Sub-national Restoration Opportunity Assessment for Kajiado-south

Kajiado County - Kenya

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WWF

IUCN

On behalf of

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for the Environment, Nature Conservation
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List of Abbreviations and Acronyms

AET	Amboseli Ecosystem Trust
AFR100	African Forest Landscape Restoration Initiative (for restoring 100 million hectares of land in Africa
ALOCA	Amboseli Land Owners Conservancy Association
AREECA	Alliance for Restoration of Forest and Landscape Ecosystems in Africa
AUDA-NEPAD	African Union Development Agency - New Partnership for Africa's Development
CBNRM	Community-Based Natural Resource Management
CBO CGIAR	Community-Based Organisation Consortium of International Agricultural Research Centres
CSO	Civil Society Organisation
DEM	Digital Elevation Model
FAO	Food and Agriculture Organization of the United Nations
FGD	Focussed Group Discussion
FLR GHGs	Forest Landscape Restoration Green House Gases
GIS	Geographic Information Systems
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GFW	Global Forest Watch
GLW	Gridded Livestock of the World
IUCN	International Union for Conservation of Nature
ISRIC	International Soil Reference and Information Centre
KEFRI	Kenya Forest Research Institute
KFS	Kenya Forest Service
KSh	Kenya Shillings
KWS	Kenya Wildlife Service
LULC	Land Use Land Cover
NDC	Updated Nationally Determined Contribution
NEMA	National Environment Management Authority

NGO	Non-Governmental Organisation
NPV	Net Present Value
PELIS	Establishment and Livelihoods Improvement Scheme
PES	Payment for Ecosystem Services
REDD+	Reducing Emissions from Deforestation and forest Degradation
ROAM	Restoration Opportunities Assessment Methodology
RUSLE	Revised Universal Soil Loss Equation
SFMTI	Sustainable Forest Market Transformation Initiative
SOC	Soil Organic Carbon
SRTM	Shuttle Radar Topography Mission
USAID	United State Agency for International Development
VSLA	Village Saving and Loan Association
WRI	World Resources Institute
WWF	Worldwide Fund for Nature

Executive summary

Kenya is committed to restoring 5.1 million ha of deforested and degraded lands by 2030 through Bonn Challenge and AFR100 targets. In its updated Nationally Determined Contribution (NDC) 2020-2030, the country is also committed to increasing and maintaining 10% of tree cover by 2022. The new government (formed in September 22022) has committed to raising the cover to 30% of the country's territory and reducing 50% of GHGs emissions from the forest sector. Supporting these commitments is a wealth of national policies, legislations, institutions, and strategic plans and programmes as well as partnerships required to drive these commitments into actions.

In line with these commitments, Kenya's Ministry of Environment and Forestry and Kenya Forest Service in collaboration with the Worldwide Fund for Nature (WWF), International Union for Conservation of Nature (IUCN), World Resources Institute (WRI), Food and Agriculture Organization of the United Nations (FAO), World Bank, AUDA-NEPAD and GIZ, through The Alliance for Restoration of Forest Landscapes and Ecosystems in Africa (AREECA) is

implementing a Large-scale Forest Landscape Restoration (FLR) programme. The project is being implemented in Kajiado South Sub-county, in Loitoktok-Amboseli landscapes and it is expected to restore about 25,000 hectares by 2025.

In order to identify priority sites and determine the enablers of achieving the targets, the AREECA project is using the Restoration Opportunities Assessment Methodology (ROAM) to undertake sub-County Forest Landscape Restoration assessment where ROAM-based geospatial techniques are used to map and quantify degradation (as an entry point) the restoration opportunity and intervention areas in the Sub County. Further, the process allows the actors to understand the landscape challenges, drivers of degradation, and define a theory of change to transition the landscapes from degraded lands to more healthy, productive, and sustainable lands. The restoration interventions are determined through a participatory study on the root cause (drivers) of degradation. Rapid Restoration Diagnostic appraisal is also undertaken to assess restoration success factors as well as the enablers including institutional and policy conditions for the sustainability of restoration investments. The key findings of this assessment as summarised below:

Degradation challenges, opportunity areas, and restoration packages

Land degradation in Kajiado south is mainly characterised by degraded rangelands, diminishing wildlife habitats, gullies, bare soils, and invasive weeds (*ipomea solanum, lantana, Mexican prickly poppy*) in rangelands. Riverbanks, streams, and springs are not protected against erosion and intensive use. During the dry season, most of the rivers run dry, communities have to rely on boreholes, and water springs for water mainly for domestic use and for livestock. Degradation mapping has revealed that about 176,668 hectares (about 28.2 % of the total land in Kajiado South) are highly or severely degraded. This is more raging in Lenksim ward near the Amboseli national park, some parts of the Kimana and Kuku wards, and a number of patches in Imbirikani ward. About 352,087 hectares are moderately degraded, (half of Kajiado South land (56.2%) while approximately 97,236 Ha of lands (15%) are not degraded.

Seven restoration interventions have been identified in Kajiado South: 1) Agroforestry; to be implemented in agricultural lands in Kuku, Rombo, and Kimana ;2) Orchards with fodder plantation- part of the agroforestry system that will be put in scale within Kimana; 3) Sustainable Forest Management of the industrial plantation compartments mainly within Loitoktok Forest Reserve; 4) Sustainable Rangeland management (including silo-pasture) in Kimana, Olugulului, Eselenkei, Kuku and Mbirikani group ranches; 5) Soil and water conservation (farmlands, springs, rivers, streams, and gullies); 6) Assisted Natural Regeneration in and around Amboseli National Park, conservancies, and the natural forest compartments within Loitoktok Forest Reserve; and 7) Greening populated areas and roadside tree planting.

1) **Agroforestry** has been identified to restore degraded agricultural land in Kuku, Rombo, Loitoktok, and in Lenkisim. About 48,253 hectares have potential for agroforestry of which 7,232 hectares are priority areas in accruing multiple benefits of food, timber and fodder production as well as erosion control. In the agroforestry package, 5% of the total land size is planted with agroforestry tree species such as *Grevillea robusta*, 10% is occupied by tubers such as English potato, 10% is planted with fruit trees such as avocado, orange, citrus or papaya, 10% is planted with fodder grasses, 5% is planted with fast-growing tree species such as *Cupressus lusitanica*, while the biggest part of the

farm (60%) is cropped with maize in rotation with beans and other crops of interest. These trees can be planted along the contours, along boundaries or on alley planting or in any other desired configuration depending on the setup of the land.

2) **Fruit orchards** (under agroforestry system) with fodder banks are proposed in agricultural land but near villages and urban settlements to improve human and animal nutrition and contribute to farmers' increased food security. Fruit orchards with fodder include a line of citrus or orange followed by a line of avocado, then a line of mango with all trees spaced by 8 m within and between lines. A 10 m wide strip of improved fodder grass separates the strips of these lines.

3) The **sustainable rangeland management** system is identified to restore about 250, 000 Ha of rangelands of which about 42,000 Ha would be the priority areas to accrue multiple benefits. It is proposed in areas around Amboseli National Park and in the group ranches.

4) **Silvopasture** (under rangeland management system) intentionally combines livestock (cattle, sheep, goats, poultry, pigs, etc.) with trees or other woody perennials and forages on the same unit of land. The silvopastoral system is recommended for Rombo, Kuku, and the upper Olugulului (in Imurtot, Kidapash, and Ilimisigiyo). In this model, a strip of trees made up of two lines of trees spaced by 5 m between trees within the line and between the lines are planted against the slope in pastureland. The strips of trees are separated with an alley of fodder measuring 20 m of width between the strips of trees. Pastureland trees are recommended such as *Acacia xanthophloea*, *A. tortilis*, *A. seyal*, *A. gerrardii*, and *Ficus sycomorus*. Fodder production in Silvopastoral system recommended is Napier grass (*Pennisetum purpureum*), Kikuyu grass *(Pennisetum clandestinum)*, lucerne *(Medicago sativa)*, boma rhodes grass *(Chloris gayana)*, and brachiaria grass *(Brachiaria ruziziensis)*.

5) **Sustainable management of industrial forest plantations** in the gazetted forest with the Plantation Establishment and Livelihoods Improvement Scheme (PELIS) as well as the establishment of new plantations is recommended on 9,700 Ha of which 2,600 ha are a priority to accrue multiple benefits. The establishment of forest plantations on public land with PELIS is recommended in Loitoktok forestland - for the production of wood products (timber and other ecosystem services). A similar on-farm plantation model of can be done on degraded patches on private land near Loitoktok forest, in north-west Rombo, south-west Kuku, and extreme south and extreme north Kimana. Trees should be spaced by 3 m, 1st to 4th thinning and pruning should be respected, water retention trenches on steep slopes, etc. These species can include *Pinus patula, Eucalyptus saligna, Grevillea robusta, Vitex keniensis, and Juniperus procera.* Beans and english potatoes would be cropped in rotational patterns during the first four years of forest establishment before trees start competing with the crops for light and other growth resources.

6) **River and spring protection** with buffers of indigenous tree species is meant to control siltation. This intervention concerns about 3,722 ha for 78 potential streams. The model suggests planting and maintaining a belt of grass of 1 m wide starting from the shores or edge of the river, followed by one line of trees of *Acacia xanthofloea, or A. tortilis, A. seyal, A. gerradii, or Ficus sycomorus* with individual plants spaced by 5 m, then a strip

of grass of 8 m of *Pennisetum purpureum*, or *P. clandestinum*, *Medicago sativa*,*Chloris gayana*, *Eragrotis superba* or *Brachiaria ruziziensis*, followed by a line of trees, then a 1 m wide strip of grass.

7) **Gully and riverbank rehabilitation** using gully plugs and check dams is meant to reduce the velocity of run-off and retain soil sediment. The shallow ravines (<1 m deep) can be easily reclaimed with simple cultivation. The management of medium to deep ravines starts with designing and instituting a series of composite check dams in the gully bed using the gully plugs. These check dams are found to be very effective to stop erosion, detaining the sediment and runoff water behind the structure, which ultimately results in groundwater recharge.

8) **The roadside tree buffer** comprises two rows of trees spaced at 5 m between lines and 10 m within the line. The proposed tree species include *Croton megalocarpus, Senna siamea*, *Spathodea nilotica, and Senna siamea*.

9) **Assisted Natural Regeneration (ANR)** is designed to restore degraded natural forests. About 19, 000 ha are degraded spread across the Amboseli National park, ranches/conservancies of which 20 ha has been identified in the Loitoktok forest reserve. A buffer of 30m around the protected areas gives an additional 698 ha of plantations. The word 'assisted' in ANR simply means helping the naturally growing young trees to grow faster. During ANR, local biodiversity is enriched by: (1) Natural establishment of trees and shrubs from seeds, root sprouts, stumps or coppices; (2) Regeneration of local genetic resources adapted to local soil and climate conditions; and (3) Associated pollinators, herbivores and seed-dispersal agents of colonising trees.

Cost of restoration and benefits

The restoration assessment also covers the economic and financial analysis to estimate the costs and benefits of restoring degraded land. A model of each land use and restoration intervention is created by combining the results from the ecological modelling with market prices and an enterprise budget to account for the direct and indirect financial costs of restoring land. The implementation cost of the first year for each of the proposed interventions (in the entire sub-county) without considering management costs are in such a way that orchard and fodder production would cost about KSh 343,845,440; mixed agroforestry components cost around KSh176,171,520; PELIS system costs Ksh 158,940,200; Rangeland management costs around 763,418,553 KSh, and Riverside buffer plantation would cost about 102,771,864 KSh. All proposed interventions have multiple benefits such as timber and fuelwood, increased water table and yield, the productivity of rangelands and pasture, as well as food security and livelihood diversification. FLR above are profitable with a positive NPV and favourable return on investment at a discount rate of 8%.

1. Introduction

1.1. Context

WWF-Germany, WWF-Kenya, IUCN, WRI, FAO, World Bank, AUDA-NEPAD and GIZ – through The Alliance for Restoration of Forest Ecosystems in Africa (AREECA) - are jointly implementing a Large-scale Forest Landscape Restoration (FLR) programme in Africa in four countries namely; Cameroon, Kenya, Rwanda, and Malawi. In Kenya, the programme is implemented in Loitoktok-Amboseli area and contributes to the national efforts in meeting Kenya's Bonn Challenge/AFR100 targets of restoring 5.1 million ha of deforested and degraded lands by 2030.

The programme's overall aim is to increase the socio-economic, environmental, and climate-related benefits of Forest Landscape Restoration (FLR) on a large scale. It will increase and protect carbon stocks in vegetation and soils, increase the diversity of land-use systems and the resilience of subsistence farmers and ranchers to the negative effects of climate change, and reduce the pressure on, and loss of, habitats and hotspots that are rich in biodiversity. In addition, the programme supports capacity building and policy advice in the country in order to upscale the implementation of the FLR approach on-site, mobilize additional resources for FLR, exchange regional experiences on FLR, and monitor the results of FLR. The target audiences of the programme are land users and their local organizations, as well as the county government of Kajiado, private sector companies, NGOs, financial institutions, and government organisations. The programme helps to ensure that more evidence-based inclusive and gender-transformative landscape restoration approaches can be widely adopted and disseminated at the local level.

1.2. Objectives of the assessment

The Sub-National ROAM implementation under AREECA is the proposed in two alternative project areas of 25,000 ha each within the region and within which 5,000 ha on which concrete restoration measures have been recommend , including explanations for their selection and a proposal for potential stakeholders. In line with the project design, the assessment has pursued six key restoration objectives which include; sediment control, improved water yield, increased carbon sequestration, enhanced food security, increased climate resilience and improved biodiversity conservation. The ROAM process has further engaged the local authorities, stakeholder and communities to identify landscape challenges, validate and restoration objectives and agree on restoration interventions that would adequately address the challenges. Used in mapping the restoration opportunities, the said objectives fall within the aspiration of the AREECA project and overall national FLR

In summary, the assessment aims at achieving the following:

- Identify and map drivers of degradation and overall degradation risks in the sub-county
- Identify and map restoration opportunities
- Identify and map intervention.
- Carry out restoration diagnostics to determine the restoration readiness and evaluate key restoration success factors;

- Estimate the costs and benefits related to the identified restoration interventions
- Conduct financial analysis to identify potential sources of finance that the restoration initiative may tap into
- Estimate the potential carbon benefits from each restoration intervention in the project area
- Identify key actors and stakeholders on sub-county and county levels and analyse capacity and organizational structures.

2. Methodology

2.1. Restoration Opportunity Assessment Methodology (ROAM)

The Restoration Opportunities Assessment Methodology (ROAM) is an approach that was developed by IUCN and the World Resources Institute (WRI) to guide the processes of developing forest restoration interventions at the landscape level. It is a stepwise and iterative application of a series of analyses used to identify the best set of Forest landscape restoration (FLR) opportunities applicable to a specific site as presented in Figure 1.

Implementation of ROAM requires a systematic and rigorous assessment and quantification of restoration opportunities available in the target landscapes. The first step is to identify the main environmental challenges in the assessment area, identify site-specific priorities, and landscape intervention options available in the landscape. ROAM uses geospatial, economic, and rapid restoration diagnostic analyses to map, quantify, and assess the restoration potential, cost and benefits, and institutional readiness. The implementation of ROAM requires a set of fields of knowledge and expertise ranging from GIS, Agricultural and environmental sciences, REDD+ and carbon market, ecosystem services modelling and valuation, economics, and policy analysis.

ROAM uses restoration diagnostic tools also developed by IUCN and WRI (Annex 8) to assess the institutional readiness and success factors of restoration in place. The flow diagram (Figure 1) summarises the ROAM process.

The assessment team included local experts, as it requires good local knowledge in terms of the biophysical, social, cultural, and economic dynamics of landscapes. In this case, IUCN was entrusted by WWF to lead the assessment with a team comprising GIS experts, socio-economist, livelihood analysts, and natural resource governance experts. WWF together with IUCN engaged key partners during the inception workshop, resulting in the development of the Theory of Change, field data collection, and the restoration diagnostic, which assess the enabling condition for landscape restoration of the target area. The same partners also played a vital role in the validation of results.

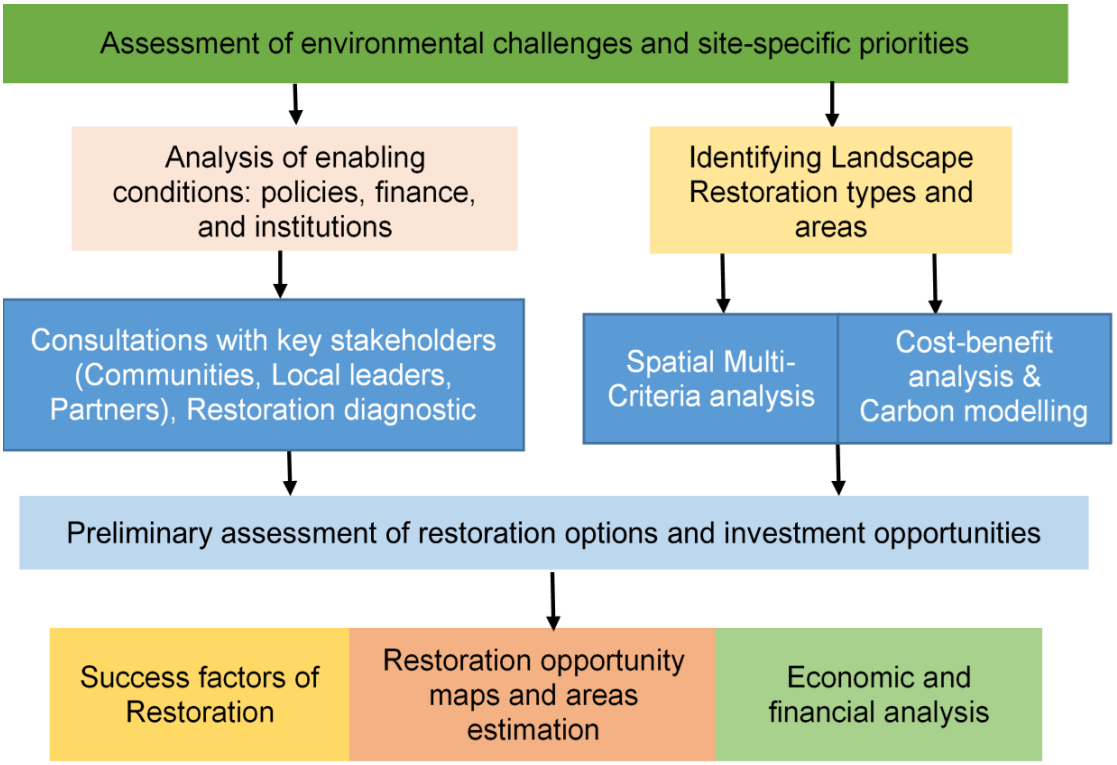

Figure 1. Restoration Opportunities Assessment Methodology

2.2. Inception workshop and community consultations

The primary data collection was carried out through a stakeholder consultation workshop held in Loitoktok town followed by the field focus group discussions with the communities in seven villages in Kajiado South namely; Esiteti, Ihuleta, Loomongi, Kimana, and Enkutoto/ Kuku, Romeo in Rombo and Loitoktok were visited across the landscape. Guiding questions were set up to guide the discussion in the three working groups namely biophysical, socio-economic and Governance. Through a consultative process, the sub-County was stratified - into five landscape zones based on the key land uses agriculture, rangelands, forest reserves, park and conservancies, and water ecosystems. The agreed stratification also formed the basis on which the villages were selected. Data collection was done around the following ROAM components : 1) landscape challenges and drivers of degradation 2) restoration objectives and benefits; 3) potential stakeholders; their interests and influence in the sub-county; 4) restoration opportunities, interventions, and priority actions; 5) gender, culture and livelihood; 6) enablers and success factors, and 7) the costs and benefit of the proposed intervention. Detailed primary data collection was done through Focus Group Discussions (FGDs) with local communities. Some of the key findings in the AREECA's 2022 baseline study formed part of the secondary data that went into the assessment.

Figure 2: Community engagement and data collection in Esiteti and Olugulului

Blending local and scientific knowledge in a ROAM process is critical not only to create restoration ownership among the land owners/users but also to validate scientific observation and or results. Using FGDs communities were engaged in identifying landscape challenges and defining restoration strategies and transitions. The local knowledge is used to build a restoration theory of change, that critical in geospatial multi-criteria analysis and defining restoration strategies and transition. A summarised ROAM questionnaire was then used to gorge critical local knowledge from communities.

Figure 3: Inception workshop - stakeholder consultation and data collection exercise

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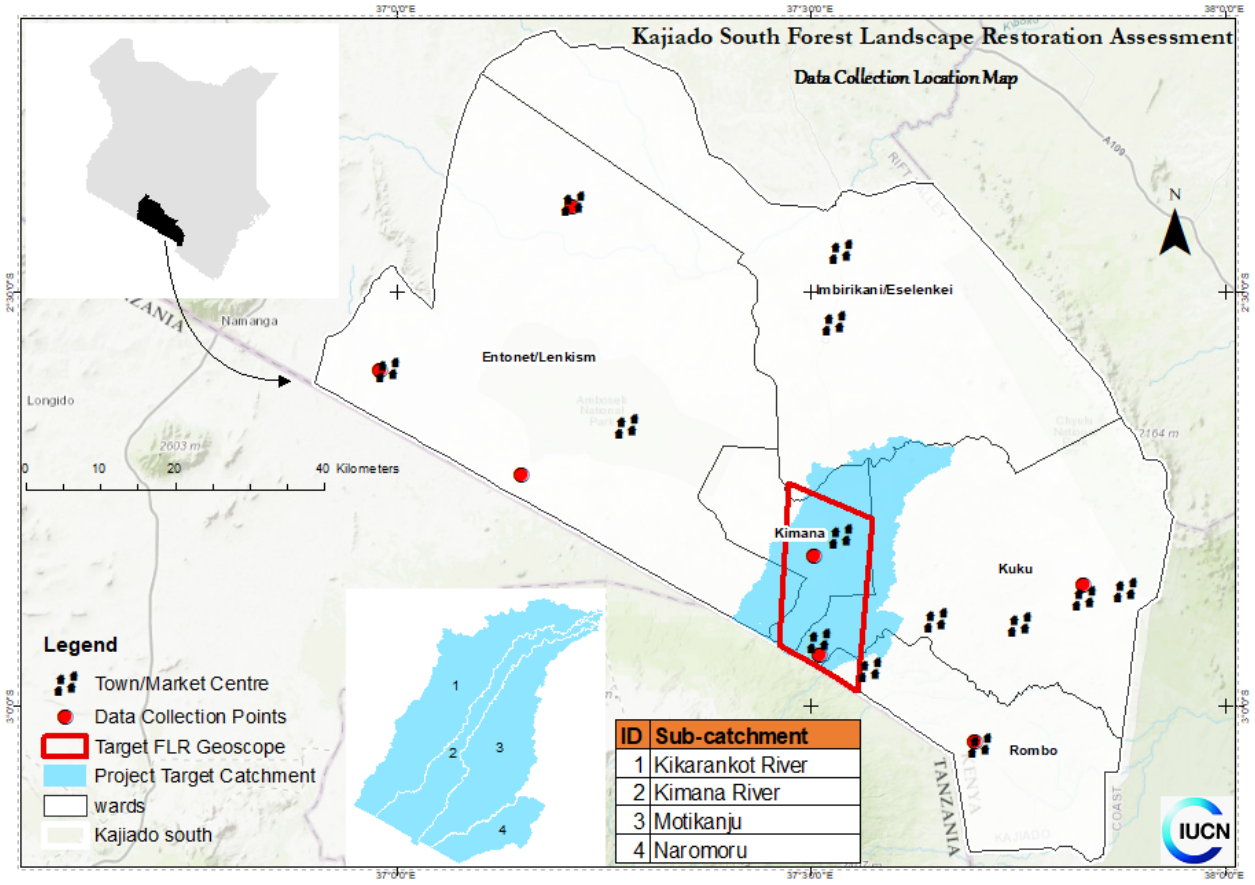


Figure 4. Kajiado South Map showing data collection sites/points

2.3. Restoration Theory of Change for Kajiado South landscape

Landscape restoration is an action-dependent process aiming to restore multiple social-ecological functions. Apart from stopping and or reversing degradation, restoration is done to achieve multiple objectives such as increased biodiversity, enhanced food security, and resilience to climate change. However, restoration interventions sometimes are inhibited by contextually inappropriate approaches and governance arrangements often less suited to

complex systems[1] (Armitage, Mbatha, Muhl, Rice, & Sowman, 2020). Thus, restoration interventions require more holistic, community-centered, context-specific, and adaptive approaches and arrangements in their planning, implementation, and evaluation if they are to facilitate essential social and institutional change. This is the explicit purpose of the Theory of Change (ToC) approach to the restoration of landscapes, which promotes an understanding of how and why an intervention works, and the processes that bring about "positive" change (Mayne, 2015)[2]. ToC can be used to account for both how change is expected to happen (i.e., planning and implementation of an intervention) and how change has happened (i.e., evaluation and adaptation of an intervention) (Douthwaite et al., 2020[3]; Mayne, 2017a[4]). In doing so, ToC can inform the actions required to bring about change by considering multiple levels of change and learning from the restoration intervention as it evolves.

2.3.1. Robust restoration ToC pathways

Given the diverse ToC terms in use, we first define the key "change elements," described below. We refer to intervention as the implementation of a specific set of actions to positively influence the desired result. While restoration interventions vary greatly in context, purpose, scale, and management approaches and governance arrangements, we use intervention as an "umbrella" term to describe any restoration initiative designed and implemented by a variety of actors (i.e., ranging from government and nongovernmental organizations to local communities), to enhance positive social and ecological outcomes. Furthermore, an action can be an activity, event, a policy or strategy, and/or even the capacity building of an organisation associated with the intervention (Mayne, 2017a). Moreover, an intervention's desired result encompasses intermediary desired outputs and outcomes, which in turn influence the final desired impact i.e., the final desired change (Mayne, 2015).

A well-informed restoration ToC pathway comprises six core steps (Figure 3):

(1) Identify the restoration intervention's main beneficiaries;
(2) Jointly identify and articulate the intervention's desired results;
(3) Define and analyse the contextual factors, conditions or events that may positively or negatively affect the intervention's desired results;
(4) Formulate actions, and identify and articulate the associated assumptions that underpin these actions, to achieve the intervention's desired results;
(5) Implement and evaluate actions to identify persistent and newly emerging issues; and
(6) In so doing constantly adapt the intervention to better achieve the intervention's desired results.

[1] Armitage, D., Mbatha, P., Muhl, E. K., Rice, W. S., & Sowman, M. (2020). Governance principles for community-centered conservation in the post-2020 global biodiversity framework. Conservation Science and Practice, 2(2), e160. https://doi.org/10.1111/ csp2.160

[2] Mayne, J. (2015). Useful theory of change models. Canadian Journal of Program Evaluation, 30(2), 119–142. https://doi.org/10. 3138/cjpe.230

[3] Douthwaite, B., Ahmad, F., & Shah, G. H. (2020). Putting theory of change into use in complex settings. Canadian Journal of Program Evaluation, 35(1), 35–52. https://doi.org/10.3138/cjpe. 43168

[4] Mayne, J. (2017a). Theory of change analysis: Building robust theories of change. Canadian Journal of Program Evaluation, 32(2), 155–173. https://doi.org/10.3138/cjpe.31122

Figure 5. Developing robust Restoration Theory of Change (ToC) pathways: (a) six core steps that frame a restoration intervention's ToC development

Note that the framework emphasises that an intervention's beneficiaries are consulted throughout the ToC process. Evaluation of the desired results identify persistent and newly arising issues that are systematically feedback into the process and lead to adaptation of an intervention through the reformulation and implementation of actions. The ToC process also considers the effect of any potential external influences

The first step is identifying the restoration intervention's beneficiaries, that is, all actors who may be affected by or have an interest in the intervention's objectives, which in landscape restoration will notably include local resource users, as well as their partners. This step is crucial to all subsequent steps, which require high levels of active participation by, and collaboration among actors to develop a more robust ToC pathway (Figure 4).

Figure 6. Collaborative partners developed the Kajiado restoration theory of change in the inception meeting held at Kibos Slopes Cottages – Loitoktok Town

The second step requires identifying and articulating the intervention's desired result, which has to be clear, logical, based upon the context and past experiences, and ultimately be both achievable with the planned actions, and measurable through evaluation[5].

[5] Mayne, J. (2017a). Theory of change analysis: Building robust theories of change. Canadian Journal of Program Evaluation, 32(2), 155–173. https://doi.org/10.3138/cjpe.31122

In order to address the root cause of degradation in Kajiado South, a robust theory of change in forming a paradigm shift was elaborated in a participatory approach. Defining restoration interventions involved first, a discussion on the key landscape challenges and or drivers of degradation to build up a case for action and forms an entry point into developing restoration packages. Key challenges identified across the sub-County are among other ; biodiversity loss, declining forest cover, reduced agricultural productivity, increasing population and human settlement, overstocking and overgrazing , human-wildlife conflict, siltation, declining water levels, increased invasive weeds (*Ipomea solanum*, lantana, Mexican poppy), eroded landscapes, increased droughts frequency and unpredictable weather patterns. In order to transition the degraded landscapes into more functional lands, seven restoration packages were identified. These include agroforestry, orchards with fodder plantation, forest plantation in PELIS system, rangeland management in and outside conservancies, soil and water conservation (springs, rivers, streams, and gullies), Assisted Natural Regeneration, and greening populated areas and road reserves. In line with the principle of accruing multiple benefits, the next step, was to define key restoration objectives based on the expected outcomes in AREECA. Figure 7 below summarises the desired ToC for Kajiado South.

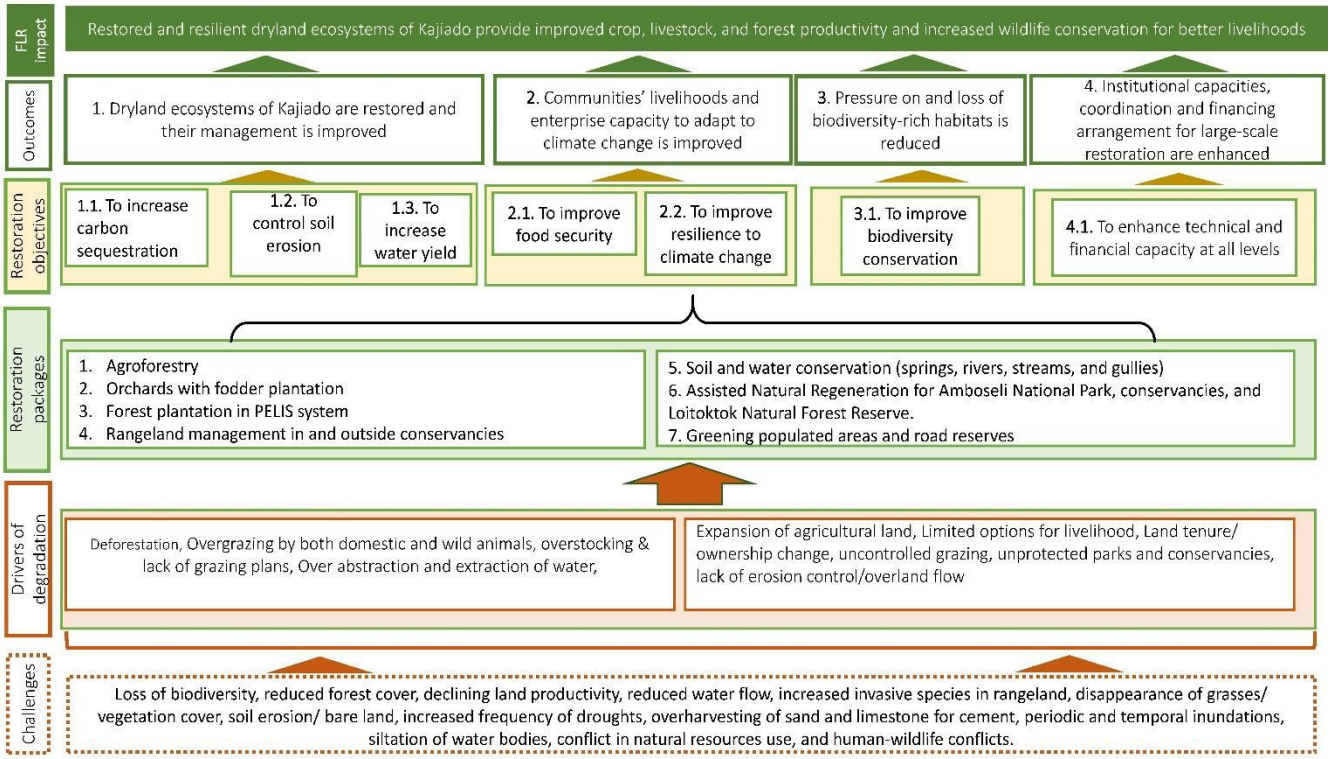


Figure 7. The Theory of Change diagram illustrates the restoration challenges, drivers of degradation, restoration packages, restoration objectives, outcomes and impact desired in Kajiado landscapes

2.4. Geospatial analysis

2.4.1. Mapping land degradation

Land degradation is defined as the long-term loss of ecosystem function and productivity caused by disturbances from which the land cannot recover unaided (Bai and others 2008). Land degradation occurs slowly and cumulatively and has long lasting impacts on rural people

who become increasingly vulnerable (Muchena 2008). In line with the ROAM protocols, Forest Landscape Restoration uses land degradation as an entry point to restoration where drivers of degradation are identified to map out degradation hotspots and consequently the priorities. In what is referred to as multi-criteria degradation mapping, drivers of degradation are parametrized and stacked together to generate a map showing the number of coincident criteria.

Using local knowledge and ground control mapping, overlapping criteria are reclassified to generate the final degradation map showing the degradation scale from very low to severe degradation. In this assessment, eight drivers of degradation were identified through a stakeholder consultation process. By stacking their GIS layers (parameterized layers at a standard resolution of 50 m) together, a multicriteria degradation map was generated. The resulting map comes with coincident criteria, which are then reclassified/calibrated using local knowledge and field observations. Table 1 below shows details of the drivers of degradation including justification, GIS proxies, and parameters used.

Table 1. Drivers of degradation and GIS data proxies

Driver	Description/justification	Spatial proxy/data & source	Parameters
Bare land	Bare lands are usually susceptible to soil erosion and loss of soil nutrients. This could be associated with human activities leading to vegetation cover loss. Such activities may include; mining, infrastructure, and development.	Land cover data. (2020 Global European Space Agency)	Bare land areas as observed in the LULC data.
Slope	According to FAO, runoff evacuation system on slopes of more than 20%, removes particles of all sizes (up to 5 or 10 mm in diameter) and digs out grooves, so that the soil surface becomes extremely uneven, with deep rills (5-20 cm) and numerous humps chiselled by rain and runoff and protected by objects such as seeds, roots, leaves, bits of pottery and even hardened or crusted clouds (Eric Roose, 1996)	30M SRTM from U.S. Geological Survey	Slope>20%
Low soil organic carbon	Soil Organic Carbon (SOC) is important in soil formation. Low soil carbon usually translates to low soil fertility and loss of biodiversity. Soil carbon is important in soil formation. Low soil carbon usually translates to low soil fertility and loss of biodiversity. (FAO 2017:Soil Organic Carbon has hidden Potential) COP21 resolutions recommended 4millie (48 tonnes/ ha) of carbon.	Soil carbon (15-30cm depth) data from ISRIC	SOC < 48 tonnes/ Ha
Low tree cover	Low tree cover may lead to soil loss and consequently low soil productivity.	Hansen/GFW data 2020	Tree cover<10%

Forest Loss	Forest loss is a physical indication of forest cover degradation/depreciation.	Hansen/GFW data 2020	Forest loss areas
Soil Erosion	Some soils are naturally prone to soil erosion due to their physical and chemical composition. (Bonilla and Johnson 2012)	Global EU soil erosion data and IUCN InVEST Model, 2020.	As observed in the RUSLE map scale. (> 40 tonnes/ ha/Year)
Populated areas/Built up areas/Settlement	Areas with higher population pressure in comparison to others in a landscape are likely to face degradation due to increased demand for natural resources. (Bai et al. (2008), Tiffen et al.1994, Boserup1965,Grepperud 1996)	Land cover data. (2020 Global European Space Agency)	Built up areas
High cattle density	The growth of the pastoralist population and subsequent increase of the livestock population and expansion of grazing activities into semi-arid marginal lands and forests causes severe degradation and reduced livestock productivity. (E. Nkonya et al., 2016)	Cattle population density	Gridded Livestock of the World (GLW) - Harvard Dataverse

2.4.2. Mapping restoration opportunities

In the context of the restoration's multiple benefits, and identifying priority areas of restoration, ROAM geospatial protocol requires that degradation hotspots be plummeted through each restoration objective to produce functional degradation maps, which upon their overlay produces an overall opportunity map. Further, the opportunity hotspots in the assessment were defined as areas with more than half the number of coincident criteria. Each restoration objective was mapped using GIS proxies indicate where such an objective would be achieved. While each objective might have different mapping proxies in a different context, FLR focuses on critical proxies that provide leads to areas satisfying the in a given restoration objective.

