

The Socio-Economic and Environmental Impacts of the Implementation of Carbon Sequestration in Humbo Woreda, SNNPR, Ethiopia

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Abstract: Carbon sequestration through forestry can help in the mitigation of global warming. For Africa, carbon sequestration also represents an opportunity to fund sustainable through financial inflows. However, with a low share of global carbon trade, there are strong concerns that African countries are losing out this valuable opportunity. Markets for environmental services have been growing in recent years wherein more and more people are willing to pay for benefits such as natural beauty, clean water, biodiversity etc. Carbon sequestration constitutes an important segment of this market. The study focused on the socio-economic and environmental impacts of carbon project implemented in Humbo district SNNPR, Ethiopia.

Keywords: natural beauty, clean water, biodiversity, Carbon Sequestration in Humbo Woreda, fund sustainable.

1. INTRODUCTION

The analysis subsequently examined the benefits that are envisaged from the project and other related issues based on the focus of the study. Quantitative and qualitative methods of research have been applied throughout the investigation. Accordingly, observation, in depth interviews, focus group discussions and questionnaires were used to gather information. The observed status of carbon project tree species and the results from socio economic results are promising to enhance local livelihoods. It also enhances access to wide varieties of environmental goods and services to local communities. Since the local communities have had poorly developed infrastructure, limited options for livelihoods and dependence on subsistence agriculture, the Carbon Project may prove to be beneficial to the local community by providing regular source of income in the form of carbon payments.

Statement of the problem:

The risk of global climate change as a result of rising greenhouse gas emissions is presenting a profound challenge to the international community. There is increasing concern about climate change and variability, which has led to a rapidly growing body of literature on impacts of warming on the economy, which may have adverse effects on agriculture. Changes in land use of the forest ecosystem have occurred as a result of climate changes and these have been documented by various researchers (Kifcon, 1994). It is therefore important to assess the role of forest carbon sequestration in the mitigation of climate change. The establishment of the potential socio-economic value of forests is critical for substantial and productive agriculture and therefore to food security. Sub-Saharan Africa, which includes Ethiopia, is hard-hit by climate change. This region experiences high temperatures and low (and highly variable) precipitation. Interestingly, the economies of this region are highly dependent on agriculture (Kurukulasuriya and Rosenthal, 2003). The levels and trends

of forest changes have also been aggravated by the increase in human population around the forest ecosystem. Parts of the forest have been converted to agricultural activities and settlement leading to a net loss of the natural forest area. Nonetheless, the lands surrounding the forest area have the potential to sequester a certain amount of carbon that has socio-economic value. In recent years, carbon sequestration in the form of forestry projects has evolved into a viable alternative to tackle global warming and climate change. It also constitutes valuable environmental services provided by forests, other important services being watershed protection, biodiversity conservation and ecotourism etc. As per the third assessment report of the Intergovernmental Panel on Climate Change-forests, agricultural lands, and other terrestrial ecosystems offer significant carbon mitigation potential (IPCC, 2001).

The IPCC report also states that in addition to reduction in atmospheric carbon dioxide, such projects may also provide other social, economic and environmental benefits such as sustainable land management and rural employment. Furthermore, such projects could only become sustainable if the socio-economic driver for deforestation and other losses of carbon pools are addressed. Therefore, an understanding of the socio-economic processes, particularly the potential benefits and risks of carbon sequestration projects, is essential before they are recommended for wider replication. While political and technical issues have dominated such debates in the past, of late there has been a growing awareness on social issues in terms of impact on local communities. It is felt that analysis of the potential of such forestry activities to support local livelihoods could therefore make an opportune contribution to the clarity of this debate (Smith and Scherr, 2002). As the above discussion brings out, there is an urgent need to look at the socio-economic aspects of forests in the context of emerging markets for environmental services such as carbon sequestration. The lessons from such projects will constitute important research outcomes, which will be used to inform the ongoing policy debates on the subject as well as to improve the effectiveness of various projects being implemented in different parts of Africa. The study will provide valuable feedback to all those who are involved in creating and regulating markets for environmental services, viz. Governmental and non-governmental organizations, research institutions and common citizens.

Objectives of the Study:

- It is to assess environmental benefits to the local community from carbon sequestration project.
- It is to investigate whether forest carbon sequestration project has an influence on the local community environmental resource management knowledge and use of forest especially in climate change mitigation.

2. LITERATURE REVIEW

Carbon Sequestration and Global warming:

Carbon sequestration is the process of removing carbon dioxide from the atmosphere and storing it in other potential reservoirs such as land, forests, oceans etc. Intergovernmental Panel on Climate Change (IPCC, 2001) describes it as 'the process of increasing the carbon content of a (carbon) reservoir other than the atmosphere. Carbon sequestration has assumed significance in the face of rising global warming, which results from build up of green house gases such as carbon dioxide, methane, nitrous dioxide, and sulphur hexafluoride etc., in the atmosphere. These green house gases (GHGS) absorb heat radiated from the earth's surface and have been responsible for maintaining temperature on the earth's surface in the past. However, over the 20th century, increasing concentration of GHGs in the atmosphere has led to unprecedented at an average of 0.5% per decade, making 1990s the warmest decade and 1998 the warmest year in the instrumental record. There is evidence to show that there is a 10% decrease in the snow cover since the 1960s and that there has been a widespread retreat of mountain glaciers in non-polar regions during the 20th century. Anthropogenic activities such as burning of fossil fuels and deforestation are the main reasons for the substantial increase in the concentration of GHGS in the atmosphere.

Intergovernmental Panel on Climate Change estimates that in a 'business as usual' scenario, temperatures could further increase by 1.4°C -5.8 °C over the next 100 years. This could cause severe climatic changes such as rise in sea levels, frequent floods and landslides, health impacts (e.g. epidemics, spread of infectious diseases etc), loss to infrastructure, increase in soil erosion, pollution, increased desertification etc. (IPCC, 2001). Apart from widespread loss of life, such severe changes in climate would threaten economic growth, particularly that of developing countries which may not have sufficient technical or financial capacity to adjust to these shocks. Therefore, climate change presents an extraordinary

challenge to the global society. This needs to be addressed at the earliest. In this context, carbon sequestration in the form of forestry activities could become an important part of the strategy to combat global warming (IPCC, 2001).

