The United Republic of Tanzania

Ministry of Agriculture, Food Security and Cooperatives

Agriculture Climate Resilience Plan 2014-2019

September 2014

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Food Security and Cooperatives

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Foreword

Agriculture in developing countries must undergo a significant transformation in order to meet the related challenges of achieving food security and responding to climate change, which is highly variable and complex, and climate trends already indicate that temperatures are rising and rainfall is becoming more erratic. Projections based on population growth and food consumption patterns indicate that agricultural production will need to increase by at least 70 percent to meet demands by 2050. Most estimates also indicate that climate change is likely to reduce agricultural productivity, production stability and incomes in some areas that already have high levels of food insecurity. This is due to weather-related risks already impacting the agriculture sector, and without urgent adaptation the impacts are likely to increase with rising climate variability

Tanzania launched a National Climate Change Strategy (NCCS) in 2013 which sets out strategic interventions for climate change adaptation measures and greenhouse gas emissions reductions. The Strategy has outlined objectives for all sectors and proposed strategic interventions in those sectors and themes. Adaptation is clearly a priority, given Tanzania's low national emissions profile, high vulnerability, and dependence upon natural resources for livelihoods.

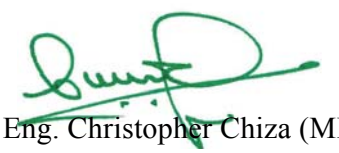
Climate Change will continue to put pressure on Tanzanian farmers therefore the need to develop a realistic and clearly designed approach is obvious. The Ministry of Agriculture Food Security and Cooperatives (MAFC) has taken a lead to develop this Agriculture Climate Resilience Plan (ACRP) so as to implement strategic interventions for adaptation and mitigation of Climate Change impacts.

The ACRP presents a wide range of adaptation options including but not limited to improving agricultural land and water management; accelerating uptake of Climate Smart Agriculture; reducing impacts of climate-related shocks through risk management; and strengthening knowledge and systems to target climate action. These would help to integrate resilience in agricultural policy decisions, influence planning processes, and implement investments on the ground. The ACRP is intended to provide Tanzania's crop agriculture sub-sector and stakeholders with a roadmap for meeting the most urgent challenges of climate change.

The preparation of ACRP for agriculture sector was done by a dedicated team of experts and efforts of various stakeholders through a participatory and a risk analysis approach. Rigorous and transparent consultation across stakeholders where implemented. Application of climate science with local expertise and priorities were combined in order to ensure that higher priority risks are identified and more effectively managed through actions and investments.

In this regard, it is our hope that the Agriculture Climate Resilience Plan will contribute a visionary perspective for future transformed Tanzanian agriculture sector. We therefore welcome all actors at the national and international levels to join hands with us as we embark into implementing the ACRP.

The Ministry of Agriculture Food Security and Cooperatives would like to thank all those who participated in one way or another and supported the development of this important Agriculture Climate Resilience Plan.



Hon. Eng. Christopher Chiza (MP)

MINISTER FOR AGRICULTURE FOOD SECURITY AND COOPERATIVES

Acknowledgement

The preparation of the Agriculture Climate Resilience Plan (ACRP) in Tanzania is a result of commitment, full participation and cooperation of many individuals and institutions.

I would like to thank sector Ministries, Departments, Agencies, Local Government Authorities, Civil Societies and other institutions for participating in the development of the ACRP. Their full commitment to participate in one way or the other in the establishment of baseline information, consultations, formal and informal discussions and finally in building a consensus by coming up with a final version of the ACRP are highly appreciated.

We are also grateful to all the agriculture stakeholders for their full participation in discussing the ACRP draft document during the Stakeholders' Meeting leading to the validation of the document. Their important and valuable contributions made the document what it is today. The frequent and tireless efforts made by the Technical Working Group (TWG) towards reshaping and editing the ACRP document cannot be underestimated; their time and efforts are recognized and greatly valued. It will not be easy to mention each and everyone who participated in making this document a reality but we thank all who were involved in different stages of making the entire task a success. Although it is not possible to mention all of them, but I would like to take this opportunity to express our heartfelt appreciation and assure them that we value their cooperation and support

I also recognize and appreciate financial support from World Bank - Tanzania, without its pioneering lead, the preparation would certainly not have materialized by this time. I also wish to acknowledge the financial support from DFID, IDRC through Sokoine University of Agriculture (SUA), and AGRA through the Open University of Tanzania

Last but not least, I will not be doing justice if I will not recognize and appreciate the tireless efforts of the MAFC – Environment Management Unit (EMU) team of experts for their dedicated efforts; who worked day and night to ensure that the plan is delivered timely and to the desired quality

Sophia E. Kaduma

PERMANENT SECRETARY

Acronyms

ACRP	Agriculture Climate Resilience Plan
AEZ	Agro-ecological zone
ARDS	Agriculture Routine Data System
ASDP	Agriculture Sector Development Programme
ASDP-2	Second Agriculture Sector Development Programme
ASLM	Agriculture Sector Lead Ministries
BFSC	Basket Fund Steering Committee
BRN	Big Results Now
CA	Conservation Agriculture
CAADP	Comprehensive Africa Agriculture Development Programme
CBO	Community Based Organization
CSA	Climate Smart Agriculture
CSO	Civil Society Organization
DADP	District Agriculture Development Plan
DRM	Disaster Risk Management
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMU	Environment Management Unit
EWS	Early Warning System
GDP	Gross Domestic Product
GoT	Government of Tanzania
HEMU	Head, Environment Management Unit
IPCC	Intergovernmental Panel on Climate Change
LGA	Local Government Authority
MAFC	Ministry of Agriculture Food Security and Cooperatives
MDAs	Ministries, Departments, and Agencies
MKUKUTA	National Strategy for Growth and Reduction of Poverty
MoW	Ministry of Water
MTEF	Medium Term Expenditure Framework
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Plan
NAPA	National Adaptation Plan of Action
NARS	National Agricultural Research System
NCCFP	National Climate Change Focal Point
NCCS	National Climate Change Strategy
NCCSC	National Climate Change Steering Committee
NCCTC	National Climate Change Technical Committee
NGOs	Non-Governmental Organizations
NSGRP	National Strategy for Growth and Reduction of Poverty
PPP	Public Private Partnerships
PPVA	Postharvest Process and Value Addition
REDD	Reduced Emissions from Deforestation and Degradation
RWH	Rainwater Harvesting
SACCOs	Savings and Credit Cooperative Societies
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
TAFSIP	Tanzania Agriculture and Food Security Investment Plan
TASAF	Tanzania Social Action Fund
TNA	Training Needs Assessment
TWG	Technical Working Group
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
URT	United Republic of Tanzania
VPO-DoE	Vice President's Office - Division of Environment
WARC	Ward Agricultural Resource Centre
WUE	Water Use Efficiency

Executive Summary

The Ministry of Agriculture, Food Security and Cooperatives (MAFC) is taking action on climate change in Tanzania. In line with the National Climate Change Strategy (2013), which calls for all climate-sensitive sectors to develop action plans to implement the Strategy's strategic interventions, MAFC has prepared the Agriculture Climate Resilience Plan (ACRP) to identify and respond to the most urgent impacts posed by climate variability and climate change to the crop sub-sector. The ACRP will serve as a roadmap for mainstreaming climate change within current agricultural policies, plans, and practices, as well as identifying gaps were new investments may be needed. It will be the guiding framework for a more comprehensive and consistent approach for confronting one of the major risks to current crop productivity and future investments.

Why is climate change a concern for crop agriculture?

Agriculture is a dominant sector of the Tanzanian economy, generating 25% of GDP, 24% of exports, and is the mainstay of 75 – 80% of livelihoods in the country including the majority of the poor. It is a sector of contrasts: despite having a relatively rich base of land and water resources and a favorable climate in many areas for the majority of years, it is hampered by low productivity and persistent poverty. Crop diversity is high, but the majority of households engaged in the sector grow a limited number of food crops for subsistence, and despite the resource endowments these households are vulnerable to food security and economic shocks. Though the Tanzanian economy and in the agriculture sector have experienced economic gains, little has translated to the poor, who still depend on rudimentary technologies and erratic rainfall for their livelihood and food security. These factors influence the impact climate variability and climate change will have on the agriculture sector, as well as the capacity to adapt to current and changing conditions.

The strategic direction of the agriculture sector is to modernize through promoting large-scale commercial farms, irrigation expansion, strengthening value chains, **and improving linkages with smallholders.** Rural poverty reduction, economic growth, and food self-sufficiency are anticipated, but this will add pressure on natural resources that already face high levels of inefficiency and degradation due to agriculture, as well as competing uses.

Tanzania's climate is highly variable and complex, and climate trends already indicate that temperatures are rising and rainfall is becoming more erratic. Recent models show that average annual temperatures will rise by 1ºC by 2050, and changes in rainfall patterns could cause dramatic shifts in agroecological zones, increase uncertainty in the onset of the rainy season, and increase the severity of droughts and floods. Other issues such as the emergence of pests and diseases moving into new geographic ranges are already suspected as indirect impacts of changing weather patterns.

Weather-related risks are already cost the agriculture sector at least $200 million per year[1], and without urgent adaptation these costs are likely to increase with rising climate variability. Most agriculture in Tanzania will continue to depend on rainfall in the foreseeable future. Looking ahead, rainfall decreases of 10% have been correlated with a 2% decrease in national GDP, [2] and temperature rise of 2°C could reduce maize yields by 13% and rice by over 7%,[3] both of which are probable in Tanzania over the next century. Climate risks will exacerbate the existing and projected pressures on water resources, soil erosion and health, and land degradation: water shortages and significantly reduced stream flows and water quality changes are already felt in key agricultural investment areas due to low water use efficiency and competing uses, and some climate models show that these are the same areas where rainfall is expected to decrease - yet these areas are slated for investment in water-intensive crops such as rice and sugarcane as well as irrigation expansion.

[1] World Bank (2013)
[2] Seitz and Nyangena (2009)
[3] Manneh et al (2007)

Building resilience despite uncertainty

As a cross-sectoral issue with far reaching economic, social and environmental implications, climate change planning cannot happen in isolation. At the same time, a robust process must acknowledge more uncertainty, given long term time horizons and limitations of climate and crop models to predict the impacts of temperature rise combined with precipitation changes on crop yields. One way to address these limitations is to adopt a more participatory risk-based approach, as has been done for the ACRP. The ACRP process has involved experts in environment, climate change, land use planning, mechanization, hydrometeorology, soil science, water resource management, pest management, rural development and advocacy, among others, to work collaboratively to develop an action plan and investments that respond to the risks but are tailored to fit the Tanzanian context from the policy level to the farm level.

How could a changing climate change Tanzania's agriculture?

Three risks emerged from the adaptation planning process, that are key to increase resiliency to climate variability in the short term and given long term climate change scenarios:

- **First, climate change will amplify the existing pressures on water resources from poor management, degradation and competing uses.** Irrigation alone will not be sufficient to adapt to climate change, and can indirectly drive vulnerability if water resources are not well managed. Adaptation measures for improved water, soil and land management are urgently needed to build resilience to current variability and future climate change by both smallholders and commercial farms.

- **Second, yields of key cereal crops are mostly likely to decline due to temperature rise and decreasing water availability, with significant implications for commercial investment, small-scale farmers, and food security.** Adaptation measures should focus on boosting productivity of cereal crops, especially building capacity of smallholder farmers to increase yields to the point of "best management practice", and researching the impact of temperature rise and rainfall variability on key crops.

- **Third, smallholder farmers are among the most vulnerable to even small variations in the climate, with major impacts on livelihoods and food security**. Adaptation measures need to consider how to reduce climate shocks to smallholder farmers, promote agricultural practices that boost productivity and safeguard natural resources, and appropriately target vulnerable areas.

These messages, reflecting stakeholder inputs, current climate science and analyses of agricultural risks in Tanzania, that were central to informing and prioritizing actions to build resilience to climate impacts.

How can agriculture adapt to a changing climate?

In order to mitigate the risks, priority actions and investments have been developed, to set the foundation for resilience over the next five years. These were identified as the areas with the highest level of vulnerability to risks, and the biggest payoffs for building resilience. Agricultural stakeholders recommended adaptation options that would help to integrate resilience in agricultural policy decisions, influence planning processes, and implement investments on the ground.

- **Action 1: Improve agricultural land and water management**

  Priority investments include water use efficiency and water storage, improvements in catchment management in agricultural planning, and adoption of sustainable agricultural land and water management to reduce degradation.

- **Action 2: Accelerate uptake of climate smart agriculture**

  Priority investments include building an evidence base for climate smart agricultural practices and incentives to offset the cost of adoption, promoting practices at the District level, and generating awareness and capacity for these practices.

- **Action 3: Protect the most vulnerable against climate-related shocks**

  Priority investments include measures to prepare for and respond to emergencies and weather-related shocks – and better integration of pests and diseases into these measures, building resilience through livelihood diversification activities targeted to the most vulnerable areas, and piloting risk management instruments such as finance instruments

- **Action 4: Strengthen knowledge and systems to target climate action**

  Priority investments include filling key research gaps, undertaking a comprehensive climate change and agriculture vulnerability assessment, developing systems for information management and communication campaigns, especially more accurate and timely weather and climate information, and strengthening gender considerations into climate change action for agriculture.

Much is already being done to build resilience in the agriculture sector. The ACRP has identified many existing initiatives and investments that consider climate change either directly – however these are generally small scale, discrete interventions. The ACRP investments are geared to build on existing activities, significantly scale up successes, and fully mainstream climate change into MAFC's activities at every level.

The way forward

Institutional strengthening will be necessary to implement the ACRP. The plan is ambitious and its success lies in strong coordination within MAFC departments and units, across several sectors, between national and subnational governments, and with a wide range of non-governmental stakeholders. Strong technical expertise and leadership is necessary to take the ACRP forward to ensure transformational, verifiable results.

MAFC will need to leverage additional funds for building resilience. Implementation of the ACRP would require a minimum of USD$25 million per year over the next five years in addition to current levels of expenditures related to climate adaptation in the agriculture sector – an increase of 22% in climate change expenditures over 2012/2013. This includes mainstreaming in existing programmes as well as opportunities for new initiatives. While not insignificant, compared with the current losses of $200 million per year due to weather-related risks, the payoffs could be substantial.

Robust monitoring and evaluation will be key to demonstrating results. Systems need to be in place to track delivery of the ACRP for national reporting, to scale up good practices, and to give confidence to funders that agricultural stakeholders can deliver on climate-resilient investments.

Introduction

Looking forward: Tanzania's Agriculture in 2050

The future of Tanzania's agriculture will need to adapt to shifting development trends. By 2050 the population will nearly triple.[4] Food choices are changing as urban consumers are shifting to rice and wheat from traditional staples such as cassava and sorghum, and overall consumption will continue to rise with population and incomes. Agriculture priorities reflect the changing demand, with significant investment in rice production systems and related investments in irrigation. The sector has continuously struggled with low productivity, but is making policy choices that promote modernization and increasing productivity through private sector incentives to invest in priority crops, expanding irrigation, and strengthening value chains. Yet natural resources – the clean and abundant water, land and soils needed for productive crops – are increasingly under pressure from both commercial and small-scale agriculture as well as other competing uses such as energy, livestock, and national parks.

Climatic trends are an additional factor: across the country farmers are already facing more erratic weather patterns, and by 2050 this is expected to intensify – complicating decisions about where, what and when to plant. Climate variability and long-term changes will also impact the future growth and development of Tanzania's agriculture. Average temperatures will likely rise by at least 1 ºC by 2050, which will impact food staple crops that are particularly sensitive to temperature, such as maize and rice. Some models suggest the already semi-arid zones in Northern Tanzania could receive up to a quarter less rainfall annually.[5] While projected changes in average annual rainfall amounts vary considerably across models, there is higher confidence that both seasonal extremes of dry and wet conditions will intensify.

Estimating the impacts of climate change on the sector in Tanzania is a challenge: weather-related factors already form the biggest risk to agricultural productivity in Tanzania now, but projecting this into an uncertain future is complex. Data are poor, climate projections and crop models are uncertain and make long-term decisions risky, and Tanzania's climate and agricultural livelihoods are diverse. Yet the impacts are already noticeable: farmers have perceived changing rainfall patterns and shifts in cropping seasons for example, which is confirmed by field survey research.[6] Estimates suggest that the net economic costs of climate change could reach 1 – 2% of GDP per year by 2030.[7] With over 20% of Tanzania's GDP reliant upon the agriculture sector, where annual production losses to the tune of $200 million are largely weather-related,[8] the impact of climate change is likely to be significant. Agriculture is also the largest emitter of greenhouse gases in Tanzania, which is expected to rise in the future as the sector develops.[9]

What can be done now to prepare for an uncertain future? Such uncertainty makes planning in the face of a changing climate complex – yet not insurmountable. Tanzania's Ministry of Agriculture, Food Security and Cooperatives (MAFC) is responding to the challenges of a changing agriculture sector in parallel with a changing climate through developing a Agriculture Climate Resilience Plan (ACRP) that recognizes both the risks and uncertainties in order to develop responses that meet the challenges and priorities of Tanzania's agriculture sector in a way that is more resilient to climate change.

[4] World Bank: HNP Stats, Population Projection Tables by Country and Group. The current population of Tanzania is projected to rise from approximately 45 million in 2010 to nearly 130 million in 2050.
[5] Wambura et al (2014). Specific weather stations analysed showing such rainfall decreases include Same, Musoma, and Bukoba.
[6] See, for example, Mongi et al. (2010), Kangalawe (2012)
[7] GCAP (2011)
[8] World Bank (2013)
[9] GCAP (2011)

The Call to Action

The latest report from the Intergovernmental Panel on Climate Change (IPCC) confirms worrying trends for Africa's agriculture: temperatures are rising, and will continue to do so; climate change will amplify existing stress on water availability in Africa, and agricultural systems (particularly in semi-arid areas) will be increasingly vulnerable as rising temperatures and changing rainfall patterns interact with other stressors.[10] As agriculture is a climate-sensitive sector that is central for Tanzania's economy, livelihoods, and natural resources, addressing the risks to crop productivity and food security is key not only to the sector's growth, but to the livelihoods of 80% of Tanzanians, as well.

Despite the uncertainty of the potential risks, climate challenges of agriculture are reflected at the highest levels in Tanzania's development plans. For example, the Five-Year Development Plan (FYDP) includes climate change as a threat to economic growth and an "underlying prerequisite" which must be addressed to ensure success of agriculture as a core growth priority. The second National Strategy for Growth and Reduction of Poverty (NSGRP, also known by the Swahili acronym MKUKUTA-II) also explicitly focuses on the risks of climate change to reducing poverty and inclusive economic growth, particularly in agriculture and disaster risk reduction. At the sector level, agriculture policies and programs tend to recognise climate change as an important issue, and propose strategic objectives and activities that could support mitigation and adaptation activities in the sector.

Tanzania has recently adopted a National Climate Change Strategy (NCCS). The NCCS, launched in 2013, sets out strategic interventions for government-wide climate change adaptation measures and greenhouse gas emissions reductions. The NCCS is ambitious in scope, outlining objectives for eighteen sectors and twelve cross-cutting areas, proposing over 200 strategic interventions in those sectors and themes. The strategic interventions related to crop agriculture are outlined in Box 1. Adaptation is clearly the priority, given Tanzania's low national emissions profile, high vulnerability, and dependence upon natural resources for livelihoods.

Box 1: Summary of Strategic Interventions Related to Agriculture, National Climate Change Strategy

Crops and crop varieties
- Assessing crop vulnerability and suitability (including cropping pattern) for different Agro-ecological zones
- Promoting early maturing and drought tolerant crops, use of pest/disease tolerant varieties, and adoption of higher yielding technologies.

Water
- Promoting appropriate irrigation systems
- Protecting and conserving water catchments*
- Enhancing exploration and extraction of underground and other supplemental water sources*
- Facilitating and promoting water recycling and reuse and rainwater harvesting*

On-farm practices
- Addressing soil and land degradation by promoting improved soil and land management practices/techniques.
- Strengthen integrated pest management techniques
- Promoting appropriate indigenous knowledge practices, agro-forestry systems, minimum tillage and efficient fertilizer utilization, and best agronomic practices such as conservation agriculture technologies
- Enhancing management of agricultural wastes.

Information
- Strengthen early warning systems for pest surveillance
- Strengthening weather forecast information sharing for farmers

Markets
- Assess trade comparative advantage on traditional export crops with changing climate
- Enhancing agro-infrastructural (input, output, marketing, storage) systems
- Strengthening post-harvest processes and promote value addition
- Development of crop insurance strategy

**Strategic interventions for the water sector that are closely linked with agriculture*

[10] IPCC (2013)

To implement strategic interventions for adaptation and mitigation, the NCCS calls on sectors to develop climate change action plans. Sectors and local governments are largely tasked with implementation of NCCS strategic interventions, including a requirement that relevant Ministries, Departments and Agencies (MDAs) prepare sector-specific climate change action plans. The NCCS highlights agriculture as a key climate-sensitive sector where impacts of climate variability are already experienced by farmers, including declines in crop productivity, shifting agro ecological zones (AEZ), increased incidents of pests and diseases, and increasingly unreliable rainfall. The Ministry of Agriculture, Food Security and Cooperatives (MAFC) has taken the lead as one of the first sectors in Tanzania to respond to this call by the NCCS to take action on climate change planning, launching preparation of an action plan in April 2013.

The Agriculture Climate Resilience Plan

The ACRP process has been led by the Ministry of Agriculture, Food Security and Cooperatives, **through the MAFC Environment Management Unit (EMU)** and guided by a Technical Working Group (TWG) composed of GoT technical experts from MAFC and several other MDAs, academic institutions, NGOs, and Development Partners. The work has benefitted from technical and financial support from the World Bank (the Bank), the UK Department for International Development (DFID), the Bank-Netherlands Partnership Programme (BNPP), and an IDRC-funded climate change project under the Sokoine University of Agriculture (SUA).

This action plan is intended to provide Tanzania's crop agriculture sub-sector and stakeholders with a roadmap for meeting the most urgent challenges of climate change. The specific objectives of the ACRP are to:

- Implement a participatory, risk-based approach to climate action that addresses the uncertainties of climate change and identifies risks while ensuring sector policies and initiatives are resilient against a range of future scenarios
- Develop time-bound, prioritized and costed actions to implement the NCCS strategic interventions for agriculture and food security;
- Identify entry-points to mainstream climate change adaptation and mitigation actions into MAFC's main programmes and projects and scale up existing resilience activities;
- Strengthen the institutional framework for addressing climate change issues in MAFC and strong coordination network with GoT, sub-national and non-governmental stakeholders; and
- Leverage additional financial resources from GoT, bilateral and international sources to promote climate-resilient agricultural growth.

The ACRP is divided into three parts:

Part 1: A case for climate action in the agriculture sector, summarizes a climate change risk assessment that: (i) provides a brief profile of the agriculture sector in Tanzania including strategic development priorities, (ii) outlines current climatic trends and future projections for temperature, precipitation and extreme events, (iii) presents the potential impacts of climate change on agriculture, and (iv) describes the risks to Tanzania's agricultural development.

Part 2: Priority resilience actions and key investments, which (i) describes the framework for how the actions and investments were developed using a risk-based approach and stakeholder involvement, (ii) conducts a situation analysis for each of the actions, (iii) presents key investments under each action, and (iv) outlines an implementation framework for each action that includes priority appraisal, cost appraisal, targeting, institutional responsibilities, and key stakeholders.

Part 3: Implementation Strategy, Which includes (i) the ACRP institutional framework, (ii) an overall cost appraisal and financing strategy, (ii) a monitoring and reporting framework, (iii) a first-year launch of the plan.

The ACRP is an ambitious action plan, reflecting the risk and potential impacts of climate change to agricultural growth in Tanzania. The Plan is anticipated to be a living document, which may require it to be revisited (e.g on an annual basis): Tanzania's agriculture sector is large and complex, and new opportunities may arise to mainstream climate action into emerging projects, initiatives and programmes, or new issues may come to the forefront that require action to address key vulnerabilities. At the present time, the ACRP focus was narrowed by the following principles to keep the scope targeted and manageable:

Box 2: ACRP Scoping Principles

Prioritize actions based on risk: The ACRP employs a risk-based approach to recognize uncertainty, and prioritize actions according to the most urgent and severe risks. A participatory method was used to combine the complexities of climate science with local expertise and priorities in order to ensure that higher priority risks are identified and more effectively managed through actions and investments.

Near term: It was agreed in a stakeholder workshop that the ACRP would have a time horizon of five years, from 2014 – 2019. This aligns with the five-year time frame of the NCCS.[11] Given the data constraints and uncertainty of climate impacts, this phase will need to support the evidence base necessary for decision-making in the medium- to long-term.

No-regrets actions: Given the uncertainties of climate projections and impacts on specific crops, the first ACRP should focus on no-regrets actions until building a strong base of evidence for more informed agricultural decision-making that considers climate change.

Adaptation, while promoting mitigation co-benefits: The ACRP should focus on climate change adaptation, but highlight interventions with mitigation co-benefits and opportunities for Nationally Appropriate Mitigation Actions (NAMAs).

