The Economics of Climate Change in Tanzania:

Importance of Reducing Emissions from Deforestation and Forest Degradation

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Executive Summary

Technological and development patterns in Tanzania are measure in terms of their carbon emissions and consequently their contribution towards climate change. Recent studies have established that per capita and total emissions in Tanzania are still low, although some sectors are projected to have significant emissions in the near future. Presently the majority of the carbon emissions are from the agriculture and forestry sectors due to their high dependence on biomass for energy sources. Tanzania has a large agricultural sector with 90% of the country's population living in rural areas, where they rely on crop production and other natural resources for their livelihoods.

Emissions from deforestation add to the agricultural emissions trends. Charcoal production and firewood collection are the chief sources of energy in both rural and urban areas, as well as an important source of income generation for most rural areas. Deforestation patterns are also linked to ineffective policy strategies that fail to control illegal logging, infrastructure and settlement expansions, wildfires and overstocking among agro-pastoral communities of the lake, central and northern zones.

More recently, Tanzania has adopted participatory forest management strategies, which encompass community forest management and joint forest management to control deforestation, promoting instead forest conservation and improving livelihoods of rural communities. Evidence from the ground acknowledges that the strategies have been very successful, with few cases of failure. Key challenges in the participatory strategies were to enhance collective responsibility of forest management, creating awareness of environmental conservation and facilitating the sense of ownership among those reliant on the forest for their livelihoods.

These successes are potentially important for the more recent Reducing Emissions from Deforestation and Forest Degradation (REDD) strategy, which aims to reduce deforestation, enhance climate change mitigation, improve community livelihoods and address poverty. Despite this sound foundation, an effective strategy of financial payment for ecosystems services needs to be established, that doesn't rely on the Participatory Forest Management (PFM) financial flow. There is still the issue of how communities which control forests on 'village land' will be adequately compensated for their contribution to a national carbon sink. A key challenge will be how to make sure that communities are able to link conservation costs with financial flow through payment for ecosystem services (PES). This study assesses the low-carbon report for Tanzania, examining opportunities and barriers for REDD in Tanzania, its implications to future household energy consumption, and demonstrate the effects of REDD on the economy and environment.

1.0 Low-Carbon Futures in Tanzania

Based on the 1994 Greenhouse Gas (GHG) inventory, the low carbon report for Tanzania estimated that the country currently has relatively low emissions of GHG, in total and per capita terms. The published inventory for 1994 puts emissions per capita at 1.3 tCO_2e (all GHGs) and 0.1 tCO_2 (CO_2 only). The report further shows that the agriculture and forestry sectors were and continue to be the leading emitters of GHGs; due to deforestation, and agriculture. The main emissions are from livestock (CH_4 from enteric fermentation) and agriculture soil (N_2O from fertilisers, animal manure etc).

These two sources accounted for 93% of emissions in 1994 (forests 70%, agriculture 23%). These estimates underline the dominance of the agriculture and forestry sectors but also the very low fossil-intensity of the energy system. Tanzania has already introduced many low carbon options, in for example, the electricity sector where there is high hydro generation capacity. However, the low use of fossil fuels for energy means high (~90%) biomass use, increasing pressure on the forestry resources and leading to higher emissions in this sector (LUCF).

These trends projects that in future years, emissions of greenhouse gases in Tanzania will increase across all sectors, overall doubling by 2030 (excluding the land use change and forestry (LUCF) sector), driven by economic motives and population growth. Although the report shows that estimates for the LUCF sector are uncertain; it is the largest emitting sector, accounting for about 48.6 $MtCO_2e$ in 2007, projected to increase to more than 165 $MtCO_2e$ in 2030 (not including natural forest re-growth as a carbon sink). This compares to inventory totals of 49.9 $MtCO_2e$ and 126 $MtCO_2e$ in 2007 and 2030 respectively without the LUCF sector. Excluding the LUCF sector, emissions per capita are projected to increase from 1.2 to 1.7 tCO_2e/capita from 2007 to 2030. Including LUCF, emissions per capita increase from 2.4 to 3.9 tCO_2e/capita. However, it should be noted that including natural re-growth as a sink may reduce per capita emissions to 0.7 to 2.9 tCO_2e/capita in 2007 and 2030 respectively.

In addition to emissions from the forestry sector, future emission increases will arise from the transport and agriculture sectors. Even in the electricity sector, which currently has a high share of renewables (hydro), the current plans for coal and gas development will

increase the carbon emissions. Furthermore, the current plans across the economy (or for some sectors, the lack of plans) could lock Tanzania into a higher emission pathway. The increases from the transport, agricultural and electricity sectors, and the associated increase in national emissions, would occur at exactly the time when there are likely to be increasing economic opportunities for international carbon credits, particularly if national level GHG mechanisms emerge.

The agriculture and forestry sectors are the dominant emitters in Tanzania, and will continue to be so in future years, with agriculture remaining an important sector, and food demand increasing; due to population growth and climate change impacts over vast rural areas. Emissions from the forestry sector will exacerbate this trend due to the high demand for biomass energy, mainly charcoal and firewood as an outcome of poor implementation or at least failure to effectively implement low-emission carbon sources in rural areas; and unreliable electricity in urban areas. In addition, many energy efficiency opportunities require significant upfront capital investment, despite the net cost being negative over the technologies' lifetime.

The assessment for DFID notes that many low cost carbon options are available, but that implementation of these remains challenging because of the diverse nature of the forest and agricultural dependents (many thousands of small holders); poor technology, inadequate awareness, expensive capital investments and lack of skilled labour. In addition, potential conflicts may arise between sectoral objectives in addressing carbon emissions. For example, reducing domestic natural resource extraction (for example in forests or indigenous coal reserves due to a shift to lower carbon energy) could be seen as undermining economic growth due to the higher costs incurred. Intensification in some sectors which are associated with development (e.g. agriculture) may increase carbon intensity as well.

These sectoral conflicts compounded with inadequate awareness among stakeholders, inadequate technology, poverty trends in rural areas, lack of commitment and perception that the country has low emission trends may hinder implementation of strategies towards low carbon initiative. Therefore, consistency with the necessary investment for mitigating and adaptation to future climate impacts, through low carbon schemes in the future may be less politically or socially acceptable due to the perception that currently there are low emissions

in Tanzania, and a perception that such strategies may be a potential hindrance to rapid economic and social development.

1.1 Information Gaps Identified

Population growth will cause major social and economic changes in Tanzania. These changes will have negative implications on land use as well as increased energy consumption. Land use change will be characterised by the expansion of the agricultural sector to meet food demand. Likewise, energy demand will increase for domestic use, particularly in urban areas.

