

# Access to water, income generating activities and forest conservation.

Experience of communities around Chome Natural Reserve in Tanzania

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## Executive Summary

Conservation scientists hold diverse views regarding the role of economic development in biodiversity conservation in the developing world. Some scientists believe that development benefits are critical to win the support of local people for conservation efforts (Peter et al., 2002; Wells & McShane, 2004). A challenge in many conservation and development projects is the tenuous or non-existent link between development benefits and conservation (Newmark & Hough, 2000). Consequently, the sustainable harvest of non-timber forest products (NTFPs) has been advocated as a way to create a clear link between forest conservation and development (Peters et al., 1989; Shackleton, 2001). However where management costs to communities often exceed benefits, the long-term viability of these arrangements is increasingly being questioned (Blomley and Hartley 2006).

In Tanzania the contribution of forests to local livelihoods and national economy as a whole is significant, but is largely unrecorded and consequently unrecognized (World Bank, 2005). At the local level, particularly in communities around Chome Natural Reserve (Same, Kilimanjaro, northern Tanzania), which is the subject of the case study portion of this report, before the upgrade the forest status to nature reserve, forests and forest resources used to play an important role in supplementing and diversifying farm incomes.

Previously, due to limited or uncertain participation or involvement of the communities, surrounding forests in the past have resulted in extractive use for short-term gain. But since the introduction of Participatory Forest Management (Joint Forest Management, JFM) via the Forest Act in 2002 (Tanzania2002) facilitated by the project (Sustainable Management of Chome Nature Reserve, CNR), communities now around CNR have been engaged in managing, protecting, and benefiting for sustainable forest management and economic development through the introduction of Income Generating Activities (IGAs) and water projects for irrigation and domestic use. Evidence from the project suggests that the dual goals of sustainable forest management and local economic development are positively achieved. This report reviews the influence made by accessibility of water from the forest as well as IGAs to the changing behaviors of the community towards forest conservation at local levels in Same district particularly communities adjacent to Chome Nature Reserve. The report is predominantly based on qualitative interviews with villagers, project stakeholders, and key informants. Some quantitative information was also collected whereby a total of 100 people were formally interviewed.

The study findings indicate that all the projects experience various challenges to such a degree that the sustainability of overall objectives of conservation and livelihood improvement are seriously questioned. People seemed to adopt quickly IGAs with short term benefits such as ginger farming and beekeeping more than those with long term benefits such as ecotourism and tree planting. Some of the projects such as beekeeping and butterfly farming improve livelihoods to a certain extent, but the scope, scale and outreach of the projects are not wide enough to include particular segments of the communities, and newcomers struggle to participate. All IGAs projects depend on highly unstable or weak markets for their achievements, creating challenges for participants. The finding further indicates the contributions of access to water from the forest to have a big influence towards the community awareness and changing behaviors towards forest conservation.

The study further found that the proportion of overall household income dependence (whether through use or exchange) from forest resources tends to decline through the improvement of alternative livelihood options. Therefore the establishment of IGAs in these communities is an asset to household livelihood and is a tactic for improving the household behaviors towards forest conservation. Not only that but also the adaptation of ginger farming in communities adjacent to the forest is very huge that put pressure to the land and water available, and hence needs special attention from stakeholders. The study also concludes that water and IGAs investment should be high enough to deliver tangible benefits to participating dwellers adjacent to the forest, if they are to support forest conservation objectives.

Therefore some projects/interventions seemed to have increased conservation awareness, even though in the long run this feeling seemed to be fragile especially in IGAs. Hence needs special strategy and continuous supports to deliver the desired outcomes and sustainability.

## Background Information

Tanzania is experiencing serious environmental degradation where by pressure on natural resources has progressively escalated, and ecological degradation is evident, especially in arid and semiarid areas (United Republic of Tanzania, 2001). Despite the significant contribution of forests to local livelihoods and the national economy, forest destruction, poor management, and environmental degradation continue with negative impacts on marginal communities that depend on forests and forest products (Mariki, 2001). Forests deforestation is at a rate of between 130,000 and 500,000 hectares per year, which results from heavy pressure from agricultural expansion, livestock grazing, wild fires, overexploitation, and unsustainable utilization of wood resources and other human activities, mainly in the general lands (United Republic of Tanzania, 2001). In order to reverse these situation, SDG number six advocates for the protection and restoration of wetlands and rivers (among other water-related ecosystems) to ensure the availability and sustainable management of water and sanitation for all (UNDP 2015).

