RECOMMENDATIONS FOR ELECTED REPRESENTATIVES ON BRINGING ABOUT CHANGE IN GOVERNMENT SUPPORT FOR CLIMATE SMART SMALL-SCALE AGRICULTURE AND REDD+

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- Report titled "Documentation of the lessons and the best practices for climate smart small-scale agriculture" of April 2013
- Study to generate recommendations on how district agricultural development plans [DADPs] can address climate change adaptation and mitigation in relation to small-scale farmers of May 2013
- Report "Policy Analysis in relation to climate change Adaptation, Mitigation, Agriculture and REDD" of August 2013

I do hope that, proposals and recommendations included in this report will draw lessons and forge a way forward in making SCA a reality in most Agricultural development plans.

ACRONYMS AND ABBREVIATIONS

AGG	-	Agriculture Green Growth
CA	-	Conservation Agriculture
CC	-	Climate Change
CSA	-	Climate Smart Agriculture
C3S	-	Climate Smart Small Scale Agriculture
DADPs	-	District Agricultural Development Plans
MJUMITA	-	Community Forest Conservation Network of Tanzania
MVIWATA	-	Farmer's Network of Tanzania
NFP	-	National Forest Programme
NGOs	-	Non-Governmental Organizations
REDD	-	Reducing Emissions from Deforestation and Forest Degradation
SAGCOT	-	Southern Agricultural Growth Corridor of Tanzania
SSCSA	-	Small Scale Climate Smart Agriculture
VADPs	-	Village Agricultural Development Plans
VLUPs	-	Village Land Use Plans

1.0 Introduction

About the Project

The project named "Climate change, agriculture and poverty alleviation: putting small-scale farmers at the heart of policy and practice" is a partnership project implemented by 5 organizations which are Community Forest Conservation Network of Tanzania (MJUMITA), the Farmer's Network of Tanzania (MVIWATA), the Tanzania Forest Conservation Group, ActionAid Tanzania and the Tanzania Organic Agriculture Movement. The project is funded through the Accountability in Tanzania programme. The project is implemented at national level and at site level in six villages within two districts (three villages in Kilosa District and 3 villages in Chamwino district). Development of this project is based on the fact that the majority of people in Tanzania are smallholders and depends on agriculture for their livelihood. When it comes to climate variability, it is small-scale farmers who are hit first and hardest by climate change (CC). It has been realized that land use changes particularly deforestation as a result of shifting agriculture, is the largest source of greenhouse gas (GHG) emissions in Tanzania. Investment in agriculture and agricultural policies and practices are prioritising a shift to more mechanised, fossil fuel dependent, larger scale agriculture with the aim of increasing productivity and commercializing smallholder production. Whilst this approach may increase short-term yields, it risks making small-scale farmers poorer and more vulnerable to CC. We believe that there are alternative approaches to land use and food production that would bring 'wins' in terms of CC adaptation and mitigation, but lack of awareness to small-scale farmers and policy makers on the adaptation and mitigation to CC has been the problem.

1.1 Background information

Goal

Poverty has been reduced amongst small-scale farmers in Tanzania and greenhouse gas emissions from agriculture have been reduced through the widespread adoption of climate resilient, low emission agricultural practices.

Intermediate objective

Tanzania has developed and is implementing policies and strategies that prioritise support to small-scale farmers to enable them to improve their livelihoods through the adoption of climate smart agriculture and sustainable land and natural resources management.

Immediate Objectives

Immediate objective 1:

- Small-scale farmers and other stakeholders are demanding the integration of climate smart, small-scale agriculture and sustainable land and natural resources management in national policy and policy implementation.

Immediate objective 2:

- Government, private sector and civil society are cooperating to support Small-scale farmers to benefit from climate smart agriculture and sustainable land and natural resources management.

Strategies of the project

In order to achieve the outcomes of the project, the five partners apply four inter-linked strategies. A strategy is a bundle of activities that is carried out to bring about the outcomes that we are striving towards. It provides the direction and logic for individual activities. Each strategy may touch upon more than one of the outcomes. Some strategies may target a single stakeholder whilst others target the environment with which those stakeholders interact.

The four strategies that the project works through are:

1. Community networking as a force for securing climate-smart agricultural land management.
2. Research on policy and practice in relation to the interface between small-scale agriculture and climate change adaptation and mitigation
3. Demonstrating an integrated approach to Climate Smart Small-scale agriculture and REDD+
4. Advocating for Climate Smart Small-scale agriculture

1.2 The major focus of the assignment

Based on the project documents, the assignment is anchored under strategy Three i.e. Demonstrating an integrated approach to Climate Smart Small-scale agriculture and REDD+

The strategy in question addresses the key out as "Small-scale farmers in two agro-ecological zones are modeling best practice in terms of climate-smart agriculture and support for C3S agriculture and sustainable land and natural resources management is integrated in District plans".

The project demonstrate climate Smart Small-Scale agriculture (C3S agriculture) and sustainable land and natural resources management in two agro-ecological zones with a view to providing real life examples of how small-scale farmers can adapt to climate change in ways that increase incomes; improve food security and minimize GHG emissions. The strategy is primarily targeted at changing the behavior of two priority stakeholders: small-scale farmers and district officials. Other priority stakeholders that will be influenced by the strategy are: elected officials, members of the National Climate Change Steering Committee and MJUMITA and MVIWATA members.