Agricultural development will involve agricultural mechanization. In this regard, tractors and other machines will be employed. Furthermore, agro-based industries will be established for food processing and export. Such developments in the agricultural sector will entail an increased use of fossil fuel and hence contribute to higher carbon dioxide emissions. Agricultural development is further driven by the belief that the agricultural sector is the main driver of economic development in the country. The advocacy is through a strategic drive known as “Kilimo Kwanza”. Although these potential developments will result in significant contributions to emission levels, the low carbon report does not take into consideration any of projected contribution of the industries to carbon dioxide emissions.

Tanzania is in the process of establishing a national REDD strategy to reduce emissions resulting from deforestation and forest degradation due to biomass consumption, illegal logging and the expansion of the agricultural sector. The national REDD strategy aims to provide strategic guidance on how to implement REDD in Tanzania. However, there are challenges in how to address drivers of deforestation bearing in mind that rural communities depend on the natural resources base for their livelihoods. This requires the transformation of agricultural systems from extensive to intensive agriculture. This can only be attained if sustainable agriculture is promoted. Also, provision of alterative sources of energy is the only way to reduce dependence on wood based energy sources. While the report emphasizes the adoption of electricity, gas and coal options; most rural communities are poor and may not be able to afford such energy sources. There is therefore a need to critically review national energy policy in the context of provisions for cheap energy substitutes in those biomass

dependent communities in both rural and urban areas. Therefore, a key information gap on this topic is how energy use divergence will contribute to future emissions in Tanzania and challenges in attaining energy switch.

2.0 General Overview of Forestry Resources, Degradation Patterns and the REDD Initiative in Tanzania

Several studies have established that the forestry sector in Tanzania, which is approximately 34.6 million ha of forests and woodland habitats (UN-REDD, 2009; Zahabu, 2008 and Blomley et al., 2008); is currently facing alarming deforestation promoted by the human demand for biomass and income generation activities. It has been estimated that Tanzania lost an average of 412,200 ha of forests per annum in the 1990s and early 2000s; this amounts to a destruction of 14.9% of its forest cover (or 37.4% including woodlands) in the period 1990-2005 alone (UN-REDD, 2009). Overall, the alarming rate of deforestation in Tanzania has received global and local policy attention.

Deforestation has been related to population dynamics, poverty among rural communities, inadequate energy substitutes and limited technology to utilise the available natural and energy resources and opportunities (UN-REDD, 2009). Biomass demand among rural and urban populations has made deforestation worse, partly due to a heavy dependence on firewood and charcoal for cooking and heating as well as the need to subsidise unreliable electricity. Forests provide over 90% of the national energy supply through wood fuel and charcoal, and 75% of construction materials (Milledge *et al*. 2007; Miles et al., 2009).

While demand for charcoal for cooking has been a policy challenge, the population growth in major towns, such as Dar es Salaam has increased deforestation in adjacent regions and forests. Population trends of Dar es Salaam, for example, are also indicative of rapid population increase: a city of 396,000 inhabitants until 1972; today it is estimated to have a population of over 3 million. This rise in population makes Dar es Salaam the 9th fastest expanding city in the world, a fact which is undoubtedly connected to rates of deforestation (UN-REDD, 2009).

Poverty has also been historically related to deforestation; 50% of Tanzanians live below the poverty line and the country as a whole is 90% dependent on biomass for its energy needs with only 1% of its rural population having access to electricity in the rural

areas (URT, 2005). One of the national strategies that were established to reverse this deforestation trend was the introduction of participatory forest management about few years ago. Participation of communities in forestry management operates in two major forms; Joint Forest Management (JFM) and Community Based Forest Management (CBFM).

Community Based Forest Management concerns forests situated on village or general land whilst Joint Forest Management, takes place on reserve land. Despite these participatory forms in the management of forests, central government still has extensive power in the management of forests on the village, general or reserved land. These claims are linked to the fact that all land constitutionally belongs to the state, and the President holds the land in trust for the people (Derby, 2002). The ministry and divisions responsible for forestry have remained in charge of managing the country's forests, and the Division of Environment (DoE) of the Vice President's Office (VPO) is still in charge of negotiating all international agreements regarding the environment, including REDD issues (UN-REDD, 2009).

Despite these challenges, REDD has received considerable attention and has been identified as one critical approach that will address deforestation trends and facilitate poverty alleviation in Tanzania. REDD has also been outlined as being a considerable global step towards climate change mitigation by reducing the levels of greenhouse gas emissions that enter our atmosphere. Some studies have established that 15-20% of global GHG emissions are attributed to deforestation and forest degradation due to activities such as increased logging, firewood demand and agricultural practises. As shown in table 1 below, Tanzania is the key stakeholder in the REDD initiative, partly due to its extensive forest cover, increased threats to forests degradation and the establishment of PFM strategies that provide bases for the implementation of REDD.

Table 1: Forest Ecosystems in Tanzania: Location, Threats and Characteristics

Ecosystem/forest type	Extent/location	Main Deforestation and Degradation drivers and threats	Other considerations
Miombo Woodlands	≈ 220,000 sq km, about 2/3rds total forest, esp. west & south: Tabora, Morogoro, Iringa, Manyara, Tanga regions.	Medium level pressure from agriculture (e.g. tobacco in the Tabora area) and charcoal.	Mostly outside forest reserves or other protected areas; valuable timber species
Coastal Forests (excluding mangroves)	≈ 8,000 sq km in 50-200 km coastal belt: Dar es Salaam, Tanga, Lindi, Pwani & Mtwara areas.	High pressure from illegal logging, charcoal, biofuel plantations and agriculture.	High levels of biodiversity and endemism (except thicket forest); tends to be small isolated patches, especially hilltops, and islands.
Eastern Arc and other Montane Catchment Forests	Eastern Arc ≈ 3,500 sq km; mainly found in national forest reserves (NFRs) and nature reserves at top of mountain blocks in Iringa, Morogoro, Tanga & Kilamanjaro regions.	High pressure from fire, encroachment, illegal logging for valuable timber species, slash & burn farming.	Very high levels of endemism and biodiversity; high tourism potential .
Mangrove Forests	≈ 1,150 sq km located in NFRs along coastal strip.	High pressure for poles, timber, boat building (especially near towns), shrimps & saltpans.	High carbon levels and critical role for climate change adaptation.
Wetlands (non-marine)	≈ 2,000 sq km, mainly found in Morogoro, Iringa and Tabora regions.	High pressure from irrigated rice, livestock grazing.	Important water catchment functions; high carbon levels.
Acacia Savanna Woodlands	≈ 175,000 sg km in north & central Tanzania, mainly in protected areas (including game reserves).	Medium-low pressure from wood fuel, poles, subsistence farming, grazing.	Game parks – tourism; livestock a key component of ecosystem.
Guinea – Congolean Lowland Forests	≈ 6,700 sq km in Kagera & Mwanza regions in northwest Tanzania (Lake Victoria Basin); mainly National Forest Reserves.	Medium-high pressures from agriculture, esp. livestock, charcoal, near urban areas.	High biodiversity values; includes Podocarpus swamp forests.

