

Knowledge Based Sustainable Land Use Management: A Case of Mainstreaming Sustainable Land Management in Agro-Pastoral Production Systems of Kenya project.

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Abstract

Land degradation in Arid and Semi – Arid Lands (ASALs) is a potential precursor to widespread desertification and is linked to various human induced factors as a result of poor land use and management practices. These factors include; inappropriate development models, unsustainable farming practices, reduced livestock mobility and over-exploitation of available pastures, high population growth encroaching on wet- season grazing areas for pastoralists as well as encroachment of agriculture into marginal land. In addition, the increasing demand to fuel wood charcoal and timber has led to loss of forest covers aggravating land degradation. These man- made crisis coupled with the devastating impacts of climate change has further undermined the lives and livelihood of pastoral and agro-pastoral communities rendering them perpetual dependents on famine relief. The ASALs of Kenya are characterized by hot and dry climate, fragile ecology, low and erratic rainfall (arid: -450mm/yr and semi-arid $500-850\text{mm/yr}$) and are most vulnerable to droughts and floods (Miriti et al. 2012; McCown and Jones 1992). The paper highlights and synthesizes findings from a review of the project that has addressed the challenges of sustainable land management using two approaches; firstly it supports review of policies related to sustainable land management and mainstreaming SLM in all national planning process, secondly, the project supports implementation of sustainable land use in the pilot sub counties (Mbeere North, Kyuso, Dadaab and Narok North) of Kenya using Farmer/Pastoral Field School (F/PFS) methodology. The local communities in the pilot sub counties are trained and supported to adopt various SLM practices and lessons learnt from these counties will be used to upscale in other ASALs areas.

Keywords: Sustainable land use, farmer field school, communities, Arid and Semi- Arid areas, degradation

Introduction

The pressure exerted on land today to support rapid population growth has led to degradation. Land Degradation has become a longstanding and increasingly severe problem in most tropical countries. Poor and inappropriate land management practices result in rapid land degradation, massive soil loss, falling yields, deforestation, the disruption of water resources and the destruction of natural pastures (Nabhan *et al.*, 1999)

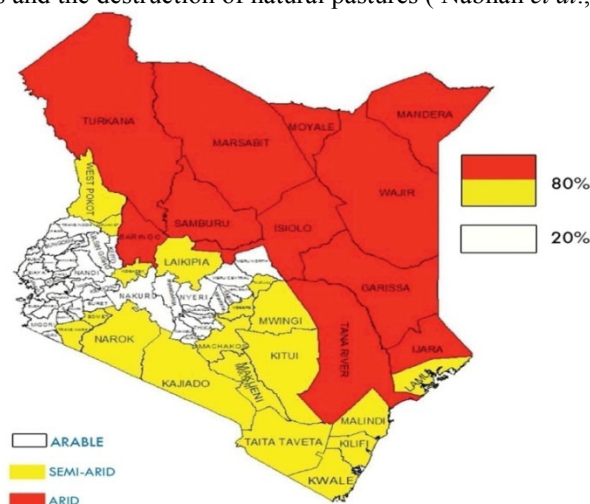


Figure 1.0 Map of ASALs in Kenya (Source: GoK 2005a)

Arid and semi-arid (ASAL) areas are defined as areas falling within the rainfall zones of 0-300 mm and 300-600 mm, respectively (FAO, 1987). In Kenya, Arid and Semi-arid areas are about 467,200 square kilometers or about 80% of the Kenya's total landmass and are characterized by generally hot and dry climate, low and erratic rainfall patterns makes the land most suitable for livestock production compared to other land use types (Miriti et al. 2012; McCown and Jones 1992). Over the years there have been changes in the land use systems that have resulted in severe land and natural resources degradation. The land degradation is primarily driven by inappropriate land use types, and interrelated factors that include inappropriate development models, unsuitable farming practices, loss of soil productivity, overstocking, especially where livestock mobility has been impeded, and breakdown of traditional customs of seasonal migration. High population growth within and

outside the ASALs has resulted in encroachment of agriculture into marginal lands and increased demand for fuel wood, charcoal, timber that has also exacerbated the land degradation processes. Land degradation in ASALs has negatively impacted productivity and compromised their ecological integrity. The unsustainable land use practices have resulted in chronic food shortages and entrenched high poverty levels in the ASALs. (Khalif et al. 2014)

