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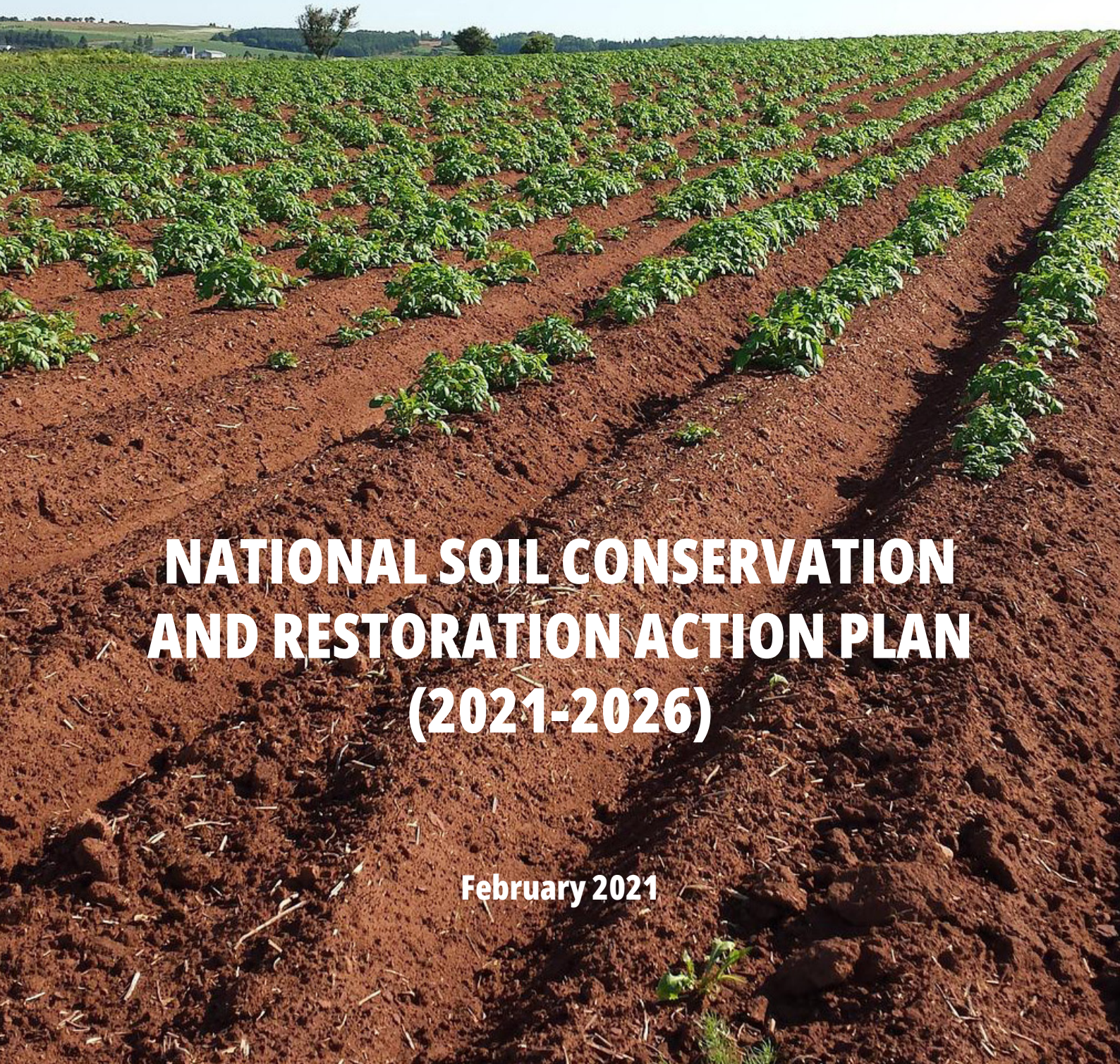

NATIONAL SOIL CONSERVATION AND RESTORATION ACTION PLAN (2021-2026)

February 2021

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ASWAp	Agriculture Sector-Wide Approach
CSA	Climate Smart Agriculture
FAO	Food and Agriculture Organization of the United Nations
GoM	Government of Malawi
LRCD	Land Resource Conservation Department
MGDS	Malawi Growth and Development Strategy
PEI	Poverty Environment Initiative
PES	Payments for Ecosystem Services
PPP	Public Private Partnership
SLM	Sustainable Land Management
UNDP	United Nations Development Program
UNEP	United Nations Environment Programme
GDP	Gross Domestic Product

EXECUTIVE SUMMARY

There is a renewed national focus on Sustainable Land Management because of increasing concerns about the implications of current trends in soil loss. In Malawi, unsustainable rates of soil erosion, loss of soil organic carbon, soil acidification, and nutrient imbalances (especially deficiencies) are recognized as significant threats to soil function. If left unchecked, these problems will constrain Malawi's ability to take advantage of agricultural opportunities created by a growing population and demand for exports. These threats have the potential to impose significant costs because ecosystem services provided by soils will be impaired. This National Soil Conservation and Restoration Action Plan provides Malawi's strategies and action plan for the Sustainable Land Management (SLM) for the period of 2021-2026. It has been prepared in response to the findings of two studies (technical and economic studies) on the amount and cost of soil loss in Malawi commissioned by PEI in the 2016/2017 upon request of the steering committee that oversees the implementation of the Poverty-Environment Action Project and in close collaboration with PEA's implementation partners that include, the LRCD, FAO and UN Women. In addition, this action plan demonstrates Malawi's commitment to the implementation of Voluntary Guidelines of Sustainable Soil Management, which requested parties to revise their strategies/action plans in line with the principles for Sustainable Land Management (SLM).

Soil loss is a major threat to agricultural development in Malawi. By extension, soil loss is also a major hindrance to the overall economic development of the country since the Malawian economy is dependent on agriculture. Although Malawi recognizes the importance of soil to its economic growth, the country does not seem to have some organized and concerted effort guidelines for sustainable soil management. Weak polices, legislations, enforcement, and overlap of mandates among institutions involved in regulation coupled with poor coordination and collaboration among institutions and stakeholders in SLM have contributed to the country's inability to effectively address soil degradation. Further, cross cutting issues such as inadequate financing of SLM activities; limited capacity of Women, Youth, and Vulnerable Groups to participate in SLM activities; unsustainable natural resource management and utilization; limited human resource capacity to undertake SLM; limited SLM research technology development and innovations; and inadequate data and information on SLM have also led to poor implementation of SLM activities. Consequently, the country needs a sound and enabling SLM action plan that will simultaneously guarantee productivity and food security while addressing soil degradation.

There are multiple issues that underpin the trend of increasing land degradation in Malawi**. Five main challenges** for promoting and scaling up SLM include:

- Limited availability, knowledge and capacity of service providers (extension staff) in soil, water, agro-biodiversity and integrated ecosystem management and in understanding interrelations between SLM and development.
- Inadequate data and knowledge on the short, medium- and long-term benefits of SLM practices adopted at farm and wider catchment/watershed level [production-food security and income, environmental services (control land degradation, water supply, flow and quality, biodiversity conservation and livelihoods and culture)];
- Inadequate attention to SLM in plans and budgets and inadequate investment in SLM by central and district governments, also other development partners despite the multiple benefits that can be generated;
- Sectoral fragmentation of activities and

inadequate mechanism(s) for providing multi-sector advice and technical support to ensure sound design and quality control for SLM interventions;

- Inadequate attention and mechanisms to address conflicts over natural resources, access and user rights (gender, youth) and security of tenure through individual and common property rights as an integral part of SLM and as a basis for sustainable investments.

Anti-erosion practices – marker ridges with vetiver grass, contour ridges, marker ridges, box ridges, swales, pit planting, infiltration trenches, storm water drain, minimum soil disturbance, and surface mulch show the greatest promise, perform well across different agro-ecologies in Malawi, and should receive funding and institutional support. However, application of single technology may not be effective. Therefore, the SLM program should design several methods combining some technologies in order to recommend the farmers in the target areas.

Nutrient replacement practices - crop diversification, legumes intercropping, crop rotation, manure utilization, crop-livestock integration, agroforestry and crop residues incorporation—show the greatest promise, perform well across different agro-ecologies in Malawi, and should receive funding and institutional support. Despite potentially promising effects, the adoption rates of these practices remain low. In addition to factors associated with both anti-erosion and nutrient placement practices, such as deferred benefits or high initial costs of adoption, the enabling environment in Malawi—specifically inadequate access to rural finance, capacity building and markets, but also insecure land tenure and distortionary public policies which tend to focus on maize production—present significant bottlenecks.

Fertilizer effectiveness and efficiency Fertilizer use requires complementary practices for efficient and optimal nutrient uptake. Integrated soil fertility management (ISFM) is the best option for Malawi to improve fertilizer effectiveness and efficiency. ISFM focuses on the combined use of inorganic fertilizers, soil amendments (e.g. lime, rock phosphate, etc.), and organic matter (e.g. crop residues, manure, legumes, etc.) to replenish lost soil nutrients. Although there are practical examples of ISFM in Malawi, widespread adoption of ISFM may need further research and trials on optimal alternatives.

The analysis shows that SLM/CSA's impact on household income and welfare indicators is mostly positive in the long term. In the short term, the incentive to adopt SLM/CSA is constrained by high upfront and production costs. Positive impacts on household income, increase in food availability, reduction of poverty were found in the long term. Higher production costs in the short term (that is, the need for mechanization or increased labor time) could impede adoption specifically for minimum soil disturbance, residue retention, and agroforestry. Some SLM/CSA practices do not increase income but do reduce income variability. The promotion of SLM/CSA must be customized to suit Malawi's specific agroecological conditions. The analysis shows that several SLM/CSA practices perform better under dry than wet conditions, which points toward their potentially favorable impact in the event of a drier future climate. Minimum soil disturbance, residue retention, and pit planting practices did not show good results under wetter conditions. Drought-tolerant varieties, agroforestry, and crop diversification show good results under both extreme dry and wet conditions, and seem particularly suitable for climate adaptation and building household resilience. Under dry conditions, the adoption of nearly all CSA practices has a significant positive impact on food security and crop production.

To achieve our goal for SLM, effective protection, management and use of our assets and values, and reduction of threats and constraints, this action plan establishes comprehensive elements for policymakers to pursue immediately namely:

- *Stimulating Community Initiatives in Sustainable Land Management*: This intervention will focus on four components namely: identification and analysis of community initiatives in SLM, stimulation and upscaling of community initiatives, awareness raising

amongst policymakers, development of methodology for upscaling and institutionally embedding SLM initiatives

- *Mainstreaming of Sustainable land management activities in national and district programs:* This intervention will focus on four components namely: support the mainstreaming of SLM issues into district development plans and budgets; support adoption of sustainable land management practices by local communities; strengthen the LRCD focal point office in the Ministry of Agriculture and the inter-ministerial committee on SLM to support implementation of the action plan; promote/support rationalization of District Environment Action Plan (DEAP) process to distract funding and ecosystem scales.

- *Enhancing adoption of Climate Smart Agriculture Practices in Malawi's Farming Systems*: This intervention will focus on scaling up of sustainable land management practices will also focus on building capacities of farmers and extension officers at local government level in an effort to build a climate change resilient society. It will specifically increase on the numbers of farmers using Climate Smart Agricultural practises, putting in place measures to improve input supply and produce markets and economic sustainability for farmers using Climate Smart Agricultural Practises.

- *Promote/support operationalization of SLM on a programmatic level*: The proposed country programmatic SLM approach will not only support adoption of SLM/ agricultural technologies, but will also play a catalytic role in the formulation and implementation of a programmatic SLM approach in Malawi. The programmatic approach will address the difficulties inherent in coordinating the current multiplicity of interventions in SLM (e.g., information flows, lack of country ownership when donors pursue specific priorities), and the need to bring in the wide range of stakeholders needed for successful interventions. It is envisaged that the SLM programmatic approach and the implementation of NAIP will lead, in the short and medium terms, to improved coordination and increasingly joint planning among the various Government and donor supported interventions, and in the -longer term to an integrated approach, Government-lead SLM program that establishes the agenda for up-scaling SLM action towards greater impact on the ground.

- *Develop an information management system for tracking SLM activities at the national/ district level:* The Agriculture Sector Wide Approach (ASWAp) includes detailed spending scheme for sustainable land management, and there are SLM interventions underway at the district level. However, there are no tracking mechanism in place to tally up what is actually being implemented. As SLM activities are spread across several different sectors, it would be advisable to develop common criteria for tallying and reporting on SLM interventions.

- *Promote/support the development of guidelines for district level bye-laws that incentivize SLM practices:* Utilizing some of the lessons learned on some projects e.g., quick adoption of conservation agriculture and the immediate benefits of other SLM interventions, LRCD and other enabling stakeholders should develop a set of guidelines for bye-laws that could be rolled out at the district level. Through such bye-laws, incentives for implementing SLM could in effect be operationalized, through payment for ecosystem services.

- *Support operationalization of holistic landscape management approaches* by harmonizing policies and supporting cross-ministerial collaboration across the agriculture, environment, water and energy sector, and across administrative boundaries. Landscape approaches include climate-smart crop, livestock and forest management and have the potential to reduce alarming rates of soil and nutrient loss as well as addressing issues of biomass burning and charcoal production, which are key for Malawi's carbon footprint

- *Promotion of Complementary practices to inorganic fertilizers under affordable inputs programme.* Complementary agronomic practices (manure/compost, nitrogen fixing legumes used in crop rotations, integrated livestock-crop system, water harvesting, and erosion control) are needed in addition to inorganic fertilizers. The organic content of soils needs to be increased through residue management and other available sources to compensate for the lack of active clays in the soils.
- *Create soil maps of nutrient deficiencies and soil acidity constraints*: The Department of Agriculture Research Services (DARS) needs to urgently conduct research to update soil maps that indicate the soil types and textures, in addition to the soil nutrient maps so as to guide on the appropriate holding and retention capacity of the soil nutrients. so as to guide on the appropriate holding and retention capacity of the soil nutrients. This is the primary information gap in Malawi preventing the creation of targeted fertilizers.
- *Establish Soil Testing Laboratories (STLs) and Mobile Soil Testing Laboratories (MSTLs) at district level (Agri-clinics).* Agri-clinics will provide paid consultancy services for enhancement of agriculture production and income of farmers by regularly monitoring soil health status in smallholder farmer fields consequently improving fertilizer use efficiency. The centres will provide advisory service on crop selection, agricultural inputs, best farming practices, soil testing and testing of irrigation water for quality, recommend fertilizer application including bio-fertilizers and provide guidance on soil reclamation and related areas. The centre will also act as a knowledge provider, enabling the farmers to get access with the latest technologies in the field of agriculture, horticulture and farm forestry.
- *Increasing farmer and extension staff knowledge on fertilizer use:* Lack of fertilizer knowledge basics: the 4R nutrient stewardship (right source, right rate, right time, and right placement) is a severe constraint to both farmers and extension workers, many of whom have never used or been exposed to fertilizers. Government and development partners should support training of farmers and extension staff on fertilizer basics. Training should be followed by simple demonstration sites to train farmers and field days that include cost analysis to show the profitability of fertilizer use. Other partners in this should be fertilizer companies (who can provide product in regions they are interested in targeting and will often financially support field day activities) and agro-dealers, who benefit from increased sales.
- *Improving policies and strategies for sustainable land management:* The national government should finalize the development of the National Land Use Planning Policy that will guide the planning and sustainable use and management of land in both urban and rural areas; develop and enact Agricultural Land Use and Management Bill to regulate management agricultural land and use of environmentally fragile areas for agricultural purposes; and Develop and implement programmes aimed at creating awareness among land users, local leaders and politicians about the existing laws, obligations and rights.
- *Support the development of Nationwide SLM Coordination Unit:* The national government should establish a national coordinating body with the responsibility, authority and funding to coordinate and support national and districts efforts to implement SLM and to operate as a "Think Tank" to advance a common vision of the issues related to scaling-up SLM programs.
- *Sustainably Financed SLM activities:* Create a solid financial base to implement the Land Use Policy and Best Management Practices by creating revenue streams from existing activities and actively seek strategic partnerships to attract funding for remaining activities.
- *Strengthen research and development in*

SLM: Increase investment in NRM research to provide information that would lead to the development and implementation of necessary SLM interventions. Sustainable utilization of any natural resource depends on the deep understanding of its nature, extent, its potentials and limitations for specific uses.

Operational guidelines at district level case of Salima: A six-point SLM strategy and approaches was developed to tackle the interlinked issues of human pressures on natural resources, poor management practices and limited capacities and the implications in terms of widespread and escalating land degradation, biodiversity loss, vulnerability to climate change and food insecurity. The SLM strategy for integrated ecosystem management and enhanced food security and livelihoods will be piloted in the district to highlight the importance of six main actions:

- The farmer field school approach on sustainable land management (FFSSLM approach) for building farmers' capacity in integrated natural resources management for the maintenance of ecosystem services and food and enhanced livelihood security;
- Participatory catchment process from diagnostic (using Land Degradation Assessment Local tools) for informing community action planning and management – and local mechanisms such as catchment/watershed committees, stakeholder dialogue and negotiation for conflict resolution and FFS – catchment linkages for scaling up proven practices;
- Demonstrating how SLM brings win-wins, contributing to climate change adaptation/building resilience and mitigation, reducing land degradation (vegetation cover, erosion control, nutrient cycling, restoring soil organic matter), enhancing agro-biodiversity, as well as socio-economic benefits/ livelihoods (yield, income, nutrition and food security, resilience and reduced risk);
- Partnership and capacity development for improved support to farming communities:
    - Build capacity of Service providers including community-based organizations (CBOs) and farmer facilitators for effective continued support to farmers (e.g. through FFS);
    - Establish multi-sector SLM teams at local Government level, and linkages with agricultural research for technical support and quality control.
- Documenting, assessing and sharing knowledge on SLM practices (tools and methods) including packages of SLM practices for specific land uses/ agro-ecosystems in the district [soil and water conservation on steep lands; crop-livestock-tree integration for food, energy and resilience; regenerating healthy lands systems through grazing and livestock management, protecting river and lake margins];

Integration of SLM into policies, planning and legislation at local, and district levels through creation of multi-sector SLM teams, synergy and partnerships with other projects and programmes mainstreaming SLM into plans and budgets and implementing guidelines for district level bye-laws that incentivize SLM practices. Public and development partners' resources should be allocated to crowd-in private sector finance and maximize finance for achieving sectoral goals and realize the potential to contribute to sustainable land management. These mechanisms have potential to address key constraints to SLM/ CSA adoption, that is, inadequate access to rural finance, capacity building and markets:

- Business partnerships with rural communities, in which agribusinesses promote the adoption of sustainable land management practices, provide environmental certification and leverage payment of ecosystem services finance; thereby providing smallholders with capacity building, access to markets, and finance.

- Out grower schemes with small-scale irrigation to promote commercial crop production. and thereby provide farmers with improved access to markets and finance, training and services.
- Participatory, integrated landscape management approaches to address multiple objectives of crop and livestock production, forest management, and environmental sustainability. Participatory elements favour knowledge exchange among rural communities and integrated land and water management practices enhance eligibility to participate in ecosystem service finance projects.
- Farmer field schools to enhance community-based learning and timely knowledge exchange, as well as facilitated market access through strengthening of farmer groups and associations.
- Pluralistic participatory extension approaches to enhance adoption of agricultural research and innovation, and spur private sector involvement in service delivery, to improve farmers' business skills and facilitate market linkages
- Cash transfer programs can be aligned with agriculture sector programs and planting cycles, to provide farmers with access to capital to start-up climate-smart agriculture operation and enhance livelihood resilience.
- Principles of gender-sensitive supply chains are applicable to each mechanism; gender-sensitive interventions may help overcome enabling environment constraints to support women to adopt CSA.

Finally, main outcomes and opportunities for scaling-up and next steps were identified for the various partners (central and local government, service providers and other actors), specifically:

- Multi-sector teams at district/National levels with enhanced capacity to guide and coordinate a SLM strategy and actions;
- Farmers, and local actors convinced of the multiple benefits generated by the SLM practices;
- SLM FFS validated as a proven approach for promoting participatory learning and empowerment for sustainable land resources management and enhanced production;
- Capacity of local actors built and demonstrations in place (FFS study plots and catchment management plans) as a basis for scaling up SLM;
- Increasing recognition of the need for governance mechanisms for SLM at local level (committees, by-laws, etc.) and for multi-sector policy, planning and integrated catchment/watershed approaches (landscape).

CHAPTER 1

INTRODUCTION

.1.1 Background

Malawi is located in the southern part of Africa with a total area of 119,140 km^2, of which 20% is water. The country is bordered by Tanzania to the north, Mozambique to the east, south and southwest, and Zambia to the west. The country has a tropical climate with variable temperatures, relative humidity and fertile soils. The country's Gross Domestic Product (GDP) was estimated at US $7.67 billion in 2019, equivalent to per capita income of about US $412. Currently, the population of Malawi is estimated at 19.1 million (2020) with an average density of 161 people /km^2 and a population growth rate of 2.69% per annum. This 80% of the population is highly dependent on agriculture for its livelihood and consequently soil resources.

The country is endowed with a diversified natural resource base, which comprises of abundant water resources and unique and diverse flora and fauna. The environment plays a very significant role in influencing social and economic development at both the household and national levels. Approximately 80% of Malawians depend on renewable natural resources for their subsistence and household incomes, and the foundation of the national economy is primarily rain-fed agriculture (World Bank 2020). The sustainable management of natural resources – such as land and soil - could contribute to enhanced growth and poverty reduction (UNEP, UNDP, PEI 2016). However, evidence demonstrates that these resources are degrading at alarming rates on account of unsustainable use largely arising from high population growth rates, poverty, agricultural expansion, inappropriate management practices, low capacities for governmental enforcement of rules, and - especially in the past - weak policies (Gil Yaron, et al 2011, Nanthambwe 2013, Omuto and Vargas 2018, Asfaw *et al* 2018).

Malawi recognizes the importance and the need to conserve natural resources including soils. In 2002, the Malawi Government developed the first National Land Resources Management Policy and Strategy (NLRMPS) as a tool for land resources management. The NLRMPS provides an avenue for achieving long-term goals on conservation and sustainable use of land resources in accordance with the Constitution, and other national and sectoral policies, plans and strategies. In addition, the Government of Malawi (GoM) formulated the Malawi Growth and Development Strategy (MGDS) as the overarching strategy for achieving economic growth and development. The MGDS sets out targets for economic growth and poverty reduction, including growth in agriculture, to achieve food security and to enhance incomes, foreign exchange earnings and the general wellbeing of Malawians. Furthermore, MGDS includes the conservation of natural and sustainable utilization. This reflects GoM's commitment in combating natural resources degradation and securing environmental sustainability. However, this commitment is not being fulfilled due to low institutional capacity, political economy factors (e.g. ad-hoc policies), changing donor priorities, changing roles of public and private institutions and NGOs (Mloza-Banda & Nanthambwe 2010, Nanthambwe 2013, UNEP, UNDP, PEI 2016, Omuto and Vargas 2018, Asfaw *et al* 2018).

1.2 Soil Resources of Malawi

Soils in Malawi are important for economic, socio-cultural and ecological purposes. Malawi's soils are of three major types: Luvisols, Lixisols, and Cambisols. Lixisols are dominant in the northern region, Luvisols in the central, and Cambisols along the Rift Valley and largely in the southern region. Cambisols and Luvisols are naturally endowed with good chemical properties that can be exploited for agricultural purposes. They can sustain good crop production especially if they are properly managed. Their vast majority implies that they can benefit the country in supporting crop production

programs. Lixisols have relatively higher in silt and organic matter content. However, they need appropriate fertilizer application in order to guarantee good performance in crop production. Furthermore, they may also take a long time to regenerate if excessively exploited through continuous nutrient mining.

In agriculture-based economies such as Malawi's, the importance of soil cannot be overemphasized. Soil is also important for other ecosystem services such as nutrient cycling; carbon sequestration, control of erosion; and cultural services derived from soil use. The degradation of soil resources, therefore, has far reaching consequences on the environment. The livelihoods of people involved in the various activities are likely to be affected as well through loss of jobs and incomes. Soil degradation, therefore, negatively affects soil supplies, fisheries, electricity generation, agriculture and water quality (Gil Yaron, et al., 2011, UNEP, UNDP, PEI 2016).

1.3 Soil and nutrient loss in Malawi

Generally, the status of land degradation in Malawi is increasing at an alarming rate. Soils are being degraded due to poor maintenance of existing erosion control structure, inadequate soil fertility management, prevalent fragile soils, steep slopes, limited extension services, poor uptake of soil conservation technologies, low levels of awareness of soil degradation and conservation technologies, low level of farmer-investment in soil conservation, erratic and high rainfall intensities, and reduction of protective soil cover. Soil erosion and declining soil fertility are the principal environmental problems facing Malawi, with 85% of the country's population living in rural areas. Soil loss is a major threat to the agricultural development in Malawi and by extension is also a major hindrance to the overall economic development of the country since the Malawian economy is dependent on agriculture (Vargas and Omuto 2015). Yet this resource continues to be degraded at an accelerating pace. Soil erosion is caused by expansion of agriculture, deforestation, overgrazing, and land scarcity leading to people cultivating in marginal and fragile areas. Overcultivation is also a significant cause of soil nutrient decline. The impact of these factors is further exacerbated by rapid population growth. Shortage of land predisposes to unstainable utilization whereby it is not possible to deploy some sustainable soil management principles such crop rotation, fallowing, consequently intensive land use not coupled with good agriculture practices which tends to be erosive. Not only does soil loss reduce the cultivable soil depth but it also removes the fertile soils. The net effect is loss of agricultural productivity, increased expenditure on fertilizers, and a general decline in profitability of crop production, which make it more difficult to achieve food security and reduce poverty

A successful agricultural sector depends on the interplay of a wide variety of biophysical, economic, and societal factors. Soil health makes up a very important piece of this puzzle; soil and nutrient loss pose a direct effect to the agrarian economy of Malawi. It is against this background that FAO recently conducted a study of soil loss (technical and economic assessment) in Malawi in partnership with the Poverty-Environment Initiative (PEI) of the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). These studies build on previous soil studies conducted in Malawi since 1970; much of this previous literature focused on plot-scale studies of soil loss rates using empirical soil loss estimation models such as SLEMSA (Estimation Model for Southern Africa). The majority of these studies have been conducted in experimental plots or small watersheds in different parts of the country. Khonje and Machira (1987) used the SLEMSA model with secondary information and expert opinion reported national average soil loss rate at 33 ton/ha/year, while the World Bank (1992) reported average national soil loss rate as 20 ton/ha/year. Although the above soil loss study results are not strictly comparable owing to differences in time, methods, and assessment scales, they pointed to a general soil loss pattern in the country. They found that soil erosion is still increasing, with the worst degradation in the densely populated southern region.