Sources: UN-REDD (2009)

2.1 Potential Opportunities for REDD in Tanzania

Extensive forest cover and alarming deforestation rates have been established as the key motivators for the establishment of REDD initiatives. These two reasons are considered worthwhile since the programme will reduce unwanted human activity in forest resources through financial compensation for avoiding deforestation and thus contribute to the conservation of forest resources. Other reasons for the consideration of Tanzania in the implementation of the REDD programme has been its policy reforms in forestry management

(mainly the National Forest Policy in 1998 and the subsequent Forest Act of 2002); that facilitated engagement of communities in forest management. This created knowledge in the value of conserving resources and facilitated cultivating a sense of ownership and collective responsibility for managing forests; the conditions which are likely to play an essential role in the implementation of REDD in Tanzania (Tanzania-REDD, 2010).

The use of PFM strategies as an important baseline for the REDD initiative is based on the reality that the interests and incentives of local forest users and resident communities are often the key determinants of whether or not forests are used sustainably or unsustainably. Traditional forest management approaches based on central government protection and regulation of use failed to adequately protect forests, as has been the case in many forested countries throughout the world. PFM in Tanzania is based within the country's local government institutional framework, which gives local communities a legal mandate through elected village councils and village assemblies. Equally important is the country's policy framework for land tenure, which grants these village governance organs with the responsibility of managing the lands within the boundaries of villages ('village lands').

Since PFM was first developed in the 1990s, both JFM and CBFM arrangements have spread rapidly. As of 2008, PFM covers extensive hectares of land, including about 1.7 million ha under JFM and 2.4 million ha under CBFM. This means that about 13% of all the forest in Tanzania is under PFM arrangements, involving over 2,300 villages across the country. Therefore, PFM strategies will provide an essential role for the engagement of communities in the conservation of forest resources through reduced forest degradation. Also, in some areas where PFM has been operating, there are already registered community based organisations (CBOs) through which payments can be channelled.

Generally, the Government of Tanzania is committed to ensuring that Tanzanian forest-adjacent communities can voluntarily participate in and benefit from REDD as a way of enhancing forest conservation outcomes and reducing poverty (Tanzania-REDD, 2009). Besides the government commitment, it has also become widely recognized that local communities who control forest land, formally or informally, must be key beneficiaries of funds under REDD if these new global payment schemes are to be successful in reversing existing rates of deforestation and forest degradation.

Because of Tanzania's existing local governance and land tenure framework, and track record of developing PFM in harmony with those other policy factors, Tanzania is well placed to demonstrate how local involvement in forest management and global climate objectives under REDD can be practically integrated. Tanzania's experience in implementing PFM demonstrates how empowering local communities to manage forests, through secure mechanisms for tenure and a clearly developed policy and legal framework, is key to reversing forest loss and degradation in rural areas.

REDD, in essence, presents an opportunity to create a new flow of benefits from forests to local forest managers, creating even stronger incentives for communities to conserve forests in exchange for carbon derived revenues. PFM therefore provides the institutional foundation for REDD, while carbon markets provide a source of new potential economic benefits which can build on existing forest values to create even stronger incentives for local people to manage forests sustainably (*ibid*).

2.2 Forestry-Climate Change Linkage

Climate change is increasingly recognized as a major global threat with the possibility of abrupt and catastrophic climate change occurring in the coming decades. Whilst climate change impacts have become a global concern, forests have been considered as the ecosystem that may reduce impacts and drivers of climate change. The potential contribution of forestry in facilitating climate change mitigation and adaptation is through the carbon-sink function and enhancing ecosystems and community resilience, such as the regulation of rainfall, which is vital to agricultural production and ecosystem regeneration.

Although global forests can play a major role in reducing global emissions through reducing deforestation and forest degradation, and enhancing carbon-sink, achieving this will depend on the success of the agreement between the 'chief' emitters and forest dependent-communities, mostly the poor in developing countries. The consideration of forests in climate change mitigation relies on the fact that forests are a vast, worldwide carbon-sink, whose monetary value has recently been estimated to be approximately $43 billion for each year that current forested lands are preserved, their "carbon off-setting" service alone being taken into account (Trivedi *et al*., 2008).

Deforestation, is a major threat to this carbon-capture potential. Most studies conclude that deforestation accounts for somewhere between 17% and 20% of global CO2 emissions in the form of released carbon and forgone storage (UN-REDD, 2009). Once the emissions likely to derive from the change in land use are considered, deforestation may account for somewhere between 28% and 32% of global CO2 emissions (World Bank Group, 2008; Stern, 2006). This makes forestry a larger emitter of CO2 than the global transport sector (Eliasch, 2008). Likewise, the annual emissions from the forestry sector – which produces around 5.8 gigatonnes (Gt) of CO2 annually – are equivalent to the total annual emissions from the US or China (*ibid*).

Whilst forests give hope of mitigating climate change and reducing emissions through developing a carbon sink, the world's forests are home to about 350 million people (*ibid*), whilst around 1.6 billion depend on forests for sources of livelihoods such as firewood, medicinal plants, and forest food (World Bank, 2004). Given that increased water demand, damage to crops, soil erosion, and more frequent droughts are all considered to be "likely consequences" of a changing climate in the near future, deforestation is projected to aggravate these impacts (IPCC, 2007).

Present deforestation rates should therefore be a source of great concern for the international community. It has been estimated that 13 million hectares of tropical forests – which are the most precious forests in terms of carbon storage and biodiversity – are lost every year; this is equivalent to a forest cover of the size of England being torn down annually (Eliasch, 2008). Modelling instruments have calculated that the global monetary cost of the climate change impacts of deforestation will reach about $1 trillion a year by 2100 if its rate remains unabated (ibid). Presently, it is also estimated that around 60% of the carbon absorbed by forests is released back into the atmosphere because of deforestation (Madeira, 2008).

As the amount of carbon stored by forests exceeds the carbon trapped by the oil reserves of the entire world (Madeira, 2008), only by tackling deforestation will the world be able to avoid the worst consequences of climate change. Doing so will not come cheaply; the Eliasch review (2008) estimates that meeting these objectives will cost about between $17 billion and $33 billion per year, including opportunity cost and forest protection cost (*ibid*).

However, economic costs seem to be high with many estimates indicating that the cost of preserving forests is low relative to other forms of reducing CO2 emissions with the technology presently available (IPCC, 2007; Stern, 2006); with developing countries being technologically poor and prone to forest degradation.

