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# Socio-economic impacts of private forest investment on local livelihoods in Niassa, Mozambique

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Forest resource and environmental economics

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Tiivistelmä — Referat — Abstract <p>The low population density and consequent high land availability in Niassa, Mozambique have attracted foreign private forest investments. Since 2005 forest companies have acquired the right to establish forest plantations in the area, which naturally affects the livelihoods in communities located close by. This study aimed to analyse the impact of forest plantations on the livelihood and wealth of local communities. The main objectives were the evaluation of impacts on natural resources, livelihood strategies and differences in the experienced impacts between different wealth groups.</p> <p>With these objectives, household interviews, focus group meetings and key informant interviews were held in five different villages in the province of Niassa. With principal component analysis (PCA) weights for valuable assets possessed by households were created and summed up to a factor score. On the basis of these scores the households were divided into three wealth groups, which were used to analyse differences in the perception of different groups of households. The main analysis of the perception of impacts on the natural resources, livelihood strategies and overall livelihood was carried out with binomial and multinomial logistic regression models. The results showed that while the natural capitals were impacted negatively by the establishment of forest plantations, households benefited from more diversified livelihood strategies. Furthermore, it was discovered that the wealth of a household does not have a major impact on the perception of impacts of a household. Instead relocation of farm plots and formal employment have been identified as determining factors. The study showed that the perception of the impacts differs greatly between the villages due to different initial resource endowment and different forest companies. Throughout the study it became evident that the weak implementation of land use rights is an underlying cause for many conflicts between companies and local communities.</p>			
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## 1 INTRODUCTION

Over the past decade private forest investments have brought socio-economic development as well as significant land use changes to the north of Mozambique. Mozambique is a Sub-Saharan country, located in southeast of Africa stretching in the East along the coast of the Indian Ocean. The capital of Mozambique is Maputo, which is located in the very south of the country close to the border to South Africa. Mozambique has a population of about 25.8 million inhabitants of which almost 70% live in rural areas (World Bank 2014).

The climate is tropical with a wet and a dry season. Furthermore, Mozambique is rich in natural resources and more than 60% of the land area is used for agricultural purposes; 49% of the area is forested (World Bank 2014). According to the forest resource assessment of 2010, Mozambique had a forested area of 39.02 million hectares in 2010, mostly consisting of Miombo and Mopane woodlands (FAO 2010b).

The country gained its independence from Portugal in 1975, but the post-independence period was dominated by civil war which hindered economic development in the 1980's. Today Mozambique is still one of the poorest countries in the world with a GDP per capita (current US\$) in 2013 of US\$593 (World Bank 2014). Although the Mozambican GDP per capita growth rate has been relatively high, with 4.5 in 2013 (World Bank 2014), in 2008 almost 60% of the Mozambicans were still living below the US\$1.25 poverty line (World Bank 2014). Hence, there is great potential for economic development and promotion of poverty alleviation.

In the past years Mozambique has experienced increased flows of foreign direct investment (FDI) (UNCTAD 2012). In 2012 the net inflow of FDI was \$5.238 billion which accounts for about 36% of the national GDP (World Bank 2014). The economy of Mozambique has benefited mainly from the increased investment activities of the fast growing transition countries including China, India and Brazil (Nhantumbo et al. 2013). Increasing demand abroad for secure food, fuel and timber has led to large-scale private investments in

forestry in Mozambique (Nhantumbo et al. 2013). FDI was mostly directed to mega-projects in the extractive industries (UNCTAD 2012). Beside the immense investment flows to mining projects, about 11% of the FDI inflow is dedicated to the agriculture, fishing and forestry sectors, with bigger forest plantation projects attracting the majority of the inflow (UNCTAD 2012).

High land availability and the prospect of high rate of returns have attracted investors in the province of Niassa, Mozambique. In Nhantumbo et al. (2013) it was estimated that the potential for industrial forest plantations in the region is about 2.47 million hectares, with about 640 thousand hectares currently in process to be allocated, which would account for total investment of more than US\$ 70 million. However, the actual planted area up to 2013 was far smaller and hence the realised investment was smaller.

On a global scale private forest investments have become increasingly important for the continuous timber supply. Additionally, forest plantations have a relative high yield compared to natural forest with usually lower production cost. Compared to forestry investments in South America and South-East Asia, large scale investments in Africa are still few compared to the potential available land.

Private forest investments in form of plantations have been discussed controversially regarding economic, social and environmental impacts. Where fast growing monocultures displace natural forest the impacts of plantations are seen critically, but those plantations established on abandoned and fallow land can have beneficial effects (Evans and Turnbull 2004). From the economic point of view forest investment supports economic development in rural areas of developing countries and provides employment opportunities for local communities. On the other hand, in many countries the establishment of forest plantations has caused land conflicts, involving displacement of households and their farm plots, and limitations of access and control over land.

Positive impacts of forest investments on the economic development might support the promotion of sustainable livelihoods of local communities in Mozambique. Nevertheless, rural population depends heavily on natural resources like farm land and firewood. Hence, negative impacts on natural resources endanger the sustainability of livelihoods. However, the impacts might affect distinct groups in the communities differently and cause various perceptions of the forest investments.

The objective of this study is to analyse the perceptions of local communities on how the establishment of forest plantations have impacted their livelihood and wealth. Natural assets, alternative livelihood strategies, and wealth as a livelihood outcome are the central aspects of livelihood which are examined in this study. The main objectives of this study are:

- (1) Analysis of the perceived impact of forest plantations on natural resources.
- (2) Identifying which livelihood strategies affect the wealth of a household and how forest investments contribute to the wealth.
- (3) Examine how households have perceived the overall impact of forest plantations on their livelihood in order to analyse if there are groups that have been affected more than others.

The purpose of this study is to evaluate how local communities have perceived the establishment of forest plantations in the province of Niassa. Positive as well as negative impacts are to be identified and build a foundation for recommendations for future investments. The results of the study could provide information for forest companies to avoid or reduce conflict with local communities. From the perspective of the local communities, the study aims to identify how households benefit from the plantation and improve their livelihood.

## 2 BACKGROUND AND LITERATURE REVIEW

### 2.1 Introduction to the sustainable livelihood approach

The sustainable livelihood approach (SLA) is based on the concepts of livelihood, well-being and sustainable development. Even though the concept of livelihood was not new, the inclusion of *sustainable livelihood* in the report “*Our common Future*”, also known as the *Brundtland report*, by the World Commission on Environment and Development (WCED) (1987) raised the concept to new awareness. Chambers and Conway (1992, p.6) took up the concept of sustainable livelihood in their discussion paper, and as a result the following definition for a sustainable livelihood was suggested:

A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood at the local and global levels and in short and long term.

The concept of livelihood is usually closely connected with the idea of sustainable development. In the Brundtland report of the WCED (1987) 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.” Thus, sustainable development affects a fair allocation and distribution of resources not only between present interest groups, but also in consideration of future generations.

In the context of sustainable livelihood Chambers and Conway (1992) distinguished external and internal sustainability and with this, respected the fact that, on the one hand, a livelihood system affects its surroundings and on the other hand is affected itself by its environment, shocks and pressures. Furthermore, they explained that a sustainable livelihood is self-sufficient, able to cope with shocks, and has high resilience.

In general sustainability comprises of three dimensions: economic, social and environmental sustainability. In order to build sustainable livelihood, sustainability in all three dimensions need to be achieved. Especially in developing countries many rural

livelihoods depend heavily on natural resources and are threatened if resources are not used in sustainable manner.

The considerations of livelihood often include concepts like well-being and quality of life. In contrast to poverty, which appears to be more a physical lack of assets or resources, well-being and quality of life are experiences and subjective constructs (Chambers 1995). Thus, it becomes evident that livelihood cannot simply be explained with a household's wealth, but instead the well-being and the households own perception of his personal state (Sen 1993).

The concept of sustainable livelihoods by Chambers and Conway (1992) was taken up by others (Ellis 1998, Scoones 1998, Ellis 2000) and further developed, modified and refined into the sustainable livelihood approach as a framework for analysis (Bennett and Dearden 2014). Most of the aspects from the definition of Chambers and Conway can be found in the SLA, although the status of *capability* is discussed and included to different extents. Ellis (2000) omits capabilities in his definition of livelihood, because in his opinion capabilities overlap with the concepts of assets and activities. On the other hand, Chambers and Conway (1992, p. 4) pointed out that livelihood capabilities represent the ability to cope with shocks and stress, as well as to utilise new livelihood opportunities. They derived the concept from the work of Sen (1993), which defined capability as “a feature of a person in relation to goods”. This could for example be the status of being in good health or having a proper nutrition.

An important aspect of capabilities is the freedom of the entity to make use of an alternative. This aspect of capabilities cannot be captured by assets or livelihood strategies, since they only proxy what the household possesses and which activities are carried out, but not what is actually possible for the household. As Chambers and Conway (1992, p. 5) pointed out the capabilities are the basis on what the household can gain its living as well as the result, opening up new possibilities and allow an enhancement of the well-being.

The SLA provides a tool to analyse the complex interactions among asset ownership, institutions, shocks and how these lead to livelihood outcomes. The framework of the SLA is traditionally divided into six sections, which are explained in the following section and a conceptualisation of the approach can be seen in Figure 1.

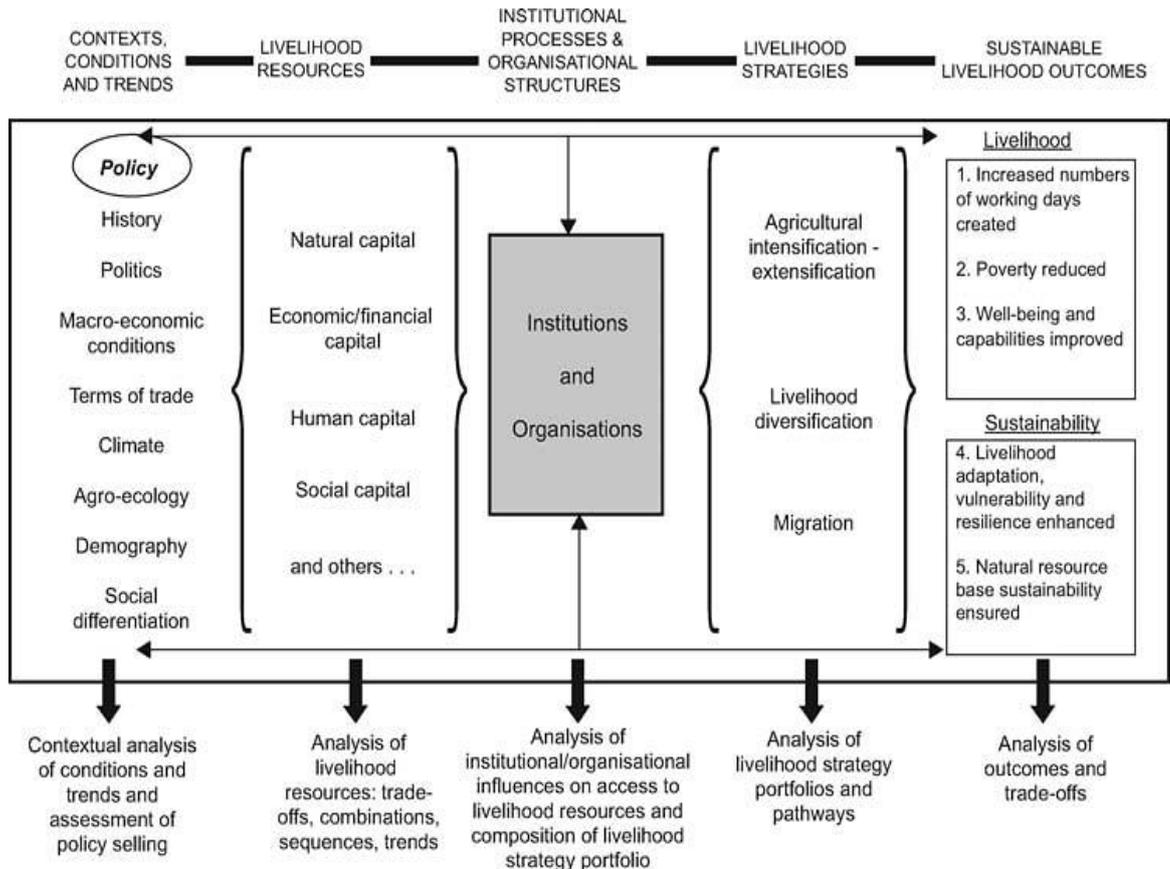


Figure 1: Conceptualization of the sustainable livelihood framework its components and connections between them (Source: Scoones 1998).

An analysis of the contextual setting around the investigated livelihood is a crucial part of the SLA (Scoones 1998). It comprises the circumstances of the livelihood which the households cannot influence. Important determinants for the contextual setting are, among others, local history, economic and political situation, ecological and climatic conditions and social differentiation of the region (Scoones 1998).

The capital assets display the foundation of the livelihood; they are the means that a household can use to build up its livelihood and well-being (Ellis 2000). In connection

with the SLA framework, the number of different capital assets which can be found in the literature varies (Ellis 2000). While Scoones (1998) emphasizes that his list of capitals is not exhaustive, he only distinguishes four forms of capitals. Other studies have identified up to seven different capitals, which includes political and cultural capital (Bennett and Dearden 2014). The most commonly used version is the one with the five capitals natural, human, social, physical and financial capital (Table 1).

Table 1: Description of the different livelihood capitals

Natural capital	Covers forest, land, water, wild animals and other resources that a household could gather from the environment. In general, renewable and non-renewable resources are distinguished, though renewable resources appear to be more relevant when analysing rural livelihoods. (Ellis 2000, p. 32).
Human capital	Comprises skills, health, education and labour that a household or its individuals possess (Scoones 1998).
Physical capital	Includes production outcomes, infrastructural aspects like roads, bridges, electricity, tools or similar physical assets (Ellis 2000). Ellis (2000) pointed out that physical capital is man-made and in the long run likely to replace natural capital in connection with industrialization and urbanization.
Financial capital	Represents the household's access to loans, ability to save money or other stocks of money. This also includes livestock or similar assets, which are held mainly to be converted into money in times of shortage. (Ellis 2000, p. 34).
Social capital	Stands, among others, for membership in associations, networks, social support from friends and family members and the status of the household in the community (Scoones 1998). Compared to the other capitals, social capital is, relatively difficult to measure and subsequently the evaluation of its impact on the household's livelihood is difficult to estimate (Ellis 2000).

Other important aspects when analysing capital assets in the SLA are access and control. Households have different access to resources. Access to capital assets is linked to control over the resources. If an asset is controlled by third parties, a part of the households might not be able to access this resource. On the other hand, if there is insufficient or no control over a resource, especially in the case of natural resources, the resource in question might be overexploited.

Institutions regulate the interactions and relations of social communities, as well as the production and endowment of capitals over the households (Dasgupta 2001).

Organisations, in this context, are governmental, non-governmental, private companies or community based associations. The analysis of institutions and organisations considers which influence institutions and organisations have on capital assets and consequently the livelihood strategies of a household. Firstly, the access and control of resources is mostly determined or regulated by organisations and institutions, for example through legislations. Secondly, organisations might provide additional opportunities for livelihood strategies, for example by providing new jobs for the region.

The rural livelihood strategies comprise the activities and actions undertaken by a household to create income aiming to sustain its living or satisfy human needs (Chambers and Conway 1992, Ellis 2000). According to Ellis (2000), capital assets and the contextual setting are the main factors determining which livelihood strategies are adopted by a household.

Scoones (1998) introduced three main types of changes in livelihood strategies; namely, agricultural intensification or extensification, livelihood diversification, and migration. Livelihood diversification means the adaption of additional strategies by the household providing it with additional income options and capabilities. A diversified strategy portfolio with several activities independent of natural resources is preferable (Ellis 2000). Considering climate change, natural resource based livelihoods are often seen as less resilient and more vulnerable than livelihoods that have additional non-natural resource based strategies. The crucial point in the diversification of strategies is when the household becomes less reliant on just one income source and thus less prone to shocks (Scoones 1998).

The sustainable livelihood outcomes are the part of the SLA which varies most in different studies depending on the purpose of the analysis. Scoones (1998) identified five key issues for the analysis of the sustainable livelihood outcomes. The five issues present different ways to analyse the livelihood outcome with emphasis on different aspects of the livelihood.

*Creation of working days* relates to how much income can be created by the livelihood strategies performed by the household through employment (Scoones 1998, p.5). The analysis target is an increased amount of days on which the members of the household are able to carry out income producing work. This refers to different aspects in the livelihood framework. An improved health of the household, for example, could increase the effective working days. On the other hand, increased employment opportunities might fail to create working days when simultaneously the population is growing (Scoones 1998).

*Poverty reduction* is naturally one of the main goals when carrying out a livelihood analysis and implement development projects. The approaches to analyse this outcome vary from absolute poverty lines to relative poverty indicators or equity measurements (Scoones 1998, p.6). However, poverty measures usually concentrate on income levels, consumption or capital asset endowment and thus they alone might not capture changes in livelihood exhaustively.

*Well-being and capabilities* as livelihood outcomes capture the quality of life that a household can achieve with its capital endowment and livelihood strategies (Chambers 1995). Possible livelihood outcomes could include the construction of a house with improved materials, like a tin roof instead of a grass thatched roof. The analysis of capabilities includes the question of what a households is actually able to do with its assets in the given context and how it contributes to the functioning of a person (Sen 1984). Functioning in this context is linked to the doing and being of a person which in combination should enable the household to build up their livelihood (Sen 1993). Following Chambers and Conway (1992) the possibility to choose between different alternatives and carry them out is a part of the quality of life.

*Livelihood adaptation, vulnerability and resilience* concern how the household responds and adapts to shocks and trends. A household that fails to adapt to new circumstances is likely to suffer from poverty in the future. This becomes especially evident in the context of climate change, where households need to adjust their livelihood strategies. If a

household succeeds to diversify his livelihood strategies, the outcome would be a reduced vulnerability and an improved resilience towards shocks.

*Natural resource based sustainability* is especially important considering that rural poor households depend on natural resources as alternative income sources beside farming (Dasgupta 1993). In many cases a countries economic growth and related increased wealth has been achieved through exploitation of natural resources (Dasgupta 2001). Since equal distribution of benefits often fails, the poorest households which depend on natural resources are deprived of an important income source (Dasgupta 2001).

The sustainable livelihood approach has been used in various previous studies and contexts. One of the main applicants of the method is Frank Ellis, who has carried out livelihood studies in several African countries (Ellis and Mdoe 2003, Ellis and Bahiigwa 2003, Ellis et al. 2003). Ellis studies concentrate mainly on the process and efficiency of poverty reduction strategy papers.

In the context of rural livelihoods in developing countries property rights play an important role, because land and forest are often owned by the public sector. Lambini and Nguyen (2014) discuss in their work the linkage of the sustainable livelihood framework and property rights. Well defined property rights and related regulation for the access and use of resources by communities would enhance the sustainable livelihoods (Lambini and Nguyen 2014).

Some other studies concentrate only on specific sections of the livelihood framework. In the work of Mogaka et al. (2014), only the capital assets are conceptualized. The study analyses the introduction of agricultural investments in biofuel in collaboration with communities in Kenya, and how capital endowment affects the decision to adopt a new alternative livelihood strategy.

For the purpose of this study the sustainable livelihood framework is viewed under the aspect of forest investments in form of forest plantations, which represent a change in the section of institutions and organizations.

This study examines how the change in institutions and organisations impacts other sections of the sustainable livelihood framework, with primary focus on impacts on natural capital assets and livelihood strategy diversification. Furthermore, the sustainable livelihood approach is used to evaluate how the forest investments and their impacts on natural capital and livelihood strategies contribute to the households' overall livelihood and wealth. A detailed analysis of all livelihood aspects would lie beyond the scope of this study. Natural capital is considered the basis for rural livelihoods. If access and control are limited by the introduction of forest plantations, households would have to adopt alternative livelihood strategies to offset the loss. In order to emphasise and analyse the trade-off between those, the mentioned sections were chosen for the analysis in the scope of this study.

For this study the evaluation of perception of households is utilized to assess the impacts of plantations on livelihoods. If negative impacts are perceived, the livelihood is assumed to be decreasing and if positive impacts are perceived, the quality of the living in the local communities is assumed to be improved. Even though the perception of locals might not reflect the actual situation, it is important to analyse how households experience negative impacts or benefits.

## **2.2 Private forest investment**

### *2.2.1 Private forest investments and overview*

The human population is constantly growing the demand for forest based products is increasing simultaneously. Moreover, the forest cover is decreasing (FAO 2010a) and natural forests are under pressure. In addition to timber production and fuel wood collection, land use changes in favour of agricultural uses have been identified as main drivers of deforestation. Fast growing forest plantations are seen as a possible solution to

satisfy the increasing demand of forest products and in addition transform fallow into productive land.

Public institutions often lack the financial means to ensure sustainable forest practices, thus private investments into the forestry sector are one of the main financing sources for sustainable forest management in the developing countries (World Bank 2008). According to the World Bank (2008), approximately US\$15 billion are yearly invested into forestry in the developing countries by private investors. The private sector includes investments by the domestic and foreign forest industry, as well as by local communities and individuals. Investments from the private sector mainly aim for commercial or productive use of forest resources.

In this study the focus lies on forestry investments in form of forest plantations for industrial purposes. Forest plantations are commonly defined as “those forest stands established by planting or/and seeding in the process of afforestation or reforestation” following the definition of the FAO and their Forest Resource Assessment (2001). Plantations can consist of either indigenous or introduced species and need to cover at least an area of 0.5 hectares with a tree crown over of at least 10% of the land cover; total height of adult trees is required to be above 5 meters (FAO 2001). Industrial forest plantations are usually even-aged managed, monocultures, which fast growing exotic genera like various species of *Eucalyptus* and *Pinus*, have a high yield and are managed intensively managed (Indufor 2012).

In 2010 the planted forest area in the world was about 264 million hectares, accounting for about 6.6% of the total forest area (FAO 2010a). Over the past 20 years the area of planted forests has increased rapidly (Figure 2). In the Forest Resources Assessment conducted in 2010 the *planted forest area* composed of more than only forest plantations for productive purposes, but it is estimated that about 76% of the planted forest areas have production as their main purpose (FRA 2010). According to a report by Indufor (2012) industrial forest plantations covered an area of 54.3 million hectares in 2012.