Sustainable Development and Carbon Forestry:

The concept of sustainable development was brought to the global stage by the world commission on environment and development (WCED, 1987). The central idea behind the concept of sustainable development is to address the relationship between the environment and development.

“Sustainable development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). The concept lies on three central pillars: environmental protection, economic progress and social equity (May, 2004). These pillars are interlinked and need to be present together at three different levels: local, national and global (Auckland et al, 2002; IUCN, 1995). Development can not be sustainable if resources are deteriorating over time, nor when only the environmental issues are addressed. Improving living standards, ensuring social equity and promoting citizens; participation in decision-making are equally important components of sustainable development (WCED, 1987). Historically, developed countries had contributed to the increase of the GHGs concentration in the atmosphere with a disproportionately higher share of emissions per capital in comparison to developing countries. The achievement of climate stabilization is connected to emissions reduction in both developed and developing countries (Ferro, 2001). Therefore, one of the greatest challenges for climate change policy makers is to achieve the reduction of the global emissions, while respecting the concept of equity and addressing the needs of the developing nations (UNFCC,2004).

Through CDM and compliance carbon market of the Kyoto protocol industrial countries can reach green house gas reduction targets, by purchasing carbon credits from emission reduction projects in developing countries and at the same time contribute to their sustainable development. (Lovell 2008, UNFCC, 2004). In order to encourage adequate policies and attract more investment in carbon forestry in the future, it is important to understand the local impact of these projects on the components of sustainable development like living standards, social equity and citizen’s participation in decision making process (WCED, 1987; Jindal, 2008).

Carbon forestry projects have been criticized mainly for disrespecting concept of equity and hindering sustainable development of the poor, by occupying the land and forbidding the forest use (Fern.2001). Some critics went all the way in comparing the carbon offset market with a new form of colonialism, so called CO₂ socialism (Eraker, 2002). A broader involvement of the local actors in design, implementation and evaluation of forest carbon projects (May, 2004) brings numerous advantages, such as recognition of the local people’s legitimate rights over the resources, better communication and relations between community and government and improvement of community managerial capacities (May, 2004).

Careful attention to the distributional impact and the encouragement of locals are thus essential for achieving sustainable development objectives. Sustainability is actually strengthened by lowering the level of poverty, which leads to a decrease in the pressure of converting the forest into the agricultural land, or land for fuel and other goods production. This land use pattern is in direct conflict with forest conservation. Conversely, protection of the forests might be crucial to the wellbeing of the forest dependent nations and communities (Sunderline et al, 2003, 2005).

Sustainable development benefits:

Sustainable development is an important issue for carbon sequestration projects. Many researchers have documented the livelihood and other development benefits of various carbon

Sequestration projects around the world. For some examples see; (Rosa *et al*,2003); (Smith and Scherr,2002); and (Totten,1999). The Kyoto Protocol stipulates that all CDM projects including carbon sequestration activities should achieve sustainable development benefits for host countries (UNEP, 2004; Olhoff et al., 2004). Although most current carbon projects in Africa are not for compliance under Kyoto, they often follow these broad CDM guidelines. Research indicates that many carbon sequestration projects in Africa are helping to improve local incomes through the sale of carbon credits. These examples signify the potential to achieve sustainable development and provide increased financial inflows for the host countries. For instance, in the Nhambita Community Carbon Project in Mozambique, local households will receive a cash payment of \$242.60 per ha over the next seven years for carbon sequestered by various land-use activities.

Although the percentage of money paid to each household will vary from 30% of the total in the first year to 10% of the total in the seventh year, a simple average works out to \$34.70 per household per annum (taking an average of one hectare of land per household). This represents a significant increase in cash incomes for most households and addresses their felt need of obtaining access to a regular income source (Jindal, 2004). Similarly, under TIST in Tanzania, local farmers receive carbon payments on the basis of the number of trees they can manage on their lands. Other benefits include increased access to fruits, timber, and firewood plus any other NTFPs the trees produce (for more details see <http://www.tist.org/>). These examples suggest that many carbon sequestration projects have potential to contribute to sustainable development in Africa and to provide increased financial inflows for host countries. More objective impact assessment studies will need to be undertaken before the full range and magnitude of benefits and costs is fully understood.

➤ **Biodiversity conservation and protection of natural resources:**

Many natural resource management projects are not viable either because their benefits are uncompensated environmental services or because national governments and other local agencies do not have adequate funds to undertake conservation activities. Carbon projects can address these concerns in two important ways, first by paying for some of the services such as carbon sequestration, and secondly by providing financial assistance to national governments to invest in natural resource projects (Gutman, 2003).

Improved land productivity through soil carbon sequestration:

Sub Saharan Africa contains large tracts of degraded lands with extremely low agricultural productivity, especially in the Sahel. For instance, average crop yields in sub Saharan Africa are 1.5 t/ha for maize, 0.8 t/ha for sorghum and 0.7 t/ha for millet. This is due to poor soil quality, which occurs when soil organic carbon is lost to the atmosphere, thus leading to desertification. Estimates of the area of degraded land range from 3.47 to 3.97 billion hectares (Lal et al., 1998). Land degradation processes can be reversed through improved agricultural practices such as conservation tillage, soil erosion control, establishment of appropriate shrubs and woody perennials, soil fertility enhancement, and crop residue management. This not only restores soil quality by increasing its organic content but also aids in mitigating climate change by returning more and more carbon to the soil. Thus, carbon sequestration activities that improve soil carbon content have the potential to improve productivity of large tracts of land in Africa.

3. RESEARCH METHODOLOGY

Bryman (2001) refers to a research method as a technique for collecting data and Mouton (2001) highlights the importance of methodology as a procedure that a researcher uses to condense, organize and analyze data in the process of undertaking scientific research in social sciences. In this research, both quantitative and qualitative approaches are used.

Quantitative method was used to measure variables that were linked to the research problem in the case study area. The rationale behind using qualitative method, in addition to quantitative data, was to increase understanding about the dynamics, opinions and perceptions of people in the case study areas about carbon sequestration through afforestation and reforestation programs and its impact in empowering the livelihood of local community and resulting in sustainable projects.