Monetary estimates of halving deforestation show that doing so will deliver substantial economic gains over the long-term, in the order of $3 or $4 trillion (Eliasch, 2008). Yet as deforestation accounts for somewhere between 17% and 32% of global CO2 emissions, and the cost of reducing emissions by limiting deforestation is less than the cost of reducing emissions in other sectors, there are sufficient reasons to argue in favour of schemes, such as REDD, to reduce deforestation and forest degradation worldwide (UN-REDD, 2009).

2.3 Potential Barriers to REDD

Climate change mitigation through the forestry sector has received considerable attention for addressing poverty, reducing deforestation and forest degradation and promoting conservation processes. Its implementation has also been based on decades of experience in the country of promotion of community based conservation in the forestry and wildlife sectors; the initiative which will facilitate the engagement of communities in the conservation, engagement and payment processes. Since the early 1990s, Tanzania has made significant steps towards improving the management of its forest resources; some important steps being the implementation of CBFM and JFM (Blomley and Idd, 2009).

Despite these preparations, there have been uncertainties that human activities will impede success in the implementation of the programmes. The main direct causes of deforestation are clearing for agriculture, overgrazing, wildfires, charcoal making, persistent reliance on wood fuel for energy, a lack of efficient production and marketing, over-exploitation of wood resources and a lack of land use plans and non adherence to existing ones. The underlying causes of deforestation are rapid population growth, poverty, policy and market failures (*ibid*).

Population growth, a growing need for industrial and residential sites, unemployment, the need for farmland and general social economic needs for forest products have lead to

increased deforestation and forest degradation. It has been documented that deforestation is taking place in both reserved and unreserved forests but more so in the unreserved forests. This is partly due to inadequate resources to implement active and sustainable forest management; and deforestation through encroachment and over-utilisation in forest reserves which are under the jurisdiction of the central or local governments (Blomley and Idd, 2009).

Another challenging issue has been the legal challenge of the management of forest resources. Although forest legislation (mainly the 2002 Forest Act) provides a clear and unambiguous legal basis for the management of forests on village lands at individual, group and community levels, implementation of JFM for instance has been more uncertain, though legalised through the signing of joint management agreements. hile the law allows for a wide range of partnerships within such agreements, and an option for delegated management where management rights can be devolved from government to a third party agency (such as an NGO, a community group, a private company or a local government body), there are no known cases of this happening on the ground. In addition, whilst several hundred villages have been supported in developing agreements around a range of forests managed by central or local government, only a limited number of these agreements have been signed by the government, particularly those relating to national forest reserves (NFRs) (Blomley and Idd, 2009). For instance, in Kasulu district, there has been delayed implementation of PFM strategies over the last 8 years.

Table 2: PFM Status in Kasulu District

Forest Name	Area (ha)	Managing Village	CBFM	Status	Year Started
Nyakitonto	750	Nyakitonto	CBFM	By laws approved by village assembly	2002
Mugombe	600	Mugombe	CBFM	By laws approved by village assembly	2002
Shunga	1500	Shunga	CBFM	By laws approved by village assembly	2002
Buhoro	1530	Buhoro	CBFM	By laws approved by village assembly	2002
Nyankwi	9.7	Nyankwi	CBFM	By laws approved by village assembly	2002
Kimori	63.8	Bukiliro	CBFM	By laws approved by village assembly	2002
Rungarunga	55.6	Kagezi	CBFM	By laws approved by village assembly	2002
Nyamabuye	106.9	Kumhasha	CBFM	By laws approved by village assembly	2002
Mramba	184.5	Kigaga	CBFM	By laws approved by village assembly	2002
Mtara	126.5	Nyarioba	CBFM	By laws approved by village assembly	2002
Kizila	534.5	Kazilamihunda	CBFM	By laws approved by village assembly	2002
Nyachenda	250	Nyachenda	CBFM	By laws approved by village assembly	2002
Mwali	1350	Mwali	CBFM	By laws approved by village assembly	2002
Kitagata	210	Kitagata	CBFM	By laws approved by village assembly	2002
Makere	560	Makere	CBFM	By laws approved by village assembly	2002
Nyamidaho	650	Nyamidaho	CBFM	By laws approved by village assembly	2002
Mvugwe	710	Mvugwe	CBFM	By laws approved by village assembly	2002

Source: Field Survey Data, 2010

Despite the overall success of PFM in Tanzania, these approaches continue to face several key challenges which may also be a constraint to REDD implementation. One challenge to PFM has been developing flows of local benefits from forests under local management. Despite many years of developing PFM, and the presence of valuable stocks of timber on many areas under PFM, there is very little revenue from these resources at village.

By contrast, levels of illegal timber harvesting in Tanzania in recent years have been high (see for example TRAFFIC report, 2006), but this trade has generally bypassed local communities. Although PFM has had many successes in improving forest conservation and community tenure security, which REDD can further; there are still uncertainties which can either be partly resolved or further exacerbated by REDD, depending on its design and execution.

Table 3: Summary of Tenure/Institutional Systems for Forest Management

Institutional/Tenure basis	**Main characteristics**	**Implications for carbon finance**
Customary Community Based Forest Management (CBFM) on village or private land	Forest areas managed for traditional, customary or sacred reasons. Managed via traditional institutions and norms. Tend to be small in size and localized in areas where traditional management is strong.	Good, although lack of formalised ownership means that permanence cannot be assured. Fragmented and small forest blocks means that aggregation is needed to reduce transaction costs.
CBFM on village land	Responsibility for forest management on village land delegated to village governments, groups or individuals. Widespread, with forest areas per village varying from a few hectares to tens of thousands of hectares. Concentrated mainly in Miombo, coastal and acacia woodlands.	Good. Legally defendable rights to trees, land and carbon. Fragmented nature of village forests means that an aggregator is necessary to reduce transaction costs. High demand for timber, land and charcoal close to urban areas makes site selection critical.
Wildlife Management Areas (WMAs) on village land	Allows an elected CBO known as the Authorised Association to manage wildlife resources on village land and obtain a share of hunting revenues. WMAs are large, but there are only 16 legally established to date due to high establishment costs and delays.	Quite good, e.g. large forest blocks and well-defined management bodies. But procedures and institutions for forest management are different to village wildlife management: clarification is urgently needed.
Joint Forest Management (JFM) in National Forest Reserves (NFRs)	Legal agreements between the state and local user sharing management responsibilities and returns. But failure to agree national guidelines on benefit sharing has constrained its spread and adoption.	Moderate. Forests contain high carbon values, but failure to clarify and legalise revenue sharing is a critical weakness, and means that carbon property rights are unclear.
Forest Nature Reserves (with no or minimal co-management)	Highest protection status under the Forest Act. Very limited local use is allowed, so limited for JFM. More nature reserves could be established in Morogoro and Iringa Regions.	Good. Tenure and protection are clear, and carbon values are high. Mixed picture for co-benefits: high biodiversity & hydrological benefits, low social/livelihood benefits.

