

Local Perceptions of Forest Use, Change and Management – A Case Study in the Tambacounda Region of Senegal

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Abstract

The addition of local ecological knowledge provides insights into ecological processes and adds value to ecosystem assessments and management plans. This research uses local ecological knowledge elicited through semi-structured interviews in nine villages from the Tambacounda region of Senegal to derive information about how the local forest is used, the processes that are driving forest change and the local impressions of forest management types. Based on the responses, forests are vital parts of the daily life supplying people with fuel, food for livestock and supplemental income. Wood cutting for timber extraction and charcoal production and fire are believed to drive much of the change in forests. Charcoal production is particularly divisive, people acknowledge both the positive (added income) and negative (increased negative ecological pressure) on the surrounding forests. Despite the pressures, forests are believed to regenerate after being cut for the production of charcoal. Forestry laws, created in the late 1990s aimed at decentralizing forest management, have not taken root. In both government and co-managed forests, people in the study feel that forest management is still the sole function of the Senegalese Forest Service. Illegal and legal harvesting of wood is said to occur in all forest management types creating a similar ecological environment regardless of government or co-management.

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*This research was conducted independently and may not reflect the views of the United States Government.

Introduction

Local ecological knowledge has long been recognized as providing far-reaching insights into ecological processes and in recent years has received increasing attention by academics and policy professionals when performing ecosystem assessments and drafting ecosystem management plans (Ellis and Swift 1988, Adams and McShane 1992, Heyd 1995, Berkes 1999, Illius and O'Connor 1999, Huntington 2000, Sullivan and Rohde 2002, Gadgil et al. 2003, Davis 2005, Fabricius, Scholes and Cundill 2006). Local societies harbor important information on valuable plants, vegetation dynamics, and land use practices that can yield insights into ecological processes and services that can then be used to help improve ecosystem management (Huntington 2000, Lykke 2000, Wezel and Lykke 2006, Roba and Oba 2008).

Local ecological knowledge takes a fine-scale, context-specific perspective (Berkes and Folke 2002) adding value to wider-scale conservation and management plans (Wezel and Lykke 2006). It can also increase the probability of success for management strategies (Ellis and Swift 1988), because people are often times more likely to abide by regulations influenced by themselves than those forced on societies from outside.

Many studies concerning local ecological knowledge have focused primarily on species, their distribution, techniques to harvest them, and their medicinal qualities (Troster 2002, Lobe and Berkes 2004, Moller et al. 2004, Kaschula, Twine and Scholes 2005). In West Africa, local ecological knowledge has been used to understand the extent of recent vegetation changes (Wezel and Haigis 2000, Gonzalez 2001, Lykke, Kristensen and Ganaba 2004), but few studies have focused on the processes that drive changes and how different management types might influence these processes.

In this research I elicited local ecological knowledge to derive information about how the local forest is used, the processes that are driving forest change and the local impressions of

forest management practices. To accomplish this, I collected and analyzed data from semi-structured interviews in nine villages in the Tambacounda Region of Senegal. This analysis of local ecological knowledge is used to supplement ecological and remote sensing data analysis (Wurster 2009, Wurster 2010) to improve the understanding of the effects of forest management and drivers of change in the study area. An identification of the most valuable land use practices, drivers of change, and management perceptions can provide a focus for future management strategies that allow a more sustainable use of forest resources and a better conservation of ecosystems.

Preface/Study Area

The research was carried out in nine villages in the Tambacounda region of Senegal. The description of the study area's ethnic composition, languages, and land use practices are based on the recent study as well as three years I spent living in Fulani and Mandinka villages while serving as a Peace Corps volunteer in the ecoregion.

Three ethnic groups dominate this region, Fulani, Wolof, and Mandinka. Small populations of the Bassari ethnic group are also found in a handful of villages. Villages with populations less than 300 are often dominated by one ethnic group with larger towns and villages in the region a mixture of ethnic groups. All ethnic groups depend heavily on agriculture as a major source of income. Ethnicities differ slightly in land use practices with Fulani communities associated with livestock and grazing activities while Wolof and Mandinka communities depend on agriculture as the primary source of income. In the following description I will describe the land use practices associated with each ethnicity and those shared across ethnicities.

Although the Fulani are traditionally known as nomadic or semi-nomadic pastoralists herding cattle, goats and sheep, many now farm (growing millet, peanuts for consumption and

sale, and cotton as a cash crop) and live in villages or towns. Three sub-groups of Fulani are found in the region, dominated by the Fula Jeeri with smaller populations of Tukulor and Fula Jalon sub-groups. Major differences among the Fulani sub-groups arise from the geographic region of origin¹ and differences in the dialect of Pulaar spoken.

Both the Mandinka and Wolof ethnic groups are traditionally more sedentary than the Fulani and are known as skilled farmers; growing peanuts, millet and small amounts of rice near to larger rivers as staple crops. Most crops are grown for subsistence farming with small amounts sold at a local market. Cotton and peanut are also grown as cash crops. Most families also raise goats, sheep, bees, or poultry to supplement their diet and/or income.

A typical village in the region, Fulani², Mandinka, or Wolof, consists of people living in compounds grouped around a central village point, usually marked by a large tree such as a baobab, silk cotton, or African mahogany (Figure 2-1). A platform used for public gatherings is usually located beneath the tree. A mosque is often located near to the square. The compounds contain a number of small houses made of clay bricks or mud with thatch or corrugate roofs. Compounds are enclosed by a 1.5-2.5m fence made of elephant grass (Figure 2-2). During times not occupied by planting or harvesting much time is dedicated to maintaining the compound (repairing roofs, fences, walls, etc.).

¹ Fula Jeeri are indigenous to the Tambacounda region and make up the largest portion of the Fulani population. The Tukulor are a sub-group who traditionally farmed along the banks of the Senegal River and migrated to the Tambacounda region over the past 100 years. The Fula Jalon traditionally lived in the mountains of Guinea to the south, but some men seasonally migrate north to Senegal to participate in the harvesting of trees for the production of charcoal Lewis, M. P. 2009. *Ethnologue: Languages of the World, Sixteenth edition*. Dallas, Texas: SIL International..

² Small Fulani villages are more likely to be more isolated than small Mandinka or Wolof villages. This is most likely a result of their historical desire to remain separate from agricultural Wolof and Mandinka villages. These villages are noticeably lower on the economic ladder (lacking covered wells, few individuals with formal educations and a higher percentage of thatched-roof huts) than less isolated villages in the region.

Many villages also have a community garden, most often managed by a group of women. These gardens generally produce a variety of vegetables including onions, cassava, lettuce, tomatoes, hot peppers, carrots, eggplant and/or potatoes. Vegetables and fruits that are not grown in the village are purchased at a local weekly market and some fruits are gathered from the forest.

Planting of crops coincides with the beginning of the rainy season usually in mid-June while harvesting time depends on the crop, but usually begins towards the end of the rainy season in September and could continue until February. During planting and harvesting seasons people work in the fields during the cooler periods of the day, between approximately 6 AM to 11 AM and then again between 4 PM and 7 PM. At other times, the men often temporarily migrate to the regional capital of Tambacounda or national capital of Dakar (approximately 500 km from Tambacounda) to look for part-time work to supplement their incomes. If they choose not to migrate, men often work in the woodlands harvesting and/or collecting timber or deadwood for sale or harvesting trees for the production and sale of charcoal (although this work is dominated by Fulani men from Fuuta Djallon). Additionally, many Fulani men migrate from Guinea, working in the region as laborers in the charcoal trade.