The project will focus on both the technological aspects of C3S agriculture; the linkages between C3S agriculture and REDD in Kilosa; as well as modeling how local governments and elected officials can support small-scale farmers to achieve this. This will include working with local government and elected officials to integrate C3S agriculture in District Agricultural Development Plans and to address local governance shortfalls in relation to agriculture, land and natural resources management.

Relative to the work that the project partners are already conducting in these districts, the proposed project allow for much more intensive training in the six villages covering a broader range of topics related to C3S agriculture. This allow for the most effective agricultural practices like from Chololo to be introduced in additional villages. While the Chololo Eco village project is developing a range of climate change innovations, it currently has very little experience of scaling up best practice to other communities, and is not resourced to do so. Strategy 3 will help us learn how that can best be achieved. Site visits alone are unlikely to achieve lasting results so the plan is to support farmers in the target villages to take up some of the most appropriate best practices, with some start up inputs including for example seed and tillage implements as well as on farm training. In the case of Kilosa, whilst TFCG, MVIWATA and MJUMITA have some funds for promoting conservation agriculture, these are very limited and are divided over the 14 villages where TFCG and MJUMITA are implementing REDD. The proposed project allow for increased involvement of MVIWATA in three REDD project villages thereby linking the farmers with a broader national network; will allow for the introduction of other technologies that have proved successful in areas such as Chololo; and will allow for training to reach beyond the single sub-village per village where training has so far been conducted. Similarly in Chamwino, whilst Action Aid have some funds for promoting improved agriculture these are divided between the 12 villages where they are working and have not been sufficient to apply many of the C3S agricultural strategies that are proving so successful in Chololo.

1.2.1 Aim of the assignment

To prepare one detailed study to generate recommendations for elected representatives on bringing about change in government support for C3S agriculture.

1.2.2 Objective of the assignment

- To Provide recommendations for the elected representatives on how the government can support for climate smart small-scale agriculture
- Provide recommendations on lessons and best practices on climate smart small-scale agriculture for elected representatives to influence government in supporting the climate smart interventions

1.3 Methodology

This study was purely a desk review assignment, where the consultant reviewed DADPs report for Kilosa and Chamwino which was conducted in 2013, Report on documentation of the lessons and best practices on climate

smart small-scale agriculture which also conducted in 2013, Overall policy analysis in relation to climate change mitigation, adaptation, agriculture and REDD which was as well conducted in 2013. Further to this other sources were also consulted and referred to as found important for the assignment.

2.0 Climate Smart Agriculture [CSA] in a nutshell

Climate change is evident in Tanzania. Given its inherent dependency to climate, agricultural production, particularly in developing countries [Tanzania being one of them], is threatened by uncertainties driven by climate variability and climate change due to extreme weather events such as floods and droughts.

Climate change poses the greatest environmental threat to life on earth, affecting our environment not only physically and economically, but also socially and culturally. Tanzania has been facing recurring drought periods that affected agricultural production, causing food shortage as well as a significant reduction of hydro-power generation, with severe consequences on the economy.

One study on documentation of the lessons and the best practices for climate smart small-scale agriculture quoted and elaborated climate smart agriculture [CSA] as a revolutionary term that aimed at integrating climate change in agriculture and make agriculture adapts to climate change and to reduce emissions (or mitigation) that causes climate change.

The same study further referred FAO (2010) which conceptualized climate smart agriculture as the agriculture that:

- Sustainably increased productivity
- Reduce climate change vulnerability (enhance adaptation).
- Reduce emissions that cause climate change (mitigation) while at the same time,
- Protecting the environment against degradation and
- Enhancing food security and improved livelihood of a given society.

Based on the evidences resulting from a diverse of studies in Tanzania on Climate change, variability and its general effects/impacts, the country need to have pro active programmes or interventions basically shouldering CSA practices that are affordable by smallholder farmers and/or their contexts and are sustainable.

2.1 CSA practices at ground in Tanzania

A range of farmer practices that are CSA focused in the country has been evidenced by a number of studies. The practices extend from adaptation to mitigation initiatives. Some of the practices but not limited to are listed hereunder [Refer Study on Policy Analysis in relation to climate change adaptation, mitigation, agriculture and REDD 2013]

Climate change adaptation, mitigation, agriculture and REDD components	**Elements considered in the analysis of policies, strategies and programmes**
Climate change Adaptation	Change of crop varieties Change of planting dates Crop and livestock diversification Erosion control Technology innovations, capacity building in climate change adaptation (e.g., breeding water stress/drought tolerant crop varieties)
Climate change Mitigation	Energy use in agriculture Land preparation Agricultural inputs (high versus low carbon food print) Land use change
Climate smart small scale agriculture	
Climate smart practices at field and	Soil, water and nutrient management along with agro forestry,

farm scale	livestock, husbandry and forestry and grassland management techniques
Diversity of land use across landscape	Land cover land use species and varietal diversity of plant and animals
Management of land use interaction at landscape scale	Management of impacts of different land uses management of impacts on other land uses and users in the landscape
Community oriented REDD+	Tenure issues Benefit sharing of mitigation activities Capacity building and institutional strengthening for local forest resource management Harmonization of conflicting climate sectoral polices and strategies Land use planning

2.2 CSA practices adoption rate

Adoption of CSA practices is still considerably low as compared to initiatives and investments by both the government and non – governmental institutions.