Sampling Technique:

The target population for the study comprised households living in the two adjacent rural administrative units (villages); the rationale behind selecting the two sample villages namely; Abela Longena and Bosa Wanchi were chosen on the basis of their involvement in the project activities. Currently, there are about 863(724 male-headed and 139 female-headed) and 692 (511 male-headed and 181 female-headed) households in the two sample villages respectively (source: Humbo Woreda cooperative association Office, 2013).

As suggested by Gay regarding the sample size, for descriptive study, 10 to 20 % of the accessible population is enough (Gay 1983, cited in Kumar, 1999). The sampling intensity of 10% was used to guide the number of households' selection. The respondents were the head of households because they are responsible for making decision on the household activities and resource use. Accordingly, in this study 10% from each of the above population groups i.e., 73 men headed and 14 women headed households from Abela Longena and 52 men headed and 19 women headed households from Bosa

Wanchi were selected by using stratified sampling methods. Therefore, the total number of Households in two villages was 33 female-headed households and 125 male headed household. As indicated above, the target population of the study was not homogeneous, i.e., there was certain variability both within and between the target population groups, which would tend to affect the representativeness of the sample. So as to reduce such an eventual sampling bias, households were stratified on the basis of their residential *kebele* and gender of the head of the household.

To determine the proportion of each stratum in the study population (p), the following formula suggested by Kumar (1999:159) was applied.

$Sx = E x/p$, Where $Sx =$ the proportion of stratum x in the population (p)

$E x =$ the number of elements in stratum x

$P =$ total population size

Accordingly, for instance, the proportion of female-headed households in Abela Longena was computed as:

Female-headed households (Sx) = $139/863 = 0.16$ (i.e. 16.10%) the proportion of each sample and gender category from both villages have been computed in Similar fashion. The sampling interval was determined by applying the formula below:

$I = N/n$

Where $I =$ sampling interval

$N =$ total number of population, &

$n =$ sample size

Sampling interval (I) of the Abela Longena male-headed households: Bosa Wanchi

$$\begin{aligned} I &= 722/73 & I &= 511/52 \\ &= 9.8 \sim 10 & &= 9.8 \sim 10 \end{aligned}$$

Therefore, the sample units were identified at an interval of ten for both population based on the list of the registrations which was arranged alphabetically.

Finally, purposive sampling technique was used to identify some key informants from both rural community and the institution itself. Accordingly, two HCP cooperative leaders, two environmental managers from World Vision Ethiopia, 12 carbon project committee members, two government development agents and one Woreda cooperative personnel were purposively selected and included in the study as sources of the information. In general, the total sample size selected by using both random and non-random sampling methods from the different target population groups of the study was about 177.

Data collection techniques:

The survey was aimed at collecting information on socio-economic, environmental perspective and the benefits accrued from HCP. Data was collected from both sampled household and village based aspects. Semi- structured questionnaire, focus group discussions aided by checklist, as well as interview and participant observation were employed.

So as to meet the already stated research objectives and answer major research questions, a wide range of data was collected from both primary and secondary sources. Accordingly, first-hand information was obtained through the above mentioned instruments while second hand information was collected through analysis of the existing documents, such as books, journal articles, websites, performance report papers, annual bulletin, research papers and etc.

Data Analysis Methods:

As mentioned above, the major types of data collection tools that were used in the study included FGDs, sight observation, personal interviews and survey questionnaire. The raw data that was collected from both primary and secondary sources through the aforementioned data collection tools were subsequently edited and tallied manually; and entered in to computer software program of MS-excel. The analysis process was also made by making use of frequency

distribution tables, percentage, charts and other descriptive statistical methods. The data gathered were coded and arranged in the manner that the reader could easily understand and also the findings of the study were adequately stated.

4. RESULT AND DISSCUSSION

Environmental Based Benefits at Village Level:

This study revealed significant appreciation to environmental improvements associated with practiced carbon project. All households' respondents mentioned the environmental improvements as important benefits at village level. Their judgments were based on increased water sources, which are flowing from mountains areas, increased rainfall, and recovery of eroded land as results of increased vegetation cover and improvements in agricultural production. Since multiple answers are possible one respondent may choose all improvements which have been observed at village level

(See Figure 1)

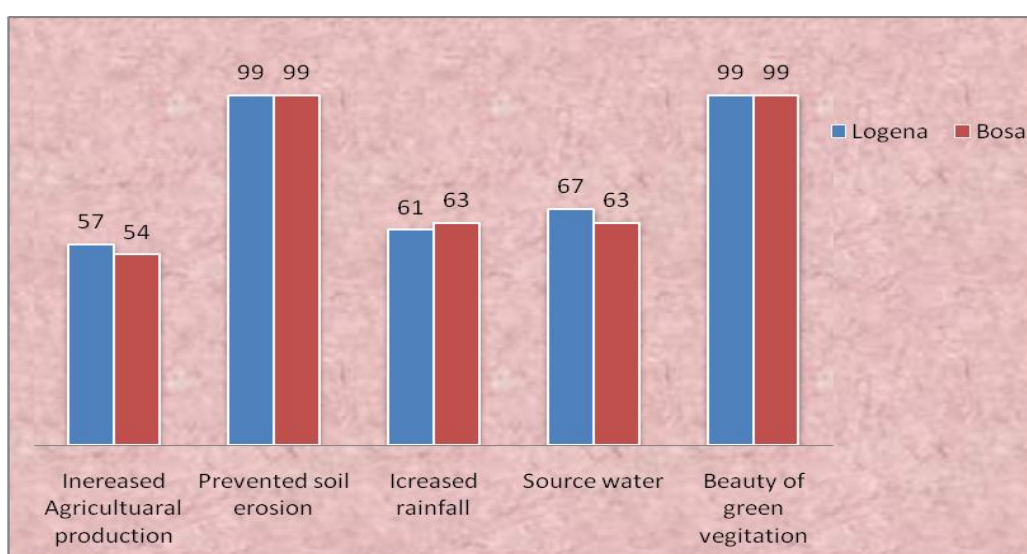


Figure 1 Percentage of respondents and environmental benefits observed at both villages.