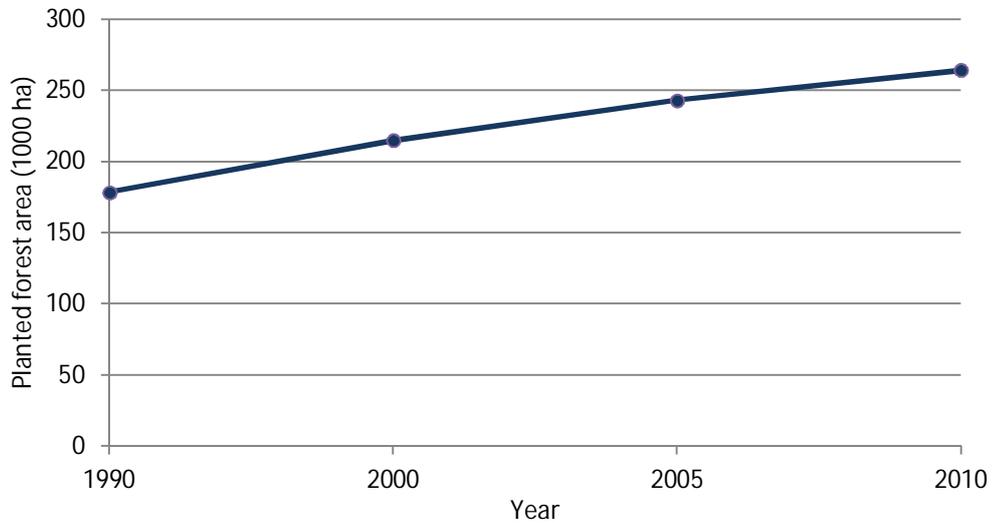


Figure 2: Development of planted forest area in the world from 1990 till 2010 (FAO 2010a).

For private investors forest plantations seem to be a lucrative investment because the managing costs of forest plantations are often lower than for natural forest. In most cases plantations consist of only one tree species, and if a suitable species is chosen a high volume per unit can be yield, which reduces the harvesting costs (Evans 2004). Still, the profitability of a forest plantation depends on various factors, including chosen species, land characteristics, labour costs and local as well as global wood prices (Niskanen et al. 1993).

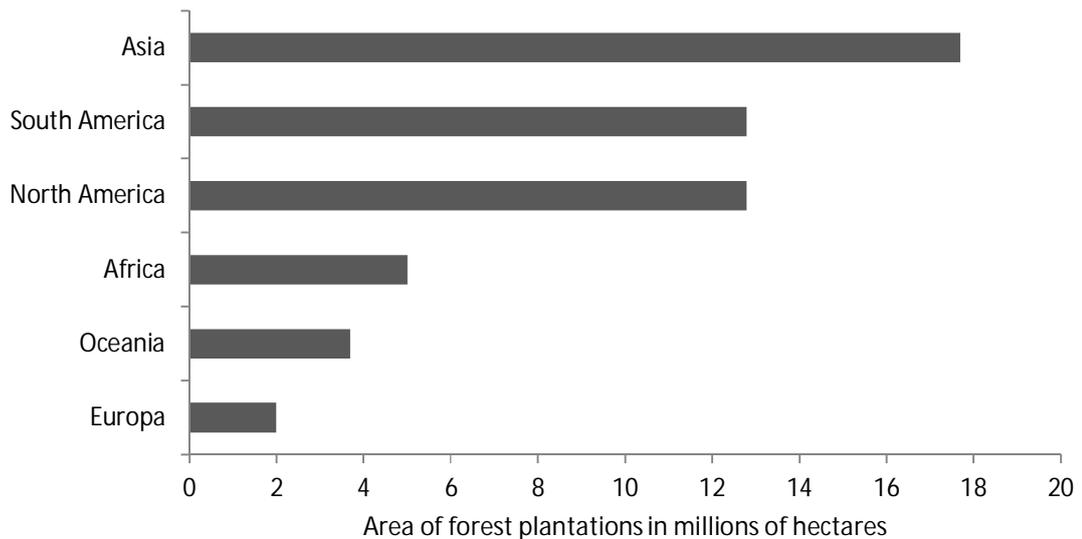


Figure 3: Area of industrial forest plantations by region in 2012 (Indufor 2012).

Figure 3 shows that especially Asia and America have large areas of industrial forest plantations. Africa, however, has relatively small area compared to the potential due to land availability. For investors in developing countries, forest plantations seem to be attractive, because the land can often be acquired cheaply and labour costs are low. Hence, successful investments in developing countries can achieve high rate of returns. On the other hand, the level of uncertainty for foreign investors is relatively high, and investments involve higher risks in many African countries. Risks can be due to political insecurity, instable political systems or economic insecurity in the country. Additionally, some governments in developing countries expect the investment projects to be socially acceptable and beneficial for the local communities and investments have been established in connection with poverty mitigation programs.

#### *2.2.2 Impacts of private forest investments / Plantations*

This section will give an overview of discussed economic, social and environmental impacts of forest plantation for local communities in earlier studies with emphasis on developing countries.

In many developing countries the growing conditions for trees are favourable, thus countries could benefit economically in form of increased exports of forest products or substitution of previously imported products (Evans and Turnbull 2004). In addition to overall contribution to the country's economy, introduction of forest plantations are contributing to the development of the local communities. Forest investments usually involve an improvement of the infrastructure of a region, for example in form of bridges, roads and power supply.

The development of the community is directly, as well as, indirectly affected by the forest company. Direct effects are partly due to the need of the forest plantations for example to have proper roads for the transportation of their machines, or as part of social responsibility programs. Positive changes in infrastructure are often seen only several years after the initial investment, which might lead to dissatisfaction in the community. In case of plantations in Ghana, households believed that infrastructure would improve once the

company makes enough profit (Schoneveld et al. 2011), hence communities were content with the introduction of plantations. Indirectly, the investment can raise the government's interest in the region, causing increased public actions. Additionally, improved cash flow through employment might lead community initiatives for more development.

One of the main arguments for forest plantations are the potential positive impacts on the employment situation for the region. Especially in rural areas where people depend on farming and natural resources alternative employment in the forest plantations is expected to improve people's livelihoods. The majority of households with employees in the plantations in Ghana reported increased income security and were able to increase their capabilities to sustain food supply, provide education for their children and cover medical expenses (Schoneveld et al. 2011).

However, the needed labour for the work on a forest plantation varies strongly over the rotation period. While initially much labour is needed for clearing the area and planting the seedlings, the demand for labour decreases after this initial phase and only increases again when the trees are to be harvested. In a case of industrial forest plantations in Indonesia it was shown that even though the majority of households were involved with the plantation, there was not enough work for representatives from all households to be employed, especially after the initial planting phase (Tyynelä et al. 2002).

Charnley (2005) brought up that even though industrial forest plantations are established in rural areas, the facilities for the further processing of the raw material are often not implemented in the same area. This limits the social and economic development potential and reduction of employment possibilities in the region. On the other hand, Evens and Turnbull (2004) argue that in this case less financial means are required and negative impacts on the environment like pollution from the factories are avoided.

In Ghana the establishment of biofuel feedstock plantations reduced the land availability and the resulting reduced farm incomes forced local households to expand their livelihood strategies (Schoneveld et al. 2011). Besides formal employment, some households

managed to take up small-scale trading of common goods, livestock keeping, or other off-farm activities (Schoneveld et al. 2011). The study by Schoneveld et al. (2011) stresses that lack of skills or financial means often limit the expansion of livelihood strategies for many households. Furthermore, Schoneveld et al. (2011) point out that formal employment should be adapted by households complement to farming and not as a substitute for the farming completely.

A study conducted in Zanzibar, analysing the impact of tree planting on livelihoods, showed that not the whole community, but only individual households can benefit from planting activities (Sitari 2005). According to Sitari (2005), especially women have fewer chances to benefit from the investments. People report positive impacts and increased wealth from the plantation activities if they are involved themselves (Charnley 2005). This stresses that the investments done with respect to the communities are viewed more positively and provides improvement for the region. In the study by Tyynelä et al. (2002) it was shown that the impacts of industrial forest plantations varied between households from different wealth groups. Wealthier households had fewer problems sustaining their livelihood due to larger land areas and access to fertilizers to yield sufficient harvest. In addition wealthy households had access to higher education leading to better positions in negotiations for land as well as providing skills for formal employment (Tyynelä et al. 2002).

While the positive impacts on the economy are mentioned in arguments in favor of private forestry investments, negative impacts of forest plantations are mostly reported on natural resources and most of the disputes and conflicts are held over the issue of land Gerber (2011). Investments in forestry, especially large-scale operations, need a rather large area of land, but at the same time farm land represents the basis of rural livelihoods. The two main issues connect to this are the property, land use rights and land use changes.

Generally, the land that a forest company needs to acquire for the establishment of its plantations is either under public or private ownership and could be for example abandoned farm land or deforested areas. In many countries where the land and the forests

are owned by the state the resources are used by local communities under customary norms (Charnley 2005). Forest companies gain access to the land with concessions given out by the government and hence have the right to occupy the land even if it is used by locals. In rural areas many locals depend heavily on customary land rights, thus the establishment of forest plantations is limiting their access to areas and decrease the availability of land (Indufor 2012). In a case where palm oil plantations were established in Indonesia, the increased scarce of natural resources, especially land, affected mainly former land owners or customary users (Obidzinski et al. 2012). In the study by Obidzinski et al. (2012) every second customary land user reported negative impacts on their livelihood due to the palm oil plantations. Many households in the study had to abandon forest product based livelihood strategies and thus, give up additional income sources. Furthermore, the study pointed out that the shifting cultivation practices became more complicated, since farmers had to walk further distances to open new farm plots (Obidzinski et al. 2012).

The crucial issue in the conflicts over land is that in several cases the establishment of forest plantations has entailed the displacement of households, their farms or both. This is probably one of the most serious impacts for an individual household. Displaced families often migrate to urban or peri-urban areas, which entails noticeable changes to the household's livelihood. Displacements occur in case land is acquire through concessions by the state as well as bought from private land owners.

One of the most extreme cases of displacement due to the establishment of forest plantations has occurred in South Africa in the late 1950ies, when about 400 households had to resettle (Tropp 2003). In the case of South Africa the displacement was initiated by the government and its intensive afforestation program, where additionally apartheid issues played a crucial role (Tropp 2003).

In many cases households are promised compensation in form of new land, formal employment or financial means. In Ecuador smallholders sold their land to a large-scale plantation company being promised among others monetary compensation as well as employment opportunities in return (Gerber and Veuthey 2010). However, the study by

Gerber and Veuthey (2010) revealed that in many cases the promises were not kept, less compensation paid and only short-term employment offered, which resulted in a resistance campaign. In the case of Indonesia (Obidzinski et al. 2012) it was shown that communities with prior experience with plantations had advantages and were able to receive compensation for given up land as well as improve their livelihoods through new opportunities.

In addition to farm land as important natural capital, forests are essential in the context of rural livelihoods as they provide firewood, non-wood forest products (NWFP), like mushrooms, berries and medical plants and cultural sites. However, deforestation and forest degradation are problems that especially developing countries have to face.

The ability of plantations to decrease the pressure on natural forests is often mentioned as a positive argument in favour of forest plantations. However, Friedman (2005) argued that plantations can only partly fulfil this expectation, because there are various other reasons for pressure on natural forests. One of the main drivers of deforestation and forest degradation is land use change, often from natural forest to agricultural crop lands and pastures. Growing population and resulting increased pressure on food security as well as shifting cultivation practices contribute significantly to the process in poor countries. However, also land use conversion of natural forest to forest plantations is seen as a degradation of the forest area, as biodiversity and certain ecosystem services are decreased.

The change of natural habitats towards monocultures can limit the access to forest resources important for rural livelihoods. In a study by Obidzinski and others (2012) a majority in local communities in Indonesia reported displacement of natural resources like timber and non-wood forest products with medical plants being the most serious. The reduction of natural forests in favour of industrial plantations forced households to walk further distances to collect products from the forest (Obidzinski et al. 2012).

The form of the conversion and the initial land use determine if a land use change is viewed positively and which groups benefit from the conversion. If abandoned land with

little agricultural value is afforested it is usually seen as beneficial in terms of all aspects (Evans and Turnbull 2004). In contrary, the conversion of potential agricultural land is viewed negatively in social terms, especially in areas with high rates of malnutrition.

Djanibekov proved in his study that the conversion of marginal irrigated agricultural land to forest plantations under the Clean Development Mechanism (CDM) can improve the rural livelihoods. This result is especially focused on long term impacts, because a decrease in income and food production was observed for the first years, but eventually an increased income was reported.

The interactions between forests or plantations and the water systems are complex and the impacts on the water system depend on the circumstances. In areas with problems of flooding plantations can carry a protective function, whereas on the other side in dry areas negative impacts have been reported. Some scientists have found negative impact on the watershed by fast growing tree plantations, while others have found positive impacts (Bowyer 2001). Following Bowyer (2001), the extent to which the hydrology of a site is affected depends on several factors like for example the chosen species, the initial land use and management practices. Some of the tree species used in plantations, especially eucalyptus, are known to require a lot of water (Friedman 2005, Gerber 2011). For the local communities negative impacts on watersheds can lead to harvest failure due to droughts as well as drying out of water sources.

Another issue is the use of chemicals and pesticides which besides the effect for the ecosystem, the chemicals and pesticides can cause negative effects on the health of local communities if residues of the chemicals get into the water sources. In Indonesia some communities have identified serious environmental problems in water as well as air pollution due to the established palm oil plantations and heavy use of herbicides and pesticides (Obidzinski et al. 2012). Even the company recommended their workers not to use water from the rivers close to the plantation sites (Obidzinski et al. 2012).

In summary negative issues in connection with forest plantations are usually dealing with a decline in natural capitals for the locals. Positive effects are usually observed for employment and economic development in the areas. This emphasises the complexity of the problem, where positive effects are desired, but are closely connected to concessions in natural resources.

## **2.3 The case of Niassa**

### *2.3.1 Rural livelihoods in Niassa*

This study concentrates on private forestry investment and livelihoods in Mozambique and especially the province of Niassa. In the following the general livelihoods with emphasis on capital assets and livelihood strategies of households are described.

Rural households in Mozambique depend heavily on natural capitals and livelihood strategies based on natural resources. Land as a natural capital is the basis for farming being the main strategy to sustain the household's livelihood. Shifting cultivation, as well as, slash and burn agriculture are still a common practices in Niassa and other parts of Mozambique. If not sufficient land is available forested areas are cut down and the area is burned. If households manage to yield a good harvest, part of the harvest is sold on local markets, providing an additional income. Most commonly cultivated crops are maize, beans and sorghum (Cueller et al. 2006).

Firewood is mainly collected from natural forests, only few household in rural locations purchase firewood or use charcoal (Cueller et al. 2006). In addition to firewood, households collect products like medical plants, forest fruits, honey, mushrooms and ropes from the forest areas (Cueller et al. 2006). Those products are mainly used for own consumption, but are also used by some households as trading goods.

Besides that, livestock keeping, charcoal production and other activities like brick making are important livelihood strategies (Cueller et al.2006). Strategies that are not depending on natural resources can for example be formal employment, business activities and trading.

However, opportunities for formal employment are rare in rural areas. Those who are employed are working as teachers, local administrative staff or health care staff (Cueller et al. 2006).

In many rural areas infrastructure is at a very low level. Houses are mainly grass thatched and don't provide a save shelter for the families during the rainy season. According to the Joint Monitoring Program for Water Supply and Sanitation in 2012 (JMP 2012), only every second person in Mozambique had access to save source of drinking water and in rural areas only 35% of the population had access to save sources.

Human capital is low, because people have limited access to high level health care and educational facilities. Mozambique has with 0.327 one of the lowest Human Development Index in the world and is ranked number 185 out of 187 ranked countries (UNDP 2013). In 2009 the literacy rate for whole adult population in Mozambique was about 50.6%, but while two third of men are able to read and write; only about one third of women are alphabetized (World Bank 2014).

### *2.3.2 Private forestry investment in Niassa*

Main target of the investments in forest plantations has been the northern Province Niassa, due to its low population density of about 9.5 persons per km<sup>2</sup> (INE 2007) and relatively high land availability. Not only due to the great distance to the capital Niassa is seen as the economically weakest and poorest part of Mozambique and is hence declared a zone of rapid development (Malonda Foundation 2014). Hence, private forestry investments in the region represent an opportunity for sustainable development in social as well as economic aspects. In addition to forest plantations also wood processing industry was planned to be established and increase the economic development (Siteo 2009).

According to Nhantumbo et al. (2013), until 2013 a land area of 640 thousand hectares were in the process of being allocated for forest plantation projects in Niassa, however far less area has yet been approved and planted. In 2013 there were six companies requesting

land area for forestry projects: Chikweti Forest of Niassa, Companhia Florestal de Massangulo (subsidised by Chikweti Forest), New Forest of Niassa, Florestas do Planalto (UPM) and Green resources.<sup>1</sup> Once realised, the combined investment of the companies would account for about US\$ 70 million. Reliable figures how much land each company has allocated and planted so far is not available, latest information, according to Nhantumbo et al. (2013), indicates that about 120 thousand hectares of DUAT have been authorised or are in process to be authorised for the forest companies. Hence, the forest investment and expansion of forest plantations will continue in the future and concern more communities in Niassa.

According to Overbeek (2010), main investments come from the Government of Sweden, financing the Malonda Foundation, the Global Solidary Forest Fund (GSFF), founded by the Lutheran Church of Sweden and the Lutheran Church Endowment and the Norwegian based company Green Resources.

Main constrains for foreign investors in forestry are the relatively weak institutional framework, low availability of human resources and the high potential of conflicts over land. Furthermore, uncertainty and corruption complicate the implementation of forest plantations for foreign investors.

### *2.3.3 Land use rights and the DUAT system in Mozambique*

In Mozambique land is under the ownership of the state, but in most parts of the country customary rights are the main form of land management. Access to land and other resources are granted as common property and managed at community level. Additionally, individuals can acquire the right to use land in form of a DUAT (*direito de uso e aproveitamento da terra*), which is a form of leasehold of the state.

Norfolk and Tanner (2007) analysed the Mozambican DUAT system and if not otherwise mentioned the information in the following paragraphs is based on their work. The current system of DUAT was introduced with the revised Land Law in 1997 to strengthen land use

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<sup>1</sup> In 2014 the company Forestas do Planalto was sold to Green Resources (Freitas 2014).

rights of the rural population and simultaneously promote private investment. In 2004 the legislation was revised, but the basic system from 1997 was kept and certain points were specified. In general, the Mozambican DUAT system distinguishes three different forms, depending on how land use rights can be acquired or applied. DUATs cannot be sold, alienated or mortgaged, but DUATs are inheritable and transmittable. The three forms are:

- a) DUAT acquired by traditional occupation
- b) DUAT acquired by occupation in good faith for at least 10 years
- c) DUAT acquired by award

While the first two options grant land use rights through long-term occupation, the third option is long leasehold with the state on basis of a concession. Option (a) grants the right to individual persons as well as local communities who used and occupied land under customary traditions, ensuring the basis for their livelihoods. Any national person who has been using a certain area of land in good faith for at least 10 years has the possibility to acquire a DUAT through option (b). This second option is not based on customary norms, but solely on long term occupation and management of the land. Both variants are meant for personal utilization of the land for the sustaining of one's livelihood and thus, the holders are free of taxes and administrative fees for this land. Additionally, both options include the right of the holders to be able to exclude third parties and have no limit in their duration.

In contrast to the first two options, the land use right option (c) needs to be applied from official authorities, depending on the size of the applied land area. This is the only alternative for foreign investors to acquire land in Mozambique. Additionally, an application must include a development plan. This form of DUAT is granted for a limited period of time, for 50 year, with an option to be renewed for a second period of 50 years.

The application for land use rights for forestry projects are usually issued by the Council of Ministers, as concession areas often extend 100 000 hectares and forestry projects have significant social and economic implications (UNCTAD 2012). In order to be eligible to

apply for a DUAT the project needs to be licensed by the Investment Promotion Centre (CPI). During the application process provincial incentives, namely the Malonda Foundation, have supported private investors in the DUAT application process.

Additionally, investors are required to hold consultations with local communities, which have the claim of land use. If the forest company wants to occupy land for which a DUAT is held by somebody, the company is required to pay compensation to the previous holder. In the rural areas of Niassa only few private households possess a registered DUAT for their farm land. Hence, companies are not required to offer compensation if the communities agree to cede the land to the forest company during the consultations, instead, the company offers employment or community funds for the communities. The company then commits to pay a certain amount, depending on the land ceded from the community to the company, into a fund, from which infrastructure projects can be realized in the communities (Mkumbira 2013, Soares 2013). After the DUAT is issued successfully, forest companies need to pay an annual usage fee in addition to taxes to the government.

In connection with the promotion of economic development in Niassa the government introduced investment incentives for private investments. According to the web page of the Malonda Foundation (2014), investors into forestry are eligible to receive tax benefits. Amongst others, the most important benefits are the reductions for corporate income taxes and the exemption from customs duties and value added tax, which are granted for the first 5 years of the investment project.

Although the legal framework of DUATs forms a basis to protect the land use rights of local communities and simultaneously promotes investment, in reality the implementation of the DUATs is weak (German et al. 2011). According to Siteo et al. (2012), one main issue in the process of land acquisition of investors can be found in the community consultations. In his case study on the forest governance in Niassa Siteo (2009) mentioned that consultations were sometimes held without officials from the local government, or with only part of the community present. Furthermore, the study points out weak institutional organisation, as for example acquired land rights did not contain specific

information on community borders, settlement areas or farm land (Siteo 2009). Siteo further reports that in some cases this led to conflicts between the communities and the investors, but in other cases companies reduced their area to respect community area and farm land of locals. Besides those conflicts several irregularities have been reported in connection with community consultations, including corruption, insufficient information for communities and land transfers arranged only with local leaders (Siteo et al. 2012).

#### *2.3.4 Previous studies on the forestry investments in Niassa*

Even though new investments into forestry are less than 10 years old, several reports and analysis have been produced already, evaluating the effects of the forest plantations on the region and its communities. However, most papers discuss the conflict over land, but only little analysis on the impact of forest plantations on the livelihood of local communities can be found. In the following a few examples are presented which deal with the matter of forest plantations in Niassa. Prior to this study Cueller et al. (2006) and Landry (2011) examined potential socio-economic impacts of the establishment of forest plantations in Niassa. Additionally, the forest plantations in Niassa are part of the report by Lemos (2011) dealing with the issue of inappropriate land acquisition by investors. The problem of land use rights in connection with forest plantations has also been analysed in the report by Siteo (2009) on the forest governance in Niassa in general. Furthermore, several reports on the impacts of forest plantations have been initiated by local as well as international NGOs.

The study by the Swedish SIDA EIA Help desk has been initiated in order to assess the possible socio-economic impacts of planned forestry investment projects in Niassa. The study by Cueller et al. (2006) took place in the two communities of Chimbonila and Chiconono, including the village of Ligogolo, which is also subject to this study. The report identified the creation of employment as the most important impact of the planned investments. Still it was made clear that the jobs provided for local communities would be low level tasks with no prior skills required. Additionally, it was pointed out that increased cash income for the households with employment would enable them to invest into amenities like improved housing as well as business or agriculture as alternative livelihood strategies. Furthermore, impacts on land availability were mentioned as possible negative

impacts, despite the low population density. The report, however, didn't specify major impacts on other natural resources like water, firewood and non-wood-forest products. Still households reported already during the study that firewood collection was getting more and more difficult (Cueller et al. 2006).

The second study concentrates on the forest plantation operations in the Sanga district, which is also part of the research area of this study (see section 3.1). Since the data collection was carried out prior to the establishment of plantations in the district, the Focus of Landry (2011) is the opinion of the households how they anticipate the establishment of forest plantations will impact their livelihood. The study showed that all households depend on natural resources and households follow similar livelihood strategies. There were only minimal differences between the wealth classes in this study, but it was pointed out that households with various livelihood strategies were wealthier than households with only few strategies. A majority of respondents in the study believed that the forest plantations will improve the employment situation. Landry (2011) reported that two third of the respondents didn't express concern about possible decreasing land availability. In the study it was reasoned that households were generally excited about the planned investments and thus expressed negative issues only reluctantly.

