The Bamboo Alternative: A Neglected Opportunity?

Exploring the potential of bamboo biomass energy for Forest Landscape Restoration in the Western Region, Ghana – a livelihoods perspective

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INBAR

THE GLOBAL PARTNERSHIP ON FOREST LANDSCAPE RESTORATION

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"Knowing trees, I understand the meaning of patience.

Knowing grass, I can appreciate persistence."

Hal Borland (1900-1978)

Abstract

Forests provide both public and private goods and services. Widespread deforestation and forest degradation have a damaging effect on these forest functions. Prevalent efforts have mainly focussed on the inhibition of deforestation. Forest Landscape Restoration comprises of a range of participatory strategies that aim to reverse deforestation and recover the functions of a forest landscape in order to fulfil the short and long term needs of both people and the environment. Bamboo as a resource has many features that are equivalent to those of trees. In theory, this fact, together with its regenerative character, makes it a promising resource for use in Forest Landscape Restoration strategies. In practice however, bamboo generally is an overlooked resource which has not been used for FLR purposes on a large scale. No research had been done as to which factors promote or hamper that its potential is put into practice. This study aimed to fill that knowledge gap.

The research has been founded on theories on common-pool resources, collective action and institutions, generating the knowledge that the relation between the people and their environment is not influenced by the de jure property rights to land and resources solely, but is also based on the more informal institutions that influence people's use of natural resources. A case study in the Western Region of Ghana formed the empirical basis for this research. A combination of several qualitative and quantitative methods were used in the Ellembelle and Mpohor Wassa East districts.

In rural Ghana, the provision of firewood and charcoal is one of the most important forest functions for forest-dependent people in their daily life. This study found that where the collection of firewood leads to forest degradation, the logging of trees for charcoal production leads to deforestation. The prevalent decline in firewood is caused by a decline in forest area, mainly for agriculture. For other forest products, the decline is caused by an increase in use. Because of the quality and characteristics of the product, bamboo firewood cannot fully replace but only supplement normal firewood. Based on interviews and focus group discussions with a pilot group who tried bamboo charcoal it was found that high quality bamboo charcoal can replace normal charcoal, although the market price, which is yet unknown, will have a large impact too. People are interested to learn more about bamboo biomass energy, but are generally not interested in developing bamboo plantations on land they depend on for food crops.
The framing of bamboo in current international policy instruments hinders the incorporation of bamboo in environmental development projects. In Ghana, in practice the use of bamboo is not hindered by formal institutions as bamboo is considered an open access resource even on private or common property land. For people to invest in the resource, institutional arrangements must be put in place to facilitate the conditions for self-organizing groups to guarantee a continued flow of bamboo resources. The key boundary condition entails the ability to exclude outsiders from using the resource. Furthermore, people's bias towards bamboo as biomass energy and bamboo for cultivation must be taken away through education, as the pilot group found that "seeing is believing".

Keywords: Forest Landscape Restoration, bamboo, biomass energy, livelihoods, common-pool resources, collective action, institutions, Ghana

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Astrid Bos (Efia)

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Abbreviations & Acronyms

AEZ	Agro-Ecological Zoning
ALA	Adaptive Landscape Approach
BARADEP	Bamboo and Rattan Development Programme
CBD	Convention on Biological Diversity
CDI	Centre for Development Innovation
CDM	Clean Development Mechanism
FAO	Food and Agriculture Organization of the United Nations
FC	Forestry Commission
FLR	Forest Landscape Restoration
FORIG	Forest Research Institute of Ghana
FSC	Forest Stewardship Council
FSD	Forest Services Division
GPFLR	Global Partnership on Forest Landscape Restoration
IFAD	International Fund for Agricultural Development
INBAR	International Network for Bamboo and Rattan
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature and Natural Resources
LULCC	Land Use and Land Cover Change
MSc	Master of Science
MSE	Micro and Small Enterprise
NFPDP	National Forest Plantation Development Project
NGO	Nongovernmental organisation
NTFPs	Non Timber Forest Products
PD	Participatory Diagnosis
REDD	Reducing Emissions from Deforestation and Forest Degradation
REP	Rural Enterprise Project
SAP	Structural Adjustment Programmes
SIPL	Subri Industrial Plantation LTD
SLA	Sustainable Livelihoods Approach
UNFCCC	United Nations Framework Convention on Climate Change
UU	Utrecht University
WUR	Wageningen University and Research Centre

1 Introduction


Image 1.1 One of the many trucks loaded with logs

Another truck loaded with logs passes by. Mr. Appiah and I are having lunch after half a day of taking interviews. Mr. Appiah is a local coordinator at INBAR Ghana. During this research, he was one of the assistants and translator. Today, we talk about the development of the landscape in his area. As an outsider, I see a lot of rain forest around the village. On the way to this district, I saw heavily deforested areas and many hectares of monoculture forest plantations. So, compared to the rest of the country, is it really that bad in this district? All people we interviewed so far, mentioned the growing scarcity of firewood and charcoal. Yes, there is still just enough wood for firewood and charcoal for cooking, but people need to travel further and further to get it. This was one of the reasons Mr. Appiah convinced the palm oil production cooperation to switch to bamboo firewood for cooking the oil. Bamboo is abundant in the area. But the people are not very enthusiastic when we talk about bamboo. They say it is an untamed plant, which spoils their agricultural land. Mr. Appiah received training on sustainable bamboo harvesting from an expert from INBAR China. I see a twinkle in his eyes, like he knows the secret. He wants to share the secret with all the farmers in his village, including those from the palm oil production cooperation. Today, he wants to share the secret with me. "You should treat bamboo like you treat a child," he says. "You have to take care of it, listen to it[1], and temper it every once in a while[2]. Then, it will do whatever you want it to do."

This anecdote gives a clear overview of the setting for this research. In this introductory chapter I will explain this setting and some other facets further. First, the partners of this research will be introduced. Second, a description of the problem will be given. Third, the social and scientific relevance of this research will be discussed. Finally, I will give a short overview of the rest of this thesis.

[1] By knocking on standing bamboo, one can hear which ones are mature and which ones are not.
[2] Actively managing standing bamboo through sustainable harvesting practices improves its quality (Kigomo, 2007; NMBA, 2004).

1.1 Background

This research project is a unique collaboration between the Utrecht University (UU), the Global Partnership on Forest Landscape Restoration (GPFLR), and the International Network for Bamboo and Rattan (INBAR). The latter two will be introduced here.

1.1.1 *Global Partnership on Forest Landscape Restoration*

GPFLR, launched in 2003, is a worldwide network that brings together governments, United Nations organisations, non-governmental organisations (NGOs), companies and individuals with a common interest in Forest Landscape Restoration (FLR). FLR comprises of a whole range of participatory strategies rather than just planting trees in order to restore a degraded forest. The goal of these strategies is to "revitalise the functions of a forest landscape that can continuously fulfil the needs of both people and the environment"(GPFLR, 2008, p. 4). In practise this entails the introduction of new crops, conservation schemes, wildlife habitats, watershed management systems, tourism opportunities and other land use practices. The main principles of FLR are:

- *Promoting active engagement, negotiation and collaboration between all stakeholders*
- *Restoring an agreed, balanced package of forest functions*
- *Working across landscapes*
- *Continuously learning and adapting*

  (GPFLR, 2008)

One of the elements of the GPFLR is a learning network, which comprises an online learning environment. The Centre for Development Innovation (CDI) of Wageningen International is responsible for creating and managing this online network. The goal of this online network is "to enable forestry practitioners from across the globe to share their experiences on forest landscape restoration, and mutually learn" (GPFLR and CDI, 2010, p. 1).

INBAR Ghana is one of the active members on this online network. INBAR provides innovative approaches to FLR which makes INBAR an important source of practical knowledge for the network. Among the tasks of this particular MSc project is to analyse the INBAR project in Ghana from a FLR perspective. Results (interim and final) are presented on the website and discussed with other members in order to create more practical knowledge.

1.1.2 *International Network for Bamboo and Rattan*

INBAR is an international network which connects governments, research institutions, commercial organizations, NGOs, rural communities and individuals, but which also undertakes bamboo and rattan development projects it selves. INBAR introduces technical innovations which enables people to make use of bamboo and rattan in development programs. Besides, it works on the institutions

and policy side that help increase the contribution of bamboos and rattans to sustainable growth and poverty reduction (INBAR, 2010).

One of the development projects of INBAR concerns the introduction of bamboo as alternative and sustainable biomass energy in Ghana (and Ethiopia). The objective is "to increase the use of bamboo as a source of energy for the poor of Ethiopia and Ghana thereby providing a more sustainable, environmentally friendly and economical option to firewood and wood charcoal" (INBAR, 2008). In practice, this involves the development of a bamboo resource base, the development of a small scale private bamboo firewood and charcoal sector and providing institutional support on government level in order to stimulate the production and use of bamboo charcoal and firewood.

This development project started in 2008. Among the tasks of this MSc project is to evaluate the results of the bamboo projects in Ghana so far and to examine whether bamboo in practice provides an alternative to *conventional* firewood.

1.2 Problem statement

What could be derived from the anecdote presented earlier in this chapter was that the problems concerning deforestation, degradation, health and management of resources are complex and highly interrelated and often have a cross scale dimension. I put these problems into three categories which will be introduced here. Please note that the following chapters concerning the Theoretical Framework and Regional Framework will discuss some of these problems in more detail.

1.2.1 *Deforestation and land degradation*

Forests, compared to many other natural resources, have a special characteristic. Forests serve both public and private interests. On the one hand, forests offer a diversity of public goods (e.g. climate regulation and soil conservation). Here everyone benefits, but no one can own it. On the other hand, forests provide private goods (e.g. timber, charcoal and fruits) that may be owned through acquiring titles of ownership (Humphreys, 2006) but which are often missing. Therefore, in many cases forests can be seen as common pool resources. For that reason "balancing the private and public goods that forests provide is the defining challenge for forest policy-makers" (Humphreys, 2006, p. XVII). This challenge, among others, will be discussed in more detail in the Governance section of this chapter.

Among the private goods that forests provide are wood-based fuels. This includes both charcoal and firewood. Where industrialized countries have moved towards more efficient types of energy long ago, developing countries often cannot afford and access alternative sources of energy (INBAR, 2008). Sub-Saharan Africa is the region where the most wood (in terms of firewood and charcoal) for cooking and heating homes per capita is consumed in the world (Sanders, 2006). It is estimated that more than 90 percent of the households in Ghana rely on wood-based fuels as their primary energy

source for domestic cooking and other productive activities (INBAR, 2008; Kusimi, 2008). Firewood and charcoal account for more than 78% of all primary energy consumption (ECA/UNESC, 2007). These consumption levels are highly unsustainable as the resources are mainly taken from natural supplies, i.e. forests. The use of firewood and wood charcoal is said to be one of the main contributors to deforestation in Africa, which has resulted in a decrease of Ghana's total forest cover from 37 percent in 1993 to 24 percent in 2005 (5,517,000 ha) (INBAR, 2008).

Rural people in Ghana do not only depend on the forests for its wood-based fuels but also for a whole variety of other wood and non-wood goods and services. On the one hand they can be seen as a cause of deforestation and land degradation because of unsustainable harvest practices of these goods. On the other hand, they are also directly affected by the consequences of deforestation and land degradation, contributing to a downward spiral of poverty (Kwaschik, 2008). In other words, rural people literally and figuratively depend on the forest mostly. Searching for solutions while focussing on rural people would therefore potentially work in both directions. This is also the underlying reason why many researchers and policy makers find including local users in forest management schemes crucial (Gibson, McKean, & Ostrom, 2000).

INBAR (2008) claims that with bamboo they have found such a solution that can help overcome, among others, the challenges of deforestation and land degradation. Because of its quickly renewing character, in theory bamboo can serve as sustainable biomass energy for the poor while conserving existing forests. Whether or not this is true in practise will be examined with this case study of the Western Region of Ghana.

1.2.2 *Individual versus collective action*

As stated in section 1.2.1, rural people can often be seen as direct causers of deforestation and land degradation as well as direct victims of the its consequences. This is the reason why this research has a strong livelihoods perspective. As said before, searching for solutions with a local people's focus can potentially work in both directions, i.e. it could counter the problem while at the same time strengthen local people's position concerning adaptation to the problem's consequences.

This presumes that the solution is to be sought in people's individual action. While I think this is at least partially true, I would like to stress the fact that people's decision making never occurs on an individual basis. That is, people also base their choices on the decisions of others, so understanding these reciprocal relations for collective action is key, especially when dealing with common pool resources. This makes the search for a solution more complex. More on collective action will be discussed in the next chapter concerning the theoretical framework.

1.2.3 *Governance of natural resources and property rights*

Management of natural resources is a true challenge for policy-makers. One way of controlling the use of natural resources is by providing property rights. Rights to own or use natural resources can be organized trough various resource regimes (see for example Heltberg, 2002; Linda, 2006; Ostrom, 2003). Here, distinctions are being made between open access, common property, state property and private property (Seabright, 1993). However, in practice these distinctions are not always as clear cut as they seem. For example, a forest may be *de jure* state property, but often turns into *de facto* open access because of encroachment, settlement and illegal logging (Seabright, 1993). If the managing and planting of bamboo will become institutionalized in Ghana, one should take into account this difference between theory and practise, as it might have serious consequences for the way people use natural resources. First it needs to be understood how the different resource regimes work in Ghana with regard to forests and how these regimes might coincide or conflict in practice.

1.3 Relevance of study

1.3.1 *Scientific relevance*

Debates concerning deforestation and land degradation and how to counter it are far from new in the academic world. Forest Landscape Restoration goes further than fighting the causes of deforestation. It is a forward looking approach focussed on restoring forest functions and more. The ideas behind FLR itself are not entirely new and build on knowledge from amongst others Sustainable Forestry theories. Much has been written about Sustainable Forestry theories and approaches. What is new about the FLR approach is the level of analysis. The focus is on the landscape level rather than on site level. Still, the conceptual founding of FLR is still relatively new and little is known about cases which have implemented (fully or partially) the FLR approach. This MSc project aims to contribute to this knowledge gap. Furthermore, it will potentially contribute to the conceptual debate on the FLR approach itself through the discussions in the learning network of GPFLR.

This study also examines the notion of bamboo in thinking about forests and its resources. Officially bamboo falls under the category of woody grasses (Scurlock, Dayton, & Hames, 2000), i.e. bamboo is not considered a tree. However, because of its characteristics and functions, some advocate that bamboo should be viewed as a tree, and not as a non-timber forest product (NTFP) (Yiping, Yanxia, Buckingham, Henley, & Guomo, 2010). While at first sight this might look like a vacuous discussion, the conceptualization of bamboo has large institutional implications. For example, only if considered a tree, bamboo can be made eligible for REDD compensation schemes (Lobovikov, Lou, Schoene, & Widenoja, 2009). This research has paid attention to these implications in the case of Ghana and will contribute to the debate on the conceptualization of bamboo.

1.3.2 *Social relevance*

The research will contribute to a collaborative learning process on FLR on the ground, as local users and micro and small enterprises (MSEs) have an interest in knowledge on a less polluting, more sustainable and economical alternative to conventional firewood and charcoal. With regard to policy-making, the District Assembly of Ellembelle has already notified to be interested in the results of this study for future development plans of the district.

Moreover, the research will contribute to a collaborative learning process at a higher global level, by connecting the learning sites to the web-based learning network. To this end, up-to-date learning methods will be developed, to feed the network with practical FLR experience, have the *lessons learned* at INBAR be disseminated and discussed amongst network members, and contribute to a world-wide process of social learning for sustainable development.

1.4 Looking forward

In this introductory chapter, the setting for the research was discussed. In the next chapter, the theories that are the backbone of this study will be explained. This also includes a discussion on the development of the academic debates relating these theories. The third chapter comprises of an elaboration of the methodology used including the research questions and hypotheses. Because an important part of the study consists of field research in Ghana, the fourth chapter elaborates on the regional framework of the research setting. The results of the empirical research are presented in the fifth chapter. Chapter six consists of a discussion concerning the results that were found and in the following chapter conclusions are drawn from these results. Finally, in the eighth chapter recommendations are given to INBAR, local policy-makers, members from the GPFLR network and academics.

2 Theoretical Framework

The issues that will be discussed in this chapter form the theoretical backbone of this research. The first topic on governance of the commons is generally considered fundamental in thinking about natural resource management and, in particular, forests. This part is largely based on the work of Elinor Ostrom and other political economists.

Compared to this, Section 2.2 has a less clear theoretical foundation and is based on more thematic debates in the world of both academics and practitioners. In order to better understand the origin of the Adaptive Landscape Approach, in this section the views on deforestation and degradation causes will be discussed and, consequently, how related forestry management regimes have evolved. However, this does not mean that ALA has already evolved into a generally accepted way of thinking about forest landscapes and acting in forestry, or more generally environmental management. Rather, this is a relatively new approach where on-going development is actually inherent to the approach itself. Still, I think it has a great potential of becoming a generally accepted way of thinking, leading to a set of fundamental theories perhaps, which is why I think it is important to get insight into the grounds on which this new approach is built.

Section 2.3 explains how the theoretical notion on bamboo has a large impact on how it is often valued and used in practice.

2.1 Governance of the commons

2.1.1 *Evolution of conceptions*[3]

Hardin's article in Science (1968) is often quoted in the debates on the commons. His tragic story explains how individual herders try to maximize their profits based on economic rational thinking and in this way inevitably provoke overexploitation and depletion of the common pasture. The idea behind this is that the benefits of increasing the herd with one animal increases the individual profit while the negative externalities (cost of overgrazing) are shared with all herders which in the end leads to a tragedy of the commons. Or, as Hardin (1968, p. 1244) puts it dramatically "ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all".

[3] The whole section of 2.1 focusses mainly on the development of property rights regimes with regard to natural resources and land tenure. More generally, the development of natural resource management discourses will be discussed in Section 2.2.

Hardin's article is beloved and criticized innumerable times, both probably for the same reason: its simplicity. Because of its simplicity it can be used in debates on all kinds of common-pool resources, that is for example, pastures, fisheries and forests (Steins & Edwards, 1999). It can be used in many regions of the world and on different scales as well. However, this generalizability also creates many shortcomings which can be summarized as follows.

First, Hardin states that only privatization or government ownership can prevent overuse of the resource. Hardin's model on the tragedy of the commons is not the only one which recommends either a market or state control solution. One other, and more formalized, model is the Prisoner's Dilemma Game in which non cooperative actors have complete information about their situation, their choices, and the possible consequences of these choices. The best individual strategies do not lead to a Pareto optimal outcome, which has a inherent paradox, that is, "individually rational strategies lead to collective irrational outcomes" (Ostrom, 1990, p. 5). Related to this is Olson's Logic of Collective Action, which stated that if people are not able to exclude others from a public good, they will act upon their self-interest only, as there is no incentive to actively contribute to a (continued) provision of that good (Olson, 1994). The problem of free-riding is inherent in all three models, with the consequence that if all or most people free-ride, the collective benefits of either the good or service will not be produced (Ostrom, 1990). As said before, according to these models only privatization or government ownership can provide solutions. As an alternative, Ostrom (1990) proposes a theory which states that self-organizing and self-governing forms of collective action could provide this solution as well. More precisely, Ostrom states that the both privatization and government ownership are suboptimal as "neither the state nor the market is uniformly successful in enabling individuals to sustain long-term, productive use of natural resource systems" (Ostrom, 1990, p. 1). An elaboration of this will follow in Section 2.1.2.

A second shortcoming, and closely related to the previous one, is that Hardin's story points out that people are trapped in this commons dilemma, not capable of creating solutions themselves (Dietz, Ostrom, & Stern, 2003), while Ostrom and others actually find empirical evidence that it *is* possible, that is, by communicating with each other and organize themselves in groups (Dietz et al., 2003; Ostrom, 2000). In this respect, the term *environmental entitlements* was introduced by Leach, Mearns, and Scoones (1999) introduced, implying that sustainable behaviour is based on more than just rights and claims, as suggested in Amartya Sen's famous work (1983). Rather than solely focusing at the claim itself, it is more important to examine who is entitled to use certain resources in reality, and how access rights are obtained and legitimised. "Various institutions, both formal and informal, shape the ways in which different actors get access to and derive well-being from environmental

services and natural resources (natural capital). In doing so, they also influence the course of ecological change" (Burgers, 2004, p. 27).

Based on empirical research of herself and others Ostrom (2000) found that there is some consensus as to which attributes of both the users as well as the resources increase the likelihood for the forming of self-organized groups (Table 2.1). It must be stressed that this list of attributes is not a set of hard conditions. Rather, the "relative size of the expected benefits and costs they generate as perceived by participants"(Ostrom, 2000, p. 39) is crucial to increasing this likelihood.

Attributes of the Resource		Attributes of the Users (Appropriator)	
R1	Feasible improvement	A1	Salience (user dependence)
R2	Indicators (of the resource system) are	A2	Common understanding
R3	Predictability (of flow of resource units)	A3	Low discount rate
R4	Spatial extent (of the resource system is relatively small)	A4	Trust and Reciprocity
		A5	Autonomy
		A6	Prior organizational experience and local leadership

Table 2.1 Resource and Users Attributes that are beneficial to an increased likelihood of self-governing groups formation[4]

Here too, individuals are rational decision-makers as the attributes influence the cost-benefit calculations of the users of a resource (Ostrom, 1990). Including and comparing the influence of the old and new rules will affect the incentive to change, which can be either positive or negative. Consequently, the attributes of a resource, but also of the users themselves, influence both the benefits and costs of institutional change (Ostrom, 2000).

Third, there is a conceptual misunderstanding about the definition of common-pool resources. While Hardin is talking about the 'commons', some argue he actually describes an open access situation (Steins & Edwards, 1999). This is because Hardin actually only distinguishes between public and private goods. However, there is now consensus that two crucial dimensions are at stake, namely excludability and rivalrous of a good, which lead to four different types of goods, that is, pure private goods, public goods, club goods, and common-pool goods (Gibson, McKean, et al., 2000) (for an example of different types of forest goods, see Table 2.2). Linked to this categorization, Ostrom (2003) advocates for making a distinction between public-goods problems and common-pool resource problems. This distinction can be made based on whether or not "consumption by one person subtracts from the availability of benefits to others" (Ostrom, 2003, p. 261). Consequently, public-goods and common-pool resources overuse gives different outcomes. The latter may lead to congestion, degradation and potentially depletion. Because public goods are non rival, these risks are not present. However, this is complicated by the fact that within one area, different types of goods may be present. As emphasised in Section 1.2.1 and shown in Table 2.2, this is especially the case

[4] Based on Ostrom (2000) and Gibson, Ostrom, and McKean (2000)

with forest landscapes. A more complete distinction between property regimes will be discussed in Section 2.1.3.

	Rival	Non-Rival
Excludable	**Quadrant 1** *Private goods* (timber; nuts; berries; fruits; rubber; bush meat; private forest land; local forest commons regimes: access by outsiders is regulated; tradable emission permits)	**Quadrant 2** *Club goods* (protected forest areas: access is regulated, a toll may be charged for entry; patents on the properties of forest species; including traditional forest-related knowledge- possibly with a share of the benefits being paid to host governments and traditional knowledge holders)
Non-Excludable	**Quadrant 3** *Res Nullius (open access)* (local forest commons that are undermined through unregulated access from outsiders; protected forest areas that are undermined through unregulated access from outsiders; the atmosphere as a pollution sink)	**Quadrant 4** *Public goods* (biological diversity; carbon sequestration and atmospheric regulation; pollination; soil conservation; watershed management; sites of local cultural and spiritual value; protected forest areas under effective management with free access to the public; traditional forest-related knowledge)

Table 2.2 Types of goods provided by forest landscapes[5]

2.1.2 *Excludability and the central role for institutions*

As Olson (1994) stated, for all collective action problems, exclusion is the key attribute (see also Ostrom, 2003). Naturally, this also includes cases with natural resources. “All collective action problems share the problem that excluding non-contributors to a collective benefit is non-trivial” (Ostrom, 2003, p. 241). If there is no possibility of excluding others from the benefits, an owner or owner’s group will not have any incentive for a sustained provision of that good. This could be a reason why in certain cases users, e.g. farmers, do not invest in land that is practically an open access area. Consequently, the right to exclude others is important for the condition of a forest (Dahal, Larson, & Pacheco, 2010).

To ensure excludability, certain measures can be taken. For example, an area can be literally fenced off (for example in the case of ‘fortress conservation’, Section 2.2.2), or regulated by property rights (see also Section 2.1.3). Property rights are human institutions which involve claims and power differences in decision-making over resources (Gibson, McKean, et al., 2000).

This is where the notion of institutions comes in. As Larson, Marfo, Cronkleton, and Pulhin (2010, p. 94) explain, “both the nature of the institution representing the collective and its domain of powers are fundamental to the distribution of access to land and forest resources and to the benefits they generate”. Formal and informal institutions structure the way we organize the distribution of land and the rights to resources. Moreover, the reason why many researchers put institutions central in understanding the (mis)management of resources is the belief that institutions, in combination with the incentives and behaviours they generate, form the basis of explaining forest use and forest condition (Gibson, McKean, et al., 2000; Thomson, 1992). “Since local institutions guide the daily

[5] Based on Humphreys (2006), edited by author.

consumption of natural resources, it is appropriate to keep them at the center of analyses concerning forest use" (Gibson, McKean, et al., 2000, p. 4).

Institutions are also closely linked to rule compliance. That is, if laws and rules (both formal and informal institutions), are not generally agreed upon, increased chances of corruption (between guards and forest users in the form of bribery) or conflict are present. The laws and rules regard the rights to resources, but also agreements on sanctioning rule breakers (Gibson, McKean, et al., 2000). Formalized in general compliance theory, this means that compliance depends on both instrumental (i.e. enforcement), normative (feeling of obligation) and other factors (Hansen, 2011, p. 576). Non-compliance is often linked to a flawed policy and legal framework, low enforcement capacity, lack of information about the resource and about illegal practices, corruption and a high demand for timber (Hansen, 2011). Although Hansen's research focussed on Ghana, all these flaws are experienced as major obstacles for forest law compliance in the whole area of West Africa (FAO & ITTO, 2009).

As discussed above, Ostrom states that empirical research shows that, forest users themselves have developed rules that control harvesting patterns so as to ensure the a sustainable provision of forest resources over time (Ostrom, 1990, 1999, 2000). However, there is no consensus with regard to the size and heterogeneity of these groups and their effects on the success of self-governance. Olson (1994) argued that the smaller groups are, the lower the transactions costs become. Smaller groups are therefore more likely to overcome collective action problems than larger groups. However, this does not mean that the risks of collective action problems have disappeared with common property arrangements. Because common-property regimes are comprised of more than one individual owner, the temptation inside a common-property regime to cheat on community rules can still be present (McKean, 2000). Moreover, Gibson, Ostrom, et al. (2000, p. 232) claimed that "smaller groups may be disadvantaged when it comes to marshaling resources sufficient to monitor the use of a forest or to enforce local rules through the use of the courts". These authors suggest that here, national governments could facilitate self-governance by "providing accurate information about natural resource systems, providing arenas in which participants can engage in discovery and conflict-resolution processes, and providing mechanisms to back up local monitoring and sanctioning efforts" (Gibson, Ostrom, et al., 2000, p. 233). However, based on the findings on forest law compliance obstacles as discussed above, I question if in practice, in countries with weak central governments and relatively strong local governments, such as certain chieftaincies in Ghana, central governments are more capable of fulfilling these tasks for enabling self-governance compared to local bodies.

2.1.3 *Property rights regimes*

An understanding of different property rights regimes is vital if one studies natural resources. Heltberg (2002) distinguishes between open access, common property, state property and private property. Common-property regimes for forests and other natural resources are then defined as "institutional arrangements for the cooperative (shared, joint, collective) use, management, and sometimes ownership of natural resources" (McKean, 2000, p. 27). This means that rights are assigned to a certain group which makes it implicitly different from open access. However, these categories are not always fixed and clear-cut. For example, an area where the state is the de jure owner, it can be considered open access in practice (Heltberg, 2002).

When talking about rights to land and resources, some differentiate between *property rights*, i.e. real estate, and *tenure*, i.e. the way in which rights are administered (Larson, Barry, & Dahal, 2010). This categorization is different from the more general grouping cited above, as here communal tenure systems and common property exist on either state or private land, rather than being a separate property category. *Tenure rights* are bundles of rights, which include access and use rights, management, exclusion and alienation authority (Schlager & Ostrom, 1992). This means that *forest tenure* is about who owns the land and who has the right to use, manage and make decisions (Larson, Barry, et al., 2010). It is not uncommon that in practice this involves different people, especially in countries like Ghana where land tenure is vested in the stools, i.e. the chiefs, but where families practically have all user rights (this will be explained in more detail in Chapter 4).

Another distinction can be made when talking about rights to land and resources. That is, there is a difference between rights to flow and rights to stock (McKean, 2000). Common property arrangements exclude certain people from the rights to goods, which in a way can be seen as privatization of the goods, without dividing the goods themselves. In other words, common property arrangements "offer a way of parcelling the *flow* of skimmable or harvestable 'income' (the interest) from an interactive resource system without parcelling the *stock* or the principal itself" (McKean, 2000). Some natural resource systems provide more goods and services without being divided, i.e. in the case of biodiversity of forests, and for others it may be practically impossible to divide it into parcels, i.e. with fisheries.

In the previous section, a distinction was made between four different goods. In this section, four different property rights regimes were discussed. There is however little agreement about which regimes fit best with which goods. There is only consensus that "private goods are best held as private property" and "that private property is an inadequate arrangement for public goods and bads (that is, when we have positive or negative externalities)" (McKean, 2000, p. 33). Therefore, which property right regime guarantees a sustainable provision of bamboo in Ghana cannot be said with

certainty, based on theory only. Moreover, depending on whether bamboo in Ghana is managed[6] or not defines what type of good it is, i.e. private or open access. In Chapter 6 I will further discuss this issue.

2.1.4 *Link to this study*

What is the relevance of this discussion for this research on bamboo in Ghana? First, the forests of Western Region can be considered common-pool resources, and so do the bamboo stocks. However, the prevalent property regimes in the Ghana are more complex than the four as described in Section 2.1.3. At this stage, bamboo is still abundant, but what will happen if the demand for bamboo for charcoal and firewood rises? As Ostrom (2000) argues, any renewable resource can go through different stages. It may suffer from congestion, but it may also be overharvested to such a degree that the stock generating the flow of resources is depleted. "An unregulated, open-access common-pool resource generating highly valued resource units is likely to be overused and may even be destroyed if overuse destroys the stock or the facility generating the flow of resource units" (Ostrom, 2000, p. 30). Therefore, for the sake of a sustainable provision of bamboo, one could argue that not only the use of wood and timber must be regulated, but also that of bamboo. On the other hand however, McKean (2000) advocates not to regulate in cases where there is no need to. For example, not to transfer open access into common property when the demand for that resource is too low.

During the last decades, there was a widespread privatization of property rights all around the world. The reasons behind these conversions are numerous, it is believed to increase efficiency, enhance incentives for investment, create incentives for resource protection and sustainable management (McKean, 2000). According to McKean, one should be reserved when transferring open access into common property, but also when considering transferring traditional rights to land and resources into others:

> *"the people who live nearest to these forests still have ample opportunity to use them, but when they lose secure property rights in the resources to others, they also lose any incentive they might have felt in the past to manage these resources for maximum long-term benefit. […] In many instances, the transfer of property rights from traditional user groups to others eliminates incentives for monitoring and restrained use, converts owner-protectors into poachers and thus exacerbates the resource depletion it was supposedly intended to prevent".*
>
> (McKean, 2000, p. 35)

[6] For a definition, see Section 3.4.

Based on the attributes of resource and users as shown in Table 2.1, it must then be analysed whether in this case a self-organizing property regime is expedient in the case of Ghana as well. To illustrate, one of the user attributes will be particularly interesting here. That is, with regard to A2, i.e. common understanding, it must be studied whether groups with different cultural backgrounds, who share access to a common resource, have different views on the "structure of the resource, authority, interpretation of rules, trust, and reciprocity" (Ostrom, 2000, p. 45). This would influence the likelihood of success from self-organized governance.

2.2 Addressing forest degradation: towards adaptive landscape management

As said before, the Adaptive Landscape Approach is still relatively new. This section aims at getting a better understanding of its theoretical foundation in order to value its use for bamboo management in Ghana. Figure 2.1 illustrates the structure of this section.

Figure 2.1 Towards the Adaptive Landscape Approach

2.2.1 *Deforestation and Forest Degradation: debates on causes and effects*

In Section 1.2.1 the significance and scale of deforestation and forest degradation has already been discussed. This section aims to give insight into the debates regarding the causes of deforestation and forest degradation in general and the effects on the environment and the livelihoods of forest-dependent people. What has become clear from literature research, is that these topics are discussed in depth already for a long time, but that consensus on the general causes and effects (and the thin boundary between them) is missing (see also Gibson, McKean, et al., 2000).