The respondents were attributing the change with reduced illegal activities and disturbance to the carbon project. These perceptions were supported by expert interview and carbon project conservation committee. All respondents also mentioned that the condition of biodiversity has improved at both villages. This is due to the growing forests are dense and species regenerating vigorously. Moreover, grazing and cutting trees are totally controlled. In addition to this, in Abela Longena villages some people have replaced the usage of firewood with stoves. On the other hand, they all explained activities like effective protection with intensive patrol and boundary demarcation, conducting forest management and conservation operations played a greater role to attain these environmental improvements.



(Source: Humbo Project PDD 2006)

Figure 2 the degraded land of Humbo before the commencement of carbon project



Source: (picture taken by the researcher April, 2013).

Figure 3 Humbo carbon project after the commencement of the project.

According to expert interview improvements in air quality generated by reforestation extend beyond the sequestration of CO₂. He mentioned that reforestation benefits air quality in other ways. For example, trees also play a role in intercepting and filtering particulate matter in the air. Moreover, when reforestation is practiced it will be a home for valuable wildlife habitat. In turn, wildlife habitat generates forest litter, which is an important part of the food chain and enriches the soil. A forest's tree canopy moderates the temperatures of rivers and streams, which aids the survival of aquatic species. Providing habitat for endangered and threatened species is another potential benefit. He also mentioned carbon project can help remediate former degraded lands by improving water quality. Tree roots stabilize degraded land soil, which was susceptible to soil erosion.

The following remark was given by one of the informants.

"In my father's time, there was a huge forest including fruit trees. We used to go to the mountain to collect fruit to eat and to sell. We also used to go and hunt wildlife and this was a benefit. When the trees were dense, downstream it was like a glory. But it was lost during the past time. It was a mad history. But because of this carbon project –our environment is getting more and more beautiful. All the things that we lost are coming back. Now the forest is protected, the lost life is coming back and we are expecting things to go well. We now cut grass and carry it to livestock. Temperature is decreasing and rainfall is increasing. In brief, now we enjoy good thing from the carbon project".

All in all, there are promising results indicating carbon project activity enhance tree species diversity and local livelihoods. This study has revealed carbon project program has potential to recover the land from previous degradation through community based forest conservation. The results were observed based on trees species diversity, stocking, regeneration potentials and re growth of previous threatened species.

The expert interview also mentioned the ecosystem services decried from a forestation and reforestation other than preservation of carbon sink, like watershed and soil protection and biodiversity conversation, would also potentially enhance the socio-economic benefits of carbon project. He explained these ecosystem services indirectly contribute to a livelihood and well-being of the under privileged local communities. Meanwhile, the beneficiaries were asked to evaluate the impact of carbon project benefits for the community. Majority (80%) of respondents replied that the project has had a large impact on the community in terms of infrastructure, environmental rehabilitation and community development project. A total of 20% responded that the project had little impact, while only 1% replied that the project had no impact on the community.

Awareness about climate change and global warming:

As far as awareness on issues related with climate change is concerned, 85.4% of those interviewed were aware of issues to do with climate change, 10.8% were unaware and the rest 7% were uncertain (See Table 1)

Table 1 Awareness of climate change issue

Variable	Abela Longena		Bosa Wanchi		Total frequency	Total percentage
	frequency	Percentage	frequency	Percentage		
Aware	75	86.21	60	84.50	135	85.44
Unaware	9	10.34	8	11.27	17	10.76
uncertain	3	3.45	3	4.23	6	3.80
Total	87	100.00	71	100	158	100.00

When asked about the perception as to whether carbon project can help in reducing global warming, 59.5% of the respondents agreed strongly, 25.9% agreed, 12.7% neutral another (1.9%) strongly disagreed. This implies the majority of the local people are aware of the fact that carbon project can be used to reduce global warming (See Table 2).

Table 2 perception of carbon project in reducing global warming

Variable	Abela Longena		Bosa Wanchi		Total frequency	Total percentage
	frequency	percentage	percentage	percentage		
Strongly agree	52	59.8	42	59.2	94	59.5
Agree	23	26.4	18	25.3	41	25.9
Neutral	11	12.6	9	12.7	20	12.7
Strongly disagree	1	1.2	2	2.8	3	1.9
Total	87	100	71	100	158	100

At present, global warming is a matter of grave concern. Since the late 19th century, the global temperature has increased by 0.3-0.61⁰c, and, globally, sea levels have risen 10-15cm over the past 100 years (IPCC, 1995) due to over population, especially in African countries, natural resources are under extreme pressure, which, cumulatively, is causing environmental problems.

Forest Management Skills, Knowledge and Education:

The level of community knowledge, on the general environmental topics and especially on the forests role in climate change has improved as a result of the project. Even though 83% of interviewed people in the survey said they were aware of the forest role in climate change mitigation, only 8% gave the correct explanation. Sometimes the people found it hard to express themselves, which resulted in the ambiguous answers. However, from the answers the researcher was able to notice a certain level of understanding of environmental process, like the interrelation between forest and water availability, forest importance in wind protection and oxygen production and similar. All the people who correctly answered this question were taking training about climate change, this again supports the idea that project has a positive influence on the local environmental knowledge.

As the survey question was formed to particularly examine the understanding of the concept of carbon project and what it signifies, high percentage of people were able to give a correct answer to this question. The most common answer was a simplified explanation of tree planting activity to get carbon payment. Some mentioned carbon project is a process of reducing emission of CO₂ from atmosphere to mitigate climate change. A few respondents were trying to relate the concept with the pollution problem in industrialized countries.

This again supports the idea that project has a positive influence on the local environment knowledge. Furthermore, 64% of interview answered that the main reason to protect the forest at present is the ecosystem services that the forest provided, 36% said it was payment from the project (, this result shows the change in the main incentives to conserve the forest. It appears that the community started recognizing the forest's ecosystem services as an important precondition for the community development and welfare.

Other benefits envisaged from carbon project:

- **Human capital benefits in the villages area.**

Human capital refers to the issues of education and skills accrued by members of community pertaining to the carbon project activities. In both study villages focus group discussion results indicated that they benefited from various training in relation to forest management and conservation. For example, some members have received training in tree nursery, beekeeping activities, and entrepreneurship skills. Some members of the communities have also benefited from agro forestry training courses. Moreover, the project organizes the environmental education program for all members; it involves importance of the natural resources and risk of the fire and other human induced activities. Each of the community members are eligible and supported to take part in the forest protection. This indicates that the practiced carbon project is also improving human capital through various training which was not provided before the existing carbon project. Expert interview and carbon project committee mentioned that the training was facilitated by world vision and Humbo agricultural office.

