Livelihood Impacts of Forest Carbon Project and its Implications for Forest Sustainability: the Case of Regenerated Forest in Humbo District, Southwestern Ethiopia

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Abstract

This study examines the impacts of forest carbon project on the livelihoods of rural households and its implications for the sustainability of forest by focusing on a regenerated forest in Humbo district of Southwestern Ethiopia. The methods through which primary data were gathered are a triangulation of household survey, key informant interviews and focus group discussions. A total of 132 households were covered by the survey. Findings indicate that though majority of the households resorted to use resources on their own land, the change in the households' access to the forestland made 24.2% of the sample households to purchase fuel-wood, 39.4 % to purchase fodder and 62.9 % to reduce their livestock possessions. Although some households benefited from the jobs created and the skill trainings given by the initiative, only 22% of the sample household attributed the improvement of their yearly income to the benefits associated with the project. The protection of the forestland came up with negative livelihood outcomes particularly for households which previously highly depended on the forestland and for those living in the close proximity of the protected forest. Finally, among several variables considered, only educational status of the respondents, size of farmland and the distance of the households from the forestland were found to statistically significantly influence the attitude of the respondents towards the forest. Achieving positive livelihood outcome, therefore, requires among others fencing the forest area to reduce human-wildlife conflict; and developing frameworks for access to microcredit services in the study areas.

***Key Words**: Carbon project, Ethiopia, forest sustainability, Humbo, livelihood, regenerated forest.*

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Introduction

Forest resources, nowadays, are receiving great attention of global communities due to their dual functions of supporting livelihoods and mitigating climate change. When their role in livelihood is considered, World Bank (2008) indicated that forests contribute to the livelihoods of more than 1.6 billion people around the world. The linkage between forests and woodlands and the livelihoods of rural people in the developing world have been loudly pronounced in literature (Gibson *et al*. 2000; Homewood, 2005; Timko *et al*. 2010; Yasuoka *et al*. 2012). For instance, it has been estimated that over two third of Africa's 600 million people rely on forest products (CIFOR 2005), where forests act as a safety net for rural households in times of stresses and shocks (Byron and Arnold 1997; Yemiru *et al*. 2010; FAO 2013).

In Ethiopia, forest resources play a significant role in the country's economy, particularly in the livelihoods of rural people, as important sources of energy, food, employment, medicine, fodder and income (Alemayehu 2010; Yemiru *et al*. 2010; Aynalem 2012). For instance, biomass energy provides 87.9% of the total energy consumed in the country (Hilawe *et al*. 2011). Apart from depending on forests and woodlands for domestic energy, studies (Kasahun 2008; Alemayehu 2010; Yemiru *et al*. 2010) indicate that rural households in different parts of the country engage in commercial supply of wood, charcoal, and other non-timber forest products to urban areas to generate cash income thereby to support their livelihoods.

Besides the significant role forests play as livelihood assets to rural people, currently their role in controlling and maintaining the stability, functioning, and sustainability of global ecosystems in the face of frighteningly changing global climate is highly recognized (Streck *et al*. 2008; World Bank 2008). This recently recognized role of forests has contributed to the emergence of markets for ecosystem services such as Clean Development Mechanism (CDM). Having twin objectives of reducing green house gasses and promoting sustainable development in host countries, CDM projects are under implementation in the non-industrialized countries since 2005 (Maraseni *et al*. 2005; Streck *et al*. 2008). In line with this, in 2006, Afforestation and Reforestation (A/R) project was introduced to Humbo *Woreda* (district) of southwestern Ethiopia to regenerate 2,728 hectares of previously degraded forestland with the aim of enhancing the

local communities' livelihoods through improved environmental conditions as well as financial inflows to be achieved through linkages with carbon markets (WVA 2011).

Since its introduction to the study area by World Vision Australia (WVA) and World Vision Ethiopia (WVE), the initiative managed to restore 2,728 ha of degraded forest by enclosing the land that had long been an open access resource (Aynalem 2012). Brown *et al.* (2010) identified that the regeneration and protection of the forest has undeniably contributed to the reduction of carbon dioxide from the atmosphere. However, the initial area closure and the later conservation of the regenerated forest take us to the very important issue of access to forestland and forest products by local people. Because, access to forest products and/or consumption of other returns associated with the conservation of the rehabilitated forest and the positive valuation of such returns by the surrounding communities are indispensable for the sustainable management of the resource.

With its twin objectives, the CDM claims to address the issue of securing benefits to local people. However, there is an ongoing debate over CDM projects' commitment to achieve their sustainable development goal in host countries. Winkler *et al*. (2011) indicated that much of the attention has been given to emission reduction than that of sustainable development even in the very outlining of modalities and procedures for the CDM Projects. In a similar vein, by assessing the potential contribution of some CDM projects, Sutter and Parreno (2007) concluded that the tradeoff is in favor of cost efficient emission reduction objective than that of contributing to local livelihoods. Jindal *et al*. (2008) also indicated that, in the short run, the forest carbon projects are less likely to benefit local communities and may even harm them by restricting access to natural resources and competing for scarce groundwater. Taking the other side of the argument, World Bank Carbon Finance Unit (2011) asserted that A/R projects alleviate poverty and promote the socioeconomic development of rural areas of the host countries.