Sustainable Land Management in the Dry Lands of Kenya: Issues and Challenges

According to Khalif (2014) nearly all our needs; wood for fuel and shelter, food, water and other products come from the land and renewable resources on it. This reality is critical for Kenya whose land is the most strategic resource and natural capital that form the backbone of the country's subsistence and national economies. The question is: will the land and these resources be able to sustainably support the growing population? There is increasing scarcity of water, loss of productive agricultural land, forests, woodland, and grazing lands. Today, land use change in most cases denote negative change. These changes are mainly driven by population increase, economic growth and new technology alongside man's inappropriate uses and extractive management regime. The urgency to "develop" continue to damage and degrade landscapes and deplete natural systems that sustain renewable resources.

In the arid and semi – arid areas of Kenya (ASALs), land degradation is attributed to various factors. Some of the major factors include high population growth, government policies and inappropriate development models. The growing population has resulted to increased pressure on pockets of fertile land as more pastoralists sedentarize due to poverty or the need to access social amenities i.e. schools. Livestock losses due to droughts or cattle rustling have also resulted to more people engaging in charcoal production. There is evidence of vegetation degradation due to forest clearing, uncontrolled logging, selective harvesting and loss of canopy cover, invasive species, and uncontrolled fires. The situation is aggravated by climate variations and change (Khalif et al. 2014)

The reality is that land is being degraded at increasing rates despite the fact that ecological, sociological and biophysical causes of land degradation being known. There is an urgent need to put in place the proper mix of current knowledge, techniques and approaches to help us understand the limited potential of land to sustainably produce products of value to people and to nature in general.

The concept of sustainable land management is still evolving but with a common understanding that land production systems must aim for environmental sustainability. This requires information and knowledge on the structure, function and dynamics of the land and landscapes. In addition, there is a need to know the political, fiscal, technological and policy constraints and challenges that would affect realization of full benefits of sustainable land management (Khalif et al. 2014).

Sustainable land management (SLM) is the adoption of land use systems that through appropriate management practices can enable pastoralists, farmers and other land users to have maximum economic and social benefits from the land while maintaining or enhancing the ecological functions of the land resources. Ensuring long-term productive potential of the land resource is critical to SLM. Considering that ASALs cover a significantly large area in Kenya, a large proportion of this area is affected by various levels of land degradation (Khalif et al. 2014).

Knowledge gap is one of the key issues that undermine SLM in the drylands. This is despite the fact that research institutions and universities have been undertaking studies and publishing on SLM. Khalif et al (2014) argues that the knowledge gaps in ASALs are attributed to inadequate extension services, poor infrastructure and high level of illiteracy. This gap can be addressed by enhancing linkages between research institutions and extension services as well as improving extension services in the remote areas

Methodology

The SLM Project: An Overview

Mainstreaming Sustainable Land Management in Agro-pastoral Production Systems of Kenya Project is jointly co-financed by Global Environment Facility (GEF), United Nations Development Programme (UNDP) and the Government of Kenya. It is implemented by the Government of Kenya through the State Department of Livestock with UNDP support and oversight. The 5 year project (2010-2015) is a pilot project intended to generate lessons and practices that can be up scaled to other ASAL areas.

The overall goal of the project is to institute 'Sustainable Land Management' that provides the basis for economic development, food security and sustainable livelihoods while restoring ecological integrity in the ASALs. The project objective is to provide knowledge and skills to land users and managers; financial incentives; enabling policy environment, and institutional capacity for effective adoption of SLM in four pilot districts of Mbeere North, Kyuso, Narok North and Dadaab in Kenya.