Another legal challenge has been attributed to the fact that the forest law remains silent on how the benefits of forest management, particularly in forest reserves managed for timber production purposes can be equitably shared with participating communities. In many cases, benefit-sharing arrangements remain in a legal limbo with *de facto* management at the local level taking place, in return for vague promises about benefits at a later date. Clearly, this is a situation that cannot be sustained indefinitely. Without benefits reaching a level that is equal to or exceeds the costs being borne, in terms of local forest management, the long term future of PFM through JFM and CBFM remains uncertain. With the increased discussion in Tanzania over revenues from carbon financing, particularly under REDD; the question of the division of revenue is likely to be rekindled (Blomley and Idd, 2009).

In fact, benefit sharing is likely to be key drawback in the implementation of the REDD initiative in Tanzania. While policy and legal frameworks in the management of forests seem to provide considerable conditions for its implementation, benefit sharing mechanisms have yet to provide systematic financial flow channels and assess cultural and economic aspirations of major forest dependents, mostly the rural poor communities. A key challenge would be how to influence willingness to pay and accept among the poor and adjacent communities. For instance, asking how the REDD programme will be accepted among firewood dependents, timber harvesters, poachers, and those who depend on the forest for food.

The challenge may also be extended to the evaluation of how different contributions of forest resources to households will be adequately covered through finance. This is due to the fact that forest contribution, demands and preferences can be different even at individual household level. For instance, while a key priority for women may be firewood for cooking, heating and NWP; men may be more in need of wood products like timber and building poles. The key question at this level may be how to compensate household requirements based on gender schemes.

Furthermore, another major weakness of the current legislation regarding PFM in Tanzania is that it is highly sectoral in nature, and gives little regard for other natural resources available at the community level. Although both the National Forest Policy and the Wildlife Policy of Tanzania were approved in March 1998, which would suggest some degree

of parallel evolution, the sectors have developed divergent ideas about how to devolve management to the village level. The forestry sector, in its provisions for PFM builds on Tanzania's structures of local government and customary village-based land tenure.

The key institutions for PFM are the Village Council, Village Assembly, and VNRC. The basic management tools are village by-laws and land use plans, which are legally grounded in the Local Government Act and Village Land Act, respectively. One of the reasons why CBFM has taken off easily in Tanzania, with over 1,400 villages establishing their own village forest reserves, is that this framework is relatively simple and based on existing local institutions, such as village and district governments (Blomley and Idd, 2009).

The highly sectoral nature of natural resource legislation constrains opportunities for communities to obtain multiple benefits from the management of forest and wildlife resources on village land. The highly sectoral nature of forest and wildlife laws means that the process for establishment of community based forest and wildlife management differs markedly. Although they do not necessarily conflict, a number of legal "grey areas" constrain community level managers wishing to manage both forest and wildlife resources in a given area of village land. As a result, the possibility of obtaining multiple revenue flows from wildlife and forest harvesting is being lost, which significantly reduces local incentives for long term natural resources management (Blomley and Idd, 2009).

Despite the major efforts of the government to support JFM over the past 15 years, its long term viability remains in the balance. Firstly, given the high conservation status of many of the forests under joint management arrangements, the total level of permitted benefits that may be legally harvested from the forests is very low (and may be significantly less than the range of benefits people obtained prior to JFM being established, albeit illegal in nature). Secondly, even where opportunities exist for extractive use of forest reserves (such as in production forests where timber harvesting is permitted), the relative share (and type) of benefits that can be captured by communities has yet to be agreed on and the mechanism for sharing of benefits is not yet in place (*ibid*).

A further challenge in the implementation of the REDD initiative has been emission leakage, because local projects, albeit successful, might fail to deliver any net emission

reductions from reduced deforestation in the aggregate amounts. The Tanzanian case proves the statement that leakage can never be completely overcome. Yet it also suggests some ways in which leakage can be minimized. Even if strategic planning can ensure the monitoring of activities such as illegal logging, strategic conservation projects will not on their own satisfy the energy needs of Tanzania's rural population. This is why, in the final analysis, leakage can be brought to tolerable levels only with the implementation of practices such as sustainable charcoal production (UN-REDD, 2009).

Although carbon stored in trees, soils, vegetation and leaf litter offers great promise for African countries to participate in global carbon markets, Africa as a whole has made little progress in benefiting from such opportunities (Policy brief and COMESA, 2009). Also, the inclusion of forest degradation and forest enhancement in REDD, implies that countries will need to carry out forest inventories on a regular and systematic basis in order to quantify forest carbon stock changes. This would be an expensive undertaking if professional surveyors were employed, and there may be serious shortages of labour (Skutsch et al, 2009). Hence, while the focus of REDD is mitigating emissions, alleviating poverty and providing livelihood alternatives among the poor, a lot of the financial investment will end up being diverted to employ technical staff to estimate carbon stock.

The REDD initiative may also face a critical challenge in enforcing rights over forests among rural communities. Even though forest law, policy and other supporting measures such as the Village Land Act give communities clear rights over forests, enforcement often proves challenging. One concern that has arisen globally with regards to REDD is whether the creation of new flows of revenue based on forests' carbon values will result in weakening local rights to use and manage forests. This concern is based on the fact that as forests' commercial values rise as a result of carbon market trends, many parties such as wealthy individuals or private investors may try to obtain forests that communities have not yet secured their rights to.

Thus, the carbon market and REDD might prompt a rush for control over forests similar to the recent rush for control over lands in Tanzania's coastal areas that has occurred as a result of the growth of the biofuels market. If REDD results in outsiders claiming control over forests that were previously used by local communities, such developments might

undermine the very objectives of REDD in Tanzania. Furthermore, if communities lose access to land or resources it will also weaken their capacity to adapt to climate change. Developing REDD in a way that helps communities to secure tenure over forests, and integrates REDD with PFM, is therefore also important to the aim of integrating the climate change mitigation and climate change adaptation agendas (Tanzania-REDD, 2009).

Some final key questions which will need to be addressed as a part of REDD preparation in Tanzania are: What is the best way to develop efficient and equitable mechanisms for channelling benefits to local communities under REDD arrangements? How can the transaction costs of making many relatively small payments to local groups be minimized in order to make the system practical? How will a system of national payments made under the formal REDD system be integrated with currently growing opportunities for local forest managers through voluntary carbon markets? These questions call for continued thought and engagement by all stakeholders in order to prepare Tanzania for REDD implementation (Tanzania-REDD, 2009).