A study on Assessment of Climate Change Adaptation and Mitigation Practices Suitable for Smallholder Farmers – by Faida Mali September 2012, showed a number of hindrances towards adoption that included:

- Limited awareness amongst wider government and citizens on climate change
- Poor economic status of smallholder farmers to enable them adapt to some of resource needy practices e.g. water harvesting, biogas, solar etc.
- Practices are not well documented, disseminated and/or widely shared.
- Practices are not sufficiently backed with scientific evidences
- Lack of appropriate policies that safeguards the practices on sustainable application of agricultural related resources, promoting smallholder farmers innovative practices etc

In another study, it was learnt that, most often, agricultural research and extension tends to overlook the existing technical knowledge (indigenous knowledge) of farmers in particular area, which is based on generation of experience and field testing.

3.0 Highlights on important factors to carry aboard in support of C3S Agriculture

This chapter seeks to assist elected leaders noting some key areas that will support them push the C3S agendas on its inclusion to district development plans. The chapter views the DADPs development process based on the government guidelines, the Agricultural related policies environment and the C3S practices [both that are promoted by the government and the ones on the ground]

3.1 Some key areas for notifications in the DADPs development process

Through scrutiny, it is clearly noted from the DADPs guidelines of December 2007 and the revised version of December 2011 that, emphasis is put on addressing community needs and priorities at different stages of DADPs development process (village, ward and District). But the following need to be looked onto:

- In practice, community participation seems to be limited.
- The guideline lists categories of district agriculture stakeholders to be involved in the stakeholders meeting. In the list there are representatives from farmers (category vii of list). However, the guideline does not specify the number of farmers.
- The number of farmer representatives to stakeholders meeting does not take care of representation from special groups and other factors like gender etc.
- C3S expertise for stakeholders [as outlined in the guidelines] raises doubts.

- Since DADP guidelines do not specify the number of farmer representatives in the district agriculture stakeholders' meeting and the modalities/criteria of getting those farmer representatives, there is a high possibility of having farmers underrepresented in the stakeholders' meetings and hence limited assurance on addressing farmers' priorities in the DADP based on their context.
- The other key point to take aboard in the process is that, limited Agriculture related policies are considered and leave out other crucial ones [see recommendations under the process]
- The voices of smallholder farmers in the stakeholders meeting may not be heard taking into account the categories of people in the meeting.

3.2 Important notes to be taken aboard in as far as CSA related policies.

Study on: Documentation of the lessons and the best practices for climate smart small-scale noted that, various sector policies in Tanzania are silent when it comes to CSA and so is small scale CSA. This is probably because CSA is a new concept.

Study on: Policy Analysis in relation to climate change adaptation, mitigation, agriculture and REDD noted major gaps in the policies and policy implementation that relate to:

- Inconsideration of climate change risks in the policies which is also reflected in the implementation strategies and programmes.
- Lack of harmonization and coordination of cross-cutting issues resulting into duplication or conflicting efforts during implementation.
- Inexistence of statement of support for piloted mechanisms for benefit sharing between communities, local authorities and central government from mitigation activities in the agriculture and forest sectors and
- Insecurity of land tenure among small scale farmers which may defeat any effort on climate smart agriculture and community oriented REDD+.

Further to that, study to generate recommendations on how DADPs can address climate change adaptation and mitigation in relation to small-scale farmers policies and policy implementation in climate smart, small-scale agriculture and community oriented REDD generally indicated that:

- Climate change is not yet practically mainstreamed into some sectoral policies, programmes and activities. Also that, even in policies where climate change is mainstreamed, enforcement is questionable and/or insignificant.
- In reality, there are relatively few specialists (in terms of number and expertise) engaged with climate smart agriculture agenda, and this may be one of the factors contributing to climate smart agriculture being given less priority in the DADPs as observed in the reviewed DADPs guidelines.
- Inadequate or doubtful political will to push climate change issues in the national and local government development programs and projects and hence excluded in most of the development initiatives.
- Lack of formal link between small scale climate smart agricultural practices and researchers work for validation and latter scaling up by extension staff for wide dissemination and use of feasible and successful small scale climate smart agricultural adaptation practices.

3.3 Smallholder farmer – Local based best practises

This section aims at enabling the elected leaders have at least a clear picture of diverse of CSA on the ground. In line to that, the leaders will be able to choose and advice the best practices adaptable to their environment and hence being able to advocate for. The section provide buffet of CSA practices at both levels [Local or indigenous and improved or internationally accepted practices].

CSA Practice	Brief description of CSA practise	Pictorial presentation	Benefits/potential	Constraints/Challenges/limitations
Reduced tillage [using Magoye rippers]	Ripping is achieved by using a ripper that breaks clogs along the planting rows, leaving the spacing between rows undisturbed. The ripped area also acts as micro-catchments to collect rainfall water and increase infiltration. Ripping can be done by using tractors or oxen.		Conserves water by reducing water evaporation with mulch covering, reduces erosion because the top soil is protected, reduces soil compaction, and protects impact from rain and wind.	If not carefully done, weeds compete with the main crops, high tendency of the insect pests and diseases from the crop residues, organic matter are not evenly distributed or are concentrated at the topsoil.
Cover crops - Crop cover or soil cover	These crops are usually creeping crops that will not compete for light with the main crops. the growing season or Crops planted with the aim of providing soil cover during and after growing season of the main crop so as to minimize soil erosion and conserve moisture.		Prevent soil erosion from wind and water, build soil organic matter (grass cover crop), improve water quality, suppress weeds, and provide nitrogen to following cash crop (legume cover crop).	The challenges in using cover crops is when the cover crops cannot be used as food crop or if have no any other uses, it provide less incentive for adoption. Also the seasons can be challenging especially in areas with only one short rain season, the cover crops may not provide soil cover throughout the year.