The results of soil loss assessment in Malawi carried out between 2010 and 2017, topsoil loss rates increased by over 10%. In 2010, the mean soil loss rate was estimated at 26 ton/ha/year, which rose to 29 ton/ha/year in 2014 and to 30 ton/ha/year in 2017 (Vargas and Omuto (2015). Although not entirely cross compared, these soil loss reports point to a relatively high rate of soil loss in the country. Some studies that have translated these soil loss levels into yield losses arranging from 4% to 25% loss each year. The severely affected areas, the Rift Valley ridges in the Central (in Dedza and Ntcheu) and in the south (in Zomba, Machinga and Neno) and while Nkhata Bay and some parts of western Mzimba. Overall, Nkhata Bay and the border between Phalombe and Mulanje are the soil loss hotspot areas in Malawi (Omuto and Vargas 2018). The exacerbating factors in these areas appear to be topography (many steep slopes), fragile and shallow soil types, erosion caused by high rainfall, and poor soil management practices.

These studies identify two main factors behind Malawi's high soil loss rates: fragile soils on steep slopes and erosive rainfall. Anthropogenic activities have also been flagged out as exacerbating factors: engaging in agricultural activities in fragile soils or steep slopes plays a large role in increasing the rate of soil loss. The expansion of Malawi's agricultural land at the cost of natural forest cover has reduced vegetation cover and exposed more soil to the country's erosive rainfall. In addition, sustainable land management policies have not been adequately implemented to protect vegetation cover and ensure the sustainable use of non-renewable natural resources.

Soil erosion is one of the major types of land degradation that pose a threat to sustainable agricultural production. Asfaw *et al* (2018) estimated that a 10% increase in soil loss per year would translate into monetary losses of about 0.26% of the GDP of Malawi and 0.42% of the total agricultural production value. Higher soil loss rates would lead to larger impacts: for example, a 25% increase in soil loss would result in monetary impacts of about 0.64% of the GDP and about 1% of the agricultural production. The worst-case scenario would result in a 50% increase in soil loss yields which translates to monetary losses corresponding to about 1.28% of GDP and 2.1% of the total agricultural production value (Asfaw *et al* 2018).

Prevention of soil and nutrient loss through sustainable land management (SLM) practices is a common method for soil and water conservation and of paramount importance to Malawi. Sustainable management practices can improve land cover, reduce raindrop impact and, in turn, reduce runoff and soil erosion. FAO studies went further to do economic analysis of current SLM practices and found that in all scenarios of soil loss the highest economic mitigation impact results from the adoption of vetiver grass, followed by terraces, tree belts and bunds. In each of the three soil loss scenarios, as well as in the status quo (current loss rate), the most effective practices are represented by vetiver grass and terraces. In particular, in the status quo, the adoption of these two practices increases maize productivity by about 275 kg/ha and 200 kg/ha in comparison with non-adoption. Tree belts and erosion control bunds produce much lower impacts in terms of productivity growth, which range from about 80 to 120 kg/ha, depending on the severity of the soil loss scenario. The soil loss studies in Malawi have recommended that among antierosion practices that vetiver grass and terraces are the most successful strategies for farmers to tackle events of extreme soil loss while for nutrients, crop diversification and legumes intercropping can significantly reduce the loss of Phosphorus and Nitrogen

Input subsidies are one of the strategies for addressing poverty, inequalities, vulnerabilities, food insecurity, and replacing nutrients in the soil. In Malawi, subsidy programs have been implemented since the 1960s to increase access to external farm inputs and their adoption by the resource poor smallholder farmers, with the desire of stimulating production, increasing farmers' incomes, and spurring economic growth. The subsidies have covered the span from universal to targeted programmes. The universal subsidies existed up to the early 1990s (ADMARC's implicit taxation and the Starter Pack). Targeted subsidies started in

the late 1990s and continue to date, including the Targeted Farm Input Program (TIP) and the Farm Input Subsidy Program (FISP). The new Government has just announced the Affordable Inputs Program (AIP), which is universal in nature since it targets about 4.3 million farming households in the 2020/21 growing season (roughly all farming households in Malawi)

Asfaw *et al* (2018) estimated the profitability for the current level of N loss (4 kg/ha) and for a projected loss of 22 kg/ha. Under current NPK and Urea application rates, an increase of N loss reduce profitability by around 10.7% (from 65000 MWK to 58000 MWK). However, using the profit maximizing recommended rates (around 170 kg/ha) would increase profits by 13.1%. This study concludes that current application rates of NPK (Chitowe) fertilizers are inadequate to cope with a moderate increase in Nitrogen loss, even with FISP subsidized price.

Many technocrats argue that the subsidy programs have mainly focused on supporting maize production. The subsidy programs of 2005/06-2019/20 also included some legumes, namely soybean, common beans, pigeon pea and groundnuts, but were still skewed toward maize production. This is in response to prioritizing conservation agriculture practices, and an increased recognition of integrated soil fertility management, complementing mineral with organic fertilizer, crop rotation and other land and water management practices. The narrow scope of the subsidy program is a concern because farms and farming systems in Malawi are diversified: farmers operate throughout rainy and winter seasons, and cultivate neglected and underutilised crops such as millet, Bambara-nuts and Amaranthus for food and nutrition security. Moreover, input requirements vary across the different agro-ecological zones (Low, mid and high altitude). It is important that agricultural input support programs are aligned with agricultural and food diversification policies and interventions for example area specific fertilizer recommendation.

The Malawi Soil Health Consortium estimates that although the average crop yields in Malawi have increased in tandem with the increase in use of fertilizers, the economic and agronomic efficiency of using fertilizer is stuck at less than 50% of actual potential (Mutegi et al, 2015). In layman's terms this means that up to 50% of the potential impact of fertiliser being applied is being wasted. This is due to blanket application of a 'one size fits all' fertiliser as well as sub optimal soil pH, organic matter and moisture levels. Addressing issues of soil fertility through climate smart agriculture (CSA) practices in conjunction with the correct fertiliser being applied has the potential to significantly, and sustainably, increase yields.

Omuto and Vargas (2018) in part on series of FAO studies in Malawi in partnership with the Poverty-Environment Initiative (PEI) of the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) laments on low institution capacity in terms SLM. These authors suggest that staff in Malawi's Land Resources Conservation Department (LRCD) could be better supported through training in software and models to monitor soil loss and environmental resource use throughout the country. They also suggest that, policymakers need to ensure that research results are used to develop strategies, programs, and extension services to implement SLM programs in high-risk areas. Finally, the study recommended the creation of a monitoring network to ensure that soil loss and fertility is measured correctly on a routine basis. Such a network can go a long way in giving policymakers the scientific evidence they need to enact effective, SLM programs.

1.4 Sustainable Land Management

Sustainable Land Management (SLM) concept reflects an ambition centred on conservation and responsible management of soils. SLM is a valuable tool for soil conservation and restoration, and a pathway for safeguarding key ecosystem services. Due to the incalculable value soils provide to society through ecosystem services, SLM ensures a high return on investment by supporting and increasing these services. Widespread adoption of SLM practices generates multiple socio-economic

benefits, especially for smallholder farmers and large-scale agricultural producers whose livelihoods directly depend on their soil resources.

The foundational agreements and documents of the Global Soil Partnership provide the international context for SLM. Most significant are the Revised World Soil Charter (FAO 2015), the Status of the World's Soil Resources report (ITPS 2015) and the Voluntary Guidelines on Sustainable Soil Management (FAO 2017). These assert that soils are an essential and non-renewable natural resource hosting goods and services vital to ecosystems and human life. While the SLM concept is new, and still evolving, many of the practices that make up SLM already exist in the country and are used by farmers to cope with different types of production risks. Mainstreaming SLM requires critical stocktaking of ongoing and promising practices for the future, and of institutional and financial enablers for SLM adoption and scaling. This study profiles the country to provide a snapshot of SLM from policy, institution, programmes and projects, and activities/practice level to create a spring broad of an action plan of soil conservation and restoration in Malawi.

1.5 Legal and Institutional Framework

1.5.1 Policy and Legislation

Natural resource management is not governed by single framework legislation in Malawi. However, appropriate umbrella policies and legislation have been formulated to address the problems and challenges of sustainable soil management. Table 1.1 highlights some of the legislation, their gaps and areas of conflict that prevent effective regulation of sustainable land management in Malawi.

Table 1.1: Provisions and Gaps on Sustainable Land Management in Some ENRM Policies in Malawi

Policy & Implementation Arrangements	**National Fertilizer Policy (2018)**
Lead Institutions	Ministry of Agriculture
Description	***Key policy aims***: The policy encourages soil testing, soil mapping and fertilizer blending and Extension support to improve the use and performance of fertilizers. The Policy is also proposing increasing access to high quality fertilizers by farmers (for all crops), mostly through commercial suppliers, in line with the commercialization focus of the National Agriculture Policy Progress in implementation: on-farm trials for fertilizer blends underway ***Key barriers/challenges faced;*** Inadequate facilities for testing and analysis of fertilizers, Limited capacity to enforce regulations, Lack of understanding of policies, standards and guidelines by field staff and communities, Lack of funding for implementation
Relevance to SLM	The promotion of sustainable soil management at farm level can support the restoration of soil – a key SLM practice
Policy & Implementation Arrangements	National Agriculture Science Plan 2018 – 2023
Lead Institutions	Ministry of Agriculture
Description	Key policy aims: The plan provides for the advancement of science and Technology in Malawi, which includes research in soils. Progress in implementation: Not much has been towards SLM Key barriers/challenges: Agricultural technology generation in Malawi is skewed towards crops at the expense of natural resource conservation
Relevance to SLM	Technology generation

Policy & Implementation Arrangements	National Agricultural Investment Plan (2018)
Lead Institutions	Ministry of Agriculture
Description	Key policy aims: The plan provides for investment in Sustainable Land and Water Management as a pillar and invest in soil testing facilitates Progress in implementation: Not much has been towards SLM Key barriers/challenges: The main challenge is that it is not being followed and Lack of understanding of the plan
Relevance to SLM	Sustainable funding for SLM
Policy & Implementation Arrangements	National Resilience Strategy (2018 – 2030)
Lead Institutions	Department of Disaster Management Affairs
Description	Key policy aims: NRS will promote agricultural diversification to enhance resilience to environmental and economic shocks by spreading risk across a more diversified portfolio of agricultural enterprises and reform input subsidy programme
Relevance to SLM	Promotion of SLM practices
Policy & Implementation Arrangements	National Climate Smart Agriculture Framework (NCSAF) 2018
Lead Institutions	Ministry of Agriculture
Description	Key policy aims: The NCSAF was developed through the auspices of the VUNA program (supported by DFID), whose objective was, inter alia to address the coordination problem in the CSA space. The NCSAF highlights the challenges that the agriculture sector faces and the action areas necessary to increase resilience, including creating an enabling environment for enhancing adaptive capacity and resilience, climate risk management, and gender inclusiveness. The framework uses a value chain approach with the purpose of fostering commercialization, and emphasizes the need for capacity building, extension, and awareness-creation regarding the challenges posed by climate change Key barriers/challenges: Lack of understanding of policies, standards and guidelines by field staff and communities, Lack of funding for implementation, District offices have inadequate technical and financial resources Devolved functions often still executed in practice by the Department
Relevance to SLM	The promotion of CSA at village level can support the restoration of community watersheds – a key SLM practice.
Policy & Implementation Arrangements	Environmental Management Act (2017)
Lead Institutions	Ministry of Forestry and Natural Resources
Description	Key policy aims: The act aims at to ensure sustainable use of natural resources; facilitate restoration, maintenance and enhancement of ecological systems and processes and preservation of biodiversity; and promotion of community based natural resource management Key barriers / challenges faced: Environmental management policy requires the co-operation, coordination and participation of numerous stakeholders from all sectors, which may not necessarily be forthcoming, Need to develop the capacity for natural resource management in all public sector institutions, Lack of funding for sustainable utilization of natural resources
Relevance to SLM	The policy contains a specific strategy to promote development and dissemination of agro-forestry practices

Policy & Implementation Arrangements	National Forest Landscape Restoration Strategy (2017)
Lead Institutions	Ministry of Forestry and Natural Resources
Description	Key policy aims: The aims to restore deforested and degraded landscapes by 2030 through scaling up improved management of forests and natural resources, sustainable land management practices with a focus on tree-based restoration practices that contribute to increased food security, resilience to climate change, watershed protection and improved water supplies, increase production of forest products and biodiversity conservation, while enhancing gender equity
Relevance to SLM	The policy contains a specific strategy to promote development and dissemination of SLM practices
Policy & Implementation Arrangements	National Forest Policy (2016)
Lead Institutions	Ministry of Forestry and Natural Resources
Description	Key policy aims: Promote sustainable forestry management and it also aims to reduce overdependence on wood fuel, promote efficient use of wood fuels as a way of reducing the rate of deforestation and advocates the promotion of sustainable charcoal production Key barriers / challenges faced: Lack of understanding of policies, standards and guidelines by field staff and communities, Lack of funding for implementation, District forest offices have inadequate technical and financial resources, Devolved functions often still executed in practice by the Department of Forestry, Ambiguity around division of district- and central-level decision making responsibility, Unclear benefits sharing mechanisms between forest dependent communities, district and central government authorities
Relevance to SLM	The promotion of sustainable management of forest resources at village level can support the restoration of community watersheds – a key CSA practice
Policy & Implementation Arrangements	National Agriculture Policy (2016)
Lead Institutions	Ministry of Agriculture
Description	Key policy aims: The policy advocate to facilitate timely and equitable access for farmers to high quality farm inputs, including inorganic and organic fertilizer and promote investments in climate-smart agriculture and sustainable land and water management.
Relevance to SLM	Provide policy framework for adoption of CSA practices that enhance food security

1.5.2 Institutional Framework

Malawi has an institutional arrangement aimed at creating an enabling environment for implementation of the Land Resources and Conservation and other SLM-related conventions. The current arrangement includes the central and local government levels through which relevant statutory corporation and non-governmental organizations (NGOs) participate. The organizations are linked through committees and focal points at various levels.

At policy level, the Cabinet Committee on Natural Resources and Environment (CCNRE) informs the cabinet on land resources and conservation issues to seek political guidance and support. They are supported by the Parliamentary Committee on Natural Resources and Climate Change (PCNRCC). These Committees get policy direction from the National Council on the Environment (NCE). The Technical Working

Group on Sustainable Land Management advises the NCE on technical issues. The Land Resource and Conservation Department provides guidance to actors involved in SLM. At the local level, the Directorate of Agriculture and Natural Resources (DANR) coordinate sustainable land management issues in the district and Village Natural Resource Management Committees (VNRMCs) partly coordinate sustainable land management activities at the community level. However, there are various institutions that address land and resource conservation at different levels. These include Government departments, Private Sector, Development Partners, Regional and Global Institutions as well as other stakeholders. These different institutions and stakeholders undertake policy formulation, regulatory functions, research and technology development, advisory and service provision, implementation, capacity building and financing SLM related activities.

At district level, the coordination mechanism among various departments represented, the NGOs and the private sector is very much functional and efficient through the District Executive Committees and their subcommittees including that on environment. The problems at that level include lack of adequate well qualified personnel, inadequate and untimely funding, lack of proper equipment for SLM promotion, insufficient means of mobility and poorly resourced extension services.

Land Resources Conservation Department (LRCD) in the Ministry of Agriculture is responsible for the coordination, planning, implementation, monitoring and evaluation of land resources conservation policy, legislation, programs and projects in the country. It has programmes in all eight Agricultural Development Divisions funded on revenue budget and projects funded on development budget. LRCD is at the forefront of promoting environment and natural resource management (ENRM) in agriculture. On ENRM it promotes activities in a number of areas: Soil and Water Conservation, Rainwater Harvesting, Climate-smart Agriculture, Agroforestry and Soil Fertility Enhancement, Land Resources Surveys and Evaluation, Environmental Education. The technical staff of Land Resources and Conservation Department includes the Agriculture Extension Development Officer (AEDO) who is their direct link to the farmer. The capacity of the department to fulfil its mandate is hampered by low institution capacity e.g. lack of trained technical staff at EPA level and training facilities for formal and informal training in SLM. The mandate is further undermined by lack of influence and functional Land Management Data Base and Information System and outdated equipment.

1.5.3 Ongoing SLM initiatives

Some of the key ongoing SLM initiatives are described as;

Shire River Basin Management Programme: The project aims at reducing soil erosion in high-priority catchment areas by improving land management practices, including forest management, riverbank protection, conservation agriculture, crop diversification, ridge alignment, planting of vetiver grass and natural regeneration of trees. In the longer run, these interventions brought (1) increased efficiency of hydropower generation (through reduction of sediment runoff and weed growth in the Shire) and (2) reduced poverty through higher farming yields, revenue from alternative income activities, and increased gender equality in access to resources.

ASWAp Programme: The Agriculture Sector Wide Approach (ASWAp) project represents one of the most serious intentions of Government to embrace Conservation Agriculture under the component of its Sustainable Growth Initiative. The programme has three main components and these are; (a) Institutional development and capacity building, (b) Sustainable food security; and (c) Project coordination. So far, the initiative has managed to increase adoption of environmentally sustainable maize-based cropping practices by adapting and up-scaling innovative conservation farming technologies, including minimum tillage, and mulching with crop residues; complementary technologies including permanent pit / basin planting, intercropping

and rotation with legume crops and trees (agroforestry).

Kutukula Ulimi m'Malawi (KULIMA): This project aims to contribute to the growth and expansion of commercial agriculture while also tackling the long-term aspects related to improved food and nutrition security. It intends to do so through: a) increase in agricultural productivity and diversification through mainly upscaling climate-smart agriculture technologies; b) agriculture value chain and business development; c) support to improved governance in the agriculture sector. So far, the initiative has managed to support soil analysis for project sites to enhance fertilizer efficiency.

Food and Agriculture Organization (FAO): FAO Malawi has been implementing Climate Smart Agriculture project in Malawi for some time now, This, has generated strong evidence on the determinants of adoption of agricultural practices contributing to adaptation to climatic changes such as legume intercropping, minimum soil disturbance, soil and water conservation, tree planting, use of organic and inorganic fertilizers as well as improved seeds. The findings of FAO projects also highlight that participation in social protection programmes significantly increases the probability of adopting CSA practices and sustaining adoption over time. Some policy options have been suggested that link social protection to the promotion of CSA practices as a viable option for enhancing CSA adoption such as: bundling participation in social protection with extension advice on CSA practices which creates long term sustainability; developing public work programmes based on skills that are transferable to farmers, such as building erosion control systems or planting agroforestry tree; varying the social protection payment conditional on the adoption and duration of adoption CSA practices.

CHAPTER 2

CONSTRAINTS AND PATHWAYS TO ACHIEVING SUSTAINABLE SOIL MANAGEMENT

2.1 Introduction

This chapter provides an update on priorities for improving soil condition across Malawi's agricultural landscapes. The section builds directly on previous assessments of priorities for the Malawi Government's and development partners' initiative and the soil loss assessment in Malawi reports (Vargas & Omuto 2015, Asfaw et al 2018, Omuto & Vargas 2018). The analysis of soil erosion has indicated that soil and nutrients loss are among the major impediments to a stable and sustained agricultural development in Malawi. Some of the potential drivers of high rates of soil loss include poor maintenance of existing erosion control structure, inadequate soil fertility management, prevalent fragile soils, steep slopes, limited extension services, poor uptake of soil conservation technologies, low levels of awareness of soil degradation and conservation technologies, low level of farmer-investment in soil conservation, erratic and high rainfall intensities, and reduction of protective soil cover.

2.2 SLM Interventions identified for respective target landscapes and soil conditions

Malawi's landscape, climate and land use systems have seen the country become ever more vulnerable to almost all forms of land degradation. The recent FAO study indicated that almost all districts in Malawi are at risk from one form of land degradation or other.

2.2.1 SLM issues in the Forest and Highlands

Forest and highlands contain Malawi's water catchment areas as well as forests, some of which are protected areas. Malawi's forests are estimated to contribute to 6.2% of Malawi's GDP, excluding charcoal and direct subsistence uses. Forests also support most of the productive and service sectors in the country, particularly agriculture, fisheries, livestock, energy, wildlife, water, tourism, trade and industry. Biomass from forests comprises about 80% of all energy used in the country. Trees also facilitate the rehabilitation of degraded lands, leading to improved environments and ecosystem recovery. Forests also act as carbon sinks, providing an opportunity for the country to benefit from international carbon markets. Deforestation is the major threat to the sustenance of forest and highlands in Malawi. The main drivers of deforestation in Malawi are a rapidly growing and extremely poor population converting forested land to support small-scale subsistence agriculture for food provisioning and income and using wood as a primary energy source, illegal logging and charcoal burning.

SLM Practices with Potential: Since the forest and highlands host both protected lands (natural ecosystems) and human settlements, especially smallholder farmers (agro-ecosystems), interventions must target both types of ecosystems. This means protecting existing forests and catchment areas from further degradation and restoration of those already degraded. Interventions include; afforestation programmes, farm forestry and agroforestry. Planted forests facilitate the recovery of forest resources and commercial use of forested areas. Forests shield the soil surface from heavy rainfall and reduce the rate of runoff by increasing infiltration. Forests decrease flooding, mitigate soil erosion and limit the sedimentation of rivers and reservoirs. Other interventions include water harvesting structures (to increase catchment storage and reduce flooding), revegetation of riparian

lands and protection of wetlands. Soil and water conservation measure in the cultivated areas also contributes to securing forests and highlands from further degradation. Also, providing alternative energy, e.g. developing micro hydropower stations to ease pressure on wood-based fuels (firewood, charcoal), use of biogas and subsidies for other energy sources such as solar energy, so as to reduce pressure on wood-based energy sources.

2.2.2 SLM issues in the agricultural lands

The majority of the farmers in Malawi are smallholders located in the rural areas who cultivate land parcels about 2 hectares or less. Many of these farmers cultivate areas on steep slopes and fragile soils which are highly susceptible to erosion. The farmers depend on already degraded lands to meet their food requirements. The ever-increasing demand for food with an increasing population in Malawi but with stagnant or declining agricultural productivity has led to extensive land use systems. Often, smallholder farmers expand their farming systems to new and sometimes fragile ecosystems, and lacking incentives, they engage in unsustainable farming practices that contribute to the degradation of these areas. Thus, poor farmers are unable to invest in inputs such as fertilizers, manures, pesticides, machinery or irrigation, resulting in low agricultural production.

SLM practices with potential: Soil and water conservation; terraces, grass strips, stone lines, vegetative buffers, Integrated soil fertility management, manures, cover crops, mulching, crop rotations, Conservation agriculture- minimum tillage, stubble mulching, spot tillage, strip cultivation, deep tillage, Rainwater harvesting; retention ditches, micro-basins (e.g. zai), pitting systems, Runoff diversion with supplemental irrigation; road runoff harvesting, Agroforestry systems and tree planting, including woodlots, hedgerow intercropping, Protection of riparian lands and wetlands e.g. pegging and planting grass or trees

2.2.3 SLM issues in the wetlands (Dambos)

Wetlands in Malawi, characterised by hydromorphic soils, and grass and sedge growth throughout the year are called dambos. Topographically dambos are usually broad, gentle sloping valleys occurring in the catchment area of Malawi's main rivers. Dambo soils are waterlogged at or near the surface for a large part of the year. Wetlands cover about 12% of the total area of Malawi, used mostly for grazing, sugarcane and rice production. The excessive pressure on the vegetation in Malawi's wetlands faces an onslaught from both land conversions for agriculture as well as increasing livestock densities on the ever-dwindling land space left for grazing. This has adversely affected the production potential and carrying capacity of wetlands. Wetland degradation is manifested by the loss of vegetation cover and increase in proportion of bare soil surface. The loss of vegetation cover and increased erosion can be attributed to livestock overgrazing.

***SLM practices with potential*:** water harvesting – Small dams, weirs, ponds, pans, tanks, underground cisterns, infiltration galleries, Runoff harvesting for soil moisture conservation to grow trees, grasses/fodders – semi-circular bunds, basins, pits, ditches, road runoff harvesting, Contour bunds/ contour strips to improve infiltration which can be mechanized, controlled grazing – rotational grazing and de-stocking, reseeding rangelands.

2.2.4 SLM issues in the flood prone areas

Some areas of Malawi are at risk of flooding which results in soil erosion, loss of property and even lives. Floods have increasingly become a major threat to life, property and the environment, a factor associated with land degradation and climate change. Flooding can be reduced or mitigated through structural measures such as dykes, dams, retarding ponds, river training, urban drainage measures and water harvesting with small storages upstream. It also incorporates the concept of using the natural retarding effects of lands subject to frequent floods such as pasture management. Repairing/ reclaiming flood damaged fields can be done in three stages.

Stage 1: Remove debris and sediment; the debris is grouped into general categories; biodegradable and non-biodegradable debris. Biodegradable debris can be incorporated into the soil with normal tillage operations. One concern, and this will be a recurring theme, is to not perform tillage when the soil is too wet. This will cause compaction and create more of a problem than it solves. Also, burying high-carbon crop residues may temporarily tie up nitrogen in the soil as microbes break it down. Other debris should be removed from the field.

Sedimentation from floods can pose a great challenge for crop production on agricultural land. The difference in texture of the deposition and the native soil below can cause major production issues. The depth of the deposition will determine how it is best handled:

- 0-5 cm: incorporate with normal tillage operations
- 5-20 cm: incorporate with chisel or mouldboard plow (i.e. deep tillage).
- More than 20 cm: spread or remove to a depth of 20 cm or less and incorporate as listed above
- Tillage in the native soil should be the depth of the sand plus 1.5 times the depth of sand; for example, you would till 25 cm deep for 10 cm of sand [10 + (1.5 x 10) = 25].
- Avoid tillage or other field operations until soil is dry enough to reduce the chance of compaction

Stage 2: Repair erosion

The degree of erosion can vary from a few inches to many feet and different levels will need to be managed differently.

- Tillage – if soil can be smoothed and farmed following a normal tillage operation
- Earth Moving – if erosion is too deep to be corrected with tillage, but can be filled, then farmed. Fill eroded areas or top dress with native soil from other parts of the field, depending on the depth of the erosion.
- Abandonment – may be the only option if erosion is too deep to correct economically, even with earth moving.

If you're using sediment depositions to fill eroded areas, use native soil from another area in the field for the final 60 -90 cm to avoid droughty areas. Avoid field operations until the soil is dry enough to reduce chances of compaction. After major erosion repairs, sample the soil in the repaired area. (Consider sampling from both the repaired area and undisturbed area to determine if fertility should be managed differently in each.).