In Ethiopia, the available studies (Brown *et al*. 2010; WVA 2011) indicate that the forest carbon project at Humbo is generating revenues from the sale of carbon stocks. However, the studies overlooked those important issues such as the responses of local people to restrictions imposed on

access to the forestland, and the impacts of the benefits claimed to be associated with the forest carbon project on the livelihoods of local people.

The costs incurred or the benefits enjoyed by a given community due to the area enclosure significantly influences the way that community views and manages the natural resource under consideration (Yeraswork 2000; Homewood 2005). If the carbon sequestration initiative is perceived by locals as an impediment to their livelihoods, it may create an incentive for behaviors that threaten the sustainability of the regenerated forest and the permanence of carbon sequestration. Therefore, this study was conducted to fill the identified knowledge gap concerning the impacts of Humbo forest carbon project on the livelihoods of local people and its implication for the sustainability of the regenerated forest. In order to specifically address the aforementioned issues the study had the following objectives.

- To identify major changes in the households' access to the forestland and their responses
- To describe the household level livelihood impacts of the regeneration of the forest and other benefits associated with the forest carbon project
- To identify factors influencing the respondents' attitude towards the regenerated forest

The Sustainable Livelihood Framework (SLF) that has been forwarded by the British Department for International Development (DFID) was used as a guiding conceptual and analytical frame for this study. It is a widely used framework for analyzing livelihoods and it improves ones understanding of livelihoods, particularly the livelihoods of the poor (DFID 1999). Livelihood literature widely recognize that any analysis of livelihoods should address the fundamental question of what particular context (such as policy settings, politics, history, agro ecology and socio-economic conditions and so forth), what combination of livelihood assets result in the ability to follow what combination of livelihood strategies to obtain what livelihood outcomes? (Ellis 2000). SLF is one of the most widely used livelihoods frameworks perhaps for it adequately answers the above question. The framework summarizes the main components of livelihoods and complex relationships among the components such as transforming structures and processes, vulnerability

contexts, livelihood assets, livelihood strategies and livelihood outcomes. The framework is used not only to present the main factors that affect people's livelihoods, and typical relationships among them but also it can be used in assessing the contribution to livelihood sustainability made by the existing activities (DFID 1999). Therefore, the framework has been selected and used in this study with the later view in mind, i.e. to assess the livelihood contribution of forest carbon project.

Methodological Applications

The study was conducted in Humbo district of Southern Nations, Nationalities and Peoples Regional State of Ethiopia. It is located at 397 km to southwest from the capital city of the country. The district had a total population of 144,739 of which 72,729 were males and 72,011 were females in the year 2013. Out of the total population of the district, only 7,897 were urban dwellers and the rest 136,842 were rural (Wolaita Zone Finance and Economic Development Department 2013). Mixed farming is the most important livelihood strategy of the local people (WVE 2006; Aynalem 2012). The study employed both purposive and systematic random sampling techniques to select sample Forest Protection and Development Cooperatives (FDPCs) and households respectively. Out of seven FDPCs under Humbo Assisted Natural Regeneration project, three FDPCs, namely, Bossa Wanche, Bolla Wanche and Hobicha Badda were selected purposively. From the three selected FDPCs, a total of 132 households (41 households from Bossa Wanche, 53 from Hobicha Badda and 38 from Bolla Wanche) were sampled for survey using systematic random sampling technique. From the sample households, household heads were contacted to respond to the survey questionnaire which covered issues related to demographic, socio-economic and geographic characteristics of the households; changes in the households' access to the forestland and their responses to it; the impacts of regeneration and protection of the forest and other benefits associated to the project on livelihoods of the households; and their attitude towards the protected forest.

In addition to the household survey, three key informant interviews and three Focus Group Discussions (FGDs) were also conducted (one key

informant interview and one FGD at each FDPCs) to supplement survey data. The key informants of the study were members of executive committee of FDPCs and the participants of FGDs were senior members of FDPCs. The fieldwork was conducted from mid-March to end of April 2014. The data generated by the questionnaire were entered into Statistical Package for Social Science (SPSS version 20) and analyzed using descriptive statistics, chi-square and multiple regression. The information collected through key informant interviews and focus group discussions were analyzed contextually to supplement the data obtained through household survey.

Households' Access to the Forestland: Changes and Responses

The forestland under consideration had been an open access resource until the time A/R project was introduced to the area as indicated by the key informants of this study. As one of the informants from Bossa Wanche stated "starting from the beginning of *Dergue* regime (1974-1991) until the introduction of the A/R project in 2006, the area remained open to public which resulted in unmerciful destruction of the forest and killing and chasing of wild animals that used to live in it." As indicated by the key informant, the open access regime that governed the utilization of the forestland allowed the surrounding individual households to use the forestland as they wanted to. Contrariwise, the recent introduction of A/R project to the forestland came up with a change in the use of the land. The sudden changes in conditions for access to the historically open access resources in turn take us to the issue of the responses of the stakeholder households to deal with the changes. Disclosing forestland utilization status of the households in the time immediately before the area enclosure is, therefore, very important to identify changes in access to the forestland caused by the project activities.