Land immediately surrounding villages (usually less than 1km from the village edge) is used for farming (Figure 2-3). Trees and shrubs are scattered throughout the landscape, but most of the arable land is used for cultivation of peanuts, cotton, or millet. Most land outside of agricultural plots is used for grazing. Grazing of cattle, sheep and goats occurs throughout the region but varies in intensity from village to village (Figure 2-4).

The words forest and bush (*ladèh* in Pulaar, *ñaakoo* in Mandinka, *alaa* in Wolof) are referred to interchangeably as land outside of the village not used for agriculture. Forests are depended on by the local population for cattle grazing, hunting, collecting firewood, deadwood,

timber and non-timber forest products such as fruit, medicinal plants, and honey. Fuelwood used for cooking is the sole source of cooking energy for local populations. Local populations do not depend on any other source of energy because wood is accessible and free.

The abundance of wood resources in the region has made the forest an important source of supplement income for many in the area. Timber is harvested, deadwood is collected, and charcoal is produced and sold along the road or to large merchants who transport it for sale to Dakar. In the last 15 years this region has produced much of the country's charcoal for urban consumers (Ribot 1995, Manga 2005, PROGEDE 2007) and is currently one of two regions (Kolda being the other) in Senegal where it is legal to produce charcoal.

The cutting of any live tree is illegal and people wishing to produce charcoal must first obtain a permit from the Forest Service. Authority to actively manage and controlling access to all forests are the main points of tension between local villagers and the Forest Service. The forests are depended on by local people, but management authority is controlled mainly by the forestry department with some shared responsibilities distributed to local rural councils in the last 10 years.

Historically, village chiefs functioned as regulatory bodies implementing and enforcing laws and resolving conflicts among villages. In some areas, villages also had forestry chiefs responsible for the management of the forest adjacent to the forest (Thiaw and Ribot 2005). Throughout the 20th century, control of the forests was centralized in the Forest Service. Until 1998, no forestry codes in Senegal transferred management authority to local communities (Ribot 2001). When "participatory" codes were first put in place in 1993, there was hope that decentralization would allocate more power to local communities, but little changed (Kanté 2006). But in practice it did no (Ribot 1995). Up to 1998, charcoal merchants and their workers

would arrive in a village accompanied by foresters and harvest wood without input from the rural councils or any other local leaders (Faye 2006). This would often lead to conflicts between the local communities, foresters, and charcoal laborers and merchants since many villages were against the harvesting of wood for charcoal production around their villages because of the negative effects it had on the forest and the feeling that others were benefiting from the forest while they were not allowed.

The forest code of 1998 promised to change this by allocating power to the rural councils over the management of a forest pending an approved forest management plan. The law gave the council jurisdiction over the cutting of wood and required the Forest Service to obtain the signature of the president of the rural council before any commercial production (i.e. charcoal production) could take place in their forests. The code also gave the council the authority to decide who could produce in their forest. Finally, the law required a majority vote of the rural council approving production before anyone could produce in the Rural Community forests (Faye 2006).

Due to the area's importance to the country's charcoal trade and the 1998 forest code it became the focal point of international forestry and natural resource management projects including the World Bank funded Programme de Gestion Durable et Participative Des Energies Traditionnelles et de Substitution (PROGEDE) and United States Agency for International Development (USAID) funded Wula Nafaa project. These projects used the new forest code as a foundation for the development of community managed forests (Figure 2-5). Components of the projects assisted local communities to develop management plans thus gaining authority to manage their Rural Community forests. These projects created seven co-managed forests in the region, but a large majority of the forests are still under official governmental control as

classified forests or unofficial government control as Rural Community forests lacking community designed co-management plans.



0 25 50 100 Meters
Figure 0-1 - Satellite image of village highlighting village center/meeting area (red arrow) and an example of the perimeter of a typical compound (yellow arrow).



Figure 0-2 - Field outside of a traditional compound. Elephant grass fencing encompasses the compound with thatch-roofed huts.



0 125 250 500 Meters

Figure 0-3 - Satellite image of landscape around village and leading up to the classified forest. The red arrow illustrates an example of the edge of a field approximately 1.5 km from the center of the village. The yellow line demarcates the edge of the adjacent Classified Forest. The area to the right of the line is inside the Classified Forest.



Figure 0-4 - Two Fulani boys herding sheep.

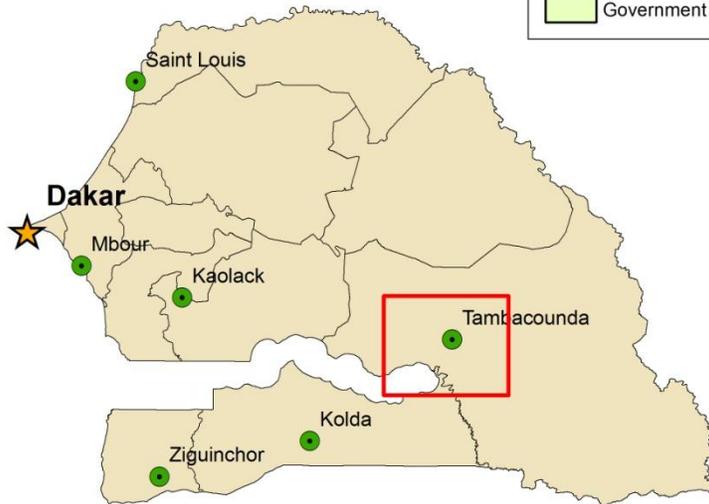
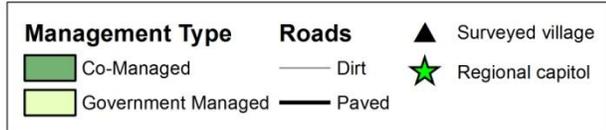
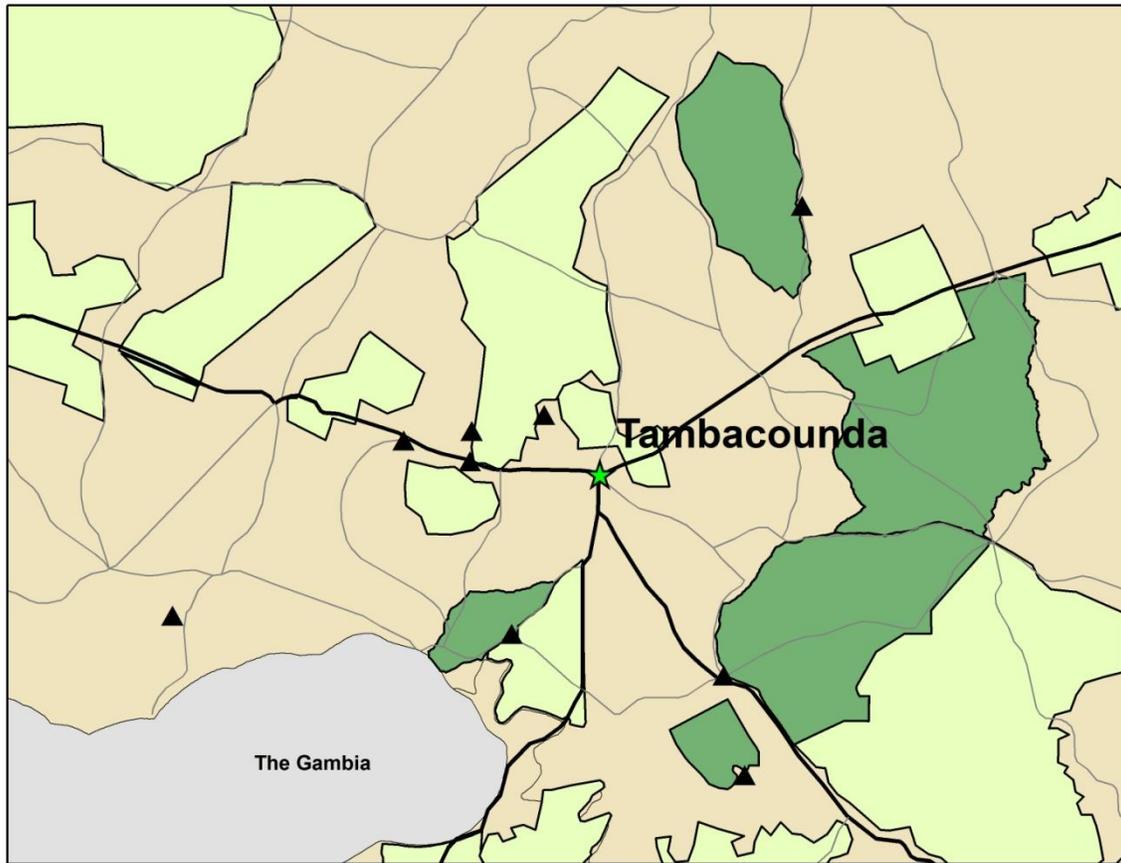