There are six FLR objectives used in this assessment and as and agreed upon through stakeholder consultation. These are; biodiversity conservation, resilience to climate change, improved food security, increased water yield, soil erosion control, and increased carbon sequestration. Food security was spatially defined as water-stressed croplands where low rainfall and soil water capacity are leading factors. Finding local continuous raster data on rainfall was difficult and so Worldclim data was used. Croplands were extracted from the LULC data (2020 Global European Space Agency).

Figure 8 below summarises the workflows used in developing the aforementioned maps that a critical in landscape restoration:

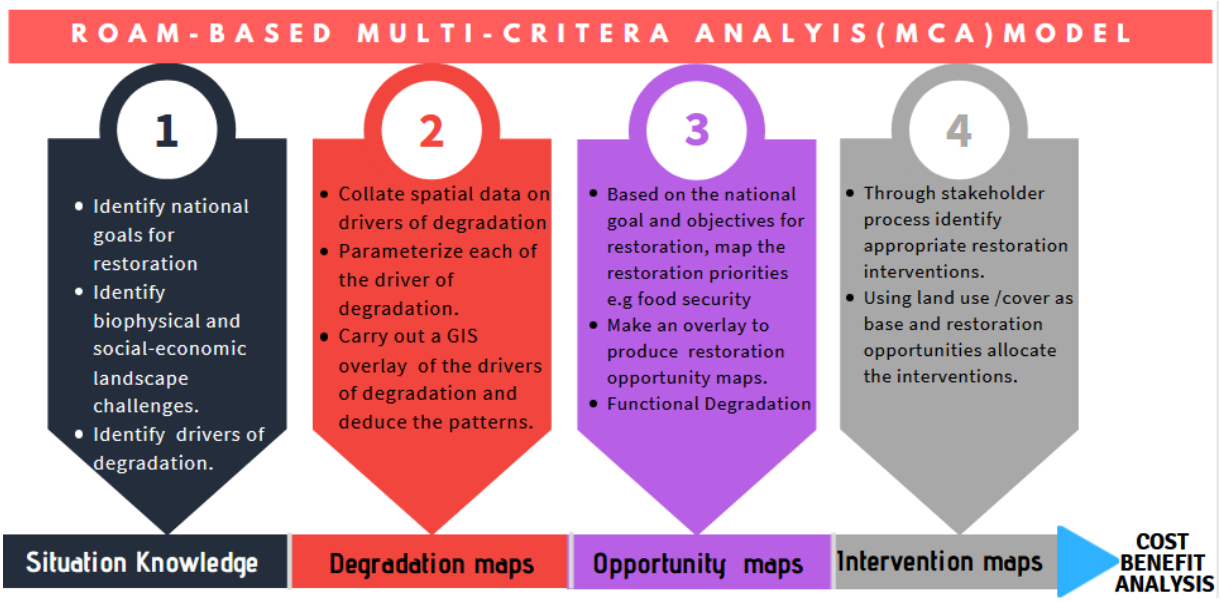


Figure 8. ROAM-based Multi-criteria Analysis workflow

2.4.2.1. Ecosystem service modelling

Ecosystems services are central in defining restoration pathways. More often, they consequently define restoration objectives when it comes to accruing restoration multiple benefits such as water yield, soil erosion control, soil fertility, clean air and so on. To quantify them, their InvEST[6] models are run to generate spatially explicit data for restoration prioritization. Ecosystem services considered in this assessment are; carbon, sediment delivery ratio, and annual water yield. Key input data for the three models are shown in table 2 below.

Table 2. InVEST models input data: Carbon, sediment Delivery Ratio, and Annual Water Yield

Ecosystem Service	Input data	Source	Data Resolution
Carbon	Land cover	2020 Global European Space Agency	20m
	Carbon pools/biophysical table	InVEST Guide	-
Sediment Delivery Ratio (SDR)	Land cover	2020 Global European Space Agency	20m
	Digital Elevation Model (DEM)	Shuttle Radar Topography Mission (SRTM)	30m
	Rain Erosivity	Resampled WorldClim data	100m

[6] https://naturalcapitalproject.stanford.edu/software/invest

Ecosystem Service	Input data	Source	Data Resolution
	Soil erodibility (K)	Wischmeier and Smith, 1978	100m
	Watersheds	Calibrated hydrosheds using the 30m DEM	-
	Biophysical table	InVEST Guide	-
Annual Water Yield	Land cover	2020 Global European Space Agency and	20m
	Rain Erosivity/Precipitation	Resampled WorldClim data	100m
	Evapotranspiration	International Soil Reference and Information Centre (ISRIC)	250m
	Plant Available Water	International Soil Reference and Information Centre (ISRIC)	250m
	Depth to root restriction	International Soil Reference and Information Centre (ISRIC)	250m
	Watershed and sub-watershed	Calibrated hydro sheds using the 30m DEM	-

2.4.3. Mapping restoration interventions

For each of the proposed interventions, a spatial criteria matrix is set to optimize landscape suitability. The design of the restoration package informs both the number of criteria and the parameters used to define their spatial extent. In this assessment, the spatial definition of each intervention (and consequently GIS mapping layers) is drawn from Kenya's 2016 FLR report[7] that provides a set of criteria for mapping various opportunities/interventions including rangeland management, agroforestry, the restoration of degraded natural forest etc. In an effort to inform decisions on prioritization, both potential and priority areas are indicated in the mapping process. Priorities are further set by multiplying each intervention with restoration opportunities so that their implementation assures multiple benefits.

2.4.4. Economic analysis

2.4.4.1. Cost and benefit analysis

The economic analysis used cost-benefit analysis (CBA) to assess the contribution of restoration

[7] Technical Report on the National Assessment of Forest and Landscape Restoration Opportunities in Kenya 2016

interventions. CBA is an economic evaluation method where benefits and costs of interventions are identified, measured (normally in monetary terms) and compared to determine whether the benefits of an intervention exceed its costs (EFCCC, 2019; IUCN, 2018b). CBA is used to determine whether an intervention is economically justified (Nurmi & Ahtiainen, 2018), and can be used either to rank projects or to choose the most appropriate option. The ranking or decision is based on expected costs and benefits (Saarikoski et al., 2016)
To understand the real profitability of the different proposed restoration interventions, the CBA compared the costs and benefits from implementing restoration actions in Kajiado south. To assess the contribution of interventions in storing carbon, the FLR Climate Impact tool, developed by Winrock International and IUCN was used to estimate the average tons of carbons that will be requested for each intervention].

Data were collected through focus group discussions in Kajiado County and the financial flow models for the restoration interventions were generated right after. The literature review was used to generate the additional information on yields and prices from national reports and publications. The costs considered in this study are those related to the implementation and management of the FLR action. Costs related to the FLR action are costs related to on-farm (land preparation, inputs, labour); and management costs throughout the intervention period. To estimate the benefits from direct use values, this assessment used market prices as discussed during technical workshops using yields/production and their relative price per unit area (direct use value). To estimate the indirect use values, the FLR climate impact tool was used to provide an estimate of the impact of FLR on erosion and carbon sequestration. The FLR Climate Impact tool was developed to support practitioners in estimating and visualizing the carbon dioxide impact of past and planned forest landscape restoration activities. The carbon calculated by the tool was directly used for CBA as a direct benefit from restoration interventions.

2.4.4.2. Carbon sequestration

Deforestation and forest degradation, as well as forest landscape restoration activities, play a principal role in the global carbon cycle[8]. Preventable deforestation, sustainable forest management and natural regeneration of second-growth forests provide a low-cost mechanism that yields a high carbon-sequestration potential with multiple benefits for biodiversity and ecosystem services (Chazdon et al., 2016).

In collaboration with IUCN, Winrock International developed two comprehensive databases: (1) a global forest greenhouse gas emissions database and (2) a global FLR carbon dioxide removals database. These databases give information at both national and subnational scales on the greenhouse gas impacts that specific land-use activities have and thus provide a new resource to policy makers, donors and researchers for science-based decision-making. The FLR Climate Impact Tool aims to support practitioners estimating and visualising the carbon dioxide impacts of past and planned FLR activities. The FLR removal calculation tool was developed using data from the global removals database (Bernal et al., 2018). The FLR Climate Impact Tool estimates tCO_2 per hectare based on the type of FLR, location and age of the plantation.

Table 3. Carbon sequestration capacity of suggested FLR interventions

[8] https://winrock.org/document/forest-landscape-restoration-climate-impact-tool/

Interventions	Carbon sequestration capacity tCO2/ha/year	Rotation period (years)	Total tCO2
Fruits orchard and fodder	11	23	253
PELIS/On farm tree production	39	20	780
Rangeland	11	10	280
Riparian forest	39	20	780
Roadside tree planting	39	25	700

2.4.4.3. CBA indicators

Net Present Value (NPV); Benefit Costs Ratio B/C) and Return on Investment were used to indicate the level of profitability of restoration interventions. The discount rate of 8%, which is the current rate of the Central Bank of Kenya (CBK), was used to reflect the time value of money, which recognizes that money can be invested to generate profits or increase profits.

Net Present Value –NPV: The net present value is the difference between the sum total of the present value of discounted benefits and the discounted value of costs over a specific life period of a project or intervention (Krieger, 2001). The NPV allows various sums of money to be compared over time by discounting values that occur in the future so they are comparable with the current values. The first principle of NPV reflects the fact that usually people prefer money in the present rather than money that comes in the future. Hence, future cash flows are discounted each year and the discount rate represents the opportunity cost of the capital mobilized. The second principle of NPV is to consider all the future net cash flows linked to the project intervention opportunity. The formula for the NPV is as follows (Balana et al., 2012):

$$\left[NPV = \sum_{t=0}^{n} \frac{B_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{C_t}{(1+i)^t}\right] eq.1$$

Where: NPV: Net Present Value; Bt: Benefit at time t; Ct: Costs at time t; i: Discount rate
t: Time in years (1, 2,…n)

Benefit-Cost Ratio: The benefit-cost ratio is the total discounted benefits divided by the total discounted costs. It is another decision rule, which is, in effect, another way of comparing the present value (PV) of a project is cost with the present value of its benefits. The BCR formula is as follows (Litman, 2009):

$$BCR = \sum_{t=0}^{n} \left(\frac{\frac{B_t}{(1+i)^t}}{\frac{C_t}{(1+i)^t}} \right) eq.2$$

Where: Bt = the benefit at time t, Ct = the cost at time t, i = the discount rate, t = time in year, n= number of years over which the future costs or benefits are expected to occur (the current year t being year 0).

Return on Investment: Return on investment (ROI) is a measure that investigates the amount of profits produced per unit of a certain investment. It can be used to compare different scenarios for investments. This ROI calculates the amount of value that was generated from

every Kenyan Shilling invested in restoration activities, where the total cost in year 1 is considered the investment. The formula is as follows (Moore, Boardman, Vining, Weimer, & Greenberg, 2004):

$$ROI = \frac{\left(\sum_{t=0}^{n} \frac{B_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{C_t}{(1+i)^t}\right)}{\sum_{t=0}^{n} \frac{C_t}{(1+i)^t}} \quad eq.3$$

2.4.5. Assessing key success factors of FLR: Rapid Restoration Diagnostic

The assessment team conducted key informant interviews in the plenary sessions, community consultations, and desk research, to better understand the situation related to the key success factors for forest landscape restoration in Kajiado South. The results of this assessment were compiled within the framework of the Rapid Restoration Diagnostic (Rapid Appraisal), to assess the key success factors required to allow restoration to occur at large scale.
Analysis of historical cases of restoration revealed three common themes to successful restoration:

1. A clear motivation. Decision-makers, landowners, and/or citizens inspired or motivated to catalyse processes that led to forest landscape restoration.
2. Enabling conditions in place. A number of ecological, market, policy, social, and institutional conditions in place that created a favourable condition for forest landscape restoration.
3. Capacity and resources for sustained implementation. Capacity and resources **mobilized** to implement forest landscape restoration on a sustained basis on the ground.

3. Land degradation and restoration opportunities in Kajiado South

3.1. The current state of land degradation in Kajiado South

The level of degradation in Kajiado South is presented in figure 7 and table 4. The map was generated by overlaying eight drivers of degradation. These are; slopes above 20%, bare soil, soil erosion risk, low soil carbon, forest loss, tree cover below 10%, populated areas, and overgrazing (high cattle density). Table 2 shows the data sources and the GIS proxies used.

The s analysis shows that 176,668 hectares (about 28.2 % of the total land) are highly or severely degraded. This is more raging in Lenksim ward near the Amboseli national park, some parts of the Kimana and Kuku wards and various patches in Imbirikani ward. About 352,087 hectares are moderately degraded, (half of Kajiado South land (56.2%) while approximately 97,236 ha of lands (15%) are not degraded.

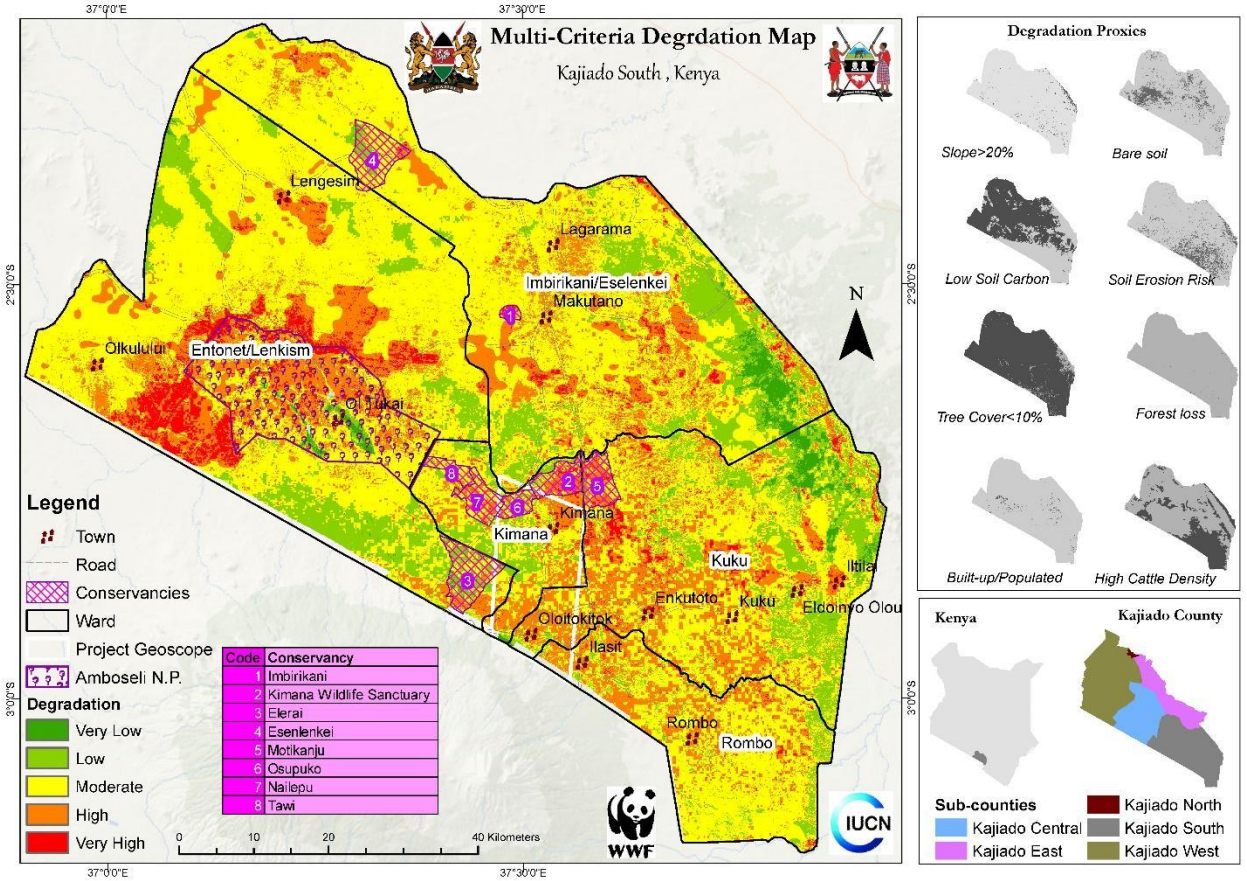


Figure 9. Land degradation map of Kajiado South landscape

Table 4. Degraded areas in Kajiado south

Ward	Very Low	Low	Moderate	High	Very High	Total (Ha)
Entonet	1,299	27,433	137,775	52,971	15,597	**235,074**
Imbirikani	4,028	26,541	108,165	35,402	3,617	**177,753**
Kimana	154	6,503	15,657	10,142	717	**33,173**
Kuku	3,587	23,013	56,160	36,880	4,748	**124,388**

Ward	Very Low	Low	Moderate	High	Very High	Total (Ha)
Rombo	17	4,661	34,331	15,635	959	**55,603**
Total (Ha)	**9,085**	**88,151**	**352,087**	**151,029**	**25,639**	**625,990**
AREECA Geoscope	**121**	**4,108**	**9,656**	**9,801**	**441**	**24,127**

Land degradation in Kajiado south is also characterized by gullies, bare soils, and invasive weeds (*Ipomea hildebrandtii, Solaanum incanum, Lantana camara, Argemone mexicanay*) - especially in the rangelands. Water scarcity exacerbated by recurring droughts is a pressing challenge across the sub-county. During the dry season, most of the rivers run dry forcing the residents toy rely on boreholes and water springs for water mainly used for livestock, domestic use, and small-scale irrigation. As noted during the data collection exercise, the sub-County is endowed with several water springs. The springs are however under unprecedented pressure, due to the increasing population, expansion of built-up areas, and agricultural activities around them. Characterizing degradation also are the bare lands in and around Amboseli National Park and Conservancies - which is a result of increased human activities and overstocking. Flooding in some parts of the park has been linked to run-off from the upstream and increased base flow triggered by deforestation upstream.

The use of nature-based solutions to the above-described problems offers an opportunity to restore degraded lands and at the same time generate multiple benefits ranging from ecosystem goods and services to social-economic impact. Locally tuned restoration measures informed by the current ecological and social-economic situation can be more effective as a long-term measure to restore the ecological functionalities of the landscape.

3.2. Restoration opportunities in Kajiado South

To restore degraded lands, six restoration goals/objectives were set (see 2.4.2). One of these goals is to improve water yield and or restore the water levels in the sub-country. Although exact replicas of past conditions are hardly possible, deploying nature-based solutions such as planting native trees and shrubs, corridors, protecting springs, and establishing gully plugs would be a long-term intervention that ensures maximum ecological benefits and minimum alteration of ecosystems. In this case, the proposed interventions are therefore aimed to enable groundwater recharge, be sustainably cost-efficient and encourage community participation. Other objectives set in this assessment include improved food security, soil erosion control, resilience to climate change, carbon sequestration, and improved biological diversity.

An overlay of the objectives in a GIS environment produces an opportunity map that is critical for restoration prioritization. Suitable areas for each restoration objective are also presented as functional degradation maps that can always be used by actors to restore landscapes for specific objectives. According to the analysis, the total area suitable for restoration is about 72,770 hectares.

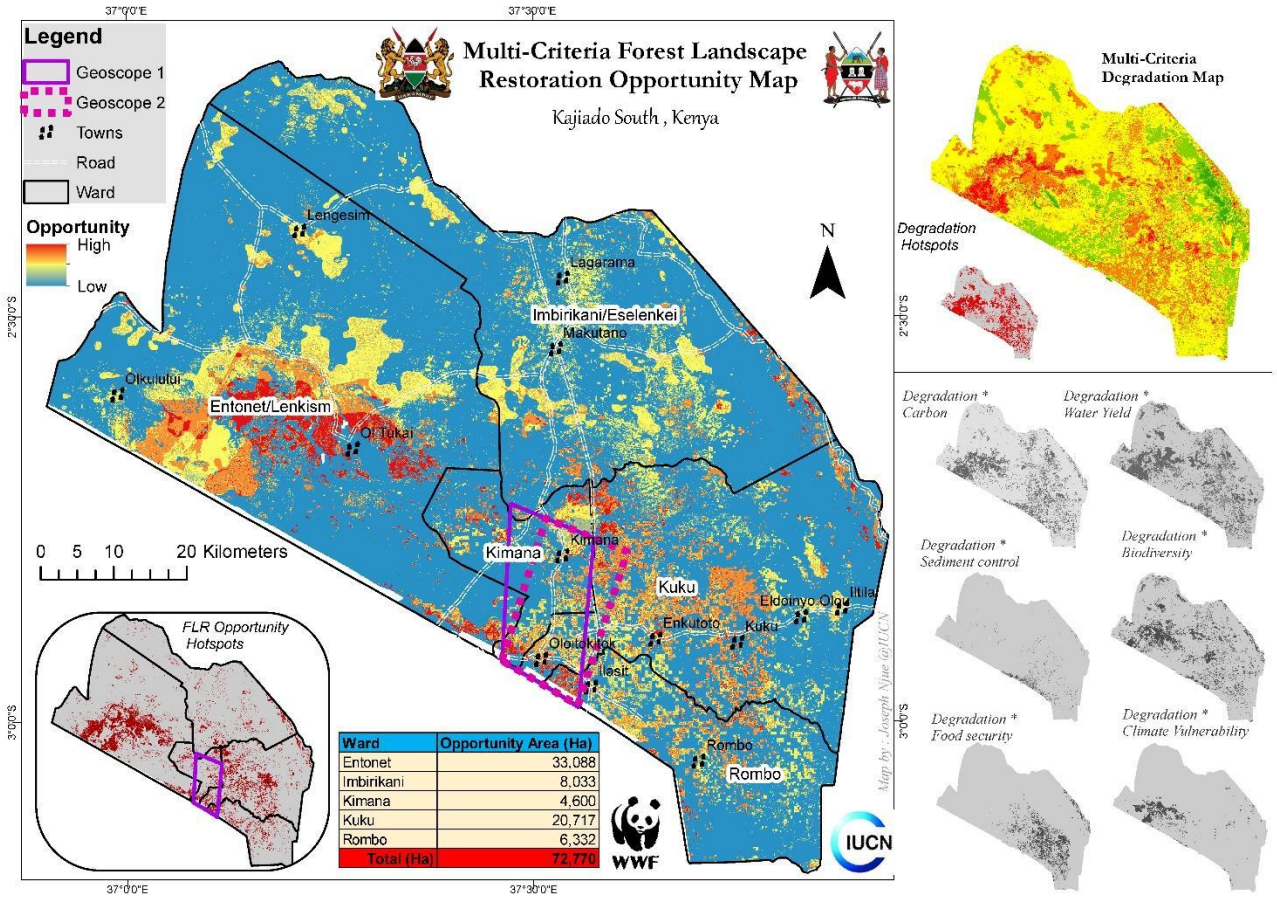


Figure 10. FLR opportunity map of Kajiado South

3.3. Restoration intervention packages recommended in Kajiado South

The assessment team identified six degraded land uses that could benefit from the restoration through the strategic introduction of trees (preferably natives) and management practices identified in the degraded landscape. Relevant governmental and non-governmental stakeholders in Kajiado South were consulted to identify the preliminary list of degraded lands . These are:

1. Degraded agricultural lands
2. Poorly managed rangelands
3. Degraded protected areas
4. Unprotected water bodies; rivers and springs
5. Unprotected populated areas /villages

Stakeholders and communities identified seven restoration interventions. These are:

1) Agroforestry for Kuku, Rombo and loitoktok on agricultural land;
2) Orchards with fodder plantation;
3) Forest plantation for Loitoktok forest land;
4) Rangeland management for Olgulului, Eselenkei and Mbirikani conservancies
5) Soil and water conservation (springs, rivers, streams, and gullies)
6) Assisted Natural Regeneration for Amboseli National Park, conservancies, and Loitoktok Natural Forest Reserve.
7) Greening populated areas and road reserve

3.3.1. Suggested species to use in the restoration of degraded Kajiado landscape

During stakeholder workshops and community consultations, various tree/shrub/grass species were suggested for restoration based on community preference and local knowledge, their multiple uses, and land use suitability. The costs (price) of the products and ecosystem services provided by these selected species (energy wood, service wood, soil fertility, fodder, feeding, carbon sequestration etc.) were sought. For example, Table 5 shows the tree species to be considered in the restoration of Kajiado South.

Table 5. Major Species recommended for the restoration of Kajiado South in different landscape zones

Landscapes	Tree species
Plantation exotic forests (Loitoktok PELIS)	*Cupressus lusitania, Pinus patula, Eucalyptus saligna, Grevillea robusta, Vitex keniensis, Juniperus procera,*
Natural forests (Loitoktok Natural Forest)	*Olea africana, Acacia seyal, Acacia nilotica, Xanthoxylum usambarense, Prunus Africana, Juniperus procera, Ficus sycomorous, Erythrina abyssinica, Warburgia ugandensis, Fagoropsis angolenis,* and *Rhamnus staddo*
Rangelands	*Acacia tortilis*, *Acacia xanthophloea*, *Acacia seyal*, *Acacia mellifera, Balanites spp, Boscia spp*
Farmlands	*Cuppressus lusitanica*, *Pinus patula*, *Grevillea robusta*, *Eucalyptus saligna*, *Acacia* Spp and *Croton megalocarpus,* and Fruit trees (e.g. Avocado, Citrus, Orange and Papaya).
Urban areas/ roadsides	*Senna siamea, Senna spectabilis, Terminalia mentalis, Saraca asoca, Araucaria species, Croton megalocarpus,*
Rivers, springs, and wetlands	*Acacia xanthophloea*, *Acacia tortilis*, *Acacia seyal*, *Acacia gerradii*, *bamboo sp.* and *Ficus sycomorus*

It is important to note that the selected species can be for multiple uses as seen in table 2. Indeed, the success of a landscape restoration program must take into account species that provide multiple goods and services (riparian protection, fertility improvement, nutrition, energy wood, cultural values, medicine etc.). In addition, some species are planted in association with crops (agroforestry system, PELIS System). We should also note that the bamboo is much expected to restore the water bodies but also to play a role of service wood.

3.3.2. Agroforestry (Kuku, Rombo, and Loitoktok)

Agroforestry has been identified as a measure to restore degraded agricultural land of Kuku, Lombo, Loitoktok, and in Lenksim. Spatially, these are croplands on a slope less than 20% and in areas with a tree cover of less than 10%. From the analysis, about 48,253 hectares are potential for agroforestry while based on the opportunity map 7,232 hectares are priority areas for accruing multiple benefits. The following activities are proposed for the agroforestry system: 1) establishment of soil conservation structures such as gabions, terraces, 2) promotion of organic manure, 3) enhanced local extension services, 4) establishment of fruit tree nurseries 5) planting agroforestry trees mixed with fodder, and 6) establishment of woodlots for timber and fuelwood in PELIS system.

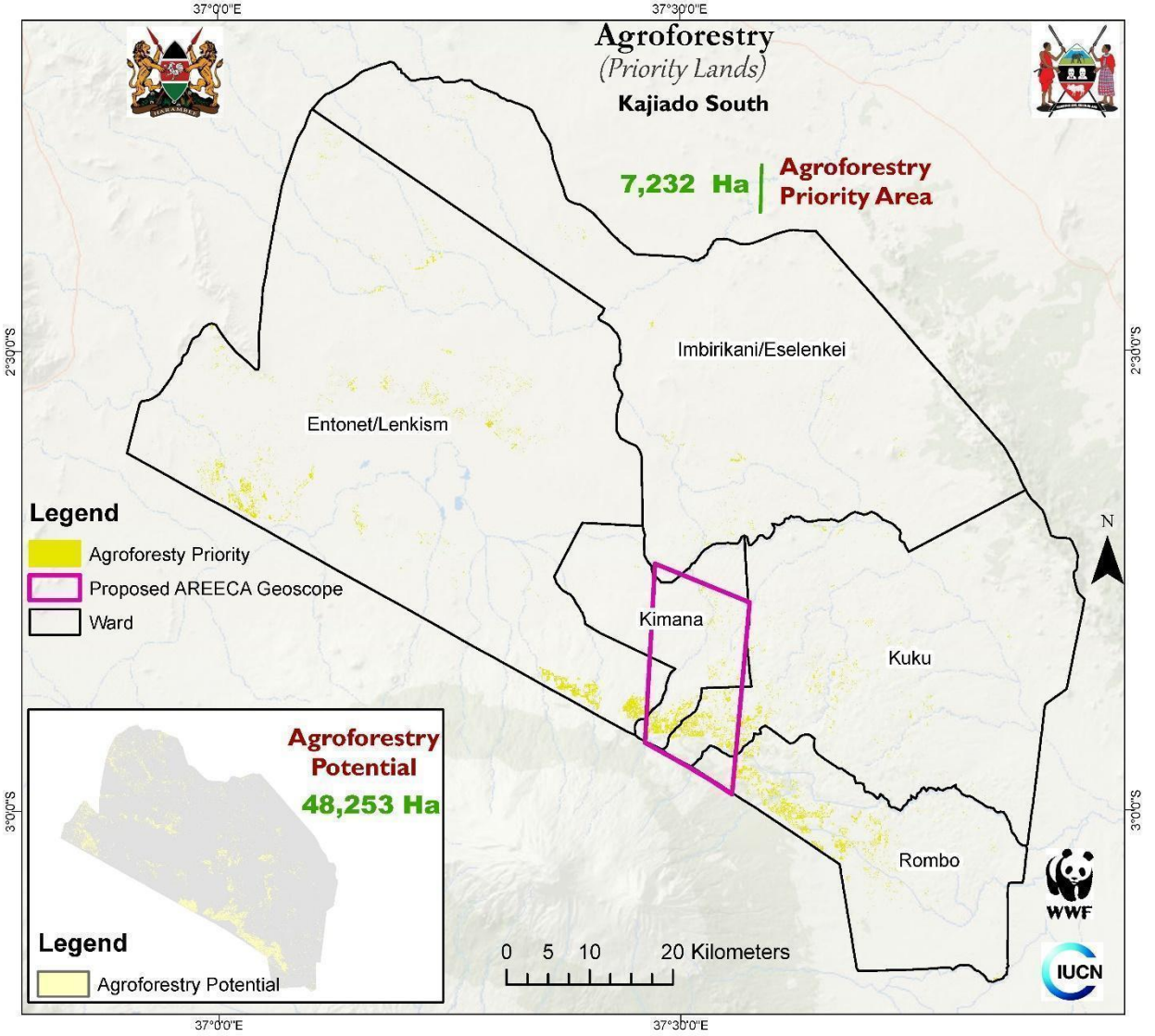


Figure 11. Map showing areas suitable for agroforestry

The agroforestry model is mainly proposed in mosaic agricultural landscapes of the southern Kimana, south-west Kuku, and north-west of Rombo or some irrigated farms of southeast Lenkism. The package mimics the current farmers' practice and aims at producing fruits, tubers, and maize, beans, fodder, and tree products on the same farm simultaneously. Maize can be rotated with beans in this model. This model can be adapted and adjusted by farmers depending on their primary needs in terms of food, biomass energy, poles, and income.

In this package, 5% of the total land size is planted with agroforestry tree species such as *Grevillea robusta*, 10% occupied by tubers such as english potato, 10% planted with fruit trees such as avocado, orange, citrus or papaya, 10% planted with fodder grasses, 5% planted with woodlot of fast growing tree species such as *Cupressus lusitanica*, while the biggest part of the farm (60%) is cropped with maize in rotation with beans. Trees should be spaced by 5 m between trees and between lines of trees. While the cited crops and trees can be mixed up on the farm, it is recommended to keep trees planted in rows going from east to west to limit light competition (shading effects of trees) and allow for irrigation of specific patches depending on the need based on the stage and status of each component of this system. For instance, woodlot areas may not need irrigation when trees have grown while crops may need it during drought spell periods.

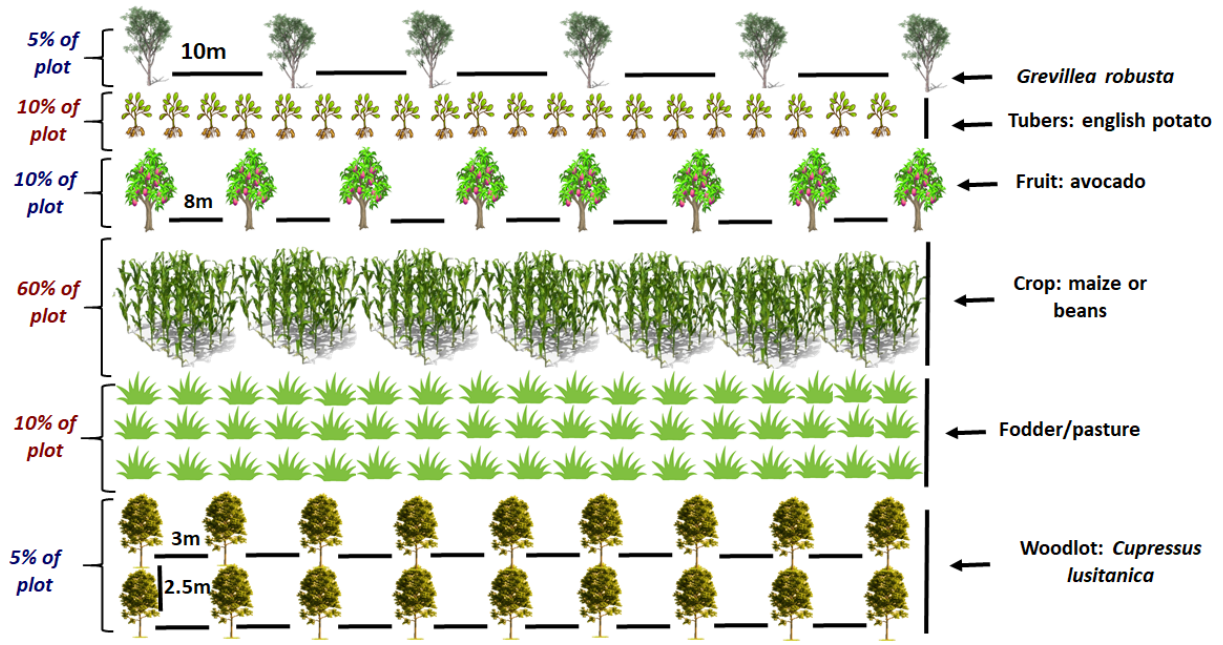


Figure 12. Typical agroforestry mixture model to address multiple objectives

3.3.3. Fruit orchards with fodder (Kuku, Rombo and Loitoktok)

The model of fruit orchards with fodder is proposed in agricultural land (included in the suitability area map of agroforestry) near villages and urban settlements to improve human and animal nutrition and contribute to farmers' increased food security through economic benefits from the packages. The proposed model includes a line of citrus or orange followed by a line of avocado, then a line of mango with all trees spaced by 8 m within and between lines. A 10 m wide strip of improved fodder grass separates the strips of these lines. The short and shed tolerant grass can also be planted in between the tree lines but sparing a radius of one metre around each tree to avoid direct competition of water and nutrients with trees. Small ruminants can be allowed to graze in the system once trees are well established, adding value to the overall system utility.