Kuberega and crop burning	An indigenous technology common in eastern and central zones.		Non-burning of organic/plant residues can conserve soil and moisture due to residues form a surface mulch to cover the soil while non-burning reduce GHG emission.	Requires change of mindset to ensure residues are not burnt.
Chololo pits	Indigenous in situ rainwater harvesting developed and practiced in Dodoma Municipality, consisting of small pits of 22 cm diameter and 30 cm deep, dug along the line at 60 cm space between pits in a row and 90 cm between rows of pits. The Chololo pits are made with soil bunds around the pit to help retain rain water, farm yard manure and compost, and 1 to 2 maize/sorghum/millet seeds can be planted per pit.		Promote infiltration of rainwater, minimize soil, water and nutrient losses from the field, reduce siltation and pollution (by agrochemicals) downstream of the fields Groundwater recharge as soil water is lost through deep drainage especially on sandy soils Reduce erosion within the farm in loamy soils	Water logging may occurs in high rainfall seasons
Earth Basins/bunds.	Earth basins are other in-situ rain water harvesting which can be circular, half cycle/moon, square or rectangle shaped with earth bunds intended to capture and hold rain water for plant use. Sometimes the bunds are stabilized with vegetation (grasses, pigeon peas)			

Crop residue strips	This is a valuable technology for farmers who grow their crops on hill slopes.		The technology can contribute to increased production as well as preventing soil erosion; improve water penetration and concentration of organic matters	Readiness of farmers to apply the technology from their traditional ways of farming
Composting	Important and affordable technique for small scale farmers for recycling organic waste [weeds, crop residues, waste from postharvest processing, dung, night soil, urine etc]		Characterised as slow release organic fertiliser which stimulates soil life and improves soil structure. It also has beneficial effects on the resistance of plants to pests and diseases	The constraints may include the availability and quality of raw materials, transport, labour and water
Adaptive crops selection	Involves application of drought tolerant, diseases resistant and early maturing crop varieties.		Assures a degree of harvests even in bad years	Despite their potentiality the major challenge remain to be on the adherence of other recommended agronomic practices Other challenge lies on the fact that potential indigenous varieties are disappearing [Genetic erosion]
Irrigation	This technology is important for supplementing moisture during deficit. Water can be obtained from rainwater harvesting and runoff collection in mini reservoirs/dams to conserve water for irrigation during rainy season		Micro irrigation projects and techniques [lift pump, small dams, shallow wells water harvesting tanks etc] affordable to farmers significantly can compensate for crop losses due to moisture stress.	Large scale irrigation schemes require high investment and management capacities which in most cases is lacking to smallholder farmers.

Agro-forestry	Agro forestry involves raising trees in combination with other agricultural enterprises, including livestock. Different species of trees can be planted with many types of crops in a variety of patterns.		In addition to providing fodder, fuel, wood, and other products, trees in agro forestry systems promote soil and water conservation, enhance soil fertility, and act as windbreaks for nearby crops.	Limited knowledge to farmers in growing best mix of trees, crops, livestock etc [in practical terms]
Afforestation through Tree planting	This involves encouraging the communities to establish tree fields which incorporate diverse varieties of trees for different uses. Otherwise, communities are sensitised to conserve the forests		Trees are important in harvesting carbon dioxide hence a potential mitigative measure; conserve environment; source of income through selling or beekeeping etc	Knowing or growing useful varieties important for different uses [at right place and time]
Use of alternative energy like Biogas production and utilization or use of Energy saving stoves	This technologies aim at reducing the extreme of trees as source of energy e.g. Biogas mostly use animal wastes as raw material while energy saving stoves require very few fire woods at a time		Generate energy for cooking and to manage manure and reduce GHG emissions. Use of energy saving stoves will reduce forest invasions and deforestation	Biogas are sometimes expensive for an ordinary farmer
Bench or	These can be done by stone		The technology can	The construction of terraces is

ladder step terraces -	terraces, fanya juu, or residue strips across the slope to reduce distance of runoff and capture eroded particles on the stone line, earth bund of fanya juu or residue strips, which over time develop a ladder-like step terraces. Terracing is another CA technology for soil and water conservation which is effective especially in steep slope areas	 	contribute to increased production as well as preventing soil erosion; improve water penetration and concentration of organic matters	laborious at initial stages, but later the labour requirement is reduced as only maintenance is done when required.
Contours/Contour furrow	Is another in-situ RWH, where the furrow and ridges are made against the slope (along the contour) with furrow upslope and ridge down slope with approximate spacing of 1.5 m. Can be contracted by furrow and soil bunds up the hill (Fanya juu) on the relatively same altitude		The furrows are used to trap rain water and are tied at the end to prevent water flow out of the furrow at the end of the furrows. The contour furrow are suitable for inter cropping especially cereal and beans.	Contour bunds are laborious to construct and are usually used for production of high value crops such as vegetables.
Mulching	This is normally a shallow layer at the soil/air interface. Mulch application on the soil surface can replace seed bed preparations in zero – tillage systems. Widely used traditional mulches include; layer of dry grass, crop residues [straws, leaves etc], fresh organic matters from trees, live plants [cover crops,		In addition to reducing weed seed germination and emergence, mulch can improve the growth and competitiveness of established crops by conserving soil moisture and modifying soil temperatures	In some circumstances, mulching can aggravate weed problems. Organic mulches, especially hay from off-farm sources, may carry seeds of new weed species into the field.

