

EXPLORING THE RELATIONSHIP BETWEEN FOREST RESOURCE USERS AND THEIR
DISAPPEARING FOREST: WHAT DO RURAL GAMBIAIS THINK ARE THE CAUSES AND
SOLUTIONS FOR DEFORESTATION?

By

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A Project Submitted in Partial Fulfillment of the Requirements

for the Degree of

Master in Natural Resource Management

University of Alaska Fairbanks

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Abstract

This is a case study of a small rural community in The Gambia where I was a Peace Corps volunteer for 27 months. The savannah woodland there is classified as a dry tropical forest and like many such areas in the Sahel, the population is growing rapidly. During my time there, I observed a great dependence on local forests but no apparent management. One man told me, “If all the trees perish, then we will all perish.” Given this level of dependence, I was surprised to see little evidence that they were planting trees or taking other measures to protect the forest.

I wanted to find out just how dependent people were on the forest and whether they saw deforestation as a problem. If they saw it as a problem, what did they feel were the causes of it and what did they think would solve it? Since I was living in the area, I was able to use participant observation as a method in my research. I also used semi-structured interviews of key informants and focus group interviews in five communities that were located close together.

I found that the people are extremely dependent on the local forest for firewood, lumber for houses and fences, foods like baobab and mangoes, and herbs for medicines (they had limited access to commercial medicines). This dependence places them in a precarious situation as rural poverty and food insecurity forces farmers to expand their agricultural fields at the expense of the forests. Everyone saw deforestation as a problem and noted that they have to walk farther to gather firewood and that the forest was once thick with trees and wild animals, but now “many trees have perished” and there are few animals. They saw population growth as the primary cause of deforestation, because that forces them to clear trees to make room to grow more crops. They also mentioned illegal logging, drought and bushfires as problems for the forest.

They viewed tree planting as the primary solution and would like to plant trees near their homes where they could protect them, but there are a host of challenges to growing seedlings in this region. The biggest problems are watering the seedlings, as that requires carrying many gallons of water to each seedling on a daily basis, and protecting young trees from termites as well as goats and other animals. They would like to have more support from the Gambian government to teach them better ways to plant and grow trees, to learn more about manure and other ways to improve soil fertility, to help them pay for good fences, and to combat bushfires.

There are many studies regarding tree planting, but few of them address the cultural perspective of forest use and management in the way this study does. These people face a life-threatening dilemma in

trying to solve the problem of deforestation. They have had little success planting trees and will face serious shortages of essential items like firewood, lumber, medicines and food if the problem continues. They do not have the income to buy these goods. I hope this study will contribute to understanding the complexity of the situation, which in turn should assist NGOs and others to develop workable solutions to the problem of deforestation in this and other dry tropical forests of the Sahel.

Key words: The Gambia; Sub-Saharan West Africa; Sahel; deforestation; tree planting; agroforestry; FMNR; subsistence farmers; local knowledge; case study; grounded theory; Peace Corps

Dedication

I dedicate this work to the most important person in my life. My beloved wife, life partner and friend, Sara Alden Harris. She put up with my writing and working on this for far too long. I can't imagine a more supportive partner and am so grateful for your constant encouragement and belief in my ability to accomplish this huge undertaking.

I would also like to dedicate this work to my host family and the people of Jimbala. Without which this study would not have been possible. What you all gave me is impossible to explain in words. In Wolof, the best way I know to say it is that *suma xól be ceda na ak kontan naa*. I dedicate this work especially to my host family including my host father, *suma baay* Chendou Ceesay, host mother, *suma yaay* Dado Mbye, late host grandmother, *suma maam* Fatim Ceesay, host cousin, Ndey, host sisters, Fana, Jugol (Maram), Kumba, and Hoja Ceesay, host brothers, Maddi, Abdulaat, Fafa Touray, and Malick (Yura) Ceesay. Ak pur nit ñi yup Jimbala, jéréjeén jéf waay! Maangee santa yalla pur xam yéen. Suma xól be fés na. Yalla ngéén am garab yi yu bari, lem bu neéx ak bari, xalis yi yu bari, ak lekaa bu neéx ak bari. Nama naa leén bu baax ak baax. Mbaa man naa delu ci kanam tutti rekk.

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List of Acronyms

CITI	-----	Collaborative Institutional Training Initiative
FAO	-----	Food and Agriculture Organization of the United Nations
FMNR	-----	Farmer Managed Natural Regeneration
IPCC	-----	Intergovernmental Panel on Climate Change
IRD	-----	International Relief Development
ITC	-----	International Trade Commission
JBSC	-----	Jimbala Basic Cycle School
LSA	-----	Livelihood Supported Activities
MoFEN	-----	Ministry of Forestry and the Environment
NGO	-----	Non-Governmental Organization
PCV	-----	Peace Corps Volunteer
PES	-----	Payments for Environmental Services
REDD+	-----	Reducing Emissions from Deforestation and forest Degradation
SNRE	-----	School of Natural Resources and Extension
SOFI	-----	State of Food Insecurity
TEK	-----	Traditional Ecological Knowledge
UAF	-----	University of Alaska Fairbanks
UNCHE	-----	United Nations Conference on the Human Environment

Acknowledgements

I would like to acknowledge all of the many people that made this study possible. A sincere and honorable thank you to the late Katim Touray of Ballanghar, who accompanied and translated for me all of the interviews to make data collection possible. May he be in peace.

And to Muhammedou Bah (MMS Bah) for translating and transcribing the interviews from Wolof to English.

To my counterparts and extended host family: Malick Ceesay (Baay Bundaw), Malick (Seidou) Ceesay, Awa Ceesay (Yaay Awa) Tafa and Kiwe Ceesay. I hope the gardens and trees are growing and that the honey is plentiful.

To Haddy Sowe, the teacher posted at JBCS, for all of our important and insightful discussions, for your contribution in furthering gender in development, and for your service as an educator in Jimbala.

Alpha Ann, thank you for your invaluable friendship and support. Alpha is a friend to all Peace Corps who sincerely wishes to visit the United States. I wish for him that he might be allowed this opportunity.

To all Peace Corps Gambia staff (2012-2014), including Jainaba (Jacey) Camara, Boubacarr Barry, Dr. Blessing Dziwa, Leon Kayego, Nikki Shire, Juliana Aiyabo, Alasan Sey, Alex Bangura, Momodou Jallow, Pa Lamin Sanneh, Momodouh A. Bah (Bah2), Saikou Njai, Katim Touray, Arses Jarju, Remy Mendy, Muhammadou MS Bah (MMS Bah), Muhammed Touray, Linda Murgatroyd, Mbye Njie, Mafugi Sanneh, Lamin Sarr, Modou Touray, Alieu Jawo, Peter Gassama, Sulayman Wadda, Alpha Jallow, Modou-Lamin Manneh, Adam Njie, Alagie Camara, Sophie Ndene, Haddy Sowe, Marie Drammeh, Samaka Fye, John Jabang, Gibril Sumbuntu, Aminata Njie, Sargo Dumbuya, Sheriff Njie, Fatou Sowe, Lamin Cham, Mustaphy Fatty, Anna Jatta, Bakary Camara, Baboucarr Sallah, Ida Keita, Gibril Touray, Daniel Demba, Kunta Kambi, Ebrina Bah., and any I may have unintentionally missed not listed here.

To the many staff at the UAF graduate school and SNRE, for helping me cross all my “t’s” and dot all my “i’s.” I cannot imagine working with more dedicated, professional and friendly group of people.

To my advisor and mentor Susan Todd. This work has been incredibly benefited by your advice and guidance and is a much better paper because of it. Thank you for your countless hours in editing, advising and guiding. You helped me to see the potential and importance of this study and kept me going.

Finally, to all of my friends and family both near and far, for their much appreciated and important support and encouragement throughout this process. And for all of those who care for our neighbors, both foreign and domestic, and our environment. For ours affects theirs and vice versa. May we all continue to strive to be better stewards to the environment and better people to each other. May we also be fortunate and willing enough to open our minds and hearts to friends and family of distant cultures on opposite sides of the Earth.

Chapter 1 Introduction

“If the forest goes, so will we” – comment from Jimbala resident, 2014

1.1 Deforestation in a forest dependent region

In The Gambia, forest use by forest dependent people appear to exceed the carrying capacity of dry tropical forests. Forests in The Gambia exist in a Sudano-Sahelian climate domain with long dry seasons of approximately eight months and short rainy seasons of roughly four months with precipitation ranging between 850mm – 1,200 mm (FAO, 2010a). The forests discussed in this study mostly resembled savanna woodland as defined by Letouzey (1982). This is a dry tropical environment where research and investigations of forest management and restoration in these climate zones is lacking even though they make up 42% of the world’s forests where the majority of dry forest ecosystems are in Africa accounting for 70-80% of the forested area (Murphy & Lugo, 1986: 67). A decline in global forests per capita is occurring in every climatic domain (except temperate) as populations increase and land is converted to agriculture or other land uses, (FAO, 2016a: 3). The FAO defines deforestation as the conversion of a forest to another land use. Greater net losses in forests and net gains in agriculture are seen in poorer countries with increasing rural populations (FAO, 2016b: 9), like The Gambia. At the same time, dependency and reliance on forests of dry tropical zones is more pronounced where it’s estimated that over 320 million people (from a 2000 estimate) in Sub-Saharan Africa inhabit and rely on these forests for their rural livelihoods (Eva, et al., 2006). The FAO stated that “More than elsewhere, forests in the drylands of sub-Saharan Africa have the potential to contribute to poverty reduction and food security, as long as they are well valued and sustainably managed,” (FAO, 2010a: iv).

1.2 Purpose of this study

I was a Peace Corps volunteer in the rural community of Jimbala, The Gambia between 2012 and 2014 with a primary assignment in agroforestry. Over the course of my time there, I noticed that the people were highly dependent on the forest for essential products like fuelwood, building materials, food and medicines. In my conversations with them, they were aware that the forest was disappearing as their pressure on the forest was increasing. The distance to fetch fuelwood had increased which added to the amount of time it took for women to collect it which is needed for cooking meals. It puzzled me why they were not putting more effort into conserving or restoring their forests for future use. I wanted to know how they saw their situation and to gain insight into their perception on tree use, forest loss, and potential solutions. This included questions about tree planting preferences, challenges and other issues.

While my primary objective was to learn more about the perception of forest use and issues in a small rural community, I also wanted to investigate the following related questions:

1. What did the local people see as the causes of deforestation?
2. What did they think should be done to solve it?
3. What could I do to assist The Gambia and other countries facing similar challenges to develop policies to mitigate deforestation?

1.3 Need for the Study

Decades of research and practical experience provide resource managers with many of the tools necessary to address critical resource challenges, but are insufficient to manage social ecological systems under conditions of rapid change. –Kofinas, 2009, 78

Dry tropical forests are the most threatened and least studied of the forest ecosystems worldwide where climate change increases vulnerability to climate and environmental changes (CIFOR, 2014). Research on management and restoration for dry tropical forests accounts for only 3% of the literature on tropical forest restoration (Meli, 2003). While studies exist exploring forest user's perspectives and insights about woody vegetative species and forest use and management practices in these areas, few are from The Gambia. In order to measure the importance of these forests, investigations must focus on the people that live in and around forests and depend on for their rural livelihood (FAO, 2014: vii). Key recommendations from the Food and Agriculture Organization of the United Nations (FAO) include a call for data collection to "focus on people – not trees alone."

Through their evaluation of forest valuation studies, Sheil and Wunder (2002) express the importance of assessing views and perceptions of local people directly, when that is the focus and the intent is to inform policy, versus indirect assessments of uses and values from external measures. Other methods for interacting with local communities to assess their perceptions includes the collection of Traditional Ecological Knowledge (TEK), or local knowledge which is important for understanding forest ecosystems including the status of certain species (Paré et al., 2010). Important insights on endangered or other important species can be determined by questioning local forest users (Wezel & Lykke, 2006).

In addition to the importance for gathering local knowledge on certain tree species, there is room to further our understanding about how people are navigating through environmental changes that are exacerbated from climate change. Tengo & Belfrage (2004) explored and compared management

practices of smallholder farmers with regard to uncertainty in agroecosystems in Sweden and Tanzania. These authors noted that few studies have explored the interaction between social and ecological systems including how those relationships further impact sustainable management.

1.4 Methods

This was a qualitative study that explored the thoughts and perceptions of forest users on various forest related topics through focus groups, participant observation, and other semi-formal interviews. Questions were developed with the help of my advisor and translator who also acted as the focus group facilitator. Grounded theory was also used throughout the investigation for data collection and theory derivation. Data was organized into codes and themes to consider frequency and deeper analysis as described in grounded theory methodology.

1.5 Organization of this paper

In chapter 2, I will discuss the current state of knowledge on tree planting outside of forests by rural subsistence farmers by exploring previous works and assessing the knowledge gap that remains. Chapter 3 discusses the methodology used for this study. Chapter 4 presents my results and discussion while Chapter 5 summarizes my conclusions as well as recommendations on how to ameliorate the problem and suggestions for future research.

Chapter 2 Review of Previous Investigations

“We have no plan to plant trees in the forest, but in our yards and farms, because we can't protect the trees in the forest.” – Respondent from Jimbala interview

My understanding that trees and forest resources were disappearing without replacement despite heavy dependence inspired this exploratory study. One of the main discoveries from the interviews was the notion that resource users were not comfortable or interested in the idea to plant trees in the forest. If they wanted to plant trees, it was important that they be in a secure location on land they own and have rights to. Another important discovery was that there is much that influences and drives behavior, which can have a profound impact on whether or not someone decides to engage or succeed in a particular activity like tree planting.

This literature review therefore summarizes what scholars have determined regarding incentives and disincentives to planting trees outside of forests, by forest-dependent people, particularly in dry tropical eco-regions. This review considers factors that influence behavior and motivation especially on the part of rural subsistence farmers. This is because Foundjem-Tita et al., (2013: 490) identified rural farmers as the principle actors who can contribute to tree planting in these regions. Literature from peer reviewed articles, agency and conference papers and books were used based on their relevancy to the study questions and the environmental and socio-ecologic conditions of The Gambia.

The literature on tree planting in the explored context is in some respects limited and others vast. It is organized by three main themes: 1) inputs and influences that contribute or interfere with tree planting; 2) benefits to tree planting; and 3) risk and uncertainty. Inputs and influences that contribute or interfere with tree planting

2.1 Inputs and influences that contribute or interfere with tree planting

There are multiple factors that effect and influence tree planting efforts and outcomes. These include 1) biophysical factors and challenges like climate and access to tree planting resources like seeds, seedlings, or water; 2) farmers' assets including available labor and time for planting; 3) land to grow on and rights to tree resources as influenced by government policies; and 4) factors that motivate and influence behavior as derived from socio-demographic factors like income, social status, etc. The above provides the organization for this section.

2.1.1 Biophysical inputs and challenges

“We had support from [the local NGO] AVISU that gave us polypots to grow plants. It went well the first time. We transplanted the trees in the garden but because we had water problem they all died,”
– Jimbala resident, 2014

In The Gambia, I observed more failure than success when it came to tree planting projects and initiatives. In Niger, Tougiani et al., (2009: 378) noted a low seedling survival rate of 20 percent. Similarly, Bishaw (2001: 9) reported the same percentage in Ethiopia as the overall national average success rate for tree planting. Farmers have reported poor tree growth and survival rates, generally (Franzel et al., 2002: 57). This in and of itself can be very discouraging.

Much of this has been attributed to poor rainfall, improper nursery and transplanting techniques, pests and soil quality. Additional challenges include forest fires (Appiah, et al., 2009: 472; Rudel, 2013) and erosion (Bishaw, 2001: 20). Altogether these conditions allow for a negative feedback cycle to occur where the environment becomes ‘hardened’ by climatic or other events. This makes it more difficult for trees to grow which can further increase the vulnerability of the land and region to desertification, drought, and erosion. Trees and forests can help mitigate these climatic effects but it becomes more challenging to grow them as landscapes change because of deforestation. The FAO (2013: 23) State of Food Insecurity (SOFI) report stated that:

Forests and trees outside forests play a large part in protecting soil and water resources. They promote soil fertility, regulate climate and provide habitat for wild pollinators and the predators of agricultural pests. They can help stabilize agricultural output and provide protection from extreme weather events.

There is no doubt that climate change plays a significant role in desertification and drought, which contributes in turn to deforestation. Authors from the Intergovernmental Panel on Climate Change (IPCC) publication (2014) mention that an increase in tree mortality has been attributed to climate change and observed in several places throughout the world. The authors also discuss observed increases in fire, pest outbreaks, windstorms and droughts. Authors from the same report also stated that:

... climate change may play an even more prominent role [with regard to food insecurity] in the coming decades [and that] mitigating its impacts and preserving natural resources

will be major objectives, especially in connection with the management of land, water, soil nutrients and genetic resources.

The authors from an earlier SOFI report (2010b) stated that interventions like agroforestry practices have been shown to be “effective in reducing risks associated with climate hazards.” The authors continue to state that “promoting good agricultural practices” should be done in an effort to reduce risks and improve risk management.

Agroforestry, or “farm forestry,” is an ancient practice that involves combining trees (ideally species that fix nitrogen) with other crops in the same field. The trees improve the soil while also providing benefits like fodder, shade, edible pods, firewood, fence posts, erosion control, etc. Most of the literature regarding incentives and disincentives to planting trees were part of agroforestry studies. This is relevant for the situation in The Gambia where people prefer to plant trees in their yards or on their private land rather than in the communal forest where they cannot easily care for them or prevent others from cutting them.

In terms of agroforestry adoption, authors refer to a framework established by Mercer and Pattanayak (2003: 284) which demonstrate that “adoption is a function of market incentives, biophysical conditions, resource endowments, risk and uncertainty, and household preferences,” (Mercer, 2004: 315). Pattanayak et al., (2003: 183) shows that biophysical factors can be one of the more important influences on whether or not someone participates in agroforestry or farm-field tree planting. Given the difficulties that can be associated with growing trees, Tougiani et al., (2009: 381) shared that “a vast ‘underground forest’” exists where live stumps on farmland have the ability to regenerate when given the opportunity. This practice is known as Farmer Managed Natural Regeneration (FMNR).

This practice began as an experiment with a few willing farmers in Niger in 1983 and promotes the regeneration of trees from living stumps, roots, and seeds on degraded farmland (Rinaudo, 2011). The practice is to promote the growth of stems from living stumps (Weston, et al., 2015). Stumps or other seedlings on farm fields may be perceived as a nuisance where farmers are constantly cutting back stems on their land. Instead, farmers are encouraged to select the number of stems they want to manage and to oversee their growth and pruning for the first several years. This process is attractive as it requires minimal additional labor, no tree planting, and does not take up additional space beyond that which is already taken and can restore land. Incorporating certain tree species on agriculture land, particularly fallow or unproductive fields, can improve the land and crop yields by adding soil nutrients, producing organic matter, adding soil stability (important for run-off and erosion control) (Garrity et al., 2010: 197)

and can have a positive effect on soil hydrology including groundwater recharge and preferential flow (which can also be effected by termites) (Tobella, 2016: 57).

Some examples that have shown promise are cases from Niger which Rinaudo (2011) reports have 10-20 times as many trees compared to 20 years ago. He contends that because of FMNR, an estimated additional 500,000 tons of cereal is produced a year. This is due to the benefits imparted to crops and farmland by trees. The success of similar projects in Ethiopia have inspired Niger's government to commit to reforest 15 million ha of degraded land as part of a climate change and renewable energy plan to become carbon neutral by 2025. In Senegal, participants noticed that attitudes about tree cutting has changed where before, it was considered nobody's business but now if cutting is seen, people will request that it stop because they are now aware of the benefits from FMNR (p. 21).

2.1.2 Farmer' assets including planting resources, labor and time

When it comes to tree planting, access to the most basic resources can pose as barriers if they are not available or easily obtainable (Zubair & Garforth, 2006; Foundjem-Tita et al., 2012; Gyau et al., 2012). This includes access to water as well as tree planting tools such as planting containers (e.g., 'polypots,' empty tomato sauce cans, plastic jugs, etc.,) seeds, watering cans, and tools for digging (Peace Corps, 2010). In addition, private, dedicated, and secured spaces for planting trees are important. This may require resources for fencing or tree guards or other effective perimeters for keeping animals and people out.

Low availability of tree seeds has proven to be major constraints on efforts to improve degraded farmland in Zambia and Kenya (Scherr & Franzel, 2002: 148). The authors have proposed high quality seed orchards in order to improve access and availability. In Cameroon, farmers have expressed challenges in obtaining planting materials (Foundjem-Tita et al., 2012; Gyau et al., 2012). In Western Himalaya, results from Sood and Mitchell (2004: 251) indicated that farmers that knew where to access and get seedlings were more engaged in agroforestry and tree planting. Access to these resources depends on one's location relative to markets, roads, and to a lesser degree, finances. The cost of basic planting resources like seeds and seedlings are relatively low especially for small-scale farmers (Scherr & Franzel, 2002: 153). Costs could be further reduced if motivated farmers harvested seeds from their local forests instead of purchasing exotic seeds.

While it may appear that exotic species would be most desired (these include mango and cashew for the Gambia), Schreckenberget al., (2006: 37) explains that farmers are convinced in the investment of

indigenous fruit species reporting a high “degree of farmer-driven domestication.” Here, the authors describe domestication as the incorporation of an indigenous species into a “managed environment.” Tougiani et al., (2009: 380) notes, however, that farmers were previously discouraged from planting indigenous trees and that forestry consultants in Nigeria in the 1970s “dismissed indigenous species as ‘useless bush.’” Forestry agents falsely believed that indigenous species grew extremely slowly, which encouraged the emphasis on exotic species. For farmers interested in allowing indigenous species to exist within their farm, FMNR could be an attractive alternative as it would not require planting trees from seed (Buffle, Reij, & Guadago).

The consideration of the labor involved for tree planting projects can be a hurdle for some farmers. Swinkels et al., (2002b: 102) suggest that additional work required for managing trees including pruning may be unappealing. With limited time available, farmers have to prioritize. Meijer et al., (2015: 1) surveyed farmers in Malawi where they learned that farmers felt there were more pressing needs to focus and invest in including food, agriculture inputs and children’s education. This is an important finding and emphasizes the need to address poverty and the ailments of poverty while engaged in other development work (discussed more in 2.2.2).

Labor is not as much of a concern for those that can and tend to hire out for labor, however. Mahapatra and Mitchell (2001: 47) determined that farmers that hire out for labor are more likely to plant trees and that those with the ability to hire labor are also more likely to have more resources and thus more able to invest in new activities like tree planting. In some cases, authors observed that reduced available farm labor could actually encourage tree planting adoption (Frayer, et al., 2014). Mercer (2004) explains that the direction in which labor availability encourages or discourages adoption depends on how the prospective adopter perceives the labor demands. If someone’s field is particularly labor intensive and it is perceived that incorporating trees can reduce some labor (through improved soil fertility as an example) then they may be more tempted to adopt the activity. A similar example is a farmer with a lot of unproductive land and the prospect of converting some of that land to a wood lot or orchard that may be more profitable or productive over time with less labor.

2.1.3 Land ownership and rights to resources

The issue of land ownership and legal definitions of one’s rights to trees and tree products was consistent throughout the literature. Depending on how ownership is defined, farmers may feel discouraged to engage in agroforestry including FMNR or other tree planting activities if their rights are limited or conditional.

The Gambia National Forest Assessment (FAO, 2010: 95-96) shows that some of the requirements for private forest owners under the Gambian Forest Act (1998) may add disincentives for tree planting. The authors note that the policies were both difficult to enforce and confusing regarding the rights of the tree planters or owners. One example is provided from the section on Private Forests, Part VIII section 74(2) of the Forest Act (1998):

The forest produce and non wood [*sic*] forest produce found in or bought from private plantations shall be owned in full by the owner and used as he may wish provided that the removal of such produce a permit that is obtained from the nearest Forest Officer.

Obtaining a permit would be difficult in a number of rural areas where transportation can be difficult to come by and expensive if needed to reach forest officers. The act also adds additional hurdles through established parameters for private forest owners directing them to prepare management plans for private forests less than 25 ha and additionally a required forest inventory for private forests greater than 25 ha. Both would be required to be submitted and approved by the Director of Forestry. This model can be seen throughout the Sahel. McLain (1992: 1) notes that the Sahelian forest code of forest management requires land registration for control and use of trees on one's own land, otherwise the trees fall under state control.

Poorly constructed forest policies are not limited to the African continent. A policy intended to increase tree production and profitability of sandalwood backfired for the Nusa Tenggara Timur province of Indonesia. Beginning in 1986, the government sought to capitalize on the valuable sandalwood resource and declared ownership of all stands on government land including ownership for any naturally occurring sandalwood on private or corporate land (Marks, 2002: 227). Landowners were eligible for 15% of profits for trees on their land while the government received the rest. In poorer rural areas, where residents had been managing their forests themselves, the government provided even less for the total value of their trees (Marks, 2002: 227). Due to the inequitable policies, the result was a dramatic reduction of sandalwood stocks from illegal harvesting (p. 223).

Government ownership of all trees in Niger was also met with a negative outcome. The policy subjected farmers to unwanted fines if trees on their land were felled – regardless if the felling occurred naturally or intentionally (Tougiani et al., 2009: 383). Farmers fearful of fines took less ownership in tree protection. Similarly, in Western Himalaya, farmers were less likely to plant trees if they perceived there to be felling restrictions (Sood & Mitchell, 2004). Those that were not aware of any restrictions or perceived there to be no restrictions were more likely to plant trees.