Often, a distinction is made between on the one hand direct and on the other hand underlying and proximate causes of deforestation and forest degradation. One of the direct causes of deforestation and degradation is said to be intensification, extensification of agricultural production, and overgrazing of pastures (Lamb & Gilmour, 2003). With regard to the latter two this is, at least in Africa, often amplified by an underlying factor, namely a productivity level of the soil that was relatively low already before the deforestation and degradation started. This is what Barbier (2000) calls the 'cumulative causation' link between degradation and land conversion. Barbier is referring to land degradation in particular, but I think this link is also visible in many tropical *forest* landscapes where agricultural activities take place. The difference is that while degrading or deforesting a forest, not only degradation of the soil takes place, but also other goods and services that forests (used to) provide are diminished. Based on a cross-national analysis Allen and Barnes (1985) conclude that

deforestation is caused to population growth and indeed agricultural expansion, but that this is intensified over by wood harvesting for fuel and timber export.

Other, more underlying and proximate, causes of deforestation and forest degradation that are often mentioned are population growth, population density, affluence, technology, national debt, commercial logging, government policy, forest accessibility and political stability (Gibson, McKean, et al., 2000).

Of course, many of either the direct, underlying or proximate causes are often site-specific, which is undoubtedly also the case in Ghana. For example, the national policy reforms such as the Structural Adjustment Programmes in Ghana[7] is often linked (indirectly) to the increased deforestation and degradation in the past decades (Benhin & Barbier, 2004). These and other site-specific factors will be discussed in Chapter 4 and in Section 6.1.1. Despite the fact that these policies are nationally determined, they often are comparable with what happens in other countries where economic liberalization has also led to major reforms (Angelsen & Kaimowitz, 1999).

With regard to the *effects* of deforestation and forest degradation there is consensus that it brings about many negative effects for both the environment and the forest-dependent users. With regard to forest degradation, few would therefore contradict the statement of Lamb and Gilmour (2003) that "the overall effect of this process of forest degradation is a reduction in human well-being and a loss of biodiversity and ecological goods and services". The negative externalities that are caused by unplanned deforestation are summarized by Gibson, McKean, et al. (2000, p. 1) as "loss of biodiversity, elevated risk of erosion, floods and lowered water tables, and increased release of carbon into the atmosphere associated with global climate change". These externalities can be found on-site and off-site (Lamb & Gilmour, 2003).

What becomes clear is that the dynamics of causes and effects of deforestation and degradation are complex. Deforestation and forest degradation are linked processes but the distinction between them should be clear too (see also Section 3.4). Sometimes the boundary between causes and effects become blurred as well. For example, access to land and resources is a crucial factor in (agricultural) production and economic development (Dei, 1992). But at the same time it is also an important factor in the cause of environmental degradation and in determining people's responses to it (Blaikie, 1989). More on these responses will be explained in the next section, where the focus is on forest management schemes. With regard to this research, it is important to acknowledge the complex relationships regarding deforestation and degradation at stake in the case study area. Bamboo can

[7] For an in-depth study on the influence of Structural Adjustment Programmes on forests in the Amazon, I would like to refer to Wood and Porro (2002)

only become a substantial tool for FLR if it first becomes clear what role it can, and cannot, play in this deforestation-degradation-restoration nexus.

2.2.2 *Approaches in forest management*

Different types of forest management schemes have been introduced as a response to widespread deforestation and forest degradation. These schemes form the basis for (national) conservation and natural resource management policies. As diverse as the causes and effects of deforestation and forest degradation are, so are the responses to it. However, a general trend in the history of these responses can be found when one focusses on the position of the human being in relation to the forest or to the environment in general.

In colonial times, forest dependent people were seen first and foremost as a threat to the forest. Interventions by government bodies were legitimized by a conservation discourse that was based on the view that people who are living in the area are the cause of deforestation and forest degradation problems. This idea led to *fortress conservation* schemes (Himmelfarb, 2006) and the creation of protected areas and National Parks. This entails that people should be fenced off and that any use of the areas' resources should be regulated.

This protectionist thinking of conservation was dominant for many years in large parts of the world. A shift is noticeable during the period of the mid-eighties to mid-nineties, when the discourse of community based natural resource management and community-based conservation emerged. Here, forest dependent people become an integral part of the resource planning and management system (Appiah et al., 2009). In this way, it can be seen as an alternative to the more exclusionary protectionist policies of the past, like the fortress conservation discourse (Hackel, 1999). This shift goes hand in hand with a growing attention for new livelihoods centred approaches, such as the Sustainable Livelihoods Approach (SLA) initiated by UK's Department for International Development (Chambers & Conway, 1992; Scoones, 1998a). However, it most be emphasized that the goal of SLA was above all poverty reduction and not nature conservation per se. Still, the new approaches were used to explain the failures of conservation in history and to criticize in this way the old protectionist practices. For example, as Dei (1992, p. 83) puts it when discussing deforestation in Ghana, "if the goal of conservation is to serve the needs of the urban elite and their friends and agents (e.g., multinational logging companies) then local people are not going to embrace any calls for conservation. (…)Without having alternative choices or some form of local autonomy over available resources, rural peoples have every incentive to cut down the trees before someone else does".

In 1987, the famous Brundtland report was published by the World Commission on Environment and Development, titled *Our Common Future*. Here, sustainable development was defined as:

> *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs." (WCED, 1987)*

The report stressed the need to incorporate the human, economic and environmental dimension in development thinking. It formed the basis for many new approaches under which the Ecosystem Approach. This approach was initiated by the Convention on Biological Diversity (CBD) which defined the Ecosystem Approach as a "strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" (Sheperd, 2008). Unlike the SLA, the emphasis is on biodiversity conservation but also on sustainable development in general. Where SLA is actor oriented, the Ecosystem Approach is more process oriented.

More recently the Forest Landscape Restoration approach was developed and is still under development. What is new about this approach is that it is a forward looking approach, focussing on restoration (see Section 2.2.3) rather than, for example, countering degradation. Moreover, rather than being actor oriented or process oriented, it is an holistic approach (GPFLR, 2006) with a landscape focus (see Section 2.2.4). FLR is clearly based on previous approaches as those explained above (see also GPFLR, 2006; Pfund & Stadtmüller, 2005), and can be seen as complementary to these approaches (ITTO, 2005). However, it also aims to provide an alternative to what Sayer (2008) calls *threat-based* approaches as those mentioned above, which still form the basis for many conservation organizations. While a whole evolution in development and natural resource management thinking has taken place during the last century, when it comes to conservation, according to authors like Sayer we are perhaps not acting that different from what Himmelfarb (2006) called 'fortress conservation'. Rather than focussing on the zoning of areas, FLR tries to set priorities on the functions of a landscape (GPFLR, 2006). I think the next decade will prove whether the rise of Forest Landscape Restoration is truly changing the old paradigm or if it is just 'old wine in new bottles'.

2.2.3 *Towards a restoration approach*

In the last decade, attention has grown for restoration like approaches for forest management. Both academics and conservation organizations like IUCN and WWF acknowledged the need for an approach where an improvement is central of both the landscape and livelihoods in deforested or degraded areas (Lamb & Gilmour, 2003). They emphasised that this new approach involves more

than just planting trees, as revived forests entail much more goods and services than just a new bunch of trees (GPFLR, 2008; ITTO, 2005; Lamb & Gilmour, 2003; Maginnis & Jackson, 2002).

Generally when debates on new approaches arise, a consistent definition of concepts is lacking. Here for example, the terms restoration, rehabilitation and reclamation are often used interchangeably. Lamb and Gilmour (2003, p. 13) make a distinction between those three concepts. They state that restoration is aimed at recreating "an ecosystem as close as possible to that which originally existed at the site". But this imposes questions as to which 'original state' the authors are referring. A brochure from the Global Partnership on Forest Landscape Restoration (GPFLR, 2006) stresses that it is *not* about desperately trying to get back the pristine forests of the past, but that FLR rather tries to restore a certain package of forest functions. This inevitably brings about trade-offs which should be discussed and agreed upon. These trade-offs encompass issues of addressing public versus private needs, and opting for development versus conservation goals (Lamb, 2005). These and related trade-offs are especially hard to avoid at the local level, which is why the landscape approach has been introduced (Maginnis, Rietbergen-McCracken, & Jackson, 2005; discussed in more detail in Section 2.2.4).

Which functions should be restored depends on the results of discussions about these trade-offs, but also on the goal of restoration at the landscape level. Lamb and Erskine (2008) therefore distinguish between a biodiversity goal and a combined goal of biodiversity and productivity. It becomes hard, if not impossible, to restore an area that has been completely deforested already. In a lightly degraded forest, perhaps little intervention is needed and the main strategy would be natural regeneration. In an heavily degraded area where intensive logging takes place, enrichment planting and coppice management is needed (Sabogal, 2005). Moreover, a degraded primary forest needs different restoration strategies (e.g. protection of the remaining forest patches, natural recovery, management of natural regeneration, enrichment planting or direct plantation) compared to a secondary forest which is currently used for agriculture. In the latter case, emphasis will be on restoring productivity and generating income for livelihoods through for example agroforestry and less on protective measures (Sabogal, 2005).

As Figure 2.2 shows, there is a clear overlap with earlier approaches. Sustainable forest management focusses more on the productive side of areas, while protected areas address more the biodiversity needs (WWF, 2003). Consequently, which restoration goal to select is linked to which functions to restore, but is at the same time largely constrained by the environmental state and forest landscape type. As can be derived from this, the way one defines the concept of restoration is related to the intended outcome. The next question is, what can be considered a success and how to measure this? That will be discussed in Section 2.2.7.

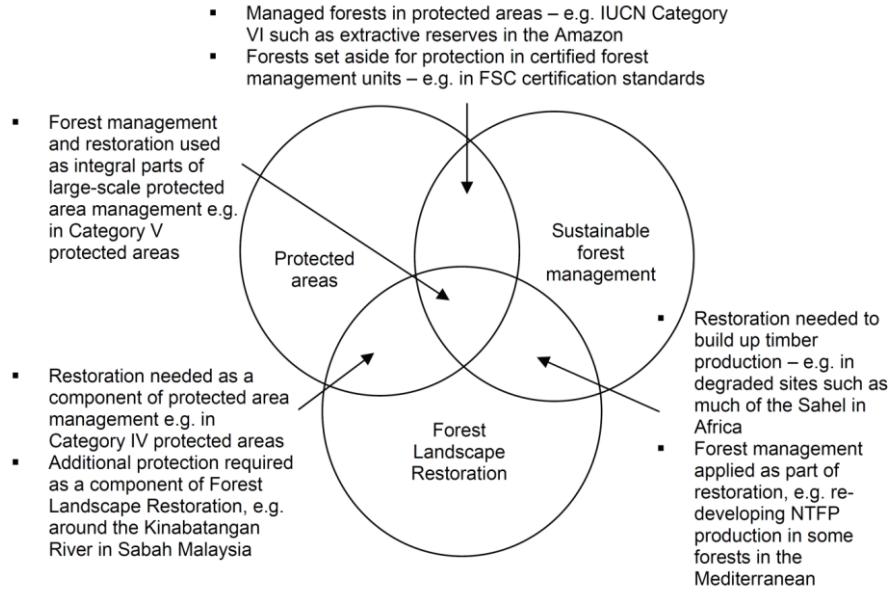

Figure 2.2 Overlaps between protection, management and restoration[8]

2.2.4 *Towards landscape approach*

A second issue that is new for forestry management schemes is the scale of action. As an alternative to micro level schemes, such as the SLA, or holistic approaches, such as the ecosystem approach, FLR focusses on the landscape level. In the last decade, more scholars have acknowledged the benefits of working with a landscape approach. For example, the trade-offs "inherent in modern production forestry can only be fully understood at a landscape level, large enough for addressing complex and competing land use demands yet small enough for addressing local concerns regarding sustainable land use" (Saint-Laurent & Carle, 2006, p. 40). Moreover, as opposed to the site level, "forest restoration at a landscape scale […] is better suited today for addressing a broader range of issues and needs" (GPFLR, 2006, p. 2; see also GPFLR, 2009). That is, the human needs can best be met when the goods and services that *different* forest types provide are combined (Sayer, 2008), and the existence of different forest types can often only be found at a broader geographical scale. But in order to provide these goods and services in a sustainable way, the environment must be restored to be able to provide these goods and services in the first place. This is what Jackson and Maginnis (2005, p. 28) call the *double filter*, that is, the "need to enhance human well-being and restore long-term ecological integrity at the landscape level". As has been acknowledged in the previous section, this leads to trade-offs inevitably. Balancing the needs therefore entails making compromises. As summarized by Jackson and Maginnis (2005, p. 28), "the double-filter principle reflects an acknowledgement of the inevitability of some site-level specialization and trade-offs between

[8] Source: WWF (2003)

economic, social and conservation values of the land. However, the principle also reflects the notion that these individual site-level trade-offs must be balanced at the landscape level."

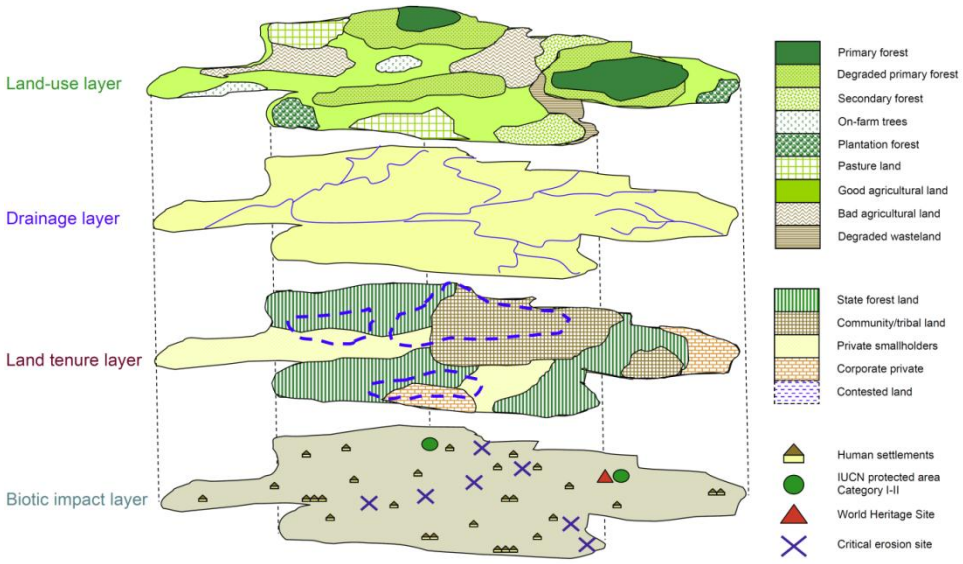

Figure 2.3 Example of a forest landscape mosaic map[9]

What then is the difference with other broad scale approaches such as the ecosystem approach? FLR wants to emphasise its multidisciplinary character. This means that a landscape is not only shaped by its biophysical elements, but also by its human elements such as the legal, regulatory, social and aesthetic components, which should therefore also be considered being part of that system (Farina & Napoletano, 2010; Sayer, 2008). When analysing a landscape, the area should be seen as a mosaic, which consist of different types of layers corresponding to both these human and biophysical elements (Gilmour, 2005b). Figure 2.3 shows an example of such a mosaic map. According to the IUCN, combining these environmental and human elements is necessary because "landscapes include the physical and biological features of an area together with the institutions and people who influence the area and the cultural and spiritual values of the area" (IUCN, 2008, p. 14). These biophysical and human or institutional elements not only exist synchronously and both influence the landscape, they also influence each other at the same time. This is the reason why, although the focus of this research is mainly on livelihoods, they are always linked to the existing institutions which shape both these livelihoods and the landscape.

2.2.5 *Towards adaptive management*

After having discussed the restoration (2.2.3) and landscape element (2.2.4) of the Adaptive Landscape Approach for Forest Landscape Restoration, now it is time to turn to the third and last element of this approach, that is, the adaptive aspect.

[9] Source: Gilmour (2005b)

The essence of adaptive management is that human beings play a dominant role in complex ecosystems (Gilmour, 2005a). This entails that people are not only playing a role in deteriorating a landscape and its functions, but also that they can play an active role in changing the landscape in other ways, e.g. restoring forest functions.

Adaptive management can be seen as a trial and error way of working, as management schemes are adapted based on experiences from similar cases. It differs from conventional management schemes where principles are instructed top-down and where knowledge is based on more theoretical foundations. Adaptive management is build around what Gilmour (2005a, p. 35) calls 'collaborative learning', which includes:

- "Collaboration and learning;
- Combining the learning and action that take place within a group of people (capturing both knowledge generation and the application of this knowledge in action);
- Knowledge-sharing among group members."

Adaptive management, as the name explains, should not be seen as a fixed route of actions, but rather as a series of interrelated processes (Gilmour, 2005a, p. 36):

- "understanding the social and biophysical context at multiple levels[10];
- negotiating objectives and outcomes for different levels;
- applying action learning (plan, act, observe and reflect);
- monitoring and impact assessment."

The idea behind adaptive management is that the process learning and doing is on-going rather than an one-off event (Gilmour, 2005a), which originates from action research (see for example Reason & Bradbury, 2001).

In the last decades, this adaptive element of these management schemes has received more recognition from scholars, especially in governance of natural resources. Dietz puts it even as a necessity for successful commons governance (Dietz et al., 2003). This makes the third and last element of ALA a vital part of contemporary forest management, or rather, landscape management.

2.2.6 *The Adaptive Landscape Approach for Forest Landscape Restoration*

The previous sections described the foundations on which the Adaptive Landscape Approach is built. In that sense, although it is a flexible approach, this does not mean that the ideas are baseless. An important element of ALA is action learning, which has been mentioned shortly in 2.2.5. The learning cycle for ALA is visualized in Figure 2.4.

[10] This is in line with other landscape approaches as explained in 2.2.4. To come to this understanding, first stakeholder analyses are needed (Kusumanto, 2005).

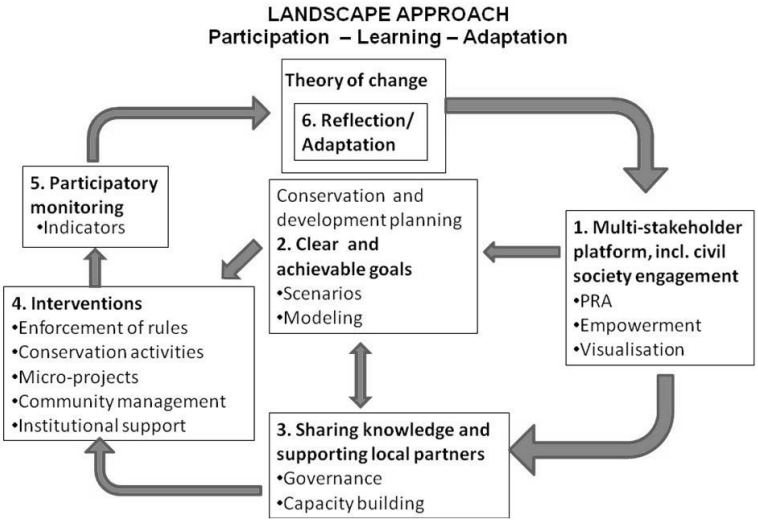

Figure 2.4 Learning cycle for Adaptive Landscape Approach[11]

This learning cycle has resulted in a set of principles, as already shown in Box 3.2 (see Section 3.4). These principles are implemented then in practice, and reflected on, amongst others, the GPFLR network website.

The search for general principles is the strength as well as the weakness of the ALA. Strength in the sense that general agreed-upon principles can guide local initiators of restoration approaches, that is, amongst others NGOs and local policy-makers. Moreover, discussing these principles in itself contributes to collaborative learning. The pitfall is that if searching for general principles becomes the main goal of the ALA, the discussion can ignore local people's needs and makes itself in that way impractical or even useless. Therefore, I think that rather than to focus on the outcome, i.e. the principles, too much, its strong value must be highlighted. That is, the ALA principles facilitate first and foremost the discussions and encourage debate which contributes together to collaborative learning.

2.2.7 *Defining success – process and outcomes*

The conclusion of the previous part emphasised the importance of looking at the process of FLR, rather than at the outcomes only. Still, unsurprisingly, initiators, donors and participants demand a successful outcome in order to justify the time and effort they put into the project. But whatever priority is taken, successful outcome or successful process, how to define what *is* success?

Besides a complete framework for monitoring and evaluation, Gasana (2005) gives a list of indicators for success and distinguishes between process and outcome indicators. Here, the process indicators for success mainly refer to the degree of stakeholder participation and capacity-building[12].

[11] Source: GPFLR (2009)

With regard to the outcomes, Lamb (2005) gives several indicators, which consist of both improvement of the environment (e.g. conservation of remaining natural forest; increased forest cover; reduced erosion; improved river water quality; improved inter-connectedness of forest patches; improved biodiversity in secondary forests; more stable land use patterns) and of the provision for socio-cultural needs. The indicators given in the book by Lamb and Gilmour (2003) are similar, although here there is also a distinction made between stability, efficiency and flexibility related indicators. Although stability and flexibility indicators might look contradictory at first sight, in my view both are crucial for an adaptive approach aiming at successful Forest Landscape Restoration. Similar to the trade-offs as discussed in the previous sections, here, trade-offs between efficiency and flexibility can be overcome at a landscape level.

As shown above, several scholars have attempted to set up indicators for success. Still, defining the success of outcomes is a difficult thing, as on the one hand, the adaptive element of ALA in itself implies an on-going development. On the other hand however, funding for these kind of initiatives are often project based, which implies that it is not for an infinite period of time. The final indicator for success from the author cited above (Lamb, 2005, p. 124) states that it is also important that "the need for external financial subsidies or incentives declines" to secure sustainability after donors leave. I think this is a crucial but challenging indicator for success. Later in this thesis I will reflect on whether I think this indicator for success is realistic to use in the case of bamboo biomass energy promoting projects in Ghana.

To conclude, how restoration is defined, which strategies are chosen and how success indicators are selected all depends on the landscape opportunities and constraints, and on the priorities that are taken for defining the initial goal. Different sets of principles have been designed, of which the ALA is just one of many. There are also more regional focussed principles, which focus in particular on country specific issues related to deforestation and degradation. The IUCN and local universities developed FLR principles for Ghana which are similar to the ALA principles, but which also include country specific strategies for, amongst others, sustainable charcoal production (Blay, 2010). The main differences between the sets of general principles can be assigned to the focus of the scholars that have proposed them (Schlaepfer, 2005a). Although FLR in principle is a multidisciplinary issue, scholars from different disciplines, i.e. socio-economic or ecological backgrounds, have put their stamp on these principles. Reaching consensus concerning these principles remains a true challenge, among academics from different fields of study, but also among practitioners setting the FLR strategies.

[12] The outcome indicators from Gasana (2005) are comparable to those given by Lamb (2005) which are sited in this thesis.

Or, as Sayer, Maginnis, Buck, and Scherr (2008, p. 2) put it:

> *"Shaping landscapes is more a process of negotiation than of planning. And measuring success first requires some shared understanding amongst stakeholders of what 'success' looks like."*

Perhaps this is the reason why there are so many different sets of principles and success indicators. However, although reaching consensus about these principles for FLR is important, it should never become the one and only purpose of the FLR debates.

2.3 Bamboo: a disputed resource

In an early stage of this research I encountered that there are different views on bamboo. The main altercation between people in both the theoretical debates and the field concerns whether bamboo should be considered a tree or not. Rather than to come to a conclusion about what bamboo exactly is, this section aims to get an understanding about how these different interpretations of the notion of bamboo have evolved and to describe what the consequences of this are for how it is currently used.

2.3.1 *Tree or horticulture?*

Instead of focussing on what bamboo is, the focus is often on defining trees and to subsequently decide whether bamboo falls under this category. The FAO (2000b, p. 370) defines a tree as "a woody perennial with a single main stem, or in the case of coppice with several stems, having a more or less definite crown". It explicitly includes bamboos, palms and other woody plants that meet the criterion cited above.

However, botanically speaking, bamboo is a grass and not a tree, which is why bamboo is not included in declarations regarding, for example, carbon sequestration (Yiping et al., 2010), unless it has been mentioned separately and explicitly such as in the FAO case given above. Neither the United Nations Framework Convention on Climate Change (UNFCCC) nor the Kyoto Protocol define a tree, which has caused uncertainty about whether bamboo can be included in CDM frameworks or REDD projects (Lobovikov et al., 2009). Moreover, bamboo does not fall under the definition of 'forest' in either the Kyoto Protocol, Marrakech Accords or IPCC (Yiping et al., 2010). According to the FSC standards, bamboo falls under the category of Non Timber Forest Products (NTFPs) (Buckingham & Lou, 2009) and is in that way separated from trees. However, "if bamboo were to be adequately recognized within 'forestry,' bamboo could potentially occupy an important position in climate change mitigation, adaptation, and sustainable development" (Yiping et al., 2010, p. 10).

2.3.2 *Bamboo in policy frames*

In history, bamboo is used in different ways in policy frames. In many cases, bamboo was (and is) grouped under horticulture, but the resource is fundamentally different (Buckingham et al., 2011). The same authors state that in history, this has frequently turned out to be a major constraint for developing the production and use of bamboo in developing countries which is one of the reasons that INBAR actively lobbies for a recognition of bamboo as equivalent to trees in existing policy frames. Buckingham and Lou (2009, p. 5) emphasize that this "lack of consensus highlights the pressing need for plurality of approaches, to borrow from forestry, agriculture and livelihoods development". Using a range of approaches however, makes putting bamboo under one of the categories even more difficult. Distinguishing bamboo from every other type of resource and putting it in a separate category but on the same level as trees in policy frames could be a solution. However, in this way bamboo would become automatically, and potentially incorrectly, excluded from already existing policy frames such as the CDM or REDD, unless reassessment of international forest policy takes place (Buckingham et al., 2011). There are several reasons to put bamboo under a separate category:

- "Bamboo could deliver many key contemporary forest policy needs as well or better than trees;
- The ecology of bamboo requires fundamentally different models of commercial management;
- Existing forestry mechanisms, such as FSC, are inappropriate when applied to bamboo. Bamboo and silvicultural forest policy diverge regarding different cultivation ecologies, issues of 'illegal logging' operate on less challenging and more local scales, bamboo harvesting requires fewer safety measures, and biodiversity policy linkages relate more to its invasiveness rather than species richness assemblages." (Buckingham et al., 2011, p. 2)

In Chapter 6 this discussion will be linked to the results from the field work. In Chapter 7 on the Conclusions I elaborate on this topic further by explaining which categorizations hamper or foster the use of bamboo for FLR in Ghana based on the findings of this research, which will be followed by some advice in the Recommendations Chapter (Section 8.2).

The role of bamboo in climate change mitigation in the form of carbon sequestration (Yiping et al., 2010) and climate change adaptation (INBAR, 2009) has been studied and discussed already. Also bamboos role as bridge between climate change mitigation and poverty alleviation has been studied (Lobovikov et al., 2009). But the potential of using bamboo for restoration efforts has not been

studied so far[13]. Therefore, this study aims to contribute to this knowledge gap. As the literature cited above already underscore, it is of vital importance that the conceptualisation of bamboo, or the lack of it, in policy frames and its consequences has to be taken into account.

2.4 Looking forward

Based on a literature study this chapter looked at some theoretical notions on commons governance and property rights, forest restoration schemes, and the labelling of bamboo resources. This chapter formed the background for the Methodological Framework for the field work, which will be described in the next chapter.

[13] An exception is WWF's Ecuador Bamboo Initiative for Forest Landscape Restoration, but in-depth studies or background literature concerning this project is lacking.

3 Methodological Framework

This chapter presents the methodological framework on which this research is based. First, the objectives and research questions will be discussed, followed by the hypotheses. The conceptual model itself will be presented and explained in the third section of this chapter. Fourth, the operationalization of the main concepts will be discussed. In the fifth section, the methods and techniques used will be discussed, followed by some limitations regarding the methodology.

3.1 Objectives and Research questions

3.1.1 *Objective*

The aim of this research is twofold. First, the objective is to gain more knowledge on the current and potential role of bamboo in forests and for livelihoods in Ghana. This is still a hardly explored research terrain. Understanding the differences and similarities in forest functions between on the one side bamboo, and on the other side trees and Non Timber Forest Products is vital when one wants to explore FLR options using bamboo.

The second objective is strengthening the FLR network by providing the network with innovative and up-to-date FLR experiences at the learning site level. These experiences will be shared with other network members and contribute to better knowledge on FLR practice around the world. Furthermore, the research will function as a *reality check*, to see whether the principles of the Adaptive Landscape Approach have been realistically formulated, and whether they are applicable to local contexts such as the case of INBAR in Ghana.

3.1.2 *Central research question*

To what extent can a sustainable production and use of bamboo for firewood and charcoal contribute to Forest Landscape Restoration in the Western Region, Ghana?

3.1.3 *Sub questions*

The landscape level

1. What are the main **causes** of **deforestation** and forest **degradation** in the project areas of INBAR Ghana?
2. Can an improved production and use of bamboo **reduce pressure** on forest landscapes, **restore forest functions** or **both**?

The people and their livelihoods

3. What are the main characteristics of rural **livelihoods** in the Western Region, Ghana and what **role** does **biomass energy** currently play in these livelihoods?

4. Is the use of bamboo for firewood and charcoal a more superior and sustainable option for **local users and producers** compared to conventional firewood and charcoal, and if so, in what ways?

The institutions

5. Are the current **formal and informal institutions** enabling or disabling the use of bamboo in Forest Landscape Restoration? If disabling, how could **policies** be improved to make it more pro-poor, while supporting Forest Landscape Restoration?

These sub questions are grouped into three categories corresponding to the three sections in Chapter 5 where the results are presented. The sub questions are also related to the different stages of this research and the different methods and techniques used. A schematic overview of this relation is presented in Section 3.5.

3.2 Hypotheses

Bamboo can contribute to Forest Landscape Restoration

As mentioned before, officially bamboo falls under the category of woody grasses (Scurlock et al., 2000), which means that bamboo is not considered a tree. Therefore, bamboo might not be considered as a direct contributor to FLR. However, as the creation of a bamboo resource base for firewood and charcoal reduces, at least in theory, the pressure on current forests (Lobovikov, 2010), it could be considered as an indirect contributor to FLR. This hypothesis is to be investigated through this project. This hypothesis is inherent in the central question. However, this does not imply that a positive link between a sustainable use and production of bamboo and FLR has already been proven. A hypothetical answer to the *to what extent* central question might therefore be *zero* meaning that there is no link between bamboo and FLR.

The Adaptive Landscape Approach is good way to measure the degree of success for FLR

As explained in Section 2.2, the ALA (GPFLR, 2009) is developed for and in cooperation with the members of the GPFLR network. Currently, there are several sets of principles concerning FLR. Examples of these are general principles like the Sangha Guidelines (IUCN, 2008) and Lally Principles (Sayer, Buck, & Scherr, 2008), and more country specific principles like the Forest Restoration Guidelines for Ghana (Blay, 2010). The ALA principles are an example of general principles, and this is its strength as well as its weakness. For this research, the request from GPFLR was to investigate whether the principles are easily applicable for the local cases or whether adjustments in the principles self are needed. This was called the *reality check* in Section 3.1.1. Therefore, for the research I will work with the hypothesis as written above, but in the chapter on Recommendations some advice will be given on how the principles can better suit local circumstances.

3.3 Conceptual model

Figure 3.1 shows the conceptual model of this research. The model is based on the Sustainable Livelihoods Approach (SLA) (Chambers & Conway, 1992; Scoones, 1998b). As explained in Section 2.2.4, the Adaptive Landscape Approach (ALA) is based on this and other approaches. For this research, the methods are mainly based on the SLA, rather than on ALA, for several reasons. First, the ALA is still quite new and relatively underdeveloped with regard to research methods. This does not mean that ALA is ignored. Rather, the well defined SLA methods are used as a fundament for ALA like tools and techniques such as landscape mapping. Second, in my opinion ALA can never become a success without cooperation of the forest dependent people. Therefore, it is better to focus on those people first, in research as well as in practising FLR projects, based on the idea that if the development component is not included, conservation will not be achieved. Therefore, this research focuses first on the SLA, and then includes by the ALA specific components for the landscape element.

As can be derived from the scheme, the forest dependent livelihoods, the forest landscapes and the relations between them are central in this research. The three bounding boxes represent the cross-scale dimensions of the research topic in particular with regard to the vulnerability and institutional context.

