

REVIEW OF CLIMATE CHANGE MITIGATION IN AGRICULTURE IN TANZANIA:

Prepared by

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Executive summary

This report assesses and identified policies, strategies and initiatives led by the Tanzanian government towards addressing the impact of climate change in agriculture. Supporting 80% of the population, agriculture is still the main stay of the economy, and hence any negative impact originating from climate change to this sector has significant effect to the country economy and community livelihoods.

The commitments of the Tanzanian government towards combating climate change at national, international and local level have been exemplary. Furthermore, due to less mechanized form of agriculture which also a rainfed, less input in terms of inorganic fertilizer and chemical pesticides, the country is still contributing less to the emission of the greenhouse gases (GHG).

GHGs emission in Tanzania is reported mainly to be from land use change and forestry by 87.33%, energy and agriculture ranking second and third by contribution 6.39% and 5.68% respectively. This information gives an impression that despite less emission of GHGs in agriculture compared to other sectors, special attention needs to be paid on soil and livestock in order to reduce the emission from agriculture.

The expected growth in agricultural sector may trigger acceleration of GHGs emission which might surpass other sectors, currently the conversion of natural forests and woodlands into agricultural fields is at alarming rate, the current rate of deforestation that have been reported by the government stands at 400,000 ha/year, agricultural sector is said to be the key contributor of deforestation.

The REDD+ readiness phase is the most significant mitigation program, the readiness phase has been implemented through the UN-REDD and the NICFI programme with a total budget of over 100mil USD. The readiness phase has laid down a foundation to most ground work to support accounting on GHGs emission.

Moreover, the readiness phase gave set up of the MRV system together with a road map for RL/REL. currently the ability of the nation to collect emission data (NFI) is much enhanced than before. Institutional arrangement and coordination for Carbon monitoring is well underway through the NCMC. However the development of MRV system in Tanzania is still at infancy stage as many of the key issues are not in place viz. NFMS, RL/REL and the definition of forest.

Tanzania has a good foundation of policy framework to address adaptation and mitigation of climate change in agriculture. It needs very complex and accommodating methods and tools that

will capture differences in agro-ecologies farming systems, agricultural input levels and other land management.

Keywords: GHG emissions, climate change variability,

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List of Acronyms

AGITF	Agricultural Input Trust Fund
AIDS	Acquired Immuno-Deficiency Syndrome
ARI	Agricultural Research Institute
CAIT	Climate Analysis Indicators Tool
CCIAM	Climate Change Impacts, Adaptation, and Mitigation
CDM	Clean Development Mechanism
COP	Conference of Parties
DNA	Designated National Authority
EMA	Environmental Management Act
FAO	Food and Agricultural Organization of United Nations
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Green House Gases
GIS	Global Information System
GTZ	German Technological Cooperation
HIV	Human Immunodeficiency Virus
ICRAF	International Centre for Research in Agroforestry
IDRC	International Development Research Centre
IPCC	Inter-governmental Panel on Climate Change
MRV	Monitoring, Reporting and Verification
NAFORMA	National Forest Resource Monitoring and Assessment
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NSGRP	National Strategy for Growth and Reduction of Poverty
NCMC	National Carbon Monitoring Center
NCCFP	National Climate Change Focal Point
NCCS	National Climate Change Strategy
NCCSC	National Climate Change Steering Committee

NCCTC	National Climate Change Technical Committee
NIMP	National Irrigation Master Plan
NEP	National Environmental Policy
QDS	Quality declared seeds
REALU	Reducing Emission from All Land Uses
REDD	Reducing Emission from Deforestation and Forest Degradation
R&D	Research and Development
REL	Reference Emission Level
RL	Reference Levels
SUA	Sokoine University of Agriculture
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environmental Program
URT	United Republic of Tanzania
USD	United States Dollar
VPO DoE	Vice President Office, Division of Environment

1.0 Introduction

Tanzania is signatory to the United Nations Framework Convention on Climate Change since 1992. It has undertaken various initiatives at local and international level to affirm its commitment to combating impacts of climate change including efforts leading to reduction of greenhouse gases (GHG). In 2003, Tanzania submitted its initial communication on status of GHG emission in the country. Stock taking of the status of GHG emission in the country is very important and could be used as a basis for targeting reductions. However, regular estimation has been a challenge, as of to-date the country has not submitted the updated version of the GHG emission levels due to various reasons, mostly associated with methodological approach and other constraints.

Tanzania is among the two countries that participated in the implementation of the Food and Agriculture Organization of the United Nations (FAO) -led pilot projects as part of the larger MICCA program (<http://www.fao.org/climatechange/micca/en/>). In Tanzania, the MICCA pilot project (2011-2014) is being implemented in collaboration with World Agroforestry Centre (ICRAF), CARE International Tanzania and FAO. The pilot project site is located in Morogoro region, on the hillside of the southern slopes of Uluguru Mountains.

One of the major components of the MICCA pilot project in Tanzania was to undertake a study on assessment of the greenhouse gases (GHG) emission in smallholder farming systems, led by ICRAF. Similar studies are very rare in Tanzania, albeit conducted in isolated manner. The efforts to aggregate lessons and information from these studies are vital in compiling country-wide emission levels and recommendations for mitigation options. In absence of such foundation, MICCA pilot project resorted to undertake this desk review study to unveil the status of GHG emission from agricultural sector and available mitigation options from policy provisions and initiatives in the country.

2.0 Background

Tanzania is located in Eastern Africa between 29⁰ - 41⁰ E and 1⁰ - 12⁰S (URT, 2007). It covers an area of 945.203 million ha, of which 44 million ha is suitable for agriculture. It has a population of 44.9 million with current GDP of \$73.86 billion and per capita income of \$599

(Watkiss *et al.*, 2011; URT, 2012). Agriculture is the mainstay of the country's economy contributing to 25% of the GDP and employs 80% of the workforce. Only 22.9% of the arable land is currently put into use and majority of the users are the smallholder farmers (85%) with an average plot size of 0.2 - 2 ha (Lyimo, 2011). Shifting cultivation is very predominantly in most parts of the country. Policy frameworks in the country on the agricultural sector provide thrusts towards addressing good agricultural practices are in place (URT, 2013b).

Low mechanization in crop farming in Tanzania is the most prominent prototype carried out by smallholder farmers using the hand hoe. A growing trend towards mechanization has however, become evident very recently due to significant government efforts. This has included reducing import taxes for the agricultural machinery such as tractors. Furthermore, the government of Tanzania through '*Kilimo Kwanza*' (simply Agriculture First) has made additional thrust into mechanization by massive importation of tractors and other farm implements. This has made the farming implements readily available together with their spare parts, and thus triggered more demand and usage. Currently, 64% of farmers use the hand hoe, 24% draught animal power and 12% tractors. Annual demand for *single axle* tractor and implement has risen to a range of 1,500 – 1,800 while *double axle* tractor power is 1,500-2,000 (Lyimo, 2011). The government has also established Agricultural Inputs Trust Fund (AGITF) to provide long term and affordable loans for agricultural machinery to individual farmers, farmers groups and private entities.

Rainfed agriculture is dominant type across all agro-ecological zones where unimodal and bimodal rains are experienced. This has increased the risk to farmers when climate variability has gone to extreme. Utilizing the irrigation potentials of various existing water bodies and storm water is still very low. Only 5% of potential irrigation land has been put into use, mostly from traditional irrigation systems. Major river basins and wetlands have not yet fully utilized their potentials for irrigation. Low investment and inadequate policy support is dragging back the irrigation despite the country's large resources of water bodies. Despite launching of the National Irrigation Master Plan (NIMP) in 2002 (URT, 2002), only 450,392 hectares were realized by 2013 out of 29.4 million ha identified.

Fertilizer use is still very low in Tanzania, and this is the key feature as experienced in entire sub-Saharan Africa (Figure, 1). Inadequate efforts by farmers to sustain soil fertility and low

input of fertilizer has led to poor crop yield. The government of Tanzania has put in place a fertilizer voucher subsidy program to make leverage efforts. It has further established a Tanzania Fertilizer Regulatory Authority, which is responsible for regulating and facilitating fertilizer import, distribution and quality monitoring. Among the bottlenecks of low fertilizer use in Tanzania is farmers' bad experience in 1960s and 1970s which led to perception that inorganic fertilizer destroys soil. Extension packages and pilot projects have tried to disprove this notion but it is still widely maintained by farmers in most parts of the country. Overall, this translates to very low input of chemical fertilizers in the agricultural soils, which in turn reduce reactions that could have otherwise increased GHGs emissions.