In Ghana, absent or confusing policies for resource rights to trees discouraged land owners to manage trees or their produce (Quisumbing et al., 2001). In some instances, depending on local laws, certain individuals could find themselves in legal and financial trouble for managing certain protected species (Foundjem-Tita et al., 2012: 500; Tougiani et al., 2009: 383). Relaxing forestry regulations so that farmers and landowners can utilize trees on their land is critical for encouraging and incentivizing tree planting. Garrity et al., (2010: 205) stress the importance of allowing farmers to cut and prune their own trees and use tree products without punishment. Gyau et al., (2012) expressed the importance of land ownership for tree planting noting that those without land, including renters or tenants, are less likely to plant trees. Mercer (2004) further showed that land ownership is an important predictor for agroforestry adoption. With supportive policies in places Tougiani et al., (2009: 378) describe that “spontaneous adoption of agroforestry” can occur by “resource poor households.”

There are of course examples where policies support tree planting. One example is a policy that was set to assist reforestation efforts on private lands in China. Frayer et al., (2014: 249) discuss how deforestation rates decreased and reforestation rates increased after the Chinese government devolved land rights to local communities through a program dubbed “Three Fixes Policy.” Xu and Jiang (2015: 2) state that this policy transferred responsibility and benefits to farmers through the clarification of forest rights, creating private plots, and developing a “forestry production responsibility system.”

While these policies are important, many farmers are not familiar with forest regulations and may be reluctant to grow trees as a result. Foundjem-Tita et al., (2013: 503) indicated that no studies exist providing empirical evidence of farmers’ awareness and perception of forest regulations stressing that it would be a valuable and important contribution to the body of literature.

2.1.4 Socio-demographic and other influences

Trees need but a few things to grow. Land (with appropriate soil), water, and at times, where the carrying capacity of a forest has been reached, a facilitator to grow them. This sub-section is about the facilitator and what motivates or influences them with regard to tree planting.

Some authors have shown that factors like social status, attitude, education, gender, etc., can contribute to one’s willingness to plant or adopt new activities like agroforestry. In reviewing a number of agroforestry adoption studies, Pattanayak et al., (2003: 173) reminds that making generalizations from adoption studies is difficult if not inappropriate because of the variability among studies including

assessed factors as well as limitations with each investigation. Explored factors and influences associated with tree planting or agroforestry adoption are summarized in Table 2-1.

The table highlights what authors have determined with regard to positive (“+”) or negative (“-”) or neutral (“N”) associations with certain socio-demographic or other factors and tree planting. As per the sage advice from Pattanayak et al., (2003) it does not appear that influential factors are consistent throughout different studies in different geographic regions. Several authors speak to the importance of household income for instance while another author found no significant correlation. Interesting influences include an observation from a study in Malawi where authors determined that matrilineal kinship household arrangements had a more positive influence on tree planting.

The results from Hines and Eckman (1993) and Gyau et al., (2012) regarding gender and planting revealed that women were more skeptical than men regarding the potential benefits of tree planting activities. It is difficult for women to be confident about possible benefits of tree planting when they are not included or involved in tree planting trainings or education programs. In Niger, Garrity et al., (2010: 206) remark that women benefit when trees are nearby due to increased access to fuelwood, which saves time that can be put towards other activities. Because women are often the ones utilizing forest products, greater efforts should be made to include and involve them in any tree planting program or project (Africa Partnership Forum, 2007; Colfer & Minarchek, 2013).

Table 2-1 Socio demographic and other influences on tree planting

Socio-demographic factor	Pos (+), Neg (-) or Neutral (N)	Notes	Authors
Age	+/N	Younger farmers' perception of social pressure combined with their motivation level or motivation to plant trees was generally more positive in Malawi where there was also a strong correlation among young farmers and farm forestry in Pakistan; another study from Brazil did not determine a strong correlation.	Meijer et al., 2015: 6 and Zubair and Garforth, 2005: 6;
Attitude	+	In Malawi, an overall positive attitude was measured towards tree planting; In Western Himalaya, a positive attitude towards agroforestry was strongly associated with households that engaged in tree planting.	Meijer et al., 2015: 6; Sood and Mitchell, 2004, 253
Education	+/N	The education level of the household head was not a significant factor in Malawi; however farmers that were engaged in farm forestry in Pakistan had significantly more education than those that were not	Meijer et al., 2015: 6; Zubair and Garforth, 2005: 6
Family size	N	The number of members in a household was not a significant factor.	Meijer et al., 2015: 6
Food security	+	Higher food security in terms of the number of months a household could survive from their maize crops were associated with a more positive attitude towards tree planting.	Meijer et al., 2015: 6
Gender	+ for men, - for women	Women preferred planting in groups while men preferred planting alone (Tanzania). When comparing men and women where women were able to make decisions about planting, men tended to adopt tree planting more readily; Another study also determined women were less likely to plant trees than men given their other important household duties.	Hines & Eckman, 1993; Gyau, et al., 2012
Income	+/N	Three studies showed that farmers with more income felt more confident or comfortable to engage in tree planting. This included livestock ownership; while another did not indicate a strong correlation.	Meijer et al., 2015: 6 and Mahapatra and Mitchell, 2001: 47 and Mercer, 2004: 325; McGinty, 2006: 70
Land size	+/N	Two studies determined that farmers with more land felt more confident or comfortable to engage in tree planting; two others determined that larger landholdings did not necessarily lead to increased adoption for tree planting.	Meijer et al., 2015: 6 and Zubair and Garforth, 2005: 6; Mahapatra and Mitchell, 2001: 47 and McGinty, 2006: 69
Matrilineal kinship	+	Households with this structure in Malawi were associated with a more positive attitude towards tree planting.	Meijer et al., 2015: 6
Membership to a farmers group or village organization	+	Positive impact on attitude towards tree planting where attitude was demonstrated to be dependent on this factor.	Meijer et al., 2015: 6; Mahapatra and Mitchell, 2001: 45
Non-farm employment	+	Farmers that had employment outside of farming were also more likely to engage in farm forestry in Pakistan.	Zubair and Garforth, 2005: 6
Outside or urban experience	+	Visits to urban areas or exposure to the outside world had a positive contribution.	Mahapatra and Mitchell, 2001: 42, 45
Previous planting experience	+	Farmers that had previously planted trees (within the last five years) held more positive attitude of tree planting versus farmers that had not planted in the last five years.	Meijer et al., 2015: 6
Progressive or modern farming techniques	+	Farmers that employ modern methods including diversified cropping patterns were more likely to be tree planters	Mahapatra and Mitchell, 2001: 45
Ranked items in terms of priorities	low	Investing in seeds and seedlings was ranked 10 th out of 20 by 5/16 focus groups in Malawi. Items that ranked higher included food, fertilizer, and children's school fees.	Meijer et al., 2015: 7
Social pressure	+	People were encouraged to plant trees in Malawi.	Meijer et al., 2015: 6
Social status	+	This was found to be an important factor that distinguished tree planters from non-planters, however it may not be important on its own but in conjunction with other factors and influences. Those that belonged to "socially disadvantaged ethnic community groups" were slower to adopt new technologies or innovations.	Mahapatra and Mitchell, 2001: 45-46.

2.1.4.1 Other influences including planned behavior

In terms of predicting behavior for tree planting, Meijer et al., (2015) uses Ajzen's (1991) "Theory of Planned Behavior," to 'examine the relationship between attitudes and behavior' of smallholder farmers in Malawi. The author demonstrates that certain factors contribute to the predictability of the desired or target behavior when they are known. To describe these in the context of tree planting it would be important to know the following: how the participant feels about tree planting (their attitude toward the behavior), how tree planting is considered by the rest of the community (the 'subjective norm'), and how much control over tree planting the participant feels they have (206). In other words, how do they arrive at adopting or ignoring additional tree planting practices?

Additionally, the authors conducted focus groups and questioned farmers about barriers to tree planting in order to further assess attitude and behavior relationships. I have summarized those in Table 2-2. The results showed that a majority of respondents feel lazy, have no desire or are unaware of the benefits as reasons for not planting trees. Other top ranking responses included land scarcity and lack of seeds and seedlings.

Table 2-2: Barriers to tree planting from Meijer et al., 2015

Pairwise ranking of barriers (grouped and added)	Frequency
Personal including laziness, no desire, perceived as difficult, not aware of benefits, poverty, poor health	23
Biophysical factors like rocky soils, termites/pests, poor soils, death of tree seeds, deforestation and climate	18
Access to resources including equipment (lack), water (too far), tree seeds/seedlings (not enough), extension and training (lack)	18
Farmers' assets including land (scarcity), time (too long to see benefits)	14
Risks including bush fires, theft, livestock browsing	5
Other including government interference, population growth, no procedure for planting	3

Source: Meijer et al., 2015, p. 8

Sood and Mitchell (2004) considered socio-psychological factors of smallholder farmers in Western Himalaya and determined that greater adoption of agroforestry was associated with those that perceived the forest as disappearing and that less forest resources would be available in the future.

Authors indicate that understanding these beliefs and influences of forest users and farmers is important when trying to engage them in a new technologies or innovations like tree planting.

When promoting a new technology, which tree planting can be considered, Bunch (1995: 149) suggests asking certain questions in order to better assess the adoption process. Some of these questions consider what participants think about the innovation or technology they are using, why they did or did not decide to try it for themselves, rumors they have heard, advantages and disadvantages, problems they may have had, and anything else they have learned about the technology. Research on agroforestry emphasizes the importance of understanding and measuring how groups or individuals decide to engage in agroforestry practices, especially if they were previously opposed to doing so (Glendinning, et al., 2001: 285).

Considering and valuing the “ideas, knowledge, experience and enthusiasm” of community members about projects dealing with land degradation or poverty alleviation was mentioned as an important ‘discovery’ by the Nigerian Forestry Department (Tougiani et al., 2009: 378). Glendinning et al., (2001: 285) makes a similar observation noting that the local knowledge of rural people “about trees and their place in the land-use system of the region... can be decisive in the participation decision.” The authors stressed the importance of measuring the “attitude and inclination to change” in order to determine the “potential of the targeted group” to adopt agroforestry.

Opinion leaders, including authorities such as chiefs, traditional land custodians, and religious leaders can also have an influential role regarding the adoption of new technology (Cameron, 2011; Mahapatra & Mitchell, 2001: 42). The authors remarked on a successful tree planting project in Central America and attribute the success to a demonstration done by planters with ‘social status,’ which the authors determined to be one of the more important influences with regard to adoption. Feder and Savastano (2006: 1287) stated that individuals are influenced by “their social environment, the network of their contacts, and their status within that network.” The innovation itself, early adopters and information sources used were also noted as important factors that influenced behavior (Glendinning, et al., 2001: 285).

In cases where a project calls for a lead person to work with the rural poor, Bunch (1995: 173) stresses the importance that the ‘leader’ be one of their peers and at the same income level as the farmers they are working with. Sharing the same religious beliefs, a sincere desire to help, and empathy for those they are helping, are also important. Bunch cautions however that the leader not be paternalistic. The

author also explains that beyond being relatable to those you are working with, enthusiasm is “the driving force behind development,” (p. 23).

2.2 Benefits of trees

What is there to be enthusiastic about? Already it may be clear that tree planting in these contexts is far more complex than it may appear on the surface. There are some real benefits to incorporating trees on farms, however, that should be encouraged and promoted. The perceived benefits of trees is one of the more important factors for encouraging adoption of tree planting by rural subsistence farmers. In this section, benefits are discussed in terms of 1) non-market and market goods including environmental services, food, fuelwood, medicine, etc.; and 2) cash or other supportive incentives through monetary, land, food or other support.

2.2.1 Non-market and market goods

Benefits from trees do not always have market value and those with “indirect-use values (environmental functions) and non-use values (cultural, religious, existence values) should not be underestimated,” Boffa (2000: 15). Non-market values are often appreciated by local people, but if a tree species yields marketable commodities, it can also be an incentive to plant those species. Table 2-3 summarizes the economic value of tree products, including produce, wood and other products like resins.

Local policies prohibiting or making it difficult to market tree products from farm trees has resulted in little data regarding those markets and market opportunities. While Africa may have “abundant wild plants” with “great agronomics and commercial potential as food crops,” (Gebauer et al., 2002) getting products to market remains a challenge. As Foundjem-Tita et al., (2012: 490) note, most countries do not have policies governing indigenous trees on farmlands or any policy for products from on-farm plantations. Despite farmers’ interests in marketing fruit products from indigenous trees on their fields, policy makers, foresters and agriculturalists continue to pay little attention to that issue (Schreckenberget al., 2006: 36). The authors also noted that indigenous fruit-bearing species are more suitable for smallholder farmers in developing countries because they are less likely to compete with international markets. Foundjem-Tita et al., (2012) stressed the importance of market opportunities including access to farms by roads, establishing prices for products, considering processing of products and additional income that could be made from trees. Furthermore, Tougiani et al., (2009: 378) and Russell and Franzel, (2004) state that spontaneous agroforestry adoption by resource poor households might also occur if farmers’ access to market tree and forest goods was made easier.

The issue is slightly different for fuelwood and charcoal. While there is a market for charcoal, charcoal production in The Gambia remains an illegal activity where most local production occurs on the border of Senegal near the Cassamance region, a politically conflicted area (Thoma & Camara, 2005). This political conflict supports charcoal production and allows the price to remain competitive to fuelwood where the production places a toll on already compromised forests.

While demand for wood products like fuelwood and charcoal is important, retrieving accurate numbers on actual demand is difficult due to limited reporting from countries (Arnold & Persson, 2003). In their research assessing forestry enterprises in The Gambia, Thoma and Camara (2005) identified fuelwood production as one of the more enterprising developments. The report stated that women could raise as much as 57% of their total income through sales of firewood. Women further organized themselves to increase their profits and improve their marketing scheme which includes the promotion of fast growing fuelwood seedlings for their business. The report did not indicate how this promotion has impacted tree growing or forests.

Table 2-3: Non-market and market goods from trees and environmental services

Product and Examples	Potential to serve as an incentive for tree planting	Authors
Fruit and nut trees like mango, avocado and cashew	Most countries do not have policies that address products from on-farm plantations which adds significant hurdles to market access. Researchers in Zimbabwe noted that “local policies often prohibited [the sale of indigenous fruits], in the name of protecting a natural resource.” This further contributes to poor data on market incentives for farm-field tree products.	Foundjem-Tita, et al., 2013: 490; Russell and Franzel, 2004: 349
Timber	Authors report that there are not many species in Gambia that are “sawable” where the most prominent species that are include <i>Khaya senegalensis</i> and <i>Pterocarpus erinaceus</i> ; Another author noted that in Western Himalaya, farmers that perceived an increase in the price of wood led to greater adoption of tree planting.	Thoma and Camara, 2005: 4; Sood and Mitchell, 2004
Charcoal	Charcoal production is outlawed but the law was loosely defined and known production still occurs. Most charcoal for sale in Gambia however is imported. One report suggests that households spend 800 Dalasi a month or \$17.53. To put that cost in context for The Gambia, a 50 kg bag of rice (a staple for all households) costs approximately 1,100 Dalasi or \$23.86 and can last one month if consumed for lunch only by a large family.	UNDP 2012; Sora, 2013; Ann 2017
Fuelwood	Both fuelwood and charcoal account for 95% of household energy in The Gambia. Fuelwood became marketable in 1994 after urban centers grew beyond the demand of available wood from preferred species. The cost is still low and is determined by transportation costs.	Thoma & Camara, 2005; FAO, 2011
Gum arabic and other resins	Authors considered commercial markets for gum Arabic from Cameroon, Niger and Senegal and determined that improving the professionalization of gum arabic collection, and strengthening knowledge surrounding resource management, pricing and quality could improve commercial opportunities.	Mujawamariya, et al., 2013

Beyond marketable items, trees offer other benefits through improved agriculture production by stabilizing and enriching soil. Nitrogen-fixing trees, many of which occur naturally and frequently in The Gambia, compared to costly fertilizer improve soil fertility, for example (Scherr and Franzel, 2002: 151-152). Farmers utilizing species for soil fertility improvement may see improved crop yields. These benefits, in addition to the others mentioned, can provide “resilience of the farm enterprise to a variety of risks,” (Garrity et al., 2010: 205). Mahapatra and Mitchell (2001: 43) echoed Garrity stating that tree

planting can be viewed as a risk neutralizing method, especially when farmers are experiencing fluctuating net revenues.

2.2.2 Income and other support through tree planting

Wunder (2005) determined that the only substantial way to address environmental conservation is to address poverty. Indira Gandhi is often mentioned as one of the first to make this connection when she said, “We do not wish to impoverish the environment any further and yet we cannot for a moment forget the grim poverty of large numbers of people. Are not poverty and need the greatest polluters?” (Ghandi, 1972). For tree planting, this statement highlights that hungry forest users may have more demanding issues to contend with including food security and health care. Trees on farms can assist in areas of poverty and food security by increasing production and providing additional income, but as has been previously mentioned, knowledge of these benefits or access to those markets may not be well known or achievable.

Hence the idea to provide direct payments or other livelihood support in exchange of resource management or conservation. This has been approached in a number of ways. Some of these include direct cash transfers or Payments for Ecosystem Services (PES), Livelihood Supported Activities (LSAs), carbon sequestration and credits including Clean Development Mechanisms (CDMs). For each method, the bottom line is about compensating farmers (or target group) for their conservation (or other work) efforts. Wangari Maathai’s work in this arena is well known. She worked successfully with poor rural women in Kenya providing compensation for successfully established seedlings. Her efforts grew to become known as the “Green Belt Movement,” where 51 million planted trees in Kenya have been reported since 1977 (The green belt movement, 2017).

Several governments have adopted tree planting incentives that address conservation in impoverished regions. In Niger, the government took it upon itself to incentivize agroforestry by providing food aid to farmers willing to engage in FMNR practices (Garrity et al., 2010: 205; Tougiani et al., 2009). Garrity et al., (2010: 205) stated that several villages now have 10-20 times as many trees as before thanks to a combination of efforts including FMNR. Another boon to tree growth included the further cooperation by the government of Niger in the form of relaxed forest regulations that had previously restricted farmers from managing their own trees.

In China, the government-driven Sloping Land Conversion Program proved to be relatively successful by encouraging farmers to convert steeply sloped cropland to forests or grasslands by offering

monetary and in-kind compensation including grain subsidy, free seedlings or cash subsidies (Fraye et al., 2014: 249; Bennett and Xu, 2005). The program which began in the late 1990s aimed to convert 14.67 million hectares into forestland by 2010. By 2012, this program was able to successfully transform over 9.26 million hectares of sloping agriculture land into forested land.

In Ghana, researchers studied the role of farmers in restoring degraded tropical forests. Farmers were given land to engage in agroforestry activities utilizing agriculture and forest crops to improve livelihood by improving land conditions and productivity (Blay, et al., 2007). The outcome appeared successful in that an additional 250 ha of plantations were established utilizing mostly indigenous tree species (and one exotic). The authors observed a high participation rate where participants demonstrated interest and a desire to invest in more materials to expand their efforts.

2.2.2.1 Carbon markets and credits

There is also economic value of ecosystem services provided by trees, especially in agroforestry systems (Mahapatra and Mitchell, 2001: 42-43; Zubair and Garforth, 2005; Kamanga et al., 2009: 614; Tougiani et al., 2009: 378; Garrity et al., 2010; Frayer et al., 2014; Meijer et al., 2015). According to Mbow et al., (2014: 8) “Agroforestry provides assets and income from carbon [storage], wood energy, improved soil fertility and enhancement of local climate conditions...” Carbon markets have been developed in an effort to further incentivize these important services.

Carbon markets and REDD+ (reducing emissions from deforestation and forest degradation) activities have the potential to contribute to tree planting efforts (Doyle & Edman, 2010). Nanasta (2007) observed that Africa has fewer forestry-based carbon projects than other developing regions. Jindall et al., (2008) assessed forestry-based sequestration projects in Africa and out of 23, noted that only one was in West Africa (Senegal).

Antle and Stoorvogel (2008) explored the impacts of paying for soil carbon sequestration in three countries including Senegal. The authors determined that rural incomes could be raised as soil carbon loss is decreased through these payments. The authors suggest that a “likely positive correlation between soil degradation and rural poverty [allow for] soil carbon sequestration [projects as a] way to target farmers in the poorest, most environmentally vulnerable areas.” Soil carbon sequestration can involve tree planting of species that would increase soil organic matter, making this model a viable approach and worthwhile consideration as an incentive to tree planting by poor rural farmers.

There appears to be great opportunity for more countries in Africa to explore these models, especially as and if carbon markets become more available to them. One issue is the perception that dry forest ecosystems are not especially valuable for carbon storage (Miles, 2010). The author suggests more research be conducted including above and below ground biomass to assess potential value for these ecosystems. Júnior et al., (2016) investigated carbon stocks of dry forests in Brazil. Carbon stocks were measured from woody, litter, herbaceous and root biomass of the sampled trees. Their results indicate that tropical dry forests can stock as much as 70.8% of all carbon found and are effective in decreasing CO₂ from the atmosphere. It may not be visually apparent that some species in the Sahel have carbon storage from aboveground biomass but several species in the Sudanian Regional Centre of Endemism (which covers most of The Gambia) develop “large perennial underground structure[s]” in order to regenerate “aerial structures” after external harm from fire or drought have occurred (FAO, 2000).

2.3 Risk and Uncertainty

External threats like fire are some of the concerns farmers have with regard to planting trees. As a species, we tend to be risk adverse by nature (Peters, 2014). There is no exception for farmers. No matter which practice the farmer decides to use to regenerate trees on their land, there is a sense of risk and uncertainty (Foundjem-Tita, et al., 2013, Pattanayak, et al., 2003: 183). Glendinning et al., (2001: 285) explains that whether or not one decides to participate in a new activity is determined by weighing the risks and benefits against unknowns associated with the activity.

It should not come as a surprise that farmers may be hesitant or resistant to alter their practices when their precarious food production systems are potentially at risk (Anderson and Fishwick, 1984: 47). Howley et al., (2015) explain that farmers are production oriented and want to produce as much on their land as possible even if it does not make the most economic sense. Some farmers believe that engaging in agroforestry is a long term business and that growing trees on their land will interfere with their food production by taking up space or crowding out crops (Zubair & Garforth, 2006; Tougiani et al., 2009). The idea that trees could be in competition with crops could especially discourage hungry farmers, as they would be motivated to produce as much food as they can and might think that more planting space will help them to achieve that goal (Tougiani, et al., 2009: 383).

Beyond farm crops, there are tree crops as discussed earlier. However, the length of time it takes trees to grow before they are productive gives farmers pause when considering incorporating trees or tree crops (Gyau et al., 2012: 271). While trees do take a long time to grow, some species, including indigenous ones, are not as slow growing as some may think. Some are even fast-growing (Tougiani et

al., 2009: 380). Compared to annual crops, however, trees will not provide a product within a year, although some have extensive root systems that begin protecting the soil within the first year.

As stated above, farmers are also concerned about physical threats to trees. Zubair and Garforth (2005) and Gyau et al., (2012) determined that farmers fear the vulnerability seedlings have from humans, animals and pests. They also worry about additional diseases trees and seedlings could bring to their fields, further damaging their crops.

For established trees, there is the very real risk of fire, something that farmers worry about (Gyau et al., 2012). There is also the concern of losing their valuable products to thieves or for being fined for the illegal felling of trees (Tougiani et al., 2009). This last point connects back to the issue of land ownership and clear rights to trees and their resources.

2.4 Summary

Tree planting involves much more than seeds, soil and water. It requires a willingness, supportive policies, community and family support, and has to make sense to the person doing it. There needs to be a strong perception that the benefit of tree planting outweighs the risks. Some of this is formulated by perceived benefits and market potential.

Addressing poverty, infrastructure and access to general health care, clean water and affordable energy all play important roles in forest management and mitigating deforestation.

Chapter 3 Methods

In this chapter, I outline the methodology used for this qualitative exploratory study. The selected methods were considered the most appropriate for investigating the relationship between forest resource users in rural Gambia and their forest in order to better understand local perceptions of forest use and deforestation. Focus groups were conducted in five different villages of the Jimbala community with an estimated total of more than 20 males and more than 40 females between the ages of 13 to 50+ where not everyone that attended participated. Participants were asked ten semi-formal questions (table 4-1) about forest use, the status of the forest, and solutions they have for deforestation. The following subsections expand on project selection, project site, methods used, data collection, data analysis, data quality and ethical considerations.

3.1 Project selection

Be sure you have what you need for your home and job, and then keep your mouth shut and watch carefully for a few months. If you don't fit in, you'll be ineffective. —PCV Fiji

Masters International graduate students are told that our Peace Corps service should come before our master's project. This means crafting your project around your service and not the other way around. This further requires taking time to integrate into your community to learn the language, culture, customs, people and issues they face. Before departing to The Gambia, I had imagined I'd be doing a waste management study... not forestry. After allowing myself to sit and be quiet for the first year however, it was apparent that deforestation was the most pressing issue, and one that I wanted to try to understand through the eyes and minds of those that depended so heavily on dwindling forest resources. My community and surrounding communities were selected as the research sites in which to conduct this investigation.

3.2 Project site

Jimbala is a small rural community where a majority of residents rely on rain-fed crops for their own food and income. In this area, the majority of crops grown include corn, millet, sorghum, groundnut and sesame. A small amount of sugar cane is grown almost primarily for children. Rice is a staple crop and grown throughout the country but was unsuccessful (as an upland rice variety) in the region the study took place. There are productive rice fields approximately 10 km southeast near the Gambian River. Most rice is purchased from shops, however, where 50-kilogram sacks are sold for close to \$20 or more US dollars.

Beyond rice, millet was the second most commonly consumed grain referred locally as *coos* or *chéré*. Millet grains and other crops are still all processed by hand. The sound of women pounding the grain into a coarse powder with large mortar and pestles was a daily ritual during the growing and harvesting seasons. Meals are cooked over open fires inside larger structures typically made of mud bricks, and usually without a chimney. There is no electricity in Jimbala except for occasional solar panels which were primarily used for charging cell phones. Propane or gas tanks used for cooking were only seen in teachers' quarters or my own house.