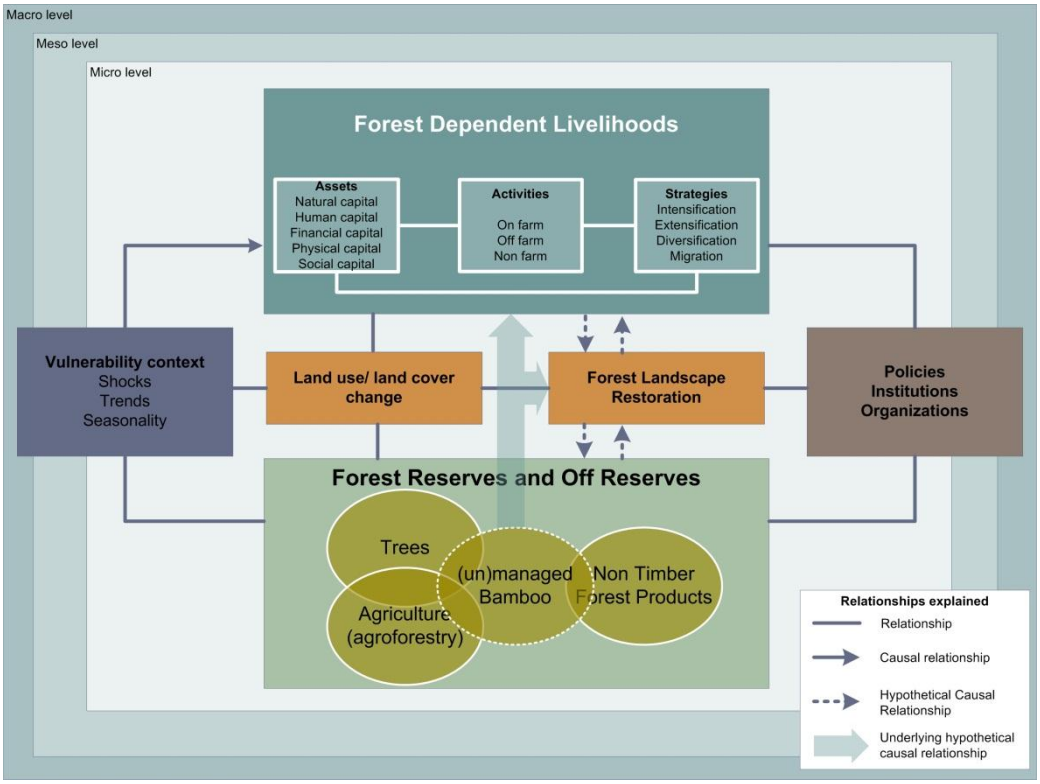

Figure 3.1 Conceptual model

The formal and informal institutions influence the people's decision making and thus their livelihoods. They also influence the forest landscape by shaping *de facto* and *de jure* user rights for example. The ALA and other FLR principles can also be seen as institutions, which explains the link between the Institutions box and the FLR box.

The vulnerability context influences both the livelihoods and the landscape. It is also directly linked to land-use and land-cover change (LULCC) as LULCC is not only caused by anthropogenic factors but, for example, also through natural hazards. In this research, the vulnerability context has not been studied in isolation, but always as part of the landscape or livelihoods context.

In this scheme, the LULCC and FLR are presented as separate boxes. In reality though, FLR can be seen as a part of LULCC. This research has taken into account the importance of the LULCC context, but primarily focuses on FLR.

3.4 Definition and operationalization of concepts

This section will explain the main concepts of this research, especially those stated in Section 3.1.3 and 3.3, and how they are defined into measurable factors. The concepts are alphabetically ordered.

Bamboo

In this research, a distinction is made between natural existing bamboo and bamboo plantations. Several species, especially *Bambusa vulgaris* are abundantly present in Ghana, mainly in the forest zone (Aboagye, Obirih-Opareh, Amissah, & Adu-Dapaah, 2007). This is considered natural bamboo. INBAR has started plantations, introducing new bamboo species[14] into the area (INBAR, 2008). These plantations however, are still quite young and in their experimental phase, and harvesting for biomass energy purposes is not taking place yet. In this research, *bamboo production* refers to bamboo plantations. *Bamboo use* can both refer to bamboo plantations and natural bamboo.

A further distinction can be made between managed and unmanaged bamboo. With regard to plantations bamboo is by definition managed. Natural bamboo stands are considered managed when sustainable harvesting is taking place (Yiping et al., 2010). That is, culms should be selected culms for cutting rather than clear felling of the area, the culms should be mature (at least six to eight years), and damaging the young remaining culms should be prevented as much as possible (Kigomo, 2007; NMBA, 2004). The latter can be done by implementing certain specific harvesting methods, which are presented in Figure 3.2. Part of INBAR's activities is educating communities and informing them about these sustainable harvesting methods (INBAR, 2008). This research examines to what extent these sustainable harvesting methods are being used in the region already, whether people

[14] That is, *Phyllostachys pubecens, Dendrocalamus giganteus, Dendrocalamus membranaceus, Dendrocalamus brandisii*, and *Dendrocalamus hamiltonii.*

developed their own indigenous harvesting techniques or whether current harvesting practices can be considered to fall under the category *unmanaged*.

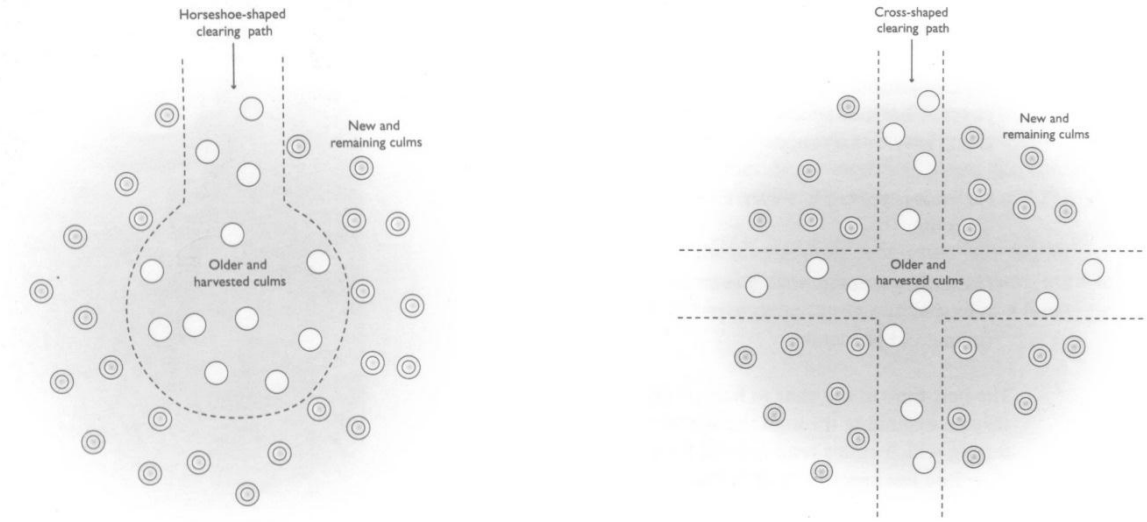

Figure 3.2 Two ways for sustainable bamboo harvesting: the horseshoe clump (left) and cross tunnel (right) harvesting method[15]

Biomass energy

Biomass is defined as "Living plant and animal material both above-ground and below-ground usually expressed as dry weight" (Schoene, Killmann, Lüpkem, & LoycheWilkie, 2007, p. 20). Here, biomass energy is narrowed down to the biomass energy uses as used in Ghana, i.e. firewood, charcoal, bamboo firewood and agricultural waste (e.g. coconut shells) (Obiri & Nutakor, 2010). Furthermore, bamboo charcoal and bamboo briquettes are also considered biomass energy.

Conventional firewood and charcoal

Under conventional wood and charcoal is considered all woody biomass energy products used by the people in the Western Region, excluding bamboo products. It includes firewood harvested from private farm land as well as wood that has been harvested (il)legally in forest reserves. Charcoal can be produced by the user at home or bought from MSEs in the area or (large) trader companies.

Deforestation

According to the UNFCCC (2001, p. 58), deforestation is "the direct human-induced conversion of forested land to non-forested land". More precisely, I follow the first two notes from FAO's elaboration on this definition (Schoene et al., 2007, p. 8), as presented in Box 3.1.

1. *Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human induced or natural perturbation.*
2. *It includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas.*

Box 3.1 Definition of deforestation

[15] Source figures: NMBA (2004)

Degradation (forest)

Forest degradation is defined as "the reduction of the capacity of a forest to produce goods and services. 'Capacity' includes the maintenance of ecosystem structure and functions" (ITTO, 2005, p. 136). More precisely, this reduction of capacity is caused by human activities. As a consequence, "a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity" (Convention on Biological Diversity, 2001).

Forest

Forest is broadly defined as land under natural or planted stands of trees, whether productive or not (World Bank, 2005).

Forest functions

Forest functionality is the "ability of a forest to provide goods and services and maintain ecological processes" (ITTO, 2005, p. 136). These goods and services, i.e. forest functions, can be divided into woody goods (e.g. firewood), NTFPs and environmental services.

Forest Landscape Restoration

FLR is defined as the recovery of "the functions of a forest landscape that can continuously fulfil the needs of both people and the environment"(GPFLR, 2008, p. 4). This encompasses forest land that has been deforested and forest land that has been degraded. Or, as Schlaepfer (2005b, p. 8) puts it: "A forest landscape needs restoration when it or parts of it are damaged and its quality is no more sufficient to cover human's needs". For measuring the level of FLR, the ALA principles (GPFLR, 2009) are used (Box 3.2).

1. *Continual Learning and Adaptive Management*
2. *Common Concern Entry-Point*
3. *Multiple Scale*
4. *Multi-Functionality*
5. *Multi-Stakeholder*
6. *Negotiated and Transparent Logic*
7. *Clarification of Rights and Responsibilities*
8. *Participatory and User-Friendly Monitoring*
9. *Resilience*
10. *Strengthened Stakeholder Capability*

Box 3.2 Adaptive Landscape Approach Principles

Household

As Malleson et al. (2008) acknowledge, defining households in Ghana is often difficult. Widespread used definitions such as people who share the same pot or live in the same house may not be useful as rural people often live in compounds instead of separate houses and these compounds may consist of several families. Moreover, as was experienced during the field work, whether people live in compounds or not differs per ethnic group which makes comparison between communities more complex. Therefore, for the semi structured questionnaire, it was decided to set up some additional criteria to the *share the same pot* criterion to come to more or less comparable household settings:

- Include all people that live outside the household temporarily (to study etc) and still depend on the household for money and/ or material support;
- Include (grand) parents, (grand) children or other relatives living in the house;
- Exclude people (children) that have their own house/family and those who do not depend on the household's capital (anymore).

Additionally, people were asked to show the boundaries of their compound to come to a distinction between *members of the household* and *neighbours* [16].

Institutions

Institutions are broadly defined as "the prescriptions that humans use to organize all forms of repetitive and structured interactions" (Ostrom, 2005, p. 3). It can be structured by rules, norms and shared strategies (Crawford & Ostrom, 1995, p. 582). Furthermore, North (1990, p. 3) makes a distinction between formal and informal *constraints* in the sense that the former includes rules, laws and constitutions, and the latter comprises norms of behaviour, conventions, and self imposed codes of conduct. Here, I adopt this distinction. However, I would like to stress the fact that institutions may also generate opportunities rather than just the constraints as stated by North's definition.

Landscape

For this research, the definition from Schlaepfer (2005a, p. 70) is taken: "Landscape is a dynamic geographical space, resulting from combined actions of human and natural driving forces, in general including several interacting terrestrial, aquatic or urban ecosystems, and which can be differentiated from neighbouring landscapes". In this sense, a forest landscape is "a broad, typically heterogeneous land area characterized by forests, but which may also contain a mosaic of vegetation types and human elements such as land-uses and settlements" (Laestadius, Saint-Laurant, Minnemeyer, & Potapov, 2010). In practice, it is not that easy to distinguish landscapes. Defining the landscape level was therefore inherent in the first phase of this research and has been thoroughly discussed with several forest experts in Ghana and on the GPFLR network website. For this research, the human elements of a landscape were used for defining the scope of a landscape, i.e. the district boundaries. As a result of the online discussions it was found that it is easier and more significant to focus on the core (characteristics) of a landscape, rather than on the boundaries. With Landscape Mapping (see 3.5.1) the people at the research sites were asked to draw what they considered as their landscapes based on the different land uses. More on the results of these Mapping exercises will be discussed in Chapter 5.

[16] Unlike several ethnic groups in, for example, the North of Ghana, the compounds of people living in the Western Region do not have clear-cut boundaries formed by clay walls.

Land-use and land-cover change

Land-use and land-cover change (LULCC) involves both socioeconomic and biophysical drivers of land-use and land-cover change. The land use is dependent on the resource allocation. The resource allocation of households and firms are influenced by both the socioeconomic and biophysical drivers. The drivers can exist on different levels, i.e. distant (global), intermediate (landscape), and proximate (local) level (Wood & Porro, 2002). A completely deforested area can be one outcome of LULCC. Another example of a possible outcome of LULCC is regrowth of the forest through Forest Landscape Restoration. A scheme of LULCC and its drivers can be found in Appendix A.

Livelihoods

Livelihoods are simply defined as means of gaining a living (Chambers & Conway, 1992).

> *"A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base" (Carney, 1998, p. 8).*

Based on Scoones (1998b), five types of capital as livelihood assets are distinguished:

- Natural capital - the natural resource stocks (soil, water, air, genetic resources etc.) and environmental services (hydrological cycle, pollution sinks etc.) from which resource flows and services useful for livelihoods are derived.
- Financial capital - the capital base (cash, credit/debt, savings, and other economic assets, including basic infrastructure and production equipment and technologies) which are essential for the pursuit of any livelihood strategy.
- Human capital - the skills, knowledge, ability to labour and good health and physical capability important for the successful pursuit of different livelihood strategies.
- Social capital - the social resources (networks, social claims, social relations, affiliations, associations) upon which people draw when pursuing different livelihood strategies requiring coordinated actions.
- Physical capital (according to FAO, 2010) - the basic infrastructure and physical goods that support livelihoods. Infrastructure consists of changes made to the physical environment that help people to meet their basic needs and to be more productive. It includes among other things affordable transport systems, water supply and sanitation and machines.

Livelihood activities are divided into three categories, that is, on farm, off farm and nonfarm activities. A combination of the three suggests a form of livelihood diversification (see below). The

distinction of livelihood activities is used in different ways, so a clarification is. Here, the definitions as given by Barrett et al. (2001) are taken:

- On farm activities refer to the production or gathering of unprocessed crops or livestock or forest or fish products from natural resources.
- Nonfarm activities are activities that generate all other sources of income on the farm, including from processing, transport of trading of unprocessed agricultural, forest and fish products. It also includes income from non agricultural products, such as for example handcrafts.
- Off farm activities are related to the spatial aspect of income generation. All incomes generated outside the farm of the household, fall under off farm activities. For example, if one member of the household is a wage labourer at another farm, this will be part of off farm activities.

A distinction is made between three types of livelihood strategies, following Scoones (1998b).

- Agricultural intensification/extensification – between capital-led (supported often by external inputs and policy-led) and labour-led (based on own labour and social resources and a more autonomous process) intensification.
- Livelihood diversification – between an active choice to invest in diversification for accumulation and reinvestment, and diversification aimed at coping with temporary adversity or more permanent adaptation of livelihood activities, when other options are failing to provide a livelihood. Diversification might be a strategy to cope with or adapt to all kinds of shocks or stress.
- Migration – between different migration causes (e.g. voluntary and involuntary movement), effects (e.g. reinvestment in agriculture, enterprise or consumption at the home or migration site) and movement patterns (e.g. to or from different places).

Non Timber Forest Products

Non Timber Forest Products are “all forest products except timber and wood, including products from trees, plants and animals in the forest area” (ITTO, 2005, p. 138). As a result of the discussion as presented in Section 2.3, in this research, bamboo is considered a NTFP as well.

Primary and secondary forest

According to ITTO (2005, p. 139) primary forest is a forest “which has never been subject to human disturbance, or has been so little affected by hunting, gathering and tree-cutting that its natural

structure, functions and dynamics have not undergone any changes that exceed the elastic capacity of the ecosystem".

In this sense, a degraded primary forest can be defined as "primary forest in which the initial cover has been adversely affected by the unsustainable harvesting of wood and/or non-wood forest products so that its structure, processes, functions and dynamics are altered beyond the short-term resilience of the ecosystem; that is, the capacity of these forests to fully recover from exploitation in the near to medium term has been compromised"(ITTO, 2002, p. 10).

Secondary forest is "woody vegetation regrowing on land that was largely cleared of its original forest cover (i.e. carried less than 10 percent of the original forest cover). Secondary forests commonly develop naturally on land abandoned after shifting cultivation, settled agriculture, pasture, or failed tree plantations" (ITTO, 2005, p. 139).

Reserves and Off-reserves

Off reserve: agricultural fields, secondary forests, riparian forest strips along streams, sacred groves and some closed-canopy forests (Osafo, 2010)

3.5 Research methods and techniques

This is a case study research. As the project of INBAR is still in its pilot phase, only a few villages are working with bamboo charcoal and firewood. The research will take place in the two districts involved in this pilot. More on these districts, their background and the selection procedure of research villages and towns within these districts will be discussed in the next chapter. Because of the unique character of this pilot, a case study is more suitable than, for example, a survey. Consequently, the results cannot be generalised to a greater population. Still, important lessons can be learned from a case study when considering whether and how this project should be copied to other places. This research will have a high participatory character. This entails for example that the research questions and their (preliminary) results will be reflected on by network members through the web-based learning network.

As explained earlier in this chapter, the research questions are linked to the different stages of the research. Moreover, different methods and techniques are implemented to come to an answer to these questions. The stages and their corresponding methods and type of analysis are presented in Figure 3.3.

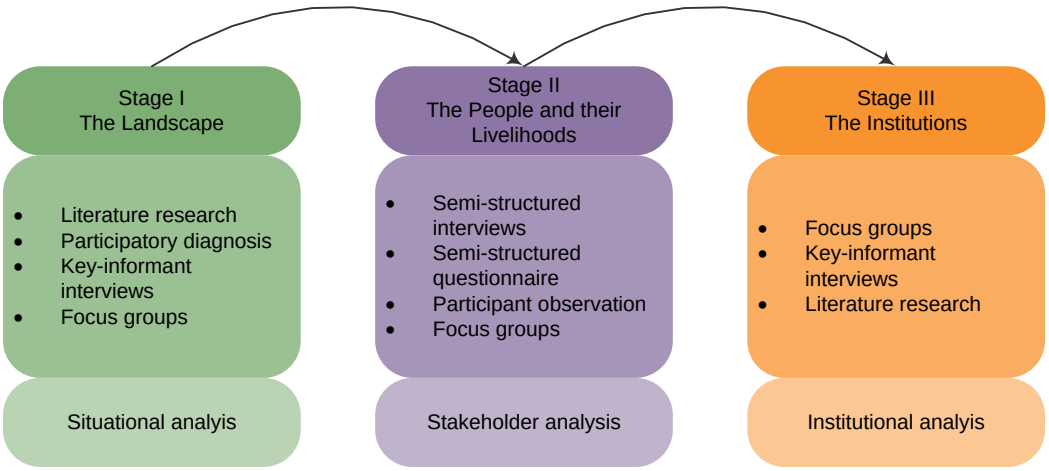

Figure 3.3 Research stages

3.5.1 *Stage I The Landscape – Situational analysis*

The first stage aims at identifying the local circumstances relevant for the research. This can be done by means of a situational analysis. It entails the process of "understanding the status, conditions, trends and key issues affecting people, ecosystems, or institutions in a given geographic context at any level (local, national, regional, international)" (Oosten, 2009a). The main idea is to get a grip on the problem and to map and understand the visions of different stakeholders involved. It is also a way of reaching consensus among researcher and participants on the definition of the problem itself. Therefore, it entails both participatory and qualitative research methods.

Literature research

In addition to the literature research for the theoretical framework (see Chapter 2), secondary data was examined to get a first understanding of the situation in the research area. However, only one exploratory study has been executed in these particular districts and on this specific topic (Forestry Research Institute of Ghana, 2010). Consequently, the amount of baseline data on district and village level is low.

Participatory diagnosis

Participatory diagnosis (PD) can be used as a first meeting between villagers and researcher. The process of a PD is divided into three steps (Horne & Stür, 2003). The first step includes **participatory observation** (in order to get to know the farming systems), selection of the participants and the organisation of the PD. This was done during the first visits and meetings with village leaders.

Image 3.1 Participatory village mapping

The second step concerns the PD itself. Some **participatory mappings** (Image 3.1) were performed on both the village and landscape level. Also, with the different village leaders the tool of **storytelling** was used to understand the history of the villages and the main changes of the landscape as a result of, for example, deforestation.

The third step is to make a plan of action for the research and the search for solutions. This was done in cooperation with the villagers during the first focus groups, which will be discussed in more detail below.

Key-informant interviews

A whole range of local informants helped me during this research, but especially during this first research stage. In a way, the translators, i.e. the local coordinators from INBAR, can be seen as informants as they knew where to go to get, for example, household lists and they knew where to find chiefs or other village leaders. Also government officials from both the districts and the Forestry Commission, the Regional Officer of INBAR West Africa, researchers from FORIG, village leaders and others were helpful for obtaining case and site specific data. The formats for these key informant interviews can be found in Appendices C, D, E, F and G.

However, as Willis (2006, p. 148) warns, one should stay critical when it comes to information obtained through informants. For example, does the informant have an interest in telling the researcher specific things and is this information complete or not? In that way, informants become gatekeepers; they are important for getting information or for meeting people but at the same time they have a lot of power in influencing the research process. In this case, I felt that some of the village leaders became gatekeepers. Although they based their choices on my criteria, *they* invited the people for the focus groups. Moreover, in two villages focus groups were being held at the village leader's place which cannot be seen as a neutral place. However, as I was free to choose any person for the individual household interviews, I considered myself still to be in control of the research process most of the time. Moreover, in most cases, many more people showed up than those invited. Especially during focus groups that were held in public village halls, which were as a matter of fact the majority, people considered these meetings publicly accessible. For practical reasons a maximum of ten participants per focus group is considered best. Nonetheless, these meetings with sometimes forty people were regarded as transparent and people said they felt important as they could participate and contribute to the discussions. In short, the gatekeepers did have an influence on my research, but the consequences of this were only limited.

Focus group discussions

As explained earlier, the main goal of this stage and in particular of a PD is to identify and prioritise the main problems (Horne & Stür, 2003). In order to be truly participatory, identifying the main problems experienced by the villagers should be one of the first steps of participatory research. Therefore, during the first focus group discussions, **problem trees** (Image 3.2) were created. In this way, the main problem can be distinguished from problems that are effects of the main problem (response), and from problems that are rather the cause of the main problem (driver), all according to the villagers (Oosten, 2009a).

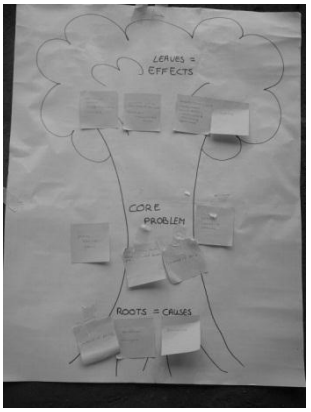

Image 3.2 Problem tree

3.5.2 *Stage II The People and their Livelihoods – Stakeholder analysis*

The second stage is closely linked to the first one and some methods and techniques overlap, although the emphasis is different. Stakeholder analysis is used for "understanding a system by identifying the key actors - or stakeholders - in the system and assessing their respective interest (and involvement) in that system" (Oosten, 2009b). The goal is to understand how stakeholders affect and are affected by the problem. Everyone (individual, group or institution) who has an interest a particular resource, process, service or intervention and who is directly or indirectly affecting or affected by someone else's decision making, can be considered a stakeholder. A stake can not only be a product, but also a service (e.g. biodiversity conservation or soil erosion) or an interest (e.g. benefit, influence or power) (Oosten, 2009b). Examples of stakes in this research are bamboo, forest with its different forest functions or an interest in the form of decision-making power.

The stakeholders that are analysed most thoroughly are the local people and their livelihoods. As explained in Section 1.2.1 they are most directly affecting and affected by the issue. Therefore, an important part of this stage was formed by the semi-structured interviews and questionnaires.

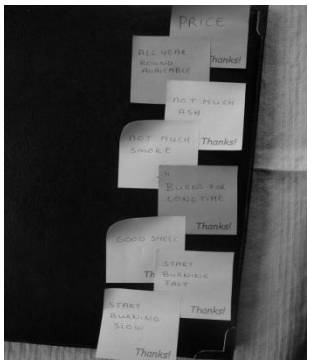

Image 3.3 Ranking biomass energy characteristics

Semi-structured interviews[17]

Semi-structured interviews were held at household level and were randomly selected. There were four different types of semi-structured interviews, that is, general household interviews and interviews with charcoal producers, charcoal sellers and charcoal consumers for

[17] Please note that the semi-structured interviews differ from the semi-structured questionnaires, which will be explained next.

commercial purposes. Formats of these interviews can be found in Appendices H, I and J. Tools like **ranking** and **seasonal calendar** were used to get a basic understanding of the livelihoods characteristics and their differences between communities and between households.

A researcher can be easily biased by visiting the villages only at one season of the year (Binns, 2006, p. 15). Therefore, the **seasonal calendar** was also used to limit this seasonal bias. In this case, the empirical research took place during the rainy season. It should be noticed that some livelihood activities, particularly charcoal making, do not or hardly take place during this season.

In order to understand which characteristics of biomass energy are considered important, a **ranking tool** (Image 3.3) was created with cards in different categories, e.g. market related characteristics. The people had to place these cards in order of importance. They had the choice to leave cards out if they were not considered relevant. Also, they got the opportunity to add characteristics.

Semi-structured questionnaire

An important part of the empirical research was formed by the semi-structured questionnaires. As mentioned in Section 3.5.1, general baseline data was hardly available. Therefore, besides the initial goal of this questionnaire, that is, acquiring solely information focused on the use of biomass energy in households, also more general questions were asked to get more quantitative data on rural livelihoods of these districts. The questionnaire can be found in Appendix B. A **Multi Stage Cluster Sample** was used for the semi-structured questionnaire. The focus was on the districts that are involved in the pilot project of INBAR, that is Mpohor Wassa East and Ellembelle. Next, one village per district was selected based on a set of criteria:

- For practical and financial reasons, the villages must be easily accessible.
- In order to be able to compare the two villages, they must have similar characteristics. That is, approximately the same number of households, both in the vicinity of a forest reserve and both must have bamboo resources reasonably nearby. It must be noted that in one of the villages, bamboo was abundant where in the other people had to walk for more than half an hour to get to bamboo resources. The consequences of this difference will be discussed in more detail in Chapter 5.
- As so far only a few households have participated in the pilot project of INBAR, it was decided not to select the INBAR villages for the semi-structured questionnaire. In my opinion, the selected villages are better representatives for the districts, as the two INBAR villages are an exception rather than the rule. Most of the households that did participate in the pilot project of INBAR were already interviewed through the semi-structured interviews and focus groups.

Based on these criteria the villages in Adzeankyewodam in Mpohor Wassa East and Nyamebekyire in Ellembelle were selected. In academic literature on statistics, there are several formulas available for calculating the correct sample size. However, as both villages turned out to be consisting of less than 50 households, it was decided to select all households in these villages in order to reduce the influence of extreme outliers on the results. For statistical purposes, the total number of respondents is still quite limited. This limitation will be discussed in more detail in Section 3.6.

District	Village	Number of households	Number of respondents[18]
Mpohor Wassa East	Adzeankyewodam	18	15
Ellembelle	Nyamebekyire	24	20
Total		42	35

Table 3.1 Selected villages showing number of households and respondents

All adult members of the households were allowed to become the interviewee. In order reduce the number of non response, no-show households were revisited at least three times on different days. People had the choice not to participate, however, this never occurred.

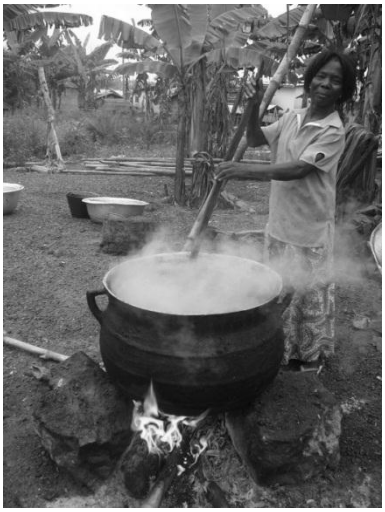

Image 3.4 Palm oil production using bamboo firewood in Mpohor Wassa East District

Participant observation

A distinction can be made between unstructured and structured observation (Beazly & Ennew, 2006). During the field research, the former takes place everyday at all times. The latter takes place in order to check certain patterns. Examples of this are a visit to a cooperative palm oil producing site where bamboo is being used as firewood (Image 3.4), and a visit to a charcoal producing village.

Focus group discussion

In these group discussions issues were discussed which were raised during individual interviews. The aim is to get insight in the range of opinions and perceptions found in the community. Occasionally, separate focus groups for men and women will be held to identify gender issues (Momsen, 2006, p. 48). **Venn diagrams** were made by participants to understand how power differences are perceived by stakeholders themselves. Moreover, **weighing scales** were made to identify the perceived differences between firewood and charcoal and between bamboo and conventional wood. By repeating this exercise in every village, differences in perceptions on biomass energy could be observed between villages that did or did not participate in the INBAR pilot project.

3.5.3 *Stage III The Institutions – Institutional analysis*

[18] Calculated by using the number of households subtracted by the number of non response

As explained in Section 3.4, institutions include the *de facto* rules and are in this sense more than the rules that exist merely on paper. Institutions are "the prescriptions that humans use to organize all forms of repetitive and structured interactions" (Ostrom, 2005, p. 3). Institutions are subject to change. In this stage the main focus lies on institutional change. In focus groups and key-informant interviews, fishbone diagrams have been used as a tool to understand the changing intuitions and its hampering and fostering factors. Moreover, as FLR itself can be seen as institutional change as well, the backbone of how the conclusions of this research are presented in Chapter 7 is also formed by the hampering and fostering factors of institutional change.

Focus group discussions

The focus groups in this stage of the research overlap with those in the previous stage. Here, the focus lies more on the change aspect of FLR. What changes are needed to establish FLR? Which factors prohibit this change from happening? In order to answer these kind of questions, **fishbone diagrams** (Image 3.5) were made during the focus group discussions in the different villages.

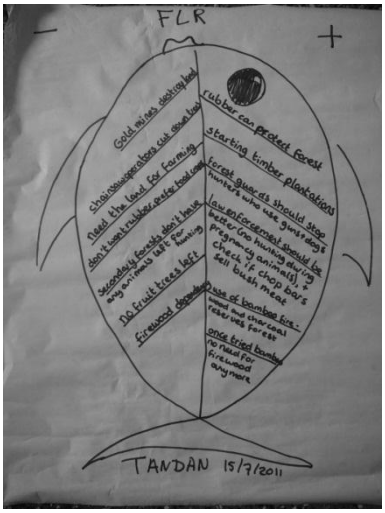

Image 3.5 Fishbone diagram

Key-informant interviews

Concerning the topic of institutional change, several experts were interviewed, including representatives of the District Assemblies, Ghana's Bamboo and Rattan Development Programme (BARADEP), and the International Union for the Conservation of Nature (IUCN) Ghana. These interview formats can also be found in Appendices D, E and F.

Literature research

To better understand the outcomes from the focus groups and key-informant interviews and to put them into perspective, some more literature research was done with regard to Ghana's regulations and policies, including their constitution, natural resources regulations and main land laws.

3.6 Methodology related limitations

This section discusses the limitations that are directly linked to the methodology that has been chosen. Other limitations, for example with regard to the execution of the research itself, will be discussed in Chapter 6.

Qualitative, quantitative and participatory methods

As explained in this chapter, this research consists of qualitative, quantitative and participatory methods. With a mix of methods, the aim is to make most of the strengths of all methods, and at the same time reducing the limitations. For example, sometimes a qualitative method will be most useful

to get a holistic overview, while participatory methods will be too context specific. In other situations or for other goals, participatory methods will be more appropriate compared to quantitative methods (Mayoux, 2006, pp. 118-120). Quantitative methods are usually inadequate to understand causal processes while qualitative methods are often conducted at the individual (case study) level. Consequently, you cannot generalize the results to a larger population. Participatory methods are more useful to investigate development processes and complex interactions between grass-roots perceptions and strategies, institutions and interventions (Mayoux, 2001, p. 13). Nevertheless, also participatory methods have limitations, as it requires special skills and knowledge and as it is difficult to perform in remote areas, for example in the case of focus groups (Mayoux, 2001, p. 14). Combining methods will therefore overcome the weaknesses of each method. Combining methods will also enable the researcher to compare and check the results obtained by different techniques (McGregor, 2006, p. 201). Using a combination of methods is the strength of this research, but may also results in difficulties for analysis.

Questionnaire

The semi-structured questionnaire was chosen as a method to acquire quantitative and, to a lesser extent, qualitative data. For several reasons, which will be discussed in more detail in Chapter 6, 35 was the maximum number of households that could be interviewed. Therefore, it makes no sense to use these data for comprehensive statistical regression analysis and care must be taken when generalizations are made for the whole district(s).

Stakeholder analysis – which stakeholders?