In addition to those two regional studies, a Mozambique wide study on the issue of *land grabbing*, considering also forest plantation investments, has been published by Lemos (2011). This study concentrates on the issue of land acquisition by international investors for agricultural, biofuel and forestry projects. Lemos draws a very critical picture of the process and criticises weak land use rights of local communities. Main issues were occupation of land without notification of the current users and displacement of households. In some regions of Mozambique whole households had to move and even though the companies provided alternative settlements it was criticised that the displacement was carried out improperly (Lemos 2011). Employment and opening of boreholes have been mentioned as benefits and the northern regions seem to have been more satisfied with the investments than central and southern regions of Mozambique (Lemos 2011).

Sitoe (2009) identified three major causes for the land conflicts between communities and forest companies. Firstly, village chiefs had ceded land to the companies on behalf of the village without consulting the community. Secondly, companies failed to prepare a detailed map in collaboration with the communities to identify community and other land use areas. In the third place, companies deviated from the legal process of land acquisition. (Sitoe 2009). Furthermore, Sitoe mentioned in his work a positive example of successful community consultations. In the community of Chiconono<sup>2</sup> the forest company reduced their targeted area for the forest plantations, when it became evident that it would affect negatively on important community areas (Sitoe 2009).

In the Report by Overbeek (2010) it is pointed out that the establishment of forest plantations has an overall negative impact on the livelihood of the households and instead of enhancing development increases poverty. The report claims that the created employment opportunities in the region are not sufficient to compensate the loss in agricultural land for the communities. Even though this report deals with the same topic, it can only be considered with caution, since it lacks scientific methods. Still it provides a good image on how the private forest investments in Niassa are viewed by NGOs.

In summary, most studies on the impacts of forest plantations in Mozambique concentrated on the issue of land conflicts. However, in the areas where forest plantations have been already established the reduced land availability and reduced access to natural resources cannot be reversed in the near future. Thus, an evaluation on the possibilities for local communities to offset loss in natural capital with alternative livelihood strategies is necessary. Formal employment and increased economic activity can improve the local livelihoods and households' resilience towards shocks like droughts and harvest loss. Beyond the issue of land conflicts, previous studies have only little studied the perception of locals on the changes that forest investments have brought to their lives. This study tries to close those gaps for the impacts of forest investments in Niassa.

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<sup>2</sup> The village Ligogolo, which is part of the research site of this study (see section 3.1) belongs to the community of Chiconono.

## **2.4 Hypothesis**

Based on the reviewed literature following hypotheses are made and tested in the course of this study.

- (1) Local households perceive the impact of forest plantations on natural resources negatively.
- (2) Livelihood diversification for the livelihood strategies of the households has been affected positively by the introduction of forest plantations.
- (3) The introduction of forest plantations is perceived more negatively by poorer households and more positively by wealthier households.

In previous studies the establishment of forest plantations has often been discussed controversially, due to the different implications for the locals. Regarding natural resources mostly negative impacts have been reported in previous literature, which is reflected in hypothesis (1). On the other side, increasing employment has been mentioned often as a positive argument for plantations, especially in rural areas, hence it is here supposed (2) that the impacts on livelihood strategies are positive. Poorer households depend more on natural resources, thus, poorer households have a more negative perception. Employment is usually offered to people with more education and wealthier households can afford more education, thus, wealthier households benefit more easily from positive impacts on livelihood strategies. Hypothesis (3) is based on those two mentioned points.

## 3 DATA AND METHODS

### 3.1 The research site

The research area is located in the northern part of Mozambique in the province of Niassa (Figure 4). The province capital is Lichinga. Five villages were selected for the research in three different districts; Sanga, Muembe and Lichinga District. The main selection criteria for the villages were: their proximity to a forest plantation, minimum number of households and the ownership of the plantations by different companies. The villages selected for the study are Malulu (Sanga), Ligogolo, Mussafa (both Muembe), Mapaco and Colongo (both Lichinga District). In Mozambique a community can comprise several villages, but in the context of this study community is referred to as the people living in the researched villages only. Four of the chosen villages are located close to at least one forest plantations each owned by different forest companies, while up to autumn 2013 there has been no forest plantation close to Mussafa. This village acted as a control village to compare the situation without a plantation to the situation in the villages with a plantation, due to the absence of sufficient baseline data. Mussafa was chosen for this purpose, because at the time of the household survey the forest company Florestas do Planalto planned the establishment of a forest plantation close the village. The negotiations between the company and the village leader had already started. Consequently, the village was in a similar position as the other villages had been before the investments which increased the relevance of the questions also for the control village. In the following a short description with the most important characteristics of the villages is given.

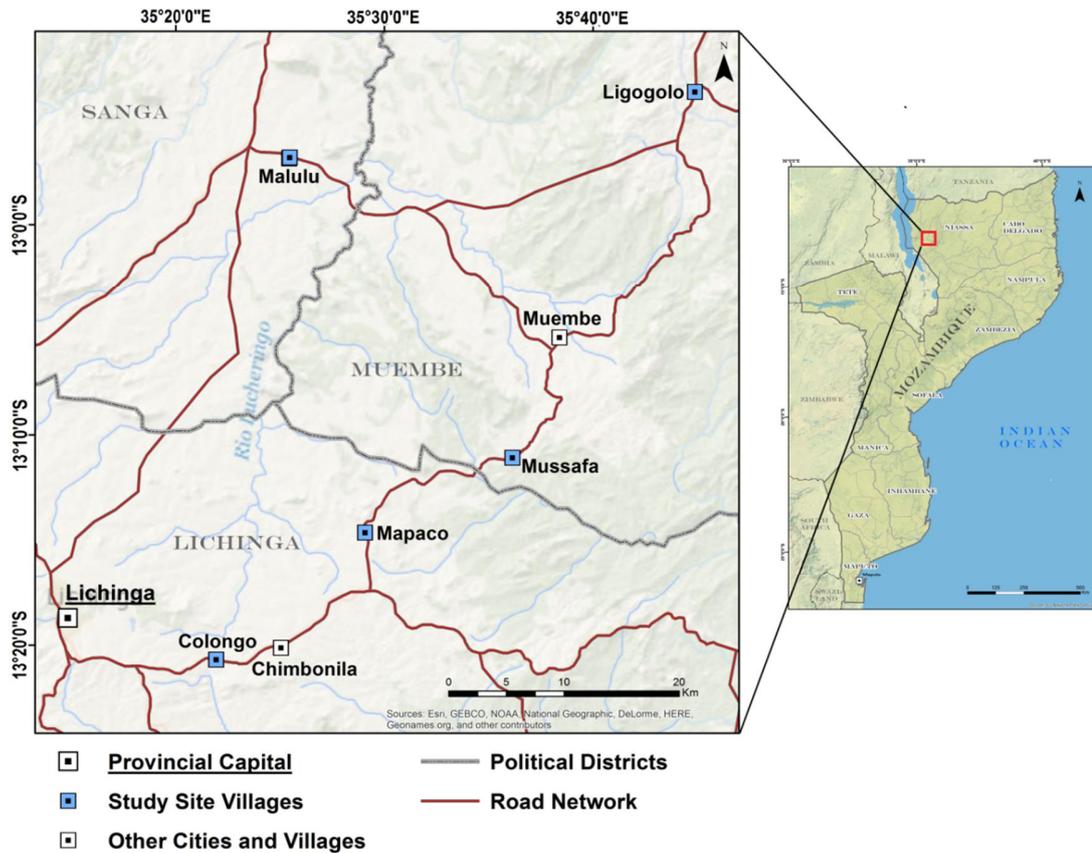


Figure 4: Map of the location of the research villages in the districts Sanga, Muembe and Lichinga in Niassa (Bergroth and Willberg 2014).

The village *Malulu* is the biggest of the villages in the study, with about 670 households. Since 2007 the forest company Green Resources has acquired land close to the village and planted eucalyptus and pine trees. In the village there are five water pumps, a hospital and secondary school for with the forest company Green Resources had sponsored a classroom with computers; some households have access to electricity.

*Ligogolo* is the village that is furthest away from the province capital Lichinga (Figure 4). The company New Forests has started planting near the village 6 years prior to the collection of data for this study. However, 90% of the tree stands in the plantations have been planted less than 3 years before. Compared to the other villages the distance between the village and the plantation is further away, which resulted from successful community consultations (Siteo 2009). Additionally, Ligogolo has still two old pine plantations that

used to belong to the state during colonial times providing the village with additional firewood. The village has health care centre and a primary school, which goes up to grade seven. The facilities of the primary schools were sponsored by New Forests in 2010.

Of all five villages *Colongo* is the one that is closest located to Lichinga (Figure 4) and additionally, to another bigger village, Chimbonila, which has a secondary school and health care facilities with a maternity wing which was built by the forest company Chikweti. Colongo is also the village that has been under the impact of forest plantations the longest. The forest company Chikweti started planting close to the village seven years prior to this study. The village has one water pump, a primary school and a health care post and is located close to the office of the company Chikweti. This also led to electrification of the village, because stable power supply was needed for the company and surrounding villages benefited.

*Mapaco* is the only village that has two different forest companies and their plantations close to the village area. The companies Florestas de Niassa and Florestas do Planalto have plantations close to the village. The plantation of Florestas does Planalto functions as a test site for the company. Mapaco is located in the Lichinga district and has about 404 households. It has two water pumps, of which one was reported to be broken. Furthermore the Village had primary school and a health care post, which was funded by the company Florestas de Niassa.

*Mussafa* (control village) didn't have a forest plantation close by at the time of the household survey. The village has one water pump and some households use a well located close to the village. There is a primary school in the village, no health care centre, but two traditional healers.

### **3.2 Data collection**

The data for this study was mainly collected in a household survey, focus group meetings and key informant interviews in Niassa. Representatives from NGOs, companies and governmental institutions were contacted for key informant interviews prior and after the

main data collection to gain different perspectives on the issue of forest investments. In the following the questionnaire, data collection process in focus group meetings and household survey as well as collected data are presented.

For the collection of household data a structured questionnaire with closed ended questions was used which can be separated into three main parts. Firstly, general household characteristics were recorded like for example number of children or number of members who are able to communicate in Portuguese. In the second part the respondents were asked about their livelihood strategies and if members of the household are formally employed either in general or specifically in one of the forest companies. The third part contained questions regarding other livelihood capitals, especially natural resources, and how the establishment of forest plantations has affected those capitals from the point of view of the interviewed person. For the household survey in the control village the questionnaire was modified with the result that instead of observed impacts respondents faced questions about expected impacts of the forest plantation. Examples for both questionnaires can be found in Appendix 2 and Appendix 3.

The questionnaires for the household survey were designed and twice tested in Finland with several volunteers from different African countries. Firstly, the duration and functioning of questions was tested. Secondly, test-respondents made comments on the relevance of questions and possible problems. Additionally, a final draft of the questionnaire was tested with different respondents in one of the research villages in Mozambique.

In each village two to three focus group meetings were held before the household survey was carried out. The purpose of the group meetings was to gain background information and get an overview of the relationship between the village and the forest plantation. Additionally, it introduced the field workers and the study to the village, with the hope to increase willingness to participate in the following household survey.

For each meeting focus groups contained 10-15 people. Groups were comprised always of

either only female or only male members, in order to prevent women from abstaining themselves from participation due to intimidation. In case enough people were present males were divided into a younger and an older group.

As main task the participants were asked to draw a hazard map of their village and surroundings including, among others, resources, important locations and potential conflict areas. Subsequently, these topics were discussed further. Each group discussion was moderated by at least one member of the project staff with the support of interpreters. Afterwards, the moderators of the different groups compared the outcomes of the group discussions. The information collected in the focus group meetings are of a general nature, but gave an insight into resource, climate and plantation issues in the villages.

For the purpose of this study the relevant sampling unit is the household rather than families to avoid overlapping, because as also people living in different places in the village might be considered part of the family. A household here comprises the members that cultivate farm land together, eat together and sleep in either the same or neighbouring houses. The members of a household make their living together, thus experience similar impacts on their livelihood. Still it needs to be mentioned that the individual respondent, answering in place of the household, has a major effect on the outcome of the survey.

The number of households in each village was obtained either from the responsible administrative posts or the village leaders. According to these numbers (Table 2), the total amount of households in all five villages was 2074. The targeted sample size for the whole household survey was set to 200 interviews, which was considered to give a sufficient overview under the given limitations of budget and time. The minimum sample size for the control village was set to 40, leaving 160 interviews for the other four villages. The number of households in each those four villages was set in relation to the sum of the households from the plantation villages to determine the minimal amount of required interviews for each village.

Table 2: Number of households corresponding targeted and actual collected sample by village

Village	District	Number of households	Minimum sample size	Actual sample
Malulu	Sanga	669	58	63
Ligogolo	Muembe	407	36	36
Colongo	Lichinga District	350	31	34
Mapaco	Lichinga District	404	35	40
Mussafa (CV)	Muembe	244	40*	45
total		2074	200	218

\* - determined preliminary separately; CV – Control village

An exhaustive list containing all households could not be acquired for all villages, thus random sampling, which would have been the desired sampling method, could not be applied. Instead systematic sampling was applied and for every village the sampling interval was chosen by dividing the number of households for the village by the targeted sample for the village and according to this, either every seventh or every fifth house was sampled. Starting from a random point houses were counted along the roads and in addition to the main roads, smaller paths beside the main road were covered in similar manner. If no eligible respondent was found in this house, the rule to go to the next following house in the row was set, only if nobody was found there either the counting was started again. With this method it was aimed to cover the whole village to achieve a higher representativeness of the population in the village.

The interviews were carried out in September and October 2013, which marks the end of the dry season in the region. During this time of the year more people can be found in the villages, because intensive farming activities start only a few weeks later with the beginning of the rainy season in November. The interview took in general between 45 and 60 minutes.

Interviews were mostly held in Chiyao, the local language, or in Portuguese with the help of interpreters, fluent in Chiyao, Portuguese and English. In addition to language skills the interpreters also possessed social skills and valuable cultural knowledge, which contributed significantly to the successful data collection.

The actual number of carried out interviews is 218 (Table 3) and additionally 24 households refused to answer the survey which marks a response rate of about 90%. A total of 218 Households were interviewed in the five villages. Of these, 108 interviews were answered by a female, 91 by a male and 19 together by female and male respondents (Table 3). About 84% of the households were male headed. Households had an average of 6 household members (Table 3). According the Mozambican National Institute for Statistics (INE 2007) the gender distribution of the population in 2007 in Niassa was 51% women and 49% men. The gender distribution of the respondents in this study is similar to this statistic (Table 3), hence both genders are represented well in this study.

Table 3: General household information of the sample by village

	Gender of the respondent in %			Gender of head of the household in %		Average household size
	Male	Female	Both	Male	Female	
Malulu	38.1	49.2	12.7	91.8	8.2	6.00
Ligogolo	50	47.2	2.8	83.9	16.1	6.14
Colongo	41.2	47.1	11.8	73.5	26.5	6.21
Mapaco	32.5	57.5	10	82.1	17.9	6.44
Mussafa (CV)	48.9	46.7	4.4	86.7	13.3	5.73
Total	41.7	49.5	8.7	84.8	15.2	6.08

CV – Control village

Assuming that the head of a household should have the best knowledge on the situation and livelihood of a household, it was desired to carry out the interviews with the head of the household. If the head of the household was not present another adult person who was present and ready to answer was chosen as respondent. In some cases husband and wife decided to respond together. However, since the majority of household is led by men, who are more often responsible for the work on the farm plot or other activities outside the house, often a women present at the house was interviewed instead. Hence, the share of female respondents is much higher than the share of female headed households, which causes a more equally balanced gender distribution (Table 3). Due to this the sample represents males as well as females in this study well.

### **3.3 Data analysis methods**

#### *3.3.1 Wealth categorization*

In order to get an overview of the economic status of the interviewed households within the dataset the households were classified in three wealth groups. Since the researched area is in one of the most rudimentary regions of Mozambique, the categorization on the basis of monetary values was not applicable. Instead, an asset based approach for wealth ranking was applied. This work employed the principal component analysis (PCA) following Filmer and Pritchett (2001) in assessing household wealth in absence of expenditure or income data.

In the first step seven indicator assets were identified based on literature review. In this study the wealth ranking was based on observed housing characteristics, fire brick house and tin roof, and durable asset endowment, including, motorbikes, television, bicycles, mobile phones and ownership of at least one other valuable asset. These assets were considered as status symbols and proxy what kind of amenities the household could afford. It was assumed that an increased wealth rank increases the quality of live and thus, the livelihood of a household. Land or livestock owned by the household were not included for the wealth ranking, because they represent investments that the household makes into livelihood strategies, not to improve the standard of living. In contrary, the primary purpose of amenities is not to create an income for the household.

Principal component analysis is usually used to reduce the number of variables and their correlation in an analysis by aiming for the orthogonal linear combinations that contain similar information (Filmer and Pritchett 2001). When applying PCA in wealth ranking, the assumption needs to be made that “the long-run wealth of a household explains the maximum variance (and covariance) in the assets variables” (Filmer and Pritchett 2001). With other words, assets with a smaller variance don’t separate the households significantly, while assets with high variance point to differences in the wealth of a population.

All variables were converted to the binary form of “1” indicating the possession of an asset by a household and “0” indicating the absence. In the case of the variable for the main material of the house, which consists of the three categories mud, sun brick and fire brick, only fire brick was considered as an amenity and coded with the value “1”. Both other categories were coded with the value “0”.

The first principle component of the PCA was then used to estimate the weights of the different household assets (Table 4). The solution explained 28.5% of the variance between the households. The higher the variance of an asset between the households the higher is also the absolute weight of the variable (McKenzie 2005). The weights for the material of the house, fire brick and tined roof, had the greatest weight, while owning a bike had the lowest weight of the included variables (Table 4).

Table 4: Principle component analysis component matrix

	Amenity weights
Bike	0.351
Motorbike	0.368
Television	0.451
Mobile phone	0.500
Fire brick house	0.762
Other valuables	0.341
Tin roof	0.771

Extraction Method: Principal Component Analysis.

The sample contained 16 missing variables due to lack of information about the roof material or main material of the house. In those cases the missing variable value was replaced with the mean of the variable. This replacement did not alter the wealth classification of the other households and the 16 cases were not lost for analysis.

Subsequently, the households were categorised into three wealth groups on the basis of their factor scores. For the separation of the groups percentiles were set to 40% and 80% forming the poorest wealth group for the lowest 40% of scores, medium wealth following from there to 80% of the lowest scores and highest wealth group for the 20% with the highest scores. The decisions for the percentiles at 40 and 80 was based firstly on the example of Filmer and Pritchett (2001), who suggested this separation due to the fact that in

developing countries the share of people with the lowest wealth is much higher than the share of people with higher wealth. Additionally, the distribution of the produced factor scores showed biasness towards lower scores (Figure 5), suggesting, that the highest wealth group should be smaller than the other two groups. All cases and the assigned wealth categories were reviewed to ensure sensibility in the categorization results. In all cases the categorization appeared suitable, for example no household with a firebrick and tin roofed house got classified in the poorest wealth group and likewise no household with only a bike and a mobile phone as amenities got classified in the highest group.

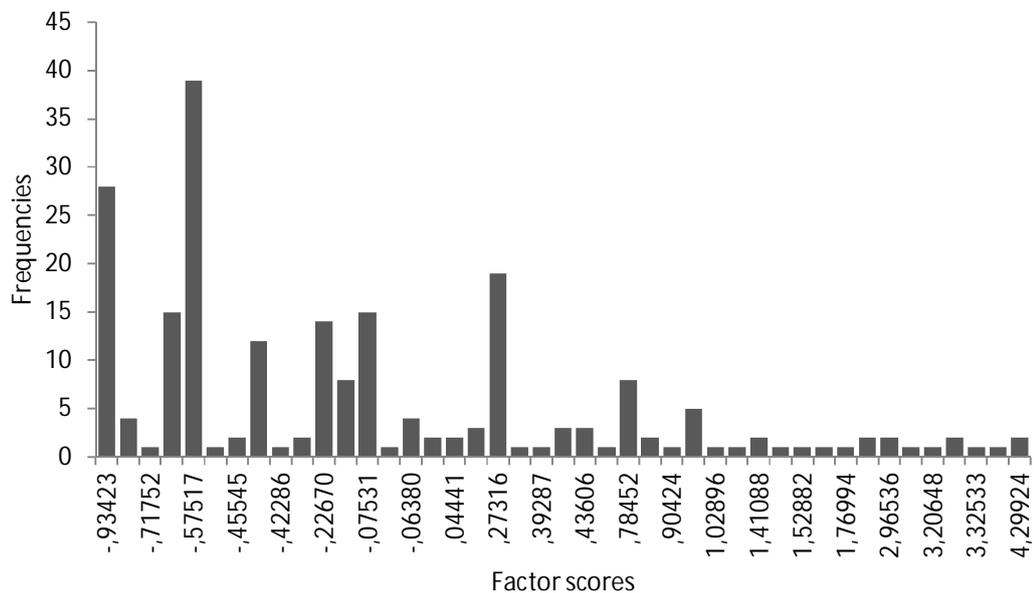


Figure 5: Distribution of factor scores resulting from principle component analysis on the wealth of households, which shows biasness towards lower factor scores.

One needs to keep in mind that the outcome of this wealth ranking is only applicable for this study and situation. It measures the relative wealth of the households in this context and due to the application of PCA the weights are customized for this data set. Additionally, this wealth ranking only accounts for one point in time, when the interviews were carried out. Especially households which invested successfully into livestock and land are likely to be able to afford more amenities in the future.

### 3.3.2 Logistic regression analysis

The central objective of this study is to analyse the perceptions of local households on the impacts of forest plantations on natural resources, livelihood strategies and overall livelihood including wealth status of the households. In order to assess those relationships logistic regression was chosen for analysis of the data, because all dependent and most of the independent variables are categorical. Logistic regression allows evaluating the effect of different factors on the perception of an impact or the membership to one of the wealth categories.

The logistic regression model is based on a logistic distribution with a s-shaped curve as the conditional mean of the output variable for dichotomous data needs to be equal or bigger than zero and equal or smaller than one (Hosmer et al. 2013). In contrast to linear regression in logistic regression the outcome variable ( $Y$ ) is transformed into logits, which is the natural logarithm of the odds of  $Y$ . The odds equal the ratio of the probability to belong to one category ( $p_i$ ) relative to the probability not to belong to the category ( $1 - p_i$ ). For dependent variables with more than two categories, the multinomial logistic regression model is applied. In this case the odds are the ratio of the probability to belong to one category ( $p_i$ ) relative to the odds to belong to a reference category ( $p_0$ ).

The logistic regression takes the form (1) with  $X_i$  being the predictors or independent variables,  $a$  the constant,  $b_i$  the estimates for the predictors, in the binomial case  $p_0$  can be replaced with  $(1 - p_i)$  where the non-occurrence is the reference category.

$$\text{Logit}(Y) = \text{Ln}\left(\frac{p_i}{p_0}\right) = a + \sum b_i * X_i \quad (1)$$

The coefficients of the predictors in logistic regression express the changes of the odds to be in one category in comparison to a reference category of the dependent variable, under the assumption that the other predictors are held constant. In logistic regression odds are usually compared in form of odd ratios (OR).