There are eleven individual villages that comprise the Jimbala community, each are governed by their own village chief or *alkalo*. All but one village was reported in the Gambia 2013 Census (Gambia Bureau of Statistics, 2013). Each individual village has small population sizes ranging from less than 100 to more than 500. Due to the small populations, the individual communities that participated have been identified as K1 – K5 in order to protect the anonymity and identities of those that participated. An aggregated total population for all villages that participated in the study is approximately 1,226 and 2,326 for the entire Jimbala community. Figure 1 displays a map of The Gambia with a star to resemble the location of the study site. Figures 2-3 display satellite imagery for the Jimbala community and nearby forests.

Compounds are approximately 16,000 square feet. Estimating the number of compounds and average family size of 10 people per compound for the entire area (233 compounds) could add 233 – 1165 trees if each compound had a minimum of one tree per compound or maximum of five (five is used as example and does not suggest that is the maximum amount that would fit).

Additional land available for tree planting includes farm fields. These plots range from 1-2 ha where people might have one or more plots that they own. Some trees are visible on people's fields that either were left from initial land clearing or have since grown back and not been removed. Planting trees requiring 6 feet of spacing renders 2,300 trees per ha and 2,000 for trees requiring 10 foot row-spacing (but 5 feet between trees, recommended for hardwood species) (LandOwner Resource Center and Ontario Ministry of Natural Resources, 1995). Using the 233 compound estimate for the entire community, with 2 ha available each and using the smaller estimate for hardwood species, 932,000 trees could be added with 100% land use, 466,000 for 50% use, and more realistically, 93,200 if each farmer devoted 1/10 of their farmland for tree planting. These are rough estimates intended to provide some idea of available land for tree planting and would change depending on the species that are used and if crops are still being grown in conjunction with trees (as with agroforestry).

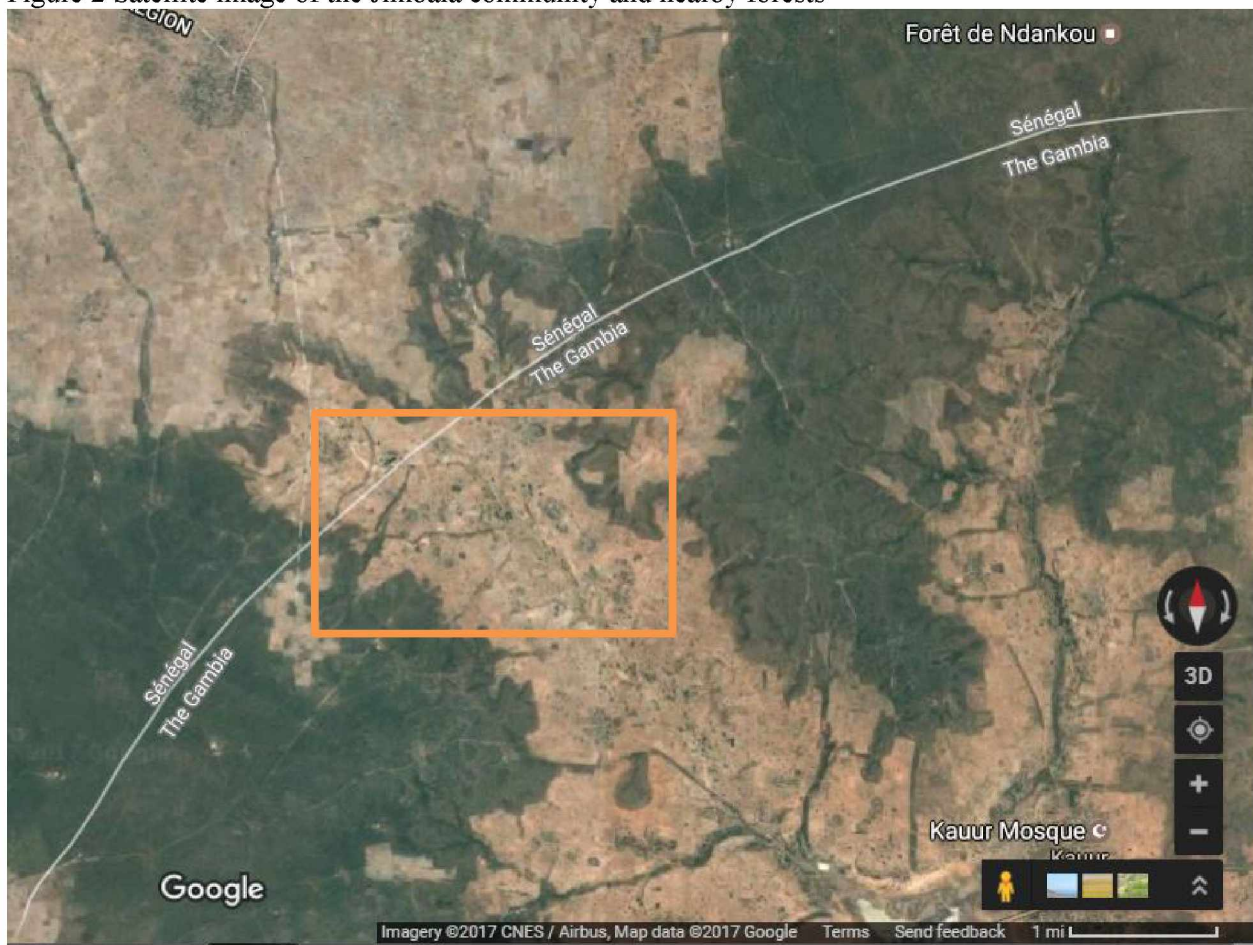
Figure 1 Map of The Gambia



Source: Google Map Data retrieved June 6, 2017.

Figure 2 displays the region in which this study was conducted including nearby forests. The forests span over both The Gambia and Senegal. On the western side, the forest is labeled Forêt de Ndankou in Senegal and is listed as a protected area that is 34.61 square kilometers (Protected Planet, 2017). The rectangle displayed on the figure represents the borders of the study site and parameters for Figure 3, which provides a closer view of the villages in the community.

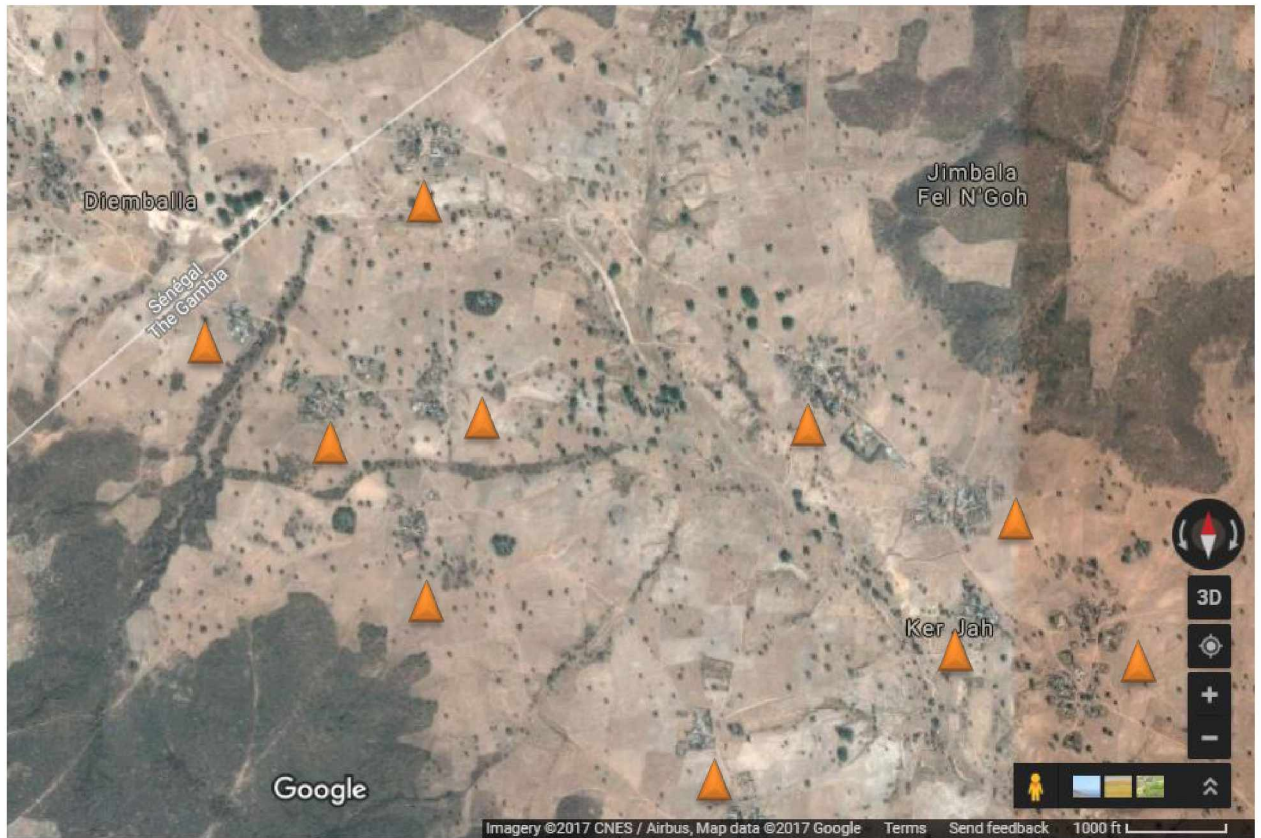
Figure 2 Satellite image of the Jimbala community and nearby forests



Source: Google Map Data retrieved June 6, 2017.

In figure 3, triangles represent community centers. These centers are visually approximated from the satellite image and may not be exactly accurate. One of the Jimbala villages is outside of view further south and is one of the larger communities.

Figure 3 View of Jimbala community



Source: Google Map Data retrieved June 6, 2017.

There is a concern about desert encroachment in the northern area of Senegal and to a lesser extent, this region in The Gambia. Figure 4 displays a satellite image of the Sahara desert relative to the study site which is marked.

Figure 4 Sahara desert relative to the study site



Source: NASA, 2002

Table 3-1 provides additional images to provide greater context for this area. These include an example of a standard house, a cooking area, fuelwood, a cooking fire, a tree nursery, a hand pump, a groundnut farm, etc.

Table 3-1 Photos from Jimbala



Typical House



Fuelwood for cooking



Cooking fire



Tree nursery in re-used containers



Leuceana that tree I planted behind my house, approximately 1 year old



Pounding millet



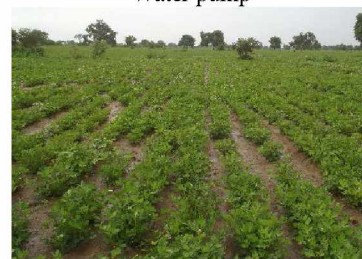
Traditional lunch bowl (*domada*) for 5-7 people



Water pump



Gully



Example of a groundnut farm

3.3 Selected methodology

3.3.1 Case study research

There are multiple ways to investigate the question of local perceptions on forest use. All of them require interacting with the community members to assess their thoughts on the issues. Yin (1994: 1) explains that case studies are appropriate methods for social science research “when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context.” Both of these factors were true for this study. I had little control over events and the context was critical to the questions being asked.

3.3.2 Grounded Theory

This study also follows a grounded theory methodology. Grounded theory was developed by Glaser and Strauss (1967) as an alternative to the positivist approach (Suddaby, 2006). The intention was to derive theory from qualitative data, to ground the research in the data (Glaser & Strauss, 1967). This methodology has become especially popular among nursing research (Goulding, 1998) and is appropriate when the researcher enters into a situation without any prior knowledge, assumptions, or hypothesis (Strauss & Corbin, 1998).

Suddaby (2006) warns, however, that grounded theory does not mean that one is a blank slate with no idea of the research question or knowledge of the literature before embarking on their investigation. Instead, the researcher needs to continue to reflect on how previous influences might affect their interpretation of results and be careful not to allow the desire to test a hypothesis either intentionally or subconsciously, which could bias the direction of the research (Suddaby, 2006). For this study, it was tempting to test the hypothesis that resource dependence does not equate to sustainable resource management. A general research question was formulated regarding forest use and management as perceived or understood on the part of the resource users.

For data collection, there are two fundamental concepts with this methodology including the simultaneous comparison and analysis of data (“constant comparison”) and “theoretical sampling,” where new data collection is based on previous collected data, i.e., the data informs where next to gather and collect additional data. Data from this investigation was collected from the focus groups, interpreted and compared with my previous focus groups as well as to data collected from participant observations. Interview questions were adjusted as data emerged and was evaluated in the field.

In grounded theory, data should be collected until “no new evidence appears,” (Suddaby, 2006: 636). Patterns and repetition were evident by the second focus group and remained throughout the study. On qualitative methods, Miles et al., (2014: 304) express the importance of “seeking *disconfirmation* on what you think is true.” The authors describe this can be less instinctive and considered an extreme version of outlier seeking. In this study, my observation and question was inspired by deforestation and degradation in the area. Throughout data collection, I was seeking any evidence to the contrary in order to satisfy negative evidence collection.

For data interpretation, the researcher is “an active element of the research process” where this type of research “has a creative component that cannot be delegated to an algorithm,” (Suddaby, 2006: 638). Qualitative data analysis software was not used to derive codes or data inference. Data was coded and interpreted by the researcher alone.

The Peace Corps Masters International program fits well with the grounded theory method. Researchers (or volunteers) are placed in a region they have likely never been, and learn from the ground up what the issues are within that region.

3.4 Data collection

Information was collected from focus groups, participant observation, face-to-face semi-structured interviews, and other informal interview methods (Bernard, 2011).

3.4.1 Focus groups

Carey (1994: 226) defines the focus group as a “semistructured [*sic*] group session, moderated by a group leader, held in an informal setting, with the purpose of collecting information on a designated topic.” The author described focus groups as the best setting for exploring sensitive subjects and that the group setting can provide advantages over one-on-one interviews. The author explains that one of the reasons for this is that the group setting can enhance individual participation. The author also describes issues of group settings where depending on participants, people may feel more compelled or discouraged from sharing. This may be more true for participants that have never met each other versus the focus groups from this study where participants were family, neighbors, friends, etc. Carey (1994: 236) described that one’s profession and social status could influence other respondents as well as perceived dominance and submissiveness. Given both the positives and negatives of this approach, it was determined to be the most appropriate and efficient given the time available for my translator and community members.

Meetings were held in the afternoon right after lunch during the hottest period of the day when people were less likely to be working or engaged in other activities. Meetings were orchestrated through village chiefs who would use villagers to spread the word of the gathering and collect participants. The message given to the chief and delivered to the community was that I wanted to talk to community members about the forest and deforestation.

These meetings were led by my translator, Katim Touray. Carey (1994: 227) explains that the group leader can be someone other than the researcher and that it is even appropriate that they are someone not closely connected to the researcher. General notes were taken assessing a rough estimate of the number of attendees, their gender, and age. During the meetings, I was able to follow along, generally, given my advanced ability in the language. My translator would also summarize parts to me in English so that it was easier to follow along with the discussion.

Due to the small size of these communities, recording individual participants was not done in order to maintain anonymity. I observed that some participants dominated the meeting while others did not participate at all. For a rough sketch of demographics of the participants, refer to Table 3-2. These meetings were recorded by a digital recorder and written notes. Communities are identified using K1, K2, K3, etc. in order to again protect the identity of community members of these small villages.

Table 3-2: Focus group demographics

Community	K1	K2	K3	K4	K5	Totals
# Male & Female	6 Male & 4 Female	11 Male & 20 Female	~20 Male & ~30 Female	2 Male & 3 Female	2 Male & 13 Female	~62 Male & ~70 Female*
Age range	20-50+	20-50+	13- 50+	20-50+	16-50+	13-50+

*The large number of female attendees does not mean that their voices contributed the most. Most meetings were dominated by men.

Semi-formal interview questions were drafted with the assistance of my translator, Katim Touray, and Advisor Susan Todd. Katim was free to modify or adjust questions to best fit the need of the audience (McLafferty, 2004). Five focus groups were held in five different communities in total. Complete transcripts are provided in Appendix B-F.

3.4.2 Semi-formal interviews

Another group interview was conducted with employees with the NGO, AVISU (Agency for Village Support – Gambia). This organization was known for assisting with agriculture extension

projects including women's gardens and assisting with foot bridges in rice fields. As one of the nearest organizations to the community that focused on development work including agriculture, I wanted to know their involvement with reforestation or tree planting. This interview was documented through written notes (i.e., it was not recorded). I conducted the interview in English. Employees were asked how their organization addresses forest management assistance to the communities they serve or whether their organization addresses forest management at all.

I also conducted a semi-formal interview with a local forester regarding management practices of extension workers working for the Ministry of Forestry. This interview was also recorded by written notes only.

3.4.3 Participant observation and research interviews

Bernard (2011: 257) describes a method called participant observation which allows researchers to informally collect data through observation. Bernard defines it as the ability to collect any kind of data you want within its context or "where the action is."

In addition to this, throughout the course of my service I engaged in numerous conversations that I considered "research interviews" as described by Kvale & Brinkmann (2009): "The research interview is based on the conversations of daily life and is a professional conversation; it is an inter-view, where knowledge is constructed in the inter-action between the interviewer and the interviewee." These conversations helped me establish a context and baseline comprehension of a number of issues that Gambians face. While forestry was not always the primary topic, it was related to other issues including agriculture, hunger, and poverty. Site books, journals, and a blog were other resources used to document my time and data. Site books are provided to all Peace Corps volunteers where they are encouraged to document important notes, observations, and other project activity. Mine contained a rough map of the community, documented tree planting projects, made notes of individuals that were most interested in working with me on tree planting and gardening, etc. Personal journals also documented my insights and observations but on a more personal level. The blog served as a public online journal to share some of these insights and experiences with friends, family, and others that were interested in my Peace Corps experience.

3.5 Data analysis

Data analysis was conducted as discussed by Gill (2013). The interviews were translated and transcribed from the local Wolof language to English by a Peace Corps staff member and language

coordinator, Muhammadou Bah. I analyzed and coded the translated and transcribed interviews. Saldaña (2009: 3) defines a code as “most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data.”

Ryan and Bernard (2003: 85) state that analyzing text involves four important components: “(1) discovering themes and subthemes, (2) winnowing themes to a manageable few (i.e., deciding which themes are important in any project), (3) building hierarchies of themes, and (4) linking themes into theoretical models.” The transcripts were reviewed multiple times to refine the codes. If codes were similar to each other and could be grouped, they were. Katz (1983: 136) mentions that the more heterogeneous or divided the data is, the less likely it is to reach statistical significance. Interviews that were not transcribed were coded from the field notes. The codes were then assessed for overarching themes. The number of times each code occurred was determined for all the interviews.

Suddaby (2006: 636) cautions emerging grounded theorists from concluding their analysis from word counting or tallying codes alone. The author reminds researchers that “grounded theory is not to make truth statements about reality, but, rather, to elicit fresh understandings about patterned relationships between social actors and how these relationships and interactions actively construct reality.”

Microsoft Excel was used to organize the data. Forty-three codes were developed. Codes were applied to sections of text in an effort to summarize and pull out the main point or topic that was mentioned. The derived codes were created with the intent to represent the interviews and key interview topics as accurately as possible. The complete Code Book explaining the meaning of each code is provided in Table 4-2.

Counting the number of times a particular topic was mentioned is a major part of analyzing most interview data. Codes with a high frequency indicate topics and themes discussed the most. Conversely, codes with low percent distribution or with few or zero mentions are also important for understanding what is *not* being discussed. Topics that were rarely mentioned may indicate that: 1) community members were not interested in discussing it; 2) they assumed certain subject areas to be universal knowledge and therefore felt no need to mention it; or 3) it can indicate a gap or lack of understanding or awareness in certain subject areas (Ryan & Bernard, 2003).

3.6 Consideration of study quality

Katz (1983: 136) is a classic work in qualitative research that describes four important criteria that should be considered when evaluating the quality of a study. These include replicability, representativeness, reactivity, and reliability.

Replicability: if someone else used these methods and asked these questions, would they find similar results?

The main variable here is the researcher, both how they are received by and interact with the community and how they would interpret the results. The Peace Corps component of this study is just as important in this methodology as anything else as it established a firm basis in which to carry out the study. This foundation includes time dedicated to learning the language, integrating into the culture, and developing culturally sensitive and respectful practices in order to achieve a respectable reputation. Without these components, especially time investment at the site, I do not think that data collection or interpretation would be the same or accurate. I am confident that another Peace Corps volunteer or individual employing similar integration tactics, would gather the same information I did.

Representativeness: Does the study represent just the subjects or does it refer to a generalized group?

Katz explains that extensive data collection assists with the generalizability of a theory. This is because generalization is more easily achieved when there is greater variability in which to test the hypothesis or question against. The ruling out of certain ideas allows the remaining theory to be more valid. Producing valid generalizable theories further allows for greater application for other studies when implementing the analytic method. Using Katz's assessment, I cannot know that which I have not studied but with the analytic method, I can apply my knowledge against those factors that remain unknown. In this case, it may be appropriate to generalize the conclusions of this study to other regions of the Gambia or Sub-Saharan West Africa where most variables are the same.

Reactivity: How genuine are the responses from subjects towards the researcher as a) a participant observer and b) interviewer?

Franzel et al., (2002: 53) shows that "farmers often state that they like a technology, even when they do not, because they hope to obtain material or social benefits from interacting with facilitators, or because of cultural taboos against criticism." This could be true in this case as it relates to tree planting.

The culture of the people in this region is very hospitable, so much so that they will do what they can to make you feel welcome and happy to be there even if that means feigning an interest in tree planting. This was known at the time of the investigation. What seems the most appropriate in countering this was the length of time I spent at the site developing relationships and making observations. Just as with many social relationships, we may be able to put on a show or put our best selves forward for a time but eventually authenticity will win out. In this case, it was important to note those that were consistently interested in tree planting and agriculture training versus those that may have seemed interested initially.

Participant observation and the length of time spent in the community was also important to compare focus group responses to observations made from day-to-day living. This is because my presence and the nature of my questions themselves could have affected responses. Having the ability to compare those discussion to longer-term observations was important for comparing any anomalies that may have come from those reactions.

Reliability: How well was the data collected and interpreted?

As a non-native speaker of the language in which the interviews were conducted, I relied heavily on my translator and transcriber. Transcripts appeared to mostly cover a summarized version of the interviews and were not prepared as a complete word-for-word analysis which reduced the quality of the data. Furthermore, it is difficult to know how much of the data was skewed through the interpretations of those who helped me with translations. However, if I had a question or wasn't sure about something from the transcript, my grasp of the language is strong enough that I was able to independently play back the interviews to understand what was said, or at least the context in which it was said.

How might personal bias or expectation influence results?

Suddaby (2006: 640) reminds grounded theorists that they “must account for their positions in the research process [and] engage in ongoing self-reflection to ensure that they take personal biases, world-views, and assumptions into account while collecting, interpreting, and analyzing data.” Throughout my service, I was careful to run my observations by counterparts or local friends in the area to verify certain comprehension of practices, priorities, or other factors as viewed through my cultural lens. I studied and drew advice from a Peace Corps manual entitled “Culture Matters” which acts as a field guide for volunteers with regard to cultural immersion, integration and interpretation. I tested multiple conclusions against my derived data and codes in order to consider all angles and viewpoints.

3.7 Ethical consideration

I successfully completed the basic course on Social Behavioral Research Investigations and Key Personnel through the Collaborative Institutional Training Initiative (CITI) (Reference #5155096). Beyond this, names of individuals who participated in the study were not included. Sensitive or personal information about finances, health care needs, etc., was not collected. Before conducting the focus groups, community members were asked for their permission to discuss the issues of the forest and to record the conversations on a tape recorder. Permission to disclose the name of the community of Jimbala was given by the community.

Chapter 4 Results

4.1 General overview of interview data and results

In this section, I discuss the results from the community interviews that were conducted in five villages in Jimbala. These interviews took place in February and April of 2014. As discussed earlier, the interviews were with focus groups of about 10 to 40 people, roughly.

A local translator led the discussion in the Wolof language. The interviews followed the semi-structured list of questions shown in Table 4-1. In a semi-structured interview, there is a list of questions that need to be answered, but the interviewer does not follow it in a rigid way. Instead, the participants play a role in determining what they discuss and have a chance to volunteer information that would not be revealed if they only responded to our questions.

Table 4-1 Semi-structured interview questions, which were translated into Wolof

- 1) What do you and your families use the forest/bush for?
 - a. Medicine?
 - b. Firewood?
 - c. Timber?
 - d. Food?
 - e. Other?
 - f. And how far do you and your family travel for forest products?
- 2) Which trees are sacred or most important for the Wolof people here and why are these important?
- 3) Which trees are protected here? Are they protected by the people or the government? Why are these trees protected?
- 4) Who can clear the forest and/or cut down trees? Does permission need to be granted? Do they need a permit?
- 5) Which trees have the most use? What are their uses?
- 6) Which trees do you and your family normally try to grow? How do they grow them? Where are they grown, in the compound, field, bush? Why are those in particular grown? What problems are you faced with for planting them?
- 7) How has the forest changed here since you were a child? Have you noticed a change in wildlife?
- 8) What suggestions or ideas do you have for preserving and or re-establishing the forest? Do you feel you and your family yourselves need to change any behaviors at this point to preserve the forest? What changes?
- 9) Anything else you wish to contribute?
- 10) What is the plan to replace the trees?

The interviews were recorded, then translated and transcribed from the Wolof language to English by the Peace Corps language coordinator, Muhammadou Bah. As was stated earlier, the transcripts and translations were largely a summarized version of the interviews and were not prepared as a complete word-for-word record.

It was not possible to compile a complete list of participants in the focus groups because the interviews took place in public forums and were open to anyone who wished to participate. The number varied during an interview and because I was occupied listening and asking questions, I did not keep an exact tally of the number of people. In total, approximately 70 community members attended the five meetings. Of them, about thirty were men and forty were women. As is customary, the women said very little in these forums. In each of the five communities, one to four men with high social positions answered most of the questions. Other community members lent their participation by concurring with the statements made, or occasionally offering unique statements that had not been made previously. However, most of the information came from about twenty high-ranking men in the communities.