In Section 3.5.2 it was explained that the community members were considered the main stakeholders in this research. Obviously, the are not the only stakeholders. Nevertheless, some (potential) stakeholders have not been included in this research at all. For example, for practical reasons no interviews have taken place with (inter)national traders of bamboo products. Other stakeholders were not included because they are *invisible*, for instance illegal chainsaw operators. This could be seen as a limitation of this research. Other stakeholders that *were* included in this research are the Forestry Commission, District Assemblies, traditional rulers, firewood and charcoal producers and sellers.

3.7 Looking forward

This chapter concerned the methodology of the research. Before moving on to the results of this research (Chapter 5) a brief introduction to Ghana is needed to understand the regional context of this study. Therefore, the regional framework will be presented in the next chapter.

4 Regional Framework

Rather than providing a full description of the country, here, some location related themes will be discussed that are relevant for this research. Ghana is administratively subdivided into ten regions. This research took place in the Western Region (Figure 4.1). Regions consist of districts, where district assemblies are situated in the capital town. This study focussed on the districts Mpohor Wassa East (Figure 4.5) and Ellembelle (Figure 4.6).

Figure 4.1 Map of Ghana with Regions

4.1 Continental region: West Africa

Ghana is part of the geopolitical region of West Africa. In this section, two themes that are relevant for the context of this research will be discussed, that is, biodiversity and energy, emissions & health.

4.1.1 *The Guinean forests: A biodiversity hotspot*

Myers (1988) introduced the term *biodiversity hotspots* as a way to prioritise conservation areas to combat widespread extinction of tropical forests. Nowadays, these hotspots hold 44 percent of all species of vascular plants and 35 percent of all species in four vertebrate groups while only comprising 1.4 percent of the land surface of the Earth (Myers & Mittermeier, 2000). "By concentrating on such areas where needs are greatest and where the pay-off from safeguard measures would also be greatest, conservationists can engage in a more systematised response to the challenge of large scale extinctions impending in tropical forests" (Myers, 1988, p. 187). The Guinean forests of West Africa are also considered such a biodiversity hotspot. Ghana, and especially the southern part including the Western Region of Ghana, forms part of this chain of tropical rain forests. This entails that, from the international level, priority is set to protect these forests and to counter deforestation and forest degradation in these areas.

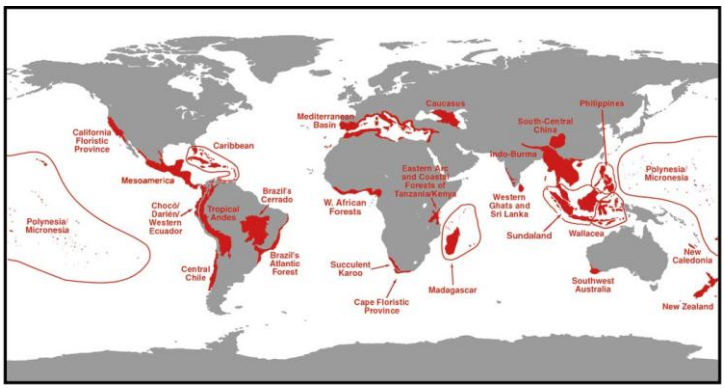

Figure 4.2 Biodiversity hotspots including the Guinean forests of West Africa.[19]

[19] Source: Myers and Mittermeier (2000)

4.1.2 *Energy, emissions and health*

The energy, emissions and health issue is a perfect example of a problem with a cross scale dimension. Deforestation is one of the main contributors to CO_2 emissions, which is one of the causes of global climate change (see for example IPCC, 2001). However, on the local scale people have to adapt to the environmental changes, for example when extreme weather events occur (INBAR, 2009). Moreover, on the local level the emissions of wood-based fuels have a direct effect. Burning firewood leads to "the emission of carbon monoxide, methane, nitrogen oxides, benzene formaldehyde, aromatics and respirable particulate matter", and to indoor air pollution (INBAR, 2008, p. 6). Although wood charcoal produces fewer emissions compared to firewood, production techniques are often highly polluting (INBAR, 2008). Each year, more than 400,000 people, primarily women and children, die prematurely in sub-Saharan Africa from respiratory diseases caused by the pollution from such fires (INBAR, 2008). The same source states that bamboo can serve as a sustainable alternative of biomass energy, leading to less emissions and less indoor air pollution.

However, this introduction of bamboo as sustainable source of energy should not be seen as something that stands on its own. On a global level, there a significant rise in the production and consumption of biofuels and biodiesel (Ejigu, 2008). This growing attention is used to promote the potential of biofuels for sub-Saharan Africa on the household level as well. It could be only a small step to move from the highly polluting and unsustainable traditional biomass to a more efficient form of biofuels and biodiesel derived from plants and agricultural crops. "Beyond efficiency, modern bioenergy offers tremendous opportunities to meet growing household energy demands, increase income, reduce poverty, and mitigate environmental degradation. In the African setting, energy and livelihoods security are indeed inseparable" (Ejigu, 2008, p. 1).

At the same time, as attention for biofuels grows, critics fear that a production of biofuels on the household level in developing countries could jeopardize the self-sufficient food security of people (see for example Ewing & Msangi, 2009). These concerns regard other types of biofuel than bamboo, such as oil seeds and sugar cane which are considered to drive up food prices directly as well as indirectly by taking up large amounts of former agricultural land. However, it should be examined whether in the future this threat could be an issue in the bamboo case as well, i.e. if the production of bamboo on agricultural land, and thus on former food production sites, is actively stimulated.

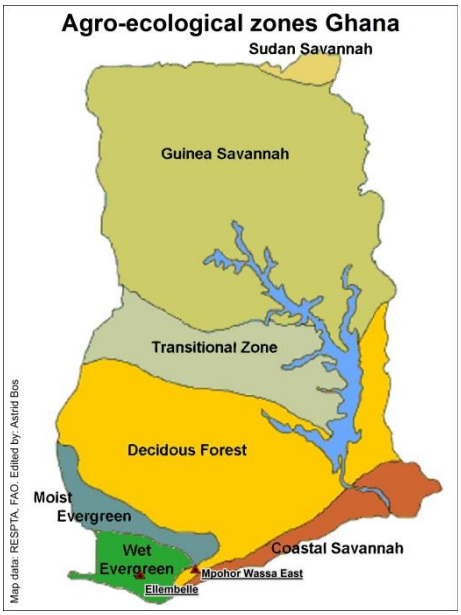

Figure 4.3 Agro-ecological zones of Ghana including the location of research sites

4.2 National and regional level: Ghana and the Western Region

4.2.1 *Geographical context*

Ecological zones

From an ecological perspective, Ghana is diverse country. Following the Agro-Ecological Zoning (AEZ) system of the FAO (2000a), Ghana can be divided into seven zones, ranging from Savannah areas in the North to several tropical rainforest types in the South (Figure 4.3). The AEZ is a framework of standards for a global characterization of climate, soil and terrain conditions relevant to agricultural production (FAO, 2000a). As can be derived from Figure 4.3, the research districts of Ellembelle and Mpohor Wassa East are located respectively in the Wet Evergreen and on the border of the Wet Evergreen, Moist Evergreen and Deciduous Forest.

Bamboo in Ghana

According to Obiri and Oteng-Amoako (2007) natural (unmanaged) bamboo exists everywhere in the country, except for the Coastal Savannah region. However, the predominant bamboo species, i.e *bambusa vulgaris*, can only be found in the three forest regions in the South of the country. It is unknown how large this bamboo resource base exactly is, but it is generally considered that the bamboo takes up 5 percent of the forest vegetation area, especially in the Western Region (Obiri & Oteng-Amoako, 2007). Bambusa vulgaris grows best at lower altitudes, under humid conditions along rivers and lakes (Louppe, Oteng-Amoako, & Brink, 2008), which are conditions that are all relevant in the Western Region. However, as will become clear in Section 4.3 and Chapter 5, on the local level variation in bamboo existence and thus bamboo resources use exists. For people with no access to transport facilities, living only six kilometres from a bamboo resource base can be already a serious constraint to access bamboo resources.

4.2.2 *Political and institutional context*

Political and economic history

Ghana is characterized by a turbulent history. For several centuries, Europeans used the area of what was then called *Gold Coast* for trading gold and later slaves. After many years of wars, in 1901 the British defeated the Ashanti, and the Gold Coast officially became a British colony. Under colonial rule, forest reserves were gazetted. This process was largely completed by the end of the 1940s (Hansen, Lund, & Treue, 2009).

In 1957 the Gold Coast became independent and changed its name into Ghana. Kwame Nkrumah from the Convention People's Party became the first president. He also played an important role in building a foundation for what is now known as the African Unity. From the mid 1960s onwards however, the political situation in Ghana became unstable again as a result of a series of coups.

This instability was reinforced by the economic crisis of the 1970s and 1980s. The International Monetary Fund and the World Bank provided loans on the condition of the implementation of Structural Adjustment Programme (SAP). Together with the Economic Recovery Programme it aimed at promoting national economic growth and improving rural economic conditions by removing the main constraints to productivity and by implementing an export-led development framework that emphasized cash (including tree) crop production (Dei, 1992; Kendie, 1995). As the SAP led to increased prices, it gave an incentive to expand production (Benhin & Barbier, 2004). An adverse effect of the SAP has been a huge increase in deforestation throughout the country (Codjoe & Dzanku, 2009). This whole process of trade liberalization, increased agricultural prices and extensification of agriculture is said to be a tragedy in itself, as overexploitation of biomass and loss of long term productivity of the land seems to be inevitable (Barbier, 2000). At the same time, an increased availability of chainsaws from Nigeria in the 1980s caused a boost in charcoal production and an increase in local timber contractors who obtained timber concessions from the local chiefs, village elders, and the state (Dei, 1992). Although in this sense the environmental state of the state's resources deteriorated, at the political level the situation improved for Ghana. From 1992 onwards, Ghana is officially a democracy. A new constitution, an absence of coups and a recovery of the national economy made Ghana become a stable country again.

Power in Ghana: from legal pluralism to legal integration?

As discussed in Section 2.1, Ostrom (1990, 1999) discusses the opportunities of self-organization, but before making conclusion on whether this is possible or perhaps already happening to some extent in Ghana, it is important to understand its current institutional context.

Ghana knows a long history of chieftaincy. This traditional structure of hierarchy exists next to the democratic structure. This coexistence can be seen as a form of legal pluralism, as Ghana's constitution officially recognizes customary law as one of the land laws (Marfo, Colfer, Kante, & Elías, 2010). Marfo et al. (2010) distinguish four models in which customary laws have been recognized by the state. They differ in degree of state intervention:

1. Minimalist method (state recognizes customary laws and does not intervene)
2. Agency method (state identifies an agent who then represents a group)
3. Group incorporation (customary group joins cooperatives, enterprises with legal standing)
4. Decentralized system of land boards (authority of traditional leaders transferred by law to boards)

According to Marfo et al. (2010) Ghana can be considered to fall under the category of the agency method. However, one should be careful with making generalizations too easily. For example, the

Paramount Chief has no absolute power, but he has been recognized by the state as legitimate custodian of stool land and forests (Marfo et al., 2010).

An important note should be made however with regard to chiefs' accountability as chiefs are not elected. The agency model of Ghana is often considered simple and effective, but there is always a risk that the representative may not act in the interest of the group (Larson, Marfo, Cronkleton, & Pulhin, 2010). On the contrary, "currently, traditional authorities appear to present substantial obstacles for communities to gain benefits from the opportunities presented by new forest rights" (Larson, Marfo, et al., 2010, p. 110). Therefore, the authors make a plea for "transparent rules of the game, including broad agreement on how representatives are chosen, the creation of accountability mechanisms and the specific domain of powers of each authority" (Larson, Marfo, et al., 2010, pp. 114-115).

In Ghana, but also in other countries, "(…) the recognition of customary rights has not resulted in an effective integration of formal and customary law" and although the constitution recognizes the customary law as a legitimate legal order, the content and meaning of these customary laws have often been disputed (Marfo et al., 2010, p. 77). Therefore, Marfo recognizes a call for a paradigm shift from legal pluralism to legal integration which involves tenure norms and rights as an embedded part of the system of institutions and laws that govern human activity.

4.2.3 Land rights and rights to natural resources

> *"[...] institutions at all [...] levels have been created to enable and regulate trade, transportation, competition, and conflict. The institutions shape environmental impact, even if they are not designed with that intent." (Dietz et al., 2003, p. 1908)*

Land tenure

Compared to many other developing countries including those of Western Africa, land ownership in Ghana is organized in a quite unique way, which for outsiders often leads to confusion and misunderstanding. Moreover, the rights to natural resources are linked to land ownership in a certain way, but there are important differences between land owners and resource right owners, which is why these issues are presented here as separate topics.

Formally, in the area where this research took place, ownership of land is based on customary law, which entails that it remains with Stools[20], which are the traditional and officially recognised land-

[20] The Stool refers to the stool on which Chiefs in the South sit and symbolizes the Chieftaincy. Historically, Stool land is defined as communal land which is "possessed by the whole tribe, and the orders of the Chief of the tribe have to be obeyed with regard to it" (Shelford, 1911, p. 473). Nowadays, it is recognized by the State and therefore included in the Office of the Administrator of Stool Lands Act, as "any land or interest in, or right over, any land controlled by a stool or skin, the head of a particular community or the captain of a company, for

owning communities (Aryeetey, Ayee, Ninsin, & Tsikata, 2007). However, the management and user rights of forests and trees found on these lands have been heavily regulated by colonial and post-colonial governments (Hansen et al., 2009), which will be discussed in more detail below. There is distinction between access to and control over land (Dei, 1992). As Dei explains, for individuals, *access* is traditionally granted through the Stools, which define the right to use or benefit from a portion of their social group's land. The *control* over land, i.e., the actual exercise of such rights rests with the *abusuapanyin,* the family or matrilineage head. Besides gaining access through lineage, tenancy arrangements and leases for a fixed period also exist (Dei, 1992). Here, the rights of the tenants depend on the terms of the lease they agreed to with the owner, i.e. the landlord (Osafo, 2010).

Rights to natural resources

Besides family land, there is also public land, which is vested in the President (Republic of Ghana, 1992). Forest Reserves and National Parks are examples of this. In Ghana there is a difference between forest reserves and off-reserve forests. For *forest reserves*, the allodial title[21] belongs to the Stool. The right to resources of the forest and the effective management control are vested in the State (Osafo, 2010). This entails that concessions for logging or mining for example, are distributed by the State. Furthermore, for collecting NTFPs, permission must be asked at the Forest Services Division (FSD) of the FC (Acheampong & Marfo, 201). For *off-reserve forests*, the customary laws count, which entails that rights, interests, and entitlements in land and trees are based on the customary system of land tenure and administration. This means that all rights and interests are generally held by the landowner, which could be the Stool, families or communities (Osafo, 2010). As discussed above, people can also derive rights through tenancy arrangements or leases. As Osafo rightly points out however, there is one important exception, that is, the commercial rights to the tree belong to the state. As Kalame, Nkem, Idinoba, and Kanninen (2009) explain, the Ghana Timber Resource Management Amendment Act 617 of 2002 does not allow farmers to harvest timber from their farmlands. This is said to have caused a lot of conflicts and a depreciation of trees for local communities. If local communities do not have the right themselves to sell timber from their land, and timber contractors commissioned by the government violate the compensation rules for crop damage caused by logging, there is no incentive for protecting a tree on their land (Hansen, 2011; Marfo & Schanz, 2009; Owubah, Le Master, Bowker, & Lee, 2001) or to participate in tree planting (Kalame et al., 2009). In other words, and experienced during the field work as well, to prevent crop

the benefit of the subjects of that Stool or the members of that community or company" (Republic of Ghana, 1992).

[21] The Allodial title is "in essence a title to a property, normally land, where the ownership of the land is unencumbered and the owner of the land has absolute ownership of the land, i.e. does not derive their title from a superior landlord. Title to land cannot be taken away by law" (Osafo, 2010, p. 5).

damage caused by timber contractors, people often cut down the (valuable) trees themselves and use it as construction material or sometimes just for firewood.

With regard to forest plantations, Ghana installed some special forest management systems. In the 1930s, this started with the traditional Taungya system. Here, parcels of degraded forest reserves were assigned to farmers who could produce food crops and help establish and maintain timber trees at the same time (Agyeman et al., 2003). The idea behind this is that the land is suitable for producing food crops in the first years of the plantations. As long as the canopy is not yet closed, there is enough sunlight for food production. However, with regard to forest plantation, there where conflicting interests between food crop production and tree growth (Blay et al., 2008). People had no rights to benefit from the trees leading to all sorts of negative consequences including damage of the tree seedlings and illegal encroachment of other forest areas, which is why the system was suspended in 1984 (Agyeman et al., 2003).

In the beginning of this century, in line with the new National Forest Plantation Development Project (NFPDP), the Modified Taungya System (MTS) was put in place by the Government of Ghana, with support from the FAO and World Bank. The main difference is that the farmers are included in the benefit sharing framework, which entails that from the benefits after harvesting of the trees 40 percent is reserved for the farmers, 40 percent for the Forestry Commission, fifteen percent for the (traditional) landowners and five percent for local communities who live in the area (Agyeman et al., 2003). Moreover, besides these long-term benefits and the short-term benefits that attract farmers to participate and invest labour, a continues flow of benefits needed for farmers to participate and keep participating after three years, when food crop production is not possible anymore (Agyeman et al., 2003). Up till now, some MTS projects have proven to be successful with regard to restoring degraded forests and community participation and thus providing both economic and ecological benefits (Blay, 2004; Blay et al., 2008; Tropenbos International, 2005). Anyhow, for many people the absence of rights to harvest the tree[22] is still a constraint for participating in MTS-like projects. Therefore, the IUCN is busy with projects in which people are granted ownership titles to trees they planted for REDD purposes (Nyame, 2011). For this research, it would be interesting to see what can be learned from these experiences and if bamboo fits in such a structure as well. At this moment, there is no special remark in Ghana's forest laws with regard to the harvesting of bamboo, which means that bamboo should be considered a NTFP. As explained above, this entails that for off-reserves, the user rights depend on customary law, whereas for forest reserves, at least officially, people must ask for permission at the FSD of the FC.

[22] As prohibited by the earlier introduced Ghana Timber Resource Management Amendment Act 617 of 2002.

4.3 The local level: districts and communities

In this section, the two districts and the communities involved will be introduced. How respondents in these communities were selected has already been discussed in the previous chapter. Although the districts are only about 75 kilometres apart as the crow flies, this chapter will show there are some significant differences between the districts, but also within the districts. It is important to keep these differences in mind while examining and discussing the results (Chapter 5 and 6) and drawing conclusions from them (Chapter 7), as these differences might have a large impact on the degree to which generalizations can be made from the results.

Image 4.1 A water borehole, Adzeankyewodam

4.3.1 *Mpohor Wassa East*

Mpohor Wasssa East district is situated near the eastern border of the Western Region (Figure 4.6). The capital of this district is Daboase. The whole district has approximately 125,000 inhabitants[23]. Most people belong to the Akan ethnic group and speak the Twi language. The total size of the district is 1880 km^2. There are four reserves in the area, with a total size of 179km^2, which are all under control of the Forestry Commission (FC). The main income generating activities are agriculture, palm plantation, small and large scale mining and logging. In Daboase, there is a farmer cooperation on palm oil processing (see also the anecdote as presented in Chapter 1). A large part of the processing of palm oil is based on bamboo firewood. Furthermore, INBAR is active in Daboase by providing bamboo charcoal to selected farmers from the town. The kilns for producing bamboo charcoal are close to the town. There is a large plantation company situated in Daboase, called the Subri Industrial Plantation Ltd (SIPL). The company used to experiment with different tree and plant species, including bamboo. However, at the moment of the field research, the plantations were not in use because of a company takeover. It was unsure if in the future, the bamboo plantations would be restored again. Because of bad weather and insufficient transport facilities, it was not possible to visit the plantations at that time.

In this district the research took place in Adzeankyewodam mainly. This village is situated approximately three kilometres from Daboase. The community consists of approximately eighteen households and one hundred inhabitants[24]. There are no electricity or tap water facilities, although according to the local chief, plans are ahead for connecting the village to the already existing

[23] Data from District Assembly Mpohor Wassa East, based on the census of 2000.
[24] Approximation based on own survey.

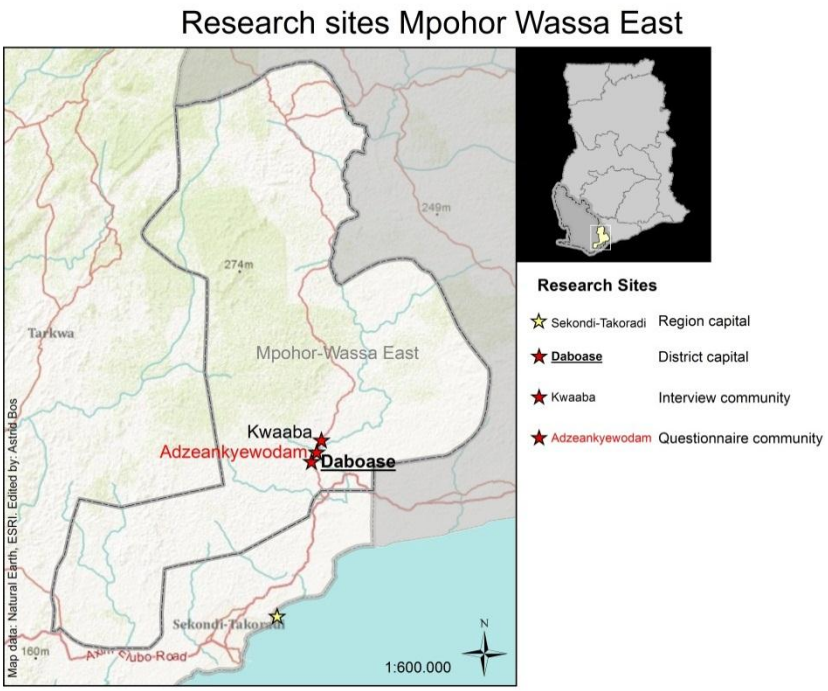

Figure 4.5 Research sites in the Mpohor Wassa East district

electricity network. Access to water is limited to one borehole, a stream and a river near the village. There is a gari[25] farmer cooperation in the village, and there is a machine for gari processing in the village, made available through the Rural Enterprise Project (REP) and funded by the International Fund for Agricultural Development (IFAD). However, during the weeks of visiting the community, this machine was not used for unknown reasons. Bamboo is abundant in the surroundings of the village and is used for many purposes[26]. However, there are no people from Adzeankyewodam involved in the INBAR bamboo charcoal project, although some had heard of it before.

Figure 4.4 The main road through Kwaaba

The other village in this district that was included in this research is Kwaaba, situated around four kilometres from Daboase. According to estimates from the village leader there are around 500 people living in Kwaaba. There is electricity but no tap water. It has an elementary school and there are several development projects in the village, regarding providing a gari machine, bicycles and computers. Like in Adzeankyewodam, the area surrounding the village is rich in bamboo, but again, people from Kwaaba have neither received bamboo charcoal nor training on the use of it.

[25] Gari is a kind of flour made from cassava.
[26] For more details, see Section 6.2.2.

4.3.2 *Ellembelle*

Created in 2008, Ellembelle is one of the new districts as a result of a reorganization of districts in Ghana. There are approximately 150,000 people living in the district [27], of which most people form part of the Nzema ethnic group. There language is Nzema, which differs from that of the Akan people. The district capital is Nkroful, which is not the largest town in the district, but it takes an important place in the political history of Ghana, being the birthplace of the first president after independency, Kwame Nkrumah. The main economic activities in the district are agriculture and fishery, although there is also a large Australian gold mining company active in the area. According to the district assembly there are no large timber companies in the district, but widespread deforestation is a serious issue in the area. There are two main forest reserves in the district, which are under control of the FC. There are several on-going development projects, including programmes on infrastructure, which aim to link the largely inaccessible northern part of the district with the south; improving sanitation and water sponsored by the EU and World Bank; improving education facilities; facilitating sprayings and fertilizer for cocoa farms; and rice growing projects in the wet areas of the district.

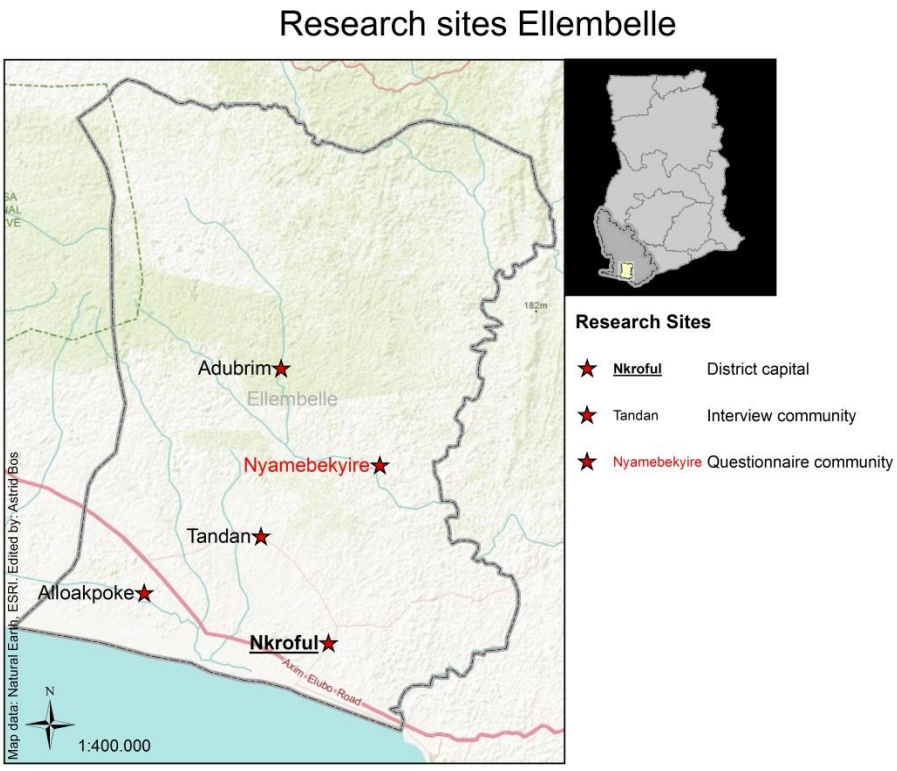

Figure 4.6 Research sites in the Ellembelle district

[27] Data from District Assembly Ellembelle, based on the census of 2000

Besides Nkroful, where interviews with District Assembly representatives took place, the communities of Nyamebekyire, Tandan, Adubrim and Alloakpoke were involved in this research. Nyamebekyire consist of approximately 24 households[28], but compared to Adzeankyewodam, here, kinship plays a different role and most households consist of a kind of compounds on which several generations and the so-called extended family lives together, which implies larger households. Almost all households are connected to the electricity network. Nyamebekyire lies on the border of one of the district's forest reserves. To access the village from Nkroful, it is an approximately twelve kilometres drive of which two kilometres consists of dirt road only. There is no bamboo in the immediate vicinity of the village, but some households have used bamboo as construction material collected from bamboo resources approximately five kilometres away. The INBAR bamboo charcoal project does not involve people of Nyamebekyire, nor did anyone I spoke to knew about it. Three years ago there was a project where the FC provided training and loans for animals to farmer groups to provide alternative livelihoods. In return, people were not allowed to take any resources from the forest reserve anymore. According to the village leader and some villagers it led to conflicts in the village. Some people were not part of a group and did not receive money or support. Others did take part in the training sessions for a year, but after receiving the money, they did not continue with the animals for which they had been granted a loan. In this village, the semi-structured questionnaire, village leader interviews, and participatory mapping exercises took place.

Tandan is a town that lies approximately twelve kilometres from Nkroful, along a paved road. Almost every house has electricity. There is a large amount of bamboo resources close to the village. Some inhabitants from Tandan are participants in the INBAR bamboo charcoal project, which entails they receive training, bamboo charcoal to experiment with and energy saving stoves for cooking. This charcoal came from the kilns of Daboase, but there are plans to build new kilns on a reserved site near Tandan. Furthermore, there is a small bamboo nursery for experiments with different bamboo species. In this town, focus groups and interviews with farmers, INBAR participants, charcoal users and sellers took place.


Figure 4.7 Bamboo canopy Tandan

Adubrim is a town on the other side of the reserve on which Nyamebekyire lies on the border as well. This town is accessible by paved road. Like in Nyamebekyire, three years ago the FC started here the alternative livelihoods project. However, the animals died because of a disease, and people where not able to pay back the loan. Still, inhabitants said that illegal harvesting of forest resources from

[28] Based on field observation and conversations with village representatives.

the reserve had decreased because of the alternative livelihoods project and increased control. During a focus group discussion however, people said that the lack of access to timber was considered a major constraint for their livelihoods. For this research, besides a focus group discussion, in this town the village leader was interviewed.

Alloakpoke is the fourth and final community in Ellembelle that was included in this research. The main economic activity in this village is the production of (wood) charcoal, which is distributed to other regions as well. This is first and foremost a task for the men in the village. It is the main contributor to deforestation in the area. The women are responsible for firewood collection, which is also sold to other places. Some people in the village took part in the INBAR bamboo charcoal project, by helping to build the kilns in Daboase. In the village itself however, the focus so far is on normal charcoal production only. A focus group discussion and interviews with charcoal producers were performed in this village.

4.4 Looking forward

In this chapter, I aimed to explain the geographic context of this research by introducing the continental-regional, national, regional and local setting. In this way, it becomes easier to understand and link the results, and to put them into perspective. These results will presented in the next chapter.

5 Results

In this chapter, the results of the field work are presented. With regard to the literature research, a distinction has been made between literature on theories and literature on relevant empirical studies. The former has already been presented in Chapter 2. In Chapter 6 the results as discussed in this chapter will be linked to results from literature research. In other words, in this chapter the emphasis lies on the results themselves. An interpretation of the findings will be given in Chapter 6.

The results presented in this chapter are based on observations, semi-structured interviews, semi-structured questionnaires and focus groups. However, rather than providing a complete report on all the results, this chapter aims to give an overview of the main findings. Some additional results can be found in the Appendices K to N. This chapter is structured as follows. First, the landscape results will be presented, corresponding to research sub question 1 and 2 (see Section 3.1.3). In the second and most comprehensive section, the livelihoods are central with a special focus on energy. The third and final section comprises of the results related to the topic of institutions, in the broadest sense of the word.

5.1 The landscape

5.1.1 *Their view on their landscape*

The current state of the landscape in the research districts can be described as a mosaic of land uses. Both districts have areas of protected Forest Reserve and patches of secondary forest that is owned by either chiefs or families. According to the village leader of Nyamebekyire it is especially the secondary forest that is changing the most. The reserves are not changing that much because they are controlled by the FC or sometimes hardly accessible. Secondary forest is going down everywhere in the district. The village leader of Nyamebekyire assigns this first and foremost to the increased need for agricultural land, a cause which is given many times in the interviews. Family and chief land is a mix of forest and farm land. People normally cut down the trees when they would like to use that parcel for agriculture. Increased population is a often mentioned underlying cause of the increased demand for agricultural land. Timber companies are allowed to log parts of the secondary forest after permission from DA, and the chief or family who owns the land. However, like described in Section 4.2.3, conflicts with regard to timber companies who neglect to pay compensation for crop damage frequently occur.

Although in most interviews and focus groups deforestation and degradation in forest reserves is said to be relatively stable, according to the FC it is an considerably large problem. If a reserve is hardly

accessible, one would assume that illegal use is limited. This is certainly true, but it makes controlling hard at the same time. One day during the field work, I paid a visit to a partially degraded Forest Reserve, which the FC and INBAR were considering as potential site for bamboo plantations. As said, this was a protected area, but there were clear signs of an illegal charcoal production site in the middle of the forest. Furthermore, there was a clear sound of chainsaws in the distance. I was accompanied by one ranger from the FC, but no intervention by the FC staff took place. Understaffed and with a significant risk that illegal chainsaw operators are armed make the FC quite forceless in these kind of situations.

Image 5.1 An illegal charcoal production site in a forest reserve

Besides bamboo plantations, tree plantations such as rubber and acacia receive more and more attention from both the FC as well as DAs and farmers. People have positive attitudes towards planting trees on degraded land, even for restoring complex forest functions such as biodiversity. To my knowledge, no scientific studies has been focussed on this topic in the study area, but people said game returned in forest plantations on previous degraded lands (see also Figure 5.15). The FC stresses the importance of establishing on marginal lands. However, many farmers do not want to start plantation on land they depend on for food production, but according to the FC one should not strive for this either.

As discussed in the previous chapter already, bamboo is abundant in the region and especially in the areas of the research districts. Near rivers and streams, high bamboo stems are visible in the forest patches. The overall attitude towards wild bamboo is negative. The proliferation of bamboo on farmland makes that people want to reduce it. Exemptions can be found when speaking to respondents who have benefited in one way or the other from INBAR's pilot project. One of those farmers in Tandan for example, emphasised that she wanted the state of the bamboo around her farm to be improved. Then, because of its regenerative character, she would have access to an energy source all year round, so even when in times of rain charcoal and dry firewood are scarce.