Mainstream resilience actions where opportunities exist, scale up what works and fill existing gaps: The ACRP should recognize that financial and human resources are scarce, and be designed to mainstream actions into planned and existing policies, programmes and projects. Many efforts underway have already built climate resilience. Lessons should be identified and successful interventions scaled up

C**rop Productivity and Food Security:** Tanzania's agriculture sector is technically broader than MAFC, and extends to livestock and fisheries in addition to crop agriculture. However, for this Action Plan, stakeholders agreed that, while the livestock sector is vulnerable and tightly linked to crops, the ACRP should focus only on crop agriculture for several reasons, including institutional structures and manageability.[12]

Broad goals of crop productivity rather than individual crops or zones: To develop a climate change plan that is sufficiently comprehensive to meet the needs of every food and cash crop, agro-ecological zones, or livelihoods is not realistic. The uncertainty of both crop-specific and geographical impacts of climate change is high, and decisions made in the absence of good evidence could lead to maladaptation.

The ACRP has benefitted from a strong participatory process. Two stakeholder workshops were held, first to establish the scope and strategic framework, and a second to involve technical experts to identify climate impacts, risks, and propose priority adaptation measures to address the most severe risks. A

[11] URT (2013d), p. 85

[12] The primary justification for focusing on crop agriculture include (i) the structure of EMA and the NCCS is such that climate change planning is the responsibility of MDAs, and livestock and fisheries are under a different Ministry than crops and food security, (ii) given the previous reason, an action plan prepared by MAFC that included actions under the purview of the MLFD would not be implementable given separate institutional mandates, (iii) Given the ACRP is the first of its kind in Tanzania, it would be prudent to keep the scope more modest to increase the likelihood of its implementation given scarce resources and institutional constraints, (iv) Subsequent action plan for sectors such as livestock can link to the relevant actions in the MAFC ACRP, and (v) the NCCS is structured with separation strategic interventions for agriculture and food security and with livestock as a separate theme.

Technical Working Group (TWG) was also established to provide overall guidance to the ACRP process. The TWG is chaired by the Head of the MAFC Environment Management Unit, and includes over 20 members from the various departments in MAFC, technical experts from related MDAs, agricultural NGOs, academia, and Development Partners. The TWG met early in the process and several times over the ACRP preparation to give technical inputs on the content, members participated in workshops, and engaged in discussions of the ACRP content. Several technical reviews were undertaken as well, including literature reviews, a budget screening, and institutional and policy review, and an activity mapping.

Part 1: The Case for Climate Action

1.1 Agriculture Sector Profile

Key Characteristics

The agriculture sector in Tanzania is a sector of contrasts: despite having a rich base of land and water resources and a favorable climate in many areas, the sector is hampered by low productivity and persistent poverty. Crop diversity is high, but the majority of households engaged in the sector grow a limited number of food crops for subsistence, and despite the resource endowments these households are vulnerable to food security and economic shocks. Notwithstanding growth in the Tanzanian economy and in the agriculture sector, little has translated to the poor, who still depend on rudimentary technologies and uncertain rainfall for their livelihood and food security. These factors influence the impact climate variability and climate change will have on the agriculture sector, as well as the capacity to adapt to current and changing conditions.

Economy

Agriculture is a dominant sector of the Tanzanian economy, generating 25% of GDP, 24% of exports, and the mainstay of 75 – 80% of livelihoods in the country including the majority of the poor. Yet growth is slow compared to other sectors, with the share of GDP falling from 29% to 23% between 2000 and 2012. Sector GDP has grown but at a slower rate than the economy as whole, 4.4% compared to 7%.[13] This is also low compared to a 2.4% rural population growth rate.[14] Most growth of the sector has concentrated on larger-scale production of rice and wheat, and export crops (cotton, sugarcane, tobacco) in the country's northern and eastern areas. Taken together, these trends indicate linkages between modest sector performance and the persistence of rural poverty. The slow pace of agricultural growth relative to other sectors stems from a range of factors, including weaknesses and low capacity along the entire supply chain, vulnerability to climate shocks, and poor infrastructure.[15]

Land base

Tanzania is endowed with 44 million hectares, or 46% of its land territory, suitable for agriculture. However, part of this arable land is only marginally suitable for agricultural production due to a combination of factors including infertile soils, erosion and degradation, proneness to drought. In fact, according to the Agricultural Sector Development Strategy, only 10.1 million hectares (23% of the arable land) are cultivated. As of 2011, this had increased to nearly 14 million ha (32% of arable land). This includes 2.2 to 3.0 million hectares of annual crops, fallow of up to five years duration, and permanent crops and pasture.[16] Tanzania also has huge potential for irrigated agriculture: the area suitable for irrigation is estimated to be about 29.4 million ha, of which approximately 450,000 ha is used (1.5%).[17] To date agricultural productivity gains in Tanzania have been based more on the expansion of cultivated land rather than yield increases,[18] and this expansion of land for cultivation is one of the major drivers of deforestation and land degradation in the country.[19]

[13] URT (2011c)
[14] URT (2011c), World Bank Development Indicators (2010)
[15] URT (2011c)
[16] World Bank (2013)
[17] MAFC, BRN
[18] African Development Bank (2010)
[19] URT (2013a)

Livelihoods

Smallholder agriculture is the predominant livelihood in Tanzania (75 – 80%), which, being mostly rainfed, is highly dependent on the climate. Smallholder farmers tend to operate on an average of 0.9 to 3.0 ha, and are by far the primary users of arable land ranging from 80% - 90% of agricultural land use under smallholder production.[20] Most smallholder farmers are women, with 98% of economically active rural Tanzanian women engaged in agriculture. Adoption of agricultural technology is low, with cultivation generally done by hand hoe (62%), and only 14% by tractor.[21] Smallholder agriculture is predominantly rainfed and, especially in arid and semi-arid regions that depend entirely on livestock and food crop production for survival,[22] even small variations in rainfall patterns can have significant impacts on livelihoods as well as food security.

Crops and Productivity

Crop agriculture in Tanzania produces a diverse mix of food and cash crops, and is largely rainfed. Food crop production accounts for about 65% of agricultural GDP, with cash crops accounting for only about 10%, and about a quarter of the remainder accounted for by the livestock sub-sector. Within food crops, maize is the most important, accounting for over 20% of total agricultural GDP, followed by rice, beans, cassava, sorghum, and wheat.[23] Sector performance has varied among sub-sectors with the best performance in export crops such as sugar, tea and tobacco, which have recorded growth rates of almost 10% per annum.[24] Crop farming by smallholders, the predominant system, is labor-intensive and has very little access to modern farm technologies and inputs. As a result crop productivity and profits are low. The major constraints facing the agriculture sector are declining cheap labor and diminishing land productivity as a result of poor technology and over reliance on irregular weather conditions. Tanzania's dependency on rainfed agriculture makes it acutely vulnerable to weather changes. Unreliable rainfall in terms of intensity and distribution as well as extreme events such as drought and flood have been cited as one of the most likely and damaging production risks to Tanzanian agriculture.[25]

Natural Resources

Tanzania has had an abundant natural resource base (forests, water and soil) to support agricultural development, but management of land and water is a growing challenge that threatens productivity. For example, soil fertility depletion and erosion are already threatening the sustainability of arable agriculture. Soil health is declining due to nutrient losses, with estimates that cropping activities deplete soil nutrients at a rate of six to seven times greater than the rate at which they are replenished.[26] The combination of dry periods followed by heavy rainfalls along with inadequate land maintenance systems aggravate land degradation processes, making the country's agricultural production highly vulnerable to weather-related shocks.[27] Despite water resources in greater abundance than in neighboring countries,[28] water availability has been assessed as a common issue in ASDP irrigation schemes,[29] and degradation of water resources and lack of watershed management repeatedly cited as a challenge for the sector.[30] Tanzania's agricultural strategies emphasize that appropriate use of natural resources including land, water and forests would enhance productivity and profitability in the agricultural sector as well as conserve the environment.[31]

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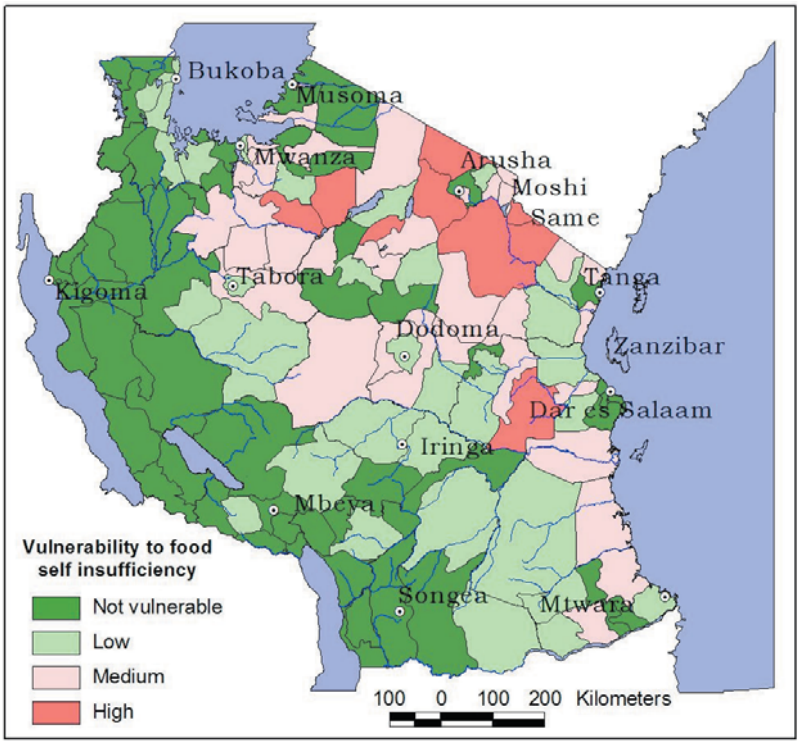
[20] URT (2011c), MAFC BRN statistics
[21] Sokoine University of Agriculture (2010), MAFC (2011)
[22] World Bank (2013)
[23] World Bank (2013)
[24] URT (2011c)
[25] URT (2010a), World Bank (2013), URT (2007)
[26] Shetto and Owenya (2007)
[27] *Ibid*
[28] According to the SAGCOT Investment Blueprint, Tanzania has approximately 2,300m3 of 'internal fresh water' per person, which is 1.4 times greater than that of Uganda and 3.6 times greater than Kenya
[29] Nkonya et al (2013)
[30] See, for example, URT (2011c), URT (2012), URT (2007), URT (2013)
[31] URT (2011c), URT (2010b), URT (2011d), URT (2012a)

Food Security

Tanzania is, overall, relatively food secure but substantial inter and intra-regional variability exists. Tanzania's food availability forecast nationally for 2012/13 was overall satisfactory, with a food self-sufficiency ratio of 113%, slightly higher than 2011/12.[32] However, major inter- and intra-regional variations exist due to localized food crop failures of varying magnitudes and vulnerability: some regions and districts have had food surpluses on an annual basis, but some regions and districts have pockets of persistent food shortage annually.[33] In 2011/12 year MAFC identified 63 councils in 17 regions that could experience food shortage and required close monitoring.

Rainfall and food security are closely linked as can be seen in
Figure 1– areas with higher levels of vulnerability to food insecurity (left, pink and red shaded areas) largely align with semi-arid zones and arid lands (see Figure below). Lean periods are typically experienced during the planting season when households near the end of their food stores, and those areas with low rainfall and high dependence on crop agriculture are more exposed to food security risks. In an average year, food production is usually satisfactory at the national level, but it fluctuates between higher rainfall years with food surpluses in good seasons and years of food deficits in poor rainfall seasons. Even in food secure areas, most households still experience food security shocks: in 2009/10, over 88% of households had experienced at least one shock in the past year, the most common being drought (58.4%), high food prices (53.4%), and plant and animal diseases and pests (34.7%).[34]

Figure 1: Food security and agro-ecological zones



Source: MAFC data, 2011/12 (map by SUA)

Strategic Directions

Tanzania's agricultural development policies and plans include ambitious targets and large-scale investments. The overarching aim is increasing crop productivity and modernization, encouraging a transition from subsistence agriculture to commercial farming. Strategies and policies tend to promote improved knowledge and skills of farmers, incentives for private sector involvement, strengthening value chains and productive activities, ensuring food security, and infrastructure (largely irrigation development).

[32] URT (2010a)
[33] URT (2011c)
[34] URT (2010a)

These sector priorities and targets are largely rooted in the Agriculture Sector Development Strategy (ASDS, 2006) and *Kilimo Kwanza* initiative ("Agriculture First," 2009).

Box 3: Select Agriculture Sector Development Targets

6%	**Annual growth target for the agriculture sector** *Tanzania Agriculture and Food Security Investment Plan*
10%	**Percent of national budget to be allocated to the agriculture sector** *Kilimo Kwanza*
100%	**Food self-sufficiency and food security** *Tanzania Vision 2025*
7,000,000	**Hectares of new irrigation** *Kilimo Kwanza*

The agriculture sector is carrying out several large-scale programmes and initiatives aimed to meet the sector's strategic priorities and targets. The main investments considered most tightly linked to the ACRP are:

Tanzania Agriculture and Food Security Investment Plan

Tanzania Agriculture and Food Security Investment Plan (TAFSIP) is a 10-year road map for agricultural and rural development[35]. TAFSIP is designed to operationalize the objectives of the Comprehensive Africa Agriculture Development Programme (CAADP), which includes (i) Tanzania achieving an average annual sectoral growth of six percent; (ii) attaining food and nutrition security; (iii) developing agricultural markets; and integrating farmers into the market economy. TAFSIP is expressed in terms of thematic areas, the main themes being Irrigation Development, Rural Commercialization, Market Access and Trade, Private Sector Development, Food and Nutrition Security, and Disaster Management, Climate Change Adaptation and Mitigation.

Second Agriculture Sector Development Programme

The Government is finalizing the formulation of the Second Agriculture Sector Development Programme (ASDP-2), which follows the conclusion of the first Agriculture Sector Development Programme (ASDP). ASDP was launched in 2006 to contribute to the targets of reducing rural poverty from 27 percent to 14 percent by 2010, and raising agricultural growth to 10 percent per year by 2010. This first seven-year phase (out of a planned fifteen) concluded in 2013. Like ASDP, ASDP-2 aims to guide and implement activities to realize Tanzania's Vision 2025. ASDP-2 will have a comprehensive coordination framework to encompass a wider spectra of agricultural sector development initiatives than ASDP, and clearly stipulate broad goals relating to food and nutrition security, commercialization, trade, growth, agriculture services, gender equality and women's empowerment (GEWE), youth employment and environmental protection. All of these areas will align with national development plans and policies.

ASDP-2 will make use of recommendations from a draft ASDP-2 through Basket Fund (ASDP-2-BF) document which proposes to focus on strengthening farmer organizations so that they can view farming as a business and produce for markets; on development of market and productive infrastructure; on supporting agribusinesses linked to farmer organization production systems; on generating and disseminating technologies, and on institutional capacity building. ASDP-2 coverage aims at fewer districts and interventions focused on selected commodities in order to increase productivity of priority commodity

[35] URT (2011c). The Comprehensive Africa Agriculture Development Programme (CAADP) is an initiative of the African Union's New Partnerships for Africa's Development (NEPAD), adopted by the Heads of State and Government in Maputo, Mozambique in 2003.

production systems and to improve the producers' access to agricultural inputs and financial services. Moreover, the proposed approach was expected to help focus investments in infrastructure and other interventions in priority areas. The commodities selected under ASDP-2 for intervention during the initial years of the proposed programme include rice, maize, oil seeds (sunflower and sesame), sugarcane and horticultural crops.[36]

Southern Agricultural Growth Corridor of Tanzania

The Southern Agricultural Growth Corridor of Tanzania (SAGCOT) is an initiative designed to improve the productivity of Tanzanian agriculture, agro-processing and manufacturing of finished goods from agriculture commodities. SAGCOT's mandate is to catalyze large volumes of private investment, targeted at rapid agricultural growth, with major benefits for food security, poverty reduction and reduced vulnerability. SAGCOT promotes clusters of profitable agricultural farming and services businesses, with major benefits for smallholder farmers and local communities, focusing on value addition, infrastructure development, agricultural productivity and public-private partnerships[37]. SAGCOT goals are deliberately designed to be consistent with ASDP objectives.

Big Results Now!

Big Results Now (BRN) is an initiative designed to address the lagging pace of implementing national development targets. BRN started with six sectors including agriculture. For the agricultural sector three programmes have been prioritized including: (i) building warehouse-based trading systems for maize (275 warehouses in 12 districts); (ii) building 78 professionally managed commercial rice irrigation schemes (in 10 districts); (iii) and supporting 25 commercial farming (agri-business) deals including those in the SACGOT region – 150,000 ha of mainly sugar cane and rice plantations.[38]

Box 4: Principle of Sustainable Agricultural Intensification

Tanzania's agricultural development programmes recognize the importance of sustainability with respect to resource use through the principle of "sustainable agricultural intensification." This refers to strategies that increase the amount of food produced per unit of land, but without negatively affecting the environment or resource base through degradation or pollution.

ASDP-2, for example notes the need to better understand trade-offs between productivity and resource management to develop farming systems, which are both more productive and more sustainable. A "**Green Growth Investment Framework**" (or SAGCOT "Greenprint") was prepared for the Southern Agricultural Growth Corridor, which provides a detailed plan for addressing the issues of climate change, environmental conservation and natural resource management that were identified as critical to the Corridor's long-term economic development.

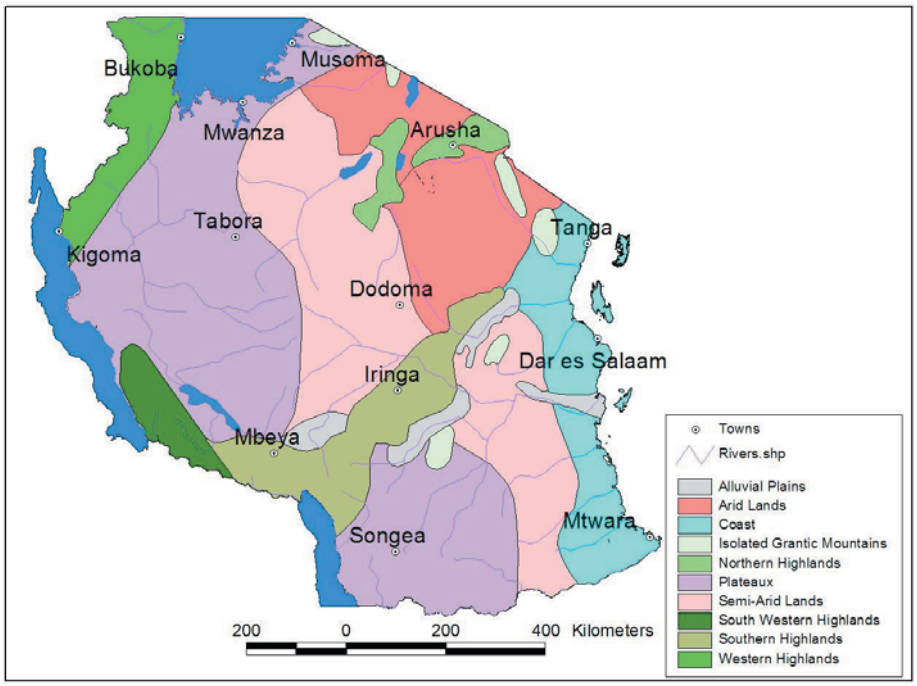
1.2 Climate Trends and Projections

Tanzania's climate is highly variable and complex. The climate is driven by tropical processes, the Inter-Tropical Convergence Zone (ITCZ), which influences rainy and dry season patterns. El Niño and La Niña years are associated with extreme flood and drought events. While annual seasonal temperature variation for locations is fairly small (approximately 3-4 °C), variability for rainfall is much higher both geographically and seasonally with extreme dry and wet conditions over the course of the year. Alternating dry conditions with heavy rainfall combine with inadequate land management in many areas that exacerbates land degradation and increase vulnerability to weather-related shocks.[39]

[36] URT (2013a)
[37] URT (2013a)
[38] *Ibid*
[39] Enfors, E.I. & Gordon, L.J. (2007)

High climatic variability results in a wide range of agro-ecological conditions, which allows for diverse agricultural livelihoods. Tanzania's agro-ecological zones (AEZs) range from higher rainfall areas on the coast and highlands in the north, far west, south and southwest, to arid and semi-arid areas in the interior of the country (Figure 2).

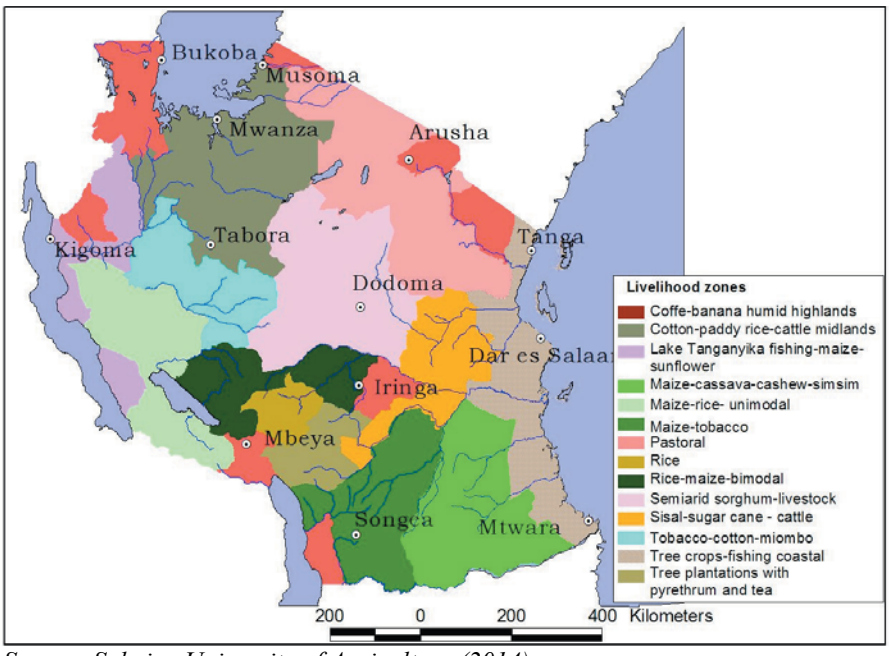
Figure 2: Tanzania's Agro-ecological zones



Source: SUA

The main cropping patterns reflect the climactic and biophysical variance: while major subsistence food crops such as maize have wide coverage throughout Tanzania, the economic base of rural livelihoods varies among and within the AEZs (Figure). Arid and semi-arid areas, for example, are largely pastoralist and have a higher dependence on more drought-tolerant crops such as sorghum. Higher rainfall areas on the coast, lake zones and highlands vary considerably, with a wide diversity of crop livelihoods in the southern corridor (SAGCOT) and a mix of fishing and food crops in the coastal and lake zones.