Table 4-2 shows the list of codes, or topics, and how frequently they were mentioned in the interviews (listed from highest to lowest frequency). For example, the topic most frequently mentioned was “Tree Planting.” That code/topic was applied whenever someone mentioned something related to planting trees. The code “tree planting” was applied to 28 comments, so out of a total of 241 comments, tree planting was mentioned 12% of the time. It may appear that tree planting was mentioned the most frequently but when you combine all forest uses (firewood, food, herbal medicine and lumber) you get 26% (from 62 comments). Similarly, when you combine all tree planting challenges including biophysical factors and farmers’ assets, there is a frequency of 18% from 45 total comments, nearly twice as many as comments about tree planting.

The topics mentioned the most often are presumably the most important to the local people. However, their frequency is also partly a function of the questions we asked. We tried to lessen this effect by allowing the conversation to flow to topics they felt were most important and they volunteered many points we would not have thought to ask. Some of the responses might be ones they thought I would want to hear most. However, most comments came from village leaders who are not inclined to kowtow and after living in these communities for two years, the residents were increasingly frank with me about many topics. Therefore, I do not believe they were just telling me things they thought I wanted to hear.

Table 4-2: Codes (or topics) listed by their frequency in the comments (out of 241 comments)

Codes for various topics found in the comments	Brief description	# of comments involving this topic	This topic as a percent of all comments
Tree planting	People mentioned this topic the most frequently. This code includes all mentions of actually planting locally available trees, the need to plant trees to combat deforestation, and the need for more information on how to do this successfully. Comments that discussed tree planting techniques such as the use of polypots, transplanting and direct seeding, were also captured by this code.	28	12%
Biophysical factors	These include environmental factors that were reported to interfere with tree planting including soil fertility, rocks, erosion, wind, water, pests like termites, seedling death from natural causes, etc.	27	11%
Firewood	Wood harvested from the forest for cooking or warmth. Including discussion of distance traveled for collection.	19	8%
Farmers' assets	These issues include access to planting resources like water and polypots, and secured land for procuring trees which may require materials like fencing.	18	8%
Local responsibility & permission	This refers to who gives permission to cut trees on land owned by those entities. It can be the community elders, local government, or an individual depending on what land is involved and who owns it. It also refers to responsibility for protection of forest resources	16	7%
Herbal medicine	Medicinal uses of trees. This includes the harvesting of roots for medicine and was offered as a factor that led to tree death and deforestation.	16	7%
Food	Edible tree products as fruits, nuts and leaves that are used by community members for food.	14	6%
Lack of controls	Little or no controls over timber harvesting or land clearing.	13	5%
Forest destruction	This code captures comments describing the change in the forest including increased vulnerability to environmental factors.	12	5%
Lumber	This code was used when they referred to using wood for local fence making, building homes, making beds, etc.	12	5%
Land clearing for farming	The act of clearing land of trees or agriculture waste for farming purposes.	11	5%
Dependency on forest resources	This code was used when respondents mentioned their dependence on forest resources for food, medicine, and lumber, etc.	11	5%
Environmental factors	Natural environmental factors as they relate to deforestation including bushfire and drought.	11	5%
Tree benefits	Other benefits that were mentioned beyond forest uses were captured under this code. These include shade, income, soil stability, and in a couple cases, the connection between trees and rainfall.	10	4%
Training and support	This was often mentioned as a need community members felt with regard to their ability to engage in reforestation and management efforts. In several instances this was conveyed as a direct request for training and education in specific areas.	9	4%
Government	This refers to who is responsible for forest management and protection of forest resources. This code also refers to government disclosure of deforestation problems in the country and the issue that those problems are not spoken of publicly. Only those who use the forest are aware of the problems.	8	3%
Human population growth	Refers to human 'overpopulation' of people in the community that creates so much demand for forest products that it overwhelms the forest's ability to regenerate naturally.	4	2%
Tree extirpation	Refers to the local extinction of a certain tree species. A few species were mentioned by one person as having disappeared from the local forest. Some of these were reported as having value while others were described as having no value.	1	0%
Total number of unique codes = 19	Total number of comments coded	241	100%

4.2 Key themes

I grouped the above codes into three major themes, as follows, and will discuss these themes in the sections that follow.

1. What is the problem?
2. What is causing the problem?
3. What can be done to address the issue?

A table is provided at the end of each theme or topic or set of topics within a theme summarizing important related comments that were made during the focus group interviews.

4.3 What is the problem?

I found two basic problems in Jimbala with respect to forest resources: 1) the forest is shrinking and 2) the people are very dependent on forest products. They recognize that they are totally dependent on the local forest for many essential items and they know that their harvest (along with other factors) is contributing to the disappearance of the forest. First, I will discuss the evidence that deforestation is happening and then I will discuss the extent to which they depend on the forest.

4.3.1 Evidence of forest disappearance

The site for this study was originally set up for an education volunteer by the request of the community. After that volunteer left, the Program Manager for the Environment sector thought it would be well suited for an agroforestry volunteer due to the level of deforestation in the area.

The participants had many comments about the changes that have taken place in the forest. One man told us, “The forest trees are going down and there are no improvements. There were many wild animals like antelopes.” A man from another community told us, “It is said that during our great grand fathers’ generation the forest was very thick... The distance between the two villages was thick and dark.”

Another community mentioned similar changes when asked about forest destruction and animal extinction explicitly:

The forest is destroyed and there are no places for the animals to hide. There was a time when you dare not to go far in the forest, particularly at night [because the forest was so thick]. You dare not to go out at night as far as that house over there [pointed to a distance approximately 150-200 yards away]. Many trees have perished. You can find many herbal

medicines in Kanalai [the former president’s farm in a different region that receives slightly more rainfall], because there are lots of trees. We have seen that the forest has changed because there were things in [it] that you can’t see in [there] now. There was a time when the soil was fertile making a good yield, but now you plant a big farm and get very little harvest.

Upon discussing forest changes, four out of five communities specifically mentioned local animal extinction. Additionally, one person mentioned tree extirpation. That participant spoke of three species that are no longer locally available that were useful. I was unable to determine the scientific name for these species, their local names include Dougout, Katjankume and Soto arjana.

Participants also mentioned different distances they travel daily for firewood and forest resources, ranging between 2-5 km depending on which community was asked. In my village, women would typically spend 45 minutes to an hour gathering firewood every day, and the forest was about a 15 minute walk away. Additional comments about deforestation are included in Table 4-3.

Table 4-3 Some key comments from the communities regarding deforestation

Question	Comment	Community
How did the forest get destroyed like this and why did the wild animals perish?	The forest is destroyed and there are no places for the animals to hide. There was a time when you dare not to go far in the forest, particularly at night. You dare not to go out at night as far as that house over there. Many trees have perished. You can find many herbal medicines in Kanalai, because there are lots of trees. We have seen that the forest has changed because there were things in that you can’t see in now. There was a time when the soil was fertile making a good yield, but now you plant a big farm and get very little harvest.	K1
What is causing forest destruction here? Yakka yakka alla?	People have cut down the trees for firewood, making it hard to find now. You go for miles to get firewood	K1
In your observation, what changes have happen to the forest?	The forest trees are going down and there are no improvements. There were many wild animals like antelopes.	K2
Were there trees that are not found here now?	Trees like ‘soto ajana’ sort of a fig tree, ‘katjankume’ and ‘dougout’ are no more here or are hard to find here. These are plants that were very useful to us.	K2
The changes happening to the forest, when has that started?	The elders can remember how the forest was like in the past compare to the forest today. It is said that during our great grand fathers’ generation the forest was very thick... The distance between the two villages was thick and dark.	K3
How about the wild animals that were in the forest?	Almost all the wild animals are gone or not found here now.	K3
What has made the perished?	They have no safe place to hide.	K3
What do you use the forest for?	People travel 3-4 km for firewood every day and medicine, travel is as needed.	K4
How has the forest changed?	The water table has receded. It used to be 28 m and is now 33 m. More hills cause more erosion. Everything has changed since more than thirty years ago. It used to be that you could see small animals they ate but now just those that ruin farms remain. Lion, tiger, and antelope all used to be there, fox are still there but not many, also birds and bats are fewer.	K5

4.3.1 Evidence of dependence

Questions of dependency were not asked specifically. Statements were marked with this code if statements about a dependent relationship on forest resources were made. This dependence was evident from the heavy reliance on forest products for food, herbal medicines, firewood and lumber.

Another strong indication of their reliance on trees was the number of times participants mentioned tree species and their uses. Overall, there were 130 comments regarding specific trees and a total of 39 different species were mentioned. This is a significant percentage of the 48 species that have been identified in this Central River Region of The Gambia (FAO and MoFEN, n.d.: 53).

It seemed as if anyone could have told me about the trees in their area, and their uses, including children as young as eight. People reacted to my interest in their trees as strange, as if it all was common knowledge, but I found their knowledge to be impressive.

Of the 39 tree species mentioned, 19 were reported as having medicinal properties, 17 were discussed as being used for food from their fruits or leaves, 12 were mentioned as being used for firewood, 8 for timber and 7 as species that are desired for planting. Three tree species were noted as regionally extinct (Soto ajana, Katijankume, and Dougout) and only one species was mentioned as having no use (Kanku). Participants from K2 explained that the tamarind and mahogany trees “have secrets,” implying that there are beliefs about those trees that make them special. These were coded as ‘taboos’ and were responses to the question of which trees were valued. Members from K3 also reported those species, as well as the hiinji tree, as “trees people fear most.” The beliefs regarding the saloum plum tree was explained: “*We also need the saloum plum and there are superstitions that say that if you cut down a plum tree you get into trouble.*”

All of the species that were mentioned are listed in Table 4-4. The table provides additional information for reference including whether the species is indigenous or exotic with an ‘I’ and ‘E’ respectively. It also notes trees that are known nitrogen-fixing species with an ‘N,’ live fencing with an ‘L,’ and if there are taboos with an ‘S.’

Due to the significance of tree species, additional discussion on select species is provided in Appendix A.

Table 4-4: Tree species mentioned from focus groups (in order of frequency, includes species not mentioned in the text but discussed in Appendix A)

<i>Scientific name, common name</i>	Wolof name	Exotic or Indigenous (E/I)	Food (F); Medicinal (M); Nitrogen-fixing (N); Planted (P); Tree Taboos (S); Timber (T); Firewood (W); Live Fence (L)	No. of times mentioned	Frequency (%)
<i>Mangifera indica</i> , Mango	Mango	E	F, M, P	16	12%
<i>Anacardium occidentale</i> , Cashew	Ndarkasu	E	F, M, P, W	13	10%
<i>Tamarindus indica</i> , Tamarind	Daxar	I	F, M, N, S, T	10	8%
<i>Adansonia digitata</i> , Baobab	Bui/Gui	I	F, M	10	8%
<i>Pterocarpus erinaceus</i> , African rosewood, teak, and gum tree	Wen or Ven	I	M, W, T	6	5%
<i>Khaya senegalensis</i> , Mahogany	Xaay	I	M, S, T	6	5%
<i>Ficus platyphylla</i> , Fig tree	Soto	I	F, M, W	6	5%
<i>Diospyros mespiliformis</i> , West African Plum or Ebony (Saloum plum)	Alom	I	F, M, S, W	6	5%
<i>Cordyla Africana</i> , Bush Mango	Dimbu	I	F, M, T	6	5%
<i>Moringa oleifera</i> , Moringa	Nemedye	E	F, M, P, L	5	4%
<i>Combretum micranthum</i>	Bara	I	F, M, W	5	4%
<i>Gueira senegalensis</i>	Ngeeran	I	M, W	4	3%
<i>Parkia biglobosa</i> , African locust bean	Nete	I	F, M, N	2	2%
<i>Gmelina arborea</i>	Gmelina	E	P, T	2	2%
<i>Cola cordifolia</i>	Taba	I	F	2	2%
<i>Cobretum glutinosum</i>	Ratt	I	M, W	3	2%
<i>Citrus sinensis</i>	Sorance	E	F, P	3	2%
<i>Citrus limon</i>	Limong	E	F, P	2	2%
<i>Azadarachta indica</i>	Neem/cassia	E	P, T	2	2%
<i>Anagious viocarpas</i>	Geejan	I	W	3	2%
<i>Combretum nigricans</i>	Taap	I	W	1	1%
<i>Detarium microcarpum</i>	Dànq	I	M	1	1%
<i>Hymenocardia acida</i>	Ekeleñ	I	M	1	1%
<i>Vitex doniana</i>	Lënga	I	F, M, W	1	1%
<i>Lannea acida</i>	Soon	I	T	1	1%
<i>Bombax custatum</i>	Garabu lawbe	I	T	1	1%
<i>Musa spp</i>	Banana	E	F	1	1%
<i>Hibiscus sabdariffa</i> , Roselle	Sissop	I	P	1	1%
<i>Eucalyptus spp.</i>	Xotibotel	E	T, W	1	1%
<i>Celtis intergrifolia</i>	Mbul	I	F	1	1%
<i>Cassia siberiama</i>	Senjeng	I	M	1	1%
<i>Carica papaya</i>	Papakaya	E	P	1	1%
<i>unknown</i>	Hiinji	I	S	1	1%
<i>unknown</i>	Jamtab	I	W	1	1%
<i>unknown</i>	Kanku	I	Not needed	1	1%
<i>unknown</i>	Loodo	I	M	1	1%
<i>unknown</i>	Dougout	I	extinct	1	1%
<i>unknown</i>	Katijankume	I	extinct	1	1%
<i>unknown</i>	Soto arjana	I	extinct	1	1%
<i>Acacia albida</i> , Winter thorn	Kàdd	I	N, L	0	0%
<i>Acacia nilotica</i> , Egyptian thorn	Nèp	I	N, L	0	0%
<i>Ceiba pentandra</i> , Silk Cotton	Benteng	I		0	0%
<i>Zizyphus mauritania</i> , Chinese date or Indian jujuba	Dém or Sideém	I	L	0	0%
<i>Prosopis africana</i> , Ironwood	Hiir	I	N	0	0%
<i>Delonix regia</i>	Flamboyant	E		0	0%
<i>Leucaena leucocephala</i>	Leucaena	E	N	0	0%
Totals	39 tree species mentioned	10 (E) and 29 (I)	17F; 19M; 7P; 8T; 12W	130	--

One of the more profound statements about dependence came from a participant in K1: We asked, “If we neglect the forest until all the trees perish, then what will happen?” One of the leaders responded, “If we leave all the trees to perish, then we will all perish.”

Given the absence of efforts to protect and restore the forest and the dependence on forest products people were reporting, I was surprised to hear this statement. I had expected community members to declare that they would move or leave, not that they would perish. Participants in three other communities made similar comments.

An example of assessing dependence through resource use including firewood, herbal medicines, food and lumber can be seen from the following comment:

The baobabs help us pay our taxes every year [by selling products for cash, see Appendix A for more detail]. We value moringa, bush mango, locust bean fig tree because we use them both for food and medicine. We value mahogany, 'bara' tree and tamarind and 'mbull' tree. We eat their fruits... The domestic animals feed at the forest. We get wood from the forest for fence posts and firewood. We can't mention all the benefits of the forest because there are lots of herbal medicines that we get from the forest.

These statements were similar across the different communities. An example from another community is below:

The bush is used for timber to build fences and roofs and beds. It is also used for food and finance like selling leaves and tree sap.

Community members also spoke of the daily need for firewood, “Before you eat food you must get firewood. So we go to the forest every day to get firewood to cook.” This statement was consistent throughout the communities. One community remarked that if you could not get firewood, it would mean you could not eat. Another said that firewood is so essential that people would collect it “until it is gone”—i.e. until there is no wood left to collect. Another community said they did not have an option but to cut trees because they need the wood for their houses and homes. They often made comments that they had no other choice but to harvest the trees, even though they wanted to conserve the forest. For example, “Sometimes we don't have an option, because we use the wood to make your [our] houses and homes. If you go to get firewood and you cut a living tree, tomorrow it won't be there.”

Additional comments about dependence are in Table 4-5.

Table 4-5 Comments relating to resource use and dependence

Question	Comment	Code	Community
What do you use the forest trees for? You may need the forest trees for firewood or medicine?	We get wood from the forest to make beds. We get fence posts from the forest also.	Lumber	K1
She wants to know the things you get from the forest like firewood, timber and medicine. What else do you get from the forest?	We get food from the forest too. We get tree sap from the forest for cash and our own use like laalo. (used for cooking chere)	Lumber, tree benefits	K1
Do you get other needs from the forest as far as where you get firewood?	Yes we get all our needs from far as where we get firewood.	Dependency on forest resources	K1
How often do you fetch firewoods?	Before you eat food you must get firewood. So we go to the forest every day to get firewood to cook.	Firewood	K1
How about the trees you use for medicinal purposes, how often do you get them?	For those trees we get them only if one is sick, like suffering from general body pain and the like.	Herbal medicine	K1
Why is baobab useful?	We eat baobab. We eat the leaves as sauce (laalo). We eat the fruit juice with porridge. The fruit is also cures general body pain. We use the fiber at the bark as rope to tie things.	Food, herbal medicine	K1
How about mango and cashew?	We eat the fruits and treat it for infections. We eat cashew fruits and use the dry branches for firewood. It also treat diarrhea. If you soak the bark in water and drink it.	Food, herbal medicine, firewood	K1
When do you normally cut wood from the forest?	We cut wood from the forest during the dry season. We cut wood for fencing.	Lumber	K1
Who are the ones, who normally cut them from the forest?	The people making fences, building houses and women cutting firewood.	Lumber	K1
The first question is what do we do with the forest? What does it benefit us?	The baobabs help us pay our taxes every year. We value moringa, bush mango (dimbou), locust bean (nette) fig tree (soto) because we use them both for food and medicine. We value mahogany, 'bara' tree and tamarind and 'mbull' tree. We eat their fruits.	Tree benefits, food, herbal medicine	K2
Is that all the benefits of the forest?	The domestic animals feed at the forest. We get wood from the forest for fence posts and fire wood. We can't mention all the benefits of the forest because there are lots of herbal medicines that we get from the forest.	Tree benefits, lumber, firewood, herbal medicine	K2
Among the benefits you mention like wood, timber, firewood, medicine and other benefits, like selling things from the forest for money. How do you fetch firewood? Is it yearly, monthly, weekly or daily?	We get firewood from the forest every day.	Firewood	K2
How often do you get herbal medicines from the forest?	We get medicine from the forest daily because there are different medicines for different illnesses. Like if one is sick we go to the forest and get medicine for him/her.	Herbal medicine	K2
How do you go about getting fence posts and wood? Do you get them yearly, monthly, weekly or daily? Can we hear from the women? It is like only men answering all my questions.	We get wood when we need them, because it is like we have time for getting wood for different purposes. We get wood for roofing from the forest like when rainy season is approaching. So it means that you don't get roofing woods from the forest daily.	Lumber	K2
How about fruits or food you get from the forest?	We get them when they are available. We get moringa (nebedaye) from the forest too.	Food	K2
Who cuts firewood?	People fetch firewood base on their needs.	Firewood	K2
This was a question about tree benefits	They bear fruits every year that we and the domestic animals eat.	Food, tree benefits	K3
A question about forest uses	The bush is used for timber to build fences and roofs and beds. It is also used for food and finance like selling leaves and dakante (tree sap). People travel 3-4 km for firewood every day and medicine, travel is as needed. Food is harvested seasonally.	Firewood, herbal medicine, lumber, food, tree benefits	K4
A question about forest uses	The forest has use for food from mango, bui, and dimbu and also use for shade and for rainfall (first time someone made that connection, from a female). Also have use for stabilizing soil, firewood, medicine, timber, and green manure.	Food, tree benefits, firewood, herbal medicine	K5

4.4 What is causing the problem?

After asking questions about how the forest had changed, we asked community members about the causes of deforestation. The direct translation in Wolof sounds like, “What is breaking (or destroying) the forest?” *Yakka yakka alla?* There are three primary causes contributing to deforestation in this area: 1) environmental factors like bushfires and drought; 2) land clearing for agriculture; and 3) a lack of controls on the amount of wood harvested. Of these, land clearing is likely to be the most significant. A summary of comments related to deforestation causes are in Table 4-6.

4.4.1 Environmental factors

Environmental factors were mentioned in response to questions about forest changes and forest destruction. Participants from all communities brought up the issue of drought or bushfires or both as it relates to deforestation.

When asking respondents about tree cutting and forest degradation, we asked if fetching firewood was the only factor causing forest destruction. Respondents from K1 stated, “bushfires are the most serious cause of the forest damage.” They also stated that “[forest degradation] is caused by drought and bushfires [and that] some trees fall from natural effects”

Community members in K4 stated that “Bushfire drought and sometimes wind are the causes of deforestation... Overpopulation, uprooting trees for medicine, bushfire, drought which has lasted since 1982 have caused trees to reduce.”

In another community, we asked when the destruction of the forest began:

Natural effects has caused the forest destruction. The distance between the two villages was thick and dark... The destruction started when there was drought. When there was drought trees started to die and tree population decreased. This coupled with bush fires destroyed the forest.

We asked another group, “What do you think would happen if the forest is neglected?” One participant spoke on behalf of the community stating, “You have seen those places where there are no trees have problems of no water. If farmers don’t have rains, that means there is a drought.”

Another community (K3) noted that trees became more susceptible to death during times of drought, “When there was drought trees started to die and the tree population decreased.”

Participants from this same community added:

If there is an outbreak of bushfire at a certain time there is less problem, but at a certain time of the year trees are seriously affected. Even if it rains they don't grow. In the month of June if there is a bushfire trees would die.

It seemed clear from these statements that residents of these communities feel powerless to combat issues like bushfire or drought, which they perceived to be the main elements contributing to deforestation. Statements also imply a disconnection in terms of responsibility, in that these factors are outside of their control. While these were discussed as natural effects, an argument could be made that bushfires are caused by people as a result of slash-and-burn agriculture. Participants also seemed to feel they are not responsible for slowing or deterring land clearing for farming and population growth.

4.4.2 Land clearing for farming and population growth

Participants from all but one community focus group spoke of land clearing for farming as a major contributor of forest destruction. In three out of five communities, participants considered human population growth as the reason to expand farm fields.

This statement from K2 provides an example:

"...Population growth has contributed to deforestation, because more land is cleared for farming... Because the forest between these two villages was thicker. This is caused by two main factors: Bushfires and people activities like clearing for farming and population growth."

Similarly, from K1: "The farming machinery have also contributed to the forest destruction," implying land clearing for agriculture expansion or activity.

Given the growing population of people in this area, community members spoke of land expansion as if they have no other option in order to keep up with growing demands for food. Discussion about achieving greater yields on existing land was not discussed either through questions or on its own. Evidence of land degradation also came through from these discussions, "...There was a time when the soil was fertile making a good yield, but now you plant a big farm and get very little harvest."

Few farmers and community members seem aware of alternative methods for improving crop production. Some discussion of improving soil fertility took place where participants across different communities voiced their interest in learning how to improve soil fertility.

Table 4-6 Comments associated with environmental factors, land clearing for farming and population growth

Question	Comment	Community
Is it only fetching firewood causing the forest destruction?	bushfires are the most serious cause of the forest damage. The farming machinery have also contributed to the forest destruction.	K1
Why did the forest perish?	It is caused by drought and bushfires. Some trees fall from natural effects.	K1
How did the forest get destroyed like this and why did the wild animals perish?	... There was a time when the soil was fertile making a good yield, but now you plant a big farm and get very little harvest.	K1
Why has the forest population reduced?	Because the forest between these two villages was thicker. This is caused by two main factors: Bush fires and people activities like clearing for farming and population growth.	K2
In your observation, what changes have happen to the forest?	... Population growth has contributed to deforestation, because more land is cleared for farming.	K2
When did the destruction start?	Natural effects has caused the forest destruction. The distance between the two villages was thick and dark. The clearing of the land for farming has contributed to the forest destruction.	K3
You have said that the forest was thick in the past. When did it start to be destroyed?	The destruction started when there was drought. When there was drought tree started to die and trees population decrease. This coupled with bushfires destroyed the forest.	K3
Do you have anything to say about deforestation?	The land is very poor. If we can get support to improve the soil fertility, by getting compound fertilizer would help. The government can help in selecting someone among us who will lead us and no one would oppose him in his instructions. But if there is no one who can tell people to go and put off the bushfire, then people may not go. But if there is someone with that authority then everyone would go to put off the fire.	K3
So what can people do to better revive and sustain the forest?	If there is an outbreak of bush fire at a certain time there is less problem, but at a certain time of the year trees are seriously affected. Even if it rains they don't grow. In the month of June if there is a bush fire trees would die.	K3
What is the cause of deforestation?	Bushfire drought and sometimes wind are the causes of deforestation... Overpopulation, uprooting trees for medicine, bush fire, drought which has lasted since 1982 have caused trees to reduce	K4
What is causing the forest destruction?	The sand is brought by erosion increasing the spoiling of the plants. Farming has also increased sand. Clearing the land by burning may cause it also. Burning is done because it's difficult to put the plant residue somewhere. The water table has receded. It used to be 28 m and is now 33 m. More hills cause more erosion. Everything has changed since more than thirty years ago.	K5

4.4.3 Local responsibility & permission and a lack of controls

In trying to better assess local management practices and local controls on resource use we asked who protects forest resources and who gives permission to harvest them. One example of a question relating to this included: “How do people fell those trees, do they get permission from authorities?” Another example, “Who are the people that can go and clear or cut down trees for farming? Can anyone do that here?”

The answers to these questions were often contradictory. Respondents from one village commented that people are responsible for the protection of the trees on their communal land. The interviews also revealed that trees on one's own land could be used without permission and that people

did not have time to seek permission from village authorities for shared forest products from the local forest. Another participant stated, “We just feel that the government gave them permit. If I want to clear my farm, I will ask for the *alkalo*’s permission.”

We asked if, “they get permission from anyone ... [like] the *Alkalo* or the district chief?” They responded, “We don’t normally get permission. It is just based on needs. Anyone who needs anything from the forest would just go for it.”