Forests are important assets in Tanzania, offering numerous goods and services in the national economy, to society at large, and to local livelihoods. Forests and woodlands are recognized as an important resource base for Tanzania's social and economic development, and for provision of many basic benefits and opportunities to rural and urban communities (Mariki, 2001). Evidence shows that the cash and noncash contributions made by forests and natural resources to household income and livelihoods are not accurately captured by official statistics. Values of forest goods and services, however, are often underestimated, wrongly attributed to other sectors, or entirely omitted. The 1998 Forest Policy also breaks new ground by explicitly recognizing the contribution made by forests to poverty reduction and human welfare.

## Forest resources conservation and the adjacent communities' economy

Around 1.6 billion people worldwide depend on forests for their livelihoods, while 60 million indigenous people rely on them for their existence, according to conservation group WWF. An important strategy for rural households to improve their standard of living is to diversify their range of activities, income sources and assets (Ellis 2000). Borgerhoff and Coppolillo (2005) recommended that conservation initiatives should address the welfare and cooperation of the



people living in and around protected areas, while Abbot et al. (2001), Western (1994), and Getz et al. (1999) called for a mix of conservation and development objectives. Fisher et al. (2005) note that the economic benefits generated by Integrated Conservation and Development Projects (ICDPs) rarely have been enough, either as an incentive or as an alternative to prevent the activities that exert pressure on the protected areas. A range of factors that have been associated with ICDP failure in the past have been identified through a broader series of examples by Wells and McShane (2004). These include over-optimistic goals, weak assumptions, unconvinced local participation, targeting of the wrong threats, uncertain financial sustainability, low benefit generation, lack of market access, and finally a heavy need for donors to have rapid success and thereby leaving the project sites before the ICDPs become sustainable.

Water projects and IGAs are among the ICDP that seek ways to convert conservation of resources and trying to compensate communities for ongoing costs of conservation, thereby also raising awareness and acceptance of conservation efforts (Sandbrook 2006; Blom et al. 2010). Evidence from the revised literatures which supported by project “Sustainable Management of Chome Nature Reserve” study findings suggests that the dual goals of sustainable forest management and local economic development are in positive track. But if not well handled, however where management costs to communities often exceed benefits, the long-term viability of these arrangements is increasingly being questioned (Blomley and Hartley 2006).

Currently the evaluation of conservation projects has become a focal issue for policy makers at the macro level, with the Convention on Biological Diversity (CBD) driving the agenda (Mascia et al., 2014). Despite the policy-level commitment to evaluation and the development of various evaluation tools, conservation organisations, governments and development agencies worldwide are still implementing numerous local-scale interventions without strong evidence for whether, where, or under what conditions these approaches are effective. Furthermore, local-scale evaluations are still not standard practice, and some types of intervention are implemented with only blind faith that they are working. In particular, there is a lack of evaluation of the effectiveness of alternative livelihoods or alternative income-generating activities (IGAs) as a conservation strategy (Wicander et al., 2014). Therefore almost no studies provide a baseline data with which to evaluate behavior findings. Literature and more general conservation and development literature, studies examining behavior are rare and lacked quantifiable behavioral measures as well. However several recent studies report a positive relationship between conservation behavior and conservation projects (Abbot et al. 2001; Holmes 2003; Stem et al. 2003).

In conclusion, the traditional project and program monitoring and evaluation has largely failed to show impacts of the alternative livelihood and water access projects to the changing behavior of communities towards forest conservation. Firstly, because it is difficult to measure impact within the short time frames typically associated with project interventions and, secondly, because it is difficult to measure behavior pattern of people.