The project objective is to be achieved through the following outcomes:

- Outcome 1: Knowledge based land use planning forms the basis for improving dry lands sustainable economic development;

- Outcome 2: Viability of the agro pastoralism production system is increased through diversification and access to finances for SLM;
- Outcomes 3: Policy and institutional frameworks are supportive of mainstreaming SLM in agro pastoral production system and ASALs;
- Outcome 4: Project is managed effectively and lessons learnt are used to upscale SLM in the ASAL districts.

The Sustainable Land Management (SLM) project aims to address the above challenges using two approaches: firstly, by supporting review of policies related to sustainable land management and mainstreaming SLM in all national planning processes. Secondly, by implementing sustainable land use community level initiatives in the pilot districts (now sub-counties) using Farmer Field School (FFS) approach to up-scale best-bet technologies for sustainable land management in ASALs. According to FAO, Farmer Field Schools (FFS) consist of groups of farmers who get together to study a particular topic. The topics covered vary from conservation agriculture, organic agriculture, animal husbandry, and soil husbandry, to income generating activities such as handicrafts. FFS provide opportunities for learning by doing. It teaches basic agricultural and management skills that make farmers experts in their own farms. FFS is a forum where farmers and trainers debate observations, experiences and present new information from outside the community.

Since the launch of the project in January 2012, SLM project continues to undertake various interventions to curb land degradation in selected sites located in pilot sub-counties. The project sites are located in Mbeere North of Embu County, Kyuso of Kitui County, Narok North of Narok County and Dadaab Sub-County in Garissa County. The interventions in each site took into consideration aspects such as the levels and spread of land degradation, type of agro-ecological zone and current land use systems. Below, we highlight some key issues and the achievements of the SLM project.

Results and Discussion

Mbeere North

Mbeere Sub-County covers a total area of 2,092.5 km² with an estimated population of over 200,000. The soils vary but are generally strongly weathered and low in fertility with widespread soil erosion in the project sites (Mbeere District Development Plan (2008-2012)). Although Kiango'ombe hill has global environmental significance because of its endemic plant species, most of the hill has been allocated to individuals. The remaining part of the hill continues to be threatened because of the traditional practice of slash and burn cultivation. The Mbeere community has not been known to embrace soil conservation and very few soil conservation structures had been established in the landscape before intervention by SLM project.

The project has used holistic approach to curb land degradation and enhance environmental protection in Mbeere North. This includes sensitization of the community on issues of land degradation and formed eleven Farmer Field Schools (FFS) around the Kiango'ombe hill. The schools offer training on various SLM technologies and also support in exchange visits of farmers and field days which act as extension and knowledge sharing forums. Through SLM project support, mapping and inventory taking of plant species on Kiang'ombe hill have been undertaken. Over 80,000 trees have also been planted on the degraded hill sides. The project has also supported pasture re-seeding, established SLM Award Scheme for FFS as well as the primary and secondary schools to promote SLM innovations and, to recognize champions of sustainable land management innovations. To date a total of four springs have been rehabilitated and four water troughs constructed. The project has also supported livelihood diversification by promoting beekeeping, drought resistant crops and improved livestock breeds. Post-harvest technologies were also promoted to reduce loss of crop yields. Communities have been trained and currently adopted soil and water conservation structures on their farms. The community members have been sensitized on energy efficient technologies such as improved house hold cook stoves. The project has also established and trained Charcoal Producers Association and trained their members on all aspects of efficient and sustainable charcoal production technologies.

Kyuso

Kyuso is located in Kitui County, which is predominantly covered by grassland interspersed by savanna vegetation. The soils are of low fertility and prone to erosion. The climate is hot and dry for the greater part of the year with erratic rainfall that normally ranges between 400 mm and 800 mm per year, with the short rains more reliable than the long rains. The main livelihood activities are marginal mixed farming, agro-pastoralism, stone quarrying, sand harvesting and petty trade. There is high level of de-forestation due to massive charcoal production driven by high level of poverty.