One community stated that the *alkalo* or village chief is responsible for protecting fruiting trees and that one must get permission otherwise it would be stealing. It was not specified if this statement referred to harvesting of fruit only or if it referred to cutting the tree. A similar sentiment was given for land clearing for agriculture purposes. Respondents stated that the landowner can clear their land and does not need to seek permission from anyone. One commenter did state that permission for land clearing should be sought from the *alkalo*.

Local controls and management were not fully clarified by these interviews. The majority of responses indicate that they are responsible for the trees and tree products on their land and that there is no time to worry about or even seek permission for cutting trees and harvesting products from communally shared forests.

This was also evident from discussions of harvesting wood poles for construction of houses and absence of control with regard to obtaining forest products in general. When discussing the felling of trees, it was not clear if respondents thought that felling would always bring death to the tree or if the tree would survive from root suckers or sprouting by vegetative growth.

Another comment suggests that harvesting products, especially firewood, is harming the forest:

Fetching firewood, digging roots for medicine and cutting down trees, which is most affecting the forest. Cutting trees for firewood. Anywhere you cut firewood there would be no development. People have cut down the trees for firewood, making it hard to find now. You go for miles to get firewood

These comments suggest respondents may be referring to the felling of trees, or the overcutting of branches. We asked, “How do they cut the trees, do they cut the branches or the stem?” One person responded, “Some cut the stem and some cut branches, and the tree sprouts again.”

Several comments about tree cutting and the need for forest products imply that community members feel they have no other choice but to harvest at the level they do:

Sometimes we don't have an option, because we use the wood to make our houses and homes. If you go to get firewood and you cut a living tree tomorrow you won't get it there. If you don't get firewood you won't eat. So you go to the forest and look for dry trees or branches for firewood.

There were several comments differentiated between harvesting dry branches or 'wet' branches. This differentiation implied that they thought dry branches were dead and wet branches were not or that cutting dry branches caused less overall harm to the tree than wet ones did.

We asked when people normally cut wood from the forest, "We cut wood from the forest during the dry season. We cut wood for fencing."

The fact that the people feel they have no choice but to harvest trees may explain why there are not more restrictions on harvesting. Overall, it appears there is no organized control or management with regard to the harvesting of firewood, lumber or other forest products.

In addition to unchecked forest use, not all forest activity is known or reserved to the community that uses it. Participants reported knowledge of 'illegal logging,' from the neighboring country of Senegal. Katim and I explored this with members from K2: "Sometimes you come across a big tree being chopped down. Who does that? Does the government give them permit to cut the trees? Like that mahogany tree chopped down?"

"We the people of the village are not informed about it," was the response from K2 residents. Respondents from K5 offered that "Senegal normally comes to steal timber from Gambian forests." They later expressed that they did not know how to stop or control international theft and mentioned that illegal loggers could be armed with weapons.

One community did state that they will try to catch the illegal loggers and that if they can catch them, they will take them to the chief where they may be held for three or more years. Illegal logging had very few mentions but is a concern and could be contributing to local deforestation. A summary of key comments are in Table 4-7.

Overall, community members seemed the most perplexed about how they could best conserve resources without affecting their daily living. Currently, what is used is only what is needed. Respondents expressed that they cannot reduce resource use beyond what is needed for daily living.

Table 4-7 Key comments about local responsibility, permission and a lack of controls

Question	Comment	Code	Community
Does the government protect them?	Yes, they protect them. The people of the village also protect them.	Local responsibility & permission	K1
Do they get permission from any one?	We don't ask for permission if we are using the wood for building our homes.	Local responsibility & permission	K1
Who are the ones, who normally cut them from the forest?	The people making fences, building houses and women cutting firewood.	Lack of controls	K1
Who protects them?	No one protects them. They protect them when they get fruits up until they are ripe. The community and forestry agents protect the forest too.	Local responsibility & permission	K2
Who manages the forest?	The forest guards and the people of the village.	Local responsibility & permission	K2
Do they get permission from anyone? Do they get permission from the Alkalo or the district chief?	We don't normally get permission. It is just base on needs. Anyone who needs anything from the forest, would just go for it.	Local responsibility & permission	K2
How do they come to cut those trees?	We just feel that the government gave them permit. If I want to clear my farm, I will ask for the alkalo's permission.	Local responsibility & permission	K2
So, does the farmers protect the trees at their own farms?	Yes, any trees at your farm, you are responsible for its protection.	Local responsibility & permission	K2
So the community protects it?	Yes, we thought maybe is the government, the alkalo or the village.	Local responsibility & permission	K4
How do people fell those trees, do they get permission from authorities.	They just go out and clear their land without permission.	Lack of controls	K4
Who are the people that can go and clear or cut down trees for farming? Can anyone do that here?	If it is your land, then you can clear it.	Lack of controls	K4
Answering a question about who cuts trees	Whoever needs the trees can cut them.	Lack of controls	K4
Answering a question about permission	The alkali is responsible for protecting the fruiting trees and must get permission unless you steal it... Senegal normally comes to steal timber from their Gambian forests	Local responsibility & permission	K5

4.5 What are the solutions?

We asked questions to solicit ideas and suggestions from participants with regard to how they felt issues of deforestation and tree planting challenges could best be solved. We wanted the suggestions to come strictly from community members themselves, so we were careful to avoid leading questions like 'do you think you should plant trees?'

Tree planting was offered as the main solution in response to deforestation and forest resource harvesting. Tree planting challenges were mentioned more often as biophysical challenges and farmers' assets like a secure places to grow trees and money for fencing materials. Additional suggestions include a request for more training and support from organizations including from the national government.

4.5.1 Tree planting

Questions about tree planting included asking which trees they plant and how they plant them. A summary of key comments are provided in Table 4-8. Specific questions included whether they use nurseries, where they get seedlings and where they prefer to plant trees. We also asked about polypots (narrow plastic bags used for planting tree seeds) specifically, since this was a method that came up often. We also asked where people could get polypots for planting. In terms of popular techniques mentioned, transplanting, direct seeding, saving fruit seeds and seed treatment (like scarification) were mentioned most often under this theme.

Before you can plant, you need seeds or a seedling. It was not obvious where people obtained these. We wanted to know if people collected seeds in the forest or if they purchased either seeds or seedlings. To model what we wanted to know about local seed gathering, I gathered some seedpods that were lying in a field and showed them to the group. When we asked where people got their seeds, they stated they never thought to plant native trees or to gather seeds from their fields as I had demonstrated. They recognize that their livestock, particularly cattle, rely on certain seedpods as fodder. This could mean that they value seedpods as fodder over potential seedlings.

In another village, one respondent stated that they would visit a friend's compound to get mango seeds. The importance and need for quality seeds came up in a few instances. A few respondents offered that they would save fruit seeds (typically mango seeds).

We also asked questions to determine the level of knowledge of planting techniques. During my two years there, I observed that people rarely planted trees and the few that were rarely survived. I wanted to know if they knew how to treat seeds or plant them properly. Knowing more about their views on planting could help us better understand the situation. We asked, "...how do you plant seeds?" Or, "how do you plant those trees?" Their responses indicated that the people were in fact aware of several seed treatments and techniques. For example, the question of planting mangos was asked specifically, "how do you plant mangoes?" Respondents' answers included techniques of direct seeding, transplanting

and nurseries: “We just plant them directly on the ground. When transplanting, we dig a hole and put manure in and mix it with the soil and then transplant in it.”

A respondent from another community answered: “You peel the seed and plant in a plastic bag [polypot] or dig a hole and plant it there.”

A person from another community answered, “I dig a hole and put manure in it, and then plant in it,” implying direct seeding.

We asked where people prefer or try to plant their trees. Several people replied that they plant in their yards: “We plant them at the back of our compounds. So in case you plant some trees and experience some challenges.” Challenges are described in more detail in the next subsection but include issues of goats or other livestock disturbing seedlings.

The above comments on tree planting demonstrate that people were familiar with direct seeding, transplanting and the use of polypots. They also demonstrate their awareness of seed treatments from comments like “...you peel the seed...” Hot or cold water soaks are recommended for several West African tree species. It was not ascertained if community members knew of these methods specifically or if they had knowledge of which species required which recommended treatments.

Other techniques mentioned included methods to enrich the soil as through manure or fertilizer. I did not ask about manure specifically because I wanted to see what techniques respondents would mention on their own. Based on their comments, it was clear that their knowledge on manure was limited. Manure was volunteered as a technique used for transplanting trees and also as a technique community members wanted more training in. One of the participants wanted to know more about green plant manure specifically. I never observed the use of compost, and it did not come up in the interviews. However, community members were aware that manure can improve soil fertility, but rarely collected it to use in planting crops or trees. I was aware of only one woman in my village who collected animal manure for this purpose.

The interviews were consistent with my observation that people rarely used manure as a fertilizer. I did not observe anything else used as fertilizer and most farmers told me they could not afford chemical fertilizers.

Only one person mentioned mulching as a planting technique. They had some idea that it helps plants, but wanted to know more. Members from K3 made the only comment about mulching and observed that “when mulch is placed around the base of the plant, and you bury the grass along with the plant it can cause a risk of termite infestation.”

Overall, it appeared that several people had experience attempting to plant trees, but ran into several challenges that discouraged them. While the basics seemed well understood, the call for support and training indicate that farmers and residents would like to know more about planting trees. It seemed that they felt strongly that if they received more support and training, their efforts could be more successful.

One resident from K1 explained that the soil was “no good” which was why trees would not grow there. In response, my host father explained that I had grown many trees in my secured backyard or bathing area and that it was the same soil as the rest of the village. After that comment was made, respondents seemed stumped about how to explain why their trees were not growing. This made me think that perhaps they were trying to come up with reasons for their failure to plant trees, as they did not want to say they had not tried.

In terms of potential for protecting and conserving specific species, some were mentioned as being particularly feared or revered. Comments that described these were grouped under this theme because some of the taboos and beliefs that surround certain tree species affect the harvesting of those species, their products and protection. One participant stated that “Hiinji, tamarind, and mahogany are trees people fear most.”

We asked why people fear or value those trees and if they are only valued in the village or if it occurs elsewhere. One respondent stated that “They are valued in the whole of Gambia. We don’t cut down tamarind, saloum plum, fig tree and taba.”

Taba was a tree that was mentioned as one that is not cut because the wood is perceived as not useful:

Taba is a tree that you can’t use for wood or any other thing except the fruits or leaves. That is why people don’t cut them. We also need the saloum plum and there are superstitions that say that if you cut down a plum tree you get into trouble.

An explanation of the ‘type of trouble’ was not specified. Comments about tree taboos and beliefs suggest that they may be effective in conservation efforts.

From personal field observations, I also saw that trees located within burial sites were left alone. People explained to me that there are taboos and beliefs about those trees that discouraged people from harvesting them. Some of these beliefs include the presence of spirits that could be good or evil. In the next section, I present more on possible solutions for reforestation and combating deforestation as suggested by participants of the focus groups.

In summary, it surprised me that it had not occurred to them to gather seeds themselves to plant native trees, whose seeds are readily available, and that they rarely use manure though they are dependent on their crops. However, they are aware of several seed planting techniques such as scarification, direct seeding and transplanting. From these interviews, while it was brought up in K3 that “the way people plant trees contributes to the challenges,” I do not think it is the main reason to explain the lack of grown trees in this area. While there appears to be enough general knowledge in this area, I do think there is room for more knowledge and training.

Nevertheless, there are several challenges to planting, and those are the subjects of the next two sub-sections divided by biophysical factors and farmers’ assets.

Table 4-8 Key comments related to tree planting

Question	Comment	Community
How do you plant mangoes?	I dig a hole and put manure in it, and then plant in it. But they are always destroyed by termites.	K1
Is that the only way you plant trees?	We plant trees in poly pots.	K1
Where do you get the poly pots?	We just recycle plastic bags.	K1
Do you have Agriculture extension workers around to help?	We had support from AVISU, that gave us poly pots to grow plants. It went well the first time. We transplanted the trees in the garden but because we had water problem they all died.	K1
In your views what can you do to restore the forest?	We can restore the forest by planting more trees. If we collaborate with the forest agents to help us with seedlings and protection, that would help. If we are train how to use local manure would help, because the chemical fertilizer is not good to the soil.	K1
Which trees do you plant?	They include mango, cashew, lemon, neem and nmalayna.	K2
How do you plant those trees?	You peel the seed and take a plastic bag or dig a hole and plant it there.... We plant trees by digging a hole and putting manure in a plant.	K2
What can we do to improve or revive the forest?	... [people] need to replant trees by planting all types of trees they can find during the rainy season.	K2
What plans do you have to improve the forest?	... planting more trees is the solution. Planting trees and caring them.	K2
What can we do to improve the forest?	If we want to improve the forest, we must plant mangoes and cashews. That can improve the forest.	K2
Do you have any comment or contributions?	Caring of the plants is the challenge.	K2
How do you plant these trees?	We plant them during the rainy season.	K3
How do you plant them in nurseries?	We peel them and plant them in poly pots.	K3

How about you the women, how do you plant seeds?	We just plant them directly on the ground. When transplanting, we dig a hole and put manure in and mix it with the soil and then transplant in it.	K3
Where do you get you seeds?	We got mangoes in the mango season.	K3
Do you get seedlings from somewhere?	No we normally plant it on our own. I got my seeds from [a woman's] garden, after when I ate the mango fruits.	K3
We the people of the community should think and make plans to revive the forest. What plans do you have to revive the forest?	Planting more trees can help.	K3
Are you ready to plant more trees?	Yes, we are ready.	K3
Are you ready to plant more trees in the forest?	Yes, as I said, by the time you come back here you will see by yourself.	K3
Do you plant trees around your houses and at you farms?	Yes. We have no plan to plant trees in the forest, but in a yards and farms, because we can't protect the trees in the forest.	K3
A question about which trees are grown and where	They try to grow mango, cashew Moringa by direct seed and transfer and polypoets doing so behind their houses but water is their problem.	K4
A question about which trees are grown and where	Mango, Cashew, Sissop (karasow), limon and orange are desired and planted. They have not tried or thought to plant bush (native) trees... They try direct seeding and transplant and will do in their bathing or bath area (wanag) in the backyard (outside)	K5

4.5.1.1 Biophysical factors as planting challenges

The discussion of tree planting indicated that people felt it was important to plant trees and that they were trying to plant them based on their knowledge of planting techniques and recollections of past experiences. One of the big questions we had was, if all this tree planting activity was going on, where were the trees? Having noticed this discrepancy, Katim and I decided it was important to ask what people felt were the challenges to tree planting. These questions were inspired in part by the answers we were receiving about tree planting due to the challenges that were brought up simultaneously and also by the observed lack of success of established trees in these areas.

This comment from K4 is an example of a common response highlighting several challenges:

Problems are the watering and obtaining good seeds. We try direct seeding and transplant and will do it in our bathing or bath area in the backyard (outside) but encounter termites, and lack of good fencing. Stones or rocks in the ground are also a problem. The soil also has no strength.

Table 4-9 summarizes the breakdown of challenges by topic and the frequency in which they were discussed.

Table 4-9 Summary of topics that came up under biophysical challenges to tree planting

Code	Number of mentions	Frequency topic was discussed compared to other challenges
Pests (termites and animals)	9	33%
Water	7	26%
Soil fertility	4	15%
Erosion and sand encroachment	3	11%
Seedling death by natural causes	2	7%
Rocky soils	1	4%
Wind	1	4%

Pests including termites and animals like goats received the most comments with regard to biophysical challenges. As mentioned previously, termites were frequently cited as a threat to seeds and seedlings receiving more mentions than goats, other livestock or other insect pests: “I dig a hole and put manure in it, and then plant in it. But they are always destroyed by termites.”

Nearly every person I spoke to about tree planting, both formally and informally, complained of termites. Termites also compromised my Peace Corps housing to the extent that I had to temporarily vacate it for repairs. Termites came in through the ground, walls, and damaged wood frames and wooden roof posts. Before a tree nursery could even take root, termites would damage the seeds if precautions were not taken. When asked about methods to combat termites, some people spoke of waste oil, chemicals, or other poisons. Creosote oil was the preferred treatment, but few community members could afford it. Few community members, if any, also knew of the technique of applying plastic-free wood ash to garden and tree pits. Plastic-free wood ash was not easy to come by as plastics were commonly used as kindling to light cook fires. Wood ash was a best-practice technique agriculture volunteers were trained in, but community members did not easily adopt the practice.

Water was another major challenge. There were no questions that asked respondents about their water problems specifically. All discussion of water challenges were volunteered when we asked about tree planting challenges in general. Upon their discussion of erosion and other issues, participants from K5 stated that “The water table has receded. It used to be 28 m and is now 33 m.” This was essentially the only focus group that discussed water table depth increases as a connection to forest changes. One

issue with this is that the Ministry of Agriculture does not promote, encourage or support garden projects in areas where the water table is greater than 10 meters in depth.

Respondents from K4 described certain trees they try to plant and cited at the end of the statement “...but water is our problem.” Based on my field observations of various garden and tree planting projects, I noticed that the success of tree nurseries or transplanted trees depended greatly on the proximity to water. A statement from K1 reflects this observation: “We had support from [the local NGO] AVISU that gave us polypots to grow plants. It went well the first time. We transplanted the trees in the garden, but because we had water problem they all died.”

This ‘water problem’ was not specified but could refer to a number of issues. One of the more common water problems I observed was the chronic breakdown of hand pumps. When this occurred, if communities were not prepared, the pump could be left in disrepair for extended periods due to the cost of repairs. The problem could be the additional time and work it takes to carry water to the trees, which I know from my own experience watering a small tree nursery as a Peace Corps Volunteer.

Tree planting projects need to be placed in a protected area (secured by a fence or other barrier that is effective at keeping livestock out) with easy access to water, which raises the cost extensively if a well needs to be dug. Katim (my translator) suggested saving some bath water for trees that are planted in one’s outdoor bathroom and bathing area locally referred to as *wanag*. Buckets of approximately 5L are used for bathing with 1L cups for rinsing. Peace Corps Volunteers referred to this as a “bucket bath.” Katim had several trees in his *wanag* where he swore by this method because the area is in most cases, secure, and also frequently has containers of water brought there for bathing and washing. A tree planting project I led as a volunteer failed because access to water was not nearby. We transplanted 100 gmelina trees in an effort to combat erosion. Community members decided they would be best located near a road that had experienced severe damage from runoff (see Figure 5). The trees were planted during the rainy season. In Figure 6, the dry branches are meant to protect the gmelina cuttings after planting.

Community members were instructed to water the trees during times of no rain and warned that the trees would likely die if they did not receive enough water. The trees were approximately 100 yards from the nearest hand pump. Over two hundred liters was needed to water the trees twice a day. The best time of year to plant coincides with the farming season when people are the busiest. Common water containers included 10L oil jugs, or 15-20L open round plastic basins. Delivering 200 liters of water (for one hundred trees, as in this example) would have required approximately 20 trips with an oil jug (*bidong*) or 15-20L (33-44 lbs.) container (*pan*). These water containers are not easy to come by; they are in constant use by community members for fetching water and doing laundry. The men engaged in the project

ultimately were unable to water the gmelina saplings on a regular basis and they all died. Figure 5 Erosion gully near Jimbala



Figure 6 gmelina tree planting project in Jimbala. Branches were placed over the seedlings to retain moisture.



Soil fertility was brought up as a serious challenge where practices like slash-and-burn agriculture may contribute to soil degradation and erosion. Questions about soil fertility were not asked specifically. It was stated as a challenge by comments like “the soil also has no strength.”

Slash-and-burn agriculture is commonly practiced and subjects villages and fringe forests to bushfires. Upon asking why fields are burned, outside of these focus groups, people would tell me that they do this because their fathers and grandfathers did it. Some admitted that they knew it was bad but did not know any other method. Others believed it was the best way to provide nutrients to the soil. Several farmers told me they would like to have farm equipment and fertilizer and would use those instead of burning crop waste for farm clearing. A participant from K5 explained that they did not have any other place to discard plant residue. Turning it into the soil by hand would have been a major undertaking on top of already laborious work. There were also concerns that material like this would attract more termites. Using it for compost or fuel were relatively new concepts and required new techniques and additional time and labor. A stove was locally developed to use plant residue for cooking. This stove was gifted to my host mother for anyone in the community to use. A demonstration was made and attendees appeared interested and grateful. After the demonstration, the stove collected dust, unused.

Only one community (K5) spoke of issues and challenges of erosion (see photo of a gully from Table 3-1 and Figure 4) and sand encroachment.

The sand is brought by erosion increasing the spoiling of the plants. Farming has also increased sand. Clearing the land by burning may cause it also. Burning is done because it's difficult to put the plant residue somewhere... More hills cause more erosion. Everything has changed since more than thirty years ago.

Again, upon asking why they think these changes have happened, they described biophysical and environmental factors like drought (translated as broken rain). When asking what caused the 'broken rain,' a village leader explained it was due to the disappearance of trees.

The last few comments captured by the "Biophysical factors" code include issues of wind, rocky soils and seedling death. In a couple cases, respondents described that their seedlings would die or get destroyed but did not elaborate how. Similarly, for rocky soils, one person commented that the rocks would disturb the seedling. In another case, someone suggested that if the plant were not pressed firmly, wind would enter the ground and kill the seed.

4.5.1.2 Farmers' assets for tree planting as challenges

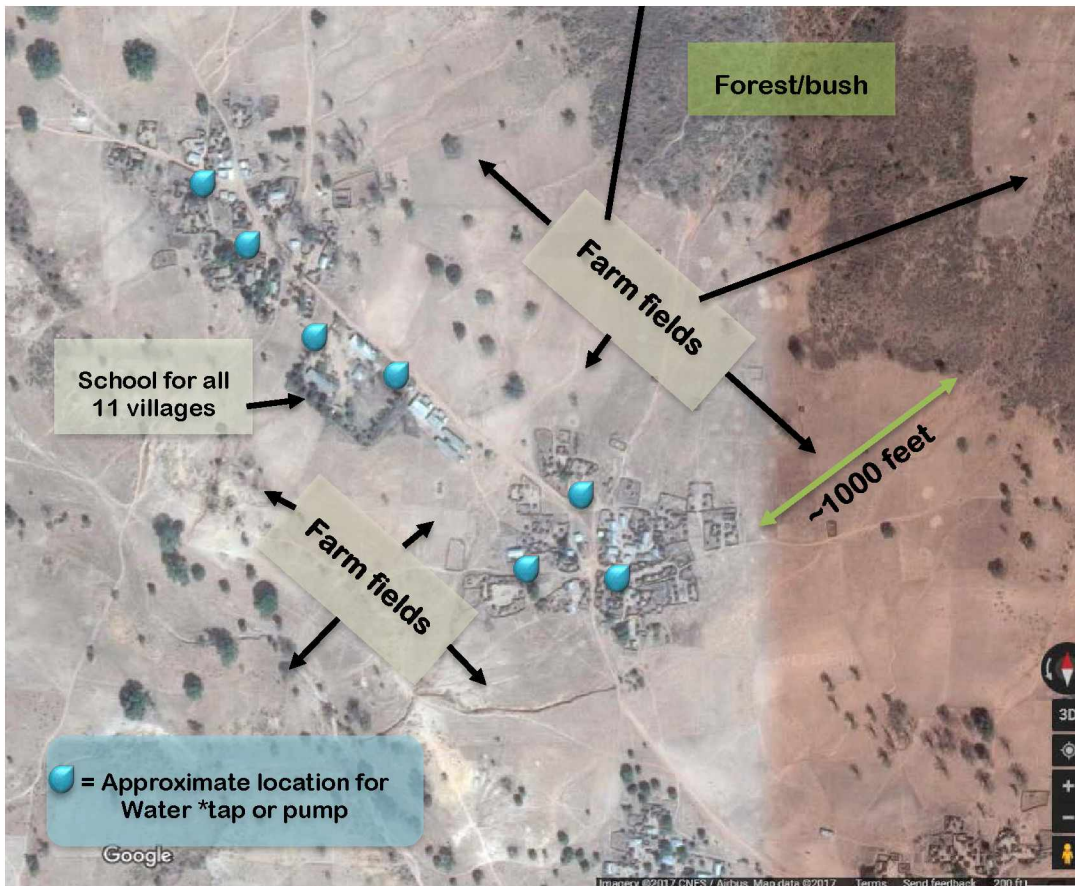
One of the more profound statements from these interviews was this one about planting in the forest, "We have no plan to plant trees in the forest, but in our yards and farms, because we can't protect

the trees in the forest.” Even though I had not observed any planting in the forest, I was still surprised to hear this, especially when tree planting was proposed as a solution for combatting deforestation. I thought they would want to plant them in the communally owned forest.

Upon reflection, it made sense to me when I considered the logistics of caring for seedlings in the forest. The forest can be a long distance from any water source. It is also as they said, difficult to protect trees there unless using individual tree guards which still require either purchasing a guard or making one and then transporting them to all of your seedlings. The forest is also open to anyone that wants to use it. Surveillance of trees in the forest would be difficult if not impossible. There are greater risks that trees could be taken or killed by other causes after investing personal time and labor. Figure 6 provides a general layout of some villages relative to farm fields, the forest, and water sources to help visualize this situation.

The concept of protecting trees on private yards and farms are aspects of farmers’ assets. This also includes materials for securing land or trees with a barrier like a wall, fence or tree guard and access to planting resources.

Figure 7 Layout of villages relative to farm fields, the forest and water sources



Source: Google Map Data retrieved June 15, 2017

*This area qualified for water assistance after a countrywide assessment from the Japanese government and was gifted a large solar borehole. This added a number of water taps throughout the villages allowing community members to collect water from a spigot instead of a laborious hand pump

When people mentioned their need for fencing, it seemed as if they meant fencing material that you could buy like chain link or chicken wire. This type of fencing seemed to be more highly valued compared to live or local fences. Some of the challenges with regard to this type of fencing is of course the cost for purchasing materials and labor for erecting the fence. These more expensive fences, which are almost always erected through the help of an NGO or local community organization, can still wear down within a year or two, especially if aggravated by large animals or humans.