Therefore this report provides a detailed assessment of how the accessibility of water and income generating activities (IGAs) in local livelihoods can contribute to the forest conservation in Same district.

The study is framed in the program “Sustainable Management of Chome Nature Reserve” which is being implemented for five years by ONGAWA, TFCG, Same district council and Chome natural reserve office, under the funding of European Union (EU), co-founded as well by other Spanish

donors<sup>1</sup>. The program is aimed to promote Chome Natural Reserve forest conservation by the use of Participatory Forest Management (PFM) approaches.

## Chome Nature Reserve Current Problem

Forests in Tanzania can be divided into two broad categories namely reserved forests and non reserved forests. Reserved forests include central and local government forest reserves, government-owned industrial plantations, and village land forest reserves (VLFs) at the community level that have been recognized by the central government. Unreserved forests are on “general” or “village” lands where forests and woodlands are not formally classified as reserves (Tanzania 2001). Chome in particular is a nature forest reserve recognized in 2016.

Chome Nature Reserve is among the eleven Nature Reserves (NR) in Tanzania of which is the only one among the fourteen forest reserves in Kilimanjaro region managed under TFS Northern zone. The reserve is among of eight nature reserves found in the Eastern Arc Mountains.

Figure: 1 Map of Chome Nature Reserve with surrounding villages



<sup>1</sup> Junta de Castilla y León, Diputación de Valladolid, Ayuntamiento de Valladolid, Diputación de Ciudad Real, UNDP-Small Grant Programs and Obra Social La Caixa

Forest Policy states that all catchment watersheds and land which is liable to soil deterioration to the extent of interfering with water supplies should be under the control of the Central Government as Nature Reserve (CNR new management plan 2016). This is aligned with SDG goal number 15 which aims to conserve and restore the use of terrestrial ecosystems such as forests, wetlands, dry lands and mountains by 2020(UNDP 2015). Thus, Chome Nature Reserve forest has been reserved because of its watershed and biological diversity values worth of conservation. According to its new reserve management plan areas land clearance for small-scale subsistence farming is one of the major causes of forest cover loss, largely due to increasing populations and poor agricultural practices forcing the people to practice shifting cultivation which promotes deforestation. Dependence by resource-poor households on cash income from the sale of forest products, such as charcoal, timber, and firewood appears to be another major driver of deforestation. Chome Nature Reserve is mainly threatened by fire, illegal timber harvesting, livestock grazing and of recent is gold mining which started early in year 2008. Lack of systematic management of this reserve previously has led to such threats.

Before the upgrade the forest status to nature reserve, forests and forest resources used to play an important role in supplementing and diversifying farm incomes. This is because since 1951 the reserve was established for both production and protection purposes, but since 2016 it was set only for protection and not production. This change has denied the local communities chances to exploit the forest (not allowed to do any human activity in the forest) as it used to be. But still most rural poor people around Chome Nature Reserve maintain diversified livelihood option because they cannot obtain sufficient income from any single livelihood option to survive. This is why most villagers are not actually solely small agriculturalists, and many included forest products to their livelihood systems. In a survey conducted by eastern arc mountains conservation endowment fund in 2013 within CNR using 538 trees and 932 poles, found about 73 trees per ha and 105 poles per ha were dead. This shows the extent forest destruction was reached so far in the nature reserve before the project intervention which launched within the same year.

Establishing only a legal status of a reserve is likely not to be a sufficient and effective measure on its own to conserve forest resources. In order to increase equity and effectiveness of conservation policies and practices, additional interventions have to be applied to areas outside reserve, and all development programs should be integrated with conservation strategies. This has led to an introduction of a variety of additional sources of income and other interventions that should not threaten the existence of plants and animals within the Nature Reserve. Such activities were water projects both for domestic and irrigation use, butterfly farming, ginger farming, tree nurseries/planting and honey production. These is based on the principles of Integrated Conservation and Development Projects (ICDPs), which recognizes that the solutions to ecosystem management problems is found with socio cultural and economic systems, and views local people as part of the solution and not as a part of the problem.