### *The model specifications*

For the assessment of the desired objectives and the stated hypotheses different models were built like shown in Table 5.

Table 5: Description of different models used in this study, their purpose and reference category

Purpose	Model	Form of model (BN/MN*)	Contrast (first mentioned is reference category)
Analysis of perceived impacts of plantations on natural resources	Farm model	BN	no negative impact reported vs. negative impact reported
	Water model	BN	no negative impact reported vs. negative impact reported
	Firewood model	BN	no negative impact reported vs. negative impact reported
	NWFP model	BN	no negative impact reported vs. negative impact reported
Analysis of impact of livelihood strategies on wealth	Wealth model	MN	highest wealth group vs. lowest wealth group; middle wealth group
Analysis of perceived overall impact on households' livelihood	Overall benefit	MN	negative reported impact vs. no reported impact; positive reported impact

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\* BN = binomial logistic regression model ; MN = multinomial logistic regression model

The models to analyse the perceived impacts of plantations on natural resources were examined with binomial models and the dependent variables were transformed into dichotomous variables. Since the main aim of this part of the analysis was the question what caused respondents to report negative impacts on natural resources, the dependent variables in the models contrasted the reporting of negative impacts (1) with the non-reporting of negative impacts (0) (Table 5). The Non-reporting of negative impacts thus included the responses “no impact”, “positive impact” and “I don’t know”.

The wealth model for the analysis of livelihood strategies and their contribution to the households' wealth was assessed with a multinomial model, because the dependent variable had three categories. In contrast to the other presented logistic regression models,

the wealth model analysis didn't have a dependent variable that was derived directly from the respondents, but instead, was computed and externally assigned like described in in the previous section (3.3.1). The reference category for the dependent variable was the highest wealth group, because the main purpose of the analysis was to identify which livelihood strategies enable households to reach higher wealth standards.

For the wealth analysis an ordinal logit model would have been appropriate, because the outcome categories are ordered. An ordinal logistic regression model in this case the proportional odds model would allow a simpler interpretation of the results, because it contrasts a higher class to a less than or equal to in contrast to a higher class (Hosmer et al. 2013). When applying the ordinal model the assumption of proportional odds needs to be made and tested with the parallel lines test. For this model the test of parallel lines produced a significant ( $p \leq 0.05$ ) result, hence the assumption of proportional odds is violated. Like suggested in Hosmer et al. (2013) the multinomial logistic regression was chosen as the alternative. For the purpose of this study the analysis with a multinomial logistic regression model is sufficient, since the contrast between the wealthiest and the other two groups should be emphasized.

The perception of the overall impact is assessed with a multinomial regression model, as there are more than two response categories (Table 5). Twelve respondents were not able to evaluate the overall impact on their household and are omitted in the analysis, since no significant explanation could be found. The main target of the analysis is the impact of wealth on the perception of overall benefit from forest plantations. Furthermore, the negative reported impact was chosen as reference category (Table 5),

Theoretical considerations and preliminary statistical analysis were used to identify possible independent variables on basis of significant relationships with the dependent variables. Significances for the logistic regression models are reported in this study at the levels 10%, 5% and 1% for the p-values, instead of the conventionally used risk levels of 5%, 1% and 0.1%. Including the 10% risk level allows to consider factors that are close to the 5% level and otherwise would have been omitted, but which might contain valuable

information for the analysis of the model. In order to assess the goodness of fit and eligibility of predictors McFadden pseudo  $R^2$ , Hosmer-Lemeshow test, maximum likelihood ratio test and  $-2 \log$  likelihood are used as statistical measures. The final model was controlled with variables like the gender of the respondent, gender of the head of the household, wealth class, household size and others. The SPSS program PASW Statistics 18 was used for the basic statistical as well as the regression analysis and the principal component analysis. If not differently specified, the p-values are based on Pearson chi-squared test.

## 4 RESULTS

### 4.1 General household information

Most of the households in the study live in a sun brick house with grass thatched roof. Only few households can afford a house made out of fire bricks and tin roofed as presented in Figure 6. While in Malulu the share of houses with out of fire bricks is highest, nobody owns a firebrick house in the control village Mussafa (Figure 6). Of the households that have a member employed in a forest company 18.5% reported to have built a new house since the employment started.

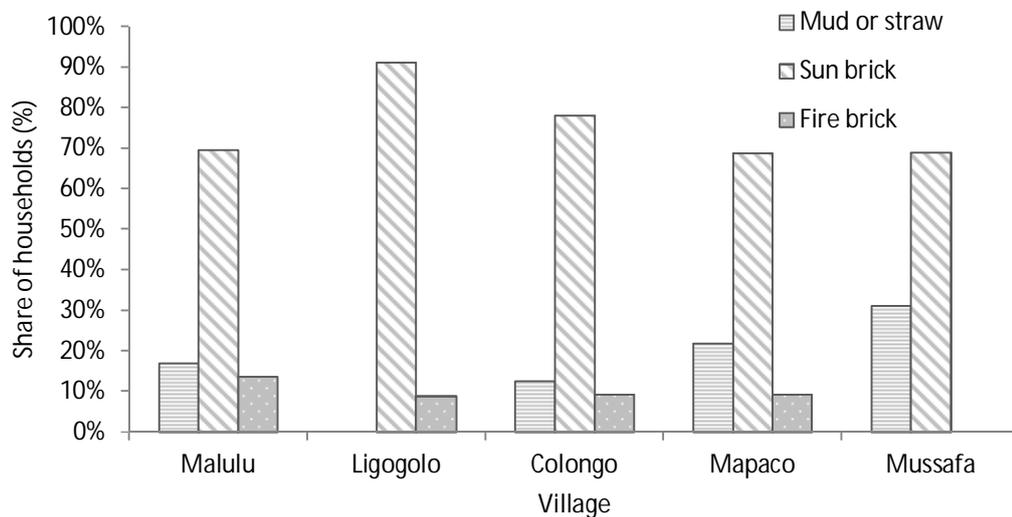


Figure 6: Main material of the house by village

The analysis of the created wealth groups showed that some households with certain characteristics are more often in the poorer wealth groups than others. A significant ( $p \leq 0.05$ ) difference between the gender of the head of the household and the wealth categories was found. About 60% of the female headed households were categorized in the poorest wealth group, only 6.3% in the highest wealth group.

A similar differentiation can be observed between different age groups of the respondents. Of all the people categorised in the oldest age group 71% belonged to a household in the poorest wealth group. None of them belonged to a household in the wealthiest group. The

respondents in the youngest and middle classified age groups were distributed more equally than the older respondents. The data on the age of the respondents is not as representative as other data, since the information is missing for about 44% of the cases.

Table 6: Distribution of wealth categories in the Villages

Village	Lowest wealth group (share in wealth group)	Middle wealth group (share in wealth group)	Highest wealth group (share in wealth group)
Malulu	30.2% (21.8%)	38.1% (32.0%)	31.7% (35.7%)
Ligogolo	25.0% (10.3%)	47.2% (22.7%)	27.8% (17.9%)
Colongo	55.9% (21.8%)	11.8% (5.3%)	32.4% (19.6%)
Mapaco	57.5% (26.4%)	27.5% (14.7%)	15.0% (10.7%)
Mussafa (CV)	37.8% (19.5%)	42.2% (25.3%)	20.0% (16.1%)

CV – Control village

Significant ( $p \leq 0.01$ ) differences were also found between the wealth groups in the villages (Table 6). Mapaco has the highest share of people in the lowest wealth group and simultaneously the lowest share of people in the highest wealth group (Table 6). In contrary, the share of people in the lowest group in Colongo is almost as high as in Mapaco, but the share in the highest wealth group is higher than in other villages as well (Table 6). Most of the households categorized in the highest wealth group live in Malulu (Table 6). The wealth groups in the control village Mussafa don't show great differences compared to the other villages. The share of households in the highest wealth group is the second lowest, but the share in the middle wealth group is the second highest (Table 6).

Households in higher wealth groups have significantly ( $p \leq 0.01$ ) more human capital in form of education. More than half of the households in the highest wealth group have an education score higher than average, whereas less than one third of the lowest wealth group have an education score higher than average.

The most common cultivated crops are maize and beans which are produced by almost all households and simultaneously are also used as cash crops more often than other crops (Figure 7). Households from higher wealth groups cultivate a higher variety of crops than households from the poorest wealth group ( $p \leq 0.05$ ).

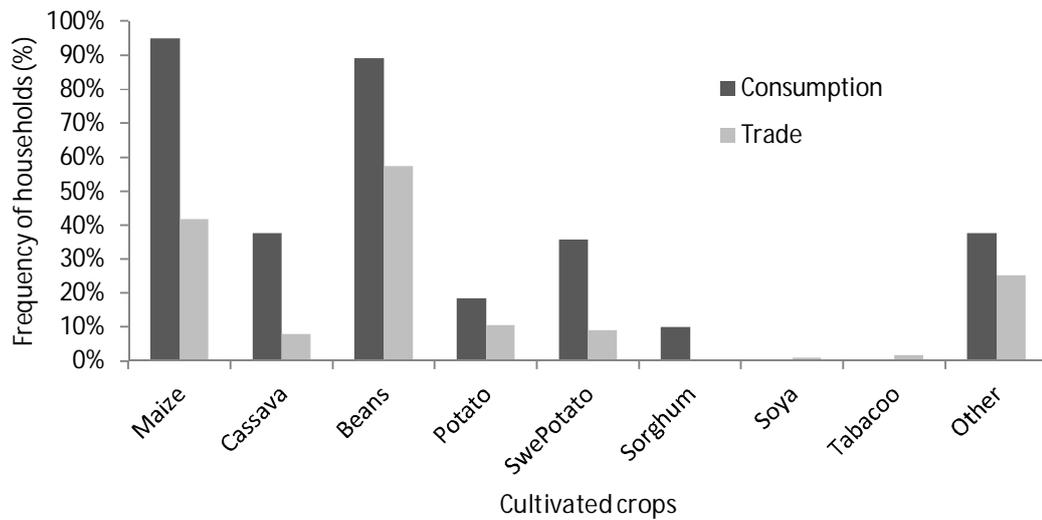


Figure 7: Frequency of crops cultivated by the households for own consumption and trade.

#### 4.2 Perceived impacts on natural capitals

This section will mainly present the results testing the hypothesis (1), whether the establishment of forest plantations has impacted negatively on natural capital of local households. Firstly, an overview over the natural resource in question and its use by the households is given. Secondly, the perceived impact on the resource by the forest plantations is assessed.

*Farm land* is one of the most important livelihood capitals for rural households, as it provides the basis for farming activities. All except seven households in this study own at least one farm plot. In average the interviewed households cultivate 1.57 farm plots. However, almost half of the households manage only one plot, while about 10% claimed to have three farm plots (Table 7). In the control village the share of households with a third field is higher than in the villages close to a forest plantation (Table 7).

Table 7: Number of plots owned by households by village

Village	No plot	1 Plot	2 Plots	3 or more plots
Malulu	4.8%	69.8%	20.6%	4.8%
Ligogolo	2.8%	50.0%	38.9%	8.3%
Colongo	2.9%	26.5%	61.8%	8.8%
Mapaco	2.5%	22.5%	67.5%	7.5%
Mussafa (CV)	2.2%	48.9%	24.4%	24.4%
Total	3.2%	46.8%	39.4%	10.6%

CV - Control village

Shifting agriculture is the common practice; respectively respondents in this study had occupied their current plots in average for about 5 years. According to this study, occupation of free or abandoned land is in 3 out of 4 cases the main procedure to acquire land for new farm plots. During all the interviews merely two people claimed to possess a DUAT for at least one of their farm plots. Most households were not familiar with the concept of DUATs as land use rights.

An increasing scarce of land in some villages became evident during the interviews. Almost every second of the respondents in Colongo expressed not to have sufficient farm land to provide food for the whole year for their household. In the other villages with a plantation close by about every fourth or less of the households reported a lack of land for their household. The lowest rate, however, was found in the control village where only 9% of the households reported a scarce of land.

The establishment of forest plantations has impacted the land availability negatively in the opinion of more than half of the respondents in all villages (Table 8). During the Focus group meetings the impact on farm land availability was identified and perceived in two main forms. Firstly, greater land areas were occupied by plantations and thus no longer available for potential establishment of new farm land in context of shifting cultivation. Secondly, individual households had to relocate their farm plot in order to make space for the forest plantations. With the establishment of the plantations the households in the communities lost access as well as control over the occupied area. The issues impacting on

the likelihood to report negative impacts on land availability were examined using logistic regression analysis and the results are presented in Table 10.

The perceived impacts on the availability of farm land differ greatly between the villages (Table 8). In Colongo and Mapaco a great majority of households claims that the forest plantations have impacted the land availability negatively. In Ligogolo, on the other hand, more than three quarters don't think that the forest plantations have impacted the land availability (Table 8).

Table 8: Perceived impacts on land availability by village

Village	No impact	Negative impact	I don't know
Malulu	58.1%	38.7%	3.2%
Ligogolo	77.8%	22.2%	0%
Colongo	9.1%	87.9%	3%
Mapaco	12.5%	87.5%	0%
Total	42.1%	56.1%	1.8%

One of the main reasons for the differences between the villages is that local people had to give up their farm plots for the forest plantations. Households that had been relocated have 3.8 times higher odds to report negative impact on land availability, at a risk level of 5% (Table 10). In Colongo and Mapaco the highest proportions of people which had to give up farm land for the forest plantations could be found (Table 9). Ligogolo has the lowest rate of the four villages, which is partly due to the fact that the forest plantation is established further away than in the other villages, as a result of successful community consultations.

Table 9: Share of relocated and compensated households by village

Village	Relocated farm land	Compensated (of those who relocated)
Malulu	14.8%	57.1%
Ligogolo	5.6%	0%
Colongo	44.1%	21.4%
Mapaco	37.5%	0%
Total	24%	18%

In addition to the households who actually had to relocate their farm plot the context of high relocation in a village affects the perception of households which didn't have to give up farm land themselves. It is here assumed that the higher share of relocation in the village causes also other households to report negative impacts as they observe other households giving up their farm land. In order to analyze the effect of the contextual relocation, a dummy variable for a high share of relocation in the village is introduced. Mapaco and Colongo have high shares of households which had to relocate farm land compared to Malulu and Ligogolo, where the share of relocated farm land is relatively low (Table 9). The results from the logistic regression analysis show that households from villages with high share of relocation have 16.7 times higher odds to report negative impacts than households from villages with small relocation shares (Table 10).

At the same time, in Malulu and Colongo some of the respondents reported to have received compensation for given up land. During consultations with the forest companies it was stated that companies generally don't compensate the villagers personally, but compensation is offered in form of support for the whole community, for example by sponsoring a new school building. The majority of relocated households searched for new land by themselves, but 75% had to walk a longer distance to the new plot and half of the new acquired plots were smaller than the previous one.

Table 10: Logistic regression model on perceived impacts on farm land with non-reporting of negative impacts as reference category.

Reporting negative impact on farm land				95% C.I. for EXP(B)	
	B	Sig.	Exp(B)	Lower	Upper
Household sells crops	.796	.090	2.22	.883	5.568
Household had to relocate farm plot	1.345	.027	3.84	1.164	12.665
Household lives in a village with high relocation rate	2.819	.000	16.76	6.321	44.414
Number of household members	.138	.066	1.15	.991	1.330
Household owns livestock	.770	.087	2.16	.895	5.205
Constant	-2.520	.000	.08		

n=160; reference category for dependent variable: non-reporting of negative impacts; -2Log-likelihood: 144.626; Hosmer-Lemeshow test 0.754; C.I. = Confidence Interval

The number of household members is significant only at a 10% risk level and thus its contribution to the model is weaker than for the other variables (Table 10). The coefficient is positive; hence higher number of household members increases the odds to report negative impacts as. The bigger the household the more food needs to be produced on the farm plots and thus bigger families are more dependent on the land availability.

Similarly, a higher number of livestock that a household owns increase the odds to report negative impacts significantly ( $p \leq 0.05$ ) (Table 10). Even though most of the livestock is running free in the village, some supplementary fodder needs to be provided or in the case of cattle pastures, hence households with livestock are also dependent on land and more likely to report negative impacts.

*Firewood* is the most important fuel for the households and most of the respondents use only firewood for cooking and only about 12 % reported to use charcoal in addition to firewood. None of the households uses exclusively charcoal as their main fuel. In Ligogolo the share of people using firewood and in addition charcoal is the highest with 22.2 %.

The majority of the interviewed households in the villages close to the plantations think that the forest plantations have impacted negatively on the firewood availability (Table 11). The perception of impact on firewood varies between the villages (Table 11). Statistical cross tabulation analysis, as well as logistic regression analysis has shown that the village of the respondents is the main factor determining the perception of impacts. The logistic regression model was reduced only to the villages and is thus not presented here.

Table 11: Perception of impacts on firewood availability by village

Village	Negative impact	No impact	Positive impact
Malulu	88.9%	7.9%	3.2%
Ligogolo	41.7%	52.8%	5.6%
Colongo	88.2%	11.8%	0%
Mapaco	92.5%	7.5%	0%
Total	79.8%	17.9%	2.3%

In contrast to other villages, more than half of the respondents in Ligogolo didn't express concern about impacts on firewood. In connection with this stands the origin of firewood, which includes the information whether the household uses a different source for their firewood than the natural forest. In Ligogolo many people use old plantations from colonial times as an additional source for firewood. Hence the rate of perceived negative impacts is lower than in the other villages.

During focus group meetings as well as individual interviews the impact was described as, on one hand, decreasing natural forest area and, on the other hand, restricting the access to natural forest area. As a result households often had to walk longer distances either to reach the border of the decreasing natural forest or because the direct way to the plantation was occupied by the plantation. In most cases the villagers were prohibited to enter the plantation area and thus had to walk around.

In the focus group meetings the villagers were asked to make indication on the hazard map about the development of the forest cover over the past decades. Especially in Mapaco and Malulu the villagers reported that there had been a thick forest around the village about 20-30 years ago. But with growing population the forest cover had been reduced constantly already for years before forest companies have started introducing plantations. Firewood collection for cooking, but also charcoal production and greater need for farmland were mentioned as main drivers for deforestation around the villages. Nevertheless, the communities reported in the focus group meetings that for the establishment of forest plantations natural forest area is reduced or degraded woodlands are converted into plantation land. Abandoned farm plots, for example, contained trees and dead wood providing additional sources of firewood for the households.

*Water* is essential for human live and very valuable in rural areas. The villages are differently equipped with pumps, which are seen as the safest source of water in this context. In the focus group meetings people gave various reasons for not using the pump as their main water source. Firstly, the proportion of pumps to the inhabitants of the villages is inappropriate and causes long waiting times, thus, people decide to use alternative water

sources. Secondly, in four of the five villages people reported non-functioning, stolen or dried up pumps, which forces people to use alternative sources. As third reason, in many cases people have to pay a small contribution, if they want to use the pump. Especially poorer households refuse or are not able to afford the usage of a water pump.

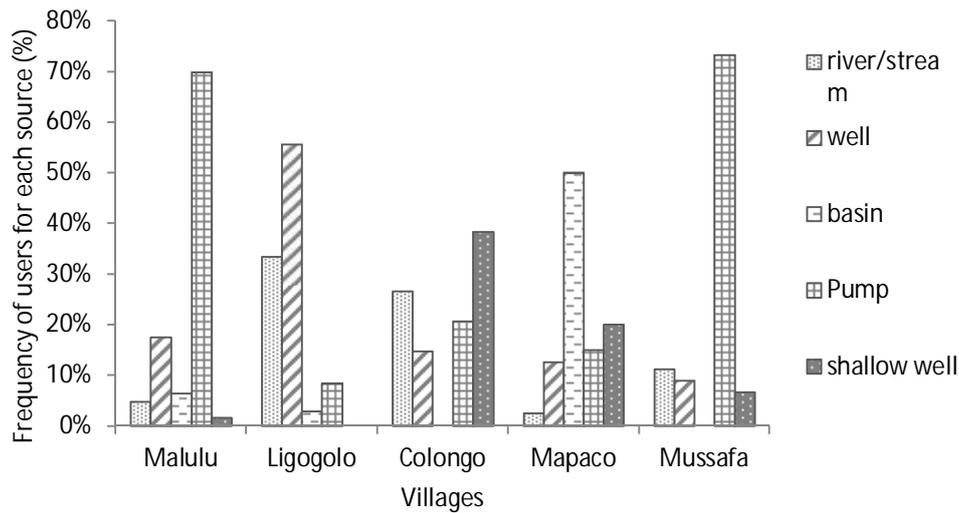


Figure 8: Share of households using different water sources by village.

The highest shares of households using the pump in the wet season has been observed in Mussafa, where almost three out of four people use the pump as their main source and in Malulu, where about 70% use the pump (Figure 8). The lowest rate was found in Ligogolo where people use mainly wells or the close-by river (Figure 8). In all villages households reported to need more time for water collection during the dry season. In general, around 30% of the interviewed households stated to need at least one hour more for the collection of water during the dry season.

Two third of the households are not satisfied with the available water supply. In Malulu only about 21% state to be satisfied, while in Colongo almost half of the people is satisfied with the water sources. The statistics on the water sources in the villages shows that the water situation is on a low level and presents a great concern and problem in the communities.

Table 12: Perceived impacts on domestic water availability by village

	No impact	Negative impact	Positive impact	I dont know
Malulu	65.1%	9.5%	1.6%	23.8%
Ligogolo	63.9%	5.6%	0%	30.6%
Colongo	55.9%	41.2%	0%	2.9%
Mapaco	52.5%	40.0%	0%	7.5%
Total	60.1%	21.9%	0.6%	17.3%

Regarding the perceived impact of forest plantation on the water sources more than half of the people in the villages didn't report any impacts. For the domestic consumption 60% of the households didn't observe impacts and only about every fifth reported negative impacts (Table 12). Reasons for perceived negative impact were usually given as decreased rain due to the plantation, usage of water sources by the forest company in case of fire emergency or decreasing water level because of the water use of the trees.

Of all natural resources analysis in this study the perceived impacts of forest plantations on water availability has been one of the most difficult for the respondents. This becomes evident when looking at the rate of people who were not able to evaluate the impact on water and answered with "I don't know" (Table 12). Thus the following model, presented in Table 13, displays the difference between no-negative impacts reported, as reference category, and negative reported impacts.

Table 13: Logistic regression model on perceived impacts on water with non-reporting of negative impacts as reference category.

