly gave responsibilities to the local stakeholders. Following this Constitution, all States' forests of the state were classified as central forest reserve, and put under the supervision of Forest Department.

In 2002, the Ugandan government signed one of the first NFP, and integrated thereafter recommendations of this plan, into a broader strategy, as fight against poverty (FAO, 2006).

The reform to the Ugandan decentralized administration and the signature of NFTPA lead to the establishment of the NFA, semi-autonomous agency, which aims at the self-financing of its activities. It is responsible for management of central forest reserves.

At first, the objectives of NFA has been support a production of wood and other forest products and to protect mountainous natural environments and provided environmental benefits.

Later, these objectives have been extended to nature conservation, research, management of entertaining activities in reserves and eradication of the poverty of the local communities. Since NFA tries to improve the management of these reserves, especially by involving the local communities in management through the Collaborative Forest Management (CFM)[1].

Uganda ratified on the other hand all major international conventions linked to the environment of these last two decades (Appendix 4). This whole text makes of Uganda one of the African countries better armed to protect its forest.

But the application of all these regulations was often poor, and Uganda has shown by the international institutions because of the rapid loss of the forest cover, with a average loss of 2 % of forest cover over period 1990-2005 (FAO, 2007b). In addition by a party of these decisions, the government threaded natural environments. In fact, it tried to sell a part of natural resources for the benefit of industries. This point will be developed in the future.

Thus, the protection seems prevalent, the reality shows permanent attacks against the forest. The FOREAIM project therefore decided to work to improve the process of restoration.

The Mabira Forest Reserve was chosen for three main reasons:

- the strong links which exist between Norway and Uganda;
- the strong human pressures which practices on Mabira, by the close urban population and neighbor populations

1 CFM : Collaborative Forest Management: management means a mutually beneficial arrangement in which a forest user group and a responsible body share roles, responsibilities and benefits on a forest reserve of part of it. Parlement-d'Ouganda, 2003. *The National Forestry and Tree Planting Act*. the Uganda Gazette, vol XCVI (37), pp 60.

- the importance of biodiversity in the reserve.

We are now going to explain this choice more for a long time.

1.4. MABIRA: A FOREST RESERVE CENTER OF ALL ATTENTIONS

The Mabira Forest Reserve is located 60 km from the capital city, Kampala, and 20 km on the road towards Jinja, the second largest city of the country.

The map below represents the borders of the reserve of Mabira. It was represented the main facilities which change the characteristics of enclaves, like road network or presence of plants. It also noted the main cities and the places of interviews.

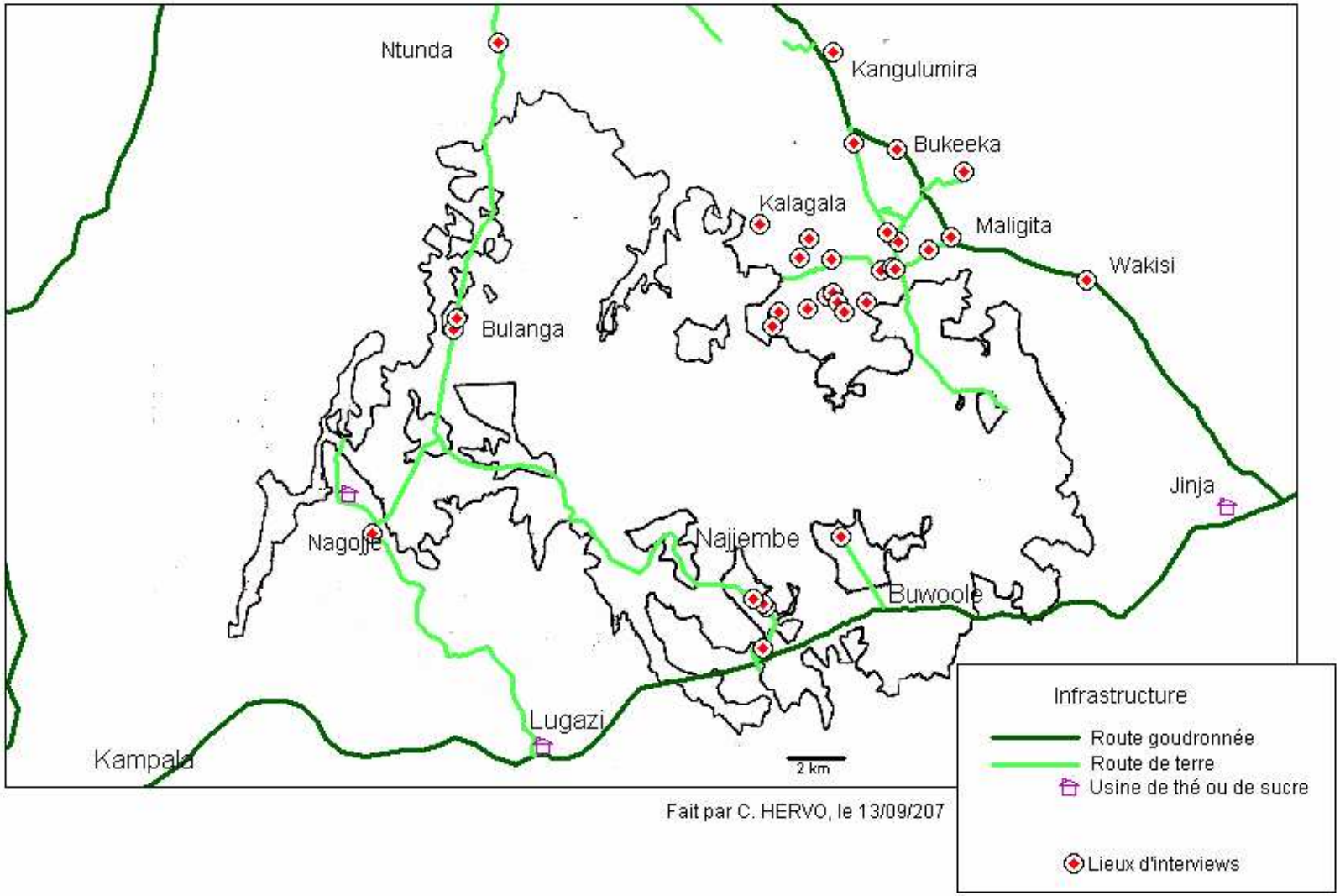

Figure 3 : Facilities and places of interviews in Mabira Forest Reserve

FAO described Mabira like a degraded primary forest (FAO, 2007a) (Box 1) and semi caduc humid forest of medium altitude (Uganda Forestry Department, 1997).

With these 31,293 ha, it is the largest humid rainforest in north of the Lake Victoria (0°24'-0°35' - 32°52' - 32°52'-33°07'). It is crossed by many rivers, including Musamya in the North and swamps (Figure 3).

Box 1: Definition of degraded primary forest

A degraded primary forest is a primary forest whose the initial cover has been compromised by not sustainable harvesting of wood and non wood forest product, so its structure, its processes, its functions and its dynamics are corrupted beyond the short term resilience of the ecosystem ; i.e. the capacity of these forests to recover entirely from the operation, in short or medium term, was compromised (OIBT, 2006).

The Mabira Forest Reserve spanning two districts Mukono and Kayunga, and specifically 4 counties (LC IV) of Ntenjeru, Nakifuma, Mukono and Buikwe (Uganda Forest Department, 2002).

There are 27 official village enclaves within the forest. According to the management plan of Mabira forest (Uganda Forestry Department, 1997), it represents about 50,000 inhabitants, mostly farmers.

This forest is characterized by three types of vegetation, named respectively young person or colonizing forest (2,7%de the surface), mature mixed forest (51 %) and mixed forest of *Celtis* (46 %, (Uganda Forestry Department, 1997)).

The forest was classified as forest reserve since 1932 and managed by Forest Department. But under the dictatorial governments of Amine and Obote (from 1976 till 1986), the forest is put under a status of free use, to promote activities in forest and so dispelling the rebels who hid from it. Farmers settled in forest to plant banana trees and cacao tree. The harvest of precious wood are particularly important. Forest Department controlled little these intrusions into reserve. Many migrants arrived in the area at that time, following conflicts in other part of the country and because the land is available. It explains that whereas the tribe of Buganda is majority, there are numerous representatives of all other tribes.

In 1988, Museveni came to power, ordered to stop cultures in forest and to organize expulsion. It was initially planned to plant zones the more degraded by *Broussonetia papirifera* and *Maesopsis eminii*. *Broussonetia* was planted to supply wood pulp plant, which finally did not open. The tree has been a pioneer invasive tree. It is now predominant in the North East party of the forest, where farm activities were more important. The current forest management plan ended this year, it was therefore under way of rewriting.

The forest is divided into 4 management zones (Appendix 5), according to their state of degradation:

Management zone	Area (ha)	Geographic situation	State of forest
Strict nature reserve	6,245	Central area	Intact forest
Buffer zone or recreation zone	4,227	South part	High use of very specific species, important tourist activities
Production (low impact)	11,827	West part	Not much degraded zone, importance of marketable species and trees
Production (perturbed area)	8,994	East part	Degraded zone, few marketable species or trees

Chart 1: Management zone of Mabira Forest Reserve.

The management rules and the local communities' rights differ in these zones:

- in the central area, strict reserve, all activities of harvest are forbidden. Only tourism and research are allowed;
- in the buffer zone, recreational activities are promoted (establishment of marked path, tourist center);
- in low impact zone, there was an inventory and now valued timber were harvested by a sawmill;
- finally in the disturbed zone, there is not production nowadays, because the valued timber supplies were weak further to past logging.

In the three zones of production and recreation, the firewood collection, medicinal plants or all other natural elements is allowed within the limits of personal consumption. All commercial activities require an permit obtained from NFA against the payment of a fee. The manufacture of charcoal is always prohibited on the soil of forest reserves.

According to the Mabira Forest Reserve Biodiversity Report., the number of wood species was 312, among which 4 main introduced (*Mangifera indica, Artocarpus heterophyllus*, *Theobroma cacao* and *Broussonetia papyrifera*, (Davemport & al., 1996). The first three essence was introduced further to the farm activities allowed under dictatorship, the last following the NFA plantations.

The biodiversity of wildlife is also very important: these included 109 species of birds, 199 butterflies and 23 small mammals, among which some endemic species in Mabira or in the country. But there are few large mammals. (Uganda Forest Department, 2002).

In 1990 the border of the forest was marked by the regular line plantion of *Eucalyptus* and *Senna spectabilis*. Borders are therefore well known and respected in the majority of cases.

There is no more clearing land for agriculture. On the contrary there have still charcoal illegal activities, particularly in the North East zone of the forest.

In 1994, the tourist center was opened in the South of the forest (Najjembe) and in 1995 negotiations for the installation of contract CFM began, the first of which was signed in 2006. The tourists who visit Mabira Forest are Ugandans and foreigners in equal parts. For period 2005-06, it represented 5,000 visitors. Moreover, village association of tourism are created, MAFICO, which employ tour guide, persons in charge of the tourist center. Some users' group were created, e.g. for trader, hunter, seller on the market of Najjembe (who go to forest to get stick to roast meat).

In management plan, NFA announced that the main use of the forest of Mabira is the illegal production of firewood and charcoal for use by enclaves' inhabitants and surrounding cities' inhabitants.

So the choice of this forest played made on set of criteria, recapitulated in the box (Box 2)

Box 2: Summary of selecting criteria of Mabira Forest Reserve

Mabira is:

- Forest of Uganda, and the country is closely linked to Norway, particularly University of Makerere;
- Degraded primary forest;
- Forest protected for a long time;
- important ecologically (Lake Victoria);
- highly used for a long time;;
- the object of numerous scientific studies;

In this context, how are perceived degradation and which are real dependencies of populations in the forest..

2. DEGRADATION OF THE FOREST AND RESTORATION OF THE TREE

2.1. THE DISAPPEARING OF THE FOREST IN UGANDA

According to FAO figures, 2% of the surface of the forest disappear each year in Uganda and primary forests are mostly deteriorated. Even so some authors (Fairhead & Leach, 1998) believe that these figures of deforestation were hard overrated, it would appear that the forest area is decreasing all the same. What causes has the disappearance and which governmental actions confine it?

2.1.1. Evolution of the forest management

For a long time Uganda is regarded as a country with high biodiversity, particularly through its landscapes diversity. It is possible to see forests of high altitudes on Mount Rwenzoni, Savannahs tree in the park Queen Elizabeth, the sub-arid areas in the north, and river vegetation along Lake Victoria.

This awareness of the natural resources' potentialities has led to a protective will for many years. In 1932, the first protective law apply to the forest. All natural forests owned by the state are placed within the legal framework of forest reserves, including Mabira. The management of these reserves was delayed in the hands of the Forest Department, a state agency.

The boundaries of reserve were generally respected, until 70's. But the political instabilities of these next years have led many forest encroachments. 1975 is critical year, degradations were at their most extreme. The Farmers' Society of Kanani Cooperative settled in the eastern part is from the forest. The district's administration did not consider their actions like encroachments, but like a plan to help themselves. Then Forest Department grants a permit to cultivate in forest to the 115 persons of this association. This one is accompanied with some rules on the future activity in reserve:

- Stop to clean new plots of forest;
- Stop to harvest some high value species, defined as reserved species;
- Ban to construct buildings..

In 1976, fear of the rebels was very important. The government decided to expulse them out the forest, where they were hidden. Through the reform of 1976, the government of Idi Amin puts the "lands that are not rented or occupied under the regime of customary tenure" in a new regime. These lands can be occupied without a license obligation." Disturbances of certain regions from the north of the country push people to run away and opportunity to acquire freely lands attract populations. In less than a year, 200 people moved into the reserve, in 1981 nearly 1,800 people are installed and about 7,241 ha of the reserve is degraded on 31,000 ha.

In 1981, the president of Movement revolutionary Museveni overturned the president Idi Amine and was elected at the head of the new republic. He decided the fast eviction, sometimes violently, of all persons living in forest reserves. One new forest law are voted in 1988 (Parliament of Uganda, 1988), which specified the forest is primarily a manufacturer of wood and the administration should manage to maintain the sustainable production.

Forests and their protection took back a central place in policy, because they are included in the new Constitution of 1995 and Forest Act which followed from it (Parliament of Uganda, 1998); The Constitution of 1995 instituted the natural resources' protection. By specifying that the forest reserves, the benefits of protection should be fairly distributed among all Ugandan people.

Uganda voted a policy to protect the old growth forest which was put in harm by the political 70's vagaries. Since, awareness allowed to restart a policy of resources' protection, with the support of the population

2.1.2. Protect the forest to protect resources

The dependency of the poorest persons in relation to forest resources was recognized in Uganda in official texts such National Forest Plan (NFP) of 2002 (MWLE, 2002). According to 2002 census, 15 % of the population (i.e. 2.7 million persons) lived in a forest reserve neighboring parish and 6 other million persons have access to a private forest. Uganda is considered by UNEP to be one of the poorest countries of the world (UNEP, 2007).

The dense rainforest was considered to be one of the pillars of wood supply, but it degraded in time, losing its biodiversity and its productive capacities. 30 % of rainforests are now considered as degraded, the private forests have a higher rate of degradation than those managed by the government

From 1990, combined effects of deforestation to farm activities and of high firewood and charcoal consumption let predict a wood deficit from year 2000 for the whole country. Measures were therefore taken to put energy problem and protection of resources in the middle of institutional reforms (Appendix 3).