In the past due to limited or less participation or involvement of the communities surrounding the forest, resulted in the extractive use of forest for short-term gain. Since the introduction of Participatory Forest Management under joint forest management-JFM using the Forest Act of 2002 (Tanzania2002) in the program "Sustainable Management of Chome Nature Reserve", communities now have engaged in managing, protecting, and benefiting from the forest for sustainable forest management and economic development through their participation in conservation in collaboration with Chome Nature Reserve office.

The experience from communities around this area has identified similar elements to the ones appointed as challenges in other conservation projects. This includes the lack of market access,

low benefit generation and optimistic communities' expectations as well as uncertain financial sustainability to support the established ICPS. That's why ONGAWA as the leading project implementing partner has a strategy of making long term follow up of the established interventions to be able to assure their sustainability.

Despite efforts already invested in diversifying local livelihood, the impacts of most conservation-focused IGAs interventions are hard to evaluate because of their complex nature, small scale and case-specific outcomes. Perceptions of project success, particularly in terms of the social components such as behavior change, are inevitably subjective and dependent on the perspective of the person being asked. In order to adequately conceptualize the links between accessibility of water, alternative livelihoods option and forests, it is important to have a society wide perspective towards forest conservation in relation to project intervention.

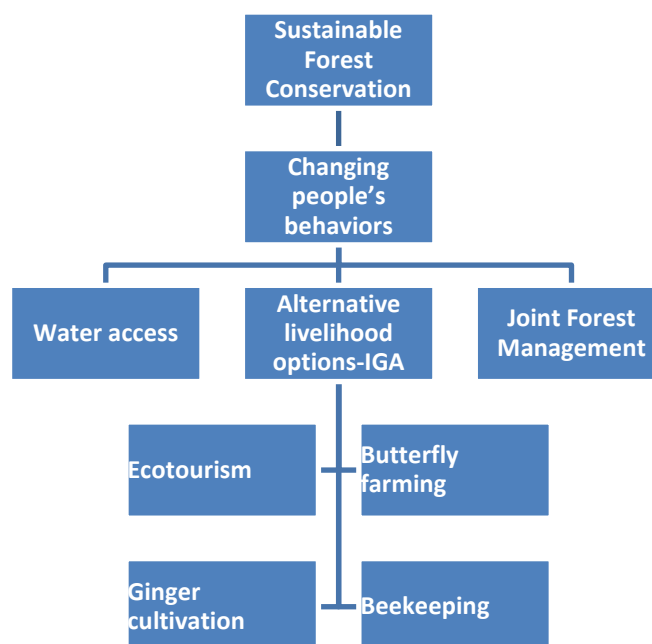
Therefore this report is looking on the influence of water access from the forest and IGAs to the changing behaviors of communities around Chome Nature Reserve towards forest conservation. Some lesson learnt in this report will be of the interest of many other stakeholders.

## **Connecting water access, livelihoods and forest conservation: data collection and analysis**

The "Sustainable Management of Chome Nature Reserve" program is expecting to improve the livelihoods of about 87,818 people of 35 communities of Same District through their empowerment and active participation in the management of natural resources. The initiative intends to improve livelihoods, preserve biodiversity, and decrease forest degradation. The established incentive measures are for local people to see the direct benefits from conservation to their household and supposedly conserve the forest. Therefore, the projects within the study area aims to both help people improve their livelihoods, and at the same time enhance conservation awareness and behavior.

The conceptual framework taken into account by the program is presented in the following figure, that shows the influence of water access, Joint Forest Management plan elaboration and Income Generating Activities (IGAs) to forest conservation:

*Figure: 1. Conceptual framework of the program*



In order to better understand the connections among water access, livelihoods and forest conservation, it has been performed a study to examine how the availability of water access for agriculture and domestic use as well as establishment of IGAs as an alternative means for community around CNR livelihood options can reverse forest decline, provide incentives for sustainable forest management, and contribute to local economic development at the same time.