Figure 3: Tanzania livelihood zones

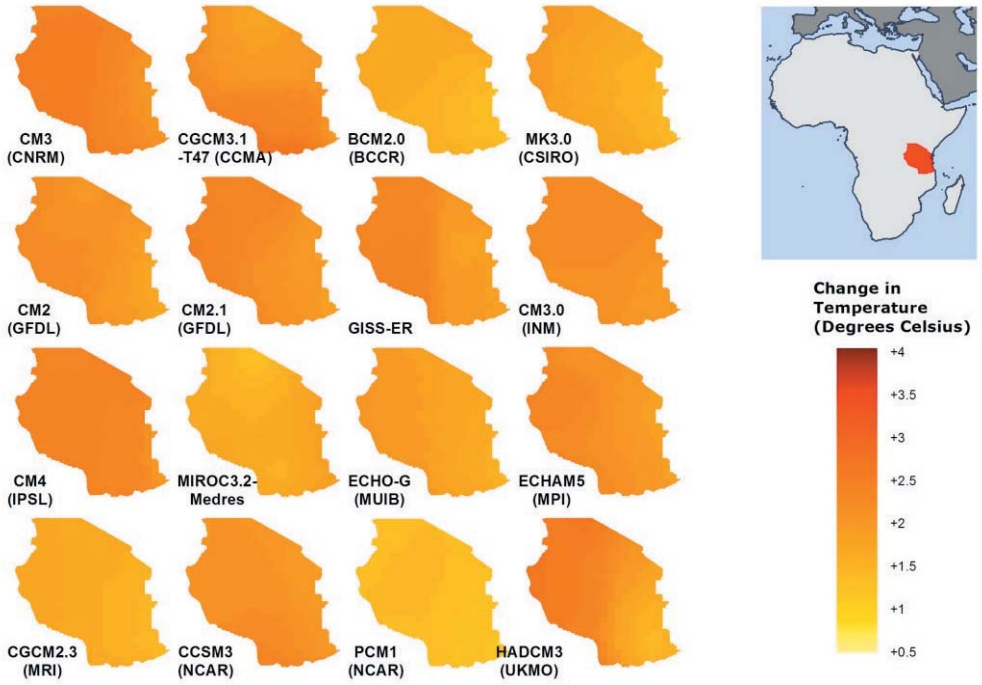


Source: Sokoine University of Agriculture (2014)

Tanzanian agriculture is highly sensitive to even small changes in temperature and precipitation given the high dependence on rainfed agriculture and low ability to adapt to current variability. High existing variability makes it difficult to generalize about the impacts of climate change, and for a nationally heterogenous sector such as agriculture, general assumptions could be misleading. For example, while average annual rainfall for the nation is projected to increase, this masks expected rainfall decreases at the regional level in areas that are already highly vulnerable to drought conditions. Likewise, overall shifts in the onset of the rainy season may not appear dramatic when aggregated, in areas that depend on rains for livelihoods and food security at a time when they are reaching the end of their food stores during the dry season, variability and unpredictability in terms of days can impact food availability. In fact there is some evidence that the AEZs are shifting along with changes in temperature and rainfall patterns, which could have dramatic implications for landscape of agricultural livelihoods and agricultural policy.[40]

Tanzania is growing hotter: The evidence is clear from climate trends that monthly temperatures across Tanzania have steadily increased over the past thirty years,[41] with the average temperature rising by 1.0° C between 1960 and 2006.[42] Mean maximum and minimum temperatures, for January and July, have increased in almost all zones between 1961 and 2005.[43] This is consistent with the latest IPCC report for Africa, which provides strong evidence of a warming trend across Africa, and predicts likely mean annual temperature rise of over 2ºC by 2100.[44] Climate models for Tanzania indicate future increases in average annual temperatures between 1ºC to 3ºC above the baseline period (1961-1999) from a range of models and emission scenarios by the 2050s (Figure), with the latest projections indicating a high certainty of a 1 ºC rise across the country.[45] By 2100 temperatures increases could range from 1.5°C to 5°C. Studies agree that the rise in temperature will be greater during cooler months (June to August) than warmer ones (December to February) and will result in consistent patterns of seasonal temperature increase (Figure)[46]

Figure 4: Comparison of climate models and change in Temperature by the 2050s under the A2 scenario

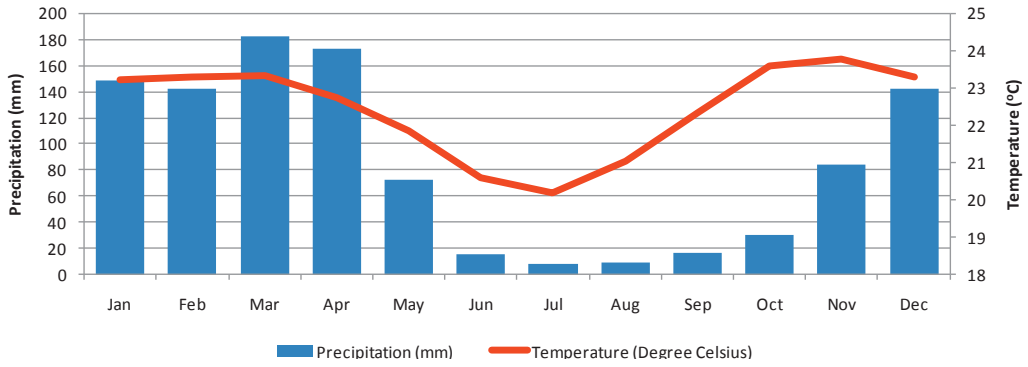


Source: World Bank Africa Spatial Services Helpdesk, using data from http:\\www.climatewizard.com (accessed 2013)

[40] URT (2007), Meena et al (2008)
[41] URT (2007)
[42] McSweeney et al., (2010)
[43] Munishi (2009)
[44] IPCC WGII AR5, Chapter 22: Africa. (2014)
[45] Wambura et al (2014). Projections based on Coupled Model Intercomparison Project phase 5 (CMIP5) model using Mid-Century Representative Concentration Pathway (RCP) 8.5. A total of twenty global circulation models (GCMs) were downscaled based on the eleven Tanzania climatological zones using thirteen synoptic weather stations.
[46] *Ibid*

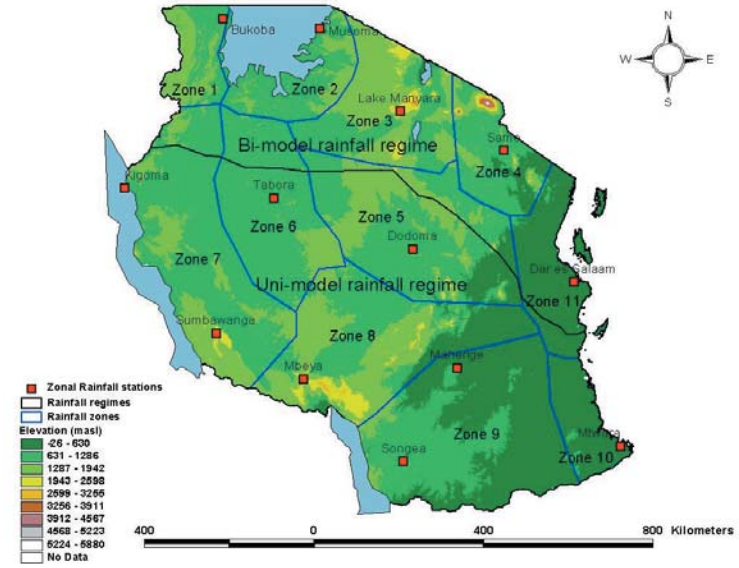
Rainfall is already highly variable, and is growing more unpredictable. Annual rainfall varies from below 500 mm to 2500 mm, which depends mostly on altitude and climatic zone, and amounts vary significantly throughout the year (Figure) Rainfall follows two distinct patterns in Tanzania, which strongly influences crop and planting decisions. The northeastern highlands, Lake Victoria basin, and northern coastal areas feature a bimodal rainfall regime with short rains (*Vuli*) from October-December and long rains (*Masika*) from March-May. The rest of the country including central, southern coast, southwestern highlands, southern and western areas experiences a different, uni-modal regime with a single rainfall pattern from December to April (*Musumi* or *Musimu* rains) as indicated in Figure and Figure . In bimodal areas the *Vuli* planting season begins around October/November and the corresponding harvests occur in late January/February. The *Masika* planting season starts in late February/March with harvesting in July/August. Most of the country's crop production takes place during the *Masika* season, with around 80% of total planted area compared to 20 % of the total planted area during the *Vuli* period.[47]

Figure 5: Average annual temperatures and precipitation in Tanzania (1901 – 2000)



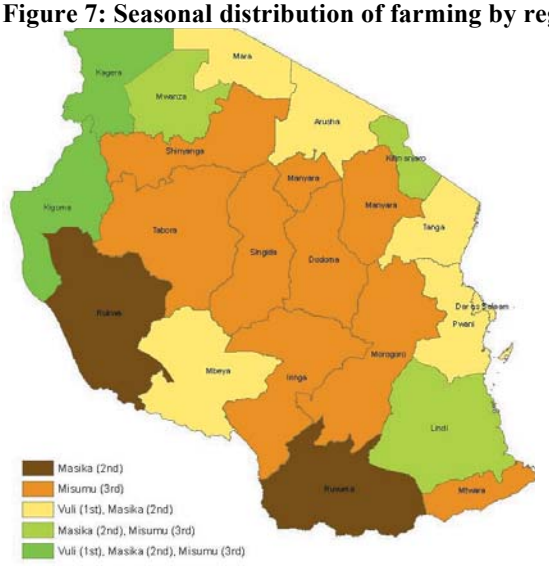
Source: World Bank Africa Spatial Services Helpdesk, using data from the International Research Institute (IRI) (accessed 2011)

Figure 6: Tanzania rainfall zones



Source: Wambura et al (2014)

Figure 7: Seasonal distribution of farming by region



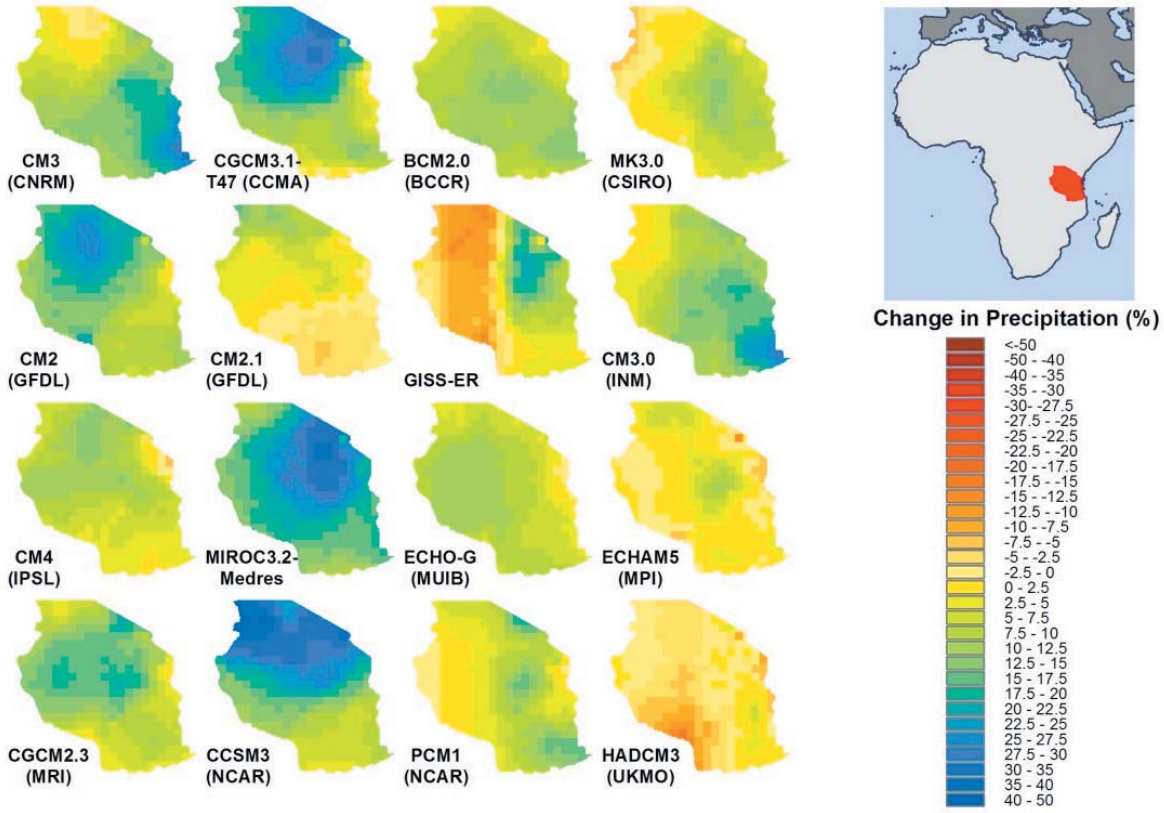
Source: 2009/2010 CFSVA data (MAFC)

Projected changes in precipitation are more uncertain. Historical records have shown decreasing trends for mean annual rainfall as well as increasing dry spells in some areas,[48] and also show high variability between annual rainfall cycles.[49] However, determining the impact of climate change on rainfall patterns is

[47] World Bank (2013)
[48] See, for example, Matari et al (2008), Enfors and Gordon (2007)
[49] TMA (2007)

highly uncertain: climate models show that rainfall regimes will change by the 2050s, but the degree and even the direction of change differ across the models (Figure). Projections also vary widely between seasons, regions, and rainfall regimes.

Figure 8: Comparison of climate models for percent change in annual precipitation by the 2050s under the A2 scenario



Source: World Bank Africa Spatial Services Helpdesk, using data from http:\\www.climatewizard.com (accessed 2013)

Changes in rainfall patterns will vary depending on current climate and geography. While overall rainfall is expected to increase on average by as much as 10% by 2100,[50] not all climactic zones will experience the same changes. When climate impacts on precipitation are examined at a sub-national level, three important trends emerge that have important implications for agriculture:

Rainfall patterns are increasingly unpredictable and expected to become increasingly variable: This includes shifts in the onset of the rainy season (especially in the south) and increasing seasonal variations.[51] Some models indicate a potential 6% decline in rainfall during June and August (typically dry season) and over 16% increase in the short rains between December and February.[52] Certain areas may already be shifting from bimodal to unimodal, which could continue and cause more dramatic shifts in agro-ecological zones and thus growing seasons. The onset of the rainy season, which is particularly important for planting decisions in rainfed systems, is already observed by farmers and viewed as a major risk to crop productivity.[53]

Some areas will likely experience heavier, more concentrated rainfall: Some areas will likely experience rainfall increases overall, but the trend is toward more extreme rainfall events. This is mostly likely in bimodal areas including the Lake Victoria basin, coastal areas, and northeast highlands, with increases from

[50] SUA (2010)
[51] Wambura et al (2014)
[52] Agrawala et al (2003)
[53] World Bank (2013)

5% - 45%.[54] More recent projections also indicate that rainfall in central Tanzania could increase by 9% whereas the south would have an even greater increase of 13% - these increases would largely be in the month of April, indicating more rain but in a short time span.[55]

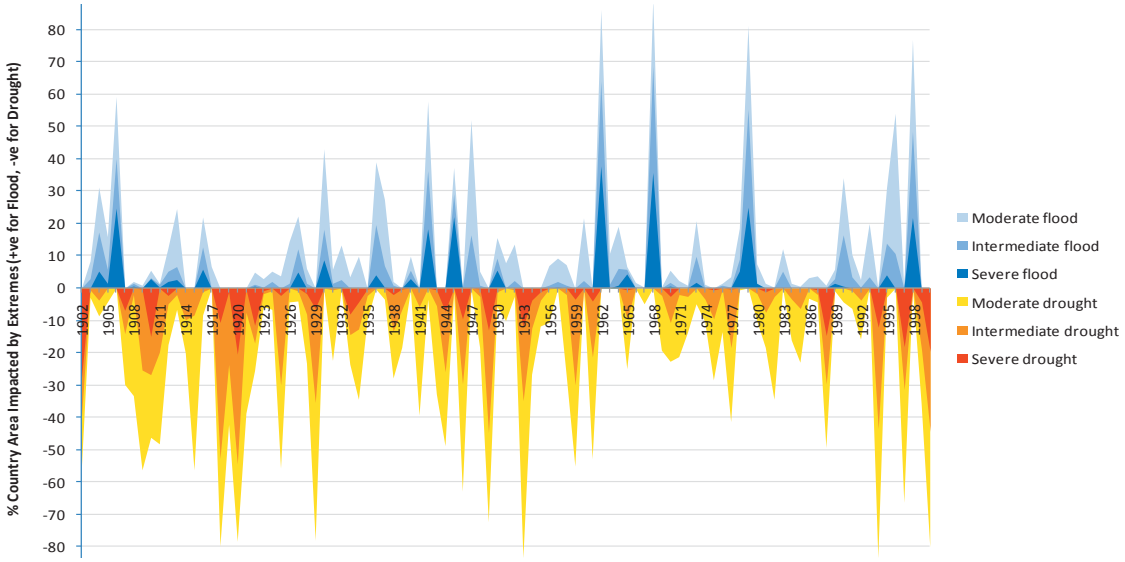
Other areas will likely experience rainfall decreases: This is most likely in areas that already have unimodal rainfall seasons, which could experience annual rainfall decreases of 5% - 15%.[56] However, recent projections also indicate decreases of up to 26% by 2050 in northern regions in the bimodal zone, though these areas showed a relatively higher degree of uncertainty to unimodal areas.[57] Southern regions might be particularly vulnerable to reductions in rainfall, with some projections indicating up to 10%.[58] This is most likely in the central, western, southern, southwestern and eastern zones. While uncertain, this projection does align with studies of current and historic trends. For example, there is evidence of changing rainfall patterns in the Same District (a semi-arid area), showing negative changes in rainfall since the early 1980's, including a decline in the long rainy season and total annual rainfall, and overall greater unpredictability of rains.[59]

Extreme weather events including droughts and floods are frequent and can cause significant shocks to the agriculture sector, economy, and food security at the local level. While most of the above changes are projected over the long term (30-60 years), the adverse impacts of climate variability have already being witnessed through extreme weather events such as the major droughts of 2005/6 and flooding in 1997/8, both of which had significant economic costs for Tanzania. Costs from the 2005/6 drought have been estimated at 1% of Tanzania's GDP. Most extreme wet conditions can be linked to El Niño episodes (1961, 1968, and 1997). Figure shows the frequency and geographic scale of drought and flood conditions from 1900 – 2000, demonstrating that the country is highly impacted by extreme events, sometimes with both droughts and floods within the same calendar year. Figure 2 depicts the geographic distribution of extreme events, indicating that the distribution is wide-ranging, and many areas are prone to both extremes.

Droughts are already one of the highest risks to crop agriculture. While droughts occur with less frequency than other production risks to crop agriculture (e.g. erratic rains, pests and diseases), the impacts are often more severe. [60] More than 33% of all disasters in Tanzania over a 100-year period were related to drought, largely in semi-arid regions.[61] Drought risk for production losses has been identified as most severe for maize, rice and cotton crops, thus posing risks for both food and commercial crops but with particular risks for food security.[62] Droughts are also the most common cause of food security shocks: in 2010, of the 88% of households that experienced at least one food security shock in the previous year, drought was the most commonly reported (60% of households).[63]

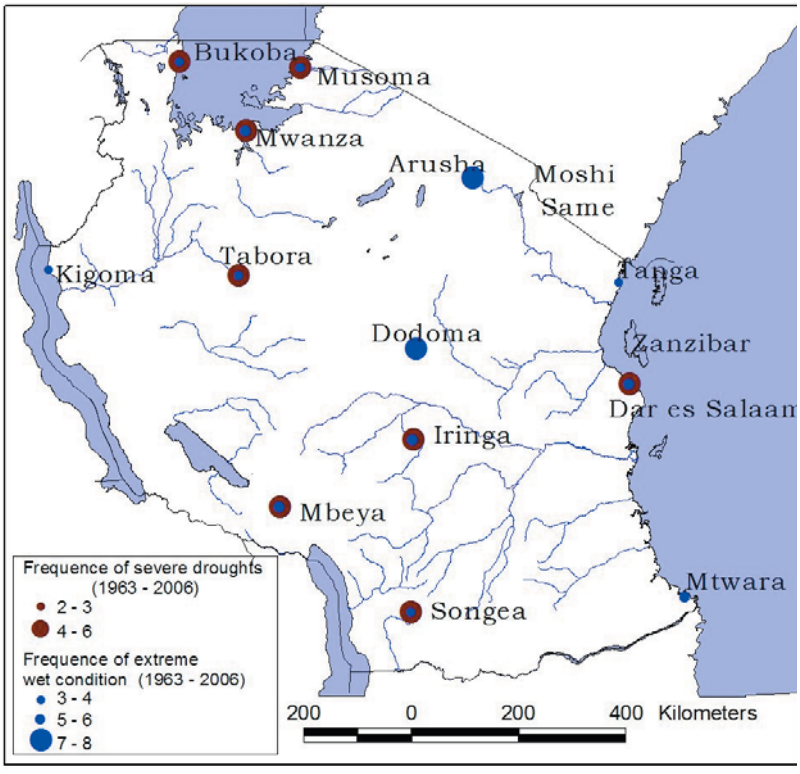
[54] URT (2003), Matari (2008)
[55] Wambura et al (2014)
[56] URT (2003), Matari (2008)
[57] Wambura et al (2014). Specific weather stations analysed showing such rainfall decreases include Same, Musoma, and Bukoba.
[58] Paavola (2003)
[59] Liwenga et al. (2012)
[60] World Bank (2013)
[61] Hatibu et al. (2000)
[62] World Bank (2013)
[63] URT (2010a)

Figure 9: Extreme event frequency and impact (1900 – 2000)



Source: World Bank Africa Spatial Services Helpdesk, using data from the International Research Institute (IRI) (accessed 2011)

Figure 2: Frequency of droughts and floods, 1963 – 2006



Source: Sokoine University of Agriculture (2014)

The effect of climate change on extreme events is highly uncertain. The information on droughts and floods is variable and future projections vary widely across models. Current weather cycles such as El Niño and La Niña will continue to impact climate variability, but it is unknown how climate change will affect the frequency and severity of these events, and predictions about the impacts in Tanzania are unreliable. [64]

[64] GCAP (2011)

1.3 The Climate Challenge for Agriculture

Responding to the potential impacts of climate change will be complex, which calls for an approach that can facilitate prioritization of adaptation measures based on risk. The ACRP used such a process, which has been previously employed in other countries on a subnational level, and adapted this to fit both the Tanzanian context and a national-level planning process. This was done mainly at a stakeholder workshop focused on risk-based planning, in order to identify the most significant climate change impacts, and to propose a range of adaptation measures as a basis for the ACRP. Current climate science was combined with local expertise and priorities for agricultural sector development through the workshop as well as a continuous stakeholder engagement process. This process should continue as the ACRP is implemented and updated, especially as new information from better data and more accurate modeling comes online, and planning processes gain traction at the local level.

Stakeholder responses to scientific information about the range of possible future climate outcomes and the implications for crop agriculture begin with utilizing experiences from managing climate variability. The participants were specialists from the Technical Working Group, academia and NGOs with specializations ranging from agricultural water management to pests and diseases to land and soil management. The stakeholders evaluated potential climate impacts, vulnerabilities and proposed adaptation measures using the risk matrix method described above, and assessed the likelihood of impacts and their severity. The workshop focused on six climate change characteristics: (i) temperature rise, (ii) higher, more concentrated rainfall, (iii) rainfall decreases, (iv) increased rainfall variability and uncertainty, (v) increased drought frequency and severity, and (vi) increased flood frequency and severity. Impacts stemming from these characteristics were then determined for five key areas of concern for crop agriculture: (i) low rainfall areas, (ii) higher rainfall areas, (iii) pests and diseases, (iv) land management, and (v) water availability. The following section outlines the findings from this exercise.

Impacts of Temperature Rise

Stakeholders assessed the potential impacts of higher temperatures on crop agriculture. The most significant impacts were largely concerned with impacts on water availability and pests and diseases, including possible expansion of pest and disease ranges and significant impacts on soil moisture and fertility due to increasing evaporative losses (Table 1).

Table 1: Potential Impacts of Temperature Rise on Crop Agriculture

Likelihood of temperature rise: High certainty that temperatures will continue to rise

Scale of temperature rise: 1.5°C to 5°C by 2100

Severe negative impacts	▪ Population and range increases for pests species and crop diseases ▪ Higher mortality rate of pollinators ▪ Reduced available water through evaporation loss ▪ Soil moisture depletion ▪ Increased maintenance costs of water infrastructure ▪ Reduced food crop yields
Moderate negative impacts	▪ Decreased base flow in perennial rivers ▪ Changes in soil chemistry ▪ Reduced soil fertility
Potential opportunities	▪ Population and range decreases in some pest species ▪ More favorable environment for some crops (e.g. sunflower)

The direct impact of temperature changes is a particular concern for food crops. For example, maize and wheat are especially sensitive to temperatures above 30°C: during the growing season, each day above 30°C reduces the final yield of maize by 1 percent under optimal rain-fed conditions, and by 1.7 percent under drought conditions.[65] Crop modeling studies have found that cereal yields could face significant impacts:

[65] Lobell et al. (2011)

one study found that in Tanzania by 2050, projected seasonal temperature increases by 2°C reduce average maize, sorghum, and rice yields by 13%, 8.8%, and 7.6% respectively.[66] Rice, especially during the flowering stage, is particularly sensitive to high temperature stress.[67] With rice cultivation steadily expanding ton areas of Tanzania that will get hotter and are expected to experience decreases in rainfall, the combined effects could have significant implications on rice production. The impacts on maize and rice together pose a serious challenge to food security.

Impacts of Precipitation Changes

Because changes in rainfall are likely to manifest in different ways across Tanzania, stakeholders analyzed climate impacts on three new potential rainfall patterns: (i) higher, more concentrated rainfall, (ii) decreased rainfall, and (iii) increased rainfall variability and uncertainty (e.g. onset of the rainy season). The most significant impacts of such precipitation changes are set forth in Table 2 and include:

- Increases in rainfall intensity pose risks of costly damages to infrastructure and crops, as well as soil degradation.
- Decreases in and/or increased variability of rainfall, are of particular concern, especially during the *masika* rains in bimodal areas, where even small variations in the onset of rains can have a significant impact on crop productivity.[68]
- Water availability is a major issue for areas that experience rainfall decreases as well as seasonal variability, resulting in reduced soil moisture and overall soil health being the significant risks.
- Rainfall increases could improve crop productivity in certain areas, as well as provide opportunities for new but water-intensive crops, such as paddy rice. However, projected rainfall increases should be treated with caution because an upward trend in total annual rainfall could be the result of more concentrated rainfall events, which can have severe negative impacts on soil health (e.g. erosion and nutrient leaching) and damage plants during the growing stage.

[66] Rowhani, et al (2011)
[67] Manneh et al (2007)
[68] URT (2010a)

Table 2: Potential impacts of precipitation changes on crop productivity

Likelihood of changes in precipitation patterns: Moderate degree of uncertainty

Scale of changes in precipitation patterns: Overall rainfall amount likely to increase, with uneven effects as some areas likely to see decreasing trends and greater variability in seasonal rainfall patterns.

	Higher, more concentrated rainfall	**Rainfall decreases**	**Increased rainfall variability and uncertainty**
Severe negative impacts	▪ Soil nutrient leaching ▪ Occurrence of microbial anaerobic conditions in non-water loving crops ▪ Flooding	▪ Soil moisture losses ▪ Reduced population of soil organisms ▪ Impaired crop growth and development ▪ Reduced water availability	▪ Higher uncertainty of planting times and reduced number of growing seasons ▪ Increased cost of production ▪ Longer season of drier soils
Moderate negative impacts	▪ Landslides ▪ Soil erosion ▪ Increased gully formation ▪ Physical damage to plants renders them more susceptible to pest attack ▪ Damage to water infrastructure	▪ Population and range increases by some pests ▪ Depletion of water sources ▪ Higher uncertainty of planting time ▪ Populations of bio-agents decrease	▪ Reduced soil fertility
Potential opportunities	▪ Increased seasonal soil moisture ▪ Reduced population of some pests ▪ Increase in food production for water-loving crops (e.g. rice)	▪ Decrease in food toxins due to reduced wet season/less moisture ▪ Possible introduction of new crop varieties and crop diversification	

Impacts of Extreme Events

While projections of droughts and floods are highly uncertain, there are serious implications for widespread crop failure, costly damage to infrastructure, and degradation to soil and land (Table 3). These impacts are consistent with the impacts currently experienced during extreme events, and highlight the significance of water availability during times of drought and the risk of flooding on soil health due to erosion and nutrient leaching, for example.