As data collected from sample households shows, 92.4% of the sample households used to depend on the forestland (mainly for fuel-wood, fodder and as a main grazing land) before the area enclosure. This indicates that the forestland was of some value to local people though it was considered as degraded land by the project initiators. On the contrary, only 21.2% of the respondents reported that their respective household currently uses forest products such as firewood and grass from the rehabilitated forest. From this one can notice the existence of a considerable change in the households'

dependence on the forestland after the area enclosure. Therefore, it is imperative to disclose the details of major changes in access to the forestland and the responses of the households.

Access to Fuel-Wood

Forests and open woodlands are very important sources of domestic energy in rural areas (CIFOR 2005; World Bank 2008). In the study areas, 90.2% of the respondents reported that their household used to depend on the forestland under consideration for fuel-wood immediately before the introduction of the project to the study areas. This indicates that fuel-wood was collected from the forestland by considerable number of households though the forestland was degraded. Here, it is imperative to disclose the main source of fuel-wood for the households after the introduction of the project in order to identify the changes caused by the initiative and the responses of the households.

Table 1. The households' main source of fuel wood after the introduction of the A/R project

		Main source of fuel-wood			Total
		Own land	Protected forest	Market	
Cooperatives	Bolla Wanche	35(26.5%)	0(0.0%)	3(2.3%)	38(28.8%)
	Hobicha Badda	23(17.4%)	3(2.3%)	27(20.5%)	53(40.2%)
	Boossa Wanche	36(27.3%)	3(2.3%)	2(1.5%)	41(31.1%)
Total		94(71.2%)	6(4.5%)	32(24.2%)	132(100.0%)

As Table 1 shows, 71.2%, 24.2% and 4.5% of the respondents identified own land, local markets and the rehabilitated forest respectively as the main source of fuel-wood for their respective households during the survey. There was noticeable variation between the study sites as shown in table 1. While the overwhelming majority of households in Bossa Wanche and Bolla Wanche depended on trees on their own land, more than half in Hobicha Badda reported to obtain fuel-wood by purchase. This is perhaps due to the smaller land possession and the sub-urban nature of the Hobicha Badda FDPC members. However, the smaller portion of households obtaining fuel-wood from the regenerated forest across the study sites evidences the fact that the rehabilitation of the forest hasn't improved the households' access to fuel-wood in contrary to the mid–term evaluation report of the same project by World Vision Australia (2011). Instead, it made 24.2% of sample households to incur additional cost in order to purchase fuel-wood from local suppliers. This in turn detrimentally affects the financial capital of those households.

Evidences collected from FGDs were used to augment survey findings with regard to the responses of the households to changes in access to fuel-wood. In this regard, participants of FGD at Bossa Wanche and Bolla Wanche revealed depending on trees on own land followed by using crop residues such as stalk of maize as the main coping strategies of the households in the area. Whereas, relying on trees on own land and purchasing fuel-wood from local suppliers were identified as dominant coping strategies by participants of FGD at Hobicha Badda. The above evidence of this study differs from the finding of Abebe *et al.* (2012) where rural households in forest-degraded areas of Tigrai, Amhara, Oromia and Southern regions of Ethiopia respond to fuel-wood shortages by increasing their labor input for fuel-wood collection. However, as indicated by the participants of FGDs, in the present study areas the households have no other alternative community woodlands to increase labor input for fuel-wood collection.

Access to Fodder

In addition to wood products, rural households depend on forests for various non-wood forest products. In this respect, fodder (mainly grass and tree leaves) is an important forest product that rural households harvest from forests in their vicinity. In the present study, it was found that 84.1%

of the sample households used to utilize fodder from the forestland immediately before the area enclosure. Here it is imperative to identify the main source of fodder for the households after the introduction of the project in order to reveal its impacts on the livelihoods of the stakeholder households.

Table 2. The households' main source of fodder after the introduction of the A/R project

		Main source of fodder			Total
		Own land	Market	Rehabilitated forest	
Cooperatives	Bolla Wanche	20(15.2%)	11(8.3%)	7(5.3%)	38(28.8%)
	Hobicha Badda	16(12.1%)	33(25.0%)	4(3.0%)	53(40.2%)
	Boossa Wanche	27(20.5%)	8(6.1%)	6(4.5%)	41(31.1%)
Total		63(47.7%)	52(39.4%)	17(12.9%)	132(100.0%)

During the field survey, as shown in table 2, 47.7%, 39.4% and 12.9% identified own land, market and the rehabilitated forest respectively as the main source of fodder for their households. Pearson's Chi-square statistic in table 3 below shows the existence of relationship between the respondents' FPDCs and their main source of fodder ($X^2 = 20.808$, and $p < 0.001$). This can also be noted from table 2 where the greater majority of those who obtain fodder by purchase were from the Hobicha Badda site. This variation can partly be explained by the sub-urban nature of and the small land size that characterize the Hobicha Badda FDPC members. Likewise the issue of domestic energy, i.e. access to fuel-wood, access to fodder was also making

39.4% of the sample households to incur additional costs which in turn detrimentally affect the savings of the households.