Socio-political benefits of the project:

According to Swart and Venter (2001), development related NGOs and civil society associations share similar characteristics in terms of moral, political and social commitments towards alleviating poverty and human suffering. With this in mind, qualitative field survey methods such as focus group discussions identified relationship building as a social benefit, and they pointed training as part of the social benefits because it increased awareness and facilitated information exchange and networking.

It involves networks among the community and how well villages are able to negotiate with external environment. Furthermore, the qualitative data provided additional information about the perceptions of people concerning the social benefits of the projects. All the informants agreed that they have socially benefited from the projects in one way or another.

According to the informants at there was not a good relationship among the beneficiaries prior to the project implementation. As the result of the project intervention, the relationship among beneficiaries has strengthened. According to the informants, a sense of unity and cooperation was created among one another. The interview with Humbo cooperative manager and staff members acknowledge the increased socio-political attributes in their villages. They mentioned that carbon project activity has strengthened local institution.

The following remark was given by one of the informants:

“We all were nobody before, because we were despised. We did not have any access to natural vegetation. Each of us had wishes to help ourselves and make our families self-sufficient, but we were caught in deprivation. We could not borrow money from the bank because we did not have any asset to show as collateral. But after we formed cooperatives in our villages to facilitate carbon project, we started thinking collectively and our status increased. Our unity made us legible to borrow some money from the local cooperative credit fund and saving account. We have taken a loan and now we are becoming somebody from nobody. Above all, we believe that we will not be borrowers but we will be lenders in the future because our social capital is increasing.”

In this regard, the writings of Puntam (1993) highlight the role of social capital in development. He notes that social capital as institutions, relationships and networks shapes the quality of societies' social interactions and enables them to prosper economically. In terms of development activities, such social capital has the potential to bring about meaningful sustainable results. This view, and in accordance with the research findings, fits in with the beneficiaries understand social benefits in this case study area.

Project sustainability:

A self-sustaining participatory development process is based on the mobilization of local resources, and infers continuity after project completion. In this sense, participation is fundamental to developing a self-sustaining momentum of development, which will insure continuity of activities when outside support terminates (Penderis, 1996). Focus group discussion pointed out, HCP might be counter-productive in the long run, as it influences the change of the forest conservation rationale livelihood to the monetary value of ecosystem services. This kind of equity approach adopted by the project is expected to have sustainable results in the project long term ran ,up to 99% of interviews were aware of existence of the protected part of the forest, while 99% of them voluntarily came under the carbon project.

It emphasizes the increased role and responsibilities of the community on one hand, and the decreasing role and responsibilities of facilitators or development actors on the other hand. This should be done to ensure mutual trust and improve capabilities of community members to prepare the community for new challenges.

This entails people talking together, developing a collective intelligence, a form of 'communal wisdom', which integrates past, present and future experiences (Barton, 2000:150). One of the means of ensuring sustainability is to strengthen the collaborative efforts of the beneficiaries and the facilitators, work hand in hand and empower them before transferring the project to the target beneficiaries.

According to interview with cooperative leaders, membership to the cooperative societies (carbon project) is open to all genders groups including men, women and the youth. Majority of members are however men, since membership is based on head of household and most households are male headed. There is a provision however to recruit youth to be members

of the cooperative societies. Women are not specifically targeted for leadership of the cooperative societies but have been advised by a project evaluation team to include them.

They established that members are appointed to sub-committees based on their knowledge and experience and this could be an opportunity for capable women and youth to be elected to leadership of the cooperative societies. Moreover, the existence of cooperatives in both villages is a crucial in process of involving the local people under carbon project. The offices of the study cooperative leaders are situated in project area, near to the project and the villages. This makes possible the everyday exchange of the information among leaders, committees and local community.

With regard to project sustainability, the quantitative field survey findings indicate that 95% of respondents indicated that the projects would be sustainable in the future, while only 5% responded that the project would not be sustainable. Similarly, the respondents were asked how the sustainability of projects be maintained, the majority (76%) responded that the community would take responsibility, this is also supported by expert interview on the deliberate effort to train community members is yet another important step that WVE has instituted to ensure that communities take on project management. Where only 13% said that don't know what would happen to the projects in the future. A total of 10% indicated that more project funds would come from the donors to continue project activities, while only 1% said that the project would come to a halt after the withdrawal of the facilitators.

Potential Risks and adverse impacts of the project:

A qualitative field survey was conducted to assess the perceptions of local community on the potential risks and adverse impacts of the carbon project. Many respondents mentioned that the project may introduce wide disparities in socio-economic status of various households that may result in local conflicts and unrest. With most households being extremely poor, any household that gets an employment opportunity with the project or some other economic benefit, suddenly becomes very different from others and rises up the economic hierarchy. This does not only affects its standard of living but also generates tension amongst other households that are left behind.

According to cooperative association manager, the communities' institution promoted by the project is almost non-existent. While most of the project activities are supervised by World Vision at the moment, the long-term sustainability of the project will depend upon how well cooperative union (the local institutions) can take responsibility for managing these activities.

According to expert interview, although women play a major role in carbon project activity particularly in the area of tree nursery and other important activity, they still need to be integrated into the project activities as well as have a representation in the people's institution to have any formal say in the project of both villages.

In addition, an increase in density of forest cover may also increase the number of wild animals in the area, which are already perceived as a major threat by most people since the wild animals started destroying crops on the farm. Moreover, fire and drought are often threats to the forest.

5. CONCLUSION AND RECOMMENDATIONS

CONCLUSION:

Humbo carbon project supports high levels of biodiversity and provides sundry ecosystem services to the local communities. In addition, as a medium carbon density land cover type, it can provide a global service as carbon store helping to mitigate climate change. The results of this study illustrate the potential socio economic value of carbon storage helps the local community.

Local community participation in carbon project is a key to stop alarming degradation. This is a win-win situation; if afforestation and reforestation is better practiced, the local communities have better access to natural resources they need for their own welfare and survival.