Figure 0-5 - The top map illustrates the locations of surveyed villages and government and co-managed forests. The bottom map shows the location of the study region (red box) to other large towns in Senegal.

Methods of Semi-Structured Interviews

In each village, upon arrival, we would hold a brief meeting with village elders, explaining who we were (that we were only students interested in learning about the local forest), why we were there and what we would be doing. We would present the village chief with a kilogram of cola nuts and sugar, who would then distribute the gift to each compound head. At this point the village chief identified a compound in which we could spend the length of our stay. Because we were a group of three researchers staying 3-4 days in each village, we contributed enough money and fresh produce to our local host compound to off-set the cost of our stay. Throughout our fieldwork we were never turned away from a village. In all villages we were given a hut to sleep in and provided with breakfast and dinner.

Semi-structured interviews were conducted in nine villages. Villages were identified via the random selection of previously known charcoal production points, generally one to ten kilometers from an old charcoal production point located in Rural Community forests, classified forests or co-managed forests. In total, 36 people were interviewed (Figure 2-6). Nine of the interviewees were identified by the village chief as someone who is very knowledgeable of the forest and harvesting for charcoal production. As discussed previously, nearly all of the people in the region who live in small villages, regardless of ethnicity, are farmers who supplement their income with activities in the forest. Individuals nominated for interview by the chief were often village elders and although they had a rich understanding of the forest and its uses, they frequently appeared to lack information on the present day condition of the forest and activities that went on in the forest. Because these individuals would create a highly skewed sample of respondents (they were often also friends of the village chief and/or possibly beholden to him in some way) 25 of the interviews were conducted opportunistically in the forest en route to or while regeneration surveys were being conducted. This approach allowed for the targeting of

	# Villages	# Interviews
Government managed	5	21
Co-managed	4	15
Total	9	36

Table 0-1 - Villages were classified into government managed (GM) forest or co-managed (CM) forest villages based. This classification was based on the designation of forests around each village. GM forests included Classified Forests and Rural Community Forests that did not have a government acknowledged management plan and CM forests included PROGEDE and Wula Nafaa supported forests. Semi-structured interviews were conducted in nine villages (five nearest to GM forests and four nearest to CM forests) and with 36 interviewees (21 in GM villages and 15 in CM villages; 11 in the village and 23 in the field).

individuals who were actively collecting fuelwood and/or in the process of harvesting wood for charcoal production.

Conditions for the each interview were attempted to be conserved from interview to interview. Interviews were carried out under two general conditions: within a person's compound or at the person's work in the forest. The first condition included meeting a person in his or her compound (home), speaking at a time convenient to them and not taking more than an hour of the person's time. The second condition included an opportunistic meeting in the field.

A digital recorder was used to record the entire conversation. Before initiating the interview, we asked permission to digitally record the interview. No one refused to be recorded. Discussions usually lasted approximately 40 minutes. Prior to beginning the interview, the interviewer stated that he received permission to record the interview, the date, time, location (in a village or in the forest), ethnicity of the interviewee, and forest type in which the interview was taken place, but each person was informed that their names or village's name would not be attached to a particular statement. If the interview was done opportunistically in the forest, the activity the interviewee was conducting immediately prior to the interview (cutting grass, cutting live wood, building a kiln, etc.) was noted.

Interviews were conducted by a Senegalese field assistant who has spent most of his life (28 years) in the region; only leaving to attend the University of Cheikh Anta Diop where he

received a degree in linguistics. During the time of field work, he was living and working as a teacher in Kedougou, the regional capital of the Kedougou region. His native languages were Pulaar and Bassari, second Wolof and third Mandinka. He also spoke fluent French and English. Because of his exceptional language skills, each semi-structured interview was therefore conducted in the first language of the interviewee (Pulaar, Mandinka or Wolof) and later the same day translated into English.

An additional field assistant was hired to help perform forestry surveys and did not participate in conducting or translating the semi-structured interviews. This assistant was a Fulaani from The Gambia and had not previously visited any of the surveyed villages.

Although the semi-structured interviews ranged over topics in a flexible discussion, 8 questions (four leading questions each with a follow-up question) were used as a guide for the semi-structured interviews. Interviewees were allowed to give as little or as much information as they desired. In most instances, interviews conducted in the forest, away from the ears of other locals, were more free-flowing. The questions that guided each interview were as follows:

1. How is the forest around this village used?
 - a. Does this degrade the forest?
2. Has the forest around this village changed over time?
 - a. If so, how has it changed?
3. Is charcoal produced in the forest around this village?
 - a. Does harvesting for charcoal production degrade the forest?
4. Who manages the forest around this village?
 - a. Has this changed over time?

Afterwards, in the village setting and during our 3-4 days in the village, in order to have a sense of the social and economic status of the interviewees, we observed personal characteristics, including family size, the number of wives, types of illnesses for people who were sick, diet, and personal possessions. Also, we observed and noted the presence or absence of economic indicators including, horse, horse-cart, cement house, household member overseas, and television set. These indicators serve as a proxy for annual income. Finally, for each interview we noted a subjective impression of the quality of responses.

Because the issue of forest management and charcoal production is sensitive in the study region, some people appeared to shape answers concerning management strategies into something that we might want to hear. When this occurred we reiterated that we just wanted to hear what they think, not what they think will please us. The presence of outsiders made some interviewees noticeably nervous and appeared skeptical of our true intentions. In the village, when the chief or other villagers knew they were talking with us, discussions were much more generic than discussions in the forest. Discussions in the forest appeared more frank and had more depth.

Importance of Forest to Local Users

Interviewees proved to be very knowledgeable about the surrounding forest. A single question usually opened up the conversation that continued for upwards of 45 minutes. People seemed genuinely concerned about the state of the environment surrounding their village and the overall state of the environment in the region.