3.0 Ongoing REDD Projects

Norway's International Climate and Forest Initiative was launched in 2007, with a global commitment towards REDD efforts at international and national levels. Drawing from this initiative, in April 2008, Norway and Tanzania signed a letter of Intent on a Climate Change Partnership; with a focus on supporting REDD pilot activities in the field, capacity building, national strategy development and implementation. The Government of Tanzania has since embarked on developing a national REDD strategy which will be the basis for implementation and management of REDD activities in the country. Moreover, there are other REDD initiatives, which include UN-REDD, Forest Carbon Partnership Facility (FCPF) and the Clinton Foundation Climate Change Initiative (CCI) in which Tanzania is participating.

REDD pilot activities that have been supported by the Norway and Tanzania Climate Change Partnership are:

Tanzania Forest Conservation Group and MJUMITA

- Making REDD work for communities and forest conservation in Tanzania

- **Budget:** USD $5,900,000 over 5 years
- **Region:** Montane and lowland coastal/Miombo forest in the eastern Arc Mountains and Coastal Forest
- **Expected Outcome:** 50,000 hectares of conserved forest, absorbing approximately 110,000 MTeCO2, and providing economic benefits to approximately 20,000 people. Establishment of a community carbon cooperative. National and international advocacy on REDD policy.

The Jane Goodall Institute (JGI)

- Preparing the Masito-Ugalla Ecosystem Pilot Area to support Tanzania's national REDD strategy
- **Budget:** USD $2,759,641 over 3 years
- **Region:** Western Tanzania, working in 15 villages
- **Expected Outcome:** 70,000 hectares of conserved forest, absorbing 55,000 MTeCO2

Mpingo Conservation Project (MCP)

- Combining REDD, PFM and FSC certification in southeastern Tanzania
- **Budget:** USD $1,948,123 over 4 years
- **Region:** Southern Tanzania, working in 12 villages
- **Expected Outcome:** 50,000 hectares of conserved forest, absorbing 50,000 MTeCO2, and providing economic benefits to approximately 18,000 people

Tanzania Traditional Energy Development and Environment Organization (TaTEDO)

- Community based REDD Mechanisms for Sustainable Forest Management in Semi-Arid Areas
- **Budget:** USD $2,102,752 over 4 years
- **Region:** Northern/central Tanzania, working in 10 villages
- **Expected Outcomes:** 2,500 hectares of conserved forest, absorbing 108,285 MTeCO2, 6,000 beneficiaries

African Wildlife Foundation (AWF)

- Advancing REDD in the Kolo Hills Forests

- **Budget:** USD $2,061,794 over 3 years
- **Region:** Northern/Central Tanzania, working with 15 villages
- **Expected Outcomes:** 18,000 hectares of conserved forest, 15,000 beneficiaries

CARE Hifadhi ya Misitu ya Asili (HIMA)

- Piloting REDD in Zanzibar through Community Forest Management
- **Budget:** USD $5,539,175 over 4 years
- **Region:** Unguja and Pemba islands, Zanzibar
- **Expected Outcomes:** 60,000 hectares of forest, benefiting 16,000 rural households

4.0 Implications of the REDD initiative on Household Energy

4.1 Overview of Biomass Dependence in Tanzania

Wood fuel, mainly firewood and charcoal, account for over 97% of the total wood products consumed in Tanzania. However, the percentage of dependence has been increasing over time, partly due to population growth and the quantity of agricultural produce, such as tobacco that requires semi-processing. For instance, in 2003 alone, the total consumption was around 44.8 million m3: 55.7% of this was used as firewood for domestic cooking and heating; 39.7% was employed for the production of charcoal; 2.9% was used by rural industries; and 1.6% was used for processing agricultural crops (URT, 2005).

In general, Tanzania relies on biomass as the source for 91% of its energy supply (*ibid*). Arguably, the biggest driver of deforestation in Tanzania is the harvesting of wood for fuel and charcoal production. Populations in rural areas rely heavily on firewood for their energy (primarily for cooking), while urban populations use charcoal. Similar studies have also raised concerns that high proportions of households in tropical Africa depend on wood fuel for about 90% of their total domestic energy supplies (Dunkerly and Ramsey, 1983; Simon, 1991). According to the literature, a high dependence of households on firewood and charcoal relates to the inability of some households to adopt alternative sources of energy due to low income; and sometimes, wood fuel is still cheaper than alternative forms of fuels such as biogas and kerosene (Leach and Mearns, 1988; Hosier and Milukas, 1989; Boahene, 1998).

A study by Boahene (1998) ascertains that even if the price of wood fuel were to increase, demand would not be drastically reduced due to the unavailability of substitute energy sources like electricity (Boahene, 1998). These claims were made in similar studies by Leah and Mearns (1988) and Boahene (1998), which suggest that the majority of the villages and small towns, in Tanzania in particular, have no access to electricity. Even where electricity is available, the majority of the population are unable to afford it (TaTEDO report, 2009).

Other studies have shown that there is poor electrical coverage in Tanzania, and significant differences in coverage exist between urban and rural areas. The studies have also acknowledged that even in urban areas there are a significant number of districts (e.g. some districts of the Kigoma, Ruvuma, Lindi and Mtwara regions) that are still not connected to the national electric grid (URT, 2002; Abdallah and Monela, 2007).

Although rural households account for 75% of the population, urban households use relatively more biomass, as they account for about 40% of total wood fuel consumption (URT, 2005). Therefore, in forests surrounding village areas, deforestation has been occurring partly due to the heavy demand for firewood. High demand for charcoal in the cities (for example, Dar es Salaam accounts for 50% of national charcoal consumption), enhances widespread deforestation, in particular in areas surrounding the cities (UN-REDD, 2009).

The market price for charcoal remains competitive relative to other energy sources, even when it is transported from regions far from the cities. Small quantities of charcoal are produced locally by individuals in forests surrounding their villages and sold on the roadsides, but commercial quantities of charcoal are usually produced by non-local individuals or groups, who often move around the country, and transport the charcoal to the cities. As urban centres expand, so does the demand for energy, and thus for charcoal, as it remains the most viable and economically competitive source of energy for cooking purposes.

4.2 Potential REDD Outcomes of Woodfuel Patterns

Wood fuel demand, settlement patterns, infrastructural development and agricultural expansion compounded by population dynamics have in some instances being key drivers of

deforestation in Tanzania. Although patterns and causes of deforestation differ depending on the nature of economic and social development of an area, wood fuel demand is one of the major causes of deforestation throughout Tanzania. As suggested in the previous section, wood fuel demand affects the livelihoods of the rural and urban communities who rely on it.