Stage 3: Manage Other Factors

- Soil Crusting. Surface soil texture changes and the loss of structure can cause effects resembling compaction. This can restrict root penetration and reduce water infiltration. Tillage should remedy a shallow (less than 5 cm) crust.

2.2.5 SLM issues in the Urban and Peri-urban areas

Areas surrounding major cities and towns are undergoing rapid land conversion from agricultural to unplanned settlements which exacerbate land degradation. This is driven by the fact that urban land is expensive when compared with land prices of the same quality in the rural areas. Thus, rural people are selling their farmlands or converting them into residential or commercial estates. The peri-urban areas suffer from lack of outright authority as existing institutions are not structured to handle the different land use changes. It is where government and local authorities' responsibilities and mandates are sometimes not clear or sometimes in conflict. As such, there is poor oversight of human settlements, control of pollution and waste management. This results in environmental degradation and ecosystem loss with effluents and other pollutants becoming a menace. It is therefore necessary to include urban and peri-urban areas as a special category targeted by SLM interventions.

SLM practices with potential; Urban planning (factories, roads, housing, amenities); Green

infrastructure- create green zones/ protected forests adjacent urban areas, Waste disposal and management (solid waste, waste-water); Drainage of storm flows in a safe manner (isolate storm-water from sewers), Soil and water conservation (some urban areas are on hilly areas), Rainwater harvesting and storage (to reduce flooding, to augment water supplies), Support peri-urban agriculture with clean irrigation water (from stormwater or recycled), Reduce the high demand for charcoal by subsidizing other energy types (e.g. solar energy).

The SLM interventions described above will be implemented as sub-projects that will focus the activities taking cognizance of the clustering of the country into five landscape zones. This is meant for targeting the action plan to tackle common challenges holistically. It is instructive that a single project would most likely combine two or more of the technologies /practices identified here (Table 2.1).

Table 2.1 Technologies/Practices for scaling up SLM in each Landscape Zone

Landscape	**Recommended SLM Interventions for the Target Landscape**
Forest and Highlands	• Micro-watershed approach in to implement IWRM • Farm forestry and Agroforestry • Soil and water conservation structures (terraces, contour bunds, cut-off drains, infiltration strips, vegetative buffers) • Integrated soil fertility programme (fertilizers, manures, Compost making, cover crops) • Water harvesting structures (weirs, small dams, ponds, pans, cisterns) • Energy saving stoves, biogas units, micro hydropower • Alternative livelihoods (eco-tourism, brick making, sustainable use of forest products, e.g. bee keeping) • PES schemes and Voluntary Carbon Markets (VCM), Water Funds
Smallholder Agricultural Lands	• Soil and water conservation structures (terraces, contour bunds, cutoff • drains, infiltration strips, vegetative buffers) • Integrated soil fertility for croplands (subsidized fertilizers, manures, • compost making, cover crops, mulching, CA) • Water harvesting structures (weirs, small dams, ponds, pans, cisterns) • Runoff farming (semi-circular bunds, zai pits, micro-basins) • Supplemental irrigation – spate diversion • Tools and equipment for SLM implementation (walking tractors, trenching and pitting tools) • Farm forestry and agroforestry • Energy saving stoves, biogas units • PES schemes/Voluntary Carbon Markets (VCM), water funds

wetlands (*dambos*)	• Integrated rangeland management and rehabilitation (controlled grazing) • Revegetation of degraded rangelands (grass re-seeding) • Erosion control structures (ditches, infiltration strips • Water harvesting structures (weirs, small dams, ponds, pans, cisterns) • Runoff harvesting, runoff farming technologies • Alternative livelihoods (eco-tourism, use of invasive species to make artifacts)
Flood-prone areas	• Flood control structures (dykes, check dams) • Runoff diversion and storage (canals, cut-off drains, dams, ponds) • Drainage of waterlogging soils • Water harvesting structures (weirs, dams, ponds, pans, cisterns) to offset floods upstream • Supplemental irrigation/ spate irrigation to utilize flood waters elsewhere • Catchment protection works to protect downstream areas from flooding
Urban and Peri-urban Areas prone to Land conversion	• Urban planning (factories, roads, housing, amenities) • Green infrastructure- create green zones/ protected forests adjacent urban areas • Waste disposal and management (solid waste, waste-water) • Drainage of storm flows in a safe manner (isolate storm-water from sewers) • Soil and water conservation (some urban areas are on hilly areas) • Rainwater harvesting and storage (to reduce flooding, to augment water supplies) • Support peri-urban agriculture with clean irrigation water (from storm water or recycled) • Reduce the high demand for charcoal by subsidizing other energy types.

The Voluntary Guidelines for Sustainable Soil Management (FAO 2017) provide a sound framework for outlining preferred management principles and practices at the national level. We have adopted the relevant sections of the Voluntary Guidelines in Table 2.2 for the themes addressed by this study. The mitigation measures have been selected based on prominent soil conditions in Malawi (i.e. soil acidification, low soil organic carbon, soil and nutrient loss, and nutrient imbalances). Table 2.2 provide a summary of mitigation measures based on prevailing soil conditions. A much larger effort is required to develop the locally specific technical manuals at the district level highlighting specific practice-guidelines.

Table 2.2: *Summary of SLM practices and their likely effect on soil condition*

Management practice	Soil condition improvement			
	Soil acidification	Soil organic carbon	Soil erosion	Low soil fertility
Agroforestry	■	■	■	■
Manuring	■	■	■	■
Inorganic fertilizer			■	■
Integrated use (organic & inorganic fertilizer)	■	■	■	■
Liming	■			■
Mulching		■	■	■
No tillage		■	■	
Residue incorporation	■	■		■
Legume intercropping		■		■
Crop rotations		■		■
Improved fallows		■	■	■
Conservation Agriculture		■	■	■
Soil testing	■	■		■
Contour ridging			■	
Box/tied ridges			■	
Raising footpaths and garden boundaries			■	
Contour stone lines			■	
Contour vegetative hedgerows			■	
Gully reclamation			■	
Stream bank protection			■	
Physical terraces			■	
Basin planting			■	
Swales			■	
Rainwater harvesting			■	
Flood water harvesting			■	
Ditches			■	
Trash heaps/lines			■	

**shaded area means that particular technology/practice can be used alleviate the soil condition*

2.3 Climate Smart Agriculture in Malawi

Climate-smart Agriculture (CSA) is defined as agricultural practices that sustainably increase productivity and system resilience, while reducing greenhouse gas (GHG) emissions. It is not a single specific agricultural technology or practice that can be universally applied. Rather, it is a combination of policy, technology, and finance options that involves the direct incorporation of climate change adaptation and mitigation into agricultural development planning and implementation (FAO, 2010). Malawi holds great potential for CSA, but this needs to be further explored. Although the country has traditional agricultural practices as well as research-based programs and techniques that have CSA qualities, CSA promotion requires concerted action from multiple actors to allow for context-specific approaches to be designed, implemented, and monitored. In the process of identifying suitable CSA

techniques adapted to local needs, the primary focus is on-farm adaptation.

Efforts are underway through government, non-governmental organizations, bilateral donor, and research institutions to enhance mitigation of soil loss. Such efforts include promotion of greater access to CSA practices (e.g., conservation agriculture, drought tolerant crop varieties and agro-forestry systems). For instance, the Malawian Government's Greenbelt Initiative aims to increase the level of irrigation in farming as a key national adaptation measure (Malawi Government, 2015). The Malawi Agricultural Sector-Wide Approach promotes conservation farming technologies that build soil fertility, prevent soil erosion, and conserve rainwater (e.g., contour ridging, application of manure, preparation of compost, minimum tillage, agroforestry, box ridges, tractor ploughing to break the hard hoe pan, and use of herbicides as a labor-saving technology). The NAIP also aims to increase agricultural productivity by additionally recognizing gender roles and responsibilities. In general, these activities/ technologies fall under two broad categories: soil and water management and soil fertility enhancement technologies. Adoption of these technologies remains a challenge due to a number of problems including labour constraints, poor extension as well as lack of resources to access improved inputs and equipment that may be required.

2.3.1 CSA technologies and practices

CSA technologies and practices present opportunities for addressing climate change challenges, as well as for economic growth and development of the agriculture sector. These practices have been identified as climate smart based on (i) economic benefits; (ii) bio-physical benefits; (iii) environmental benefits and (iv) social benefits Table (2.3). For example, Theirfelder and Mutenje (2018) found that CA maize-legume intercropping had the highest internal rate of return (IRR) which suggests that farmers who are able to adopt this CSA have a better chance of recovering their investments than with CA maize and the conventional maize system across Malawi. In the same study they also highlight CA maize-legume intercrop is the most economically viable CSA option for land constrained communities. The estimated profitability of CA maize-legume intercropping system over the other CSA practices and the conventional system in the land constrained communities is attributed to improved land and labour use efficiency and increased crop yields. CA maize-legume intercropping had the highest internal rate of return (IRR) which suggests that farmers who can adopt this CSA have a better chance of recovering their investments than with CA maize and the conventional maize system.

Table 2.3*: List of locally preferred CSA techniques and use benefits*

SLM practice	Brief description	Cost Benefit Analysis
Conservation Agriculture	Improves soil fertility and yields, soil remains in its natural state, makes work easier, reduces labour amount (if used with herbicide), reduces labour costs for ploughing, retains soil moisture during dry-spells, protects soil from heat, reduced logging as	Benefit Cost Ratio (BCR) varies between 3.78 to 3.85 the benefits that accrued to individual farmers from manuring were universally positive. Return on investment (ROI) periods were all less than three years
Manuring	Application of livestock or compost manure to enhance soil fertility, water retention and friability	BCR varies between 1.14 to 2.42 the benefits that accrued to individual farmers from manuring were universally positive. ROI periods were all less than three years
No tillage	Avoiding tillage to ensure minimal soil disturbance	

Mulching	Using crop residues as mulch to reduce weed growth and conserve soil moisture through reduced evapotranspiration and limited direct sunlight	
Legume Intercropping	Planting two or more crops simultaneously (usually a cereal and a legume) in the same field	BCR varies between 1.95 to 2.74 the benefits that accrued to individual farmers are universally positive. In some cases, there is a drop in yield for the main crop maize
Crop Rotation	Seasonal rotation of different crops on the same plot of land	
Improved Fallowing	Land left uncultivated, unutilized for a season or more	
Trash heaps / lines	Piling trash in heaps or lines of vegetation / crop residues to restrict the flow of water / loss of soil	
Contour hedge rows	Cross slope, field boundary barriers solely involving planting of vegetation, such as Napier and Vetiver grass	
Physical terraces	Any cross-slope barrier which involves the construction of banks	BCR varies between 2.04 to 2.13 the benefits that accrued to individual farmers are universally positive. The return period is around 5 years
Agroforestry	Any system where trees are included in the cultivated area or along field boundaries	BCR varies between 1.19 to 1.61 the benefits that accrued to individual farmers are universally positive. The return period is around 5-6 years
Ditches	The presence of ditches intended to alter water flow	
Water harvesting / storage	Any mechanism to capture water within a field and / or store it for later use	

In general, Malawi soil restoration opportunities assessment is positive and shows that smallholders who adopt these activities would likely be better off in the long run than their peers who did not (Table 2.3). The results from the cost benefit analysis (CBA) suggest agricultural technology-based restoration activities produce more private benefits than public benefits and could be paid for with grassroots investments made directly by smallholders and also with funds distributed through private financing businesses like microfinance institutions and other businesses that offer farm credit. In contrast, some types of physical infrastructure-based restoration interventions, especially activities designed to improve sediment retention or flood control, generate a large number of public benefits. As a result, physical infrastructure-based restoration interventions that will positively impact the creation of public goods may be best financed with public funds since their nature may make it difficult for any single investor to capture the benefits and earn a return.

CSA goals – adaptation, mitigation, and food security and nutrition – as well as its gender impact from the perspectives of income and time use. As Table 2.4 indicates, women usually have more control over the income produced by home gardens, water harvesting, and legumes, which require different amounts of time to yield benefits. Common CSA

Table 2.4: *Some potential CSA practices and related gender implications*

CSA option/practice	Gender impact		
	Potential household food security and nutrition impact	Women's control of income from practice	Relative amount of time until benefits are realized
Conservation Agriculture	High	Low	High
Manuring	Medium	Medium	Low
No tillage	Low	Low	Medium
Mulching	Medium	Low	Low
Legume Intercropping	Medium	Medium	Low
Crop Rotation	Medium	Low	Medium
Improved Fallowing	Medium	Low	Medium
Trash heaps / lines	Low	Low	High
Contour vegetative hedgerows	Low	Low	High
Physical terraces	Low	Low	High
Agroforestry	Low-medium	Low	High
Ditches	Low	Low	High
Water harvesting / storage	High	High	Low
Stress tolerant varieties	High	Low	Low
High yielding varieties	High	Low	Low
Improved home garden	High	High	Low

practices such as conservation agriculture and on-farm tree planting require a long time to yield benefits, and often women have limited control over the resulting income.

2.3.2 Geographic priority areas to target the SLM Framework based on soil condition

The potential for CSA technologies (CA, Agroforestry, Manure, and Integrated Soil Fertility Management) is the highest in areas with (i) low soil nutrients, (ii) low soil pH, (iii) high soil loss rates. Based on these criteria, the districts with the greatest potential for such technologies to collectively alleviate soil degradation and improve food security are Dowa, Nkhotakota, Ntcheu, Karonga, Mzimba, Nsanje, Blantyre, and Neno districts. While soil and water conservation structures (vetiver grass, terraces, tree belts and bunds) are most valuable in areas with high soil loss rate and erodible soils, districts with this type of landscape present the greatest opportunities for soil and water conservation infrastructure particularly Mzimba, Karonga, Nkhotakota, Ntcheu, Dedza, Dowa, Blantyre, Mangochi, Neno, Mwanza, and Nsanje districts which have high topsoil loss rates with high proportion of observable signs of soil degradation.

2.3.3 CSA practices for food security and poverty reduction

CSA technologies associated with higher crop yields and increased incomes among smallholder farming households are considered viable for food security and poverty reduction. Although the relationship between agricultural technology and poverty is complex. The potential for increasing rural incomes through wider adoption of CSA technology such as those in Table 2.5 is quite substantial. CSA technologies can reduce poverty through direct effects on output levels, food security, incomes and overall socioeconomic welfare, thereby making them more viable for women and vulnerable groups. Table 2.3 presents a selection of CSA practices with high climate-smartness scores in Malawi.

Table 2.5 *Selected soil loss mitigation practices and technologies for women and vulnerable groups key for food security and poverty reduction*

CSA Technology/Practice	Measured Impact
Conservation agriculture – minimum soil disturbance, retain organic soil cover, diversify crop species: 6% of total maize are produced under conservation agriculture • Reduced tillage • Reduced tillage and mulching • Reduced tillage and Legume integration • Reduced tillage and Herbicide application	Yield increases 9-11% Labour costs reduced 25% over conventional agriculture Poverty reduction not yet quantified
Integrated Soil Fertility Management Technologies • Maize Legume Rotation Systems • Intercropping	Potential of reducing ~25% of the fertilizer use Yield increases 20-40% Women focal crops groundnuts and soya beans
Agroforestry systems – mixed crop and tree species intercropping for fertility maximisation • Fertiliser tree species e.g. *Faidherbia Albida*, *Cajanas Cajan* • Some for fodder/soil fertility	Yield increases up to 100% Poverty reduction not yet quantified
Water retention structures • Stabilisation of hedgerows with vetiver • Pit planting • Box ridges • Infiltration trenches, weirs and swales • Small scale irrigation systems	Treadle pump gave 300% increase in net farm income from increased yields Poverty reduction not yet quantified
Early-maturing, drought-tolerant crop varieties	Unknown
Livestock feeding systems • Intensive zero feed systems maximises weight gain and milk production in dry conditions	Unknown

2.3.4 Barriers for CSA

Well-functioning institutions have a critical role to play in enabling rural communities to adapt and be more resilient to climate change. Over 70 institutions (government, non-government, private, and farmers' organizations) are involved (individually or as alliances and/or taskforces) at different levels in CSA and related interventions in Malawi**.** Despite the strong presence of institutions working towards promoting CSA practices in Malawi, the impacts to date have been limited. This may be attributed to weak coordination and collaboration across the different organizations, alliances, and taskforces. For instance, there are separate taskforces for rainwater harvesting, agroforestry, irrigation, and CSA, resulting in considerable duplication of effort. Most of the institutions are working in isolation, which has handicapped efforts to gain efficiencies and increased impact. Strong opportunity exists for coordination, harmonization and use of common data and evaluation protocols for measuring success and impacts.

This could help address the challenge of conflicting messages regarding impacts of CSA. Lack of targeted financial resources is an important impediment to collaboration. This is of particular concern for government institutions and has resulted in peripheral involvement of key institutions in the implementation of CSA.

Malawi has several investment plans such as National Climate Change Investment Plan and National Agriculture Investment Plan that highlighted a number of funding options for CSA. Through different frameworks, the country has also benefitted from a number of donor-funded projects that seek to enhance adoption of CSA. However, access to CSA financing in Malawi is still low. This is largely due to lack of awareness among stakeholders of most of the CSA funding for which Malawi is eligible to apply. Weak capacity, particularly in government institutions, to develop competitive grant proposals, and the stringent requirements of donor agencies, are additional challenges. Weak institutional linkages and some inter-agency competition also contribute to the issue. The financial situation of Malawi has a direct effect on the institutional framework for CSA. Indeed, the agenda for CSA is mostly driven by international NGOs rather than the national government. This negatively affects the continuity and sustainability of most CSA initiatives, and impairs the development of functional private and public partnerships at national level necessary for enhancing CSA.

A number of challenges also hinder adoption of CSA practices at the farm level. A lack of knowledge about such practices, lack of relevant inputs, and poor access to both input and output markets, especially on the part of smallholders, are ongoing challenges. Female farmers in particular have low access to and control over agricultural productive resources, technologies, and markets. This is further compounded by bias towards CA thereby a significantly limiting adoption of other important CSA technologies/practices. Weak coordination of CSA activities and projects in the country impedes scaling out of CSA practices. This is despite the presence of a wide range of platforms and alliances in charge of different aspects of CSA, climate change, and resource management.

Despite the barriers, opportunities exist for scaling out adoption of CSA practices in Malawi. According to the CSA Investment Proposal (FAO 2013) an opportunity lies in improving farmers' access to accurate and timely weather and market information, inputs, credit and extension services. Redress of the existing land issues, improvement of infrastructure, establishment of a common national platform for CSA, harmonization of the policies relating to CSA, and enhanced funding and research supports are important enablers. This can be enabled by politicians taking decisions for the greater good and by the economy growing and diversifying. Consideration of indigenous and farmer knowledge and widening the scope beyond CSA also has the potential to enhance CSA adoption.

2.4 Gender Inequality and Agriculture productivity

Gender inequality has a profound impact on a wide array of activities in Malawi, affecting agricultural productivity, opportunities in the non-farm sector, the demographic transition, and households' resilience against shocks. Reducing gender inequality will allow for quicker progress along the pathways and help improve the socio-economic status of people in Malawi. The agricultural productivity (i.e., yields or financial returns per hectare) of women farmers is often lower than that of men farmers (Croppenstedt, Goldstein, & Rosas, 2013). In an analysis of six countries (Ethiopia, Malawi, Rwanda, Tanzania, and Uganda), the World Bank (2015) highlighted that women farmers consistently produce less, in monetary terms, per hectare than their men counterparts. The gender-related productivity gap between men and women farmers has been estimated at 25 percent in Malawi (O'Sullivan et al., 2014). A United Nations Development Program /World Bank study in three countries estimated that closing the gender gap in agricultural productivity in Malawi could increase crop production by 7.3 percent, generating a USD 100 million increase in GDP and a USD 90 million increase in agricultural GDP. Closing the gender gap in agricultural productivity in

Malawi could potentially lift 238,000 people out of poverty (UN-Women, UNDP, UNEP, World-Bank, 2015).

2.4.1 Key factors for gender productivity gap

Labour was identified as a key barrier to achieving equality in productivity across countries profiled by the World Bank (O'Sullivan, Rao, Banerjee, Gulati, & Vinez, 2014). Labour concerns revolved around women's own labour ability to produce outputs and the quantity and quality of the additional labour women are able to access (i.e., hired or often their own children). Insufficient labour, poor supervision of labour, and family responsibilities are constraints for smallholder farmers. Women's labour is also constrained because of their unpaid work in the care economy, which can vary over their life (e.g., prior to childbirth, childcare, or caring for the elderly) (Peterman, Quisumbing, Behrman, & Nkonya, 2010). Women are also subjected to social norms around gender that make it very difficult to hire male wage labour. Moreover, women's relatively high burdens of unpaid care work and domestic work leave them time poor, with less ability than men to invest their own labour in agricultural work.

Additionally, women farmers in particular may not have the same power as men farmers to make important decisions relating to changing agricultural practices. Just as CSA practices may be climate-smart in one context but not in another, similarly they may have different implications for gender roles in different regions and cultural contexts. The resources, knowledge, and capacity required to adopt a new CSA practice can be significant (World Bank, FAO, & IFAD, 2015). In the scale-up and scale-out of CSA practices, gender roles, access to and control of productive assets and power relations need to be factored into design, delivery, and diffusion of each CSA practice so that barriers or opportunities for CSA adoption are better understood. The promotion of CSA practices needs to be underpinned by more rigorous gender and socioeconomic analysis of direct and indirect effects on farmers' livelihoods (Huyer, Twyman, Koningstein, Ashby, & Vermeulen, 2015; Twyman et al., 2015).

It is important to ensure that the promotion of CSA practices, considered to deliver agro-environmental benefits, does not directly or indirectly generate co-disadvantages that adversely affect the workloads of rural women and children (Giller et al., 2015; Giller, Witter, Corbeels, & Tittonell, 2009). For instance, conservation agriculture may increase the burden of labour on women due to increase in weeding responsibilities, while decreasing the burden of labour on men due to reduction in tillage responsibilities (Kaczan, Arslan, & Lipper, 2013). Different approaches to weed control (e.g., hand hoe weeding versus herbicides) can have differential impacts on the labour and time-use burden on women smallholder farmers (Thierfelder, Bunderson, & Mupangwa, 2015).

Women have limited access to agricultural inputs. As a result, female-controlled fields have relatively lower yields because important inputs such as inorganic fertilizer and pesticides are used mostly on male-controlled fields. In most cases, women tend to have less access to both types of fertilizer. One of the primary explanations for women's relative lack of access to fertilizers and pesticides is their relatively lower cash income, which is related to heavy demands on their time in performing unpaid work at home. In addition, gender gaps in access to information and extension services can contribute to the lack of adoption

2.4.2 Potential intervention for Narrowing Gender Productivity Gap

To address the gender productivity gap in the country requires a holistic program covering five broad areas; increasing women's access to labour and time-saving equipment and services, facilitating women's shift to high-value crops, improving women's access to non-labour agricultural inputs, strengthening women's land rights, pursuing other interventions which close the gender gap, increasing the capacity of different institutions working with extension services should be prioritized to enable narrowing gender productivity gap.

Increase women's access to labour and time-saving equipment and services: One avenue towards rectifying this situation is to build on supportive cultural aspects that have a bearing on women from hiring male labour to spur greater community mobilization and address cultural norms that dictate that men and women engage in different agricultural tasks. These norms would be challenged by dedicating more resources to communication and outreach about the benefits of gender equality through rural radio, expanded extension services, and support for NGOs to provide community trainings on gender equality to help ensure the success of subsequent policies aimed at strengthening women's ability to hire wage labourers, male and female. Support by evidence-based advocacy to policymakers and community leaders on the importance of women's economic empowerment in households — and specifically, the importance of engaging women in sustainable agriculture. As discussed in the UN Women–PEI reports, policies to assist women in gaining access to hired labour include increasingly redirect cash-for-work programs toward women to enable them have cash to hire labour, as well as doorstep delivery of equipment and training. Reforms which provide women with greater access to time-saving household and farming equipment will help reduce their time and free up their own labour to engage in productive agricultural work. Household equipment would include energy-efficient and environmentally friendly improved cooking stoves to reduce the amount of time women spend fetching firewood, thus freeing up their time for productive work. The government and its stakeholders should establish and/or support equitable benefit sharing agreements that include provisions to avoid elite capture and to ensure appropriately compensated community-level participation and governance.

Facilitate women's shift to high-value crops: Women have relatively lower access to new farming techniques and seed technologies. To address this constraint include improving women's access to information, promoting gender awareness in research and development on new technologies, and confronting social norms around crop choice and marketing. The diffusion of new seed technologies that match women's preferences will help. In planning agricultural innovations, it is important to differentiate between male and female preferences affecting technology choice and adoption decisions, rather than assume uniform household preferences Improve access to info & markets. It is critically important to increase investment in extension, outreach, and knowledge-sharing programs separately designed for women and men to reduce knowledge and skill barriers and promote adoption. Outreach activities, like farm radio programs, can also reduce information barriers by discussing the practical steps of growing different high value crops and highlighting the benefits that smallholders could expect to receive.

Improve women's access to non-labour agricultural inputs: An overriding constraint for women in accessing needed agricultural inputs is their purchasing power. The government has already made significant strides to reduce gender productivity gap through input subsidy program. Another avenue to transform women agricultural productivity is to increase women's access to credits this can be achieved by targeted provision of small-scale loans through microfinance initiatives that can support and incentivize women's agricultural activities and promote economic welfare. Increase support for the development of wider range of agriculture machinery and well-coordinated extension materials and training programs of agricultural technologies to increase crop yields, diversity incomes, and increase the climate resiliency of croplands.

Strengthen women's land rights: Land rights need to be guaranteed in such a way that women can exchange, lease, donate, sell or mortgage land in an enforceable manner. Recommendations for policy reforms supported by findings in the UN Women–PEI reports center on changing the legal structures governing women's land rights. This objective can be achieved through improved documentation, stronger communal rights, constitutional revisions to inheritance rights and land titling programmes. Improve the transparency and accountability of customary land management by mobilizing Traditional

Authorities and high-level political to correct gender biases in laws.

Pursue other interventions which close the gender gap: Several additional interventions can directly target women's engagement in the agricultural sector and contribute towards narrowing the gap in accessing multiple key inputs. One of the most important such interventions is legislative reform around gender-based violence, stronger enforcement of such laws, and other programmes to change attitudes towards and raise awareness about gender-based violence (UN Women and UNDP-UNEP PEI, 2019a, 2019b and 2019c). Some avenues to reduce gender productivity gap include: promote climate-smart agricultural practices by mobilizing increased technical support, such as through extension services, expand support for farmer-to-farmer visits, peer-to-peer training, and other capacity building activities, promoting women's engagement in profitable value chain development (VCD) stimulates economic growth and sustainable development impacts, provide agricultural skills training, promote women's representation in cooperatives.