	green manures etc]			
None burning of residues	The practice close related to mulching above		Non-burning of organic/plant residues can conserve soil and moisture due to residues form a surface mulch to cover the soil while non-burning reduce GHG emission.	Requires change of mindset to ensure residues are not burnt.
Crop diversity	To include mixed but non competing crops in the same field. In the highlands, cover crops establishment at the end of growing season to protect soils during dry season can be done taking advantage of residue moisture.		Prevent soil erosion from wind and water, build soil organic matter (grass cover crop), improve water quality, suppress weeds etc. It is also a crop insurance practice	How to obtain and plant the best mix of crops especially in smallholder farmers environment
Crop rotation	A practice of growing different crops on the same land in a regular recurring sequence. It means the planned order of specific crops planted on the same field. It also means that the succeeding crop belongs to a different family than the previous one.		Crop rotation is recommended to achieve crop diversity, reduce incidences of pest and diseases of particular crop.	Choice of crops to rotate should needs to consider differences in growing habits, nutrient requirement, and disease and pests susceptibility/resistance to ensure maximum benefit of crop diversity

Bee keeping in conserved areas	Number and different types of hives are hanged in the established [man made or natural] forests or tree farms		• Conserve the biodiversity • Informally control invasion of forests. • Source of income from honey and their products	Poor enforcement of environmental related by laws at village levels
Rainwater harvesting (RWH)	**Is** important in areas with water shortage and more important in this climate change era. Rain water harvesting is the collection of runoff from rain water for various purposes. Rain water harvested can be stored in the soil profile (in situ) or collected in reservoirs		Important in supplementing moisture during dry spell through [micro irrigation techniques] and source of water for livestock	Depending on the scale of the catchment area, it is laborious to establish during initial stages. A degree of knowledge is required to establish right orientation and capacities
In situ rain water harvesting	Refers to soil and water conservation techniques that trap rain water and prevent runoff within the cropland to flow out of the crop land and allow enough time for infiltration		The in-situ RWH technologies harvest water over short distance, stores water in the soil profile to ensure water supply to crops	
Micro-catchment	A micro – catchment is a specially contoured area with slopes designed to increase runoff from rain and concentrate it in a planting basin where it infiltrates and is effectively “stored” in the soil profile. The water is available to plants but protected from evaporation		The water collected in the reservoir can be used for irrigation. The water can also be for domestic use or livestock watering. This technology has great potential to take advantage of unreliable and erratic rainfall characterized by high intensity rainfall over short growing period.	

Introduction of alternative Income generating micro projects like keeping small stocks	These are kind of alternative income generating activities that may compensate the risks and effects arising due to climate variability e.g. Poultry keeping, Beekeeping, Goat, piggery etc		Spreading risks of income and food security in bad years Some of these have been quite stable sources of income and nutrition	Keeping small stocks requires adequate knowledge and skills for such projects to be beneficial.

Other smallholder farmer's practices

Practice	Description	Benefits	
Mapambano organic compost – Kondoa Dodoma	- Dig a pit of 3 m of depth and 2.5 m width. - Put a layer of fuel wood ash of about 1" thick at the bottom and smear sidewalls up to half a meter high - Add a layer of grass of about ½ feet deep - Continue add organic matter of any kind until the pit is felt up with a heap of about ½ meter above the ground level. In addition to organic maters put in the pit, the innovator adds also domestic waste water and animal urine. - When it full, the compiled organic matter is covered with a layer of wood ash followed by a small layer of pasture grass. Domestic waste water is added continuously to maintain it moist - After 5 to 6 months, the compost is ready for use. The end product is a sooth brown to greyish soil like mixture. - During sowing season, the compost is applied at rate of ¼ to ½ a litre per planting hole.	- Increased yield maize grain to 20 bags per acre - Increased money income - Food secured household	 
Converting a sand river to potential arable land – Kondoa Dodoma	- First thing is to dig pits of rectangular form. - After reaching the normal soil, add organic compost to increase soil fertility status as some of nutrients are washed out by water runoff - Cover the compost with a small layer of normal soil and sow the seeds. After seed germination and as the seedlings grow up, return back the sand to fill up the pit to the level of the sand or until flowering. - At this stage, what is remaining is to harvest as the crop does not need watering or weeding. Sometimes pesticides application is required	- Managed to convert sand river into arable cropland - Increased production and money income per unit area	 

Indigenous Irrigation Methods for Increased Crop Productivity – Mufindi Iringa	A Total of fifty to sixty bamboo pipes are laid down in the trenches and buried. These pipes facilitate water flow movement to reach the farm area. During actual watering of the plants, pieces of plastic tubes are fixed on the joints between bamboo pipes and openings to easy irrigation	The innovation enabled to irrigate vegetables and other crops successfully 3 acres farm throughout the year.	 