	B	Sig.	Exp(B)	95% C.I. for EXP(B)	
				Lower	Upper
Household lives in a village with high relocation rate	1.806	.000	6.088	2.405	15.410
Male respondent present	.805	.067	2.238	.944	5.303
Household had to relocate farm plot	1.497	.001	4.470	1.903	10.500
Constant	-3.228	.000	.040		

n=171; reference category for dependent variable: non-reporting of negative impacts; -2 Log Likelihood 139.698; Hosmer lemeshow : p=.914; C.I. = Confidence Interval

Similarly to the perception of farm land the shares of reported negative perception are high in Colongo and Mapaco, but low in Ligogolo and Malulu. Hence, the same context variable was used measuring the effect of relocation in the village. The analysis with logistic regression revealed a strong effect of relocation on the perception of impacts on water (Table 13). Even though the impacts on water availability are not related to the relocation of farm land, individual relocation of the farm plot by a household as well as living in a village with high relocation rate increased the odds to report negative impact on water sources significantly ( $p \leq .001$ ) (Table 13). Households who had to move their farm land have 4.4 times higher odds to report negative impacts on domestic water availability than households who have not been relocated (Table 13). The reason for this might be that respondents transfer the negative experience of relocation to a general attitude towards forest plantations and hence more often report negative impacts than other households.

If the respondent is male or if at least a male was present at the time of the questionnaire the odds that negative impacts on water collection were reported are significantly ( $p \leq .1$ ) higher (Table 13). In general, women and children are responsible for the collection of water, thus it is assumed that they are able to evaluate the development of the water availability better. Hence, it is possible that male respondents reported negative impacts due to other reasons, although they were informed about the actual impact.

The collection of *non-wood-forest products* varies between households and villages. The proportion of people collecting a product depends, firstly, on the occurrence of this product close to the village and, secondly, on traditions and need for the product. The share of households collecting various forest products is presented in Figure 9 for the most frequent products. Grass, which is used to thatch the houses, is collected by almost everybody in the villages (Figure 9), while for example the collection of wild fruits and mushrooms differs greatly between the villages. However, for almost all NWFP the highest share of collecting can be found in the control village Mussafa, which is due to higher proximity and extend of natural forest to the village.

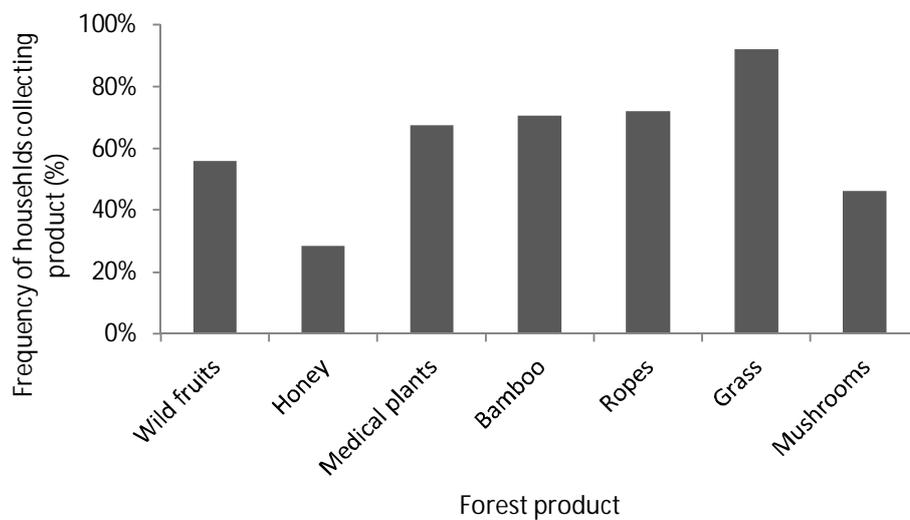


Figure 9: Share of households collecting non wood forest products.

Figure 10 shows that most of the households collect at least two different kinds NWFP. Only very few households stated to not collect any products at all, most of them come from the village Malulu. This shows that almost all households make use and to some extent depend on the resources from the forest.

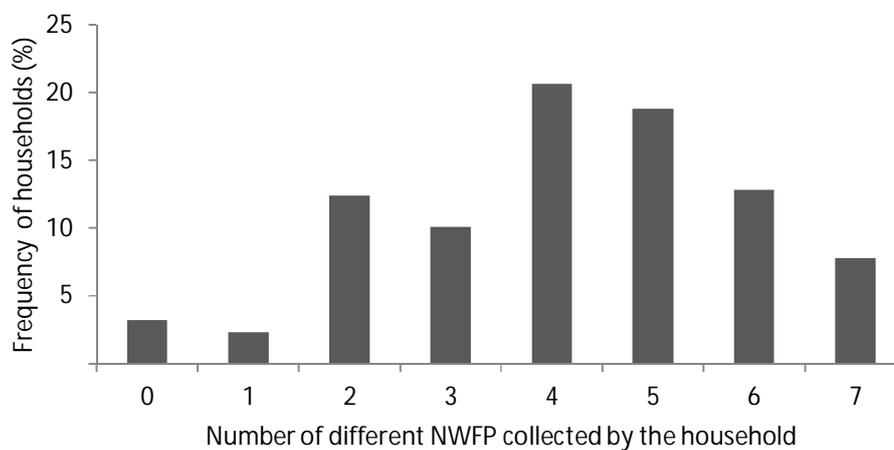


Figure 10: Number of different NWFP collected by the households.

The impact on NWFP by forest plantations was experienced negatively by more than half of the households. Similar to the perceived impacts on firewood the negative impacts were reported in form of decreasing natural forest or longer distances towards natural forest due

to limited access in the plantations. The results of the logistic regression for the perceived impacts on non-wood forest products are presented in Table 14. The model was tested with all variables for the different non-wood forest products that were measured, like for example the collection of mushrooms, grass, ropes or bamboo. The collection of medical plants has turned out to be the only significant predictor.<sup>3</sup>

Table 14: Logistic regression model on the perceived impacts on NWFP with non-reporting of negative impacts as reference category

	B	Sig.	Exp(B)	95% C.I. for EXP(B)	
				Lower	Upper
Number of collected NWFP	.357	.016	1.430	1.068	1.913
Malulu	2.315	.000	10.126	2.965	34.583
Colongo	3.394	.000	29.797	6.349	139.85
Mapaco	3.453	.000	31.597	8.026	124.39
Household member has been sick	-.991	.015	.371	.167	.827
Household collects medical plants	-.952	.038	.386	.157	.948
Constant	-2.188	.003	.112		

n=165 -2 Log likelihood: 163.356; Hosmer and Lemeshow test: p=0.791; C.I.= Confidence Interval

Like for the other natural resources, the perceived impact on non-wood forest products varies between the villages. For Colongo and Mapaco about 80% of the households have reported negative impact, in Malulu still more than half of the households, whereas in Ligogolo only about every eight respondent reported negative impacts on non-wood forest products (Table 15).

This model does not apply the same context variable as the farm and the water model, because unlike in the other two models the rate of negative perceived impact in Malulu is relatively high compared to its low relocation rate. Thus, an aggregated context variable would not be applicable. Ligogolo is the reference category for the logistic regression analysis and the other villages are set in contrast to Ligogolo. If the respondents are from

<sup>3</sup> A dimension reduction of the 9 different measured non-wood forest products was tested with factor analysis with varimax rotation, but no sensible factor solution could be found.

another village than Ligogolo the odds to report negative impacts on non-wood forest products are higher than for the people in Ligogolo (Table 14).

Table 15: Perceived impacts on NWFP by village

Village	Negative impact	No impact	Positive impact	I don't know
Malulu	54%	43%	3%	0%
Ligogolo	11.4%	80%	0%	8.6%
Colongo	82.4%	14.7%	0%	2.9%
Mapaco	80%	15%	2.5%	2.5%
Total	57%	38%	2%	2.9%

The more different kinds of non-wood forest products a household is collecting, the more the odds to report negative impact on this resource are increased. For every different product that is collected additionally, the odds to report negative impact increase by a factor of 1.4 (Table 14).

Households who have collected medical plants or where a household member has been seriously sick during the past year have decreased odds to report negative impacts (Table 14). No significant correlation could be found between sickness and medical plant collection, but of the households who have had sick members about two third have collected medical plants. An interaction effect of sickness and collection of medical plants was tested with the model, but found insignificant. A reason for the negative sign could be that those households have recently been in the forest collecting medical plants and that for medical plants no crucial reduction can be observed.

In summary, many households perceived negative changes in the availability of the resources, especially concerning farm land and forest. All households seem to depend on natural resources regardless of their socio-economic background, hence wealth status, education or gender of the head of the household play no major role in the perception of impacts. However, the perception varies greatly between the villages and some villages seem to have been impacted stronger than others. The initial natural resource endowment of a village and the relocation of farm land seem to mark the main differences between the

villages. In some of the villages the natural resources have been scarce already before the introduction of forest plantations. Nevertheless, the forest plantations seem to have compounded the situation. Simultaneously, individual as well as contextual relocation affect the attitude of the villagers towards the companies. In Villages with high relocation rates many households reported negative impacts also on other natural resources besides land.

### **4.3 Livelihood strategy diversification and its impact on the wealth of a household**

In the following the second hypothesis, whether livelihood diversification for the livelihood strategies of the households has been affected positively by the introduction of forest plantations, is tested. Firstly, different livelihood strategies found in the villages are presented and the impact of plantations on them is analysed shortly. Subsequently, the logistic regression of wealth categories is presented which provides an insight on the importance of various strategies for wealth of a household.

*Farming* is seen as the most important livelihood strategy. According to the analysis of this study, with only few exceptions all households cultivate crops as their main livelihood strategy. While about a quarter of the households cultivate crops only for their own consumption, the rest regularly sell part of their harvest in order to increase the income for their household. Like shown in Table 16, the rate of households who are selling part of their harvest is significantly ( $p \leq 0.05$ ) higher in the control village.

Table 16: Share of people selling part of their harvest by village

Village	Not sell crops	Sells crops
Malulu	31%	69%
Ligogolo	37%	63%
Colongo	34%	66%
Mapaco	25%	75%
Mussafa (CV)	11%	89%
Total	27%	73%

Kendall's tau-b sig:  $p=0.014$ ; CV - Control village

As presented in the previous section 4.2, the availability of farm land has been perceived to be impacted negatively by the forest plantation establishment; hence also the farming activities are impacted negatively.

*Livestock keeping* as a livelihood strategy is carried out by less than half of the households in the villages. Of all households 39% owned at least one different kind of livestock and about 15% owned more than one different kind of livestock. Compared to the south of the country, cattle is uncommon in Niassa and additionally expensive, therefore, only four households owned cattle. Furthermore, in the control village a group of men had jointly applied for a loan from the government and bought 10 animals of cattle, which, they hold together. The highest share of households without any kind of livestock was found in Colongo with 70%.

For none of the household the livestock has been seen as the main income sources. Livestock is usually categorized as a financial asset, because it can relatively fast be converted into cash. Households sell part of the animals mostly in times of need for money or food shortage, for example after crop failure or death of family members. The differences between the owned livestock and the one that is farmed for sale are presented in Figure 11. The share of goats and cattle that is sold is higher than the shares for other animals.

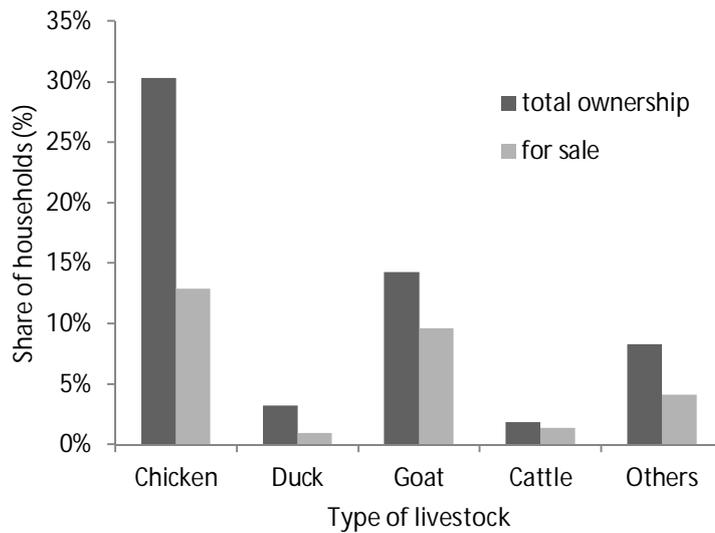


Figure 11: Share of households that own livestock and share of households which sell livestock by type of livestock.

*Charcoal production* has been increased over the past years in the region and put additional pressure on the natural forests. For households in the study area charcoal can provide additional income, but unsustainable use will limit the possibilities for this livelihood activity in the future.

Of all households in the survey less than a third produces charcoal; the highest share is produces in Mussafa, the lowest in Ligogolo (Table 17). In contrast to the results for the production of charcoal, Ligogolo has the highest share of people purchasing charcoal, while in Mussafa this rate is the lowest (Table 17). Overall, the number of people producing charcoal compared to people using charcoal is much higher. This is due to the fact, that produced charcoal is not used by the household itself, but sold, usually in the province capital Lichinga where the price is up to three times higher than in the villages.

Table 17: Production and purchase of charcoal by village in percent

	Produce charcoal	Purchase charcoal
Malulu	19.4%	11.1%
Ligogolo	8.3%	22.2%
Colongo	26.5%	8.8%
Mapaco	35 %	7.5%
Mussafa (CV)	62.2%	2.2%
Total	30.4%	10.1%

CV – Control village

Since the Charcoal production is based on the endowment of forest area, in villages where negative impacts and reduced forest cover were reported, possibilities for charcoal production have been limited.

Some households have members which have *special skills* that can create an additional income for the family. In Malulu every second household possesses at least one skill, whereas in Mapaco or Ligogolo only every fourth household possesses any skills. Most common skills are cooking, brick making and carpentry (Figure 12). Cooking refers to households where females produce small pastries to sell them. Some of the skills are unevenly distributed over the villages. Of the 17 households that have a brick maker 15 live in Malulu and the other two in Mapaco.

People working in the forest companies are usually carrying out easy tasks like planting or guarding. Three of the workers employed in a forest company claimed that they have been trained by the forest company and gained skills like driving and sawing. All three come from Mapaco and had been trained by the company Florestas de Niassa.

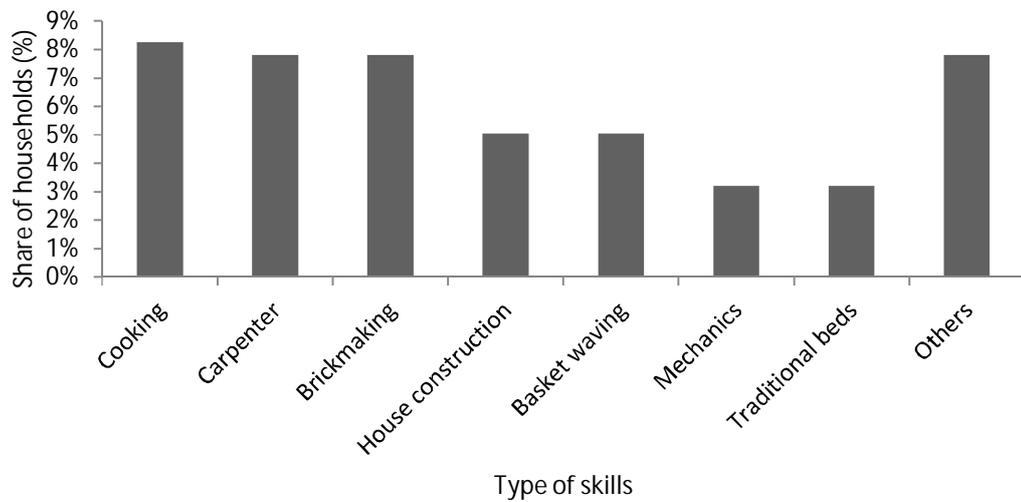


Figure 12: Share of households which possess skills by type of skill.

Even though possessing a skill offers the household alternative income strategies, some of the skills are depending on natural resources, mainly from the forest. People with carpentry skills or who produce traditional beds, use materials from the forest, like for example bamboo and ropes.

#### *Formal employment*

Some people in the villages are formally employed and gain a regular salary. Formal employment includes the engagement in a forest company as well as jobs like teachers or police officers. Piece work or independent jobs, like house construction, are not counted here, but considered in other categories.

Overall 23.4% of all respondents have a member in their household with formal employment (Table 18). Of all households who have formally employed members, 60% have members employed in a forest company. In total 31 households have members who work for a forest company (Table 18). The share of people working for a forest company is similar in the villages with a forest plantation close by and they vary between 12 % and 20% (Table 18). Surprisingly, also households in the control village Mussafa have members who have found employment in a forest company. They are rare cases, where people work for a company in other communities further away from the village.

There are no significant differences between the villages regarding formal employment or current employment in the forest companies. In contrary, the differences between the villages regarding previous forest company employment are significant ( $p \leq 0.05$ ). In Malulu, Colongo and Ligogolo the shares of households with at least one member formally employed are higher compared to Mussafa and Mapaco (Table 18).

Table 18: Employment situation in the villages

Village	Formal employment (in %)	Employment in a forest company (in %)	Previous employment in a forest company (in %)
Malulu	28.6%	17.5%	22.2%
Ligogolo	25.0%	19.4%	22.2%
Colongo	29.4%	14.7%	35.3%
Mapaco	17.5%	12.5%	22.5%
Mussafa (CV)	15.6%	6.7%	0%
Total	23.4%	14.2%	19.7%

CV - Control village

Comparing the share of people who are currently employed in a forest company to the share of people who used to be employed previously it becomes evident that the figures for previous employment are higher in all plantation villages. The greatest difference between current and former employment can be found in Colongo where previously about 35% of the households had a job in the forest company but in autumn 2013 less than 15% of all households in Colongo were employed. The possible reason is that, in general, work on the plantations only requires a high workload in the initial phase when cleaning the area and actually planting the seedlings. Hence, many lost their employment after a few years, when fewer work forces in the plantation were required. About 70% of the currently employed households in Colongo have been in the company for at least 3 years.

Overall, in the villages with a forest plantation 75% of the respondents believe that the introduction of forest plantations has improved the employment situation for their community (Figure 13). The highest rate of positively perceived impact was found in Colongo with almost 90% and the lowest in Malulu where only every second out of three respondents reported positive impacts on employment. Unlike in the case of natural

resources the positive impact on employment is more easily accountable, since the created job opportunities would not have been there without the forest companies.

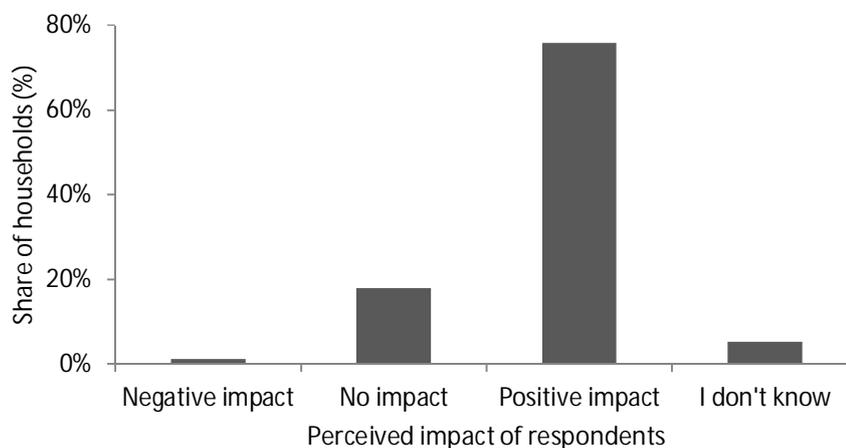


Figure 13: Perceived impact on the employment situation in the villages close to a plantation.

*Trading and business activities* comprise an important form of livelihood strategies, because they enable a household to be self-employed and in some cases be less dependent on their farming activities.

The main trading activity that can be found in the villages is selling of harvested crops; however, the selling of crops is not included at this point, as most households only sell crops if they have produced a surplus. In the context of this study the trading and business activities consider the trade of common goods like for example soap, clothing or salt and additionally business activity like the ownership of a maize mill or doing piece work.

Overall 15.6% of the respondents reported that their households are engaged in some kind of business activity (Table 19). A comparison of villages regarding the share of people engaged in business activities (Table 19) showed that there is less business activity in the control village Mussafa. The difference between the villages regarding their share of households with business activities is significant at a 10% risk level ( $P=0.084$ ).

Trading and business activities are indirectly affected by the forest plantations. Households that have members employed in the forest company increased their share of purchased farm goods, but additionally also bought more other products like soap and clothing are traded more often according to the villagers, because of the increased cash flow.

Table 19: Share of households engaged in business or trading activities by village

Village	Engaged in Business activities
Malulu	14.3%
Ligogolo	25%
Colongo	14.7%
Mapaco	22.5%
Mussafa (CV)	4.4%
Total	15.6%

CV – Control village

Overall the respondents from the villages close to a forest plantation perceived positive impacts on the trading possibilities by the forest plantations (Table 20). According to the perceived impacts, households in Colongo have benefited more than households in the other villages from improved trading possibilities. Additionally, the higher share of business activities in the plantation villages compared to the control village indicates that forest plantations have impacted positively on the trading and market possibilities of the locals.

Table 20: Perceived impact on trading and market possibilities

Village	Negative impact	No impact	Positive impact	I don't know
Malulu	4.8%	47.6%	31.7%	15.9%
Ligogolo	0%	54.3%	31.4%	14.3%
Colongo	2.9%	17.6%	73.5%	5.9%
Mapaco	2.5%	40%	47.5%	10%
Total	2.9%	41.3%	43.6%	12.2%

P=0.013

The wealth model shows which livelihood strategies cause households to belong to the highest wealth group and not to a lower wealth group. The emphasis is here on the

predictors related to livelihood strategies impacted by forest plantations. The result of the multinomial logistic regression analysis is presented in Table 21.

Possessing a higher number of livestock significantly ( $p \leq .01$ ) increases the odds for the households to be in the highest wealth group rather than the lowest (Table 21). Wealthier households have significantly ( $p \leq 0.05$ ) more livestock and more variety of livestock than poorer households, this simply deduces from the ability of wealthier households to afford more livestock. While 31 % of the poorest group have at least one kind of livestock, middle group at least 33% and richest group 59% have at least one livestock.

In contrary to that, a higher number of livestock for sale in a household reduces the odds to be in the highest wealth group (Table 21). The reason for the different effect of possessing livestock and selling livestock on the wealth of a household is the characteristic of livestock as financial mean. If livestock needs to be sold often and is hence considered as *livestock hold for sale* it means that the household has a lack of other financial means and needs to liquidise the livestock often. Wealthier household don't need to liquidise their livestock very often and are able to hold it longer or consume it themselves.

Table 21: Logistic regression model on factors determining membership to the highest wealth group with the highest wealth group as the reference category

		B	Sig.	Exp(B)	95% C.I. for Exp(B)	
					Lower Bound	Upper Bound
lowest wealth group*	Intercept	2.139	.000			
	Number of livestock	-1.298	.000	.273	.137	.544
	Number of livestock for sale	.832	.050	2.297	1.00	5.277
	Education	-1.233	.002	.292	.133	.641
	Forest company employment	-2.700	.000	.067	.019	.240
	Business activities	-1.470	.007	.230	.079	.668
middle wealth group*	Intercept	1.235	.001			
	Number of livestock	-.974	.002	.377	.203	.702
	Number of livestock for sale	.736	.055	2.09	.984	4.428
	Education	-.410	.283	.664	.314	1.403
	Forest company employment	-.880	.066	.415	.162	1.060
	Business activities	-.481	.292	.618	.253	1.511

n= 218; -2 Log Likelihood: 129.608; McFadden: 0.128; \*reference group= highest wealth group; C.I.= Confidence Interval

Regarding education the model showed that higher education in the household increases the odds to be in the highest wealth group rather than in the lowest wealth group (Table 21). This seems to be a vicious cycle, because wealthier families can afford a better education for their children. On the other hand without education it is more difficult for household to increase their wealth.