Proposed fruit varieties/ cultivars should be grafted and short varieties of avocado, mango, and citrus/orange to ease light competition while favouring early maturing and better productivity.

The cultivars must be adapted to the environmental conditions of Kajiado locality in which they are to be grown, and there should be a good market demand for them. Fodder to be grown can include napier grass (*Pennisetum purpureum*), kikuyu grass *(Pennisetum clandestinum)*, lucerne *(Medicago sativa)*, boma rhodes grass *(Chloris gayana)*, and brachiaria grass *(Brachiaria ruziziensis*).

The system can take three to five years to fully develop and mature. During this period the orchard goes through different stages of development including:

- Site preparation: 3 to 4 months before planting (bush clearing, land preparation and orchard layout)
- Planting fruit trees sapling and fodder, followed by tendering practices such as mulching, 1st to 2nd year shaping cut, staking, weeding, etc.
- Orchard management: 2nd to 3rd year of training and shaping fruit trees.
- Orchard main production period ranging from 3rd year to 12th year after which the system would need rejuvenation.

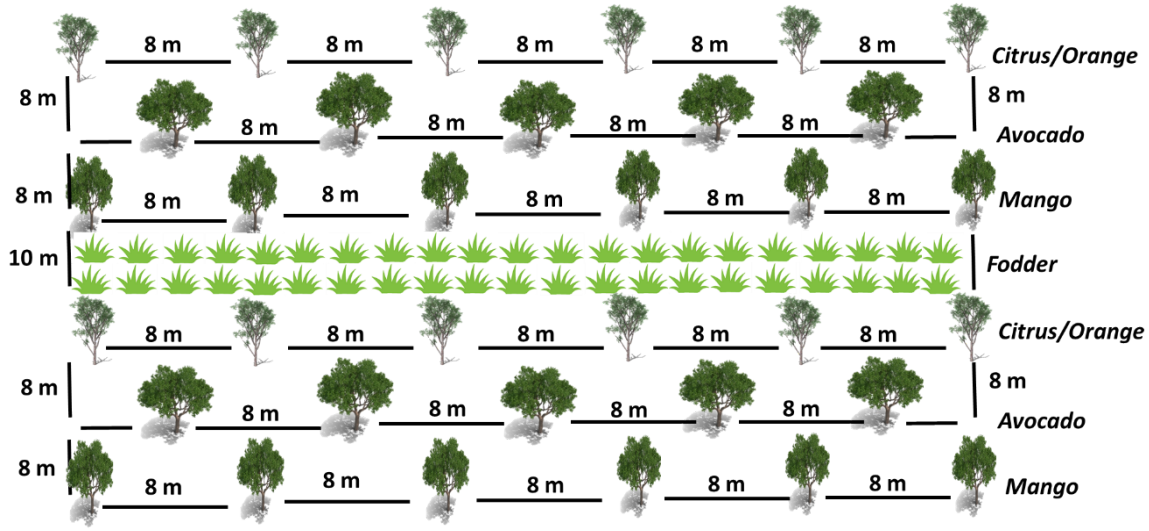


Figure 13. Example of an orchard model with fodder production

3.3.4. Rangeland management

Based on the 2020 ESA LULC map, close to 40% of the lands in Kajiado South is grassland/range lands presenting the largest opportunity to transition the lands into more functional landscapes with multiple goods and services for the pastoralist community. With the increasing cattle population, in the area, there is a need to develop a restoration strategy capable of restoring or improving the productivity of the land use. Re-introducing the traditional grass that serves as a folder, controlling the invasive species, managing the grazing patterns or movement and conserving water resources are critical steps in achieving the said functionality. According to the 2016 national FLR report, rangelands potential is spatially defined as degraded grasslands. In this analysis, the potential areas are further intersected with opportunity areas to generate areas with priority of the. Overall, Kajiado South has an opportunity to restore about 250, 000 ha of land using the rangeland management system which is described in detail in the subsequent sections. Further, about 42,000 ha (17% of the total potential) would be the priority areas for accruing multiple benefits.

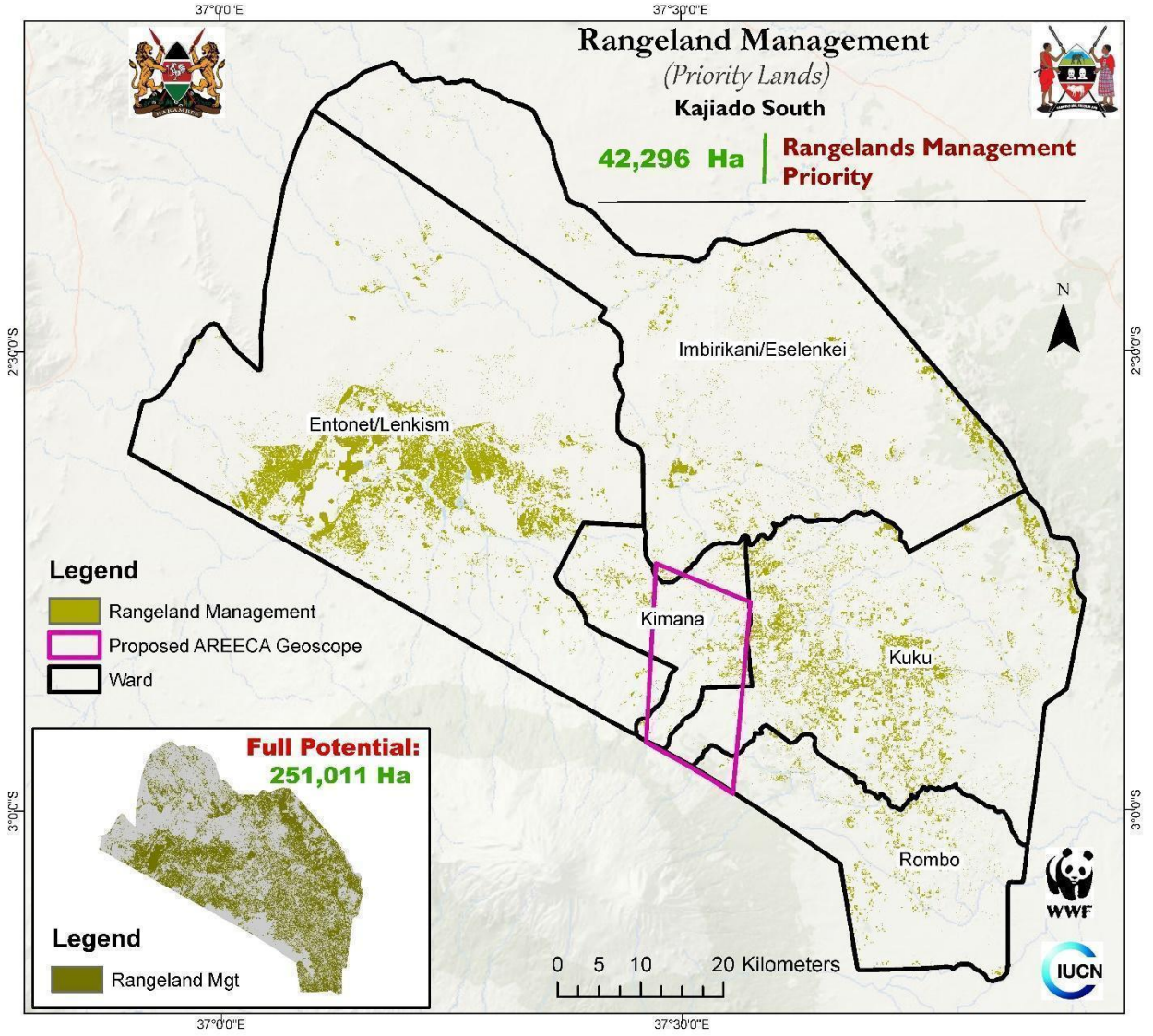


Figure 14. Map showing areas suitable for rangeland management

Pastoral communities and diverse wildlife predominantly inhabit the rangelands in south Kajiado. Overgrazing by wildlife and livestock has led to degradation of these rangelands, negatively

affecting the livelihoods of communities and accelerating wildlife population decline. The sustainable rangeland management and restoration interventions aim to optimise both livestock production and wildlife conservation through better management and restoration of the rangelands in conservancies. In addition, the interventions would be suitable for some of the degraded rangelands within group ranches of the south Kajiado. Therefore, the interventions are mainly proposed in the rangelands neighbouring the Amboseli National Park i.e. 18 conservancies where communities are keeping livestock and conserving wildlife for tourism enterprises, and within the 19 group ranches.

Interventions should aim at bringing together the landowners to come up with common grazing land where they do not exist. The grazing plans should recommend control of stock numbers and stock access in order to reduce overstocking and reverse rangeland degradation, allow wildlife to use the area as a dispersal area and corridor, allow the rangeland to recover and as most grasses are annuals, allow the establishment of perennials that can support grazing for longer periods in the year.

The grazing plans virtually subdivides the rangeland into grazing blocks where livestock is allowed to graze in a block at time considering the carrying capacity of the block. The livestock is then moved from one grazing block to another once the pasture is completely utilised to let the block fully recover grass with onset of rains as the soils become fertilised by animal manure. The plans should also aim to assure livestock keepers use the wettest rangelands in the dry season to provide adequate pasture for their livestock in all season without fencing out to exclude wildlife in conservancies.

The proposed activities to enhance sustainable rangelands management and restoration should follow the existing natural resources management plans (e.g. Amboseli Ecosystem Management Plan, the Amboseli Land Owners Conservancies Association Plan, etc.) and include:

1 Establish grazing plans with communities where they don't exist,
2 Promote community education and awareness,
3 Revegetate rangeland with grass and shrubs on bare land in collaboration with communities, KARLO, and KFS,
4 Promotion of bylaws to regulate grazing,
5 Train community scouts to enforce the respect of the grazing plan
6 Apply diverse human-wildlife conflict mitigation methods in the conservancies through the involvement of relevant institutions and committees,
7 Improvement of livestock breeds

3.3.5. Silvopastoral system for Rombo, Kuku and upper Olugulului

Silvopasture intentionally combines livestock (cattle, sheep, goats, poultry, hogs, etc.) with trees or other woody perennials and forages on the same unit of land such that mutual benefits to each component arise. Silvopastoral system was recommended by stakeholders in Kajiado to be applied in Rombo, Kuku, and the upper Olugulului (in Imurtot, Kidapash, and Ilimisgiyo). A silvopastoral model was developed and can be applied on some rangelands management opportunities as well as from some agroforestry priorities where livestock rearing is a major activity.

In this model, a strip of trees made up of two lines of trees spaced by 5 m between trees within

the line and between the lines are planted against the slope in pastureland. The strips of trees are separated with an alley of fodder measuring 20 m of width between the strips of trees. The model considered *Acacia nilotica* for illustration and CBA calculations. Trees such as *Acacia nilotica* provide benefits such as pods used for fodder, windbreaks, termite resistant timber, and they are good for rehabilitation of degraded sites.

Other pastureland trees such as *Acacia xanthophloea*, *A. tortilis*, *A. seyal*, *A. gerrardii*, and *Ficus sycomorus* can be recommended. Fodder production in the system can consider napier grass (Pennisetum purpureum), kikuyu grass *(Pennisetum clandestinum)*, Lucerne *(Medicago sativa)*, boma rhodes grass *(Chloris gayana)*, and brachiaria grass *(Brachiaria ruziziensis)*. In the early establishment period of the system, livestock should be controlled not to damage the trees by covering the seedlings with a sac opened either on top or by fencing the line of trees by dead branches or barbed wire wherever possible.

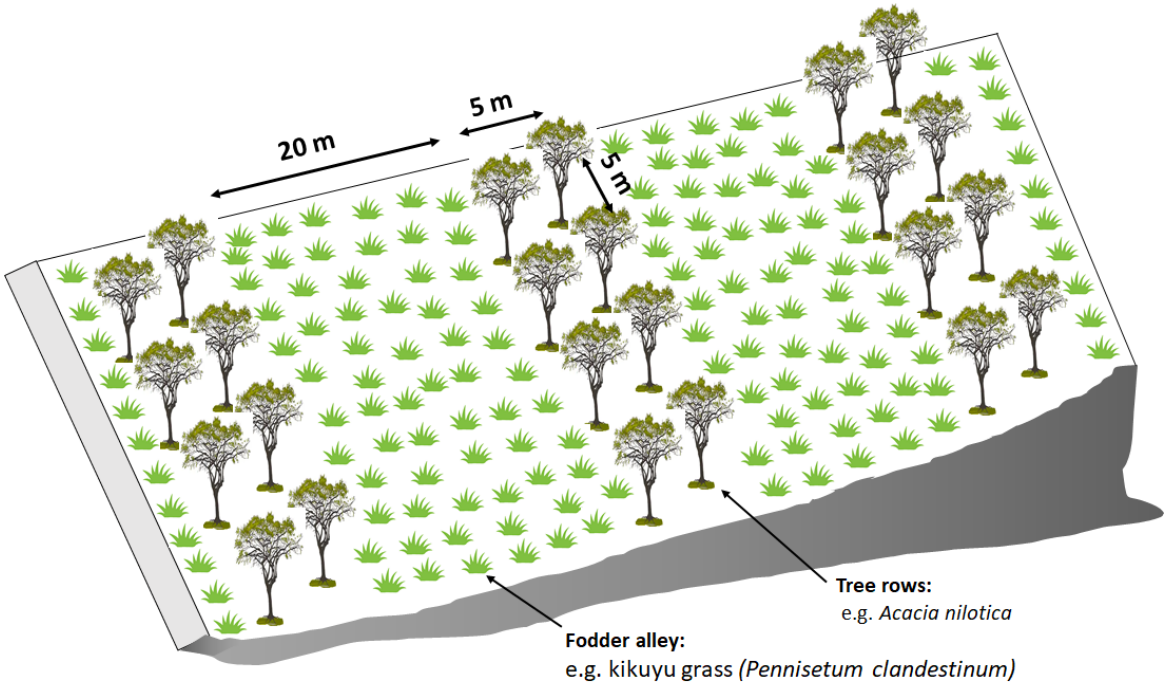


Figure 15. Example of a silvopastoral system model

Figure 16. Pictures to illustrate mature silvopastoral systems

3.3.6. Forest plantation with PELIS

The establishment of forest plantations on public land with PELIS (Plantation Establishment and Livelihood Improvement Scheme) is recommended in Loitoktok forestland for the production of wood products (charcoal, firewood, timber, etc.) and other ecosystem services. A similar model can also be done on degraded patches on private land (e.g. in north-west Rombo, south-west Kuku, and extreme south and extreme north Kimana) on a smaller scale as woodlots. While many different species can be relatively suitable, this package illustrates forest plantation using *Cupressus lusitanica* as exotic fast growing tree species. Though a mixture of exotic and indigenous tree species would be best for biodiversity outcomes, the current forestry regulation in Kenya does not allow it. It is therefore recommended to revisit the current silviculture recommendations and policies to allow a mixture of indigenous and exotic stands and allow harvest of both species. In this model, trees should be spaced by 3 m and attention should be given to other common silviculture practices such as firebreaks establishment, 1st to 4th thinning and pruning, water retention trenches on steep slopes, etc.

The fast-growing trees would be harvested after the 25th planting year before re-conversion. The recommended tree species should focus on commercial species (industrial) preferred on the local market. These species can include *Pinus patula, Eucalyptus saligna, Grevillea robusta, Vitex keniensis, and Juniperus procera.* Beans and English potatoes would be cropped in rotational patterns during the first four years of forest establishment, before trees start competing with the crops for light and other growth resources. Rotation patterns should aim to not phase out cropping in PELIS with english potatoes since the harvest of this crop leaves soils very disturbed with little to no capacity to regenerate grasses. When phasing out cover crops in PELIS, it should be assessed whether soils still have potential to regenerate the under canopy vegetation (through soil seedbank and seed rain) or whether additional support to broadcast some grass seeds during the rainy season will be needed.

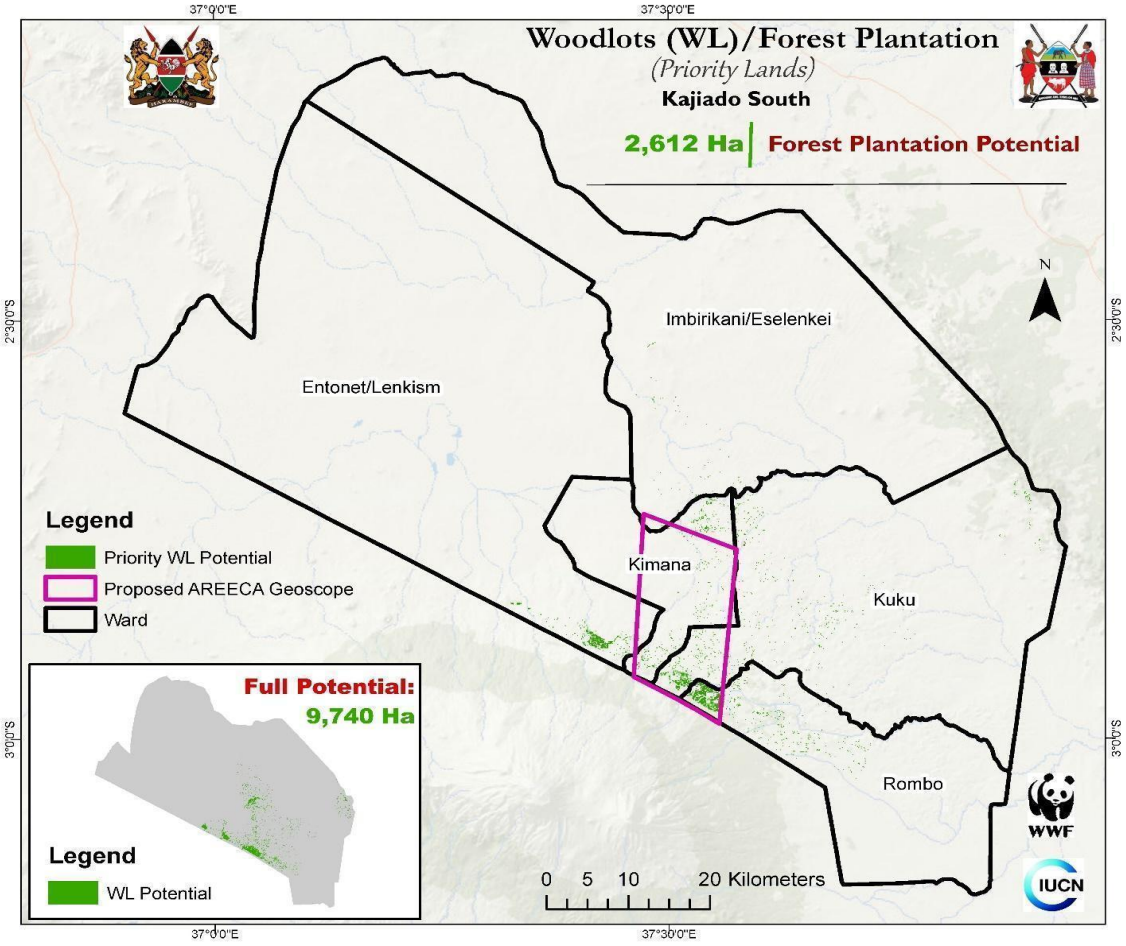


Figure 17. Map showing areas suitable for forest plantations

Areas potential for woodlots are defined as potential marginal croplands with access to a road network within a radius of 10km and in areas with at least 500 mm of rainfall. The map below shows that Kajiado South has a potential of restoring about 9700 ha while based on the opportunity map, 2,600 ha are priority for the AREECA project.

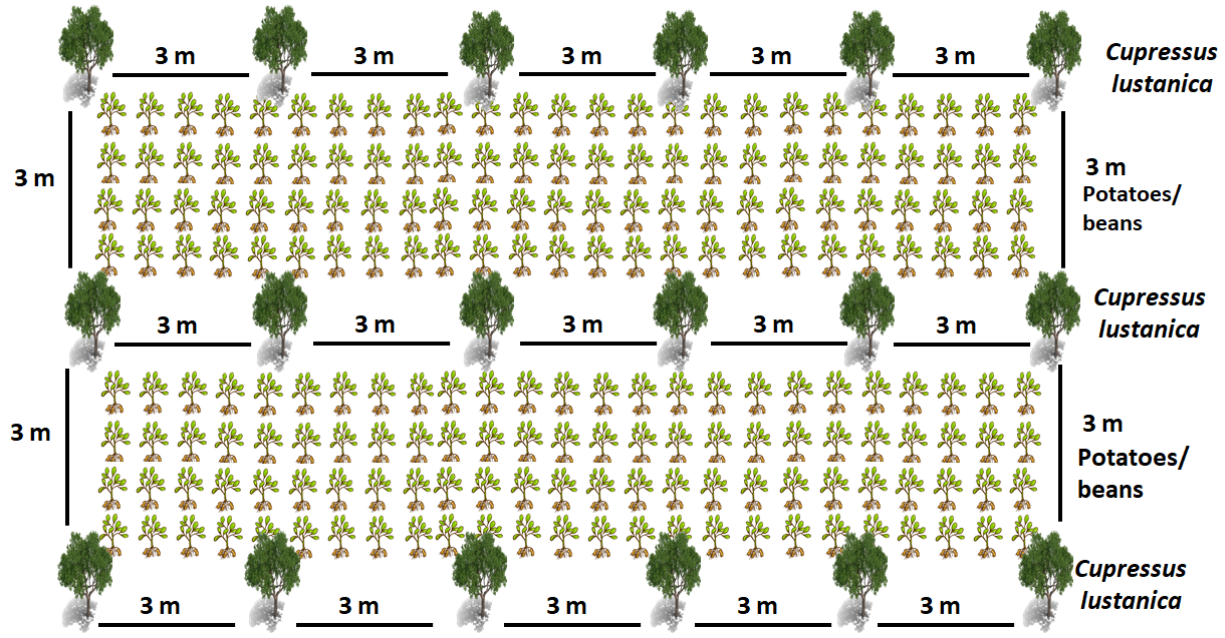


Figure 18. Forest model with fast growing exotic tree species in PELIS

3.3.7. Soil and water conservation

3.3.7.1. River & spring protection

To determine suitable areas for soil and water conservation, a hydro analysis was carried out using a 30m DEM to generate streams and drainage points. Streams generated in this manner depict possible rivers/ streams and gullies. According to environmental law, lands within 10m from the river/stream shoreline are designated riparian reserves. A buffer of 20m was therefore generated (Figure 14) to calculate potential areas where riverbank protection can be done to improve water yield, water filtration, and purification, and sediment export control. This applies also to spring/drainage points. While protective walls have been previously elected sound some springs, this report encourages the use of nature-based solutions as described under this package. From the analysis, about 3,722 ha can be restored in Kajiado South using river/stream buffer protection. We also have about 78 potential springs with three as a priority for the AREECA project.

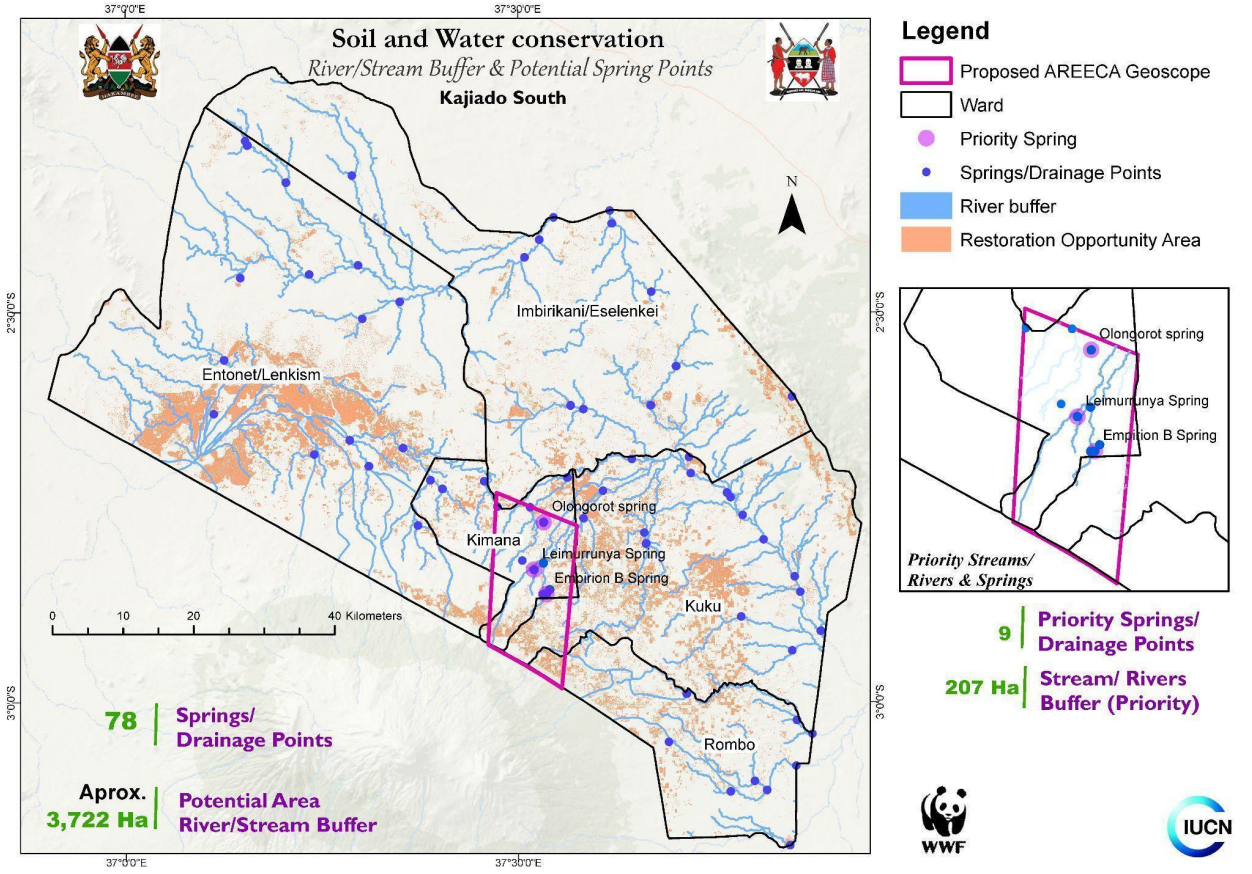


Figure 19. Map showing areas suitable for riparian forests and ravine restoration

Rivers, springs, wetlands, and other water bodies are protected through the creation of a buffer zone of native trees and grasses to protect these important water bodies from the harmful effects of erosion. The major purpose of this model is to protect water resources while generating income from the restoration. The following restoration model (Figure 15) is designed to serve the protection at the same time serve as a fodder source for livestock and wildlife. The model suggests planting and maintaining a belt of grass of 1 m wide starting from the shores or edge of the river, followed by one line of trees with individual plants spaced by 5 m, then a strip of grass of 8 m, followed by a line of trees, then a 1 m wide strip of grass. The two lines of trees

should be planted staggered/offset to provide the maximum retention of sediments from the watershed. The grass and trees extraction should only be allowed once the system has matured and it should be a conservative extraction of grass regeneration and tree replanting/ restocking. The tree resources can then be used directly or commercialised by the communities while grass harvested conservatively can be used as animal fodder.

The tree species proposed here are *Acacia xanthofloea* but does not preclude it from integrating other species such as Acacia *tortilis*, *Acacia seyal*, *Acacia gerradii*, and *Ficus sycomorus*. The fodder grass can include *Pennisetum purpureum*, *Pennisetum clandestinum*, *Medicago sativa*, *Chloris gayana*, *Eragrotis superba* and *Brachiaria ruziziensis*.

Figure 20. Example of a model for protection of riverbanks to preserve water quantity and quality

As a complementary measure, wherever necessary (e.g. due to potential animal damages and agriculture encroachment), springs sources could be fenced by masonry using locally available materials collected in environmental friendly manner (e.g. using surface materials to avoid deep excavations which can lead to more degradation). One of the successful cases is the *Merro Leshurie* spring protection project in Kuku (Figure 21).

Figure 21. Merro Leshurie spring protection project funded by Dorcas in Kuku

3.3.7.2. Gullies rehabilitation

Globally, the gully landscapes are considered among the world has most degraded ecosystems. Therefore, restoring gullies is considered a high priority item in the landscape restoration programs. Gullies are spread over the Kajiado landscape. With recommendations to use nature-based solutions, soil and water conservation with gully plugs and check dams to reduce the velocity of run-off and retain soil sediment. Both can be made of wood and are expected to hold soil capable of supporting trees growing in the ravine. Figure 22 presents an example of a gully plug made from brushwood.

Figure 22. Photo showing a grazing land destroyed by run-off in Imbilikani ward downstream the limestones concession for cement production (IUCN field visit, October 2022)

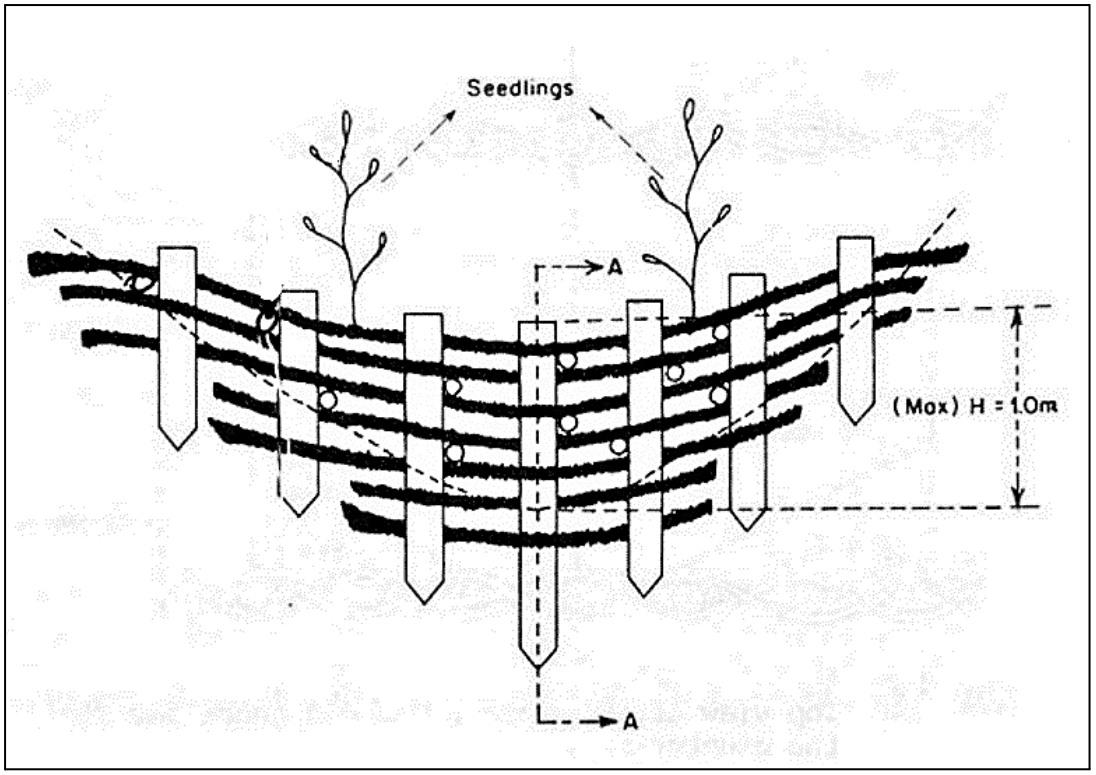


Figure 23. Brushwood check dam placed across the gully. Source: FAO (1986)

Gully plugs protect the gully beds by reducing the runoff velocity, distributing the water spread, increasing infiltration opportunity time and improving the soil moisture regime for improving the vegetation cover. The vegetation cover is supplemented with appropriate conservation measures and is the most sought restoration strategy. Gully plugs made of various materials i.e. brush wood, live hedges, or sandbags and where needed gabions could be applied. The size and materials for the gully plug depends on the width, length and bed slope of the gully and anticipated runoff. The earthen gully plugs are found to be the cheapest. The gully plugs are required to be constructed for a life expectancy of 5 years at least. During these periods it is estimated that the vegetative growth of tree species planted will be sufficient to take care of soil erosion as well as their root system will be sufficiently developed to extract the moisture from deep soil layers.

The engineering measures are a prerequisite for slope stabilization and sustainable productive utilization in the ravine ecosystem. Several methods for slope stabilization are available but only few are applied in ravine land. Therefore, in this package, we advise only those slope stabilization techniques which were successfully applied for the restoration of ravine land elsewhere. The project could pilot selected techniques depending on the type of gully (from shallow to deep gullies).

The shallow ravines (<1 m deep) can be easily reclaimed with simple earth moving hoe for the cultivation of crops. The management of shallow ravines starts with designing and instituting a peripheral bund along the gully head to check the runoff generated from the adjoining marginal lands. The land levelling operations across the slope and smoothening on the upstream side of the peripheral bund increase the infiltration opportunity time for the runoff generated from the field. The in-situ soil moisture conservation increases the water and nutrient use efficiency of the trees planted within the ravine area. Vegetative barriers are used for either supplementing or substituting earthen bunds. The *Dichanthium annulatum, Cenchrus ciliaris, Vetiveria zizanioides* vegetative barriers has revealed to be effective in reducing runoff and retaining nutrients around

the bunds. Vegetative barriers are grown across the slope in paired rows of 10 cm slip-to-slip spacing.

For the medium and deep gullies, the land cannot be easily reclaimed with a simple earth-moving hoe. The management of deep ravines starts with designing and instituting a series of composite check dams in the gully bed using the gully plugs. The construction of a gully plug at regular intervals with provision for safe disposal of runoff assists in the stabilization of the gully bed, which can be alternatively utilized for raising trees or perennial fruits (in farmland) tolerant to waterlogging. The easing of the gully is required in the deep gully to prevent caving action against steep slopes due to runoff and protect the adjoining marginal land to collapse inside the gully due to unstable slope. The medium and deep gully can be reclaimed by terracing and or trenching for the conservation of runoff, soil loss, and associated nutrients and to stabilize the steep slopes with time. These check dams are found to be very effective to check erosion, detaining the sediment and runoff water behind the structure which ultimately results in groundwater recharge. After the siltation of these composite check dams, the level terraces formed in the gully beds are stabilized and put under cultivation. Therefore, these reclaimed deep gully beds are subsequently planted with forest trees.

3.3.8. Roadside protection and greening populated areas

This package is proposed to protect roadsides of main and feeder roads of at least 6 m wide. It comprises two rows of trees spaced by 5 m between lines and 10 m within the line. The proposed tree species include *Croton megalocarpus, Senna siamea*, *Spathodea nilotica, Senna siamea*, and *Croton megalocarpus*. These trees not only protect the road and provide shed for pedestrians, they are also ornamental with decorative yellow, and red flowers. Trees with different flower colours are mixed to increase the beautification of the roads. This package is mainly proposed for Esinet, Kimana, Loitoktok, Rombo, border post, Ochoka, and Namerok roads.