Image 5.2 Bamboo is abundant along rivers and streams, like here near Adubrim

Albeit their regenerative character and abundance, bamboo and rattan resources are going down as well. However, bamboo is far from being considered scarce, so uncontrolled harvesting continues. At this stage, people do not find the bamboo situation worrisome at all, and their harvesting is not constrained by law or an imminent scarcity of the resource.

During the focus group discussions, one topic concerned the prevalent environment-related problems in their area. Most problems mentioned were related to agriculture and the climatic and soil conditions that cause a limited productivity of the land. For example, soil that has too much rocks, is too sandy, too dry or too wet weather conditions were considered serious, but hardly surmountable at the same time. Therefore, they rather talked about other problems, such as crop damage as a result of insect infestation. This is a problem they can control by using sprayings. The participants faced problems with assigning the causes of the problems.

At the focus group meetings, the notion of landscape was discussed as well. In small groups participants were asked to draw the main features of what they considered to be their landscape. People had difficulties with distinguishing between village and landscape, and decided in the end that their landscape was formed by the village boundaries and adjacent agricultural and forest land.

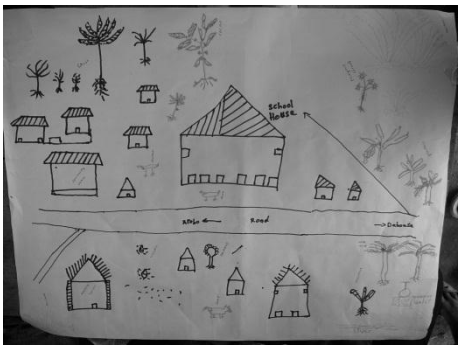

Image 5.3 The end product of a landscape mapping exercise in Adzeankyewodam

5.1.2 *Forest products and changes in supply*

In the semi-structured questionnaire that was held in Ellembelle and Adzeankyewodam, people were asked to mention the most important products they take from the forest, regardless the type of forest (on or off reserve) or whether they had permission to take it or not. People could add products if they were not on the list already. Moreover, they were ask to define whether the natural supply of these products had decreased, increased or remained the same during the last five years. The results can be found in Figure 5.1[29]. The four most mentioned products are respectively firewood, medicinal plants, snails and game. Concerning those four products, the majority of respondents said that for all but the medicinal plants the natural supply has declined during the last five years.

As said before, it is considered that the forest reserves are in better condition compared to the off-reserve areas. This entails that forest reserves are better in supplying the forest products. However, collection of these products from forest reserves is forbidden. During the focus group discussing in Adubrim, a community situated just outside the border of a reserve, participants said that this ban formed a large problem for them, as some of the products can be found only or almost solely in the forest reserves. This naturally puts a pressure on the forest reserves, but also on the remaining forest products from the secondary forests.

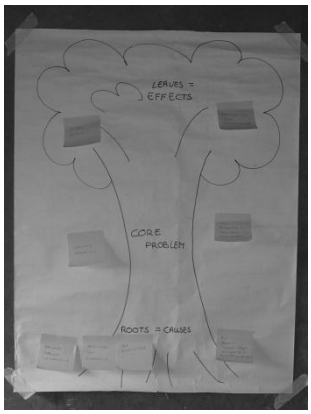

Image 5.4 Using post-its and a problem tree frame, problems were grouped and prioritized in focus group discussions

[29] Graphs that show the results per village can be found in Appendix K.

5.1.3 *Reasons for decline and responses to a degrading landscape*

The most mentioned forest product in Figure 5.1 is firewood, as 33 out of 35 respondents said to take firewood from the forest, either on or off reserve. Furthermore, most of these people (27) said that the availability of firewood has declined during the past five years. The people were asked what they thought was the main reason for the decline of all given forest products, which could differ between the products. Figure 5.2 shows some interesting results. An increased use of that product by the community members themselves was said to be the main reason for the decline of all forest products, except one. That is, for the decline in firewood people said the main reason was the reduced amount of forest area. I will elaborate on this in the next chapter.

They were then asked to explain how they dealt with the decline in firewood. They could choose a maximum of three types of responses. Furthermore, they were ask to rank the responses in order of importance. The most important response received three points, the third response one point, and not mentioned responses received obviously zero points. Afterwards, all points from all respondents were added up and percentages for each category were calculated. The results are presented in Figure 5.3. The most important response was an increased collection time and collection of firewood from further away. What is striking is that this response does not provide a structural solution to the problem of declined supply. On the contrary, it has an amplifying effect on the decline in firewood supply.

As could be derived from Figure 5.3, some of the responses degrade the forest even further and provide no sustainable solution to the problem. Also outside the semi-structured questionnaire the topic of declining forest products was discussed. During one of the interviews in Tandan, someone said their household changed to gas because of the diminishing availability of firewood. But this household is the exception rather than the rule. For most rural people gas is too expensive. Still, DA of Ellembelle sees it as priority for stopping deforestation.

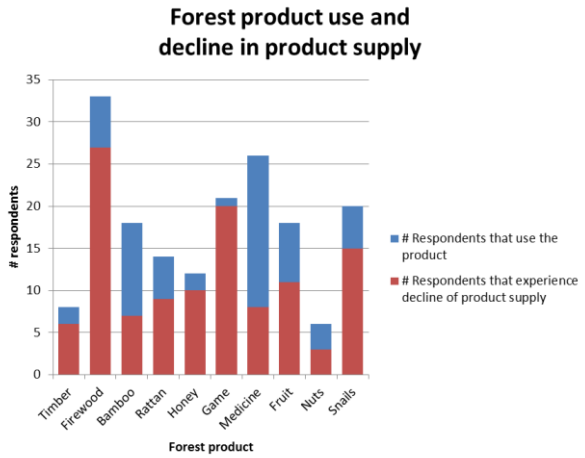

Figure 5.1 Forest product use and decline in product supply

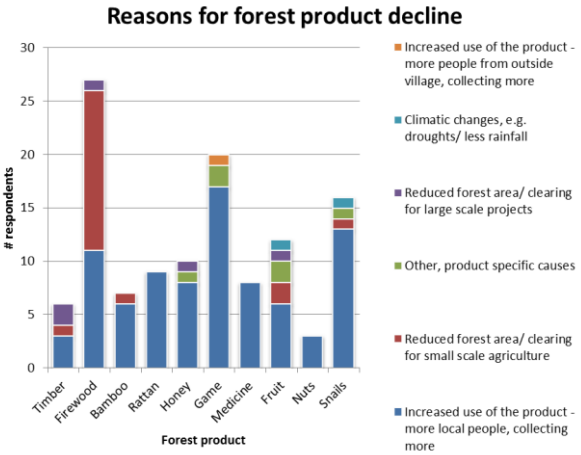

Figure 5.2 Reasons for forest product decline

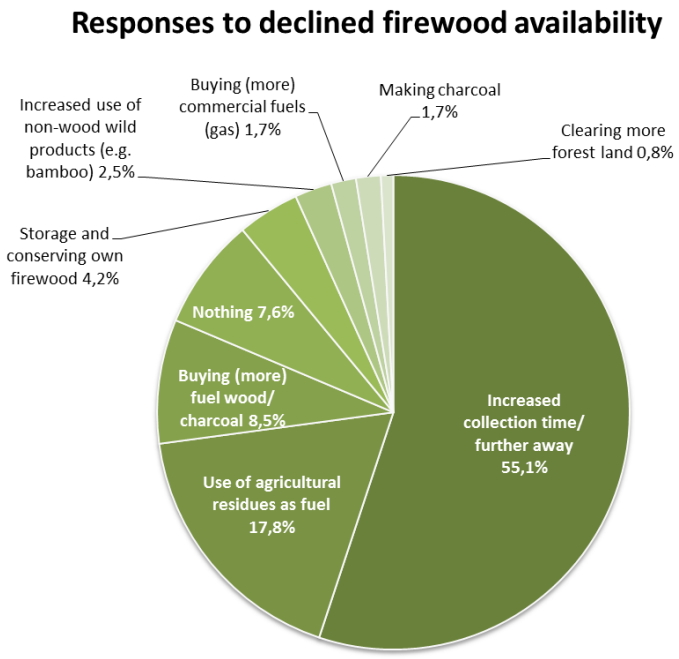

Figure 5.3 Responses to declined firewood availability

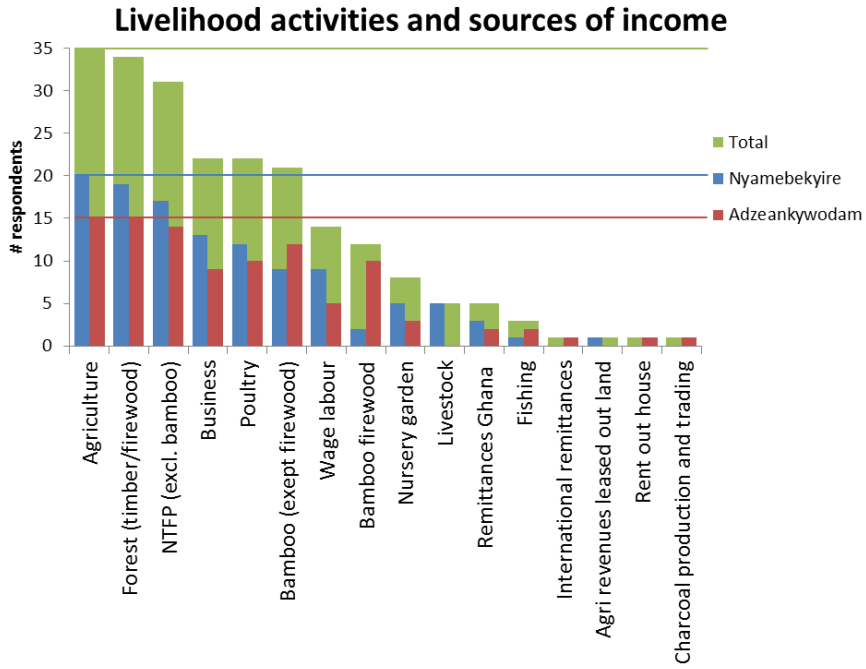

Figure 5.4 Livelihood activities and sources of income

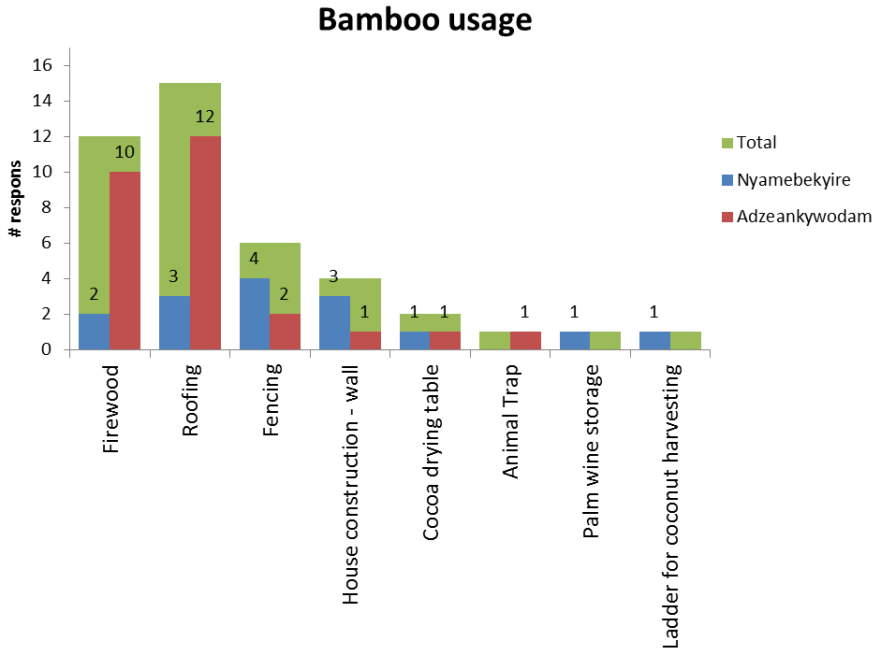

Figure 5.5 Bamboo usage

5.2 The people

5.2.1 *Livelihood activities and the current role of bamboo*

Most people in the research districts are farmers, and all respondents of the semi-structured questionnaire said to have agriculture as a livelihood activity. By far the most of them do this partially or fully for home consumption, that is, only one respondent said to sell all the agricultural yields. A complete overview of all livelihood activities in the area can be found in Figure 5.4.

The green bar represents the sum of the two communities. The horizontal lines indicates the maximum number of respondents per community[30]. This graph does not make a distinction between an activity for home consumption, for selling or for both. In general, there is a difference between crops that are produced mainly for home consumption (e.g. plantain, cassava, yam and pepper) and crops that are mainly produced to sell on the market (cocoa, palm nuts, coconuts). The business category includes trading of on farm processed agricultural products, such as selling palm oil and gari. There are a few significant differences between the communities, especially with regard to the role of bamboo firewood. That is, only two out of twenty respondents of Nyamebekyire said to collect bamboo firewood as a livelihood activity, against twelve out of fifteen respondents in Adzeankyewodam.

This does not mean that the people in Nyamebekyire hardly use bamboo, because the category of bamboo (excluding firewood) shows that almost halve of the respondents, in Nyamebekyire use bamboo. When taking bamboo for general purposes and bamboo firewood together, in Nyamebekyire nine out of twenty (45 percent) respondents use bamboo. In Adzeankyewodam, thirteen out of fifteen respondents use bamboo (87 percent). Figure 5.5 shows for which purposes bamboo is used in both communities. Please note that one respondent can use bamboo for multiple purposes, so the Y axis represents the total number of times that factor is mentioned as bamboo purpose, rather than the total number of respondents in a village. In Adzeankyewodam, where bamboo is abundant, the main purposes of bamboo are firewood and for roofing. In Nyamebekyire, where bamboo is available, but further away, the usages of bamboo are more long-lasting goods rather than firewood, although the numbers are very small.

5.2.2 *Energy and the current role of bamboo biomass energy*

To continue on firewood and bamboo firewood, it was asked which energy sources are used for home consumption. The results are shown in Figure 5.7. For both communities, firewood is the most used energy source. Most people use multiple sources of energy but for the majority, i.e. 33 out of

[30] This is done because the bars represent absolute numbers. For the purpose of this graph, the total number of respondents is too small to calculate percentages. The horizontal lines prevent misinterpretation due to difference between villages in number of respondents.

35 respondents firewood was the most important source of energy. Two people said charcoal to be the main source of energy.

As discussed before, the use of bamboo firewood significantly differs between Nyamebekyire and Adzeankyewodam. In Nyamebekyire however, more charcoal and agricultural waste products are used. In both communities, no one used bamboo charcoal. The reasons of respondents to use bamboo firewood were examined. Each respondent using bamboo firewood could give a maximum of three reasons. The twelve people who use bamboo gave a total of fifteen reasons. The results are presented in Figure 5.6. Bamboo firewood burns very fast and high temperatures are reached easily. According to the respondents, this is the most important reason for using bamboo firewood. The lack of normal firewood was the second most mentioned reason for using bamboo firewood. Palm nut processing for palm oil and drying fish need high temperatures, therefore, bamboo firewood is used. During one of the focus group discussions in Adzeankyewodam it was mentioned that although bamboo firewood is often used, it is never replaced fully by normal firewood but rather used in combination with each other.

To the 23 people who do not use bamboo firewood, it was asked what the reason was. Again, a maximum of three reasons could be given. They gave 25 reasons in total. The results of their responses can be found in Figure 5.8. The reason of unavailability was mentioned most often. However, this reason was given only by people from Nyamebekyire, so to prevent distortions separate graphs per community are given as well (Figure 5.9). In addition to these reasons, during focus groups it was now and then remarked that the use of bamboo could be dangerous. Cutting down bamboo can be a risky job, and because of the trapped air in the culm, explosions can happen. This is why some people do not wish to use bamboo in their inside kitchen.

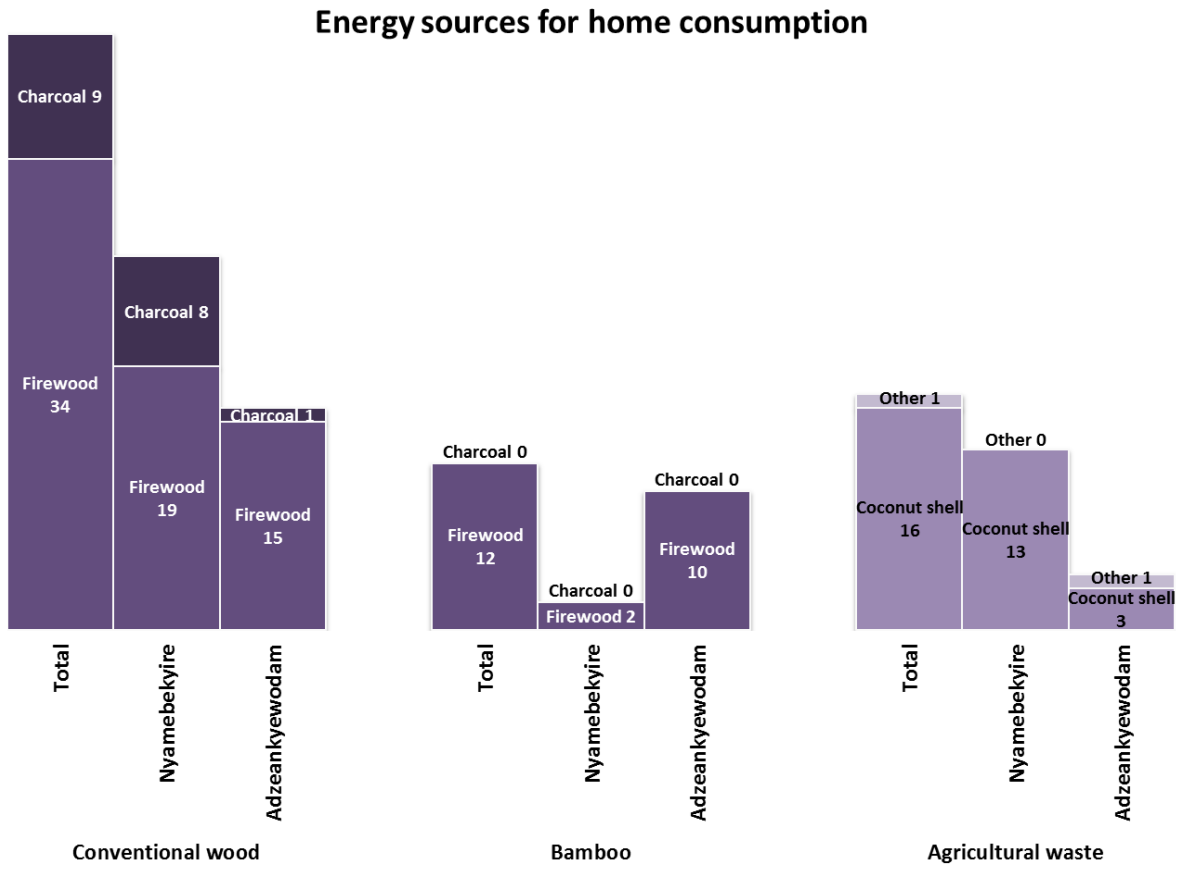

Figure 5.7 Energy sources for home consumption

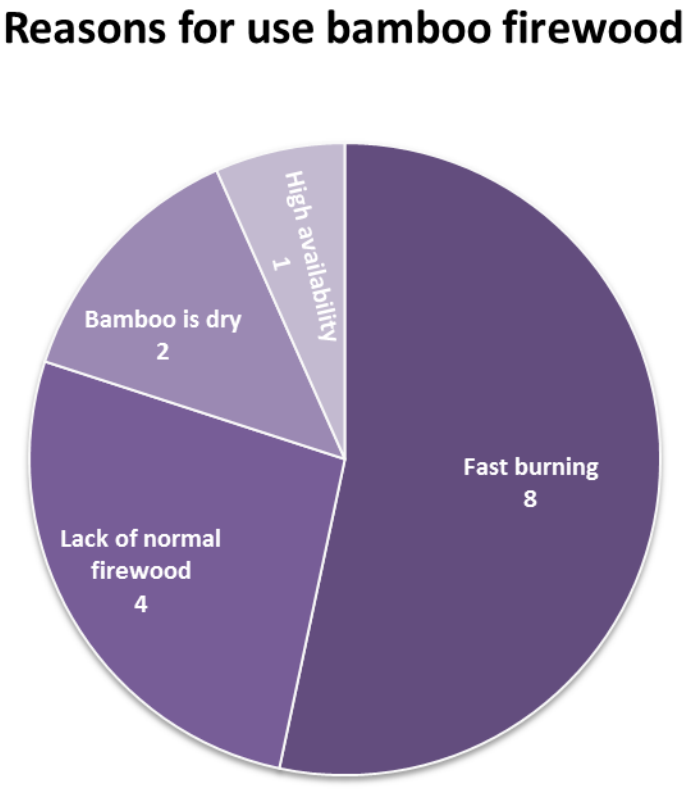

Figure 5.6 Reasons for use bamboo firewood

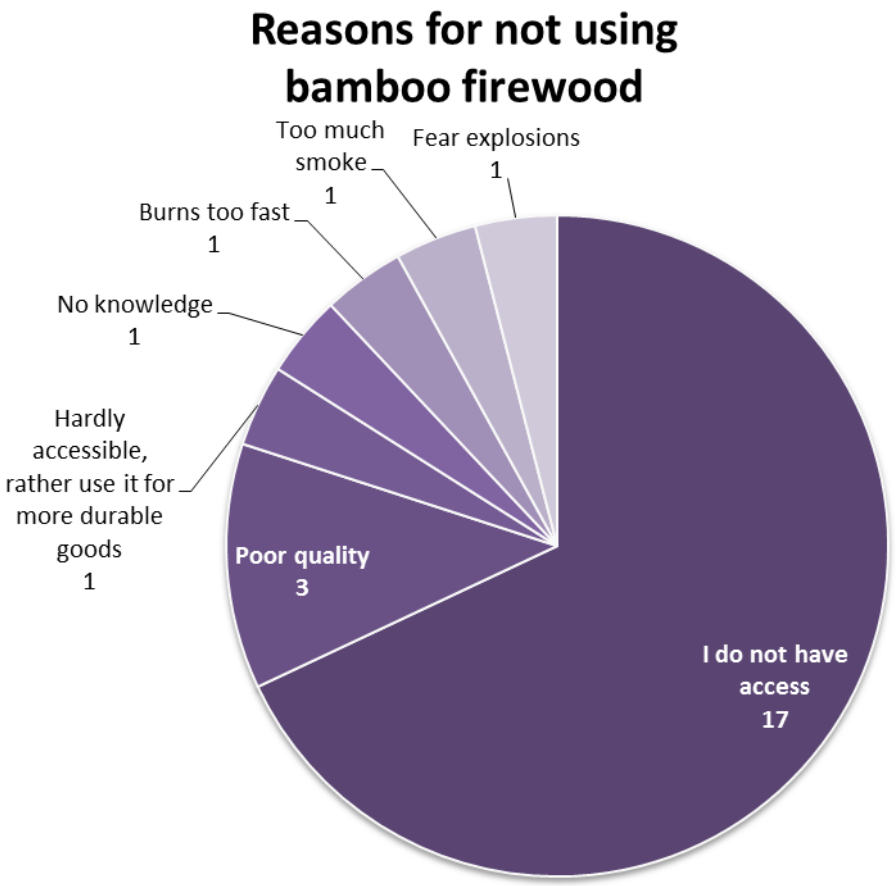

Figure 5.8 Reasons for not using bamboo firewood

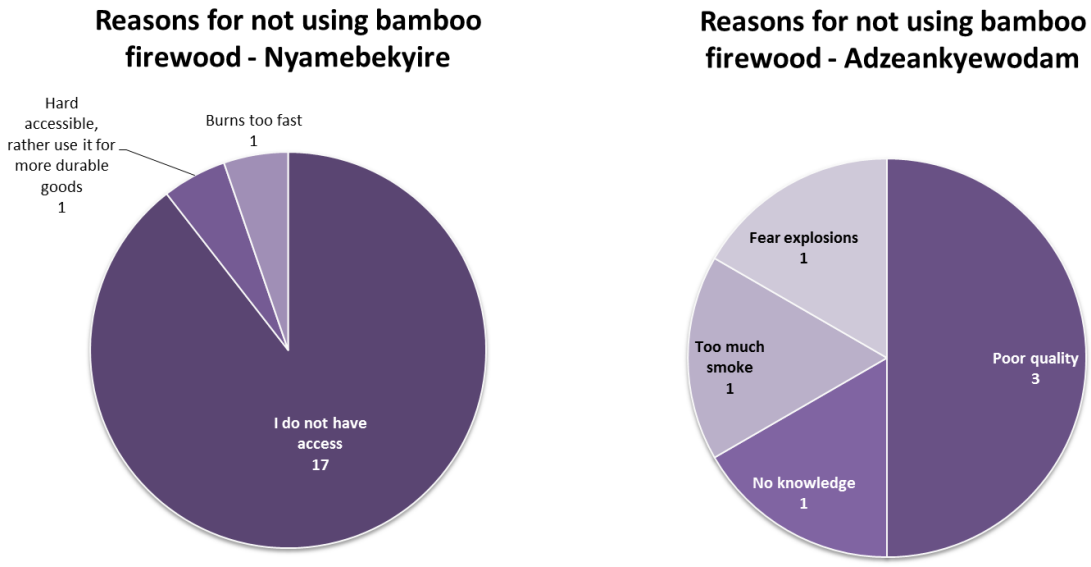

Figure 5.9 Reasons for not using bamboo firewood per community

In the household, charcoal producer, charcoal seller and charcoal consumer interviews in Tandan and Alloakpoke, Ellembelle District, it was asked what in general the factors are that determine which type of energy they prefer. They were asked to rank these factors and leave out if not important at all. The results can be found in Figure 5.10. The percentages are based on a calculation where the fact counts whether or not the factor is mentioned, as well as the height in the ranking. Price is the most important single factor, but when ordered in categories people find what I categorized as cosmetic characteristics of energy sources the most important, i.e. the absence of smoke, a product that does not cause stains, does not cause a lot of ash residue, and smells good.

Image 5.5 The traditional way of making charcoal: piles of logs and branches are covered by sand, leaves and moss and burned slowly to carbonize - Alloakpoke

Another factor that is considered important is whether the energy source is accessible all year round. This factor is found especially important by charcoal sellers. As the number of trees are going down, also in other district where charcoal is produced, charcoal traders do not have a steady access to charcoal to sell. This is enhanced by seasonal differences. Especially in the rainy season, dry firewood is scarce, the demand for charcoal rises. Producing charcoal during the rainy season is difficult as well. Although covered by sand, leaves and moss, too much rain can extinguish the slow fire inside the pile of wood (Image 5.6). Consequently, especially during the rainy season, charcoal producers and charcoal traders experience they often cannot live up to the demand for charcoal.

Image 5.6 Too much rain extinguished the fire before complete carbonization was reached - Alloakpoke

This double scarcity during the rainy season is caused by an important difference between charcoal and firewood. Generally consumers collect firewood themselves, while charcoal needs to be bought. Firewood is relatively easier to save for the wet season, as it costs only extra labour forces during the dry season, but it is harder to store on a dry place. For most consumers, saving charcoal for the rainy season is not possible. They need to rely on their savings to buy a lot of charcoal at once, but this amount is simply not sufficient.

Image 5.7 Finding dry places to store firewood for the rainy season is often hard

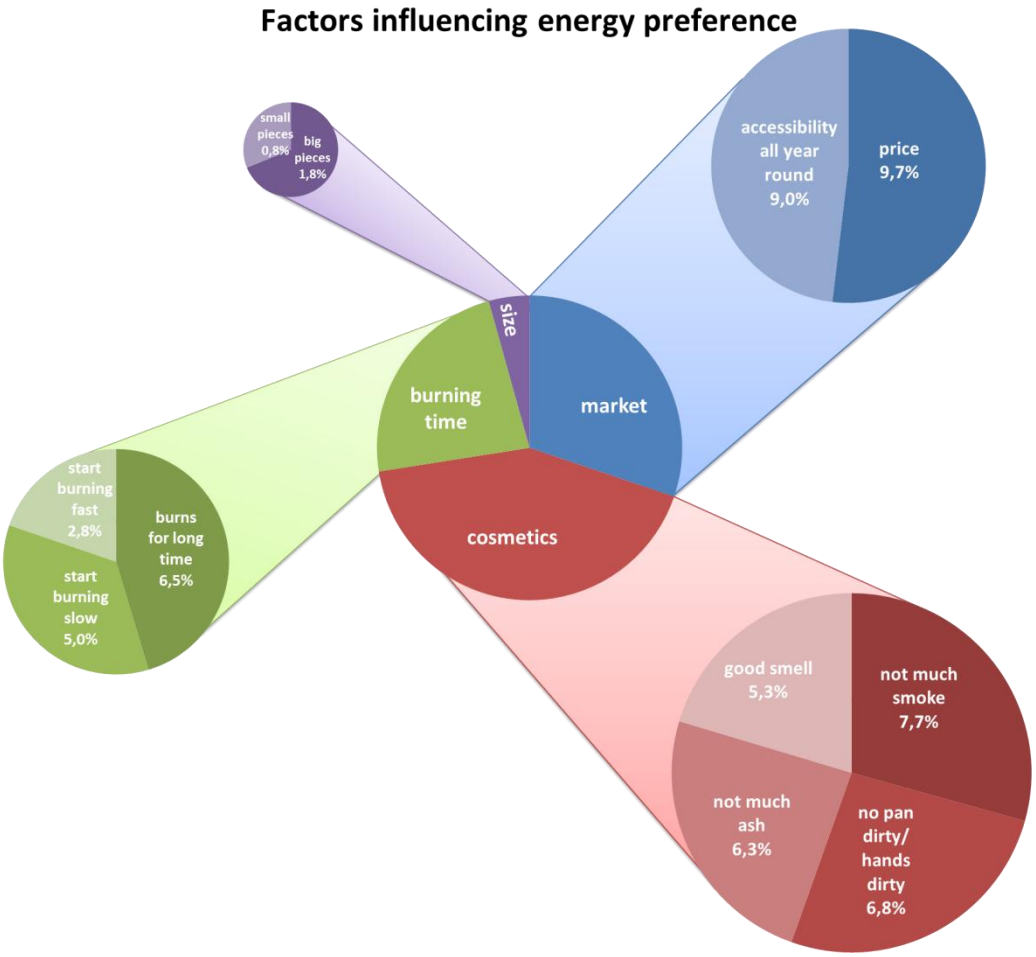

Figure 5.10 Factors influencing energy type preference, ordered by category

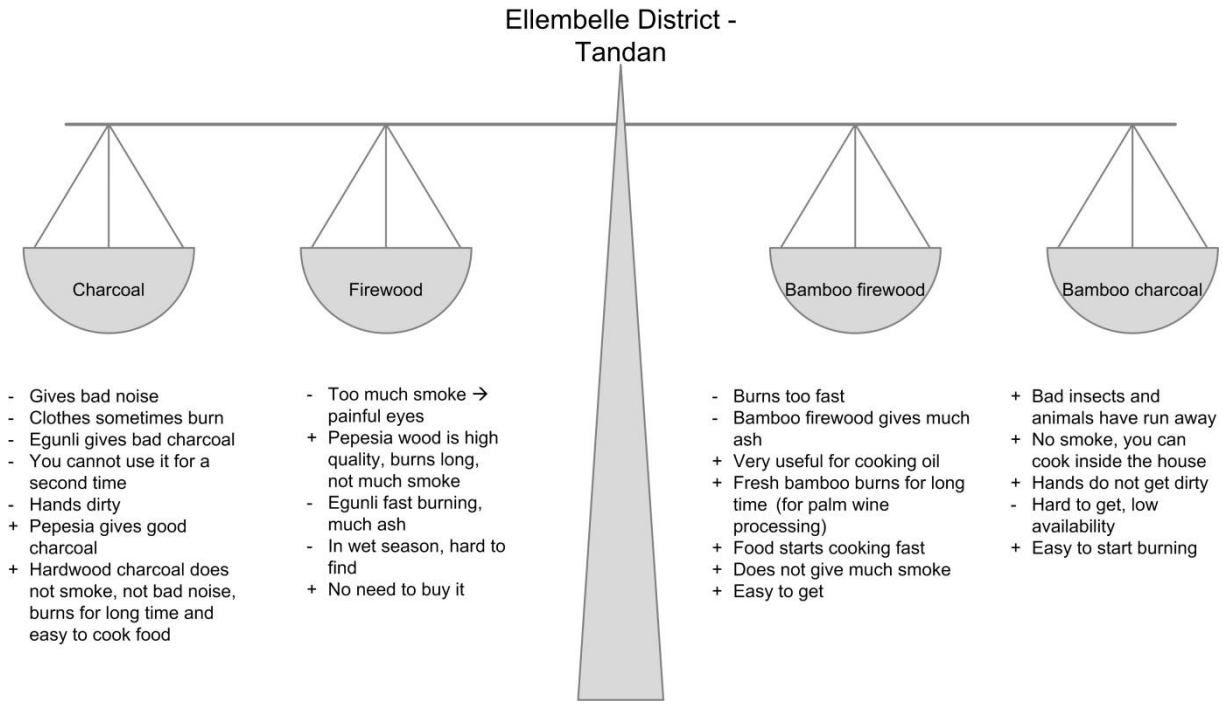

Figure 5.11 Weighing different biomass energy sources

5.2.3 *Look at the future: discussing the potential*

As discussed before, only few people have tried bamboo charcoal as part of INBAR's pilot project. In Tandan, one focus group discussion was held with the women from this pilot group. They received energy saving stoves for bamboo charcoal, as well as some bamboo charcoal itself for free. Using weighing scales, the four products of firewood, charcoal, bamboo firewood and bamboo charcoal were evaluated. The results are shown in Figure 5.11[31]. At the end of this exercise, the group of women found that overall bamboo biomass energy was better than woody biomass. During this evaluation, I noticed some paradoxes in bamboo energy source characteristics. For example, where bamboo firewood burns very fast and gives much ash, bamboo charcoal burns for a long time. Bamboo firewood is considered a completely different product when compared to normal firewood. In general, normal firewood is supposed to burn for a long time, although this partially depends on the wood species. Firewood is used for all types of cooking while bamboo firewood, if not mixed, is mainly used for palm oil cooking or heating for other agricultural processes. People who have not tried bamboo charcoal and prefer firewood over bamboo firewood, expect bamboo charcoal to be like bamboo firewood, that is, fast burning and producing a lot of ash. Consequently, people who did try the bamboo charcoal all said to be positively surprised by the quality of the product. The prejudices on bamboo charcoal, together with an elaboration on the consequences for the use of bamboo biomass energy will be discussed in more detail in the next chapter, Section 6.2.2.