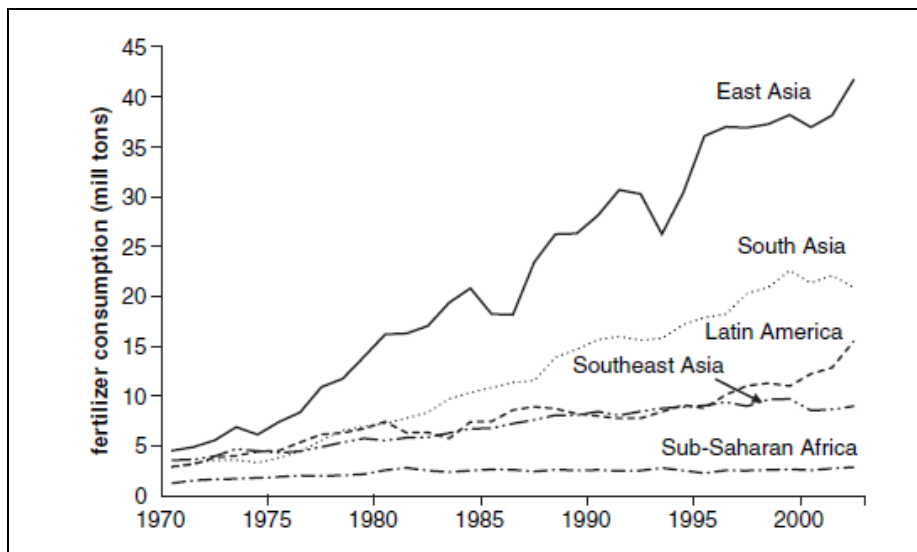


Figure 1: Fertilizer consumption 1970-2004
Source: Morris *et al.* (2011).

Use of improved seed is still very low in the country. Several varieties for improving yield, drought and diseases tolerant food crops have been made available. Breeding programs by the Agricultural Research Institutes (ARI) within the Ministry of Agriculture, Food Security and Cooperatives and in collaboration with regional and international seed companies and research institutions have witnessed release of many varieties suitable for Tanzania. Locally at rural settings, a program on producing quality declared seeds (QDS) has been spear-headed by the Ministry of Agriculture and its respective ARIs. However, most farmers do still keep and recycle their traditionally stocks despite their low yield.

Increasing protected areas network and decentralization in Tanzania has been done as part of the efforts to address over-exploitation of forests (Kajembe *et al.*, 2008; URT, 2009a). While the state increased the grip of its protected areas with strict rules and regulation (Mpanda *et al.*, 2011; URT, 2002), it also introduced participatory forest management (PFM) through joint forest management (JFM) for state owned forests and community based forest management (CBFM) for community owned forests (Blomley *et al.*, 2008). By 2008 about 2,328 villages in Tanzania were involved in PFM, out of which 1,457 villages engaged in CBFM (URT, 2008). At one point the country was praised to be the leading across Africa on PFM. As decentralization and instituting of PFM went parallel through policy reforms and ground testing, both positive and negative lessons were learnt. Issues such as improved forest resources (e.g. Mbwambo *et al.* 2012) have been observed, while unclear benefit sharing and denying adjacent forest communities access to resources were reported (Jambiya and Sosovele, 2001). Conclusively, good governance and strong institutional function are key in proper management regardless of the ownership (Mpanda *et al.*, 2011; Mbwambo *et al.*, 2012). Forests and woodlands that are under a certain form of protection such as Community-based Village Forests Management (CBFMs), private and state owned forests have relatively better condition compared to those under general lands. Suffice to conclude that forests in the general lands and unprotected areas has been neglected and thus heavily exploited. Pressure have been mounted to forests by settlement and agricultural expansion, overgrazing, firewood and charcoal production, uncontrolled fires, timber extraction, development of infrastructure/industry, mining, refugees and most recently the introduction of large scale cultivation of bio-fuel crops (URT, 2013a).

In Tanzania, at its worst, deforestation is estimated at 400,000 ha per annum in Tanzania (URT, 2013a). Large part of this land is converted to other land uses such as agriculture especially through shifting cultivation. This change of land use and associated disturbances in the forests are responsible from emission of green-house gases (GHGs). Land use change and forest (LUCF) is the major contributor of GHGs emission in Tanzania, and accounts for 87.33% (URT, 2003). Tackling deforestation and land use change is likely to depend on interventions on the drivers especially in the agricultural sector. Agriculture is the mainstay of the country's economy contributing to 25% of the GDP and employs 80% of the workforce. Only 22.9% of the arable land is currently put into use and majority of the users are the smallholder farmers (85%) with an

average plot size of 0.2-2 ha. Shifting cultivation is very predominantly in most parts of the country. Policy frameworks in the country on the agricultural sector provide thrusts towards addressing good agricultural practices are in place (URT, 2013b). Good governance and strong institutional function are key in proper land management regardless of the ownership (Mpanda *et al.*, 2011; Mbwambo *et al.*, 2012). Tanzania has over 14,000 villages; however, only 1,200 of them have land use plans. This highlights why land management and sustainability have been a problem. Villages with operational land use plans have proved to be a solution towards achieving climate-smart agriculture by controlling their land use and minimized the abuse.

In order to improve agricultural productivity the government of Tanzania had set out a sector strategy targeting that by the year 2025 agriculture should be modernized, commercialized, highly productive and profitable and utilizing natural resources sustainably. Such a strategy could have the following impact on GHG emissions;

- i. Increased inputs of fertilizers and energy resulting in higher emissions as production per ha increases.
- ii. Increased export market, as non-domestic markets are sought, potentially resulting in higher processing sector and transport-based emissions.
- iii. Less spread of cultivated land, as agriculture modernizes, potentially moves to larger scale farms and increases productivity per ha, thus reducing GHG emission.

Generally, the agricultural production in Tanzania is less mechanized and large part controlled by the smallholder farmers. Under the smallholder setting, agriculture is still at subsistence level characterized by very low inputs and thus very low productivity.

A low carbon agricultural development pathway advocated by the policy framework to contribute in adaptation and mitigation to climate change is yet to be realized at grassroots level (Watkiss *et al.*, 2011). This aimed at both improving agricultural productivity as well addressing climate change issue on reducing GHGs emission. Furthermore, attempts to estimate GHGs emission in Tanzania need to take into account the difficulties in place to obtain accurate information due to uncertainties and scattered individual sub-sectors estimates in agriculture.

This is important due to nature and obligations Tanzania had committed to international community regarding environment and climate change related agreements (Table 1).

Table 1: Climate change and other international agreements that Tanzania had ratified

S/n	International Agreements	Rectification (year)
1	The Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and Their Disposal	1989
2	Convention on Biological Diversity	1992
3	The United Nations Framework Convention on Climate Change (UNFCCC)	1992
4	United Nations Convention to Combat Desertification	1994
5	The Kyoto Protocol	1997
6	Stockholm Convention on Persistent Organic Pollutants	2001
7	The Cartagena Protocol on Biosafety to the Convention on Biological Diversity	2000

Source: Environmental Action Plan 2011

2.0 Policy environment for climate change in agriculture

The Tanzania government has put in place several policies, strategies and plans that are directly addressing issues pertaining to climate change and their impacts on various sectors. These sectors, which are highly affected by climate change, have put in place policy statements and directives that seek to provide the remedies to the impacts of climate change. These policies, strategies and plans further provided policy directives, guidelines and steps towards addressing adaptation and mitigation priorities by the various sectors that are affected by climate change.

2.1. Tanzania Development Vision 2025

Tanzania has put forward its Development Vision 2025 to foster its development agenda. Five key thrusts have been identified for emphasis in the Vision 2025, including;

- i. High quality livelihoods
- ii. Peace, stability and unity

- iii. Good governance
- iv. A well-educated and learned society
- v. Competitive economy capable of producing sustainable growth and shared benefits

This vision has been the centrepiece of the economic and social drive of the country, and gives the long term strategic focus where the country is envisioned to lead. The rest of the government policies and programs are thus expected to align themselves towards it. For instance, the issues of impacts of climate change which cut across all the five thrusts due to its nature are supposed to be addressed by all sectoral areas.