The new forested law, voted in 2001 (MWLE, 2001), attributed the different kind of forest to different organism of management. It instituted new semi-independent manager of central forest reserves, NFA. Management and surveillance of local forest reserves, what corresponded mostly to private forests, were assigned to district (LC V). Finally for trees outside forests, the officers of National Agricultural Advisory Services (NAADS) would advise the farmers. This decentralization of management is based on the official report that the poorest persons do not have access to techniques and to advice of the adapted persons.

In new forested law, objectives are issued in 11 summarized points so::

- Manage sustainablely of forest reserves, private forests and biodiversity;
- Promote private plantations and industries of transformation;
- Collaborate with the local communities and NFA for the management of the forest and trees outside forest;
- Promote urban forest, research and environmental education;
- Protect wetlands.

These objectives were aimed to reduce the pressure exercised on forest reserves, by developing the private forests and the agroforestry.

But in spite of all these reforms, the forest cover had been continued to decline by 2 % annually.

2.1.3. Uses and degradations

The forest is undergoing two types of attack: immediate deforestation – frank cup – and gradual deterioration. This last is defined by NFA as:

- Selective harvest of high economic value specie and NWFP;
- Harvests what put sustainable management in danger;
- High pressure linked to pasture and fire.

2.1.3.1. Political reasons: between period of transition and political threats

To explain the delay taken in the application of these reforms, NFA highlighted difficulties linked to transition between both institutions (Forest Department and NFA).

Furthermore if law and management authority consider potentialities and fragility of the primary forests, it is not always the case of the government itself. This last, under the influence of the president Museveni and with the agreement of the Parliament, gave away the Bugala forest reserve to a firm of palm oil production in 2001, even though the texts of laws restrict very hard the sale of these forest reserves. Regarding the cut of the primary forests for the advantage of industrial project, M Mirudi, press responsible of the president Museveni, "a forest can be planted anywhere, but industry, itself, must take into account cost: transport, energy, access to the market. They cannot install it anywhere. "

President Museveni argued his decision to support this project to answer "a urgent need for industrializing our very backward but rich country in terms of natural resources and raw materials." (Museveni, 2007).

In April, 2007, the reserve of Mabira was subjected to the same type of pressure. The president Museveni has urged the Government to withdraw the third western part of reserve to the advantage of the SCOUL sugar group, the firm owned by an Indian group and by the State. The choice of this part of the forest was based on the management zone: in effect it is one of the parties qualified as "degraded". A general clamor has risen from all directions: the scientists and the foresters of the NFA for the loss of biodiversity, the inhabitants for their livelihoods, the journalists, the World Bank, which provided a subvention for the electrical dam of Bujagali (Jinja) in exchange for the protection of environment and particularly Mabira. Peaceful demonstrations on streets degenerated, they have resulted in four deaths. The Parliament, which the members of the government, voted in great numbers for the rejection of project (Olupot & Natukunda, 2007).

2.1.3.2. Demographic reasons: between increasing demography and uses

The population growth of Uganda is among the highest of Africa, reaching the 4,3 % annual increase. And in Uganda, 90 % of the population use wood as energy. It corresponds to about 18 million tons of firewood, consumed mainly near forests, and 500,000 tones of charcoal, used in the cities. And Mabira, encircled with the two biggest cities of the country, is in the

middle of request. Forest Department retains the figure of 150 kg of charcoal consumed annually by an urban inhabitant.

Figure 4 : Breakwater of coal and ancient place with coal Pier coal and coal-old place

Despite the fears expressed in 2000, Uganda was still self-sufficient for firewood in 2007 (FAO, 2007a). But the first signs of scarceness have been felt by a significant increase of the price of charcoal and of timber harvest in forests.

2.1.3.3. Technical and economic reasons: unsustainable development and lack of market

NFA also implicated the management of the private forests, which did not correspond to the norms of sustainable development. Some forests are overexploited to produce low added values, such as charcoal. Moreover, the lack of markets for the products of higher quality is also a problem for the forest management.

2.2. TREE IN THE SYSTEM OF ACTIVITY OF FARMERS

Apart from a small proportion of forest on its territory, Uganda has a high proportion of wooded farm land.

In a survey accomplished to 64 communities, it was indicated that the proportion of lands carrying forests stood back, passing from 4 to 2 % between 1960 and 1995, while the proportion of lands under cultures is increased from 57 to 70 % (Place *& al.*, 2001).

In the same study, it was added that the percentage of wooded farm lands is crossed from 23 to 28 %.

Over 40% of the land was allocated to subsistence agriculture, and represent 24% of the national biomass in the form of isolated trees, clumps and Agroforestry (mix with trees and crops).

More than three quarters of the villages of Uganda are involved in the sale of products derived from trees. This trade is mainly outside towns, on the informal market.

According to the inventory of forest resources, the majority of available wood on markets came from private forests, without sustainable management.

The government also had needs, and it tried to satisfy through the objectives of Forest Act, that are summed up in the party 2.1.2. To achieve these objectives, the government therefore made the promotion of trees in farms to reduce pressures on the natural forest, increase the farmers' incomes and so improve food security.

It also tried to promote sustainable management in the private forests and reserve. For example to restrict the illegal harvest in forest (and catch illegal harvester), the government set up an obligation for the farmers who want to cut down a tree on their farm to make a statement to the Ministry of Agriculture. After pay a fee, the tree was hammered, and can be cut and sold then. So the origin of wood and the offenders are easily identifiable.

The forest and trees were widely used by people and government. But these uses are diverse and can led to different representation between stakeholders. How can we understand the current situation?

2.3. A MORE COMPLEX REALITY THAN SIMPLE DETERIORATION

The needs of the stakeholders differ in terms of their history and the context in which they operate.

So trees respond to different functions: economic (production of firewood and plots), environmental (shade) and cultural (Mutuba is a royal tree and sacred for Buganda).

Box 3: Definition of technique, practice, use and function

Technique constitutes a system, a set of elements in such a way such as any evolution of the one causes an evolution of group and conversely. It enabled the man to control nature (Ellul, 1990).

A farming practice is all agricultural actions implemented in the use of environment (Milleville, on 1984). It is the applying of a technique. The same technique correspond several practices.

An use is "fact to use something to acquire an effect which satisfies a need " (Larousse, 2007). To an usage always corresponds a function, but not necessarily the opposite (ex: the value of future).

A function is the " characteristic role which plays a thing on the whole of which it forms part " (Larousse, 2007).

To answer these functions, the stakeholders have often contradictory practices. It is not easy for them to find a commun ground of understanding as sufficient to establish a permanent collaboration (Box 3).

Box 4: Definition of representation and perception

Social representation indicates a form of social knowledge, socially developed and shared by the members of the same social or cultural group. It is a way of thinking, to appropriate, to interpret daily reality and relationship to the world. They are modalities of practical thoughts orientated to communication, understanding and workmanship of social, material and ideal environment (Jodelet, 1989).

Perception is "the act whereby an individual organize immediately his feelings, interpret and supplementing them by pictures and memories, opposes an object" (from Lalande). Perception is first determined by necessities of action (Bergson, 1899).

Trees and their uses are perceived by the different stakeholders, what allows them to communicate. But these representations (Box 4), which interact with uses and practices, are sometimes contradictory. For example, the practice of a type of stakeholder can be perceived by other one as degrading for the forest.

For the government and the scientists, deterioration means inevitably the illegal harvest by local communities and firewood consumption. Making this grouping, they accuse stakeholders without the same representations and therefore without the same practices. This simplification leads misunderstandings between the stakeholder. These may cause the failure of the restoration project.

Listening, persuasion, time will be necessary to make a success of this mission of FOREAIM. Across the forest, there is a humanitarian issue that should be shared by all the stakeholders.

The needs of the stakeholders are linked to their level of dependency in relation to the forest and trees. How this dependency can it be measured? Is it possible to regroup different person according to some elements which characterise their behaviour?

The degradation of the forest is the result of various practices. And these uses are function of the level of dependency on the forest of all population and particularly local stakeholders. We can wonder what is the real level of dependency of the population and degradation / restorations which it lead with it? But also we can wonder which strategies can reduce this dependency and so increase the protection of the forest?

Further to the statement of this issue, it was formulated a set of key issues and hypotheses that are seeking to resolve this study (Chart 2). To facilitate the work, secondary issues were also detailed.

Main Issues	Hypotheses	Secondary issues
How stakeholder imagine the forest?	Stakeholders have different representations of the forest	How context influences the forests' representation by the stakeholders?
	The representation of the forest depends on functions that the stakeholder credit it.	What are functions of the forest according to context? What use follow from it?
What are practices around and in the forest (agricultural and forestry)?	Practices are not always identical according to the actors	What are the different practices?
	Practices depend on internal and external stakeholder' factors	What factors influence the choices of practices by the stakeholders?
What is the stakeholders' level of dependency in relation to the forest?	The dependence of actors depends on the context	What factors influence dependency in each site?
	Dependence augments degradations	What are practices according to the level of dependency?
What is the level of degradation?	The actors have practices which degrade and that restore the forest	What are the practices that degrade the forest? What are the practices that restore the forest?
	The level of degradation depends on the context	What is the level of degradation in each site?
How the actors receive deterioration How the stakeholders perceive degradation?	The actors to receive deterioration according to their manners The actors perceive degradation based on their usage	Is degradation perceived? What are degraded elements according to the actors? How a person perceives the practices of the different stakeholders?

Chart 2: Main issues established from the hypotheses

3. METHODOLOGY

This training period taking place in FOREAIM project and particularly as work-package 1, a literature review was led to understand the involvement's of the study of uses, representations and dependency in tree resources, keystone of project. It results from it problems below and set of hypotheses. Then, it was established a list of questions and variables prove these hypotheses (Appendix 6).

Finally, he was searched for a set of methods for making data and analysis tools that make it possible to answer these questions.

3.1. UNDERSTAND A LANDSPAKE

At first, to acquire a landscape vision, the choice was made to work at a main enclave, and then to compare it with two other enclaves. The population density was very important, it was decided to interview only few persons in every village, but to go through a large number of villages to acquire this landscaping scale searched in the project.

The enclave of Wakisi and Kangulumira, which is in the North East of the forest was chosen because of its importance and its very abounding road network, even if it is not always in very good state, allowing to be always unless one hour in motorbike of a main road. This has facilitated the process of interviews presented below.

For the choice of both comparative enclaves, selection was made by searching most variability in criteria, to determine whether the initial conclusions could be generalized or not in the others. So the enclaves of Najjembe in the South of the forest and Nagojje on the West were chosen.

Criteria of selection were:

Criterion	Interest of criterion
Type of management zone adjacent to the enclave	Assess the levels of degradation and restoration as well as the differences in representations
Density of population	Assess land saturation and its influence on dependence in the forest
Distance to road Kampala – Jinja	Assess their involvement on practices and activities
Distance aux marchés de grande importance Distance to largest markets	Assess their impacts on deterioration / restoration
Distance food processing factories (sugar and tea)	Assess impact on dependence in the forest

Chart 3: Criteria of selection of the study area and their interests.

Literature review did not allow to specify the system of production of each enclaves, apart from economic activities related to the markets of Najjembe and tourist center.

He could be established neither characterization by the ethnic groups nor migrants' presence, hypotheses that we made to explain the different behaviors.

Here are the characteristics of each village according to mentioned criteria and according administration:

Enclave **Characteristic**	**Wakisi – Kangulumira**	**Najjembe**	**Nagojje**
Management zone	Production / perturbation	Buffer zone	Low impact production
Density of population	High	Very high	Middle
Distance to Kampala road	18 km	On the road	10 km
Distance to largest markets	25 km (Jinja)	Market along the road, and 20 km (Jinja)	10 km (Lugazi)
Distance to plant	Sugar cane : 21 km	Sugar cane : 5 et 16 km	Sugar cane : 10 km (Lugazi), Tea : 5 km (Nagojje)
Visited villages (LC I)2	Byabuke Kalagala Kangulumira Kkungu Kyambogo Maligita Milembe Nakirubi Naluvule Seeta Wakisi	Buwoole Kaso-Koso Nsakya	Balanga Kateete Wabosolo Wantuluntu Nagojje
Parish (LC II)	Kalagala Kangulumira Kawoomya Nakalanga Seeta-Nyiize	Buwoole Najjembe	Kateete Kyabazaala Nagojje Ntunda
Sub-county (LC III)	Wakisi Kangulumira	Najjembe	Nagojje Ntunda
District (LC V)	Kayunga	Mukono	Mukono

Chart 4: Physical and administrative characteristics of each enclaves.

To locate the villages of the main enclave, here is a more detailed map of the zone (Figure 5).

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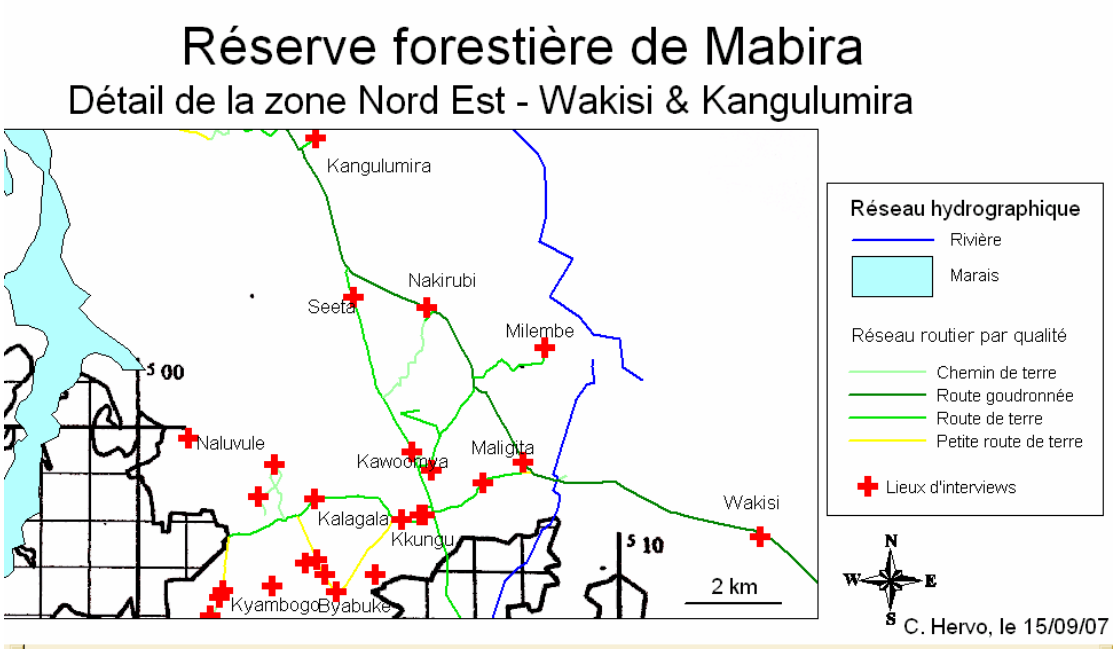

Figure 5 : Detail of North East area Mabira Forest Reserve

The three enclaves are, like the rest of the region, inhabited by a variety of ethnic groups, following the flow of immigration for years 1970-80. The main ethnic groups are still those of Buganda, from the region

3.2. 3.2. METHODS TO UNDERSTAND THE VARIOUS REPRESENTATIONS

To approach the problems of presentations, one of the techniques is the semi-directed interview. Furthermore to have a common reference foundation, a forest inventory was performed bringing so a scientific representation of the forest.