Many different organizations can drive or contribute to this process of engagement for narrowing gender gap, including; *government*, to create an enabling policy and institutional environment, with gender-responsive legislation which is enforced and staff skilled in identifying and addressing gender issues and promoting gender equality; *private sector* (employers, buyers, traders in both the large-scale commercial sector and in producer organizations), to create opportunities for gender-responsive market engagement, skills development, a decent work environment, and certification schemes along the value chain; *civil society*, to demand for gender-inclusive approaches and to increase understanding in communities about women's rights; government agencies (auditors and certification bodies), to oversee certification and codes of conduct which promote and monitor the use of good practices in the private sector; *producer organizations and women's groups*, to promote economies of scale in input purchases, provision of services (advice, training and market information), produce aggregation and post-harvest facilities, and collective action for negotiation and representation.

2.5 Revisiting fertilizers and fertilization strategies for improved nutrient uptake by plants and profitability

2.5.1 Agriculture input subsidy program

In Malawi, subsidy programs have been implemented since the 1960s to increase access to external farm inputs and their adoption by the resource poor smallholder farmers, with the desire of stimulating production, increasing farmers' incomes, and spurring economic growth. The subsidies have covered the span from universal to targeted programmes. The Farm input Subsidy Program (FISP) and the current Affordable Inputs Program (AIP) seeks to address the issue of high prices for inorganic fertilizers, thereby (1) reduce poverty and (2) ensure food security at household and national levels. These subsidy programs apart from increasing access to inorganic fertilizer have also partly enhanced the use of improved seed varieties that are more resilient to weather variations, and higher yielding. While FISP was initially successful in achieving national food self-sufficiency, albeit at a very high opportunity cost, its contribution to poverty reduction is less clear as the current incidence of poverty in the country is similar to 2005, when the program was launched.

Affordable Input Program (AIP) provide a potentially useful means to encourage system-wide coordination and farmer behaviours that raise agricultural productivity and contribute to resilience. A major challenge to enabling AIP to promote CSA outcomes stems from the major opportunity costs they entail in terms of foregone public spending on other core CSA investments such as irrigation, agricultural R&D, and extension services that could potentially promote CSA practices more effectively per dollar invested than AIP. However, there is clear scope for market-smart AIP to improve smallholder farmers' access to climate smart technologies

and overall resilience. The many issues and questions around the subsidies necessitate a rethinking of the subsidy programs.

Narrow focus of input subsidy program: It is evident that the programme has increased fertilizer consumption by making it affordable to smallholder farmers. In as far as the programme increases inorganic fertilizer and improved seed uptake, it can be said to promote good crop cover in the fields and the quality of crop residues that is good for CSA. However, this has not been paralleled by increased uptake of organic nutrient sources through application of manure. This might have negative impact on the soil's physical characteristics and soil erodibility. It can also be argued that the availability of cheap fertilizers has tended to hide the effects of bad land management practices which will be manifested once the subsidy is withdrawn. Hence the need to systematically move towards developing organic exit strategies for subsidy program (i.e. input graduation).

The input subsidy programs in Malawi including the current AIP have put much emphasis on maize which undermines efforts towards agriculture diversification, which could also allow for improved soil conservation and higher yields. The disproportionately high expenditure on subsidy programme crowds out complementary public investments to introduce and diffuse new technologies, develop irrigation and strengthen markets, all of which have significant potential to enhance the performance of the sector. The narrow scope of the subsidy program is a concern because farms and farming systems in Malawi are diversified; farmers operate throughout rainy and winter seasons, and cultivate neglected and underutilised crops such as millet, Bambara-nuts and Amaranthus for food and nutrition security. Moreover, input requirements vary across the different agro-ecological zones depending on soil fertility levels. Agriculture diversification agenda as part of inclusive agricultural intensification will be rhetorical if agriculture input subsidy is maintained in the current state. Furthermore, current AIP cost, which does not seem to be strongly sustained by a relevant return in terms of social net benefits, despite the fact that farmers – especially the poorest ones – would gain net income important for their livelihood when the nutrient loss phenomena become more severe. Increasing the access to commercial fertilizers, excluding those households that are more likely to buy from the private sector, would reduce the costs to the Government.

Crowding out extension and advisory services: Extension systems are seriously under-provisioned to perform their multiple mandates of providing new management advice to farmers, learning from their efforts and difficulties of implementation and liaising with adaptive research systems to generate and disseminate new productive and sustainable practices. Extension workers are often largely registering farmers into input subsidy program and distributing fertilizer coupons, instead of providing agronomic advice. This further dilutes the impact of already limited extension services, and likely reduced the productivity benefits of subsidized inputs. Therefore, it should not be surprising that despite heavy spending on subsidized inputs, their impacts on crop yields have been smaller than anticipated.

Intermittent and adhoc input subsidy program policy: Existing inconsistencies and uncertainties regarding whether subsidies would be provided or not are hampering the ability of actors including farmers, importers, input dealers and distributors to adequately plan for the season. It was noted that the announcement of Affordable Inputs Programme (AIP) has come very late. Such delays in program announcement contribute to delays in fertilizer delivery to farmers and the untimely application of fertilizer, which reduces response rates and the contribution of fertilizer to food production.

2.5.2 Fertilizer Value-Cost Ratio

The technical response to fertilizer use, is measured by nutrient use efficiency (NUE). The NUE for maize would have to be in the range of 7–10 or higher to provide adequate incentives to make fertilizer use attractive. Yield (Y) of maize grain was calculated in kg per ha based on the crop harvested (APES 2019). The fertilizer rates were based on recommendation from the study conducted by Asfaw et al 2018. Output: Nutrient ratio

was generally within ideal range (>7) across all ADDs expect for Shire Valley and Machinga Agricultural Development Division (ADD) and this could be attributed to abiotic stresses that affected yield. The output: nutrient ratio under projected soil loss is generally lower in all ADDs indicating there is a need to adjust fertilizer recommendation based on level of soil degradation.

One of the basic parameters defined by agro-economists to assess the viability of fertilizer use is the ratio of unit fertilizer price to unit crop price (PF/PY). Furthermore, the fertilizer efficiency (Y/F) is defined as kg extra yield (Y) produced per kg fertilizer (F) applied. Finally, the value-cost ratio (VCR) is the amount of money earned per amount of money spent, which is, within the aforementioned context, equal to (Y/F) / (PF/PY). The 'value/cost ratio' (VCR) is an indicative measure of the profitability of using fertilizer. Studies have shown that VCRs in excess of 2.0 are generally required for smallholder farmers to demand fertilizer on a sustained basis (Crawford and Kelly, 2002). While definitive studies of crop response to fertilizer in Malawi are unavailable this study used recommended fertilizer rates for profit maximization proposed by (Asfaw *et al* 2018), to calculate VCRs. Two sets of VCR values were calculated, the first based on current soil loss and the second based on projected soil loss (i.e. current level of N loss 4 kg/ha and for a projected loss of 22 kg/ha) based on subsidized fertilizer prices and full market price. The subsidized VCR (Table 2.3) is an indicator of the profitability of fertilizer application from the FISP farmer's viewpoint. The full market price VCR (Table 2.3) reflects the economic viability of fertilizer use from the viewpoint of the economy as a whole. Therefore, these estimates are based on current and projected soil loss, full market and FISP prices for fertilizer, and average farm-gate prices for maize.

Based on the assumptions mentioned above, the subsidized price VCRs range from 7.3 to 15.5 under current soil loss rate while under projected soil loss rates ranges from 5.9 to 13.5 (Table 2.3). For market price, the VCRs ranges from 1.8 to 4.4 while under projected soil loss rate ranges from 1.3 to 3.6 (Table 2.3). Returns to fertilizer in the country have been profitable and with ratios consistently greatly than 1 across all ADDs using government recommended farm gate prices, however there is big variation in VCRs across ADDs. Given current soil loss rate, fertilizer use at the full market price on maize appears to be profitable in some ADDs, but VCRs substantially drop below 2 in majority of ADDs under projected soil loss (Table 2.4). While these results are only indicative and more detailed site-specific analysis of fertilizer profitability is required, the use of available information suggests that using fertilizer on maize may not be profitable for many Malawian farmers given full market fertilizer prices, and prevailing maize prices. However, the ability of Malawian farmers to use higher levels of fertilizer profitably, consistently, and productively will depend on efforts to raise farmers' response rates to fertilizer application.

Integrated soil fertility management is a set of soil fertility management practices that necessarily include the use of fertilizer, and organic inputs, aiming at maximizing agronomic use efficiency of the applied nutrients and improving crop productivity, Malawian farmers typically grow maize monoculture (continuous cropping of maize) often rotated or intercropped with legumes or sometimes rotated. Maize-legume Intercropping significantly reduces the fertilizer requirements thereby, increasing the net crop incomes. In Malawi, maize-groundnut rotations with fertilizer are often more productive than maize monocultures (Thierfelder et al. 2013; Snapp et al. 2010; Ngwira et al. 2012). Thus, we can conclude that the use of ISFM improves maize productivity, compared to the use of inorganic fertilizer only. Since most farmers in the maize-based farming systems are crowded out of the agricultural input market and can hardly afford optimal quantities of inorganic fertilizer, enhancement of ISFM is likely to increase their maize productivity. This integration highlight areas of policy support needed to enhance ISFM uptake in smallholder maize-based farming systems. Furthermore, this integration can allow for a more efficient re-formulation of subsidy

program by bundling modern practices together with more responsive sustainable practices (such as agroforestry, and crop-livestock integration) requires minimal costs to the Government (cost of subsidizing legume seeds), and generates a very high return.

On the other hand, beneficiaries of the subsidy program are more likely to find fertilizer use profitable because they were able to acquire fertilizer at roughly quarter of the full retail price and this would effectively double the VCR values. These findings suggest that fertilizer use profitability varies across the ADDs and fertilizer use is more attractive in other ADDs. However, owing to the different output levels produced in each ADD, these variations have different impacts on fertilizer use efficiency and profitability. To make fertilizer use more profitable for all farmers across the ADDs will require raising yield response rates and increasing farm gate prices. In turn, maize prices remain highly volatile. The findings of this study indicate that the government should put measures to improve cost efficiencies in input subsidy program. The following strategies will improve effectiveness: procurement and evaluation of bids should be done by a neutral agency, provide technical support to the independent body managing the subsidy programme to strengthen capacity and increase transparency, fully embrace The Fertilizer Bill and Fertilizer Policy, to ensure transparency and donor support and fertilizer procurement should be gradually transferred to the private sector.

Additionally, spatial analysis of market supply chains should be studied further, in order to develop area specific farm gate prices/ farm gate price bunds to ensure profitability. Efforts to improve efficiency of fertilizer use among smallholder farmers through more effective extension messages could make fertilizer use profitable even at much lower application rates. However, over the past decade, public extension services have largely been underfunded while government has focused on implementing its flagship program in the agriculture sector, the Farm Input Subsidy Programme (FISP) and the current AIP. The somewhat inconsistent impact of FISP suggests to some experts that inadequate provision of information to farmers on best agricultural production practices might account for this mixed performance.

An updated analysis of soil nutrient status in Malawi would improve fertilizer use efficiency and profitability and facilitate development of targeted recommendations. Improving fertilizer recommendations or developing more effective site-specific nutrient management recommendations are crucial for not only increasing yields, but also improving the nutritional status of the food produced to address the problems of malnutrition that are common in Malawi. There is also evidence that fertilizer efficiency in smallholder cropping systems can be significantly increased by adding fertilizer in combination with high-quality organic matter. High quality organic nutrient resources (with narrow C/ N ratio and a low percentage of lignin) provide readily available N and nutrients to the soil ecosystem, and they build soil organic matter over the long term. The use of high-quality organic resources will increase soil microbial activity and nutrient cycling and reduce nutrient loss from leaching and denitrification

Table 2.6: *Fertilizer value cost ratios based on FISP and prevailing market prices*

			Yield (kg/ha)							
*Soil Loss Status	Fertilizer Practice	Total fertilizer (kg/ha)	Karonga ADD	Mzuzu ADD	Kasungu ADD	Salima ADD	Lilongwe ADD	Machinga ADD	Blantyre ADD	Shire ADD
Current	FISP (168 Basal + 173 Top)	341	3020.0	2255	2871	2666	2664	1502	2984	1419
Current	Full Market Price (111 basal +116 Top)	227	2503.0	1768	2125	2143	1836	1042	2169	1041
Projected	FISP (149 Basal + 125 Top)	274	2114.0	1548	2061	1881	1471	984	1981	925
Projected	Full Market Price (101 basal +79 Top)	180	1627.0	751	960	865	704	679	876	579
			Yield: Fertilizer ratio							
			Karonga ADD	Mzuzu ADD	Kasungu ADD	Salima ADD	Lilongwe ADD	Machinga ADD	Blantyre ADD	Shire ADD
Current	FISP (168 Basal + 173 Top)	341	8.9	6.6	8.4	7.8	7.8	4.4	8.8	4.2
Current	Full Market Price (111 basal +116 Top)	227	11.0	7.8	9.4	9.4	8.1	4.6	9.6	4.6
Projected	FISP (149 Basal + 125 Top)	274	7.7	5.6	7.5	6.9	5.4	3.6	7.2	3.4
Projected	Full Market Price (101 basal +79 Top)	180	9.0	4.2	5.3	4.8	3.9	3.8	4.9	3.2
			Value cost ratio (Maize price MK175/kg)							
			Karonga ADD	Mzuzu ADD	Kasungu ADD	Salima ADD	Lilongwe ADD	Machinga ADD	Blantyre ADD	Shire ADD
Current	FISP (168 Basal + 173 Top)		15.5	11.6	14.7	13.7	13.7	7.7	15.3	7.3
Current	Full Market Price (111 basal +116 Top)		4.4	3.1	3.7	3.8	3.2	1.8	3.8	1.8
Projected	FISP (149 Basal + 125 Top)		13.5	9.9	13.2	12.0	9.4	6.3	12.7	5.9
Projected	Full Market Price (101 basal +79 Top)		3.6	1.7	2.1	1.9	1.6	1.5	1.9	1.3

**Current = 4 kg N/ha/year, projected = 22 kg N/ha/year, Basal =Amount of Chitowe fertilizer applied, Top = amount of UREA fertilizer applied*

2.5.3 Fertilizer recommendations based on soil fertility status

A distinctive feature that characterizes smallholder farming systems in much of Malawi is the wide diversity of farming households and marked heterogeneity for both biophysical and socio-economic conditions, at short ranges. Snapp, (1998) results show a variability of more than 100% for most soil parameters across the agricultural development divisions implying that no single fertilizer recommendation can work for all the regions. The soil testing was introduced in the country and Malawi Government recognizes that soil testing is a proven, practical method for evaluating the fertility status of soils and for providing a sound basis for making recommendations in respect of fertilizer application and soil amendments to farmers (Chilimba & Nkosi 2014). The recommendations presented below are based upon soil fertility critical values of Malawi. In summary,

- Low soil N, P, K, S and Zn concentration use the following fertilizer recommendation: Basal dress with 4 bags 23.10.5+6S+1.0 Zn per hectare. Top dress with 4 bags with the same 23.10.5+6S +1.0 Zn. This recommendation will supply 92 kg N, 40 Kg P_2O_5, 20 kg K_2O, 24 kg S and 4 kg Zn.
- Adequate soil K and Zn but low soils P concentration use the following fertilizer recommendation: Use 4 bags 23.21.0+4S top dress with 2 bags urea in upland soils. This recommendation will supply 92 kg N, 42 Kg P_2O_5, 0 kg K_2O, 8 kg S and 0 kg Zn. In Shire Valley and Lakeshore top dress with 4 bags sulphate of ammonia or ammonium nitrate per hectare because under high soil pH urea is not recommended
- Adequate soil P, K, S and Zn, basal dress with two bags urea or 3 bags calcium ammonium nitrate and top dress with 2 bags urea or 3 bags calcium ammonium nitrate per hectare. This recommendation will supply 86 - 89 kg N or basal with urea and top dress with urea supplying 92 kg N ha^{-1}.
- Low soil N, P, K, S and Zn but cannot manage the first recommendation, basal dress with 4 bags 23.10.5+6S+1.0 Zn and top dress 2 bags with urea in upland soils and top dress with 4 bags sulphate of ammonia in Lakeshore and Shire Valley per hectare supplying 92 kg N, 20 kg P_2O_5, 10 kg K_2O, 12 kg S, 2 kg Zn ha^{-1} and 88 kg N, 20 kg P_2O_5, 10 kg K_2O, 60 kg S, 2 kg Zn ha^{-1} respectively.
- Low soil N, P, K, S but adequate Zn farmers can basal dress with 4 bags of 50 kg super D compound (NPK 10:24:20 + 7S) and top dress with 3 bags urea to supply 89 kg N, 48 kg P_2O_5, 40 kg K_2O, 14 kg S ha^{-1}.

2.5.4 Leguminous interventions for soil fertility management

It is widely accepted that most farmers in Malawi cannot afford sufficient inorganic fertilizers to meet the optimal crop requirements. In fact, the government of Malawi is promoting integration of legumes into the agricultural production systems to cut the cost of fertilization. Furthermore, organic resources in addition to improving soil fertility improve other soil health parameters like soil physical properties (soil water retention, soil structure etc.) and microbial diversity. As production of sufficient organic resources to meet the nutrient requirements for the crops in not feasible, most studies propose a judicious mix of both organic and inorganic materials within the framework of ISFM, thus balancing the chemical, physical and biological characteristics of the soil and improving the crop production environment (Vanlauwe et al., 2007).

Several best-bet leguminous systems have been identified in Malawi: grain legume-maize rotations with groundnut or promiscuous soybean, legume/maize intercrops with pigeon pea or fishbean, and velvet bean maize rotations. Recent research in Malawi indicates Doubled-up legume rotations (DLR) systems have better fertiliser use efficiency and higher grain yields than maize sole cropping or single legume-cereal intercrops and or rotations (Snapp et al., 2010). Doubled-up legume rotations (DLR) is novel technology involving intercrops of two

legumes with complementary phenology for two years before rotating them with maize in the third year (Kerr et al., 2007; Snapp et al., 1998). Typically, pigeon pea/soybean and pigeon pea/groundnut intercrops are used in DLR. The superiority of DLR to other legume diversification approaches relies on pigeon pea's unique growth habit leading to enhanced soil fertility benefits (Snapp et al., 2010). For instance, maize planted after a groundnut/ pigeon pea intercrop and fertilized with 23 kg N ha^{-1} produces an equivalent yield to continuous maize fertilized with 92 kg N ha^{-1}. Farmers prefer to plant a pigeon pea/ groundnut inter-crop in rotation with maize as it is labor saving and contributes to diet diversification, high levels of residual N in soil and high maize yields compared to sole crop maize and single legume/maize rotations. Constraints to increased adoption of these grain legumes include seed costs, fluctuating market prices and practical difficulties with residue incorporation for both species.

2.5.5 Elements of strategy to achieve sustainable soil fertility management

While the Government of Malawi's efforts to raise fertilizer use is laudable, GoM expenditures on input subsidy programs currently appear to produce relatively limited benefits for farmers because crop response rates are low. The contribution of the input subsidy program (and fertilizer use in general) to sustainable growth could be much greater if the soil-related constraints on agricultural productivity were addressed through a holistic program of soil fertility management. The general elements of such a holistic program are as follows:

Improve fertilizer use efficiencies through better agronomic practices and strengthen fertilizer intervention system

- Target: double the agronomic use efficiency of nitrogen from the present 12-14 kg maize/kg N fertilizer applied
- Blanket fertilizer recommendations should be replaced by site specific recommendations.
- Soil mapping and rapid soil testing should be the basis of fertilizer recommendations.
- Facilitate expansion of private fertilizer blending plants across the country to provide the right fertilizer formulas recommended by rapid soil testing.
- Fertilizer adulteration must be tackled: technology, regulation, enforcement.
- Blending plants are key for effective fertilizer use.

Broadening the Scope of Input Subsidy Programs: Diversifying the input subsidy program beyond maize and mineral fertilizer to increase resilience, but this transformation, will require more neutral policies and support to the subsidy program.

- Focus on scaling up soybean, pigeon pea, groundnuts, and common bean, in response to market opportunities.
- Increase farmer access to improved legume seeds through support of private seed industry.
- Increase commercially available, high quality inoculum for legumes
- Promote fertilizer blends targeted for legumes. Update and provide agronomic recommendations
- Agronomic information to AIP beneficiaries
    - Identify and support scaling up of innovative, successful farming system models that integrate small scale farmers
    - Incentivize practices that significantly reduce fertilizer requirements such as legume intercropping, crop rotation, and incorporation of organic fertilizers and this can hugely increase the social benefit/cost ratio, to more than 4. This adjustment can allow for a more efficient re-formulation of subsidy distribution among farmers: well-endowed farmers

can receive less from the Government, and increased distribution can be given to the middle and marginalized classes.

- Bundling of technologies that reduce fertilizer requirements with other more responsive sustainable practices into input subsidy program requires minimal fiscal cost to the Government, but it generates very high return. Furthermore, this shift can lower subsidy program fiscal cost to government, encourage private investments in input supply systems and extension, and allow farmers to choose appropriate inputs. These outcomes are decidedly more climate smart than the inorganic fertilizer dominant model.

  Revising selection criteria of input subsidy program beneficiaries: selection of input subsidy beneficiaries should account for farmer characteristics, in order to give priority to the most marginalized farmers that suffer most from soil loss impacts thereby excluding those households that are more likely to purchase commercial fertilizers (i.e. plot owners, highly educated and large HHs). On other hand, well-endowed farmers should be less subsidized, while an increase in distribution to the middle class would be desirable if the budget allows for it. This strategy would allow the Government to maintain current expenditures for fertilizer while increasing access to commercial fertilizers to more marginalized households. With this adjustment, the projected social benefit/cost (B/C) ratio of ISP improves from 0.42 to 0.89, moving closer to 1.

Strengthen Extension Services (Public and Private) for integrated soil fertility management: Farmers' ability to increase productivity depends critically on timely access to inputs, the availability of appropriate technology and reliable extension and advisory. Access means availability of inputs at retail outlets and purchasing power to acquire the inputs at prevailing prices. However, lack of harmonized standards on Agricultural Extension Services also hamper delivery of services. The Ministry needs to urgently work on this in order to guide and provide leadership to the whole sector. To strengthen Extension Services (Public and Private) requires to include the following:

- Sensitize and lobby with men to support women access to extension and advisory services
- Include more women for better targeting of women farmers
- Extend the mandate of the national content development committee to be broader to cover aspects of extension approaches
- Streamlining the role of extension workers in the administration of agricultural Input Subsidies, role clarification should be included in the revised extension policy
- Focus on training of agro-dealers in integrated soil fertility management
- Increased funding of extension services.
- The message from extension services needs to be updated and be made consistent through better linkages with knowledge providers
- Up-to-date training of new and current extension staff with emerging issues

Develop an Inclusive Monitoring and Evaluation System for the Input Subsidy Program: The M&E of the agricultural subsidy program in Malawi depends periodic/adhoc evaluation by the Planning Department of the Ministry of Agriculture and consultants hired by development partners. This type of approach has failed to fully engage multiple stakeholders in the agricultural sector and does not facilitate learning which should result into the desired changes in behavior among actors interested and affected by the subsidy program. These evaluations have put emphasis on indicators for tracking progress and effectiveness of the subsidy programs on production, ignoring the reciprocal interactions of the programs and associated human capacity development, social-cultural and agro-ecological conditions.

Improve cost efficiencies in subsidy program: Input subsidy program has some strides in improving fertilizer use, however at this time there is lack of information on the profitability of the different soil-crop-fertilizer combinations that could be employed in the different parts of the country. The lack of such information on crop-fertilizer profitability across the country means that farmers cannot tell how much they stand to gain or lose by applying a particular type of fertilizer on a particular crop. This increases their risk and creates a disincentive for use of fertilizer. Information about profitability levels can serve as an incentive for inorganic fertilizer use. Most simply, expected Value Cost Ratios (VCR) from fertilizer use can guide farmers' decisions. While detailed information to estimate the profitability of fertilizer use for farmers with different resource constraints and agro-ecologies is largely unavailable, the weight of the evidence indicates that fertilizer use is not clearly profitable for many Malawian farmers. Knowledge of soil characteristics and processes regulating nutrient availability and supply to crops is essential to raise productivity per unit of fertilizer nutrient applied.

Current policy efforts are focused on lowering the cost of fertilizer to farmers in order to increase its use. These efforts alone may increase the usage of fertilizer without necessarily improving agricultural productivity, due to the very low efficiency with which many farmers use fertilizer. However, achieving much higher levels of fertilizer use is inhibited by low crop response rates to fertilizer application, which depress farmers' incentives to use fertilizer and erode the contribution of increased fertilizer use through subsidy programs to national development goals. It is increasingly understood that crop response to inorganic fertilizer in Malawi, are depressed by a variety of soil degradation problems. Soil fertility management is a crucial yet under-appreciated dimension of sustainable productivity growth. If soil fertility problems remain unaddressed, Malawi's agricultural growth will be impeded, its agricultural lands will become increasingly degraded, its use of inorganic fertilizer will continue to be low, and it is likely to become more dependent on food imports as the rate of growth of population or consumption outstrips that of food production.

2.6 Integrating Indigenous practices with Modern Technologies for Sustainable Land Management

Smallholder farmers are the main stakeholders in agricultural development in Malawi. Their agricultural knowledge (indigenous knowledge) influences their decisions and behaviors both directly and indirectly. However, the importance of smallholder farmers' indigenous knowledge is often ignored and not considered by influential actors, such as the government and scientists. The integration of indigenous with scientific knowledge is the way to form sustainable agricultural knowledge. Local farmers learn and form their indigenous knowledge based on their long-term farming experience. A number of studies have indicated that the indigenous knowledge contains abundant ecological wisdom, which could provide solutions to agriculture-related environmental problems. Malawi's present agricultural system can draw lessons from traditional agriculture practices.

The discussion above shows that there is need to integrate Indigenous practices with Modern Technologies for Sustainable Land Management. It is an approach based on the ecological and socio-economic understanding of the environment and the local farmers and their relationship. The central idea to this way of sustainable land management is the need for active participation and cooperation between the farmers and the experts. Sustainable land management could be achieved through the increased recognition of the contribution of indigenous practices of the farmers. It is also encompassing the mechanisms through which IP is linked in to introduced or conventional technologies in land management. This is an approach based on the ecological and socio-

economic understanding of the environment and the indigenous (local) people and their relationship.