Members from K1 described the problem they face without proper fencing in their yard:

If we get polypots for planting seedlings, we will plant them in our yards. Stray goats are our problem. They ate all my trees. If not I would have got many trees now. I planted some trees until they grow to a point and the goats destroy them, because I have no good fence.

Goats push their way through most local fences if they are weak or in disrepair to search for food waste or peoples personal vegetable gardens. Goats and all livestock roam free through the communities and cause much havoc. It is not common to see any of them tied up.

Participants from one community also mentioned their difficulty obtaining quality seeds. The same community that admitted they never thought to use local seeds. It could be that they thought quality seeds need to be purchased and that local markets rarely sold them.

A summary of key comments related to tree planting challenges including biophysical factors and farmers' assets are listed in Table 4-10. Table 4-10 Key comments related to tree planting challenges

Question	Comment	Code	Community
What challenges do you have in planting trees?	Fencing and protection. Lack of poly pots. If you plant the trees in poly pots they grow well, but if planted directly on the soil they are destroyed by termites which results to their death. Getting poly pots is a problem or if you get them, having a secured place is another problem.	Farmers' assets, biophysical factors	K1
Where do you plant mangoes?	If we get what I said we will plant them in our yards. Stray goats are our problem. They ate all my trees. If not I would have got many trees now. I planted some trees until they grow to a point and the goats destroy them, because I have no good fence.	Farmers' assets	K1
Where do you plant your trees?	We plant them at our back yards.	Farmers' assets	K2
What are your challenges?	Our land has a lot of termites.	Biophysical factors	K2
Do you have any other challenges, is it only the termites?	The way people plant trees contributes to the challenges because one has to dig a hole, pull out the soil and put the top soil back in the hole along the plant and press firmly. If it is not pressed the wind can pass through at that would crack the soil that can lead to the death of the plant. Watering in the dry season should be weekly like Sunday to Sunday...but if you bury the grass along with the plant can cause a risk of termites infestation.	Biophysical factors	K2
In response to a question about how to improve the forest – and issues with tree planting	... [If we] get fencing materials [that] can help [us] protect the plants from animals.	Farmers' assets	K2
You have said the ways you plant, now have they grown to trees? What challenges did you have now?	Fencing is our problem. If the fence is good you likely don't have problems.	Farmers' assets	K3
What did you do about the termites?	We have no solution about preventing termites. We want Rohey to help us with good seed varieties.	Biophysical factors	K3
In response to tree planting issues	The require resources to plant the trees. They want knowledge in manure and pest control as for termites for planting them	Biophysical factors, farmers' assets	K4
Problems related to tree planting	Problems are the watering and obtaining good seeds...[also] encounter termites, and lack of good fencing. Stones or rocks in the ground are also a problem. The soil also has no strength.	Biophysical factors	K5
In response to a question about how to restore the forest	They need to plant trees but don't have seeds and don't normally go look for them	Farmers' assets	K5

4.5.2 Training and support including from the national government

A request for more training and support was also brought up. In order to assess their desire to improve planting outcomes, and to gauge the awareness of available resources, we asked where people could go for assistance with tree planting or gardening. Respondents from K2 felt that “Both the government and the community should join hands to improve the forest.” Respondents from K3 said that they did not feel there was any help or support available to them, “we don't have any place for help if we have such challenges.” Participants stated that they wanted help with techniques that would improve soil fertility like manure and green manure specifically, and techniques in pest control for termites.

The closest forester with the Ministry of Forestry for this community was posted in the nearby town of Kaur which is approximately 10 km away or a 1.5-2 hour walk, 45 minute long horse cart ride, or 40 minute bike ride. This agent stated that foresters would at times grow trees to give to communities

(similar to what was mentioned about the local NGO, AVISU), help educate communities about wildfire prevention, and also assist them in enrolling their forest into a community forest management program. Although, throughout my two years, I never witnessed any of these trainings or offerings. Educating rural villagers on tree nursery establishment, transplanting trees, and general plant care were not offered by the Forest service. The organization, AVISU, admitted they did not offer those trainings either, but provided support and assistance in promoting vegetable gardens for women, establishing shallow foot bridges in rice fields and marshy areas, and growing trees to offer to community members from time-to-time when resources were available.

There were also a number of comments desiring more support from the Government of The Gambia. However, Katim cautioned community members about putting all of their faith on government support:

If you put the responsibility on the government, that would not solve the problem. If the VDC [Village Development Committee] knows their responsibility many a times these problems may not happen. In some cases people are selected as VDC members and they don't know their functions. The VDC's roles include the management and development of the village.

The Village Development Committee (VDC) is supported through the government of The Gambia and supposed to be active in each Gambian village. The VDC is intended to support local village needs including road maintenance, local storage structures for crop and seed storage, farming assistance, etc. Small amounts of financial or other support could be petitioned from government departments or agencies where VDC members would help orchestrate and organize those requests. The VDC in my community appeared to be inactive.

A fellow volunteer and I hosted a VDC training with a government official whose job was to support these groups. Unfortunately, the government official was only able to assist VDCs when asked, yet few people knew he was available to offer assistance let alone knew what assistance to ask from him. The training provided a general overview of the VDC and members' roles. The two villages were then encouraged to develop short-term goals to accomplish within a set time-frame. A follow up meeting was supposed to occur but was cancelled. Scheduling meetings such as these was often difficult. If farmers are not preoccupied with the farming season, there is a 'wedding season,' 'holiday season,' etc., that keeps farmers and community members occupied.

This issue of time was not documented from the interviews but was observed as a major factor that barred individuals from being able to participate in additional trainings or activities with regard to agriculture and tree planting. The main issue was not that there was not enough of it, but that things often came up with greater priority than scheduled items like meetings. So scheduling and making future plans was difficult

In order to better assess the extent to which people felt the government are responsible for forest issues we asked, “Who should be responsible for developing the forest, is it the government, community...?” Respondents answered, “Both the government and the community should join hands to improve the forest.” We continued asking questions:

Katim (my translator): “So the community protects it?”

Answer: “Yes, we thought maybe is the government, the alkalo or the village.”

Katim (my translator): “Does the government protect them?”

Answer: “Yes, they protect them. The people of the village also protect them.”

That conversation suggested that both the community and government are responsible for the sustainability of the forest but that the roles that each might play are not explicitly clear. While asking about the benefits of the forest, one respondent mentioned that the benefits were too many to describe and that “If you hear the government talking about Gambian forest, if you don’t go to the forest you would not know about the forest problems.” This was only one comment that suggests the government does not acknowledge or address forest management concerns or problems. It should be known that at this time, under the current president, you were not permitted or safe to speak ill of the government. There were numerous stories of secret agents arresting anyone who had a negative comment, even if was simply a statement about not being happy. The previous dictator, Yaya Jammeh, had a poor reputation for how his government treated Gambians and especially perceived criminals. At one point, he was named the number one violator of human rights according to Amnesty International. This could explain why more comments like this were not made.

If this statement was true, which could at least be substantiated from the lack of support from the local forest agent and other statements implying a lack of support from the government or elsewhere, it could be difficult to receive support if the government does not acknowledge the problem.

A summary of comments related to training and support and government are provided in Table 4-11.

Table 4-11 Summary of comments related to desired assistance from government and training

Question	Comment	Code	Community
In your views what can you do to restore the forest?	... If we collaborate with the forest agents to help us with seedlings and protection, that would help. If we are trained in how to use local manure that would help, because the chemical fertilizer is not good to the soil.	Government, training and support	K1
In response to forest issues	If you hear the government talking about Gambia forest, if you don't go to the forest you would not know about the forest problems.	Government	K2
Who should be responsible for developing the forest, is it the government, community or God?	Both the government and the community should join hands to improve the forest.	Government	K2
So what can people do to better revive and sustain the forest?	The government must support in this case... We need support from the forestry department	Government, training and support	K3
Do you have anything to say about deforestation?	The land is very poor. If we can get support to improve the soil fertility, by getting compound fertilizer would help. The government can help in selecting someone among us who will lead us and no one would oppose him in his instructions. But if there is no one who can tell people to go and put off the bushfire, then people may not go. But if there is someone with that authority then everyone would go to put off the fire.	Training and support, government	K3

4.6 Comparing the results to the literature

The discussions and statements from these interviews imply that community members rely heavily on forest resources for everything from food to fuel; yet, there were very few statements about forest management or conservation to ensure resources for future generations. This dependency is consistent with the literature where Eva et al., (2006) explain that approximately 320 million people (from a 2000 estimate) in Sub-Saharan Africa inhabit and rely on forests and their resources to support their rural livelihoods.

The results also suggest that these forests are diminishing primarily through agriculture expansion. Statements provided evidence of forest disappearance and changes including those stating that it used to be thick and dark, and others explaining that there used to be more wild animals. This is consistent with the FAO (2016a) report that forests of every climactic zone (except temperate) are being reduced where one of the main causes includes agriculture expansion.

Environmental challenges that may be related to climate change, such as drought and forest or 'bushfires,' were reported in our interviews, which is consistent with the IPCC (2014) report. Other causes include a lack of controls with regard to timber harvesting. The literature also suggests that corrupt governments have not been able to properly conserve forests. Several authors have shared

instances where relaxed government intervention improved conservation (see Marks, 2002; Tougiani et al., 2000; Quisumbing, et al., 2001; Frayer et al., 2014; Xu & Jiang, 2015; and Garrity et al., 2010).

However, a number of comments indicated that community members would like more support from the government. The type of support specified included greater knowledge and training in certain areas to improve soil fertility and better combat pests like termites. Discussions of forest policies and regulations did not occur.

In terms of a solution, tree planting was mentioned with the greatest frequency. Yet, evidence of successful planting was not observed. Mercer and Pattanayak (2003) determined that biophysical factors and farmers' assets (or resource endowments) are two of four main influencing factors for agroforestry and tree planting adoption. This was shown to be major influences in the study by Meijer et al., (2015) and were also consistent with my results in that there were many comments related to both of these factors.

Additionally, one study by Meijer et al., (2015) showed that laziness was one of the most reported factors coming in between farmers and their engagement in tree planting. Laziness did not come up in my focus group interviews or from my participant observation. A key difference is that in their study, a survey was used to collect data in which "laziness" was a box that could be checked. In my study, if we asked about laziness directly, it might have come up more. However, I think it is important to question what laziness meant to those farmers that admitted it from the Meijer et al., study and also question the accuracy of those admissions. Based on my observations, there was not enough time to be lazy. It took a lot to keep someone from working (like a serious illness for instance). During the month of Ramadan, which occurred during the hottest part of the year (between July and August for 2012 and 2013), farmers would work in their fields all day while fasting, including from water. Personally, I would not cite laziness as a reason to explain the lack of tree planting in this area.

In summary, there are several results that compare to those from other studies. These include land clearing for agriculture as a primary contributor to deforestation (FAO, 2016a) and environmental challenges from climate change (IPCC, 2014). Biophysical challenges and farmers' assets were also shown to be influential in tree planting adoption as shown by Mercer and Pattanayak (2003) and Meijer et al., (2015).

Chapter 5 Conclusions

5.1 Purpose of the research

The main question and inspiration for this study came from the observation that communities in this region have a deep dependence on forest resources. This dependence includes daily needs like food, fuel for cooking and wood for building houses. Communities stated that if their forest disappeared, they too would disappear. This represents a profound reliance on these resources, yet efforts to conserve them appeared meek at best. Given that they are so dependent on the forest, I wanted to find out why greater efforts were not being taken to conserve the forest for future generations. My primary research questions were:

1. Did the local people see deforestation as a problem?
2. To what extent were the local people dependent on forest products?
3. If so, what did they feel were the causes of it?
4. What did they think should be done to solve it?

5.2 Key findings

Communities explained that their forest is changing and there were no improvements in sight. Elders in the community stated that they could remember a time when the forest was thick and dark and had more animals that cannot be found now. Other changes that were mentioned included an increase in the water table depth from 28 to 33 meters and erosion issues including an increase of sand.

It was also evident that the dependence on forest resources was great, even though there had been significant changes. Participants from nearly every focus group admitted that they would disappear if the forest disappeared, that they would perish. Participants also spoke of several tree species they use and rely on for everything from fuel to food. Eighty one percent (39 of 48) of known tree species in this area were discussed where only one was mentioned as not having any use and three were described as extirpated.

Participants in my interviews felt that forest destruction is mostly caused by environmental factors like drought and bushfires as well as activities including land clearing for farming. Several participants linked the need to expand agriculture land to their growing population and increased demand for food.

In terms of solutions, respondents discussed tree planting as an important response to cutting trees down but it was met with nearly twice as many comments about challenges. Those challenges included

biophysical ones like soil fertility, water, pests, rocky soils, etc. They also expressed a desire for more training and knowledge in the area of soil fertility including techniques like manure, including ‘green manure.’ They also requested greater support from the government in general.

5.3 The significance of the research

This case study relied heavily on those who rely on forest products for their rural livelihoods. It gave them an opportunity to voice their views on forest issues, challenges and solutions. I found few other studies that considered people’s perspectives on forest issues as a whole as this study did. Other studies focused on either specific forest species or tree planting. This study also provides a baseline of local knowledge of their forest issues. This baseline can be useful for people interested in assisting communities like this as it describes what they know, what they do not know, what they want to know, and what they hope to achieve.

5.4 Implications of findings

Adding trees to an environment that is losing them seems like a common sense way to combat deforestation. This study reveals however that there is: 1) no interest in planting trees in the forest where farmers cannot protect them; 2) tree planting efforts have been met with little to no success; and 3) more knowledge about the immediate benefits of trees as well as best planting practices may be needed in order to intensify efforts and improve results.

While I was successful planting trees in my small backyard space (secured by strong corrugate fencing), others may not have been afforded the same time to commit to those efforts or had secure places in which to plant. It is possible to grow trees in this area. This was observed by the few established mango and cashew trees that had been planted, and from my own experience. Fast growing species like moringa or leuceana may only need watering and protection for the first 6 months – 1 year until they are able to survive on their own. Local thorny species like *Acacia nilotica*, *Acacia albida* and *Ziziphus mauritiana* were not mentioned as important species but may also be worthwhile for planting as their thorns could prevent disruption from goats.

Finally, much has been written about community based natural resource management and communally owned forests, as well as the difficulty in managing common property resources (Ostrum, 1990). For this community, there seemed to be a challenge of organization and structure in terms of forest resource use. Respondents stated that anyone could use the forest at any time and that you did not need permission. There was only one comment that said otherwise. While community organization can

be very powerful, it requires leadership, structure and incentive. I did not get the sense from these communities that anyone wanted to take any initiative to change their situation even though they reported a life or death dependency on said resources. That is very surprising. The literature indicates that decentralized government control of forest resources can be effective. However, there were no issues brought up complaining about too much government control in this case. If anything, there was a request for greater involvement and support on the part of the central government.

5.5 Limitations of the study

As with any study, this one had its limitations. There were several challenges carrying out this research in a foreign location and in a foreign language. The language barrier made it difficult for me to navigate interviews and conversations alone. It also made me dependent on others to translate and transcribe the interviews and content. It is possible that nuances in translation and transcription may have effected these results. The results are also limited in depth because two of the communities were not transcribed so I had to rely on my field notes. They are further limited due to my dependence on a translator.

As far as the scope of this study, I would have liked to have collected more data from more communities including individual interviews and follow-up interviews. Scheduling or coordinating these, as was previously mentioned, was a difficult thing to manage and further hampered by my dependence on a translator. Residents in these communities are not used to being interviewed by Westerners. Showing up in a community with a tape recorder and notebook can be intimidating. I observed Gambian aid workers conduct surveys from time to time in my community so I know it was not the first time some residents were questioned about certain aspects of their lives. However, those workers were fluent in the language and culture. While my counterpart was Gambian, I was not and my presence may have affected some of the responses we received. Again, I was able to substantiate many of the comments from participant observations that occurred over the course of two years.

Despite these limitations, I think the study makes a contribution to understanding how much local people rely on forest products and what they believe are the causes of deforestation as well as how to solve it. To my knowledge, this is the first study of local people's relationship with their forest in The Gambia. No solution will be effective if those promoting it are not fully aware of the challenges local people face and what their needs are. This further aligns with a key suggestion from the FAO (2014, vii), which called for data collection to "focus on people – not trees alone."

5.6 Recommendations for forestry work and research

First, if tree planting is not working, (which was evident from the discussion on challenges and experiences as an agroforestry volunteer serving in this area) I would propose that greater efforts be placed in exploring the viability of FMNR for this region. FMNR is again one method that has been shown to be successful in “adding” trees and does not require laborious tree planting and seedling care. Several native tree species have robust root systems and vegetative growth from root suckers. They can coppice meaning they can sprout again depending on where the cut is made on the trunk and the species.

Several farmers seemed unsure of nitrogen fixing abilities of trees but did know that nitrogen-fixing trees tend to contribute to soil fertility because in many instances, nitrogen-fixing trees produce fodder that cows prefer which means manure is being added to the soil naturally. Manure is something farmers contribute to soil fertility though they request greater training and knowledge in it in order to improve their efforts. Providing greater education about nitrogen fixing trees and the benefits trees could have on their farm lands may help convince hesitant farmers to experiment by leaving certain trees on their farms. If soil fertility and stabilization improvements can be demonstrated in a few seasons, farmers may be more encouraged to allow certain tree species to remain on their fields. Seeing the benefits of established trees could encourage greater tree planting efforts. It could be that tree planting efforts have not been successful thus far due to the perception of risks outweighing the benefits.

I would also encourage researchers and organizations such as Peace Corps, local NGOs, and the Gambian government to consider the following:

- Further investigation into the reasons people may not be planting trees in this area would be worthwhile since successful tree planting is an essential component for combatting deforestation. This would include exploring some of the influential factors as determined by Pattanayak and Mercer (2003), Meijer et al., (2015), Mahapatra and Mitchell (2001), and Sood & Mitchell (2004).
- Efforts to educate and help rural subsistence farmers improve crop yields on current farmland could help reduce pressure on existing forests and slow farm field expansion.
- A more thorough investigation of farming practices and factors that influence farmers’ decisions to either plant or harvest trees and expand or not expand their fields could also be worthwhile.
- Consider programs that train farmers in best practices in agriculture and tree planting, including agroforestry and FMNR. Membership of a farmers group, for instance, was shown to be strongly

correlated to tree planting and agroforestry adoption by Meijer et al., (2015: 6) and Mahapatra and Mitchell, (2001: 45).

- Re-visit current laws related to resource rights and uses of grown trees on private lands. Construct policies to incentivize and encourage private landowners like farmers to plant trees on their land and farm fields. These policies should consider market access for selling products, as further incentive for growing and caring for trees on private lands. These should also include indigenous tree species to encourage their growth and restoration in areas where they are being diminished.
- More research on local species in these areas, particularly those that fix nitrogen to determine how they might improve agriculture fields would also be important and can support FMNR and other agroforestry efforts
- Research exploring more about taboos and beliefs of specific species and their cultural value could be useful as species to continue to promote based on local spiritual beliefs.
- These communities are impoverished. Exploring monetary incentives for forest management or tree planting, including carbon credits, could be worthwhile and effective at both combatting environmental degradation and assisting with poverty reduction
- For all of these recommendations and investigations, efforts should be made to include women. Women are often the ones harvesting forest products. They are also active farmers and in some cases, own their own farms or are the heads of their household. Previous studies have shown that women are less likely to adopt tree planting practices where authors suggested the hesitancy was related to a lack of involvement in trainings or other educational opportunities (Hines & Eckman, 1993; Gyau, et al., 2012).

Overall, greater consideration and attention should be given to these dry tropical forest ecosystems which appear to be vulnerable to overharvest, land clearing and climate change. People are so dependent on forest products that the loss of these forests could be life threatening and cause them to abandon their lands. Displaced persons from destroyed (resource poor or insecure) environments pose serious challenges and even security threats in their own nation and others. Practical and effective solutions are challenging but must be given greater attention and focus in order to slow the progression of deforestation in these areas.

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Appendix A: Important tree species

Mangifera indica, mango and Anacardium occidentale, cashew

The results from Table 4-4 show that the tree species with the most mentions are nearly all fruiting trees with medicinal properties. The two most mentioned tree species were mango and cashew trees which are both exotic. I was not surprised to find that these trees received the most mentions. It was in line with my observations and experience as a volunteer.

Mango fruits were very popular and a warm weather staple. This note from Access Gambia sums up the ‘mango culture’ well with this statement: “Mangoes are the most ubiquitous fruit as they can quite often be seen rotting everywhere particularly in the rural areas due to their sheer abundance,” (AccessGambia, n.d.). The history of *Mangifera indica* was difficult to obtain. Mukherjee (1972) wrote of the ‘Origin of Mango’ and states that all 41 valid species of mango were distributed from India and Ceylon to the Philippines (p.260). Mukherjee believed that mango plants or seeds travelled to East Africa from Goa in the early 16th Century by the Portuguese. He believed that the journey to West Africa would have followed. Purselove (1969) postulated mangoes could have arrived via Persia and Arabia as early as the 10th Century. Either way, it is thought that mango has had a long history in the Gambia and West Africa.

Purchasing mango fruits are generally much more affordable than a bag of roasted cashew seeds (depending on the mango). Because these fruits are so popular and desirable, it is not a surprise that they would be mentioned frequently as a tree that was favored. Beyond the fruits and nuts that these trees bear, they also provide excellent shade, a value that was mentioned less often but mentioned as important nonetheless.

Comments that highlighted how participants felt about cashew and mango trees can be seen in the following excerpts from K2 and K1, “If we want to improve the forest, we must plant mangoes and cashews. That can improve the forest;” and, “we eat the [Cashew and Mango] fruits and treat [...] infections [from them]. We eat cashew fruits and use the dry branches for firewood. It also treat diarrhea, if you soak the bark in water and drink it.”

The first comment, from K2 implies that these are two trees community members would like to see more of and not just in their yards but also in the forest. Tim Whewell with the British Broadcasting Company (BBC) published an article, ‘The sadness behind the Central African Republic’s mango trees.’

In the first paragraph he spoke of the connection between people and Mango trees in Africa, highlighting the value and importance they have in their community by stating “You can always tell where there used to be a village by the sudden profusion of mango trees in the middle of nowhere,” (Whewell, 2014).

It should be noted that both *Mangifera indica* and *Anacardium occidentale* have been promoted by various organizations (including US Peace Corps) at different times throughout The Gambia in order to support rural farmers with additional income and to promote more tree planting.

The International Trade Centre (ITC) is a joint agency of the World Trade Organization of the United Nations and published a report in conjunction with the Gambian government on their cashew sector development export and strategy (see ITC, n.d.). According to their report, cashew is thought to have been first introduced in Gambia in the 1960s as an agroforestry crop with intentions to be planted around forest boundaries and used as a firebreak (p. 5).

The International Relief and Development organization (IRD) in conjunction with Peace Corps hosted a number of cashew trainings during my service (see IRD, 2011). One of these instigated a cashew planting project during my first year as an agroforestry Peace Corps volunteer. Nearly all of the trees (approximately 200) that were direct seeded were observed to have died after approximately three months. There are numerous factors that may have contributed to this. While the environment was not explicitly surveyed for soil composition and mean temperature, both of those factors could have led to the projects failure. I was forewarned that the region may be too hot for the viability of Cashew trees but because there had not been much experimentation, I was encouraged to try. There were a few cashew trees that seemed to do well in the community. Some were stated to be several years old without ever having produced the fruits and nuts. Experienced cashew farmers stated that fruits and nuts could come within two to three years after planting. While people did not know exactly, they estimated that their trees were between five and seven years old and un-productive.

It seemed apparent from these interviews that there was significantly less interest in planting indigenous trees. Even the third and fourth most mentioned tree species, the tamarind and baobab trees, were not offered specifically as trees that communities try to plant. The fact that mangos and cashews are exotic, as the other fruit trees, could be why more emphasis is placed on planting them because they may not otherwise appear in the bush or someone’s yard as easily as an indigenous tree could. Because they are indigenous, it may be that they are taken for granted or assumed to always be a fixture of the environment.

Tamarindus indica, tamarind and Adansonia digitata, baobab

The tamarind and baobab trees are both fruiting trees that were also described as having medicinal uses. Medicinal properties of *Tamarindus indica* have been reviewed in terms of its use in traditional African medicine and uses. Fandohan, et al., (2010) investigated how people of different ethnic backgrounds in Benin used and valued NTFPs from the tamarind tree.

Havinga, et al., (2010) considered traditional medicinal uses. From my personal experience in West Africa, I came to know the tamarind fruit as an important component and food to Wolof people. It was popular in sauces or at the market place. The local name in *Wolof* for the tamarind tree is *daxar* also spelled *dakkar* or *dakhar*. The capital city of Senegal is thought to have been named after this tree (Houérou, n.d.). Le Houérou in conjunction with the FAO states that the tamarind tree is “one of the most used trees in the Sahel.” The uses listed in Houérou’s description for the FAO are congruent with the ones mentioned from the community interviews:

Table 0-1: Summarized description of Tamarind Products & Uses from Houérou

<p>Products & uses</p> <ul style="list-style-type: none">▪ Food from fruits and seeds – used for jams, beverages, sauces (chutneys), condiments, syrups, ice-creams, etc. Also used for livestock feed (seeds)▪ Flowers can be used in an apiary to produce quality honey▪ Wood is hard, heavy and has good strength and binding ability used to make many tools and utensils▪ Wood is also used for high quality fuel and charcoal▪ Medicine applications are innumerable. Fruits can be used as mild laxatives, biliary disorders, cardiac ailments, scurvy, throat infection, anti-poisoning, against leprosy combined with other products, pounded bark for skin infections and wound dressing, gall bladder disorders, hemorrhoids, etc.▪ Popular for amenity plantations along roads, river banks, village squares and backyards <p>Source: Houérou, n.d.</p>

Similarly, *Adansonia digitata* has been well documented (see Gebauer et al., 2002; Vertuani et al., 2002; Obizoba & Anyika, 1994; Sidibe et al., 1996 and Yazzie, et al., 1994). Nutritional values including antioxidant properties, vitamins, minerals and proteins have been investigated. These studies support the importance and strong nutritive value baobab products can offer and are in line with the comments I received.