3.2.1. Interviews of different stakeholders

To understand the representation of the different stakeholders, the method of semi-directed interviews was chosen, first in English then translated in the different local languages by an Ugandan translator. The leader of the sub-county of Kangulumira introduced us this translator during the field visit. He speaks six local languages fluently and has notions in five other languages. He allowed us to approach people very easily, with little difficulties of understanding in this zone of very high migration rate.

The choice of the panel of the interviewees was carried out in two phases. The first consisted to interview the chairman of the village (LC I) or vice chairman. He allowed us to understand quickly the history of the village and its peculiarities.

In second time, either the president introduced us some villagers, or we moved to meet them at random.

We searched a diversity of activities, ages and equivalent proportion of both sexes. During our unpredictable displacements, we also searched a diversity of distance to the forest (Appendix 7)

Cardinal points	**Sub-county**	**Number de interviewed people**	**Number of interviews**
Town	Kampala	2	2
NE	Kangulumira	43	21
W	Nagojje	8	4
S	Najjembe	7	6
NW	Ntunda	30	9
NE	Wakisi	58	29
	Total	148	71

Chart 5: Number of interviewed people.

Guide of interviews were built from hypotheses and from variables. They differed according to the social role of the person, only farmers or with political and forested role (Appendix 8). It was written in English then translated in the main local language, Luganda.

Interview began always with a presentation of the translator and the interviewer. FOREAIM project was quickly introduced as a study of the practices of farmers. This presentation had been worked with the translator before interviews. À the end of discussions, the interviewees often asked for a more accurate presentation of the project. This one was therefore worked similarly than initial presentation (Appendix 9).

Further to discussions, reports were typed then analyzed in an Excel table by variable.

The analysis of the interviewees' practices, and with the literature review, it was possible to develop a typology of stakeholders (Box 5). This one allows to characterize quickly the behavior of the stakeholders - particularly that of the farmers - and relations between stakeholders. This typology is one of the main results of this study.

Box 5: Definition of typology

" To work out a typography consists to distinguish, within range of units (individuals, groups of individuals, social facts, etc), some groups which they can consider as homogeneous of a certain point of view. The content of this notion of homogeneity […]is generally based on a certain resemblance determined from a subset of characteristics serving for representing studied units" (Gremy & Moan, 1977).

3.2.2. Forest inventories

In FOREAIM project, forest inventories corresponds to the work-package 2, which seek to characterize the forest according to the last human interventions. This is under way but has not been completed for all areas discussed in this report.

To be able to compare the statements of the stakeholder, it seemed important to have a common look in all sites. The inventory has been started therefore on plots close to the interviews' place in the sub-counties of Wakisi, Najjembe and Nagojje, nearest of villages.

In collaboration with professors of Makerere, it was decided to perform an inventory by transect and circular plots. In each village, three transects of 500 m are selected according to the evaluation of the villagers (high, medium and low affected). In the zone of Wakisi, there was two transects in the high affected zone, because it proved to be that this zone was the most affected.

Sub-county	N° of low affected transect	N° of medium affected transect	N° of high affected transect
Najjembe	2	3	1
Nagojje	2	1	3
Wakisi	2		1 et 3

Chart 6: Localization of inventory's transect.

The length of 500 m was chosen because a majority of the interviewed villagers indicated to intervene into the forest between 500 m and 1 km. It was chosen the shortest distance, because transects must be opened with a machete by two workers as the transects were to be open with a machete by two workers.

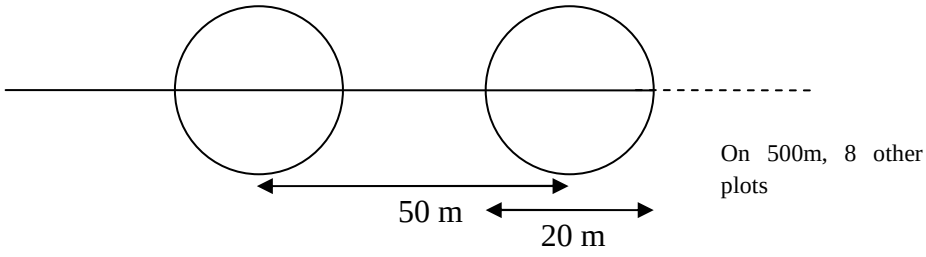

Figure 6 : Inventory plots' diagram

A circular plot of 20 m in diameter been put every 50 m (Figure 6), this distance being raised with a GPS of Garmin 12 ® type or in the decameter according to the vegetal cover and according reception of GPS. The distance between plots was chosen to acquire 30 plots by sub-county, for statistic calculations. The circle of 20 m was chosen, because it corresponds to the current norms of tree inventory in rainforest.

Sub-county	Village	Number of plots
Najjembe	Nsakya	30
Nagojje	Nagojje	30
Wakisi	Maligita	10
	Kyambogo	20

Chart 7: Geographic localization of forest inventory's transect.

Noting down concerned trees having the upper diameter in 10 cm at the level of chest, because this border allows so to know specific composition having the biggest impact on the place setting of the canopée and on the terrière surface. It was also identified the essence of every tree, with the help of an experienced botanist.

The survey covered the trees with a upper diameter than 10 cm DBH, because this limit allows so to know specific composition of stand what are the greatest impact on the canopy's cover and the basal area. It was also identified the essence of each tree, with the help of an experienced botanist.

Finally, on each plot, it was noticed in the eye several qualitative data:

- Importance of firewood on the plot and its form (stump, stem or crown), this importance was evaluated on a scale at four classes;
- Importance of visible human damage (net cut stump, stem cut in the chain saw, charcoal place), this importance was assessed on a ladder at three classes
- Covered with four layers of vegetation (percentage recovery in 5 classes):
    - Herbage : less than 50 cm;
    - Bush : between 50 cm and 1 m;

- Dominated cover : between 1 m et 5 m de hauteur, less than 10 cm of diameter;
- Canopy cover : higher than 5 m et bigger than 10 cm of diameter.

These fast criteria allow to highlight the level of forest use and to raise the importance of subjacent vegetation.

Data were taken in into an Excel table, then analyzed by set of calculated variables and indicators:

- Average of the vegetation cover, the level of degradation and the presence of firewood, by transect, village and for the forest;
- Counting of density and basal area per hectare and their relating error for the four levels of inventory (plot, transect, villages, forest). With the basal area, it was also calculated the circumference of the medium tree and the part on invasive species in the basal area;
- Calculation of the α-biodiversity indicators of Shannon – Weaver (wealth / fairness), Shannon (fairness), Margalef (wealth);
- Calculation of the similarity coefficients (biodiversity β) of Jaccard and Sorenson between the different transects of the same zone and between the different area;
- In the forest general presentation, it was mentioned that species had been introduced into the forest. But it was not found suited indicator to characterize their importance in the different zones. It was therefore create an indication of indigenous species.

See the detail of calculation in appendix for different indicators and relative error (Appendix 10).

Thus, a forest was qualified as degraded, when density of trees, a basal area, a canopy tree cover, indicators of indigenous and biodiversity are low and finally index of human damage and bush and herbage cover are high.

3.2.3. Results' returns to villagers

Analysis of these data provided information on uses and practices of the stakeholders, their representation and their dependency in forest and tree resources and degradation which result from it.

Two types of returns took place before the departure of Uganda.

The first presentation of results was made to the members of the Makerere university and particularly the persons invested in FOREAIM project. The purpose of this presentation was to discuss first results and first conclusions.

In villages, having a appointment with the chairman of village, a presentation of results took place in five villages of the North zone, to raise the impressions of the persons and their opinions on the first conclusions. These villages are Kangulumira, Kkungu, Naluvule, Kalagala and Kyambogo. They corresponded to the villages where study was the most advancing also those in whom the villagers asked for a working return.

These presentations allowed the interviewee to criticize the first analyses and conclusions. Some points have been accepted and others have been once again explained to be very including. The persons were also surprised by certain results. They had a very positive reception in general in this study.

Many interviewees asked to see the written report, when it will be available. It will therefore be sent to the presidents of villages most often visited and to the chairmen of sub counties for others.

4. THE SYSTEM OF CULTURE IN FARMS AROUND MABIRA

The population is around 90% rural and lives with agriculture. The main crops are very varied from region to region.

In the region of Mabira, climate allows a big diversity of production (Chart 8). The staple food is made from maize in the form of pulp and red beans. Coffee is a main source of incomes.

Maize	74%
Coffee	54%
Beans	51%
Matooke (banana)	49%
Jack fruit	40%
Potatoes	39%
Manioc	36%
Rice	31%

Mango	31%
Avocado	27%
Tomato	20%
Peanuts	19%
Vanilla	16%
Cabbage	15%
Papaya	13%
Pineapple	11%

Chart 8: Different cultures around Mabira, predominating place of trees.

In green the fruit trees, percentage of interviewee who point out this crops on their land.

Some of these small crops are cultivate under a tree, either by lack of place or by will to improve quality or quantity of production. It is possible to name coffee in that case.

It is necessary to point out some other species are also kept on farms land in large proportion.

There is three essence which are predominant in these trees:

- Maesopsis eminii (Musizi), which is present in 58 % of farms;
- Ficus natalensis (Mutuba), which is present in 47 % of farms;
- Milicia excelsa (Muvule), which is present in 20 % of farms.

Between trees with fruits and others trees about 97 % of farms support trees.

The other species were kept for wood, shadow, fertility, animals' feed.

At the level of environmental conditions, it would seem, according to the said of the farmers themselves, that the three enclaves was rather fertile. In the enclave of Nagojje (west), the stakeholders spoke about a lack of water which would restrict the production of some crops, as banana trees.

It is often possible to find the differences between the three study areas in the distribution of crops or in the choice of these crops.

Figure 7 : : Characteristic landscape of Najjembe.

Close mix of all cultures for lack of space, few trees and only in forest (bottom of picture)

Figure 8 : Characteristic landscapes of Nagojje.

Large fields of sugar cane, ownership in great majority of the sugar neighboring plant and one-crop rather small-size fields for the farmers.

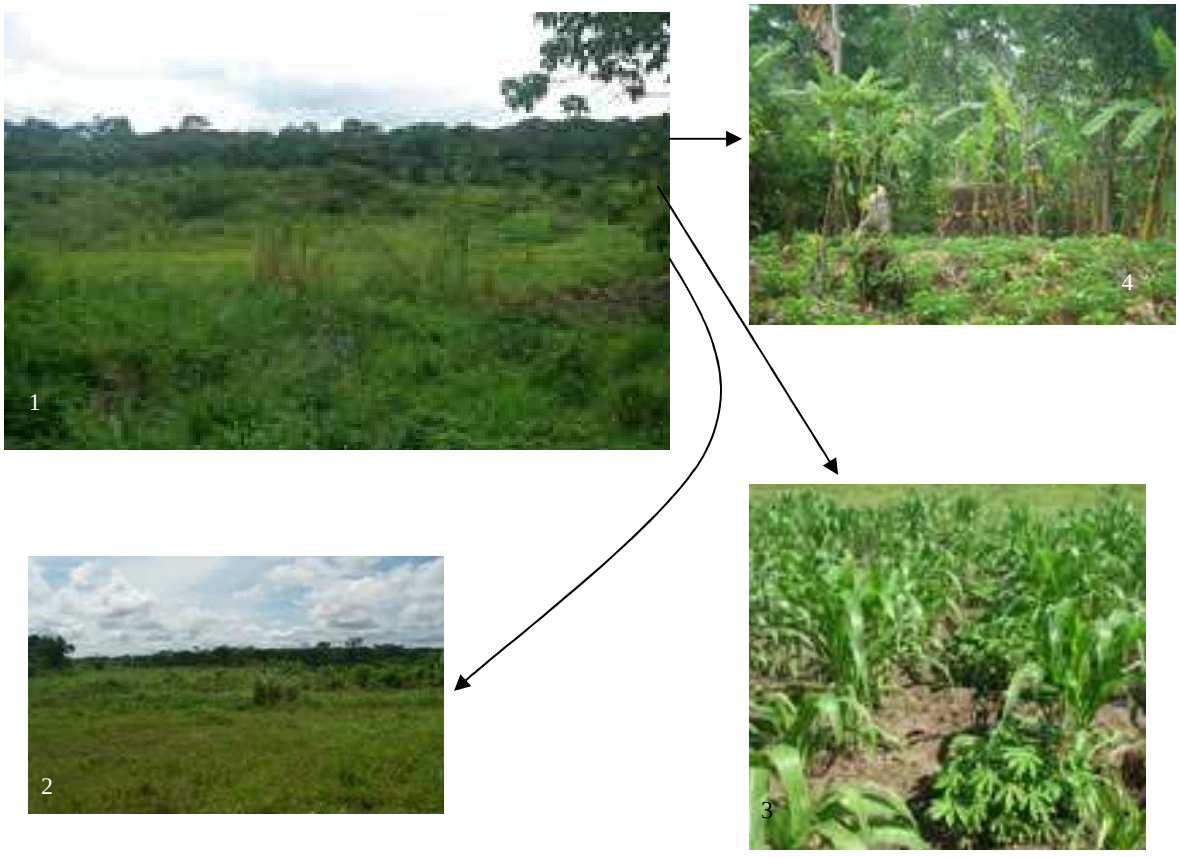

Figure 9 : Characteristic landscapes of Wakisi

General landscape (1) which can be divided into secondary landscape: rice field (2), mix of sunny crops as manioc / maize (3), mix of tree and shade crops as banana tree / potato (4)

Finally the landscape of the three enclaves differ enough. The enclave of Wakisi is made up of plateau cut by small valley, allowing to form humid zones where is situated rice fields. The zone of Nagojje is made up of a broadly predominant plateau and the relief is trifling. The Najjembe area lies on two soft slopes, the point of contact of which is the main road of Kampala - Jinja

5. THE TREE IN THE POSITIVE AND CUSTOMARY LAWFUL SYSTEMS

Security of tenure is ensured both by the positive property and by the traditional forms of tenure. Farmers whose land rights are not guaranteed, can not or will not plant trees (Place, 1995).

5.1. FOUR TYPES OF OWNERSHIP IN THE POSITIVE LAWFUL SYSTEM

There are four types of land ownership in positive right, which were defined in the new Constitution of 1995 and in Land Act on 1998. For the first time in Uganda customary ownership is recognized. Now introduce these four types of tenure.

5.1.1. Private ownership

It is the most important title of the new lawful system. It is associated with a title which defines the object. Land security is very important, because the State cannot evict owners and can only buy an land in public interest. This type of ownership was inherited from the more ancient systems of ownership.

5.1.2. Lease or rental system

If a person has a property title, he can plan to rent it. Then the tenant signs a lease. This lease can be valid for season, one year, or more. Price is at the discretion of both parties.

According to the different stakeholders (19 answers), price varies according to distance to the road, availability of water, presence of electricity and fertility of the land (Chart 9).

Village	Price for 1 acre per season (€)	Distance to road	electricity	availability of water	Fertility
Kaso Koso	238	< 1km of Najjembe	Yes	No problem	No problem
Maligita	14	Along Jinja - Kangulumira new road	No	?	High fertile
Seeta	11	Along Jinja - Kangulumira new road	No	?	Fertile
Kkungu	10	> 5 km to the road	No	No problem	Variable

Chart 9: Rent price in function of village.