Table 3: Potential impacts of increased drought and flood frequency and severity

Likelihood of increased extreme events: High degree of uncertainty

Scale of changes in extreme events: Droughts and floods will likely continue in areas already vulnerable, though models are highly variable in predicting if extreme events will become more frequent and/or severe.

	Increased drought frequency and severity	**Increased flood frequency and severity**
Severe negative impacts	▪ Reduced water availability for irrigated and non-irrigated areas ▪ Soil dessication and moisture depletion ▪ Increased susceptibility of crops to pest and disease attack ▪ Populations of bioagents decrease ▪ Increased seasonal water scarcity ▪ Decreased water storage in catchments ▪ Increase in water conflicts ▪ High mortality rate of pollinators ▪ Widespread crop failure	▪ Soil and nutrient erosion ▪ Gully formation ▪ Loss of seeds ▪ Lodging of plants ▪ Widespread crop failure
Moderate negative impacts	▪ Changes in soil chemistry, including reduced soil organisms and nutrients ▪ Increased soil hardpan	▪ Increased susceptibility of crops to pest attacks ▪ Depletion of soil fertility ▪ Increased seasonal runoff and leaching ▪ Increased distribution of pests and diseases ▪ Damage to water infrastructure ▪ Post-harvest losses
Potential opportunities		▪ Increased seasonal soil moisture ▪ Increased water harvesting opportunities

1.4 Risks to Agricultural Growth and Development

There was consensus from the participatory process that climate change will amplify existing constraints to crop productivity and no regrets measures are key for policies, planning, and investments – "no regrets" implies that actions would be worth undertaking even without a changing climate.

Despite the uncertainty of the impacts of climate change, current policy and investment decisions will impact the resilience of the agriculture sector in the future. Taking together Tanzania's agriculture sector development, current climate science, and potential impacts, three main risk themes emerged that are key for adaptation planning. These messages, reflecting stakeholder inputs, current climate science and analyses of agricultural risks in Tanzania, are central to informing and prioritizing actions to build resilience to climate impacts.

Amplified water stress

RISK: Climate change will amplify the existing pressures on water resources from poor management, degradation and competing uses

Current management of land and water resources by the agriculture sector is inadequate and inefficient: for example, traditional irrigation systems in the SAGCOT area, which divert surface water onto cropland, are highly inefficient with only 20-60% of diverted water remaining in the field.[69] Other studies have found similar results, ranging from 15% - 30%.[70] The MAFC Environmental Action Plan finds that degradation of these resources is a particular challenge to the agriculture sector, citing poor water management for irrigation, land degradation and lack of agricultural land use planning and management among top environmental challenges.[71] Similarly, the REDD+ strategy and action plan notes that large-scale agriculture is among the major drivers of deforestation and land degradation in Tanzania, losing forests at a rate of approximately 400,000 hectares annually.[72] As outlined in Section II, rising temperatures and rainfall decreases in some areas – including already-vulnerable semi-arid areas as well as areas targeted for significant agricultural investment – will place an additional, and in some cases severe and potentially irreversible stress or loss on resources that are already under considerable pressure.

Agricultural practices combined with other pressures are leading to depletion of water resources. Stream flows in key agricultural areas have been falling, while water demand continues to rise – with agricultural activities expanding their areas of cultivation but casuing degradationfive of nine river basins studied in Tanzania.[73] The Wami-Ruvu basin has seen a decrease in flows by 60% over the past 20 years, and the Pangani basin has seen flows reduced from several hundred m^3/second to less than 40m^3/second.

Rainfall is expected to decrease in key agricultural investment areas: Areas such as the Southern Highlands that are slated for significant investment through programs such as SAGCOT and Big Results Now are more likely to experience rainfall decreases, combined with temperature rise.

Tanzania is investing largely in water intensive crops. Rice and sugarcane, the two priority crops prioritized under BRN include investments such as 60,000 ha of rice irrigation alone and 25 new large-scale paddy and sugarcane farms. Both crops require relatively more water than other crops and require significant irrigation investment. Limited assessment has been done of the sustainability of such investments, especially in the face of existing water stress and future variability: in the Kilombero valley,

[69] URT (2011)
[70] Keraita (2011). WUE is defined here as the biomass per unit area (yield) of crop produced per unit of water used during the growing period.
[71] MAFC, 2012-2017
[72] URT (2013)
[73] URT (2013c)

for example, if rice alone was fully developed according to plans, the monthly water requirements would be higher than mean monthly stream flows from June to December.[74]

Rainfall decreases have a significant effect on the economy: 10% decrease in rainfall leads to about 2% decrease in Tanzania's GDP. The impact on agricultural GDP is even greater, for example a 7% decrease in rainfall in 1990 in all eastern African countries led to an 11% decrease in agricultural GDP.[75]

Irrigation can help adapt to climate change, but also poses risks of maladaptation. Existing irrigation schemes are already reporting water shortages that are linked to multiple factors including climate change, an increased number of irrigators, and increasing non-agricultural water uses. Key irrigation areas, including southeastern Tanzania, are projected to see decreases in rainfall, which, together with temperature rise, will increase evaporation of surface water, therefore possibly amplifying water shortages. The Rufiji Basin, which comprises most of the SAGCOT area, could experience rainfall decreases that result in up to a 10% decrease of water flow.[76] In parallel, rising temperatures will lead to decreased soil moisture. As populations grow and agriculture expands, demand on water resources is expected to increase, and together with potential climate impacts this will put at-risk efforts to sustainably scale up irrigated agriculture.

Adaptation message

Irrigation alone will not be sufficient to adapt to climate change, and can indirectly drive vulnerability if water resources are not well managed. Adaptation measures for improved water, soil and land management are urgently needed to build resilience to current variability and future climate change by both smallholders and commercial farms.

[74] URT (2013e)
[75] Seitz and Nyangena (2009)
[76] EcoAgriculture Partners (2012)

Decreased crop yields

RISK: Yields of key cereal crops could decline, with significant implications for commercial investment, small-scale farmers, and food security

Cereals are the crops most vulnerable to temperature rise and rainfall decreases. Two critical food staples and economically important crops – maize and rice – are also among the most climate-sensitive, which could have far-reaching impacts on livelihoods, food security and the economy. Over 60-70% of cereals are grown in regions with unimodal rains, which are most likely to experience decreases in annual rainfall and greater variability in the onset of the rainy season. A temperature rise of 2°C could reduce maize yields by 13% and rice by over 7%.[77]

Maize alone could see overall yield decreases of 16% by 2030 causing economic costs on the order of several hundred million U.S. dollars per year.[78] In some areas this will be even more dramatic, with projected decreases of 84% in central semi-arid regions, and 12% in the Southern Highlands.[79] While there is variation among regions as to the extent of yield decline, crop and climate models tend to predict an overall decrease in maize yield.[80]

There is a particular risk for food security. Diets in Tanzania are heavily cereal based.[81] Food security tends to decrease under a variety of climate scenarios due largely to the impacts on cereals, which also leads to health impacts and declines in household incomes and savings of smallholder farmers due to lower agricultural productivity.[82]

ADAPTATION MESSAGE

Adaptation measures should focus on boosting productivity of cereal crops, especially building capacity of smallholder farmers to increase yields, and better understanding the impact of temperature rise and rainfall variability on key crops.

[77] Manneh et al (2007)
[78] GCAP (2011)
[79] URT (2007)
[80] World Bank (2013)
[81] On average cereals are consumed almost daily by Tanzanian households (6.4 days/week), with maize the most common cereal consumed (5.8 days per week) (URT 2010b)
[82] Arndt et al. (2011)

Increased shocks to agricultural livelihoods

RISK: Smallholder farmers are the among the most vulnerable to even small variations in the climate, with major impacts on livelihoods and food security

Climate change is likely to affect the most vulnerable households at their most vulnerable time of year. Most climate impact assessments agree that arid and semi-arid areas will experience the most acute climate-related impacts, where even slight variability in the onset of the rainy season can cause food security shocks. The onset of the rain season is also the most vulnerable period: as households have almost exhausted their food stocks and even their income base is low.[83]

While climate impacts are uncertain, extreme events and pest and disease outbreaks are a leading cause of economic and food security shocks at the household level.[84] While climate projections are uncertain, droughts, floods and pests and diseases are critical to address given the high associated risk of impacts to livelihoods and food security.

The most vulnerable areas are less likely to be targeted for agricultural investment. Only nineteen of sixty districts found to be food insecure, largely in southeastern Tanzania and the central north, are priority districts in major investment programs.[85] While these less productive areas may not be suitable for large-scale commercial farming investment, small-scale farming is the livelihood and food base, which is more susceptible to climatic shocks.

ADAPTATION MESSAGE

Adaptation measures need to consider how to reduce climate shocks to smallholder farmers, promote agricultural practices that boost productivity and safeguard natural resources, and appropriately target vulnerable areas.

[83] URT (2010a)
[84] PMO and UCLAS (2003), URT (2010a), World Bank et al (2013)
[85] Analysis conducted using the MAFC annual food security assessment data and priority districts listed under Big Results Now and ASDP-II Programme Document as of December 2013.

Part 2: Priority Resilience Actions and Key Investments

Responding to Climate Risks

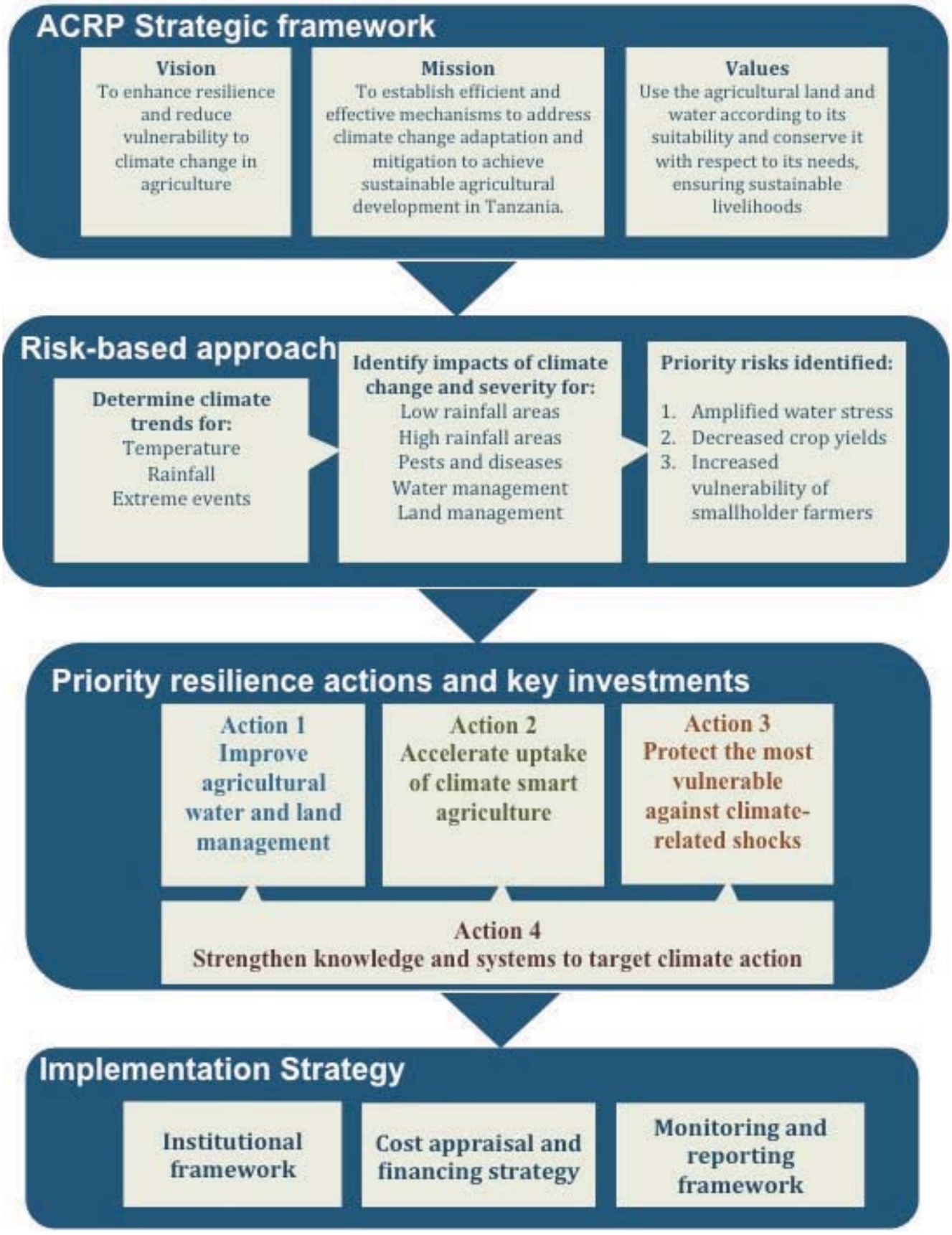
The participatory, risk-based approach outlined earlier was the basis for proposing adaptation options to mitigate the impacts and risks identified in Part 1. Stakeholders identified general adaptation measures for each of the most severe risks. First, a long list of over 200 adaptation measures was developed through the stakeholder workshop, and prioritized by (i) level of identified climate risk (see Part 2) and (ii) potential for adaptation. Proposed measures were then consolidated into a shortlist of ten generic adaptation priorities, ranked by level of risk (Figure 3):

Figure 3: A short list of adaptation priorities

Source: Stakeholder Adaptation Planning Workshop

Four thematic areas for adaptation options emerged to address the highest priority risks to water resources, crop yields and increased shocks to agricultural livelihoods. Stakeholders proposed adaptation measures to (i) improve water management through water use efficiency, catchment management and curbing degradation, and (ii) strengthen resilience specifically with smallholders at the farm level through climate smart agricultural practices and mechanisms, (iii) mitigate the risks of production and food security shocks, and (iv) strengthen knowledge and systems to better target climate action. These priority areas for adaptation were aligned with the ACRP vision, mission and values as well as cross-referenced with the NCCS strategic interventions to ensure full alignment with the Strategy. Figure 4 outlines how this process fits within the overall ACRP planning framework.

Figure 4: ACRP Strategic Framework and Priority Actions



The following section presents a more detailed analysis and investment plan for each of the four actions, including:

1. **A situation analysis** for each action outlining current issues, gaps that reduce adaptive capacity, and the potential for building resilience in each area, including linkages with current projects and programmes, and initiatives
2. **Key investments** for each action, which could be implemented as a comprehensive programme or as discrete investments, depending on funding sources and mainstreaming opportunities. Investments are directed toward policies, plans, and agricultural practices.
3. **Implementation factsheets** are provided for each action, which outline key considerations for investment planning (Table 4). Additional details on the overall implementation framework, cost estimates and financing strategy are included in Part 3

Table 4: Implementation Factsheet Considerations

Priority appraisal	Rating of **High/Medium/Low** based on (i) Importance of action in fostering adaptation and resilience and mitigation co-benefits; (ii) Urgency of action for mitigating climate risks; (iii) Linkages with other action(s) and investments; and (iv) Priority set in policies, strategies and programmes including NCCS	
Cost appraisal	Ranked as **High/Medium/Low** cost magnitude based on cost estimates (see Annex 8 for detailed description of costing methodology)	
Targeting	Indicates the most favorable geographic areas to prioritize implementation of actions and investments, which can later be scaled up to other areas, as well as alignment with current and planned activities.	
Institutional responsibility	Focal points provide leadership role for implementation as well as for engagement with other key stakeholders. Responsibility for implementation of specific investments is also indicated.	
Key Focal Points	**MAFC**	
	DPP	Department of Policy and Planning
	EMU	Environmental Management Unit
	DRD	Department of Research and Development
	DMECH	Department of Mechanization
	DNFS	Department of Nutrition and Food Security
	DLUP	Department of Land Use Planning
	DCD	Department of Crop Development
	DITS	Department of Irrigation and Technical Services
	Other GoT	
	TMA	Tanzania Meteorological Agency
	PMO-DMD	Prime Minister's Office – Disaster Management Department
	MoW	Ministry of Water
	LGAs	Local Government Authorities

The actions and investments of the ACRP are well aligned with the strategic interventions for agriculture and food security outlined in the National Climate Change Strategy (Table 5). It should be noted that, despite water and land management emerging as the highest priority investments, the NCCS strategic interventions for the agriculture sector place less emphasis on these areas. In fact, many of the proposed ACRP investments overlap with the NCCS' strategic interventions under the Water Resources sector, for which the Ministry of Water (MoW) leads on implementation, with the support of MAFC. This emphasizes the need for close coordination between MoW and MAFC as well as other stakeholders in achieving the goals set here.

Table 5: Alignment of NCCS and ACRP

Strategic Interventions for agriculture and food security	ACRP Actions			
Adaptation Strategic Interventions	**Action 1**	**Action 2**	**Action 3**	**Action 4**
Assessing crop vulnerability and suitability (cropping pattern) for different Agro-ecological zones		X		
Assess trade comparative advantage on traditional export crops with changing climate				X
Promoting appropriate irrigation systems	X			
Promoting early maturing and drought tolerant crops		X		
Enhancing agro-infrastructural (input, output, marketing, storage) systems			X	
Promoting appropriate indigenous knowledge practices		X	X	
Development of crop insurance strategy			X	
Strengthening weather forecast information sharing for farmers			X	X
Strengthening post-harvest processes and promote value addition			X	
Addressing soil and land degradation by promoting improved soil and land management practices/techniques	X	X		
Strengthen integrated pest management techniques		X	X	
Promote use of pest/disease tolerant varieties		X	X	
Strengthen early warning systems for pest surveillance.			X	
Mitigation Strategic Interventions				
Promoting agro-forestry systems.		X		
Enhancing management of agricultural wastes.		X		
Promoting minimum tillage and efficient fertilizer utilization.		X		
Promoting best agronomic practices such as conservation agriculture technologies.		X		
Strategic Interventions for Water Resources (relevant for agriculture)				
Protecting and conserving water catchments	X			
Enhancing exploration and extraction of underground and other water sources	X			
Facilitating and promoting water recycling and reuse	X	X		
Promoting rainwater harvesting	X	X		

Action 1: Improve agricultural land and water management

Action 1: Improve agricultural land and water management
Situation Analysis

Improvement of agricultural land and water management has been identified as a top priority both for the agricultural sector, and for building resilience to climate change.

Climate change will place additional stresses on natural resources. Current management of land and water resources by the agriculture sector paints a worrying picture: for example, traditional irrigation systems in the SAGCOT area, which divert surface water onto cropland, are highly inefficient with only 20-60% of diverted water remaining in the field.[86] Other studies have found similar results, ranging from 15% - 30%.[87] The MAFC Environmental Action Plan finds that degradation of these resources is a particular challenge to the agriculture sector, citing poor water management for irrigation, land degradation and lack of agricultural land use planning and management among top environmental challenges.[88] Similarly, the REDD+ strategy and action plan notes that large-scale agriculture is among the major drivers of deforestation and land degradation in Tanzania, losing forests at a rate of approximately 400,000 hectares annually.[89] As outlined in Section II, rising temperatures and rainfall decreases in some areas – including already-vulnerable semi-arid areas as well as areas targeted for significant agricultural investment – will place an additional, and in some cases severe, stress on resources that are already under considerable pressure.

Climate adaptation for land and water management are no-regrets measures for increasing crop productivity. The ACRP identifies many potential interventions that could build climate resilience through improved agricultural water and land management, summarized below in Box 5. The proposed adaptation measures are a mix of strategies to use water more efficiently, methods to harvest and store rainwater runoff, and better manage land and catchment areas.

Box 5: Stakeholder-recommended Resilience Options to Improve Agricultural Land and Water Management

Water Use Efficiency	Rainwater Harvesting and Storage	Land and Catchment Management
▪ Improve water use/application efficiencies, reduce losses (e.g. drip irrigation) ▪ Improve conveyance systems e.g. piped systems ▪ Lining irrigation canals to minimize losses ▪ Monitor soil salinity levels ▪ Promote the use of water lifting technologies to maximize area ▪ Promote the use of innovative rice paddy techniques (e.g. System for Rice Intensification, see Box 6)	▪ Increase water harvesting and storage capacity (dams/weirs, charco-dams, raised beds) ▪ Design water storage facilities to accommodate multiple users ▪ Conservation: Water rationing, Seek alternative water sources e.g. conjunctive use of groundwater, increase water points ▪ Soil and water conservation: e.g. cover cropping, crop residues management, mulching, agroforestry, and shading (nets/green house)	▪ Facilitate upstream-downstream coordination for water sharing ▪ District land use planning to maximize infiltration and reduce erosion ▪ Community managed river diversions ▪ Payment for Ecosystem Services (for example REDD+) ▪ Greater involvement of/enforcement by water basin authorities in coordinating different water uses and users

[86] URT (2011)
[87] Keraita (2011). WUE is defined here as the biomass per unit area (yield) of crop produced per unit of water used during the growing period.
[88] MAFC, 2012-2017
[89] URT (2013)

Box 6: Innovative paddy rice techniques for water use efficiency

The SAGCOT green growth strategy cites the potential benefits of the System of Rice Intensification (SRI) for yield increases and water savings, which could be a viable climate adaptation strategy in some areas:

> Within [SAGCOT], in 2009 Kilombero Plantations Ltd. (KPL) piloted an SRI program for smallholders in the communities surrounding their Mngeta farm. The program provided improved seed and extension services. Within the first year, paddy yields rose from 2-3 tons per hectare to 5-8 tons per hectare. With support from KPL and USAID, the program is expanding to 1,350 new farmers in 2012 and a projected 4,000 total farmers by 2013. Because SRI does not require major capital investment or even access to full-service input supply chains, it is ripe for scaling-up in most rice-growing regions of the Southern Corridor. That said, farmers do need access to equitable rice value chains to enable them to benefit from surplus production that is likely to result from SRI adoption. In Dodoma, SRI technology and improved value chains are being implemented through the USAID-supported Nafaka program.
> -EcoAgriculture Partners (2012)

These adaptation options are not new practices in Tanzania. In recognition of increasing conflicts over water uses the recent irrigation policy calls for the improvement of irrigation efficiency and effectiveness by promoting closed conduit systems and high efficiency methods such as drip irrigation. Such methods may require further emphasis, as a recent irrigation assessment of ASDP investments showed low WUE in traditional schemes, including high water losses and poor construction.[90] In semi-arid areas MAFC is advocating the use of underground water in addition to using water harvesting technologies such as by building charco, or earthen dams. Similarly, MAFC is promoting the multiple use of water from charco dam reservoirs for both irrigation and consumption by livestock. The irrigation policy also advocates for the construction of dams to be used for water storage. However, MAFC's Division of Irrigation does not make provisions for increased rainfall or flooding in their irrigation development plans, recognizing only an overall trend of decreasing rainfall.[91]

Despite the benefits of interventions for better land and water management, widespread uptake has been a challenge. Efforts to promote agricultural land and water management are challenging given they are cross-sectoral, involve many stakeholders, and can be high cost in terms of time and resources. Often these costs are up-front with a lag-time before seeing any significant economic, social or environmental benefits. Water and land management in the agriculture sector has been found to suffer from the following constraints:

Coordination on water resources planning requires strengthening, according to the draft updated Agriculture Sector Development Strategy (2013, p.34), which states that there is "weak coordination of integrated water resources planning and limited capacity for watershed management". Irrigation planning is the mandate of MAFC whereas water resources data are held within the Ministry of Water. Consultations with the Division of Irrigation Technologies in MAFC indicated that water availability information from MoW was sometimes not forthcoming despite being seen as essential to MAFC for planning. The result is that irrigation development plans are sometimes made without knowing water availability. The need to increase climate resilience is adding additional urgency to better coordinate water resources planning and for managing watersheds.

Payoffs from water use efficiency, water storage, land use planning and other interventions are not well understood. The relative costs and benefits of various land and water management techniques are not well understood by policy makers. It was, for example, encouraged by Members of Parliament to quantify how much rainwater is lost to agricultural production and the environment in the country, how it is lost, how to stop it from getting lost and to what extent it could benefit farmers and the environment.[92] Some evidence is available on the benefits of certain practices, but more is needed to better guide decision-making (Box 7).