The observed status of carbon project tree species and the results from socio economic study are promising to enhance local livelihoods. It also enhances access to wide varieties of environmental goods and services to local communities. The carbon project offer returns in cash, consumptive use, to indirect use synergies which act as motivation for protection and conservation of forest.

The study provides bench mark information which might be useful to support sustainable management of carbon project and local livelihood improvements in Humbo and elsewhere. The payment from carbon project has been perceived by the local people as benefit for both the local community and the individual households.

The general impression is that the community level of knowledge of environmental conservation topics has increased. The meetings and trainings are organized in order to enhance the mainstream forest conservation. Even though it is still necessary to use very simple explanations when explaining the environmental processes, then increase in environmental knowledge, particularly in the climate change field is obvious.

According to the project managers, before the project started, local community did not have any knowledge on the environmental topics and global climate trends. Potential of communities to develop in a sustainable manner is influenced by raising the level of consciousness and local integration enhancement through communities' environmental education. Before the carbon project the hereditary knowledge on forest importance became weak, which resulted in local community having a less traditional attitude towards the environment.

However, the sacred value of the forest, together with the ecosystem services were the main reasons for protecting the forest in the present, and now the primary motivations are the ecosystem services and of course carbon payment. Furthermore, the carbon project activities have a potential to improve rural livelihoods and the local community welfare, as well as to enhance the mainstream forest conservation. The standing forest is more valuable in environmental, financial and cultural terms than when it is cleared for other purpose. The observed local participation and awareness on various management arrangements such as attending meetings in project related issues, forest patrol operations and prevention of forest fire incidences were fascinating. The cooperative association has opened channels for local community to communicate their priorities to the government decision makers and project developers. In addition, this improved government, project developers and local communities' relationships in conservation and development arenas.

In general, the results from this study have found that, carbon project programme provided room for sustainable development of natural resources in different aspects. It ranges from existing policy framework which empowers local community to manage the forest and implement the activities based on local community interest to improving access to socio-economic returns. Implicitly, the sustainability can be signified also from established structural aspects, such as village by laws and effective carbon project committees which might increase accountability in carbon project activity with outcome on improving local livelihoods.

The practiced activity seemed to offer significant returns either in cash, consumptive use and hence, poses an opportunity to meet both developmental and conservational goals. In short the findings shows forest conservation can enhance economic development because un- degraded ecosystems supply valuable goods and services.

Recommendation:

- Even though environmental benefits have shown promising results through carbon project activities, more efforts need to be made to increase tangible benefits to the household level. Appropriate economic institutions and mechanisms need to be established for the CDM to result in equity and sustainable development. The effects of global warming in Ethiopia show serious consequences on the economy. The quantification of carbon sequestration, by this study, can direct policymakers, researchers, and administrators in bargaining for the price of international greenhouse gas reduction, which can advance the economic, social and environmental development of Ethiopia. The study may also be useful to possible investors in CDM projects in different parts of Ethiopia.
- Another important aspect of this study is that it is also possible to use the farms to sequester carbon from the atmosphere by practicing agroforestry, as this has proved to be a vital element of carbon sequestration. Policy makers should put in place measures to ensure that most farms are titled so as to encourage people to plant more trees.
- A strong long-term political commitment by the government to prevent logging, deforestation, to manage and protect the remaining natural forests (natural production forests and protected areas) is required as a high priority.
- The local community should be discouraged from destroying the natural indigenous forests.
- The DNA serves as the point of contact between international investors and local service providers. One important factor in establishing a DNA is its institutional sustainability, reflected in its capacity to ensure a coherent, justifiable and transparent assessment of carbon projects and to generate enough revenue through these assessments to finance itself. However, there is a concern that many countries in Africa lack institutional

- Capacity to recognize, package and promote potential opportunities for funding carbon projects. Not only there is an absence of supporting policy and legal frameworks, but
- Some countries even lack a general awareness about carbon payment processes (Kituyi, 2002). Therefore, it is imperative to invest in capacity building of these national governments. Although organizations like UNDP and UNEP are already involved in capacity building initiatives, much remains to be done. .
- On the other hand, a downside of this strategy is a possible escalation in project overheads, which may be unacceptable to international investors. Therefore, apart from donor led efforts, host countries should also be willing to invest in capacity building. A beginning in this direction can be made through developing national level CDM/carbon programs in line with national development plans and Poverty Reduction Strategy Papers. This would ensure that carbon projects meet the goal of sustainable development for poor African countries
- African countries in general need more investments to support local livelihoods and economic development programs. Although carbon investments cannot fulfill all investment needs of these countries, nevertheless they can make significant contribution towards sustainable development in the region. Some of existing carbon sequestration projects in Africa shows that many projects are already moving towards this goal. However, Africa doesn't benefit from such projects. Multilateral donors like the World Bank would need to push for more carbon investments in the region, which may also induce other investors to follow suit.
- Finally, African countries will also need to remember that carbon projects essentially represent an emerging market and not a grant-in-aid scheme. Only those countries that are well prepared and capable of participating in this competitive market will be able to seize this new opportunity.

REFERENCES

- [1] Aukland L., P.M. Costa, S. Bass, S. Huq, N. Landell-Mills, R. Tipper, and R. Carr.2002. Laying the Foundations for Clean Development: Preparing the Land Use Sector. A quick guide to the Clean Development Mechanism. International Institute for Environment and Development (IIED), London.
- [2] Babbie, E & J. Mouton. (2001).The practice of Social Research. Oxford: Oxford University Press.
- [3] Bass, S; Dubois, O; Moura costa, P; pinard, M; tipper, R; and Wilson, C,(2000): "Rural livelihoods and carbon management." International Institute for environment and Development Natural Resource Issues , paper No 1,IIED, London
- [4] Biswal, N. (2006).Human rights, Gender and Environment. New Delhi.Viva Limited company
- [5] Brown, M., and C. Funk. (2008). Food Security under Climate Change. Science 319:580-581.
- [6] Brown, S. and G. Gaston. (1995). "Use of forest inventories and geographic information systems to estimate biomass density of tropical forests: Application to tropical Africa." Environmental Monitoring Assessment 38, 157–168.
- [7] Bruce J. P; Lee H; and Haites E. F; (1996): "Climate Change 1995: Economic and Social Dimensions of Climate Change," Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge Univ. Press, New York.
- [8] Bryman, A. (2001). Social research methods. New York: Oxford University press.
- [9] Bryman, A.(2004). Social research method, 2nd ed. New York: Oxford University Press.
- [10] Burkey, S. (1993). People first. United Kingdom: Biddles LTD.
- [11] Capoor, K., Ambrosi, P. (2008). State and Trends of the Carbon Market 2008.Washington D.C. The World Bank
- [12] Chichilinsky, G. (1996). An axiomatic approach to sustainable development. Social Choice and Welfare 13 (2): 231–257.
- [13] Corbera, E., (2005). Interrogating development in carbon forestry activities: A case study form Mexico, School of Development Studies, University of East Anglia, PhD thesis.