5.1.3. Customary land tenure

It is new in this Land Act. There is recognition of customary ownership with the delivery of a "certificate of usual ownership" by courts and possibility of conversion into modern private ownership with the inclusion in the Registry. The ancient rights of harvest are converted into ownership for the persons, families, communities or associations. There is creation of the notion of communal association, who can manage some activities in association and so protect the interests of common lands and resources (pasture and watering livestock, hunting, firewood harvest and other resources including building wood) (Mwebaza, 1999).

Some unusual rights are associated with the certificate of customary ownership. For example, it is possible to rent all or part of the land, to establish the rights of passage, to delegate to a party the rights (usufruct), mortgaging land and dispose of by will. But these rights are not generally used because customary ownership is linked to the customary practice which prohibited them.

The passage of this type of ownership in a private ownership, and not the opposite, made that customary ownership is less powerful proprieties. It is not always possible to have one privat owner, particularly when the lands of village are managed in community, because it would trigger off important conflicts between farmers (for instance, watering places in semiarid zone).

5.1.4. "Mailo" tenure system

A party of lands was given to elite and in kingdoms by the English settlers in 1960s. Every unit measures one miles square (2.59 sq. km), where from the mailo name. This type of ownership was always acknowledged, even under the regime of Idi Amine. Particularly, it is possible to the owners to transmit this right to these descendants and to rent a party or entirety of these lands.

Currently some of these owners have too big area to exploit it themselves, or decided not to live there. They allow therefore a certain number of persons to occupy these lands in compensation for an annual fee of low value or kind. Law also grants rights for tenants, particularly in case of expulsion there is obligation of indemnification (Place & Otsuka, 2000).

On customary lands, insecurity is largely due to expulsion. Those who settled on this land are sometimes qualified as 'Squatters'. On the lands of mailo type, occupation is more secure, thanks to regulations taken in favor of the tenants. Security is all the bigger as the owner is on the ground (Place & Otsuka, 2000). As underlined it Frank Place (1995), land security has an influence on the planting of trees.

All lands can be governed by one of these types of ownership. Lands linked to natural resources, as the lake Victoria, rivers, national parks and forest reserves, must be managed by the State or his representative in sustainable management and remain the ownership of all population (Parliament of Uganda, 1998).

5.2. FOUR TYPES OF TREES IN THE CUSTUMORY LAWFUL SYSTEM: THE LAND AND THE TENURE

It is possible to classify trees in the customary lawful system according to four notions.

Notion of sacred: Mutuba (*Ficus natenlensis*) is associated with the Bugunda kingdom, and so the members of the tribe are not able to exploit the tree by a destructive way. The bark was used to make royal clothes. To cut a tree can be made only having delivered prayers. This taboo concerns only the single tribe. The members of emigrated tribes see a feed-producing source in Mutuba (leaves very good for the livestock). This tree produces in short time (5 years) a big quantity of firewood, and on the other hand, it has a low value as the building-wood (soft wood).

Notion of priority and internal control (Le Roy *& al.*, 1996): There are called "common" trees whose use is restricted to the members of a well defined community, it is mainly fruit trees, they are on customary land. The community decides on the management rules. As part of this study, communities are defined at village level. So every village has an elders' council which knows the history of the village and allows to manage common property and different conflicts which can exist between villagers.

Notion of boarding land: In Uganda, the borders of ownership are often marked by trees, of specific species. Forest Department used this technology to restrict the forest of Mabira by the planting of *Senna* and *Eucalyptus*. These borders are since known and respected by a majority of the population (at the end of deforestation for the benefit of agriculture).

Notion of taking over and ownership: some trees are hard linked to the land ownership, others are at a lower level.

The weaker values trees are the trees whom wood does not have high value, as the fruit trees or trees with short-term life, like Mutuba (except for Buganda) or trees which were man-introduced, as *Eucalyptus*. Their particularity is to be planted in a rather simple way, by cutting or from the food seed. Persons who are not lawful owners (positive system) be able to plant them on this land. They can also use them or cut them without asking for particular approval the owners. This may approach the term " private and specialized control " (Le Roy *& al.*, 1996).

Trees strongly associated with land ownership are high-value timber, as Muvule (*Millitia excelsa*) or Musizi (*Maesopsis eminii*). The farmers link them to authority: "These are the trees after which NFA looks." They have a slow increase, 70 and 20 years respectively. Their wood has a high commercial value on the international market. It is difficult to acquire the seedlings, because we must buy them in tree nurseries or wait for a natural seed provided by the birds. People who do not own may not decide alone to plant. Asking the true owner, occupants can protect natural seedling. To cut the tree, permission is required. Sometimes the owner comes on the land to harvest these trees, without consulting the tenant. This notion may be closer to the concept of " priority and private control" (Le Roy *& al.*, 1996). The occupants have tendency not to want to plant these trees deliberately, not to lose their investments. Some of these trees are characterized in the law as "reserves species".

It is interesting to point out, the harvest age is 20 years of Musizi and it can seem small and therefore exclude this tree of the category. But this grouping was made by the forestry workers and by the farmers itself. It seems that it is price of wood is most important to consolidate this tree with the other.

How they can see it the lawful system of tenure of the soil also plays a role in the choice of practices made by the actors, but what is this system?

As we can seen the legal system of land tenure also plays a role in the choice of practices by the stakeholders, but what is this system?

The combination of these two types of tenure (customary and positive) draws away different behaviors according to the stakeholders. But there are other criteria which influence practices, and how can they classify the actors with them?

6. WHICH STAKERHOLDERS FOR WHICH DEGRADATION?

6.1. THE DIFFERENT STAKEHOLDERS

6.1.1. Differential criteria

There are four criteria which allow to differentiate the stakeholders. Let us describe them to understand the typology. It is necessary to underline that this typology is more particularly aimed on farm activity. This explains the choice of the first criterion.

The first criterion is the presence of farm activity among stakeholder's activities. It allows to separate on the hand researchers and journalists and on the other hand farmers.

The second criterion is the size of available land. It corresponds to really owned land (private ownership or mailo), more rented land and more customary land. There are two limits : bigger land than 10 hectares and smaller land than 2 hectares.

The third criterion concerns the farmers whose land measure off between 2 and 10 hectares. It is interesting to know distance from forest to home by foot (small paths). If the distance is not to big (less than 5 km), farmers and their family will make a round trip during the day in forest to bring back some firewood while supporting other agricultural work.

The fourth differential criterion concerns the smallest farmers. The importance of farm activity in income allows to differentiate these stakeholders. If the stakeholder has another lucrative activity, then his behavior differs.

In the course of discussions, it appeared that some farmers cultivated of Khat (*Catha edulis*). The leaves of this shrub have a stimulating effect. They are sold in city by dealers who harvest them directly them in villages. This criterion is important, because the farmers acquire a very important income without too much effort. But these farmers did not come into typology, because it seems that this problem concerns not enough farms. They are located mainly in the Buwoole parish (South of the forest).

Criterion ethnic group was one of the hypotheses of study. But this region is a region of high migration rate, interviews were not enough numerous to transform this criterion in a significant criterion. He could be the object of further research

In the three enclaves, the major categories of typology are similar, in spite of difference at the margin.

Criteria were selected after a first round of interviews, then redefined and refined during subsequent interviews, so it is a constructivist approach was used. The following criteria is summarize so:

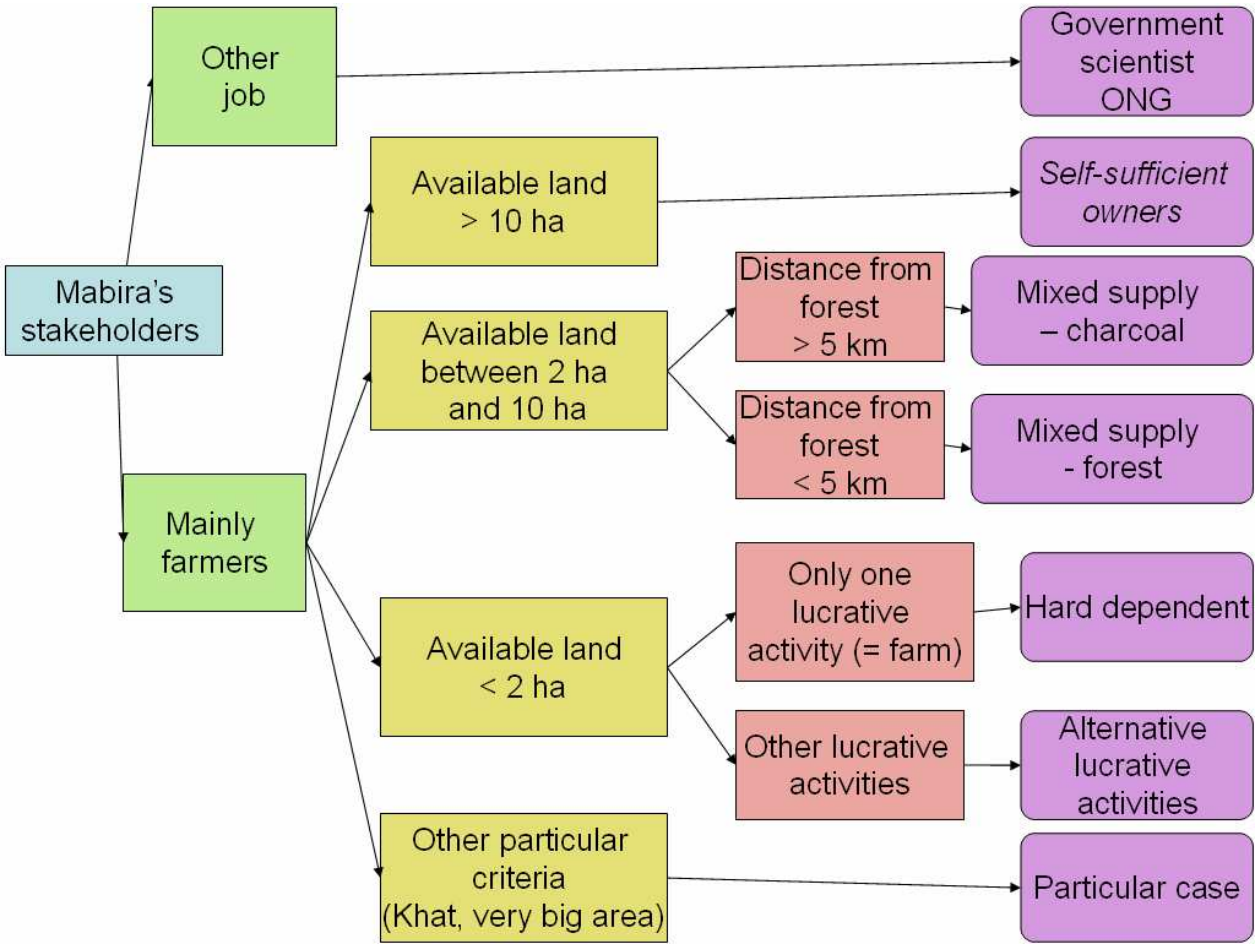

Figure 10 : Diagram of stakeholders' typology

6.1.2. The behavior of farmer stakeholder

The dependency in relation to the forest is function of the stakeholders. Now that different criteria have been developed, it is possible to describe the stakeholders and particularly their dependency in relation to the forest.

6.1.2.1. Self-sufficient owners

Farmers, own more than 10 hectares, are qualified the self-sufficient owners. In most cases, they own land in a private capacity or the mailo lawful tenure. As the tenures security is very high, they have no fear for the future. They plant a large number of trees, which answer all their needs. They choose to plant an important variety of species and often to invest in long-lived trees, e.g. reserve species (Musizi and Muvule). They also have a big variety of fruit trees. These species allow them to obtain some building wood for themselves or to sell it on the market. In addition, they plant trees which provide them firewood, or by coppice either by pruning. They collect some branches of wood trees, to do firewood. So they have a very high production of wood products, and have no need to go through the forest to recover their need.

Besides, these farmers have access to NGO's and officials information. So their forest representation is a forest which they must protect. Protection can pass by two ways: plant valued trees in forest or plant trees in farms. For them, the forest has been degraded by the smallest farmers, who illegally cut wood, perhaps with the help of the forest officers. They feel the forest degradation trough the deterioration of the natural environment (decrease rainfall). They see their practices as positive for the forest because they involve planting trees to protect the forest: "It is necessary to plant trees in farms, to avoid going through forest to cut trees for charcoal and building" (interview).

They have an influence on the other stakeholders, because they are the owners who rent land.

6.1.2.2. Farmers with mixed supply – charcoal or forest

The farmers, own land measure between 2 and 10 hectares, can be regrouped. These farmers plant trees on their land. Land security depends on the type of tenure. They have tendency to choose mainly fruit trees and firewood trees. But if land security is good, they can decide to plant wood trees. When land area is small, their tree's resource did not answer entirely their firewood needs. Therefore they have to get it from another source during punctual time.

On the one hand the distance between house and forest is less than 5 km by foot, so the family can go into forest to pick up firewood. It is mainly during rain season, because wood supply from farm is minimal and farmers don't want to prune during this season.

On the other hand the distance between house and forest is more than 5 km by foot, it is too far for the farmer. He buys some charcoal therefore on the market. This charcoal perhaps produced in the forest. These farmers do few charcoal themselves

They perceive the forest as source of a good environment. They try therefore to protect it. But they know that with their wood and charcoal need they have a negative impact on the forest, directly or through coalman. Some people have participated in project of development whose objectives was to develop the sawn wood production. The last example is plantition of *Moringa oleifera*. The farmers have currently problems to sell mature logs. There is therefore a some distrust faced with the project of development

They think that forest is degraded, because it had loss some "good quality" species, that is to say with valued wood.

The available land allows farmers to sell a part of their production, where from they earn some money to buy charcoal particularly. Either the actors decide to produce their staple food and to sell surplus, or they decide to cultivate cash crops: pineapple, coffee, watermelons. It is necessary to point out that coffee tree is also a firewood source, to coppice stems.

6.1.2.3. Farmers hard dependent on forest

The third category of farmers is composed of farmers very hard dependent on the forest. They own a very small land area, lower than 2 hectares, which they rent to the mailo owners or they use common land. Land security varies hardly. If the owner lives in the area, then security is more important. Result is that these farmers have few tendency to plant long-life trees. After ask permission to the owner, some people protecting naturally-installed seedlings.

The found trees in this land are in most cases fruit trees and Mutuba, which serves for feed livestock, providing shade and firewood. But the output is really deficient for their needs. This type of farmer goes therefore regularly in forest. Usually they go every weekend and with family, to bring back the needed quantity of wood for a week. It is forbidden to carry out wood on a bike, because NFA assumes that transported quantity is superior to home consumption and therefore that there is commercial purpose. Wood is so transported on the head (Figure 11).

Figure 11 : Transport wood on the head and use bark of Broussonetia to link bundles of firewood

The farmers assert using to collect firewood only lying on the ground. Most of them told not to chose species but to select only dry wood. Only small trees of Broussonetia were cut to take bark and link the bundle of firewood (Figure 11).

They perceive the forest as a firewood source but also crafts material or medicine and only afterwards as source of a good environment.

Among this category, we find people who make charcoal in the forest. The interviewees explained that for them coal was a punctual source of income, which allowed them to answer more expense (payment of the school fees of the children). And that this activity often did not repeated in year.