When asked about the importance of the forest, all of the 36 respondents emphasized the importance of the forest in everyday life. All participants strongly expressed that the forest is an important component of their livelihoods. The forest is used for fuelwood for local consumption,

the collection of non-timber forest products such as fruits and honey along with bark and sap for medical uses, grazing of livestock, timber and grass to make roofs, timber and charcoal.

Statements similar to this were heard in all villages regardless of the type of management around the village:

“Many of our activities are done in the bush. We need the bush even more when there is a poor rainy season. If we have short rains we must try to make money from the bush.

We cut deadwood and make charcoal. We do this only out of need.

It is not only us rural people who depend on the bush, town dwellers need it too. They buy the deadwood and charcoal and use them for cooking. Gas is too expensive so they too are forced to - buy from us.

If the rains are good, then we do not have to go to the bush as much, but only if the rainy season is good and we have enough harvest to feed our families. **Since we live here, we have nothing but the bush.**”

All respondents emphasized they use the forest out of necessity. Interviewees described the necessity to make some money so they can buy rice, peanuts, or other food to survive. If given the choice, they would much prefer not to make the daily trips to the forest to collect forest products.

In many cases people expressed that the forest was used like a bank, although, generally more like a bank that only supplied money and received no reinvestment. People would draw from the forest savings every year in which they cannot produce enough of a gain from agriculture to buy staple products like rice and peanuts. If the agricultural yield is sufficient then they will not have to enter the forest to make charcoal or extract deadwood or timber for sale.



Figure 0-6 - Typical interview conducted in the forest with a local charcoal producer.

Within co-managed and government managed forest villages people used the forest for the same products (Fig 2.7). Interviewees within each forest management type knew of legal and illegal activities occurring on the daily basis in the forest. Activity within the co-managed forests appeared to be less than in the government managed forests, but harvesting of products such as honey, bark, roots, and timber was observed during field interviews and forestry surveys. The after effects of charcoal production and current charcoal production were also observed in both management types. Current charcoal preparation and/or active kilns were also found in all management zones and around all villages.

Every interviewee mentioned that the forest was an important source of energy for the people in the village. Eight of the nine villages had no access to electricity, and the single electrified village had very minimal access in only a handful of government offices, businesses, and a few rooms in the local middle school. Gas was mentioned as too expensive and very difficult to find reliably. These factors make fuelwood the dominate source of cooking energy in the village. Charcoal is occasionally used in small quantities for the preparation of tea.

“Most people in this area take something from the forest. Some make charcoal. Some sell deadwood for sale. Some people cut live trees for timber. These are very sensitive subject for us. We will listen to the government’s ideas. We know the forest is degrading, but we need to do this so we can make money. We have no choice. We need to make money to survive.”

In two of the four villages near to co-managed forests interviewees mentioned that some fruit trees are still present in the forest, while interviewees from five of seven villages near to classified forests mentioned that fruit collection was no longer possible. Field observations confirmed that fruit trees were not abundant in any forest, but trees such as *Ziziphus Mauritania*

(an acacia species producing small round edible fruits) were found in the woodlands near to all villages (Wurster 2010).

Grazing was also mentioned as an important forest output in all villages and by 28 of the 36 interviewees. The Fulaani ethnic group was most often noted as the people who used the forest for these purposes. Livestock (cattle, sheep or goats) or the presence of livestock was observed in all forest management types.

Income generation was mentioned in all villages and by 32 of 36 interviewees. Income generation included collecting deadwood for sale, producing charcoal, and harvesting timber and non-timber products for sale. The collection and sale of deadwood was mentioned as an important source of income for 15 of 36 interviewees and in seven of nine villages. When mentioned, it was referred to as a way to supplement a family's income because of a poor agricultural yield. Deadwood³ collection was more important for people near to GM than to PROGEDE or WN managed forests (14 of the 21 respondents and four of five villages).

Charcoal production⁴ was also a very important source of income for all villages and was mentioned as a source of income by 32 of 36 interviewees. In villages near to government managed forests people usually stated that they themselves did not make charcoal, but know of people in the past and/or present that made charcoal near to the village. This was done

³ In many cases deadwood is something that is created by people, not wood that is found dead in the forest. The word for deadwood, when translated from the local languages, is closer to dry wood (*kaina laideh* in Pulaar, *ndeh looninola* in Mandinka, and *tahani mata* in Wolof) than deadwood. Generally speaking, when collecting firewood, people will go to the bush, cut or lop a tree and then leave it for a period of time to dry, thus becoming dry wood. This is done because dry wood is lighter and easier to transport than wet wood (*sopa laideh* in Pulaar literally meaning cut wood). Additionally this limits the amount space a family needs use for the storage of firewood. Trees that have been cut or have fallen due to illness or other means, are cut in the forest and brought to the village piece-by-piece in donkey carts or carried on top of the head. Often times, timber species such as dooki and bani are killed either by digging deep enough to expose the roots at the base of the trunk and either chopping or burning the roots to kill the tree or by chopping deep into the trunk of the tree on two sides (Fig 2.9). Trees are left standing until they are dead. Once the tree has lost all of its leaves or falls over on its own the timber harvesters will come to fell it and chop it into pieces for sale.

⁴ Refer to Wurster 2010 for a complete discussion of how charcoal is produced.

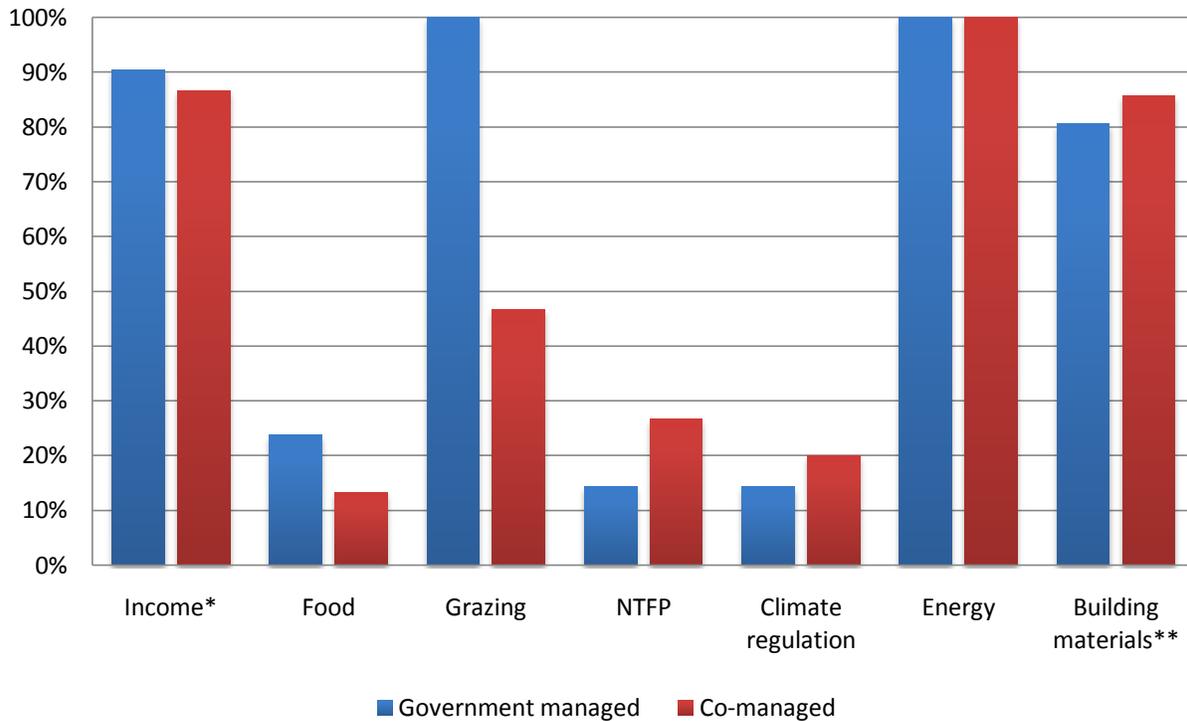


Figure 0-7 - Percentage of interviewees stating the above variables of forest services and uses within government and co-managed types. In most cases respondents listed more than one use/service of the forest. The results are not prioritized. *includes the collection and selling of deadwood, charcoal production, timber, and NTFP (non-timber forest products). **includes the collection of grass, pole timber, and soil for the building and repair of houses and fencing.

because the harvesting of wood for charcoal production is illegal in many government managed forests. 13 of 15 participants from the co-managed forests mentioned income generation (for the individual and community) via charcoal production as a primary use of the forest.