From the model analysis two predictors can be identified that have been impacted by the forest companies and the introduction of forest plantations. While the impact on employment is direct and rather straight forward, the impact on business and trading activities is indirect.

For households with at least one member employed in a forest company the odds to be in a lower wealth group and not in the highest are significantly ( $p \leq 0.1$  for middle and  $p \leq 0.001$  for lowest group) reduced (Table 21). This suggests that the establishment of forest plantations has increased the wealth for those households that have found employment in the forest company. Many of the employed people were able to acquire valuable assets like motorbikes or build a new house (Figure 14). The results could alternatively be interpreted in that effect that forest companies employed particularly people from the wealthiest group. However, since many households acquired those amenities only after they have been employed it is likely, that the household belonged to a lower wealth group before they got employed.

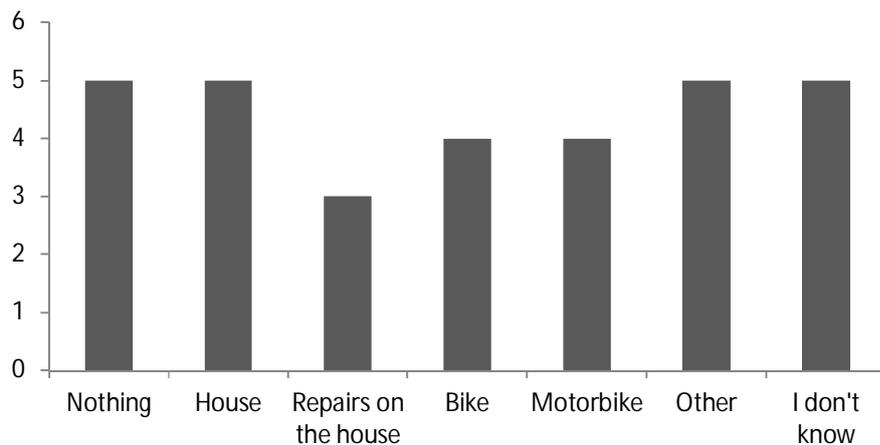


Figure 14: Most important good acquired by household since a member got employed in a forest company.

In contrast to current forest company employment, the predictor for previous forest company employment is insignificant and not included in the final model. Thus, previous employment doesn't seem to have an effect on the wealth status of a household. Comparing this to the results of the preliminary analysis, it appears that initially many people had been employed in the forest company, but only for short periods or seasonal work. The wealth regression analysis indicates that this short term work does not improve the wealth status of the household in the long term. Two third of the people that are currently employed have been in their companies for at least 3 years.

Formal employment has no significant effect on the wealth model, although households with formally employed members are significantly ( $p \leq 0.01$ ) more often in higher wealth groups. While about one third of the people from the highest wealth group are employed, only about 12% of households in the poorest wealth group are employed. Since the main interest is the impact of forest companies and the majority of employment origins from the forest companies, the reasons are not further analysed in this study.

For households that are engaged in any kind of trading or business the odds for being in the lowest wealth group compared to the highest wealth group are reduced significantly ( $p \leq 0.01$ ) (Table 21). Since no baseline data is available it cannot be evaluated if households with trading activities have been able to increase their wealth due to the establishment of forest plantations. However, trading and business as alternative strategies are linked to the higher wealth groups and positive effects have been reported by respondents. Hence, an increased cash flow due to the forest company employment might open new opportunities for other households as well.

Comprising it can be said that besides farming there are alternative livelihood strategies that can be adopted by the households. Forest plantations provide additional formal employment to the region and have thus positively impacted the livelihood strategies. Additionally, respondents reported increased business activities due to the forest companies, which appear to be a positive indirect effect of the forest investments. The results of the analysis supports the theory that households which have been able to

diversify their livelihood strategies have better chances to be in a higher wealth group. Households with low human capital in form of education are less often able to increase their wealth status and at the same time are not able to afford higher education, which is a limiting factor for poorer households.

#### 4.4 Perceived overall impact on households livelihood and impact of wealth

For the assessment of hypothesis (3), if the introduction of forest plantations is perceived more negatively by poorer households and more positively by wealthier households, a logistic regression on the perceived overall impact on the households' livelihood was carried out. The main emphasis of the analysis is on the differences in the perception between different wealth groups. Additionally, the results of the analysis of impact on natural resources were incorporated to answer the hypothesis.

With negative impacts on natural resources and relocation of farm plots the main reasons for reporting negative impacts on the overall livelihood of households are straightforward. Apart from the increased opportunities in the livelihood strategies, other positive impacts were not issue of this study, however, Table 22 presents further reasons for people to report positive impacts. Especially impacts on infrastructure have been perceived positive by the respondents. In some places companies have improved roads and bridges, because they had to prepare them for their machines and cars.

Table 22: Perceived impacts on infrastructure

	Negative Impact	No Impact	Poisitive Impact	I don't know
Roads	0%	29.5%	56.6%	13.9%
Health Care	0%	41%	45.7%	13.3%
Education	0%	48.6%	36.4%	15%

In Mapaco the forest company Florestas de Niassa built a health care post and corresponding to that in this village the highest share of positive impact from the forest plantations was reported in this village (Table 22). Overall over one third of the respondents perceived a positive impact on education by the forest plantations, while

almost half of households didn't report any impact on education (Table 22). In Ligogolo New Forests had built a new primary school and in Malulu a computer cabinet was installed by the Company Green Resources.

Overall about one third of the respondents experienced a negative effect on their household, while about 60% reported either no or positive impacts of forestry investment (Figure 15). For the logistic regression analysis a multinomial model was built with negative impact being the reference category, to identify the factors for negative experienced impacts on the household. The results of this analysis are presented in Table 23.

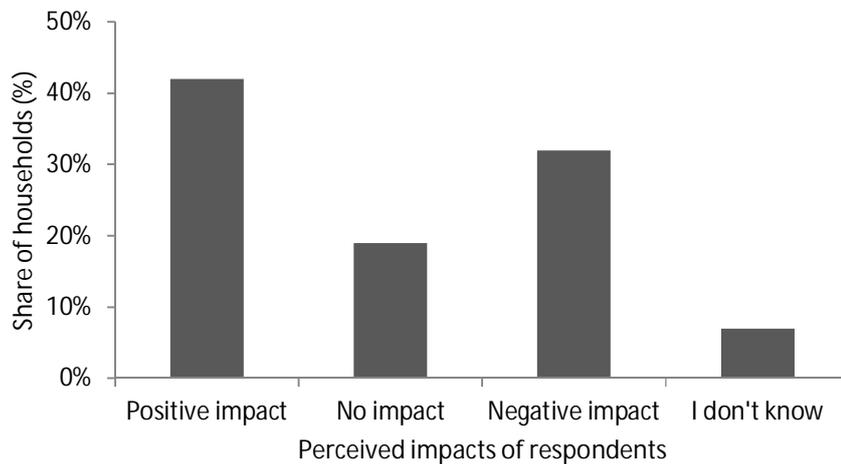


Figure 15: Perceived overall impact of forest plantations on the livelihood in villages close to a plantation.

As the main target was the testing whether there are differences in the perception in the wealth groups, the model was tested with the variable for the wealth categories, but no significant main-effect on the dependent variable was found. Nevertheless, an analysis with crosstabs showed significant ( $p \leq 0.01$ ) differences between the different wealth groups and the reported overall impact on the household. Positive impact was reported more often in the highest wealth group, while the negative impact was reported more often in the lowest wealth group (Figure 16). This indicates that the wealth group is not the major factor, but that reported impacts depend on other factors closely connected to the wealth

groups. Hence, the model is considered under the aspect of wealth as an indirect factor on the perceived impacts.

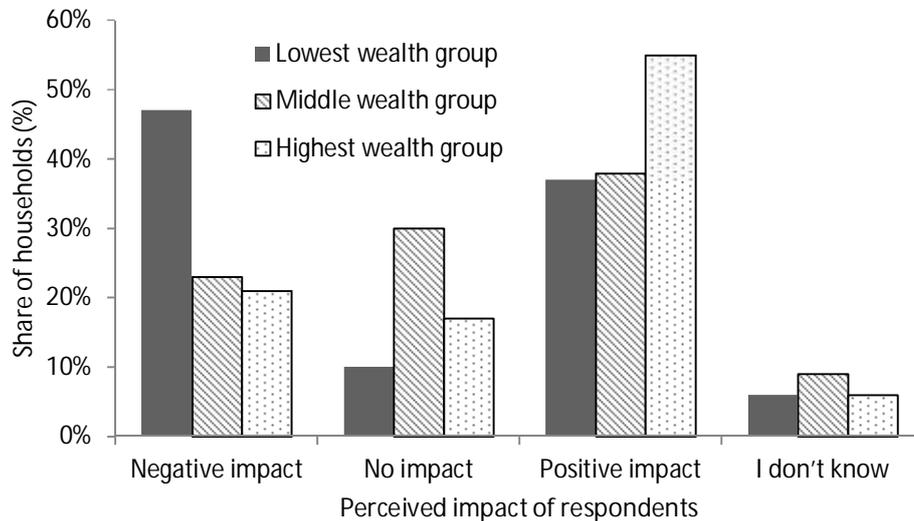


Figure 16: Perceived impact on overall livelihood on household by wealth groups.

According to the results of this analysis, forest company employment positively affects the perception of the households (Table 23). Households with at least one member employed in a forest plantation have 3.8 times higher odds to report positive rather than negative impacts on the overall livelihood. All of the households which are in the highest wealth group and have somebody employed in a forest company reported a positive impact on their livelihood. Due to the quasi-complete separation no interaction effect of wealth status and employment can be introduced to the model. The higher wealth status is not the underlying cause for those households to report more positive impacts, but rather that their households has benefited because of the formal employment and increase its wealth. Thus, wealthier households report more positive impacts if they have personally benefitted or even increased their wealth due to the forest investments.

A dummy for the poorest wealth group with interaction of female headed households is included in the model. More than half of the female headed households perceived the impact of forest plantations on their household as negative. However, households which

are led by a female are less likely to report negative impacts on their overall livelihood if they are not from the poorest wealth group. Female headed households from the poorest wealth group have increased odds to report negative impacts over no impacts. This result shows that the wealth of a household has an indirect impact on the experienced overall impact of forest plantations for specific groups.

Table 23: Logistic regression model for the overall perceived impact on households' livelihood with negative reported impact as the reference category

		B	Sig.	Exp(B)	95% C.I. for Exp(B)	
					Lower Bound	Upper Bound
no	Intercept	-1.226	.401			
impact	Number of men	.670	.029	1.954	1.071	3.567
	Household sells crops	-1.177	.095	.308	.077	1.229
	Forest company employment	-1.617	.204	.198	.016	2.408
	Household lives in village with high relocation rate	-3.131	.000	.044	.009	.203
	HoH male*not poorest group**	1.950	.198	7.026	.362	136.469
	HoH male*poorest group**	.843	.572	2.324	.125	43.236
	HoH female*not poorest group**	3.534	.044	34.277	1.109	1059.865
	positive	Intercept	-1.084	.213		
impact	Number of men	.103	.690	1.109	.668	1.841
	Household sells crops	.859	.089	2.360	.878	6.346
	Forest company employment	1.348	.043	3.851	1.046	14.183
	Household lives in village with high relocation rate	-.934	.032	.393	.168	.921
	HoH male*not poorest group**	1.150	.140	3.157	.687	14.504
	HoH male*poorest group**	.802	.311	2.230	.472	10.534
	HoH female*not poorest group**	.905	.465	2.472	.218	27.978

n=161; reference category for dependent variable: negative impact; \*\* reference group= female headed households from poorest wealth group; C.I.= Confidence Interval; -2LogLikelihood: 114.291; Mc Fadden: 0.228

Like in previous analysis, the perception of the households towards the impacts of forest plantations on their livelihood varies between the villages (Table 24). Households in Colongo have a more negative perception of forest plantations than households from the other villages. Three out of four respondents from the village have reported a negative

overall impact (Table 24). In the other three villages the majority reported either no or only positive impacts on their livelihood. In Mapaco and Colongo almost all people feel to have been impacted either in positive or negative terms (Table 24).

Table 24: Perceived overall impact on households' livelihood by village

Village	Negative impact	No impact	Positive impact	I don't know
Malulu	21%	27%	44%	8%
Ligogolo	6%	33%	42%	19%
Colongo	74%	3%	24%	0%
Mapaco	40%	5%	55%	0%
Total	32%	19%	42%	7

The dominant negative perception in Colongo would also display in the logistic regression model if the villages would be included with Colongo as the reference category. Instead, the relocation context variable, which was previously used in the farm land and the water impact models, is used here again, because the proportions for negative reported impacts are high in the villages with high relocation rates. The context of coming from a village with higher relocation rates is increasing the odds to report negative impacts over no impacts as well as over positive impacts (Table 23). The negative impact on land availability and high share of relocations in the villages of Colongo and Mapaco seems to affect the overall evaluation of impact.

Selling crops contributes to the model significantly according to the likelihood ratio test ( $p \leq 0.01$ ), but for the actual results of the logistic regression both coefficients are within a 10% risk level, thus interpretation can only be made with caution (Table 23). A possible explanation here would be that the households who regularly sell crops feel that they have benefited from the plantation establishment, because employees have less time to work on the farm, hence other households can sell more of their harvest. The results of the logistic regression indicate that households that sell crops are more likely to report positive impacts over negative impacts (Table 23). However at the same time, the odds are reduced to report no impact over negative impact, probably due to the fact that households regularly selling crops fear suffer from reduced land availability.

Households with more men are more likely to report no impact over negative impacts. With every man in the household the odds increase about 1.9 times (Table 23). This suggests that if a household has more men, it is less affected by changes caused by the forest plantation. A higher number of men always means more work force for the households, for example on the field.

In addition to the results of the analysis of this section, the results from section 4.2 are considered. In the analysis of impacts on natural resources the wealth status of a household had not affected the perception of impacts on any of the natural resources. The possible reason for this is that initially it was assumed that poorer households depend more heavily on natural resources. Even though differences between wealth groups can be identified, households from all wealth groups still depend on natural resources.

To sum up, the analysis does not directly confirm the hypothesis that there are differences in the perception of different wealth groups. Other factors have been identified more important for the reporting of positive or negative impacts on the household. Still, in connection with two of those predictors, an indirect correlation between different wealth groups and the perception of impacts of the households can be found. It appears that households that have directly benefited from the forest company via employment and thus have been able to reach a higher wealth status are more likely to report positive impacts. While on the other side, female headed households that are in the poorest group report more negative impacts. Thus, it cannot be generalized that the wealth of a household explains the perception of impacts of forest plantations. Instead, certain groups in those wealth categories show a common perception of the impacts of forest plantations on their livelihood.

#### **4.5 Differences between villages as main factor**

The analysis identified the villages of the respondents or the context of the villages as a main factor for differences in responses and perception of impacts. Firstly, the basic characteristics of the villages and their resource endowment are a reason for the differences

in responses between the villages. Secondly, all four villages have plantations from a different company and the circumstances of establishment vary between the companies.

The villages are in different distance to Lichinga, the capital of the province. Lichinga is the central place for trading and has a higher standard in infrastructure than the rest of the province. Colongo has the smallest distance to Lichinga, while Ligogolo is located furthest away. Villages located close to Lichinga have an easier access to education and health care services as well as markets. Prices for food are often much higher in Lichinga than further away, while on the other side the prices for common goods are lower in Lichinga than in communities further away.

The initial endowment of natural capitals varied between the villages. The population growth increased the requirement of communities for products from the forest, land for food production as well as water. Some villages had difficulties to allocate firewood already from before the forest investments and reported reducing natural forest cover over several decades. In those villages the introduction of forest plantations has complicated the situation for the households. In Ligogolo, on the other hand, additional sources for firewood were available, which also avoided a fast decreasing forest cover and forest products.

One of the main differences between the villages is the share of people who had to relocate their farmland because of the plantation. This is related to the initial land endowment of the communities and how many farm plots initially were located in the area of the plantation area desired by the company. Like presented in section 4.2 of this study in Colongo and Mapaco the share of households which had to give up farm land for the forest plantations were higher than in Ligogolo and Malulu. In the first two villages many farm plots were located in the areas that were later transformed into plantations, while in the other two villages enough alternative land was available. The analysis showed that individual as well as contextual relocation in the villages affected the perception of the households.

In general, the employment situation has improved in all villages, as there were not many opportunities for formal employment in many villages beforehand. The greatest difference can be found in the rate of households who used to have a member employed, which then has been laid off. While Ligloglo, Malulu and Mapaco each have a rate of about 22% of households with previous employees, Colongo has a rate of 35% (see Table 18 in section 4.3). Even though this is natural due to the characteristics of forest plantations that need more labor in the process of planting, it caused many people to report negative impacts instead of valuing the created employment possibilities.

In order to underline the importance of the differences of the villages, a direct comparison of crucial attributes of two villages was made (Table 25). As examples the villages Colongo, with high rates, and Ligogolo, with low rates of reported negative impacts, were selected. The initial resource endowment of the two villages differs considerably. While in Colongo the community reported that the scarce of firewood increased already before the establishment of plantations, Ligogolo had additional sources of firewood from old plantations, and therefore natural forest has been less under pressure.

Table 25: Comparison of characteristics of the villages Colongo and Ligogolo

<u>Cologno</u>	<u>Ligogolo</u>
- Already low bad situation for firewood beforehand	- Alternative firewood source
- Plantations located close to the village	- Plantation is in greater distance to the village
- High rate of households which had to relocate their farm plots (44.1%)	- Low rate of households which had to relocate their farm plots (5.6%)
- Plantations established about 7 years before survey	- Plantations established about 6 years prior to survey
- About 30 minutes from Lichinga	- About 3 hours from Lichinga
- 35% used to be employed -> laid off	- 22.2% laid off

Regarding the relocation of farm plots, the rate of relocated farm land is much higher in Colongo than in Ligogolo. One of the most important factors for difference is the distance of the plantations to the village. In Ligogolo the company had agreed with the village to keep a certain distance to the village and plant only on the side where only few households

had farm plots or gardens. In Colongo the plantation was established close to the village and close to an important river, where many households had farms and gardens due to the easy irrigation. The relocation of farms of many households led to a negative perception of the forest company in the village.

Even though rates of households with a current employee of the forest company differ only little, the proportion of households who used to have somebody employed in the company but who was later lay off is higher in Colongo than in Ligogolo.

Like shown in Table 19 in section 4.3 there were more trading activities found in Ligogolo, which is partly due to the great distance to capital of the province, Lichinga. While the close location to a bigger market doesn't allow many households to get engaged in trading due to great concurrence, the need for trading food as well as common goods was greater in Ligogolo.

#### **4.6 Summary of Results**

The analysis of results presented in this chapter gave an insight how households have perceived impacts on their livelihood caused by the establishment of forest plantations. Households have perceived the impacts on natural capital negatively, which was caused mainly by reduced availability and access to land and forest. Additionally, high rates of relocation of farm land in two of the villages led to a more negative perception not only in terms of natural resources but also on the overall benefits of plantations.

On the other hand, forest investments have contributed to the livelihood diversification of households in the area, although, so far the benefits have been experienced only by individual families. Forest employment and increased business activities provide important alternatives to traditional natural resource based livelihood strategies. Households with employment in the companies had a significantly more positive perception of the forest plantations.

While households with employment had possibilities to increase their wealth and standard of living, female headed households from the poorest wealth group have not been able to benefit particularly from the forest investment so far. Apart from that, the results indicated that wealth plays only a minor role in the perception of forest plantations, as all households depend highly on the negatively affected natural capital.

In general, about two third of the respondents reported either no or positive impact on their livelihoods from the forest plantations. In addition to increased employment, also improved infrastructure has been mentioned positively during the interviews.

Comparisons between the control village and the villages under the impact of forest plantations have shown that the control villages are more intensively engaged in natural resource based livelihood strategies. The households in the control village produce more charcoal than the other villages, but are less often engaged in business activities. A possible reason for this is the higher endowment of natural capital due to the absence of impact by a forest plantation.

On the other side differences between villages have been identified as major factor for varying perception of impacts. Households from villages with higher initial endowment of natural capital adapted more easily to the new circumstances and reported less negative impacts.

## 5 DISCUSSION

The aim of this study was to analyze how local households perceive the impacts of forest plantations on different livelihood aspects. Better understanding of impacts and how they are experienced by locals could support the relationship between forestry investors and local communities. In accordance with the initial hypothesis, households experienced negative impacts of forest plantations on their availability of farm land, firewood and non-wood-forest products. Impacts on water, on the other hand, had been experienced negatively only by few households.

At the same time, forest companies have increased the livelihood strategy alternatives by providing formal employment and positively affecting the business activities in the villages, which goes in line with the second hypothesis of this study. The impacts on natural resources and the livelihood diversification consequently also affect the overall livelihood of a household. The results of the overall perception of impacts of forest plantations on the livelihood of locals can be seen as an evaluation how well the declining natural capital has been set off by increased livelihood diversification. In general, the majority of households experienced either no or positive impacts.

Concerning the third hypothesis, the results of the logistic regression analysis didn't show a significant effect of the wealth status on the perception of impacts; hence other factors determine which households benefit from the establishment of forest plantation and which not. It cannot be generalized that poorer households always report more negative impacts, while wealthier households report more positive impacts. Instead, subgroups exist within the wealth classes, which report impacts in a similar way, like for example female headed households inside the poorest wealth group.

### **5.1 Discussion on the impacts of forest plantations on natural resources**

The analysis of the perception of impacts on various natural resources showed that many households have perceived impacts on land and natural forest negatively. Households expressed fear of incapability to sustain their livelihood if not sufficient farm land can be found and forest cover continues to decline. However, the fact that a majority reported

negative impacts especially on farm land and forest resources, does not alone prove that the establishment of forest plantations has actually negatively impacted on those resources.

Previous work by Landry (2011) and Cueller et al. (2006) showed that households faced difficulties with the collection of firewood and water already before and during the early stage of forestry investment in the study area. Additional information from focus group meetings have revealed that growing population and applied agricultural practices in the area cause increasing scarce of resources. Thus, the introduction of forest plantations can be seen as only one of the causes for reduced natural resources.

However, Gerber (2011) showed in his study that communities in many countries have faced increasing deforestation caused by plantations beside other conflicts. Thus, it is supposed that for some villages in the study area the forest plantations have amplified the continuous decline of the forest cover, which complicates the collection of forest products for households. The case of Ligogolo shows that alternative sources for firewood, for example older plantations, can help releasing some pressure from the natural forest.

In opposition to other studies where the establishment of forest plantations caused a water shortage for the village (Gerber 2011, Obidzinski et al. 2012), only few household in this study clearly pointed out negative impact on water sources due to forest plantations. Most of the negative responses are assumed to be caused by an overall negative image of the forest companies due to relocation of farm land. Forest companies in Niassa often use *Eucalyptus* trees, which is said to require great amounts of water (Bowyer 2001), thus it is possible that in the long term negative impacts on water sources occur. This possibility of future negative impact and the fact that water scarce is a major problem for the communities, gives the companies potential to earn positive reputation by supporting the implementation of safer water sources.