For a majority of this farmers, take firewood in forest don't degrade the forest, because they take only some dry wood. It is necessary to underline that in Wakisi enclave the farmers spoke in most cases about *Broussonetia*, because it dominated forest species.

Charcoal making is negatively perceived, but obligatory for the families' survival. The farmers know that to cut a tree in forest is illegal, but ignore that to make charcoal with dry wood within reserve is also prohibited. On the contrary some farmers asserted paying the forest officer to accomplish this activity. The activity of forest officer is also perceived as positively (protect forest) and in the same way negatively (they don't make their job

The perception of degradation varies according to the enclave. In the enclave of Wakisi, these farmers receive a forest degraded because it is dominated by *Broussonetia* and poor with other species. In the enclave of Najjembe, degradation is perceived by the disappearing of hardwood species. In the enclave of Nagojje, degradation is not perceived. However because the government decided to sell a part of the reserve, people are very resentful against authorities. Some interviewees said: " if they are going to cut the forest, why I could not go in forest to take some trees " (interview).

6.1.2.4. Farmers with an alternative lucrative activity

The fifth category of actors is characterized by the fact their farming activity is less important than another activity. This one can be linked to the forest, as the hunters or the loggers, or not, as the professors, the merchants and the sellers on the market of Najjembe (Figure 12). They have small lands to make a little of agriculture of subsidence, and buy the majority of their food.

Figure 12 : Arrival of a truck at Najjembe market, the sellers rush

Trees set up on their land are predominantly fruit trees. They often have some trees which provide them a bit of firewood. So they are quite independent of the forest for their needs. Of course loggers and hunters worked in forest and therefore are dependent on it.

This category of actors perceive degradation particularly with the loss of species diversity.

It should be noted that can be added into this category, the elder people who have from small land, but without a big household. They have few needs therefore and are not in good enough health to go in forest. It can also add the farmers whose system of activity is based mainly on livestock. If a majority of the farmers have it (80 % of interviewing tell have poultry), some people are fish farmer with a basin or a farmer with more than 60 heads of cattle.

6.1.2.5. Other types of farmers

There is an landlord in Kaso-Koso village which "owns the entire village". By itself, he owned 500 hectares on this area among which 200 hectares of pure forest, a coffee plant and some buildings and fields in other district. Also, he has established a tree nursery to answer his own needs in quality seedling. It is not in typology, even if its behavior was similar to self-sufficient owners

As it was specified in the previous party, there is a production of Khat in the region (Figure 13). But it concerns a particular village and a dozen farms outside. It is not enough to constitute a category. In contrast the relationship with the forest is changed there. Income were very important, farmers go few in forest and irregularly. The forest officer perceive lesser degradations near the concerned village than in other part. It is necessary to note that phenomenon is expanding and that new farmers have just get to in this production, but they are always people in relation to the village of origin (migrant, member of same family).

Figure 13 : Picking of Khat leaves in Buwoole village

In the following chart was counted the number of representative of every category who were interviewed:

Type of stakeholder	**Self-sufficient owners**	**Mixed supply – charcoal**	**Mixed supply – forest**	**Hard dependent**	**Alternative lucrative activities**	**Particular case**
Number of interviewees	3	14	8	16	10	2

Chart 10: Numbers of interviewees by typology's category.

Now that we described the stakeholder living around the Mabira reserve, find out the results of inventory.

6.2. DEGRADED, YES! BUT DENSE!

Further to forested inventories, it was possible to calculate averages of a some characteristic stocks value and some indicators. All results is in annex (Appendix 11).

The first remarkable result is the high value of basal area. If the average of the forest basal area is 29 m ² / ha, it reached 42 m ² / ha in the Nagojje enclave (Figure 14).

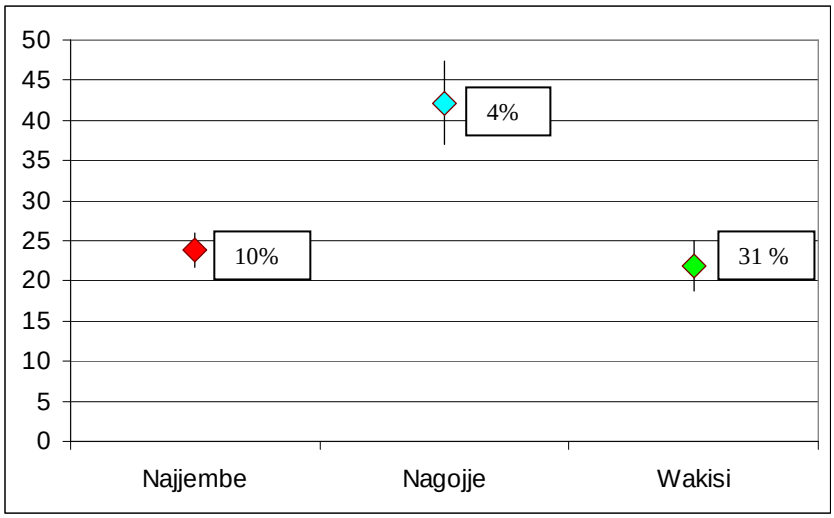

Figure 14 : Basal area by village (m ² / ha)

The figure next to every point corresponds to the percentage of invasive species.

For density per hectare, average is rather well brought up but hides a big difference (Face 15).

For the density per hectare, the average is quite high but conceals a wide disparity (Figure 15).

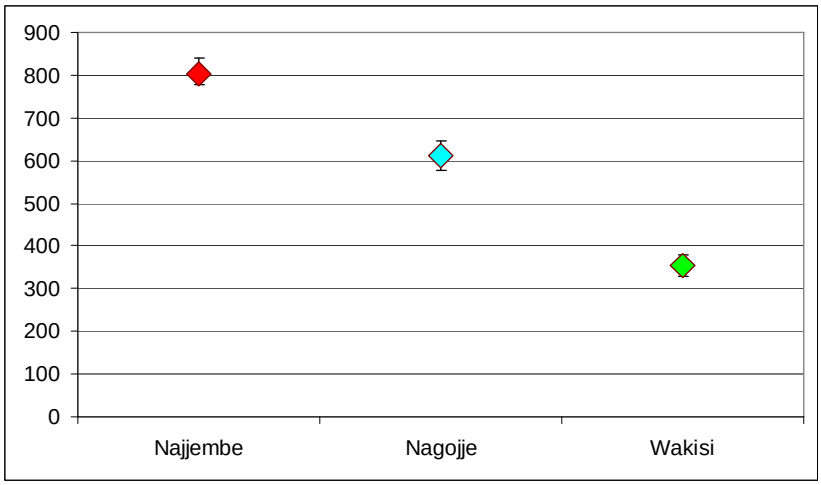

Figure 15 : Density per hectare by village (stem/ha)

If these figures were the unique indicator for the forest, it would be easy to tell that this forest is not degraded, but that it is not uniform across its surface. We already realized that the village of Wakisi is in a more degraded situation than the two other villages. Indeed it is notable that density and basal area are lower, but above all there is the importance of invasive species to Wakisi.

On the contrary if they look at indicator of human damage (remember it is based on an eye estimation, with 3 classes), we can see that the lowest basal area of Wakisi enclave hides in fact a higher level of visible damage.

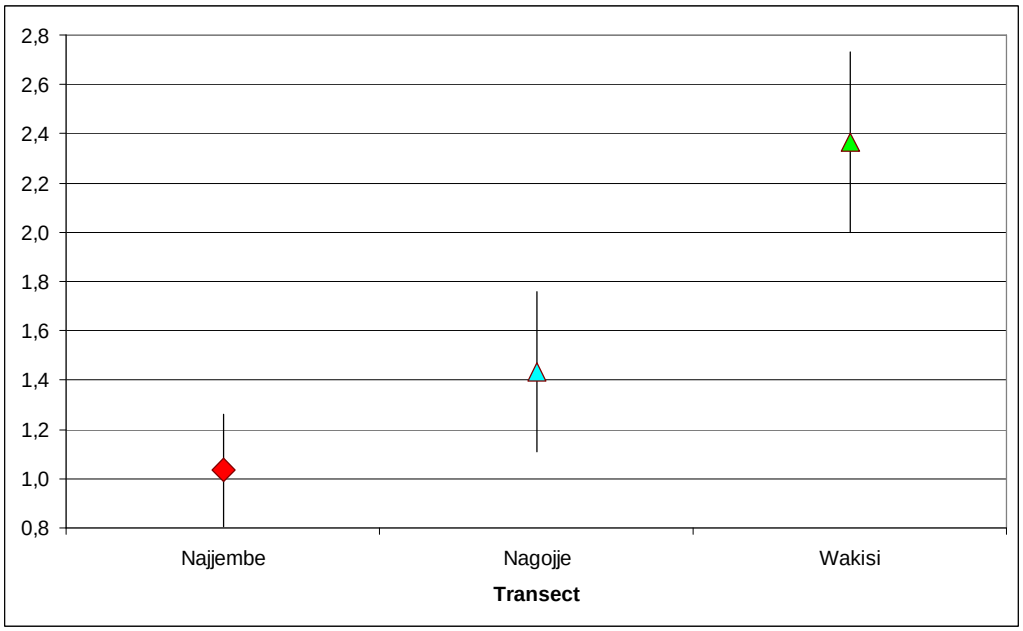

Figure 16 : Indicator of human damage by village

Finally if we consider biodiversity, it appears that the forest is rather rich, because in the course of inventories about 130 different species were identified. The indicator of Shannon – Weaver – who points out the wealth linked to the fairness – shows that the enclaves of Najjembe and Nagojje are relatively homogeneous, but that Wakisi enclave is poorer. If both characteristics are separated (see the results of the calculating of the indicators of Shannon and that of Margalef, Appendix 11), then it appears that the Wakisi area has a vegetation very poor but divided equitably.

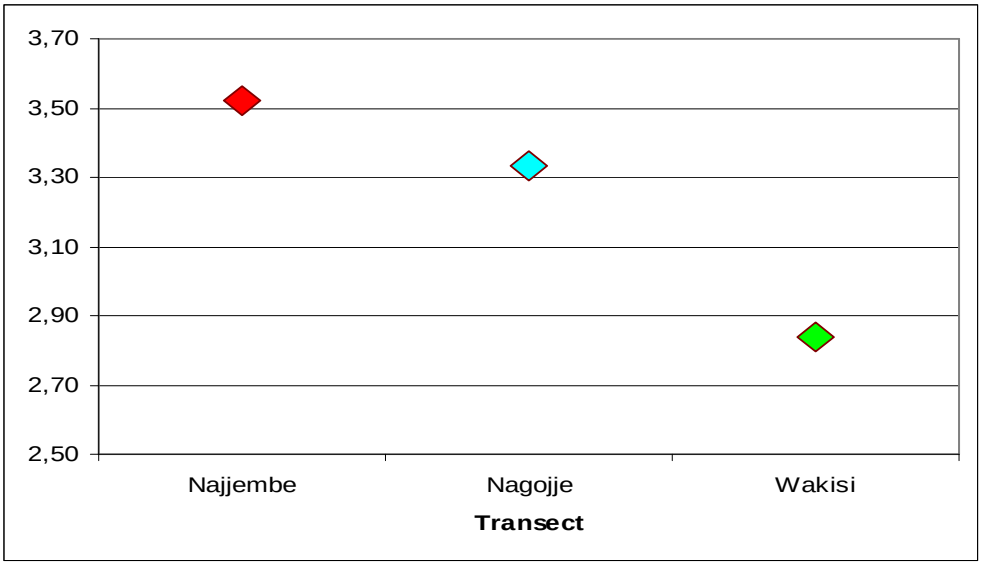

Figure 17 : Indicator of α biodiversity of Shannon – Weaver by village

It is possible to represent quickly the three enclaves:

- The Najjembe enclave is fairly dense and with a good species variability. Human degradations are not very visible; the indicator of α biodiversity is highest, but it also corresponds to an low indicator of indigenous (0,88);

- The Nagojje enclave is characterized by a very high basal area. It is partly due to the fact that the forest officers have done plantations in this zone (*Terminalia*, *Nauclea diderrichii*, *Pterygota mildbraedii*). There is also a large area (1 hectare) which has been illegally exploited;

- In Wakisi enclave, it is frequent to walk on fireplaces (Figure 18), old or full activity, this explains the high level of indicator of human damage. *Broussonetia papirifera* is predominant in the area. In forest it is possible to cross some banana plantation. There are clear-cut area and invaded by weeds, this involves differences in the vegetation cover rate (Appendix 11). They point out finally that all indicators of good health have low levels (basal area, density, biodiversity and indigenous 0,6). The importance of invasive plants (31 % of the basal area) in this enclave is also striking.

The stakeholder didn't have same forest's representation according to their activity and according where they live. How this representation can superimpose itself on inventories' results? Forest degradations are real and visible., but what are proposed options by the stakeholders?

Figure 18: Woodpile to burn charcoal in Wakisi enclave

7. SAVE THE FOREST BY AGROFORESTERIE

7.1. REAL DEGRADATIONS

After analyzing the inventories' results, it is interesting to compare the different representations regarding Mabira, its degradation and changes associated with them.

Mabira is the closest forest to the big cities, on the way of the sources of Nile. Mabira is also focused by Ugandan people and the tourists. It is even involved in modern legends: it would be the visit of the Mabira forest that would have given idea to a representative of the Arabic Peninsula' country to plant trees in his country. Mabira is one of the most present forests in works of the Makerere university.

Mabira caused violent reactions and opinions, like bloodied demonstrations (April, 2007). Scientists can see only in the forest degradation: introduced species and illegal harvest.

For farmers who live every day near the forest, situation seems less alarming. For a majority of them, the forest is not endangered by their activity, but forest changes with them. For instance, certain farmers noticed the disappearing of some essence like *Acalycha* in the South or *Futumia* in the West. In the East of the forest, change is felt by the invasion of *Broussonetia papirifera*..

They often link this plague to the stopping of crops in forest: "Since they do not cultivate any more in forest, there is lots of Nkulaido (NB Broussonetia). It would be necessary that the forest officers let us cultivate in forest, they could plant trees of good species and have a

better forest" (interview). Several proposals like this have been issued. The collaboration with the forest officers is therefore possible to have a mutual advantage. It is the spirit of CFM, even if a majority of the interviewees did not know the existence of such project.

Nowadays researchers and staff of NFA perceive the inhabitants of Wakisi enclave as hostile. But there is nothing emerged during interviews. On the contrary, the forest protection, like positive role, has been often quoted to speak about NFA. The corruption of the officers is reflected as well in the speech, majority of the farmers maintained that harvest and charcoal making are possible only with the collaboration of the officers.

It is necessary to underline that the scientist and forest officers have tendency to concentrate in the south of the forest. It is in most cases due to the easiness access since Kampala (1 h 30) and the possibility to stay in the tourist center.

One of the main concerns of scientists and government officers is increased demand for firewood. And, in forest management, some figures suggest that the forest could perfectly meet this request. When a calculation of productivity and consumption is performed (Appendix 13), it appears that current consumption corresponds to about 36 % of potential production.

The second concern is the deforestation to the advantage of agriculture. But during interviews, only one person mentioned the forest as an lost land for agriculture. Only one abandoned banana plantation was cross in forest. On the contrary, a majority of interviewees signaled that the borders of the forest do not change any more since these were marked thanks to the plantation of the *Eucalyptus* and *Senna*.