The harvesting of timber for sale in neighboring large towns was mentioned in eight of nine villages and by 30 of 36 respondents. Whenever it was mentioned it was always followed by a statement acknowledging that it is illegal and that it is not done by people from the village, but by carpenters, or people working for carpenters, from larger towns (most often citing Tambacounda). People cutting live trees for timber were observed around by us in seven of nine villages. Stumps of large trees were observed around all villages regardless of forest management type.



a)



b)



c)

Figure 0-8 – Examples of how large trees (this photo is of a *Pterocarpus erinaceus*) are partially cut and left to dry (photos a and b) before being felled and cut into smaller pieces (photo c) for timber extraction.

In addition to the physical products the forest provides, many individuals also expressed that the trees and forest are very important for climate regulation. In 6 instances interviewees made direct reference to local climate and rainfall. It is a common belief among local people that large trees attract rain, so if large trees are abundant, rain will be plentiful, tree regeneration good, and vegetation dense. If on the contrary, trees are logged, then rain becomes deficient and trees sparse. According to most people, low rainfall of the last 20 to 30 years is a major reason for vegetation changes, but the vegetation changes also reinforce the poor rainfall.

Is the forest changing and what is causing this change?

Nearly every respondent (35 of 36) in both forest types acknowledged that the forest around them was degrading. The drivers of change (fire, grazing, charcoal activity, deadwood collection, timber cutting and clearing for agriculture) were the same within co-managed and government managed forests (Figure 2-9).

When questions were asked about the previous status of the forest interviewees would talk about the past when large trees like *Pterocarpus erinaceus*, *Adansonia digitata* and *Cordyla pinnata* were abundant; times when antelopes and other wildlife were present; times when it wasn't safe to venture into the forest because of the abundance of predators. Statements such as this were common:

“When we were young, we dare not travel far from the village because we know there were dangerous animals in the bush like lions and buffalo. Now they are no longer here. No one is scared of the bush anymore. There are no animals. I even want to say that the

bush has disappeared. What we have now cannot be truly called the bush. This is nothing. This is no longer the bush⁵.”

Interviewees also spoke of the lack of large, harder wood trees in the current forest. In the past, these trees were abundant producing lots of shade, fodder for livestock, timber for roofs, and fruit. Presently, people felt that most of these were missing from surrounding government and co-managed forests. There was an abundance of smaller trees that re-grew well, but the bush lacked the larger trees that do not regrow after cutting. A point reiterated by nearly all of the respondents (33 of 36) was that people know which trees can regrow (mainly the *Combretum* species) after cutting and which species die. Timber harvesters from outside the community were blamed in many cases for the decline of large species.

“You can easily see that lots of big trees are disappearing – bani, duuki, kelleh.

Another tree that we used to use to make the roofs of houses, much like cane that can be up to 10 meters long and we used to make flutes out of the smaller portions of it, but it is no longer here. It is those who cut the trees for timber who reduce the forest.” –

Statement made by a person living near to co-managed forests.

“Kahi, bani, duuki, bori – carpenters cut these trees not charcoal workers. They cut these trees to make beds and chairs to sell in town. We (charcoal workers) see them in the bush all the time. We cut trees we know will regrow like dooki gorko. We do this hoping they will regrow so we can make charcoal here again. If you cut a tree that you know does not regrow you are killing the forest. It is those who cut those trees who hurt

⁵ The image an adult in the village has of the forest is often much different than the one they had as a child or teenager. Children are often told stories of spirits and dangerous animals living in the forest that make it a terrifying environment. Generally, as people grow older, they lose this fear. The decreases in wildlife populations might be at least in part, due to this loss of fear. Additionally, some people in the study area are born in more forested areas and might be drawing comparisons between their place of birth and present location.

the forest to make beds and doors. Charcoal makers aren't cutting these trees.” –
Statement made by a person living near to government managed forests.

The cutting of trees for timber (Figure 2-8), as mentioned when earlier discussing deadwood, is difficult to place on any one group of individuals. Since this is illegal in all forests, no one confessed to cutting large trees for timber, but instead blamed outsiders, most frequently, carpenters from Tambacounda for this practice.

Local participants also mentioned that the clearing of land for agriculture was leading to the degradation of the forest immediately adjacent to villages. People often cited the need for more land to produce cash crops like cotton. In most areas, the land immediately surrounding the village is used for agriculture. In some cases, field can extend up to the boundary of a demarcated classified or co-managed forest.

Fire is known as one of the main drivers of ecosystem change around the world (Higgins, Bond and Trollope 2000, Roques, O'Connor and Watkinson 2001, van Langevelde et al. 2003), particularly in the woodlands of Africa (Sankaran et al. 2005). Fires were mentioned as a major

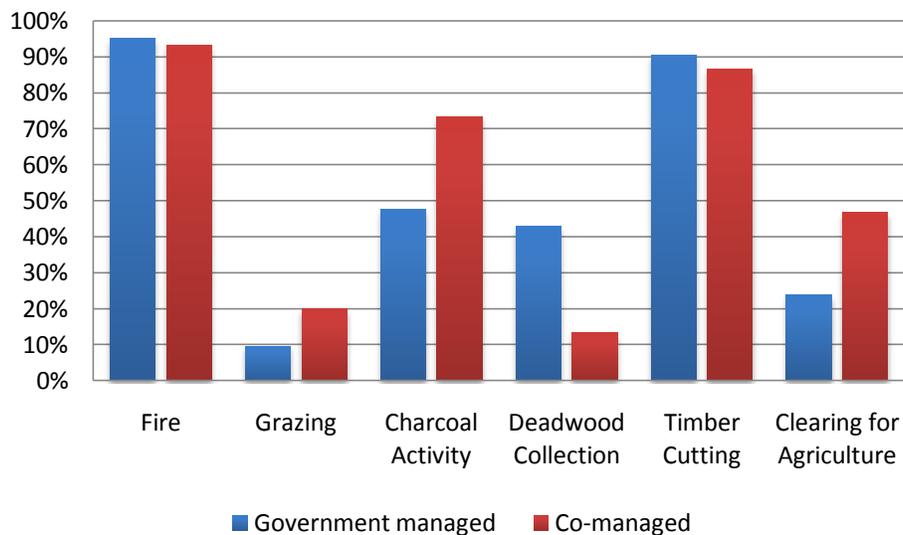


Figure 0-9 - The perceived causes of forest cover change as stated by interviewees who were living nearest to government managed forests and co-managed forests.

driver of forest degradation and change by 34 of 36 interviewees stating that reoccurring fires throughout the year never give the forest time to recover and regrow.