While all of the trees mentioned thus far have potential economic benefit for those that own and sell these products, one community mentioned the baobab tree specifically as helping them with their taxes each year (meaning they receive a cash income from it). Tamarind fruits, cashew seeds and mangos

are sold in the markets just as baobab seeds and juices. Income assistance was only associated or mentioned in relation to the baobab tree however. One reason for this could be because of the juices which set baobab apart from the others. Frozen juices, locally referred to as *iceys*, are especially popular in the summer and mostly consist of either baobab or *bissap* juice (others are made from artificial flavor packets). These can sell very quickly and provide additional income for someone with access to a freezer or ice chest.

Cordyla africana, bush mango

It was no surprise to see *Cordyla africana*, referred to commonly as ‘bush mango,’ receive several mentions. The fruits from this tree are instrumental in common *Wolof* dish called *céré* (pronounced chereh) *ak dimbu* and involves a sauce made from the bush mango served over steamed millet flour (locally referred to as *coos*). This tree was mentioned in every interview from *Wolof* communities but was not mentioned from the *Fula* community (K3). This impresses upon the notion that this species may be more valuable among the *Wolof* people than it is for other ethnic groups. I received the same impression about this tree from my time in The Gambia.

Diospyros mespiliformis, African plum

The saloum plum (alom or *Diospyros mespiliformis*) was discussed with a tone of reverence. While it is not clear as to what trouble may befall those that cut this tree down, it is clear that it holds respectable weight within the *Wolof* and *Fula* cultures. This species was mentioned most in the *Fula* community and personally observed as a favored tree amongst the *Wolof* people.

Ficus platyphylla, African fig

The African fig tree or *Ficus platyphylla*, known locally as *soto*, was mentioned as a tree that was used and valued for its edible products, medicinal properties, firewood and was also stated as being safeguarded (one that should not be cut down). From the conversations, this species came up most often as being used for medicine and being highly valued.

Khaya senegalensis, red African mahogany

The red African mahogany tree (*Khaya senegalensis*) is one of the more valuable timber species in The Gambia. During my service, this was the only tree I personally observed being cut from its base.

Some of it may have been sold but much of the wood was roughly cut into boards and planks and used as outdoor beds and benches throughout the community. We asked participants about trees that have value to their culture specifically. In his question, he stated,

We believe that every ethnic group has a [...] culture attach[ed] to trees, and ethnic groups have different regards about different trees. So we want to know the tree that the Wolof's value most. Why do you value mahogany tree?

It is important to note that we asked specifically about the mahogany tree and that community members were not given the opportunity, in this case, to volunteer that as a tree they value. As a Wolof man that lives nearby, I believe Katim felt that he would have been able to provide responses to all of the questions himself. He knew that we wanted to know what the others thought as well and tried not to interject his own thoughts and beliefs but would struggle not to participate himself and would interject every so often. The answer to his question was simple where participants stated there were lots of ‘secrets’ about the mahogany tree and that it was valued and important. Greater detail into what was meant by ‘secrets,’ was not explained.

Pterocarpus erinaceus, African rosewood

African rosewood or *Pterocarpus erinaceus* (locally known as *wen* in Wolof) was mentioned frequently for its perceived importance. This species was mentioned as a useful timber species and also mentioned as being used for medicinal purposes. An agroforestry manual developed in The Gambia by an agroforestry volunteer noted that it is also useful as fodder and is one of the timber species that is shipped to Cassamance, a region in southern Senegal, for its quality hardwood.

Moringa oleifera, moringa and Combretum micranthum

Moringa oleifera and *Combretum micranthum* (locally known as *barra*) received five mentions each for a distribution of 4%. These trees were noted as being used for food and medicine. Moringa was additionally mentioned at least once as a tree species that is desired for planting while *barra* was stated as a species used for firewood. Moringa was locally known as the ‘Never die tree’ which became *Nemedye* or *nebedye* in Wolof (this does not translate as ‘never die’). It has been known and promoted as a miracle tree and encouraged by development and aid organizations in this region because the leaves are highly nutritious. The leaves show up in some traditional dishes like *ceré ak boom* which is steamed millet grain topped with moringa leaf sauce. This is one of the more nutritious meals and touted as such.

Citrus sinensis, orange; Citrus limon, lemon; Carica papaya, papaya; and Musa spp, banana

Exotic fruit trees like orange and lemon were desired species for planting. This includes herbaceous species like papaya and banana. Bananas were sold in my community. Papayas were available but oranges and lemons were not observed in my immediate community. Citrus trees like orange and lemon did not seem to do well in my community. I experienced difficulty growing them personally and hypothesize that others experienced similar challenges based on people's interest and their absence in these communities.

Cobretum glutinosum, rattan

This species was stated as one that is important for firewood and medicine. It was not uncommon for people to make tea from this tree. I was told that if I was sick, that I should drink this tea. The president of The Gambia, Yaya Jammeh, requested for communities to harvest branches to place on the roads for his collection because he too favored the tea and medicinal properties.

An interesting issue came up regarding this particular species. When discussing tree planting and planting local versus exotic species, one member mentioned they had never seen seeds for this tree and questioned whether or not it even produced any. My translator was surprised by the conversation commenting that it was very interesting. It was unexpected to hear that some community members might think that some plants would not produce seeds just because they had not seen them. One member mentioned that if it had flowers it must have seeds. Other members were debating that they had never seen the seeds and thought maybe it did not have any. A better understanding of general plant phenology and propagation could be useful to extend to communities that are trying to grow native plants.

Azadarachta indica, neem

This species received few comments. Surprisingly it was noted as a desired species for planting. This tree was brought in as a fast growing hard wood and has since taken over as an invasive species. The roots produce a toxin that kills trees growing near it. In some areas of The Gambia, one might observe this as the only predominant tree. The Peace Corps program used to promote the use of leaves to prepare *neem cream* to be used as a natural pesticide against mosquitos. While there has been some research to support the pesticide properties, Peace Corps put a halt on further promotions stating there needed to be more substantial evidence of its effectiveness against mosquitoes. Agroforestry volunteers were discouraged from planting these trees and encouraged to destroy saplings in an effort to combat the

invasiveness. They produced excellent shade which may have prompted the respondent to state they desired it for planting.

Cola cordifolia, kola

The kola tree produces the very important kola nut. Kola nuts are presented by visitors or guests to the village chief upon arrival. It is a customary gift to also offer kola nuts to celebrate ones engagement, new child, etc. I am surprised there were not more comments about this tree, especially regarding tree taboos because I would expect communities would be interested in protecting these trees. It may be widely known and revered rendering it does not need additional protections from taboos.

Gmelina arborea, gmelina

Like neem, this species was also introduced as a fast growing hardwood. It is not suspected to be invasive and is still promoted by the Peace Corps program. It was mentioned as a desirable species for planting and timber. I had conducted a tree planting project with Gmelina stems (see chapter 4.5.1.1) but most of the trees were observed to have died due to insufficient watering. Trees that received water daily grew quickly and successfully. I was told by other agroforestry volunteers that it can be difficult to propagate this species from cuttings and that growing them from seed can be faster and more effective.

Eucalyptus spp., eucalyptus

Eucalyptus was stated as a desired species for timber and firewood. This tree was seen to have taken over the school causing problems with other planting projects. Eucalyptus creates poor soil conditions for vegetable or other plants growing directly near the tree. The headmaster was encouraged to switch them out for another tree like mangos and cashews but the project was never completed. Members in the community seemed to desire the tree for its fast growing property and quality wood.

Hibiscus sabdariffa, roselle

From the table, all but one of the trees mentioned as desired species for planting were exotic including lemon, orange, papaya, banana, mango, cashew and moringa. *Hibiscus sabdariffa* (called bissop or sissop locally) was the indigenous “tree” mentioned as desirable for planting. This species of *Hibiscus* is technically a subshrub and produces edible leaves and calyces both of which make for nice

sauces and juices (known more commonly as bissap juice, see FAO, 2004 for more information on *Hibiscus* and commercial market information).

Important tree species not mentioned in these interviews

A handful of tree species were not mentioned that I feel deserve some discussion here. Some of these were ones I experimented with personally. Others were observed as important tree species in Gambia or in my community specifically that were not mentioned in the interviews.

Acacia nilotica, Acacia albida, Leucaena leucocephala and Delonix regia

Acacia species including *A. albida* and *A. nilotica* were promoted by Peace Corps as important species due to their nitrogen-fixing abilities. Both species produce sharp thorns making them useful for live fencing. I had poor success growing *A. albida* and *A. nilotica* even in a secure location with plenty of watering. *Acacia albida*, or winter thorn, was observed to be particularly sensitive to transplanting. Only one of my *A. albida* trees survived and that was because its roots punctured through the polypot bag and was never moved.

My experience with *Leucaena* was a different story. This tree has the potential to be invasive. The Peace Corps environment program promoted this tree which is easy to grow and fast growing. The leaves and pods produce fodder although too much ingestion can be poisonous to cows. This species is also known for its ability to improve soil fertility as a nitrogen fixing species. More research should be conducted in this area specifically to investigate potential invasiveness.

Like *L. leucocephala*, I observed *D. regia* to also be fast growing. This species is not promoted for nitrogen fixing abilities but is desired by some for its beautiful red flowers, sometimes known as a flame tree. I experimented with growing it for aesthetic purposes and observed it to grow at a similar rate as *L. leucocephala*. This tree produces light shade and could be investigated for its usefulness as a species for use on fields or in gardens.

Ziziphus Mauritana, Ceiba pentandra and Prosopis africana

These native tree species were observed as important to the people of The Gambia where *Z. mauritana* was especially seen as an important species to members in my own community. Grafting of this tree to produce larger fruits was gaining popularity. Trees in their natural state produced small,

marble sized seeds with a thin, leathery skin. A small amount of pulp encased the seed. Children in particular enjoyed the sweet and somewhat sour flavor by sucking on the seeds. They would play games with each other to see who could fit the most fruits in their mouths. Seeds were disposed of by spitting. This encouraged another game where the winner was able to spit their seeds the farthest. My host grandmother was able to sell her *sideém* fruits to neighboring villagers for a small price. This species was touted by other volunteers as one that could be useful for live fencing.

Silk cotton tree or *Ceiba pentandra* was an impressive and beautiful tree that communities seemed to favor for gathering under for shade. One community even described that the reason they settled their village was due to a silk cotton tree. This was a Wolof village that used a different dialect than the Wolof people in the area I interviewed. I would have expected this species to have been stated as one that is important to Gambians or the Wolof people.

Ironwood or *Prosopis africana* was seen as an endangered species according to Peace Corps Agroforestry manuals (Peace Corps, 2010). I only note it briefly here as a valuable species that was not mentioned in the interviews. Ironwood has been in such high demand historically that it is noted as receiving and needing extra protection.

Appendix B: complete interview transcript for K1

Key for Statement Type: C = coded; T = tree species; TC = tree species and code; Q = question (not coded); S = statement

statement type	full transcript	Unique comments	codes for questions	Code word	tree species	delimited tree species
S	The purpose of the meeting is to know the problems and challenges facing the forest. We want everyone's participation and views. We need the participation of both young and old male and particularly female.					geejan
Q	Which trees do you normally use here for firewood?		firewood			ngeeran
TC	Rat, geejan, ngeeran, tab, bara and many others.		important tree species	firewood	geejan, ngeeran, tab, bara	dimbou
Q	Which trees do you use for medicinal purposes?		herbal medicine			tab
TC	We use dimbou (bush mango), ngeeran, bara and soto for medicine.		important tree species	herbal medicine	dimbou , ngeeran, bara, soto	wen
S	You know it is not all the trees you use for cooking are not use as medicine.		important tree species			bara
TC	Wen (rose wood).				wen	ngeeran
Q	What do you use the forest trees for? You may need the forest trees for firewood or medicine?		firewood			bara
C	We get wood from the forest to make beds . We get fence posts from the forest also.	We get wood from the forest to make beds.	herbal medicine	lumber		soto
C		We get fence posts from the forest also.	important tree species			
Q	She wants to know the things you get from the forest like firewood, timber and medicine. What else do you get from the forest?		firewood			baobab
C	We get food from the forest too. We get tree sap from the forest for cash and our own use like laalo . (used for cooking here)	We get food from the forest too.	lumber	food		alom
C		We get tree sap from the	herbal medicine	tree benefits		

		forest for cash and our own use like laalo. (used for cooking here)		
Q	How far do you go to fetch firewood?		firewood	cashew
C	We get firewood 3-4 km away from the village.	We get firewood	distance to forest resources	mango
C		3-4 km away from the village.		
Q	Do you get other needs from the forest as far as where you get firewood?		firewood	mango
C	Yes we get all our needs from far as where we get firewood.	Yes we get all our needs	dependency on forest resources	cashew
C		from far as where we get firewood.		
Q	How often do you fetch firewoods?		firewood	orange
C	Before you eat food you must get firewood. So we go to the forest every day to get firewood to cook.	Before you eat food	firewood	dimbu
C		you must get firewood.		
C		So we go to the forest every day to get firewood to cook.	dependency on forest resources	
Q	How about the trees you use for medicinal purposes, how often do you get them?		herbal medicine	baobab
C	For those trees we get them only if one is sick, like suffering from general body pain and the like.		herbal medicine	tamarind
S	It means that you don't go for them every time.			wen
C	It is only if someone is sick.			cashew
Q	How about things you use for fence posts?		lumber	banana
C	We get them if needed only.		lumber	moringa
Q	The trees you get fruits from, how often do you get them from the forest?		food	papaya

C	We get them in different times of the year, like if you need sap, you get it in May-June (Ceebeet).		mango
Q	If you need baobab fruits, you get them at this time. Which means is seasonal. What is causing forest destruction here? Yakka yakka alla?	forest destruction	
C	Fetching firewood, digging roots for medicine and cutting down trees; which is most affecting the forest. Cutting trees for firewood. Anywhere you cut firewood there would be no development. People have cut down the trees for firewood, making it hard to find now. You go for miles to get firewood	Fetching firewood	firewood
C		digging roots	herbal medicine
C		for medicine	
C		and cutting down trees; which is most affecting the forest. Anywhere you cut firewood there would be no development.	lack of controls
C		People have cut down the trees for firewood, making it hard to find now.	dependency on forest resources
C		You go for miles to get firewood	firewood
Q	Is it only fetching firewood causing the forest destruction?	firewood	
C	bushfires are the most serious cause of the forest damage. The farming machinery have also contributed to the forest destruction.	bushfires are the most serious cause of the forest damage	environmental factors
C		The farming machinery	land clearing for farming

		have also contributed		
C		to the forest destruction.		
Q	Which trees are more important to us?		important tree species	
T	Mango, cashew, plum (alom) and baobab.			mango, cashew, alom, baobab
Q	Why is baobab useful?		important tree species	
C	We eat baobab. We eat the leaves as sauce (laalo). We eat the fruit juice with porridge. The fruit is also cures general body pain. We use the fiber at the bark as rope to tie things.	We eat baobab. We eat the leaves as sauce (laalo). We eat the fruit juice with porridge.		food
C		The fruit is also cures general body pain. We use the fiber at the bark as rope to tie things.		herbal medicine
Q	How about mango and cashew?		exotic species	
TC	We eat the fruits and treat it for infections. We eat cashew fruits and use the dry branches for firewood. It also treat diarrhea. If you soak the bark in water and drink it.	We eat the fruits		food
C		and treat it for infections.		herbal medicine
T		We eat cashew fruits and use the dry branches for firewood		cashew cashew
C				
C				firewood
		It also treat diarrhea If you soak the bark in water and drink it		
Q	The trees mentioned, what importance do they have in your culture?		important tree species	

C	They came a long time, but they are from the west. Any tree we use for treatment is the great grand parents'. We may not know what they can cure but the Tubabs know what they can cure.		
Q	Among the trees which ones do you protect most?	tree protection	
T	Wen, mango, cashew, orange, dimbou, baobab and tamarind (dahar).	wen , mango , cashew , orange, dimbou, baobab, tamarind	
Q	Who protects them?	local responsibility & permission	
C	The people using them protects them. The people of the village.	The people using them protects them.	local responsibility & permission
C		The people of the village.	
Q	Does the government protect them?	government	
C	Yes, they protect them. The people of the village also protect them.	Yes, they protect them.	local responsibility & permission
C		The people of the village	
C		also protect them.	
Q	Why do they protect those trees? Why do they deny people from cutting those trees?	local responsibility & permission	
C	If you cut it today, tomorrow if you need it you will not find it there. But if you leave it there, that is to deny yourself so that you can use it.	If you cut it today	cutting trees
C		tomorrow if you need it you will not find it there	
C		But if you leave it there	
C		that is to deny yourself so that you can use it	
C			dependency on forest resources

Q	She said that if you cut them, it would take a long time to replace them. How about the cutting down of trees?		
C	Sometimes we don't have an option, because we use the wood to make your houses and homes. If you go to get firewood and you cut a living trees tomorrow you won't get it there. If you don't get firewood you won't eat. So you go to the forest and look for dry trees or branches for firewood.	Sometimes we don't have an option	dependency on forest resources
C		because we use the wood to make your houses and homes	lumber
C		If you go to get firewood	firewood
C		and you cut a living trees	lack of controls
C		tomorrow you won't get it there	
C		If you don't get firewood you won't eat	food
C		So you go to the forest and look for dry trees	
C		or branches for firewood	
Q	How do they cut the trees, do they cut the branches or the stem?		
C	Some cut the stem and some cut branches and the tree sprouts again.	Some cut the stem and some cut branches	stem and branch cuttings
C		and the tree sprouts again.	
Q	When do people normally cut trees from the forest?		
C	People cut trees only when they need wood.		dependency on forest resources
Q	Do they get permission from any one?		

C	We don't ask for permission if we are using the wood for building our homes.	We don't ask for permission	local responsibility & permission
C		if we are using the wood for building our homes.	lumber
Q	When do you normally cut wood from the forest?		
C	We cut wood from the forest during the dry season. We cut wood for fencing.	We cut wood	
C		from the forest during the dry season	
C		We cut wood for fencing.	lumber
Q	Who are the ones, who normally cut them from the forest?		
C	The people making fences, building houses and women cutting firewood.	The people making fences	lumber
C		building houses	
C		and women	
C		cutting	lack of controls
C		firewood	firewood
Q	So it means everyone from the village cuts trees. Why did the forest perish?		
C	It is caused by drought and bushfires. Some trees fall from natural effects.	It is caused by drought	environmental factors
C		and bushfires.	
C		Some trees fall from natural effects.	environmental factors
Q	Which trees do you plant in your community?		
T	Mango, cashew, banana, moringa and papaya.		mango, cashew, banana, moringa, papaya
Q	How do you plant mangoes?		
C	I dig a hole and put manure in it, and then plant in it. But they are always destroyed by termites.	I dig a hole	tree planting
C		and put manure in it	
C		then plant in it	

C		But they are always destroyed by termites	biophysical factors
C			
Q	Is that the only way you plant trees?		
C	We plant trees in poly pots.		tree planting
Q	Where do you get the poly pots?		
C	We just recycle plastic bags.		
Q	What challenges do you have in planting trees?		
C	Fencing and protection. Lack of poly pots. If you plant the trees in poly pots they grow well, but if planted directly on the soil they are destroyed by termites which results to their death. Getting poly pots is a problem or if you get them, having a secured place is another problem.	Fencing	farmers' assets
C		and protection	
C		Lack of poly pots	
		If you plant the trees in poly pots they grow well,	farmers' assets
C		but if planted directly on the soil	
C		they are destroyed by termites	biophysical factors
C		which results to their death	
		Getting poly pots is a problem or if you get them	
C		having a secured place is another problem	farmers' assets
Q	Where do you plant mangoes?		

C	If we get what I said we will plant them in our yards. Stray goats are our problem. They ate all my trees. If not I would have got many trees now. I planted some trees until they grow to a point and the goats destroy them, because I have no good fence.	If we get what I said we will plant them in our yards.	farmers' assets
C		Stray goats are our problem. They ate all my trees. If not I would have got many trees now. I planted some trees until they grow to a point	biophysical factors
C		and the goats destroy them	farmers' assets
C		I have no good fence.	farmers' assets
Q	Where do you report those challenges?		
C	Maybe the NGOs around to help us.		training and support
Q	Do you have Agriculture extension workers around to help?		
C	We had support from AVISU, that gave us poly pots to grow plants. It went well the first time. We transplanted the trees in the garden but because we had water problem they all died.	We had support from AVISU	training and support
C		that gave us poly pots to grow plants	tree planting
C		It went well the first time. We transplanted the trees in the garden	
C		but because we had water problem	biophysical factors
C		they all died.	biophysical factors

Q How did the forest get destroyed like this and why did the wild animals perish?

C The forest is destroyed and there are no places for the animals to hide. There was a time when you dare not to go far in the forest, particularly at night. You dare not to go out at night as far as that house over there. Many trees have perished. You can find many herbal medicines in Kanalai, because there are lots of trees. We have seen that the forest has changed because there were things in that you can't see in now. There was a time when the soil was fertile making a good yield, but now you plant a big farm and get very little harvest.

The forest is destroyed

forest destruction

C

and there are no places for the animals to hide.

There was a time when you dare not to go far in the forest, particularly at night.

You dare not to go out at night as far as that house over there.

Many trees have perished.

C

You can find many herbal medicines in Kanalai, because there are lots of trees.

herbal medicine

C

We have seen that the forest has changed because there were things in

forest destruction

		that you can't see in now.	
C		There was a time when the soil was fertile making a good yield but now you plant a big farm and get very little harvest.	biophysical factors
Q	If we neglect the forest until all the trees perish, then what will happen?		
C	If we leave all the trees to perish, then we will all perish.		dependency on forest resources
Q	In your views what can you do to restore the forest?		
C	We can restore the forest by planting more trees. If we collaborate with the forest agents to help us with seedlings and protection, that would help. If we are train how to use local manure would help, because the chemical fertilizer is not good to the soil.	We can restore the forest by planting more trees.	tree planting
C		If we collaborate	collaboration
C		with the forest agents help us	government
C		with seedlings	
C		and protection	
C		that would help	training and support
C		If we are train how to use local manure would help	
C		because the chemical fertilizer is not good to the soil.	biophysical factors

Appendix C: complete interview transcript for K2

Key for Statement Type: C = coded; T = tree species; TC = tree species and code; Q = question (not coded); S = statement

statement type	full transcript	unique comment	Code word	Tree species	delimited tree species
Q	In this meeting she is going to record all the interviews. The target groups are people aged 50 and above and people aged 30 to 50 and those of 21 years to 30. So if all those groups can participate we will record their voices. The purpose of the meeting is to know the causes of deforestation at Jimbala forest, plans we can do to revive our forest. That is why we call you to this meeting in other. We would the same meeting in other places. We did it at Kerr Chendou yesterday and today we are here. Tomorrow we will go another village. This is not a meeting that was informed but this is way we do it. We just pop into a place and do the meeting there. We want to get information from every group both male and female especially women and the youth. The first question is what do we do with the forest? What does it benefit us? A lot of benefits.				baobab
Q	Benefits like what?				tamarind
TC	The baobabs help us pay our taxes every year . We value moringa, bush mango (dimbou), locust bean (nette) fig tree (soto) because we use them both for food and medicine. We value mahogany, 'bara' tree and tamarind and 'mbull' tree. We eat their fruits.	The baobabs help us pay our taxes every year.	tree benefits	baobab,moringa, dimbu,nete,soto, mahogany,bara,t amarind,mbull	moringa
C		We value moringa, bush mango (dimbou), locust bean (nette) fig tree (soto) because we use them both for food	food		
C		and medicine.	herbal medicine		
		We value mahogany, 'bara' tree and tamarind and 'mbull' tree. We eat their fruits.			
Q	And what else?				dimbu

T	Tamarind (daxar).		tamarind	nete
Q	Do you eat the fruits?			soto
C	Yes we eat them.		food	mahogany
Q	Is that all the benefits of the forest?			bara
C	The domestic animals feed at the forest. We get wood from the forest for fence posts and fire wood. We can't mention all the benefits of the forest because there are lots of herbal medicines that we get from the forest. If you hear the government talking about Gambia forest, if you don't go to the forest you would not know about the forest problems.	The domestic animals feed at the forest.	tree benefits	tamarind
C		We get wood from the forest for fence posts	lumber	
C		and fire wood.	firewood	
C		We can't mention all the benefits of the forest because there are lots of herbal medicines that we get from the forest.	herbal medicine	
C		If you hear the government talking about Gambia forest, if you don't go to the forest you would not know about the forest problems.	government	
Q	Among the benefits you mention like wood, timber, firewood, medicine and other benefits, like selling things from the forest for money. How do you fetch firewood? Is it yearly, monthly, weekly or daily?			mbul
C	We get firewood from the forest every day.	We get firewood	firewood	moringa
C		from the forest every day.	dependency on forest resources	
Q	How far do you get your firewood?			mahogany
C	We get firewood far as 3-5Km from the village.	We get firewood	firewood	tamarind
C		far as 3-5Km from the village.		
Q	How often do you get herbal medicines from the forest?			