Integrating IP with modern technologies can contribute to local empowerment and development, increasing self-sufficiency and strengthening self-determination. Incorporating IP in SLM programmes gives it legitimacy and credibility in the eyes of both local people and outsiders. It increases cultural pride and thus motivation to solve local problems with local resources. Local capacity building is a crucial aspect of SLM.

2.7 Documentation and digitization of SLM technologies and approaches

SLM Technology is a physical practice on the land that controls land degradation enhances productivity, and / or other ecosystem services. The technology consists of one or more several measures such as agronomic, vegetative, structural and management measures. SLM Approach defines the ways and means used to implement one or several SLM Technologies. It includes technical and material support, as well as involvement and roles of different stakeholders, etc. An Approach can refer to a project/ programme or to activities initiated by land users themselves. Most of the knowledge dissemination to farmers is done by the extension workers, but in the current scenario, the extension workers are less, as compared with the required number needed to pass on the improved technologies to the farmers. The lack of information and communication sources like internet access, etc., in the rural areas leads to unsustainable utilization of natural resources. For this purpose, documentation and digitization of SLM technologies and approaches will be a viable alternative to popularize SLM among smallholder holders and emerging urban farmers sector who hardly have access to face-to-face extension services. The documentation and digitization of SLM technologies will involve populating and digitizing catalogue of SLM technologies and innovations for Malawi (i.e using WOCAT questionnaires), Support dissemination of catalogued SLM technologies and innovations through extension platforms (e.g. District Agriculture Extension Services System (DAESS)) and other digital platforms which includes use of TV, Call centres, Mobile phones, Community radio, Digital photography, video conferencing, Web portals, video, Internet-enabled computer. Digital technology is assisted due to existence of ICT projects (digital extension projects). The objective of documenting and digitizing SLM technologies is to develop a comprehensive national technical knowledge base and dynamic information system on SLM specific to Malawi's agro-ecological zones. The aim is to overcome the highly fragmented nature of knowledge available in the country and serve as a "one-stop-shop" for knowledge and information on SLM. As part of the knowledge base, a simple geospatial tool for a general audience will be developed and applied. This will provide timely information on erosion, land use, land use change, and other parameters. As the LRCD continues to digitize its soil erosion maps, and soil fertility status get underway, this work becomes increasingly important and useful to inform SLM project management and also future investment programming.

2.8 Gaps and Bottlenecks in SLM Implementation

There are numerous SLM projects/ programmes aimed at addressing land degradation in Malawi. These have been successfully piloted by development partners, non-governmental organizations, community-based organizations and the government of Malawi. The best practices in these initiatives are ready for institutional/ policy mainstreaming as well as for up-scaling and out-scaling at all levels, that is, local, and national. However, progress in mainstreaming of these best practices which will promote SLM practices faces several barriers, bottlenecks and gaps which must be addressed. Thus, some of the constraints are discussed in subsequent sections.

Barriers to SLM have been discussed in a number of consultations and through lessons learnt from previous and existing development programmes and/or projects and directly relate to the limited capacity at the systemic, institutional and individual levels. At the

systemic level this includes the absence of a strong and supporting enabling environment to promote, implement and monitor SLM and include the absence of any mainstreaming of SLM in national strategies and policies, lack of land use policies that consider SLM objectives and principles, uncoordinated activities between development and environmental conservation, limited emphasis on gender in SLM and the absence of the use of economic analysis tools to assist with decision-making on land use. There are ad-hoc and intermittent initiatives to mobilize resources to support SLM projects and initiatives and, coupled with the absence of national strategies that have fully entrenched SLM into them, it has been very difficult to monitor progress and prioritize SLM work in the country. Mandates and responsibilities of the various agencies overlap at times and cause confusion in the delivery of planning and implementation functions

At the institutional level there is limited capacity of agencies and institutions to incorporate SLM objectives and principles into their operational plans and there is an uncoordinated approach to managing information on land and land resources. This has given rise to ineffective decision-making that does not take into consideration an integrated approach towards sustainable land management and the management of natural resources. Local governments that are more directly responsible for monitoring and enforcing land-use regulations have limited staff that do not have the required knowledge and skills to promote and monitor SLM activities. Also, at the institutional level, information needs are mainly to fill in the gaps that have become evidence in Malawi's progress on implementation of environmental programmes. Such information ranging from surveys, assessment of issues affecting each sectors, management plans, geographic information system (GIS) mapping and digitizing all land use patterns and areas, soil and geology information, updated information with land tenure transformation, scientific research studies on climate variability, database information on land and marine resources, and information gathered from community on best practices that they have adopted in addressing environmental and conservation concerns. All information gathered, collated and updated needs to be synthesized, in such a way that priority areas can be determined, and appropriate approaches are taken to implement this action plan.

The absence of participatory, community-based approaches to assessing and planning for rehabilitation of degraded land or use of SLM principles and objectives in land-use planning has barred attempts to have a multi-stakeholder approach to addressing land degradation. Government agencies that oversee land matters are not familiar with participatory approaches and have not been able to get communitywide involvement and engagement in land degradation issues. Promoting SLM as a vehicle to address land degradation will undoubtedly encounter a number of these barriers that will influence the progress and direction to address soil degradation. In addition, the sharing of a common resource(s) often gives rise to disputes among its users. For example, landowners of customary lands and those of leases may encounter challenges over the use of resources among themselves such as profit sharing of an area, at the expense of sustainable management of these resources. Community-based participatory approaches can help address such situations.

At the individual level, there is very limited capacity amongst policy makers, technocrats and community members to use a wide range of tools now available that can support and enhance SLM initiatives. This limited capacity is holding people and communities back from pro-actively planning and implementing SLM programs and initiatives. The very limited capacity to; assess for land degradation, establish and monitor progress against baseline situations, use technologies to rehabilitate degraded land and practice sustainable agro-forestry activities is an important barrier that is slowing down work on SLM in Malawi.

Findings from stakeholder interviews have highlighted that there is limited policy literacy at the national, district and community levels of governance. These studies showed that at the national (i.e. Department Headquarters)

some officers are fully acquainted with policies while at district level, awareness of the policies and awareness of the contents of these policies were limited or entirely absent. The effective implementation of public or national policies depends a great deal on the extent to which the critical actors in the policy cycle are knowledgeable in the contents of the policy. Public officers such as those in the districts and EPAs, farmers, traditional authorities and Assembly members need adequate knowledge of the national policies to facilitate implementation.

Despite the existence of many research centers, universities, NGOs and other institutions, technologies for SLM adoption by land users have remained elusive. In the agriculture sector, the collapse of the extension services through attrition and employment freeze has resulted in scanty extension services reaching farmers. The strength of extension lies in the ability to deliver new and well packaged information related to specific enterprises to beneficiaries and farmers. Moreover, different types of land-users require diverse and complex information to support investment in modern SLM technologies and production systems. This is often scarce and varies with enterprises and from one agro-ecological zone to the other. The private sector has also made inputs to extension services, especially for high-value marketable produce (e.g. tobacco), but these only reach commercial farmers, leaving the vast majority of poor farmers lacking sources of information. It is necessary to establish the required functions and review existing skills and experiences to support SLM functions, especially capacity building interventions. The types of technologies to handle flood management, solid waste, soil erosion, catchment protection and sustainable agriculture are still archaic and need to be improved.

Investments in SLM should be tracked and linked to key output areas in agriculture, environment, livelihoods and economic development. It is also necessary to quantify SLM impacts on attainment of national and regional development goals. However, there is no monitoring and evaluation framework to guide such a crucial exercise whose findings feed back into the investment loop to reinforce prioritization and promotion of SLM in the country. This action plan addresses this issue by recommending an M& E for SLM which should be instituted and functionalized. An analysis of the key constraints and opportunities affecting SLM implementation is presented in Table 2.7.

Table 2.7 *Constraints and Opportunities affecting SLM in Malawi*

Issue	Key Constraints	Key Opportunities
Conducive environment	Lack of a one-stop institution responsible for SLM Extension services for SLM have become very weak	On-going policy reforms for sectors associated with SLM in key institutions (Environment, Water, Agriculture, Lands, Social Services) Decentralization of Government according more divestiture of resources
Improved funding	High investment risks, Inadequate donor mobilization and coordination, High dependency on grant financing	Renewed interest in SLM by major funding organizations, Government commitments to fund agriculture and water sector budgets Increasing private sector participation Innovative financing mechanism for smallholder farmers

Enhanced human and institutional capacity	Inappropriate training curricula Inadequate links between academicians and farmers and other practitioners, Inadequate partnerships among researchers, lecturers, extension officers and other SLM related service providers, Low funding	Regional and national centres of excellence, Qualified staff that need skill upgrading, well established research institutions Reforms in the education sector
Technology adoption for SLM	Lack of a holistic and integrated approach for improving SLM technologies for the poor, In-adequate analysis and prioritization of policy, economic, technical and social constraints	Affordable and appropriate technologies exist, Methodologies for better targeting of SLM interventions Commercialization of agriculture

Agricultural extension services are among the most important factors that drive the development of smallholder farmers. However, National agricultural extension systems have largely failed to provide the support needed by the smallholders. In this regard, the farmer to field staff link has been identified as the weakest one in service delivery, furthermore, inadequate technologies, high degree of bureaucracy and poor working conditions of field staff are commonly cited as major constraints. Though appropriate methods are still being developed, success will depend on adequate support being provided to farmers through training and technical advice. Farmers still lack knowledge about use and benefits of some of the technologies being advocated. Therefore, there is still clear need for policies to articulate strategies for providing support in the form training and advice. There is urgent need for national extension services to facilitate the development of grass root level advisory services involving farmers as the main actors and, at the same, solicit support from as many other service providers as possible.

Agricultural extension system is poorly staffed as most sections are unmanned and some frontline extension workers cover more than one section. The LRCD representation is only at District level, the Extension Planning Areas do not have Land Resources Conservation Officers as they were withdrawn following adoption of unified extension system. The extent of land degradation and the demand on land resources conservation expertise in the implementation of SSM in a district requires that there should also be Land Resources Conservation Officers at EPA level.

Technical knowledge and expertise in different sectors are a prerequisite for efficient delivery of SSM services. It is therefore recommended as a way of improving the knowledge base of both resource users and extensions agents, that effort must be made in producing different knowledge and information management products such as leaflets, posters, policy briefs on SSM and disseminate them. These products must be evidence based demonstrating the ecological, social and economic benefits of SSM and best practices from within the country and elsewhere. The in-service training institutions in agriculture, and other relevant sectors should incorporate SSM concepts and principles in their training curriculum. Likewise, curricula at the Universities should integrate SSM to ensure that future graduates are well equipped to assist resources users in SSM.

Extension systems are inadequate, under-financed, too overstretched, lack of incentives and technological capacity, knowledge and skills all contribute to inadequate delivery of services. The levels of infrastructural development are sometimes so prohibiting that they offer no incentive for staff to opt and work in some districts. Under such economic dispensation, developmental messages are seldom taken seriously more so those that have to do with SLM.

2.8.1 Thematic properties for SLM in Malawi

In Malawi, soil acidification, unstainable rates of soil erosion, loss of soil organic carbon and nutrient imbalances (deficiencies and excesses) are recognized as significant threats to agricultural productivity. To address threats requires a holistic program. The general elements of such a holistic program will include; enabling conditions for the implementation of SLM interventions, economics and finance of SLM, scaling up successful SLM interventions in Malawi, financing restoration in Malawi, and monitoring SLM implementation progress. This holistic program can be implemented as follows:

Policy and institutions: Enabling conditions for the implementation of SLM interventions: An important goal of this action plan is to create landscape conditions that incentivize the sustainable use of natural resources. Policies, administrative frameworks, and institutional strategies create the conditions within which social and economic activities either exploit or sustainably use natural resources. The following strategic priorities show how policies and institutions in Malawi can facilitate SLM and the restoration process seeks to meet:

- Supporting and facilitate the development of the National Land Use Planning Policy that will guide the planning and sustainable use and management of land in both urban and rural areas
- Support and facilitate the development and enactment of Agricultural Land Use and Management Bill to regulate management agricultural land and use of environmentally fragile areas for agricultural purposes
- Entrench SLM as a national priority consistently across newly drafted or revised policies and laws
- Engage the public sector and private citizens in a national conversation on restoration via radio, television, advertisements, and high profile events
- Engage, capacitate, and formalize responsibility of Traditional Authorities in land use and restoration planning and implementation
- Support multiagency and cross-sectoral program design and implementation of landscape restoration approaches
- Align parallel initiatives within ministries and among stakeholders on SLM
- Shift domestic government budget allocations from subsidies for mineral fertilizers to support for increased extension services, training, and outreach programs to promote improved agricultural technologies; soil and water conservation; and other SLM interventions that promote improved catchment management, increasingly redirect cash-for-work programs toward SLM interventions.
- Establish and/or support equitable benefit sharing agreements that include provisions to avoid elite capture and to ensure appropriately compensated community-level participation and governance.

In the long term, the cultural shift required to build sustainable economies at different scales in Malawi will require political and economic investment and the creation of social feedbacks that reinforce investments in sustainable development. In this vision, the full faith and confidence of Malawi and its citizens can be built and supported in perpetuity with a dedication to the long-term vision for sustainability and national prosperity and independence

Scaling Up Successful SLM practices in Malawi: Considering the level of soil degradation in Malawi a coordinated strategy that is inclusive of Malawi's national economic, social, and development goals as well as its natural resource and management aspirations will be key. Broadly, an increase in technical support and training through extension services on the components of this action will fundamentally determine the trajectory of Malawi's SLM commitment.

Expanded communication and outreach are fundamental to the successful enabling of soil

restoration at scale and therefore a critical component this action plan. Real and lasting change in land use practices that contribute to degradation will depend on reaching millions of resource users across the forest and agricultural landscapes of Malawi with key messages and information that prompts behavior change. There are several ways to reduce the information barrier to promote more widespread adoption of SLM activities. It is critically important to increase investment in extension, outreach, and knowledge-sharing programs separately designed for women and men to reduce knowledge and skill barriers and promote adoption. Outreach activities, like farm radio programs, can also reduce information barriers by discussing the practical steps of implementing different SLM activities and highlighting the benefits that smallholders could expect to receive. The following activities can facilitate the scaling up of SLM in Malawi:

- Dedicate more resources to communication and outreach about the benefits of SLM through rural radio, expanded extension services, and support for NGOs to provide community support.
- Expand support for farmer-to-farmer visits and peer-to-peer training
- Mobilize Traditional Authorities and high-level political support to organize competitions, award prizes, and recognize local champions who are leaders in adopting, adapting, and innovating with respect to SLM

To create an enabling environment that fosters widespread adoption of CSA technologies, existing agriculture, forest, and climate policies need harmonization. Key activities for scaling up the adoption of agricultural CSA technologies include the following:

- Prioritize for intervention areas that are the most food insecure, highest in poverty, and prone to drought to maximize the benefits of CSA technologies to increase crop yields, diversity incomes, and increase the climate resiliency of croplands
- Dedicate more resources to communication and outreach about the benefits of CSA technologies through rural radio, expanded extension services, and support for NGOs providing training for communities
- Shift domestic government budget allocations from subsidies for mineral fertilizers to support for increased extension services, training and outreach programs to promote conservation agriculture, FMNR and agroforestry, and soil and water conservation.
- Improve coordination between the government departments to align and increase resource allocations for SLM-based restoration interventions on farms
- Increase support for the development of more coherent and well-coordinated extension materials and training programs for CSA
- Expand support for farmer-to-farmer visits, peer-to-peer training, and other capacity building activities.
- Focus the government public works program (cash-for-work) scheme on soil and water conservation activities in watersheds at high risk for flooding and erosion. These programs (especially the World Bank–funded Malawi Social Action Fund and its Public Works Programme) provide significant inputs that could be more strongly directed toward restoration actions at the village level.

The results of the cost-benefit analyses of the priority CSA interventions have shown that the benefits of each intervention exceed the costs. Agroforestry and some soil water conservation technologies are an exception due to the higher up-front investments of labour and capital as compared to the degraded land use. Currently Malawi expends significant resources on cash-for work programs to support the poorest members of society. Increasingly these resources will be

channelled into SLM activities to improve land productivity. Some key activities that will facilitate the movement of financial opportunities for SLM include the following:

- Support farming communities to use solidarity and community lending mechanisms to incentivize communities' own investment in SLM
- Increase support and incentives for private investment to establish and manage commercial plantations aimed at production of saw timber and high-value forest products with lower-valued fuelwood as a by-product.

The establishment of a monitoring system is important for the categorization of successful SLM interventions in Malawi. A robust monitoring system would incorporate information on (i) processes, projects, and interventions being undertaken; (ii) incremental progress toward agreed-upon targets; and (iii) the medium and longer-term socioeconomic and environmental impacts and benefits of SLM. A key factor in monitoring SLM progress is the improved mapping of land use and land cover across Malawi. Malawi needs an accurate map of the current extent of croplands, forests, and other major types of land use/land cover, and an improved capacity to monitor changes in land use/land cover. More attention needs to be paid to tracking land degradation and understanding the drivers of degradation leading to changes in the productivity of land and other natural resources. Additional analysis is needed of the costs and benefits for specific restoration SLM interventions in combination with business models and enterprises in order to more accurately inform the allocation of resources to support the implementation of SLM. Applied research needs to be supported to improve the understanding of the drivers of land degradation and the key success factors for the widespread adoption of effective SLM practices.

2.9 Knowledge and Data Gaps

- Official sources of sectoral level data are necessary. However, most or all sector level data available were collected by development partners. It is of urgent need to create a new survey series of collecting sectoral level data, especially data on agricultural enterprises, soil nutrient status, efficacy of different SLM practices. Efforts should also be made to strengthen soil status data reporting, which is currently sketchy.
- To effectively evaluate the impact of agriculture subsidy program, it is important to collect data on fertilizer quality and seed quality/purity as well as their farm gate prices, which are not available in Malawi. This is a concern given the weaknesses in regulatory environment and capacity, the cost of the program, and the emerging empirical evidence from African settings regarding the poor quality of commercially available inputs.
- To understand gender gaps, collecting gender-disaggregated data is necessary. Given that women's bargaining power and role can make a huge difference in productivity and income generation capacity of households, it is important to understand individual or gender specific conditions and for this, collecting individual level, not household level, data is critical.
- Another area of agriculture data gap is the absence of frequent agricultural production survey. Crop production data is key for monitoring performance of the agricultural sector. The existing crop production data are collected by the Ministry of Agriculture and the National Statistics Office (NSO), but they are often inconsistent. The Ministry of Agriculture collects data on crop production and cropped area in its annual Agricultural Production Estimates Survey (APES). The APES data is collected by extension workers who have limited data collection expertise and possibly perverse incentive to collect objective agriculture production data. Furthermore, APES data should be accompanied with soil nutrient status data.

CHAPTER 3

ACTION PLAN FOR SOIL CONSERVATION AND RESTORATION

3.1 Introduction

The Malawi National Action Plan on Soil Conservation and Restoration is designed, taking account of the country context, sector issues, the legislative, policy and institutional arrangements at the national and county levels, as well as the salient technological issues, gaps, priorities and visions. The Goal, Purpose, Development Objectives, Environmental Objectives, Guiding Principles, Outputs, Timelines, Components and Activities that constitute the action plan are described:

Goal: The overall goal of the action plan is to provide a national level strategic planning framework, for guiding the inter-sectoral coordination, planning, prioritization and implementation of integrated approaches, and stimulating cost effective investments and budgetary support for SLM, thereby contributing to the attainment of economic development, food security and sustainable livelihoods

3.2 Top Priorities and Comprehensive Action Plan Elements

In order to pursue our vision for sustainable land management, to effectively protect, manage and use our assets and values, and to address the threats and constraints for effective development and management of our land, this action establishes three top priorities and ten comprehensive action plan elements. This action plan establishes four top priorities for all stakeholders to pursue immediately: (i). Nationwide Coordination for Sustainable Land Management (ii). Development Guidelines for Sustainable Land Management (iii). Sustainable Finance for Sustainable Land Management (iv) strengthen research and development for SLM

***Nationwide Coordination for Sustainable Land Management*:** In order to successfully implement a Sustainable Land Management (SLM), Malawi needs an overall coordinating function between the national and state agencies, traditional leaders and communities, and non-government and private sector organizations involved in Malawi's land management. The need for such a coordinating body is supported by the policy reviews, stakeholder consultations, and analysis. This coordinating body would increase the effectiveness of current systems for sustainable land management and support the implementation of this action plan proposal for additional systems and processes.

The coordinating body should be responsible for the following functions:

- Facilitating and ensuring communication and coordination between national, district traditional leaders, communities, non-government and private sector organizations involved in land use planning and management
- Collecting and disseminating land use information (e.g. geographical and scientific data, land use plans, and development standards) to the organizations involved in land use planning and management
- Supporting the development, implementation, and coordination implementation of land use classification, land suitability assessment/mapping and soil fertility mapping to guide crop suitability.
- Providing a central point of access for land use information to the public

- Preparing annual work plans and reporting regularly using a standardized format that can be easily updated and used to inform the government and the public on their progress and effectiveness in implementing Malawi's policies on sustainable land management.
- Assisting all entities involved in land use planning and management to develop and report to the coordinating body on their progress in implementing their strategic plans and annual work plans that include activities, tasks, key personnel, budget, time lines and updated data.
- Sensitivity to Gender, Minorities and Vulnerable Groups: the coordinating unit shall ensure the inclusivity both women and men, youth and people with disabilities in implementing various initiatives, to ensure inclusivity of all cadres of stakeholders. The SLM interventions shall target to reach minorities and vulnerable groups such as the landless and the poor, as these face certain limitations in tackling land degradation.
- Coordination of policy-making and technical advocacy on SLM including promotion of tools and resources available to support SLM scaling up. In addition to policy and advocacy work, publicising land resources management policy and its implication on the community through regular awareness campaigns on sound land resources management practices;

In order to successfully implement a Sustainable Land Management, Malawi needs an overall coordinating function between the national and state agencies, traditional leaders and communities, and non-government and private sector organizations involved in Malawi's land management. LRCD already has some capacity to take on this role, given the agency's expertise in managing geographical data. However, to be a fully effective coordinator between the various state and national agencies, LRCD will need additional staff, additional authority, and additional equipment

Development Guidelines for Sustainable Land Management: To maximize the benefits from the development and use of its land, Malawi needs to have comprehensive land use planning policy with guideline on a district by district basis, and develop national and district guidelines to ensure that land development and use follow and support those plans. The district guidelines must be aligned with the national policies on SLM and should have integrated monitoring framework for measuring progress and for lesson learnt and for scaling up best practices. The need for such coordinated planning is supported by the policy reviews, stakeholder consultations, and analysis supporting the development of Land Use Planning Policy.

Sustainable Finance for Sustainable Land Management: As has been pointed out in this report that social and economic development and growth depend on the natural resources base. Joint Public Expenditure Review of Malawi's Environment, Climate Change and Disaster Risk Management Sectors (2014) provides useful indications on the level of investment in SLM activities. It concluded that budget allocation to SLM was and perhaps is still considerably low. In the agricultural sector, funding under ASWAp for the sustainable land water management focal area was said to have improved the funding levels for SLM, but even that DLRC estimated it at only about 3% of the total ASWAp budget. Of course, the estimation of the financing gap for SLM activities is complicated partly due to the fact that there is inadequate knowledge and information available about the current levels of SLM and SLM-related expenditure. Concerns were also raised by stakeholders that often most of the interventions in SLM are underfunded to the point that they often do not have an impact. Thus, the development of a Medium-Term Investment Plan with associated resource mobilization plan supporting SLM is a key to increasing financial allocations for SLM interventions.

Strengthen research and development: Efforts in promoting research on resource conserving technologies must be supported and in particular there is need for increased investment in research on climate smart

technologies for climate change adaptation and mitigation as well as for sustenance of land productivity such as rainwater harvesting, floodwater harvesting, conservation agriculture and landscape restoration. The research priorities could include:

- **Agricultural value chain assessment for CSA produce.** Research up the value chain in agriculture could demonstrate where the areas are which will have greatest impact on household resilience and incomes. For example, post-harvest food waste reduction efforts may be more effective in increasing the amounts of marketable crops than increasing yields through specifically applied fertilizers.
- **Long term SLM impacts in different agro ecological zones.** There is still a lack of information of variability in SLM impacts in the short and long term across Malawi's regions. Better downscaled data will improve the ability to plan for soil loss mitigation.
- **Investigating what works for women in terms of extension services.** Studies have shown that women and men have different levels of engagement and access to: certain technologies, information, land, credit and decision-making power. Tailoring for women's needs, the majority of farmers will assist the increased efficiency, production and resilience to soil degradation of farmed areas (UN Women, UNDP and UN Environment 2018 World Bank, Op.cit).
- **CSA planning by disaggregating smallholders**. Smallholders' ability to respond to and uptake certain CSA practices, approaches and technologies varies according to their household's characteristics. It is important that CSA intervention strategies consider the potential uptake and impacts on the most marginal and vulnerable households, and those within them, as part of a poverty reduction strategy. Similarly, wealthier smallholder households may be able to increase incomes considerably through investment in specific CSA strategies and approaches. Research into a farmer-sensitive planning approach using a range of techniques across different types of smallholders, will provide better information about which approaches should benefit and be better suited to each smallholder group.
- A quantitative social science investigation into the factors that limit the uptake of soil conservation practices

Development partners' frameworks: The interest in SLM shown in different donor policies do not always translate into increased funding to SLM sectors. While different donors are aware of the importance of programmatic approach in support of government's priorities, project-based approaches in SLM interventions have continued. A number of National strategies and action programmes have suffered implementation bottlenecks due to insufficient funding. Development partners top priorities could include:

- Align frameworks not only to the nation's development planning framework such as MGDS, alignment should also be at implementation level by targeting support to specific SLM activities
- Increase funding that will support implementation of National Strategies related to NRM and SLM;
- Provide programmatic and coordinated support to SLM instead of project-based interventions that may not be sustainable;
- Promote the securing of land rights for poor small-scale farmers through advocating for implementation of land policy and legal reforms and supporting the monitoring of implementation of the land policy;
- Facilitate the development of rural land use planning policy and guidelines;
- Support work on land use classification, land suitability assessment/mapping and soil fertility mapping to guide crop suitability;
- Promote the transparency and use of quality fertilizer through advocating for implementation of fertilizer bill and policy and supporting the monitoring of

implementation of the fertilizer policy

- Develop and support 'commercialisation' of CSA
- Support National Coordination on CSA strategy development, activities, funding and knowledge sharing

3.3 Action Plan Activity Description

Outcome 1: Efficient and sustainable agriculture subsidy program (i.e. affordable input program (AIP))*:* This outcome is comprised of activities that can transform AIP. The activities include: promoting transparency in the implementation of the program in short-term while in medium will involve conducting benefit-cost analysis of AIP to guide decisions, Broadening the Scope of AIP, align agricultural input support programs with agricultural and food diversification policies and interventions, and also in the long term developing and endorsing the policy of gradual reduction in the subsidy rate along with reforms towards smarter subsidy.