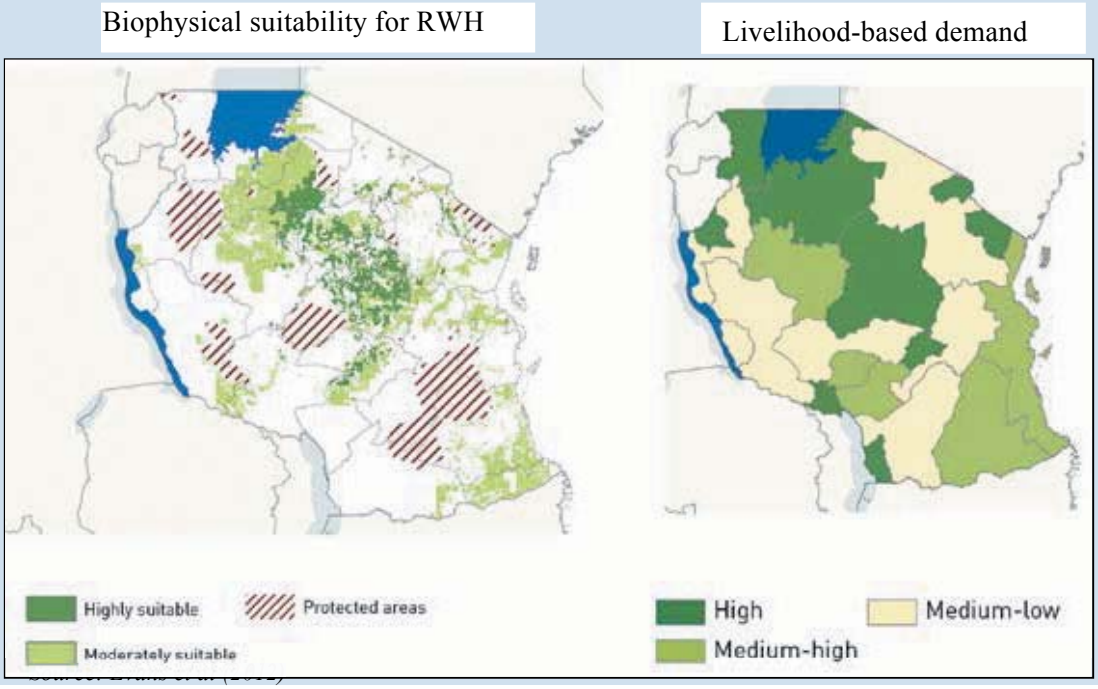
[90] Nkonya et al (2013)
[91] Lukumbuzya (2013)
[92] For example, this information was recommended by the Parliamentary committee on Water, Agriculture and Livestock in a workshop on agricultural water solutions in February 2012.

Box 7: Evidence for rainwater harvesting as an adaptation strategy

Rainwater harvesting (RWH) has repeatedly been identified as a priority measure for climate adaptation and increasing productivity of smallholder agriculture in Tanzania through capturing, storing and redirecting rainwater runoff. RWH can increase yields in rain-fed systems, as well as moderate against crop failure during dry periods and redistribute erratic rainfall more evenly throughout the growing season. This is particularly critical for semi-arid zones where the impacts of rainfall variability can be more severe.

Evidence of prioritization of RWH can be found in several places: the NAPA included several activities focused on RWH, and MKUKUTA-II includes related activities. A recent study on RWH potential in Tanzania found that, considering topography, aridity index and livelihood-based demand, in-situ RWH could benefit 0.32 to 1.5 million households and could cover up to 2.6 million ha if 50% of farmers in areas suitable for RWH adopted the technology. RWH is seen not only a strategy to better manage water resources (especially in semi-arid areas), but also as a strategy to expand irrigated areas. Figure 5 indicates that RWH investments should be targeted to areas that are suitable for the technologies, which roughly correspond to livelihood-based demand for RWH.

Figure 5: Potential for in-situ RWH and corresponding livelihood demand



Water availability and climate impacts in irrigation planning are not fully understood. Sectoral development plans including the Agricultural Sector Development Strategy (ASDS), the National Irrigation Master Plan (NIMP), Kilimo Kwanza Strategy and the SAGCOT Investment Blueprint all aim to promote significant expansion of irrigated land to promote rural development. These policies, however, do not rigorously consider climate variability impacts or water availability in the design of new irrigation, but focus on increasing the coverage of irrigated agriculture in relation to rain-fed agriculture. Irrigation schemes visited for a review of ASDP also showed increasing water shortage due to a combination of climate variability and increasing numbers of users.[93]

Enforcement of Environmental Impact Assessment is weak and may not be sufficient to assess environmental and/or climate change impacts for broad irrigation programs. The 2010 National Irrigation Policy requires all irrigation developments to conduct regular Environmental Impact Assessments (EIAs), which should consider climate change projections in the context of impacts on water availability. This has two main limitations: first, despite the policy mandate for EIA, older schemes where rehabilitation interventions predominate are not required to do so, and most schemes supported by ASDP funds did not conduct full EIAs (carrying out environmental screening instead). Second, EIAs done on a project-by-project basis may miss significant cumulative impacts of overall policy, plans and programmes which is better suited

[93] Nkonya (2013)

to Strategic Environmental Assessment. This would be an advisable activity, for example as part of the update of the National Irrigation Master Plan.

Major data gaps exist including a centralized place for storage and retrieval of climate projections, water resources availability, the locations of irrigation infrastructure, and land. These data gaps are made more critical by the fact that hydrological data is not combined with climate forecasts when irrigation planning is taking place. MAFC currently makes no provisions in their irrigation plans for floods or extreme rain events.[94] Multiple reports, including the ASDS performance assessment of December 2012 (p.34) states that one of the constraints for sustainable use of water resources is the "inadequate hydrological data and information". It is essential that hydrological data are shared and available for planning, such as before irrigation investments are undertaken so that these have a chance of being integrated and applied for sustainability.

Interventions that and 'no-regrets' actions build resilience and align well with existing MAFC policy. Tanzania's core agricultural growth and development strategies and programs emphasize sound natural resource management if the sector is to grow sustainably (Box 8). The NCCS also notes that agricultural development is strongly dependent on sustainable utilization of environmental resources including water, land, and forests, and states that these resources must be used sustainably for long-term growth in the sector.[95] TAFSIP, as one of the sector's guiding investment frameworks, recognizes these links by placing irrigation together with sustainable water resources and land use management as one unified investment area. An assessment of irrigation under Tanzania's Agriculture Sector Development Programme[96] stresses that climate change and other challenges point to the need to better develop agricultural water management to meet the sector's development goals.

Box 8: Natural resource management in agricultural policy

Agriculture Sector Development Strategy **TAFSIP** **CAADP** **Vision 2025**	*"…Have an agricultural sector that is modernized, commercial, and highly productive and which utilizes natural resources in a sustainable manner"*
SAGCOT Blueprint	*"Long-term benefits from agricultural growth will be undermined if the ecosystem and natural resources are not well managed."*
Five Year Development Plan	*"Tanzania's rich ecological resources need to be preserved and utilized at a sustainable manner."*
Tanzania Agriculture and Food Security Investment Plan	*"Appropriate use of natural resources that include land, water and forest would enhance productivity and profitability in the agricultural sector as well as conserve the environment…Future generations of Tanzanians will benefit from measures to prevent environmental degradation and sustainably manage natural resources."*

[94] Lukumbuzya (2013)
[95] NCCS, 2013
[96] Nkonya (2013)

Action 1A: Increase water use efficiency and water storage

	Key Investments
Policy	**1.1. Develop guidelines to ensure that irrigation expansion and rehabilitation plans and designs consider water availability, climate variability and climate change**, including designs for heavier rainfall and extreme events in addition to decreased water availability, increased severity, frequency and duration of droughts, and include design elements to minimize evaporation and seepage losses, and ensure sufficient drainage for downstream users. The guidelines can then be used to inform the revised National Irrigation Master Plan. **1.2. Develop policy briefs to update policies to emphasize water use efficiency improvements and embed climate change,** including the irrigation master plan and policy on agricultural water management, to consider water availability, climate change trends at the subnational level, and include measures for water use efficiency, rainwater harvesting and storage, and funding for environmental flow analyses for both existing and new small- and large-scale irrigation schemes.
Planning	**1.3. Conduct astocktaking on water use efficiency, water lifting technologies, rainwater harvesting and water storage techniques** under ASDP and other projects to assess costs and benefits, identify opportunities for scaling up successful interventions in suitable zones, examine opportunities for revenue generation, and recommend mechanisms to mainstream in agriculture sector projects. This should be coordinated with ARIs, District Irrigation Development Teams (DIDTs), ZITSU, and other stakeholders. **1.4. Use environmental assessment and enforcement strategically to integrate water availability and climate change into irrigation projects and planning,** including ensuring that water availability, downstream users, examining water permits[97], and climate change projections are considered in all new irrigation and rehabilitation projects. This will require preparing guidelines on mainstreaming water availability and climate change in the ESIA process, training on ESIA and monitoring, and capacity building for Strategic Environmental Assessment. SEA should be conducted for the updated National Irrigation Master Plan. **1.5. Promote the sustainable use of groundwater resources for irrigation purposes** including mapping areas with potential for groundwater, developing deep well boreholes and associated groundwater irrigation infrastructure, establish sustainable abstraction levels and rules, gauge usage, and monitor and evaluate groundwater condition.
Practices	**1.6. Support traditional and improved/modern rainwater harvesting techniques** in line with the provisions of the National Irrigation Policy.[98] This would include research and development, public private partnerships, training for Department of Irrigation and Technical Services (DITS), ZITSU, DIDTs, district agricultural planners, and all irrigator organizations. **1.7. Support on farm water storage facilities** for storing harvested rainwater during periods of water scarcity for farming activities, including underground tanks, charco dams, small earth dams, sand dams, sub-surface dams, bunds and wells. **1.8. Accelerate uptake of sustainable irrigation and water use efficiency technologies to smallholders,** which could include developing a financial mechanism and other incentives for suppliers and developers of these water technologies (e.g. treadle pumps, wind and solar power pumps) to reach smallholder farmers, starting in semi-arid and drought-prone areas. **1.9. Support innovative paddy rice production techniques** that can increase productivity, better manage water resources, and reduce GHG emissions (e.g. SRI). Conduct training and follow-up TA on these techniques to IOs, and sensitize DIDTs and ZITSU in implementing these innovative design and water management techniques.

[97] e.g. to ensure allocations reflect a portion of available water, rather than as absolute value across the year
[98] URT, National Irrigation Policy (2009), Subsections 2.4.1.1 and 2.4.1.2.

Action 1A: Implementation Factsheet

Increase water use efficiency and water storage

Appraisal

Priority: HIGH
Impacts of climate change on water availability for agriculture were ranked among the most severe risks by stakeholders. Water and land management are among the main environmental challenges posed by the sector that also impact productivity.

Cost: HIGH
Cost estimates to implement all activities could range from $80,000 - $60,000,000 over five years depending on if the focus would be more on capacity building or on infrastructure.

Targeting

Investments 1.1, 1.3, 1.6, and 1.7 target irrigated areas. Most of these actions would be implemented in high rainfall areas (Map 5), which also overlap as priority areas for BRN (Map 13) and SAGCOT. Some of these districts will fall under the proposed ASDP-2 (Map 14). IWMI (2010) has identified types of interventions that would have the most significant impact in these areas including river diversion and water lifting devices (Maps 9 and 10), which can be used to prioritize areas for these types of investments.

Investments 1.3, 1.2, and 1.8 are proposed to be implemented in arid and semi-arid areas. These areas are suitable for in-situ rainwater harvesting and to a lesser extent for water lifting devices (Map 11 and 10). Looking at financed or planned government actions, ASDP-2 is expected to address some parts of the arid area, while BRN is not addressing any of these areas, leaving most of the semi-arid area without support. It must be noted that a significant portion of food insecure areas will not be reached by these two programs implying the need for alternative source to finance actions called for herein.

Focal Point and Stakeholders

The MAFC DITS will lead on technical activities, with the EMU providing support on ESIA compliance and policy. LGAs are key stakeholders as well to carry out relevant activities at the district level. Other key stakeholders include academic institutions, Ministry of Water, NGOs, and Development Partners. The private sector will be key to engage, especially for Investments 1.5 – 1.9. Activities should link closely with major agricultural intensification programs such as ASDP-2, BRN, and SACGOT that have significant irrigation investments. MAFC should also coordinate with MoW's Dialogue Forum on Climate Change, and the MoW climate change action plan.

#	Key Investments	Priority	Cost	Target area	Responsible
1.1	Develop guidelines to ensure that irrigation expansion and rehabilitation plans and designs consider water availability, climate variability and climate change	High	Low	Irrigation BRN, ASDP2, & SAGCOT	DITS
1.2	Develop policy briefs to update policies to emphasize water use efficiency improvements and embed climate change	High	Low	Nationwide	EMU, DITS
1.3	Conduct a stocktaking on water use efficiency, water lifting technologies, rainwater harvesting and water storage techniques	Medium	Medium	Rufiji, Pangani IDB, and Lake Victoria basins	Universities, DRD
1.4	Use environmental assessment and enforcement strategically to integrate water availability and climate change into irrigation projects and planning	High	Low	Irrigation BRN & SAGCOT	DITS, EMU, NEMC
1.5	Promote the sustainable use of groundwater resources for irrigation	Medium	Medium	Arid/Semi-arid	DITS, MoW
1.6	Support traditional and improved rainwater harvesting techniques	High	High	Arid/Semi-arid	DITS, LGA
1.7	Support on-farm water storage facilities	Medium	High	Arid/Semi-arid	DITS, LGA
1.8	Accelerate uptake of sustainable irrigation and water use efficiency technologies to smallholders	Medium	High	Irrigation BRN & SAGCOT	DITS, LGAs
1.9	Support innovative paddy rice production techniques	High	Low	BRN, SAGCOT	DITS, LGA

Action 1B: Improve catchment management in agricultural planning

	Key Investments
Policy	**1.10. Develop an agricultural land and water coordination mechanism** between the Ministry of Water (including Water Basin Offices), the DITS, MAFC-Division of Land Use Planning, and other key stakeholders to participate in catchment ecosystem management and fill critical information gaps on hydrological data, land use, ecosystem function and environmental indicators, payment collections and expenditures according to properly established priorities, maintenance requirements and climate change. This should include mainstreaming the ACRP in the review process of the Agricultural Land Use Plan.
Planning	**1.11. Develop conservation management plans upstream and downstream of irrigation scheme catchment areas** to curb the declining irrigation water supply, especially during the dry season when it is most needed. Government at the district level (e.g. District Environmental Management Officer, District Agriculture and Livestock Development Officer, Basin Water Officer) should develop and implement these plans. District government should be capacitated and empowered to coordinate stakeholders and enforce conservation management plans and existing laws related to conservation. This should be piloted in the 10 districts receiving BRN irrigation investments and then scaled up in other areas with irrigation investments. **1.12. Develop a stakeholder engagement strengthening program to protect water catchment areas in areas slated for agricultural intensification** under programs such as ASDP, SAGCOT and Big Results Now, This would include local communities and their Water User Associations, Community Based Organizations (CBOs)/Civil Society Organizations (CSOs), and the private sector
Practices	**1.13. Develop guidelines, curriculum and capacity building training for existing and new Water User Associations** on agricultural water management and climate change for decision-making/planning, in line with policy recommendations made under Action 1.6. **1.14. Accelerate the uptake of soil and water conservation measures on irrigated and dry-land farms** to enhance water infiltration, reduce runoff and reduce evapo-transpiration and maintain healthy catchments.

Action 1B: Implementation Factsheet
Improve catchment management in agricultural planning

Appraisal

Priority: HIGH
Agriculture contributes to land degradation in catchment areas, affecting downstream agriculture, as well as causing impacts to other sectors including tourism, forests, and energy. Better catchment management would improve water flow for irrigation and other downstream uses while reducing erosion and siltation of infrastructure.

Cost: MEDIUM
The estimated cost to implement all activities is approximately $3,500,000 over five years.

Initial Targeting

Investments proposed in Action 1B are aimed at protecting areas upstream of irrigation and RWH systems from degradation. The major emphasis is in high rainfall areas, with lesser emphasis in semi-arid regions. These actions are proposed to be implemented largely through BRN and ASDP-2 since these programs support most irrigation systems. All of the proposed actions are no-regrets investments and are already being implemented in some of the identified areas, albeit at a very low level. There is a strong need to upscale these activities in the current and proposed government programs since almost all of them fall under the high priority category.

Focal Point and Stakeholders

EMU will take the lead on coordination and stakeholder engagement roles, and the MAFC Department of Irrigation and Technical Services will be key for planning activities and engagement with Water Users Associations.

Other key stakeholders include the MAFC-Department of Land Use Planning and Ministry of Lands, Housing, and Human Settlements Development, CSOs, and Water Users Associations. In addition to identifying opportunities to support catchment management through major agriculture programmes (ASDP-2, BRN, SAGCOT), there could be a good opportunity to link with the REDD+ programme to protect water catchment areas near irrigation schemes.

#	Key Investments	Priority	Cost	Target area	Responsible
1.10	Develop an agricultural land and water coordination mechanism	High	Medium	National	EMU, DLUP, MoW
1.11	Develop conservation management plans upstream and downstream of irrigation scheme catchment areas	High	Medium	Irrigation BRN & SAGCOT	DITS
1.12	Develop a stakeholder engagement strengthening program to protect water catchment areas in areas slated for agricultural intensification	High	Medium	Irrigation BRN & SAGCOT	EMU
1.13	Develop guidelines, curriculum and capacity building training for existing and new Water User Associations	Medium	Low	National	MoW, DITS
1.14	Accelerate the uptake of soil and water conservation measures on irrigated and dry-land farms	High	High	Arid and Semi-arid	DLUP

Action 1C: Adopt sustainable agricultural land and water management to reduce degradation

	Key Investments
Policy	**1.15. Develop guidelines and principles on sustainable soil and water management**. Guidelines and 'rules-of-thumb' in the form of a pocket manual are intended to equip extensionists, relevant NGO and progressive farmers with appropriate approaches or methods to be used and simple practices in addressing land management problems under differing environmental conditions.
Planning	**1.16. Build capacity of LGAs, NGOs and other development partners to plan, implement and monitor sustainable land management practices that target communities**. This will be in the form of practical training of trainers (ToT) at the district level on sustainable land management technologies for dissemination to farmers. This will improve capacity of farmers to manage land as a basis for improving productivity. This will also increase efficient use of agricultural inputs such as fertilizer by ensuring its optimal availability to crops, and avoid negative impacts such as erosion and land degradation. **1.17. Support preparation of agricultural land management plans at village level to guide sustainable land use,** which would include both subsistence and commercial farming and look at upstream and downstream water users and uses. This action will support the present efforts of ensuring agricultural development (especially at the village level) is guided by a properly laid out plan based on land suitability, including soil and climatic conditions of the area. Given the linkages, this could be started in REDD+ Project areas and scaled-up. **1.18. Support land use planning at the district level and monitoring of both subsistence and commercial farming activities,** including the identification, demarcation and development of Agricultural Land Use and Land Management Plans. Given the linkages, this could be started in the SAGOT, BRN and REDD+ Project areas and then scaled up.
Practices	**1.19. Increase community awareness of sustainable land and water management on farmlands,** using a wide variety of communication strategies and methods and via 'champions and case studies of good practice'. MAFC, using participatory approaches involving the extension service, professionals, and local development organizations, has raised considerable awareness on crop production practices. Initially, such efforts can be focused to areas under the SAGCOT and BRN programs. **1.20. Promote appropriate agroforestry technologies to improve livelihoods and the environment.** Improved land use systems which integrate trees and agriculture such as agroforestry have the potential to mitigate extensive forest, soil and environmental degradation while providing for essential household needs and service such as food, fuelwood and soil fertility improvement. **1.21. Identify and promote sustainable traditional farming systems, indigenous technologies, and farmer initiatives under similar agroecological/agro economic conditions.** Indigenous farming systems and practices still play an important role in ensuring food security and environmental conservation. Most such surviving systems and practices have climate smart and food security elements. Identification and promotion of such systems and practices will contribute to the present efforts of adaptation to climate change. MAFC- DLUP has experience in some of these indigenous farming systems such as the Chagga home garden and the Matengo pits "ngoro"

Action 1C: Implementation Factsheet

Adopt sustainable agricultural land and water management to reduce degradation

Appraisal

Priority: MEDIUM
Many practices related to sustainable on-farm land and water management exist, so there are good practices to draw from. Priority investments are needed to scale up such practices.

Cost: MEDIUM
Costs range from approximately $3,000,000 to $12,300,000 over five years for implementation of all activities. This action is lower in cost given most activities are related to capacity building and planning.

Initial Targeting

Most of the Outcome 1C actions are proposed to be implemented in arid or semi-arid areas and a few are proposed to be implemented in high rainfall areas especially highlands, with the goal of reducing soil erosion and sustaining production of high-value crops. Highland areas are appropriate to adopt soil and water management measures such as construction of terraces.

The greatest impacts of climate change are likely to occur in the arid and semi-arid regions, which also tend to be food insecure (Map 3). While these areas are not targeted through BRN, some are covered by ASDP-2 but the majority are not supported through these large investment programs, implying the need to leverage additional resources, potentially through Development Partners and/or NGOs. Some of the specific interventions can include building infrastructure and systems that support in-situ water harvesting.

Focal Point and Stakeholders

The primary focal point to lead on these activities is the MAFC Department of Land Use Planning (D-LUP). The MAFC Division of Crop Development would be key in implementing activities related to on-farm activities (e.g. 1.15 and 1.21). Other stakeholders include NGOs and CSOs (which can well-placed to help support planning processes), and academic institutions (e.g. Institute for Resource Assessment, Ardhi University).

#	Key Investments	Priority	Cost	Target area	Responsible
1.15	Develop guidelines and principles on soil and water management	Medium	Low	National	DLUP, DMECH
1.16	Build capacity of LGAs, NGOs and other development partners to plan, implement and monitor sustainable land management practices that target communities	Low	Low	Arid/Semi-arid	DLUP
1.17	Support preparation of agricultural land management plans at village level to guide sustainable land use	High	High	BRN and SAGCOT	DLUP
1.18	Support land use planning at the district level and monitoring of both subsistence and commercial farming activities	High	High	SAGCOT and BRN	DLUP, NLUPC, LGA
1.19	Increase community awareness on sustainable land and water management on farm lands	Medium	Low	Arid/Semi-arid	DLUP
1.20	Promote appropriate agroforestry technologies to improve livelihoods and the environment	Medium	Medium	Highlands	DLUP, MNR
1.21	Identify and promote sustainable traditional farming systems, indigenous technologies, and farmer initiatives under similar agro-ecological/agro economic conditions	Medium	High	Arid and Semi-arid	DCD, DRD (Farming Systems Section)

Action 2: Increase yields through Climate Smart Agriculture

Action 2: Increase yields through Climate Smart Agriculture

Situation Analysis

Smallholder farmers are among the most vulnerable to climate change: better farming practices can increase yields, safeguard natural resources, and build resilience against climate variability.

Better agricultural practices can increase resilience of smallholder farmers to climate change.[99] This can be done through scaling up practices that are considered Climate Smart Agriculture. There are not specific CSA technologies or practices that can be universally applied, but rather is an *approach* to agriculture that requires site-specific consideration of what technologies and practices are most appropriate - it can include practices such as sustainable soil and land management, drought and heat tolerant crop varieties, water use efficiency and integrated pest management.

There are demonstrated benefits to smallholder farmers of climate smart agricultural practices in Tanzania. For example, in certain areas zero tillage can greatly improve crop security by retaining out of season rainfall in the soil, and also mitigates greenhouse gas emissions through reducing soil disturbance. In other areas, such as those featuring hardpan soils, other practices such as soil ripping are more appropriate for loosening compact soils and reducing rainwater runoff. If used in suitable conditions, such practices mitigate against low agricultural productivity and declining soil fertility – both common challenges for the majority of Tanzanian farmers. Financial returns are evident in farms using terracing, which conserves soil moisture, and returns were even higher when combined with multiple other climate-smart agricultural practices such as minimum tillage and cover crops.[100] Using rippers for tilling has been shown in many cases to increase yields, reduce soil erosion, lower greenhouse gas emissions, and reduce labor costs to both men and women[101] – so uptake by farmers has great potential to improve productivity.

Box 9: Quantifying the benefits of conservation agriculture

"Conservation agriculture provides a viable means for strengthening resilience in agroecosystems and livelihoods that also advance adaptation goals."
-Intergovernmental Panel on Climate Change (2014)

Conservation Agriculture (CA) is a concept which emphasizes practices such as minimum or no-till direct seeding, and soil cover using dead mulch or leguminous cover crops that can increase soil fertility and crop rotations that are judiciously selected to control pests and diseases from the previous crop. Various forms of CA have been practiced in some areas of Tanzania for decades, including with maize and sunflower crops in drought-prone areas in the Southern Highlands in Mbeya and Njombe. Development of the SAGCOT Greenprint included an analysis of the potential benefits of wider adoption of CA on maize crops in Mbeya Rural district. The analysis found that, without increasing the area under maize cultivation, **yield would increase by an estimated 1.1 tonnes/hectare, crop water use efficiency would nearly double, and soils would be able to store substantially more carbon**. Another case study in the Mbeya Rural District found that Mbeya maize yield increased 26–100%, sunflower by 360%, in addition to reducing labor for preparing land as well as planting.[102]

While CSA practices have been successful, wider uptake across Tanzania has been a challenge:[103] While activities are taking place but the coverage remains limited to a few villages and districts, and there is no comprehensive program to target interventions to vulnerable areas where climate and environmental risks are highest. Key barriers include:

CSA costs and benefits are not well known: Some studies and programs have indicated that there are certain costs that stop wider uptake of climate smart agriculture – for example higher labor costs for some

[99] NCCS (2013)
[100] Findings from Sokoine University of Agriculture (2011)
[101] See, for example, Mkoga et al (2010), Sokoine University of Agriculture (2011), Bishop Sambrook et al (2004).
[102] Shetto and Owenya (2007)
[103] Yanda (2013), Lukumbuzya (2013)

techniques, necessary implements might be more expensive and the returns in productivity uncertain, and/or there may be maintenance costs.[104] These conclusions are from smaller case studies, and no large-scale analysis has been done to better quantify the costs and payoffs of CSA.