2.2 National Environmental Policy of 1997

National Environmental Policy (NEP) is the umbrella policy where general directives in management of natural resource base are built on. Climate change being one of the cross cutting issues in management of the natural resources is thus embedded in this umbrella policy. Therefore, on specific wording only a Climate Change Strategy exists in the country to enforce and operationalize climatic-related issues of concern as directed by this NEP and its Environmental Management Act (EMA) of 2004. Other line sectors, which are directly or indirectly interacting with NEP and EMA, have their own policies, acts, guidelines and strategies.

Particular emphasis on NEP is the commitment of the government of Tanzania to address issues that are man-caused and that transit beyond countries boundaries. For instance, it highlights the need to protect the atmosphere as global effort as per Vienna Convention and Montreal Protocol and United Nations Framework Convention on Climate Change. All these conventions address the issues of green-house gases in the atmosphere. It further, highlights a need to undertake climate studies for interventions under mitigation options.

As later included in NAPA, the NEP 1997 directed a vulnerability study on impacts of climate change and variability such that intervention options suggested should not jeopardize national development endeavour.

2.3 Revised National Forest Policy (2012 draft)

The draft version of the revised Forest Policy reiterates how climate change is poised to affect forests as climate is projected to shift towards drier regimes. Key policy areas relevant to climate change include Forest Land Management and Ecosystem Conservation and Management. Several policy statements related to climate change and REDD+ are instituted. These policy statements are instrumental in putting forward the roadmap for engagement of activities beyond the forests to address both mitigation and adaptation measures.

Policy statement 32 states that '*Forestry research and development as the basis for sustainable development and management of the forest sector will be strengthened*'. In the preceding policy directive, it includes the important aspect by directing that '*Research on the effects of climate change on forests and the environment in general, adaptation and mitigation measures will be accorded high priority*'. This provides the legal basis where in-depth research on climate change issues can be strengthened and thus support other initiatives in place. This does extend to forest users and their economic activities such as agriculture which by far is the leading pressure towards forest encroachment.

Interventions advocated by the *draft* forest policy when operationalized brought all dealings with mitigation and adaptation. Activities such as reforestation, afforestation and enrichment planting to fill vegetation gaps directly contribute to mitigation, while those activities related to use of efficient cooking stoves, efficient charcoal kilns, and agroforestry in adjacent local communities tend to provide more adaptation strategy with reduced also emissions of greenhouse gases.

2.4 National Agricultural Policy of 2013

Development of the agricultural sector in Tanzania is based on the natural resources base. The policy admits prevalence of unsustainable farming methods and systems in the country that includes deforestation, land clearing and bush fires that contribute to emission of GHGs. Sustainable development of the agriculture is the priority of the government of Tanzania and it should be based on the safeguarding of the environment. Agricultural intensification spearheaded by the government should entail a low carbon pathway in order to contribute to mitigation of climate change. The following policy statements have been put forward by the government to address environment and climate change issues pertaining to the agricultural sector;

- i. In collaboration with relevant ministries, coordination of sustainable environmental early warning and monitoring systems shall be strengthened;
- ii. The Government in collaboration with other stakeholders shall strive to improve adaptation measures to climate change effects and deal with all the risks involved;
- iii. Public awareness on sustainable environmental conservation and environmental friendly crop husbandry practices (sustainable agriculture) shall be promoted;
- iv. The Government shall enforce environmental laws and regulations that minimize environmental degradation as of result of agricultural activities;
- v. Activities that enhance the carbon storage capacity such as conservation agriculture and agro-forestry shall be up-scaled;
- vi. Public awareness on the opportunities of agriculture as potential carbon sink and mechanism to benefit from carbon market shall be established according to international protocols; and
- vii. Efficient use of renewable natural resources shall be strengthened.

2.5 National Strategy for Growth and Reduction of Poverty (NSGRP II)

MKUKUTA II (Swahili version of National Strategy for Growth and Reduction of Poverty, NSGRP II) was launched in July 2010 by the Ministry of Finance and Economic Affairs, as a guiding tool towards growth and enhancement of productivity in the country with main focus on wealth creation. This second phase is building on the MKUKUTA I (2005) which was praised for higher achievement, though it lacked any mention of climate change. MKUKUTA II have addressed this error due to the available fact that climate change is heavily affecting the livelihood of people and hence can't be ignored. For instance, the droughts of 2005/06 in the country that affected millions of Tanzanians had estimated costs of at least 1% of GDP.

MKUKUTA II has three clusters, among which the first cluster is on '*Growth for Reduction of Income poverty*' which is the one concerned with climate change. This cluster has three broader outcomes and five goals. The fourth goal states that '*ensuring food and nutrition security, environmental sustainability and climate change adaptation and mitigation*'. Five operational targets are in place, with

- i. Pursuing sound macroeconomic management
- ii. Reducing income poverty through promoting inclusive, sustainable, and employment-enhancing growth
- iii. Ensuring creation and sustenance of productive and decent employment, especially for women, youth and people with disabilities
- iv. *Ensuring food and nutrition security, environmental sustainability and climate change adaptation and mitigation*
- v. Leveraging returns on national resources (both within and outside) for enhancing growth and benefits to the country at large and communities in particular, especially in rural areas

Several cluster strategies to operationalize goal number (*iv*) have been put in place, including;

- i. Supporting research in introducing and promoting adoption of crops, livestock, and fish varieties and breeds suited to adverse conditions brought about by climate change
- ii. Applying new technologies in pest and disease management (IPM, breeding, biotechnology)
- iii. Increasing farmers, livestock farmers, fishers and aqua farmers awareness on the full impacts of climate change on agriculture;
- iv. Designing sustainable crop production and farming systems reflective of climate change scenarios such as breeding pest resistant crop and livestock
- v. Increasing carbon sequestration on farms through reduced tillage, high carbon crops and agroforestry
- vi. Improving soil and water conservation measures including irrigation development
- vii. Providing specific adaptation and mitigation options according to regional conditions
- viii. Strengthening weather projection and early warning systems
- ix. Facilitating development of market-based financing mechanisms for climate change mitigation and adaptation and leveraging private sector resources
- x. Supporting accelerated development and deployment of new technologies that ensure adaptation and mitigation actions
- xi. Enhancing policy research, knowledge and capacity building in areas of climate change and its impacts

Therefore, MKUKUTA II laid a foundation to which climate change issues are articulated in the government policies and strategies that aims at improving livelihood and reducing income poverty.

2.6 National Climate Change Strategy 2012.

Launched in 2012, the National Climate Change Strategy (NCCS) in Tanzania, covers a broader natural resource base in addressing issues pertaining to climate change. It covers interventions in adaptation, mitigation and cross-cutting issues that are affecting social, economic and physical environment. The main goal of the strategy is to enable Tanzania efficiently adapt to climate change and participate in global efforts towards mitigation in order to achieve sustainable development. This goal is in-line with Tanzania Development Vision 2025 and other sectoral policies. The implementation arrangement for this NCCS will be based on the National Environmental ACT 2004. National Climate Change Focal Point (NCCFP) is the overall coordinator of the implementation of NCCS and responsible for preparing climate change frameworks such as National Adaptation Plans (NAPs), NAMAs (Nationally Appropriate Mitigation Actions) and Monitoring and Evaluation.

National Climate Change Steering Committee (NCCSC) and National Climate Change Technical Committee (NCCTC) are cross-sectoral committees responsible to facilitate implementation of the NCCS interventions in various sectors. The NCCSC is responsible for policy guidelines and ensuring participation of various sectors. The NCCTC is responsible for providing technical advice to NCCFP. The sectoral ministries and Local Government Authorities are responsible to report the implementation of the NCCS on annual basis to NCCFP who will make such information available for public consumption.

At the implementation level the NCCS has special emphasis on agricultural sector with strategic goal being '*to enhance the resilience of agricultural sector to climate change for sustainable livelihoods*'. Realization of this goal needs to take various courses of strategic objectives and interventions (Table 2) that are key in agricultural sector for Tanzania.

Table 2: Adaptation strategy for the agricultural sector, Tanzania

Strategic statement	Strategic objectives	Strategic interventions
<p>More than 80% of population of Tanzania depend on climate sensitive rain fed agriculture as source of livelihoods. Reducing vulnerability of the sector to climate change will significantly contribute to socio-economic development and ensure food security</p>	<ol style="list-style-type: none"> 1. To identify suitable crops for new agro-ecological zones 2. To promote appropriate agricultural practices that increase resilience to climate change 3. To promote use of appropriate technologies for production, processing, storage and distribution 	<ol style="list-style-type: none"> i. Assessing crop vulnerability and suitability for different agro-ecological zone ii. Promoting early maturing and drought tolerant crops iii. Strengthening weather forecast information sharing with farmers iv. Strengthening post-harvest processes and promote value addition v. Addressing soil and land degradation by promoting improved soil and land management practices/techniques vi. Strengthen integrated pest management techniques

Source: NCCS (2012).