Image 5.8 Hard, high quality bamboo charcoal

In the questionnaire the people from Nyamebekyire and Adzeankyewodam were asked whether they already had some knowledge on the production and use of different bamboo biomass energy products and whether they were interested to learn (more) about it, regardless whether these people already used bamboo firewood or not. I would like to stress once more that these villages were not included in INBAR's bamboo biomass pilot. The results are shown in Figure 5.12. Overall, they have no or limited knowledge on bamboo biomass energy, but they are very interested in learning more about it. With

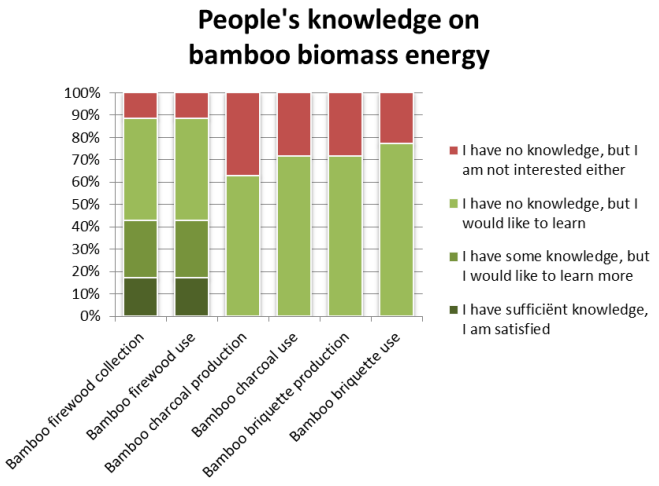

Figure 5.12 People's knowledge on bamboo biomass energy

[31] The weighing scales of other communities can be found in Appendix L.

regard to bamboo charcoal and bamboo briquettes[32] people are slightly more keen to learn about the use rather than the production.

The overall findings on the demand for training confirm what was mentioned at the interview at the DA of Ellembelle. The supply of bamboo is already there, but it is the techniques that are missing. This is not only the case for bamboo biomass energy, but also for the processing of bamboo in general. As confirmed by the representative of INBAR West Africa, if bamboo is used and processed for durable goods, e.g. furniture, it is important that the bamboo is chemically treated within five days after harvesting, otherwise the rotting process will start. People need to be educated about these techniques. With regard to the processing itself, according to the National Project Coordinator of IUCN Ghana there used to be some bamboo processing centres in the Western Region already, for making crafts and more. However, these centres were no success and currently they are not in operation.

Currently, INBAR is looking which degraded sites are suitable for bamboo plantations. Some forest reserve areas have already been chosen in cooperation with the FC. To be able to provide a sustainable flow of bamboo resources, INBAR is also interested to know more about whether farmers would like to plant bamboo on their own land. This was asked during the questionnaire in Nyamebekyire and Adzeankyewodam, and the results are clear. Only four out of 35 respondents said to be willing to plant and manage bamboo on their own land, that is, that is, one person in Nyamebekyire and three people in Adzeankyewodam. The reasons why they are interested are shown in Table 5.1. The 31 reasons why the rest is not willing to do this are shown in Figure 5.13. By far, the most mentioned reason is that bamboo destroys the land, because of the uncontrolled spreading of the resource. Again, those people did not receive trainings on the sustainable harvesting of bamboo (see also Figure 3.2 on page 31) which is said to significantly reduce uncontrolled spreading of bamboo.

Reason	Number of responses
Bamboo is profitable	2
Bamboo is a quality product	1
Would like to make own charcoal	1

Table 5.1 Reasons for willingness to plant and manage bamboo on own land

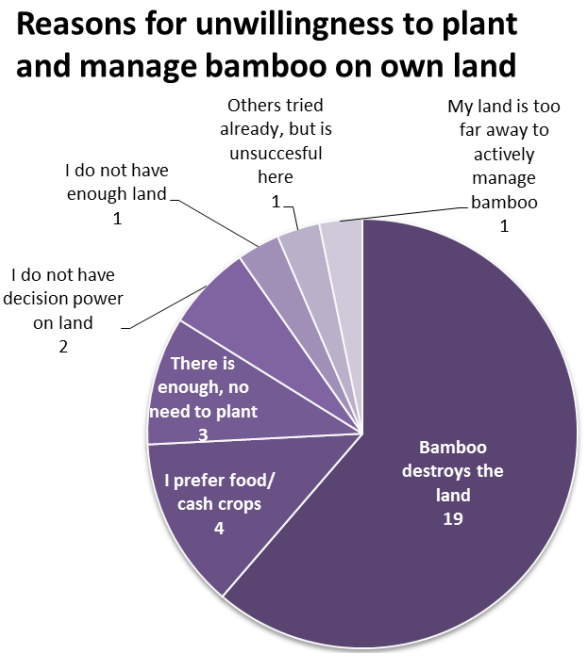

Figure 5.13 Reasons for unwillingness to plant and manage bamboo on own land

[32] At the time of the research, INBAR's pilot project did not include the provision of bamboo briquettes yet. Plans are ahead to introduce this energy type in the pilot area shortly.

5.3 The institutions

5.3.1 *View on power distribution*

As discussed in Chapter 4 already, the distribution in power with regard to land and resources is very complex in Ghana. What was found is that in practise, issues regarding conceived power and conceived interest, which are two different things, complicate things even further. In the interviews with the DA representatives as well as in focus group discussions on community level people were asked to draw Venn diagrams on de facto decision power with regard to forest land. The size of the circles represent the relative *interest* in the stake, i.e. forest land and its resources. The more a circle is situated towards the centre of the frame, the more perceived *power* this stakeholder has. In some of the Venn diagrams lines were added to represent links between stakeholders. Circles may overlap if, for example, one group is a sub group of another. The results of the Venn diagrams are presented in Figure 5.14.

There are some significant differences between the Venn diagrams, both between the two district (horizontal) and between perception of DA representatives and communities (vertical). For example, in Ellembelle, the DA says that chiefs have a large interest and much power when it comes to forest land and its resources, whereas the Adubrim community finds the chiefs have neither a large interest, nor much power. When comparing the Venn diagram made by the participants of Adubrim with their statements as discussed in Section 5.1, it seems that there are some contradictions. In the focus group discussion they said to suffer from the ban on the use of forest products from the adjacent Forest Reserve, but the Venn diagram shows a small circle for the Adubrim community as stakeholder. However, they stated that while they wished to be able to have a large interest, because it was not possible, a high interest in the stake would not make a difference. They felt they were restricted by the power of others, which forced them to create a lower interest in the forest land and their products and made them search for alternatives. An interesting difference in the other district regards the FC. The DA of Mpohor Wassa East District finds that the FC has a high interest and a lot of power. In contrast, the people from Kwaaba find that the FC has neither a high interest nor much power with regard to forest land and forest products.

Besides power and interest, Venn diagrams can also be used to understand perception on relations between stakeholders. An example of a difference on the horizontal level, i.e. between districts, can be found when looking at the chainsaw operators again. Another difference was the position of chainsaw operators. That is, the DA of Ellembelle sees them as part of the community, the respondents from the Adubrim community find that the chainsaw operators are neither linked to them, nor to other villages in the district. As discussed above, the people from Adubrim say there is no link between them and the chainsaw operators. The people of Kwaaba say there is a connection.

They explained the chainsaw operators even hired people from there village for work. Moreover and remarkably, this difference is also found on the vertical level at the same time (Table 5.2). It must be stressed however, that Venn diagrams represent perceived relations and perceived differences in power and interests of only the group that participated. Moreover, it is possible that differences between villages within the same district exist. In other words, the fact that the participants from Adubrim denied a link between chainsaw operators and their community, does not mean others in the village agree with this, and even so, a neighbouring village in the same district could in practice have a link with the chainsaw operators, on which the statement of the DA of that district could be based.

Ellembelle DA: "Chainsaw operators are part of community"	**Mpohor Wassa East DA:** "No link between chainsaw operators and community"
Ellembelle – Adubrim community: "No link between chainsaw operators and community"	**Mpohor Wassa East – Kwaaba community:** "Chainsaw operators are linked to community"

Table 5.2 Perceptions on the link between chainsaw operators and communities

As discussed in Chapter 4 already, people have to ask permission for many things concerning the use of forest products. Especially with regard to the Forest Reserves, but also regarding logging for commercial purposes, people have to ask permission from the FC. However, community members have to ask permission from the FC *through* the DA, which makes them distant from the FC. from FC but through DA. The FC are often seen as a kind of police, although in interviews and discussions many people experience a difference in recent years towards a perception in which the FC takes the role of partner as local community members are assigned as forest guard. In this way, the gap between FC and community is decreased.

When it is about land, chiefs often play a central role and they have de facto a lot of power. Landless people depend on the chief for leases mainly. The only way to go around this is if your family has had the land in its inheritance for a long time already, or if a non-chief land owner decides to offer you a kind of share cropping arrangement. This is often experienced to be hard for young and migrant families, leading to differences even within villages. This was visible in Nyamebekyire for example, where there is a (also physical) division between two parts of the village: the old, with traditional *compound* types of households, and the new part, where young families and migrants live.

Concerning the topic of power, one final note must be made. Although it is hard to study, illegal use of forest resources is considered a large problem and seems to go around all formal power structures. The act itself is often not visible[33], but its consequences are.

[33] Although at one time it was *audible*, see Section 5.1.1

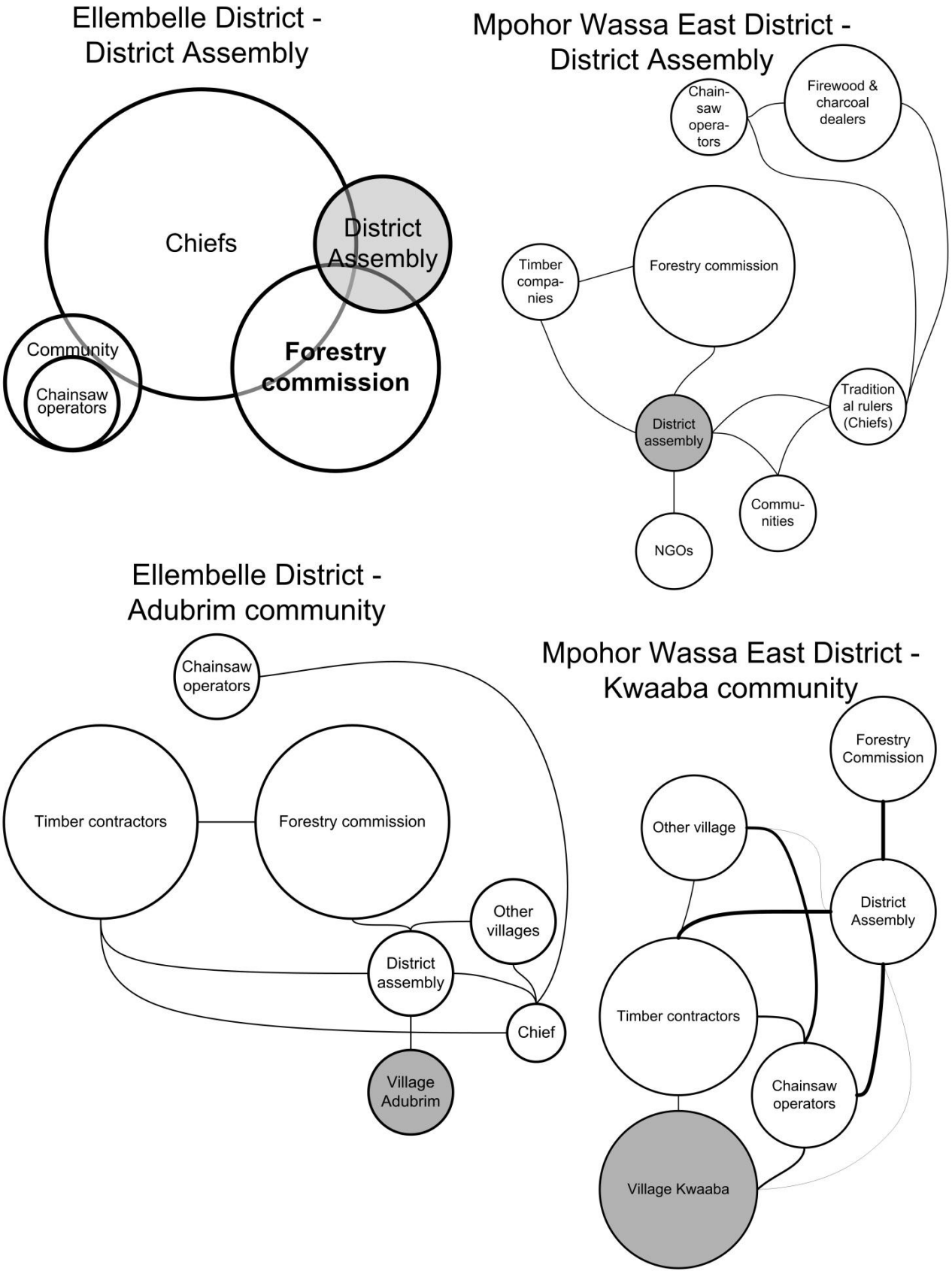

Figure 5.14 Venn diagrams of forest land and forest resources interest and power

5.3.2 *Hampering and fostering factors for change*

In the focus group discussions, people were asked to define the factors that hamper and foster a change towards restoration. The results from the focus group discussion in Tandan can be found in Figure 5.15[34]. Some of the hampering factors relate to the farming, e.g. the need for agricultural land, while for other factors they said they did not have an influence, e.g. the fact that gold mines destroy the forests. Regarding the fostering factors, people see a great role for law enforcement. As discussed before as well, they find that monoculture plantations can restore landscapes as well. All three villages, Tandan, Alloakpoke and Adzeankyewodam saw a role for bamboo, despite the fact that only people from Tandan and Alloakpoke are included in INBAR's pilot project.

However, in interviews and other discussion, most people say they do not see the need for starting bamboo plantations, because bamboo is widely available. The link between the causes of the scarcity of a product, i.e. firewood collection, and the search for a present alternative, i.e. bamboo, was not mentioned that often. People acknowledged there was a problem of firewood scarcity, but many people did not want to invest in bamboo. Is that because is just not yet considered a viable alternative or is it because the problem in this area is not imminent enough?

If the latter is true, there is still a need to extend the pilot to the northern regions of Ghana, where firewood scarcity is more severe. According to INBAR's West Africa representative, this is the intended goal, but because it is a pilot, it is better to start in an area where people are already familiar with both bamboo collection and charcoal production.

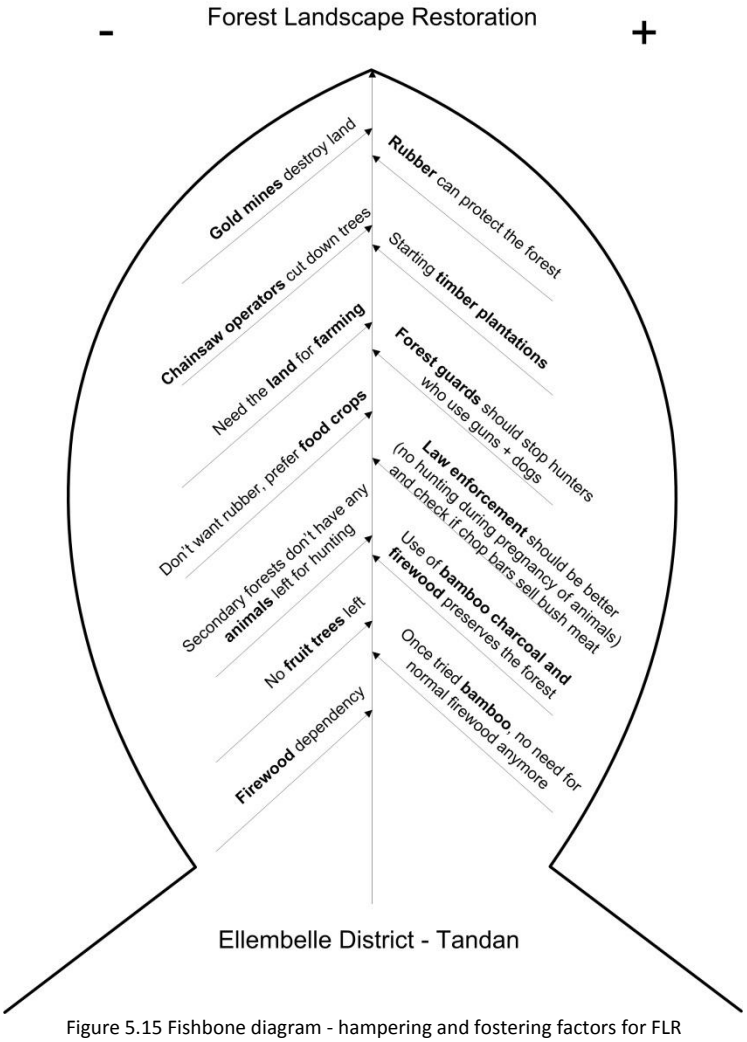

Figure 5.15 Fishbone diagram - hampering and fostering factors for FLR

[34] The fishbone diagrams of the other two communities can be found in Appendix M.

6 Discussion

Here, the main results as presented in the previous chapter will be discussed and linked to findings from previous studies. It includes an interpretation of the findings and aims to act as a bridge between these findings and the conclusions that will be drawn from them in the next chapter. This is done using the sub questions as presented in Chapter 3. Finally, this chapter reflects on the limitations of this study with regard to the field work.

6.1 The landscape

6.1.1 *Deforestation and degradation causes*

What are the main causes of deforestation and forest degradation in the project areas of INBAR Ghana?

A changing landscape

> *"Think of a tropical forest landscape and the image that probably springs to mind is of a billowing, continuous canopy with scattered solitary emergents, a sea with many shades of green and the occasional dramatic splash of colour stretching uninterrupted towards the horizon. (…) Today's 'typical' tropical forest landscape is more likely to be a mix of primary forest, managed forest, secondary forest and degraded forest lands interspersed with extensive areas of other, non-forest land-uses."* (Maginnis & Jackson, 2002, p. 9)

It is estimated that around 80 percent of original forest area is now agriculture-forest mosaic (Norris et al., 2010). This is also the impression I got while travelling through Ghana. The Western Region in which this research took place, was the still the most forested area of all regions I visited. However, so-called *pristine* forest, if at all, is limited to a couple of National Parks in the country.

Besides a worldwide trend of changing landscapes, the perception of the forest in relation to human kind has changed over time as well. At first, forests were seen as obstacles to agricultural growth and development. Later, the function of forest as means of productions was highlighted. More recently, some scholars state it is important to acknowledge the spiritual meaning of forests (Owubah et al., 2001). Moreover, Owubah et al. state that the perception of the forest changed for forest dependent communities as well, as the bundles of rights are crucial for people's perceptions of the forest. These rights changed over time. This was acknowledged by respondents in the research sites. Since the implementation of the Concessions Act, the commercial rights to trees are vested in the State (Osafo,

2010). This means that for people the value of a standing tree changes to practically nothing, and turning a parcel into agricultural land by cutting down the trees on the land is no constraint at all. Regarding the spiritual meaning of forests however, I cannot say whether this has changed or not, but I can say that the influence of spiritual leaders, and in particular fetish priests, differs per community. The notion of taboos is still prevalent in most rural communities, influencing livelihood activities. For example, in one of the research villages, going to the forest on Fridays was forbidden while in another, herding goats was forbidden.

Together with changes in landscape, decline in soil fertility characterise forest landscape degradation (Adjei-Nsiah et al., 2004). This was, at least in Adzeankyewodam, considered a large problem for farmers, enhanced by more irregular seasons, and an increasing pressure on agricultural land because of population increases. Soil conditions, which are already relatively low, deteriorate further as the cycles of shifting cultivation become shorter. The farmers of the questionnaire had an average of 8 acres[35] of agricultural land, of which most people (20 out of 35 respondents) did not have any fallow land at the moment.

With regard to countering the negative trends of landscape deterioration, there are only few incentives for farmers to engage in sustainable practices and no incentives to conserve forests (Owubah et al., 2001). An example of successful involvement of farmers in sustainable practices is given by Blay et al. (2008) through the implementation of MTS, where forest plantations are established in degraded areas while farmers get permission to use the land for agriculture in the first few years and receive a part of the revenues generated by the trees when the trees are harvested after a few decades. Key is to make sure farmers have both short and long term incentives to participate. The risk is still that people drop out during the project, if a continued flow of benefits for the farmers is not there after agricultural production and before harvesting of the trees (Agyeman et al., 2003). For that matter, I think there is a great opportunity to include bamboo. After six to eight years, bamboo is already mature (Kigomo, 2007; NMBA, 2004). If managed well, from that time onwards, bamboo provides a continued flow of revenue.

If no restoration takes place or significant changes in Ghana's logging practices occur, it is expected that Ghana will become a net importer of wood in 21st century (Kusimi, 2008). This fear is shared by many people I spoke to in the research area, including the representative of the DA of Ellembelle who said that there are well-grounded fears that in ten years time, there is not enough timber left for local people to build houses from.

[35] Including a few outliers to the higher end

Drivers of change

Other studies in Ghana found that the main drivers behind deforestation are agricultural expansion, illegal logging, fuel wood collection (Benhin & Barbier, 2004; Osafo, 2010), lack of alternative livelihoods other than farming, increased population and inadequate knowledge of sustainable farming practices (Appiah et al., 2009, p. 479). Based on the findings as presented in the previous chapter, all these factors are prevalent in the research area too. However, I contest the link between fuel wood collection and deforestation, which I will explain below.

Image 6.2 Collected firewood from agricultural-forest areas near Nyamebekyire

Image 6.1 Piles of wood for charcoal production contain logged hard wood (below) as well as dead collected wood (up)

The causes of forest degradation are argued to be over-exploitation of forest resources, unsustainable farming practices, logging, wildland fires, mining activities (Blay et al., 2008). Especially the over-exploitation of forest resources was considered a cause of forest degradation by the respondents of the questionnaire. An increased use by people from their own village was the most important reason for those forest products that declined in the last 5 years, that is, timber, bamboo, rattan, honey, game, snails, fruit and nuts. For the decline in firewood however, the most important cause that was given was a declined forest area, followed by an increased use. This is because in Ghana, wood fuel often comes from wood that is already dead, i.e. fallen branches from trees (Osei, 1993). But as the forest area declines, there is not enough dead wood for firewood anymore. This is the reason why Norris et al. (2010) argue that fuel wood and charcoal production should not be considered primary drivers of deforestation, but rather as an important cause of forest degradation. Based on my findings from the field work I agree with this statement only partially. That is, for the charcoal production site I visited in Alloakpoke, areas are logged for charcoal production. Hard wood is considered to produce higher quality charcoal. The charcoal producers I spoke to all produce and sell charcoal which contains a mix of hard and soft wood, logged and collected. These small scale producers can be categorized under what the FAO calls the informal sector. They are expected to continue to play a dominant role in the supply of woody biomass energy in the next two decades in those countries where people still mostly depend on these sources of energy. It is expected that most woody biomass energy will come from unmanaged areas, affecting the long-term sustainability and affecting those areas that are closest to urban centres mostly (FAO, 2003). Most charcoal produced in Alloakpoke goes to urban areas such as Takoradi, Kumasi and Accra. As these cities are growing, it is expected that the demand for charcoal will rise too.

The big bush fires including those of the 1980s are often mentioned as a driver of change when discussing landscape change in Ghana (Kalame et al., 2009), however, people in the research area did not mention this. The fire used during common slash and burn practices sometimes gets out of control (Appiah, Damnyag, Blay, & Pappinen, 2010), further degrading the landscape, but this was not mentioned to be a significant problem in the area either.

6.1.2 *Bamboo: forest products and environmental services*

Can an improved production and use of bamboo reduce pressure on forest landscapes, restore forest functions or both?

Forests provide woody products, NTFPs and environmental services. In theory, Bamboo can provide substitutes for the woody products that forests provide such as timber and firewood. However, several respondents, including participants of a focus group discussion in Adzeankyewodam said they prefer mixing firewood types so it is more likely that, in practice, firewood will never be completely substituted by bamboo. This means that bamboo firewood can only be seen as a partial substitute for firewood. Furthermore, the collection of firewood is not seen as a cause of deforestation, as first and foremost dead wood is being used. Therefore, the use of bamboo firewood reduces the pressure on forest landscapes, but only partially.

On the other hand, with regard to bamboo charcoal, it can reduce the pressure on forest landscape to a greater extend. That is because in the research area logged wood is used for charcoal production. By using a regenerative source of energy for charcoal production, the use of charcoal becomes more sustainable by declining the need to log trees for charcoal production.

Natural existing or purposefully planted bamboo can provide watershed services (fixing river banks, hillsides and other areas vulnerable to soil erosion), fix the top soil, reduce wind erosion, and there is on-going research on whether it can clean up degraded waters (Henley, 2009). Other complex environmental services that forests provide cannot be substituted by bamboo plantations. However, this is where I see a clear added value of the landscape approach. At the plantation site level, some forest functions can be restored as proved by Henley, and at this level it can reduce pressure on forest landscapes. Consequently, as pressure on the forest decreases, on the landscape level forest functions could be restored by the forest itself, as long as the forest was not degraded or deforested too much.

I did not find literature on bamboo forests suitable as substitutes for complex natural forests in providing NTFPs, so I cannot confirm whether or not bamboo plantations can provide any of the NTFPs where the respondents depend on, such as rattan, honey, game, fruit, nuts and snails. “New bamboo plantations may curb the pressure for deforestation by serving as wood substitutes, as

woody components of permanent agroforestry systems, and as a means to curb the spread of slash-and burn agriculture" (Lobovikov, 2010, p. 12).

The use of bamboo in degraded area is advocated by several scholars. Bamboo can be seen as a tough plant, and particular species grow also in the dry tropics, and even on shallow, degraded soils. This makes bamboo plantations a suitable and promising option for degraded or marginal land (Lobovikov et al., 2009).

Nevertheless, the discussion remains whether the establishment of plantations in general can outweigh benefits of natural regeneration in a degraded area. According to Blay (2004), this depends on the state of the degraded area. In his case the area was characterized by a nutrient-deficient soil, reduced primary productivity, and low biological diversity. Natural rehabilitation would then take a lot of time, and cannot provide the short-term needs of the forest dependent people. "Artificial regeneration on the other hand is faster and can rehabilitate the degraded areas within a shorter period of time" (Blay, 2004, p. 32). With regard to the woody type of products that bamboo can provide, bamboo plantations can provide these products even faster than fast growing wood species such as acacia.

How do bamboo plantations fit in complex agroforestry systems that aim to restore forest functions? Asase and Tetteh (2010) argue that complex agroforestry systems may act as a buffer between reserves and intensively managed areas, but only if these systems are strategically managed to create a win-win situation of sustainable agricultural production in combination with conservation of plant diversity. According to INBARs experts it is possible to use bamboo for agroforestry by intercropping in the early stages of the bamboo plantation. However, based on their current attitude towards natural bamboo on agricultural land, I expect that people in the research will not experiment with this themselves as long as intensive education is not provided. Yet, I do not think it is impossible either, as some of the people's attitudes towards bamboo energy did already change after some demonstration sessions where bamboo charcoal was provided.

6.2 The people

6.2.1 *Livelihoods characteristics and energy production and consumption*

What are the main characteristics of rural livelihoods in the Western Region, Ghana and what role does biomass energy currently play in these livelihoods?

This sub question is already largely answered in the previous chapter. Therefore, this section only provides a general overview of these results rather than a comparison with findings from literature.

Livelihood activities

All livelihoods examined for this research are characterized by diversification. All participants had agricultural activities either for home consumption, selling or, the majority, both. Besides the livelihoods activities in general, the agricultural activities are very diverse within livelihoods as well. Cocoa, palm nuts and coconut are examples of cash crops, while cassava, yam and plantain are food crops that are produced first and foremost for home consumption. People often experiment with different types of crops. In this way people try to spread the risks as crop diseases are common. Because of food crop diseases, in Ghana but also in the research area in particular, there is a trend visible that people turn some of their land that was previously used for food crops into forest plantations such as acacia and rubber. The DA, FC and some households said to fear that these plantations will put a pressure on people's food security. If planted bamboo is promoted actively, this could become serious issue too.

Image 6.3 Here in Nyamebekyire, the dead coconut trees in the background show the results of a common crop disease in the Western Region

According to Wunder (2001) NTFPs also serve as buffer or safety nets. In the questionnaire, the second most mentioned reason why people use bamboo firewood was because of a lack of normal firewood. However, certain NTFPs were rather seen as luxury products, such as game or snails. The growing scarcity of these products makes it that these products become even more special.

Energy

In the research area, the energy used for cooking is almost completely based on biomass energy. Although again people prefer, and are probably forced as well, to have a diverse set of energy sources, firewood forms the most used energy source and is considered the most important too. As most people do not produce charcoal themselves, they are limited to the market supply. Therefore, charcoal is mainly used by people who are less poor compared to others. Firewood can be bought at the market too, but as the amount of collected firewood on farmland is still sufficient although declining, the need to buy firewood is still small. Shortages are supplemented by either agricultural waste products such as coconut shells, or, if available, bamboo firewood, or both.

6.2.2 *The role of bamboo in people's livelihoods*

Is the use of bamboo for firewood and charcoal a more superior and sustainable option for local users and producers compared to conventional firewood and charcoal, and if so, in what ways?

Most respondents find that bamboo firewood is an inferior product compared to normal firewood. However, there are some specific characteristics that make bamboo firewood more useful for certain purposes. Bamboo firewood is mainly used for heating during specific agricultural processes such as palm oil production, because bamboo firewood burns fast and creates a high temperature. Furthermore, as bamboo absorbs less water after being harvested compared to normal firewood, people sometimes prefer the use of bamboo firewood over normal firewood during the rainy season.

Bamboo charcoal is new to most respondents. People who have not used it yet expected it to have similar characteristics as bamboo firewood and were therefore reserved. They expected bamboo charcoal to be soft, so that its quality would be even worse than low quality, soft wood charcoal. However, most people said to be willing to try it if the quality appears to be similar or better than that of normal charcoal, which was also found in a previous study (Obiri & Nutakor, 2010).

Image 6.5 Kiln for producing bamboo charcoal, situated near Daboase

Image 6.4 This woman tries out bamboo charcoal in an energy saving stove during one of INBAR's demonstration sessions

As explained in Chapter 5, the pilot, in which bamboo charcoal and energy saving stoves were distributed for free, was considered a success by the women concerned. According to the West Africa representative of INBAR it is important to actively create a demand, for example by letting people try the product for free and providing the necessary conditions, such as the energy saving stoves and building proper kilns for bamboo charcoal production. These kilns produce better charcoal products, because in comparison with traditional methods (Image 5.5 on page 66), these kilns are more air-tight, leading to better carbonization and thus creating charcoal with a higher quality. Currently the kilns are used for testing only, producing the charcoal used in the demonstration sessions. However, it is the intention that the rights to use the kilns will be given to the communities. Then, my concern is how it will be guaranteed that these kilns and the energy saving stoves will be used for bamboo charcoal only. The people who tried out the bamboo charcoal are impressed by its quality, but I presume it is perhaps not the product of bamboo that makes the difference, but rather the way of producing and cooking, i.e. in a brick kiln and on energy saving stove. If these items where used for normal charcoal, the chances are that the quality of that charcoal would outweigh that of the bamboo charcoal again. This risk needs to be examined further and if valid, it needs to be decided how to deal with.