The main aspects for data collection and analysis are shown in the following box:

### *Box 1. Data collection and Analysis*

#### **Sources of the data**

The sources of data were inclusive of a range of stakeholders, including both the staff of the implementing organization and the target communities. In the communities' interviews with the members of the IGAs, head of house hold and the VNRC committee members were conducted. Structured and semi-structured questionnaires were pre-tested and revised making changes where it was felt necessary. Other sources of information for this case study included existing literature and reports as well as data from office records and reports of the District Forest Office and Chome Nature Reserve Office.

#### **Data collection and Analysis**

The study used socio-economic research methods in forestry by Harrison et al. (2002) to collect data on the influence of water access and IGAs to changing people behaviors towards forest conservation. The questionnaires were administered using personal interview approach which was very good for avoiding non-response biases (Harrison et al., 2002). Therefore the study is predominantly based on qualitative interviews with villagers, project stakeholders, and key informants. Some quantitative information was also obtained. A total of 100 people were formally interviewed in five villages namely Kanza (Butterfly/Ginger, water), Marieni (Butterfly, Beekeeping, water), Mhero (Bee keeping), Gwang'a(water) and Bwambo (Butterfly, water and Ginger) with many different interventions as a sample. Having different villages with more than one project intervention beneficiaries in each village provided different angle of perspective regarding to changing people's behaviors' towards forest conservation. The collected data



## Study findings

Generally findings shows that about 87 percent of all the respondents interviewed have shown positive behaviors towards forest conservation. These means households in the project zones value their closeness to the forest due to the benefits that come with the conservation investment in the form of livelihoods improvement. Below the report is assessing each individual intervention and their influence towards changing people's behaviors towards forest conservation.

### Accessibility of Water Resources and Forest Conservation

There is a close link between forests and water quality as well as quantity. As population growth increases water stress and raises concerns about depleting water resources, which makes necessary the conservation of forest to be part of integrated water resources management plans. The argument traditionally put forward is that conserving forest area in upstream watersheds would improve water availability in nearby areas and lowland areas, where demand from households and agriculture is greatest.

Chome Nature Reserve is the only catchment for all the waters flowing in eastern part of Same, which means all rivers in Same East originated from the forest. Therefore the forest plays a major role of supporting community livelihood in terms of water for domestic and irrigation use.

From the study findings the influence of water access from the forest to the changing behaviors of people towards forest conservation has shown to be positive, whereby about 90% of respondents are linking the accessibility of water and being living near to the forest as well as believe the clearance of forest pose a danger to the availability of water from the forest. Not only that but also they thought if forest are destroyed they will no longer going to get water for irrigation and domestic use, and hence are willing to protect the forest by reporting to the authority or responsible committees on any illegal activities in the forest. The reason behind is the direct connection between the availability of water for domestic and irrigation use to the forest. In the study area almost all the water source are situated in the forest, which means the existence of the forest direct supports the communities livelihood by providing water for irrigation and domestic use. Therefore through improvements of water access infrastructures by the project, the number of people direct accessing water from the forest for irrigation and domestic use tremendously increased. This has helped people to see the direct linkage of their livelihood improvements with the forest, and hence raise awareness on the importance of conserving the forest for their livelihood.

### Alternative livelihood and Forest conservation

The logic of IGAs, which are very widely implemented in the developing world, often by local NGOs with limited capacity (Wicander et al., 2014), is that providing small scale local activities

that focus on certain types of income generation activity, will give local people the resources they need and hence reduce their need to go into protected areas to harvest resources.

IGAs in communities around CNR are different which require and utilize assets in different ways, of which some are limiting for particular group of people i.e Butterfly and Beekeeping, while others are based on encouraging the general population in the village i.e Ginger farming. Normally all the IGAs are treated in the same way but not all of them are equal. For example, those ones providing benefits in the short term are more effective than those ones providing benefits in the long term. The project has established short term and long term benefit IGAs. The adaptation of short term IGAs has shown more positive response from the communities than the long term. Still it is not clear till which point these IGAs really will continue to influence people's behaviors towards forest conservation in the long run.