The NCCS has been the main driving strategy document for the implementation of the climate change and variability agenda as well responsible to guide other sectoral strategies on this thematic area.

2.7 The National REDD+ Strategy 2013

Recently, the REDD+ institutionalization process in Tanzania seem to follow the same trend like PFM with stronger incentive package attached and formalized (URT, 2013a). Recently, the REDD+ institutionalization process in Tanzania could support the mainstreaming of sustainable

agricultural practices and seem to follow the same trend like PFM with stronger incentive package attached and formalized (URT, 2013a).

Tanzania established a REDD+ Strategy in 2013 after long process of consultations on how to address climate change mitigation in the forest sector. As part of the global efforts to reducing emission of green-house gases, REDD+ package is a standalone effort focusing on forestry sector. Institutionalization of the REDD+ initiative is based on the long term commitment of the Tanzania government on forest management and address issues of climate change. The REDD+ Strategy give additional thrust to the Forest Policy on management of forest resources in the country especially those under private, community and general lands that previously received little attention from the government.

The REDD+ strategy identified eight key factors responsible for deforestation and forest degradation that need to be dealt with. These included;

- i. Charcoal and firewood demand for domestic and industrial use
- ii. Illegal and unsustainable harvesting of forest products
- iii. Forest fires
- iv. Agricultural expansion
- v. Overgrazing and nomadic pastoral practices
- vi. Infrastructure development
- vii. Settlement and resettlement
- viii. Introduction of alien and invasive species

In making the REDD+ initiative ready for the implementation phase, two key instruments have been put in place with the assistance of the clear strategy;

- i. Establishment of the National Carbon Monitoring Centre (NCCM), and,
- ii. Establishment of the MRV system

Furthermore, the REDD+ Strategy formulated an institutional arrangement for coordination of REDD+ activities that is entrenched into existing government structure as established by NEP 1997 and EMA 2004 on coordination of climate change programs.

2.8 Agricultural Environmental Action Plan (2011-2017)

Agricultural Environmental Action Plan (AEAP) was prepared by the Ministry of Agriculture, Food Security and Cooperatives as a way of mainstreaming the environmental protection in their development planning and project implementation. This reinforces the Environmental Management Act (2004) and it was further prepared as a requirement by the General Budget Support Performance Framework in 2010. Management of natural resources in the agricultural sector have been the main emphasis for action. Key issues identified for interventions related to mitigation include;

- i. Land degradation due to deforestation and livestock overgrazing
- ii. Lack of agricultural land use management plan

Addressing the above challenges the AEAP was structured to work towards addressing impacts of climate change with joint efforts of other line sectors like livestock and forestry.

3.0 GHGs emissions from agriculture in Tanzania

3.1 Agricultural GHGs emission estimates from national authority

Early attempts by Tanzania to undertake measurement of GHG emission dates back to 1990s, when two studies were carried out;

- i. Inventory of GHG emissions (1993-1994), where main GHG studied were carbon Dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), funded through Global Environmental Facility (GEF) by United Nations Environmental Program (UNEP) and IDRC (International Development Research Centre)
- ii. Technological and other options for GHG mitigation (1994-1995), mitigation cost analysis and other parameters were studied, funded by German Technical Cooperation (GTZ)

Estimates was established for both direct GHGs such as CO₂, CH₄, and N₂O, and indirect GHGs such as Nitrogen Oxides (NO_x) and Carbon Monoxide (CO).The above studies were very important precursors to the official Tanzania GHG emissions reported to UNFCCC in 2003 (URT, 2003).

According to the initial communication (URT, 2003), higher GHGs emissions per capita is contributed by Land use Change and Forestry (87.33%). Of particular importance is agriculture which was ranked third in its contribution to GHGs in Tanzania by 5.68% on sectoral basis as shown in Figure 2.

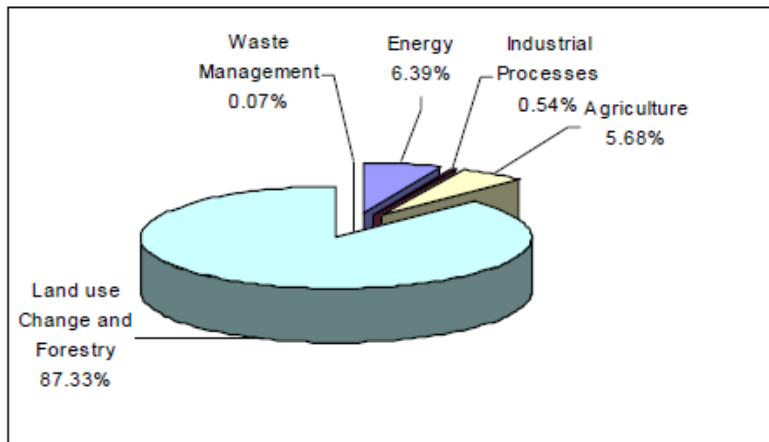


Figure 2: GHGs emission by sectors in 1990

Source: URT (2003). Initial national communication under the UNFCCC

Furthermore, within the agricultural sector, most GHGs emissions were contributed by agricultural soils and enteric fermentation from livestock as in 1990 and 1994 as shown in Figure 3. The rest of the agricultural sources contributed less than 32%.

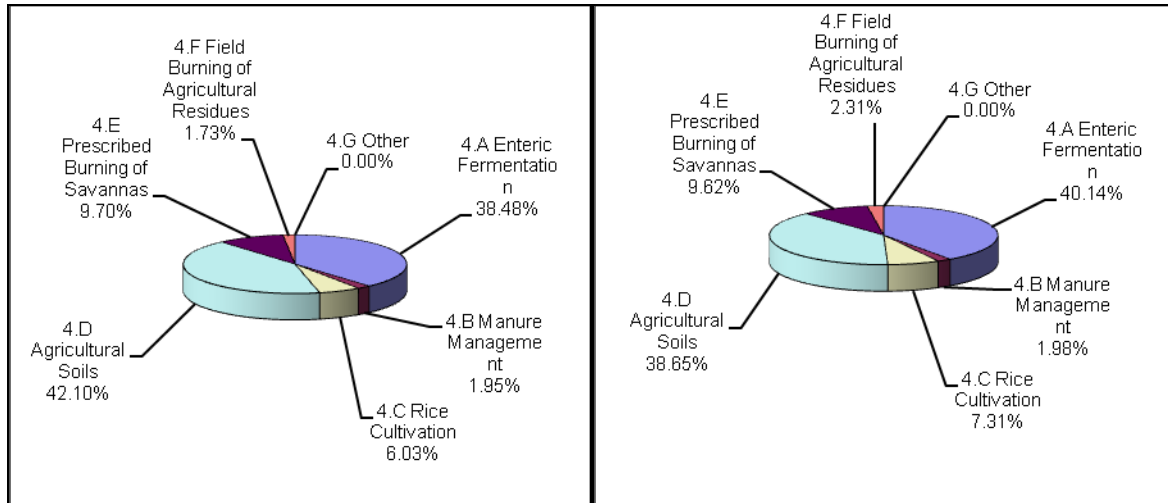


Figure3. Emission of GHGs within agricultural sector, for 1990 and 1994 respectively

Source: URT (2003). Initial national communication under the UNFCCC

The information provided gives the impression that despite less emission of GHGs in agriculture compared to other sectors, yet major interventions need to focus on soils and livestock in order to provide significant reduction in this sector.

Since 2003, Tanzania has not updated its GHGs emission data due to reasons associated with unreliable data capture and compilation. A comprehensive country specific data is envisioned to be developed during the second communication, as other countries have already updated their emission data.