CSA practices are a low priority in agricultural investment plans: Investment in CSA tends to be supported by NGOs in selected districts, and not well prioritized in district planning through DADPs nor nationally coordinated. There could be many reasons for this, including limited funds, rendering other investments such as irrigation and extension services higher priorities.

Local characteristics are not widely considered: Because climate smart agriculture includes many overlapping practices and technologies, selecting those that are appropriate depends on many site-specific factors from agro-ecological zone to crops to landscape to land tenure. More information to understand which CSA activities are appropriate in given areas to better target interventions.

Good practices could be better captured: Awareness and capacity to adopt CSA practices and technology are assumed to be low in Tanzania, but there are clear cases where education and training have significantly scaled up adoption – both with farmers that were directly trained, and then those that adopted indirectly through following the example. Good practices are evident, but there is no mechanism to capture and promote positive lessons on a larger scale.

A foundation is needed to scale up CSA. It is recommended that MAFC first adopt the FAO definition of Climate Smart Agriculture and agree on the types of activities that should be promoted as climate smart. This is to ensure that references to CSA practices are consistently defined in policies and programmes, and therefore easier to promote through planning and finance:

> *"Agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes greenhouse gases (mitigation) and enhances the achievement of national food security and development goals (reduces poverty)."*
> -FAO Definition of Climate Smart Agriculture

Table 6 presents stakeholder recommendations for a classification of climate-smart agricultural practices in Tanzania proposed for the agriculture sector for the purposes of policy mainstreaming and planning:

Table 6: Climate Smart Agriculture Interventions

Practice	Types of Interventions	
Conservation agriculture	▪ Minimum tillage/direct seeding ▪ Cover crops ▪ Crop rotation ▪ Contour cropping	▪ Mulching / composting ▪ Intercropping with leguminous cover crops ▪ Crop rotation
Soil and water conservation	▪ Crop residues management ▪ Mulching ▪ Rainwater harvesting ▪ Pit and trench farming ▪ Ripping and subsoiling ▪ Raised beds	▪ Contouring ▪ Terracing ▪ Charco dams ▪ Bunding ▪ Composting ▪ Planting basins, tie ridges
Resilient crop varieties	▪ Drought tolerant varieties ▪ Early maturing varieties ▪ Water efficient varieties	▪ Pest and disease resistant varieties ▪ High yielding varieties ▪ Heat tolerant varieties
Cropland management	▪ Crop diversification ▪ Cover crops ▪ Bottom valley farming ▪ Green manuring	▪ Crop rotation ▪ Integrated pest management ▪ Reduced tillage ▪ Residue management
Soil fertility management	▪ Soil fertility evaluation ▪ Organic and inorganic fertilizer ▪ Integrated nutrient management ▪ Water conservation	▪ Improved manure handling ▪ Compost integration ▪ Mulch integration ▪ Soil conservation

[104] CCAP (2013)

Agro-forestry	▪ Establishing tree nurseries ▪ Agricultural friendly trees (N suppliers) ▪ Crop tree planting ▪ Woodlots in transition to renewable energy fuel use	▪ Land and catchment reclamation ▪ Alley cropping ▪ Windbreaks ▪ Fodder banks ▪ River and stream protection

The interventions outlined above in Table 6 **are the basis for the following CSA investment programme, which aligns with current agricultural growth strategies.** Several of the major agricultural growth strategies already call for implementation of CSA interventions. ASDP-2, for example, includes investments in conservation agriculture, but as seen above the practices considered conservation agriculture is but one subset of practices within a much larger CSA toolbox. The SAGCOT Blueprint goes farther in stating that SAGCOT investments will help farmers adapt to climate change through development of adaptation strategies, including drought-tolerant crops, water harvesting, soil moisture retention, minimal tillage,[105] which is further analyzed in the SAGCOT Greenprint (Box 9). The foundation is therefore in place to scale up investments that will build resilience while at the same time boosting crop productivity and benefiting smallholder farmers.

Box 10: Leveraging existing strategies and plans to promote CSA

The clearest entry point for implementation of CSA is the upcoming larger-scale programs, including ASDP-2/BRN, and SAGCOT. While generally aimed at promoting agricultural commercialization, these programs include activities on increasing smallholder farmers productivity, building capacity through improved extension services, and research and development. Lessons can be gained from projects such as the Chololo Ecovillage which has demonstrated results: with improved seeds and good agricultural practices, yields have more than doubled for maize, sorghum, pearl millet, sunflower and groundnuts. [106]

The **SAGCOT Blueprint** provides a high-level commitment to environmental management and climate adaptation at the farm level, with the **SAGCOT Greenprint** as a complement that provides specific measures and strategies for guiding implementation of higher-level objectives. The **REDD+ Action Plan** (2013) also has great potential to finance interventions in conservation agriculture, agro forestry, mixed farming.

[105] URT (2011)
[106] Global Climate Change Alliance (2014)

Action 2: Increase yields through Climate Smart Agriculture

	Key Investments
Policy	**2.1.** **Build the evidence base to promote CSA,** including conducting a cost-benefit analysis and participatory evaluation of CSA vs. alternative practices, identifying what practices are appropriate for specific crops and livelihood zones, ascertaining 'barriers' and 'overcomers' to scaling up CSA and uptake at the farm level for specific practices and crops (e.g. investment costs, labor, maintenance costs), and recognizing and rewarding good practices and successes. **2.2.** **Develop clear guidelines and policy briefs for CSA technologies and practices** so these can be better mainstreamed into agricultural programmes such as ASDP-2. Guidelines should draw from existing good practice examples (both in Tanzania and in the region), and be specific to the feasibility of technologies and practices in livelihood zones, crops, and by gender. **2.3.** **Establish an emissions baseline for the agriculture sector**, and estimate emissions reductions of different CSA practices. This can prepare the sector to apply for climate change mitigation finance in projects that promote CSA.
Planning	**2.4.** **Build capacity at the District level for mainstreaming CSA in planning** through training and sensitisation of District officials, ARIs, and technical officers to build understanding and awareness of CSA. Sensitisation of district officials to mainstreaming climate adaptation in planning can draw from initial ongoing pilots in dryland areas, for example, including the development of adaptation finance mechanisms. **2.5.** **Promote CSA in DADPs planning process** through building awareness of appropriate technologies and incorporating climate resilience into district plans, starting with vulnerable districts that have productivity potential **2.6.** **Establish a monitoring system for CSA interventions**, once CSA is defined. Monitoring parameters should be decided by MAFC and can include uptake of different practices, district investments in DADPs, and a sample of case studies that track changes in yields, land and water conservation outcomes, and food security.
Practices	**2.7.** **Develop incentives to offset the costs of CSA** for smallholder farmers, districts, NGOs, and the private sector. Based on the findings of the cost-benefit analysis, a program can be designed to offset costs and other barriers to encourage planners and farmers to prioritize implementation of CSA interventions. This can also be used to promote CSA innovations and indigenous knowledge. **2.8.** **Increase awareness and capacity for CSA practices through practical training** for farmers, extension agents, and district agricultural planners. This can be done through MAFC programmes such as ASDP-2, including CSA in Farmer Field Schools, identifying and promoting champion farmers, and reviewing the curricula for in-service training of extension/ARI staff to identify entry points for training. **2.9.** **Demonstrate good CSA practices in the field.** This would include (i) Establishing one CSA demonstration farm in each agro-ecological zone, (ii) Developing resource centres for CSA on a regional level.

Action 2: Increase yields through Climate Smart Agriculture Implementation Factsheet

Appraisal

Priority: HIGH
Investments in CSA have a high potential for both improving productivity of vulnerable farmers, but also safeguarding natural resources in the near term into the long term.

Cost: MEDIUM
The estimated cost for implementation of all activities is approximately $2,000,000 over five years. The cost is modest given that most activities are related to analyses, awareness, planning, and capacity building.

Targeting

Building and promotion of climate-smart agriculture practices is the focus of Outcome 2. Most of the actions under this outcome are addressing adaptation as shown in Table 12. With exception of investment 2.7, which is proposed to be implemented in the BRN districts, the rest are proposed to be implemented either at country scale or in the selected agro-ecological zones. The proposed agro-ecological zones for implementation include alluvial plains, northern highlands, plateau, semi-arid lands, southwestern highlands, southern highlands and western highlands. BRN districts are proposed because it is much easier to realize the benefits of CSA in high rainfall areas. For example, interventions such as improving planting density and use of fertilizer to increase productivity can easily show positive outcomes if properly implemented.

Focal Point and Stakeholders

The MAFC Environment Management Unit and Department-Land Use Planning would coordinate on a leadership role for promoting CSA within MAFC and at the District level. Districts should then translate these lessons to the farm level. The Department of Mechanisation (D-MECH) is also key to involve in technologies and equipment for CSA practices. The private sector, NGOs, and academic institutions will be engaged as key implementers.

#	Key Investments	Cost	Priority	Target area	Responsible
2.1	Build the evidence base to promote CSA	Medium	High	National	DMECH, DLUP, EMU
2.2	Develop clear guidelines and policy briefs for CSA technologies and practices	Low	Medium	National	DMECH, DLUP, EMU
2.3	Establish an emissions baseline for the agriculture sector	Low	High	National	DLUP/EMU
2.4	Build capacity at the District level for mainstreaming CSA in planning	Low	High	National	DPP, DMECH, DLUP, EMU
2.5	Promote CSA in DADPs planning process	Medium	High	SAGCOT, BRN	DPP, DLUP, EMU
2.6	Establish a monitoring system for CSA interventions	Low	Medium	National	DPP, DLUP, EMU
2.7	Develop incentives to offset the costs of CSA	Low	High	National	DLUP, EMU
2.8	Increase awareness and capacity for CSA practices through practical training	Low	High	National	DMECH, DLUP, EMU
2.9	Demonstrate good CSA practices in the field.	Medium	High	AEZ, Regions	DMECH, DLUP, EMU, LGAs

Action 3: Protect the most vulnerable against climate-related shocks

Action 3: Protect the most vulnerable against climate-related shocks

Situation Analysis

Weather-related risks are the largest threats to agricultural productivity and food security in Tanzania.

Because agricultural livelihoods, food security, and weather are so tightly linked for smallholder and subsistence farmers, which are the majority of Tanzanians, even minor climate variability at some times of the year can represent a shock to income or food availability. The National Strategy for Growth and Reduction of Poverty explicitly recognises the fact that Tanzania's poor rely heavily on natural resources and are most vulnerable to external shocks and environmental risks, including extreme weather events.[107] For example marginal cropping areas are particularly vulnerable at the end of the dry season because of the low capacity to store food through to the end of the next wet season. For the top three food security shocks (late/less rainfall, high food prices, pests/diseases), the most common coping mechanisms by households is spending savings or relying less on preferred foods – households that are poorer and already having less food consumption are more likely to cope through strategies that directly impact the amount of food eaten (whereas richer household to cope by expending more assets).[108] Box 11 outlines key issues for food security in Tanzania, many of which are related to weather but also low levels of adaptive capacity that amplify the impact of weather variability.

Box 11: Key issues in food security in Mainland Tanzania

- Vagaries of weather causing instability in food supply and periodic shocks
- Lack of early warning and weak system of social protection and disaster preparedness and response
- High post-harvest losses depleting food stocks
- Weak early warning systems
- Hiking food prices
- Low productivity of food crops, livestock and fisheries
- Low capacity of current food reserve structures
- Inadequate and poor food storage facilities at household levels
- Weak and inadequate school feeding programmes.
- Poor and limited rural storage preservation facilities

Source: TAFSIP, 2011

Better management of weather-related risks is needed before, during, and after shocks occur. Interventions for the types of risks typically faced by the agriculture are of three types: (i) Risk Mitigation, or actions to prevent events from occurring, limit their occurrence, or reduce the severity of the resulting losses. Examples include pest and disease management strategies, crop diversification, and extension advice, (ii) Risk coping, or actions to help the victims of a risky event (a shock such as a drought, flood, or pest epidemic) cope with the losses it causes. Examples include government assistance to farmers, debt restructuring, and remittances through mechanisms such as social safety net programs, (iii) Risk transfer, or actions that transfer risk to a willing third party, at a cost. Financial transfer mechanisms trigger compensation or reduce losses generated by a given risk, and they can include insurance, reinsurance, and financial hedging tools. Box 12 outlines priority measures in each of these areas that were recommended by ACRP stakeholders.

[107] MKUKUTA-II (2010)
[108] URT (2010a)

Box 12: Recommended priority risk management strategies[109]

Risk Mitigation	Risk Transfer	Risk Coping
▪ Post harvest technologies ▪ Improved food storage facilities ▪ Strategic Grain Reserve of at least 4 months of national food requirement maintained[110] ▪ Appropriate design of storage facilities to reduce evaporation ▪ Improve drying technologies ▪ Strengthening MAFC Early Warning System ▪ Improve rainfall forecasting and communication protocols ▪ Integration of indigenous forecasting in early warning systems	▪ Market and pricing instruments ▪ Crop insurance schemes ▪ Microfinance and cooperative opportunities ▪ Replanting subsidies ▪ Crop insurance for pests and diseases ▪ Introducing crop micro insurance facilities[111]	▪ Social safety nets such as the Tanzania Social Action Fund

Tanzania has plans in place for building resilience to weather-related shocks, but implementation has not kept pace with the level of risk. The Tanzania Agriculture and Food Security Investment Plan (TAFSIP) has developed a comprehensive action plan on disaster management. This includes activities on early warning systems, emergency response and preparedness, reformulation of an institutional system for disaster risk management and preparedness, and capacity building[112] in order to mitigate the effects of climate change and prepare for and respond to extreme events. Additionally, the Tanzania Social Action Fund (TASAF) a social safety net program nearing its third phase, is directly intended to build resilience of the most vulnerable and protect them against shocks. TASAF plans to carry out a selection of the most vulnerable household and provide funding when disasters occur, which could provide lessons and linkages for the agriculture sector. Additionally, there could be potential opportunities for collaboration with the agriculture sector since activities under the TASAF public works program directly (e.g. building charco dams), and indirectly (e.g. generally boosting income) contribute to climate resiliency. Initiatives are currently underway in many of the areas recommended by stakeholders than can be drawn from and coordinated with the ACRP (Box 13).

Box 13: Ongoing initiatives linked with reducing risk to climate shocks

Other initiatives are underway to set up and strengthen **Early Warning Systems**, such as a UNDP-financed program on climate information and early warning systems. It will be important to link with these ongoing efforts to scale up systems and avoid designing parallel frameworks. Frameworks for pest monitoring and control such as the International Red Locust Control Organization for Central and Southern Africa could provide lessons for expanding activities on integrating pests and diseases into existing frameworks.

Value chain development is a core component of ASDP-2, so coordination with the program will be essential. The Sokoine University of Agriculture is undertaking a research program on value chain upgrading strategies and agribusiness, which could relate well with linking value chain development with climate change. The main actors for linking agricultural value-adding activities to climate change are the MAFC Department for Research and Development, academic institutions such as the Sokoine University of Agriculture, the MAFC Department for Mechanisation, and the Department for Food Security and Early Warning Systems, which can assist in targeting activities. Other stakeholders include private sector actors, the Tanzania Chambers of Commerce, Development Partners (e.g. UNIDO) and NGOs that are able to promote market linkages.

Policy analysis will also be supported under ASDP-2 with a focus on improving value chain analysis. The ASLMs will strengthen their work on analyzing specific commodities and how to improve different areas of their respective value chains. MAFC – EMU can collaborate with these other actors to strengthen the climate resilience elements of the expected value chain analysis work under ASDP-2. Commodity teams to be set up under ASDP-2 for priority commodities will bring together expertise from the ASLMs, from other initiatives, such as SAGCOT, and from the private sector. The teams will develop policy briefs and other analysis that aim to promote suitable measures to alleviate barriers along the commodity chain from input supply to consumption or trade. Similarly, this mechanism

[109] URT (2013d)
[110] URT (2010b)
[111] See, for example, pilot projects by MicroEnsure, including access to credit by small-scale farmers in the Kilimanjaro region
[112] See TAFSIP Programme 6

could support development of policy briefs to promote the building of greater climate resilience along the entire length of the various commodity value chains, from production to market.

The Department of Food Security and Early Warning Systems would be best place for leading work to oversee **development and piloting of risk transfer mechanisms**. MAFC can coordinate and draw lessons from organisations that have piloted these types of activities, such as WorldVision (which has experience with crop insurance arrangements in the Same district) and microfinance institutions such as MicroEnsure, which has offered small loans for sustainable agricultural practice projects.

The costs of weather-related risks on the economy and livelihoods is high, yet there have been constraints in adopting comprehensive risk management strategies.

Investment in disaster risk management is low. Specific gaps that have been identified for agriculture include limited emergency response and preparedness facilities, weak meteorological information and set-ups, lack of well-organized disaster maps highlighting the major sources of disasters in the country, weak institutional integration on the overall early warning system for disaster response and preparedness.[113] TAFSIP's investment plan for natural disasters is comprehensive and covers these issues, yet implementation is under-resourced – only about 1% of the funds required to implement TAFSIP's investments in disaster risk management and climate change has allocated.[114]

Communication of weather and early warning information to farmers is limited. Although the government's early warning and food security systems are comprehensive it was admitted by MAFC that there needs to be improvements to the networks used to disseminate early warning messages to communities. The Division of Disaster Management protocols are currently sufficient to identify vulnerable villages within administrative districts and wards but there are limits to the system's ability to locate vulnerable households. Difficulties in interpreting and applying the forecasts as they are currently expressed include mismatch between the variables forecast and the operational needs of farmers, lack of trust, and understanding the forecasts.[115]

Pests and disease identification and remediation are under-resourced and are currently a significant risk to crop productivity which could worsen. Pests and diseases rank as amongst the highest risks to agricultural productivity and food security.[116] Despite the current risks and assumptions that climate change will exacerbate pest and disease outbreaks, very little is known about the potential impacts of climate change and research capacity at the regional and national level is limited. Integration of pests and diseases information into early warning messages are also not well developed. The interaction between climate, pests and diseases needs to be further researched before more advanced upscaled monitoring and control systems can be deployed.[117]

Diversification of livelihoods is key to building resilience to climate variability. While livelihood diversification through actions such as postharvest processing and value addition industries has been proposed as an adaptation option and Big Results Now are targeted in select crops and investment areas. While positive, the criteria for prioritization could leave many climate vulnerable areas excluded from potential investment in strengthening value chains that could support building resilience to climate variability and shocks.[118]

While risk transfer mechanisms are commonly proposed as climate change adaptation strategies,[119] there is little precedent for these activities and lack of quality data makes their design a challenge. For example there are few examples of crop or pest insurance schemes in Tanzania to draw from, and financial initiatives that would support climate resilience activities are limited in scope, mostly limited to small pilot projects on a localized scale. [120] Most of the initiatives designed to improve the finances of

[113] URT (2011c)
[114] Yanda (2013)
[115] Sokoine University of Agriculture (2007)
[116] See, for example, URT (2010a), World Bank (2013)
[117] Lukumbuzya (2013)
[118] Lukumbuzya (2013)
[119] National Climate Change Strategy (2013); Risk-Based Planning Workshop (2013)
[120] Lukumbuzya (2013)

rural communities has focused on establishing Savings and Credit Cooperative Societies (SACCOS), but these remain limited in scope.[121] There are lessons that could be drawn from other countries and the potential to identify, develop and pilot innovative mechanisms that address the barriers for risk transfer mechanisms for farmers.

Many food insecure areas will not be targeted by the major agriculture investment programs, including the priority districts in BRN, SAGCOT and ASDP-2 (Figure 6). Most food insecure districts are in arid and semi-arid areas, which may not be suitable for agricultural development. However, livelihoods in these areas are still largely agriculture-based, and they are the most vulnerable to even small changes in the onset of the rainy season and rainfall amounts. Therefore additional efforts may be needed, through the GoT or outside partners, to comprehensively target vulnerable and food insecure areas.

Figure 6: Food insecure districts and agriculture investment

Left: Food insecure districts, 2007-2016.
Center: Districts with planned BRN investments (2013)
Right: Districts with planned ASDP-2 investments (draft)

Data source: MAFC (maps by SUA)

[121] Lukumbuzya (2013). SACCOS establishment through DADPS/ASDP are being carried out in only 20 villages in 3 districts for the financial year 2011/2012

Action 3: Protect the most vulnerable against climate-related shocks

	Key Investments
Policy	**3.1.** **Implement the TAFSIP disaster management plan,** which includes a comprehensive program for strengthening early warning systems, emergency response and preparedness, strengthening safeguards and institutional systems governance and coordination. Lessons learned from similar initiatives, such as, UNDP's pilot projects on early warning systems could be scaled up. **3.2.** **Strengthen integration of pests and diseases into monitoring protocols and early warning systems, and develop research programs on the links between climate change and pest and disease outbreaks**. This should include (i) strengthening pests and diseases surveillance and monitoring system on non-outbreak pests, (ii) quarantine mechanisms to contain/isolate/ manage the spread of diseases and pests, (iii) developing a community knowledge base around pests and diseases using mobile phone technology (see ongoing pilot in Bagamoyo as a case study), (iv) Strategic Environmental Assessment for "outbreak pests" such Quelea quelea, locusts and rats.
Planning	**3.3.** **Improve communication of weather and early warning system information to farmers**, including improved coordination of hydrometeorological information between TMA and MAFC, and developing mechanisms to communicate information to farmers to enable planning decisions. This should include (i) designing a system of feedbacks on key weather and climate information, as well as weather forecasts from the end-users' perspectives, which is a gap in the current system, (ii) include the procurement, installation and management of real-time weather stations in climate risk hotspot localities which are part of a national overlapping system of stations, (iii) establishment and communication of an early warning system for selected crops that are developed in consultation with key stakeholder information needs, (iv) identification of opportunities for private sector involvement in communications technologies. **3.4.** **Inventory lessons from EWS, DRM, and social safety net projects and scale up successful interventions** to additional vulnerable districts identified in Action 3.2 in order to better mitigate and cope with the impacts of extreme events. **3.5.** **Undertake a research program on building resilience through postharvest processing and value addition** (PPVA) – for example to identify and promote PPVA features that best address climate risk in addition to income generation. This can provide guidance on the types of projects best suited to different agro-ecological zones, food processing technologies that secure food and prevents/recycles food wastage, guidelines for marketing strategies, engagement of the private sector, and the potential for sustainability certification of certain activities, recycling of waste products and recycling of packaging to transfer nutrients back on farm and capture carbon.
Practices	**3.6.** **Develop a program to establish value adding industries for farm products** initially in food insecure and drought-prone districts – e.g. this can start by taking lessons from ASDP-I, which financed value-adding activities, and scale up successes. This would include farm products for both indigenous and newer crops, and train farmers in developing marketing strategies for drought-resistant crops that are introduced in their areas (training on types of products, where they can be sold, etc.). A program can also provide incentives to the private sector or Tertiary Institutions to establish agro-processing facilities and roll out a sustainability certification (if developed through Action 3.5) **3.7.** **Develop a program on risk management solutions for smallholder agriculture,** which would include (i) research on crop insurance possibilities for smallholders, new finance instruments such as the potential for using title deeds on agriculture land for loan collateral, identifying climate considerations for finance instruments (e.g. longer grace periods in paying back loans), and how climate change could impact on insurance risks, how to engage female farmers, and barriers for financial institutions to lend to farmers, and mechanisms to safeguard farmers against poor lending practices, (ii) based on findings, pilot programs would be developed for insurance and financial instruments.

Action 3: Implementation Factsheet
Protect the most vulnerable against climate-related shocks

Appraisal

Priority: HIGH
Extreme events such as droughts are among the highest risks to agricultural productivity, and shocks can have significant impacts at all levels from the national economy to individual households. Pests and diseases are also a top risk to crop productivity, but little is known about the linkages with climate change.

Cost: HIGH
Costs to implement all activities, which include the action plan under the TAFSIP program, would range from approximately $27,000,000 to $44,000,000 over five years. Building capacity to prepare for and mitigate the impacts of extreme events and shocks has been under-resourced despite the risks, and systems need to be built from low levels of capacity.

Initial Targeting

All the proposed actions under Action 3 are relevant for national-scale implementation. For example, TAFSIP is already planned at national level. Actions 3.2 and 3.3 are related to early warning systems, which once implemented will have nation-wide impact. Proposed research under 3.2, 3.4 and 3.5 would be done in different agro-ecological zones, with results applicable in other locations. Development of programs in 3.6 and 3.7 should be carried out at national level though during implementation few districts could be selected.

Focal Point and Stakeholders

Key focal points for these activities are the DNFS - Early Warning section, MAFC-EMU, the Disaster Management Department in the Prime Minister's Office, and Tanzania Meteorological Agency. For pests and diseases interventions, the Department of Crop Development would be involved. Other key stakeholders include the MAFC Directorate of Food Security, zonal plant health centres and units, NGOs, research institutes, and District Executive Directors at the subnational level.