#### *Ginger cultivation and forest conservation*

Ginger cultivation is the mostly adopted IGAs by the communities around Chome Nature Reserve. In general shamba darasa (demonstration farm) intervention has influenced and helped many people in adapting ginger farming in a large scale as alternative livelihood activity. Therefore ginger farming seemed to be more sustainable as large population has already adopted and claim not planning to quit in near future. Due to the rapid expansion of ginger farming in villages around the forest, the community has already started to experience shortage of water for demanding irrigation needs. Through this many ginger farmers has started doing things such as tree planting in their farms to reduce forest dependence as well forest protection initiatives that help forest conservation as their main water source in order to protect and increase the availability of water for irrigation. Among ginger farmers interviewed about 68% think if forest will be cleared they will no longer be able to continue with ginger farming as they are fully depending of forest as main source of water for irrigation. This positive trait shows that water from the forest for irrigation has helped changing the community behaviors and perception towards forest conservation.

#### *Butterfly farming and forest conservation*

In 2013, "sustainable management of Chome Nature Reserve" program initiated butterfly project in some villages adjacent to Chome Nature Reserve with the aim of improving their livelihoods and promoting biodiversity.

The butterfly farming IGAs has been established in three villages. The butterfly farming in Chome is still in infant stage with the statistics showing farmers has only managed to harvest and sell the pupae once with an average income received to be 260,000 Tsh per farmer. The most critical question revealed in this part is whether or not the link between butterfly farming and forest conservation is strong enough to change people's behaviors in a way that will benefit conservation. This has been done by looking on the relationship between butterfly farming and conservation behavior. A meta-analysis of conservation and development projects concluded that butterfly farming was likely to have a strong link to conservation (Salafsky & Wollenberg 2000).

It has been evident that butterfly farming is among the IGAs that appear to be ecologically sustainable. This is due to the fact that the farming activities have a direct link with the existence of forest for host plants. Although butterfly farming is done in cage outside the Chome Nature Reserve but farmers in the butterfly project still depend on the forest as a source of genetic diversity for their captive populations and as a source of younger host plants, which are often more desirable for egg-laying and feeding young larvae. In the long run as farmers develop their

skill to maintain captive butterfly populations and host plant nurseries, the necessity of accessing the forest will diminish.

According to the study it seemed majority of butterfly farmers see a strong relationship between their ability to farm butterflies and forest conservation. Statistically all the farmers interviewed believed illegal activities in the forest such as tree harvesting and wild fires was very dangerous for wild butterflies and their host plants. 94% of respondent farmers reported that living near the forest was very helpful for butterfly farming as they get easy access to host plants and catching butterflies for their farm and 94.1% said that it would be very difficult to continue farming butterflies if the forests in their area were cleared.

#### *Bee keeping and forest conservation*

Beekeeping gives local people and the Government economic incentive for the retention of natural habitats, and is an ideal activity in any forest conservation program (Mwakatobe, 2001; Okoso-Amaa et al, 2004). In Chome Nature Reserve forest under the project “Sustainable Management of Chome Nature Reserve”, beekeeping has been established in 5 villages, but the study has sampled two villages namely Mhero and Bwambo.

Just like butterfly farming the sector still in early stages to realize full support to the community as alternative income generating activity. Most of beekeepers around Chome Nature Reserve have indigenous knowledge of beekeeping. In terms of hive types, it was found that most beekeepers still use local style hives. The reason is that they are cheaper than other types of hive and are locally available. Most of beekeepers as in the case of butterfly farmers depend on the existence of the forest to carry out their activities, were by 80% think it would be difficult to continue if forest area were cleared. Not only that but also all the beekeepers farmers admitted that being close to the forest helped them in beekeeping and believe illegal activities especially wild fire is a threat to the hives located inside the forest.

*Table 1. Annual household income generated from beekeeping in the study villages*

Village	Variables	Income from beekeeping
Mhero	Maximum	1,218,000
	Minimum	200,000
	Average	709,000
Bwambo	Maximum	100,000
	Minimum	50,000
	Average	75,000

Apart from income generation which helps people changing attitude of relying on the forest reserve, beekeeping activities produce other tangible benefits and contribute to sustainable management of natural resources and increased biodiversity.