Proposed mitigation options in agriculture as per initial communication (URT, 2003) included;

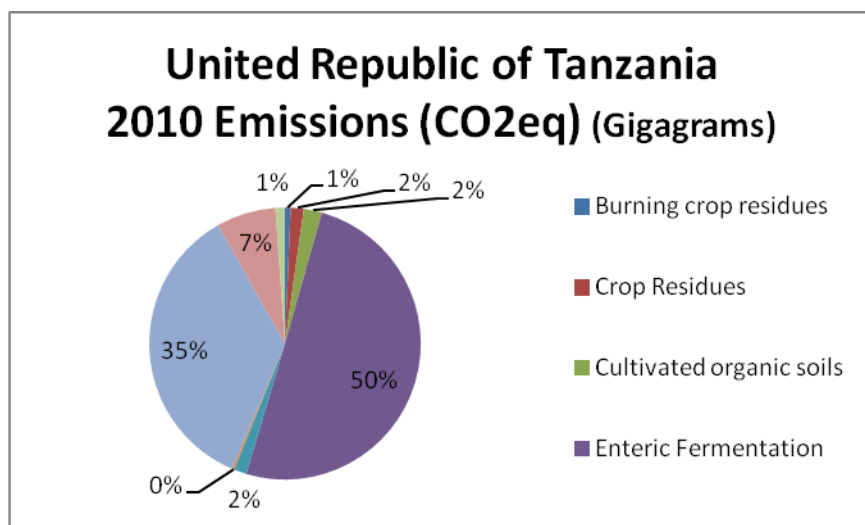
- i. Reduction of methane (CH₄) from crop production. It focused on irrigation water management, use of improved cultivars and other cultural practices and nutrient management.
- ii. Reduction of methane (CH₄) from animal production. It focused on improved pasture nutrition, improved breeding, hence destocking local breeds.

However, most of these mitigation options need to be implemented with technological improvements and efficiency in production systems in agriculture, hence they go hand in hand with other national priorities in development agenda.

3.2 Agricultural GHGs emission estimates from other sources

GHG Emissions in Agriculture

In the United Republic of Tanzania, the main greenhouse gas emissions from agriculture are from enteric fermentation, (50%), manure left on pasture (35%) and rice cultivation (7%).



Source: FAOStats, Agriculture Emissions

In 2010, the net greenhouse gas emissions from land-use change (forest land- net forest conservation) were 88 748.00 gigagrams of carbon dioxide equivalent (CO₂ eq), and from agriculture (crop land- cultivated organic soils) 6 730.27 gigagrams of CO₂eq (Source: FAOStats GHG Emissions 2012).

In Tanzania, main GHG agricultural emissions are from enteric fermentation, rice cultivation, and manure management. Outside agricultural sector, deforestation and land use change contribute significantly to the GHG emissions.

FAO (2013) and Climate Analysis Indicators Tool (CAIT) have attempted to project the GHGs emission for Tanzania over the last decade. According to CAIT (2005), the per capita emission is currently estimated at 1.5 tCO_{2e}. This figure brings Tanzania lower than many other countries as exemplified in energy sector in Figure 4.

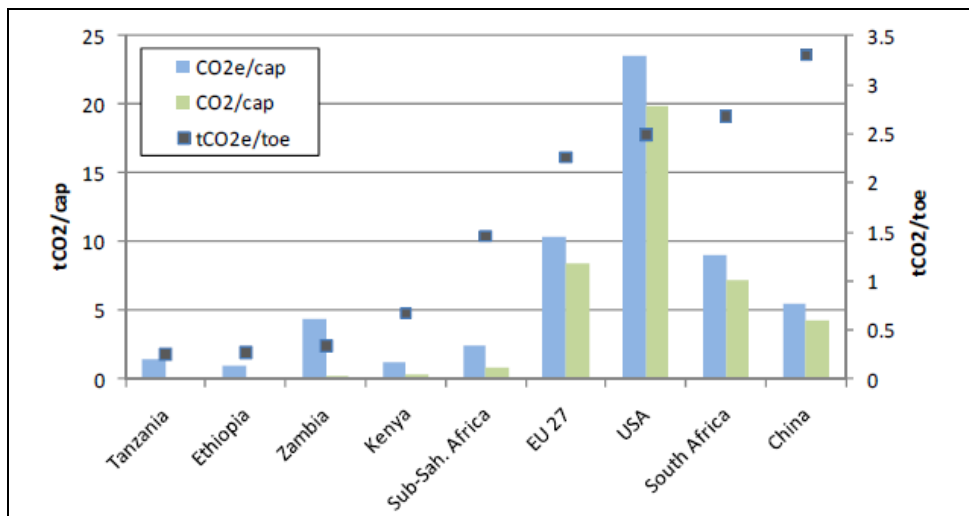
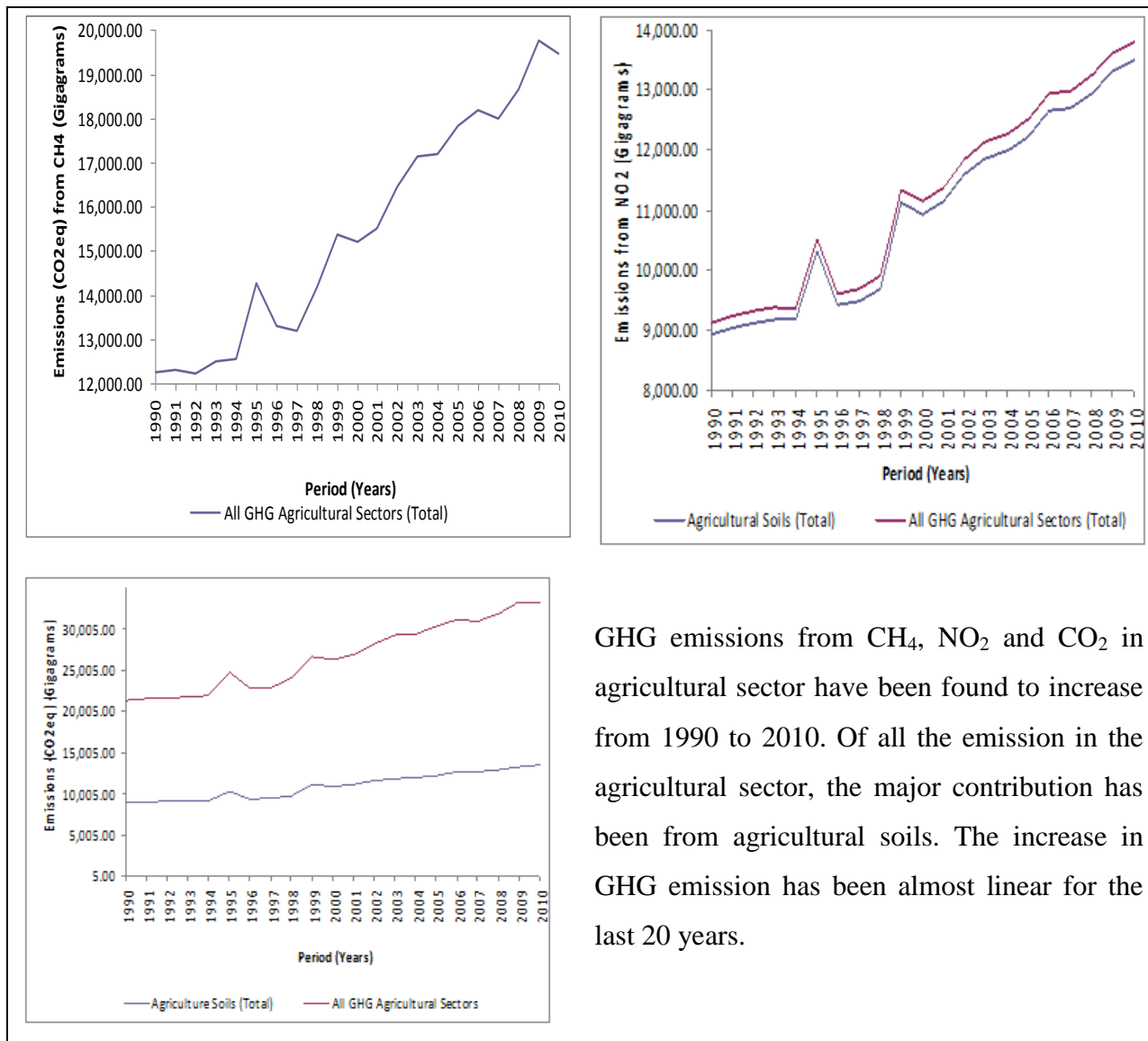


Figure 4. GHG emission per capita (*excluding LUCF emissions*) and per unit energy use in 2005
Source: Watkiss et al. (2011).

Despite its lower GHGs emission, Tanzania has witnessed annual increment of the emission since 1990s as projected by FAO and shown in Figure 5. Projections from arable land are very difficult to estimate even using Inter-governmental Panel on Climate Change (IPCC) Tier 1 methodology due to number of inputs and uncertainty involved. Population growth rate has mainly been used and very limited inputs from land use change and fertilizer applications (Watkiss *et al.*, 2011).