#	Key Investments	Priority	Cost	Target area	Responsible
3.1	Implement the TAFSIP disaster management plan	High	High	National	DNFS, PMO-DMD
3.2	Strengthen integration of pests and diseases into monitoring protocols and early warning systems, and develop research programs on the links between climate change and pest and disease outbreaks	High	High	National	DCD, TMA, EMU, DNFS, DRD
3.3	Improve communication of weather and early warning system information to farmers	High	High	National	EMU, TMA
3.4	Inventory lessons from EWS and DRM projects and scale up successful interventions	Medium	Low	National	EMU, TMA, PMO-DMD
3.5	Undertake a research program on building resilience through postharvest processing and value addition	High	Medium	National	DRD, SUA, DNFS
3.6	Develop a program to establish value adding industries for farm products	Medium	Medium	National	DMECH, DNFS
3.7	Develop a program on risk management solutions for smallholder agriculture	Medium	Low	National	DNFS

Action 4: Strengthen knowledge and systems to target climate action

Action 4: Strengthen knowledge and systems to target climate action

Situation Analysis

Implementation of the ACRP investments will need evidence upon which to make climate-smart decisions, strategies to communicate key messages, and the ability to target specific stakeholders to ensure actions have maximum reach.

The types of cross-cutting issues addressed in Action 4 are well defined in the NCCS (Table 7).[122] Twelve cross-cutting themes in the NCCS were reviewed during preparation of the ACRP, both for relevance to MAFC and to identify where these could be better integrated in Actions 1- 3. Three issues were determined to warrant special attention under Action 4, which are intended to provide the foundation for knowledge and systems to better target climate action. These three strategic interventions – information, communication, education and public awareness, Research and Development, and gender and vulnerable groups – have been highlighted as priorities through the process. Following is additional information on the current status of each of these three areas of interventions, which has been assessed through stakeholder engagement and literature review.

Table 7: NCCS Cross-cutting issues and relevance for the ACRP

#	NCCS cross-cutting issues: Sector/Theme	MAFC a key actor?	How addressed in ACRP
1	**Information, communication, education and public awareness**	**Yes**	**Activities included in Action 4**
2	**Research and development**	**Yes**	**Activities included in Action 4**
3	Technology transfer and development	No	
4	Capacity building and institutional strengthening	**Yes**	Activities included in Actions 1 - 4
5	Systematic observation	No	
6	Early warning systems	**Yes**	Action 3
7	Disaster and risk management	**Yes**	Action 3
8	**Gender and vulnerable groups**	**Yes**	**Activities included in Action 4**
9	Impacts of response measures	**Yes**	Activities included in Actions 1 - 3
10	Planning and financing	**Yes**	Included in Part 3
11	International cooperation	No	
12	Climate change and security	No	

Information and Communications

Effective communications will ensure that ARCP's objectives and outputs are accurately represented to key stakeholders. This is needed to facilitate constructive interactions among disparate stakeholders, which include farmers, extension workers, researchers, inputs suppliers, policy makers, development partner agencies, and other stakeholders, in order to create reliable partnerships in the creation and exchange of knowledge. For example, while investments have been made in climate-smart measures such as drought and pest/disease resistant crop varieties, information and communication are important factors to make use of research and development through NARS since farmers are not be able to use new products due to lack of knowledge and commercial seed production.[123] Specifically, communication needs to ensure that farmers receive timely information on potential climate induced risks, new adaptive technologies and markets related to key commodities in order to improve their productivity. Entrepreneurs will also need appropriate information on investment opportunities and policymakers need information that will lead to appropriate decision making. All these requirements call for key messages, communication products and channels to be packaged appropriately.

[122] NCCS Section 3.4.3
[123] World Bank (2013)

Box 14: The challenge of information sharing in the agriculture sector

Information sharing is a particular challenge because of the multisectoral nature of key agricultural stakeholders. A review of relevant strategic documents, such as the NCCS, ASDP, and TAFSIP indicates just how diverse these stakeholders can be. At national level important stakeholders include policy level actors such as the Agriculture Sector Line Ministries (ASLMs – including MAFC, MLFD, MITM, MoW and PMO-RALG); other public institutions with influence in the agricultural sector such as TMA, TPRI, TFDA, TBS and the crop marketing boards; research and training institutions including the ministry's ARTIs, SUA, and UDSM; and the Development Partners who are critical in supplementing government financial resources and in the sharing of international best practices.

At the field level important stakeholder groups include individual farmers, farmers associations or farmer groups such as MVIWATA; the Local Government Authorities (LGAs) who are responsible for providing extension services to communities; the private sector who include processors and millers, traders, investors and increasingly agribusiness; financial institutions like banks (NMB, CRDB and NBC), SACCOs and private micro-finance institutions such as PRIDE and FINCA; and Non State Actors such as TOAM and ANSAF who are important in the experimentation of adaptive technologies and in the local sharing of lessons learned. It is important to recognize that these various stakeholders have not only different experiences which need to be collected, processed and shared but also different information needs.

The ACRP will leverage existing information and communication channels to raise awareness of climate change. The ACRP will employ various communication methods to reach targeted audiences. These include use of electronic and print media such as web, email, text messages, newspapers, brochures, and journals; verbal communication through telephone calls and video conferencing; mass media mainly television and radio; meetings including review meetings, demonstration farm groups, farmer field schools, communities of practice, conferences and training sessions, and improving farmers' access to information by strengthening technical and market information through use of innovative technology dissemination pathways, including internet and mobile phones. Key to implementation of the ACRP will be to include messages into the communication packages of key agriculture initiatives (Box 15). For the purpose of the ACRP a MAFC-EMU led group, in close coordination with the MAFC Information and Communication Unit, will be established with the aim of identifying key stakeholders, the most relevant communication packages and the most suitable channels for conveying climate change messages to various target audiences.

Box 15: Existing information and communication channels

The ACRP will depend on existing and planned communications initiatives with relevance for agriculture and climate change such as MAFC and ASDP Communication Strategies, the Regional Rice Center of Excellence Communication Strategy under the EAAPP, the SAGCOT Communication Strategy; the Alliance for a Green Revolution in Africa (AGRA) (Tanzania Environmental Policy Action Node); and the REDD Communication Strategy.

The ACRP will also contribute to and benefit from the SAGCOT and BRN communication strategies. The SAGCOT strategy, for example, aims to build relationships between SAGCOT and credible business journalists and editors at both national and international levels. MAFC – EMU will prepare messages on climate resilience and adaptation for SAGCOT and BRN areas. The SAGCOT communication strategy expects to create broader awareness of the challenges and opportunities in the operating environment of Tanzanian farmers. These messages will be facilitated by media training, the creation of a media database and a media toolkit. The database will contain journalists and media outlets that have been selected based on their credibility and quality of reporting, as well as the relevance of their interest area to SAGCOT activities. The media toolkit is a resource to ensure that the media report on SAGCOT in an informed manner.

Research and Development

Key research gaps need to be filled to better integrate climate change into agricultural policy. The NCCS states that effective adaptation and mitigation need reliable data, thus, more research is needed to establish climate change patterns, vulnerability, adaptive capacity, mitigation options and develop technologies that will ensure sustainable response systems and minimize impacts and risks associated with climate change. The

National Agricultural Research System (NARS) is well established but performance is generally weak, though this varies by institute and by crop. There are few climate change relevant action research projects, and most of the studies that have been documented have limited sample size and small spatial representation, which make extrapolation to other areas difficult. Similarly, various vulnerability assessment studies are also based on limited household surveys and only cover small geographical areas. There is, therefore, a need for studies that cover larger areas, encompass multiple agro-ecological zones, and use statistically valid sample sizes. There is also a need for studies that employ action research methods to better understand farmer situations with regard to local adaptation options.

Box 16: Stakeholder-identified climate change and agriculture research gaps

- Better understanding how recent and projected precipitation variability and change in seasonality of precipitation will impact agriculture, including performance of different types of crops and cultivars
- Interactions between climate change, land degradation, soil depletion, loss of soil fertility, and soil salinity and acidity on crop yields, and how technological innovations can address these interactions
- Linkages between biophysical environment response to climate change and food security
- Comprehensive climate change and agriculture spatial vulnerability assessment
- Development of drought tolerant, early-maturing and pest-resistant crop varieties.[124]

Strategic research will be especially critical not only to fill the knowledge gaps on the potential impacts of climate change on the agriculture sector, but also to guide on application of this research to target interventions to vulnerable areas. ASDP-2 will be an important mechanism through which to mainstream climate change research as one objective of the programme is to strengthen the NARS to respond more effectively to farmers' technology needs. ASDP-2 also intends to support the strengthening of human resources for research and technical staff for crops based on capacity gaps and needs for commodity value chains to be identified through a Training Needs Assessment (TNA). MAFC – EMU should closely follow the process of conducting the TNA and ensure that monitoring climate changes and building resilience of crop systems will be adopted within the Programme, and ensure that other research gaps, such as a comprehensive vulnerability assessment, are undertaken.

Box 17: Current research programmes with linkages to the ACRP

- The East African Agricultural Productivity Project (EAAPP), which has established an improved rice growing programme centered at KATRIN Ifakara in Kilombero District.
- Tanzania is one of five countries participating in Water Efficient Maize for Africa (WEMA) project. WEMA is strategically designed to mitigate production constraints associated with drought. It is a public-private partnership project formed in 2008 and coordinated by the African Agricultural Technology Foundation (AATF) and collaborates with COSTECH in Tanzania. The partnership is funded by the Gates and Buffett Foundations. The goal of the project is the development and deployment of royalty-free drought-tolerant maize varieties using a combination of conventional breeding, marker-assisted breeding and biotechnology techniques and applications.[125]
- Three other research programmes with direct relevance are the Norwegian supported Climate Change Impacts, Adaptation and Mitigation project (CCIAM[126]), the Enhancing Pro-Poor Innovations in Natural Resources and Agricultural Value Chains (EPINAV[127]) projects, which are both being coordinated by the Sokoine University of Agriculture (SUA) in Morogoro. Last, the Securing Small Holder Farm Production Against Climate Induced Risks, (AGRA project) coordinated by The Open University of Tanzania (OUT).[128] These research programmes have focused on investigation the impacts of increasing climate variability on agricultural production in Tanzania. Under the CCIAM programme a consortium of Tanzanian institutions including SUA, UDSM, Ardhi University and the Tanzania Meteorological Agency are partnered with counterpart institutions from Norway in order to enhance synergies.
- There are many smaller field based research projects, many supported or coordinated through CA-SARD that are of relevance to the ACRP process. Within MAFC, the EAAPP is a research programme supported by the World Bank that aims to contribute to improving productivity and resilience of rice growing systems.

[124] URT (2013)
[125] African Agricultural Technology Foundation (2010)
[126] Sokoine University of Agriculture (2009)
[127] Sokoine University of Agriculture (2011)
[128] OUT (2012)

Gender and vulnerable groups

Better mainstreaming gender could have significant benefits for uptake of climate smart agricultural practices. The yield gap between men and women averages around 20% to 30%, and most research finds that the gap is due to differences in resource use.[129] Both the different roles of men and women in agriculture, and the specific needs of women farmers must be considered in light of the fact that wider uptake greatly depends on female farmers adopting labor-saving practices. Women have been found to often more rapidly adopt labor-saving CSA practices[130] - if gender is well-mainstreamed in CSA, this could increase the success of scaling up these initiatives such as those in Actions 1 and 2.

The ACRP is an opportunity to build resilience of female farmers through carrying out the recommendations of the National Strategy on Gender and Climate Change, which includes agriculture as a priority sector. This will require coordination across ministries, where institutional linkages are currently weak. Gender is tightly linked with communications actions, in order to develop communications packages that encourage local communities to develop and incorporate gender in their land use planning procedures. In the same way the ASDP Secretariat together with EMU are well-placed to monitor the amount of funds made available for gender activities at local level and encourage the mainstreaming of gender and climate change in ASDP-2 and DADP budgets.

[129] *Ibid.*
[130] *Ibid.*

Action 4: Strengthen knowledge and systems to target climate action

Key Investments

Policy

4.1. Draft and implement a climate change and agriculture research program. This would include (i) a stocktaking of current research related to climate change and agriculture (including ARIs), (ii) identify in more detail the key research needs and knowledge gaps, (iii) design a funding mechanism (e.g. grants) that can fill key research needs, (iv) establish a scientific review panel mandated to coordinate, communicate as well as disseminate findings, (v) research capacity building needs, (vi) develop and strengthen models for predicting climate change impacts, including implications for shifting agro-ecological zones, data analysis of rainfall patterns, and impacts on specific crops.

4.2. Develop a framework to target climate adaptation projects in vulnerable areas. This would include variables for drought, flood, pests and diseases, and food security as well as a system for updating data on at least an annual basis and when extreme events occur. This could include District and Region profiles with key socio- economic and environmental indicators to track over time how well and how fast the situation is improving, and act as a vulnerability scorecard. This should be integrated into the Information Management System developed in Action 4.4.

4.3. Conduct a comprehensive assessment on gender and climate change issues in the agriculture sector, including (i) climate change impacts on women and girls, (ii) develop recommendations and guidelines for mainstreaming gender into CCA related policies, strategies, programs, and budgets in respective areas of jurisdiction, (iii) identify best practices in Tanzania and other countries, and (iv) identify gender-appropriate technologies for activities related to water management, climate-smart agriculture, and postharvest processing and value addition, (v) capacity building and awareness on climate change for women farmers, (vi) recommendations for increasing women's access to financial and productive resources.

Planning

4.4. Develop and operationalize an Information Management System and web portal for climate change and agriculture. This would include identifying available and needed data, developing a systematic data collection and management, capacity building for ICT and other relevant staff, and a monitoring framework for the ACRP. This could include a publicly-accessible data portal that is linked with ongoing open data initiatives in Tanzania, and help to facilitate and coordinate an open exchange of climate change and agriculture information and ease sharing of data. As part of this investment MAFC should develop and maintain a climate change and agriculture website that would be a portal for research, awareness-raising, data accessibility, and updates on implementation of the action plan.

4.5. Establish stakeholder engagement and communication networks. This would include an extensive stakeholder needs analysis (e.g. farmers, extensionists, academia, policy and decision makers, CBOs) in order to document and articulate end user climate change adaptation needs, knowledge gaps, and recommend activities to fulfill knowledge needs and promote adoption of adaptation practices along with identified budget requirements; identify key network organisations and personnel with a mandate that supports climate change adaptation; and develop a community of practitioners. The analysis would also document communication preferences for the project's priority stakeholders, and design specific and tailored messages to individual farmers and farmer's groups, especially to climate vulnerable, food insecure areas in semi-arid districts.

4.6. Develop a gender and agriculture coordination mechanism between the MAFC gender desk, gender committee, and EMU. EMU will work with the gender desk to mainstream gender in CCA in each stage of the project, programme, policy cycle. The gender committee should meet quarterly to evaluate progress for gender mainstreaming in CCA related policies, strategies, programs and budgets.

Practices

4.7. Develop and coordinate a campaign using ICT to raise awareness and disseminate targeted climate and weather information, including (i) events such as Saba Saba and Nane Nane exhibitions, (ii) awareness raising workshops in the AEZ's, (iii) Information dissemination through e-newsletters, fact sheets, brochures and other media to promote research, good practices, upcoming events and consultations, etc. (iv) Develop and coordinate a media campaign to disseminate knowledge and benefits of CSA and applications on the ground (v) Strengthening of information, education and communication unit in MAFC to understand climate change issues and forge links with TMA to capture weather information and disseminate information to farmers.

Action 4: Implementation Factsheet
Strengthen knowledge and systems to target climate action

Appraisal

Priority: MEDIUM
Analysis and communication of climate change information and resilience activities has been lacking, and requires significant strengthening. These efforts may not build resilience directly, but will indirectly benefit decision-makers, practitioners, and farmers.

Cost: LOW
The total estimated cost for the above activities is approximately $190,000 over five years to develop and maintain information and communication systems.

Targeting

All activities would be on a national scale and further targeting to stakeholder groups would be carried out through Action 4.2. All the actions foster adaptation with a country as both a target area and planning scale.

Focal Point and Stakeholders

MAFC-EMU would take the lead on implementing cross-cutting activities, as the overall coordinator of the ACRP. This includes leading on identifying research and development priorities on climate change, in close coordination with the MAFC Department for Research and Development and Agricultural Research Institutes at the subnational level. On gender, MAFC will need to coordinate closely with the gender desk under the Department of Department of Administration and Human Resources (DAHR), MCDGC, and NGOs such as the Tanzania Women Lawyers Association and Tanzania Gender Networking Programme.

There are several initiatives outside of MAFC that could provide opportunities for coordination on ICT, R&D, and gender activities. The Open University of Tanzania's Environmental Policy Action Node has a focus on communications and using the media for outreach on climate change issues. The Accountability in Tanzania (AcT) programme has a climate change and environment window that includes competitive funding for communications initiatives. Sokoine University's CCIAM and EPINAV projects similarly include communications initiatives.

#	Key Investments	Priority	Cost	Target area	Responsible
4.1	Draft and implement a climate change and agriculture research program	High	Low	National	DRD, EMU, Universities
4.2	Develop a framework to target climate adaptation projects in vulnerable areas	Medium	Medium	National	EMU, MIS
4.3	Conduct a comprehensive assessment on gender and climate change issues in the agriculture sector	Medium	Medium	National	DRD, EMU, Universities
4.4	Develop and operationalize an Information Management System and web portal for climate change and agriculture.	High	Low	National	EMU, MIS
4.5	Establish stakeholder engagement and communication networks	Medium	Low	National	EMU, MIS
4.6	Develop a gender and agriculture coordination mechanism	Medium	Medium	National	EMU, DAHR, MCDGC
4.7	Develop and coordinate a campaign using ICT to raise awareness and disseminate targeted climate and weather information	Medium	Low	National	EMU, MIS, TMA

Part 3: Implementation Strategy

The ACRP is ambitious, and implementation will likely be a challenge: this plan was prepared without clarity as to the financial resources that may be available for its implementation, so given competition for scarce resources and the uncertainty of outside funding a flexible tool is needed to build resilience and safeguard growth in the sector. Because climate change has impacts and opportunities that cut across sectors and political boundaries, it will require commitment and cooperation of many key stakeholders both within and outside the Government of Tanzania.

The Action Plan is therefore designed to be flexible rather than adhere to a rigid implementation framework: some actions will be suitable for different finance sources such as development partner finance for climate change activities, others should take advantage of major GoT agriculture programmes to mainstream activities and ensure that agricultural development promotes climate change resilience while mitigating degradation and resource depletion that can drive vulnerability. Some investments will require little additional cost, as results will come from simply ensuring that climate change is considered in policies, plans, and practices.

MAFC will deliver the Action Plan through four mechanisms, which are outlined in this section:

3.1 An institutional framework, which outlines key stakeholders and roles and responsibilities across the GoT and non-state actors

3.2 A financing strategy to leverage resources for the Action Plan, through mainstreaming in sector operations and identifying sources of new funds.

3.3 Monitoring and reporting procedures to build evidence of climate change impacts and results of adaptation measures, and track delivery of the Action Plan.

3.4 First year launch, which outlines next steps for kicking off the ACRP and setting the foundation for implementation in the first year.

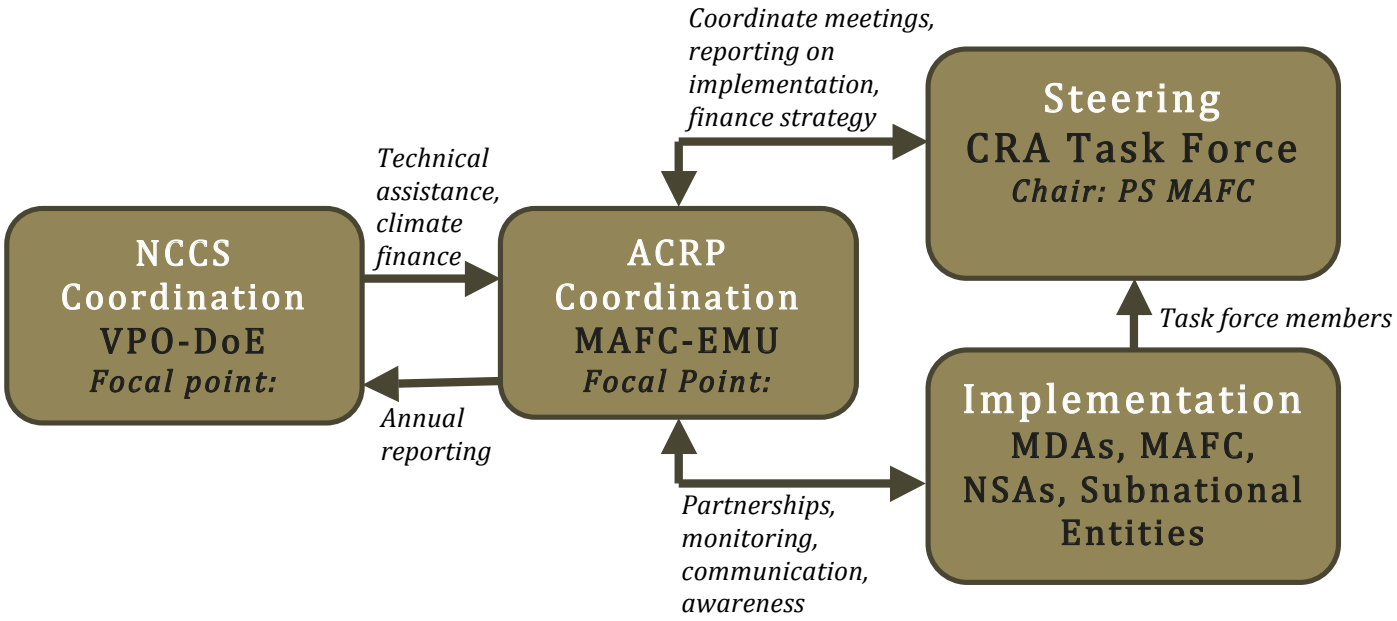
3.1 Institutional Framework

The National Climate Change Strategy's institutional arrangement follows that described in the Environmental Management Act (2004), with overall coordination by the National Climate Change Focal Point (NCCFP) in the Vice President's Office – Division of Environment. As the MAFC Environment Management Unit (EMU) is tasked with climate change issues under EMA, and has a direct line to VPO-DoE, the MAFC-EMU will be the implementation focal point for the Action Plan, with the Head of the Environment Management Unit (HEMU) having overall responsibility for coordination and delivery of the expected outcomes.

MAFC will form a Climate Resilient Agriculture (CRA) Task Force, chaired by the MAFC Permanent Secretary and including a broad range of government and non-governmental stakeholders. The ACRP Technical Working Group can be a basis for members selected for the Task Force. The East African Community (EAC) has issued a recent directive for member countries to form a Climate Smart Agriculture Task Force, and the CRA Task Force can fulfill this role rather than duplicating efforts.

The overall implementation framework for the ACRP is outlined in Figure 7 with specific roles described below.

Figure 7: ACRP Implementation Framework



Roles and Responsibilities

The ACRP Implementation Factsheets for each of the four actions include important stakeholders for each action as well as focal points for implementation responsibility for each investment. The number of stakeholders involved is many, and coordination has typically been a challenge for addressing climate change issues. Below is a brief description of the roles of each stakeholder included in **Table 8**, which is not exhaustive. The Implementation Factsheets can be consulted for more specifics.

NCCS Coordination: Vice President's Office - Division of Environment

The National Climate Change Focal Point (NCCFP) sits within the VPO-DoE, as having overall responsibility for the NCCS. The NCCFP should provide the technical and financial assistance to MAFC to implement the ACRP, and is tasked with leading coordination between sectors (e.g. the water and livestock sectors, which have strong linkages with MAFC). The NCCFP is planning to develop NAMAs and NAPs in the near future, and is best placed to access UNFCCC international climate finance. MAFC will report to the NCCFP on an annual basis to track implementation of the ACRP.

ACRP Coordination: MAFC Environment Management Unit

The MAFC Environment Management Unit (EMU) will serve as the Sector Focal Point to implement the ACRP. The EMU is in place with a Head (HEMU) and three sub-units: Environmental Assessments and Monitoring, Environmental Education and Data Management, and Natural Resource Management/Sustainable Agriculture. Climate Change issues are addressed in the Natural Resource Management/Sustainable Agriculture sub-unit. However, climate change cuts across EMU sub-units as well as MAFC Departments. In that case HEMU is responsible and accountable for ensuring the smooth implementation of the Action Plan. The main constraint is that EMU does not currently have a budget allocation for climate change activities.[131] Roles and responsibilities of the EMU are outlined in **Table 8**.

It should be noted that environmental management in MAFC already faces resource constraints, which will risk implementation of the ACRP if not addressed. During the 2010/11 budget year, the MAFC Environment Management Unit received approximately US$160,000 (Tsh 242.5 million), equivalent to 0.08% of the total MAFC budget.[132] While the EMU had 8 staff at the time, the budget was insufficient to carry out environmental management responsibilities as per EMA. In this case coordination of the ACRP will requ ire additional resources. Given the capacity limitations, it is recommended that MAFC procure a climate change and agriculture specialist consultant for at least the first six months of ACRP implementation to facilitate launching the ACRP and build capacity within the EMU and other relevant departments and units (see Section 3.4).