It has been argued by different beekeeping officers that “where beekeepers have put their hives they protect and avoid bush fires, and discourage people from grazing animals, cutting trees, and harvest other forest resources. After some time these areas become green because the vegetation is allowed to grow. This is because most people do not pass near apiaries for fear of being stung by bees, which in result gives more room for grass and other plants to grow without disturbance from human activities”. Bees also are important pollinators of wild and agricultural plants which increases income of farmers through increasing their farm yields. Therefore in the study areas especially bee keepers there is increased awareness of the value of forest resource management and as related to their livelihoods.

### *Ecotourism and forest conservation*

Tourism is one of Tanzania's most important economic sectors, contributing with more than 17% of Gross Domestic Product, 25% of the revenue generated by total exports, and more than 11% of the total employment in 2013. However, CNR tourism is underdeveloped and not maximizing on the existing potential. The total amount of revenue collected from tourists from 2010 to 2015 was Tshs 3,996,123, and the highest amount was collected in 2015 (CNR New Management Plan 2016).

Figure 3: Revenue accrued from tourism in CNR from 2010 to 2015(CNR 2016)



Unfortunately up to this moment the communities around CNR have not yet accrued much of direct income through benefit sharing mechanism from tourism. Therefore this IGA has very little direct influence to communities behavior change towards forest conservation for the time being, but still it has a potential to have very big positive influence in the future especially after the signing and implementation of Joint Forest Management agreement for cost benefit sharing scheme. For the time being most communities are indirectly benefited by the low volume of tourism visiting the forest (there some ongoing initiative to promote tourism in CNR) through selling their goods such as handcrafts, but there is no official data recorded on how much they are earning.

## Conclusions and recommendations

Generally speaking the great impact in terms of conservation knowledge brought by the project is feasible among the communities, although due to time limit (short time) of implementation the wide outcome has not been materialized. Therefore more time is needed for the outcomes of the projects such as IGAs to realize tangible and wider contributions to behavior changes through more people adaptation. The programs, especially IGAs, are still less than five years old and it may take some time to accrue benefits. For example, trees will not be ready to harvest for another decade, although will have the potential after people being allowed to harvest tree in their own farms which was previously restricted. Same applied to other IGAs which more time is needed to accrue benefit.

The adaptation and contribution of these interventions towards conservation do differ in terms of nature and scope. Some interventions such as water accessibility, beekeeping and butterfly keeping have a strong dependence of the forest. In terms of scope water accessibility and ginger farming have strong and wide impact to the community from the wide benefits and participation of almost entire community. Therefore the influence of these interventions to the changing



behaviors of people towards conservation is still not in its full potential; however there is a positive response of peoples related to water access and IGAs with forest conservation. The main conclusions of the study are the following:

- The study shows a strong link between water access from the forest and IGAs for changing behaviors of communities towards conservation. This shows the project has managed to bring awareness to the communities regarding the importance of forest conservation in relation to project interventions.
- Although the influence of water accessibility to the forest conservation has not too much analyzed in the literature and other similar experiences like IGAs influence, the study has concluded that accessibility of water from the forest being for domestic and irrigation purposes has a wider impact on people's livelihood and it has also represented a relevant incentive for communities for participating in forest' conservation. Having water access has helped the communities around Chome nature reserve to have portable drinking water close to their home as well as be able to farm almost throughout the year which has improved their food security as well as income. When they realize the close linkage between forest conservation and water availability, they are keen to participate in forest conservation. Therefore stakeholders should put more efforts on increasing water accessibility to the communities as a prime component to improve people's livelihood and touching almost all the group of peoples in one way or another. Moreover, it has shown to be also an effective strategy for promoting forest conservation.
- The Challenge remains the poverty level of the communities that forced them to consider forest products in their income portfolio. The proportion of overall household income dependence (whether through use or exchange) from forest resources tends to decline through the improvement of alternative livelihood options. This is a reflection not just of increased income opportunities in agriculture and other income generating activities, but also of decreased availability of types of forest resources that might have been abundant in the past. For many people, the transition described here ends in disappearance of forest resources in the household income portfolio. Therefore there should be interventions which promote different alternative income generating activities which might lead to a real development of households and local economy, and not only focused on a specific IGA promoted only in a small group of the community. It's the same case for water access, although it represents an important incentive towards forest conservation, it has to be implemented together with other income generating activities. The study found that income generating activities not only builds capacity, but promotes the sustainable use of some biodiversity components for example bees for honey, butterflies, which may be the most important reason why peoples benefiting from water access and participating in conservation related IGAs perceive the forest as an asset to their livelihood. It is imperative that the results of the study support the view of Morgan-Brown et al. (2009) that butterfly farmers, beekeepers, ginger farmers and water users in CNR do fear that clearance of forest reserve will affect their livelihood activities and water service, and eventually their income. Therefore it was deduced that the establishment of water intervention and IGA in these communities is an asset to household livelihood and is a tactic for improving the household behaviors towards forest conservation.
- The ginger farming has found to be the most adopted IGAs by a large population around Chome Nature Reserve. Although it's a positive aspect in the project accomplishment, in other hand the adaptation of ginger farming in communities adjacent to the forest is