Interviewees cited a number of causes for fires including: cattle herders and farmers starting them to clear land for grazing and farming, charcoal producers accidentally starting them because a kiln burned too hot, traffic from the main road (via cigarettes being flicked in to the bush or over-heating engines catching fire to the grass along the roadside), timber harvesters lighting small fires around the bottom of trees which can burn out of control, and hunters setting fires to find animals.

Cattle herders blamed charcoal producers, charcoal producers blamed timber producers and cattle herders, and timber producers blamed the others. Frequently people acknowledged their role in the fire regime, but preferred to place a majority of the blame on other groups as the primary culprits.

“Who starts fires? It is smokers, cattle herders, timber harvesters, people walking from one village to another. They start fires (as he takes a long drag from his cigarette).”

I ask, “What about charcoal producers? They smoke.”

He smiles at me as he flicks his cigarette butt onto the ground and says sarcastically, “We never do that.” Then laughs and says, “Smokers are the problem, people should avoid this activity.”

Forest degradation caused by fire was obvious to all interviewees. Because *Combretum glutinosum* was the primary species harvested for charcoal production specific questions were asked when possible about the length of time it would take for a tree to become resistant to fire. Answers varied and ranged from two to eight years. A young tree of only two years, could resist a weak fire (one that passes quickly at low heat), but would be killed by a more intense fire. It

was generally believed that regenerated saplings of over four years could resist most fires, while at eight or more years trees were considered fire resistant (Figure 2-10).

The charcoal producers interviewed in the forest mentioned specific methods to minimize the impact of fire on the forest. First, the clearing of grass would greatly reduce the intensity and frequency of fires. Interviewees mentioned that grass should be cleared, at minimum, around the freshly cut tree stumps after cutting to minimize the impact of a potential fire (reducing the fuel load and subsequent fire intensity nearest to the newly regenerating shoots). Also, Combretaceae species should be cut as close to the ground as possible. This significantly decreases the proportion of the cut tree exposed to potential fire greatly increasing the probability of survival.

Charcoal was also mentioned by as a driver of forest change by 21 of 36 interviewees. People in villages where co-management occurred often cited the uncontrolled harvesting of trees for charcoal production as a cause of forest degradation while respondents in villages depending on illegal harvesting downplayed the impacts. Charcoal harvesting frequency was observed consistently across the study area (Figure 2-11).

“It is easy to see that the forest is degrading. Look around. You see lots of trees that were cut. When you walk around the forest you see and hear people cutting trees for charcoal and timber. Some years ago there used to be many fruit trees in the bush, but they are no longer here. Nothing is here. We used to spend all day in the bush. We could feed ourselves from the bush. Now you cannot bring anything back. There is nothing left to bring back.”

Harvesting of trees for charcoal production does not necessarily predetermine a region for rapid deforestation. Interviewees differentiated between trees that naturally regenerated and trees that died after cutting.

“The bush is degrading because of the cutting of live trees like bobori and bani, trees that cannot regrow after cutting. Look how big this tree was (pointing to a large bani stump). This was cut for timber and now it will take many many years for a tree like it to be here again. Dooki is different. If you cut one, many branches will grow back quickly. This is why people only cut dooki for charcoal.”

Previous research and interviews noted that charcoal workers and fuelwood collectors also return re-cut areas that were previously harvested (Bergeret and Ribot 1990). The existence of re-cutting of Combretaceae species indicates that regeneration is taking place. This information is consistent with regeneration data for the area collected since the beginning of the 20th century (Arbonnier 1990).

The time between harvesting varied with interviewees estimating the earliest a Combretum tree could be reharvested ranged from 3 to 8 years. In many cases, 5 to 6 years was stated to be an optimal time interval to re-cut trees from the same locations⁶. Regeneration after cutting of Combretaceae species (locally generally referred to as dooki in Pulaar (individual species were *Combretum glutinosum* (dooki gorko), *Combretum lecardii* (dooki debbo), *Combretum molle* (ngañaka), and *Combretum nigricans* (busti)) was observed in all co-managed and government managed forest types. Interviewees said that the regeneration of these trees allows for the repeated cutting of forests.

⁶ Interviews conducted in Senegal, Mali, Niger and Burkina Faso stated that charcoal workers return to harvest the same area after 9 to 12 years Ribot, J. C. 1999. A history of fear: imagining deforestation in the West African dryland forests. 291-300. while other studies have estimated that woodcutters could return to re-cut at 8 years for optimal return Jensen, A. M. 1995. Evaluation des données sur les ressources ligneuses au Burkina Faso, Gambie, Mali, Niger et Sénégal. In *Examen des politiques, stratégies et programmes au secteur des énergies traditionnelles*. World Bank.. It is this data that led the co-managed projects to require an 8 year rotation between harvests Heermans, J. March 2008..

Interviewees stated that saplings or small trees less than three years of age were generally not cut. Charcoal producers stated that small trees, usually less than 3 years in age (approximately 5 centimeters in diameter 1 meter off the ground), were unprofitable because they did not make good charcoal, and therefore were left unharvested. These trees would be left to grow for a number of years until they would eventually be large enough to produce good charcoal.

Impacts of Village Economic Status and Power

Across the study area the apparent economic status of surveyed villages varied. In developing countries, the assets that households have acquired, such as consumer goods, housing quality, water and sanitary facilities and other amenities are a good indicator of their long-term economic status (Groenewold and Tilahun 1990, Morris et al. 2000, Filmer and Pritchett 2001, Mweemba and Webb 2008, Somi et al. 2008).

Although specific household or village incomes were not asked or discussed during our time in each village, we did observe and discuss proxies such as diet, apparent health of children and elders, states of compounds (presence or absence of corrugate roofing material and cement vs. mud floors) and the presence or absence of motorized vehicles.

A typical village falling onto the poor end of the spectrum would have no community garden or access to vegetables, eat only millet (occasionally rice) with a light peanut-based sauce, a majority of infants would have distended stomachs (Groenewold and Tilahun 1990), homes would be constructed of mud with thatch roofs (Morris et al. 2000, Mweemba and Webb 2008) (Figure 2-12a), and no motorized vehicles would be present in the village (Morris et al. 2000).



a)



b)



c)

Figure 0-10 Examples of effects of fire and regeneration: A) Three saplings less than 2 inches in diameter killed by recent fire. B) Demonstrates regeneration of *Combretum glutinosum* after recent fire. Shoots are less than $\frac{1}{2}$ inch in diameter. C) Demonstrating the resiliency of *Combretum glutinosum* with at least 5 years growth to fire. In this case, a large stump was burned adjacent to a group of established *Combretum glutinosum* leaving them slightly scared, but continuing to grow.



Figure 0-11 - Charcoal kiln preparation

A village falling into the other end of the economic spectrum would have a working community garden, a wider, more balanced diet, and therefore healthier children. Most compounds would have at least one or two houses with a corrugate/tin roof (Figure 2-12b) and most homes would have cement floors.

Often, poorer villages stated a stronger dependence on the forest for income and daily energy. Some of these villages were also located on major roads and voiced strong levels of frustration with government led forest management.

In one of the apparently wealthier villages (nearest to a PROGEDE forest) the traditional leader and elected leader were from the same family. This family was obviously the wealthiest in the community and had a number of children and relatives working in Europe. An additional family was also the former owner of one of the largest hotels in Tambacounda. People in this village were very content with the state of the forest and management.