Similar to the study by Obidzinski et al. (2012), land users under customary traditions dependent on farming are negatively affected and households have to walk longer distances to open new farm plots. Furthermore, it was observed that the rates of households which had to give up their farm land varied between the villages, but in contrast to the case

in Indonesia (Obidzinski et al. 2012), with few exceptions, individual households didn't receive compensation, but companies promised compensation on the community level.

In contrast to the great majority of negative perceived impacts on farm land in this study, in the study of Landry (2011) two thirds of households interviewed did not express concerns about possible negative impacts on land availability. It was stated that respondents believed that sufficient land was available for the company as well as the local communities. Landry explains that this lack of expressed concern might be due to the fear of people that the investments would be cancelled if communities showed negative attitudes. In addition it needs to be said that one of the research sites of Landry's study is the community Chiconono including the village Ligogolo, where after the establishment of forest plantations households have still not reported negative impacts on land availability and don't face immediate land scarce. Siteo (2009) reported in his work that in the community of Chiconono the company reduced the planned area for forest plantation, when they noticed it would include farm plots and community areas.

As many conflicts are held over land area, it becomes evident, that a central underlying issue in the region is the weak definition of property and land use rights as argued by Siteo (2012) and German et al. (2011). Even though the Mozambican government has made efforts to improve the situation with the introduction of the DUAT system, the conflicts show that the land use and disposal rights especially on community level need to be strengthened. This is valid, not only in the context of the introduction of foreign investments and third party disturbance, but also on the sustainable management of forest resources, as some communities showed difficulties to allocate open access resources efficiently.

Similar to the case of Indonesia (Obidzinski et al. 2012) where the communities with more experience with forest companies were able to negotiate more benefits, future encounters of companies and communities in the region might lead to fewer negative impacts on livelihoods. Communities in the region have gained more experience with forest companies and have received information from neighboring communities, thus might be

more cautious in negotiations with the companies. On the other hand this seems to complicate the land acquisition process for the forest companies, which have troubles allocating sufficient land for their plantations.

## **5.2 Discussion on the impacts of forest plantations on livelihood strategies**

The analysis of impact of livelihood strategies on the wealth status of a household showed that households with a more diversified portfolio of livelihood strategies are more likely to be in the highest wealth group. This goes in line with a study by Ellis (1998), who explained that increased diversification of the livelihood portfolio help the household to improve the standard of living and make it less vulnerable.

The establishment of forest plantations have created additional possibilities in the villages, namely in form of formal employment and trading. However, in previous literature (Tyynelä et al. 2002, Charnley 2005) mentioned forest investments are labor intensive in the initial phase of the project, but once the trees are planted many employees become redundant. The same effect can be seen already in Colongo, which has been longest under the influence of plantations. Even though many members of the community had been employed in the beginning, people reported a high rate of dismissed people. The characteristics of a forest investment give the forest companies little opportunities to provide long-term employment for a large proportion of the population.

However, in case the forest investments are extended and wood processing industry established like initially planned, the creating of employment for the region could be increased greatly and would contain more stable job possibilities for Niassa (Siteo 2009). So far no further plans for investment into wood processing industry in Niassa have been published. Furthermore, as criticized by Charnley (2005) in many cases forest industry is not established in rural areas where forest investments have introduced plantations, keeping positive effects of investments on a low level. On the other side expanded forest industry would imply further negative impacts on natural resources like pointed out by Evens and Turnbull (2004), thus the net social benefit would be uncertain.

The diversification of livelihood strategies could be seen as one possibility to enhance the capabilities of the households. Ellis (1998) even stated that already simply the capability to

adapt new strategies is a major improvement to a household's livelihood and livelihood security. Hence, the provision of formal work as an alternative contributes to a households living.

However, similar to the case of plantation establishment in Ghana (Schoneveld et al. 2011) only few households were able to use the additional opportunities and for example improve their housing or start a business. Hence, the establishment of forest plantations has contributed only little to the expansion of livelihood so far. Employees that were laid off after a short period were not able to make significant changes in their livelihood and were in a similar situation than before the employment. Only long-term employment had an effect on wealth as well as on positive reception of the forest investments. Additionally, for most households farming continued to be the substantial livelihood activity even if one or more members of the household got employed in the forest company or engaged in business activities. Similar observations were made in the study of Schoneveld et al. (2011).

Even though many studies on the impacts of forest plantations mention positive impacts on the economic development for the local communities, increased cash flow and trading activities are often not analyzed further. Since the forest companies are the only option for formal employment in some of the communities, the observed effect on business activities is small. Nevertheless, business activities, especially with common goods, are a form of self-employment that makes the household less dependent of natural resources.

### **5.3 Discussion on the overall impact on livelihood and impact of wealth**

The analysis of the perceived overall impact of forest plantations assessed whether there are differences in the perception between different wealth groups. The results of the different regression models showed that the wealth status of a household is not a primary factor in its perception of impacts.

Negative impacts on natural resources are reported by households from all wealth groups. In the study by Tyynelä et al. (2002) it was argued that wealthier households had better opportunities to deal with negative impacts and were less vulnerable due to higher income

from off farm work, better access to education and health care. However, the results of this study appear to show no significant differences in the impacts on natural resources between different wealth groups. This is due to the fact that inside the communities the social disparity is rather small and all wealth groups depend similarly on natural resources. All households collect products from the forest and almost all households own at least one farm plot. Hence, negative impacts on natural resources were perceived irrespectively of the wealth status of a household.

In the context of improved livelihood diversification the improved access to education enabled wealthier households to gain important skills increasing their chances for employment in Tyynelä et al. (2002). In this study the share of people reporting that their household has overall benefitted from the forest plantations is highest in the wealthiest group. However, since no data is available on the wealth of households before the establishment of plantations it cannot be evaluated if wealthier households have been in poorer wealth groups beforehand, and thus, directly benefitted. Nevertheless, households with employees of the forest companies report more positive impact and many households were able to acquire amenities, improving their livelihood and wealth status. Since households with former employees come from all wealth groups it could be assumed that the wealth status of a household did not play an important role in the employment acquisition. Similarly, no direct link between the education and employment was found.

Regarding the overall benefits for the household it appears that similar to the case of Zanzibar described by Sitari (2005) only individual households were able to benefit visibly from the forestry investments. Households that got involved with the company, in form of employment were able to draw benefits from it, like pointed out in the study by Charnley (2005). Similar to the case of biofuel plantations in Ghana, households with employment were able to improve their livelihood and improve their capabilities to sustain their food supply (Schoneveld et al. 2011). Households without engagement still see positive changes in form of new education or health care facilities, but if their household is not in direct need of those, the benefit for the household is marginal.

One group which seems to have been benefitted less from the forest plantations than others are female headed households. Especially households from the poorest wealth group that are led by a woman have experienced the forestry investments negatively. Additionally, only few of the households with forest company employment are headed by a female. Since for those households it is apparently more difficult to benefit from employment opportunities and increased cash flow, special incentives to support those households could have been implemented.

While the wealth status of a household doesn't appear to have a major impact on the perception of forest plantations, the village of the respondents does. The villages vary in their characteristics, as well as, how companies have approached the village and engaged the village in the process of establishing the forest plantations. Negative experiences by some of the households in a village affect the image of the forest company in the whole village.

The importance of the village characteristics and the relationship of the company and the community raise two essential points. Firstly, the results of a case study like this depend on the selection of villages to a great extent. With more villages with low initial natural resource endowment and high relocation rates the outcome of the study could be far more negative. Secondly, the results show how substantial the knowledge about a village is for potential investors. If forest companies are aware of resource scarce and take those into account during the implementation of forest plantations, negative impacts on natural capital for households would be reduced.

Most of the results of this study are in line with findings in previous literature and reported impacts in other studies. Negative problems are generally related to a scarce of natural resources and limited access and control for locals due to forestry investments. Positive impacts on the other side are created by alternative employment and community development.

In comparison with previous studies in Niassa (Cueller et al. 2006, Landry and Chirwa 2011) it needs to be said that the land availability, which attracts investors is given mostly

in remote areas, further away from villages. This, on the other hand, is also very difficult to access for forest companies, which consequently stay close to the road and thus to villages, which causes conflicts over land. However, the establishment of forest plantations has impacted the local communities not as negatively as suggested by former reports by Lemos (2011) or Overbeek (2010).

#### **5.4 Evaluation of methods and materials**

The sustainable livelihood approach provided a complex framework for analysis and a detailed examination of all its parts would have gone far beyond the scope of this study. However, the approach allows an understanding of the relationships between livelihood resources and strategies and how the introduction of forest plantations affects these. The framework furthermore provides potential topics linked to this study for possible future studies, to analyze the role of the government and other institutions, other livelihood capitals or other livelihood strategy options.

Baseline data would have been desirable for the task of comparing the situation in the villages before and a few years after establishment of forest plantations. Nevertheless, this study answers the objectives and research questions with the collected data and provides information how households experienced the establishment of forest plantations close to their community.

The structure of the questionnaire might have biased the responses, as respondents might tend to respond in the same way to similar questions following each other. For example the questions on the impact on firewood availability and availability of NWFP were directly successive. The local proximity of the two questions in the questionnaire might have influenced the results for non-wood forest products. People had already reported negative impact on firewood and might be biased with their answer. On the other hand, the two resources are closely related and an actual similar reported impact is likely.

The collected sample has a good gender balance of respondents and includes households from different groups, like female headed households, households with formal employment, wealthier and less wealthy households. Hence, the sample represents the

population in the studied villages well. Generalizations of the results and application to other villages or regions should be made with much caution, because the results are closely connected to the individual situation in the study sides. Still, the recommendation to take village characteristics into account and prevention of increasing resource scarce are universal in the context of developing countries and rural livelihoods.

In order to get a better insight into alternative livelihood strategies, it would have been interesting to collect more information on the business and trading activities of households and the increased cash flow in the villages. But since this indirect effect of forest plantations was mentioned only marginally in previous literature, the collected data on this is only of general nature. More specific data could provide a better understanding on the actual contribution of forest plantations to increased cash flow and trading activities.

Due to the dominant effect of the villages on the perception of the households, the construction of the logistic regression models was challenging in terms of finding underlying causes for the differences between the villages. An analysis with designated sub populations might have provided better results, but since the sample is rather small, the goodness of such analysis is questionable. Additional interaction effects and more complex models could provide a deeper insight into the reasons for the household's perception and thus are possible targets for further research on this data set.

Alternative to principle component analysis which was applied in this study to determine wealth groups, other statistical methods could be applied or data could have been collected already utilizing a participatory wealth ranking. Due to the limitations of this study during the data collection process and the higher relevance of other issues like the impacts on natural resources, the principle component analysis was more applicable and provided sufficient results for the purpose of this study.

## 6 CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this study are as follows. Firstly, negative perceived impacts concern mostly reduced access and availability to farm land and natural forest. It became evident that all households depend on natural capital, thus the fact that the introduction of forest plantations has increased the scarce of resources in the area is a serious problem in the area. However, growing population and agricultural practices have also contributed to the decrease in available farm land and forest resources and are not only due to forest investments.

Secondly, the forest investments have positively affected the diversity of livelihood strategies of the local households. The communities with a forest plantation close to their village experienced an increased employment rate, due to the additional option to work for the plantation. Furthermore, the increased cash flow enabled households which are engaged in business activities to increase their trading.

Thirdly, the wealth status of a household is not a major factor affecting the perception of impacts of forest plantations. Instead, households who benefit directly through alternative livelihood strategies report positive impacts, while female headed households in the poorest wealth group experience negative impacts.

Fourthly, the results of this study stress that the perception of impacts of forest plantations can be very village specific and depend on several factors related, among others, to the characteristics of the village and experiences with the forest company. Thus, establishing forest plantations close to villages with higher initial natural forest endowment might cause fewer conflicts on land use rights and firewood availability.

The intention of this study was to identify positive and negative impacts of forest plantations in order to reduce potential conflicts and improve the symbiosis between communities and forest companies. Thus, the results of this study are of interest for forest companies with active investments or investment plans in the region of Niassa as well as in

other regions with similar context. Forest companies could utilize the outcomes to either identify villages with higher resilience to impacts or otherwise reduce negative impacts and enhance positive impacts for the villages. To conclude this study some recommendations based on the outcomes of this study are presented for the main parties included in the process of forest investments in Northern Mozambique.

In general, it is recommended for forest companies to preserve natural resources and enhance livelihood strategy diversification to ensure sustainable livelihoods. Concerning investors and companies, it became evident in this study, that negative perceptions from the communities are mainly based on negative impacts on natural resources. As pointed out by Siteo (2009) the main reason of conflict are irregularities in the community consultation process, hence the consultation and the included participatory mapping should be carried out with care in future land acquisition processes. Furthermore, companies should try to avoid areas which are crucial for the collection of firewood and NWFP. As the villages in this study are already in a later phase the required recommendations are about how to reduce negative impacts and promote positive effects. It is suggested here that companies offer alternative sources if natural capital is reduced, like for example compartments of fast growing trees for firewood collection. Furthermore, training in improved agricultural practices could be offered to the communities to reduce the pressure of shifting cultivation on land availability due to infertile soil. The improved employment situation is already a positive impact on the communities, but it is recommended that companies use local labor force as much as possible. In addition employees could be offered support in education and acquisition of additional skills, which would provide them with increased job chances afterwards in case of job loss.

As conflicts have always at least two parties, communities can similarly contribute to the reduction of conflicts and improve the collaboration with the companies. In general, villages have reported that they approve of forestry investments as they bring development for their region, especially in hope of formal work opportunities. In order to ease the process for investments, all households in a village should participate in community consultations and important sources for forest products should be pointed out. This would also avoid decisions made only by local chiefs or a minority of the village. In addition,

communities should reconsider their agricultural practices as shifting cultivation as well as slash and burn culture are promoting the scarce of natural forest. This is naturally a sensitive issue as the practices are part of their culture, but in the long run changes are inevitable.

The Mozambican government was not a major part in the context of this study; nevertheless, it holds great responsibility and possibilities to improve the process of private forest investments for its objective to promote development in Niassa. As the conflicts discussed in this study have shown, the implementation of land use rights is still weak in Niassa and many villagers are not aware of the concept of DUATs. This puts the locals into a weak position in the consultation process and negotiations with investors over land. From the point of view of the Mozambican government it is recommended to increase the awareness of their rights in the area. Furthermore, close monitoring of the community consultation process is required to ensure the conformity with the law.

In connection with this, in future research the role of property and land use rights could be analyzed further and linked with the results of this study as many conflicts are caused by the ill-definition of rights. Small-scale plantations in closer cooperation with the communities could be examined as an alternative investment strategy.

Furthermore, future research could assess long term impacts and discuss alternative livelihood strategies. Variations of impacts between different groups in the communities could be analyzed further with a household survey emphasizing household structures. This would allow companies to avoid impacting the poorest groups in the community negatively, but offer specific support.

All in all this study has shown that private forestry investments in developing countries have significant changes to local livelihoods. In the context of climate change vulnerability and poverty alleviation the possible socio-economic impacts of investment projects need to be carefully evaluated beforehand.

## REFERENCES

- Bennett, N. J. & Dearden, P. 2014. Why local people do not support conservation: Community perceptions of marine protected area livelihood impacts, governance and management in Thailand. *Marine Policy* 44(0): 107-116.
- Bergroth, C. & Willberg, E. 2014. Map of the districts Lichinga, Muembe and Sanga in Niassa, Mozambique. Paimo project, Helsinki.
- Bowyer, J. L. 2001. Environmental implications of wood production in intensively managed plantations. *Wood and Fiber Science* 33(3): 318-333.
- Chambers, R. & Conway, R. 1992. Sustainable rural livelihoods: Practical concepts for the 21st century Brighton: University of Sussex.
- Chambers, R. 1995. Poverty and livelihoods: whose reality counts? *Environment and Urbanization* 7(1): 173-204.
- Charnley, S. 2005. Industrial Plantation Forestry: Do Local Communities Benefit? *Journal of Sustainable Forestry* 21(4): 35-57.
- Cueller, M., Mikael, R. & Ferrao, C. 2006. Lichinga field study: Linkages between livelihoods and natural resources. SIDA's EIA Helpdesk. Orgut July 2006.
- Dasgupta, P. 1993. An inquiry into well-being and destitution. Clarendon, Oxford. xviii, 661 s p.
- 2001. Human well-being and the natural environment. Oxford University Press, Oxford. xxii, 305 s p.
- Ellis, F. 2000. Rural livelihoods and diversity in developing countries. Oxford University Press, Oxford.
- Ellis, F. 1998. Household strategies and rural livelihood diversification. *The Journal of Development Studies* 35(1): 1-38.
- Ellis, F. & Mdoe, N. 2003. Livelihoods and Rural Poverty Reduction in Tanzania. *World Development* 31(8): 1367-1384.
- Ellis, F. & Bahigwa, G. 2003. Livelihoods and Rural Poverty Reduction in Uganda. *World Development* 31(6): 997-1013.
- Ellis, F., Kutengule, M. & Nyasulu, A. 2003. Livelihoods and Rural Poverty Reduction in Malawi. *World Development* 31(9): 1495-1510.
- Evans, J. & Turnbull, J. W. 2004. Plantation forestry in the tropics : the role, silviculture, and use of planted forests for industrial, social, environmental, and agroforestry purposes. 3rd ed. edition. Oxford University Press, Oxford. xiii, 467 p.
- FAO. 2001. Global Forest Resources Assessment 2000 – main report. Paper No. 140.
- 2010a. Global Forest Resources Assessment 2010: Main report. FAO Forestry paper 163.
- 2010b. Global Forest Resource Assessment 2010 - country report: Mozambique. FRA, Rome 140.

- Filmer, D. & Pritchett, L. 2001. Estimating Wealth Effect Without Expenditure Data or Tears: An Application to Educational Enrollments in States of India. *Demography* 38, no. 115-32.
- Freitas, B. 2014. Personal communication, 14.05.2014. Project engineer, Florestas do Planalto, Lichinga, Mozambique.
- Friedman, S. T. 2005. Environmental Aspects of the Intensive Plantation/Reserve Debate. *Journal of Sustainable Forestry* 21(4).
- Gerber, J. 2011. Conflicts over industrial tree plantations in the South: Who, how and why? *Global Environmental Change* 21(1): 165-176.
- Gerber, J. & Veuthey, S. 2010. Plantations, Resistance and the Greening of the Agrarian Question in Coastal Ecuador. *Journal of Agrarian Change* 10(4): 455-481.
- German, L., Schoneveld, G. & Mwangi, E. 2011. Contemporary processes of large-scale land acquisition by investors: case studies from sub-Saharan Africa. Occasional Paper 68 Occasional Paper 68.
- Hosmer, D. W., Lemeshow, S. & Sturdivant, R. X. 2013. *Wiley Series in Probability and Statistics : Applied Logistic Regression (3rd Edition)*. John Wiley & Sons, New York, NY, USA.
- Indufor. 2012. Strategic Review on the Future of Forest Plantations in the World. Study done for the Forest Stewardship Council (FSC), Bonn, Germany.
- INE. 2007. Database from: <http://www.ine.gov.mz/en>. National Institute of Statistics Mozambique 2014 (accessed on 22 September 2014).
- JMP. Joint Monitoring Program for Water Supply and Sanitation: Data Table Mozambique, from: <http://www.wssinfo.org/data-estimates/tables/> on 22 July 2014.
- Lambini, C. K. & Nguyen, T. T. 2014. A comparative analysis of the effects of institutional property rights on forest livelihoods and forest conditions: Evidence from Ghana and Vietnam. *Forest Policy and Economics* 38(0): 178-190.
- Landry, J. & Chirwa, P. W. 2011. Analysis of the potential socio-economic impact of establishing plantation forestry on rural communities in Sanga district, Niassa province, Mozambique. *Land Use Policy* 28(3): 542-551.
- Lemos, A. (coord.). 2011. *Lords of the Land: preliminary analysis of the phenomenon of land grabbing in Mozambique*. Justia Ambiental and UNAC, Maputo. Justia Ambiental and UNAC, Maputo.
- Malonda Foundation. 2014. Incentive schemes and tax benefits. From: [http://www.malonda.org.mz/index.php?option=com\\_content&view=article&id=11&Itemid=89&lang=en&showall=1](http://www.malonda.org.mz/index.php?option=com_content&view=article&id=11&Itemid=89&lang=en&showall=1). accessed on 26 September 2014.
- McKenzie, D. J. 2005. Measuring inequality with asset indicators. *Journal of Population Economics* 18229-260.
- Mkumbira, J. 2013. Personal communication, 15.10.2013. Community development and land acquisition officer, Florestas do Planalto, Mozambique.

- Mogaka, V., Ehrensperger, A., Iiyama, M., Birtel, M., Heim, E. & Gmuender, S. 2014. Understanding the underlying mechanisms of recent *Jatropha curcas* L. adoption by smallholders in Kenya: A rural livelihood assessment in Bondo, Kibwezi, and Kwale districts. *Energy for Sustainable Development* 18(0): 9-15.
- Nhantumbo, I., Macqueen, D. J., Cruz, R. & Serra, A. 2013. Investing in locally controlled forestry in Mozambique: Potential for promoting sustainable rural development in the province of Niassa. IIED.
- Niskanen, A., Luukkanen, O., Saastamoinen, O. & Bhumibhamon, S. 1993. Evaluation of the profitability of fast-growing tropical trees: *Eucalyptus camadulensis*, *Acacia mangium* and *Melia azdarach* as plantation tree crops in Thailand. *Acta Forestalia Fennica* 24138.
- Norfolk, S. & Tanner, C. 2007. Improving tenure security for the rural poor - Mozambique - country case study. Support for the Legal Empowerment of the Poor Working paper. FAO 5.
- Obidzinski, K., Andriani, R., Komarudin, H. & Andrianto, A. 2012. Environmental and social impacts of oil palm plantations and their implications for biofuel production in Indonesia. *Ecology and Society* 17(1): 25.
- Overbeek, W. 2010. The Expansion of Tree Monocultures in Mozambique. Impacts on Local Peasant Communities in the Province of Niassa. World Rainforest Movement.
- Schoneveld, G. C., German, L. A. & Nutakor, E. 2011. Land-based investments for rural development? A grounded analysis of the local impacts of biofuel feedstock plantations in Ghana. *Ecology and Society* 16(4): 10.
- Scoones, I. 1998. Sustainable rural livelihoods: a framework for analysis. IDS Working Paper, No.72. Brighton: Institute of Development Studies.
- Sen, A. 1993. Capabilities and well-being. In: Nussbaum, M.C., & Sen, A. (eds.). *The quality of life. Studies in development economics* edition. Clarendon Press, Oxford.
- Sen, A. 1984. *Resources, values and development*. Basil Blackwell, Oxford. viii, 547 s p.
- Sitari, T. 2005. *Forestry, community and biodiversity in Zanzibar : interaction between forest plantation and community and its impact on biodiversity (final report)*. Department of Geography, University of Turku, Turku. 90 s p.
- Sitoe, A. 2009. *Governança Florestal em Niassa: O caso de Muembe, Sanga, Lago e Cuamba*.
- Sitoe, A., Salomão, A. & Wertz-Kanounnikoff, S. 2012. *The context of REDD+ in Mozambique: Drivers, agents and institutions*. Occasional Paper 79. CIFOR, Bogor, Indonesia Occasional Paper 79.
- Soares, A. 2013. Personal communication, 17.10.2013. Corporate Social Responsibility, Chikweti Forests of Niassa; Mozambique.
- Tropp, J. 2003. Displaced People, Replaced Narratives: Forest Conflicts and Historical Perspectives in the Tsolo District, Transkei. *Journal of Southern African Studies* 29(1): 207-233.