- [14] EFAP, (1994) Ethiopian Forestry Action Program: The challenge for development. Final Report, Volume II, Ministry of Natural Resources Development and Environmental Projection, Addis Ababa
- [15] Eraker, H. (2002). CO2lonialism in Uganda. *Nor Watch Newsletter*. No. 5, 2000.<http://www.norwatch.no/index.php>
- [16] FAO, 2001. Global Forest Resources Assessment 2000, FAO, Rome, Italy.
- [17] FAO, 2009c. Role of forests in climate change. FAO, Rome, Italy. <http://www.fao.org/forestry/53459/en/>
- [18] Farley, K., le Maitre, D., McCarl, B., and Murray, B., (2005). Trading water for carbon with biological carbon sequestration. *Science*, 310(23).
- [19] Fern, K.(2001). Sinks in the Kyoto protocol, A dirty deal for forests, forest people and climate change. Fern, Brussels, Belgium.
- [20] Ferraro, J. and A. Kiss. (2002). Direct Payments to Conserve Biodiversity. *Science*. Volum 298, 29 November 2002. www.sciencemag.org
- [21] Ferrinho, H. (1980). Towards the theory of community development. Juta & comp. Ltd
- [22] Fitamo, M. (2003). Community based organizations (CBO) and development in Ethiopia. Thesis, MA. University of Cape Town, Cape Town, South Africa
- [23] Fitzgrerald, M. (1980). Urban community development in South Africa. Johannesburg: McGraw-Hill.
- [24] Frankfort- Nachumias .C and D. Nachimas,(1997). Reaserch method in the social science , 5th Edition. St Martin's press New York.
- [25] Grace, J., Krujit, B., Freibauer, A., Benndorf, R., Carr, R., Dutschke, M. Federici, S. Mollicone,D. Sanz, M.J. Schlamadinger, B. Sezzi,E. Waterloom. Valentini,R. Verhagen,J and . Putten,BV (2003.) *Scientific and Technical Issues in the Clean Development Mechanism*. CarboEurope Cluster, the European Commission.
- [26] Gutman, P. (ed.) (2003). From Goodwill to Payments for Environmental Services: A Survey of Financing Options for Sustainable Natural Resource Management in Developing Countries. World Wide Fund for Nature (WWF).
- [27] Houghton, A. (1991).Tropical Deforestation and Atmospheric Carbon Dioxide Climatic Change 19, 99-118 1991.<http://gaia.agraria.unitus.it/ceuroghg/ghg.html>
- [28] Ife, J. (1995). Community Development. Australia: Addison Wesley Longman LTD.
- [29] IPCC (Intergovernmental Panel on Climate Change), (2007), Climate Change 2007. The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Summary for Policy Makers.
- [30] IPCC, (1995). *Economic and Social Dimensions of Climate Change: Contribution of Woking Group III to the Second Assessment Report of the IPCC*. Intergovernmental Panel on Climate Change (IPCC), Cambridge University Press, UK
- [31] IPCC, (2000). Land Use, Land Use Change and Forestry. A special report of the IPCC, Cambridge University Press, Cambridge.
- [32] IPCC, (2001). "Climate Change Impacts, Adaptation, and Vulnerability. Cambridge University Press." Climate Change (2001)
- [33] IPCC, (2001). Intergovernmental Panel on Climate Change's Synthesis Report. Climate Change 2001, IPCC.
- [34] IPCC, (2007). IPCC Fourth Assessment Report, Working Group III. Chapter 9, Forestry.
- [35] IPCC, (2007). Synthesis report, IPCC, Geneva, Switzerland. pp. 104.
- [36] IUCN, (1995). A Sustainable World: Defining and Measuring Sustainable Development. Edited by Thaddeus C. Trzyna and Lulia K. Osborn. The World Conservation Union, and the International Center for the Environment and Public Policy, California Institute of Public Affairs, California, USA.