It is possible now to sum up difference of representations between authorities and farmers of "mixed supply" and "hard dependent" type (Chart 11):

Type of degradation	Opinion of authorities (NFA, scientists)	Opinion of "mixed supply" and "hard dependent" farmers
Invasion of Broussonetia	Began with work in forest and maintained by charcoal activities	Appear after forest-work stopping, due to log harvest by foresters
Decrease of mature high-value logs	Due to the illegal harvest by local communities	Harvest by NFA
Decrease of available firewood	Too important harvest by communities and charcoal production	This degradation was not quoted
Extinction of *Acalycha*	Unsustainable use of the resource by the community	Use for the market
Rainfalls' Decrease	This degradation was not quoted	Car la forêt est coupée (NFA et coupe légale et illégale par les exploitants) Because the forest is cut (NFA and legal and illegal harvest by the farmers)
Forest area's s decrease	Encroachment for Agriculture	This degradation is not perceived by farmers
Overgrown ground	This degradation was not quoted	Appear after forest-work stopping, because the NFA is not doing its job
What is the most influential stakeholder?	Local communities and the government (law)	government (sale of the forest, law)

Chart 11: Stakeholders' perception of degradations and their causes

Summarize of opinion quoted by authorities and "mixed supply" and "hard dependent" farmers about degradation and their causes

In this table, it is possible to see that NFA officers implicate only local community members in degradation. While farmers blamed forest officers, but also recognize their responsibility for the problem. Debates did not settling on a common basis, solutions will not be easy to find.

Even if the reality of deterioration is not called into question as a whole, it would seem that the forest of Mabira is the most shaded forest nor the most threatening by the activity of the local communities

Although the reality of the degradation is renounced, it would seem that the Mabira forest is neither the most degraded forest nor the most threatened by the activities of local communities.

7.2. NFA' WILL TO INTAGRATE LOCAL POPULATIONS

To reduce the risk of forest degradation, the law requires the NFA to promote plantations and private initiatives, agroforestry and the involvement of the people in forest management. Let us itemize a bit the first actions of NFA in this sense.

7.2.1. Promotions of plantations

Plots 234 and 235 of Mabira forest (South, Appendix 5), about 1 000 hectares, are considered as extremely disturbed. The conservation of the natural forest is therefore excluded. NFA therefore has decided to rent this land to individuals or legal entities, so that they are performing plantations. The planters can hire between 5 and 20 hectares of wood species. The rent price ranged €12 for the individuals to €3 for communities per year and per hectare until maturity of trees. NFA plays only adviser's role

Even if this plan cannot involve the poorest persons of Mabira, it is possible that it was the installation of real private forest. In addition the work done with communities can empower people more broadly.

On the other hand NFA has set up small tree nursery in different villages all around Mabira. So it remunerate a person while ensuring higher access to seedling (short displacements).

The project of *Moringa oleifera* is a typical plan of development of the private forest, because young plants were provided in farms at very reduced prices to facilitate the acceptance of the project. Problem is that now mature wood didn't find markets, about what complained some interviewed farmers.

7.2.2. Promotion of agroforestry

NFA worked with NAAD to promote agroforestry, through the NAADS programs for the development of good practices. For instance, in the region of Kkungu there is project to plant trees and to protect them. This region had been chosen, because the land borders forest was considered to be the most affected by degradations.

Through its tree nursery, NFA tries to develop supply of quality and indigenous species. It was even possible to see a stand of NFA in Agriculture Jinja Show. There, NFA sold eleven species of seedling. And on this eleven, eight had already been named by the farmers as presents on their farms (Appendix 12). These common species can be grouped in three categories:

- Fruit specie, like mango. They are already largely used by the population and on whom NFA did genetic-improvement researches by grafting;
- New species has strong growth, like *Eucalyptus*. NFA tries to introduce them more into farms to augment timber production;
- Old species, like Muvule. It is the economic benefits which are searched in the development of these species.

In this appendix, it is also possible to see that the farmers quoted 24 different tree species, which "physical" uses are varied, but also that some farmers expressed the need to plant trees to increase ground fertility, shade on cultures or only by aestheticism (Flame tree).

In the speech of the farmers, the mixed species crop is an requirement for some cultures, like coffee trees, or simply "better" for some others (banana tree in youth). The plantation under cover would be better, because some plants grows faster, according to farmers. It was possible to find some scientist in there speech, because there has been listen scientist speech for general public.

NFA took part of association for development of the agroforestry. It supports other associations in this sense, like Green Belt Association Anti-Desert. This association tries to protect environment and to confine poverty by developing agroforested practices The headquarters of this association is in Kangulumira.

NFA made therefore significant efforts to support agroforestry.

7.2.3. Involvement of people in management

NFA, to involve forest users in management, assisted set up of "users' group". Their representatives participated in the elaboration of management plan. Within these groups, there are also courses in the sustainable management of the resource. Problem is this work of clustering is made primarily – and almost exclusively – in the South of the forest.

The last initiative of NFA is the establishment of contracts CFM. These contracts allow local communities to take larger part in the forest management and to participate to the management council. Populations can also earn a bigger income from forest, with sustainable activities in forest. In exchange, populations have to decrease their negative impacts on the forest. Nowadays a contract is running (Najjembe, South), one is about to be signed (Seese, South) and a last has negotiated (Kkonko, East). For instance with the last plan, NFA promises to provide beehives to the farmers who agree to diminish their firewood harvert in

the forest. The production of honey is then possible and the product of sale returns entirely to the farmer.

The NFA has begun actions to achieve the goals set for it by law. But it is clear that benefits are not yet distributed equitably in entire population, like the law also requires.

7.3. CONSTRAINTS FOR AGROFORESTRY'S DEVELOPMENT

One of the solutions envisaged by the farmers is the economic development of the agroforestry, there were remain problems to be solved. But the initial approaches for resolutions are also present

7.3.1. System of tenure

The main constraint is the insecurity which exists on land tenure and trees.

Trees and forests on the customary lands have a bigger tendency to disappear to the benefit of agriculture. This is due to lack of local management structure and to lack of regulation of harvest in forests. In contrast to the mailo land, the disappearance of the forest is much slower, indicating an owners' action to protect these areas (Place & Otsuka, 2000). So the system of ownership has a direct influence on trees.

The development the Community forest on the usual lands is possible. Land Act provided for the establishment of management associations of common lands to satisfy all requests.

There remains the problem of trees' ownership. According to essence, the appropriation is more or less clear. So for high valued species, defined as reserve species, there remains an ambiguity in the speech of the farmers. These species were therefore little planted, not to have tenure problems. Such tenants speak about owners coming on lands to cut their trees. A farmer explained that an officer of the NFA had come cut from trees on his farm. And if the agroforestry is developed, this species will be privileged, there will be so more wood steal.

Another problem linked to the tenure is the law which requires paying a fee to fell a tree on its farm. In effect few farmers succeeded in quoting the contents of law, and even some of the big owners however with a larger access to this information. Besides, requested fees is not negligible. It encourages the farmers to exploit their trees without approval and therefore to favor the illegal working or at least to hide it. It would be possible to reduce this tax in the context of CFM, or as part of the broader involvement of the population in management.

FOREAIM project must seek ways to secure the land and in particular the tenure of trees. It is possible in particular to present some species, their vegetative and lawful features in village (work-package 7). Associations acting in the region based their work on this exercise. It will therefore be interesting to make contact with them to get information. These associations are working in schools or close association of women, and they empower stakeholders.

7.3.2. Available land

The second problem in conjunction with the first is the lack of available land. Majority of people have only access to small areas which did not permit to multiply the trees, at the risk to reduce crops outputs.

That's why some project are important like the one who is held in plots 234 and 235. They allow to provide to farmers new lands without losing their farm production.

Some farmers requested to plant again in forest, it is also go to this sense. In effect if a Community management is begun in some plots, i.e. to plant wood species, it would be reached the double target of the protection of the forest and the improvement of the incomes of the stakeholders.

The second problem which was revealed during the inquiry is the women's place in these situation. In effect, the land ownership is inherited by father descendants and the women have little access to the lands' management and particularly to trees. Furthermore in Luganda tradition, the woman can intervene only on a restricted number of trees. For instance harvest of the Jack fruit is forbidden to them (Nabanoga, 2005).

Finally, the forest has currently a lower value than agriculture, because the farmers do not know the potential value of the forest. Some persons claimed even that the forest officers and scientists do not know this potential value. The value of agricultural land was better know than value of forest, it can favor of deforestation. It is therefore necessary to introduce this value to the farmers, particularly by ameliorating the following point.

7.3.3. Markets for high value products

Develop the agroforestry means inevitably improve supply chain of wood and non wood products.

It passes by three ways of improvement:

- Improving markets' information on. So numerous farmers have complained that they did not know how and where to sell timber;
- Improving efficiency of processes (energy, sawmill, NWFP). Charcoal production by mole has a very weak output, between 17 and 28 % of the origin weight (Wikipedia, 2007). Besides, the loss of raw material during process sawing is very important, even forgetting to log in the forest. Finally the forest product supply chain are characterized by very low rate of process;
- Facilitation of private investment in transformation, aim is always improve the percentage of processed products in the forest products industry.

The role of work-package 6, on supply chain and markets, and work-package 7 on the communication with population is therefore primordial in the success of such project.

7.3.4. Farmers' knowledges

The last constraint is the lack of technical knowledge of farmers about plantations, maintenance, tree harvest and the implications of this plantation. So some people expressed hesitancy to plant trees, because they feared to reduce their income. But it was shown in Europe that well practiced agroforest technique increased benefits (INRA-Montpellier, 2006): fewer diseases, windbreak and limited floods, higher productivity of the trees. Project must therefore try to set up ways of information between NFA, scientists and local communities on so various subjects as legislation, ecology, forestry and management. So the actors will have all cards in hand to set up the project which corresponds to them.

It is really necessary to signal that the stakeholders, who plant trees mixed with their crops, are justified mainly citing environmental benefits which are identical to those quoted for the agroforestry. The majority of the farmers have therefore an opinion similar to the scientists, even if it is not supported by figures.

There are also problems of supply in quality seed. The role of tree nursery installed in villages appears therefore here

Finally, the problem of coordination of the activity of the farmers is also important, because by forming cooperatives or identical systems, they can have a better hold on markets

Finally, it is very important to group activities and stakeholders to have a better position on the market.

Diagram below sum up challenges of an agroforestry project:

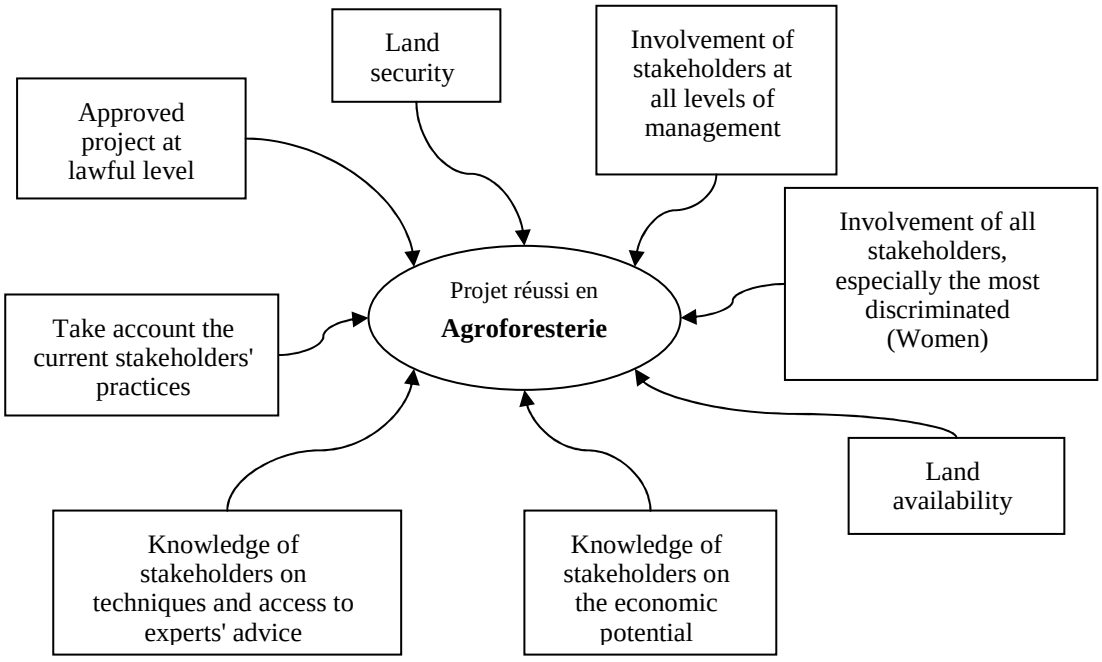

Figure 19: Summed diagram of good condition to manage a agroforest project

7.4. LIMITS ET PROSPECTS FOR STYDY

The realization of this study allowed to put ahead limits and research prospect, here is introduced.

7.4.1. Limits of study

The study of the landscape allowed to understand the general functioning of situation, but also features of every zone. A comparative study at the level of villages could bring more specific information still, which will allow to apply FOREAIM project. These studies will allow to acquire a representative of each practice.

The importance of the tenure was known by literature review. But it appeared that specific knowledge in the area was not listed. If in the course of discussions information was searched, it would not been often acquired in a very definite way. So the consequences of tenure on the behavior are poorly assessed.

On the other hand, a correlation between the ethnic group and practices on trees is known by literature review, but it could not be identified in the field survey. It would have been interesting to dig this research way.

Moreover, it became clear that in the region the farmers had numerous agroforest practices. But the potential farms' wood could not be assessed by an inventory. This inventory would have allowed an initial validation of the proposals of restoration.

During interviews and returns, many questions on the future of the forest were asked. The concern arises. The actors seem to change their representation on the forest, but it was not possible to investigate specifically this phenomenon due to lack of time. But project must take this awareness of the forest fragility and the need of protection as a result. FOREAIM project must answer these concerns in the future for the project to be a success.

7.4.2. Prospect of study

The potential of agroforestry remains to be assessed more accurately. This assessment must stay in contact with the farmers, if they want proposals to become concrete. The job with the associations with a similar objective, and that work on the zone since longer, must also be followed.

Work with the associations, which have a similar goal and work in the area much longer time, must also be continued.

Research themes	Concerned work-package
Assess the importance of the ethnic group to choose a practices	1
Assess the species diversity of the forest depending on the level of degradation	2
Assess the potential wood supply from farms	2
To assess the potential regeneration of wood tree depending on the importance of invasive plants	3
Assess the potential decrease of invasive trees or their economic uses	2 et 6
Assess the potential of natural or assisted regeneration and management of currently used species (Acalycha sp., Njulu)	1, 3, 7
Study the supply chain which have economic potential according to farmers: - Handicrafts plants - Medicinal Plants - Tree	6
Evaluate proposals restorations with farmers: - Plant trees in the forest by farmers - Develop of agroforestry on a business plan	1 et 7
Evaluate the work of associations to participate more actively in the project	1 et 7
Evaluate the problems of tenures and security solutions	1 et 7

Chart 12: Research themes for Foreaim project.

Finally vigilance must be maintained to prevent the plan of reserve sale. President Museveni could not have abandoned his proposal. FOREAIM project must therefore inform maximum local communities and other stakeholders, to ensure vigilance.