Table 3. Chi-square test for the relationship between forestry cooperatives of the households and their main source of fodder

	Value	df	+Asymp. Sig. (2-sided)
Pearson Chi-Square	20.808[a]	4	.000
Likelihood Ratio	21.102	4	.000
Linear-by-Linear Association	1.454	1	.228
N of Valid Cases	132		

In attempts made to obtain supplementary data with regard to the mechanisms the households obtain fodder; key informants from each FDPC indicated the existence of rules for harvesting grass from the forest under conservation. In this regard, a key informant from Hobicha Badda FDPC stated "periodically, based on the availability of grass in the forest, we issue coupons for members thereby they can harvest grass for two months. They pay 4 birr (Ethiopian currency) to get the coupon." As indicated by the key informant, the members of FDPCs engage in cut and carry system where they buy a coupon from their FDPCs whereby to harvest grass from the regenerated forest for a specific period of time. Nonetheless, participants of FGD at each site explicitly indicated that the grass they access through the aforementioned mechanism lasts for a short period of time. As a result, usage of *Enset* and other crop residues was identified as the main mechanism by participants of FGDs at Bolla Wanche and Bossa Wanche. Whereas, in Hobicha Badda, reducing the number of livestock, using *Enset* and other crop residues, purchasing grass from local suppliers, and purchasing hay from lowland areas such as Elo Erasho *Kebele* of Damot

Woyde district and Dale district of Sidama Zone were mentioned as the main mechanisms adopted by the households.

Some of the above coping strategies coincide with the finding of Belay *et al*. (2013) where farmers in Ginchi watershed, Ethiopia, cope feed shortage by conserving crop residue and hay, limiting livestock number based on available feed resource, and using some crop land for pasture and forage production. While using portion of land for pasture and forage production hasn't been reported, purchasing grass was a new coping mechanism reported in the present study. Given the limited availability of crop residues due to small farm size, it is plain that there is a noticeable feed shortage in the study areas which, in turn, detrimentally affects the livestock production and productivity.

Access to Grazing Land

Besides being source for various forest products, the surroundings and the floor of forests play significant role as a grazing land for livestock of the surrounding households. Therefore, it is imperative to disclose the response of the households to restriction of grazing in the project area.

In all study sites, as Table 4 shows, there existed significant dependence of the households on the forestland for grazing purpose. It had served as a grazing land for 90.9 % of the sample households prior to area enclosure. It is imperative, therefore, to see the way the households raise their livestock after the area enclosure.

Table 4. The main grazing place of the households prior to the introduction of A/R project to the areas

		Grazing land prior to the introduction of A/R project			Total
		Own land	The forest	Communal grazing land in other area	
Cooperatives	Bolla Wanche	3(2.3%)	35(26.5%)	0(0.0%)	38(28.8%)
	Hobicha Badda	2(1.5%)	51(38.6%)	0(0.0%)	53(40.2%)
	Boossa Wanche	4(3.0%)	34(25.8%)	3(2.3%)	41(31.1%)
Total		9(6.8%)	120(90.9%)	3(2.3%)	132(100.0%)

The area enclosure resulted in a noticeable change in the way the households raise their livestock. As Table 5 shows, 50.0 % of the sample households use their own grazing land; 40.2% resorted to tethering and stall feeding of their cattle and the remaining 9.8 % take their livestock to communal grazing lands. Although tethering was practiced throughout the study sites, as table 5 shows, the largest share of households that practiced it were from Hobicha Badda. As evidences collected from FGDs at Hobicha Badda and Bossa Wanche, the households that practice tethering and stall feeding either keep their cattle indoors and supply them with fodder through cut and carry system or they tether their cattle in a small plot of land in front of their house. In this regard, those who raise their cattle in this way are required to collect twofold fodder relative to what they used to collect prior to the area enclosure as the fields where they

tether their cattle are overgrazed. This shows the existence of a noticeable number of households (more than 1/3rd) to whom livestock production is at crossroads.

Table 5. The main grazing place of the households after the area enclosure

		Current grazing land of the respondents			Total
		Private grazing land	Communal grazing land	Tethering and stall feeding	
Cooperatives	Bolla Wanche	23(17.4%)	5(3.8%)	10(7.6%)	38(28.8%)
	Hobicha Badda	14(10.6%)	5(3.8%)	34(25.8%)	53(40.2%)
	Boossa Wanche	29(22.0%)	3(2.3%)	9(6.8%)	41(31.1%)
Total		66(50.0%)	13(9.8%)	53(40.2%)	132(100.0%)

There are some additional noteworthy responses of households to the exclusion of grazing in the forestland. For instance, 29.5% of the sample households reported to practice stubble grazing on crop lands particularly immediately after harvesting cereals. Although the practice is well known for its detrimental impact on soil fertility, a little less than 1/3rd of the sample households adopted it due to lack of grazing land.