very huge that might put pressure to the land and water available. According to the new Chome management plan (URT 2016), most household around CNR possess only small acre of land not enough to feed them and few has no land at all. Fertile land suitable for crop production is densely populated. This means more water and land is needed for the rapidly expansion of the ginger farming activities which will lead to more land clearance for farming purposes and water resources use conflict. This means urgent sensitization measures for sustainable agricultural practices and land use plan to improve crop productivity is still needed to sustainably contribute to livelihood improvements in communities around CNR for ginger cultivation and forest conservation.

- The study also concludes that water and IGAs investment should be high enough to deliver tangible benefits to participating dwellers adjacent to the forest, if they are to support forest conservation objectives. Since the project resources are limited, until the time when the adaptation of IGAs and water infrastructures interventions investment become available in right scales, some few households in the project areas would continue to view the forest as a liability to their livelihood since their welfare has not been addressed. Therefore it has been concluded that in order for the linkage to be translated into conservation behavior, people must believe that the accessibility of water and income they receive from IGAs is sufficient to cover the opportunity costs of engaging in conservation behavior. Not only that but also they should encourage and advocate more people in their respective villages to practice forest conservation as well as participating in the respective IGAs. This means while the results of the study agreed with past literature and though households supported forest conservation, the scale of benefit would be of major significance if Chome Nature Reserve forest benefits for the community will be more than other competed land uses. Hence conservation stakeholders should have a strategy to widen the scale or coverage of the intervention benefits to the communities.
- There is also a question of sustainability of the interventions especially IGA after the project formally have stopped funding the activities, villagers may gradually going to stop participating, which may result to the shrinking of some IGAs influence to changing people's behaviors towards forest conservation in the long run. This is happening when the IGAs needs high amount of financial inputs or expertise for people to engage in projects. During the project implementation phase the IGA can be able to change behaviors and attitudes towards conservation within the community. In such situations however, aid dependence may arise, which means that project activities and participants depend on aid to continue (Tandon 2008). In the long run when the donor then pulls out of the project with its financial capacity and expertise knowledge before sustainability is secured, the participants may not be ready or able to carry all the costs themselves, and the project may slowly, but inevitably dissolve. Therefore there is a need for the government and other stakeholders to define some strategies and set aside some budget to be used for monitoring and follow-ups of the already established water systems and IGAs as well as scaling up to other community members for sustainability and wider influence of IGAs to peoples changing behaviors towards forest conservation.

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**Acronyms and abbreviations**

CNR- Chome Nature Reserve

ICDPs- Integrated Conservation and Development Projects

IGAs- Income Generating Activities

JFM- Joint Forest Management

NGOs-Non Governmental Organizations

PFM- Participatory Forest Management

SDG- Sustainable Developing Goals

TFCG- Tanzania Forest Conservation Group

TFS-Tanzania Forest Service

VNRC-Village Nature Resources Committee