3.4 International technologies or best practices

CSA Practice	Benefits	Constraints/Challenges
Soil disturbance/Tillage practices	The agricultural soil is usually disturbed by tilling or cultivating so as to loosen up the soil to enable easy root penetration and water infiltration for adequate crop growth. Other advantages of soil disturbance is discouraging weeds growth and reduce weed competition with crops at early stages of crop development.	However, too much soil disturbance and inappropriate tillage methods has led to excessive removal of soil surface cover, destruction of soil structure and compaction, rapid losses of SOM and susceptibility to water and wind erosion during early stages of before full canopy cover.
Conservation tillage	Is the tillage system that achieve minimum soil disturbance and leave organic residue on the surface of the soil to ensure at least 30% of surface soil cover (FAO, 1993).	Refer the above explanations in section 3.3 above
No till (NT) is conservation tillage achieved by no soil disturbance at all, i.e. zero tillage.	The advantage of NT is that it ensures surface soil cover by leaving residue on the surface, conserve soil moisture, and increase SOM in the top soil.	However, NT in compacted hinders root development after seed germination especially during first years of no till, and reduced infiltration at early stages of NT. In the zero tillage or NT practices weed control depends solely on herbicides
Reduced tillage is another conservation tillage achieved by minimum disturbance of the soil in areas where seeds will be planted, either in rows or planting holes or small basins.	Reduced tillage evolved in attempt to solve some disadvantages of NT systems, and improve root growth and penetration and water infiltration while maintaining surface mulch and slow down decomposition of organic residues.	Refer the above explanations in section 3.3 above
Ripping - is the most popularly advocated conservation tillage technology in tropical soils.	Refer the above explanations in section 3.3 above	Refer the above explanations in section 3.3 above
Small Planting basin	The basins are the only spot where soil is disturbed, hence helps to conserve soil and moisture. The basins also act as in situ rainwater harvesting and store water in the soil profile.	This is reduced tillage practices, where the farm is cultivated in small fixed/permanent basins with 30-cm long and 20-cm deep, using narrow, deep and strong hand-hoes.

4.0 Recommendations to government structures in support of C3S agriculture:

As for other sections above, recommendations given hereunder are banked on the three key areas which itemised the gaps or shortfalls to be work on if C3S and CSA practices have to be mainstreamed in most Agricultural development plans. Consequently, the recommendations are given under the following subsections:

- Agricultural Plans development process currently in place.
- Policy environment around C3S.

- Climate smart small-scale agriculture practices adaptable on small scale farmer's contexts.

4.1 Recommendations on "process" of developing Agricultural related development plans

Exploring from various studies, the elected leaders may venture around the following recommendations in view of improving the process of developing agricultural plans especially DADPs with a C3S eye's on.

- Banked on the fact that the C3S concept is not much conversant to most district level stakeholders, elected leaders may need to advice/revisit the composition of District Facilitating Team. This advice/review may necessitate putting forward a criteria for representation being among others, adequate and diverse expertise and experience on issues related to climate change. The idea here to ensure professional and result oriented inclusion of climate change adaptation, mitigation and REDD practices in most DADPs,
- Leaders are advised to advocate adequate resources for C3S capacity building interventions (e.g. practical trainings, forming community environmental groups/clubs and meeting them frequently, visiting communities at home/site) and awareness creation initiatives at village and sub village levels on issues related to climate change. This will empower villagers to prioritize projects related to climate change adaptation and mitigation in their VADPs which are used to form DADPs
- The current DADPs development process considers a limited number of agricultural related policies. The advise here is for the same plans to widen inclusion of other cross linked policies and programmes as important ingredients in developing plans with C3S touch such as Environmental Policy, Water policy, Forestry, Land Policy and their respective laws/acts that are not adequately reflected in the DADPs.
- The elected leaders should see to it that, rational representation of smallholder farmers in the district stakeholders forum is in place [refer section 2.1 of DADPs development guidelines – 2011]. The guideline does not specify the number and criteria of obtaining farmer representatives, noting the size of villages, wards in each of the focused districts.

Some of the identified window of opportunities the elected leaders can exploit in selling and supporting their C3S agenda may include:

- The decentralized nature of the programme activities that may facilitate or allow communities to integrate issues of climate smart agriculture and community oriented REDD+ in their priority activities if they are aware of them.
- The development strategies and programmes emphasize public private partnership which can provide an opportunity for joint ventures and attract private sector investment especially on REDD+ if communities are well facilitated.
- Capacity building and institutionalization which provide structures at local level for investment promotion on climate smart small scale agriculture and community oriented REDD+.
- There is potential to increase food output, food security and household income of smallholder farmers if they will be integrated in the implementation of SAGCOT's AGG. This will reduce pressure for agricultural expansion and thus avoid deforestation and carbon dioxide emissions.
- Opportunities for additional benefits and incomes to communities by investing in conservation agriculture and natural resource conservation.