Table 8: MAFC Environment Management Unit - ACRP Roles and Responsibilities

Coordination and building partnerships	▪ Develop coordination mechanisms in key thematic areas, including water and land use and gender ▪ Coordinate quarterly agriculture and climate change Technical Working Group meetings ▪ Ensure the MAFC representatives on the National Climate Change Steering Committee and National Climate Change Technical Committee are informed of climate change issues and status of ACRP implementation ▪ Coordinate with key implementation stakeholders across the GoT, including within MAFC and MDAs ▪ Coordinate with key implementation stakeholders at the subnational level, including LGAs, regions, and relevant zonal units ▪ Build partnerships with non-state actors, including NGOs, research institutions, the private sector, and Development Partners.

[131] Yanda (2013)
[132] *Ibid.*

Leveraging financial resources	▪ Identify Development Partners, NGOs, Foundations, private sector and other potential sources of finance for the action plan ▪ Coordinate with NCCFP as NAMAs are prepared
Reporting	▪ Implementation of the M&E framework outlined in Part IV. ▪ Annual reporting to NCCFP ▪ Quarterly briefings to MAFC Heads of Departments on the plan and assign roles, responsibilities and milestones to coordinate task on a quarterly basis
Capacity building and awareness	▪ Coordinate zonal workshops to generate awareness of the Action Plan ▪ Ensure buy-in of the action plan by stakeholder groups ▪ Ensure that resources for capacity building are accessed from NCCFP and Development Partners ▪ Deliver capacity building where needed, especially at the local level ▪ Following up on ensuring existing environmental by-laws are enforced at grassroots level
Mainstreaming	▪ Ensure that Action Plan implementation is included in MAFC budget and MTEF ▪ Coordinate with programmes such as ASDP, BRN, and SAGCOT to identify opportunities for mainstreaming the Action Plan and monitoring results ▪ Ensure that MAFC policies, plans, and programmes have considered climate change and identify linkages with the Action Plan

Steering: Climate Resilient Agriculture Task Force

The Climate Resilient Agriculture Task Force will monitor implementation of the ACRP, serve as a vital coordination function between MAFC, MDAs, NSAs, and regional entities such as the EAC, SADC, COMESA and issue directives to all relevant MAFC departments and units for mainstreaming the ACRP in their operations.

Implementation Stakeholders

It is expected that the CRA Task Force will draw representatives from the following stakeholder groups:

MAFC Divisions and Units

All MAFC Divisions will be instrumental in implementing the Action Plan as well, and include technical and research units at the national and subnational levels. Of particular importance is the Department of Policy and Planning - as the entity with responsibility for strategic planning and policy development, the DPP will need to assist with ensuring that resources are allocated for its implementation. The ICT unit will have a key role in developing a web presence and communications. Technical divisions such as Land Use Planning, Mechanization and Irrigation will have a key role in implementing investments, which can be found in each action's implementation factsheet.

It will be important for MAFC to work closely with major agricultural programmes and initiatives related to agriculture as well as climate change, including the ASDP-2 Secretariat (**Box 18**), the Big Results Now Presidential Delivery Bureau, and SAGCOT Centre, will be important for MAFC to work closely with to promote the Action Plan and mainstream actions – opportunities for mainstreaming within these programmes and initiatives are presented for each action in Part 2. Large agriculture programmes and initiatives are well placed to promote climate resilience, pilot innovations, and reduce the environmental impacts of the sector that can drive climate vulnerability.

Box 18: Mainstreaming the ACRP through the Agricultural Sector Development Programme

Implementation of the ACRP can also take advantage of the agriculture sector-wide approach that has been established under the first phase of ASDP (i.e. ASDP-I), which is mainstreamed through existing government systems and structures through a basket fund arrangement. This arrangement will continue under ASDP-2. Conversely, ASDP-I has developed implementation systems from national down to village level, and created a mode of operation, which has streamlined planning, financial management, procurement, monitoring and reporting systems that can effectively support the implementation of proposed operations. The ASDP-I structure is designed to allow efforts to strengthen government systems at national and local levels for enhanced sustainability. Under ASDP-I the Agricultural Sector Lead Ministries (ASLMs) implement the programme while a Basket Fund Steering Committee (BFSC**)** provides overall policy and strategic guidance. There is also a Committee

of Directors, which provides technical support through Technical Working Groups (TWGs)[133]. The ACRP TWG could be sustained through this mechanism to provide advice on how to integrate climate risk in agricultural development plans from national and local levels.

At the national level, ASDP-2 will target Secretariat staff, staff from ASLMs and staff from Regions facilitating commercialization, but who require training to strengthen their understanding of how to work with the private sector and to provide suitable guidance to LGAs in this area. A series of specialized training courses using either local or international experts will be held on different aspects of commercialized agriculture, value chain approaches and rural finance[134]. Through the same process these staff could be trained on aspects of planning for increased climate variability in order that they may provide appropriate, climate sensitive advice to their clients at local level and in the private sector.

Coordination with the ASDP Secretariat presents a good opportunity for mainstreaming climate change at the district level and reaching smallholder farmers. MAFC is responsible for overall coordination of ASDP-2 implementation and performance monitoring through the ASDP Secretariat. The Secretariat is responsible for day-to-day coordination of the ASLMs and engaging with farmer groups, PMO-RALG and LGAs who have the major responsibility for field level implementation. The Secretariat will be strengthened to be able to handle new roles and responsibilities such as coordinating with the SAGCOT Secretariat and the Agriculture Delivery Bureau under BRN. As part of the ACRP, MAFC – EMU should work together with the Secretariat and PMO-RALG to update DADP Guidelines in order to reflect the need to assess climate risks and planning for building climate resilience into agriculture development plans.

Additionally, the ASDP Environmental and Social Monitoring Framework (ESMF) was widely distributed to all Regions and training provided at all levels of government (including District Environmental Management Officers). The ASDP ESMF and its tools will be reviewed and revised in preparation of ASDP-2, which would be an opportune time to include climate change issues with general environmental management, which were absent from the current ESMF. The climate change screening tool developed for small-scale investments under the Tanzania Social Action Fund project (TASAF) could be a good practice example applicable to ASDP 2.

Ministries, Departments and Agencies (MDAs)

Several other MDAs are linked with agricultural activities and necessary for implementation of activities for building resilience in the agriculture sector. MAFC will be responsible for forging links with these MDAs and incentives to coordinate. It will be important for other sectors with linked activities[135] to coordinate with MAFC as their action plans are developed to identify opportunities to link activities, since climate change is an issue that cuts across sectors.

Non-State Actors

Non-State Actors, including research institutions, universities, the private sector, NGO and CSOs, and Development Partners include key stakeholders that can contribute to fulfilling research needs, providing financial resources, and technical assistance toward implementation of the action plan. MAFC will need to coordinate closely especially with NGOs who are working in the field and are on the front line of practices that can be scaled up with additional support.

Subnational Entities

Subnational entities will be key recipients of investments, including in training, finance, and technical assistance, but much of the ACRP's implementation will rest at the subnational level as well. Entities such as District-level Local Government Authorities, District Irrigation Development Teams, Zonal Plant Health Centres, regional Agricultural Research Institutes, and River Basin Offices will all play a role in each of the four actions.

[133] URT (2013b)
[134] *ibid*
[135] Including the Ministry of Water, Ministry of Livestock and Fisheries Development, PMO-RALG, Ministry of Natural Resources and Tourism, Ministry of Energy, etc.

3.2 Cost Appraisal and Financing Strategy

Implementation of the ACRP would require approximately USD$25 million per year over the next five years in addition to current levels of climate change expenditures in the agriculture sector – an increase of 22% in climate change expenditures over 2012/2013.

ACRP cost estimates

The minimum cost of implementing the Action Plan over five years is USD$126 million, or an average of USD $25.2 million per year. A breakdown of the costs by action is included below in Table 9. The highest cost actions are among the highest priorities, based on criteria such as importance of fostering adaptation, urgency, and dependency of other interventions. Water use efficiency and water storage and risk management for climate shocks, for example, tend to be costly due to the scale of investments in climate-proofing infrastructure and other investments, yet urgent given the pressure on water resources and the linkages with natural disasters.

MAFC will need to refine the cost estimates on an annual basis to better reflect alignment with existing programming. The estimates here provide a general idea of the funding needs to implement the ACRP, but early in implementation of the ACRP an assessment will need to be done to further identify (i) existing activities that align with the ACRP investments and would be appropriate for mainstreaming (incurring moderate to minimal cost), (ii) where there are gaps that require more substantial additional resources.

Leveraging external funding sources will be critical to implementation of the ACRP, with 80% of resources expected to come from outside of the GoT's own sources. This likely allocation between GoT and outside funding sources is consistent with overall trends in climate change finance in the agriculture sector: an analysis of climate expenditures in the agriculture sector from 2010 – 2013 found that, on average, 18% of expenditures were from GoT own sources, and 82% from external finance. Within MAFC alone, the analysis showed an even lower share of climate expenditures at only 7% own source revenues as a percent of the total climate spend in the sector. As seen in Table 9, the ratio of GoT to external sources does vary within the actions, from over 90% external finance in some cases (e.g. climate smart agriculture and risk management) to GoT finance up to 45% in the case of sustainable land and water management (Action 1C).

Table 9: ACRP Total Cost Estimates

Action		Appraisal		Cost (US$)	Funding Source	
		Cost	Priority		GoT	Other
1A	Increase water use efficiency and water storage on irrigated and rain-fed lands	High	High	60,000,000	20%	80%
1B	Improve catchment management in agricultural planning	Low	Medium	3,500,000	20%	80%
1C	Adopt sustainable land and water management in agricultural lands to reduce degradation	Medium	High	12,500,000	45%	55%
2	Accelerate uptake of climate smart agriculture	Low	High	2,000,000	10%	90%
3	Advance risk management to reduce the impact of climate-related shocks	High	High	46,000,000	5%	95%
4	Build Knowledge and Systems to Better Target Climate Action	Low	Medium	2,000,000	25%	75%
			Total	**126,000,000**	**20%**	**80%**

Based on the cost estimates for the Priority Actions, Table 10 provides estimates of the funding needs on an annual basis over the five years of ACRP implementation, with an average of USD$25.2 million per year:

Table 10: Annual Resources for ACRP Implementation

Year	Est Additional Climate Resources per year	GoT own budget revenue (20%)	Other funding sources (80%)
1	$25,000,000	$5,000,000	$20,000,000
2	$27,000,000	$5,400,000	$21,600,000
3	$26,000,000	$5,200,000	$20,800,000
4	$24,500,000	$4,900,000	$ 19,600,000
5	$23,500,000	$4,700,000	$18,800,000
Total	**$126,000,000**	**$25,200,000**	**$100,800,000**
Avg/year	**$25,200,000**	**$5,040,000**	**$ 20,160,000**

Source: Mutabazi et al (2014)

The current level of climate change expenditures will need to increase by approximately 22% to implement the ACRP. In the 2012/2013 budget, the climate change expenditure review of the agriculture sector found approximately $115 million would be spent on activities relevant for climate change. Based on the most recent available year's expenditures and the ACRP cost estimates (2012/2013), this would represent a 12% increase in GoT own revenues over the previous year, and 27% in external sources (Table 11).

Table 11: Additional Resources for ACRP Implementation

	GoT own revenues	Other sources	Total
Total Agriculture and climate change expenditures (MAFC + other MDAs)	40,375,438	75,097,363	115,472,800
Additional funds needed for ACRP implementation	5,040,000	20,160,000	25,200,000
Percent increase in total climate change expenditures	**12%**	**27%**	**22%**

Source: Mushi (2013), Mutabazi et al (2014)

The GoT needs to not only secure additional funds for climate change in the agriculture sector, but more specifically address climate resilience. A screening of expenditures on climate change activities in the agriculture sector (including MAFC and other MDAs) showed that funds are already allocated to climate change activities, yet these most climate-related expenditures are (i) primarily financing irrigation, (ii) only marginally linked with climate resilience.[136] Therefore MAFC and other line sector ministries that are linked with crop agriculture will need to not only increase the amount of budget resources, but also improve overall planning for resilience activities, which in the past have been mostly limited to irrigation activities that may not sufficiently incorporate climate risk.

[136] Mushi (2013)

Funding Sources and Phasing

There is a need for substantial additional resources to implement ACRP activities, both within existing MAFC programs such as ASDP-2, BRN and SAGCOT, and as new activities. The GOT has not yet secured specific funding sources, but there are several avenues MAFC can consider from within and outside the GoT in order to finance the ACRP (Box 19).

Box 19: Potential ACRP Funding Sources

Sources accessible in the short term (1-2 Years)

MAFC budget resources for implementation of the action plan will need to be committed as soon as possible, especially to set up institutional structures as well as capacity building.

Mainstreaming actions in MAFC projects and programmes such as ASDP-2, Big Results Now and SAGCOT. This will require close coordination between the EMU and implementing entities for those programmes.

Global Environment Facility resources could be requested by Tanzania to support building resilience in the agriculture sector.

Development Partners contribute the largest proportion of climate finance in Tanzania and would be a likely source of initial funding to begin implementation of the Action Plan. MAFC can also leverage relationships with DPs for technical assistance on climate change and integrate AP activities into DP projects and programmes. DPs can also assist with international funding sources such as the Global Environment Facility and International Climate Fund.

REDD+ Strategy and Action Plan has been developed, and funds may start to flow for pilot activities and carbon credits once a financial mechanism is established. MAFC is already listed as a key implementer of the REDD+ action plan, and should explore potential resources for implementation as many of these activities link with ACRP Actions 1 and 2.

Sources accessible in the medium term (2-4 years)

National Climate Fund: The GoT is currently exploring options for a National Climate Fund. If designed, this type of fund could be developed in 1-2 years to support implementation of the National Climate Change Strategy. MAFC could coordinate with VPO-DoE to ensure that the Fund includes financing for climate-resilient agriculture.

Nationally Appropriate Mitigation Actions (NAMAs)/National Adaptation Plans (NAPs): Preparation of NAMAs and NAPs will be undertaken by the NCCFP, and could provide opportunities to fund action plans for sectors such as agriculture. Access to these funds for preparation and implementation of agriculture-related NAMAs and NAPs should be coordinated with the VPO-DoE and monitored by MAFC.

Grant funding from sources such as international NGOs. This could be especially relevant for priority research activities in Action 4.

Sources accessible in the long term (more than 4 years)

Green Climate Fund: Resources from the Green Climate Fund are uncertain, but could be accessed in the coming years. Technical assistance is needed to determine readiness for these funds and institutional arrangements between sector ministries and the National Implementing Entity as well as developing a pipeline of of transformational activities.

Stakeholder Roles for Leveraging Funds

As the focal point for implementation of the Action Plan, the MAFC-EMU will have a central role in obtaining budget resources, mainstreaming in sector operations, and leveraging additional funds. MAFC will work with other key stakeholders to ensure that sufficient resources are available, outlined in Table 12 below:

Table 12: Institutional Roles for Leveraging Funds for Action Plan Implementation

MAFC	▪ Obtain sector budget allocation and integrate in MTEF (with MoF) ▪ Coordinate with entities such as SAGCOT Centre, BRN Presidential Delivery Bureau, etc to leverage private sector contributions to promote climate resilience ▪ Build capacity to develop proposals for international climate finance ▪ Coordinate with ASDP secretariat on mainstreaming and supporting recurrent costs of action plan implementation ▪ Generate revenues through levies or fees, for example on irrigation schemes
Ministry of Finance	▪ Integrate Action Plan into MTEF ▪ Potential role in developing a financing framework for climate change
Vice President's Office – Division of Environment	▪ Provide capacity building to MAFC on accessing international climate finance ▪ Ensure that funds flow to sectors from projects on climate change mainstreaming and eventual funding from preparation of NAMAs and NAPs
Universities and Institutions	▪ MAFC can partner with key institutions such universities and research institutions to coordinate on climate change projects ▪ Seek opportunities for co-financing of climate-related projects and programmes
Development Partners	▪ Potential source of initial financing for Action Plan activities ▪ MAFC to ensure that DP-funded agriculture projects are aware of and consider financing Action Plan activities ▪ Technical assistance to MAFC for implementation of the ACRP, including climate finance readiness, project feasibility studies, and institutional strengthening ▪ Financing implementation of linked activities such as the SAGCOT Greenprint and REDD+ Strategy
Other funding sources	▪ Increased private sector investment in Tanzania brings opportunity to leverage PPPs that could finance resilience actions ▪ NGOs, foundations and research institutions are heavily engaged in areas such as climate smart agriculture and natural resources management. These relationships could be leveraged to harmonize with the action plan. ▪ REDD+ funds will flow soon and can link to related actions

Entry Points with Development Partners

MAFC has identified several opportunities where specific Development Partner programmes and projects can support implementation of the ACRP, including initial steps to launch the plan in the first year (see Section 3.4) as well as longer-term support for the actions and investments (see Table 13). MAFC will need to work closely with DPs through Development Partner Groups (namely those on agriculture, environment, and water) in order to bring awareness of the ACRP and ensure that DP support is well aligned with the priorities in the ACRP.

Table 13: Potential Support Through Development Partner Programmes

Development Partner	Programme Opportunities
DFID	▪ Pipeline climate resilience program with anticipated resources from the International Climate Fund
European Union	▪ Global Climate Change Alliance programme
GIZ/KfW	▪ Climate Finance Readiness Programme
Norway	▪ REDD+ support ▪ Support to SAGCOT
UNDP/UNEP	▪ UN-REDD ▪ Mainstreaming Environment and Climate Change Adaptation in the Implementation of National Policies and development Plans
USAID	▪ Feed the Future
World Bank	▪ Mainstreaming climate change in support for the second Agriculture Sector Development Programme ▪ SAGCOT ▪ Pipeline climate change and water resources project

3.3 Monitoring and Reporting Guidelines

The NCCS requires MDAs such as MAFC to monitor their implementation of the NCCS's Strategic Interventions and report on results. However, Tanzania does not have an established national system for monitoring and reporting on climate change and implementation of the NCCS. Regardless, establishing a monitoring and reporting system for the ACRP will be key for MAFC to demonstrate and quantify results as well as systematically identify and track climate change activities in the sector. Because a national framework is still to be defined, the MAFC monitoring and reporting system will be sector-specific while still meeting the basic requirements outlined in the NCCS.

Monitoring Framework

Within two months of adoption of the ACRP, MAFC will establish a simple climate change monitoring framework that includes the following activities in Table 14**.** This should be carried out by the MAFC-EMU and discussed with the CSA Task Force, which could be done in-house or contracted through an outside consultant if sufficient capacity is not yet available. A consultant would be expected to conduct capacity building activities for implementation of the framework. This would be included Activity 4.1 under ACRP Action 4 (to develop and operationalize a Management Information System for climate change and agriculture, including a monitoring framework).

Table 14: Steps to Develop a Monitoring and Reporting System

1	**Define and agree on monitoring and reporting procedures**	▪ Consult with the VPO-National Climate Change Focal Point to define expectations for annual reports per the requirement in the NCCS. ▪ Discuss and agree with CSA Task Force on reporting ▪ Develop a reporting mechanism on gender mainstreaming into climate change adaptation-related policies, strategies, programs and budgets (per requirements of the National Gender and Climate Change Action Plan)
2	**Set targets and milestones**	▪ Work with the CSA Task Force to establish targets for what MAFC can achieve in implementing the ACRP in the first year and each subsequent year ▪ Set annual milestones toward achieving the targets
3	**Define indicators**	▪ Identify climate-relevant indicators within the Agriculture Routine Data System that can be monitored ▪ Use proposed indicators in the ACRP annex to develop monitoring framework for all identified ACRP activities based on the targets and milestones
4	**Draft a reporting plan**	▪ MAFC-EMU will draft a reporting plan including all reporting deadlines, reporting templates, and responsibilities for the five year implementation period of the ACRP ▪ Define stakeholder channels for dissemination of reports, including publication on the ACRP website ▪ Discuss and agree on reporting plan with the NCCFP and CSA Task Force.

A Management Information System developed under ASDP is the Agriculture Routine Data System (ARDS). Significant amounts of resources were invested to build a national database known as LGMD2, with information disaggregated at district level to clarify data flows and to develop format procedures for data collection at village and ward level and for data dissemination from district to national level. JICA has provided long term technical assistance and capacity building support to this national ARDS roll-out[137]. This system provides data on the performance of the agricultural sector and relies on front-line extension staff to provide monthly, quarterly and annual information, which is compiled at district level and entered into a web-based database and made available to ASLM through Regional Secretariats and PMO-RALG. MAFC – EMU can assess the data collected through

[137] ibid

the ARDS to determine what climate relevant information is already being collected through this system, for use in the ACRP monitoring framework. In the event that data gaps are identified then MAFC – EMU can collaborate with its ASDP partners to revise or adapt the indicators collected for the ARDS, which can then be used to better inform on the climate status of Tanzanian agriculture.

MAFC – EMU will collaborate with ASDP partners to review and revise proposed SAGCOT Investment Guidelines that should help steer investors toward agricultural green growth practices with broad social and environmental benefits. The SAGCOT guidelines would enhance, but not duplicate, environmental and social safeguards put in place through ASDP/DADP or other mechanisms. SAGCOT Investment Guidelines will also be revised to accommodate climate indicators that can be monitored. EMU capacities will be strengthened in order to allow the smooth monitoring of ACRP indicators within ASDP, SAGCOT and BRN.

Reporting Requirements

After the initial six-month mobilization phase, MAFC will undertake regular reporting within the Ministry and with outside stakeholders according to the schedule outlined in Table 15 below.

Table 15: ACRP Reporting Schedule

Period	Reporting Requirement	Content
Quarterly	Presentation to agriculture and climate change task force Publish quarterly status newsletter on MAFC climate change website and distribute to stakeholders	Status of ACRP implementation, including new activities, mainstreaming, coordination, finance and partnership opportunities, and challenges.
Annually	Submit Annual Progress Report at the onset of years 2, 3, 4, and 5 to VPO-NCCFP per NCCS requirement. Submit annual progress report on gender, climate change and agriculture sent to MCDGC and VPO per the National Gender and Climate Change Action Plan Publish approved annual reports on MAFC CC website	Summarise implementation status of all actions and activities. Summarise climate change screening of new major initiatives, projects and programmes and describe implications/updates to ACRP Financial reporting should include information on any financial resources allocated for the for climate change issues per the NCCS (and therefore ACRP) Summarise successes, challenges and lessons learned.
After Five Years	Conduct final evaluation of ACRP implementation Publish final evaluation on MAFC climate change website and distribute to stakeholders	Assess impacts of the ACRP to measure achieved vs. planned results and provide recommendations for second phase of ACRP.

3.4 First Year Launch

The first year of ACRP implementation will be critical to set the foundation for implementing the ACRP. The actions and investments in the Plan will need to be further refined and aligned to activities within MAFC as well as implemented by other stakeholders to improve mainstreaming the ACRP in current and planned activities in the Ministry, GoT, and with outside stakeholders, and also identify gaps requiring additional investments.

Given the prominent role of Development Partners and other potential funders for financing the ACRP, more will need to be done at an early stage to engage and bring awareness to the Plan and MAFC's priorities on climate resilience. The following five steps outlined in Table 16 guide the initial stages of implementing the ACRP, and are key areas where donors and Development Partners can target support and technical assistance in this initial stage.

Cost estimates for initial activities to launch the ACRP are provided below, which are additional to the overall costs for the ACRP investments. Estimates are based on the contracting of a climate smart agriculture specialist to be placed in MAFC for at least six months in order to build capacity and facilitate initial activities. Estimates also include expert consulting fees and event costs.

Table 16: Steps for Launching the ACRP

Step	Task	Details	Cost
1	**Establish and mobilize the CRA Task Force**	▪ Identify and invite members from key implementation stakeholders ▪ Develop a terms of reference and operating guidelines for the Task Force ▪ Develop targets and milestones for Year 1 of the ACRP ▪ Hold quarterly Task Force meetings	$13,000
2	**Sensitize key implementers and stakeholders**	▪ Conduct a sensitization meeting with all MAFC departments and units to generate awareness of the ACRP activities ▪ Initiate setup of climate change Management Information System (Section 3.3), including coordination for monitoring climate-related activities across departments, MDAs and other stakeholders ▪ Hold a launch workshop to establish relationships with Development Partners, foundations, universities, private sector, etc and bring awareness to the ACRP ▪ Hold zonal workshops (1 in each of 7 agro-ecological zones)	$17,500
3	**Internalizing the ACRP**	▪ Building on the ACRP policy review, internalize the ACRP in all policies, plans, and programmes ▪ Design a simple climate change screening tool for all MAFC projects and programmes to identify where activities are linked with the actions in the ACRP and flag for monitoring ▪ Conduct a detailed stocktaking of MAFC activities to identify all ongoing activities that align with the ACRP, where actions and investments can be mainstreamed, and where there are gaps that require additional resources ▪ Define how screening will be done for all new projects and programmes	$10,800
4	**Draft a pipeline of "big win" investments**	▪ Identify "big win" investments for Year 1 of the ACRP ▪ Indicate ACRP activities that are mainstreaming and where new investments are required ▪ Secure budget resources and fundraise where there are gaps ▪ Conduct three pre-feasibility studies of transformative projects per the ACRP priorities	$25,400
5	**Mobilize financial resources**	▪ Draft a detailed financing strategy for the ACRP, including MAFC resources and outside sources ▪ Identify potential projects to be financed by the Green Climate Fund and identify steps for GCF readiness (including within MAFC, VPO-DoE, and how finances will flow between them) ▪ Coordinate with Development Partners to identify entry points for financing with existing and pipeline programmes	$21,000
		Total First Year Launch Cost Estimate	**$87,750**

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