As said before, at first, people were reserved when bamboo charcoal was introduced to them. By combining the outcomes of the evaluation by the participants of the pilot (Figure 5.11) with the

results from the ranking exercises (Figure 5.10) it can be concluded that bamboo charcoal matches some of the most important energy characteristics with regard to the *cosmetics* category, that is, creating not much smoke, not causing stains, not much ash as residue, and creating a good smell. Furthermore, previous studies found that bamboo is a good indoor deodorizer (Zhang, Jiang, & Zhou, 2004). However, with regard to the two highest ranked characteristics, i.e. price and all year round availability, it cannot be said whether bamboo charcoal will score high at these points too. Up till know, bamboo charcoal is produced only for the pilot in which bamboo charcoal is distributed for free. It is not known yet what the price of bamboo charcoal will be in comparison to wood charcoal, and the costs concerning the building of the kilns are have not been examined in this research. With regard to the preferred all year round supply of the energy source, it should be remarked that if the pilot is extended and bamboo charcoal is continued to be produced, the brick kilns take away the disadvantages of seasonal fluctuations in supply. That is, unlike traditional charcoal production, bamboo charcoal production using brick kilns is not weather dependent. People from the charcoal producing village Alloakpoke acknowledged that at this point, this was the major drawback of traditional charcoal production. Another advantage of bamboo charcoal production technologies is that they are less polluting than current wood charcoal technologies (INBAR, 2008).

6.3 The institutions

Are the current formal and informal institutions enabling or disabling the use of bamboo in Forest Landscape Restoration? If disabling, how could policies be improved to make it more pro-poor, while supporting Forest Landscape Restoration?

6.3.1 *Formal institutions*

According to Buckingham et al. (2011, p. 1) outmoded policy frames form constraints for developing bamboo in developing countries, which are mostly caused by what they call "bamboo's ambiguous institutional position and the dominance of silvicultural forestry". They acknowledge four specific problems which cause that bamboo is often neglected, as summarized in Box 6.1 (Buckingham et al., 2011).

(1) Agricultural and forestry departments govern cultivation; for both bamboo is not 'core' business;
(2) Bamboo is fundamentally different plant, so it does not fit in historical policy frames for silvicultural management and statistics;
(3) In international development, silvicultural science and practise is dominated by western views
(4) Market-based forest policy instruments (e.g. FSC, REDD) are only designed for trees and not for bamboo.

Box 6.1 General institutional frames that cause a neglect of bamboo

In Ghana by law, bamboo does not fall under the category of trees and is considered to be a NTFP. This makes harvesting, even for commercial purposes, relatively easy as customary law counts which only states that permission must be given by the land owner, which normally is a chief or a family. If according to the Ghanaian law, bamboo would have been considered a

tree, then the commercial right to the tree would have been vested in the State. As this is not the case, for community members the use of natural existing bamboo as well as planted bamboo is not constrained by the laws of the State.

However, from an international perspective, if bamboo would be considered to be a tree, than it can be made eligible for REDD compensation schemes (Lobovikov et al., 2009). As has been discussed before, bamboo shares a lot of characteristics with trees. Research has been done on the possibility of using bamboo for carbon sequestration purposes and proved that bamboo can be compared to fast growing tree species (Yiping et al., 2010). Moreover, the regenerative character of bamboo makes a continued provision of resource possible, even if the resource is harvested annually. This makes bamboo carbon neutral, or, according to Lobovikov et al. (2009), even a carbon sink.

In the case of Ghana, the way bamboo is formally institutionalized, creates both opportunities and obstacles for bamboo development for Forest Landscape Restoration purposes. If on an international level, it is decided that bamboo should fall under the category of trees, like the FAO (2000b) already does, this would make it easier to get funding for bamboo plantations for REDD-like projects. As BARADEP's objective is to promote bamboo and rattan plantation and industry development, I find it the responsibility of BARADAP to call for a change in the way bamboo is defined by law. When it will be considered a tree however it must be emphatically pointed that bamboo is exempted from the Timber Resources Management (Amendment) Act. I expect that this would lead to a higher valuation of bamboo resources by community members as it would give them an incentive to actively manage the bamboo as it would generate a stable flow of income if used for the (commercial) production of bamboo charcoal. The value of products is linked to the demand (Gibson, Ostrom, et al., 2000), so if the demand for bamboo charcoal rises, it is expected that the prices will rise in line with this growing demand. It is important that the institutional arrangements with regard to bamboo are clear, as only in this way the market for bamboo charcoal and bamboo products in general can be formalized.

This does entail however, that the rules regarding the use of the resource should be in consent with those affected. Because "when rules are imposed by outsiders without consulting those who are most affected, local users are more likely to become robbers, rather than cops, toward the resources they might otherwise have managed sustainably and to try to evade apprehension by the external authorities' cops" (Gibson, Ostrom, et al., 2000). An improved framework of rights to resources would not only contribute to a sustainable provision of the resource, but if it simultaneously strengthens local institutions, this will improve "livelihood security […] and […] strengthen local claims-making capacity in relation to the institutions of the State" (Afikorah-Danquah, 1997, p. 46).

6.3.2 *Informal institutions*

The previous section suggested that the right formal institutional setting can shape the conditions for local people to be encouraged to actively protect and manage bamboo. Based on my findings in the field this seems still a long way off, as besides the formal institutions, informal institutions too shape the ways in which different actors get access to and derive well-being from environmental services and natural resources.

What was found during the field work was that current sociocultural conventions and views largely shape people's opinions and prejudices about bamboo. People have reserved expectations with regard to the quality of bamboo charcoal, based on experiences with bamboo firewood. Furthermore, the majority of the people are not willing to use parts of their land for bamboo plantations, as currently unmanaged bamboo grows uncontrollably and is said to ruin the agricultural land.

Whether or not people will invest in collective action depends on all kinds of factors, but mainly on whether the expected benefits outweigh the costs (Gibson, Ostrom, et al., 2000; Heltberg, 2002). Currently, the people base their opinion on their own experiences and that of others. In their view, if bamboo growth is hard to control, management efforts will probably cost a lot of labour and will have negative impact on the agricultural yield. Their conclusion on beforehand would in that case be that the expected cost do not outweigh the benefits. It would be interesting to see whether people change their opinion if they can be convinced that the costs of management are relatively low, i.e. that it is easy to control bamboo which does not negatively affect the agricultural crops. Almost all who said to be interested in knowing more about bamboo biomass energy use, also wanted to know more about harvesting and production techniques (see Figure 5.12 on page 68). Another, more inherent, factor I expect to be relevant for their decision whether or not to invest in collective action is people's sense of own responsibility for the problem as well as the solution, in this case FLR. During focus groups, people said, for example, that it was the task of the government to stop people who sell bush meat in their village, rather than saying they had the power not to buy bush meat anymore. This might have played a role as well for the respondents of the questionnaire who said not to be interested in planting bamboo on their own land, while they were interested in using and producing bamboo biomass energy. However, I expect the notion of excludability to be more important here. As bamboo is currently abundant and has a low value, people are de facto considered to be allowed to harvest bamboo from anyone's land. Therefore, currently bamboo is considered an open access resource even on private land. Institutional arrangements and consequently agreements on excludability measures would have to be agreed upon with regard to the use of bamboo from future

plantations, as well as from natural existing bamboo on family land. Otherwise, people are not willing to invest.

With regard to non-reserve land in Ghana, in practice there are several ways for obtaining land. For most people, family land is inherited via maternal lineage, paternal lineage, spouse's family land, but people can also get access through hiring from chiefs or other families, through Taungya systems, personally owned (bought) land, or through sharecropping with others (Adjei-Nsiah et al., 2004). In the field work, poor people's farmland was often characterized by land 'ownership' of hired land or sharecropping land only. This makes that people do not have the decision power over their land concerning crop change, including the decision to start a bamboo plantation. This makes FLR practices of bamboo biomass energy production not particularly pro-poor. However, one of BARADAP's goals is to reduce poverty in rural areas, by building capacity of people living in rural communities. In this way, people are encouraged to participate in processing or bamboo for example. This makes BARADEP's activities more pro-poor, but does not change that poor people often cannot make a change in restoration purposed land use change. Bamboo is often considered to be *the poor man's timber* (Lobovikov et al., 2009), but the representative of INBAR West Africa does not expect bamboo charcoal to become a product for the poor, as production is costly and the market price of bamboo charcoal is expected to be relatively high. However he expects that, like what happens with many other products, lower quality but cheaper bamboo charcoal will probably be sold next to higher quality products so it is possible that poor people will benefit anyhow. Nevertheless, by adding value to a product by processing it into a quality product, it is likely that it will no longer be solely *poor man's timber*.

A final note I would like to make regards family structures. Pro-poor projects often give special attention to gender. However, in most interviews with DAs and other government agencies, gender was considered not to play an important role in development programmes. Based on results from their study in Ghana, Ahenkan and Boon (2011) found that for women with no formal employment, the farming of NTFPs provided both a safety net and a coping strategy for times in which agricultural revenues turned out lower than expected. Remarkably enough, the challenges that limited the full exploiting potential of NTFPs are similar to those found in this research. That is, "lack of a clear policy to promote NTFPs, unsustainable harvesting practices, poor processing and packaging skills and lack of organised market" (Ahenkan & Boon, 2011, p. 12). As charcoal production and timber logging are considered men's activities, and bamboo harvesting and bamboo charcoal production are similar, I am inclined to state that for bamboo biomass energy production it is probably most logical that men play a central role in these activities. Nevertheless, as women in Ghana play the biggest role in trading, they will probably be the ones who distribute and sell the end product. Moreover, firewood

collection is often considered a women's job in Ghana (Ewing & Msangi, 2009). By providing a viable alternative in the form of bamboo charcoal, women save productive labour time, which can be used for other, livelihood improving, purposes.

6.4 Field work related limitations

A few final notes on the research process need to be made before conclusions can be drawn from the results of the whole process.

First, with regard to the semi-structured questionnaire (see Appendix B), several of the questions were used in a previous research of mine in Vietnam in 2010. Especially the questions on livelihoods characteristics were only slightly changed to fit the Ghanaian situation. However, due to several external factors only limited time was available for performing the questionnaire. Hence, the questionnaire was only tested once and adjusted on the basis of these test results. During the actual survey however, it turned out that questions on income generating activities were considered to be difficult to answer, which was different from the experiences in Vietnam. Due to time and money constraints it was not possible to change these questions. As I expect these particular results not to be fully valid and reliable, I did not include them in the results on livelihoods characteristics. With the wisdom of hindsight, I should have chosen a different technique for ranking income generating livelihood activities.

Second, it has to be noted that no funding was available for this research. All research related costs had to be covered at my own expense. I was fortunate to work with research assistants who were willing to participate while their compensation was only small. Travelling around remote rural areas in Ghana entails that one has to depend on private transport, i.e. taxis. This is relatively expensive. Consequently, the selection of the research sites was partially based on their accessibility in order to limit the research costs and time.

7 Conclusions

The previous chapter aimed to link the results from the field work with other findings and to answer the research questions. This chapter tries to answer the central question by giving the main prevalent hampering and fostering factors that respectively hinder and promote the institutional change needed for the development of bamboo biomass energy for FLR in the Western Region of Ghana. Here, the central research question is given once more.

To what extent can a sustainable production and use of bamboo for firewood and charcoal contribute to Forest Landscape Restoration in the Western Region, Ghana?

7.1 Hampering and fostering factors

Bamboo's distinctive characteristics

Bamboo is characterized by several characteristics that make the resource unique compared to trees or other natural resources. It matches the main characteristics of trees, but its self-regenerative character and sustainability of supply make it a special resource and particularly suitable for restoration purposes.

Curbing or on-going deforestation and degradation – the (limited) role of bamboo

Whether bamboo can contribute to FLR by countering deforestation and forest degradation depends on two factors. First, the extent is important to which bamboo can act as a sustainable alternative to other products which use is considered do be contributing to deforestation and degradation. Second, the positive impact of bamboo on FLR is limited by on-going deforestation and degradation caused by factors on which bamboo does *not* have an influence. Firewood collection in Ghana does not contribute directly to deforestation but only to forest degradation, as only dead wood is used and no direct logging takes place. The decline in firewood is caused by factors that reduce the forest area and forest patches on agricultural land. In that sense, bamboo can serve as an alternative, or rather, supplement to firewood, but it cannot curb the factors that cause the decline in firewood. In the research area charcoal production is based on a mix of both collected dead wood and logged wood and does therefore contribute to direct deforestation. The regenerative character of bamboo makes bamboo charcoal a sustainable alternative to normal charcoal and can in this way reduce the effect of one of the deforestation causes.

Forest functions – the role of bamboo

Forests provide woody products, NTFPs and environmental services. Bamboo can substitute some of the woody products and watershed services of forests. Bamboo is considered to be useful as supplement to normal firewood and as substitute for normal charcoal. But overall, the added value of bamboo in FLR practices is that it reduces the pressure on the forest by providing alternative products. In this way, if the forest is not degraded too much, the forest is able to restore its own forest functions over time.

In degraded areas where people depend on the forest for their livelihoods, plantations are favoured over natural rehabilitation. Although artificial regeneration cannot replace complex forest functions, they are able to respond to the short term demands of forest dependent livelihoods.

Environmental constraints

There are areas where bamboo does not grow naturally. Although on the landscape level restoration to some degree might be achieved, some local communities cannot benefit from natural existing bamboo resources, simply because these resources are too far away. This is where bamboo plantations could play a role.

Formal institutional drawbacks and opportunities

In Ghana, the current main forest laws do not provide incentives for people to conserve trees on their agricultural land. Together with agricultural expansion this is seen as one of the most important drivers for deforestation and land degradation. For bamboo on the other hand, it is the international framing of the bamboo resource as NTFP that makes it excluded from all kinds of forest policy instruments such as REDD. On the local level, the rights to bamboo resources are defined by customary law but in practice this entails that bamboo can be considered to be an open access resource on common property and private property land. In order to provide a continued flow of high quality bamboo without undesirable spreading, it is important that sustainable harvesting methods are being used. This means that some sort of regulation needs to be put in place to guarantee a high standard of the resource even before there is a high demand for the resource. The solution can be found in self-governing groups who jointly are responsible for the provision of a continued flow of resources and who are able to exclude others from using their collective good.

Prevalent sociocultural conventions - but seeing is believing

In general, people who are not part of INBAR's pilot project consider bamboo biomass energy sources and bamboo in general to be inferior products compared to their woody equivalents. However, despite of their reserved expectations people said to be willing to try and learn more about

the new biomass energy. Those who had the chance to try bamboo charcoal were all surprised that the quality of the product was so high. Bamboo charcoal appears to have exact contrary characteristics compared to bamboo firewood. Bamboo firewood and bamboo charcoal together matched with most of the highest ranked characteristics that people described to be for an ideal energy source. However, price was also considered to be the most important characteristic while bamboo charcoal is expected to be relatively expensive.

After showing the advantages of bamboo biomass energy sources, now education of people on sustainable harvesting techniques becomes key. Currently, people are not convinced that it is possible to cultivate bamboo in a controlled way without undesirable spreading or damaging other crops.

Facilities for producing bamboo charcoal

By providing kilns and energy saving stoves and trainings, INBAR's pilot project focusses on providing durable goods and knowledge. These durable goods can increase the sustainability of the project after there is no funding anymore, as they can still be used afterwards. However, there is a risk of what I call here *leakage* which entails that after the energy stoves are provided and the kilns handed over to the communities, there is a risk that the people will use the stoves and kilns for which it has not been intended, i.e. normal charcoal. This is especially the case if it turns out that the high quality of the bamboo charcoal does not depend so much on the resource, but rather on the improved production techniques.

Market matters

Similar to finding of studies in Ghana on markets for other NTFPs, the market for bamboo products is underdeveloped. However, with regard to bamboo biomass energy it is expected that bamboo charcoal can act as a supplement or in some cases as substitute for normal charcoal. Therefore, bamboo charcoal needs to compete with normal charcoal on the existing local markets. As bamboo charcoal in Ghana is still only produced on a pilot basis and distributed during demonstration sessions for free, it is not known what the market price will be for bamboo charcoal. Despite all positive reactions by participants from INBAR's pilot project on the cosmetic characteristics of bamboo charcoal, it is expected that the price will determine whether bamboo charcoal can compete with normal charcoal.

Organisational limitations

As the name already implies, INBAR's *pilot* project is only temporary. BARADEP is considered to take over the project after the pilot project has finished, but they face limited resources as well. As long as

the market for bamboo biomass energy is not yet working on its own, funding is needed to produce bamboo charcoal, to distribute it, and to generate demand.

7.2 Some concluding remarks

In this section, I would like to shortly discuss the main hypothesis as discussed in Chapter 3 of this thesis.

Bamboo can contribute to Forest Landscape Restoration

There is certainly a potential for both natural as well as planted bamboo to contribute to FLR, but providing some charcoal producing kilns, stoves and bamboo charcoal for free is not enough. At this stage, the current prevalent institutional arrangements are structured in such a way that people do not have any incentive to protect trees on their land, leading to widespread deforestation and degradation. Moreover, the current predominant undervaluation of bamboo as biomass energy and as resource in general make that, outside the INBAR pilot project, bamboo can still be seen as a neglected opportunity for FLR. The changes in policy frames, together with the changes in institutional arrangements that were both discussed and suggested in this thesis could however benefit both the people for their short term needs, and their landscape in the long run.

8 Recommendations

In addition to the conclusions as presented in the previous chapter, I would like to give some recommendations for future work and research.

8.1 Recommendations for INBAR

During the fieldwork, I spoke to a representative of a small scale mining company, who was interested in planting bamboo for restoration purposes. Currently, mining companies only receive their permits if they guarantee that reclamation of degraded areas takes place after mining processes have stopped. I did not focus on this topic, but as gold mining is widespread in the Western Region there is a high potential for bamboo plantations for restoration purposes in these areas. In areas where agricultural land is scarce, bamboo plantations might be better placed on these large scale areas than on land where people depend on for food crops. It is therefore worthwhile to explore this potential further.

8.2 Recommendations for policy-makers

The government of Ghana and especially BARADAP should emphasize on the international level that in international, as well as national, policy frames bamboo should be considered equally important as trees. There is a high potential for bamboo to be included in REDD projects, but a reformulation of bamboo is needed first. While acknowledging the similar functions of bamboo and trees, the distinctive characteristics of bamboo should not be ignored. Therefore, if bamboo will be considered a tree, they should not be treated alike in certain specific tree related acts such as the Timber Resources Management (Amendment) Act which states that all commercial rights to trees are vested in the state. For people to be able to start with bamboo plantations it is important that they have the commercial right to bamboo.

8.3 Recommendations for the GPFLR network

Often, to find funding for development projects is considered to be hard, and donors request tangible results. Therefore there is a need for concrete indicators that prove to donors that a project is successful. The ALA principles are useful for the set up of a project, but may be not concrete enough for measuring success. My advice is to focus on ITTO (2005) indicators and specify then towards country specific ALA principles for measuring success.

8.4 Recommendations for further research

Bamboo is such a diverse product, it would therefore be an insult to focus only on the potential of bamboo biomass energy for FLR. This research already tried to have a slightly broader focus by looking at the other livelihood purposes of bamboo as well. However, more research is needed when one aims to give a complete overview of forest functions that can be restored, substituted or supplemented by bamboo. Furthermore, in addition to the work of Obiri and Nutakor (2010), more research is needed on developing the techniques and creating a market for other bamboo products. Not much is known about the commercial potential to produce bamboo charcoal on a larger scale either. Insight in the future prices of bamboo charcoal are needed to know what can be expected to happen when the kilns are handed over to the communities after INBAR's pilot study has finished. If, because of an expensive kiln, a need for skilled people and a labour intensive production of bamboo charcoal, the prices of bamboo charcoal turn out to become too high for most rural people, then it is possible that despite the high quality, normal charcoal remains preferred over bamboo charcoal.

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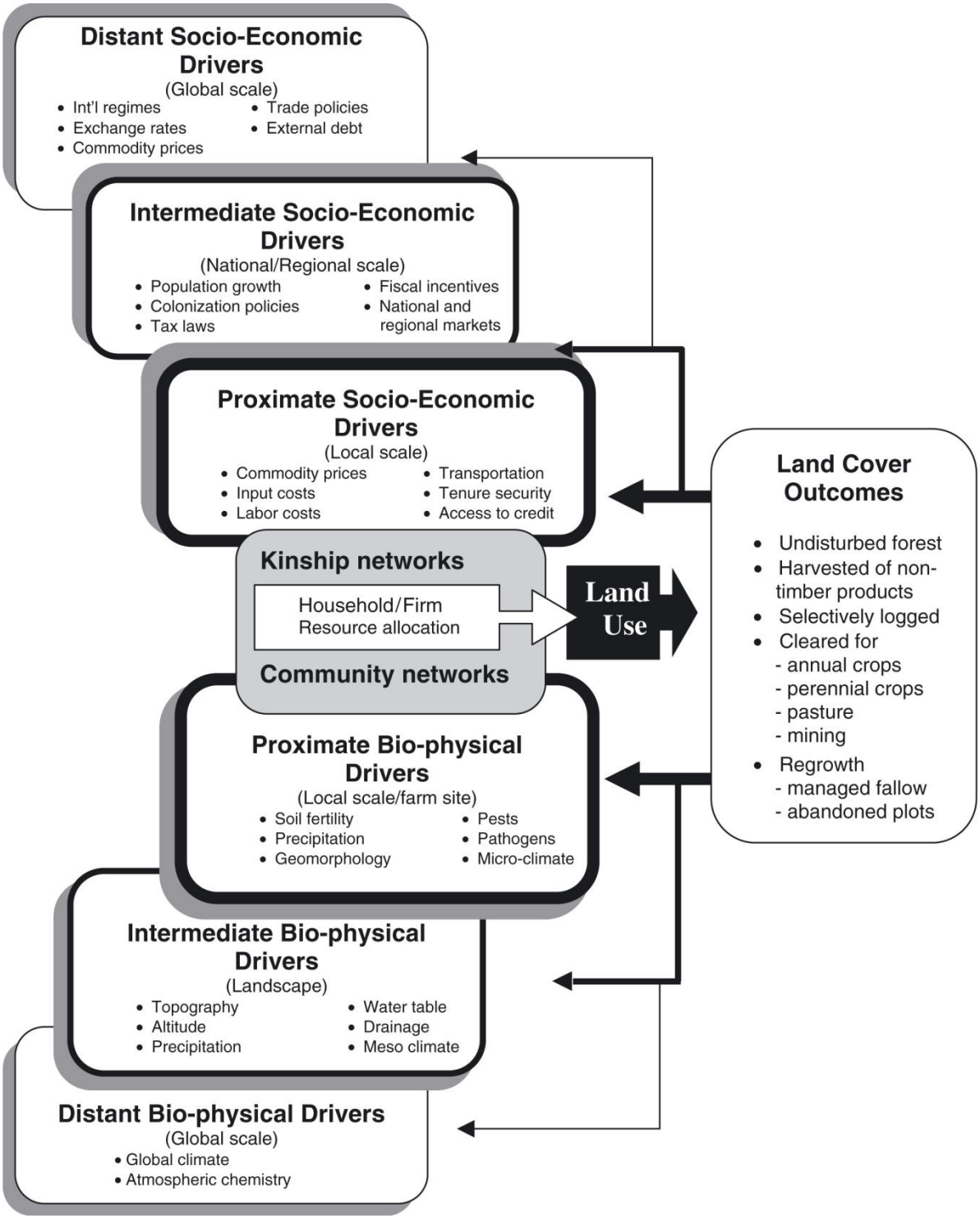
Appendices

Appendix A Socioeconomic and biophysical drivers of land use and environmental change



Source: Wood and Porro (2002)

Appendix B Semi-structured Household Questionnaire

If necessary, please contact Astrid Bos (0240764910/astridbos@gmail.com)

Nr.		Date		Status	❒Complete ❒Did not reply ❒Partially replied ❒Other:_____		
Name				Community		District	

Dear Sir/Madam. I, Astrid Bos, am thanking you for your help with this questionnaire. I am a student from the Utrecht University, the Netherlands. I am in Ghana to do research for my studies. I am working together with INBAR, based in Kumasi. With this questionnaire, I hope to get a better understanding of forest depending livelihoods, with a special focus on your energy needs and your forest needs.

HOUSEHOLD QUESTIONNAIRE

All information contained will be kept strictly confidential. Data will never be published together with the respondent's name.

A	*Background information*							
1	Sex	❒Male (1) ❒Female (2)	2	Age	___years old	3	How many years have you gone to school?	____years
4	Ethnic group	❒Akan(1) ❒Ewe(2) ❒Ga-Adangbe(3) ❒Dagbani(4) ❒Gurma(5) ❒Other:_____ (6)						
5	Relation to head of the hh	❒ I am the head (1) ❒Wife/husband (2) ❒Son/daughter (3) ❒Parent (4) ❒Other:_____(5)						
6	How many members does your household have? • *Include people that live **outside** the household **temporarily** (to study etc)but still depend on the household's money/material support.* • *Include (grand) parents, (grand) children or other relatives living in the house.* • *Exclude people (children) that have their own house/family and those who do not depend on the household's capital (anymore).*							_____ members

B	*History*			
1a	Are you born in this village? ❒Yes (1) ❒No (0	1b	*If yes*, is at least one of your parents born in this village?	❒Yes(1)❒No (0)
1c	*If no,* how long have you lived in this village?	❒ ≤5 yrs (1) ❒6-10 yrs (2) ❒11-15 yrs (3) ❒16-20 yrs (4) ❒>20 yrs (5)		

C	*Land ownership*						
1a	Do you own and/or have access to land? ❒Yes (1)❒No (0)			1b	If yes, what kind of land ownership applies to you? (form)		
	Type of land	Ownership (c)	Size of land		Type of land	Ownership (c)	Size of land
	❒ 1. Living area/home garden		__m2/acre/ha		❒ 3. Forest plantation(rubber)		_____Acre/ha
	❒ 2. Agricultural land (incl agroforestry, cacao)		_____Acre/ha		❒ 4. Natural forest		_____Acre/ha
					❒ 5. Other_____		__m2/acre/ha
1c	If agricultural land, how many ha of your land are fallow/bare land at the moment?					_____acre/ha	

Codes land ownership:
1. Family land inherited via maternal lineage
2. Family land inherited via paternal lineage
3. Spouse's family land
4. Hired land
5. Taungya (or MTS)
6. Personally owned land (bought)
7. Share cropping
8. Other (specify) _____

D	*Energy needs*					
1	What types of energy do you use in your household for cooking? At the *, thick the most important one (just 1)					
	Energy type	How do you get this? Check all that apply	*	Energy type	How do you get this? Check all that apply	*
	❒1.Firewood	❒Collect ❒Produce myself ❒Buy	❒	❒4 Bamboo firewood	❒Collect ❒Produce myself ❒Buy	❒
	❒2. Charcoal	❒Produce myself ❒Buy	❒	❒5. Bamboo charcoal	❒Produce myself ❒Buy	❒
	❒3. Gas(LPG)	❒Buy ❒Other_____	❒	❒6. Livestock manure	❒From own livestock ❒Other_____	❒
				❒7. Other_____	❒Collect/produce myself ❒Buy	❒
2	Where is the food of your household being cooked?	❒Outside house (1)	❒ Inside house (2)	❒Both (3)		
3a	**If collecting firewood**, does your household now spend more or less time on getting firewood compared to 5 years ago?	❒more (1)	❒ about the same (2)	❒less (3)		
3b	How has availability of firewood changed over the past 5 years?	❒declined (1)	❒about the same (2)	❒increased(3)		
3c	If **declined**, what are the household's **responses**? (rank max 3. 1=most important)	Response 1_____	Response 2_____	Response 3_____		
	1. Increased collection time (e.g. from further away) 2. Planting trees on own land 3. Use of agricultural residues as fuel 4. Buying (more) fuel wood/charcoal 5. Buying (more) commercial fuels (gas) 6. Reduced need for use of fuels (eg improved stove) 7. Less cooked meals 8. Increased use of non-wood wild products (e.g. bamboo) 9. Restricting access/use own forest 10. Conserving own trees for future 11. Making charcoal 12. Making bamboo charcoal 13. Other, specify:_____					
3d	If **increased**, can you explain **why** the availability of firewood has increased over the past 5 years?	_____ _____				
4	If **use** of **bamboo** charcoal/ firewood, what are the reasons? Thick max. 3	1. ❒Lack of normal firewood 2. ❒High quality 3. ❒Fast burning	4. ❒High availability(Fast growing, renewable)	5. ❒Light weight 6. ❒ Other_____		
5	If **no use** of **bamboo** charcoal/firewood, what are the reasons? Thick max. 3	1. ❒I do not have the knowledge 2. ❒ I do not have access to bamboo	3. ❒Not available all year round 4. ❒ Not enough availability on market	5. ❒Too expensive 6. ❒Poor quality 7. ❒ Other_____		

E Livelihood activities			
1	What are the sources of income in your family? Please check all that apply and give the estimated (annual) income		
		Source:	Income or hh consumption?
	1.	❒ Agriculture (cacao, beans, cash crops, fruit, vegetable)	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	2.	❒ Forest (forest product timber/firewood sale)	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	3.	❒ Non Timber Forest Products (NTFP) (excl. bamboo)	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	4.	❒ Bamboo firewood	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	5.	❒ Bamboo charcoal	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	6.	❒ Bamboo for other purposes (housing, baskets, etc)	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	7.	❒ Wage labour (outside farm, incl. migrational work)	❒(Estimated) Income:_____GHC
	8.	❒ Fishing	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	9.	❒ Business (Shop, shoe-making, tailoring, etc.)	❒(Estimated) Income:_____GHC
	10.	❒ Livestock (pig/ cow/sheep, milk, meat, manure, etc.)	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	11.	❒ Poultry (chickens etc)	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	12.	❒ Service/Pension	❒(Estimated) Income:_____GHC
	13.	❒ Remittances within Ghana	❒(Estimated) Income:_____GHC
	14.	❒ International remittances	❒(Estimated) Income:_____GHC
	15.	❒ Nursery garden (vegetable, fruit, tree seedlings)	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	16.	❒ Seed (cereals, vegetables)	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
	17.	❒ Social welfare support (help for poor, etc)	❒ In goods and services (food etc) (1) ❒ Both goods/services +money: _____GHC (2) ❒ Only money, income: ____GHC (3)
	18.	❒ Other: _____	❒For hh consumption only (1) ❒ Both hh consumption and selling:_____GHC (2) ❒Only selling, income:_____GHC (3)
2a	If 6 (bamboo non-energy), please explain which types of goods		_____
2b	If 4,5,6 (bamboo), where do you get the bamboo from?		_____
2c	If 4,5,6 (bamboo), is this managed or not managed bamboo *(managed means when the bamboo is regularly harvested)*		❒ Managed (1) ❒ Not managed (0)
3a	Are you willing to plant and manage bamboo on your own land?		❒Yes (1) ❒No (0)
3b	Why (not)?	_____	

F Livelihood capital (Financial)					
1a	Have you borrowed (**loan**) any money during the past 12 months?			❒Yes (1) ❒No (0)	
1b	If yes, where did you get the money?			❒Bank (1) ❒Other_____ (2)	
1c	If yes, for what purposes? *Please check all that apply*				
	1. ❒Farming/ animal raising	4. ❒Health (e.g. medicine)	7. ❒Education	10.❒Household products(eg vehicles)	
	2. ❒Forest plantation invest	5. ❒Marriage	8. ❒Consumption	11.❒Foreign employment (migration)	
	3. ❒Off-farm/micro-enterprise	6. ❒Housing	9. ❒Firewood	12.❒Other_____	
1d	If no, why not? *(thick 1)*	❒I want to loan, but I cannot(1)	❒No need (2)	❒Do not want to (3)	❒Other_____ (4)
1e	If loan, do you have any problems with paying back your loans, including your interest rate?			❒Yes (1)	❒No (0)
1f	If yes, what is the main cause?	❒High interest rate (1) ❒ Unproductive investment of the money (2) ❒Other _____(3)			
2a	Do you have any **savings**?	❒Yes (1) ❒No (0)	2b	If yes, where? *(thick 1)*	❒At home (1) ❒At bank (2) ❒ Other_____(3)
3a	Does your household have any **insurance**?			❒Yes (1)	❒No (0)
3b	If yes, for what? (thick all)	❒Health	❒House	❒Agriculture	❒Other_____
3c	If yes, did you need it during the 12 past months?	❒Yes (1)Explain:_____			❒No (0)
3d	If no insurance, why not?	_____			

H Livelihood capital (Human)			
1	With whom of the following people or institutions did you have contact during the last 12 months?		
	Person/ institution	How often do you contact this person/ institution? *(codes 1-4)*	Type(if both →*informal*)
	❒a. Chief	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal (1) ❒ Informal (2)
	❒b. Church/priest	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒c. Forest commission	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒d. Timber trader	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒e. Charcoal trader	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒f. Fertilizer trader/ supplier	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒g. Seedlings trader/ supplier	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒h. Bank	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒i. INBAR	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒j. Other NGO_____	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
	❒k. Other: _____	❒More than once a week ❒Weekly ❒Monthly ❒Less than once a month	❒Formal ❒ Informal
2a	Have you/your household undertaken any agriculture, bamboo or forestry-related training?		❒Yes (1) ❒No (0)
2b	Type of training (**code!**)	Who trained you? (**code**!)	How did you benefit (**see code!) (1 choice!)**	Duration (nr of days)
	I			
	II			
	III			
	IV			
	V			
2c	Would you like to get (more) training(s)?	❒No (0)	❒Yes type of training code(s)_____ (1)	

Type training code		**Who ran the training?**	**Benefit type**	
1. Bamboo carbonization	5. Forest plantation (rubber)	1. FC	1. Skill Improved	4. Employment Generated
2. Bamboo nursery	6. Vegetable	2. INBAR	2. Cash Income	5. Soil Erosion Prevented
3. Bamboo cultivation	7. Livestock (cattle, etc)	3. Other _____	3. Family Health Improved	6. Other _____
4. Bamboo harvesting	8. Fire protection			7. No improvement
	9. Other_____			

3	What **knowledge** on production and use of **bamboo energy** do you have? *(codes1-4)*					
	Firewood collection__	Firewood use__	Charcoal production__	Charcoal use__	Briquette production__	Briquette use__
	1. Have knowledge, I am satisfied	2. Some knowledge, like to learn more	3. No knowledge, but I would like to learn	4. Have no knowledge, not interested		

I Livelihood capital (Natural)													
1	How far do you live from the forest border? (managed/natural)						_____km					_____min walk	
2a	Do you take products from the forest? (managed/natural)	❒No (0) ❒Yes (1)	1. Timber	2. Firewood	3. Bamboo	4. Rattan	5. Honey	6. Game	7. Medicine	8. Fruit	9. Nuts	10. Other__	
2b	If yes, what products? *Thick with an X*												
2c	Are you allowed to take these products? *No (0), Yes anytime (1) Yes, but only with permission (2), I don't know (3)*												
2d	During the last 5 years, has the availability of these products declined (1), not changed (2) or increased (3)? (for firewood, checkD3b)												
2e	If **declined**, what is the most important reason? (max 1 reason per product, see codes!)												
2f	If **increased**, what is the most important reason?(max 1 reason per product, see codes!)												