Figure 2:0 Rehabilitation of degraded land in Kyuso, Kitui County

SLM project activities are mainly in sites around Kyuso, Kamwongo, Tseikuru, Itivanzou, Kavaani and Mulangoni areas. The SLM interventions include establishment and training of FFS, rehabilitation of Itivanzou gullies, support rain water harvesting in primary and secondary schools, establishment of 3 tree nurseries with over 15,000 tree seedlings, planting of trees in degraded areas and in schools and other public institutions. There has also been support to water projects including digging a water pan in Itivanzou, 2 shallow wells and 1 sand dam. FFS in the area involves training on soil and water conservation. The FFSs are also given incentives to establish terraces on their farms. Other support includes provision of improved livestock breed and drought resistant crops to FFS.

Narok North

Narok North Sub-County is situated in the South Rift, south-western part of the country. The sub-county has two distinct zones - the highland zone above 2300 m and the lowland zone between 1000 m and 2300 m above sea level. Much of Narok North is in transition from pastoralism to agro-pastoralism. Previous communal land has been sub-divided and fenced hence livestock movements are restricted. The Suswa hill area is severely eroded with some of the gullies reaching depths of over 25 m and widths of over 30 m (Khalif et al. 2014).

The soils are stratified with hard pans underlain by loose silty loam strata that are readily eroded. The area is densely bushed with *T. camphoratus* being the dominant tree species. Over the years, the land continues to be depleted of ground cover making it susceptible to soil erosion. Due to increased poverty, the community has also resorted to cutting down indigenous tree species for charcoal production. Recently, Narok has been identified as one of the hot spots of environmental concerns in Kenya, due to the massive production of charcoal with a ready market both locally and in the adjacent urban areas.



Figure 3: Rehabilitation of degraded land in Narok North

To combat land degradation in Narok, the SLM project has undertaken diverse activities including mapping of vegetation species in Narok and rehabilitation of over 250 ha of gullies in Suswa in partnership with Kenya Agricultural and Livestock Research Organization (KALRO), University of Nairobi (UoN), Kenya Forestry Research Institute (KEFRI) and Jomo Kenyatta University of Agriculture and Technology (JKUAT). The activities involved the establishment of numerous soil and water conservation structures such as water retention ditches, terraces, cut-off drains, semi-circular bands, water pans, check dams and planting of trees in degraded areas. The project also supported establishment and training of over 450 FFS members on SLM practices including sustainable charcoal production; pasture establishment and adoption of drought resistant crops and improved livestock breeds. SLM supported tree planting in schools and established SLM award to promote environmental protection.

Dadaab

Dadaab Sub-County is situated about 100 km north of Garissa. The area receives an average annual rainfall of about 350 mm year. The pastoral livelihood is affected by frequent droughts which reduces pastures and fodder leading to massive livestock deaths. The place experiences flooding occasionally causing both human and livestock losses (Garissa District Strategic Plan 2005-2010)



Figure 4.0 Rehabilitation of degraded land through planting of trees

Over the years, Dadaab has experienced massive environmental degradation due to high population of refugees. This has led to opening up of pastoral areas for refugee settlement and cutting down of trees and shrubs to provide firewood for the refugees and host communities. The high demand for firewood has led to further push into pastoral lands to harness firewood. The area suffers from under development because of persistent

insecurity caused by inter-clan conflicts and recently, terrorist attacks.

Some of SLM achievements include establishment of Pastoral Field Schools (PFS) and extensive training on best agro-pastoral techniques; establishment of demonstration sites to train community on sustainable farming practices; establishment of tree nurseries and support to planting of medicinal and fruit trees; promotion of adoption of drought resistant crops; pasture establishment, improving livestock breeds; support to veterinary services, livestock disease surveillance along the stock routes; energy saving jikos; support to rehabilitation of a livestock market facility; establishment of slaughter slabs to reduce hides/skin damage, training on flaying and skin/hide treatment and support to peace building to facilitate access to pasture and water sources especially during dry seasons/droughts.