CONCLUSION

Thanks to this study, it was possible to identify four major types of farmers. Their representation and their use of the forest differ, as well as their dependence on it.

The self-sufficiency owners have a speech of protection of the forest very strong. They are dependent on the forest regarding the quality of environment which it provides. They often received lands of the English settlers, called now mailo owned. Thanks to this type of ownership, these stakeholders have a great security of the land and plant a big variety of trees which answers all their needs.

Then there are owners with mixed supply in energy, whose own tree resource is not sufficient to answer at their need. They complete therefore by purchase of coal or by pick up firewood in forest according to the distance of the forest.

The third type of stakeholders gathers the small owners, whose dependence on the forest is very big. Land tenure insecurity prevents them from planting long life trees and their wood supply comes almost exclusively from the forest. It is among them that they find coalmen mainly in forest.

The last major type gathers the actors whose agricultural activity is only a complement benefit of another lucrative activity, like teachers.

Hypotheses linked to distance to markets, to plants and to big city are not wrong, but are confused with the possibility of having another source of income. Population density is, however, correlated with secondary sources of employment. If people move into a densely populated area is that there can easily get another source of income

Current degradation, suffered by Mabira forest, take in most cases the form of illegal harvest of specific species and charcoal making in forest. The borders of the forest are known and respected by the majority. There is therefore a loss of density of trees and diversity of species, but no surface for the benefit of agriculture. But even if these negative influences exist, they are not as important as literature suggests. Deterioration is not still perceptible by all actors farmers.

For future, needs in forest products will increase strongly, due to the increase in the population in general, especially of the urban population, consumer of charcoal. But this degradation will touch first private forests then forest reserve after the fall of production of the first ones if they are not sustainably managed.

One solution would be to develop agroforestry for sale. So farmers would have another source of income and would go less in forest (less time and more money). But two major problems arise: the necessity to ensure land security and to create markets for products, what implicates to work with landowners to ensure tenants' land security to allow them to plant trees without apprehension. The second problem is recurrent in projects of development. The agents of development try to ameliorate products or the process techniques, but do not go further to supply chain. With its multi-disciplinary approach, FOREAIM project examines markets and their potential to answer particular needs in this region.

The threat was put by the government on the forest seemed to surpass the other, by its fastness and its quasi permanent character. It is therefore necessary that population, politicians, international organizations and scientists adopt a common speech of protection.

Following plan, researchers have to consult the farmers on the way of restoration. The involvement of populations in this research project by their knowledge and their practice is one of the features of this project. It will in the long term that the project results will be sustained

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Appendix

APPENDIX 1:
OVERALL GOALS OF FOREAIM PROJECT AND WORK-PACKAGE 1

Objectifs généraux :

- Comprendre scientifiquement les processus de restaurations ;
- Produire des connaissances, des outils pratiques, des modèles et des guides d'aménagement pour la restauration ;
- Regrouper l'ensemble des informations économiques, sociales, légales et marketing avec l'aide de tous les acteurs impliqués dans ces problèmes, afin d'améliorer le revenu de tout le secteur.

Objectifs spécifiques du volet 1 :

- Caractériser les facteurs déterminants de la dégradation et les pratiques de gestion liées à ces facteurs dans le contexte de la législation actuelle, des politiques et des forces du marché ;
- Évaluer les connaissances agroécologiques des acteurs locaux sur la forêt et les pratiques de gestion de l'arbre. Utiliser leurs perceptions, besoins, contraintes et stratégies concernant les ressources naturelles comme base pour désigner des techniques de restauration durables en utilisant des espèces autochtones d'importance économique et écologique ;
- Évaluer les bénéfices attendus des technologies proposées et identifier les conditions de la participation des populations locales. Identifier des processus de gestion permettant un suivi de la restauration des forêts dégradées par un système de production durable à l'échelle du paysage.

APPENDIX 2:
FOREST DEFINITION IN UGANDAN LAWFULL SYSTEM

Collaborative forest management means a mutually benefical arrangement in which a forest user group and a responsible body share roles, responsibilities and benefits on a forest reserve of part of it.

Community forest means an area declared to be a community forest under section 17 (NFTPA, 2003).

Farm forestry is the growing of trees as part of an integrated farming system.

Farmer innovators are farmers who spontaneously initiate and experimentally test different agricultural practices in the field.

Firewood includes parts of tree made up into bundles or loads or cut up in manner in which it is usual to cut wood for burning and all refuse wood generally, but does not include sound straight timber, logs or poles of any hind.

Forest ecosystem means any natural or semi-natural formation of vegetation whose dominant element is trees, with closed or partially closed canopy, together with the biotic and abiotic environment.

Forest management means the practical application of scientific, economic, and social forestry principles to the administration of forests for specific forestry objectives.

Forest means an area of land containing a vegetation association that is predominantly composed of trees of any size, and includes (a) a forest classified under this Act, (b) a natural forest, woodland or plantation, (c) the forest produce in a forest, and (d) the forest ecosystem.

Forest produce means anything which occurs or grows in forest and includes : (a) trees, timber, firewood, poles, slabs, branch wood, wattle, roots, withes, sawdust, charcoal, bark, fibres, resins, gum, wood oil, latex, leaves flowers, fruits and seeds, (b) honey, mushrooms, grass, orchids, climbers, creepert, wood ash, litter soil, (c) stone, gravel, clay or sand wich occurs naturally in a forest and which is not mineral within the meaning of Mining Act, and (d) a living organism or product or derivative of living organism.

Forest reserve means an area declared to be a central or local forest reserve under this Act (NFTPA, 2003).

Forest user group means a group comprising members of local community registered in accordance with regulations.

Forestry means the management and conservation of forest and trees, and includes the management of land that does not have trees growing on it, but which forms part of an area reserves for or dedicated to forestry. Forestry includes all activities related to forests, tree growing, forest produce, forest conservation, forest management and forest utilization.

Government land includes all gazetted land held in trust by government for the people of Uganda (e.g. Forest Reserves, National Parks, Wildlife Reserves).

Local community includes households and persons living in a defined geographical area, in close proximity to a forest, and identified by common history, common culture or common

residence, and may include all the residents of a village which shares a boundary with a forest.

Local council means local government councils and administrative unit council established under the Local Governments Act, 1997.

Non-wood forest produce means all forest produce that is not trees, timber, firewood or any product directly derived from them, or mineral under the Mining Act.

Permanent Forest Estate is defined as land that is set aside for forestry activities in perpetuity.

Private forest means a natural forest or a plantation forest or area dedicated to forestry, registered under section 21 or 22 (NFTPA).

Private land includes all nongazetted land owned under mailo, freehold, leasehold and customary land tenure.

Protected Areas are all land gazetted and held in trust by government, such as Forest Reserves, National Parks and Wildlife Reserves.

Reserved forests are forests growing on government land.

Reserved species means a tree species declared to be reserved under section 30 (NFTPA, 2003).

Strict nature reserve means an area within a forest reserve set aside for species and habitat protection and in which only research, education and monitoring are permitted.

Sustainable forest management is the management of forest resources so as to supply goods and services to satisfy the needs of present and future generations in perpetuity.

Tree includes palm, bamboo, cane, shrub, bush, climber, seedling, sapling and re-growth of all kinds, and any apart of them.

Trimber includes a tree or any part of a tree which has fallen or been felled, and all wood, whether or not sawn, split, hewn or otherwise cut up or fashioned but does not include firewood.

APPENDIX 3
ALL THE RECENT LAWS AFFECTING THE FORESTS

Constitution of the Republic of Uganda, 1995

The National Environment Management Policy for Uganda, 1994

The National Environment Statute, 1995

The Water Statute, 1995

The National Policy for the Conservation and Management of Wetland Resources, 1995

The Uganda Wildlife Statute, 1996

The Local Governments Act, 1997

The Land Act, 1998

The Gender Policy, 1997

The Forest Reserves Order, 1998

The Uganda Wildlife Policy, 1999

The National Water Policy, 1999

The Uganda Forestry Policy, 2001

The National Forest Plan, 2002

The National Forestry and Tree Planting act, 2003

APPENDIX 4:
INTERNATIONAL OBLIGATIONS WHICH AFFECT THE FOREST AREA

The Ramsar Convention on Wetlands, 1971

The Convention for the Protection of World

Cultural and Natural Heritage, 1972

The Convention on International Trade in Endangered Species, 1973

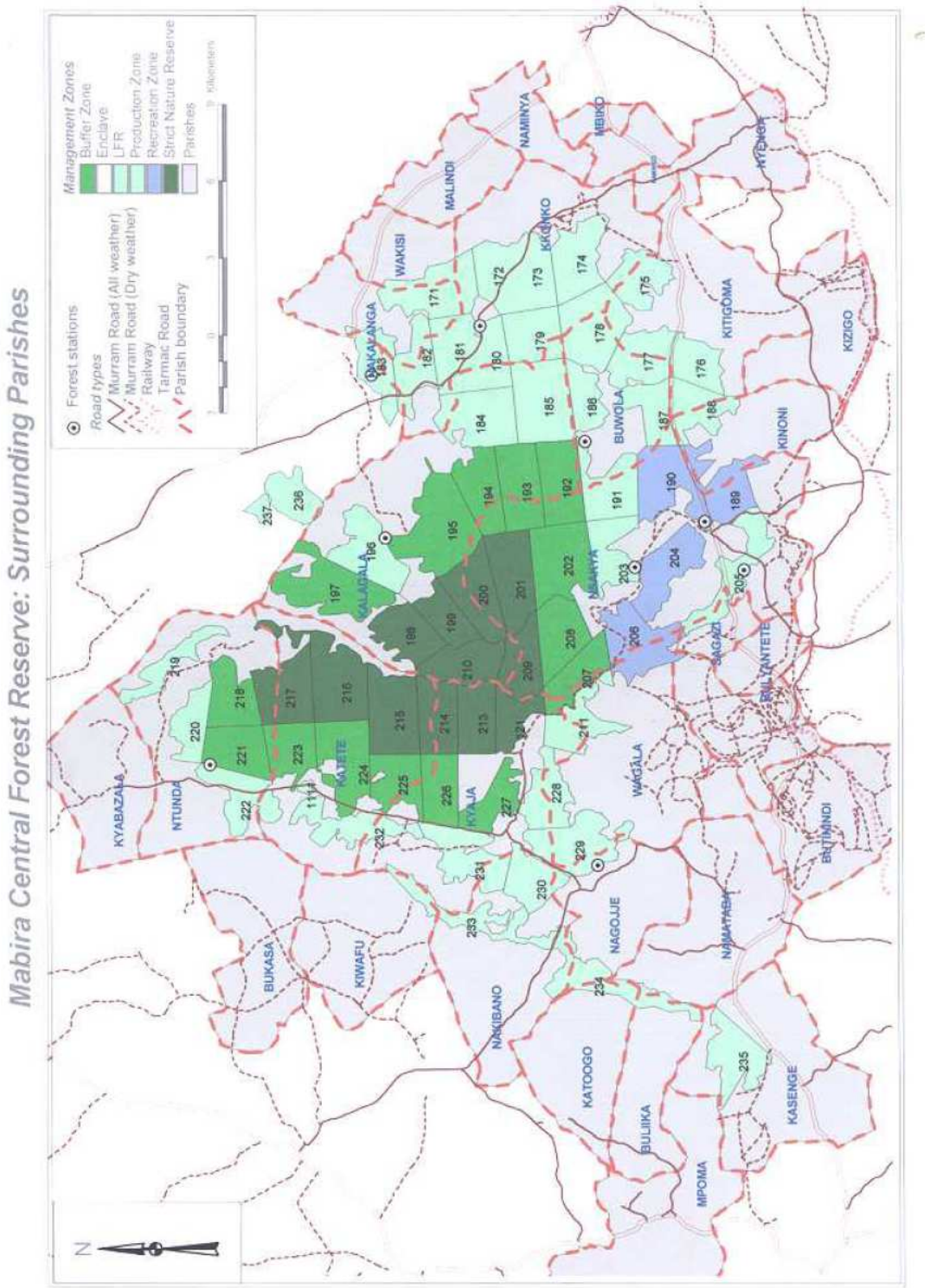
The Bonn Convention on Migratory Species, 1979

Agenda 21, 1992

The International Convention on Biological Diversity, 1992

The Convention to Combat Desertification, 1994

APPENDIX 5:
MANAGEMENT MAP OF MABIRA FOREST RESERVE



APPENDIX 6: LIST OF VARIABLES

Description of villages

- Historical aspects
    - Evolution of villages : demography, facilities
    - Ethnic groups (migration)
- Geographical aspects
    - Distance to the asphalt road
    - Distance to Kampala-Jinja road
    - Distance to forest
- Customary Aspects
    - Customary tenure system (land and natural resource)
- Village organizations / associations which user groups
    - Goals
    - Operation
- Implications of NGOs, government agencies
    - Presence of government projects (responsible, but, date, people involved, result)
    - Presence of NGOs' projects (responsible, but, date, people involved, result)
- Lawful aspects
    - Access to land (land, natural resources)
    - Knowledge / application / perception of legal systems (positive / customary)
    - Evolution / impact of legal systems
- Economic aspects
    - Access to the market
    - Access to other sources of income (plants / job)

Description of farm

- Farming activities
    - Operating systems (practice, strategies)
    - Evolution of practices (abandonment / innovation / factor)
- Activities relating to trees outside forests
    - Agroforestry system
    - Practices (species / markets / strategies)
    - Evolution of practices / factors (abandonment and innovation)
- Forest activities
    - Statute of forests
    - Domestic use of forest products (wood or non)
        - Stakeholders
        - Type de harvest (species, frequency, quality, quantity, transformation)
        - Changes in harvest rate / factors
        - Uses

        - Relationship with the organism of control
    - Commercial exploitation of forest products (wood or not)
        - Stakeholders
        - Type de harvest (species, frequency, quality, quantity, transformation)
        - regulations / relationship with the organism of control
        - Changes in harvest rate / factors
        - Opportunity / supply chain
- Other activities
    - Purchase of forest products (charcoal)
    - Other sources de income

Functions and representation of trees / forests

- Role of trees outside forests
    - Function / use
    - Representations
- Role in forest
    - Function / use
    - Representations

Impacts of activities

- Perception of the impact of farm and forest activities
- Changes in the forest
    - Quantitative evolution
    - Qualitative evolution
    - Factors of evolution
    - Perception of this evolution and factors
- Solutions to restore or protect forest
    - Through farm and forest activities
    - Through plantations (reforestation, tree in farm…)

APPENDIX 7:
DETAIL OF INTERVIEWEES BY SUB-COUNTIES

	Farmers		**Key informants**		
			Villages		**Other**
Sub-county	**Women**	**Men**	**Women**	**Men**	
Kampala	0	0			- Journalist - Leaders Foreaim
Kangulumira	19	14	- farm adviser of sub-county - LCI vice C/P	- 4 LCI C/P[3] - LC II C/P - student	- NFA officer
Nagojje	4	3		- LC III C/P	
Najjembe	1	2		- logger	- NFA officer - tourist guide
Ntunda	8	14	- secretary of du LCI, LCII and farm adviser	- LC III C/P - 2 loggers	- Medical assistant - 3 teachers
Wakisi	26	22		- charcoal maker in forest - farmer – NAADs' representative - 3 LCI C/P	- Officier of sub-county - 2 teachers - LC III C/P - NAADS officer
Total	58	55	3	15	10

3 C/P : chairperson, président d'une entité administrative

APPENDIX 8: INTERVIEWS' GUIDES

"Key informant"

Questions	Purpose
What is the history of this village?	Changes in living conditions, migration
Can you talk about your village? Population Available infrastructures (Distance to nearest) Land tenure	Description of the pertinent facts: Population density, land saturation Access to care, market, jobs Importance of types of tenure
Can you describe the category of the activities of the people in this village?	Activities of farmers / System of activities Typology of activities
What are the activities of villagers in the forest?	Use of forest, of the villagers' role
What are the constraints for farming activities? What are the advantages for farming activities?	Changing of practices and factors Perceptions of practices
Who are the stakeholders of Mabira Forest?	Perception of stakeholders' activities, of their impacts and of their importance
Do you have any project on this village?	Action of government and NGOs' project of development
When somebody ask you about Mabira Forest, what come in your mind?	Perception of forest, of this changes, of this use and of this degradation

"Farmers"

Questions	**Purpose**
Can you spoke about you?	Statute of stakeholder Typology of stakeholders
Can you talk about your land?	Tenure system Access to land
Which activities do you do? Crops Livestock	Activities / system of activities Prioritization Perception of practices' impacts
What are the constraints for your activities? What are the advantages for your activities?	Changes of practices and factors Perceptions of practices
Can you talk me about the trees on your farm?	Species, origin Practices
How do you take care of your trees?	Management rules, ownership rules agroecological Knowledge
Who taught you how to plant these trees? Who taught you how to manage these trees?	Factor of innovation and evolution
Are you / people used to go to the forest?	Forest use, perception and function of forest
Which species do you use for these activities?	Use, change of resource Perception of practices' impacts
When somebody ask you about Mabira Forest, what come in your mind?	Perception of forest, of this change, of this use, of this degradation
For you, what is a good / bad forest?	Perception of forest, change

APPENDIX 9:
ENGLISH AND LUGANDA INTRODUCTION OF INTERVIEWER AND PROJECT

My name is Cécile HERVO. I'm a French student doing environmental Engineering. And am connected to Makerere University to do my Research : the Training period of four months in Uganda to finish my master's Degree. My purpose is understand the activities and practices of farmers and others stakeholders in this region.