4.2 Recommendations on policies

This sections offers some recommendations on which elected leaders can bank on, in view of improving the policy environment that incorporates C3S related concepts and practices. Some of those recommendations include [not limited to] the following:

- ✓ Elected leaders may facilitate review and mainstreaming of climate change adaptation innovations into policies that will act as a strong incentive to farmers' involvement. Here, Non-governmental organisations are likely to play an increasingly important role in building awareness and delivering appropriate technologies to farmers.
- ✓ As part of policy option, elected leaders may ensure that DADPs [linked to other related sectors], seek to facilitate development of Village Land Use Plans (VLUPs) which clearly demarcate settlement areas, grazing land, farming land and reserve land. This will discourage and control some of bad practices that are not

climate/ecological friendly for example bush fire, shifting cultivation, forest clearing etc. This will also encourage establishment and conserving village forests hereby supporting REDD initiatives.

- ✓ Elected leaders have or should assume the crucial role of enforcing relevant laws/acts and regulations that are directly or indirectly linked to CSA.

Some of the proposed pathways for integrating climate change adaptation and mitigation in sectoral policies, programmes and plans may include:

- Elected leaders may play a coordinating role in ensuring that it is a requirement for ministries, departments and agencies for climate change sectors, donors and key stakeholders at sector level to take actions to ensure climate change adaptation, mitigation and REDD+ priorities established at national level are mainstreamed in the respective polices, strategies, programmes and plans including DADPs.
- Increasing motivation and incentives among climate change stakeholders to share and contribute their experiences in the process of developing DADPs. This can be achieved through:
    - Developing sound policies or enabling environment that aims at promoting successful farm-level adaptation practices, information and experience sharing, and ways to implement adaptations through affordable means. Policies, Laws, and Procedures at national and District levels need to recognize successful local innovations by farmers and promote them.
    - Improving the use of communications networks and emerging media with interest around climate change to raise awareness and increase domestic demand for climate change activities.

4.3 Recommendations on C3S practices

Being representatives and/or advocates of communities they represent, elected leaders may campaign, lobby and if possible use their political powers to influence not all but the most feasible C3S practices affordable and adaptable to the areas. Some of the recommended C3S practices that are adaptable and affordable to smallholder farmers based on the strength, potential and benefits outlined in the matrix above may include [but not limited to] the following:

i. Soil and nutrient management practices:

Recommended practices under this section are very practical in enhancing sustainability of farming by increasing the organic matter content of the soil and promoting soil life. They also contribute to nutrient recycling by increasing and balancing nutrient reserve

- **Composting making and application**: Improve handling and quality of manure. Manure should be kept under shade, protected from direct sunlight and rainfall to reduce Nitrous emissions. The manure should be kept and allowed to decompose and cool before applied in the farm for maximum benefits. When applied in the farms, should be covered by soil or mixed with soil to reduce further emissions and Nitrogen losses.
- **Manure application:** In traditional smallholder farmer, this implies in most cases application of animal residues for improving organic matter contents and improving soil structure and characteristics – a strong point here is that, it is affordable and most widely applicable traditional practices
- **Integration of organic and inorganic fertilizers** for crop production, application of these fertilizers at the right time and rate as per crop requirement is essential. Farm yard manure can be used in combination with phosphate fertilizers during planting and Nitrogen-containing fertilizers at low rates can be used as top dressing. Maximum benefit of inorganic fertilizers will be realized in these areas if soil-water conservation technologies are practiced, as they require moisture to solubilize and taken up by plants roots.

ii. Managing flow of slow radiation, air and water practices

There are cross linked relationship between techniques on microclimate management, water management and erosion control. The practices supporting these techniques contribute to creating favorable conditions for plants and animal life, conserving water and soil and reducing climatic risks. Some the practices recommended under this may include [not limited to]:

- **Terracing:** is a Conservation Agriculture technology for soil and water conservation which is effective in steep slope areas. Terraces are constructed by cutting off slope with bunds made of stones and soil with or without cut-off drains to form short distance land areas with relatively same slope along the long slope resulting in a large step-like structure.
- **Contour furrow:** another in-situ Rain Water Harvesting, where the furrow and ridges are made against the slope (along the contour) with furrow upslope and ridge down slope with approximate spacing of 1.5 m. The furrows are used to trap rain water and are tied at the end to prevent water flow out of the furrow at the end of the furrows. The contour furrow are suitable for inter cropping especially cereal and beans.
- **Ngoro/Matengo pits system:** Ngoro/Matengo pits is an indigenous soil water conservation that improve soil fertility and crop yield, found on steep slopes of Mbinga District of Southwest Tanzania. The grasses are buried in the ngoro pit, which when decomposes add SOM and fertility and the pit trap rain water and reduce erosion.
- **Chololo pits.** Chololo is another indigenous in situ rainwater harvesting developed and practiced in Dodoma Rural district, consisting of small pits of 22 cm diameter and 30 cm deep, dug along the line at 60 cm space between pits in a row and 90 cm between rows of pits.
- **Mulching:** it is an important practice for improving soil microclimate; enhancing soil life, structure and fertility. Further to this, conserve soil moisture; reduce weed growth, preventing damage by impact from solar radiation and rainfall [erosion control] and reducing the need for deep tillage.
- **Windbreaks:** this is one of the practices that improve microclimate or decrease wind erosion – may be formed of living hedges – narrow bands of closely planted woody species; generally planted around fields, garden or farm compounds. Besides influencing microclimate, hedges can be useful in keeping animals out of fields and/or producing fruit trees, herbs, fodders, mulch, thatching materials or fuel.
- **Erosion control strategies:** to slow down runoffs using **crop residue strips, divert runoffs to reservoir points,** contract cut off drains and stabilize with grasses along the village roads, paths and grazing route to reduce, prevent and hill gullies and rills.
- **Micro-catchment's rain water harvesting and water storage in reservoir**: to provide water for irrigation during prolonged dry spell and for production of high value crops such as vegetables
- **Use stone:** to slow down runoffs in the plains and helps to retain eroded soil particles within the plains to help vegetation regeneration
- **Tie ridging:** tied ridges alternating with furrows can be constructed by inter tying main ridges ploughed along the contour lines with smaller perpendicular cross ridges every few meters
- **Strip cropping:** practice where farmers have to grow their crops on slopes. The crops are sown in narrow, tilled rows along contours on the hillside. The strips of land between the rows, which are left untilled in natural grasses, slow the flow of rainwater down the slope and preventing it from washing away the topsoil. More water penetrates into the soil and provides moisture for the crop.