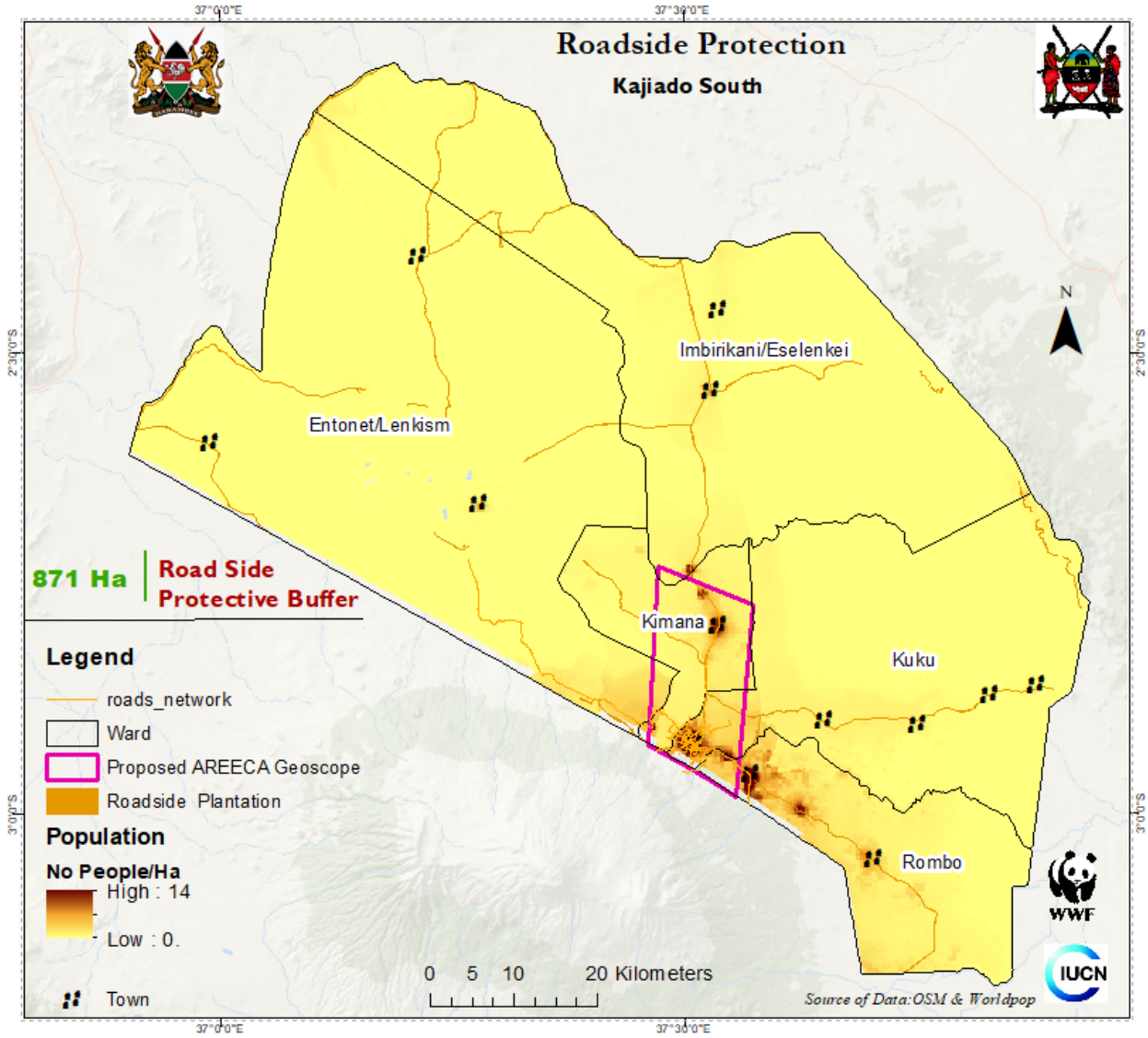


Figure 24. Map showing areas suitable for roadside tree buffer

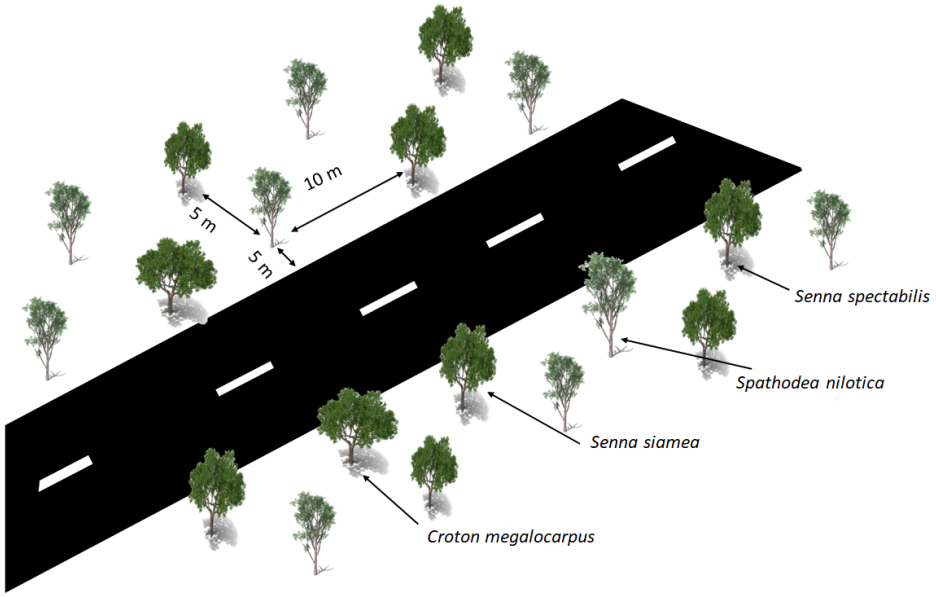


Figure 25. Roadside tree buffer model proposed for roads in Kajiado

3.3.9. Assisted Natural Regeneration (ANR) in Amboseli National Park, conservancies, and Loitoktok Natural Forest Reserve.

Natural regeneration interventions are designed to capitalise on Kajiado degraded natural forests of intact natural forest to both expand and restore the ecosystems that are particularly important for their wildlife and livestock. Improving and expanding the natural forests would improve habitat for wildlife, which can attract greater tourism revenues. Two types of natural forest interventions were assessed as part of the geospatial analysis: 1) establishing plantations around existing closed natural forest of Loitoktok; and 2) restoring degraded natural forest inside reserves of Amboseli national park, Loitoktok natural reserve and other conservancies.

Assisted Natural regeneration (ANR) is a biological process that can be assisted and managed to increase forest cover and achieve the recovery of the native ecosystem or some of its functions. To understand ANR, it is important to note what happens in degraded and denuded lands that are not burned or otherwise disturbed. After 10 to 20 years, trees and many other plants, growing from seeds spread by birds, animals, wind and other means, will cover these lands. The word ‘assisted’ in ANR simply means helping the naturally growing young trees to grow faster. During ANR, local biodiversity is enriched by: (1) Natural establishment of trees and shrubs from seeds, root sprouts, stumps or coppices; (2) Regeneration of local genetic resources adapted to local soil and climate conditions; and (3) Associated pollinators, herbivores and seed-dispersal agents of colonising trees. ANR accelerates the natural successional process by protecting against disturbances (from fire, stray domestic animals and humans) and by reducing competition from grasses, bushes and vines that hinders the growth of naturally regenerated trees.

The spatial definition of assisted natural regeneration are all the degraded protected areas which according to the analysis is about 19, 000 ha. Further, a buffer of 30m around the protected areas gives an additional 698 ha.

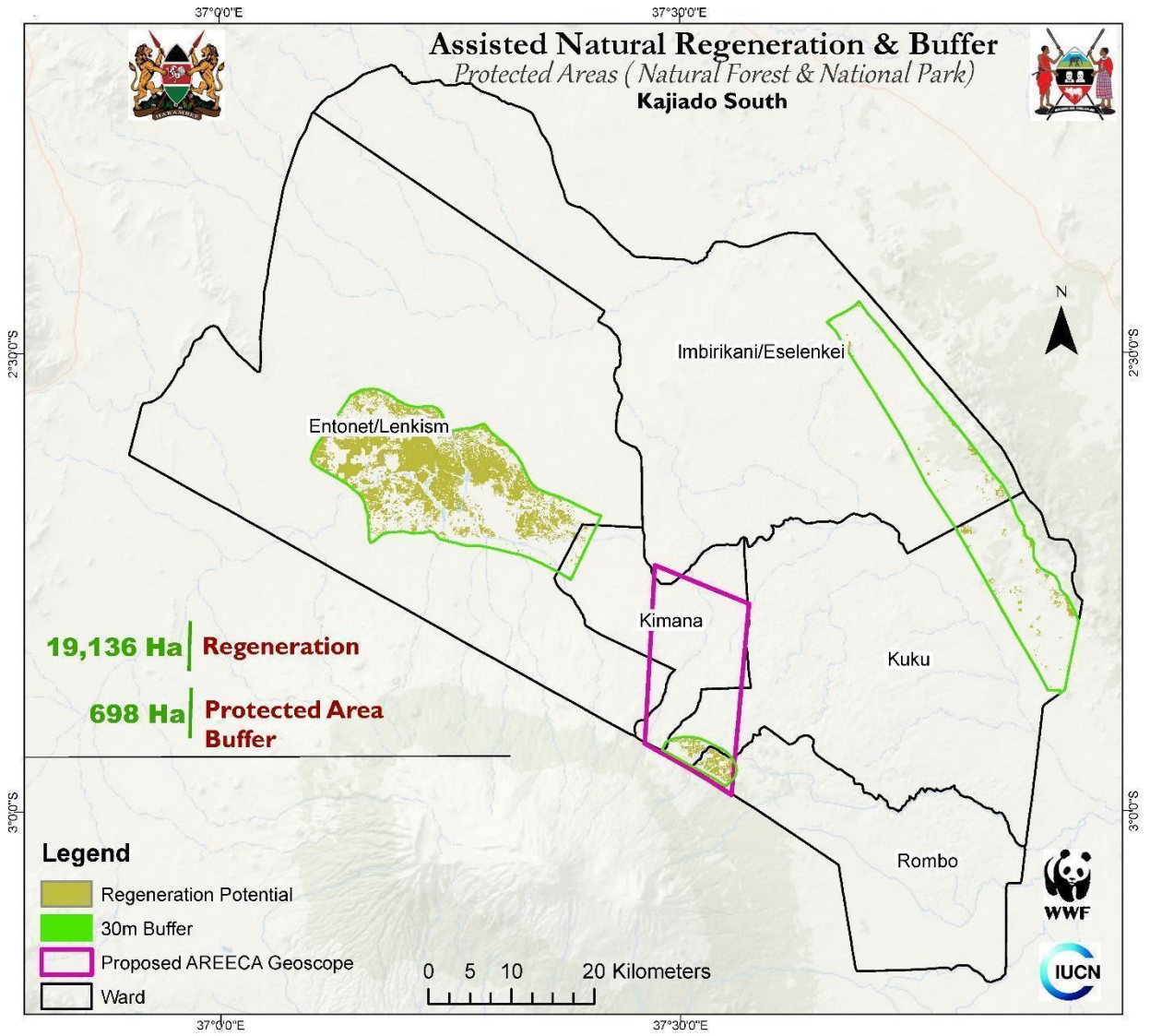


Figure 26. Map showing areas suitable for Assisted Natural Regeneration (degraded Amboseli, conservancies and Loitoktok natural forest reserve)

There are certain ecological, socio-economic and regulatory conditions that favour forest restoration through ANR:

1) Adequate density of naturally regenerated tree seedlings. The minimum number of naturally regenerated seedlings required will vary based on their distribution, species composition, growth rates, soil fertility, rainfall and so forth.
2) Availability of seed inputs. There should be remnant forest patches nearby that can serve as seed sources; seed dispersers are required to carry these seeds to the restoration site. Soils should not be heavily disturbed. There should be a viable seed bank in the soil.
3) Controlling disturbances. It is essential to prevent or at least minimise human induced disturbances, including fires, grazing and unsustainable harvesting.
4) Social support. Local communities need to be interested, willing and incentivized to participate in forest restoration.
5) Competing land uses. The area should be not suitable for land uses that are economically more attractive.

Fences can be used to exclude livestock during the early stages of ANR. Enrichment planting is also a form of ANR technique. Enrichment planting is recommended where: 1) canopy closure does not occur due to low density of natural regenerants; and/or 2) desired tree species are not present amongst the natural regenerants. If the remnant forest is far from the ANR site and seed-dispersing animals are not present in sufficient numbers, enrichment planting may be needed to bring back the full complement of late successional forest tree species.

ANR can also apply direct seeding. Direct seeding involves: 1) collecting seeds from native trees in nearby remnant forest and if necessary storing them until sowing; 2) sowing them in the ANR site at the optimal time of year for seed germination; and 3) manipulating field conditions to maximise germination. The method is inexpensive because there are no tree nursery costs. Transporting seeds to the restoration site is obviously easier and cheaper than trucking in containerized tree seedlings, so the method is particularly suitable for less accessible sites. In Loitoktok natural forest area, assisted natural regeneration should consider the degraded tree species such as *Olea europea, Juniperus procera, Warbugia ugandensis, Prunus africana*, *Fagoropsis angolenis, Ficus sycomorus, Erythrina abbysinica* and *Rhammus stado*.

3.4. Summary of restoration interventions and AREECA geoscope selection

Overall, rangeland remains the largest interventions in Kajiado south with and appears to have potential in not only the lower zone (Etonet & Imbirikani) but also in the upper zone (Kuku, Rombo and some parts of Kimana). Agroforestry comes second with its potential appearing in all the five wards. While the lower zone is largely grassland occupied by pastoralist communities, the FLR programme should capitalise on this potential to improve the food security situation. A summary of the five intervention packages has been summarised in the table below and support decision on priority wards. Figure xx: is the map showing all the interventions and the proposed AREECA geoscope. The map also shows the target group ranches and conservancies.

Table 6. Restoration interventions

	Area (Ha)					
Ward	Agroforestry Potential	Agroforestry Priority Areas	Woodlots Potential	Woodlots Priority	Rangeland Mgt Potential	Rangeland Mgt Priority
Entonet	19,478	2,668	1,723	444	84,851	21,304
Imbirikani	8,350	315	726	72	68,492	4,936
Kimana	3,266	791	1,714	359	11,204	1,914
Kuku	7,637	1,649	2,943	812	61,582	12,039
Rombo	9,522	1,809	2,634	925	24,883	2,103
Total	**48,253**	**7,232**	**9,740**	**2,612**	**251,011**	**42,297**

	Area (Ha)				No. of Springs
Ward	Assisted Natural	Protected Area Buffer	River Buffer	Roadside Protection	Spring Protection
Entonet	16,988	297	1,267	257	21
Imbirikani	389	178	970	337	17
Kimana	90	40	317	40	10
Kuku	1,007	178	832	178	20
Rombo	662	20	337	59	10
Total	**19,136**	**713**	**3,722**	**871**	**78**

To optimise decision for AREECA project, this assessment has tabulated the restoration interventions (for multiple benefits) in two possible project geoscopes. Geoscope 1 which was selected before the assessment has a total restoration potential of 4,409 ha while Geoscope 2, (informed by ROAM) has a total 5, 823 ha. The breakdown of these interventions and their spatial depiction is shown in Figure 27.

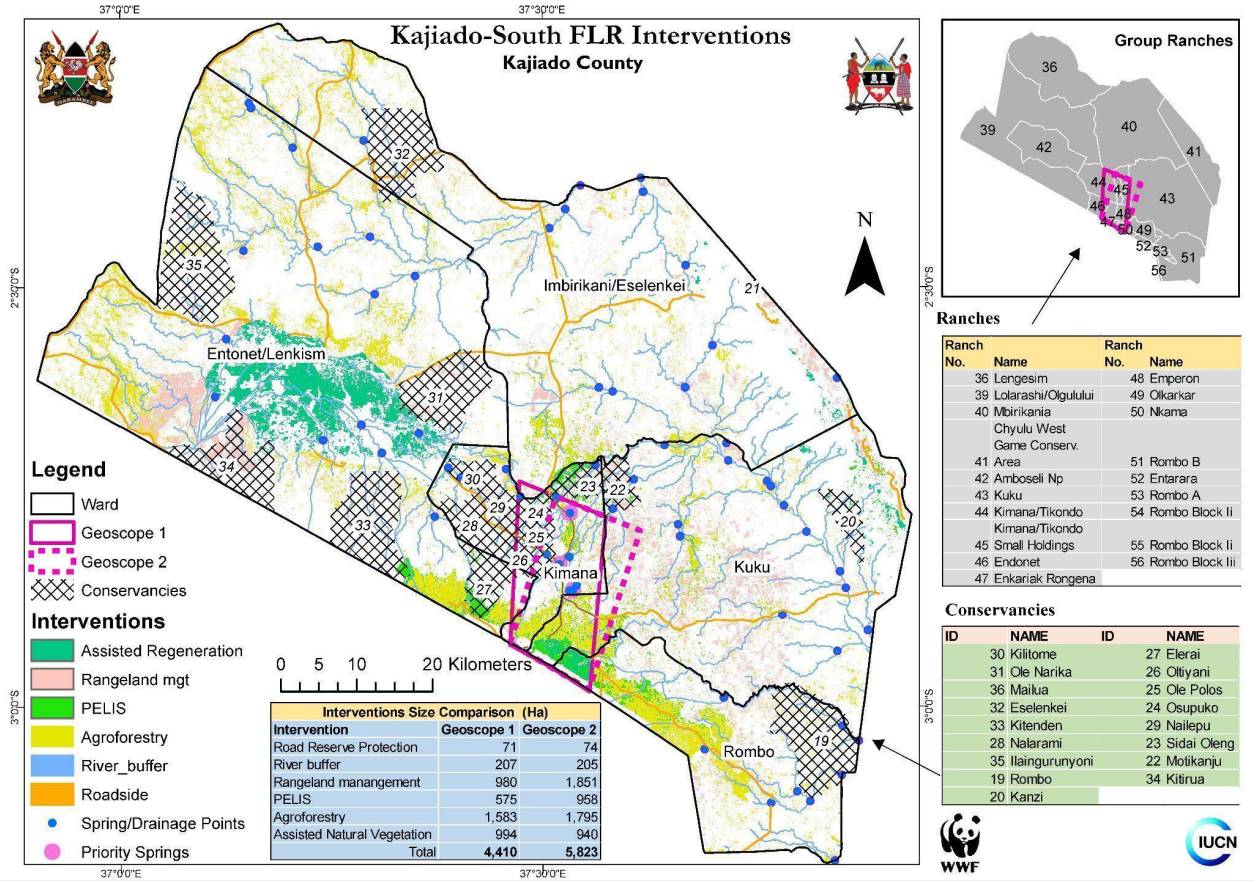


Figure 27. Proposed FLR interventions in Kajiado south

4. Socio-economic analysis

4.1. Financial and Economic analysis

4.1.1. Financial analysis for Business as usual

The analysis considers two types of land uses: traditional agriculture and poorly managed woodlots or deforested/degraded lands. Poorly managed woodlots and degraded lands are considered unproductive. The three restoration transitions defined are:

- Traditional agriculture to fruits orchard and fodder (agroforestry)
- Traditional agriculture to trees mixed with potatoes and beans system
- Degraded public forest plantation to PELIS system
- Degraded lands to riverside plantation
- Degraded lands to roadside reserve protection

The traditional agriculture consists of alternating maize and beans in two seasons of the year. BAU considered mainly maize and beans production costs. It also considered the cost of inaction, which is equivalent to the value of soil lost from erosion. Yields are the benefits from traditional agriculture that were estimated using market prices and the current production from both maize and beans. As shown by Figure 28, the annual net benefits from traditional agriculture is very small due to reduction of agriculture production and the cost of inaction as results of yearly loss of fertile soil. Degraded/deforested lands are considered unproductive and the current production is zero.

The following graph present the annual net benefit of traditional agriculture (BAU)

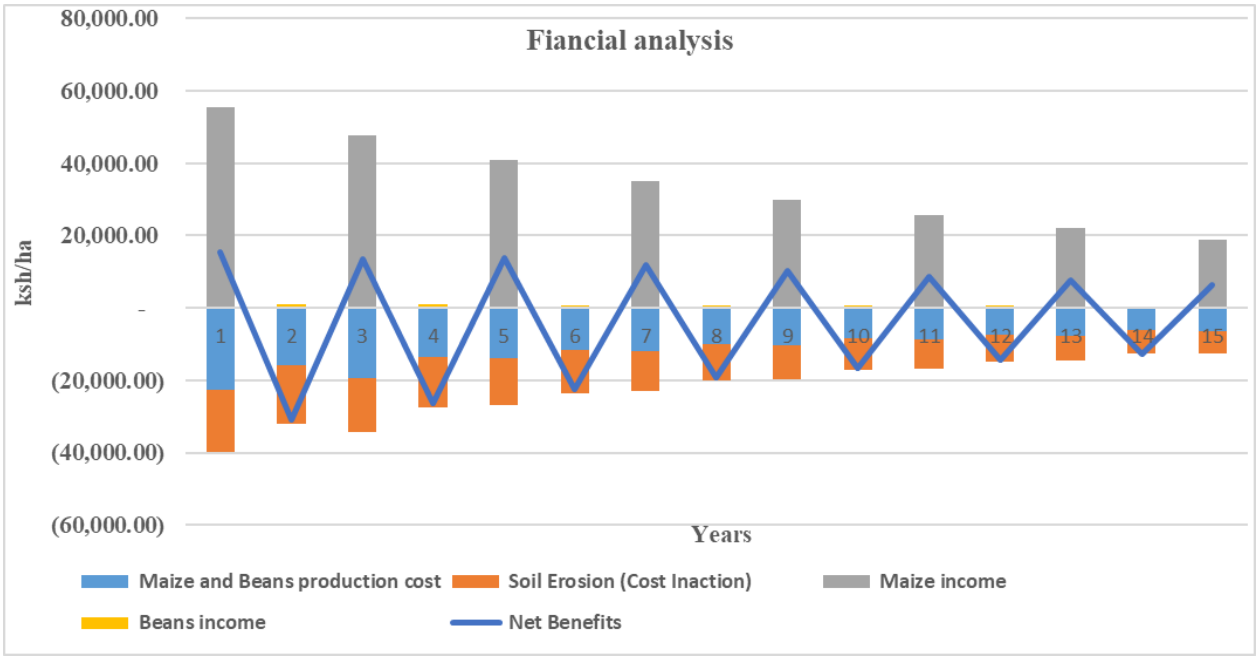


Figure 28. Annual net benefit from traditional agriculture

The results from financial analysis considering t shows the below results at a discount rate of

8%.

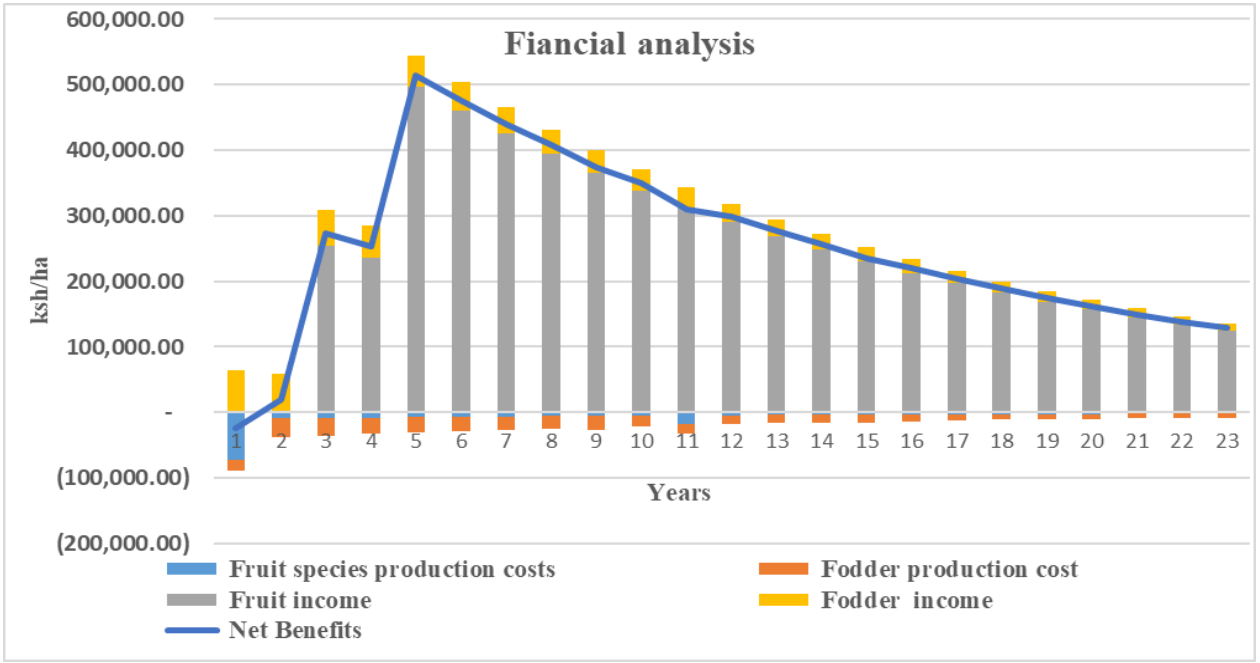
Interventions Traditional Agriculture	NPV 8%	B/C	ROI
Traditional agriculture	25,241	1	0.08

4.1.2. Cost-benefit analysis for FLR actions

All proposed interventions are profitable; the anticipated benefits outweigh the cost of implementation. The section presents the difference between financial and economic analysis for each proposed intervention. The economic analysis considered carbon and avoided soil loss as indirect or public benefits.

4.1.2.1. CBA for Fruits orchard

The costs and benefits of the agroforestry system with fruit orchards are represented in the two figures below. The analysis considered an agroforestry system on a one-ha unit area. The agroforestry system is made of fruit orchards. As shown by the figure 29, the benefits of this agroforestry system outweigh the cost of establishment, and of production and management for both analyses.



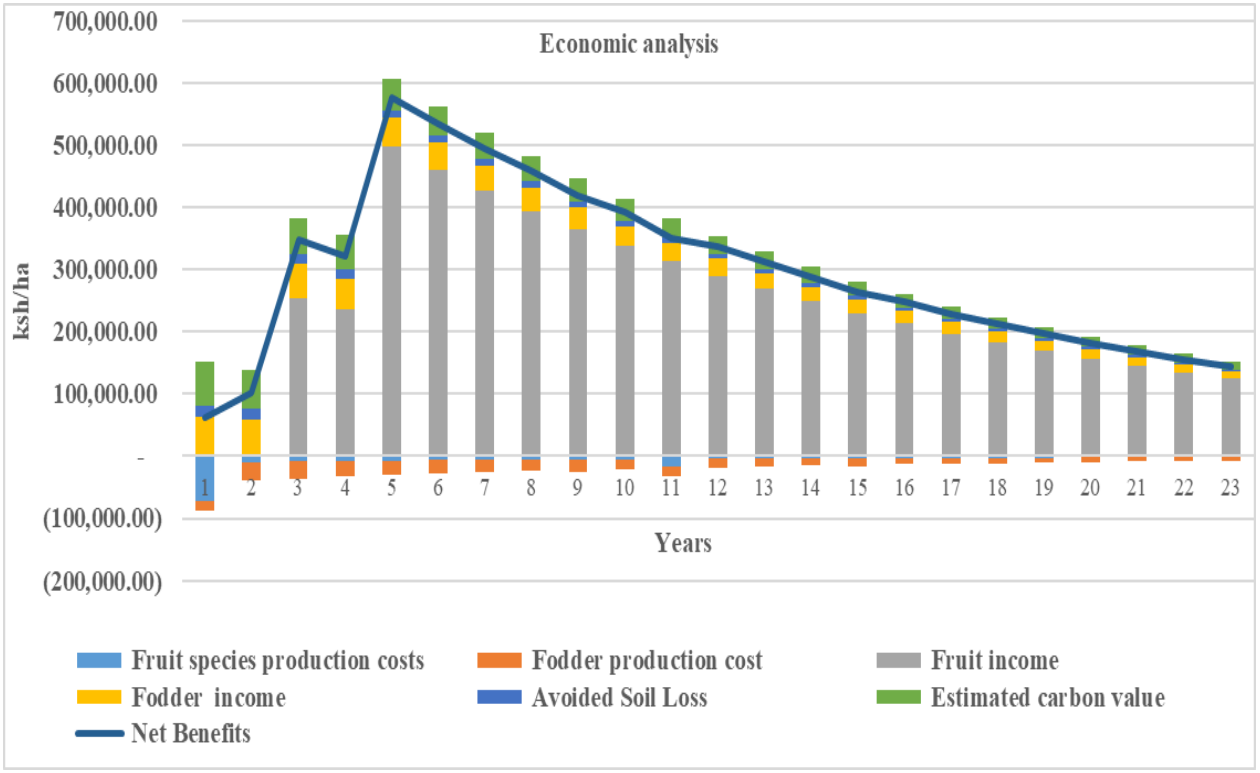
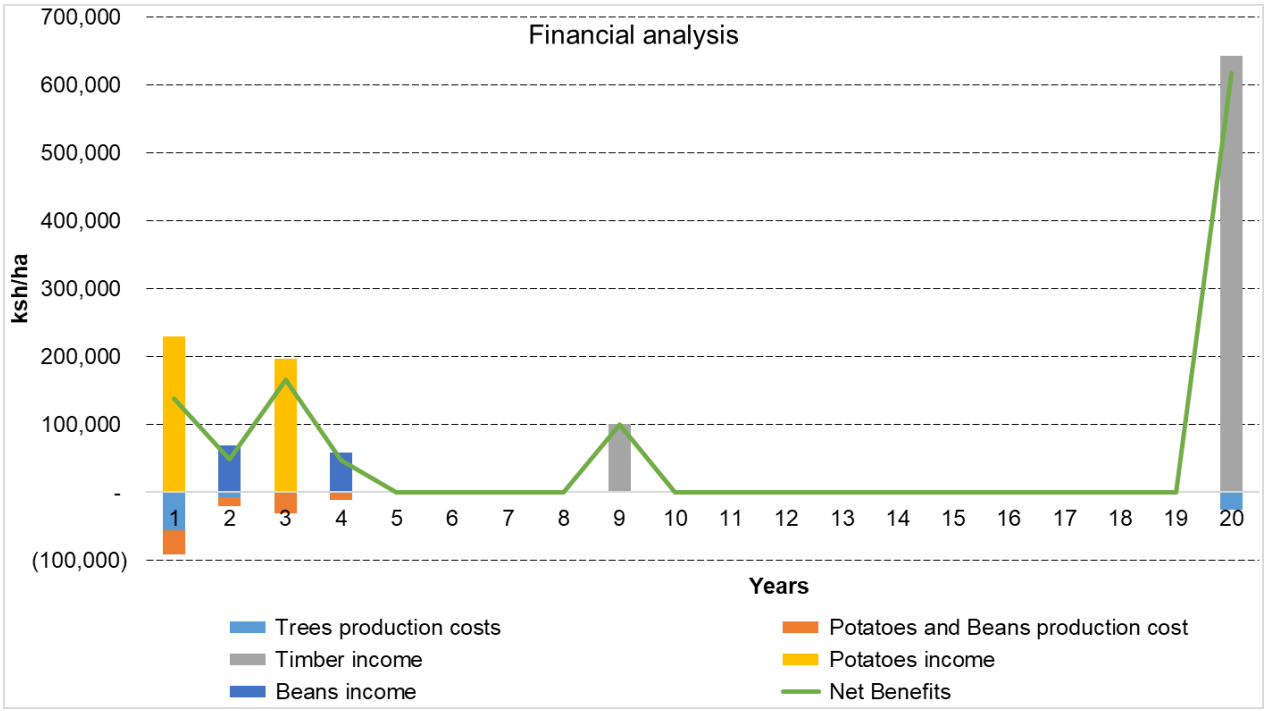


Figure 29. Annual net benefits from Fruits orchard

4.1.2.2. CBA for PELIS system

This is a PELIS system or plantation of exotic forests whereby the first four years' trees are mixed with potatoes and beans alternating respectively on a yearly basis. The difference between two figures express the value of carbon sequestration and avoided soil loss from FLR action.



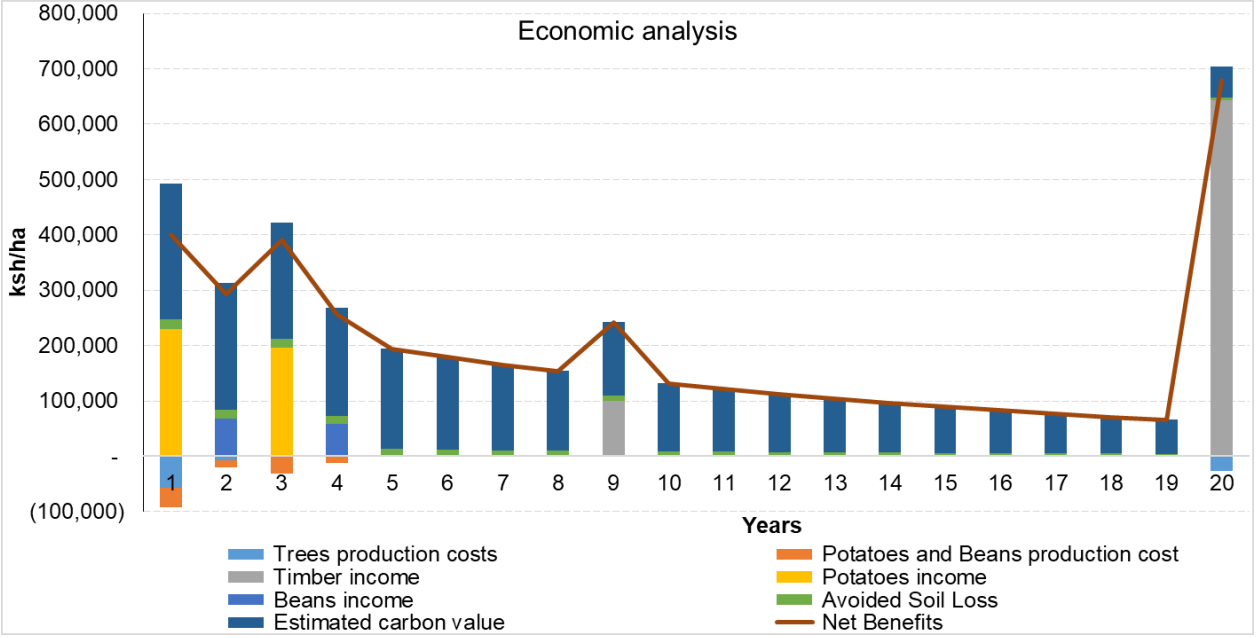
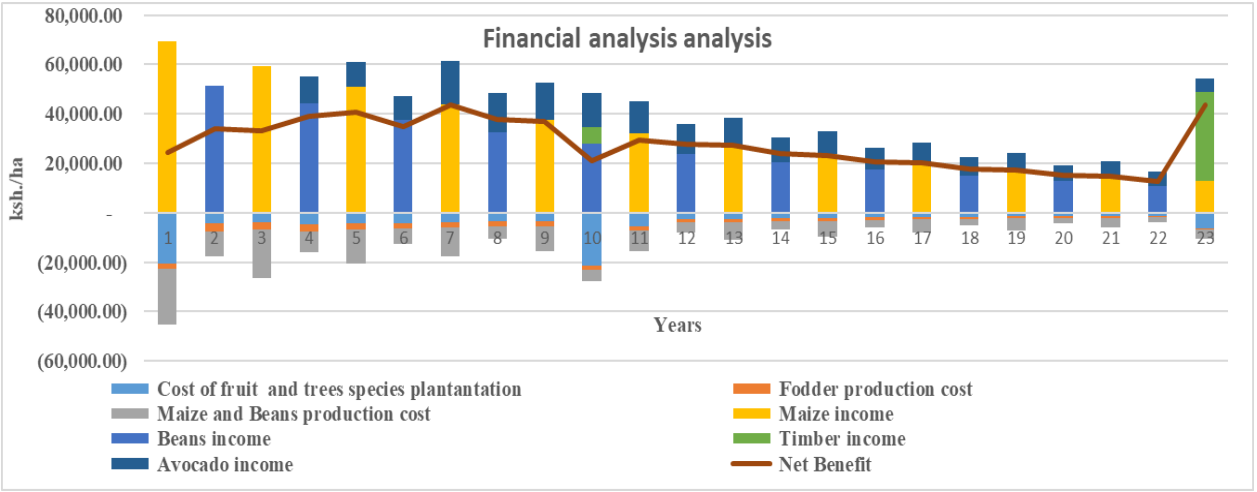


Figure 30. Annual net benefits from PELIS system

4.1.2.3. CBA of mixed agroforestry components

The stakeholders proposed the cost-benefit analysis of mixed agroforestry components and it encompasses crops, grasses, trees and fruits. The analysis considered the system on a 1ha unit area for 25 years, which is considered as the physiological maturity of some proposed trees. Throughout the rotation period, the farmer will choose to rotate crops according to what brings a higher return at 60% and other components occupy 40% of the plot. The system can provide firewood, contribute to livelihoods and provide other indirect benefits, like the capacity to sequester carbon and reduce erosion which was considered for economic analysis.