Finally, reducing the number of livestock was another strategy adopted by households of the study area. 62.9 % of the sample households reduced the number of livestock by selling out in order to deal with lack of grazing land and associated shortage of animal feed. This shows that the exclusion of grazing in the project area detrimentally affected livestock production

which is the integral part of the main livelihood activity of the overwhelming majority of the households.

Impacts of the Project on the Livelihood Assets, Livelihood Strategies and Livelihood Outcomes of the Households

Livelihood assets refer to the resources upon which people draw in order to carry out their livelihood activities (DFID 1999; Neefjes 2000). In this regard, SLF identifies five types of assets (human, social, financial, physical and natural capitals) upon which livelihoods are built. In this sub section, emphasis is given to the project's impact on each livelihood asset, main livelihood strategies and livelihood outcomes of the sample households.

Impacts on Human Capitals of the Stakeholder Households

Human capital represents skills, knowledge, ability and potential to labor and good health that in combination with other assets enables people to engage in different livelihood activities (DFID 1999). In this regard, this study has mainly emphasized on employment creation, and knowledge and skill transfer endeavors of the project in order to identify its impact on the aforementioned human capitals of the stakeholder households. To this end, the respondents were asked whether they benefited from job opportunities created by the project. As field survey data indicates, 68.9% of the sample households benefited from job opportunities created by the project such as production and planting of seedlings, pruning activities, forest guarding, bird survey and carbon monitoring.

During the field survey, only 6.8% of the sample households were participating in jobs created by the project. Evidence collected from participants of FGDs also revealed that the availability of job opportunities in association to the project has gradually declined. Participants mentioned forest guarding and pruning activity as the only job opportunities currently available in association to forest conservation. Therefore, this not only shows the irregularity of the jobs created by the project, but also shows that their absence by time in which the stakeholder households were most vulnerable to food insecurity since the survey was conducted in well known food insecure months (March-April) in the area. From the above finding it is evident that the job opportunities created by the project were not in a situation to meaningfully contribute to the health, education, housing and food security of the stakeholder households. Therefore, the impact of

employment generated by the project on human capital of the households was not worth mentioning.

Another important human capital is the skill of the household members. In this regard, emphasis was given to the trainings provided by the project. As field survey data shows, members of 79.5% of sample households took trainings associated with the assisted regeneration project. As indicated by the key informants of this study too, the project provided trainings to the stakeholder households concerning family planning, reproductive health, HIV/AIDS, soil conservation, forest management and so on. In addition to the general trainings on the aforementioned issues, some households were exposed to skill trainings. In this regard, 37.1% of the sample households were trained in farm and non-farm income generating activities such as animal fattening, poultry, beekeeping, carbon monitoring, tailoring, and so forth. This shows that the project gave trainings to members of more than 1/3rd of the sample households in income generating activities in order to enhance their capacity to diversify their livelihood away from the extraction of forest products.

Identifying whether the households make use of the skills they developed through training sessions is imperative in order to weigh up the contribution of the endeavor to human capitals of the concerned households. In this regard, it was found that 25.8% of the sample households was benefiting from the income generating activities in which they were trained. Hence, the above figure indicates that the trainings assisted about a quarter of sample households to get additional income by engaging in income generating activities introduced to them. Conversely, it also makes explicit the existence of some households which were not benefiting from the income generating activities in which they were trained for one or another reasons. Finally, as some studies (Asquith *et al*. 2002) indicated, improving stakeholder households' access to health services and potable water was associated with forest carbon projects. However, in the present study, there was no evidence of provision of healthcare services and of improvement in the households' access to potable water.

Impacts on Social Capitals of the Stakeholder Households

Social capital comprises social networks, memberships of formal and informal groups, relationships of trust, reciprocity and access to wider

institutions of society (DFID 1999; Neefjes 2000). In the present study, among others, the role of the forest carbon project in creating an opportunity for the stakeholder households to be members of formal social groups and its impact on their ability to work together towards their shared goals was considered. Seemingly, the project enabled all stakeholder households to be members of the FDPC (formal group). However, in addition to the existence of such social network, it is imperative to disclose the functionality of this social network vis-a-vis the livelihoods of the households. Apparently, the households' membership to the FDPCs enabled some households to be eligible for various benefits associated with the project such as exposure to trainings, provision of equipments, and participation in job opportunities.

The project's impact on the individual household's ability to work with other members of FDPC was also considered. In this regard, the respondents were asked whether they perceive that the project enhanced their households' ability to work with other members of their respective FDPC. As field survey data indicates, 75% of the respondents reported that they perceive their ability to work with other members of their FDPC has been enhanced due to the project. The remaining 25% were those who didn't perceive that their ability to work with others has been enhanced.

Impacts on Financial Capitals of the Stakeholder Households

Financial capital refers to the financial resources, such as savings, access to credit services and inflows of money that are available to people in pursuit of their livelihood strategies and outcomes (DFID 1999; Neefjes 2000). In the present study, emphasis was given mainly to the impacts of the project on the households' savings both in forms of cash and liquid assets particularly livestock, and access to credit. To this end, the respondents were asked whether they perceive that the yearly income of their households has increased after the introduction of the project. Findings of the study show that the yearly income of 24.2% of the sample households has been improved after the introduction of the A/R project and almost all of them, i.e. 22% associated the improvement in their households' yearly income to the project.