iii. Pest and Disease control practices

This part recommends some of possible practices smallholder farmer can practice to control pests and diseases. Some of the recommended practices include:

- **Intercropping:** involves growing two or more crops at the same time in the same field. The cropping is intensified in terms of both time and space. Research has shown that, intercropping has positive effects in terms of reducing occurrences of pests, diseases and weeds. Natural enemies of insect pests tend to be abundant in intercrops than mono – crops. Also, most combination of crops tends to suppress weed growth by providing an early ground cover.
- **Crop rotation:** A practice of growing different crops on the same land in a regular recurring sequence. It means the planned order of specific crops planted on the same field. It also means that the succeeding crop belongs to a different family than the previous one. Crop rotation is recommended to achieve crop diversity, reduce incidences of pest and diseases of particular crop.

- **Crop diversity:** Mono-cropping has many disadvantages such as increase incidences of pests and diseases, similar rooting system of the crops results in poor structure and ultimately low productivity. To sustain crop production diversification of crop is recommended in highland areas.
  - Use of local botanicals in control of pest and diseases.

iv. **Application of improved seeds adaptable to specific agro ecological zones [Resilient crops and varieties]:** Selection of crops and varieties to grow remains the central component of any crop production. Considering climate change impact, short duration/early maturity varieties are likely to be more resilient to climate change and reduces risks of crop failure due to moisture deficit. More adapted crops to highlands especially with high value should be grown in the highlands. All in all improved varieties resistant to diseases and insect pests should be grown in these areas.

Crops, varieties and traits that are resistant to pests and diseases will improve producers' ability to adapt to climate change.

v. Choosing, Conserving and Improving Genetic resources

- Without jeopardizing the initiatives and effort by researchers, strengthening community capacity to manage genetic resources [local supply, conserving local varieties and breeds, handling and storing seed] is vital in as far as climate adaptation practices are concerned. If scientists, government agencies and NGOs collaborate with farmers in trying to improve the selection, conservation and distribution of genetic resources, management of the same can be tapped and kept alive.

vi. Integrating farm systems

Combining different plant and animal species and applying variety of techniques to create favorable conditions for protecting environment also helps farmers maintain the productivity of their land and reduce farming risks, especially on sloping land and under unpredictable climatic conditions. Some of common practices can include:

- Integrated crop – Livestock – Fish farming
- Agro forestry and beekeeping in conserved areas/forests

vii. Income Generating Activities: The recommendation provides room for sensitization, skill and knowledge provision to rural communities which are most affected by climate change impacts and variability. The idea here is enable and if possible to support initiation of micro projects like poultry keeping, goat and piggery project and possibly any other context based non – farm enterprise.

viii. **Alternative energy:** if well handled and efficiently used, the technology has a number of advantages. Some of those include: limited tree cutting, limited forest reserve encroachments, time saving in search of firewood especially to women, minimal contribution on accumulation of carbon dioxide in the atmosphere etc. some of those technology may include [but not limited to]:

- Biogas units/plants installation
- Installation of solar energy devices
- Use of energy saving stoves [using fewer fire woods per unit cooking].

Despite all what has been recommended on the above three sections, leaders can further tap the current prevailing opportunities for strengthening mutual accountability in as far as Climate change adaptation and mitigation is concerned. The opportunities include:

- Potential to link existing systemic political mobilisation around environmental issues with climate change
- Improved communications networks and emerging media interest around climate change expected to raise

6.0 Conclusion and Recommendations

6.1 Conclusion

It is undoubtedly that Climate Change and variability is and will continue to have serious negative implications on agriculture and food security in Tanzania. Further to this, impacts of climate change have direct implications on social and economic development in the country. Adapting to Climate Change impacts provide opportunities to enhance resilience of affected communities in coping with the impacts.

6.2 Recommendations

The consultant overview highlights the following key areas where elected leaders may further facilitate and advocate for, in their efforts to prepare their constituencies in climate change adaptation. These include:

- **Policy and Process:** Screening of sectoral policies, programmes and strategies in view of mainstreaming climate change and C3S practices.
- **Capabilities:** seeking sources for basic knowledge and technical expertise on climate change that may be useful to Climate change service providers/interested parties including the communities which are the most affected.
- **Resources:** Having in place sustainable strategies for resource mobilisation [both technical and financial] at all levels of government structures.
- **Coordination and leadership:** Having a coordination mechanism in place that will enable sharing and exchanging on the diverse of climate change adaptation initiatives from various actors in their constituencies.

7.0 References

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