GHG emissions from CH₄, NO₂ and CO₂ in agricultural sector have been found to increase from 1990 to 2010. Of all the emission in the agricultural sector, the major contribution has been from agricultural soils. The increase in GHG emission has been almost linear for the last 20 years.

Figure 5: Estimates of GHGs emission from Agriculture from 1990-2010 in Tanzania

Source: FAO (2013). FAOSTAT Emissions Database (<http://faostat.fao.org/>)

Expected growth in the agricultural sector may trigger acceleration of GHGs emissions mainly from the sector itself or other sectors such as energy, forest and transportation. Conversion of natural forests and woodlands into agricultural fields is still ongoing. Agricultural drivers of deforestation rank high in Tanzania due to expansion of agricultural frontiers and slash and burn practices. Deforestation rate in Tanzania stands at 400,000 ha/year and agriculture contributes significantly on this (URT, 2013). Energy demand from rural communities, which depend on biomass energy, is expected to rise with the same rate as agriculture expands. Currently, 90% of

rural population depends on woodfuel, and majority of it comes from surrounding forests. Furthermore, emissions due to support for agriculture in terms of infrastructure development and transportation of inputs and agricultural products will increase.

Recent study by the World Bank has shown how the increase of GDP corresponds to overall increase of GHGs emissions, Figure 6.

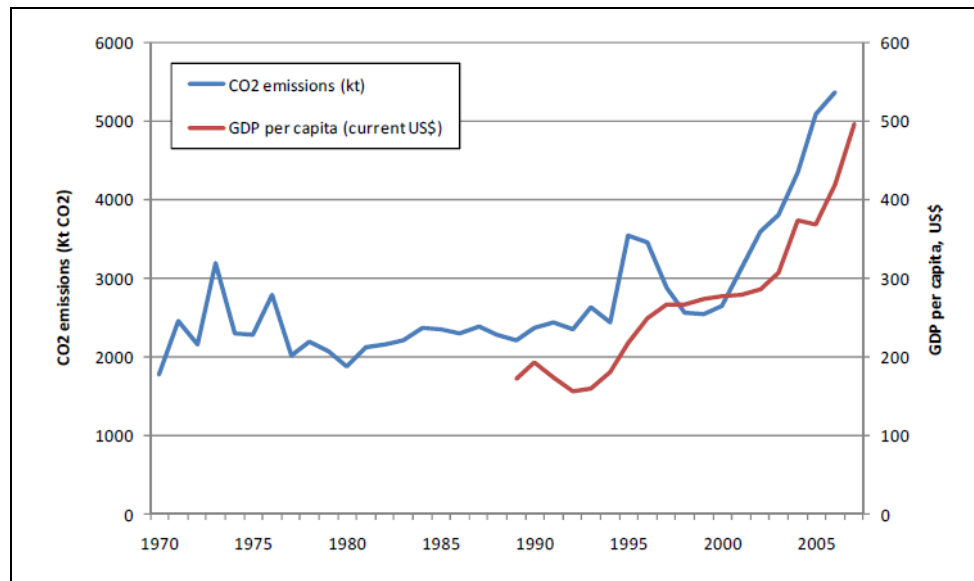


Figure 6: Historical trends of GDP and CO₂ emissions per capita in Tanzania

Source: Watkiss *et al.* (2011).

The study showcased that any increase in GDP has a corresponding effect on CO₂ emissions. This is explained by associated factors such as population increase, energy demand and food production. A low-carbon development pathway is very important for Tanzania as it will keep into check this GDP development vs. GHGs emission.

3.3 Adaptation and Mitigation priority options in agriculture

3.3.1 National Adaptation Programme of Action (NAPA)

Tanzania developed the National Adaptation Programme of Action (NAPA) and endorsed in 2007 in adherence to the guidelines of UNFCCC as agreed by conference of parties (COP) in

2001 and as a tool towards sustainable development as envisioned by country's National Development Vision 2025.

Agriculture is the backbone of the economy by providing raw material for direct consumption and industrial use. Assessment of the vulnerability of various sectors to impacts of climate change and their adaptation strategies (existing and potentials) revealed that agricultural sector (Table 2) is the most prone. Therefore, in the NAPA, agriculture and food security have been ranked as first priority for adaptation. This is due to the fact that agriculture affects the majority of the country's population in terms of livelihoods and food security.

Table 2: Vulnerability and adaptation strategies in Agricultural sector in Tanzania

Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
<ul style="list-style-type: none"> • Unpredictable rainfall, uncertainty in cropping patterns • Shifting in agro-ecological zones • Prolonged dry spells beyond normal patterns • Increased weed competition with crops for moisture, nutrients and light • Ecological changes for pests and diseases • Decline of maize yields, the national food crop nationwide by 33% due to temperature rise; highest decline reported for Dodoma and Tabora 	<ul style="list-style-type: none"> • Small scale irrigation • Rural and development on drought tolerant seed varieties • Agriculture extension activities • Diversification of agriculture: growing different types of crops on different land units • Water harvesting 	<ul style="list-style-type: none"> • Alternative farming systems • Promote indigenous knowledge • Change planting dates in some agro ecological zones • Increase irrigation to boost maize production in selected areas • Drip irrigation for specific regions • Reduce reliance on maize as staple food by growing short-season and drought tolerant crops such as sorghum and millet • Shift crop farming to more appropriate agro ecological zones • Change crop rotation practices • Integrated crop and pest management • Make better use of climate and weather data, weather forecasts, and other management tools • Create awareness on the negative effects of climate change • Sustainable water management to boost food crop production • Strengthen early warning system

Source: NAPA (2007)

Several activities have been proposed in NAPA on agriculture and food security (Table 3) and further ranked in order of importance. The activities covered a wide range of interventions that could address adaptation to impacts of climate change in agriculture.

Table 3: Ranking of activities in order of importance

Sector	Activities	Ranks
Agriculture and food security (including livestock)	Increase irrigation to boost maize production in all areas	1
	Alternative farming systems	2
	Make better use of climate and weather data, weather forecasts, and other management tools and expand climate and weather data collection network	3
	Create awareness on the negative effects of climate change	4
	Increase the use of manure and fertilizer	5
	Range management for livestock production	6
	Change land use patterns	7
	Dip irrigation for specific regions	8
	Control pests, weeds, and diseases	9
	Biological control of tsetse fly	10
	Promote indigenous knowledge	11

Source: NAPA (2007).

Further prioritization with stakeholders came up with five projects one of which directly linked to agriculture in semi-arid areas of Tanzania. Therefore, NAPA proposed an 8.5 million USD project titled ‘*Improving Food Security in drought-prone areas by promoting drought-tolerant crops*’. This proposed project was meant to be implemented in Shinyanga, Dodoma and Singida regions, which were top in the list of drought stricken areas of Tanzania. Of particular interest was the direct link between climate change and its effect on the change in agro-ecological zones in the selected areas thus affecting crop calendar and performance.

3.3.2 Nationally Appropriate Mitigation Actions (NAMA)

NAMA involves a set of voluntary actions set to facilitate transition to low carbon development. These includes policies, projects and programmes and can be done unilateral, supported or creditable, that are undertaken at different scales and that are broad-based. Most of the existing NAMAs consist of a letter-form affirmation that does not have detailed information of what has to be done.

In the National Climate Change Strategy of Tanzania, proposed mitigation actions cover eight sectors which include energy, industry, transport, mining, waste management, forestry and agriculture. Each sector is envisioned to develop its own NAMA together with other interventions. In agriculture, the proposed mitigation actions are as found in Table 4.

Table 4: Proposed mitigation actions in agriculture for Tanzania

Strategic statement	Strategic objective	Strategic intervention
Climate change and its associated impacts on agriculture is a major concern in Tanzania. Agriculture sector can contribute to mitigation as a consequence of improving productivity and sustainability	To enhance efficiency and productivity in the agriculture sector	<ul style="list-style-type: none"> i. Promoting agroforestry systems ii. Enhancing management of agricultural wastes iii. Promoting efficient fertilizer utilization iv. Promoting best agronomic practices technologies

Source: NCCS 2012

By virtual of the NAMAs definition itself (*‘set of policies and actions undertaken by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, aimed at achieving a deviation in emissions relative to ‘business as usual’ emissions’*), the country has already engaged in low-emission development pathways. The enabling policies and strategies that have been erected and contain statements showcase implementation of the NAMA.