Nevertheless, the financial impact of the project was detrimental to some sections of the communities. For instance, the area enclosure eroded cash savings of some households by making them obtain fuel-wood and

animal feed through purchasing as indicated in table 1 and table 2. In this regard, the resource poor households were undeniably the ones that were hit hard as they were made to incur additional cost for purchasing fuel-wood and fodder which in turn undeniably erodes their savings. The impact of the project on other kinds of saving such as livestock was detrimental to the overwhelming majority of the sample households. In this regard, 62.9% of the sample households reduced the number of their livestock by selling out due to exclusion of grazing in the forestland and the associated shortage of animal feed. Therefore, this shows that the project inadvertently negatively affected the households' effort to keep their saving in the form of livestock.

Finally, it is important to uncover the projects' impact on the households' access to credit service. Though the FDPCs are receiving carbon revenue on yearly bases, access to microcredit services hasn't been reported by the respondents of the filed survey. The key informants from each cooperative also indicated providing microcredit service as only a long term plan of their respective FDPC. Therefore, this shows that the households' social network, i.e. membership to the FDPCs, hasn't enhanced their access to loan services though it had a big potential to do so.

Impacts on Physical Capitals of the Stakeholder Households

Physical capital represents the basic infrastructure and producer goods (roads; schools, secure shelter and buildings; adequate water supply and sanitation; affordable energy and so on) that people use to function more productively and support their livelihoods (DFID 1999; Neefjes 2000). In the present study emphasis was given only to the project's impact on household level physical capitals. With regard to equipments received by the households, as field survey data shows, 70(53%) of the sample households received one or another equipment from the project. However, here, disclosing the type of equipments received by the households would allow one to judge whether the equipments received were productive or not.

Table 6. The Type of Equipment Received By the Households

Equipments the households received from the Project	Percent	Frequency
Improved cook stove	23	17.4
Modern beehive	7	5.3
Sewing machine	4	3.0
Forestry equipments (e.g. sickle and machete	36	27.3
Total	70	53.0

As it can be seen from table 6, only 25.7 % of the sample households received equipments, namely improved cook stove, modern beehive and sewing machine that can enhance the other capitals of the households in one way or another. Whereas, the larger share (27.3%) received forestry equipments such as sickle and machete whose contribution to other capitals of the households is negligible. Except the provision of the aforementioned equipments which were limited in their coverage, the impact of the project on other private physical capitals of the households was not apparent. As none of the respondents reported receipt of cash income from carbon revenue, they couldn't add on their private physical capitals.

Impacts on Natural Capitals of the Stakeholder Households

Natural capital represents natural resource stocks (atmosphere, trees, land, rivers, wells and so forth) from which resources useful for livelihoods are derived (DFID 1999). As many natural capitals are not privately owned by individual households, in this study the emphasis was only given to the impact of the project on the privately owned trees, and private land of the stakeholder households. The study attempted to identify whether tree plantation on own land of the respondents' households has increased in association to the project. In this regard, it was found that tree plantation has

increased on the own land of 42.4% the sample households. This concurs with the results of focus group discussions particularly at Bolla Wanche and Bossa Wanche where there was a strong consensus among the participants that households with marginal land have increased their tree holding by planting seedlings provided by the project particularly during seedling production.

It is imperative to see the A/R project's impact on land since land is a very indispensible capital of farm households. Participants of FGDs particularly at Bossa Wanche and Hobicha Badda indicated the reduction of water and wind erosion on lands adjacent to the rehabilitated forest. Furthermore, participants of FGDs at all sites agreed that the moisture retention capacity of soil has been enhanced due to the rehabilitation of the forest. The exclusion of grazing in the forest area, however, came up with a detrimental impact on the private land of some households. In this regard, it was found that 29.5% of the sample households practice stubble grazing particularly in harvest seasons. The practice, in turn, is likely to make the land vulnerable for wind erosion and thereby to reduce the productivity of the land. Furthermore, as 62.9 % of the sample households reduced the number of cattle they posses due to the exclusion of grazing in the forest area, it is plain that the amount of manure that the households spread over the land was also reduced. This in turn negatively affects the productivity of the agricultural land of the households.

Impacts on the Livelihood Strategies of the Households

Livelihood strategies are the combination of activities that people choose to undertake in order to achieve their livelihood goals (DFID 1999). In fact, rural households pursue multiple portfolios of livelihood activities. However, in the present study emphasis was mainly given to the impacts of the project on farming, i.e. crop and livestock production, as it was reported to be the main livelihood strategy of 84.8% of the sample households and undeniably highly related to the project activity.