In addition to the above activities, the project is also supporting post graduate research and review of curricula in partnership with the University of Nairobi.

Implementation of the project activities will continue over the next one year. It is envisaged that more positive results and impacts will be achieved towards sustainable land management in the targeted sub-counties.

Knowledge based land use planning in-place.

The project undertook household and community baseline surveys on demographic, livelihood, natural resources and environment profiling were conducted in the pilot project districts. In addition, the project also conducted land capability assessment and adopted sustainable land management practices and innovations for purposes of up scaling ASALs. The project also established collaboration with national universities and research institutions in order to support mainstreaming SLM into curriculum of various degree courses. Knowledge has been imparted to land users and managers through trainings, demonstrations, workshops, experiential learning, exposure visits, technical documents and documentaries. The following knowledge based activities were conducted;

- Improvement in rangeland condition through pasture reseeding and fodder growing.
- Improvement in woodlands condition through agroforestry and analysis of tree seedlings survival especially in the communal areas.
- Quantity of land managed using SLM principles through rehabilitation of degraded lands by terracing and erection of storm water barriers.
- Improvement in food security through provision of drought tolerant crops, upgrading of local breeds of livestock and chicken.
- Carbon mitigated from sustainable charcoaling by conducting trainings on charcoal rules, sustainable charcoaling and construction of communal kilns.
- FFS members were equipped with knowledge and skills on land use planning in demonstration plots that have been adopted in their farms.
- Graduated PFS/FFS members are training newly community-initiated FFS and PFS
- Drought tolerant crops have been introduced and are thriving in project sites
- In collaboration with KALRO soil fertility analysis has been undertaken and appropriate cropping systems have been recommended.
- SLM project facilitated review of the Range Management and Soil and Water Departments B.Sc. M.Sc. and Phd curriculum to include sustainable land management in ASALs. Agro-pastoral SLM methodology, science and techniques have been included in university curriculum at undergraduate and postgraduate levels in the University of Nairobi
- Sponsorship for Master Courses in Universities and short courses in Environmental Impact Assessment among others for Project Executing Officers at DMTs
- Exposure tours to various other project sites and Institutions

Community based experiential learning for SLM

The project facilitated communities to engage in intensive learning, experimentation and integration of SLM knowledge in agropastoral innovations, using farmer field schools techniques. PFS and FFS groups in the project sites have been trained on SLM based experiential learning for SLM practices and technologies in demonstration plots and their own farms. FFS learning takes place both on plot level where the group carry out field trials and experiments, and at landscape level where the group provides managers and resource users with skills and support system to apply a wide range of SLM practices. The project supported the following knowledge based activities;

- The project mobilized community natural resources management across selected landscapes.
- Communities are engaged in rehabilitating degraded areas, hill tops tree planting, springs restoration and construction of water points.
- Development of Community Action Plans (CAP) on SLM

- 44 FFS/PFS were established in all pilot Districts
- Developed award schemes to provide motivation and incentives for the CAP development process
- Child Adopt a Tree SLM Award schemes are established in schools and Best student and Farmer awards in communities.
- Identification and up scaling of suitable SLM practices and innovations
- Graduated FFS/PFS are undertaking SLM practices and are involved in formation and training of new FFS/PFS in the wider community.
- Capture indigenous and local knowledge
- Promotion of local farmer innovations

Technical staff provided with skills and other capabilities for SLM

The project supports national and local environmental authorities training on the SLM principles tested in the community based learning and innovation process. Key institutional processes at national level are supported. The support includes exposure field visit for committee, extension officers and community members to sites with innovative ecosystem management activities in place to ensure that discussions at national policy level represents the actual situation on the ground. It also organizes field visits to share experiences with other SLM projects. The following were conducted;