In relation to mitigation, Tanzania is implementing an initiative titled *‘Low emission capacity building program’* aimed at strengthening the national capacity into the following outputs;

- i. Environment and Climate Change adaptation mainstreamed in National development planning processes as part of the Second National Strategy for Growth and Reduction of Poverty (MKUKUTA-II) implementation with a focus on agriculture, forestry and livestock sectors.
- ii. Reviewed NAPA as part of the development process of the National Climate Change Response Strategy and Nationally Appropriate Mitigation Actions.

- iii. Strengthened Institutional Framework for Climate Change Governance.
- iv. National Climate Change Financing Mechanism for maximizing Tanzania's potential to access international climate change funding developed.
- v. Improved level of information availability and awareness on climate change impacts and adaptation strategies, environmental laws and regulation among the general public and rural communities

3.3.3 Synergies of NAPA and NAMA

Tanzania has engaged in various adaptation and mitigation projects, programmes and initiatives and has developed policies, programmes and strategies to demonstrate its commitment to contribution to global efforts in combating climate change. Ratification of the UNFCCC and Kyoto protocol enabled enactment of local policies and Acts that reinforced the agreements at local level.

The development of NAPA ensured an adaptation agenda that is put in higher place with clear strategies of implementation at local and sectoral levels. This provided the benchmark for stakeholders to contribute to their respective areas of operations and expertise in order to build resilience of both people and ecosystems against the impacts of climate change. On the other hand, mitigation has been implemented through Clean Development Mechanism (CDM) and REDD+ initiatives. At local level, other initiatives such as Participatory Forest Management and other various forms of forest management including farm forestry have been undertaken resulting into net carbon sinks.

At the operational level especially in agricultural sector, there is higher synergy between adaptation and mitigation actions. Smallholder farmers who form 80% of Tanzania's population are benefiting more when the synergy is maximized. For instance, a tillage technology for soil and water conservation aimed at adaptation to drought can be maximized if water retention and percolation is enhanced through incorporation of shrubs.

Compatibility of the NAPA and NAMA in Tanzania especially in agriculture is feasible. As agriculture remains the backbone of the economy, most of development pathways that utilize agricultural produce can be streamlined to undergo low-carbon trends. In the current settings,

most of these are independently implemented, but with coming into force of the National Climate Change Strategy there is higher possibility of utilizing the synergy between adaptation and mitigation.

In most of large scale programs on sustainable land management in Tanzania, at implementation level most of the activities fall and utilize the synergy between adaptation and mitigation especially in areas where climate change impacts are felt e.g. Kilimanjaro, Tabora, along the shores of Lake Tanganyika etc. However, the resultant problem has been at the planning phase in which the synergy is not well captured and articulated but latter forced its way into reporting. If this shortcoming will be addressed a higher impact could be felt to the immediate beneficiaries.

4.0 Synergies and mechanisms for reducing GHGs emission in Agriculture

4.1 REDD+ and GHG emission mitigation in Agriculture

In Tanzania, the REDD+ Readiness phase is the most important large-scale mitigation program that has received substantial support. Two significant initiatives funded by the Royal Norwegian government, are described below;

- i. UN-REDD Program – Tanzania Quick Start Initiative (a 24 months project, October 2009 to September 2011). It is part of the Norwegian program on ‘*Climate and Forest Initiative*’, with financial support of 4.2 US \$ and had four outcomes, which included;
Outcome 1: National governance framework and institution capacities strengthened for REDD
Outcome 2: Increased capacity of capturing REDD elements within National Monitoring, Assessment, Reporting and Verification Systems
Outcome 3: Improved capacities to manage REDD and provide other forest ecosystem services at district and local levels
Outcome 4: Broad based stakeholders support for REDD in Tanzania
- ii. The Royal Norwegian Government’s led ‘*Climate and Forest Initiative*’ had supported the REDD+ program (with financial package of 100 million US\$) on institutional arrangements, pilot projects on REDD+ and capacity building program titled ‘*Climate*

Change Impacts, Adaptation and Mitigation program' (CCIAM 2009 - 2014) led by Sokoine University of Agriculture in Tanzania.

REDD+ readiness phase to which Tanzania is engaged had laid the foundation to most of ground work that suffice to support accounting on GHGs emission. Lessons from REDD+ pilot projects in Tanzania have indicated that most of the interventions need to be done on agricultural land. It is the inability of agricultural land to sustain livelihoods that leads to encroachment to forests.

As REDD+ invests to address disturbances on the forests, all the pressure is anticipated to return to agricultural lands and may inflict more damage. This on itself leads to leakage, where people relocate overexploitation from forests to trees on the agricultural lands. Therefore, addressing GHG emissions reduction from all land uses has been advocated, which embrace the whole landscape approach (van Noordwijk *et al.*, 2009), where all GHG emission can be considered in the geographical area.

Thus reducing emissions from all land uses is important in the following aspects;

- i. Effective, in bringing major 'leakage' concerns into the accounting rules and allowing increased land use intensity outside forests as a contributor to net emission reduction.
- ii. Efficient, by providing many cost-effective options for emission reduction, including tropical peatlands and smallholder agroforestry.
- iii. Equitable, by applying the same accounting rules for Annex-I and non-Annex-I countries, and embracing low-forest-cover countries on a proportionate basis and rewarding the rural poor.

REDD+ is poised as an incentive-based mechanism for mitigation. Already two approaches are in negotiations, namely fund and market based. It is envisioned that if the same is extended to the agricultural sector, then almost 80% of the Tanzania population will engage into mitigation activities.

4.2 Participatory Forest Management (PFM) and GHG Emission reduction

Tanzania is among the leading countries in Africa in embracing the Participatory Forest Management (PFM). By 2008, the country had 4.1 million ha of forests engaged in PFM comprising participation from 2,328 villages (URT, 2008). PFM in Tanzania has contributed to the reduction of GHG emission through combating deforestation and forest degradation. This has been reported as decrease of destruction as well increase in forest cover and resources over the time interventions has been applied (Mbwambo *et al.*, 2012; Mpanda *et al.*, 2011).

Interventions in the PFM have been such that sustainable use of the forests were advocated with clear focus on ensuring increased carbon stocks and leveraging provision of forest ecosystem services through extension of adaptation and mitigation activities on farm e.g. encourage agroforestry approaches, established community based income generating activities, promoting ecotourism and elevating the use of non-timber forest products.

Though PFM lacked well elaborated MRV system to gauge its contribution towards reduction of GHG emission, the practices in place had ensured protection of the forest resources even in areas that previously were subjected to intensive exploitation (Blomley *et al.*, 2008). On the other benefit sharing streams between the government and adjacent local people have been problems especially where timber forest resources have been a key product in particular forests.

4.3 Carbon trading mechanisms in Tanzania

UNFCCC under the Kyoto Protocol established the Clean Development Mechanism (CDM) that could contribute to mitigation activities. One of the mitigation options is offsetting emission through carbon credits offered to projects undertaking afforestation/reforestation in order to enhance carbon sequestration. Therefore, the Certified Emission Reduction required by developing countries could lead to benefits of the seller of carbon credits.

In Tanzania, forest based CDM projects have been undertaken mainly by foreign companies under the auspices of their mother countries. Most of the CDM projects and other CDM-bidders are located in the southern highlands of Tanzania where the tree business and land is readily available for such large investments. One of the challenges that have been facing Tanzania in engaging with the CDM is the high transaction costs especially in the verification processes,

which does not suit smallholder woodlot owners. It requires multilateral companies that have large financial resources to invest into the process.

Furthermore, concerns over the benefit sharing from CDM have surrounded the whole idea due to various happenings. For instance, a Norwegian based and funded company called Green Resources is engaging in the CDM activities with the arrangement to sell the carbon to another Norwegian oil producer and exporter Statoil. Funds to develop the CDM project under the Green Resources Limited are provided by the Norwegian government through various forms to make it a Norwegian government project. This means the entire mechanism is not to support the developing countries but rather seizing the opportunity to continue benefiting the carbon emission sources (Kalumbiza and Menne, 2011).

4.4 Establishment of the MRV system

Setting up of a robust MRV system in Tanzania is the highest priority with several concurrent activities going on to make it happen. A comprehensive MRV system needs first to address some very basic issues related to forest definition and Reference Emission Level (REL) or Reference Levels (RL).

The definition of forest found in policy documents in Tanzania were not fulfilling the requirement of the UNFCCC which requires definition to give a minimum estimate on land area, crown cover and tree height based on country's circumstances. For instance;

- i. Definitions of forest as found in Tanzania's Forest Act of 2002;

'Forest means an area of land with at least 10% tree crown cover, naturally grown or planted and or 50% or more shrub and tree regeneration cover'.