The project came up with both positive and negative impacts on crop production as evidences collected by this study show. For instance, as indicated by participants of FGDs, the timely rain fall and enhanced moisture retention capacity of soil which resulted from the forest rehabilitation has enabled the farm households to cultivate various crops

like *Enset*, sweet potato, yam, potato, cassava, and so on. However, the participants expressed that, it is in vain since their crops are severely destroyed by wild animals mainly warthog, baboons, porcupine and bush duikers. This clearly shows the differential impact of the restoration of the forest on the stakeholder households' activities where households near the forest land are highly exposed to harm caused by wild animals returned to the forest.

When the impact of the project on another equally important livelihood activity (livestock rearing) is considered, it was found that 62.9% of sample households reduced the number of livestock by selling out due to the exclusion of grazing in the forest area and the resultant shortage of fodder. Furthermore, the threat posed by wild life on the livestock of some households adds to the aforementioned negative impact of area enclosure on livestock production. In this regard, participants of FGDs disclosed that the livestock of inhabitants closer to the forest land are exposed to frequent attack from wild life like hyenas, leopards, and some bird species. This fact evidences the project's latent discouraging effects on livestock rearing of the majority of stakeholder households.

Impacts on the Livelihood Outcomes of the Households

Livelihood outcomes are the achievements of livelihood strategies, such as more income, increased well-being, reduced vulnerability, improved food security and a more sustainable use of natural resources (DFID 1999; Ellis 2000; Neefjes 2000). It is very essential to disclose the livelihood outcome of the households since the impacts of the project on the households' livelihood assets and livelihood strategies are ultimately reflected on their livelihood outcomes. To this end, bellow emphasis is given to income, food security, and vulnerability of the households.

Since increased income is clearly relevant to the economic sustainability of the stakeholder households, it is imperative to look at the impact of the project on it. In this regard, it was found that the forest carbon project has contributed to the improvement in the income of 22% of the sample households. Conversely, it does mean that the income of 78% of the sample households was either unchanged or decreased due to the project.

The impact of the project on the food security of the households is worth mentioning. In this regard, it is important to see the way the project activities influenced production and availability of food at household level.

According to participants of FGDs, the protection of the forest enabled them to receive a timely rain which in turn allowed the households to cultivate various crops at least twice in a given year. Nonetheless, as participants of FGDs particularly at Hobicha Badda and Bossa Wanche indicated, the small land size of majority of the farm households didn't allow them to make a good use of improved local climate. Furthermore, for households near the forest it is not only the small land size that limits their effort to use the improved local climate in order to produce more food, but also the attack of wild animals on major root crops. Consequently, the participants indicated that, the households with larger land size and residing far away from the protected forest are advantageous in producing more food for their households. The indirect detrimental impact of the project on *Enset* plant has been identified as an evidence for increasing food insecurity of the households particularly in the close proximity of the protected forest. In this regard, the increased pressure on *Enset* plant due to rampant attack from wild animals and the utilization of the same plant for animal feed has eroded the plant's longstanding role in food security of the households of the study sites.

The discouraging effects of the project on livestock production uncovers the project's detrimental impact on the food security of the households since income from selling livestock and livestock products plays an essential role in food security of farm households. Participants of FGD at each study site indicated that the households of the areas used to depend on incomes from the selling of small livestock like sheep, goat and calf of cattle to purchase farm inputs like seeds, and to purchase foodstuffs particularly between harvests. After the area closure, participants exposed that, they were left with nothing to depend upon during food insecure months due to their inability to raise small animals like sheep and goat.

Forests and woodlands provide important supplementary cash income particularly for poorer rural households in both resource rich and resource poor contexts (World Bank 2008). In this regard, it is well recognized that marketing of forest products plays an important role in reducing the vulnerability of poorer households. In the present study, it was found that 40.9% of the sample households used to depend on selling fuel-wood and charcoal in order to generate cash income in time of economic shocks. Such

dependence of the households on forest products has ceased after the area enclosure.

Looking at the ways those households (i.e. previously engaged in forest based livelihood activities) substituted the livelihood activities they lost due to the area enclosure may shine some light on the projects' impact on the vulnerability status of the households. Only 7.6% and 4.5% of the respondents mentioned income generating activities introduced by the project and jobs created by project respectively as a substitute livelihood activity for their households. 16.7 % and 2.3% of the respondents mentioned productive safety net program and daily labor respectively as a supportive livelihood activity for their households. The rest 9.8% of the respondents reported that their households were left without any supportive livelihood activity. This shows that the area enclosure that accompanied the forest carbon project has increased the vulnerability of some previously highly forest dependent households by leaving them without any safety net.

Finally, since none of the respondents reported a receipt of cash income from carbon sell, it couldn't be claimed that the carbon revenue has reduced the vulnerability of stakeholder households. In a nutshell, the payment for ecosystem service of the regenerated and protected forest hasn't been used to reduce the vulnerability of the stakeholder households.