Deforestation trends in Tanzania suggest the need for appropriate mechanisms to stop deforestation and enhance forest conservation. REDD has been established to facilitate forest conservation and under the programme, conservation will reduce carbon emissions and facilitate carbon sinks. However, a key challenge in attaining these goals is how to adequately provide alternative energy sources for cooking and heating among rural and urban communities. This is due to the fact that proper operation of REDD will depend on the ability of communities to stop deforestation and change their energy and production sectors. Change however, will be accompanied by technological and economic costs, which some communities may not be able to cover. Also, in reducing deforestation, an immediate consequence will be the reduction of biomass available for energy generation.

Because biomass is steadily becoming a scarce resource due to demographic expansion, per capita consumption has declined in the last 40 years. Notwithstanding an overall increase in the amount of biomass consumed, further reducing its availability could have substantial negative impact living standards. If usable biomass is further reduced through REDD policies, without simultaneously providing alternative sources of energy and income, there could be a number of negative social effects. In many areas, women and children already spend several hours a day fetching firewood, which takes away the opportunity to attend school from children, and prevents women from being able to engage in income generating activities.

Furthermore, scarcity of firewood forces some households to cook fewer meals per day, changing their diets, which can have negative impacts on their health and nutrition. Also, in cold areas where fire-wood is used for heating, its scarcity can create health problems for children and elderly people (URT, 2005). Finally, charcoal production is one of the main sources of income for many rural communities. If REDD further adds to the scarcity of usable biomass (both for satisfying energy needs and generating income), then these social

problems will be exacerbated to a large extent and accompanied by a potential fall in income, unless relevant countermeasures are taken (UN-REDD, 2009).

Moreover, increased poverty among rural and urban communities will significantly exacerbate energy scarcity due to the inability of most rural communities to adopt alternative energy sources. Even if alternatives are provided, additional issues may arise from the fact that many people will not be able to afford the costs of the alternatives. Eventually, the energy-poverty relationship will have negative impacts on the health of those who have to spend more of their income on energy when it would otherwise have been spent on food. However, in general terms, the greater the reduction in firewood and charcoal use through alternative energy sources, the better it will be for the general health conditions of the population.

Because the energy sector in Tanzania has not developed reliable commercial energy sources, it will be unlikely to find alternatives that would allow a decisive shift away from wood fuel for domestic cooking, which in 2014 will still most likely account for over 80% of total energy use (URT, 2005). The high annual rate of forest depletion in Tanzania should urge policy-makers to reform the energy sector. Using more efficient stoves to cook on can reduce biomass energy demand, but stoves are still a large investment for the poor, and there is no incentive to make that investment while charcoal prices remain low.

Even though investment in cooking stoves could be promoted through a series of subsidies and the contribution of REDD funds, and eventually contribute to the reduction of demand for biomass; awareness among rural communities is still very low and infrastructural support limited. Due to the increasing scarcity of wood fuel, people may adopt other methods for reducing consumption of wood fuel such as the improvement in kitchen management, for example, using firewood to increase burning efficiency and sometimes extinguishing firewood and charcoal right after cooking (UN-REDD, 2009).

An interesting alternative solution for producing charcoal for cooking purposes is the one developed in Senegal, where the increasing scarcity of forest resources, due to soaring population and economic growth, pushed local communities to take countermeasures. In

2004, PERACOD[1] started a project of diversification of sources of energy supply for domestic fuels in the city of Saint Louis, Senegal. The pilot project explored and developed techniques of agglomeration of the fine carbon dust (originating from charcoal) into carbon briquettes. The technology developed by PERACOD consists of a "Rotor Press" solidifies biomass carbon dust by blending it into a mix of grass and clay. This creates a substitute to bio-carbon that reuses carbon dust and thus diminishes deforestation occurring from charcoal production (UN-REDD, 2009). This innovation could be explored in Tanzania as a viable, albeit temporary solution for charcoal substitution. At the national level, the debate revolves around the choice to build a national grid or to continue with off-grid rural electrification projects. However, given the limited financial resources of Tanzania, it is unlikely that the government will be able to provide the whole country with such an investment in infrastructure as a national grid.

Although alternative energy sources such as hydropower and natural gas are available in Tanzania and are relatively cheaper than charcoal, there are several problems with the use of these alternatives at the moment. The first is that, while the stream of energy of these alternative sources may be cheaper, and sufficient infrastructure already exists in some areas, the household installations and appliances needed to use these energy sources are too costly an investment for most families. A second problem is that the units in which these energy sources are sold (e.g. gas cylinders) are often too large, requiring a large up front, whilst charcoal can be bought in small quantities and the payments thus divided and dispersed.

Studies show that the size of charcoal bags is becoming smaller and smaller to accommodate the consumers' needs and the price of charcoal is such that it is more convenient for a family to purchase it than gas canisters. With a 30kg charcoal bag, an entire family (the average Tanzanian household is formed of about 5 members) can cook for up to a month. Gas canisters are too expensive to justify the higher investment of buying gas stoves (URT, 2005). It is also essential that the carbon emissions of these alternatives are accounted for when assessing the role of the REDD programme in climate change mitigation.

An additional problem is market price distortions caused by the government taxing these other energy sources, especially electricity, at high rates. Given the financial

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[1] *Programme de Promotion de l'Electrification Rurale et de l'Approvisionnement en Combustible Domestiques*

constraints but also the natural endowments of Tanzania, the energy sector should promote a portfolio of energy alternatives, so that the focus of energy generation capacity can be directed towards the development of wind and solar power and small hydro technologies. Even though wind power is characterized by intermittency, it will ease the reliance on hydropower, which is vulnerable to droughts.

5.0 Overview of Co-benefits of REDD to the Economy and Environment

Co−benefits, often called multiple benefits, are the positive impacts of Reducing Emissions from Deforestation and Forest Degradation (REDD) that are additional to emissions reduction. These include ecosystem and social benefits such as improved biodiversity and non-timber forest products. Potential co-benefits from REDD are widely relevant in Tanzania, where forests and woodlands support the livelihoods of 87% of the rural poor (Milledge *et al*. 2007).

One of the potentials of the REDD initiative is revealed through the conservation of forests and enhancement of natural carbon stocks, which are now considered a key climate change mitigation measure. The initiative has been established to reduce deforestation and enhance forest conservation on the basis that recent studies have estimated emissions from land use change, mainly tropical forest loss, are contributing about 17.4% of the total anthropogenic greenhouse gas emissions (IPCC 2007a); which is equivalent to around 5.8 Gigatonnes (Gt) of carbon dioxide (CO2) per year.

Conserving forests also promotes the continued provision of wood and non-wood benefits under environmental change, thus increasing resilience to climate change for both natural ecosystems and communities (Campbell *et al*. 2009). An important consideration in the implementation of REDD is that co-benefits generated will differ depending on the location and the type of ecosystem under management.