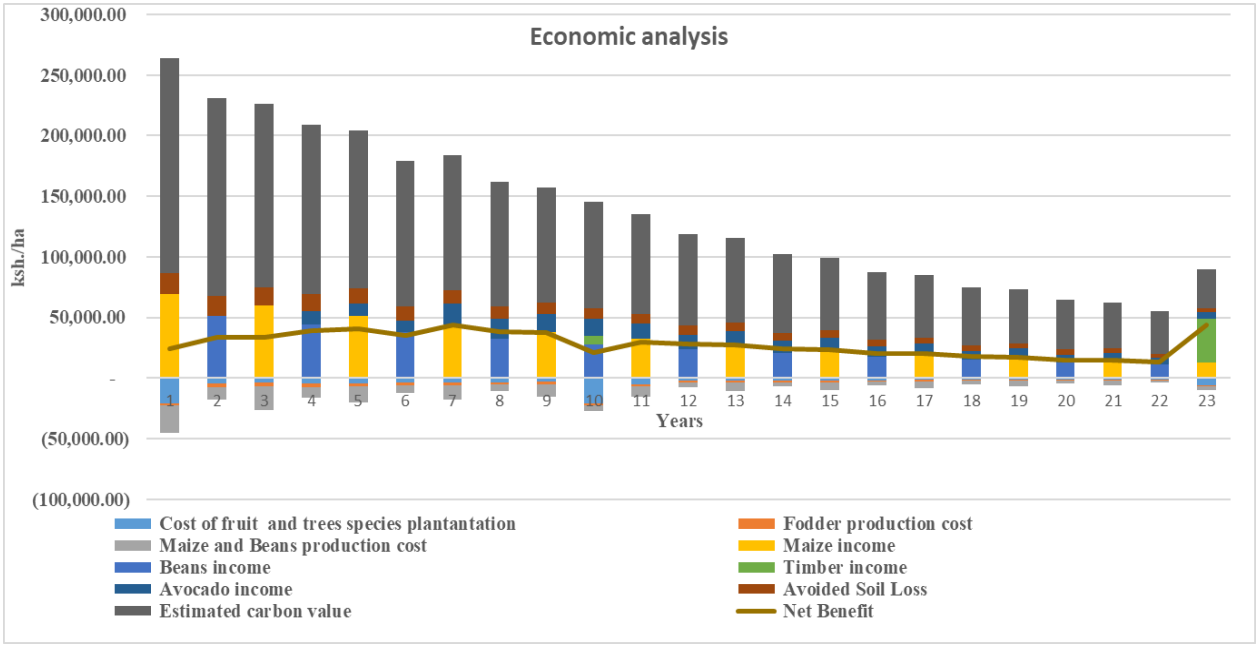
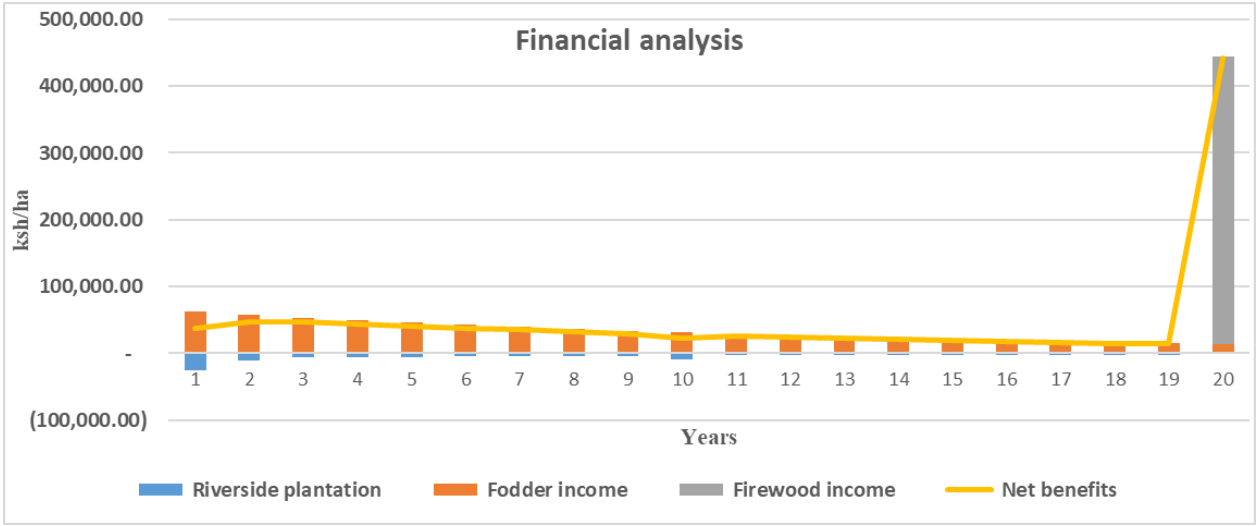


Figure 31. Annual net benefits from forest plantation

4.1.2.4. Protective forests

Protective forests, riverside and roadside reserve protection were illustrated and described in the package section of this report. The riverside plantation is mixed with fodder for animals. Both interventions assume that trees may need to be replaced after a period and be used for firewood services to avoid accidents that may be caused by old unproductive trees.



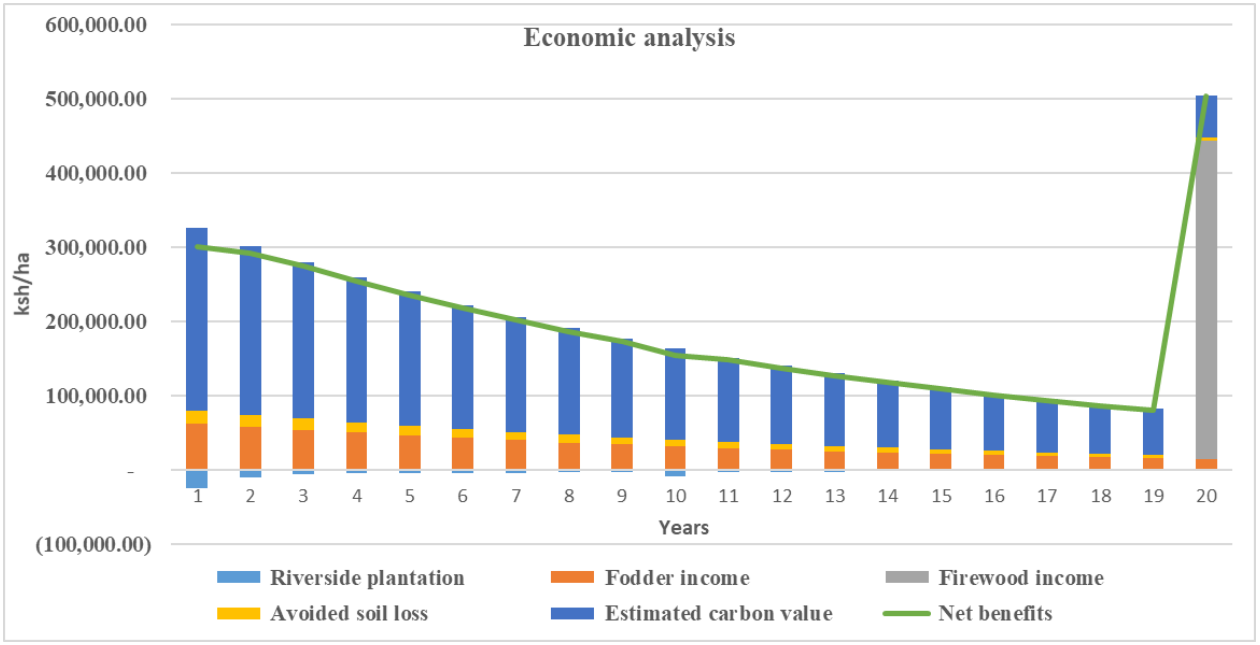
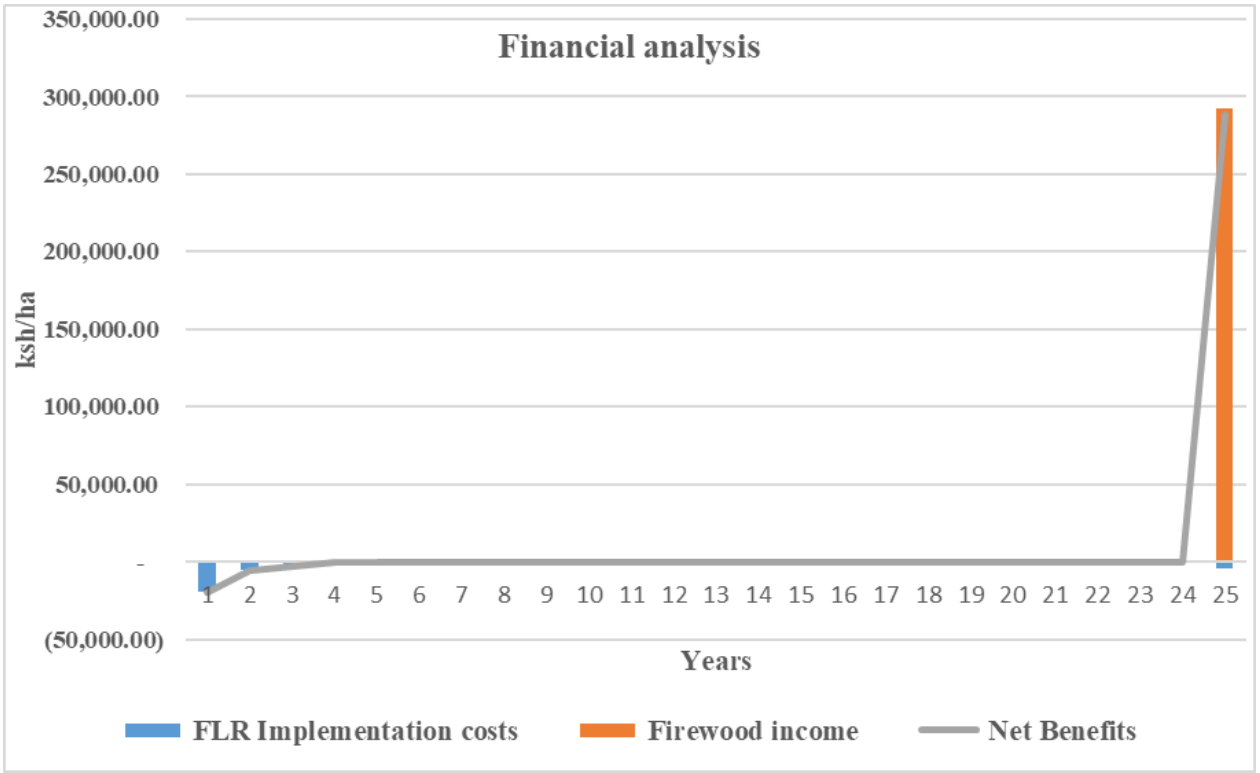


Figure 32. Annual net benefits from riverside plantation



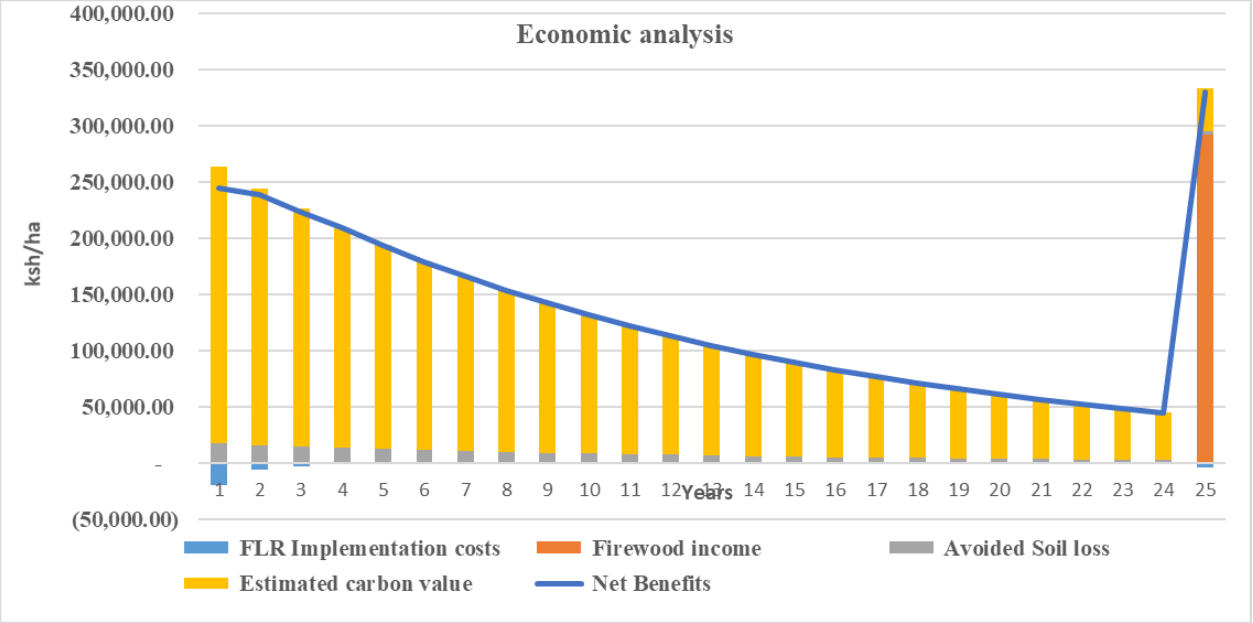
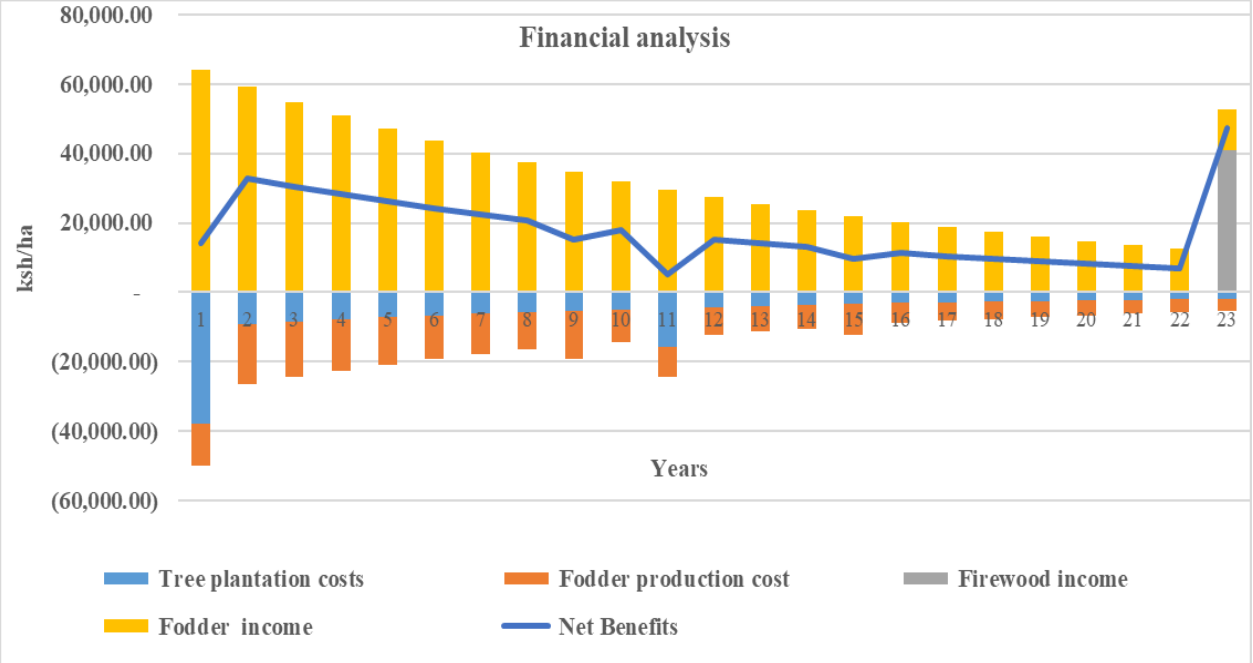


Figure 33. Annual net benefits from roadside reserve protection

4.1.2.5. Silvopastoral system

Silvopastoral system was proposed to serve cattle keepers. Due to high demand of fodder for animals, and the changing forest cover/grasses, this intervention was proposed to compensate for the fodder shortage. It can also be used for private farmers who might need to make investments in fodder bulking. The below graphs present both financial and economic analysis for the silvopastoral system.



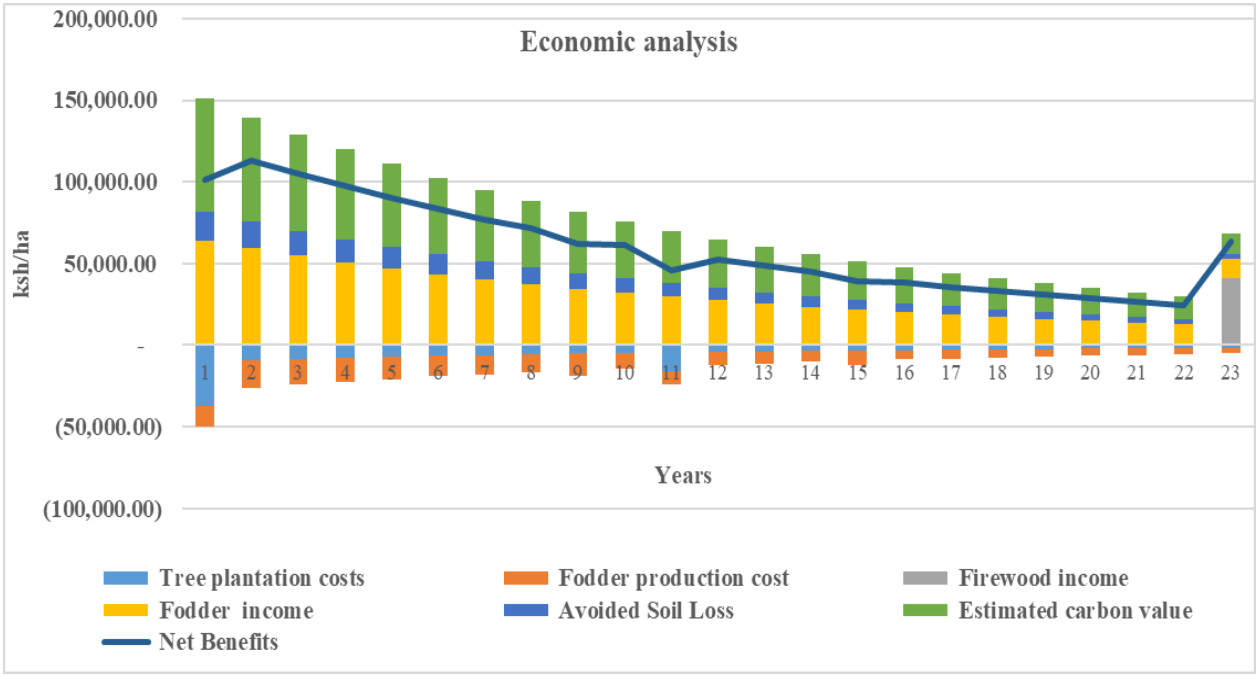


Figure 34. Annual net benefits from silvopastoral system

The tables below present the summary of the financial and economic analysis for the proposed interventions. Net present Value, Cost benefit ratio and Return on Investment are the appraisal criteria that were used for both analyses.

Table 7. Summary of NPV per proposed interventions for both financial and economic analysis

financial analysis	NPV 8%	B/C	ROI	Incremental NPV 8%
Fruits Orchards	5,825,080	11.9	10.9	5,799,840
PELIS system	1,108,983	6.9	5.9	1,083,742
Mixed AF components	640,526	3	2	640,526
Rangeland management	419,880	13	12	419,880
Riverside plantation	991,116	10.8	9.8	991,116
Roadside reserve protection	260,663	9.3	8.3	260,663
Silvopastoral system	399,798	2.12	1.12	374,557

Economic analysis	NPV 8%	B/C	ROI	Incremental NPV 8%
Fruits Orchard	6,798,233	13.7	12.7	6,772,992.36
PELIS system	3,904,066	21.7	20.7	3,878,825
Mixed AF components	2,815,418	10	9	2,815,418
Rangeland management	1,827,036	56	55	1,827,036
Riverside plantation	3,786,199	38	37	3,786,199
Roadside reserve protection	3,299,616	106	105	3,299,616
Silvopastoral system	1,372,950	4.8	3.8	1,347,709

4.1.2.6. Sensitivity analysis

The sensitivity analysis is used to assess how the change in inputs and the discount (margin tax rate) will affect such output as the net present value (NPV) of the restoration interventions. It appears that the NPV decreases as the discount rate increases. To test the robustness of both financial and economic analysis, the sensitivity analysis used the official discount rate of Kenya central bank of 8%. The analysis considered the change in discount rate, which might be linked to the inflation throughout the rotation period of several proposed interventions. The below table shows the results from economic analysis and financial analysis with different discount rates.

Table 8. Sensitivity analysis for both economic and financial analysis

Restoration packages	Financial analysis			
	NPV 3%	NPV 8%	NPV 13%	NPV 25%
Fruits orchards	10,180,071	5,825,081	3,641,550	1,525,061
PELIS system	1,108,983	1,108,983	1,108,983	1,108,983
Mixed AF components	1,116,577	640,526	411,727	196,050
Rangeland management	537,660	419,880	337,009	217,780
Riverside plantation	1,968,966	991,116	570,796	240,265
Roadside reserve protection	913,302	260,664	67,091	(15,100)
Silvopastoral system	700,228	399,798	260,671	131,873
	Economic analysis			
Fruits Orchard	11,723,032	6,798,233	4,319,934	1,898,180
PELIS system	3,904,066	3,904,066	3,904,066	3,904,066
Mixed AF components	4,564,930	2,815,418	1,927,843	1,029,930

Rangeland management	2,326,510	1,827,036	1,474,934	966,543
Riverside plantation	6,204,364	3,786,199	2,570,639	1,365,877
Roadside reserve protection	5,870,570	3,299,616	2,153,830	1,119,339
Silvopastoral system	2,243,189	1,372,950	939,055	504,991

4.1.2.7. Sensitivity analysis considering yield and price changes

Yield and prices are also the changing parameters that might determine the results from our models. It is therefore important to consider the both parameters in sensitivity analysis. Since we do not have the historical background of yield and prices of all the proposed value chains, the report considered 20% increase and 20% decrease of both prices and yields for optimistic and pessimistic scenarios respectively.
The table below present the sensitivity results of both financial and economic analysis.

Table 9. Sensitivity results of both financial and economic analysis

Intervention	Financial analysis		Economic analysis	
	Pessimistic scenario (NPV 8%)	Optimistic scenario (NPV 8%)	Pessimistic scenario (NPV 8%)	Optimistic scenario (NPV 8%)
Fruits Orchard with fodder	3,793,868	8,307,673	4,572,391	9,475,457
PELIS	773,877	1,482,394	3,009,943	4,799,467
Riverside plantation	666,716	1,368,535	2,988,601	4,636,814
Agroforestry systems	563,075	734,227	2,302,989	3,344,097
Rangeland management	256,825	619,169	1,382,550	2,307,757
Roadside protection	155,531	389,159	2,633,418	3,965,813
Silvopastoral system	134,005	722,838	912,528	1,890,621

From the above results, no proposed interventions are sensitive to the increase and decrease of price (20%).

4.1.2.8. The estimated implementation costs for proposed

interventions

The below table presents the implementation cost of the first year for each of the proposed interventions without considering management costs that will be accrued through the restoration period of interventions. Orchard and fodder production, and mixed agroforestry components represent the overall opportunities for agroforestry assuming that they are both equal.

Table 10. Implementation cost of FLR interventions

Interventions	Implementation costs per hectare /first year in Ksh	Number of hectares	Total Cost
Orchard and fodder production	95090	3616	343,845,440
Mixed agroforestry components	48720	3616	176,171,520
PELIS system	60850	2612	158,940,200
Rangeland	18049	42297	763,418,553
Riverside plantation	27612	3722	102,771,864
Roadside reserve protection	20845	971	20,240,495

4.1.3. Ecosystem services analysis

Some ecosystem values and services equally important for the ecological and socio-cultural heritage within the landscape are not included in the financial analysis (monetary valuation) due to the complexity of the evaluation criteria and insufficient data; however, it matters to highlight them. These ecosystem services are but are not limited to erosion control, Improving water resources, biodiversity conservation, and socio-cultural values such as traditional medicine, religion, and cults.

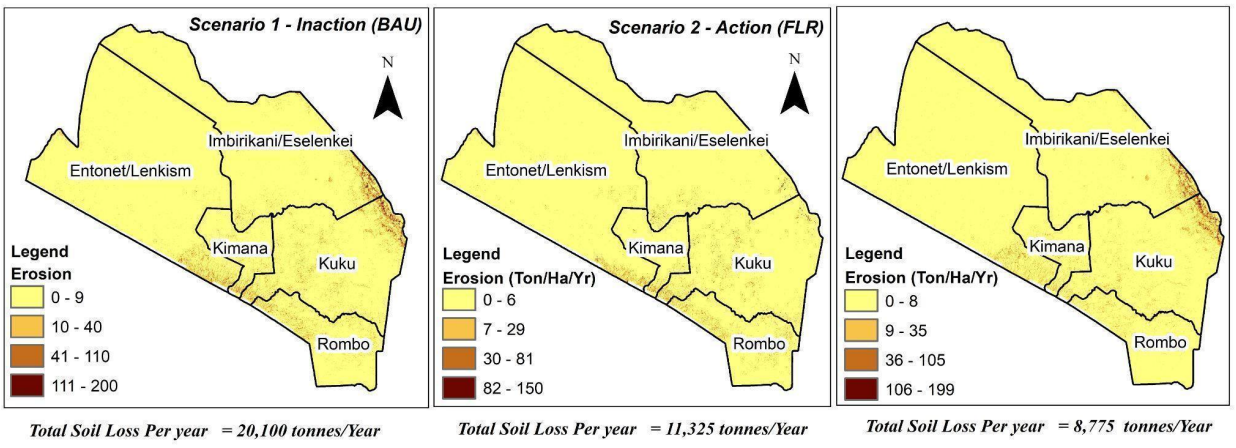


Figure 35. Soil erosion maps comparing land use in business as usual vs and land use with FLR action

4.2. Financing mechanisms

The economic, ecological, and environmental values of forest landscape restoration are increasingly being recognized, and many countries have understood the need to better manage their resources. Forest landscape restoration is a long-term process and will require a sustained source of funding. Even if there is an overreliance on grants, either from short-term or long-term projects, grants are not the only source of funding. Traditional financing sources of FLR/restoration in developing countries have been domestic public and private, foreign public and private, and international organizations, including NGOs. The global financing trends in general are changing, and a wave of economic liberalization is providing incentives for increased private sector participation (Schuyt, K., 2005).

The key to financing opportunities from both private and public funding sources for landscape restoration lies in recognizing its full economic and financial value. This necessitates estimating and recognizing the economic values of restoration and therefore recognizing the benefits provided by restoring landscapes. The restoration or loss of these landscape benefits can then be more realistically weighted against other possible uses of land. In a landscape context, it then becomes possible to better select areas within the landscape for different uses, allowing a potentially more complete range of values and benefits to be offered. This requires a proper pricing of forest goods and services and setting up a mechanism where money is transferred to pay these prices. One way of FLR finance is through Payment for Ecosystem Services (PES), which consists of selling environmental services from Forest Landscape Restoration such as carbon sequestered, watershed protection, and other biodiversity services. The PES mechanisms ensure that those who use these services pay those who supply these services. New opportunities for financing large-scale restoration are rising from the private sector in addition to public funding sources.

The section below discusses different sources of funding at the national and sub-national levels:

4.2.1. Multilateral and bilateral donors

Despite the declining overseas development assistance, efforts must be directed at maintaining current funds from multi and bilateral aid. The environment has been mainstreamed in all development activities under the new sector approach embraced by many donors' agencies. Successful proposals for forest landscape restoration from multilateral and bilateral donors need to explain how forest landscape restoration activities will address poverty alleviation while mitigating climate change. Furthermore, it is also important to use overseer development agencies to leverage private funding for restoration. The World Bank's sustainable Forest Market Transformation Initiative (SFMTI) and United State Agency for International Development (USAID) Biodiversity Conservation Network are perfect examples of initiatives for this category and can be expanded to attract more funding

4.2.2. Domestic public financing sources

This financing mechanism consists of using the government budget (national and county) for landscape restoration activities. The general strategy to increase public sources for large-scale restoration must involve activities such as improving expenditure policies on forestry, reforming macroeconomic policies and putting in place new incentives, subsidies, and technical and institutional changes to support restoration that provide a wide range of benefits. In the wake of

drought in the county, AREECA programme can leverage the various studies to produce s strategic policy brief targeting county and national government on the increased funding for sustainable rangeland restoration.

4.2.3. Private for-profit sources

This financing mechanism includes the mobilization of private, institutions, farmers, and households to invest in forest landscape restoration. The household investment will have an effect only if the project offers short-term benefits with an acceptable level of risk. Another example of private investment includes NGO that has forest business related like timber investment companies. Equity bank, one of the key project stakeholders and representing the larger business community, offers a perfect opportunity to expand restoration financing through not only its social-corporate responsibility plans (contributing to the 15 billion trees initiative[9]) but also creating local FLR investment plans targeting individual farmers and farmer groups. Other micro-financing institutions include the Agricultural Finance Corporation and Kenya Women Micro-financing.

4.2.4. Private non-profit organization

Private non-profit includes financing channelled through local communities, international foundations and NGO for forest landscape restoration activities. International NGOs have become important for providing new financing mechanisms, of which environment trust funds of foundations are particularly interesting for providing financing to natural resources. Trust funds are not philanthropic foundations, rather they raise money to carry out their programmes and have specific missions, interests and sometimes geographical focuses. Some of the existing networks that project can explore include; Justdiggit, CGIAR, Shokut Naretoi Community Project and Amboseli Ecosystem Trust (AET).

4.2.5. Adoption of Payment for Ecosystem services

A good example of payment for environmental goods is the certification body, which develops a market for suitably produced products that come with a certificate. Another example is the PES mechanism where downstream beneficiaries pay for the sustainable management of forests upstream. This mechanism provides opportunities for innovative funding for forest landscape restoration. While both of them are applicable in the sub-county, strong policy and institutional, frameworks are critical in the development and operationalization. An example of a company that can potentially work with the county to roll out a typical PES would be Simba cement. Given the complexity and politics involved in such a process, developing this mechanism requires a partnership with the national government where most of the natural resources management policies are developed.

4.2.6. Available sources of finance in Kajiado south

In agriculture, 10% of farmers obtained credit to cover a range of production costs including farm management, and the purchase of agricultural inputs such as seeds, fertilizers, pesticides, and water for irrigation. The loans were obtained from various sources including Cooperatives, other farmers, and banks at approximately 2% each as well as other sources (4%) which included women and community groups. Approximately 5% of the livestock farmers took loans from

[9] https://www.president.go.ke/wp-content/uploads/DOC-20221105-WA0163..pdf

cooperatives, banks, and other farmers to finance livestock production activities. Rangeland pastoralists obtain credit from group ranches and other support including stipends from partner organizations **(Source: Baseline study and capacity needs assessment for FLR Loitoktok, December 2021)**. There are also other sources of finances within the communities like VSLA and table banking that can be used to get money for restoration activities.

4.3. Livelihood and Food security analysis

Livelihoods and Poverty are societal factors contributing to restoration implementation paths. The two when not taken into account can be obstacles to effective implementation of restoration interventions. Integrated Development Plans (the 2013-2017 and the 2018-2022) indicates that high poverty level is one of the critical cross cutting development issues in Kajiado County. The document indicates that 47 per cent of the population in the county live below the poverty line. This coupled with an annual population growth rate of 5.5 percent way above the national average of 2.9 percent; implies the high population growth rate, which poses a challenge to reducing poverty but equally to handling the other crosscutting development issues particularly the issue of the environment and sustainable development including the restoration of landscapes. The challenges related to the two issues have been enumerated to include rapid urbanisation, human wildlife conflict, increased unemployment and mushrooming of informal settlements, which in combination can have adverse effects to the environment. This is happening in the context of global warming has led to adverse climatic changes such intensification of drought conditions of which the country suffers from time to time. Other effects of poverty and population growth include tremendous pressure being put on land use as evidenced by land subdivisions, degradation of vegetation due to rampant cutting of trees for firewood and charcoal production and environmental problems due to the liquid and solid waste created by human settlements.

Livelihood options denote a wide range and combination of activities and choices that people undertake in order to achieve their livelihood goals. They include productive activities, investment strategies and productive choices. These strategies are composed of activities that generate means of survival. Maasai communities are particularly vulnerable to the effects of droughts, as they are more likely to live in arid and semi-arid lands and are highly dependent on both water and forage for their livestock. To these pastoralists, livestock are not just a source of protein, but are representative of income, savings, social status, and security. During droughts, the demand for livestock products, such as milk and meat, are significantly lower than that of rains. This lack of demand is accompanied with a decrease in productivity, and pastoralists are often forced to sell their cattle instead of letting them starve to death (Orindi et al., 2007). The need for water access and forage for livestock has also resulted in increased conflicts between pastoralists and sedentary farmers. Together, these factors make it difficult to sustain a pastoralist lifestyle, resulting in many pastoralists switching to agricultural practices (Campbell et al., 2000).

The Maasai pastoralists whose main livelihood production is livestock have historically dominated Kajiado South. The existent hardships are both in terms of limited water and grazing land availability; putting greater challenges to their livelihoods. The pastoralists have used their land predominantly for keeping cattle and nothing else until recently when in-migrant farmers moved in, and the lands adversely fragmented for agricultural use. Even though Kajiado South is predominantly arid and semi-arid land, **Kimana** in particular rests on a wetland; hence making it attractive to both crop farming and pastoralists due to all year round presence of water. The

presence of a wetland, with water available for irrigable agriculture has provided a favourable environment for influx of small-scale farmers, necessitating competition for pasture and water in the area. Such mobility forces the migrants to adopt new livelihood strategies of taking to arable farming, due to the available vast quantities of land among the pastoralists (Ackah and Medvedev, 2010). Recent in-migrants include people from other ethnic communities, the majority Kikuyu, Kamba, and the Sukuma from Tanzania who came in primarily in search of pasture for their few cattle as a disguise. The secondary reasons for in-migration include good land for crops, moving away from diseases, land shortages and conflicts in their places of origin (Antezza, 2008). The greatest part of Kimana is of alluvial flood plains situated at an elevation of slightly less than 300m above sea level. The area has about 336,340 hectares of land potential for irrigation, among 434,390 hectares, which are potential for irrigation in Loitoktok region. The traditional staple food is rice but now maize has been adapted to. Acquisition of land by the in-migrants is by opening unused lands leased by the Maasai to in-migrants who practise agro-pastoralism. With a population of 19,644 people in Kimana, and a total fertility rate of 3.1 percent annum (KDHS, 2014), it is a sign that if this goes on uncontrolled it would lead to population explosion in the area. In 2005 for example, the group ranch had 844 members, everybody was given 60 acres /person for livestock rearing, and 2 acres / person in wetland for crop production, and they were given title deeds. They also got an urban plot where to settle.

The AREECA baseline survey shows that Kajiado South is the main producer of maize for both subsistence and commercial purposes in the entire county. The main food crops produced are maize (25,950ha, annually), beans (40,650 ha, annually), and tomatoes (940 ha, annually) (Kajiado County Integrated Development Plan 2018-2022). The County Government of Kajiado is in the process of a tomato-processing factory in Namelok area to develop the tomato value chain through value addition. The county practises both capture and culture types of fish farming. Main fish species are tilapia Nilotica and catfish with an annual production of 16,000 and 14,000 metric tonnes respectively. The capture of fish farming is practised in the rivers, wetlands ecosystems, and in water reservoirs. There are 85 No. fishponds occupying an area of 36,000 m^2 across the country with Kajiado South (FLR target area) leading with 45 No. ponds.

The proportion of households with food secure is only 45.2 per cent. This is reflected by the level of malnutrition in children. The comparison between children's nutritional status in Kajiado South and those at County and National levels is shown in Table 11. The sample size is 72 of which 14 children are from Entonet/ Lankisim, 15 children of Mbirikani/ Eselen, 22 children from Kuku, and 21 children of Rombo (Omondi et al. 2015).