Codes reasons ***decline***		
1. Reduced forest area (small-scale clearing for agriculture)	5. Increased use of products due to more people from other villages collecting more	10. Charcoal burning
2. Reduced forest area (large-scale projects)	6. Restrictions on use by central or state government (e.g., for forest conservation)	11. Brick burning
3. Reduced forest area due to people from outside buying land and restricting access	7. Local restrictions on forest use (e.g., community rules)	12. Poor harvesting practices
4. Increased use of products due to more local (village) people collecting more	8. Climatic changes, e.g., drought/less rainfall	13. Product attacked/consumed by forest dwelling vermin (eg animals/insects)
	9. Timber harvesting	14. Bush burning
		15. Increased marketing potential for product
		16. Other: _____

Codes reasons ***increase***		
1. Less clearing of forests for agriculture (incl. pastoralism)	4. Reduced use from large-scale commercial users/projects	8. Tree planting
2. Fewer local (village) people collecting less	5. Changes in management of forests	9. More illegal access of protected area
3. Fewer people (other villages) collecting less	6. Climatic changes, e.g., more rainfall	10. Improved access rights to product
	7. Forest clearing increases supply of product (e.g. fuelwood)	11. More secondary forest (cleared land, regenerates)
		12. Other: _____

J Livelihood capital (Physical)			
1a	Do you **irrigate** your land?		❒Yes (1) ❒No (0)
1b	If yes, what type of irrigation system do you use? *Check all that apply*	1. ❒Community canals 2. ❒Privately owned canals	3. ❒Stream/river 4. ❒Well 5. ❒Water pump 6. ❒Other_____
1c	If yes, which types of land? *Check all that apply*	❒ Garden(1) ❒Agricultural field(2) ❒Forest plantation(3) ❒Other_____(4)	
2a	Did you use any **fertilizer** (manure or chemical) on your land during the last 12 months?		❒Yes (1) ❒No(0)
2b	If no, why not? *Please check 1 main reason*	❒Not necessary (1) ❒Lack of knowledge (2)	❒Unavailable in time(3) ❒Expensive (4) ❒Fear soil degradation (5) ❒Other _____ (6)
2c	If yes, what kind of fertilizer? *Check1*	❒Only natural manure)(1)	❒Only chemical (2) ❒Both (3)
2d	If yes, for what type of land? *Check all that apply*	❒ Garden(1) ❒Agricultural field(2) ❒Forest plantation(3) ❒Other_____(4)	
3a	Did you use **pesticides** during the last 12 months?		❒Yes (1) ❒No (0)
3b	If no, why not? *Please check 1 main reason*	❒Not necessary (1) ❒Lack of knowledge (2) ❒Unavailable in time (3)	❒Expensive (4) ❒Fear of soil degradation (5) ❒Fear of food getting unhealthy (6) ❒Other _____(7)
3c	If yes, which types of land? *Check all that apply*	❒ Garden(1) ❒Agricultural field(2) ❒Forest plantation(3) ❒Other_____(4)	
4	Do you have **electricity** in your house?		❒Yes (1) ❒No (0)
5	Which of the following **assets**/products do you have? *Check all that apply.*	❒Radio ❒TV ❒Telephone ❒Plough ❒Chainsaw ❒Shotgun ❒(pesticide) sprayer ❒Charcoal kiln/ casamance ❒Motor bike ❒Tractor ❒Bicycle ❒Car/jeep ❒Truck/ bus ❒Other 1 _____	

K Shocks and coping strategies					
1a	**During the last 12 months, have you or has your household suffered from any of the shocks listed below? How did you cope with that?**				
	Type of shock	Coping strategy (code)	Type of shock	Coping strategy (code)	
	❒ 1. Inundation of House (Flood)		❒ 10. Divorce or separation		
	❒ 2. Wild fire (in crops/ forest/grasslands etc)		❒ 11. Loss of job		
	❒ 3. Damage of house due to bad weather		❒ 12. Theft		
	❒ 4. Damage of trees due to bad weather		❒ 13. Conflict inter/intra community		
	❒ 5. Poor agricultural production/harvest failure		❒ 14. Loss of land		
	❒ 6. Death/loss of livestock/poultry		❒ 15. Force migration due to security		
	❒ 7. Major illnesses in family		❒ 16. Irregular remittance		
	❒ 8. Death of HH member		❒ 17. Other, specify _____		
	❒ 9. Arrest of HH member		❒ 18. Other, specify_____		
1b	**Rank the 3 major shocks mentioned above** *(shock 1= most important)*	Shock rank 1	Shock rank 2	Shock rank 3	

Coping strategies:
1. Use saving
2. Cash loans
3. Grains loans
4. Adjustment to meals
5. Farmland mortgaged/ leased out
6. Sold small animals
7. Sold jewellery
8. Sold large livestock
9. Sold standing crops
10. Sold trees
11. Sold farm land
12. Sold human labour
13. Occupation change
14. Migrated to sell labour
15. Help from family/relatives
16. Help from (international) organization (e.g. Red Cross)
17. Help from government
18. Migration
19. Do nothing
20. Other:_____

L Future plans		
1a	Do you have any plans for the next 5 years?	❒Yes (1) ❒No (0)
1b	If yes, please explain: _____	

M Further information		
1	If necessary, can I contact you for further information?	❒Yes (1) ❒No (0)
2	Do you have any comments on this questionnaire? _____	

Thank you for your participation!

2011.05.30 Interview with

Forest commission

Goal visit: gaining knowledge on Forest Commission activities and the (potential) role for bamboo

Topic 1: Forest commission and general information

1. General tasks of Forest commission
2. Organisation of FC
3. Introduction of interviewee: what is his position and tasks
4. What is the link between the FC board and government agencies?
5. What is the link between the FC board and local people?
6. What is the link between the FC board and civil/international organizations? (NGOs)

Topic 2: Projects

1. What type of projects do you manage in the area?
2. What are, according to you, the benefits and limitations of a command-and-control way of protecting the forest vs. the use of financial incentives?
3. Conditionality: What should happen if one of the parties is not obeying the rules of the contract?
4. What are the main challenges regarding reforestation and rehabilitation at the moment?
5. What are the main challenges regarding forest protection at the moment?
6. Is there a role for poor people in reforestation and rehabilitation and forest protection? Should there be special attention to poor/landless people? Why (not)?
7. Is there a need to pay special attention to gender issues in forest management (regarding equity)? If yes, why and how?
8. What role plays (lack of) land tenure in forest protection en restoration?

Topic 3: Bamboo

1. Are you engaged in the bamboo charcoal and firewood project? In what way?
2. Do you see a role for bamboo in forest landscape restoration? How? Or why not?
3. What main changes should be realized before bamboo projects can put into practice?

Topic 3: FC future plans

1. What are the plans of FC board for the near future?

Tools

Venn diagram, participatory mapping (district)

2011.07.21 Interview with

BARADEP

Goal visit: gaining knowledge on current bamboo initiates in Ghana and its potential for the future

Topic 1: BARADEP and general information

7. General tasks of BARADEP
8. Organisation of BARADEP
9. Introduction of interviewee: what is his position and tasks
10. What is the link between BARADEP and Ministry of Lands, Forestry and Mines
11. What is the link between BARADEP and government agencies (incl FC)?
12. What is the link between BARADEP and INBAR?
13. What is the link between BARADEP and local people?
14. What is the link between BARADEP and civil/international organizations? (NGOs) (BARNET/Green Cross Ghana)

Topic 2: Projects and activities (INBAR, Bicycle, China,…)

9. What are BARADEP's main activities?
10. What are the main challenges regarding implementing your bamboo projects?
11. Is there a specific/special role for poor people in your projects? Should there be special attention to poor/landless people? Why (not)?
12. Is there a need to pay special attention to gender issues in bamboo management (regarding equity)? If yes, why and how?
13. What role plays (lack of) land tenure in forest protection en restoration? Are most of your projects on reserve, community, or family land?

Topic 3: Bamboo

4. Regarding collaboration with INBAR, is there a (in)formal agreement (agreed on paper)?
5. What projects do you organize which are not a part of INBAR's work?
6. According to INBAR, their pilot projects will be taken over by BARADEP in the future. How do you see this in practice?
7. To what extent can a government agency create and/or stimulate markets?
8. What role does BARADEP play in the education of people?
9. Do you see a role for bamboo in forest landscape restoration? How? Or why not?
10. What main changes should be realized before more bamboo projects can put into practice?

Topic 3: Bamboo legislation and BARADEP future plans

2. What are the current main laws/policies on bamboo in Ghana (are not online)?
3. What are the plans of BARADEP for the near future?
4. Any development plan which I can use/quote?

Tools

Venn diagram

2011.08.11 Interview with

IUCN Ghana

(mr. Samuel Kofi Nyame)
Goal visit: gaining knowledge on current FLR initiates in Ghana and its potential for the future

Topic 1: IUCN and general information

15. General tasks of IUCN
16. Organisation of IUCN
17. Introduction of interviewee: what is his position and tasks
18. What is the link between IUCN and Ministry of Lands, Forestry and Mines (Land and natural resources)
19. What is the link between IUCN and government agencies (incl FC)?
20. What is the link between IUCN and INBAR/BARADEP?
21. What is the link between IUCN and local people?
22. What is the link between IUCN and civil/international organizations? (NGOs, GPFLR)

Topic 2: Projects and activities

14. What are IUCN's main activities in Ghana? Voluntary Partnership Agreements? FLEGT? NTFP's project in Wassa Amenfi West District?
15. Methods of research? Landscape level? IUCN's Poverty toolkit?
16. What are the main challenges regarding implementing your projects?
17. Is there a specific/special role for poor people in your projects? Should there be special attention to poor/landless people? Why (not)?
18. Is there a need to pay special attention to gender issues in forest management/conservation issues?
19. What role plays (lack of) land tenure in forest protection en restoration? Are most of your projects on reserve, community, or family land? Statutory/customary laws?

Topic 3: Bamboo

11. In the areas where you work, are there bamboo resources?
12. Do you include bamboo resources in conservation programmes? Why (not)?
13. According to you, what are the values of bamboo? Do you see a role for bamboo in FLR? Is bamboo a tree or NTFP?

Topic 4: GPFLR and IUCN future plans

5. Do you make use of FLR principles? Which ones?
6. There is a whole variety of sets of principles on FLR. Do you think they should be integrated? How?
7. What are the plans of IUCN for the near future? Do you have a development plan?
8. Are there any recent (academic) articles available concerning your projects?

District level interview

Goal visit: getting overview and socio-economic and geographical characteristics of the villages.

Topic 1: Map with villages, kinds of forest, list of households with poor and non-poor households

Topic 2: Role of District Assembly and specific function of interviewee

Topic 3:

Socio econ. data of the district + definitions:
- Average income
- Agricultural production
- Various investments
- Population
- Population growth ratio

Data agriculture and forest production:
- Total natural area
- Agricultural area
- Forest land/ reserves?

Topic 4: (Forest) development projects
ITTO, IFAD?
If yes, what form of support? (seedling, fertilizer, loan, education, other)
If yes, which villages, which households?
Other projects (NGOs, other)
Which kind of strategies does the district have for the future?

Topic 5: Land tenure
What is the role of District Assembly in land tenure issues
Any land tenure conflicts?
Contact with chiefs?

Topic 6: Land use (livelihoods and changes)
What kind of land use (agriculture, plantations, reserve)
Land use changes?
If yes, for what reasons? (projects, conflicts, other?)
How are land use restrictions enforced in practice?

Topic 7: Relations with management agencies:
What is the relation of this DA with FC
What is the relation of this DA with village leader/chiefs
What is the relation of this DA with region level (Western Region)
What is the relation of this DA with business people/ exploitation companies?

Topic 8: Practical issues
List of villages → are these relatively homogenous villages (i.e. no big differences between villages)?

Topic 9: Provision of any other information that might be relevant for our research.
Role of bamboo: opportunities for the future?
Venn diagram: relations in land/forest management.

Village representative

Goal visit: getting overview of the village, its people and relation to the forest

Topic 1: **General data (demographics)**

1. In what year was the village established? Short history of the village.
2. What is the current population of the village? *persons*
3. How many households live currently in this village? *households*
4. Difference with 10 years ago?
5. In migration
6. Out migration
7. How many different groups (ethnic groups, tribes or castes)

Topic 2: **Infrastructure**

1. How many households (approx.) have access to electricity (from public or private suppliers)?
2. How many households (approx.) in the village have access to (= use) piped tap water?
3. How many households (approx.) have access to formal credit (government or private bank operating in the village)?
4. Are *informal* credit institutions such as savings clubs and money lenders present in the village?
5. Is there any health centre in the village?
6. Is the village and the forest all year round accessible by cars/trucks?
7. What is the distance from the village centre to the nearest:

	Name of place	km	minutes	Type of transport
District market				
Market for major consumption goods				
Agricultural products market				
Forest products market				

Topic 3: **Livelihood activities and land use**

1. Main sources of income
2. Average income
3. What kind of land use (agriculture, plantations, protection forest, pond, home garden, other)
4. Land use changes in last decades?

Topic 4: **Ownership issues**

1. Types of ownership (private/communal/protective)
2. User rights of resources
3. How can people obtain these rights?
4. Differences between *de jure* rights and *de facto* practices when it comes to resource uses? I.e. conflicts?

Topic 5: (**Forest) development projects**

1. International/ national?
2. If yes, what form of support? (seedling, fertilizer, loan, other)
3. If yes, which households?
4. Other projects (NGOs, other)

Topic 6: **Stakeholders**

1. Villagers' organizations (farmer groups etc)
2. Role of Forest Commission in this area?
3. Who are other main stakeholders?

Topic 7**:Provision of any other information that might be relevant for research**

1. Possible to organize focus groups? Neutral place?

Tools: Venn diagram, participatory mapping

Household interview

1. Composition of household (amount of children, age of oldest and youngest child, all living in this house?)
2. Owner of land?
3. Ethnic background
4. History of household, migrants or not?
5. Livelihood activities:
   on farm
   off farm
   non farm
6. Ownership
   Land/user rights for what types of land? How obtained?
7. Livelihood capital
   Human capital (e.g., health, nutrition, education, knowledge and skills, capacity to work, capacity to adapt)
   Social capital, e.g., networks and connections (patronage, neighborhoods, kinship), relations of trust and mutual understanding and support, formal and informal groups, shared values and behaviors, common rules and sanctions, collective representation, mechanisms for participation in decision-making, leadership
   Natural capital, e.g., land and produce, water and aquatic resources, trees and forest products, wildlife, wild foods and fibers, biodiversity, environmental services
   Physical capital, e.g., infrastructure (transport, roads, vehicles, secure shelter and buildings, water supply and sanitation, energy, communications), tools and technology (tools and equipment for production, seed, fertilizer, pesticides, traditional technology)
   Financial capital, e.g., savings, credit and debt (formal, informal), remittances, pensions, wages
8. Energy needs
   Source of energy in household. How obtained? Bamboo? Why (not)?
9. Livelihood strategies
   intensification (more labour)
   extensification (more land)
   diversification (other sources of income)
   migration
10. **Problems** they face, Causes of problems, How to cope with, adapt to or solve the problems?
11. **Forest** related questions
    Differences with 10 years ago? Your idea of main causes? Is there something that should change? What?
12. Plans for the future?

- Ranking: how to define sustainable development: environmental, social and economic indicators
- Ranking: importance of different sources of income
- Seasonal calendar (when to plant/harvest which resources, which other seasonal activities)

Charcoal seller/producer interview

General info

1. Name
2. Name of town
3. Name of market
4. Gender

Charcoal

1. What type of charcoal or wood based fuel do you sell?
2. Where do you get your charcoal from?
3. Do you know where the wood is coming from (managed/natural forest etc)
4. Do you ask your suppliers to give you special types of charcoal such as hard or soft heavy or light?
5. What tree species do you prefer for the charcoal you sell? Why? Do you think your customers have the same preferences?
6. What are the specific demands for charcoal that your consumers make to you?
7. Are there any complaints from customers regarding your charcoal? If yes, explain
8. How much charcoal is supplied to you per period? (1)Week (2) Month (3) Others……..
9. How much charcoal is sold per day or week?..... (in bags/ in money)
10. Is this the same all year round? If not, explain
11. Do you often have adequate supply of supply of charcoal?
12. Are you facing any problems with your charcoal business?
13. Do you have experience with mixing different types of charcoal? Explain

Bamboo charcoal/briquettes

1. Do you have information/knowledge about bamboo charcoal and briquettes?
2. If yes what do you know about these
3. Will you consider selling bamboo charcoal and briquettes?
4. If Yes, what are your reasons?
5. If no, what are your reasons?
6. If yes what qualities would you expect the bamboo charcoal and briquette to have
7. Which (type) of your customers do you think will buy this product? (type of business)
8. Can you or your suppliers produce bamboo charcoal and briquettes if you are requested for it?

- Ranking: how to define sustainable development: environmental, social and economic indicators
- Ranking: characteristics of charcoal

Charcoal consumer interview (business consumers)

A General info

5. Name
6. Name of town
7. Description of business
8. Gender

B Fuel

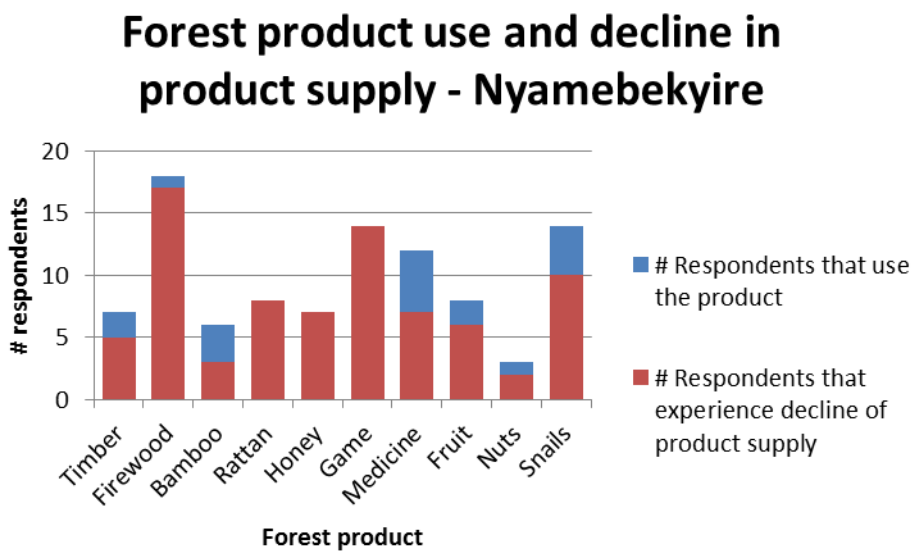
1. Which type of fuel do you prefer? Why?
2. Are there any problems have you had with the use of normal charcoal? Explain
3. What quantity do you use per day/week/month?
4. How much does it cost you per load/bag?
5. Are there any problems with your access to wood fuel or charcoal (shortage etc)
6. Do you have experience with mixing different types of charcoal? Explain

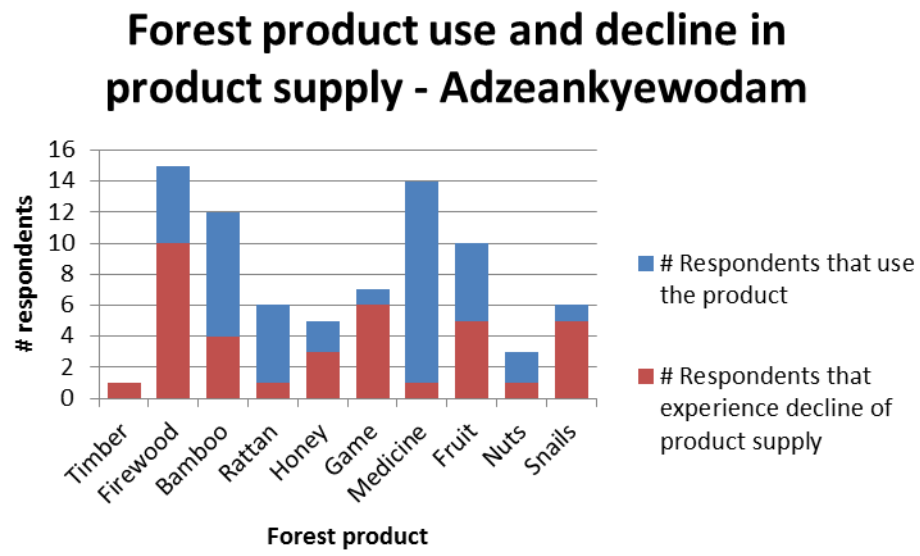
C Bamboo charcoal and briquette

1. Do you have information/knowledge about bamboo charcoal and briquette?
2. If yes what do you know about these?
3. Have you used bamboo charcoal and briquette before?
4. Will you consider using bamboo charcoal and briquette for cooking or as fuel? Explain why (not)
5. If yes which bamboo fuel do you prefer? (1) Charcoal (2) Briquette and Why
6. Do you use improved/fuel saving charcoal/briquette burner? If yes mention the type (picture if possible)

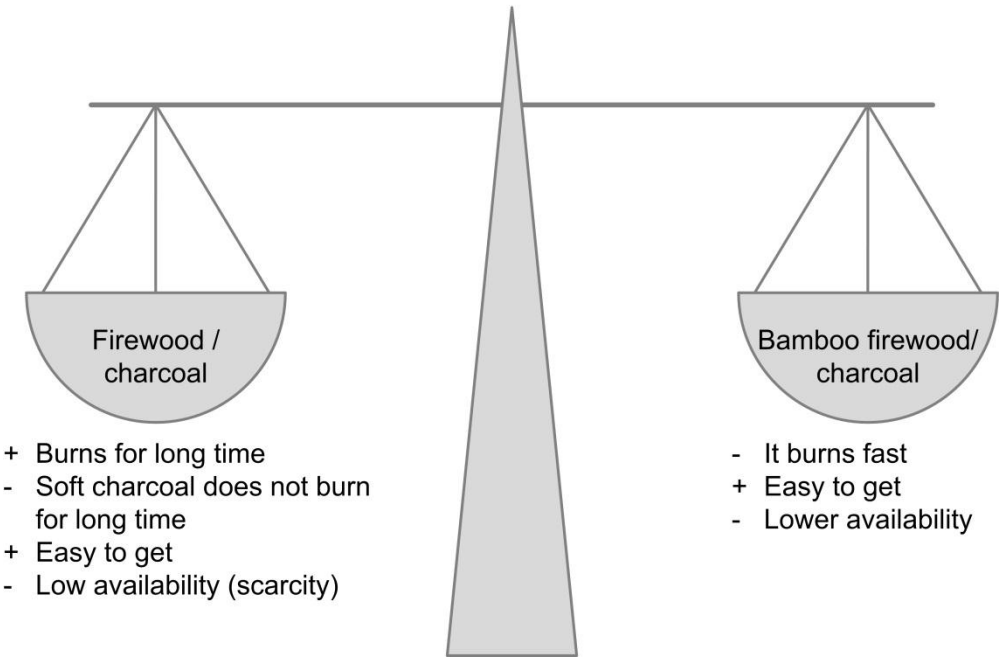
- Ranking: how to define sustainable development: environmental, social and economic indicators
- Ranking: characteristics of charcoal

Appendix K Forest product use and the decline in product supply per village





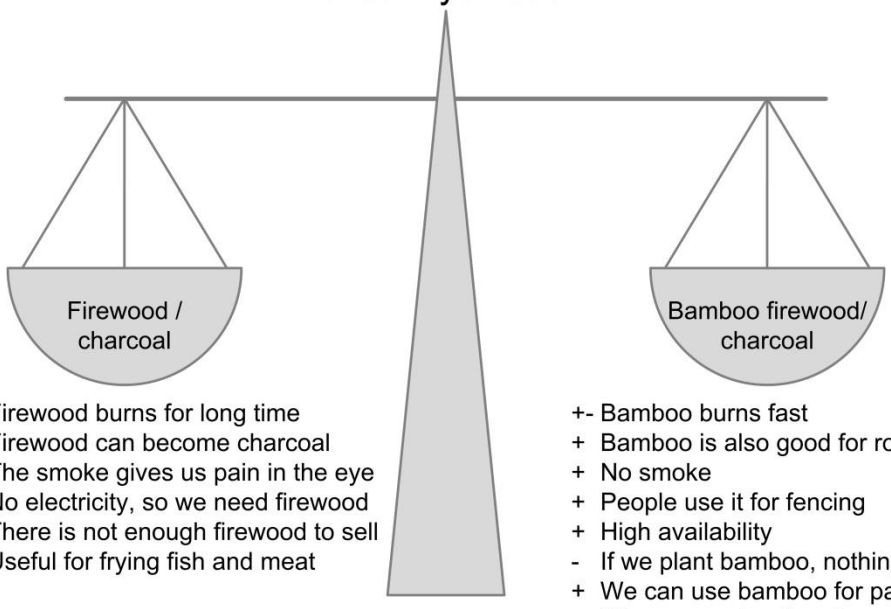
Mpohor Wassa East District - Kwaaba



+ Burns for long time
- Soft charcoal does not burn for long time
+ Easy to get
- Low availability (scarcity)

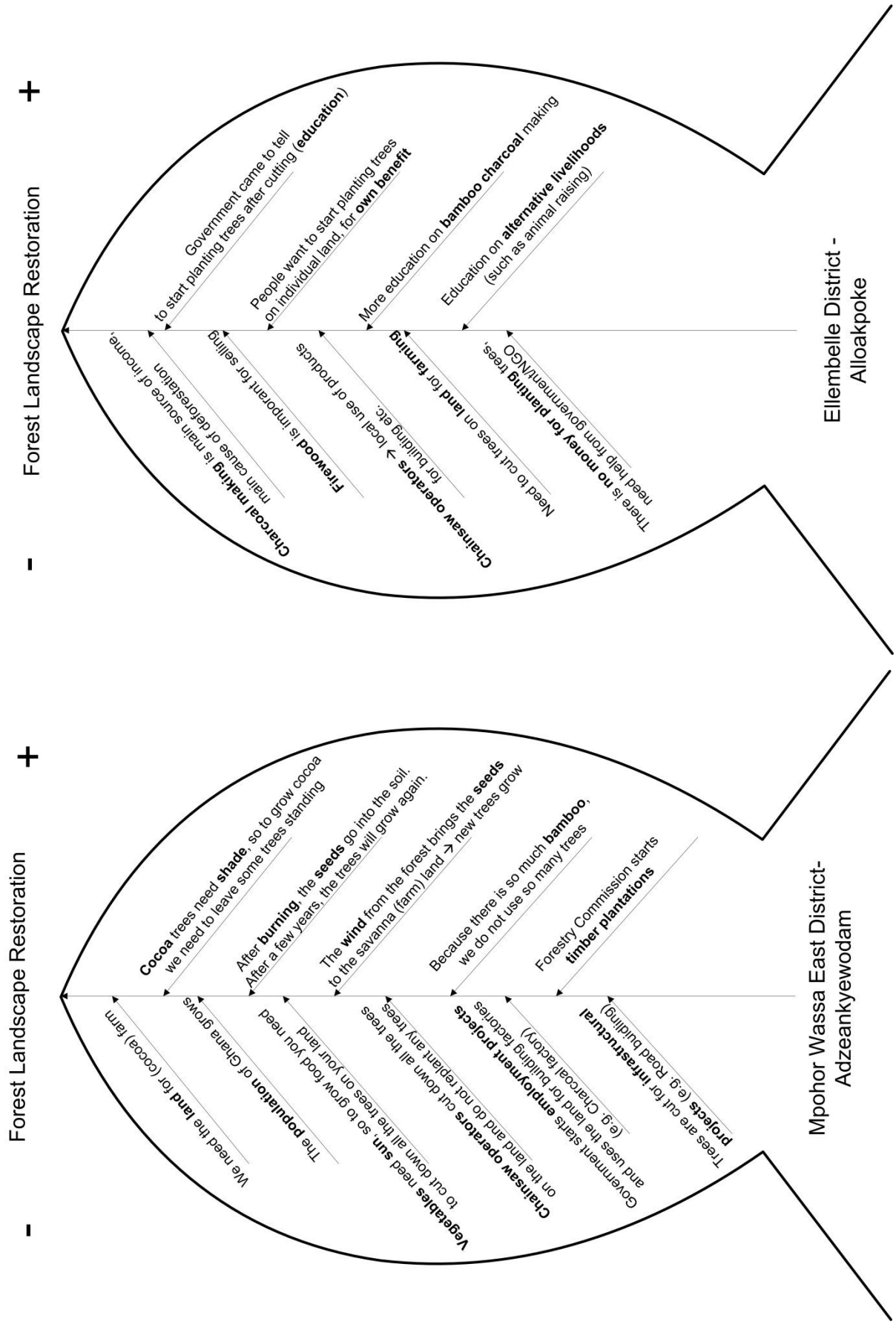
- It burns fast
+ Easy to get
- Lower availability

Mpohor Wassa East District - Adzeankyewodam



+ Firewood burns for long time
+ Firewood can become charcoal
- The smoke gives us pain in the eye
+ No electricity, so we need firewood
- There is not enough firewood to sell
+ Useful for frying fish and meat

+- Bamboo burns fast
+ Bamboo is also good for roofing (multiple purposes)
+ No smoke
+ People use it for fencing
+ High availability
- If we plant bamboo, nothing else can grow there
+ We can use bamboo for paddling
+ We can use bamboo for making/cooking banku
+ In rainy season bamboo is better than firewood


Forest Landscape Restoration
+
-
Government came to tell to start planting trees after cutting (education)
People want to start planting trees on individual land, for own benefit
More education on bamboo charcoal making
Education on alternative livelihoods (such as animal raising)
There is no money for planting trees, need help from government/NGO
Need to cut trees on land for farming
Chainsaw operators → local use of products for building etc.
Firewood is important for selling
Charcoal making is main source of income, main cause of deforestation
Ellembelle District - Alloakpoke
Forest Landscape Restoration
+
-
Cocoa trees need shade, so to grow cocoa we need to leave some trees standing
After burning, the seeds go into the soil. After a few years, the trees will grow again.
The wind from the forest brings the seeds to the savanna (farm) land → new trees grow
Because there is so much bamboo, we do not use so many trees
Forestry Commission starts timber plantations
Projects (e.g. Road building)
Trees are cut for infrastructural
Government starts employment projects and uses the land for building (factory)
(e.g. Charcoal factory)
Chainsaw operators cut down all the trees on the land and do not replant any trees
Vegetables need sun, so to grow food you need to cut down all the trees on your land
The population of Ghana grows
We need the land for (cocoa) farm
Mpohor Wassa East District- Adzeankyewodam