Wabomba Dan is my guide and my translator. He has a Diploma in Education Secondary and now is perusing a Degree in Public Administration and Management in Kampala International University. He works with Kangulumira Sub-County as a Support Staff.

We work with farmers and others stakeholders in Kangulumira sub-county and Wakisi sub-county.

Amanya nga nge nze Cécile HERVO. Ndi muyizi okuva muyunivasite ye'bufaransa. Nga nkola kosi ekwata kubwobutonde (Enviromental Engneering). Nga nyambibwako abe Makerere University mukunonyereza, ndiwamala emyezi enna mu Uganda. Sobole okumala Master's Degree yange. Omulimu gwange kwekumanya emilimu jabantu nebyebalima nga abalimi. Nebekikwatako mukitundu kino.

Wabomba Dan yantambuza era yemunvunuzi wange. Nga alina Diploma mubusomesa bwa nsiniya (-Secondary). Nga ate kati ankola Diguli eyobukulembeze nokulabilira abantu ne bitongole, okuva Mukampala International Univasite. Era nga akola Kungombolola nga Sitafu.

This study is a part of a big European study in three African countries: Uganda, Kenya and Madagascar with France, Scottish and Sweden like partner.

The aim is to understand the relationship between forest and population, that can degrade or restore forest. The objective is to improve the well-being of the population and the protection of the forest, change or find new techniques.

My part is to study the practice and there are other teams that study soil erosion, species in forest, forest product market or growth of the forest.

Okunonyereza kuno kukwata kunsi zebwelu nga France; Scotish; Sweden, nensi ezomuesiti Africa nga Uganda, Kenya, Madagasika.

Omugaso gwo'kunonyereza kwekutegera ekolagana eri wakati wabantu ne Kibira. Okulabanti abantu bakumye ekibira oba bakisanyizawo. Ekigendelerwa kyo kunonyereza kwakulaba nti bantubula kumbela zabantu, okukuma amabira, okufuna obukodyo obupya mubyokulima

APPENDIX 10 :
METHOD OF CALCULATION FOR INDICTORS OF BIODIVERSITY AND INDIGENOUS

Indice de Shannon-Weiner (richesse spécifique et équitabilité)

$$H_S(\mathbf{p}) = -\sum_{k=1}^{S} p_k \ln(p_k)$$

pi = proportion par espèces i allant de 1 à S

Shannon, C. 1948. Mathematical Theory of Communication, Illinois Press Wiener, N. 1948. Cybernetics, MIT Press

Indice de Shannon (indice d'équitabilité)

$$E = H' / \ln S$$

S = nombre d'espèces

E = 'Evenness', varie entre 0 et 1

Shannon, C. 1948. Mathematical Theory of Communication, Illinois Press

Indice de Margalef (indice de richesse spécifique)

$$D = (S-1)/\ln(N)$$

S = nombre d'espèces

N = nombre d'individus

Margalef, R. 1958. Information theory in ecology. General Systems 3: 36 - 71

Indice d'indigénat

$$I_{indi} = \sum_{(k=1,\,N)} C_k * N_k / N$$

C_k = Coefficient fixe, 0 si l'espèce est introduite, 1 si elle est indigène

N_k = Nombre d'individus de l'espèce k

N = nombre d'individus total

Coefficients de Similarité (entre 2 sites)

Indice de Jaccard

$$CJ = j / (a + b - j)$$

Indice de Sorenson

$$CS = 2j / (a+b)$$

Ecart-type :

$\bar{x}$

$SCE = \sum (x-\bar{x})^2$

somme des écarts à la moyenne

$S = \sqrt{(SCE / N)}$

Écart type échantillon

$ESM = S / \sqrt{(N-1)}$

Standard deviation of the mean

$m = X \pm t_\alpha ESM$

X : moyenne de l'échantillon

m: moyenne de la pouplation

$t\alpha$: coefficient de student, à 95 % et plus 30 individus, vaut environ 2

APPENDIX 11:
GLOBAL CHART OF FOREST INVENTORIES' RESULTS

Level of results	Density per ha	Relative error on density	Basal area per ha	Relative error on basal area	Indicator of indigenous	Relative error on indicator of indigenous	Level of human damaga	Relative error on level of human damaga	Indicator of Shannon-Weaver	Indicator of Shannon	Indicator of Margalef
Forêt	590	54	29	5	0,81	0,03	1,6	0,2	4,13	1,84	2,91
Najjembe	804	75	24	4	0,88	0,02	1,0	0,3	3,52	1,39	3,58
Najjembe 1	891	123	27	9	0,79	0,02	1,2	0,6	3,09	1,19	3,69
Najjembe 2	866	119	26	8	0,93	0,03	0,9	0,6	3,10	1,23	3,42
Najjembe 3	656	100	18	4	0,91	0,04	1,0	0,6	3,47	1,39	3,67
Nagojje	612	68	42	10	0,94	0,03	1,4	0,4	3,33	1,41	3,25
Nagojje 1	465	116	20	6	0,88	0,09	1,9	0,6	2,94	1,44	2,50
Nagojje 2	675	86	50	18	0,99	0,03	1,1	0,6	3,04	1,22	3,63
Nagojje 3	697	95	57	18	0,94	0,04	1,3	0,7	3,22	1,30	3,56
Wakisi	354	48	22	6	0,60	0,07	2,4	0,3	2,84	1,70	1,80
Wakisi 1	357	113	20	13	0,85	0,08	2,6	0,3	3,07	1,62	2,36
Wakisi 2	398	66	29	12	0,54	0,17	1,7	0,7	2,28	1,38	1,66
Wakisi 3	309	61	16	5	0,42	0,06	2,8	0,3	1,62	1,15	1,36

Level of results	Indicator of dry wood	RE on indicator of dry wood	Indicator of herbal cover	RE on indicator of herbal cover	Indicator of bush cover	RE on indicator of bush cover	Indicator of dominated cover	RE on indicator of dominated cover	Indicator of canopy cover	RE on indicator of canopy cover	Circumference of the medium	RE on circumference
Forêt	1,35	0,21	3,7	2,1	3,9	0,6	3,3	7,0	4,2	2,8	80	7
Najjembe	1,13	0,34	3,0	2,4	4,0	1,2	3,3	6,2	4,2	2,4	61	7
Najjembe 1	1,43	0,50	3,2	1,8	3,5	1,1	3,1	6,2	4,2	2,5	62	12
Najjembe 2	1,13	0,72	2,7	2,0	4,4	1,2	3,3	6,9	4,1	2,8	63	16
Najjembe 3	0,83	0,49	3,0	2,9	4,0	0,7	3,5	6,7	4,4	2,8	59	8
Nagojje	1,49	0,43	4,4	3,8	3,4	1,1	3,3	5,9	4,3	2,9	92	12
Nagojje 1	2,07	0,96	3,9	2,2	3,1	1,3	3,6	6,1	3,8	2,4	83	30
Nagojje 2	1,00	0,65	4,4	2,6	3,6	1,3	3,2	6,4	4,7	2,6	94	18
Nagojje 3	1,40	0,40	4,8	4,7	3,7	0,6	3,2	5,7	4,3	3,4	100	14
Wakisi	1,42	0,34	3,7	5,2	4,2	0,7	3,4	6,1	4,2	3,2	87	12
Wakisi 1	1,13	0,57	4,5	3,4	4,8	1,5	2,7	4,6	4,0	2,8	81	19
Wakisi 2	1,20	0,40	3,4	5,6	3,7	0,5	3,8	3,2	4,3	2,3	96	27
Wakisi 3	1,93	0,67	3,3	0,0	4,1	0,0	3,7	0,0	4,3	0,0	83	19

RE: Relative error

APPENDIX 12:
LIST OF QUOTED SPECIES BY FARMERS AND THEIR USES

Tree species	Local name	English Name	French Name	Family	Forest	Invent	Show	Use
Albizia coriaria	Kibere / Mugavu			Fabaceae	Y	N	O	BC/C
Albizia glaberrima	Nongo			Fabaceae	N	O	O	BC/BF/C
Antiaris toxiaria	Kirundu	Upas tree	Ako	Moraceae	N	O	N	BF/BC
Antocarpus heterophyllus	Fene	Jack fruit tree	Jacquier	Moraceae	O	O	O	F/f
Calliandra calothyrsus	Kaliyandula			Fabaceae	O	N	N	
Carica papaya	Paapaali	Papaya tree	Papayer	Carcaceae	N	N	O	F/f
Catha edulis		Khat tea		Celastraceae	N	N	N	f
Coffea robusta	Mwanyi	Coffee tree	Caféier	Rubiaceae	O	N	N	F/BF
Cordia millenii	Mukebu			Boraginaceae	O	N	N	BC
Cuppressus lusitanica		Christmas tree		Cupressaceae	N	N	O	BF/BC
Entandrophragma utile	Muniama	Mahogany	Sipo	Meliaceae	O	O	N	BC
Eucalyptus (citriodora)	Kalitunsi	Spotted gum		Myrtaceae	N	N	O	BC/M
Fagaropsis angolensis	Mafu			Rutaceae	N	O	N	
Ficus natalensis	Mutuba	Bark cloth fig		Moraceae	O	N	N	BF/BC/f/M
Maesopsis eminii	Musizi			Rhamnaceae	O	O	O	BF/BC
Mangifera indica	Muyembe	Mango tree	Manguier	Anacardiaceae	O	N	O	F/BF/BC/f
Millitia excelsa	Muvule		Iroko	Moraceae	O	O	O	BF/BC/M
Moringa oleifera	Muringa	Drumstick tree		Moringaceae	N	N	N	F/BC/f/M
Musa acuminata / balbisiana	Matooke	Banana tree	Bananier	Musaceae	N	N	N	F/f
Persea americana	Avocado	Avocado tree	Avocatier	Lauraceae	O	N	N	F/f
Pinus	Pine	Pine tree		Pinanceae	N	N	O	BC
Terminalia (velutina)	Terminalia			Combrétaceae	N	O	O	BC
Trichilia dregeana	Msambia			Meliaceae	O	O	N	BF/BC
		Orange tree	Oranger	Rutaceae	N	N	N	F

Forest:

O quoted species as present in forest,

N no quoted species

Invent:

O inventoried species in forest,

N no inventoried species

Show:

O sold species during Jinja show,

N no sold species

Use:

F edible fruit,

BF firewood,

BC build wood,

C charcoal,

f foliage (to feed animals or raw material),

M medicinal plant

APPENDIX 13:
CALCULATION OF PRODUCTION AND CONSUMPTION OF FIREWOOD

Management plan announces that it is possible to harvest 1 m3 of the logs precious wood of more than 50 cm in diameters a year and by hectare. It is on the 30,000 hectares of forest and on a period of 60 years.

And according to approximations accepted in the forest world, for 1 m3 of the log, there is 1 m3 of wood in form of crown, therefore usable for firewood.

To underestimate the production, considering that 1 m3 of wood weighs 0.7 tonnes (estimate because the woods are mostly less dense than water). So every year, it would be possible to harvest 21,000 tonnes of wood.

And according to the FAO (FAO, 1983) on the humid plateau of East Africa, the consumption of fuelwood is a bit superior to 2,8 kg per day and per person. To be sure of calculation, let us consider a consumption of 3 kg.

About 50,000 inhabitants lived in enclaves around Mabira in 1997. Let us take a population about 70,000 inhabitants nowadays with the natural population growth.

It represents an annual consumption therefore about 7,600 t.

The local communities consume therefore about 36 % of potential production.

ABSTRACT:

Foreaim European project aims at the restoration of the degraded forests of Eastern Africa and Madagascar, by ameliorating the incomes of the rural inhabitants through seven work-package. The work-package 1 corresponds in search of practices, uses and representations linked to the tree and the forest. The present study tries to present the different stakeholders as well as representations, the levels of dependency and possible resolutions for forest restoration. In collaboration with CIRAD and the University of Makerere, this job was performed around Mabira Forest Reserve, located between two biggest cities of Uganda near the lake Victoria. It is based on a socio-economic survey by interviews and a forest inventory.

First of all, there were studied the lawful system, positive and customary, linked to the tree in farms and the forest. It was shown that the boundary of the forest was not subjected to large attacks of agricultural cleaning and that deterioration was more diffuse (charcoal, disappearing of overexploited species).

Then, we were approached the practices of the farmers linked to planting trees on farms The forests' use by the enclaves' inhabitants depended on the size of the land, on their incomes and on the distance between the forest and their house. It was possible to define three main types of farmers: the big wood-self-sufficient landowners, owners with a partial dependence on the forest, and the small owners depending broadly on the forest. Other threats influenced the forest, the urban coal consumer and the industrial project of deforestation.

An inventory, accomplished near the places of interviews displayed another form of representation, pointed out that the forest remains dense on important sectors (600 stems / hectare and 30 m^2 / hectare on average) but that degradation was visible in the form of invasive species (e.g. *Broussonetia papiriféra*).

Thanks to these different factors, it was possible to determine the levels of dependency of the stakeholders, their uses and the impact on the forest Then it was given some suggestions to understand the reasonings of different types of stakeholders, in the subsequent act to restore Mabira forest.