Table 11. The level of Children malnutrition in Kajiado South

Malnutrition indicators	Kajiado South	Kajiado	Kenya Overall	Kenya rural
Stunted	47.2 %	18.2%	26.0%	29%
Wasted	5.5 %	3%	4%	4%
Underweight	15.3 %	8.1%	11%	17%
Obese	2.7 %	-	-	-

There is a need for an advocacy against many wives (i.e. discourage polygamy and early marriage). Most so, poverty, hunger, and dependence on natural resources, which are inherent

in the culture. Consider changing the eating habits (i.e. eating exclusively rice and meat) during harvesting time, but instead include other available foodstuffs for better nutritional status.

4.4. Culture and gender consideration in FLR

Referring to Kajiado County culture and heritage policy (2018), among the Maasai, the section (*Olosho*) forms the basic as well as the ultimate unit of land ownership. The fragile ecological conditions influenced the Maasai pastoral system that was marked by traditional patterns of migration in accordance with shifts in rainfall patterns. The Maasai had a well-organised system of transhumance with equally well-developed migratory patterns. For instance, during the dry season, they move their livestock to highlands (*osupuko*) and during wet seasons, they move back to semi-arid lowlands (*orpurkel*). Within the Maasai community, culture is inextricably intertwined with people, land and the environment. The community has developed culturally relevant rules and regulations that have helped sustain their natural environment. The commercialisation of land for the Maasai is a major driver for cultural erosion. Therefore, safeguarding and securing land tenure rights is key to the continuity of Maasai culture. The main assumptions being that: locals are better placed to conserve natural resources, only if the benefits exceed the costs of conservation, and are linked directly to their quality of life.

Table 12. Culture policy measures matches with Landscape restoration principles

Country Culture and heritage policy	Landscape restoration guiding principles
The County government shall use a community-based natural resource management (CBNRM) approach that combines conservation objectives with the generation of economic benefits to local communities	A forward-looking approach to restoring the functionality of the landscape. Aim to generate a suite of ecosystem goods and services from a range of restoration activities.
The County government in collaboration with the local and international agencies shall actively assist in the sustainable management, preservation and conservation of the environment.	Actively engage local stakeholders in decisions regarding restoration goals, implementation methods, and trade-offs
The County government shall align with the county spatial plan and other relevant policy documents.	Restore entire landscapes rather than sites to balance a mosaic of interdependent land uses. Consider a wide range of eligible technical strategies for restoring trees on the landscape
The County government shall promote conservation measures that are hinged on traditional rules and regulations which also sustains culture and environment based on indigenous knowledge systems	Actively engage local stakeholders in decisions regarding restoration goals, implementation methods, and trade-offs
The County government shall map, protect, preserve and gazette public land that is earmarked for cultural ceremonies and heritage sites for the Maasai people.	Adapt restoration strategies to fit local social, economic, and ecological contexts. Adapt restoration strategies to changes in human knowledge and societal values. Address ongoing loss and conversion of

Country Culture and heritage policy	Landscape restoration guiding principles
	primary and secondary natural forests

Some culture practices favour landscape restoration to take place:

- Communities value trees and shrubs since some are medicinal, as they provide shed and fodder to their goats and cattle.
- The communities collect dead wood for domestic use and charcoal production is for commercial activities
- The community has bylaws from their indigenous knowledge to manage where to graze and in which season.
- Communities let trees fall on their own, and don't burn charcoal to not cause a wildfire.
- Communities do not kill wildlife since they believe that if you eat game meat, you will be cursed to never get a chance to own cows, and you are given shameful names.
- During drought, Communities are not allowed to uproot grass but can cut the top to feed their goats and cattle. This is to give chance for the regeneration of grasses
- Communities move together when drought hits, they separate grazing areas for cows and calves.
- In the bush near places where *Murans* stay, trees are well maintained for shelter.
- However, in Kimana, urbanization is slowly changing the youth.

About Gender, evidence indicates that gender aspects are often overlooked and invisible when programs are planned and when leadership roles are being apportioned. It is worth noting that gender roles change across age and overtime and that power dynamics change. These changes and what they portend must therefore, be considered in planning and implementation of FLR programs. Paying attention to gender issues or putting on a gender lens in FLR projects quite simply means recognizing the different needs, capacities and contributions of women, girls, men and boys in landscape restoration programmes.

A baseline study (Envasses EC Ltd., 2022) was conducted in Kimana and Kuku wards on the 25,000ha landscape with about 7,000 households (49,173 people) including forest adjacent communities, farmers and pastoralists. Women were 49.9%, men were 50.1% and the youth was 30%. The study concluded that women are highly participating in FLR activities at various scales. The majority of the members of the Loitoktok Conservancy forum are potential partners in FLR implementation activities. They have 612 women (53%), 362 men (31%) and 182 youth (16%). Another potential partner group could be ALOCA, which has 317 men (73%), 86 Women (20%), and 30 youth (7%). Other FLR stakeholders include youth and women groups namely Mazingira Safi Women Group, Kajiado Environment Conservation Group, Naveta self-help group and Naretungishu self-help group. The existence of these groups and their involvement in FLR indicates that there are existing efforts to mainstream their participation in FLR interventions. The study further recommended that Women, men, youth and persons living with disabilities (PWDs) are supported to engage in FLR activities such as tree nurseries

establishment, tree planting (either in Loitoktok Forest or in their farms), apiculture and trainings in value addition and marketing across the value chains i.e., agriculture, livestock, trees, nature-based enterprises and fodder. It is important that such support be channelled through the established groups rather than individuals to ensure collective benefits from FLR and safeguard investments for the good of the local communities.

Another baseline survey (CESPAD and NIA. 2017) was conducted in Kajiado County, which covered ten sub-catchments targeting Water Resources Users Associations (WRUAs) in Kajiado County, revealed that the leaders' commitment to ensure social inclusion at grassroots is minimal, and resulting in lack of community involvement in planning and management of WRM and WASH projects. This makes sustainability and ownership of WRM and WASH projects in the county almost impossible. The low participation of the communities was attributed to: 1) Strong belief in the Maasai Culture that prohibits youths and women to take part in decision making; 2) Poor people are perceived to lack knowledge and capacity to contribute in the interventions hence excluded from decision making process; 3) Persons with disability (PWDs) are viewed as less important in the society and their ideas are not considered in decision making; and 4) Poor knowledge sharing mechanisms, lack of awareness creation as well as weak use of social accountability tools by the stakeholders in the county are some of the factors that have contributed to minimal public participation at the grassroots. FLR programs are guided by one of the principles of inclusive participation throughout the process as key to implementation success.

In fact, Gender mainstreaming in FLR is not about creating a separate line of activities and budget for Women or solely spending FLR budget on women's programs. Rather Gender-responsive FLR seeks to ensure that FLR programs and intervention is carried out in ways that advance gender equality and women's empowerment. Adopting a gender-responsive approach to landscape restoration therefore permits to eliminate harmful practices and cultural behaviours that may prevent women and girls to benefit from FLR outputs and outcomes as equally as men and boys do.

5. Enabling conditions for restoration of Kajiado South landscape

5.1. Kenya's policies, acts and strategies enabling forest landscape restoration

Kenya has several sectoral policies and laws relevant to forest landscape restoration (FLR) whose synergies and institutional collaboration will ensure restoration success. Specifically, for the subnational ROAM, Kajiado County regulatory and implementation frameworks would be very important for fast tracking the law enforcement and policy implementations with regard to landscape restoration.

The following Kenya's policies, laws, and strategies are enablers of FLR implementation:

Policy conditions:

1. Forest Policy, 2014. The overall Goal of the present cross-sectoral Policy is sustainable development, management, utilisation and conservation of forest resources and equitable sharing of accrued benefits for the present and future generations of the people of Kenya. In particular, the objectives of this Policy are to: a) Increase and maintain tree and forest cover of at least ten percent of the land area of Kenya; b) Establish an enabling legislative and institutional framework for development of the forest sector; c) Support forestry research, education, training, information generation and dissemination, and technology transfer for sustainable development; d) Promote public, private and community participation and partnership in forest sector development; e) Promote investment in commercial tree growing, forest industry and trade; f) Enhance management of forest resources for conservation of soil, water biodiversity.

2. National Environment Policy, 2013. This National Environment Policy proposes a broad range of measures and actions responding to key environmental issues and challenges. The goal of this policy is the better quality of life for present and future generations through sustainable management and use of the environment and natural resources. The objectives are to: (a) provide a framework for an integrated approach to planning and sustainable management of Kenya's environment and natural resources; (b) strengthen the legal and institutional framework for good governance, effective coordination and management of the environment and natural resources; (c) ensure sustainable management of the environment and natural resources, such as unique terrestrial and aquatic ecosystems, for national economic growth and improved livelihoods; (d) promote and support research and capacity development as well as use of innovative environmental management tools such as incentives, disincentives, total economic valuation, indicators of sustainable development, Strategic Environmental Assessments, Environmental Impact Assessments, Environmental Audits and Payment for Environmental Services; (e) promote and enhance cooperation, collaboration, synergy, partnerships and participation in the protection, conservation, sustainable management of the environment and natural resources; (f) ensure inclusion of cross-cutting and emerging issues such as poverty reduction, gender, disability, HIV and other diseases in the management of the environment and natural resources; (g) promote domestication, coordination and maximisation of benefit from strategic multilateral environmental agreements. The implementation of this Policy will be guided by the following principles: (a) environmental right; (b) right to development; (c) ecosystem approach; (d) total economic value; (e) sustainable resource use; (f) equity; (g)

public participation; (h) subsidiarity; (i) precautionary principle; (j) polluter pays principle; (k) international cooperation; (l) good governance; (m) benefit sharing; (n) community empowerment.

3. National land policy, 2009. This National Land Policy will guide the country towards efficient, sustainable and equitable use of land for prosperity and posterity. The Mission of the Policy aims at: promoting positive land reforms for the improvement of the livelihoods of Kenyans through the establishment of accountable and transparent laws, institutions and systems dealing with land (sec. 1.3). The overall objective of the National Land Policy is to secure rights over land and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Specifically the policy shall offer a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide: a) All citizens with the opportunity to access and beneficially occupy and use land; b) Economically viable, socially equitable and environmentally sustainable allocation and use of land; c) Efficient, effective and economical operation of land markets; d) Efficient and effective utilisation of land and land-based resources; and e) Efficient and transparent land dispute resolution mechanisms (sec. 1.4). Sustainable land use practices are key to the provision of food security and attainment of food self-sufficiency (sec. 118).

4. National Agriculture policy 2021: It provides measures towards sustainable use of natural resources, particularly land and water, which are expected to boost agricultural production and productivity. In addressing the challenges, the Policy recognizes institutional and capacity limitations in the Agricultural Sector and provides for functional linkages between the Sector and respective institutions whose domains have potential impacts on agricultural value chains. It takes cognizance of crosscutting issues, particularly agriculture in a changing climate, youth and gender, which have significant effects on agricultural development.

5. The Kajiado Culture and Heritage Policy 2018. The policy intends to protect, preserve the Maasai culture and way of life, as well as provide a framework for research and a committee to oversee cultural activities in the county. Kajiado Culture and Heritage Policy August 2018 Culture is recognized in Kenya as the foundation of the nation and as the cumulative civilization of the Kenyan people and nation. The Kajiado County government commits to promote all forms of cultural expressions through literature, arts, traditional celebrations, science, communication, information, mass media, publications, libraries and other heritage sites. The Kajiado Cultural Policy therefore guides people's participation in determining their own social and economic life that is based on their culture, and protects the language and culture. This document aims to preserve the flora and fauna of this culture.

6. Kajiado County Sustainable Forest Resources Management and Exploitation (Charcoal) Policy 2018. The goals of this policy document is to ensure at least 10% forest cover to ensure climate change adaptation and resilience in Kajiado County; promote sustainable exploitation of forest resources for holistic environmental conservation and protection and for the benefits of current and future generations of Kenyans; respect socio-cultural values and ensure access to justice, gender equity and inclusiveness; sustainably conserve water catchments areas by facilitating human capacity building for innovation and development among members of Conservation Forest Associations; attaining 90% appropriate awareness of forest conservation and protection affairs by the local communities the next one year for ownership and participatory forest conservation and protection.

7. Kajiado County Investment Policy 2018. The County Investment policy addresses private investments at the county. It is a comprehensive and harmonised policy to guide attraction, facilitation, retention, monitoring and evaluation of private investment. The County Investment policy further recognizes the central role of Kenya's Constitution (2010), which clearly delineates the complementary roles that national and county governments play in investment promotion. The County Investment policy also creates an institutional framework that fosters coordination for efficient investment attraction, facilitation, and a favourable investment climate. The policy actions proposed in the Kajiado County Kajiado Investment policy (KCIP) are designed to support and stimulate private sector development and improve the overall ease of doing business and competitiveness in the county. Kajiado County promote sustainable development, the respect of human rights by investors, environmental protection among others. The objective of this policy is to ensure responsible investment conduct by influencing investor behaviour by clearly articulating investor obligations.

8. Kajiado County Water and Sanitation Policy, 2019. The Kajiado County Water Policy is developed to facilitate the implementation of county functions stipulated under Part 2 of the Fourth Schedule to the Constitution of Kenya, 2010, which assigns specific functions related to water sector to counties. In addition, the policy seeks to facilitate realisation of Art. 43 (d), which provides for the right to clean and safe water in adequate quantities. In addition, the policy seeks to provide for a mechanism for intergovernmental collaboration, consultation and coordination in the water sector to ensure sustainable water sector management and governance. The policy will be implemented through the water sector plan, laws related to the water sector including regulations and rules, guidelines, and departmental strategic plans.

Legal framework:

1. **Constitution of Kenya 2010:** offers guiding principles on the governance of land and the environment. The proposed FLR activities are directly linked to constitutional provisions i.e. Article 60 (1) (e) provides for sound conservation and protection of ecologically sensitive areas while Article 69 (1) has provisions with direct relevance to the environment. Under Article 69, the State is obliged to (a) Ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources, and ensure equitable sharing of the accruing benefits and (b) work to achieve and maintain a tree cover of at least 10% of the land area of Kenya.

2. **County Governments Act, 2012 (No. 17 of 2012).** The cooperative system of devolved governance ensures adequate environmental protection through integrated county planning and management. Article 102 (d) obliges County governments to protect and develop natural resources in line with national policies. Article 103 (i) has provisions of County planning to work towards the achievement and maintenance of a tree cover of at least ten per cent of County area. County Governments (Amendment) Act, 2016 (No. 1 of 2016). Amends the County Governments Act by adding a new provision (6A), which concerns the physical location of county governments for each county listed in the (new) Third Schedule. The county governor shall confer the status of an urban area to the seat of the county government in accordance with the provisions set out in the Urban Areas and Cities Act

3. **Forests Act No. 7 of 2005 (Cap. 385) revised 2012.** This Act makes provision for the conservation and management of public and private forests and areas of forestland that require

special protection, defines the rights in forests and prescribes rules for the use of forestland.

4. **Forests (Participation in Sustainable Forest Management) Rules, 2009 (Cap. 385).** These Rules provide for sustainable forest harvest and community management of forest resources and provide with respect to granting of a permit, timber-licence, special-use licence, contract, joint management agreement, concession, community forest management agreement and cultivation-permit and the exercise of rights related to such authorizations. The Rules require the Kenya Forest Service to adopt a management plan covering a period of at least five years in respect of every state forest. A person who wishes to make an application to the Service for an authorization shall prepare a site-specific forest management plan in accordance with guidelines prescribed by the Service. Activities lasting more than one year require an operations plan for every year of activity. The Service shall evaluate the site-specific forest management plans and operation plans submitted to it. The Service may invite the private sector to participate in the sustainable management of state forests. The Rules define the basis for such participation (e.g. licence, concession or agreement) and set out eligibility requirements for potential participants. The Service may enter into a joint management agreement in the management of state forests. The primary purpose of a joint management agreement is to conserve the forest. An agreement may allow limited consumptive use of forest resources if sustainable.

5. **Natural Resources (Classes of Transactions Subject to Ratification) Act, 2016 (No. 41 of 2016).** This Act concerns classification of transactions regarding natural resources to make their granting subject to ratification by Parliament in accordance with Article 71 of the Constitution. Classes are set out in the Schedule to this Act and include, amongst others, the extraction of underground steam within a water conservation or other water resource protected area, the extraction of sea water within the territorial sea for private commercial use, excision or change of boundaries of gazetted national park or wildlife protection area, long term concession of a gazetted forest resource, excision or change of boundaries of gazetted public forests of nature reserves.

6. **Forest Conservation and Management Act No 34 of 2016.** This Act makes provision for the conservation and management of public, community and private forests and areas of forestland that require special protection, defines the rights in forests and prescribes rules for the use of forestland. It also makes provision for community participation of forestlands by community forest association, the trade in forest products, the protection of indigenous forests and the protection of water resources.

7. **Wildlife Conservation and Management Act, 2013 (No. 47 of 2013).** This Act provides for protection, conservation and management of wildlife in Kenya and related matters. The Act shall apply to all wildlife resources on public, community and private land, and Kenya territorial waters.

8. **Environmental Management and Coordination Act No.8 of 1999/revised 2012**. An Act to provide for the establishment of the National Environment Council, the National Environment Management Authority, the National Environment Trust Fund, the Environment Restoration Fund, the National Environment Action Plan Committee, the Standards and Enforcement Review Committee and the National Environment Tribunal, and to regulate various matters relating to the institutions established and various matters relating to protection of the environment including environmental impact assessment, environmental audit and monitoring of

the environment. It has many implementing regulations that enable and are useful for Forest Landscape Restoration (FLR) to be implemented and monitored: These are (1) Environmental (Prevention of Pollution in Coastal Zone and other Segments of the Environment) Regulation, 2003 (Cap. 387). (2) Environmental (Impact Assessment and Audit) Regulations, 2003 (Cap. 387). (3) Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006 (L.N. No. 160 of 2006). (4) Environmental Management and Coordination (Water Quality) Regulations, 2006 (Cap. 387). (5) Environmental Management and Coordination (Waste Management) Regulations, 2006 (Cap. 387). (6) Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009 (Cap. 387). (7) Environmental Management and Coordination (Amendment) Act, 2015 (No. 5 of 2015).

9. **The Climate Change Act, 2016 (No. 11 of 2016).** This Act shall be applied for the development, management, implementation and regulation of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya. The Act places duties on the national government and county governments to mainstream climate change responses into development planning, decision making and implementation and to respond in various other ways to climate change. The Act sets out principles of climate change planning and implementation of measures. The National Climate Change Council is established as an unincorporated body. The Cabinet Secretary for the time being responsible for environment and climate change affairs shall be the secretary to the Council. The Council shall provide an overarching national climate change coordination mechanism. It shall, among other things, approve and oversee implementation of the National Climate Change Action Plan. The Act also establishes a Climate Change Directorate and a Climate Change Fund. The Directorate shall be the lead agency of the government on national climate change plans and actions to deliver operational coordination and shall report to the Cabinet Secretary. A Director of Climate Change shall head the Directorate.

10. **Land Control Act 1967 (Cap. 302).** The Minister may, by notice in the Gazette, apply this Act to any area, if he considers it expedient to do so. The Minister may, by notice in the Gazette, divide a land control area into two or more divisions, if he considers it expedient to do so. The Minister shall, by notice in the Gazette, establish a land control board for every land control area or, where it is divided into divisions, for each division. Each of the following transactions: (a) the sale, transfer, lease, mortgage, exchange, partition or other disposal of or dealing with any agricultural land which is situated within a land control area; (b) the division of any such agricultural land into two or more parcels to be held under separate titles, other than the division of an area of less than twenty acres into plots in an area to which the Development and Use of land (Planning) Regulations, 1961 for the time being apply; (c) the issue, sale, transfer, mortgage or any other disposal of or dealing with any share in a private company or cooperative society which for the time being owns agricultural land situated within a land control area, is void for all purposes unless the land control board for the land control area or division in which the land is situated has given its consent in respect of that transaction in accordance with this Act. The Minister shall establish for each province which contains a land control area, in consultation with the Provincial Commissioner of that province, a provincial land control appeals board and a Central Land Control Appeals Board is established.

11. **Land Act (Act No.6 of 2012).** An Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalise land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes.

This Act makes provision for a wide variety of matters regarding public and private land and community land (as defined respectively by Articles 62, 63, 64 and 260 of the Constitution), and in particular provides for the sustainable administration and management of land and land-based resources. It also provides for (compulsory) acquisition of land.

12. **Land Registration Act (Act No.3 of 2012).** This Act makes provision for a wide variety of matters regarding public and private land and community land (as defined respectively by Articles 62, 63, 64 and 260 of the Constitution), and in particular provides for the sustainable administration and management of land and land-based resources. It also provides for (compulsory) acquisition of land. The Act principally concerns the registration of interests in land. This Act shall apply to: (a) registration of interests in all public land as declared by Article 62 of the Constitution; (b) registration of interests in all private land as declared by Article 64 of the Constitution; and (c) registration and recording of community interests in land.

13. **Land Registration (Registration Units) Order, 2017 (S.I. No. 277 of 2017).** This Order of the Cabinet Secretary implements provisions of the Land Registration Act in respect to the establishment and operation of land registration units as constituted under section 6 (I) of the Act. The Cabinet Secretary establishes registration units as set out in the First Schedule. Upon establishment of a registration unit under regulation 3, the office or authority responsible for land survey shall commence the activities set out in section 6 of the Act, as applicable including the carrying out of such survey works as may be deemed necessary to enable the implementation of the Act. Work of the land registration also concerns conversion of public land into private land.

14. **National Land Commission Act (Act No. 5 of 2012).** This Act provides with respect to the administration, structure, operations, powers, responsibilities and (additional) functions of the National Land Commission established by Article 67 of the Constitution and aspects of management and administration of land in accordance with the principles of land policy set out in Article 60 of the Constitution and the national land policy. Pursuant to Article 67(2) of the Constitution, the functions of the Commission shall include the management of public land on behalf of the national and county governments, the recommendation of a national land policy to the national government, encouraging the application of traditional dispute resolution mechanisms in land conflicts and advising the national government on land registration. The Commission shall recommend legislation to provide for investigation and adjudication of claims arising out of historical land injustices for the purposes of Article 67 of the Constitution and shall establish county land management boards for purposes of managing public land.

15. **Land Consolidation Act, Chapter 283/Revised 2012.** This Act makes provision for various matters relating to the adjudication of title in land in areas of Trust land to which this Act applies in virtue of section 2 of this Act. The Minister may, at the request of a local authority, by Order, direct that this Act shall apply to such area of Trust land as is specified in the Order for purposes of the ascertainment of rights and interests in, and the consolidation of, and the registration of title to, any such area of Trust land (other than land to which the Land Adjudication Act applies). This land, called an adjudication area, shall be subject to rules of this Act relative to adjudication of title, i.e. of ownership or the existence under native law and custom of any right or interest whatsoever in, to or over any land in an adjudication area. There shall be for this purpose an Adjudication Officer in each adjudication section who shall exercise general control and supervision over the adjudication and registration of the adjudication area and may issue general or special directions as regards adjudication. This Officer shall appoint a Committee, which shall prepare an Adjudication Plan and carry out other functions, and the

Minister shall appoint an Arbitration Board. The Committee shall set aside land in the adjudication section such land as may, in its opinion, be required for the needs of the community. Whereas, Land Consolidation Regulations (Cap. 283), under the Land Consolidation Act, specify, in the Schedule, fees to be paid by each landowner whose name is contained in a Consolidation Register in respect of any consolidation area or section in any district specified in the first column of the Schedule. The Regulations also stipulate that no fee shall be refunded except by order of the Chief Land Registrar.

16. **Agriculture Act (Cap. 318).** Consolidated version of 2012 of Act No. 8 of 1955 as amended last by Act No. 6 of 2012. An Act of Parliament to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry. This Act provides for the establishment of the Agriculture, Fisheries and Food Authority, the administration of matters of agriculture and the preservation, utilisation and development of agricultural land and related matters.

17. **Kenya Agricultural and Livestock Research Act, 2013 (No. 17 of 2013).** This Act provides an administrative framework for agricultural research in Kenya and provides for the promotion and coordination of agricultural research activities in Kenya. It establishes the Kenya Agricultural and Livestock Research Organisation and establishes the research institutes specified in the Second Schedule. It also establishes a Scientific and Technical Committee.

18. **Community Land Act, No. 27 of 2016.** This Act makes provision for the recognition, protection and registration of community land rights and provides for conversion of community land, special rights and entitlements with respect to community land, environment and natural resources management of community land and settlement of disputes relating to community land. In the performance of the functions and exercise of powers under this Act, every person dealing with community land shall be guided by principles and values set out in the Constitution.

19. **Water Act, 2016 (No. 43 of 2016).** This Act provides for the regulation, management and development of water resources and water and sewerage services in line with the Constitution. Authorities shall, in administering or applying this Act, be guided by the principles and values set out in Articles 10,43. 60 and 232 of the Constitution. It establishes the Water Resources Authority ("Authority"), the National Water Harvesting and Storage Authority, the Water Services Regulatory Board, the Water Sector Trust Fund and the Water Tribunal. This Act shall apply to Community land but any powers and functions conferred or imposed under the Act affecting land shall, in respect of community land, be exercised and performed subject to any written law relating to that land. The provisions of the Environmental Management and Coordination Act, 1999 relating to water resources conservation and protection and water pollution control shall be exercised subject to the relevant provision of this Act and only in the event that the Board has failed or neglected to take appropriate action to exercise its powers and functions under this Act.

20. **Energy Act 2019.** This Law essentially consolidates the laws relating to all forms of renewable and non-renewable energy in Kenya and provides extensively for the promotion of the efficient management of energy within the country. The Cabinet Secretary, in consultation with stakeholders, is empowered by this legislation to develop and publish a national energy policy, which shall be reviewed every five years. Annexed to this is the power to develop, publish and review energy plans in respect of coal, renewable energy and electricity. The Cabinet

Secretary is also required to publish a report on the implementation of the integrated energy plan.

21. **Mining Act, 2016.** Part XI of the Mining Act provides that mining operations must comply with the laws concerning the protection of the environment, use of water, use of land. Before a person is granted a mining licence, they are expected to obtain an Environmental Impact Assessment, and an approved Environmental Management Plan. Equally, prospecting, retention and mining licences cannot be granted unless the applicant submits a site mitigation and rehabilitation or mine-closure plans for approval. In this regard, the applicant is required to provide an Environmental Protection Bond (or financial security) sufficient to cover any costs associated with the implementation of the environmental and rehabilitation obligations. Rehabilitating mines in degraded areas or other areas affected by mining activities is part of landscape restoration, and in this framework, the environmental protection bond could be a source of restoration finance.

22. **Kajiado County Disaster Management Act, 2016 (No. 6 of 2016).** This Act designs and establishes the Kajiado county disaster management structure and provides with respect to disaster prevention and mitigation in Kajiado County. It establishes the Disaster Management Committee, the Disaster Management Directorate, defines functions and powers of the Committee and the Directorate, and provides with respect to the administration of the funds. The Act sets out the measures to be taken by the County Government for purposes of disaster management. For the purposes of this Act, a disaster exists when the Governor declares by notice that a disaster exists after receiving advice from the Committee that a disaster has occurred. When an emergency exists or is imminent or a disaster has occurred or is imminent, the Directorate or other persons designated in the Plan may cause the County Disaster Management Plan to be implemented. The Act establishes a County Disaster Management Fund.

National Strategies, plans and Programmes relative to FLR

1. **Kenya Vision 2030. Kenya vision 2030** is a national strategy covering the period from 2008 to 2030. Developed through an all-inclusive and participatory stakeholder consultative process, the Vision aims to transform Kenya into a newly industrialising, middle-income country providing a high quality life to all its citizens by the year 2030. The strategy is based on three pillars: economic, social and political.

2. **National Strategy for Achieving and Maintaining Over 10% Tree Cover by 2022 (2019-2022).** The overall goal of the strategy is to accelerate actions towards the achievement of maintaining 10% national tree cover, for environmental integrity and social economic development. Ten strategic objectives are set out, namely : 1) to produce 1.8 billion quality tree seedlings by 2022 needed to increase tree cover to 10%; 2) to implement national policies , legislation and rules that require increased tree planting by 2022; 3) to strengthen institutional capacity of Kenya Forest Service to implement its mandate, including fire management and law enforcement and compliance strengthened; 4) to enhance conservation and protection of natural forests on public, community and private lands and rehabilitation of degraded areas; 5) to strengthen coordination and collaboration in the governance of the forest sector; 6) to establish commercial forest plantation on public, private and community lands to provide adequate and sustainable timber, poles and fuelwood for industrial and domestic consumption; 7) to implement innovative restoration programmes; 8) to enhance national tree planting campaigns through

national and county tree planting events, public education and awareness; 9) to adopt use of alternative energy sources and efficient wood conversion and utilisation technologies by institutions, industry and households; 10) to strengthen forest resources assessment, monitoring and reporting capabilities of forest sector institutions.

3. **Kenya's Updated Nationally Determined Contribution (NDC) 2020-2030.** NDC aims to ensure a climate resilient society through mainstreaming climate change adaptation into Development Plans and implementing the following adaptation actions: enhancing the adaptive capacity and climate resilience both at national and local level and across all the sectors of the economy: disaster risk reduction, agriculture, environment, energy and infrastructure, water and sanitation, health, population and urbanisation, gender, youth and other vulnerable groups, tourism, private sector; enhancing climate resilience of local communities through financing of locally led climate change actions; enhance uptake of adaptation technology especially of women, youth and other vulnerable groups, incorporating scientific and indigenous knowledge; enhancing investment in ocean and blue economy. The most relevant mitigation activities included in the NDC are: increasing of renewables in the electricity generation mix of the national grid; enhancement of energy and resource efficiency across the different sectors; achievement of a tree coverage of at least 10% of the Country land area; achievement of land degradation neutrality; scaling up Nature Based Solution (NSB) for mitigation; enhancement of REDD+ activities; clean, efficient and sustainable energy technologies to reduce over-reliance on fossil and non-sustainable biomass fuels; low carbon and efficient transportation systems; climate smart agriculture; sustainable waste management system; harness the mitigation benefits of the sustainable blue economy, including coastal carbon Payment for Ecosystem Services (PES).

4. **National Forest Programme (NFP) 2016-2030.** The economic development of any country centres on its environment, natural resources and the choice of appropriate conservation and management strategies. Forest development in Kenya is dependent on the rich natural resource base especially with regard to tourism development, energy production, food security, timber production, and provision of a host of non-timber forest products that directly or indirectly contribute to the livelihoods of citizens. In addition, forests support the provision of environmental services including resilience to the impacts of climate change. However, the natural resource base is facing pressure from increased population growth and unsustainable use of forest resources.

5. **National Forest and Landscape Restoration Implementation Action Plan 2021-2025 (FOLAREP).** Kenya Forest Service in support from WWF, IUCN, WRI, FAO and NACOFA has developed the FOLAREP 2022-2026 to accelerate interventions on the ground. The goal is to sustainably manage deforested and degraded landscapes and contribute to the country's Bonn Challenge and AFR100 commitment to restore 5.1 million hectares by 2030. This five-year plan is being developed following a rigorous multi-stakeholder consultative process informed by the country's Restoration Opportunities Assessment Technical Report (2016) and relevant national and county level policies, strategies and legal frameworks.

6. **The National Climate Change Response Strategy (NCCRS) 2010.** The National Climate Change Response Strategy is a strategic document with a multi-sectoral approach whose vision is for a prosperous and climate change resilient Kenya. The objective is to strengthen and focus nationwide actions towards climate change adaptation and Global Greenhouse Gas emission mitigation. In summary, the objective of the NCCRS is to respond to

climate change by, among other aspects: enhancing understanding of the global climate change negotiations process, international agreements, policies and processes and most importantly the positions Kenya needs to take in order to maximise beneficial effects; assessing the evidence and impacts of climate change in Kenya; recommending robust adaptation and mitigation measures needed to minimise risks associated with climate change while maximising opportunities; enhancing understanding of climate change and its impacts nationally and in local regions; recommending vulnerability assessment, impacts monitoring and capacity building framework needs.

7. **Kenya Climate Smart Agriculture Strategy (2017-2026)**. The Vision of the Kenya Climate Smart Agriculture Strategy (CSA) 2017 – 2026 is a climate resilient and low-carbon growth sustainable agriculture that ensures food security and contributes to national development goals. Its Mission is to facilitate agriculture that sustainably increases productivity, enhances resilience and minimises greenhouse gas emissions. The overall objective of this strategy is to build resilience and minimise emissions from agricultural farming systems for enhanced food and nutritional security and improved livelihoods. The Specific Objectives are: 1) To enhance adaptive capacity and resilience of farmers, pastoralists and fisher-folk to the adverse impacts of climate change. 2) To develop mechanisms that minimise greenhouse gas emissions from agricultural production systems. 3) To improve coordination and collaboration among institutions and stakeholders in climate smart agriculture. 4) To address crosscutting issues that adversely affect or enhance CSA.

8. **Climate Smart Agriculture Implementation Framework (2018)**. This Climate Smart Agriculture Implementation Framework (KCSAIF) is a nationwide sectoral document aiming at providing guidance in mainstreaming Climate Smart Agriculture (CSA) together with providing options for implementing the Kenya Climate Smart Agriculture Strategy 2017-2026, launched in March 2017. The Framework envisions a climate resilient and low carbon growth sustainable agriculture that ensures food security and contributes to national development goals in line with Kenya Vision 2030. Focal points of the document are (i) exploration of climate smart practices relating to sustainable intensification of crop, agroforestry, livestock and fisheries production; (ii) adaptation and mitigation practices in livestock production systems; (iii) efficient management of agricultural commodity value chains; (iv) opportunities to leverage climate finance for CSA; (v) knowledge sharing and effective learning; (vi) strengthening key institutions and systems; and (vi) mainstreaming CSA elements into national policies and development planning process.

9. **National Water Master Plan 2030**. The National Water Resources Master Plan of Kenya implements Kenya Vision 2030 with respect to water resources. Water is defined as an essential resource to support the development activities planned under Vision 2030. In order to achieve Vision 2030, the proper implementation system and planning of water resources management are essential to be able to cope with the increasing water demands of domestic, irrigation, industries, etc. while conserving the catchments' sustainability. These new developments and global climate change require renewal of the National Water Master Plan in 1992. NWMP 2030 aims to present a framework for water resources development and management consistent with the country's social and economic development activities.

10. **National Adaptation Plan 2015-2030**. This National Adaptation Plan (NAP) is a nationwide sectoral document aiming to consolidate the country's vision on adaptation supported by macro-level adaptation actions that relate with the economic sectors and county level vulnerabilities to enhance long-term resilience and adaptive capacity. This NAP builds on the Adaptation Technical Analysis Report (ATAR) that provides a detailed analysis of sectors and vulnerabilities in the various counties, identified adaptation needs in various economic processes, and developed a long list of potential adaptation actions. To achieve the overall goal, the NAP identified the following strategic objectives (i) highlight the importance of adaptation and resilience building actions in development; (ii) integrate climate change adaptation into national and county level development planning and budgeting processes; (iii) enhance the resilience of public and private sector investment in the national transformation, economic and social and pillars of Vision 2030 to climate shocks; (iv) enhance synergies between adaptation and mitigation actions in order to attain a low carbon climate resilient economy; and (v) enhance resilience of vulnerable populations to climate shocks through adaptation and disaster risk reduction strategies.

11. Kajiado County Integrated Development Plan 2018-2022. The theme of the 2018-2022 CIDP is "Fostering social economic and political development for sustainable growth". The plan implementation period coincides with the term of the current county government administration hence its emphasis on the full implementation of aspirations of the county residents. This plan sets out the programmes and projects, financing framework and the timelines that will guide the implementation of the county priorities in the five years. The plan is aligned to the Medium Term Plan III pillars (Social, Economic and Political/ Governance) and is further classified into the structure of County Government. On Social pillar, the county aims to focus on accessible and affordable healthcare; Quality, relevant and accessible pre-school education; Skills development and youth empowerment, women and persons with disabilities; environmental management and accessibility to clean water. Economic pillar will mainly focus on Agriculture and Livestock production and productivity; and promotion of trade and tourism. The plan also focuses on Infrastructure development including roads, parking and energy; and Information Communication Technology (ICT) clustered as foundations/enablers.