- ii. Definition of forest as found in the National Forest Policy of 1998 and draft 2009;

'Forest means all land bearing a vegetative association dominated by trees of any size, exploitable or not, and capable of producing wood or other products of exerting influence on the climate or water regime or providing shelter to livestock and wildlife'.

This necessitated Tanzania to re-evaluate and re-submit a forest definition to CDM related engagements through UNFCCC by adopting the FAO definition of ‘forest’. This has resolved the matter. The resubmitted definition states that;

‘Forest refers to land with an area of more than 0.5 hectare and tree crown cover (or equivalent stocking level) of more than 10 percent. The trees should be able to reach a minimum height of 5 m at maturity in situ’.

The UNFCCC allows for a more flexible forest definition: minimum canopy cover 10–30%, minimum tree height 2–5m, minimum area 0.1 ha. However, this has been a matter of contentious debate as inconsistencies surfaced among countries and thus questioning the qualifications for deforestation (Van Noordwijk and Minang, 2009).

On the other side, constructing a REL/RL remains a priority, so far the nation has set a road map towards the realization of REL/RL through the UN-REDD program. A wide range of stakeholders have been contacted to attract expertise, experiences and approaches. It targeted key areas on methodology development, data collection, institutional arrangements and coordination and capacity building.

Methodology development and data collection: There were several national initiatives that were developed to collect data and support national and project level carbon accounting system, including:

- i. National Forest Resource Monitoring and Assessment (NAFORMA). This was massive tree inventory covering 30,000 plots for measuring and monitoring carbon stock change across above ground woody biomass, soil carbon and dead wood pools. It is the backbone for the MRV system for forestry in Tanzania.
- ii. Light Detection and Ranging (LiDAR), research based project implemented jointly by Sokoine University of Agriculture in Tanzania and UMB in Norway, as well as the Group on Earth Observation’s Forest Carbon Tracking initiative. Tanzania is a national demonstration country for LiDAR.
- iii. Developing Allometric Equation (AE) for emission factor estimation for lowland forest through the support of UN-REDD program.

- iv. REDD+ pilot projects: Pilot project have gathered data and developed methodologies in a myriad of ways on carbon stock assessment, such kind of data could be adopted and used in developing the REL/RL based on either sub-national or nested approach.

Institutional arrangements and coordination: a National Carbon Monitoring Centre (NCCM) is being established to serve as a national carbon registry. It will coordinate national carbon activities, including establishing procedures and standards for accounting and verification of carbon at the national, sub-national and project levels. Centre is set to be semi-autonomous, overseen by Ministry responsible for climate change i.e. Vice President's Office – Department of Environment (VPO DoE). NCCM is temporarily hosted at Sokoine University of Agriculture (SUA) in the Faculty of Forest and Nature Conservation.

Capacity building: the UN-REDD program supported capacity building for MRV. UN-REDD was working with the Tanzania Forest Service to build the capacity of technical staff on various MRV related issues, including GIS and remote sensing, mapping, allometric equation development and forest modeling. Additionally, the CCIAM program is further engaged in capacity building on MRV related studies.

Therefore, the development of the MRV system in Tanzania is still evolving and is meant for REDD+. However, it is best placed to provide vital role in mitigation activities in the country. Establishment of the MRV system that incorporate agricultural sector in the estimates of GHGs emissions in Tanzania is essential in emission reduction. Upscaling of the current MRV system for the REDD+ to cater for agriculture will require more inputs in terms of data capture.

5.0 Conclusion and recommendations

5.1 Conclusion

Tanzania has a good foundation of policy framework to address adaptation and mitigation of climate change in agriculture. Characterized by very low inputs, the agricultural sector in Tanzania is still conducted at subsistence level. This makes the agricultural-dependent communities in the rural areas more vulnerable to the impacts of climate change, due to their limited adaptive capacity. Efforts by the government to modernize agriculture are underway through policy reforms and engagement of the private sector. On the other hand, the government has engaged in efforts to reduce emission of GHG as obliged by international commitment that the country is signatory.

The prevailing official communication of Tanzania to UNFCCC dates back to 2003. This communication is based on data estimates of 1993/4 years. This represents a good 20 years old data which need updates. In the last 20 years, the country has witnessed significant change in terms of macro-economic environment which might have affected various sectors including agriculture, thus altered GHG emissions. Engagement of Tanzania in the REDD+ readiness phase has surfaced key and interesting information, tools and infrastructure that can be utilized for updating the estimation of the GHGs emissions in agriculture and other sectors. The country is now climate change sensitive due to the impacts already observed in various sectors including agriculture. The projected impacts of climate change in the economy of the country rings bell for immediate measures including mitigations.

The proportion of GHGs emissions in the agricultural sector in Tanzania is still very low, estimated at 5.68%. However, agriculture is responsible for accelerating GHGs emission in other sectors especially forestry and energy. Any attempts to modernize agriculture through intensification under low carbon development pathway will be very positive in minimizing GHGs emission in other sectors as well.

Tanzania is among the front-liners at global level in REDD+ readiness. Establishment of institutions to support implementation of REDD+ in Tanzania provides ground for other mitigation activities to be well integrated. Key among those are the development of the MRV

system, establishment of the National Carbon Monitoring Centre and enabling policy environment. The incentive nature of the emission reduction in forestry is very important and could have more impact if agriculture would be part of it.

The government of Tanzania has shown willingness to address the impacts of climate change in agriculture through both mitigation and adaptation.

5.2 Recommendation

Several recommendations are proposed here regarding the whole spectrum of reducing climate change impacts from mitigation stand point. This is done with acknowledgment of the fact that estimating GHGs emission in the agricultural sector in Tanzania needs very complex and accommodating methods and tools that will capture differences in agro-ecologies, farming systems, agricultural inputs levels status and other land management. These include; information gathering, institutional strengthening and financial support.

Table 4: Challenges and proposed recommendations for

Challenge	Recommendation
A comprehensive, updated and reliable GHG emission data is lacking	VPO-DOE needs to devise a mechanism that will capture GHG emission information from isolated studies in Tanzania as a short term measure. In the long run, VPO-DOE needs to ensure there is a mechanism in place to archive and enable retrieval of GHG emission information readily.
Existing MRV system in place is REDD+ oriented and does not have window to accommodate other sectors	The current development process for MRV system should be widened to include other sectors apart from REDD+ alone. NCCMC should be strengthened and become broad based to undertake MRV in other sectors i.e. agriculture, energy and transportation.
Cross-cutting nature of climate change issues makes it difficult to track the expenditures if in-line with budgeted items in the Tanzanian government budget	Mechanisms should be in place to trace the expenditures allocated to climate change interventions to enable proper assessment and reflections on relief to impacts
Disconnect between the central government	Mechanisms should be established to build

Challenge	Recommendation
and local government on climate change coordination and interventions	capacity at local government level on climate change issues and improve coordination

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Annex 1: Terms of Reference



Food and Agriculture organization of the United Nations

Terms of Reference for Consultant /PSA

Minimum number of years of relevant experience required: 1yr 5yrs 12+yrs

Name: Prof. Amos Majule	
Job Title: National Consultant on Climate Change	
Division/Department: NRC	
Programme/Project Number: GCP/GLO/270/MUL	
Location: Tanzania	
Expected Start Date of Assignment: 15th February, 2014	Duration: 15 working days up to 31 st May, 2014
Reports to: Name: Kaisa Karttunen	Title: Senior Natural Resources Officer, NRC

GENERAL DESCRIPTION OF TASK(S) AND OBJECTIVES TO BE ACHIEVED

The national consultant will support the MICCA pilot project in producing a short review on the GHG emissions in agriculture, mitigation options for different agricultural land uses, and the status of NAMA's development in the country.

The report and power point presentation shall include a review of:

- GHG emissions from agriculture using available national data, or if not available, the FAOSTAT data
- Mitigation priority options and NAMAs/NAPAs identified or proposed
- Synergies with REDD+ activities and MRV implications
- MRV systems and issue of scale
- Climate change related policies, programs and initiatives, including recognition and implementation of climate smart agriculture

KEY PERFORMANCE INDICATORS

Expected Outputs:

Report: Climate change country review on GHG emissions, and options for mitigation in agriculture (approx. 20 pages including charts and tables)

Presentation ppt on the main findings of the report (20 slides)

Required Completion Date:

By 31st May 2014