Outcome 2: Enhanced Policy, Legal, Institutional and Investment Support in SLM sector: This outcome will identify and address the key barriers and bottlenecks to SLM within the policy, legal, regulatory, institutional and financial environment, and identify ways to improve investments for the SLM sector. The main activities will include: to improve coordination in SLM sector by establishing an inter-sectoral coordination mechanism for SLM, supporting and facilitate the development of the National Land Use Planning Policy that will guide the planning and sustainable use and management of land in both urban and rural areas, entrenching SLM objectives and strategies in different policies and programmes, facilitate and support the revision of National Land Resource Management and Strategy 2000 to incorporate relevant emerging issues, lobbying for increased investment in NRM research to provide information that would lead to the development and implementation of necessary SLM interventions, support and facilitate the development and enactment of Agricultural Land Use and Management Bill to regulate management agricultural land and use of environmentally fragile areas for agricultural purposes. It is recommended that policies development and implementation should be accompanied by strong awareness campaign and packaged in forms such that people can easily understand by focusing on 3 key domains (i) *process*, understand approaches to enhance the likelihood of policy adoption; (ii) content, identify specific elements that are likely to be effective; and (iii) outcomes, document the potential impact of policy and translating them in local languages.

Outcome 3: Narrow Gender Productivity Gap: This outcome will create awareness on CSA among women and vulnerable groups and support development gender transformative CSA technologies and develop gender analysis tools for SLM activities. The outcome will also leverage and lobby for diversification of social protection packages and enhancing women rights and control over household resources.

Outcome 4: Strengthen research services for SLM best practices: The activities under this outcome include: efforts in promoting research on resource conserving technologies and increased investment in research on soil loss mitigation as well as for sustenance of land productivity such as rainwater harvesting, floodwater harvesting, climate smart agriculture and others, facilitate to secure facilities and equipment to facilitate promotion of SLM such as survey equipment for characterization of the resources, maps aerial photographs, satellite images, laboratories for scientific determination of management parameters and the associated computer facilities to enable automated analysis of information, build human capacity on Geographic Information System, Remote Sensing and Geographic Position System (GPS) capabilities to be able to carry out change detection studies and monitor the impact of the SLM technologies on the environment, supporting participatory Action Research to Inform SLM Best Practices, and supporting and supporting on-farm trials on SLM technologies, support and facilitate work on land use classification, land suitability assessment/mapping and soil

fertility mapping to guide crop suitability.

Outcome-5: Strengthen extension and advisory services for SLM best practices: The activities under this outcome will include: supporting and establishing formal and strategic linkages through national and district stakeholder panels, strengthening extension and advisory services (EAS) through message harmonization by using catalogues SLM technologies, supporting development of skills to promote market-oriented agriculture, supporting transformation of DAESS platforms to fulfill their expected role in coordinating district extension services by stimulating farmers' demands for market-driven production, and diversification of production for SLM and sales, supporting and facilitate the expansion of membership by researchers in stakeholder panels and District Agricultural Extension Coordination Committee (DAECC) platforms, and establishing of formal liaison agreements between extension and research to stimulate research that responds to priority needs of farmers, and demonstrate benefits of adopting SLM practices through diversification and or intensification that increase farm incomes and improves Food and Nutrition Security, and reaching women, men and special interest groups (youth) in extension delivery, supporting Department of Agricultural Extension Services (DAES) to tackle the imbalanced extension worker vacancy rate and encourage private and civil society involvement for EAS in relatively better-off areas, prioritizing the allocation of public extension workers to poorer areas where extension worker vacancy rates are highest, supporting EAS providers to integrate new approaches, including those centred on Information Communication Technology (ICTs), into existing EAS methods like group trainings, while being sensitive to farmers' needs and abilities, such as mobile phone literacy. On community level will include increasing training opportunities for lead farmers, providing incentives and reimburse lead farmers' costs of offering services, reinforcing lead farmers' roles in gender empowerment, supporting lead farmers' extension activities by providing training materials and other supplies.

Outcome 6: Medium Term Investment Plan and Resource Mobilization Strategy for supporting implementation of SLM*:* The main thrust of this outcome is to develop a multi-sectoral Medium-Term Investment Plan with associated resource mobilization plan supporting SLM. This outcome will be achieved by creating enabling environment for coordinated SLM planning, budgeting and investment by establishing and operationalize Inter-Ministerial Coordination Committee (IMCC), establishing and operationalize the Inter-Ministerial Technical Committee (IMTC), establish and operationalize intergovernmental SLM platforms and develop guidelines for SLM public private partnerships, build Capacity of stakeholders in developing fundable programmes that would benefit from the various funding windows of the Multilateral Environmental Agreements; and lobbying for adequate resources; financial and human for the implementation of the existing national strategies and action programmes.

Outcome 7: Strengthening SLM Knowledge Management, M&E and Information Dissemination: This activity will gather knowledge and document relevant project activities, lessons learnt, and knowledge generated, organizing it into a coherent knowledge-base. It will also facilitate the effective management and dissemination of knowledge in user friendly formats to all stakeholders according to their knowledge needs and capacities. A transparent and participatory M&E system will be developed to help track the progress in SLM sector. This outcome will be achieved through some activities as follows:

- ***Documenting successful SLM technologies and approaches:*** This activity aims to systematically document the wide range of SLM technologies, practices and approaches that have been successful in mitigating land degradation and promoting sustainable crop, livestock and forestry production in different parts of the country. It will document existing SLM interventions and any emerging ones, including indigenous technologies and farmer innovations based on different agro-

ecological zones.

- ***Development of Soil and SLM Information System:*** Through this activity, a central knowledge base for SLM will be established. It will collate and archive a comprehensive SLM database drawing from interventions from the national, district and local level public and private sector stakeholders. The SLM Information System will have two sub-activities; (i) development and operationalization of national soil information system for Malawi, and (ii) development and institutionalization of an SLM Information System.
- ***Develop National Soil Management Framework (Monitoring, adaptation and Mitigation):*** This activity will establish framework for assessment and monitoring impacts of agricultural systems on soil quality are imperative to establish best management practices and sustainable land use for mitigating climate change, conserving biodiversity and achieving food and energy security. The framework will use the 2010 and 2017 sampled sites as benchmarks to guide DARS and LRCD in routine soil testing and assessment within each ADD.
- ***Development and implementation of Communication Strategy:*** A communication, advocacy and consensus building strategy centred on a common SLM vision is a key priority in the delivery of the action plan. Based on needs assessment, a communication strategy will be developed specifying what knowledge products and services will be delivered to which target stakeholder cadres, their actions, information gathering and sharing modalities and feedback mechanisms (analogue, ICT, print, electronic and other media

Outcome 8: Farmer-Focused Tools to Improve Soil Health Monitoring on Smallholder Farms: This outcome will involve setting up new Soil Testing Laboratories (STLs) and Mobile Soil Testing Laboratories (MSTLs). Knowledge on soil fertility and soil testing is quite low in Malawi. Most farmers are not aware of their soil fertility status despite the fact that the soils are sick. Crops, like all living things, require nutrients and in the right proportion to be healthy. Soil tests helps farmers understand their soils, deal with the deficiencies and excesses and ensure that the soil nutritional content is correct. Soil Health Management (SHM) is one of the most important interventions under SLM approaches. SHM aims at promoting location as well as crop specific sustainable soil health management and judicious application of fertilizers. It is being proposed to establish of soil testing labs at district level as one key priority for this action plan. The establishment of District Soil Testing Laboratories will ensure that every farm holding in the district will be tested for soil fertility. The establishment of agri-clinics cum soil testing laboratories will help to provide the advisory service on crop selection, agricultural inputs, best farming practices, soil testing and testing of irrigation water for quality, recommend fertilizer application including bio-fertilizers and provide guidance on soil reclamation and related areas. These Agri-clinics will be coupled with mobile soil testing laboratories. The mobile soil laboratory. will act as knowledge provider at village level and help in effective technology transfer thereby increasing the crop productivity and per capita income of the farmers and help farmers to diagnose the nutrient status of the soils on their farms in order to determine the right type and rate of fertilizer to apply. It is envisaged that these labs will be under technical supervision of Department of Agricultural Services and administrative under district directorate of agriculture and natural resources. However, it is expected that government will encourage involvement of other agencies such as Private Companies associated with Agriculture Extension in some way such as Fertilizer Companies, NGOs, Cooperative Societies and private entrepreneurs. The Governments will need to announce clear guidelines for involving these private sector agencies in the operation and management of these Soil Testing labs.

Outcome 9: Implement on-the-ground projects and activities to promote and upscale SLM: This main thrust of this outcome is to

support investments in projects and activities that facilitate the adoption, implementation and scaling-up of proven SLM technologies and best practices, bearing tangible impacts to land users and on the ground. The investment in SLM field activities will lead to the restoration, recovery and improvements in the productive capacity and protective functions of Malawi's land resources, resulting in increased agricultural productivity, wealth creation, healthy environments and resilient ecosystems. Outcome 9 identifies the types of SLM technologies and best practices to be implemented at field level through this action plan. Indeed, there are hundreds of SLM technologies and practices to choose from, but only the most relevant in the Malawian context have been proposed. In particular, field level SLM interventions will be

identified, planned and implemented according to the principles and practice of community based participatory planning and management, as per the Terr Africa Guidelines. Thus, the propose approaches include: Micro-Watershed Approach; Support Tree Planting (Farm Forestry and Agroforestry); Soil and Water Conservation (SWC) Programmes; Integrated Soil Fertility Management; Water Harvesting and Storage; Runoff harvesting (Runoff farming); Tools and Equipment for SLM Implementation; Energy Saving Initiatives; Flood Control and Management; PES and Carbon Markets Schemes; Alternative Livelihood Interventions.

3.4 Guide to application of on-farm SLM interventions - SLM pilot project case of Salima district

Salima has wide range of relief, with elevations ranging from 472 m to 1561 m above seal. Four physiographic units have been recognized namely the southern dissected area (highlands), the rift valley escarpment (mid –elevation), the lakeshore plain and lake Malawi itself. The area experiences a tropical continental climate with a single wet season lasting from December to March or April. Rainfall varies between 760 mm and 1140 mm, the mean annual temperature is in the range 18 to 24 dependent upon altitude. However, some areas experience low and intermittent rainfall. Abroad relationship is apparent between topography, climate and natural vegetation, the last-mentioned also being closely related to soil types.

As indicated in earlier sections SLM interventions being proposed in this study are based on synthesis of research findings in Malawi and elsewhere. The SLM interventions are grouped into two main broad categories. These include (i) On-Farm Practices; and (ii) Off-Farm Practices. On-Farm Practices include all applicable activities that can be performed on the farm, be it for crop or livestock production, and post-harvest handling of the produce. On the other hand, Off-Farm Practices include those activities that farmers do outside the farm but relevant to crop or livestock production. To some extent, On-Farm Practices may vary across agro-ecological zones (AEZs) depending on prevailing conditions, while Off-Farm Practices can be practiced in any AEZ. On-Farm and Off-Farm Practices are complementary to crop and livestock production. Table 3.1 below presents the SLM interventions that are promoted in Malawi and are recommended for adoption in the country.

Table 3.1. Soil related constraints in micro-catchment in Salima and corresponding soil management strategies to be undertaken by farmers

Soil constraints	Recommended SLM Interventions for the Target Hot Spot
Low soil fertility	o These include: i) crop rotations, ii) green manure, iii) tobacco remains, iv) homestead refuse, v) cattle, goat, sheep, pig and chicken manure, and vi) agroforestry technologies. Of the agroforestry technologies, the following have shown potential to improve soil fertility: (i) alley cropping, (ii) relay and strip cropping, (iii) intercropping cereals with *Faihderbia albida*, (iv) intercropping cereals with legumes, (v) under sowing cereals with *Tephrosia vegelii*, and (vi) the use of improved fallows using various leguminous tree species (e.g. *Sesbania sesban*, pigeon peas and *Tephrosia vogelii*).
Soil moisture stress	o Spreading manure or compost over the soil – this minimizes evapotranspiration and also provides valuable nutrients to the soil through processes of decomposition o Mulching – mulch is a layer of organic (or inorganic) material that is placed on the root zone of the plants. Examples of mulch materials include straw, wood chips, Inorganic mulch in form of plastic sheeting is also used. Mulching is most suited for low to medium rainfall areas, and less suited for areas with very wet conditions. o Conservation tillage – reducing or, in extreme cases, completely eliminating the tillage to maintain healthy soil organic levels which increases the soils capacity to absorb and retain water. Conservation tillage is a specific type of such approach where crop residue is left on the soil to reduce evapotranspiration, and protect soil surface from wind, sun and heavy rain impacts. o Crop rotation – growing different types of crops every season helps improve soil structure and thus water holding capacity. Examples include rotating deep-rooted and shallow rooted crops that make use of previously unused soil moisture, as plants draw water from different depth levels within the soil. Crop rotation may also improve soil fertility and help control pests and diseases. o Green manuring – growing of plant materials with the sole purpose of adding to the soil for improved organic matter and nutrients. The improved soil quality then also improves water retention capacity. o Deep tillage – suited for some areas and soils, deep tillage can help increase porosity and permeability of the soil to increase its water absorption capacity. o Mixed cropping and intercropping - cultivating a combination of crops with different planting times and different length of growth periods. o Contour ploughing – by ploughing the soil along the contour instead of up- and downward slopes, the velocity of runoff is reduced, creating even barriers, and more water is retained in the soils and distributed more equally across the cropland. o Strip cropping - growing erosion permitting crops and erosion resisting crops in alternate strips. Other soil moisture conservation techniques may include rainwater harvesting to minimize runoff and collect water for use on site. o Incorporation of decomposed trashline material; protective intercropped canopy; timely planting; weed control.

Soil erosion	○ Soil and water conservation: use of marker ridges using the A-frame that are aligned on the contour, ii) making box and tried ridges, during years of low, uncertain and poorly distributed rainfall pattern, and iii) planting of vetiver grass, and other grasses, on the marker ridges, gullies, buffer strips and farm boundaries
River bank cultivation and erosion	○ Implementing Vetiver grass-based riverbank protection programmes ○ Provides extension and advisory services on the size of the buffer zone along rivers and the recommended management practices of such zones
Flooding	○ Flood control structures (dykes, check dams) ○ Runoff diversion and storage (canals, cut-off drains, dams, ponds) ○ Drainage of waterlogging soils ○ Water harvesting structures (weirs, dams, ponds, pans, cisterns) to offset floods upstream ○ Catchment protection works to protect downstream areas from flooding
Waterlogging	○ Strategic Deep Tillage and Subsoil Manuring ○ Raised Bed System ○ Bio-drainage or bio-pumping using specific types of fast growing tree vegetation with high evapotranspiration demand and is considered an economically viable option in dealing with the drainage congestion and environment hazards
Deforestation	○ Farm forestry and Agroforestry ○ Alternative livelihoods (eco-tourism, brick making, sustainable use of forest products, e.g. bee keeping) ○ Energy saving stoves, biogas units, subsidized LPG ○ PES schemes/Voluntary Carbon Markets (VCM) ○ Community forests and woodlots

The SLM interventions described above will be implemented as sub-projects that will focus the activities taking cognizance of the clustering of Salima district into ten micro catchments. This is meant for targeting resources to tackle common challenges holistically. It is instructive that a single project would most likely combine two or more of the technologies /practices identified here (Chart 1). In this chart, the challenging conditions have been condensed to general grouping terms, to avoid ambiguity of some challenges. Similarly, the SLM interventions are condensed to general grouping terms to account for all related practices that are mentioned (as examples) in the boxes. In the chart, challenging conditions are presented in red boxes, and the appropriate specific practices in green boxes. The common practices presented are in grey box.

On this chart, there is average slope, annual rainfall, and temperature they serve to remind the user that the linkages among slope and climatic conditions, as well as challenging conditions and appropriate practices are all related to the AEZ under context. Apart from soil erosion and soil fertility, the outrageous production challenge in Malawi is climate change. Climate change is in this case addressed by considering rainfall and temperature characteristics, coupled with slope

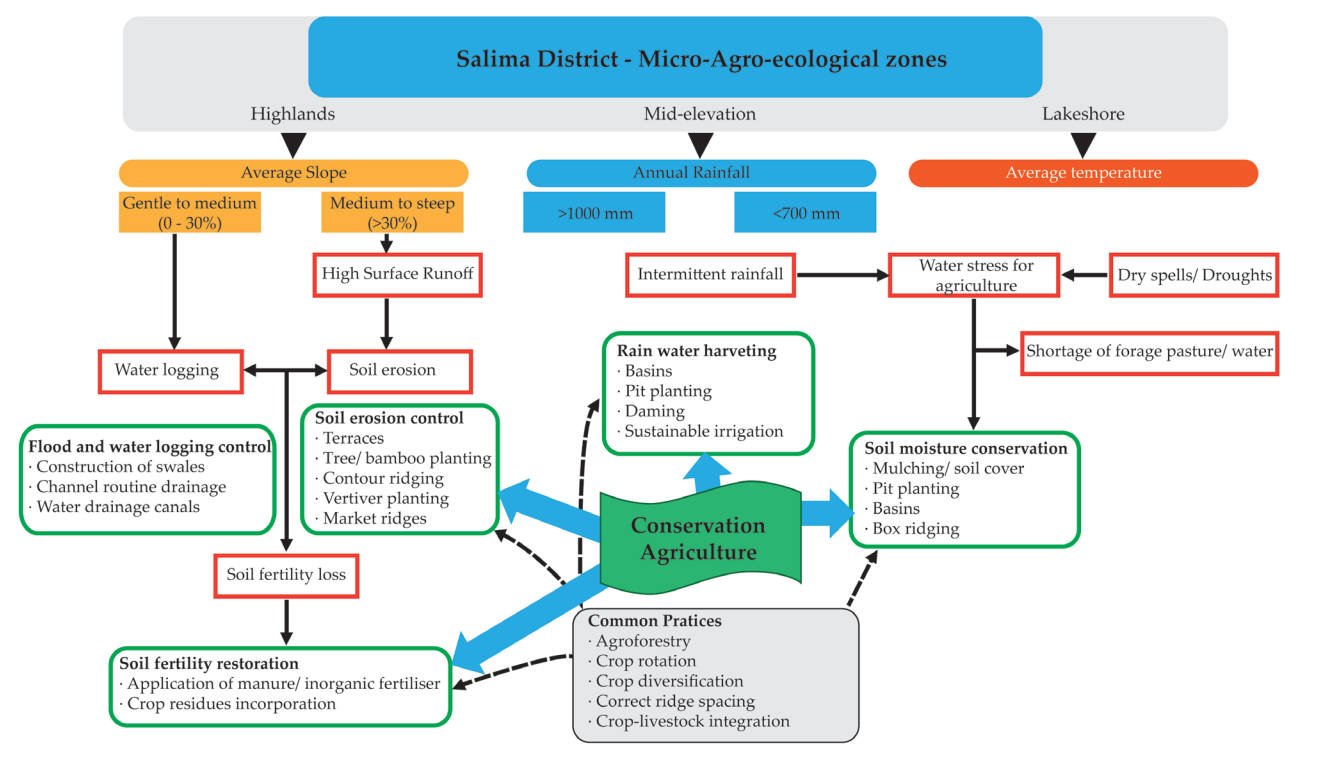

Chart 1: General SLM interventions for Salima district

characteristics of the area which further has a bearing on soil erosion. By using this chart, user should bear in mind soil characteristics described in chart 1.

Operational guidelines at district level case of Salima: A six-point SLM strategy and approaches was developed to tackle the interlinked issues of human pressures on natural resources, poor management practices and limited capacities and the implications in terms of widespread and escalating land degradation, biodiversity loss, vulnerability to climate change and food insecurity. The SLM strategy for integrated ecosystem management and enhanced food security and livelihoods will be piloted in the district to highlight the importance of six main actions:

- The farmer field school approach on sustainable land management (FFSSLM approach) for building farmers capacity in integrated natural resources management for the maintenance of ecosystem services and food and enhanced livelihood security;
- Participatory catchment process from diagnostic (using Land Degradation Assessment Local tools) for informing community action planning and management – and local mechanisms such as catchment/watershed committees, stakeholder dialogue and negotiation for conflict resolution and FFS – catchment linkages for scaling up proven practices;
- Demonstrating how SLM brings win-wins, contributing to climate change adaptation/building resilience and mitigation, reducing land degradation (vegetation cover, erosion control, nutrient cycling, restoring soil organic matter), enhancing agro-biodiversity, as well as socio-economic benefits/ livelihoods (yield, income, nutrition and food security, resilience and reduced risk);
- Partnership and capacity development for improved support to farming communities:
    - Build capacity of Service providers including community-based organizations (CBOs) and farmer facilitators for effective continued support to farmers (e.g. through FFS);

- Establish multi-sector SLM teams at local Government level, and linkages with agricultural research for technical support and quality control.

- Documenting, assessing and sharing knowledge on SLM practices (tools and methods) including packages of SLM practices for specific land uses/ agro-ecosystems in the district [soil and water conservation on steep lands; crop-livestock-tree integration for food, energy and resilience; regenerating healthy lands systems through grazing and livestock management, protecting river and lake margins];

Integration of SLM into policies, planning and legislation at local, and district levels through creation of multi-sector SLM teams, synergy and partnerships with other projects and programmes mainstreaming SLM into plans and budgets and implementing guidelines for district level bye-laws that incentivize SLM practices

3.4.1 Key assumptions underpinning project design include the following;

- The various institutions will be willing to collaborate on integrated approaches to sustainable land management and on sharing access to land information systems;
- Government authorities will remain committed to reviewing and strengthening SLM issues into government legislation, policy and national plans;
- Government and the key institutions involved will commit the resources needed to maintain beyond the life of the project,
- That the SLM monitoring, and evaluation systems are developed with project assistance;
- Government commits the resources necessary for digitizing the land survey/ ownership records, as well as would require making the land information systems the most useful for SLM monitoring and planning.
- That all stakeholders remain committed to SLM principles and practices.

3.5 Implementation of the action plan

This action plan will be implemented in target micro-basins across all districts in the country. However, SLM interventions will be targeted at identified areas in a phased approach, to facilitate the country meeting the targets of increased productivity and natural resources protection and sustainable management. This action plan will enhance capacities for institutional, investment, technical and activity implementation for SLM, making use of research, lessons learning, monitoring and evaluation as interlinked processes. At the policy level, this action plan will be coordinated and advised by a multi-stakeholder, inter-sectoral mechanism, organized and implemented as follows:

3.5.1 Institutional Arrangements

Malawi has in place an institutional arrangement aimed at creating an enabling environment for implementation of SLM programs. The current arrangement includes the central and local government levels in which relevant statutory corporation and non-governmental organizations participate. The organizations are linked through committees and focal points at various levels.

In view that there are many institutions dealing with SLM related activities, these include a number of ministries and departments, NGOs and private sector organizations. The establishment of national coordinating agency will be key to implementation of this action plan. The proposed coordination mechanism is intended to be lean and result-oriented in view of competing demands on resources. This calls for involvement of relevant partners for SLM sector coordination, with institutional partners drawn from the national and local governments, development partners, private sector, research and training institutes, and civil society.

3.5.2 National Government Ministries

The implementation of this action plan will be led by a core team of inter-ministerial coordination mechanism comprising ministries that carry mandates relevant to SLM. Led by the Ministry responsible for agriculture, the other core Ministries include those responsible for natural resources and environment, lands, housing, local government, finance, planning, and social services. This core inter-ministerial coordinating body will co-opt as members of Non-Governmental Organizations (NGOs) whose functions involve various aspects of SLM.

3.5.3 Local governments

Implementation of SLM interventions will be mainly undertaken at district level. It is therefore vital that local governments be supported to build human and institutional capacity for implementing SLM down to farm level. Just as in the national government, SLM issues at district level in many cases fall across more than one Department. In this regard, there will be need to create forums for inter-departmental consultation and coordination for planning and investments. In addition, there are interventions such as catchment protection or exploitation of resources such as water and forests that cut across more than one county, requiring inter-county coordination

3.5.4 Development partners

There are many development partners involved in SLM in Malawi, who will be engaged in the implementation of this action plan. Development partners play a key role of not only providing financial resources for SLM but are important for expertise. This action plan inter-sectoral arrangement will recognize the unique competencies of each partner and assign responsibilities equitably among the government and development partners. The partnership will be organized in the context of reciprocity where the government creates an enabling investment environment for development partners to make their contributions and support the government in delivering on its development.

3.5.5 Private Sector

The private sector is actively involved in SLM investments such as agroforestry and compost making. In addition, a number of private sector companies such as seed companies play a role in research and production of climate-smart agro inputs for different ecological conditions. The private sector however lacks a coordinating body for their voice in SLM

3.5.6 Research and Capacity Building Institutions

Research and Development is required to support adoption of appropriate of sustainable land use regimes, tackle land degradation and development of context specific tools and technologies for promotion of SLM. Also, capacity building on SLM is conducted at all levels from universities to farm level. Thus, technical capacity for SLM is concentrated across the various research institutes, universities, tertiary training institutes which are also sources of innovations and new technologies. The inter-sectoral coordination mechanism will involve researchers and other think tanks to help advance innovation, science and technology in the implementation of the action plan.

3.6 Enhancing Sustainability at systemic, institutional, and individual level

The main benefits of SLM shall arise from restoration, recovery, protection, and improvements in the productive capacity of land resources, which will result in Malawians enjoying increased agricultural productivity, wealth creation, healthy environments and resilient ecosystems. To sustain these interventions and benefits to the citizens this action plan proposes investing resources in capacity building in the following areas:

- Institutional sustainability – This will entail strengthening existing coordination institutions or establishing new ones where none exists. Strong institutions are needed not only to implement agreed and identified priority interventions but also to provide continuity and institutional memory.

- The plan also encourages adequate resources to be provided in technical training because in the last couple of years the advisory and extension services capacity has declined due non-recruitment and retirement of staff. This gap in services delivery is unlikely to be filled through public services only. Therefore, the private and non-state actors in the sector must increasingly be integrated to provide advisory and extension services through innovative delivery systems such as contracted services delivery models or PPPs. Without adequate and qualified technical capacity, the identified SLM interventions will not be effectively implemented.
- The other strategy for enhancing sustainability is to devote adequate resources in relevant research. Many traditional SLM interventions are not only expensive to implement, but also laborious. Research in appropriate cost reduction and labour saving technologies will therefore be needed to sustain implementation of SLM interventions and benefits.