12. Kajiado County Spatial Plan 2019-2029. County Spatial Planning is a tool put in place to provide a guide for exploitation and use of land with the aim of achieving the delicate balance to meet development/growth demands and sustainably harness the resource for integration. Planning ensures order, environmental protection, safeguards against depletion and rational methods preferred to sustain land resources and human activities undertaken. County and national space planning, commonly referred to as spatial planning, navigates a process of balancing rational use of space to achieve order, preference and better use. This is expressed in strategies that take the shape of spatial forms (mapping), statistical projection or policy statements. Therefore, highly priced undertakings that sustain and support community practices (human activities) are protected and nurtured through protective/conservation methods. The aggressive and modern enterprises are equally managed through controlled mechanisms. Such practices may include enterprises like urbanisation and industrialization that enjoy preference over traditional non market- oriented enterprises.

5.2. Assessment of key success factors for forest landscape restoration

The following table summarises the findings of the Rapid Restoration Diagnostic exercise in the workshop. The goal was to identify the gaps and bottlenecks to be addressed in the course of the implementation of the restoration interventions. It is important to note that not all factors are required in order to be successful. In the results tables below, the column labelled “Ability to Improve” refers to the effort required to improve the situation related to the feature, with “High” being the most probable to change and “Low” being the most difficult to change. The analysis of the successful restoration case studies in several countries suggest that a successful restoration exhibits three common themes:

1. **A clear motivation**. Decision makers, landowners, and/or citizens were inspired or motivated to catalyse processes that led to forest landscape restoration.

2. **Enabling conditions in place**. A number of ecological, market, policy, social, and institutional conditions were in place that created a favourable context for forest landscape restoration

3. **Capacity and resources for sustained implementation**.

Capacity and resources were mobilised to implement forest landscape restoration on a sustained basis on the ground. From the table below, restoration strategies were proposed to respond to the existing problems before or during the restoration process. The proposed strategies marked red should be addressed before the restoration process while strategies marked yellow can be implemented during the restoration process. The other remaining marked green success factors are in place and favour the restoration process.

Table 13. Results for FLR diagnostic assessment

Theme	*Feature*	*Key success factor*	*Response*	*Proposed strategies to improve*
Motivate	a. Benefits	Restoration generates economic benefits	Yes	
		Restoration generates social benefits	Yes	
		Restoration generates environmental benefits	Yes	
		Benefits of restoration are publicly communicated	Partially	Creating awareness among communities
		Opportunities for restoration are identified	Partially	communicate the results from ROAM assessment,
		Crisis events are leveraged	Yes	
	d. Legal requirements	Law requiring restoration exists	Yes	
		Law requiring restoration is broadly understood and	Partially	Law enforcement needs to be enhanced. The government plans to recruit additional rangers and

Theme	Feature	Key success factor	Response	Proposed strategies to improve
		enforced		forest extensionists who could assist.
Enable	e. Ecological conditions	Soil, water, climate, and fire conditions are suitable for restoration	Partially	Adaptively manage or adjust restoration plan
		Plants and animals that can impede restoration are absent	No	Remove invasive plants
		Native seeds, seedlings, or sources populations are readily available	Partially	Working with KFS and KEFRI to increase the availability of species. Capacity building and subsidise prices of seeds
	f. Market conditions	Competing demands (e.g., food, fuel) for degraded forestlands are declining	No	Using CBA results from ROAM assessment, improve livelihoods and food security, alternative source of energy like briquettes, biogas etc.; promoting NTFPs
		Value chains for products from restored areas exists	Partially	Improve value chains and create incentives and linking producers to markets. For example livestock products, crops, NTFPs
	g. Policy conditions	Land and natural resource tenure are secure	Yes	
		Policies affecting restoration are aligned and streamlined	Partially	Conduct policy assessment and create awareness, enforcement is needed
		Restrictions on clearing remaining natural forests exist	Yes	
		Forest clearing restrictions are enforced	Partially	Additional strengths and Capacity building for effective law enforcement
	h. Social conditions	Local people are empowered to make decisions about restoration	Partially	Structures are locally established but more capacity building and training of stakeholders, sensitization and empowerment of community, local engagement
		Local people are able to benefit from restoration	yes	
	i. Institutional conditions	Roles and responsibilities for restoration are clearly defined	Partially	Mapping all stakeholders and define roles and responsibilities
		Effective institutional	Partially	Capacity support of national and

Theme	Feature	Key success factor	Response	Proposed strategies to improve
		coordination is in place		sub-national taskforce to improve coordination
Implement	j. Leadership	National and/or local restoration champions exist	Yes	
		Sustained political commitment exists	Yes	
	k. Knowledge	Restoration "know how" relevant to candidate landscapes exist	Partially	Conduct capacity building of stakeholders
		Restoration "know how" transferred via peers or extension services	Partially	promote FFS and visits
	l. Technical design	Restoration design is technically grounded and climate resilient	Partially	National FLR plan exists but a grounded sub-national plan is needed. Sectoral management plan exist and need to be aligned with restoration plan
		Restoration limits "leakage"	Yes	
	m. Finance and incentives	Positive incentives and funds for restoration outweigh negative incentives	Yes	
		Incentives and funds are readily accessible	No	Develop incentive mechanisms that promote restoration process, adequate budgetary allocation by government and private sector, encourage local financing mechanisms, prioritisation of restoration activities. There is an establishment of tree growing fund
	n. Feedback	Effective performance monitoring and evaluation system is in place	Partially	There is a national forest monitoring systems exist but not fully operational, applying restoration barometer , there is FLR monitoring framework
		Early wins are communicated	Partially	Communicate and visit where restoration has succeeded

GREEN= IN PLACE

YELLOW= PARTLY IN PLACE

RED= NOT IN PLACE

Although, it is important to note that not all factors are required in order to be successful, a large number of these factors were in place where restoration has occurred in the past. A successful restoration should provide economic, environment and social benefits. The above table presents the overview of FLR success factor as a starting point for development and implementation of restoration projects.

The absence of success can be caused by barriers, which may need to be removed before progress can be made. One of the key benefits of the success factor analysis is that it facilitates a discussion by the project participants over, and learning about the factors that will lead to project success. These factors can be built into the project monitoring and evaluation framework and revisited for example every 6 months or annually on the project. The project team can also be clear about which factors it is attempting to influence, or remove barriers.

5.3. Kajiado stakeholders' engagement in the ecosystems restoration

Stakeholders include any people or organizations that can directly or indirectly affect or be affected by landscape restoration initiatives. Four broad stakeholder classes have been identified in Kajiado South landscapes:

1. Local communities: these includes individual farmers, farmer groups or associations, and Cooperatives (e.g. Entuara Entomonok Dairy Cooperative),
2. Governments: Ministries and parastatal agencies (e.g. KFS, KWS, NEMA, KEFRI)
3. Private sector: e.g. Simba cement company,
4. Civil society organizations and Community based organisations (ALOCA, AET).

As shown by table 14, these groups often have different values and influences, interests and approaches. Interests can also vary within each group. For example, land and water agencies could have conflicting interests with mining and energy agencies. Some civil society organizations focus on community livelihoods, while others work on biodiversity conservation. The process of designing and implementing FLR brings these stakeholders together as equal partners to negotiate mutual interests and collaborative partnerships. The following section summarizes the roles and interests of each stakeholder group, as well as the potential benefits FLR can provide them. Three stakeholder clusters have been identified:

1. **Local communities:** Communities have important knowledge about forest management, wildlife, rangelands management, adapted agriculture practices and water resource protection. This knowledge is valuable for designing, implementing, monitoring and evaluating FLR intervention in these landscape zones. For these reasons, local communities can and should play a pivotal role in ensuring the effectiveness and sustainability of any FLR efforts in Kajiado South.

   There are multiple benefits for local communities participating in the implementation of the restoration programme. Such benefits of FLR to local communities include (but not limited to):

   - Increased access to products and services in the landscape contributing to improved livelihoods and social security in the long term;
   - More economic opportunities through restoration-related jobs and activities, and through trade and value-addition of forest products and services;

- Improved grassroots institutions and multi-stakeholder platforms as a pre-condition or by-product of FLR processes, which contributes to addressing inequality gaps in gender, resource access and benefits, participation and representation.

2. **Government:** Government stakeholders include ministries and agencies that manage forests, wildlife, land, livestock, water resources and related livelihood issues in the landscape. Their interests can include other sectors such as agriculture, mining and infrastructure. Some are based within the landscape or outside it in Kajiado county and central government in Nairobi. Government stakeholders develop and implement laws and policies. Depending on their roles, locations and administrative levels, their decisions will affect the landscape to different degrees. However, they often have the strongest impacts on the landscape and on other stakeholders.

   Potential benefits of FLR for government stakeholders include (but not limited to):
   - Increased progress towards National and Kajiado county targets on restoration, biodiversity conservation and poverty reduction
   - Boosted local economic development and livelihoods through improved value chains, taxes and revenues
   - Reduced gender and social inequalities and improved livelihoods among communities
   - Closer engagement with local communities and other stakeholders while developing and implementing policies and strategies
   - Improved stakeholder understanding of, and compliance with, relevant laws and policies enabling landscape restoration
   - Increased policy impacts on long-term ecological sustainability and economic efficiency
   - Reduced conflict over natural resources, especially land, forests and water

3. **Civil society organizations (international, national CSOs and CBOs):** the CSOs and CBOs include non-profit and non-governmental organizations, community-based organizations and research and education institutions. Their interests vary from human rights to animal rights, from environmental sustainability to social-economic development. They play a supporting role, helping Kajiado communities and the County government to achieve restoration goals. Their work ranges from data and research to financing and implementing FLR activities. Their presence is important in landscapes where farmers and community groups lack capabilities (knowledge and skills) and resources to initiate FLR activities.

   Potential benefits of FLR for CSOs and CBOs stakeholders include (but not limited to):

   - Opportunities to introduce their perspectives and to influence local stakeholders through platforms created through FLR processes
   - Improved access to local knowledge and resources

Table 14. Stakeholder analysis matrix

High Influence/ Low Interest	**High influence/ High Interest**

1. Ministry of lands 2. Opinion leaders 3. National land commission 4. Shokut Naretoi Community Project (SNCP), 5. Greening Loitoktok 6. Private sector, 7. Faith (religious) based Organisation, 8. Cement company, 9. Horticulturists, 10. Cement Company 11. Media	1. Ministry of environment and forestry 2. Ministry of agriculture, livestock, fisheries and cooperative 3. Ministry of water, irrigation and sanitation 4. Ministry of interior and coordination of national government 5. Kenya Forest Service (KFS) 6. Kenya wildlife service (KWS) 7. County government of Kajiado 8. Water Resource Authority (WRA) 9. Kenya Forest Research Institute (KEFRI) 10. National Environment Management Authority 11. (NEMA) 12. Loitoktok Community Forest Association (LCFA) 13. Water Resource Users Association (WRUAs) 14. CGK – Environment department 15. Big Life Foundation 16. Maasai Wilderness Conservation Trust (MWCT) 17. International Fund for Animal Welfare (IFAW) 18. Amboseli Land Owners Conservancies Association (ALOCA) 19. Ewasongiro South Development Authority (ENSDA) 20. Community groups and leaders, 21. Amboseli Ecosystem Trust (AET) 22. Amboseli Tsavo Community Rangers Association 23. International union for conservation of nature (IUCN) 24. Worldwide fund for nature (WWF) 25. World Resources Institute (WRI) 26. African Conservation Centre (ACC) 27. Africa Wildlife Foundation (AWF) 28. Sustainable Agriculture Community Development Programme (SACDEP)
Low influence/ low interest	**Low influence/ high interest**
1. Research and Learning institution (KMTC) 2. Financial institutions 3. Kwetu ni Loitoktok 4. Entuara Entomonok Dairy Cooperative	1. Individual farmers, Communities, 2. Self-help groups (Naretungishu, Naveta, Entuara Entomonok, Ramayana, Rongai) 3. Group ranches 4. Ewaso Nyiro south development authority (ENSDA) 5. Greening Loitoktok/ Entonet 6. Opinion leaders, 7. Schools Imurtot 8. Nairobi conservancy-CFA Forum 9. National Alliance for community forest associations (NACOFA) 10. NB-Enterprises, 11. Matonyok organisation 12. Mazigira Safi Women Group 13. Entuara Entomonok Dairy Cooperative 14. Seed ball Kenya 15. Nature Kenya

6. AREECA-ROAM implementation plan

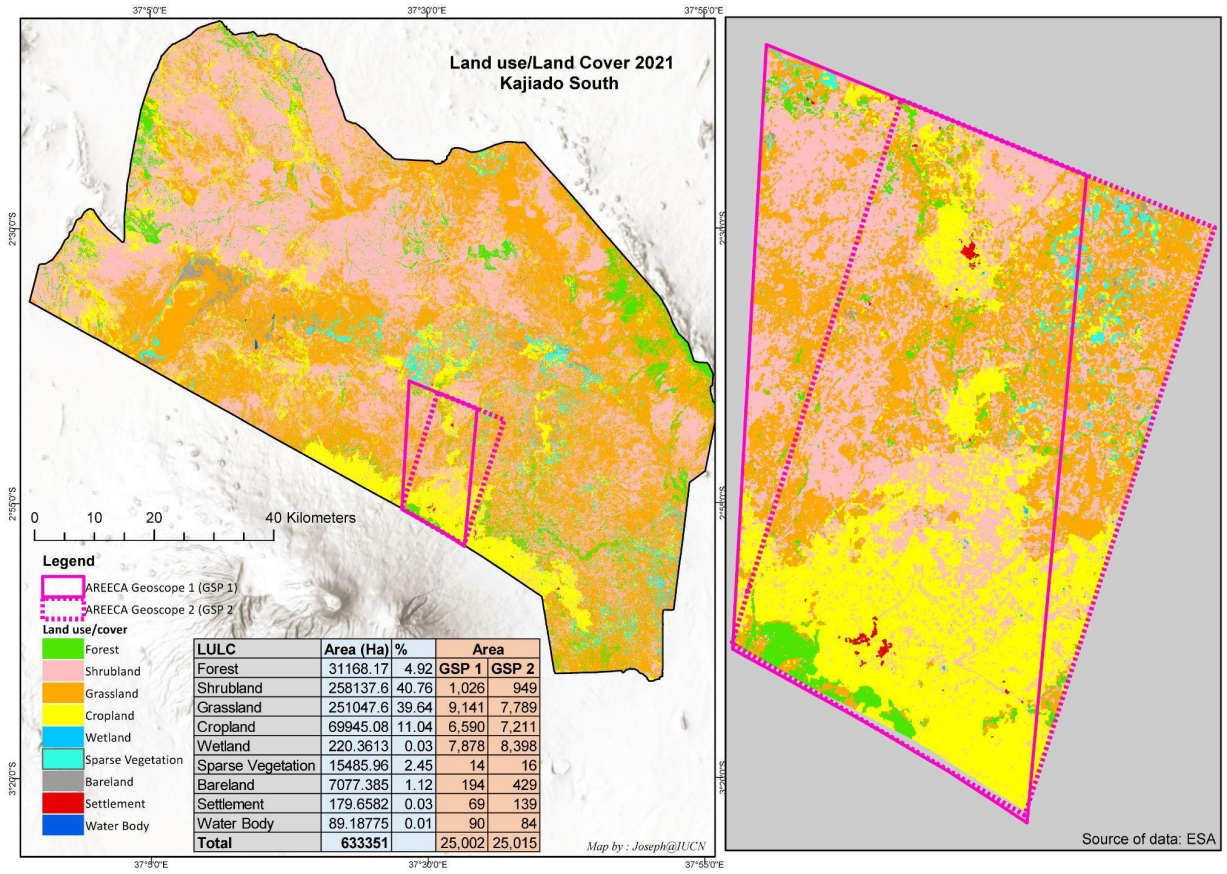
In this chapter, ROAM results have been considered to inform and articulate specific on-ground actions related to the proposed restoration packages. Key considerations include the prioritization mapping, the restoration package design and recommended zones, the market prices used in developing the CBA models, policy and institution arrangement, stakeholder map, and other crosscutting issues including gender and culture. Largely, the chapter provides an insight into how to use the Kajiado South ROAM results in implementing the AREECA project. The implementation plan includes the project site adjustment from the initial Geoscope (GSP1) into the adjusted Geoscope (GSP2), the intervention areas in the two GSPs, restoration packages and activities for each restoration package.

6.1. Brief description of the AREECA project area

As indicated in previous chapters, Kajiado-South ROAM intends to assess the restoration opportunities at the sub-county level but at the same time dive into the specifics of the restoration efforts by AREECA initiative, which seeks to restore 5,000 ha of degraded lands and forest within a geoscope measuring 25,000ha. Referred to as Geoscope 1 (GSP1) in this report, initially selected, and delineated during project baselining period, the Geoscope size was informed by the project scaling-up ambitions, where direct on-ground restoration efforts are expected to radiate restoration in 20,000 ha more. The selection of the Geoscope (stretching from the Loitoktok forest to Kimana sanctuary) was based on stakeholder's decisions and most importantly, the county's priority to restore degraded water towers and or catchments in Kajiado South.

Further, the project needed to target degraded croplands and rangeland in a bid to stop or reverse further degradation, improve lives and livelihoods and increase resilience to climate change in both crop-growing and pastoral communities. In order to determine the suitability of the said Geoscope, a landscape prioritization process comprising degradation mapping, restoration opportunity mapping, and identification of suitable interventions were undertaken to determine the total number of hectares if restored would accrue multiple benefits. The geospatial analysis, within Geoscope 1, shows that we have 4,410 ha as a priority degraded areas that need restoration. This is 590 ha short of the target for AREECA project. A stakeholder decision was then made to tilt the GSP1 towards the Kuku and Rombo where more opportunities were located in the restoration opportunity map of Kajiado South. The title resulted in what is referred to as Geoscope 2 (GSP2) and provides the ideal 25,000 ha landscape where the AREECA project can be implemented.

Both Geoscopes touch the Loitoktok Forest Reserve, adjacent farmlands, and group ranches further downstream (Figure 1- GSP1 & GSP2). Both Geoscopes are ideal for forest conservation, water catchment, food, and livestock production although GSP2 presents more opportunities than GSP1. Loitoktok forest reserve has indigenous and exotic tree species and is important in protecting Mt. Kilimanjaro water tower and enhancing food security under the Plantation Establishment Livelihood Improvement Scheme (PELIS). Landowners' holding and size are small around the forest with farmers growing crops and keeping livestock (mainly under zero grazing). In rangelands, further down the stream, wildlife conservation and livestock production are the key socio-economic activities of the Loitoktok-Amboseli conservancies' landscape. Figure 34 shows the major land uses in the Kajiado South and in the AREECA project area.



LULC	Area (Ha)	%	Area	
			GSP 1	GSP 2
Forest	31168.17	4.92	1,026	949
Shrubland	258137.6	40.76	9,141	7,789
Grassland	251047.6	39.64	6,590	7,211
Cropland	69945.08	11.04	7,878	8,398
Wetland	220.3613	0.03	14	16
Sparse Vegetation	15485.96	2.45	194	429
Bareland	7077.385	1.12	69	139
Settlement	179.6582	0.03	90	84
Water Body	89.18775	0.01	25,002	25,015
Total	**633351**			

Figure 36: Land use land cover map of Kajiado South zoomed to AREECA project site (GSP1/GSP2) (ESA, 2021)

6.2. Land degradation status and opportunities in the project sites

Zooming degradation map at the geoscope level was part of the process used to inform the selection of project alternative Geoscope. With high and very high levels of degradation as priority areas, a tilt of the GSP1 would definitely target more severely degraded lands to the north. See Figure 37 below. This is further supported by an opportunity map (Figure 36) which shows more restoration opportunities on the sides of Rombo and Kuku. Considering the maps and field observations made during data collection and validation workshop, the pixelated data is subjected into the generalization to create concrete polygons (sites) which on overlay with various interventions are further delineated over satellite image to produce a map shim the location of different restoration packages. For example, from the process, PELIS or forest plantation is largely around the Loitoktok forest and a few areas around Leimurrunya and Emperon springs (on-farm plantations in the private land). The agroforestry system on the other hand should be implemented in Sompet and Suheka landscapes and areas around the springs to enhance food security and improve community livelihoods Details of other restoration packages are provided in section 6.3.

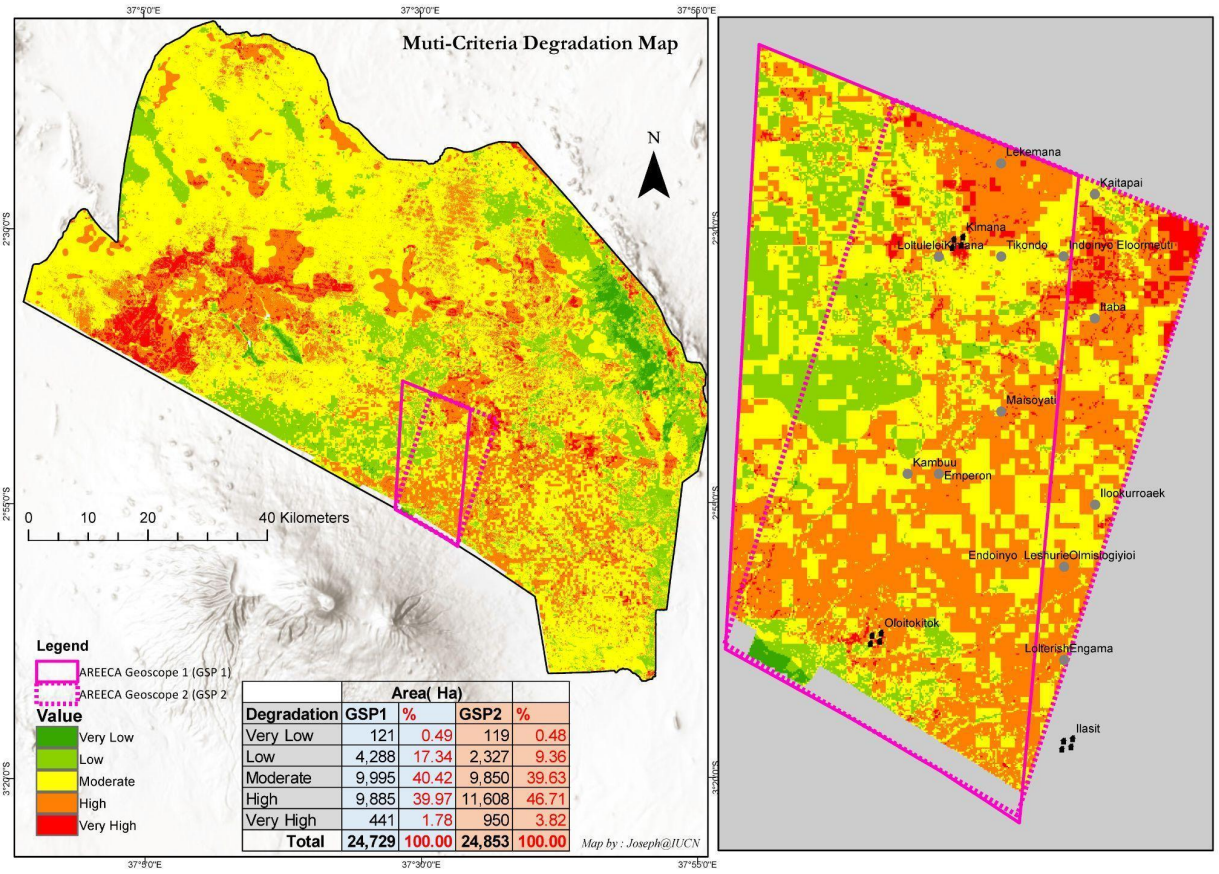


Figure 37: Degradation map of Kajiado South zoomed to AREECA project site (GSP1/GSP2)

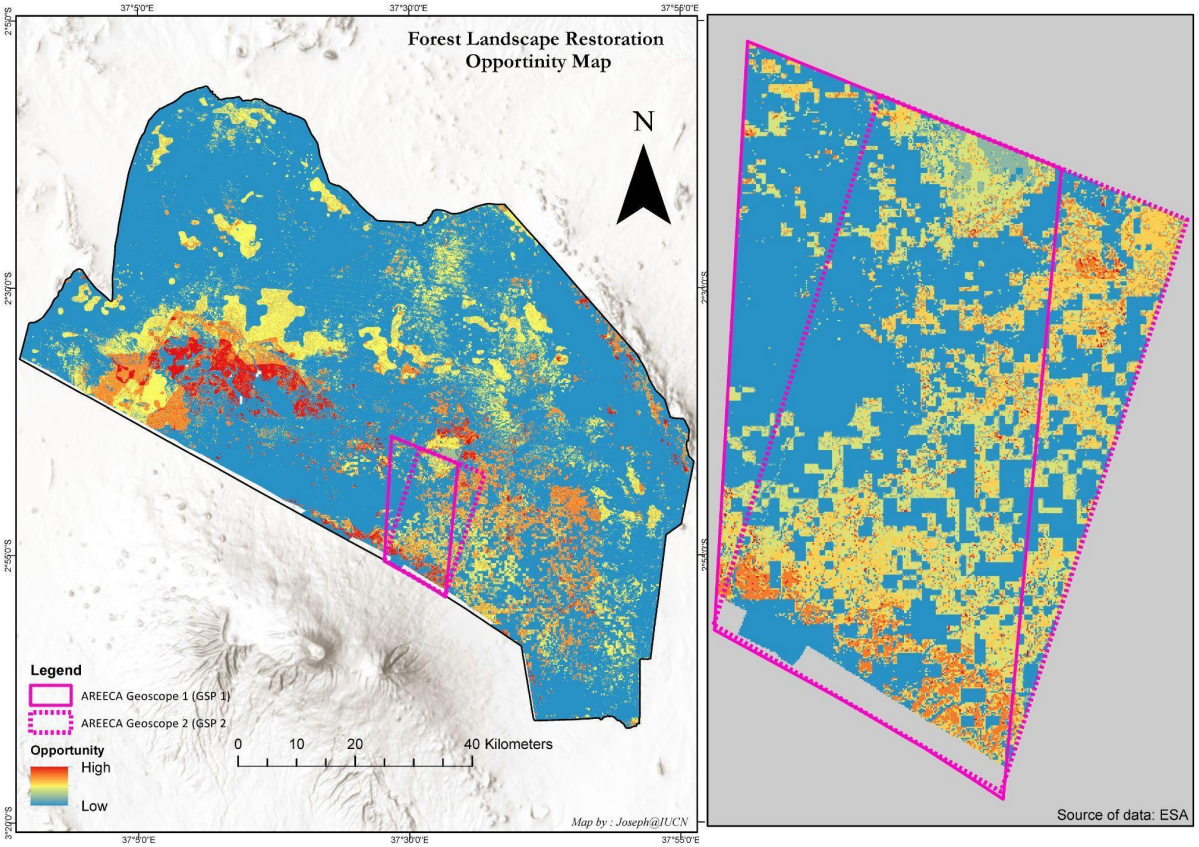


Figure 38: Opportunity map of Kajiado South zoomed to AREECA project site (GSP1/GSP2).

6.3. Restoration interventions in the project site and implementation costs

Seven broad restoration interventions and packages have been identified by stakeholders and mapped (Figure 39, Table 15); that could be used to improve the ecological and economic productivity of degraded land uses:

1) Agroforestry in cropland
2) Fruit Orchards on irrigable agricultural land
3) Assisted Natural Regeneration in conservancies
4) Plantation Establishment and Livelihood Improvement Scheme (PELIS) in gazetted public land and on-farm plantation for private and community land
5) Protective forests around rivers (river buffers) and springs
6) Silvopastoral systems and review and support the implementation of grazing plans in rangelands
7) Urban greening and roadside protection for populated areas and road reserve

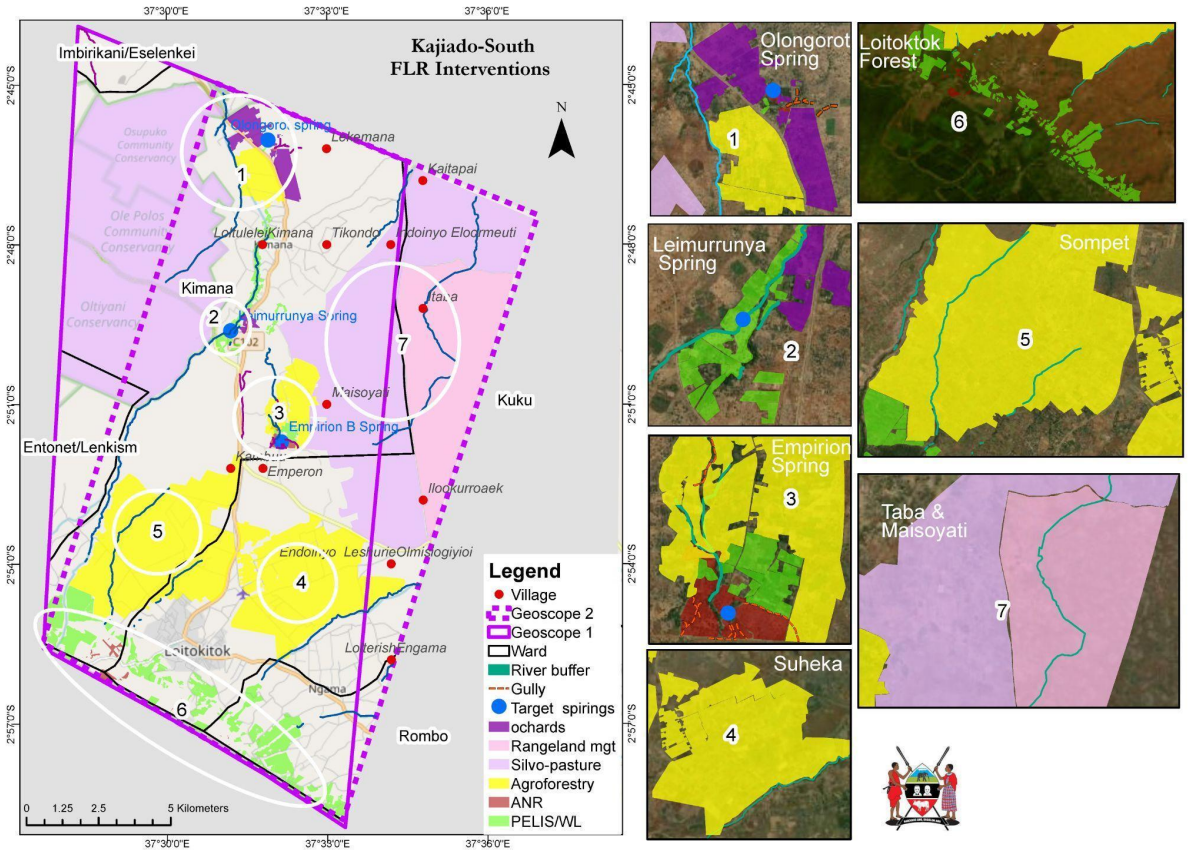


Figure 39. Map showing FLR intervention areas within the AREECA project site (GSP1/GSP2)

Table 15. Table summarizing FLR specific packages in the AREECA project site

FLR packages	GSP1 area (Ha)	GSP2 area (Ha)	Total GSP1 cost (KSH)	Total GSP2 cost (KSH)
1. Agroforestry	1,261	1,436	22,550,790	25,594,040
2. Fruit Orchards	317	359	13,367,746	15,056,457
3. Assisted Natural Regeneration	994	940	20,537,784	19,455,840
4. PELIS	575	958	33,622,400	55,603,536

FLR packages	GSP1 area (Ha)	GSP2 area (Ha)	Total GSP1 cost (KSH)	Total GSP2 cost (KSH)
5. River buffers	207	205	8,127,613	8,055,095
6. Silvopasture	375	703	3,168,250	5,395,370
7. Springs protection			7,139,346	7,139,346
8. Support grazing plans	610	1,148	9,578,050	12,539,740
9. Urban greening & Roadside protection	71	74	4,282,618	4,437,292
Grand Total	**4,410**	**5,823**	**122,374,597**	**153,276,716**

The agroforestry interventions focus on incorporating trees into agricultural landscapes, including lands being used for cultivating crops while silvopastoral system consist of increasing trees grassland for raising livestock. The silvopasture is it is most readily achieved through the assisted farmer-managed restoration of savannah forests and shrub land. The opportunities for Agroforestry in the AREECA project site is about 1,261ha in the GSP1 or 1,436ha in the GSP2 and its implementation cost up to 25,594,040 KSh. The suitable land for fruit orchard has be identified using criteria of proximity to water and availability of ground water resources. Only 317ha for GSP1 and 359ha has be identified for orchard development with a maximum cost of 15,056,457 KSh. The detailed costing in presented further in the Table 17, Table 19

The interventions associated with natural forest regeneration include restoring degraded natural forest inside Waza Park and community forests. For the 'degraded savannah' intervention, we extract areas from the forest cover dataset defined as "degraded savannah" and overlay these areas with the boundaries of reserves and national parks. Any forest areas degraded that overlap with these boundaries are quantified as opportunity areas for assisted natural regeneration.

6.3.1. Sustainable Forest Management for industrial plantations in Loitoktok Forest

According to the Loitoktok Participatory Forest Management Plan (FMP 2018 – 2022), the plantation areas are located in one block, namely Loitoktok. There are five (5) different species grown in the plantations namely; *Cupressus lusitanica* which is the dominant species with 52% of the stocked plantation area in the forest. The other species are *Pinus patula*, *Grevillea robusta*, *Eucalyptus saligna* and *Juniperous procera*. ROAM assessment identified about 958 hectares degraded forestland across GSP2 of which 72ha unstacked forestland were reported in the FMP 2018-2022. The following degradation issues have been reported by the FMP and raised during stakeholder consultation and field observations:

1) Poor silviculture practices leading to low yield
2) Illegal logging and fire
3) Lack of harvesting plan
4) Limited forests plantations for private and communities putting pressure to Loitoktok reserve
5) Overgrazing leading to accelerated soil erosion

The restoration of Loitoktok forest plantation and establishing the farm-forests will have benefit of improving timber industry in the region and reducing the pressure on forest reserve. The following restoration actions are recommended including considering to support the revision of the forest management plan for the next five years (Loitoktok FMP 2023 – 2027) as the previous

is expiring (FMP2018-2022)

1) Undertake timely silvicultural operations such as pruning, thinning, coppice reduction
2) Establish the contour ditches against accelerated erosion
3) Establish harvesting and replanting plan
4) Establishing and maintaining the fire breaks
5) Introduction of exotic hybrid trees improved for timber production such as pines and cypress
6) Establishing a nursery to provide restoration materials
7) Introduction of exotic hybrid trees improved for timber production
8) Establish quality forest plantations free from pest and diseases.
9) Remove invasive species

6.3.1.1. PELIS model

The establishment of forest plantations on public land with PELIS (Plantation Establishment and Livelihood Improvement Scheme) is recommended in Loitoktok forestland for the production of wood products and other ecosystem services. The Table 2 describes specific restoration activities that need to be implemented in partnership with the AREECA project.