- [37] Jindal, R. (2004). Measuring the socio-economic impact of carbon sequestration on local communities: An assessment study with specific reference to the Nhambita pilot project in Mozambique. MSc thesis, University of Edinburgh, UK.
- [38] Jindal, R. (2008). Miombo community land use and carbon management, Nhambita pilot project. Special reports, Impact assessment of the Nhambita Community, Carbon Project, in Final report Mozambique, 4-1.
- [39] Jones, P.G and Thornton, P.K. (2003). The potential impacts of climate change on maize production in Africa and Latin America in 2055. *Global Environmental Change* 13:51-59.
- [40] Kifcon, J. (1994): "Kakamega Forest: The official guide," Kenya Indigenous Forest Conservation Programme, Nairobi, Kenya.
- [41] Kituyi, E. (2002). Attracting Clean Development Mechanism Projects: Prerequisites for African Governments in Clean Development Mechanism. African Centre for Technology Studies, Nairobi, Kenya. Volume 1, Number 1, July 2002.
- [42] Kumar, R. (1999) *Research Methodology: a step-by-step guide for beginners*. SAGE
- [43] Kurukulasuriya, P., and S. Rosenthal, (2003): "Climate Change and Agriculture: A Review of Impacts and Adaptations." "Climate Change Series 91. Environment Department Papers," World Bank, Washington, D.C.
- [44] Lal, R. (1998). *Potential Soil C Sequestration in Sub-Saharan Africa*. Paper presented at the Workshop on Carbon Sequestration in Soils and Carbon Credits: Review and Development of Options for Semi-Arid and Sub-Humid Africa, held in 1999 at the United States Geological Survey (USGS) EROS Data Center, South Dakota, USA.
- [45] Lal, R. (2004). Soil Carbon Sequestration Impacts on Global Climate Change and Food Security. *Science* 11. 304: 1623 - 1627.
- [46] Lal, R. (2004). Soil Carbon Sequestration Impacts on Global Climate Change and Food Security. *Science* 11.304
- Lovell, H., Bulkeley, H., Liverman, D. M., (2008). Carbon offsetting: Sustaining Consumption? *Environment and Planning A* (Special issue on the carbon economy)
- [47] May, P. (2004). Local sustainable development effects of forest carbon projects in Brazil and Bolivia A view from the field, *Environmental Economics Programme*.
- [48] Mouton, J. & H. Marais. (2001). *Basic Concepts in the Methodology of Social*
- [49] Nachmias, C.F., and D. Nachmias. (1996). *Research Methods in the Social Science*. Fifth edition.
- [50] Oakley, P. (1991). *Projects with people: The practice of participation in rural development*. Geneva: International Labour Office.
- [51] Pandey, D. (2002). Global climate change and carbon management in multifunctional forests. *Current Science*. 83(5), 593-602.
- [52] Penderis, S. (1996). *Informal settlement in the Helder Berg basin: people, place and community participation*. University of Stellenbosch (MA thesis). Cape Town. *Practitioners- Researchers*. Blackwell Publishers, UK. publications Ltd, London
- [53] Putnam, R. (1993). *Civil traditions in modern Italy*. Princeton University Press.
- [54] Richards K., and Stokes C., (1995): "Regional Studies of Carbon Sequestration: A Review and Critique," Mimeo, Pacific Northwest Laboratory, Washington, DC.
- [55] Robson, C. (1993). *Real World Research, A Resource for Social Scientists and Practitioners- Researchers*. Blackwell Publishers, UK.
- [56] Rohit J., Swallow B., and Kerr J., (2006). Status of carbon sequestration projects in Africa: Potential benefits and challenges to scaling up. WP 26 Nairobi. World Agroforestry Centre.
- [57] Roodt, M.(2001). *Participation, civil society and development: development theory, policy and practice*. (eds). Coetee, J, Graff, J; Hindrick, F& Wood, G. South Africa: Oxford University Press.

- [58] Rosa, H., Kandell S., and Dimas L., (2003). Compensation for Environmental Services and Rural Communities: Lessons from the Americas and Key Issues for Strengthening Community Strategies. PRISMA, El Salvador. (www.prisma.org.sv)
- [59] Sanderson, E., & Kindon, S., Progress in participatory development: Opening up the possibility knowledge through progressive participation. Progress in development studies, (April 2000). Vol. 4. Issue 2 p114. EBSCO publication (accessed on 06/04/04).
- [60] Scherr, S., White A., Khare A., Inbar M., and Molar A., (2004). For Services Rendered. The current status and future potential of markets for the ecosystem services provided by forests. ITTO, Technical Series No. 21. International Tropical Timber Organization. Science. Pretoria: Human Science Research Council.
- [61] Smith, J. and S.J. Scherr. (2002). Forest carbon and local livelihoods: Assessment of opportunities and policy recommendations, CIFOR Occasional Paper no. 37, Bogor Barat, Indonesia.
- [62] Smith, P., D. Martino, Z. Cai, D. Gwary, H. Janzen, P. Kumar, B. McCarl, S. Ogle, F. O'Mara, C. Rice, B.Scholes, O. Sirotenko, M. Howden, T. McAllister, G. Pan, V. Romanenkov, U. Schneider. S. Towprayoon. (2007.) Policy and technological constraints to implementation of greenhouse gas mitigation options in agriculture. Agriculture, Ecosystems and Environment 118 (2007) 6–28
- [63] Sunderlin, W., Angelsen, A., Wunder, S. (2003). Forests and poverty alleviation. In Food and Agriculture Organization of the United Nations (FAO) (ed.), pp.61-73.
- [64] Tamas,A. (2000). System theory in community development. www.tamas.com/samples/source%252520docs/%20System252520Theo%C920in%252520CD.pdf (accessed on 08/25/04).
- [65] Totten, M. (1999). *Getting it Right: Emerging Markets for Storing Carbon in Forests*. World Resource Institute, Washington D.C., USA.
- [66] UNEP, (2004). *CDM Information and Guidebook*. Second edition. Edited by Myung-Kyoon Lee. Contributors – J. Fenhann, K. Halsnaes, R. Pacudan, and A. Olhoff. UNEP Riso Centre on Energy, Climate and Sustainable Development, Riso National Laboratory, Denmark
- [67] UNFCCC, (2002). The Clean Development Mechanism. United Nations Framework on Climate Change Convention (UNFCCC). (<http://unfccc.int/cdm/index.html>)
- [68] UNFCCC, (2004). Land-use, land-use change and forestry, Decision11/CP.7, UNFCCC/SBSTA Marrakech Accords).
- [69] UNFCCC, (2009). Kyoto Protocol – Mechanisms – Clean Development Mechanism[http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718 .php](http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php)
- [70] UNFCCC, (2003). Caring for Climate: A Guide to Climate Change Convention and the Kyoto Protocol. United Nations Framework on Climate Change Convention (UNFCCC), Bonn, Germany. (<http://unfccc.int/resource/cfc-guide.pdf>)
- [71] United Nations Environment Programme (UNEP), (2002). *The Clean Development Mechanism*. UNEP Collaborating Centre on Energy and Environment, Riso National Laboratory, Roskilde, Denmark.
- [72] United Nations Third Conference of the Parties of the Framework Convention on Climate Change (1997). Kyoto Protocol to the United Nations Framework Convention on Climate Change. United Nations, December 10.
- [73] WCED, (1987). Our Common Future or the Brundt land Report. United Nations World Commission on Environment and Development, WCED.
- [74] WCED, (1987). Our Common Future. Report of the World Commission on Environment and Development, Oxford: Oxford University Press.
- [75] Williams, S. (1995). The Oxfam handbook of development and relief. United Kingdom: Oxfam. Limited.