- Strengthen Office of the District Livestock Production Offices (DLPO) to host DMT for SLM project execution.
- Trained and equipped District Environmental Committee (DEC) on Environmental Impact Assessment, GIS, Carbon Credits, Watershed and Landscape Management alongside provision of GIS equipment.
- DMTs are actively encouraging farmers to develop innovative practices and providing platforms for farmer-to-farmer extension of innovative production methods
- Exchange visits for FFS group
- Inter-pilot district FFS/PFS exchange visits have been undertaken.
- Visits to research institutions and special interest sites have been mounted

Rehabilitation of degraded lands

The project identify rehabilitation techniques that are suitable for the unique set of circumstances in the pilot sites in order to facilitate inventory survey and mapping off badly degraded lands in the pilot as well as rehabilitation of the lands using suitable species and techniques.

The project addressed land degradation through rangeland and woodland restoration and rehabilitation of severely degraded sites through a landscape approach. It has also introduced and advocated sustainable land management practices, enhanced adoption of technologies that ensure sustainable and efficient use of natural resource while conserving the environment.

Conservation agriculture through minimum tillage and construction of water and soil conservation structures has been carried out and about 120,000 m of structures such as terraces have been constructed. Others interventions include: micro water harvesting, mulching and correct use of inputs such as manure to improve soil water retention capacity. Productivity has been enhanced by adoption of fast maturing crops with high yields, drought tolerant crop varieties; high value crops and multi-purpose crops such as fruit trees. ASAL suitable crops such as sorghum, sweet potatoes and cassava production have been introduced. Surplus production has been attained in some areas and farmers in Mbeere returned 191 kg of harvested DTC seeds to the project for resupply to other groups. Pasture bulking has been effected in 8 sites and 12,180 kg of pasture seeds has been planted in 1,954 hectares of rangeland.

Carbon sequestration efforts have been initiated through trainings on sustainable charcoal production techniques, charcoal rules education by Kenya Forestry Service, construction of improved kilns and formation of charcoal producers associations to ensure adherence to the charcoal rules. The introduced agroforestry practices combine livelihood improvement, carbon sequestration and woodland rehabilitation. The following knowledge land use activities were achieved;

- Surveys and mapping of degraded sites were undertaken in collaboration with KALRO, KEFRI, UoN and JKUAT.
- Completed identification, selection and commencement of rehabilitation interventions in Kyuso (Itivanzou), Narok (Suswa).
- Suitable tree and grass species identified and planted in selected sites.
- Demonstrate importance of water harvesting as the basis for regeneration of rangeland vegetation.
- Methodologies for rangeland vegetation regeneration identified and applied in form of retention ditches, gabions, water pans and Zai pits.
- Monitor changes in species richness, composition and total density of plants over time in the pilot sites,

- publicize and disseminate information and results through training and workshops
- Re-establishment of pastures, survival rates of trees continuously monitored in restoration target areas.
- Publicity materials on SLM have been produced and disseminated in various languages and media including pamphlets, news bulletins, documentaries and project reports. Transfer of technology to end users
- Local community participation in rehabilitation activities and transfer of skills and technology to end users done. Explore the use of these sites for planting quick growing species for sustainable charcoal production
- Sustainable harvesting for charcoaling demonstrated and in use in Mbeere North.
- Collaborate with academic and research institutions that have conducted similar studies in the region.
- Technical collaboration with universities, KALRO and KEFRI resulted in successful rehabilitation of degraded sites.