If a successful management campaign is measured by minimal visible human impact in a forest, then this would be one of the best in the area. Very few people were



Figure 0-12 – Typical huts from different socioeconomic levels; a) thatch-roofed hut with mud floors, b) corrugate-roofed hut with cement floors.

seen working in the forest and there was very little sign of livestock grazing. One man was found preparing wood for charcoal production. He was aware of the rules and necessary paperwork needed to produce charcoal in the forest and showed us documentation proving that he was there legally.

Large fire breaks created by large bulldozers divided the forest into varying zones of use (rotating charcoal production zones along with access to deadwood, fuelwood collection and grazing) and two large community gardens for women were also created as part of the project. These large initial investments could be interpreted as a successful means of getting buy-in from the local community in assisting with the management and control of the forest. On the other hand, the perceived relative wealth, high level of education and employment in cities within and outside Senegal probably played an important role in determining the dependence of the community on the surrounding forest. In reality it is most likely a combination of all factors including political connectivity, wealth, education, management, and initial investment that allowed for the visibly successful management and conservation of resources within the nearby forest.

Who is responsible for the management of the forest?

When asked their impressions of forest management mixtures of opinions were heard. Nearly half of the respondents were content with how the forest was managed (16 of 36), although there was a noted difference between respondents who lived near to co-managed forests and government managed forests (11 of 16 lived near to co-managed forests). The relative contentedness with management appeared to stem from communities being more tied to potential profits collected via charcoal production and inclusion in determining how the forest should be managed. In villages near to government managed forests, 16 of 21 respondents thought

management of the forest needed improvement (Figure 2-13). Improvement usually meant increasing local involvement in decision making and receiving a greater cut of profits from charcoal production.

The opinions of forest management by the Forest Service and co-managed projects of Wula Nafaa and PROGEDE varied by individual; some were very happy with government control:

“The government chose to work in this village and make it a co-managed area. As a community we are now involved in the management of the forest. Our task is to look for and stop bush fires. We are also supposed to report illegal harvesting and activity in the forest. In the forest the government does a good job of controlling the area. Because they are here, the forest is not decreasing like it is in other areas. They are doing a good job.

The government also created a garden for the women of the village. The women manage it themselves and receive a good profit from what they produce.” – the perspective of a local forest manager.

Others felt the management of the forest by government entities as a façade:

“This area is a classified forest (government managed forest), but there is really no management here. The Forest Service only comes here and walks the road around the edge of the forest. It is very easy to cut illegally because they never go into the forest. Who would work next to the road? They waste their time thinking they are working while driving around the forest. This is all they are paid to do. They “hire” young people from the villages to go into the forest for them, but they never pay them for the work. They do not pay local people or give them bikes to go into the forest to enforce the rules.

We would not work cotton for free. We need to earn a living.” – quoted by a charcoal producer in the bush 3-4 kilometers from the edge of the Classified Forest.

Others perceived the Forest Service as a government entity who only appeared in the village to take forest products from people that had no choice but to use the forest. In many instances, people spoke of how they had to produce charcoal, with or without the correct paperwork, and how Forest Service workers waited until the charcoal was ready for sale to confiscate the charcoal and tools. Many people stated that local ecological knowledge should be used to create management that would benefit the local populations while OF should be used as an enforcing agent.

“We are the ones who live in the bush. We know the bush. We know what is going on in the bush. We need the bush. Before the Forest Service came we had local committees who took care of the bush. We still have these committees. The Forest Service is working here for us and they need our help to keep the bush healthy.”

But when it came to enforcing laws...

“The local people have no power. People fear the Forest Service. If local people only managed, we do not fear each other. A civilian cannot enforce a rule on another civilian. Neither owns the forest. Each has no right to stop the other. We should keep the Forest Service managing because they are feared. The management of the forest is for our own interest, but we need the Forest Service to manage the forest for us.”

When asked about who actually managed the forest 24 of 36 respondents said that the Forest Service was in control of the management process (Figure 2-14). In areas of co-management, the Forest Service was still perceived by a third of the respondents (Five of 15) to be in control and responsible for the management of the forest. Wula Nafaa managed forests

appear to be sharing the conceived responsibilities of management (six of seven respondents believed the forest was truly co-managed) better than PROGEDE managed forests (four of eight respondents believed the forest was still mostly managed by the Forest Service).

All communities have Rural Community forests surrounding them, in most cases this land is also controlled by the Forest Service. The cutting of any live tree, inside or outside demarcated forest parks and within Rural Community forests, is illegal and people wishing to produce charcoal must first obtain a permit from the Forest Service. These regulations probably helped lead 19 of 21 respondents nearest to government managed forests to feel that the Forest Service was the sole manager of the forest, inside and outside park boundaries.

Impacts of Management on the Forest

The forests in both co-managed and government managed areas looked quite similar. Some areas were thickly wooded while others were sparse. Activity was observed in all forests. Grazing was apparent, fires occurred, and illegal timber harvesting was happening. During the interviews people exhibited a high level of understanding of the current forest management and rules and regulations that they placed on individuals who used the forest. The rules were known, but were they actively applied?

In government managed forests, people generally stated that in order to avoid contact with Forest Service officials they worked in areas where they knew Forest Service officials would not go. As long as harvesting was done at least one-half kilometer from the forest edge or road the Forest Service used to patrol they were generally safe from Forest Service officials. A majority of local people felt they had no responsibility to confront illegal harvesters because it was not their job. It is the responsibility of the Forest Service to enforce.

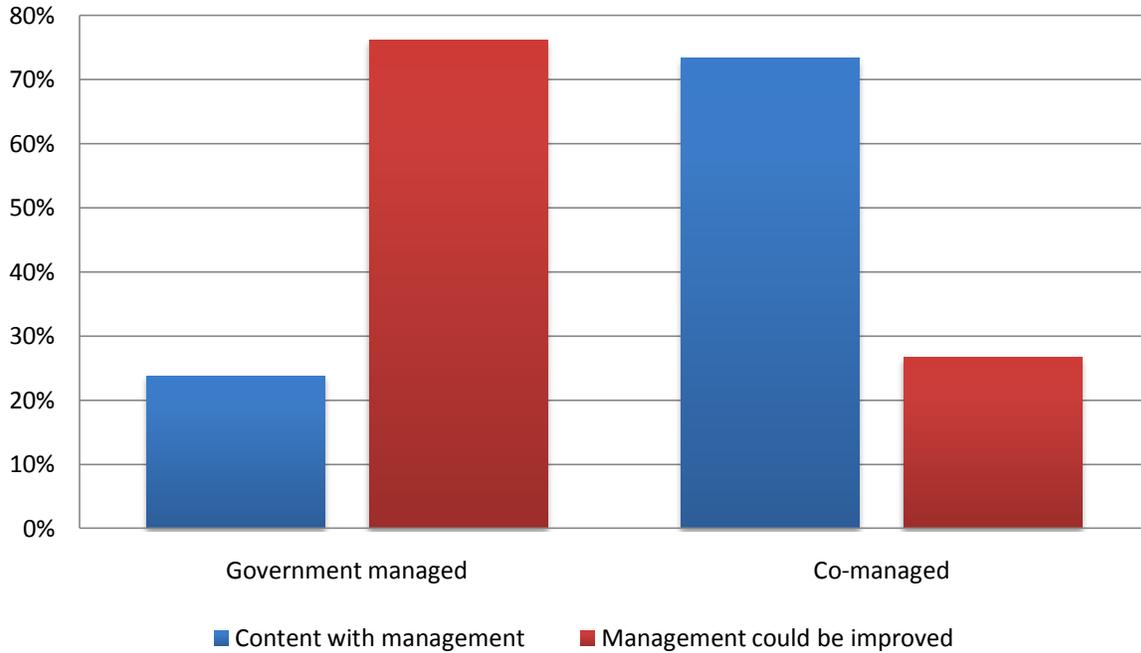


Figure 0-13 – Percentage of interviewees in government and co-managed forest type villages expressing that they were content with how the forest was managed or that forest management should be improved.