C	We get medicine from the forest daily because there are different medicines for different illnesses. Like if one is sick we go to the forest and get medicine for him/her.		herbal medicine		lemon
QC	How do you go about getting fence posts and wood? Do you get them yearly, monthly, weekly or daily? Can we hear from the women? It is like only men answering all my questions.				baobab
C	We get wood when we need them, because it is like we have time for getting wood for different purposes. We get wood for roofing from the forest like when rainy season is approaching. So it means that you don't get roofing woods from the forest daily.		lumber		tamarind
Q	How about fruits or food you get from the forest?				cashew
TC	We get them when they are available. We get moringa (nebedaye) from the forest too.		food	moringa	mango
Q	How far do you go to get fence posts, wood and fruits?				moringa
C	Some are far and some are not.				baobab
Q	We believe that every ethnic group has a so culture attach to trees, and ethnic groups have different regards about different trees. So we want to know the tree that the Wollofs value most. Why do you value mahogany tree?				tamarind
TC	There are lot of secrets about that tree			mahogany	soto
Q	How about tamarind?				mango
TC	They have secrets too.			tamarind	cashew
Q	How about the others you mentioned?				lemon
C	They are medicines and food.	They are medicines	herbal medicine		neem
C		and food.	food		
Q	Among the trees, which are the ones you protect most?				gmelina
T	Mango, cashew, baobab, tamarind and lemon.			mango, cashew, baobab, tamarind, lemon	mango
Q	Who protects them?				sotoajana
C	No one protects them. They protect them when they get fruits up until they are ripe. The community and forestry agents protect the forest too.	No one protects them. They protect them when they get fruits up until they are ripe.	local responsibility & permission		dougout
C		The community			
C		and forestry agents			

C		protect the forest too.		
Q	Which is most important among the trees?			katijankume
T	Mango, moringa, baobab, tamarind and fig tree (soto/geng).		mango, moringa, baobab, tamarind, soto	cashew
Q	Who manages the forest?			eucalyptus
C	The forest guards and the people of the village.	The forest guards	local responsibility & permission	
C		people of the village.		
Q	Who fetches firewood or harvest forest trees?			mango
TC	The women harvests bush mangoes (dimbou).		dimbu	dimbu
Q	Who cuts firewood?			
C	People fetch firewood base on their needs.		firewood	mahogany
Q	Do they get permission from anyone? Do they get permission from the Alkalo or the district chief?			
C	We don't normally get permission. It is just base on needs. Anyone who needs anything from the forest, would just go for it.	We don't normally get permission.	local responsibility & permission	mango
C		It is just base on needs. Anyone who needs anything from the forest, would just go for it.	lack of controls	cashew
Q	Is it only women who fetch firewood?			
C	Both men and women fetch fire wood.	Both men and women		
C		fetch fire wood.	firewood	
Q	Sometimes you come across a big tree being chopped down. Who does that? Does the government give them permit to cut the trees? Like that mahogany tree chopped down.			
C	We the people of the village are not informed about it.		lack of controls	
Q	How do they come to cut those trees?			
C	We just feel that the government gave them permit. If I want to clear my farm, I will ask for the alkalo's permission.	We just feel that the government gave them permit.	government	
C		want to clear my farm	land clearing for farming	

C		I will ask for the alkalo's	local responsibility & permission
C		permission.	
Q	So, does the farmers protect the trees at their own farms?		
C	Yes, any trees at your farm, you are responsible for its protection.	Yes, any trees at your farm, you are responsible	local responsibility & permission
C		for its protection.	
Q	Which trees do you plant?		
TC	They include mango, cashew, lemon, neem and nmalayna.		tree planting mango,cashew,lemon,neem,gmelina
Q	How do you plant those trees?		
C	You peel the seed and take a plastic bag or dig a hole and plant it there.	You peel the seed	
C		and take a plastic bag	tree planting
C		or dig a hole and plant it there.	tree planting
Q	Where do you plant your trees?		
C	We plant them at our back yards.		farmers' assets
Q	What are your challenges?		
C	Our land has a lot of termites. We plant trees by digging a hole and putting manure in a plant.	Our land has a lot of termites.	biophysical factors
C		We plant trees by digging a hole	tree planting
C		and putting manure in a plant.	
Q	Do you have any other challenges, is it only the termites?		
C	The way people plant trees contributes to the challenges because one has to dig a hole, pull out the soil and put the top soil back in the hole along the plant and press firmly. If it is not pressed the wind can pass through at that would crack the soil that can lead to the death of the plant. Watering in the dry season should be weekly like Sunday to Sunday. Put mulching around the base of the plant, but if you bury the grass along with the plant can cause a risk of termites infestation.	The way people plant trees contributes to the challenges	
C		because one has to dig a hole, pull out the soil and put the top soil back in the hole along the plant and press firmly.	tree planting

C		If it is not pressed the wind can pass through at that would crack the soil that can lead to the death of the plant.	biophysical factors	
C		Watering in the dry season should be weekly like Sunday to Sunday.	biophysical factors	
C		Put mulching around the base of the plant, but if you bury the grass along with the plant can cause a risk of termites infestation.		
C		can cause a risk of termites infestation.	biophysical factors	
Q	Have you ever put wood ash around the base of the plants to prevent termites? Termites can be prevented by wood ash and poultry manure. The poultry manure is a good fertilizer. In fact if you put too much of it on some vegetables it burns them. You put it inside around the base of the plant. Beside the wood ash, do you have any other preventive measures?			
C	Other things we use are waste oil and powder poisons.		biophysical factors	
Q	In your observation, what changes have happen to the forest?			
C	The forest trees are going down and there are no improvements. There were many wild animals like antelopes. Population growth has contributed to deforestation, because more land is cleared for farming.	The forest trees are going down and there are no improvements.	forest destruction	
C		There were many wild animals like antelopes.		
C		Population growth has contributed to deforestation	human population growth	
C		because more land is cleared	land clearing for farming	
C		for farming		
Q	Were there trees that are not found here now?			
TC	Trees like 'soto ajana' sort of a fig tree, 'katijankume" and 'dougout' are no more here or are hard to find here. These are plants that were very useful to us.		tree extirpation	sotoajana, katijankume, dougout
Q	What can we do to improve or revive the forest?			

C	Protecting the forest from bush fires. People cutting down mahogany trees for wood, needs to replant trees by planting all types of trees they can find during the rainy season.	Protecting the forest	local responsibility & permission	
C		from bush fires.	environmental factors	
C		People cutting down mahogany trees		mahogany
C		needs to replant trees		
C		by planting all types of trees they can find during the rainy season.	tree planting	
Q	Who should be responsible for developing the forest, is it the government, community or God?			
C	Both the government and the community should join hands to improve the forest.	Both the government	government	
C		and the community		
C		should join hands to improve the forest.	collaboration	
Q	What plans do you have to improve the forest?			
C	We have water problem, but planting more trees is the solution. Planting trees and caring them. If we can get eucalyptus seedlings can help, because we can use them for building houses, fire wood. Get fencing materials can help protect the plants from animals.	We have water problem	biophysical factors	eucalyptus
C		but planting more trees is the solution.	tree planting	
C		Planting trees and caring them.		
C		If we can get eucalyptus seedlings can help, because we can use them for building houses,	lumber	
C		fire wood.	firewood	
C		Get fencing materials can help	farmers' assets	
C		protect the plants		
C		from animals.	biophysical factors	
Q	Eucalyptus plants are good, but if you plant them in your farm you can't grow any other plant 5 meters around them. Neem trees are also poisonous. It is good to plant eucalyptus at place that is only for them. Final question. What can we do to improve the forest?			

TC	If we want to improve the forest, we must plant mangoes and cashews. That can improve the forest.		tree planting	mango,cashew
Q	If you have those plants in place, what plans do you have to sustain them or maintain them?			
C	Protect them with fence and caring the plants.	Protect them		farmers' assets
C		with fence		
C		and caring the plants.		
Q	Do you have any comment or contributions?			
C	Caring of the plants is the challenge.		tree planting	
Q	When is the best time for planting and transplanting?			
	During the rainy season.			

Appendix D: complete interview transcript for K3

Key for Statement Type: C = coded; T = tree species; TC = tree species and code; Q = question (not coded); S = statement; QC = coded question

statement type	Full transcript	Unique Comments	Code word	Tree species	delimited tree species
Q	When did the forest start to be destroyed? The trees that the Tukulor's value or have superstitions about. Trees that we use for firewood and timber. These are things we want to know. The purpose of the meeting is to have a good knowledge about the forest and how can people properly manage the forest and environment. So she wants all of you, men, women, boys and girls to participate fully. We want everyone's participation. The first question is: which trees do you normally use from the forest? Which trees do you use for firewood?				geejan
T	We use rat, geejan, ngeeran, bara and jamtab. If people go out to cut firewood and the see both dry jamtab and another dry, they would take the jamtab.	We use rat, geejan, ngeeran, bara and jamtab.		geejan, ngeeran, bara, jamtab	ngeeran
C		If people go out to cut	lack of controls		bara
C		firewood	firewood		
C		and the see both dry jamtab and another dry, they would take the jamtab.			
Q	Are there trees that you use for medicine?				wen
TC	We use wen, senjang, danxa, loodo, bara and rat, henkeleng and ngeeraan.		herbal medicine	wen, senjang, danxa, loodo, bara, rat, henkeleng, ngeeran	jamtab
Q	Which trees do you use for fence posts and timber?				gmelina
TC	We use soon, nmalayna, wen, garabi lawbe, dimbou, neem and mahogany.			gmelina, garabilawbe, dimbou, neem, mahogany, soon, wen	senjang
C			lumber		
Q	Do you have trees in the forest that you eat their fruits?				alom
TC	We eat salum plum (alom) cashew, mango, dimbou, soto/geng, nete and baobab.		food	alom, cashew, mango, dimbou, soto, nete, baobab	danxa
Q	Do you have trees in the forest that you don't need?				kanku
TC	Kanku is among them.			kanku	loodo
C	How far from your village do you go to fetch firewood?		firewood		bara
C	About 2 kilometers away from the village				rat
Q	How often do you fetch firewood and medicine from the forest?				hiinji
TC	Hiinji, tamarind, and mahogany are trees people fear most.			hiinji, tamarind, mahogany	henkeleng

Q	Why do you fear or value them? Are these trees mentioned valued only at your village or elsewhere?				tamarind
T	They are valued in the whole Gambia. We don't cut down tamarind, saloum plum, fig tree and taba.	They are valued in the whole Gambia.		tamarind,alom,taba,soto	ngeeran
C		We don't cut down tamarind, saloum plum, fig tree and taba.			dimbou
Q	Who protects these trees?				taba
TC	Taba is a tree that you can't use for wood or any other thing except the fruits or leaves. That is why people don't cut them. We also need the saloum plum and there superstitions that say that if you cut down a plum tree you get into trouble.	Taba is a tree that you can't use for wood or any other thing except the fruits or leaves.	food	taba,alom	garabi lawbe
C		That is why people don't cut them.			neem
		We also need the saloum plum			mahogany
C		and there superstitions that say that if you cut down a plum tree you get into trouble.			soon
Q	So the community protects it?				wen
C	Yes, we thought maybe is the government, the alkalo or the village.	Yes, we thought maybe is the government	government		cashew
C		the alkalo	local responsibility & permission		mango
C		or the village.			dimbou
Q	Why do you protect those trees?				soto
C	We protect them for future benefits.	We protect them			nete
C		for future benefits.			baobab
Q	Benefits like what?				tamarind
C	They bear fruits every year that we and the domestic animals eat.	They bear fruits every year that we	food		mahogany
C		and the domestic animals eat.	tree benefits		alom
Q	Why do people cut down trees like that?				alom
C	People cut down trees for farming purposes.	People cut down trees			taba
C		for farming purposes.	land clearing for farming		soto
QC	How do people fell those trees, do they get permission from authorities.				mango

C	They just go out and clear their land without permission.	They just go out and clear their land	land clearing for farming	mango
C		without permission.	lack of controls	
Q	Who are the people that can go and clear or cut down trees for farming? Can anyone do that here?			
C	If it is your land, then you can clear it.	If it is your land	lack of controls	
C		then you can clear it.	land clearing for farming	
Q	You don't take permission from the district chief or the alkalo when going to fetch firewood? Who are the people that can go and clear or cut down trees for farming? Can anyone do that here?			
C	If it is your land, then you can clear it. If it is your land, you don't need permission from any one.	If it is your land		
C		then you can clear it.	land clearing for farming	
C		If it is your land, you don't need permission from any one.	lack of controls	
Q	When do they give permission to use the forest?			
C	We don't have time for that (permission). We go out to the forest at any time we need something there.	We don't have time for that (permission). We go out to the forest at any time we need something there.	lack of controls	
Q	When do women fetch firewood?			
C	Every time we go out to fetch firewood.		firewood	
Q	Do you cut trees for other purposes?			
C	If only we are doing gardening.		land clearing for farming	
Q	Who are the people who cut the trees?			
C	Women fetch firewood and some men.			
Q	Why has the forest population reduced?			
C	Because the forest between these two villages was thicker. This is caused by two main factors: Bush fires and people activities like clearing for farming and population growth.	Because the forest between these two villages was thicker.		
C		This is caused by two main factors: Bush fires	environmental factors	
C		and people activities		
C		like clearing	land clearing for farming	
C		for farming		

C		and population growth.	human population growth	
Q	Which trees do you plant most?			
T	Mango, cashew, papaya, banana and moringa (nebedaye).			mango, moringa, cashew, papaya, banana
Q	How do you plant these trees?			
C	We plant them during the rainy season.		tree planting	
Q	How do you plant them in nurseries?			
C	We peel them and plant them in polypots.	We peel them		
C		and plant them in polypots.	tree planting	
Q	How about you the women, how do you plant seeds?			
C	We just plant them directly on the ground. When transplanting, we dig a hole and put manure in and mix it with the soil and then transplant in it.	We just plant them directly on the ground.	tree planting	
C		When transplanting, we dig a hole	tree planting	
C		and put manure in and mix it with the soil and then transplant in it.		
S	For me I just plant in the wet soil like that. I put my seeds in plastic containers for a nursery.	For me I just plant in the wet soil like that.		
		I put my seeds in plastic containers for a nursery.		
Q	Where do you get you seeds?	Where do you get you seeds?		
TC	We got mangoes in the mango season.		tree planting	mango
Q	Do you get seedlings from somewhere?			
TC	No we normally plant it on our own. I got my seeds from Sang's garden, after when I ate the mango fruits.	No we normally plant it on our own.	tree planting	mango
		I got my seeds from Sang's garden, after when I ate the mango fruits.		
Q	You have said the ways you plant, now have they grown to trees? What challenges did you have now?			
C	Fencing is our problem. It the fence is good you likely don't have problems.		farmers' assets	
Q	What did you do about the termites?			
C	We have no solution about preventing termites. We want Rohey to help us with good seed varieties.	We have no solution about preventing termites.	biophysical factors	

C		We want Rohey to help us with good seed varieties.	training and support
Q	The trees that you are talking about, where do you normally grow them?		
C	We plant them at the back of our compounds. So in case you plant your trees and you experienced some challenges	We plant them at the back of our compounds. So in case you plant your trees and you experienced some challenges	farmers' assets
Q	where do you go for help?		
C	We don't have any place for help if we have such challenges.		training and support
Q	The changes happening to the forest, when has that started?		
C	The elders can remember how the forest was like in the past compare to the forest today. Population growth has contributed to it.	The elders can remember how the forest was like in the past compare to the forest today.	forest destruction
C		Population growth has contributed to it.	human population growth
Q	When did the forest start to be like this?		
C	It is said that during our great grand fathers' generation the forest was very thick.		forest destruction
Q	When did the destruction start?		
C	Natural effects has caused the forest destruction. The distance between the two villages was thick and dark. The clearing of the land for farming has contributed to the forest destruction.	Natural effects has caused the forest destruction.	environmental factors
C		The distance between the two villages was thick and dark.	forest destruction
C		The clearing of the land for farming	land clearing for farming
C		has contributed to the forest destruction.	forest destruction
QC	You have said that the forest was thick in the past. When did start to be destroyed?		
C	The destruction started when there was drought. When there was drought tree started to die and trees population decrease. This coupled with bush fires destroyed the forest.	The destruction started when there was drought.	
C		When there was drought tree started to die and trees	

population decrease.

C		This coupled with bush fires destroyed the forest.	environmental factors forest destruction
C			
Q	How about the wild animals that were in the forest?		
C	Almost all the wild animals are gone or not found here now.		
Q	What has made the perished?		
C	They have no safe place to hide.		forest destruction
Q	What caused the changes of the forest?		
C	The changes are all caused by the people.	The changes	forest destruction
C		are all caused by the people.	local responsibility & permission
QC	The population has increased three times what it was before. So which means if the population grows the need for farming land increases and if the farms increases then the forest would continue to be destroyed. What do you think would happen if the forest is neglected?	The population has increased three times what it was before.	
		So which means if the population grows the need for farming land increases	
C		and if the farms increases then the forest would continue to be destroyed.	forest destruction
		What do you think would happen if the forest is neglected?	
C	You have seen that places where there are no trees have no water problems. If farmers don't have rains, that means there is a drought.	You have seen that places where there are no trees have no water problems.	biophysical factors
C		If farmers don't have rains	
C		that means there is a drought.	environmental factors

Q	So what can people do to better revive and sustain the forest?		
C	The government must support in this case. If there is an outbreak of bush fire at a certain time there is less problem, but at a certain time of the year trees are seriously affected. Even if it rains they don't grow. In the month of June if there is a bush fire trees would die.	The government must support in this case.	government
C		must support in this case.	training and support
C		If there is an outbreak of bush fire at a certain time there is less problem	
C		but at a certain time of the year	
C		trees are seriously affected.	forest destruction
		Even if it rains they don't grow.	
		In the month of June if there is a bush fire trees would die.	
QC	So we should protect the forest during that time of the year. That is our responsibility to protect the forest.		local responsibility & permission
C	We need the support of the forestry department.	We need the support	training and support
C		of the forestry department.	government
Q	We the people of the community should think and make plans to revive the forest. What plans do you have to revive the forest?		
C	Planting more trees can help.		tree planting
Q	Are you ready to plant more trees?		
	Yes, we are ready.		
Q	Are you ready to plant more trees in the forest?		
	Yes, as I said, by the time you come back here you will see by yourself.		
Q	Do you plant trees around your houses and at you farms?		
C	Yes. We have no plan to plant trees in the forest , but in a yards and farms, because we can't protect the trees in the forest.	Yes. We have no plan to plant trees in the forest,	tree planting
C		but in a yards and farms,	farmers' assets
C		because we can't protect the trees in the forest.	local responsibility & permission
Q	Do you have anything to say about deforestation?		

C	The land is very poor. If we can get support to improve the soil fertility, by getting compound fertilizer would help. The government can help in selecting someone among us who will lead us and no one would oppose him in his instructions. But if there is no one who can tell people to go and put off the bushfire, then people may not go. But if there is someone with that authority then everyone would go to put off the fire.	The land is very poor.	biophysical factors
C		If we can get support to improve the soil fertility, by getting compound fertilizer would help.	training and support
C		The government can help in selecting someone among us who will lead us and no one would oppose him in his instructions.	government
C		But if there is no one who can tell people to go and put off the bushfire, then people may not go. But if there is someone with that authority then everyone would go to put off the fire.	
QC	If you put the responsibility on the government, that would not solve the problem. If the VDC knows their responsibility many a times these problems may not happen. In some cases people are selected as VDC members and they don't know their functions. The VDC's roles include the management and development of the village.		local responsibility & permission

Appendix E: Interview notes for K4

full transcript	Unique comment	Code word	tree species	delimited tree species
Geejan, tap, rat, and barra are used for firewood and dimbu, soto, rat, wen, ngeran, and barra are used for medicine. The bush is used for timber to build fences and roofs and beds. It is also used for food and finance like selling leaves and dakante (tree sap). People travel 3-4 km for firewood every day and medicine, travel is as needed. Food is harvested seasonally. Collecting firewood continues to contribute to deforestation where wood is taken until its finished.	Geejan, tap, rat, and barra are used for firewood	firewood	geejan,tap,rat, barra	geejan
	dimbu, soto, rat, wen, ngeran, and barra are used for medicine.	herbal medicine	dimbu,soto,rat, wen,ngeran,barra	dimbu
	The bush is used for timber	lumber		soto
	to build fences			rat
	and roofs			wen
	and beds			ngeran
	It is also used for food	food		barra
	and finance like selling leaves and dakante (tree sap)	tree benefits		tap
	People travel 3-4 km for firewood every day			rat
	and medicine, travel is as needed			barra
	Food is harvested seasonally			alom
	Collecting firewood continues to contribute to deforestation where wood is taken until its finished.	dependency on forest resources		cashew
Mango, Halom, Cashew, Baobab, Lunga are useful for commercial, medicine, firewood, food, and rope making (baobab)	Mango, Halom, Cashew, Baobab, Lunga are useful for commercial	tree benefits	mango,alom,cashew,baobab,lunga	mango
	medicine	herbal medicine		baobab
	firewood	firewood		lunga
	food	food		mango
	and rope making (baobab)			cashew
Wen, Mango, Cashew, Orange, Dimbu, Baoab, and Daxar are not cut. The people protect them for their usefulness.	Wen, Mango, Cashew, Orange, Dimbu, Baoab, and Daxar are not cut.	local responsibility & permission	wen,mango,cashew,orange,dimbu,baobab,tamarind	wen

	The people protect them for their usefulness.		orange
Whoever needs the trees can cut them.	Whoever needs the trees can cut them.	lack of controls	dimbu
Bushfire drought and sometimes wind are the causes of deforestation.	Bushfire	environmental factors	baobab
	drought and sometimes wind are the causes of deforestation.		tamarind cashew
They try to grow mango, cashew Moringa by direct seed and transfer and polypopts doing so behind their houses but water is their problem.	They try to grow mango, cashew Moringa by direct seed	tree planting	mango,cashew ,moringa
	and transfer	tree planting	moringa
	and polypopts	tree planting	
	doing so behind their houses	farmers' assets	
	but water is their problem.	biophysical factors	
More plants means they would not have to go far for firewood.			
		firewood	
They would not stay and the people would disappear if the forest disappeared		dependency on forest resources	
The require resources to plant the trees. They want knowledge in manure and pest control as for termites for planting them	The require resources to plant the trees.	farmers' assets	
	They want knowledge	training and support	
	in manure		
	and pest control	biophysical factors	
	as for termites for planting them		
They feel they can't fight bushfire or drought	They feel they can't fight		
	bushfire		
	or drought	environmental factors	

Appendix F: Interview notes for K5

full transcript	Unique comment	Code word	Tree species	delimited tree species
The forest has use for food from mango, bui, and dimbu and also use for shade and for rainfall (first time someone made that connection, from a female). Also have use for stabilizing soil, firewood, medicine, timber, and green manure. The people have to travel 2-3 km for wood.	The forest has use for food from mango, bui, and dimbu	food	mango,baobab ,dimbu	mango
	and also use for shade	tree benefits		baobab
	and for rainfall	tree benefits		dimbu
	Also have use for stabilizing soil	tree benefits		baobab
	firewood	firewood		alom
	medicine	herbal medicine		mahogany
	timber	lumber		tamarind
	and green manure	tree benefits		mango
	The people have to travel 2-3 km for wood.			cashew
Daxar, gui, halom, and xaay (most important)			tamarind,baobab,alom,mahogany	sissop
The alkali is responsible for protecting the fruiting trees and must get permission unless you steal it	The alkali is responsible	local responsibility & permission		limon
	for protecting the fruiting trees			orange
	and must get permission			
	unless you steal it	lack of controls		
Senegal normally comes to steal timber from their Gambian forests	Senegal normally comes to steal timber from their Gambian forests	lack of controls		
Overpopulation, uprooting trees for medicine, bush fire, drought (maral) which has lasted since 1982 have caused trees to reduce	Overpopulation	human population growth		
	uprooting trees	herbal medicine		
	for medicine	herbal medicine		
	bush fire	environmental factors		
	drought (maral) which has lasted since 1982 have caused trees to reduce			
Mango, Cashew, Sissop (karasow), limon and orange are desired and planted. They have not tried or thought to plant bush (native) trees. Problems are the watering and obtaining good seeds. They try direct seeding and transplant and will do in their bathing or bath area (wanag) in the backyard (outside) but encounter termites, and lack of good	Mango, Cashew, Sissop (karasow), limon and orange are desired and planted.		mango,cashew ,sissop,limon,orange	

fencing. Stones or rocks in the ground are also a problem. The soil also has no strength.				
	They have not tried or thought to plant bush (native) trees.	tree planting		
	Problems are the watering	biophysical factors		
	and obtaining good seeds.	farmers' assets		
	They try direct seeding	tree planting		
	and transplant	tree planting		
	and will do in their bathing or bath area (wanag) in the backyard (outside)	farmers' assets		
	but encounter termites	biophysical factors		
	and lack of good fencing.	farmers' assets		
	Stones or rocks in the ground are also a problem.	biophysical factors		
	The soil also has no strength.	biophysical factors		
The sand is brought by erosion increasing the spoiling of the plants. Farming has also increased sand. Clearing the land by burning may cause it also. Burning is done because it's difficult to put the farm waste somewhere. The water table has receded. It used to be 28 m and is now 33 m. More hills cause more erosion. Everything has changed since more than thirty years ago. It used to be that you could see small animals they ate but now just those that ruin farms remain. Lion, tiger, and antelope all used to be there, fox are still there but not many, also birds and bats are fewer.	The sand is brought			
	by erosion increasing the spoiling of the plants.	biophysical factors		
	Farming has also	land clearing for farming		
	increased sand.	biophysical factors		
	Clearing the land by burning may cause it also.			

	Burning is done because it's difficult to put the farm waste somewhere.			
	The water table has receded.	biophysical factors		
	It used to be 28 m and is now 33 m.			
	More hills cause more erosion.	biophysical factors		
	Everything has changed since more than thirty years ago.			
	It used to be that you could see small animals they ate but now just those that ruin farms remain.			
	Lion, tiger, and antelope all used to be there, fox are still there but not many, also birds and bats are fewer.			
If the forest disappeared the people would go too, they would die		dependency on forest resources		
They need to plant trees but don't have seeds and don't normally go look for them	They need to plant trees	tree planting		
	but don't have seeds	farmers' assets		
	and don't normally go look for them			