In general, the global economic rationale for REDD focuses on conserving to promote community sustainability and reduce global emissions generated from deforestation and forest degradation. Some studies have also asserted that forestry conservation will facilitate halving carbon emissions by up to 50% by 2030. Conversely, a more ambitious emission reduction target could be attained at the same cost if deforestation is reduced (Eliasch, 2008).

Furthermore, a recent study by Kareiva (2009) has shown that poverty reduction projects linked to conservation objectives have proved more successful than projects focused solely on poverty alleviation. Further evidence has pointed to the tendency towards an inverse relationship between rural income and deforestation rates, whereby a rise of the former (after a certain threshold) is generally correlated with a reduction in the latter (Culas, 2004). This evidence makes a case for attaching REDD initiatives to as many pre-existing development projects as possible, as well as for the inclusion of poverty alleviation and development measures in climate change mitigation.

The economic and environmental benefits of carbon trading are particularly relevant for Tanzania due to the fact that there have been high demands for sustainable forest management and poverty alleviation. The strategies are grounded in the heavy dependence on land and forests for subsistence and the growing threat of widespread forest resource degradation. Therefore, successful implementation of REDD, and carbon trading in particular, could raise funds to sustain forest management, and raise local and other forest workers' incomes as well as creating alternative development and energy sectors. The analysis further shows that alternative development and livelihood options are necessary under the current and projected climate change impacts. This is partly linked to the fact that currently forests provide global food security and resources, food, fuel and medicine for most of the 1.2 billion people living in extreme poverty.

Despite potential successes in the implementation of REDD, there have been concerns that emission leakage may reverse the conservation outputs; because while some areas may prove successful, some might fail to deliver any net emission reductions from reduced deforestation. This is linked to the pattern of deforestation in most 'general lands'. Almost half of Tanzania's forested lands fall under the 'general land' category, which is 'open-access' for everyone. Forests in this category are characterized by insecure land tenure, shifting cultivation, annual wild fires, harvesting of wood fuel, poles and timber, and heavy pressure for conversion to other competing land uses, such as agriculture, livestock grazing, settlements and industrial development (Zahabu et al., 2008).

Likewise, it has been estimated that the majority of deforestation in Tanzania takes place on general land (*ibid*), partly due to the fact that it (with its open-access feature) is

subject to a classic tragedy of the commons, where undefined user rights have been leading to over-exploitation of the resources. This situation is not unique to Tanzania, with similar scenarios occurring in other countries with open-access land. As a global lesson, REDD initiatives are unlikely to work well at a national level as long as vast areas of a country remain open-access where a lack of policing can lead to severe deforestation. Again, the Tanzanian case-study is not only indicative of a common problem but also points to a potential solution (*ibid*).

Evidence is arising of local communities in Tanzania who have stopped harvesting forests unsustainably "as they realized it's *their* resource" (UN-REDD, 2009). This highlights the need for expanding community-based forest management to larger sections of general land, spreading "rights, responsibilities, and revenue" to local communities for a more effective management of common forests (Sumbi, 2009). In these cases, REDD initiatives can provide the presently missing financial incentives for local communities to bring open-access forests under a regime of commonality and sustainable forest management.

In addition, REDD initiatives can be both affected by and be an agent of change of land tenure systems. Insecure land tenure can lead to the failure of REDD, but REDD can also help define and secure land tenure rights, providing the incentive for communities to do so too. Generally, effective monitoring of REDD projects and sustainable forest conservation (e.g. sustainable charcoal production and consumption) can ensure that the REDD initiative in Tanzania is a success, and bring leakage to manageable levels. This should be complemented by the enhancement of alternative sources of energy.

Furthermore, successful implementation of the REDD initiative will depend on the ability to ensure that the price per ton of carbon collected will be high enough to prevent the proprietors of the forests from using the forests for other purposes, including but not limited to agriculture, industrial development, commercial harvesting, firewood collection, and cultivation of alternative crops such as those used for bio-fuels (UN-REDD, 2009). This is associated with the fact that, very often, the owners/users of forest resources have little option besides cutting down the forests to satisfy their basic needs. This is why initiatives such as UN-REDD will be successful only if they are integrated into a strategy of overall development, whereby the energy and agricultural needs of developing countries are given

the same consideration as the global benefits deriving from the conservation of the world's forests (UN-REDD, 2009).

6.0 Summary

Over centuries, forests have been supplying a variety of wood and non-wood products, offering employment, being sources of revenue through the sale of wood and non-wood products and services, conserving soil and mitigating climate change through absorbing carbon. They are a source of water for domestic and industrial use, agriculture irrigation and power generation and have aesthetic, recreational, cultural, spiritual, medicinal and scientific value. The forests have also been sustaining ecosystems of high biodiversity value and contribute to agricultural stability by protecting the soil whilst contributing to poverty reduction through the products and facilities that they provide. There are estimates that the annual value of forest goods and services in Tanzania was about USD 2.2million or about 20.1% of Gross Domestic Product (GDP) based on 2006 prices (MNRT, 2008a); with about 3 million people being employed in forest industries, government forest administration and self-employed in forest related activities (MNRT, 2008a, Blomley and Idd, 2009).

Despite these positive effects on socio-economic development the adverse impacts of climate change on environment, human health, food security, human settlements, economic activities, natural resources and physical infrastructure are already noticeable in developing countries, Tanzania in particular. There have been several global strategies intended to address the problem of climate change through mitigation and adaptation measures. Reduced Emissions from Deforestation and forest Degradation (REDD) have been proposed as a measure to address mitigation and adaptation to climate change effects, and generate financial income to fund sustainable forest management and poverty reduction (UN-REDD, 2010).

The government of the United Republic of Tanzania considers the REDD initiative as a viable option that can provide opportunities for the country to meet its obligations of managing its forests and woodlands on a sustainable basis and at the same time respond to poverty reduction and climate change mitigation and adaptation initiatives. Consultations and outreach activities have been undertaken to work towards the development of the National

REDD Strategy; which aims to ensure that all relevant stakeholders participate in REDD initiatives and enhances transparency and accountability in decision making (UN-REDD, 2010).

Although the REDD initiative links well with climate change mitigation, participatory natural resources management, poverty alleviation and community development; its emphasis on the carbon value of ecosystems over other values may lead to serious negative impacts on food, water resources, access to traditional medicines and seeds, and other socio-economic, cultural, spiritual and ecological values of forests.

Also, REDD frameworks show that there will be a result of greater preservation of forest resources with some harvesting restriction. Although there would be much reduced forestry degradation; conservation measures that prevent access to forests will have negative social implications, such as increasing the time and effort required to collect firewood. Furthermore, little is known about the present status of REDD related carbon trading projects in Tanzania. There is little or no information on what projects have been undertaken and where they have been implemented, and we know little about what their social impacts have been.

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