3.7 Implementation Plan and Scaling-up strategy

This action plan will initially be implemented over 5-year period in two terms. Short term; The main activities during this phase will be foundation in nature and will entail establishment and strengthening capacities for SLM coordination institutions such as Inter-Ministerial SLM Coordination Committee (IMCC), Inter-Ministerial SLM Technical Committee (IMTC), District SLM Steering Committees, recruitment of staff, training, review of policies and regulatory frameworks and mobilizing resources. Another key activity during this phase will be establishment of the M&E system for SLM at national and district levels. Medium to Long term while some of the SLM investments will be on-going or shall commence, the main implementation will be undertaken during Phase 2. It is also in phase 2 that interventions that shall prove successful in phase 1 will be scaled up. Table 3.2 provides an implementation plan of high-level activities needed to implement SLM interventions.

Table 3.2 *High level implementation plan*

Key Activity	Lead Organization	Period	Expected results
1. Promote implementation/ application of SLM best practices and technologies	All actors/ stakeholders	All years	Restoration, protection, recovery and improvements in the productive capacity land resources, resulting in increased agricultural productivity, wealth creation, healthy environments and resilient ecosystems.
1.1 Convene a high-level meeting for National Action on Soil Conservation and Restoration	Ministries responsible for Agriculture and natural resources + FAO, UNDP, PEI, UN Women	2021	Build a consensus on SLM priorities and approaches.
1.2 Entrench in the national and district development plans and strategies	National/ local governments	All years	Ensure adequate allocation for SLM implementation
1.3 Hold a High-Level Summit for SLM with all key stakeholders	Ministries responsible for Agriculture and natural resources + FAO, UNDP, PEI, UN Women	2021,	Increased awareness and political goodwill for SLM
2. Create enabling environment for coordinated SLM planning, budgeting and investment	National/ district governments.	All years	Establishment of an institutional framework for a coordinated inter-sectoral joint planning, budgeting, investments and sharing information
2.1 Establish and operationalize Inter Ministerial Coordination Committee (IMCC)	Ministries responsible for Agriculture and natural resources + FAO, UNDP, PEI, UN Women	2021-22	Coordinated planning and resource mobilization for SLM investments
2.2 Establish and operationalize the Inter-Ministerial Technical Committee (IMTC)	Ministries responsible for Agriculture and natural resources + FAO, UNDP, PEI, UN Women	2021-22	Coordinated planning and resource mobilization for SLM investments
2.3 Operationalize district SLM platforms	local governments.	2021	Coordinated planning and resource allocation for SLM investments
2.4 Recruit Staff for extension and advisory services staff	Ministries responsible for Agriculture and natural resources	All years	A functional and widely accessible extension and advisory services

2.5 Establish and operationalize intergovernmental SLM platforms	Ministries responsible for Agriculture and natural resources + FAO, UNDP, PEI, UN Women	2022	Synergy between county and national government on SLM implementation
2.6 Develop a national land use policy	Ministries responsible for Agriculture and natural resources + FAO, UNDP, PEI, UN Women	2022	Provide a basis for prioritization and development of rules, and guidelines on resources allocation for SLM
3. Mobilize resources for SLM implementation			Increased and sustainable funding for SLM
3.1 Develop guidelines for SLM PPP	All actors/ stakeholders	2020	Encourage private sector investment in SLM
3.2 Issue guidelines for PES	All actors/ stakeholders	2021	Encourage engagement of land owners and possible funders in investing in SLM
3.3 Establish a Trust Fund for SLM	All actors/ stakeholders	2024	Harness global funds
4. Establish an M&E Framework for SLM			Provide parameters for assessing change
4.1 Develop SLM information system and data collection tools and processes for SLM	Ministries responsible for Agriculture and natural resources + FAO, UNDP, PEI, UN Women KSS.	2022	Create a dashboard on SLM investments and interventions
4.2. Develop and operationalize communication strategy for SLM	All actors/ stakeholders	2022	Improved profile awareness and consensus around SLM

CHAPTER 4

A FRAMEWORK FOR MONITORING PROGRESS ON SOIL CONSERVATION AND RESTORATION

4.1 Introduction

The establishment of a robust monitoring system is important for catalyzing successful soil conservation and restoration (SCR) in Malawi. A monitoring system serves both to document progress toward Malawi's target of sustainable land management, as well as to provide critical evidence to help adapt SCR implementation strategies and better understand the influence of restoration on Malawi's development goals.

The National SCR action plan outlines nine components/goals that if can be achieved will: improve food security, increase energy resources, increase climate resilience, improve water quality and supply, conserve and restore soil biodiversity, ensure gender equity and equality, and alleviate poverty. Table 4.1 provides more detail on how SCR action plan contributes to each of these goals.

Table 4.1 Goals Targeted by Malawi's National Soil Conservation and Restoration Action Plan

National Goal	SCR contributions to national goals
Improve food security	Reduce soil and nutrient loss, restore soil organic matter content, increase and diversify crop yields and cultivars, enable more efficient use of inorganic inputs
Increase energy resources	Increase supplies of locally managed and sustainable sources of fuel wood
	Decrease sedimentation in catchments of hydropower infrastructure to boost energy outputs
Increase climate resilience	Restore soil fertility to boost yields, diversify farming systems and facilitate adaptation of farmers to erratic weather patterns
	Reduce landslide risks, reduce consequences of flooding/extreme weather events
	Support ecosystem-based adaptation
Improve water quality and supply	Control erosion mitigation and reduce sedimentation
	Protect source water from sedimentation
Conserve and restore ecosystems	Contribute to more effective protection, accelerated regeneration and ecological restoration of native ecosystems and fragile landscapes
	Help to restore the health of ecosystems and increase the flow of ecosystem services
Ensure gender equity and equality	Promote women's access to, ownership and control of productive resources including land, water, and farm inputs
	Promote agricultural education and technical training for women
	Facilitate access to finance for women in agriculture
Alleviate poverty	Increasing agriculture productivity

More specifically, the M&E framework is designed ensure that,

- Key SLM interventions, their outcomes and impacts at all levels are well documented and measured.
- Timely feedback is provided to policymakers and other stakeholders on the implementation progress and outcomes, for their action and response.
- There is agreement on a common set of indicators at national, district and community level, and
- Baseline data and realistic targets are set for each of the indicators and that there is a common reporting format.

The M&E results framework with targets and indicators at various levels is outlined in Annex 2. The Results Framework also outlines indicators for the priority SLM interventions as identified.

4.2 Benchmarks and implementation

The framework proposed as part of this study provides the core indicators, metrics, and data sources, as well as some baseline data for monitoring progress on SCR in Malawi. This framework is a first step in developing a robust, long-term monitoring system for SCR in Malawi. The following activities are recommended as key next steps for operationalizing the monitoring framework:

- Securing high-level ministerial support to adopt the framework as the national standard for monitoring progress on cross-sectoral SLM activities in Malawi.
- Establishing a multi-sectoral SLM monitoring system task force dedicated to developing the monitoring system, which would include assigning specific responsibilities to task force members, establishing a plan for long-term funding support, and developing a work plan for implementation.
- Convening stakeholders to agree upon and set measurable, achievable benchmarks for progress on each indicator using the baseline data.

During the preparation of this framework, it was apparent that there is scant baseline data that could be used to set benchmarks and targets for SLM. However, an M&E system is as good as its baseline and targets, because by monitoring these two aspects it is possible to measure progress or lack of it. Generation of baseline data is usually costly, time consuming and the activity has to be well planned to ensure involvement of key stakeholders. As part of action plan implementation, a baseline study to quantify the indicators identified in the results framework will be undertaken as priority within year one.

4.3 Data Collection, Processing, and dissemination Arrangements

During implementation of the action plan, the results framework and the monitoring system will be agreed upon and shared with key stakeholders to guide reporting and feedback. However, as noted elsewhere in this report, the SLM sector in Malawi is characterized by multiplicity of institutions, policies, strategies and planning frameworks, legal and regulatory frameworks that in some instances contradict each other. To foster a coordinated approach for SLM knowledge, a structured data collection and processing system, from the grassroots, districts and at national level will be put in place as part of action plan implementation. This structure will ensure that indicators will be relevant for various levels to inform the national results framework. Simple and cost-effective data collection and dissemination instruments based on modern information technology platforms, including mobile phone technology, will be used for information gathering and dissemination. Where necessary, other technologies in data collection such as GIS, satellite imagery and real-time data collection tools will be used. All these will contribute to building up a coherent central depository of SLM data/information and hosting the SLM information system, culminating in a one-stop SLM knowledge hub.

4.4 Proposed indicators for the national monitoring framework

The indicators are organized according to the relevant restoration goal or target, and include information on the metric (i.e., quantitative measure), the source of the data, the dimension of progress measured, and whether they are already being regularly collected. Some of the proposed core indicators and metrics are already being regularly collected through the NSO's Integrated Household Survey (IHS), which is conducted every three to five years nationally in Malawi. These indicators have been included due to relevance, reliability, quality, sensitivity to SLM interventions, and ease of communication. Since the IHS provides such a robust and reliable source of data at minimal additional cost or effort for soil conservation and restoration monitoring.

However, some gaps remain in measuring progress on certain soil conservation and restoration. For example, all of the indicators related to soil quality, efficacy on integrated soil fertility management, and river siltation are not currently being regularly collected, so additional resources would need to be allocated for their collection to ensure that progress toward all goals is being adequately captured in the framework. Furthermore, indicators such as quantification of river- and stream-bank restoration and government budget allocation toward SLM-related projects

Table 4.2 Core Indicators of national action on soil conservation and restoration

Indicator	Metric	Source of Data	Dimension of progress measured	Regularly collected?
1. Improve food security				
Crop yield	Average annual crop yield per household per hectare (kg/ha), by crop type	NSO IHS—Agriculture Survey APPES	Trend in crop yield over time indicates effectiveness of SLM interventions at restoring productivity to agricultural lands and improving food security.	Yes
Welfare of basic needs	Proportion of households reporting inadequate consumption of food	NSO IHS—Household Survey	Directly measures progress on the national restoration goal to improve food security and is influenced by on-farm restoration activities	Yes
Types of crops cultivated	Proportion of plots by type of crop cultivated and average acreage	NSO IHS—Agriculture Survey	Demonstrates crop diversity, a sign of resilient agricultural practices and a component of agricultural technology interventions that promotes food security.	Yes
Soil quality	What proportion of agricultural plots have soil quality characterized as: 1-Good 2-Fair 3-Poor	NSO IHS—Agriculture Survey	Perception of soil quality indicates where on-farm interventions have been effective at improving crop yields, food security, and climate resilience, and where more interventions are needed.	Yes

Soil fertility status for sentinel sites	Soil quality indicators	To be determined	Measure effectiveness of SLM interventions and soil health status	No
Access to extension services	A) Proportion of households that received advice from extension services on: crop production, fertilizer, seed, forestry or agroforestry, integrated soil fertility management, soil and water conservation disaggregated by gender B) Proportion of households that followed the advice, disaggregated by gender	NSO IHS—Agriculture Survey	Indicates level of knowledge dissemination and uptake of agriculture, forestry, and SLM, which is related to the effectiveness and sustainability of these interventions. Collecting gender disaggregated data indicates progress made in promoting agricultural education and technical training for women.	Yes
2. Increase Energy Resources				
Domestic activities	Proportion of persons aged between 15-64 years who do specific household activities and average daily hours spent on collection, disaggregated by gender	NSO IHS—Household Survey	Measures how much time women spend on collecting wood, indicating progress toward the goal of ensuring gender equity	Yes
Source of energy used within the household	Proportion of households by main source of energy (collected firewood, purchased firewood, charcoal, crop residues, animal waste, electricity, gas)	NSO IHS—Household Survey	Measures level of dependence on fuel wood, which indicates need for SLM interventions to increase energy resources.	Yes
Source of firewood	Proportion of households that collect firewood from: 1. Own woodlot, 2. Community woodlot, 3. Forest reserve, 4. Unfarmed area, of community, 5. Other (specify	NSO IHS—Household Survey	Measures progress on specific SLM interventions to increase energy resources and indicates where more interventions are needed to increase supplies of locally sourced fuel wood.	Yes

3. Increase Climate Resilience				
Recent shocks to the household	Proportion of households severely affected by shocks during the last 12 months	NSO IHS—Household Survey	Measures impact of SLM interventions in reducing the consequences of flooding, landslides, and weather events to support increased climate resilience.	Yes
Soil organic carbon	Soil organic carbon	Field measurements	Soil organic carbon, a proxy for soil organic matter, indicates soil fertility and carbon sequestration on agricultural land, which contribute to increased climate resilience and improved food security	No
4. Improve Water Quality and Supply				
Access to safe drinking water	Proportion of households with access to safe drinking water	NSO IHS—Household Survey	Measures progress on SLM interventions of improving water quality and supply.	Yes
Domestic activities—Water collection	Proportion of persons aged between 15–64 years who collected water and average daily hours spent on collection, disaggregated by gender	NSO IHS—Household Survey	Measures progress of SLM in improving water quality and supply at local sources. Also measures how much time women must spend on collecting water, indicating progress toward the goal of ensuring gender equity.	Yes
Level of erosion	Proportion of agricultural plots with the extent of erosion characterized as: 1-No Erosion 2-Low 3-Moderate 4-High	NSO IHS—Agriculture Survey	Perception of erosion on agricultural plots indicates the effectiveness of SLM interventions on mitigating erosion and protecting source water from sedimentation, which measures progress on the national goal of improving water quality and supply.	Yes
Turbidity in surface water	Turbidity in rivers and streams (NTU	To be determined	Measure of turbidity demonstrates impact of SLM interventions on preventing sedimentation and erosion and improving water quality. For catchments with hydroelectric power, it indicates effectiveness of upstream SLM interventions at reducing sediment accumulation in downstream reservoirs	No

5. Sustainable use of land based resources				
A. Agricultural technologies				
Adoption of low input, low-cost organic fertilizers (especially farm manure, the integration of legumes into the farming systems, and augmenting organic fertilizers with low rates of inorganic fertilizers)	Average proportion of households in a community using organic fertilizer	NSO IHS—Agriculture Survey	Indicates extent of adoption at the community level of organic fertilizers, one of the primary agricultural technology interventions	Yes
Adoption of integrated soil fertility management strategies	Average proportion of households in a community that practice ISFM	To be determined	Indicates extent of adoption at the community level of ISFM, one of the primary agricultural technology interventions.	No
Adoption of climate smart agriculture interventions	Average proportion of households in a community that practice CSA	To be determined	Indicates extent of adoption at the community level of CSA, one of the primary agricultural technology interventions.	No
Application of synthetic fertilizers	Annual application of synthetic fertilizers per household (kg), including information on type of fertilizer (i.e., nitrogen content), and by crop type	To be determined	Type and application rates also indicate where additional SLM interventions are needed to improve natural fertilization techniques.	No
Crop residues	Method of management or disposal of crop residues per household (e.g., burning, field application, fodder, biofuels)	To be determined	Management method for crop residues indicates the adoption level of conservation agriculture techniques	No
B. Soil and Water Conservation				
Soil and water conservation interventions	Proportion of agricultural plots that implement erosion control/ water harvesting interventions, which include: 1. No erosion control 2. Terraces 3. Erosion control bunds 4. Gabions / Sandbags 5. Vetiver grass 6. Tree belts 7. Water harvest bunds 8. Drainage ditches 9. Other	NSO IHS—Agriculture Survey	Indicates level of adoption of specific soil and water conservation interventions	Yes

Barriers to soil and water conservation interventions	Proportion of households that do not invest in conservation structures on any plots owned and/ or cultivated by the household for the following reasons: 1. Requires too much labour 2. Materials not available 3. Materials too costly 4. No soil or water erosion problems on any plots 5. Too risky/benefits unclear 6. Other	NSO IHS—Agriculture Survey	Reasons that soil and water conservation interventions are not being implemented indicate where more resources need to be invested to adaptively manage intervention techniques and outreach strategies	Yes
Bund adoption	Average proportion of households in a community that have earth or stone bunds	NSO IHS—Community Survey	Indicates extent of adoption at the community level of earth or stone bunds toward soil conservation and restoration	Yes
Terrace adoption	Average proportion of households in a community that have terraces	NSO IHS—Community Survey	Indicates extent of adoption at the community level of earth or stone bunds toward soil conservation and restoration	Yes
C. Community Forests and Woodlots				
On-farm tree cover	Number of hectares of cropland with at least 5% tree cover	To be determined	Indicates extent of adoption at the community level of SLM toward soil conservation and restoration	No
Community forests / woodlots	Number of hectares of community forests / woodlots	To be determined	Indicates extent of adoption at the community level of SLM toward soil conservation and restoration	No
D. River- and Stream-bank Restoration				
River- and stream-bank restoration	Percent of river and stream banks with deep rooted cover within 30 m	To be determined	Indicates extent of adoption at the community level of SLM toward soil conservation and restoration	No
E. Budget Allocated to SLM				
Government allocation of budget toward SLM related projects	Percent of budget allocation per ministry that is earmarked to fund SLM related projects	To be determined	Indicates overall governmental support for National Action Plan and the targets it sets.	No

6. Ensure Gender Equity and Equality				
Decision making authority for agricultural plots	Primary plot decision making by gender	NSO IHS—Agriculture Survey	Trend in agricultural plot decision-making by gender indicates progress made in promoting women's control of productive resources, one of the identified action plan contributions to ensuring gender equity.	Yes
Ownership / management of plots	Primary plot ownership by gender	NSO IHS—Agriculture Survey	Trend in agricultural plot ownership by gender indicates progress in promoting women's ownership of productive resources and equity in agricultural decision-making	Yes
7. Alleviate Poverty				
Perception of household current economic well-being	Percentage distributions of household perceived current economic wellbeing	NSO IHS—Household Survey	Measures progress on the action plan towards alleviating poverty	Yes
Income from sale of surplus crops, and forest products	Annual income from sale of surplus crops and forest products per household (MK)		The availability of income from sale of surplus products at market indicates where SLM interventions are increasing yields, which both alleviates poverty and increases food security	Yes
8. Institutional capacity building				
Training provided at national or district level to promote inter-sectoral coordination on SLM	Number of trainings	To be determined	Measures progress on inter-sectoral coordination on SLM	No
Soil health monitoring facilities	Number of labs/ portable testing equipment	To be determined	Measures capacity on soil testing and accessibility of soil health monitoring services	No
Annual public outreach programs	Number of meetings	To be determined	Measures public awareness level of SLM	No
University level course on SLM and biodiversity developed and taught	Number of courses and people trained	To be determined	The availability of well-trained personnel on SLM	No

9. SLM pilot projects				
Direct project beneficiaries	Number of beneficiaries	To be determined		No
Female beneficiaries	% of female beneficiaries	To be determined		No
Strategic plans for SLM for pilot areas	Number of pilot areas and plans	To be determined		No
Degraded areas identified and categorized in strategic pilot areas	Number of sites	To be determined		No
Farm level plans developed	Number of farms and plans	To be determined		No
Area restored or conserved	Area under SLM	To be determined		No
Farmers trained on SLM interventions	Number of farmers	To be determined		No

4.5 National Soil Information System

The concept of soil information system involves putting together the most efficient elements that provide timely information and feedback for decision making at various levels. Essential elements are the people-users, personnel, data and information, hardware and software as well as resources such as finances. It also includes data collection methods, storage, processing, output and data exchange mechanisms. In the context of action plan monitoring framework, the soil information system will involve investments in data and information systems in an integrated IT system.

4.6 Communication/ Dissemination Plan

The organizations and programs that succeed are those which collect relevant information, analyze and disseminate knowledge effectively, thereby becoming a knowledge hub for stakeholders. Given the multiplicity of SLM stakeholders in Malawi, a well-designed information dissemination strategy backed by a communication plan is essential for the success of the action plan. In its simplest form, a communications plan outlines who needs to be communicated with what information, how to do it, how often and the content. There are also other considerations such as clientele typologies, timing and budget. An effective communications plan is therefore necessary for the implementation of the action plan, to track and facilitate achievement of stated goals, objectives and deliverables. This will help improve the operational efficiency and manage the inputs, outputs and expectations of stakeholders and target audiences. Developing the communication plan for the action plan will be among the early activities for functionalizing this strategy.

4.7 Recommendations and Next Steps

The framework proposed as part of this study provides the core indicators, metrics, data sources, and some baseline data for monitoring progress on national action plan on soil conservation and restoration. An important next step in developing the monitoring system will be to convene stakeholders to agree upon and set measurable, achievable benchmarks for progress on each indicator using the baseline data. These benchmarks will guide progress on restoration activities and indicate whether these activities are achieving their potential or adjustments need to be made.

CHAPTER 5

CONCLUSIONS AND POLICY IMPLICATIONS AND RECOMMENDATION

5.1 Introduction

As a country, Malawi has been undertaking a number of SLM-related activities through programmes of different government ministries and departments, NGOs and some private sector organizations with the support of cooperating partners. These have in the past been done without national action plan. However, the emphasis on the need for sustainable utilization of land-based resources or at least intentions are entrenched in most of the sector policies such as agriculture (land resources conservation), forestry, irrigation, wildlife, lands, environment and tourism. This action plan aims to operationalize some commitments in the MGDS and NAIP to, among others, improve sustainability, food security and poverty reduction, particularly among the most vulnerable groups in the country, including women, child-headed households and the elderly.

5.2 Soil Conservation and Restoration Interventions and Opportunities

Two types of mutually supportive restoration interventions were identified as having the greatest potential for scaling up across Malawi to address existing degradation and land use challenges. These are on-farm and off-farm interventions. On-Farm Practices may vary across agro-ecological zones (AEZs) depending on prevailing conditions, while Off-Farm Practices can be practiced in any AEZ. The on-farm practices are: (1) agriculture technologies and (2) Soil and water conservation technologies. Some of the off-farm practices are: (1) community forests and woodlots, (2) natural forest and plantation management, and (3) river and stream-bank tree planting and natural regeneration. Based on assessment of this study and other studies, the key recommendations are to:

- Integrate these interventions into district-level development and resource allocation
- Provide for the full participation and empowerment of women and take steps to enhance gender equity in all communications and outreach, training, technical assistance and other support for restoration interventions.
- Focus more resources on implementing agricultural technologies, given that it is the most widespread and is key to improving Malawi's food security and the well-being of smallholder farmers.
- Dedicate more resources to communication and outreach about the benefits of agricultural technologies through rural radio, expanded extension services and support for NGOs providing training for communities.
- Reinforce local environmental governance by supporting the adoption and enforcement of strong community by-laws that have direct bearing on SLM interventions.
- Enhance training and assistance for establishing soil and water conservation measures such as check dams and infiltration ditches, to protect investments in croplands from flooding and erosion.
- Provide seedlings and other material resources and associated training to encourage river- and stream-bank tree planting and regeneration to secure water resources and mitigate erosion and flood risks.

- Increase support for farmer-to-farmer and community exchange visits to facilitate peer-to-peer learning and direct dialogue about successful restoration practices.
- A landscape approach that emphasizes inter-sectoral approaches and co-location of investments should underpin all of the above efforts.

5.3 Policy implications and recommendation

Analysis of enabling conditions for large-scale soil conservation and restoration led to a number of recommendations for policies and laws, enforcement, education and awareness, cultural factors, and finance. In this section, we consider the implications of our action plan on soil conservation and restoration regarding policies and institutional frameworks in ENRM. Institutional reforms and policy support recommended for urgent action include: 1) Improve Institutional Arrangements; 2) Increase Capacity for Land Use Planning and SLM; 3) Establish Zoning and Development Guidelines 4). Strengthen Enforcement Capacity across agencies; 5) Raise Public Awareness 6). Balance Culture with economic development; 7) Develop and Implement land resource conservation Strategies; 8) Diversify funding and create revenue stream for SLM; 9) Create Incentives and Economic Opportunities to promote SLM; 10) Actively Participate in International Conventions. All these are key for soil conservation and restoration and hence be accorded the highest priority for implementation of the action plan. The details for these proposals are presented below:

Some key reforms on national and sectoral policies include:

- Improve inter-sectoral planning and implementation among ENRM and other relevant sectors to enhance synergies among different policies and programmes that will benefit promotion of SLM;
- Increase investment in ENRM research to provide information that would lead to the development and implementation of necessary SLM interventions. Sustainable utilization of any natural resource depends on the deep understanding of its nature, extent, its potentials and limitations for specific uses;
- Establish appropriate compliance mechanisms to strengthen enforcement of related laws and policies, in particular for Land Use Planning. Weak enforcement of SLM policies and by-laws—underpinned by high resource demand, limited financial and human resources, rent seeking behaviour, and corruption risks—was identified as a main barrier to achieving soil conservation and restoration at scale

Some key reforms on Donor Cooperation Frameworks include:

- Increase funding that will support implementation of National Strategies related to NRM and SLM; and
- Provide programmatic and coordinated support to SLM instead of project-based interventions that may not be sustainable

Some key reforms on Regulatory Framework and Enforcement Mechanisms include:

- Develop and implement programmes aimed at creating awareness among land users, local leaders and politicians about the existing laws, obligations and rights.
- Strengthen extension and enforcement systems by providing adequate human and financial resources to effectively enforce existing laws.
- Develop and enact Agricultural Land Use and Management Bill to regulate management agricultural land and use of environmentally fragile areas for agricultural purposes.

Some key Principles and Approaches for Enhanced SLM Adoption include:

- Targeted policy and institutional support, including development of incentive mechanisms for SLM adoption and income generation at the local level.
- Integrated use of natural resources at

ecosystem and farming systems levels.

Some key recommendations related to education, awareness, and cultural factors include:

- Integrate soil conservation and restoration into the education curriculum being implemented by most schools in Malawi. This will entail collaboration with Environmental Management Clubs, and other entities within the school structure responsible for environmental management and associated programs.
- Closely involve Traditional Authorities in planning district restoration interventions and implementation.
- Build national ownership for SLM interventions through a comprehensive communications strategy. Build on supportive cultural aspects that have a bearing on SLM—to spur greater community mobilization, and address cultural barriers to restoration including production, transport, and use of charcoal. Include financial institutions in advocacy and awareness.

Some key recommendations to capitalize on the potential economic and financial benefits of restoration interventions include:

- Prioritize the implementation of restoration interventions with relatively lower costs and higher benefits including conservation agriculture, farmer managed natural regeneration, and other forms of agroforestry.
- Diversify domestic government budget allocations from subsidies for mineral fertilizers to support for increased extension services, training and outreach programs to promote soil conservation and restoration activities.
- Provide support for improved data collection and analysis of costs and benefits from a variety of proven SLM interventions that are being implemented at scale.
- Support active research to improve the monitoring of significant outcomes and impacts of investments in conservation and restoration, with attention to the valuation of public goods associated with the restoration of hot spots.