Tyynelä, T., Otsamo, A. & Otsamo, R. 2002. Changes and alternatives in farmers' livelihood planning in an industrial forest plantation area in west Kalimantan, Indonesia. *Forests, Trees and Livelihoods* 12(4): 257-281.

UNCTAD. 2012. *Investment Policy Review: Mozambique*. United Nations publication Sales No. E.12.II.D.11. New York and Geneva.

UNDP. 2013. *Human Development Report 2013: The Rise of the South: Human Progress in a Diverse World*. United Nations Development Programme.

World Bank. 2008. *Forests sourcebook : practical guidance for sustaining forests in development cooperation*. World Bank, Washington, D.C.

– 2014. *World Development Indicators Online (WDI) database*. accessed on 04 September 2014.

World Commission on Environment and Development. 1987. *Our Common Future* (Vol.383). Oxford: Oxford University Press.

## APPENDICES

### Appendix 1: Independent variables used in the logistic regression models

Variable name	Explanation	Code
Household sells crops	Household sells part of its harvested crops	0=no; 1=yes
Household had to relocate farm plot	Individual Household had to relocate farm land	0=no; 1= yes
Household lives in village with high relocation rate	Village context relocation/ Village with high share of relocation of farm land	0=low relocation rate in the village; 1=high relocation rate in the village
Number of household members	Total number of members in the Household	
Household owns livestock	Household owns at least one kind of livestock	0=no; 1= yes
Male respondent	Male respondent was present (in case male and female were present, also considered here as male)	0= only female respondent; 1=male respondent
Number of collected NWFP	Number of different Nwfp that the household collects	
Malulu	Household lives in the village Malulu	0=no; 1= yes
Colongo	Household lives in the village Colongo	0=no; 1= yes
Mapaco	Household lives in the village Mapaco	0=no; 1= yes
Household member has been sick	At least one household member has been sick during the past year	0=no; 1= yes
Household collects medical plants	Household collects medical plants from the forest	0=no; 1= yes
Number of livestock	Number of different kind of livestock that the household possesses	
Number of livestock for sale	Number of different kinbd of livestock that the household keeps for trade	
Education	Household has over average education	0=no; 1= yes
Forest company employment	At least one household member is employed in the forest company	0=no; 1= yes
Business activities	Household has business or trading activities	0=no; 1= yes
Number of men	Number of men in the household	
Head of household	Gender of the head of the household	0=male; 1=female

**Appendix 2: Questionnaire of household survey (plantation villages)**

PAIMO household survey - Questionnaire

Survey number: \_\_\_\_\_

date of survey: \_\_\_\_\_

Village: \_\_\_\_\_

Respondent:  male  female

\*\*\*\*\*only for researcher\*\*\*\*\*

Observations: House characteristics:

Main Material of the house:  sun brick  mud  fire brick  cement  straw

Main Material of the roof:  grass (thatched)  tin roof

Windows:  no windows  open windows  glass  wood

Electricity:  Yes  No

Other remarks: \_\_\_\_\_

\*\*\*\*\*

**A. HOUSEHOLD CHARACTERISTICS**

1. Are you the head of the household?  Yes  No

2. How many women (including you), older than 18, are living in your household?

Women: \_\_\_\_\_

3. How many men, older than 18, are living in your household? Men: \_\_\_\_\_

4. How many children younger than 18 years live in your household?

Number children \_\_\_\_\_

5. How many members speak Portuguese? \_\_\_\_\_

6. Is there any member that is currently absent because of work or studies from the household and living somewhere else?

Yes, because of  work  studies  No

7. Were you born in this area?

Yes  No -> How many years have you lived here? \_\_\_\_\_

8. Are you aware of any forest plantations near your community?

Yes -> Do you know from which company?  No

Chikweti  New Forests  Green Resource

Florestas de Niassa  Florestas do Planalto  Other \_\_\_\_\_

Malonda Foundation

9. Did you know about the plantation projects before the first trees were planted?

Yes about all

Only about some, those were: \_\_\_\_\_

No

10. Who first told you about the plantations projects?

Relatives/ neighbours /friends  local chief  Somebody from the government

Company  Malonda Foundation  ICT  other NGOs (which) \_\_\_\_\_

B. LIVELIHOOD STRATEGIES

1. Are you .....(activity)? Are men, women or children responsible for this activity? Can these activities be carried out during wet and dry season?

Activity	check the ones that apply	Men	Women	Children	Season W/D/B
Tending crops					
Tending livestock -> 2.					
Tending fruit and/or trees					
Firewood collection					
Charcoal production					
Hunting					
Fishing					
Other_____					

2. Do you have livestock? What kind?

- Chicken  Ducks  Goats\_\_\_\_\_  Cattle\_\_\_\_\_  Others \_\_\_\_\_  
 None

3. Which of this livestock is creating an income for your household?

- Chicken  Ducks  Goats  Cattle\_\_\_\_\_  Others \_\_\_\_\_  
 None

4. Does any member of the household have an employment

- Yes: What kind of work?\_\_\_\_\_ where? \_\_\_\_\_  No

5. Do members of your Household possess other skills that generate an income for the household?

- Wood carving  Pole making  Brick making  Mechanics  House construction  
 Basket weaving  Driving  Cooking  Other\_\_\_\_\_

6. Are members of the Household currently employed in a plantation project?

- Yes -> How many?\_\_\_\_  No (-> go to 5.)

If yes: a. What kind of job are they doing in the company

- Plantation  Administration  Guard  other\_\_\_\_\_

b. Are you satisfied with the salary?  Yes  No

c. What is the longest period that one of the members has been employed in the plantation?

- Less than 6 months  6-12 months  1-3 years  more than 3 years

d. Which goods have you acquired since members started to work in the plantation project?

- Built a house  Repairs on the house  Bike  Motorcycle  other\_\_\_\_\_

7. Has any member of the household been previously employed in a plantation project?

- Yes  No (> go to 5.)

- a) For how long?  
 Less than 6 months  6-12 months  1-3 years  more than 3 years
- b) Why did the employment stop?  
 Salary not high enough  Conflict with employer  Retirement  labour needed  I didn't like it  Temporary contract  I don't know  Other\_\_\_\_\_

C. RESOURCES AND ASSETS

1. Which are the 3 most important plants or crops that you cultivate for domestic use? Give also the order if possible.

- Maize  Cassava  Beans  Potato  Sweet Potato  
 Soy  Other\_\_\_\_\_

2. Which are the 3 most important crops that you cultivate for trade? Give also the order if possible.

- Maize  Cassava  Beans  Potato  Sweet Potato  
 Soy  Cotton  Tobacco  Other\_\_\_\_\_

3. Describe your machambas. How big is it? How is the quality of the soil, how many hours does it take to get there? How long have you been using this plot? Is it close to a plantation? How many are currently cultivated, how many are resting?

Agriculture lands (main type of crop)	SIZE 1: Big; 2: medium; 3: small;	How many bag of your main crop does this plot produce per harvest?	How many hours does it take you to get there?	For how many years have you been using this plot?	Is this plot close to a plantation? No: 0/ Yes:1	Water source
Plot 1						
Plot 2						
Plot 3						

4. How did you acquire these plots?

- Inherited  purchased  acquired DUAT  
 occupied new land  was ceded, by whom?\_\_\_\_\_  other

5. Do you possess a DUAT for these machambas?

- Yes, for all  Yes, for some  No  I don't know

6. Has your Household been relocated or had to give up farm land, because of a plantation project?

- Yes  relocated  gave up farm land  No (go to 7.)

a. If yes, did you get compensation for the relocation or the land you gave up?

- Yes:  Monetary  new land  other\_\_\_\_\_

No

i. How did you deal with the situation?  search new machamba on its own

share with family or friends

other\_\_\_\_\_

b. If you acquired new land (through compensation or other), how is the land compared to the land you had to give up in terms of:

Distance:  closer  same distance  further away

Size:  bigger  same size  smaller

Productivity:  better productivity  same quality  decreased productivity

7. Have the plantations affected the availability of farm land for your household? Increased or decreased?  Yes, increased  Yes, decreased  No  I don't know

8. Do you have enough machamba land to provide food for the household for the whole year?

Yes  No

▪ For how many month is there usually a shortage?\_\_\_\_\_months

▪ How do you sustain your food supply in those months?

Buy food	
Borrow food	
Gather food from forests	
Trade assets against food	
Hunt or Fish	
Other_____	

9. What source of water do you use for farming?

river/ lake  rainwater  well  borehole  other\_\_\_\_\_

10. Which is your most important source of fresh water for domestic use during the wet season?

River/ stream  well  spring  Borehole

Rainwater  piped water  Other\_\_\_\_\_

11. Is this also your most important water source during the dry season?

Yes  No -> which is it then?

River/ stream  well  spring  Borehole

Rainwater  piped water  Other\_\_\_\_\_

12. How many hours does your household spend every day for the collection of water for domestic use?

a) during the wet season:  Less than 1  1-2 hours  3-4  more than 4

b) Does it take longer during the dry season?:

Less than 1  1-2 hours  3-4  more than 4

13. Are you satisfied with the available amount of water ?

Yes  No, not at all  I don't know



24. During the past 12 months have you received any support or assistance from the outside your household? Have you received.....? From whom?

	Check the ones that apply	From whom? 0:Government; 1:NGO; 2:Plantation company; 3:friends/relatives; 4:other (please specify)
Financial support		
Natural resources (firewood, food, ...)		
training / education		
Farm supplies (seeds, fertilizers, tools)		
Medical assistance		
other support		

25. Does your household save money or participates in a Group saving and Credit Scheme (XITQUE)

- |   |  |
|---|--|
| <input type="checkbox"/> Yes, how?                      | <input type="checkbox"/> No, why not?:         |
| <input type="checkbox"/> Group saving and credit scheme | <input type="checkbox"/> Not enough money      |
| <input type="checkbox"/> At a bank account              | <input type="checkbox"/> No facility available |
| <input type="checkbox"/> Other _____                    | <input type="checkbox"/> Don't want to         |
|   | <input type="checkbox"/> Other reason_____     |

26. Has your household ever borrowed money?

- |   |  |
|---|--|
| <input type="checkbox"/> Yes, where from?               | <input type="checkbox"/> No, why not           |
| <input type="checkbox"/> Bank institution               | <input type="checkbox"/> No collateral         |
| <input type="checkbox"/> Group saving and credit scheme | <input type="checkbox"/> We don't want to      |
| <input type="checkbox"/> Family or friends              | <input type="checkbox"/> Process too difficult |
| <input type="checkbox"/> Other _____                    | <input type="checkbox"/> Other _____           |

a. If yes, why did you borrow the money?

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> To purchase food        | <input type="checkbox"/> to purchase seeds | <input type="checkbox"/> construction or reparation work |
| <input type="checkbox"/> to purchase asset:_____ | <input type="checkbox"/> other_____        |  |

27. Have any of your Household members been sick during the past year so that he could not contribute to the livelihood activities?  Yes  No

If yes:

a. Did this illness decrease your income significantly?

- Significantly     only little     not at all

b. Was a treatment applied to cure?

- |   |   |                                       |
|---|---|---------------------------------------|
| <input type="checkbox"/> Use health care facilities | <input type="checkbox"/> Traditional treatments | <input type="checkbox"/> Other_____   |
| <input type="checkbox"/> No, not needed             | <input type="checkbox"/> No, not enough money   | <input type="checkbox"/> Not possible |



31. Do you think the forest plantations have changed the traditions of the community?  
How do you think they have changed.....

Impacts	*(0/1/2/3)	How? additional information if given
Traditional land use/usage of other crops		
Religious customs		
Changes in labour division		
Family structure		
Hunting and Fishing customs		
Other_____		

\* 0: no changes /1: negative changes /2: positive changes /3: I don't know

32. Do you feel that your household has been in general benefited from the forest plantations?  
 strongly disagree  rather disagree  no effects  rather agree  strongly agree

Do you think the plantations will bring more changes to your community in the future? How do you think the following things will change in the future?

What do you think will change?	*(0/1/2/3)
Water sources	
Land availability	
Infrastructure like Health care, Roads	
Community Traditions	
Others_____	

\* 0: no changes /1: negative changes /2: positive changes /3: I don't know

Do you know anything about more/other plantation projects that are planned close to your village or farm plots?  Yes  No

a. How do you think about that?

positive  negative  I don't care  I don't know

33. Choose one of the following options that you would hope for your household to achieve in the future?

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> enough good water | <input type="checkbox"/> higher education | <input type="checkbox"/> good health    |
| <input type="checkbox"/> food security     | <input type="checkbox"/> bigger livestock | <input type="checkbox"/> more farm land |
| <input type="checkbox"/> formal employment | <input type="checkbox"/> nothing          |   |

**Appendix 3 Questionnaire of household survey (control village)**

PAIMO- Questionnaire – control site

Survey number: \_\_\_\_\_

date of survey: \_\_\_\_\_

Village: \_\_\_\_\_

Respondent:  male  female

\*\*\*\*\*only for researcher\*\*\*\*\*

Observations: House characteristics:

Main Material of the house:  sun brick  mud  fire brick  cement  straw

Main Material of the roof:  grass (thatched)  tin roof

Windows:  no windows  open windows  glass  wood

Electricity:  Yes  No

Other remarks: \_\_\_\_\_

\*\*\*\*\*

**A. HOUSEHOLD CHARACTERISTICS**

1. Are you the head of the household?  Yes  No
2. How many women (including you), older than 18, are living in your household?  
Women: \_\_\_\_\_
3. How many men, older than 18, are living in your household? Men: \_\_\_\_\_
4. How many children younger than 18 years live in your household?  
Number children \_\_\_\_\_
5. How many members speak Portuguese? \_\_\_\_\_
6. Is there any member that is currently absent because of work or studies from the household and living somewhere else?  
 Yes, because of  work  studies  No
7. Were you born in this area?  
 Yes  No -> How many years have you lived here? \_\_\_\_\_
8. Do you know anything about any plantation projects that are planned close to your village or farm plots?  
 Yes -> Do you know from which company?  No  
 Chikweti  New Forests  Green Resource  
 Florestas de Niassa  Florestas do Planalto  Other \_\_\_\_\_  
 Malonda Foundation  I don't know  
a. How do you think about that?  
 positive  negative  I don't care  I don't know
9. Who first told you about the plantations projects?  
 Relatives/ neighbours /friends  local chief  Somebody from the government  
 Company  Malonda Foundation  ICT  other NGOs (which) \_\_\_\_\_  
 We saw it when they started planting

10. Have you heard about impacts of forest plantations on the communities from other villages?

Impacts	*(0/1/2/3)	How? additional information if given
Impact on Water		
Impact on Firewood		
Impact on land availability		
Impacts on Infrastructure		
Impact on employment situation		
Impact on community traditions		

B. LIVELIHOOD STRATEGIES

8. Are you .....(activity)? Are men, women or children responsible for this activity? Can these activities be carried out during wet and dry season?

Activity	check the ones that apply	Men	Women	Children	Season W/D/B
Tending crops					
Tending livestock -> 2.					
Tending fruit and/or trees					
Firewood collection					
Charcoal production					
Hunting					
Fishing					
Other_____					

9. Do you have livestock? What kind?

- Chicken  Ducks  Goats\_\_\_\_\_  Cattle\_\_\_\_\_  Others \_\_\_\_\_  
 None

10. Which of this livestock is creating an income for your household?

- Chicken  Ducks  Goats  Cattle\_\_\_\_\_  Others \_\_\_\_\_  
 None

11. Does any member of the household have an employment

- Yes: What kind of work?\_\_\_\_\_ where? \_\_\_\_\_  No

12. Do members of your Household possess other skills that generate an income for the household?

- Wood carving  Pole making  Brick making  Mechanics  House construction  
 Basket weaving  Driving  Cooking  Other\_\_\_\_\_
- None

13. Do you think members of your household would be interested in getting employed in the forest plantation?



40. Do you have enough machamba land to provide food for the household for the whole year?  
 Yes     No

- For how many month is there usually a shortage? \_\_\_\_\_ months
- How do you sustain your food supply in those months?

Buy food	
Borrow food	
Gather food from forests	
Trade assets against food	
Hunt or Fish	
Other _____	

41. Which is your most important source of fresh water for domestic use during the wet season?  
 River/ stream     well     spring     Borehole/ Pump

Rainwater     piped water     Other \_\_\_\_\_

42. Is this also your most important water source during the dry season?  
 Yes     No -> which is it then?

River/ stream     well     spring     Borehole

Rainwater     piped water     Other \_\_\_\_\_

43. How many hours does your household spend every day for the collection of water for domestic use?

c) during the wet season:  Less than 1     1-2 hours     3-4     more than 4

d) Does it take longer during the dry season?:  < 1h     1-2 h     3-4     > 4h

44. Are you satisfied with the available amount of water ?  
 Yes     No, not at all     I don't know

45. Do you think the forest plantations would affect the water availability for your domestic or agricultural farm use?

Yes: Domestic use     Yes: Farm use     No     I don't know

c) How would it be affected:

Improved

Degraded

Additional sources

Longer distances to sources

Sources carry more water

Sources carry less water

Other \_\_\_\_\_

Other \_\_\_\_\_

46. Do you think the forest plantations would affect the cleanness of the fresh water? How?  
 Yes, improved     Yes, degraded     No     I don't know

47. What do you use for cooking?

Firewood -> 5     Charcoal -> 6.     Something else \_\_\_\_\_

48. Where do you get the firewood from?

Collect in natural forest     collect in plantation area  
 Purchase on market     Other \_\_\_\_\_

49. Where do you get the charcoal from?

Produce ourselves     Purchase     Other \_\_\_\_\_

50. Do you think the forest plantations would affect the availability of firewood?

yes improved     yes decreased     No     I don't know

Why/how

Collection from plantation areas

Improved roads/Bridge

Other \_\_\_\_\_

Why?

longer distances to the forest

reduced natural forest area

Other \_\_\_\_\_

a. If it would be decreased: How would you cope with that?

use charcoal     use gas     use electricity     purchase firewood     other \_\_\_\_\_

51. If you have trees on your land, for what purpose(s)?

Food (Fruits)     medical     Firewood     Other \_\_\_\_\_     we don't grow trees

52. Which non-wood forest products do you collect?

Wild fruits     Honey     Medical plants     Bamboo     Ropes  
 Grass for roof     Other \_\_\_\_\_     None

53. Do you think the forest plantations would affect your access to non-wood forest products?

Yes improved     Yes decreased     No     I don't know

Why/how

Collection from plantation areas

Improved roads or bridge

Why?

longer distances to the forest

reduced natural forest area

54. Do you own any other assets that are important for your livelihood?

Hoe     Axe     Bike     Motorbike     Television  
 Mobile phone     Other 1 \_\_\_\_\_     Other 2 \_\_\_\_\_

55. During the past 12 months have you received any support or assistance from the outside your household? Have you received.....? From whom?

	Check the ones that apply	From whom? 0:Government; 1:NGO; 2:Plantation company; 3:friends/relatives; 4:other (please specify)
Financial support		
Natural resources (firewood, food, ...)		
training / education		
Farm supplies (seeds, fertilizers, tools)		
Medical assistance		
other support		

56. Does your household save money or participates in a Group saving and Credit Scheme (XITQUE)

- |   |  |
|---|--|
| <input type="checkbox"/> Yes, how?                      | <input type="checkbox"/> No, why not?:         |
| <input type="checkbox"/> Group saving and credit scheme | <input type="checkbox"/> Not enough money      |
| <input type="checkbox"/> At a bank account              | <input type="checkbox"/> No facility available |
| <input type="checkbox"/> Other _____                    | <input type="checkbox"/> Don't want to         |
|   | <input type="checkbox"/> Other reason_____     |

57. Has your household ever borrowed money?

- |   |  |
|---|--|
| <input type="checkbox"/> Yes, where from?               | <input type="checkbox"/> No, why not           |
| <input type="checkbox"/> Bank institution               | <input type="checkbox"/> No collateral         |
| <input type="checkbox"/> Group saving and credit scheme | <input type="checkbox"/> We don't want to      |
| <input type="checkbox"/> Family or friends              | <input type="checkbox"/> Process too difficult |
| <input type="checkbox"/> Other _____                    | <input type="checkbox"/> Other _____           |

a. If yes, why did you borrow the money?

- |   |  |  |
|---|--|--|
| <input type="checkbox"/> To purchase food         | <input type="checkbox"/> to purchase seeds | <input type="checkbox"/> construction or reparation work |
| <input type="checkbox"/> to purchase asset: _____ |  | <input type="checkbox"/> other _____                     |

58. Have any of your Household members been sick during the past year so that he could not contribute to the livelihood activities?  Yes  No

If yes:

a. Did this illness decrease your income significantly?

- Significantly  only little  not at all

b. Was a treatment applied to cure?

- |   |   |                                       |
|---|---|---------------------------------------|
| <input type="checkbox"/> Use health care facilities | <input type="checkbox"/> Traditional treatments | <input type="checkbox"/> Other _____  |
| <input type="checkbox"/> No, not needed             | <input type="checkbox"/> No, not enough money   | <input type="checkbox"/> Not possible |

59. Do some or all of the children in your household attend a school? If not, check all the reasons that apply.

- Yes all:                       Yes some of them, + ➔                       No, why not /why not all?  
 not enough money                       health reasons  
 religious reasons                       gender reasons  
 Labour is needed                       don't want  
 School too far away                       Other \_\_\_\_\_

60. How many of the household members have ..... level of education?

Education Level	Number of HH-members
Primary	
Secondary	
Higher Education	
None	
Other	

61. How do you think the Forest plantations would change the following points in your community?

Impact	If Yes →* (0/1/2/3)	Which are important to your household? (up to 3)
Employment situation		
Condition of roads or bridges		
Number of Health care facilities		
Number of Educational facilities		
Number of shops/markets		
Changed prices for food		
Changed prices for firewood		
Others_____		

\* 0: no impacts /1: negative impact /2: positive impact /3: I don't know

62. Do you think the forest plantations would change the traditions of the community?  
How do you think they would change.....

Impacts	*(0/1/2/3)	How? additional information if given
Traditional land use/usage of other crops		
Religious customs		
Changes in labour division		
Family structure		
Hunting and Fishing customs		
Other_____		

\* 0: no changes /1: negative changes /2: positive changes /3: I don't know

63. Do you think that your household would in general benefit from the forest plantations?

strongly disagree  rather disagree  no effects  rather agree  strongly agree

Choose one of the following options that you would hope for your household to achieve in the future?

enough good water

higher education

good health

food security

bigger livestock

more farm land

formal employment

nothing

other