Benefits derived by communities from SLM project

The project activities and achievements with tangible benefits to the communities. The benefits were diverse and included economic improvement, enhanced social linkages, improved agricultural and livestock production practices, environmental conservation and governance improvement. The project has also imparted skills and knowledge on a wide range of aspects that improved community, and individual farmer and herder well being.

i) Socio economic benefits

From the SLM project, the communities in the pilot Counties have accrued socio-economic benefits that include:

- Economic empowerment through diversified income generating activities such as sale of value added products such as treated hides and skins, nyir nyir and honey. Beadwork, basketry, soap making and the use of donkeys as draught animals are other SLM initiated enterprises that are not dependent on natural resources, livestock or agriculture.
- Improved nutrition has been realized through increased crop yields, introduction of new crops, milk and egg production. The fruit trees introduced as part of agroforestry diversification will enhance nutrition and increase income in future. The interventions in agriculture and livestock production systems will alleviate food insecurity and reduce relief food dependency.
- The SLM project initiatives have enhanced communities' conflict resolutions and peace building capacities leading to enhanced peace and cohesiveness amongst them. This will contribute to a peaceful environment that is a prerequisite for economic development in the target ASAL areas.
- Gender equality and women's empowerment is being realized as the FFS methodology incorporates women in the leadership structures. Women-friendly enterprises such as dairy goats, chicken farming, and KTBH have improved women's access to and control over resources. The use of energy saving devices has reduced the time spent on sourcing firewood and reduced quantities used and as a result has freed women to undertake other activities.
- Improved social dynamics and cross community learning have been achieved by drawing FFS members from different community groups, age groups, gender and social categories in an area.

ii) Agriculture

The ASALs are characterized by food insecurity and the SLM project has supported adoption of suitable agricultural technologies for dry lands. Results have been attained in the following areas:

- Breed improvement: Upgrading of local livestock and poultry has led to breeds that are more productive in meat, milk and eggs; tolerant to drought (Galla goat) and have a faster growth rate.
- Training on appropriate land husbandry practices through AESA has improved soil fertility and reduced soil erosion and water loss.
- Enhanced agricultural productivity through adoption of conservation agriculture strategies and introduction of drought tolerant crops has led to increased food availability in the pilot areas.
- Community sensitization on aspects such as weather and drought early warning information that affect production in Agropastoral systems.

iii) Environmental conservation

Dependence on natural resources in the ASALs has resulted in land and resource degradation leading to changes in vegetation structure and composition. The SLM project has initiated environmental protection and restoration through:

- Rehabilitation of severely degraded land and water sources in Suswa, Itivanzou and Kiang'ombe springs.
- Agroforestry on communal areas and individual farms, pasture seeding and re-seeding, soil and water conservation is improving the pilot areas environments.
- Popularization of energy saving devices has reduced tree logging and emission of carbon dioxide.

- Formation of charcoal producer associations and training on sustainable charcoaling and charcoal rules aims at reduction of tree cutting, regeneration of trees and reduction in carbon dioxide emissions.

iv) Governance

The project recognized and incorporated traditional, religious governance institutions and the provincial administration in SLM activities thereby enhancing uptake of SLM initiatives by the diverse communities. The project has also supported revitalization of traditional natural resource management systems and institutions.

Challenges facing the SLM initiatives

Challenges emanating from climatic variations, cultural practices, socioeconomics, financing, mobile pastoralism and the devolved governance has affected the execution of some SLM initiatives.

i) Unpredictable weather conditions

Food security interventions through provision of drought tolerant crops, pasture restoration by reseeded and agroforestry establishment are dependent on availability of rains. Unpredictable weather patterns negatively impacted on these season-dependent activities in the pilot sites. Rain failure resulted in poor pasture establishment, crops failure and depressed tree seedling survival.

ii) Livestock movement

Rehabilitation of Suswa gullies has been affected by incursion of livestock and wildlife into the rehabilitated area in search of pasture. The reestablished grass and vegetation was grazed to the ground.

SLM project up-scaling strategies

In the spirit of promoting sustainable land use practices to reach other communities, SLM has been

1. Graduating beneficiaries who have acquired knowledge to create room for other new groups hence up scaling to other areas
2. Engaging in networking and learning opportunities e.g. workshops, conferences to share its best practices

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