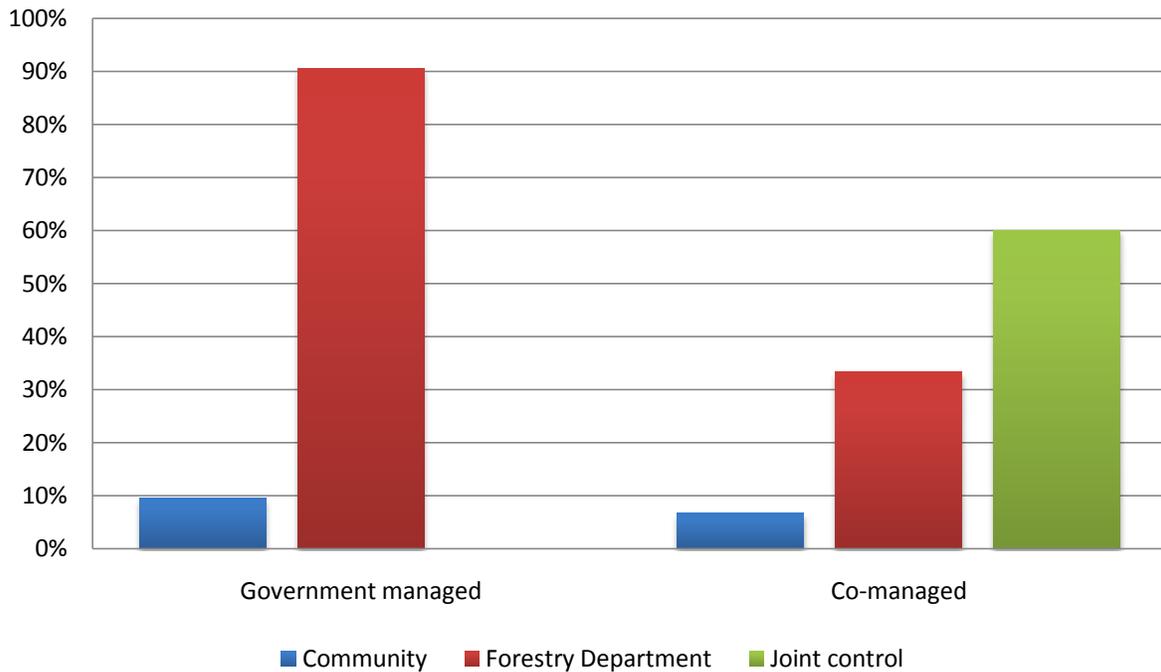


Figure 0-14 - Percentage of interviewees in government and co-managed forest villages who felt the management and access to the forests surrounding their village were controlled by the government, the community, or jointly by both the government and community.

In Co-managed forests the situation was different. Illegal harvesting was observed and noted by people in the community. The methods of confronting, documenting and charging people with illegal forest extraction was thoroughly discussed, but when illegal harvesting was encountered during two field visits forest patrollers expressed great hesitation in confronting people illegally harvesting timber. They reiterated statements made by people in government managed lands saying that confrontation of illegal harvesters is best handled by Wula Nafaa or Forest Service officials.

They were theoretically “empowered”, but did not act. Why? Often regional representatives, prefecture reps, and village chiefs feel powerless when addressing forest extraction and harvest issues (Ribot 2009). Forest laws that were intended to decentralize power, share the profits of charcoal production and limit the negative perceived impact resulting from charcoal production never materialized (Faye 2006, Ribot 2009). Previous research looking at power dynamics throughout the 1990s and into the early 2000s demonstrated that power was held by a handful of patrons and the OF (Ribot 2009). To date, the people outside of GM and CM lands still lack the power, and therefore lack the will, to confidently enforce forest access regulations. Local awareness was raised through some campaigns (Faye 2006), but awareness is little without action. People gave the impression that action would not be taken unless the people in the forests have the power to enforce laws and restrict access to the forests surrounding their villages.

In some villages young men were hired through the Wula Nafaa, PROGEDE or the Forest Service to patrol the forest. When people were hired by the Forest Service they were promised monetary compensation, but that promise was rarely kept and if it was it was not for long. After a period of a couple months, many interviewees stated that the Forest Service would

only demand information without paying the individual for their efforts. People saw this type of enforcement not as beneficial to the village by giving some men small jobs, but instead negative in that they saw the Forest Service officers as lazy and corrupt, not wanting to do the work they are hired to do.

In Co-managed forests young men spoke freely about how the projects had given them jobs and how the community was benefiting from the charcoal that was being produced in their village. They said they did the work for their community, but also stated repeatedly that if they were not getting paid for their time they would not be patrolling the forest. The focus was on charcoal activity, not illegal timber harvesting.

Because of this, the perceived impact of management on forest and forest regeneration by local people was minimal. People said they knew the bush as degrading and knew what was causing the changes, but felt powerless to act.

Conclusion

The answers provided by interviewees only scratch the surface of the important economic, political and ecological issues of how forest resources are controlled and managed. The information gathered serves as a good starting point for future discussions and is valuable information to compare ecological data against.

The local ecological knowledge derived from semi-structured interviews demonstrated that local people have extensive knowledge of forest uses, the drivers of forest change and thoroughly understand the realities of government and co-managed forests. This research emphasized the extent to which local villages in the Tambacounda region of Senegal depend on the surrounding forest for energy, food, and income. The forest products harvested and income

generated by the forest often helps supplement their diets and frequently offset the income lost due to a bad agricultural year.

The uneven distribution of power over forest resources and management is believed to minimize the influence of management type on forest ecology. Local people believe that forest are changing in both government and co-managed areas; large, hardwood species are disappearing, animals are sparse or are locally absent, illegal harvesting of timber is throughout, fires burn, and wood is harvested (legally or illegally) for charcoal production. Charcoal was often a divisive topic with people acknowledging the positive and negative effects it brings; supplemental income, but also increasing pressure on the environment.

Many interviewees believe that in spite of the many pressures on the environment, the forest is regenerating in both government and co-managed areas. Many people who use the forest on the daily basis understand that certain species (mostly trees in the Combretaceae family) regenerate after being cut for fuelwood or the production of charcoal.

In many respects, in spite of efforts to decentralize power, management of the forest is believed to be sole function of the Forest Service. This is even the belief of some interviewees in communities that are signed into co-management plans. The decentralization forest code of 1998 raised the interest level of local communities by potentially allocating increased power and decision making to rural councils, but in the opinion of interviewees, the Forest Service still maintains much of the authority to determine where, when and what is harvested within forested areas. People are willing to participate in management, but the lack of resources and an incomplete transfer of authority to local rural communities are limiting people's willingness to participate in forest management.

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