Respondents' Attitude towards the Regenerated Forest: Implication for Sustainability

The attitude of rural households towards any natural resource at their disposal is influenced by a number of demographic, socio-economic and geographic factors. In this study, the attitude of respondents towards the protected forest was taken as a dependent variable. The independent variables considered include age and educational status of the respondent, farm size of the respondent's household, distance of the households from the forestland, the FDPC of the respondent's household, the main livelihood activity of the respondent's household, the household's main source of fuel wood and the household's main source of fodder. However, as test results for all categorical variables indicate, no statistically significant relationship has been found between the variables. Multiple regression was computed to examine the relationship between metric independent variables, i.e. age and educational status, farm size, and distance of the household from the forestland, and the dependent variable. Multiple regression result showed

that educational status of the respondent, the size of farm land of the households and the distance of the households from the protected forest were important factors influencing the attitude of the respondents towards the regenerated and protected forest. The coefficient of adjusted multiple determination is 0.697 indicating that about 70% of the variation in the attitude of the respondents towards the regenerated forest was captured by the model.

Table 7. Multiple linear regression results

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	13.982	2.707		5.165	.000
Educational status of the respondent	1.521	.136	.658	11.164	.000
The size of farmland of the households	5.472	1.604	.169	3.411	.001
The distance of the households from the forest	2.015	.423	.249	4.763	.000

a. Dependent Variable: The respondent's attitude towards the forest

As shown in Table 7, educational status of the respondents was strongly and positively correlated with their attitude towards the protected forest (at $p<0.01$) which shows the tendency of more educated people to more favorably view the regenerated forest. There is also a statistically significant positive correlation between the size of farmland held by the households

and the respondents' attitude towards the protected forest. This could be explained by the fact that resource poor households are more likely to strongly depend on communal resources than households rich in livelihood capitals. Consequently, the resource poor households are more likely to negatively view any intervention that acts as a barrier to their livelihoods. Finally, a statistically significant moderately strong positive relationship was found between the distance of the respondents' households from the protected forest and the respondents' attitude towards the protected forest. In this regard, less favorable attitude associated with living closer to the protected forest was perhaps due to a considerable reduction of the households' dependence on the forest and noticeable harms caused by wild life as evidences collected from FGDs suggest.

The attitude of the stakeholder households towards the regenerated forest sheds some light on the sustainability of the forest as people's action is highly influenced by their attitude. As disclosed in the foregoing discussion, among others, the distance of the stakeholder households from the forestland and the size of farmland held by the households found to statistically significantly influence the household heads' attitude towards the forest. As field survey data indicates, 76.5% of the sample households were located within 2 km distance from the forest. Concerning the size of farmland, 75% of the sample households possessed farmland below 0.5 hectare. This shows that the overwhelming majority of the sample households possessed smaller farmlands and were in the close proximity of the forest. From this one can understand that the overwhelming majority of the sample households held unfavorable attitude towards the forest which, in turn, is highly likely to encourage actions that are against the sustainability of the regenerated forest.

Conclusion

The study investigated the livelihood impacts of forest carbon project and its implications for the sustainability of the forest by taking a regenerated forest in Humbo district as a case. The Sustainable Livelihood Framework (SLF) developed by DFID was employed as a conceptual and analytical framework. The result of this study uncovered that the changes in the households' dependence on the forestland forced the households to devise various strategies to cope with the shortage and/or loss of some resources. Though significant number of households resorted to use their private

resources, asset poor households were coerced to tether their cattle and, to the worst, to reduce their livestock possession. Therefore, it indicates that the resource poor households were hard hit by the area enclosure that accompanied the A/R activities.

Concerning the impacts of the benefits associated with the forest carbon project on the livelihood of the households, the project created some job opportunities and provided various trainings and equipments to contribute to the livelihoods of the households. The training opportunities enhanced the skill of about a quarter of households thereby contributing to the livelihood of the households. However, as almost all job opportunities were of a very short duration and existed only at about the beginning of the project, the income that could be generated from them hardly enables the households, i.e. particularly the households not benefiting from the income generating activities introduced by the project, to sustainably invest it on the other assets of the households. With regard to the impact of the project on the livelihood strategies of the households, in fact, the project introduced some alternative farm and non-farm livelihood activities to the area and a handful of households successfully adopted them. Its impact on crop production was encouraging for households located far away from the forest while being detrimental for households close to the forest particularly due to the severe damage on crops caused by wild animals. Likewise, it discouraged resource poor households from livestock production. When one considers the overall impact of the forest carbon project on the livelihood outcomes of the households, it was positive for few households (22%) who have successfully adopted and were benefiting from the alternative livelihood activities introduced by the project. Its impact on the livelihood of the households located in the vicinity of forest was negative since it exposed their crop to the attack of wild life, reduced the income they used to generate from the sale of livestock and livestock products and whereby making the households more food insecure and vulnerable than they had been.

Multiple regression identified educational status of the respondents, the size of agricultural land of the households and the distance of the households from the forestland as important variables that influence the attitude of the respondents towards the protected forest. Positively contributing to the livelihood outcome of the stakeholder households in

general and resource poor households in particular is imperative as the sustainability of the forest in general and the carbon sequestration in particular depends on the positive valuation of the forest by the surrounding inhabitants. In this regard, fencing the forest area to reduce human-wildlife conflict and developing frameworks for access to microcredit services in each FDPC are, therefore, recommended measures.

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