Some key recommendations to reduce the gender gap in agriculture to include:

- Use cross-sectoral policies that recognize both gender gaps and women's rights as a mechanism to target women in vulnerable situations and tailor SLM intervention packages to households' needs around livelihoods and income, food security, and water and energy access.
- Since women have higher demands on their time, their ability to participate in implementing conservation and restoration activities can be limited, yet it is critical that measures be taken to increase women's role in implementation especially in areas with higher percentages of female populations. Facilitating access to technology that is time saving, promoting women empowerment and their rights, changing of cultural practices that constrain women's participation and access to productive resources can all promote women's participation in decision-making at the household, community, district and national level.
- Promote women's empowerment and women's access to and control over resources such as loans, land, extension services and training.
- Promote generation and dissemination of sex-disaggregated data and gender indicators in the monitoring and evaluation framework.
- Propose and mainstream SLM implementation in capacity development programmes at all levels, building on the suite of policies that recognize gender and capacity development priorities.

5.4 Summary of Innovative Delivery Mechanisms to Support SLM Adoption

Innovative approaches are required to promote SLM adoption in Malawi and can help to overcome barriers in the enabling environment. Even though long-term household benefits incentivize SLM adoption at the farmer level, adoption remains low, often because information, skills and support to cover upfront costs are missing, inadequate access to finance, and lack of input and output markets. This component will focus on several mechanisms that can overcome these barriers.

- *Stimulating Community Initiatives in Sustainable Land Management*: This intervention will focus on four components namely: identification and analysis of community initiatives in SLM, stimulation and upscaling of community initiatives, awareness raising amongst policy makers, development of methodology for upscaling and institutionally embedding SLM initiatives
- *Mainstreaming of Sustainable land management activities in national and district programs:* This intervention will focus on four components namely: support the mainstreaming of SLM issues into district development plans and budgets; support adoption of sustainable land management practices by local communities; strengthen the LRCD focal point office in the Ministry of Agriculture and the inter-ministerial committee on SLM to support implementation of the action plan; promote/support rationalization of District Environment Action Plan (DEAP) process to distract funding and ecosystem scales.
- *Enhancing adoption of Climate Smart Agriculture Practices in Malawi's Farming Systems*: This intervention will focus on scaling up of sustainable land management practices will also focus on building capacities of farmers and extension officers at local government level in an effort to build a climate change resilient society. It will specifically increase on the numbers of farmers using Climate Smart Agricultural practises, putting in place measures to improve input supply and produce markets and economic sustainability for farmers using Climate Smart Agricultural Practises.
- *Promote/support operationalization of SLM on a programmatic level*: The proposed country programmatic SLM approach will not only support adoption of SLM/ agricultural technologies, but will also play a catalytic role in the formulation and implementation of a programmatic SLM approach in Malawi. The programmatic approach will address the difficulties inherent in coordinating the current multiplicity of interventions in SLM (e.g., information flows, lack of country ownership when donors pursue specific priorities), and the need to bring in the wide range of stakeholders needed for successful interventions. It is envisaged that the SLM programmatic approach and the implementation of NAIP will lead, in the short and medium terms, to improved coordination and increasingly joint planning among the various Government and donor supported interventions, and in the -longer term to an integrated approach, Government-lead SLM program that establishes the agenda for up-scaling SLM action towards greater impact on the ground.
- *Develop an information management system for tracking SLM activities at the national/ district level:* The Agriculture Sector Wide Approach (ASWAp) includes detailed spending scheme for sustainable land management, and there are SLM interventions underway at the district level. However, there are no tracking mechanism in place to tally up what is actually being implemented. As SLM activities are spread across several different sectors, it would be advisable to develop common criteria for tallying and reporting on SLM interventions.
- *Promote/support the development of guidelines for district level bye-laws that incentivize SLM practices:* Utilizing some of the lessons learned on some projects

e.g., quick adoption of conservation agriculture and the immediate benefits of other SLM interventions, LRCD and other enabling stakeholders should develop a set of guidelines for bye-laws that could be rolled out at the district level. Through such bye-laws, incentives for implementing SLM could in effect be operationalized, through payment for ecosystem services.

- *Support operationalization of holistic landscape management approaches* by harmonizing policies and supporting cross-ministerial collaboration across the agriculture, environment, water and energy sector, and across administrative boundaries. Landscape approaches include climate-smart crop, livestock and forest management and have the potential to reduce alarming rates of soil and nutrient loss as well as addressing issues of biomass burning and charcoal production, which are key for Malawi's carbon footprint

- *Promotion of Complementary practices to inorganic fertilizers under affordable inputs programme.*Complementary agronomic practices (manure/compost, nitrogen fixing legumes used in crop rotations, integrated livestock-crop system, water harvesting, and erosion control) are needed in addition to inorganic fertilizers. The organic content of soils needs to be increased through residue management and other available sources to compensate for the lack of active clays in the soils.

- *Create soil maps of nutrient deficiencies and soil acidity constraints*: The Department of Agriculture Research Services (DARS) needs to urgently conduct research to update soil maps that indicate the soil types and textures, in addition to the soil nutrient maps so as to guide on the appropriate holding and retention capacity of the soil nutrients. so as to guide on the appropriate holding and retention capacity of the soil nutrients. This is the primary information gap in Malawi preventing the creation of targeted fertilizers.

- *Establish Soil Testing Laboratories (STLs) and Mobile Soil Testing Laboratories (MSTLs) at district level (Agri-clinics).* Agri-clinics will provide paid consultancy services for enhancement of agriculture production and income of farmers by regularly monitoring soil health status in smallholder farmer fields consequently improving fertilizer use efficiency. The centres will provide advisory service on crop selection, agricultural inputs, best farming practices, soil testing and testing of irrigation water for quality, recommend fertilizer application including bio-fertilizers and provide guidance on soil reclamation and related areas. The centre will also act as a knowledge provider, enabling the farmers to get access with the latest technologies in the field of agriculture, horticulture and farm forestry.

- *Increasing farmer and extension staff knowledge on fertilizer use:* Lack of fertilizer knowledge basics: the 4R nutrient stewardship (right source, right rate, right time, and right placement) is a severe constraint to both farmers and extension workers, many of whom have never used or been exposed to fertilizers. Government and development partners should support training of farmers and extension staff on fertilizer basics. Training should be followed by simple demonstration sites to train farmers and field days that include cost analysis to show the profitability of fertilizer use. Other partners in this should be fertilizer companies (who can provide product in regions they are interested in targeting and will often financially support field day activities) and agro-dealers, who benefit from increased sales.

- *Improving policies and strategies for sustainable land management:* The national government should finalize the development of the National Land Use Planning Policy that will guide the planning and sustainable use and management of land in both urban and rural areas; develop and enact Agricultural Land Use and Management Bill to regulate management agricultural land and use of environmentally fragile

areas for agricultural purposes; and Develop and implement programmes aimed at creating awareness among land users, local leaders and politicians about the existing laws, obligations and rights.

- *Support the development of Nationwide SLM Coordination Unit:* The national government should establish a national coordinating body with the responsibility, authority and funding to coordinate and support national and districts efforts to implement SLM and to operate as a "Think Tank" to advance a common vision of the issues related to scaling-up SLM programs.
- *Sustainably Financed SLM activities:* Create a solid financial base to implement the Land Use Policy and Best Management Practices by creating revenue streams from existing activities and actively seek strategic partnerships to attract funding for remaining activities.
- *Strengthen research and development in SLM:* Increase investment in NRM research to provide information that would lead to the development and implementation of necessary SLM interventions. Sustainable utilization of any natural resource depends on the deep understanding of its nature, extent, its potentials and limitations for specific uses.
- *Support Farmer Field Schools to strengthening community-based Learning and Technology Adoption.* This sub-component will focus on farmer field school approach on sustainable land management (FFS-SLM approach) for building farmers capacity in integrated natural resources management for the maintenance of ecosystem services and food and enhanced livelihood security.
- *Support Pluralistic Participatory Extension Approach to foster Linkages Between Research and Extension*. There are several extension models, such as the traditional supply-driven public extension model, private extension services including NGOs, and demand-driven, participatory, and pluralistic services. The latter recognizes the diversity of farmers and farming systems and is characterized by the coexistence of multiple public and private sector approaches, providers, funding streams, service types, and sources of information and experiences. It can include membership-based farmer organizations, private or commercial enterprises, and NGOs. Each has the potential to provide complementary services and to thereby contribute to long-term sustainability of advisory service delivery to farmers
- Pursue the positive agriculture sector reform path of revising affordable input program into a program, which supports agricultural diversification and adoption of complementary practices targeted to Malawi's agroecological zones. The analysis shows the benefits of crop diversification and legume intercropping improve fertilizer efficiency and effectiveness.

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ANNEXES

Annex 1: Detailed Monitoring and Evaluation Framework

Outcome 1: Efficient and sustainable input subsidy program										
Short-terms options										
Activities	**Indicator**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Support and Disseminate information on subsidy to all stakeholders well in advance of the season to address uncertainty and unpredictability	Amount of funding and Input subsidy calendar developed and disseminated and followed							Input Subsidy Schedule Published in the media	Funding and Technical Expertise available	Ministry of Agriculture +FAO + UNDP
Conduct benefit-cost analysis of ISP to guide decisions. Also, encourage private sector to take increased role in the market.	Amount of funding and research results							Economic analysis for ISP published and disseminated	Funding and Technical Expertise available	DARS+LRCD+DAES+FAO + UNDP+PEI
Support sensitization of stakeholders on impending changes to ISP in line with area specific fertilizer recommendation	Amount of funding, number of stakeholders								Funding and Technical Expertise available	DARS+LRCD+DAES
Support and develop better tracking using IT to ensure all allocated fertilizer go to intended beneficiaries	Tracking system developed and operational								Funding and Technical Expertise available	DARS+LRCD+DAES+DAPS+FAO + UNDP+PEI
Medium-term Options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Broadening the Scope of Input Subsidy Programs (ISP)	Number of farmers accessing legume seeds							ISP reports	Reforms implemented as planned	DARS+LRCD+DCPFAO + UNDP
	Number of crops and fertilizer blends							ISP reports		
	Number of inputs under subsidy program							ISP reports		

Align agricultural input support programs with agricultural and food diversification policies and interventions	Number of guidelines, tools and strategies developed and implemented to diversify agriculture in line with ISP							Government guidelines and ISP reports	Reforms implemented as planned	DARS+LRCD+DCP+DAES+FAO + UNDP
	Number of ISP beneficiaries practicing/ adopting agriculture diversification							ISP reports		
Streamlining the role of extension workers in the administration of agricultural Input Subsidies	Guidelines of ISP regarding extension service involvement							Government guidelines and ISP reports	Extension and Advisory Service Streamlined	
Develop an inclusive monitoring and evaluation system for the Input Subsidy Program	Number of systems developed and implemented for monitoring ISP							ISP reports	Funding and Technical Expertise available	DAPS+DARS+LRCD+DCP+DAES+FAO + UNDP
Long-term Options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Develop and endorse the policy of gradual reduction in the subsidy rate along with reforms towards smarter subsidy	Policy developed and implemented by 2025							Policy approved and Implemented	Strong political will towards input graduation and funding	DAPS+DARS+LRCD+DCP+DAES+FAO + UNDP+PEI

Develop sustainability guidelines of agriculture input subsidy program	Number and types of inputs being used by ISP beneficiaries							Assessment reports and ISP report	Funding and Technical Expertise available	DARS+LRCD+DCP+DAES+FAO + UNDP
	Number and percentage of ISP beneficiaries graduating from lowest levels of poverty							Assessment reports and ISP report		
	Number of productive farmers that top up subsidy with own resources									
	Number and percentage of ISP beneficiaries graduating from on-farm to off-farm activities							Assessment reports and ISP report		
Outcome 2: Enhanced Policy, Legal, Institutional and Investment Support in SLM sector.										
Short-terms options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Establishing an inter-sectoral coordination mechanism for SLM	National SLM coordination institutional structure established and functional									Ministry of Lands + LRCD
	Inter-governmental SLM coordination sub-committee established.									
SLM mainstreamed into national strategies, sector policies and local government and departmental work plans.	SLM interventions are mainstreamed in GOM programs (both national and district) and donor programs									Ministry of Lands + LRCD

Support and develop land use planning policy	Amount of funding and policy functional									Ministry of Lands + LRCD
Support technical working groups on land use related issues through strengthening evidence based knowledge sharing	Funding and technical expertise provided and number of meetings							Extension circulars and Fact Sheets		Ministry of Lands + LRCD
Support roundtable meetings with respective cabinet committees, parliamentary committees, and inter-ministerial committees on NRM related policies and legislation	Funding and technical expertise provided and number of meetings							Rights holders aware of NRM related policies and legislation	Funding and Technical Expertise available	Ministry of Lands + LRCD
Support development and implementation of communications strategy on NRM legislation and policies	Funding and technical expertise provided and communication strategy developed							Communica-tion Strategy in place		Ministry of Lands + LRCD
Build human capacity of rights holders at community, district, national level on NRM related policies and regulations	Amount of funding and number of people trained at community, district, national level							Rights holders aware of NRM related policies and legislation		Ministry of Lands + LRCD
Support development of national agriculture management information systems that addresses NRM data needs	Amount of funding and functional database							Networked national agriculture management information systems		DAPS+DARS+LRCD+DCP+DAES
Medium-terms options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**

Develop and implement Land use policy to enable land zoning to safeguard quality agricultural lands and identify lands best suited for the production of specific crops	Land suitability map for key crops developed and used to inform the implementation of the Land Use Policy							Land use policy	Funding and Technical Expertise available	DAPS+DARS+LRCD+DCP+DAES
	Roadmap to implement the Land Policy developed and endorsed.									
	Lobby undertaken for the endorsement and implementation of the Land Policy.									
Train staff of relevant government and local government agencies on relevant SLM policies and international guidelines	Number of trainings by content and staff trained									DAPS+DARS+LRCD+DCP+DAES
Long-terms options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Revise, update and enforce regulations to govern the NRM in Malawi	Number of regulations reviewed							Reformed policies and legislations		Ministry of Agriculture, Natural Resources and Lands
Build physical, human and operational capacities for enforcement NRM policies and legislation at National District, and Community levels	Number and type of infrastructure, Number and cadre of personnel recruited /trained, and Amount of funds allocated and used							Personnel trained		Ministry of Agriculture, Natural Resources and Lands
Review SLM regulations to provide for harmonization of institutional mandates and responsibilities.	Number of regulations reviewed							Institution mandates streamlined	Funding and Technical Expertise available	Ministry of Agriculture, Natural Resources and Lands

Identify mechanisms to upscale funding for SLM	Recommendation paper developed on the process of mainstreaming SLM into national planning and budgetary processes									
Establish and operationalize Inter Ministerial Coordination Committee (IMCC)	Coordinated planning and resource mobilization for SLM investments									All actors/stakeholders
Establish and operationalize the Inter-Ministerial Technical Committee (IMTC)	Coordinated planning and resource mobilization for SLM investments									All actors/stakeholders
Establish and operationalize district SLM platforms	Coordinated planning and resource allocation for SLM investments									All actors/stakeholders
Establish and operationalize intergovernmental SLM platforms	Synergy between district and national government on SLM implementation									All actors/stakeholders
Baseline: Malawi has policies that deal with use and planning of land however these do not incorporate and are guided by SLM principles. Government staff and community leaders are also not familiar with SLM principles and how they can guide land use to ensure there is minimal land degradation.										
Outcome 3: Narrow Gender Agriculture Productivity Gap										
Short-terms options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Create awareness on CSA to women and vulnerable groups	At least 70% of surveyed women and vulnerable groups are aware of the values of CSA and have taken steps to adopt it							Women participating CSA activities	Funding and Technical Expertise available	LRCD+DAES

Support development CSA technologies and innovation responsive to needs of women and vulnerable groups	Amount of funding and Number of technologies							Gender responsive CSA technologies	Funding and Technical Expertise available	LRCD+DAES
Support identification and analyze potential CSA-related income generating activities targeted at women and vulnerable groups	Amount funding and Number of analyzed income generating activities and measurement of their potential positive impact on women and vulnerable groups							Number of income generating activities	Funding and Technical Expertise available	LRCD+DAES
Support identification and promote use of labour-saving technologies and alternative energy technologies	Amount funding and Number of analyzed technologies and measurement of their potential positive impact on women and vulnerable groups							Number of labour-saving technologies	Funding and Technical Expertise available	LRCD+DAES
Support identification and analyze of potential market-led incentives on CSA related technologies and innovations adopted by women and vulnerable groups	Amount of funding and number of analyzed incentives and measurement of their potential positive impact on women and vulnerable groups								Funding and Technical Expertise available	LRCD+DAES
Support women's participation in mapped out high-end agricultural value chains	Amount of funding and at least 70% of surveyed women and vulnerable groups are aware of the values of mapped out high-end agricultural value chains and have taken steps to adopt it							Number of value chains	Funding and Technical Expertise available	LRCD+DAES

Medium-term options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Local consultants engaged to develop gender analysis tools for use in the SLM project	Consultant identified engaged and Gender analysis tools developed for use							Gender analysis tools		LRCD+DAESFAO + UNDP+PEI+UNWOMEN
Training conducted for government and NGO staff in use of gender analysis tools.	Training planned and implemented									LRCD+DAESFAO + UNDP+PEI+UNWOMEN
Gender analysis tools used in planning and implementing SLM project activities.	Gender analysis tools made use of during project implementation							Gender main-streamed in SLM projects		LRCD+DAESFAO + UNDP+PEI+UNWOMEN
Diversify social protection activities in order to allow women to access employment and income	Productive Social Safety Net Programme established and Number and percentage of jobs (person-days) generated for women and men in the community, proportion of women employed in unskilled, technical, management, and supervisory roles, by sector								Funding and Technical Expertise available	Ministry of Agriculture, Local Government, and Finance FAO + UNWOMEN
Support and Strengthen women's land rights	Amount of funding and improvements in implementation of land law reforms								Funding and Technical Expertise available	FAO + UNWOMEN

Long-term options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Support and enhance women's rights, control over household resources, and decision-making at home and in the community.	Amount of funding and Number and percentage of women with increased access to household resources and community-based resources							Reports and records		All actors/stakeholders
Support and develop programmes to control or eradicate the spread of gender-based violence	Number of research activities that involve women in documenting gender-based violence and men's local knowledge of resource management and changes in resource availability and use, Number and percentage of women and men in civil society organizations trained on eradication of gender-based violence							Reports and records		All actors/stakeholders

Support and build capacity of women in agricultural skills and formation of cooperatives	Amount of funding and Number and percentage of women and men who receive training, by type of training and Number of training sessions targeted at women and men, by content area							Reports and records		LRCD+DCP+DAES
Baseline: A number of individuals in Malawi have had training in gender and gender analysis for development planning and implementation however specific tools have not been developed and used for SLM-related policies and interventions.										
Outcome-4: Strengthen research services for SLM best practices										
Short-term options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Entrench SLM in national research master plan and engage a research institution to conduct a review of priority research themes for SLM	Consultation workshop implemented and research priorities identified									All actors/stakeholders
Support and promote participatory action research to inform SLM Best Practices.	Number of research grants supported									Academic/DARS+FAO + UNDP+PEI
Support and conduct research on development of local inputs. Research produces and market local inputs as alternative to inorganic fertilizer	Number of research studies supported									Academic/DARSFAO + UNDP+PEI
Support and improve soil testing to facilitate adoption of area specific fertilizer recommendations and formulations	Number of soil testing facilities							Demonstrate increase in research funding & output		LRCD+DCP+DAES+FAO + UNDP+PEI

Support development of fertilizer system interventions (Soil testing and mapping, fertilizer blend development, creation of awareness, commercialization and distribution, farmer access)	Efficient fertilizer intervention system							Demonstrate increase in research funding & output		Academic/DARSFAO + UNDP+PEI
Evaluate on farm performance of different SLM technologies and innovations for different agro-ecological zones										Academic/DARSFAO + UNDP+PEI
Support and conduct a detailed study of soil nutrients loss due to acidification:										Academic/DARSFAO + UNDP+PEI
Baseline: There has been very few research activities undertaken by researchers on the subject of land degradation and links to conservation and poverty. This output will contribute to development of research methodologies that can be used by researchers and students and contribute also to improving the information and knowledge base for SLM.										
Outcome-5: Strengthen extension and advisory services for SLM best practices										
Short/medium-term options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Support and filming up institutional organizational and human capacity gaps limiting famers access to extension and advisory services on SLM	Institutional and human capacity gaps report							To demonstrate enhanced capacity and actual implementation and local level and demonstrate clear link of SLM and soil degradation & increased investments	Reports and records	DAES+LRCD+DARSFAO + UNDP+PEI

Developing institutional organizational and human capacity for delivery of quality of extension and advisory services on SLM	Number of institutions that strengthen farmers access to quality extension and advisory services on SLM, Number of extension workers trained on SLM or soil mitigation measures							To demonstrate enhanced capacity and actual implementation and local level and demonstrate clear link of SLM and soil degradation & increased investments	Reports and records	
Provide technical support to national agriculture content development and clearance committee on SLM	Amount of funding and number of meetings and extension circulars								Reports and records	
Populate and digitalize catalogue of SLM technologies and innovations for Malawi	Amount of funding and number of meetings, technologies catalogued, and functional information portal								Reports and records	
Developing training materials and extension circulars on catalogued SLM technologies	Evidence that training materials, training sessions by content and level of governance have been conducted and developed								Reports and records	

Support dissemination of catalogued SLM technologies and innovations through ICT and District Agriculture Extension Services System (DAESS)	Results of surveys for pre-defined key stakeholders demonstrating change in human behaviour towards SLM							To demonstrate enhanced capacity and actual implementation and local level and demonstrate clear link of SLM and soil degradation & increased investments	Reports and records	
Support and set up demonstration plots at sentinel sites showcasing SLM techniques. Facilitate farmers training on SLM through farmer field schools.	Demonstration plots showcasing SLM techniques established and operational								Reports and records	
	Farmers training on SLM facilitated through farmer field school								Reports and records	
	Knowledge and communication products and services developed and promoted								Reports and records	
Support and develop national database to store all data on the agriculture sector for decision-making	National agricultural database designed and established								Reports and records	
Revitalize inter-sectoral extension system for SLM										
Outcome 6: Medium Term Investment Plan and Resource Mobilization Strategy for supporting implementation of SLM.										
Short-term options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Establish and operationalize Inter Ministerial Coordination Committee (IMCC)	Coordinated planning and resource mobilization for SLM investments									
Establish and operationalize the Inter-Ministerial Technical Committee (IMTC)	Coordinated planning and resource mobilization for SLM investments									

Operationalize district SLM platforms	Coordinated planning and resource mobilization for SLM investments									
Establish and operationalize intergovernmental SLM platforms	Synergy between county and national government on SLM implementation									
Medium-term options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Entrench SLM in the national and district development plans and strategies	Adequate allocation for SLM implementation							Investment Plan and Resource Mobilization strategy documents, Programme design documents, SLM Project evaluation report	SLM continues to be prioritized by national government and Donors continue to support SLM and poverty reduction initiatives	Ministry of Agriculture, Natural Resources and Lands FAO + UNDP+PEI+UNWOMEN
Consultations undertaken with government agencies, NGO's and donor partners to develop the SLM Investment Plan	Consultation workshop implemented and improved coordination arrangements identified									All actors/stakeholders
	Investment Plan developed and presented to stakeholders and cabinet for consideration and endorsement.									All actors/stakeholders
Train Govt and NGOs in project management and development of project proposals.	Training implemented and guideline used.									All actors/stakeholders

Project proposals developed based on priorities and presented to Government and donors for consideration and support.	Number of proposals submitted and funded								SLM continues to be prioritized by national government and Donors continue to support SLM and poverty reduction initiatives	All actors/stakeholders
Leverage alternative and parallel financing mechanism such as public works programme, and social cash transfer to support CSA and NRM activities at community level	Number of social protection programmes integrating SLM									All actors/stakeholders
Create awareness of the existence of many global funds and eligibility criteria to access such funds	Harness global funds									All actors/stakeholders
Develop guidelines and procedures for PES for community participation by incorporating global and local lessons learned.	Payment for environmental/ ecological services (PES)									All actors/stakeholders
Support and conduct diagnostic Trade Integration Study and related actions for SLM to facilitate ATF	Innovative funding mechanisms for SLM									All actors/stakeholders
Establish a clear link between SLM investments and trade to attract funding from local and international companies, and international trade financing mechanisms such the Aid for Trade Initiative										All actors/stakeholders
Establish a Trust Fund for SLM	Harness global funds (amount of funds)									

Baseline: Malawi has National Agriculture Investment Plan but SLM is a cross cutting issues therefore it requires a Medium-Term Investment Plan and associated resource mobilization strategy and government staff have limited capacity to develop these										
Outcome 7: Strengthening SLM data management, monitoring and evaluation, and information dissemination.										
Medium-term options										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Documenting successful SLM technologies and approaches	An electronic data set on SLM technologies & MIS established									DARS+LRCD+Academic+FAO + UNDP+PEI
Development of Soil and SLM Information System	National Soil Information System and SLM Information system developed and implemented									DARS+LRCD+Academic+FAO + UNDP+PEI
Develop National Soil Management Framework (Monitoring, adaptation, and Mitigation):	Management framework developed and parameters for assessing change									DARS+LRCD+Academic+FAO + UNDP+PEI
Development and implementation of SLM Communication Strategy	Improved profile awareness and consensus around SLM									DARS+LRCD+Academic+FAO + UNDP+PEI
Procure appropriate equipment and software for Land Information Management	Networked system established and access improved									LRCD+FAO + UNDP+PEI
Engage expertise and implement training activity in Land Information Management	Training implemented									Ministry of Agriculture, Natural Resources and Lands+FAO + UNDP+PEI
Establish an M&E Framework for SLM	Parameters for assessing change									Ministry of Agriculture, Natural Resources and Lands+FAO + UNDP+PEI

Outcome 7: Implement on-the-ground projects and activities to promote and upscale SLM										
Activities	**OUTPUT INDICATORS**	**BASELINE**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Means of verification**	**Assumptions**	**Responsible Organization**
Investments to promote upscaling of SLM	Number or % of land users adopting SLM practices									All actors/stakeholders
	Hectares or No of SLM practices adopted									All actors/stakeholders
	% reduction in degraded land									All actors/stakeholders

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