Table 16. Description of the restoration activities to be done for the PELIS Model

FLR Activities	Description	Who can do it
Mobilize and sensitize the communities from Loitoktok forest on the planned activities	With special focus on youth and women, the project should carry out a one-week campaign of sensitization and mobilization of Loitoktok CFA (~400 members) on the planned PELIS activities.	AREECA and KFS
Seedling production	Hands-on training should be provided to the CFA while establishing the tree nurseries in Loitoktok forest. The project in partnership with KFS and KEFRI should provide quality seeds for *Cupressus Lusitania* for the nursery already established in Loitoktok forest but with additional cover on the seedbeds (see picture below). Numbers of seedlings required that matches the available land be provided in the following budget section.	AREECA & CFA
Sites preparation for planting the seedlings	Slushing bush and digging holes should be done prior to sowing.	AREECA & CFA
Planting seedlings	Seedlings should be planted following spacing of 3m x 3m.	AREECA & CFA
Beating up	Beating up should be done during the following short rains if survival rates is between 30 and 75 %	AREECA & CFA

FLR Activities	Description	Who can do it
Maintenance of the PELIS for three years before the forest is left to grow without crops	The forest plantation should be monitored and controlled for pests. Sensitization program to the farming community at the on-set of crop planting season to not damage the young trees.	AREECA & CFA

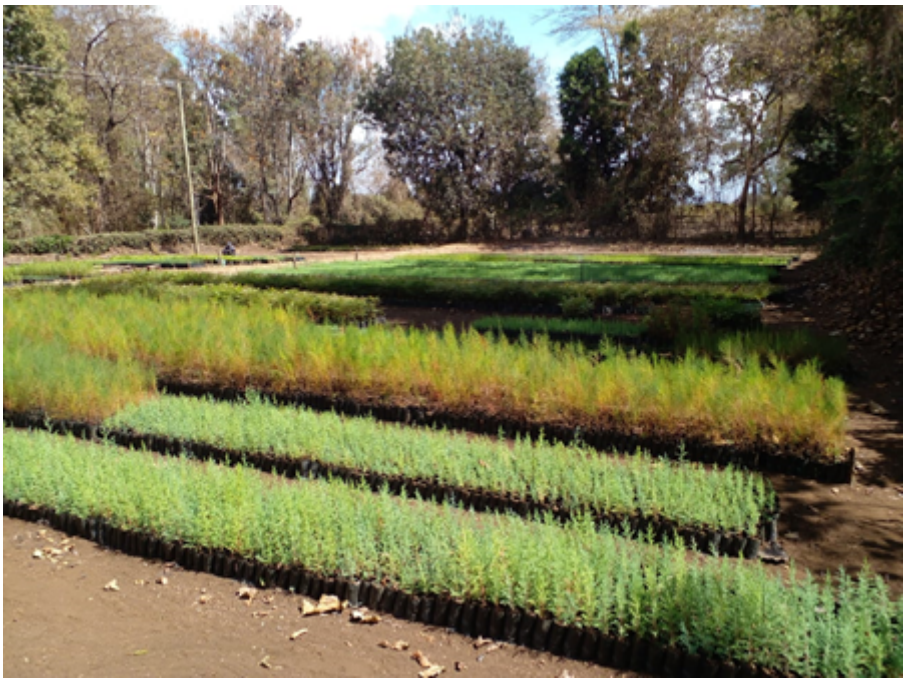


Figure 40. Nursery established by CFA for forest planting in Loitoktok forestland

Table 17 present the costs for establishing the PELIS. ROAM assessment identified about 958 hectares across the AREECA project geoscope (GSP2) including on-farm forests on private land, to be planted at maximum cost of 55,603,536 KSh.

Table 17. Estimated costs for establishing the PELIS model

Restoration activities PELIS	Area (Ha)	Area (Ha)	Quantities		Cost unit	Total Cost (KSH)	Total Cost (KSH)
	GSP1	GSP 2	GSP1	GSP2	(KSH)	GSP1	GSP2
1. Mobilize the Loitoktok communities	575	958	400 people	400 people	-	622,000	622,000
2. Seedling production	575	958	632,500 seedlings	1,053,800 seedlings	39	24,667,500	41,098,200
3. Sites preparation for planting the seedlings	575	958	-	-	5,505	3,165,375	5,273,790
4. Planting seedlings	575	958	-	-	1,835	1,055,125	1,757,930
5. Beating up (30%)	575	958	-	-	7,152	4,112,400	6,851,616

Restoration activities PELIS	Area (Ha)	Area (Ha)	Quantities		Cost unit	Total Cost (KSH)	Total Cost (KSH)
	GSP1	GSP 2	GSP1	GSP2	(KSH)	GSP1	GSP2
6. Maintenance of the PELIS for three years before the forest is left to grow without crops	575	958	-	-	-	-	-
TOTAL	**575**	**958**			**14,531**	**33,622,400**	**55,603,536**

6.3.2. Assisted natural regeneration in the Loitoktok forest reserve and Amboseli conservancies

Assisted natural regeneration is proposed for Loitoktok natural reserve in the project site through the establishment of a plantation buffer of 250ha around Loitoktok natural forest, and enrichment planting within the natural forest using indigenous tree species. The *Table 4* describes the activities required to establish an assisted natural regeneration (ANR). The following restoration actions has been recommended by stakeholders in order to accumulate the multiple benefits from ANR intervention:

1) Remove invasive species,
2) Enrich the biodiversity by planting with appropriate indigenous species,
3) Promote beekeeping in framework of participatory forest management
4) Maintain the fire breaks
5) Develop a permanent nursery to provide restoration materials
6) Create awareness and sensitize the communities for their participation in safeguarding the Loitoktok forest reserve, and
7) Consider the physical fencing 250 hectares of natural forest using nature-based materials
8) Promote participatory forest Management in Natural forests rebranded as “Tree Establishment for Livelihood Support (TELIS). This can be done in for the first years of planting with Beans and Potatoes, however maize is discouraged by the Government of Kenya.

Table 18. Description of the restoration activities to be done for assisted natural regeneration activities

Restoration Activities ANR	Description	Who can do it
1. Mobilize the communities	Carry out one-week campaign of sensitization and mobilization of Loitoktok CFA (~400 members) on the planned assisted natural regeneration activities in Loitoktok natural forest. For Amboseli conservancies the project should consider collaborating with Amboseli Land Owners Conservancies Association (ALOCA)	AREECA & KFS & ALOCA, CFA
2. Seedling	Support CFA from Loitoktok to produce seedlings for	AREECA &

Restoration Activities ANR	Description	Who can do it
production	indigenous tree species. The nursery is located within Loitoktok forest and can be good to use if with few rehabilitations such as additional cover on the seedbeds. Numbers of seedlings required that matches the available land for both the buffer planting around the natural forest and the enrichment within the natural forest be provided in the following budget section.	CFA
3. Sites preparation for planting the seedlings	Slushing bush radius of 1m around a whole should be done. Vegetation should not be entirely cleared to avoid disturbances on the natural ecosystem.	AREECA & CFA
4. Planting seedlings	Seedlings should be planted following spacing of 3m between the trees in a line, and 5m between the lines, making around 6 lines totalling the 30m wide buffer target. For the enrichment inside the natural forests, 20 ha degraded are expected to be restored	AREECA & CFA
5. Beating up	Beating up should be done during the following short rains if survival rates is between 30 and 75 %	AREECA & CFA
6. Maintenance	The planted seedlings should be continuously monitored for survival and weeding around them to facilitate better growth.	AREECA & CFA

Having participatory forest management plan (PFMPs) in place (although need to be updated, and agreement with CFA possibly may need to be renewed to accommodate the AREECA project implementation framework) should facilitate greater CFA involvement in the design of reforestation and greater integration of reforestation with a long-term management plan. It would also likely lead to a more official community role in monitoring and enforcement at a reforestation site. It is reasonable to assume that there would be moderately more successful reforestation as a result. Table 19 estimates the cost of establishing the ANR to a maximum of 19,455,840KSh.

Table 19. Estimated costs for assisted natural regeneration (ANR) of the natural forest reserve. The cost of physical fencing is not included.

Assisted Natural Regeneration (ANR)	Area (Ha) GSP1	Area (Ha) GSP2	Cost unit (KSH)	Total Cost (KSH) GSP1	Total Cost (KSH) GSP2
Mobilize and sensitize the communities on the planned activities	994	940	-	622,000	622,000
Seedling production	994	940	39	38,766	36,660

Sites preparation for planting the seedlings	994	940	5,505	5,471,970	5,174,700
Planting seedlings	994	940	1,835	1,823,990	1,724,900
Beating up (30%)	994	940	7,152	7,109,088	6,722,880
Maintenance	994	940	5,505	5,471,970	5,174,700
Grand Total	**994**	**940**		**20,537,784**	**19,455,840**

6.3.3. Orchards with fodder plantation

Fruit farming with fodder plantation is proposed in Rombo with fodder bank and can work for small-scale farmers provided there is availability of water for irrigation (proximity to springs or availability of the ground water resources. It the project area, communities in Loitoktok, Kimana, Kuku are the most beneficiaries of this intervention. There are species recommended on the bank such as multipurpose trees and shrubs (*Grevillea robusta, calliandra spp, sesbania sesban, leucaena spp, gliricidia spp*). The Table 20 describes the activities required to establish fruit orchards with fodder trees and the Table 21 estimates the cost for establishing fruit orchards to a maximum of 15,056,457 KSh on 317 hectares suitable for orchard plantation with fodder trees for livestock farming.

Table 20. Description of the restoration activities to be done for the orchards with fodder plantation

Restoration activities	Description	Who can do it
1. Mobilize the communities from around the Olongoro and Leimurrunya springs	Carry out a 1-week sensitization campaign for the farmer communities around Olongoro and Leimurrunya springs and work closely with Naveta self-help group and Loitoktok small-scale farmer's forum on the planned restoration activities including orchards establishment.	AREECA, KFS, Water Resource Users Association (WRUAs)
2. Seedling production	Hands-on training on fruit grafting and nursery establishment should be provided to groups of farmers in each target landscape (e.g. Naveta self-help group, Loitoktok small-scale farmers forum, etc.), leveraging on those already trained by KFS. Nurseries in the project sites should be located closer to Olongoro and Leimurrunya springs and where farmers have boreholes or water pans. Quality root stokes and scions should be used. Numbers of seedlings required that matches the available land be provided in the following budget section.	AREECA, Farmers or communities around the Leimurrunya and Olongoro springs. The farmer groups (Naveta self-help group and Loitoktok small scale farmers' forum) can produce the seedlings and ensure the maintenance

Restoration activities	Description	Who can do it
3. Sites preparation for planting the seedlings	This will be done 3 to 4 months before planting and shall involve bush clearing, land preparation and orchard layout	AREECA, Farmers or communities around the Leimurrunya and Olongoro springs.
4. Planting seedlings	Seedlings should be planted following spacing of 8m x 8m. Patches between the fruit trees should be planted with fodder or cropped especially in the first two years of the orchard establishment. This would be followed by tendering practices such as mulching, 1st to 2nd year shaping cut, staking, weeding, etc.	AREECA, Farmers or communities around the Leimurrunya and Olongoro springs.
5. Orchard management	This will be done in the 2nd to 3rd year of training and shaping the fruit trees.	AREECA, Farmers or communities around the Leimurrunya and Olongoro springs.

Table 21. Estimated costs for establishing the orchards and fodder plantation

Orchards and fodder plantation	Area (Ha) GSP1	Area (Ha) GSP2	Qties Nb.	Qties Nb.	Cost unit (KSH)	Total Cost (KSH) GSP1	Total Cost (KSH) GSP2
Mobilize and sensitize the communities on the planned activities	317	359				622,000	622,000
Seedling production	317	359	49,452 seedlings	56,004 seedlings	175	8,673,881	9,823,102
Sites preparation for planting the seedlings	317	359			5,505	1,745,085	1,976,295
Planting seedlings	317	359			1,835	581,695	658,765
Maintenance	317	359			5,505	1,745,085	1,976,295
Grand Total	**317**	**359**			**13,020**	**13,367,746**	**15,056,457**

6.3.4. Agroforestry

Figure 41. Seedling in the project site protected using local material against animal raiding

In both project Geoscopes (GSP1& GSP2), stakeholders suggested agroforestry as the main intervention on agricultural land. Section 3.3.2 describes packages suitable for the agricultural lands in the South-Kajiado while this section intends to depict and detail target area and restoration activities that AREECA could undertake on agroforestry. The Table 22 describes the activities required to establish agroforestry systems and the Table 23 estimates the cost to a maximum of 25,594,040 KSh for establishing about 1,261 hectares of agroforestry.

Table 22. Description of the restoration activities to be done for establishing agroforestry systems

Restoration activities	Description	Who can do it
1. Mobilize AREECA & Suheka and Sompet landscapes Communities	Sensitization and mobilization campaign for farmers in Suheka and Sompet on the planned agroforestry restoration activities. This would prepare the communities to receive seedlings and participate in planting them on their own farms in the right niche for the right purpose.	The project staff and KFS
2. Seedling production	Trainings would be provided to farmer groups within Sompet and Suheka landscapes or where farmers have boreholes or water pans. Potential species are described in the report but for the project is advised to go for *Grevillea robusta, Cupressus lusitanica*, Fruits such as Avocado, etc. Numbers of seedlings required that matches the available land be provided in the following budget section below.	AREECA & Suheka and Sompet landscapes Communities
3. Sites preparation for planting the seedlings	Farmers, supervised by the project staff and/or extension officers, will do digging holes on farms mainly going against the slope of the field.	AREECA & Suheka and Sompet landscapes Communities
4. Planting seedlings	Farmers will pick seedlings from nurseries with numbers matching their farm size and shall plant them on their farms. They will be free to adapt their configuration and design. For those not committing to plant trees within the farm; boundary planting will be suggested as the initial step towards adoption of agroforestry. Due to roaming animals, protection measures for the tree seedling should be put in place (e.g. see picture below in the project site).	AREECA & Suheka and Sompet landscapes Communities
5. Monitoring survival rates and beating up	Monitoring will be done for survival rates and if below 75%, beating up will be done to fill the gaps.	AREECA & Suheka and Sompet Communities

Table 23. Estimated costs for establishing agroforestry

Restoration activities Agroforestry	Area (Ha) GSP1	Area (Ha) GSP2	Cost unit (KSH)	Total Cost (KSH) GSP1	Total Cost (KSH) GSP2
Mobilize and sensitize the communities on the planned activities	1,261	1,436		622,000	622,000
Seedling production	1,261	1,436	6,380	8,045,180	9,161,680

Restoration activities Agroforestry	Area (Ha) GSP1	Area (Ha) GSP2	Cost unit (KSH)	Total Cost (KSH) GSP1	Total Cost (KSH) GSP2
Sites preparation for planting the seedlings	1,261	1,436	3,670	4,627,870	5,270,120
Planting seedlings	1,261	1,436	3,670	4,627,870	5,270,120
Beating up (30%)	1,261	1,436	3,670	4,627,870	5,270,120
Grand Total	**1,261**	**1,436**		**22,550,790**	**25,594,040**

6.3.5. Rangeland management

Pastoral communities have all along developed local mechanisms for managing forage resources to cope with recurrent severe droughts. Unfortunately, these practices are not sufficient to cope with prolonged drought and communities are struggling from losses due to the effects of drought on livestock feeds and water. Several studies found out pastoralists have insufficient training in pasture management, contributing to low levels of pasture conservation during periods of excess pasture. The frequently practiced methods were traditional herd tethering and migration. Hence the is a need to adopt and practice modern systems such as paddocking, zero grazing, haymaking and the use of other supplementary feeds. Additionally, water-harvesting technologies to reduce the possibility of rivalry and conflict between and within communities arising from limited water supply during drought should be promoted. There is a need for the project to support pastoralists in the project area to establish sustainable strategies to accelerate capacity building in pasture resource management.

The following are restoration measures to improve the management of pasture resources by associating trees with grasses.

1. Development of grazing plans
2. Establishing and empowering the grazing committee
3. Consider reseeding on bare land
4. Restocking of pasture lands (grass growing)
5. Introduce fodder trees
6. Remove invasive species.
7. Respect of land carry capacity in livestock
8. Promotion of bylaws to regulate grazing
9. Improvement of livestock breeds
10. Tree Enrichment and silvopastoral system (for the upper part of Olugului (Multot, Kidapash, Ilmisigiyo), Kuku and Rombo
11. Establishing water bodies (Check dams) in rangelands and conservancy
12. Delineation of critical wildlife corridors and using local interventions to safeguard connectivity (with gazetting option)
13. Rain water harvesting facilities (example: water pans)
14. Establishing fodder bulking (on commercial scale – large scale)
15. Adopting silvopastoral system for Rombo and Kuku with possibility to introduce paddocking

6.3.5.1. Silvopastoral system

The silvopastoral system was recommended by stakeholders in Kajiado to be applied in Rombo, Kuku, and the upper Olugulului (in Imurtot, Kidapash, and Ilimisgiyo) in the project area. The design model is explained in the section 3.3.5 of this report. Below are the specific activities that

would be done to establish the model, as well as the cost it would take.

Table 24. Description of the restoration activities to be done for the Silvopasture

Restoration activities	Description	Who can do it
1. Mobilize the communities from Maisoyati, Indoinyo Eloormeuti and parts of Kaitapai villages	Sensitization campaign for a week for communities in Maisoyati, Indoinyo Eloormeuti and parts of Kaitapai villages on the planned restoration activities required for establishment of silvopastoral systems	AREECA, KFS and Kimana/Tikondo group ranch as well as the Kimana/Tikondo Small Holding.
2. Seedling production.	Train communities and produce *Acacia nilotica*, which provides benefits such as pods used for fodder, windbreaks, termite resistant timber. The calculations of required seedlings number are provided in the table below in accordance with the suitable area.	AREECA, KFS and Communities pastoralists of Maisoyati and Indoinyo Eloormeuti villages and parts of Kaitapai village.
3. Sites preparation for planting the seedlings	Slushing grasses and only digging where trees will be planted with minimum disturbance of the soil. Dig holes in two parallel lines spaced by 5m within the line and 5m between the trees in the direction against the slope. Another similar strip should be placed within 20m away and oriented in the same direction.	AREECA, KFS and Communities pastoralists of Maisoyati and Indoinyo Eloormeuti villages and parts of Kaitapai village.
4. Planting seedlings	Planting seedlings in the prepared holes at the on-set of the long rains. In between the tree lines, grass/fodder production should be improved through direct sowing of grass seeds (choices are provided in the section 3.3.5).	AREECA, KFS and Communities pastoralists of Maisoyati and Indoinyo Eloormeuti villages and parts of Kaitapai village.
5. Monitoring of the planted tree seedlings	In the early establishment period of the system, livestock should be controlled not to damage the trees by covering the seedlings with a sac opened either on top or by fencing the line of trees by dead branches or barbed wire wherever possible.	AREECA, KFS and Communities pastoralists of Maisoyati and Indoinyo Eloormeuti villages and parts of Kaitapai village.

Table 25. Estimated costs for establishing silvopastoral system

Restoration activities Silvopasture	Area (Ha) GSP1	Area (Ha) GSP2	Qties Nb.	Qties Nb.	Cost unit (KSH)	Total Cost (KSH) GSP1	Total Cost (KSH) GSP2
Mobilize and sensitize the communities on the planned activities	375	703				622,000	622,000
Seedling production	375	703	30,000 seedlings	56,240 seedlings	39	1,170,000	2,193,360
Sites preparation for planting the seedlings	375	703			1,101	412,875	774,003
Planting seedlings	375	703			1,468	550,500	1,032,004
Beating up (30%)	375	703			551	206,438	387,002
Maintenance	375	703			551	206,438	387,002
Grand Total	**375**	**703**			**3,709**	**3,168,250**	**5,395,370**

6.3.5.2. Supporting grazing plans

Table 26. Description of the restoration activities to be done for supporting grazing plans

Restoration activities	Description	Who can do it
1. Awareness and behaviour change campaigns on grazing plans	Carry out campaigns on awareness raising for the existing grazing plans among the concerned communities. These should focus on raising awareness on plans' recommendation on stock numbers control to reduce overstocking. They can also include awareness on delineation of land units and their use prescribed by the plans in different seasons.	AREECA, ALOCA, Amboseli Tsavo Community Rangers Association (ATCRA) Group ranches
2. Train and support local rangers to enforce the grazing plans	Local selected rangers among community members can be trained to guide and enforce the community bylaws and grazing plans.	AREECA, ALOCA, ATCRA
3. Removal of invasive species in the rangelands	Removing invasive species widely spread within rangelands can be costly. The project should capitalize on the local communities (use of local intelligence and labour) by providing them daily wages to remove the invasive systematically from the rangelands.	AREECA, Communities,

Restoration activities	Description	Who can do it
4. Development of grazing plans where not existing. This is preferably within Kuku and Kimana/ Tikondo Group Ranch.	The project can also support the development of grazing plans where they do not exist, preferably within Kuku and Kimana/ Tikondo Group Ranch.	AREECA,, KFS and county government

Table 27. Estimated costs for supporting grazing plans

Restoration activities Supporting grazing plans	Area (Ha) GSP1	Area (Ha) GSP2	Cost unit (KSH)	Total Cost (KSH) GSP1	Total Cost (KSH) GSP2
Awareness and behavior change campaigns on grazing plans	610	1148		622,000	622,000
Train and support local rangers to enforce the grazing plans	610	1148	622,000	2,488,000	2,488,000
Removal of invasive species in the rangelands	610	1148	5,505	3,358,050	6,319,740
Development of grazing plans where not existing (Joseph to find information on names in the Geoscope)	610	1148	622,000	3,110,000	3,110,000
Grand Total	**610**	**1148**		**9,578,050**	**12,539,740**

6.3.6. Soil and water conservation

The general description on approach to restore riverbanks is explained in the section 3.3.8.1 of the report. The current section describes the actions that can be taken by the project in the specific project area (Geoscopes).

Table 28. Description of the restoration activities to be done for riverside protection,

Restoration activities	Description	Who can do it
1. Mobilize the communities from around rivers and gullies contributing to the water quality and quantity	Sensitization campaign on the planned restoration activities to rehabilitate rivers targeting communities living around rivers, streams, waterways and gullies contributing to the water quality and quantity around Leimurrunya, Olongorot and Empiron springs	AREECA, KFS, WRA Water Resource Users Association (WRUAs)
2. Seedling production.	Train communities and produce *Acacia xanthophoea* to be planted on riversides. The calculations of required seedlings number are provided in the table below in	AREECA, Water Resource Users Association (WRUAs), and communities around Leimurrunya, Olongorot

Restoration activities	Description	Who can do it
	accordance with the suitable area along the rivers.	and Empiron springs
3. Sites preparation for planting the seedlings	In this case, site preparation would mainly involve digging holes with minimum disturbance to the soil. Dig holes in two parallel lines spaced by 8m within the line and 5m between the trees in the direction of the river but leaving a margin of at least 1 m from the river and this should be done for both sides of the river.	AREECA, Water Resource Users Association (WRUAs), and communities around Leimurrunya, Olongorot and Empiron springs
4. Planting seedlings	Planting seedlings in the prepared holes at the on-set of the long rains to a distance that is less likely to flood to avoid harming the seedlings. In between the tree lines, grass/fodder production should be improved through direct sowing of grass seeds (suitable species are provided in the section 3.3.8.1).	AREECA, Water Resource Users Association (WRUAs), and communities around Leimurrunya, Olongorot and Empiron springs
5. Beating up	Beating up should be done during the following short rains if survival rates is between 30 and 75 %	AREECA, Water Resource Users Association (WRUAs), and communities around Leimurrunya, Olongorot and Empiron springs
6. Maintenance of the trees until they are firmly established	The planted seedlings should be monitored and controlled for pests for at least 2 years until they are firmly established. Sensitization program to the farming community should be done to avoid damage by animals.	AREECA, Water Resource Users Association (WRUAs), and communities around Leimurrunya, Olongorot and Empiron springs

Three major springs in need of rehabilitation and protection in the project were identified and mapped. These are Olongorot, Leimurrunya, and Empiron B springs. Below are the activities proposed.

Table 29. Description of the restoration activities to be done for springs protection

Restoration activities	Description	Who can do it

1. Protection of the springs with a stone wall (Substructure & Superstructure)	Bush clearing and shrubs on areas to excavate, Excavate for wall trench Construction of the foundation with reinforced concrete Construction of the stone wall	AREECA & Service provider, Water Resource Users Association (WRUAs)
2. Seedling production	Nurseries should be established next to each spring. For each spring, produce *Acacia xanthophoea* (250 seedlings), *Acacia tortilis* (250 seedlings), *Acacia seyal* (250 seedlings), and *Acacia gerradii* (250 seedlings). This means a total of 1,000 seedlings for each spring should be produced.	AREECA, Communities using the Olongorot, Leimurrunya, and Empiron B springs, with guidance from WRA
3. Tree planting	Trees should be planted along the water flow bed with limited disturbance of the soil and making sure that the tree species are mixed to mimic the natural environment.	AREECA, Communities using the Olongorot, Leimurrunya, and Empiron B springs, with guidance from WRA

Table 30. Estimated costs for the protection of springs and riverbanks using NBS solutions

Restoration activities Springs and rivers protection	**Area (Ha) GSP1**	**Area (Ha) GSP2**	**Qties Nb.**	**Qties Nb.**	**Cost unit (KSH)**	**Total Cost (KSH) GSP1**	**Total Cost (KSH) GSP2**
Mobilize and sensitize the communities on the planned activities	207	205				622,000	622,000
Seedling production	207	205	82,800	82,000	44	3,643,200	3,608,000
Sites preparation for planting the seedlings	207	205			4,602	952,614	943,410
Planting seedlings	207	205			3,670	759,690	752,350
Beating up (30%)	207	205			4,882	1,010,574	1,000,810
Maintenance	207	205			5,505	1,139,535	1,128,525
Grand Total	**207**	**205**	**82,800**	**82,000**	**18,703**	**8,127,613**	**8,055,095**

Table 31. Estimated costs for spring protection using hybrid grey infrastructure

Restoration activities Spring protection using grey infrastructure	**Units**	**Unit Cost (KSH)**	**Total Cost (KSH) Geoscope 1 or 2**
1. Protection of the springs with a stone wall			
Substructures	3 springs	895,166	2,685,498

Superstructure	3 springs	884,820	2,654,460
Supervision and contingencies	3 springs	266,998	800,994
Tax VAT 16%	3 springs	284,798	854,394
2. Seedling production and planting	3000 seedlings	48	144,00
TOTAL			**7,139,349**

The costs are estimated based on the bill of quantities done for Empiron B and shared by WWF-Kenya. We assumed the budget for the other two springs to be protected (Olong orot and Leimurrunya) would be in the same range.

6.3.7. Urban greening and roadside protection

Urban greening plays a vital role in human health by providing the following multiple social, economic and environmental benefits:

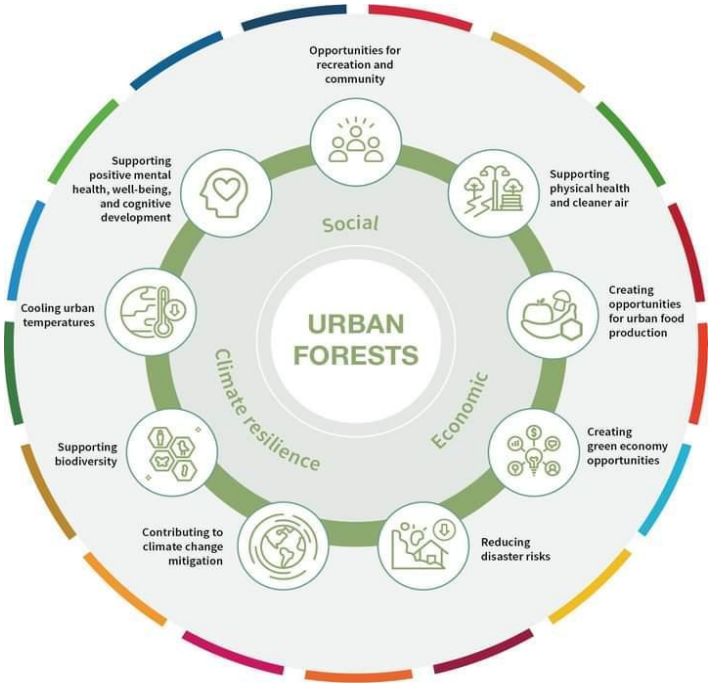


Figure 42. Diagram illustrating the multiple functions of urban forests

IUCN promote urban greening[10] by advising governments to adopt 3-30-300 rule aiming to increase tree cover in built environment. The urban greening is recommended for Kimana, Loitoktok towns as well as in scattered villages across the AREECA project geoscope GSP1 or GSP2, whereby the project shall seek to distribute suitable trees to urban dwellers. The 3-30-300 rule consist of:

- Each home has at least 3 trees,
- The villages and towns get to 30% tree canopy cover, and
- To ensure a distance of 300 meters from the nearest park or green space.

While the project may not reach this alone, efforts will be provided to distribute seedlings to households in villages and towns focusing on fruit trees and ornamental species. Table 32 presents the restoration activities required to establish trees in urban areas and in the road

10 https://iucnurbanalliance.org/promoting-health-and-wellbeing-through-urban-forests-introducing-the-3-30-300-rule/

reserves. To accrue the multiple benefits in greening urban space and roadside reserves, it is important to:

1. Promote homestead fruit trees such as avocado, mango, citrus, macadamia, guavas,
2. Promote non -timber forest products such as bee keeping, establishment of herbal gardens
3. Select suitable trees, and start Kimana, Cineti, Rombo, and Loitoktok towns
4. Promote roof water harvesting to watering homestead trees.

Table 18 shows that 74 hectares has been identified for urban greening in the Loitoktok –Amboseli landscape and estimated costs for greening urban spaces up to 4,437,292 KSh. The project in partnership with KFS and the Kenya Forestry Research Institute (KEFRI) could establish tree nurseries using Loitoktok Community Forest Associations ("LCFA") in establishing these nurseries for the communities to have access to trees for their homestead. Similarly, with roadside plantations LCFA could prepare seedlings under a contract agreement with AREECA project. The cost for preparing seedlings, planting and maintaining the tree up to the survival is estimated to 4,437,292 KSh.

Table 32. Description of the restoration activities to be done for the greening of populated areas and roadsides planting

Actions	Description	Who can do it
1. Mobilize and sensitize the communities from Loitoktok and Kimana town	Sensitization and mobilization campaign for urban dwellers in Kimana and Loitotok on the need to green their homes and roads. This would prepare the communities to receive seedlings and participate in planting them on their own homes.	AREECA, KFS, CGK/Environment department
2. Seedling production	The project should facilitate the production of fruit and ornamental trees near towns where they will be planted. Numbers of seedlings required that matches the available homes and roads be provided in the following budget section below.	AREECA, KFS, Greening Loitoktok/ Entonet, CGK/Environment department Urban dwellers
3. Sites preparation for planting the seedlings	**For homes:** the local communities in the towns will be sensitized on best sides to dig holes and plant trees within their homes. **For roads:** the project should contract local service providers in collaboration with the county government to establish the roadside plantations.	AREECA, KFS, Greening Loitoktok/ Entonet, CGK/Environment department Urban dwellers
4. Planting seedlings	**For homes:** communities will pick trees from the nurseries at their choice and plant them in their homes. It is advised to include at least 1 fruit tree among the 3 to 5 trees that would be given to each home.	AREECA, KFS, Greening Loitoktok/ Entonet, CGK/Environment department Urban dwellers

Actions	Description	Who can do it
	For roads: the project should contract local service providers in collaboration with the county government to plant and maintain the ornamental trees on roadside. The contractor should work closely with communities neighbouring the roads for joint protection of the trees.	
5. Monitoring survival rates and beating up	**For homes:** Project staff and extensionists to help communities monitor the survival rates and replacing the dead seedlings. **For roads:** Monitoring will be done for survival rates and if below 75%, beating up will be done by the service provider to fill the gaps.	AREECA, KFS, Greening Loitoktok/ Entonet, CGK/Environment department Urban dwellers

Table 33. Estimated costs for the urban greening and roadside tree planting

Restoration activities Roadside protection & urban greening	Area (Ha) GSP1	Area (Ha) GSP2	Qties Nb.	Qties Nb.	Cost unit (KSH)	Total Cost (KSH) GSP1	Total Cost (KSH) GSP2
Mobilize and sensitize the communities on the planned activities	71	74				622,000	622,000
Seedling production	71	74	44,375 seedlings	46,250 seedlings	49	2,174,375	2,266,250
Sites preparation for planting the seedlings	71	74			3,670	260,570	271,580
Planting seedlings	71	74			5,505	390,855	407,370
Beating up (30%)	71	74			6,253	443,963	462,722
Maintenance	71	74			5,505	390,855	407,370
Grand Total	**71**	**74**			**20,982**	**4,282,618**	**4,437,292**

6.4. Restoration co-benefits – Carbon abatement

It is worth highlighting the results of Carbon sequestered by different restoration interventions, illustrating the relevance of the increase in carbon storage in terms of benefits. Carbon stock value is mainly determined by two factors forest type or tree species having different biomass and forest area (Chiabai, A. et al 2001). For this assessment, the carbon sequestration from different restoration interventions were calculated for Kajiado south. As shown by Figure 44 , in total, the AREECA project would contribute to Carbon removal of about 1,349,778 tons (GSP1) and 1,893,010 tons of carbon through the restoration interventions with PELIS performing the highest.

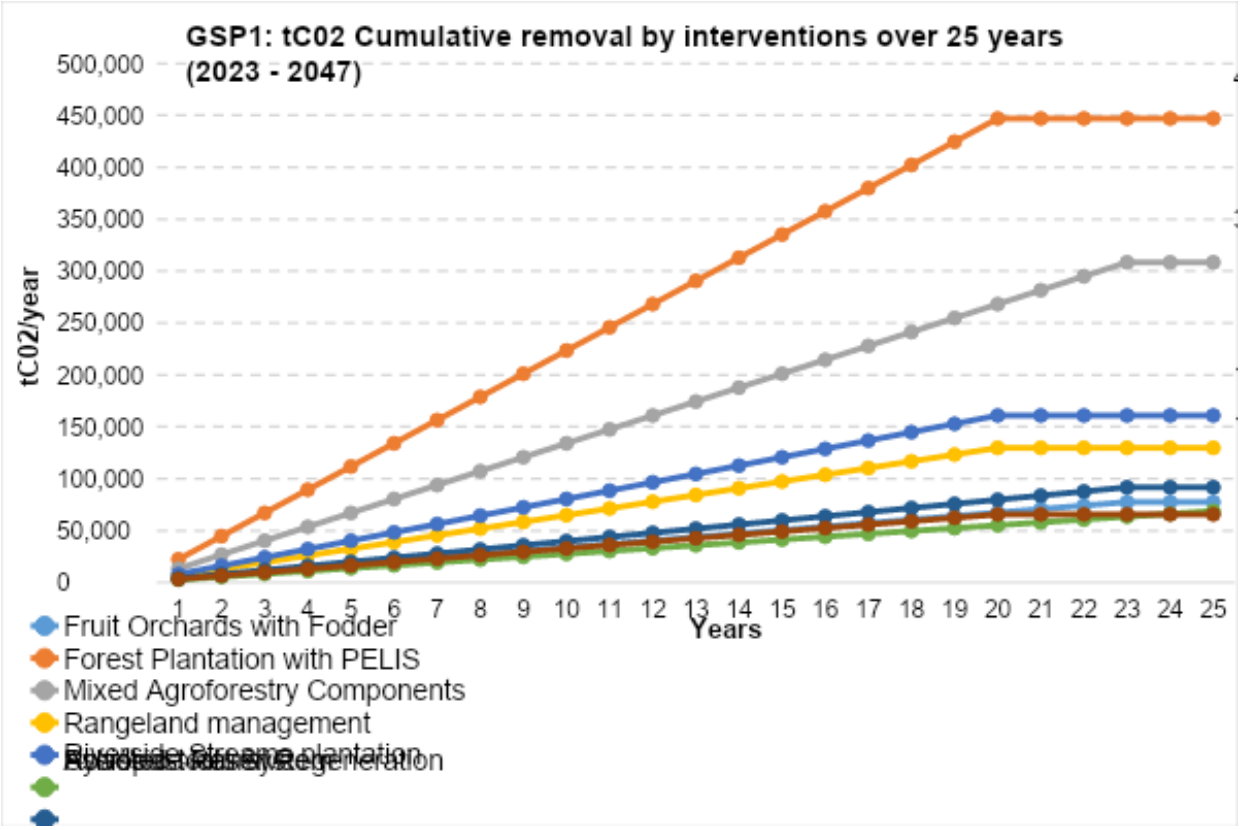


Figure 43. Cumulative carbon abatements by interventions for a period of 25 years (2023-2047) in the project GSP1

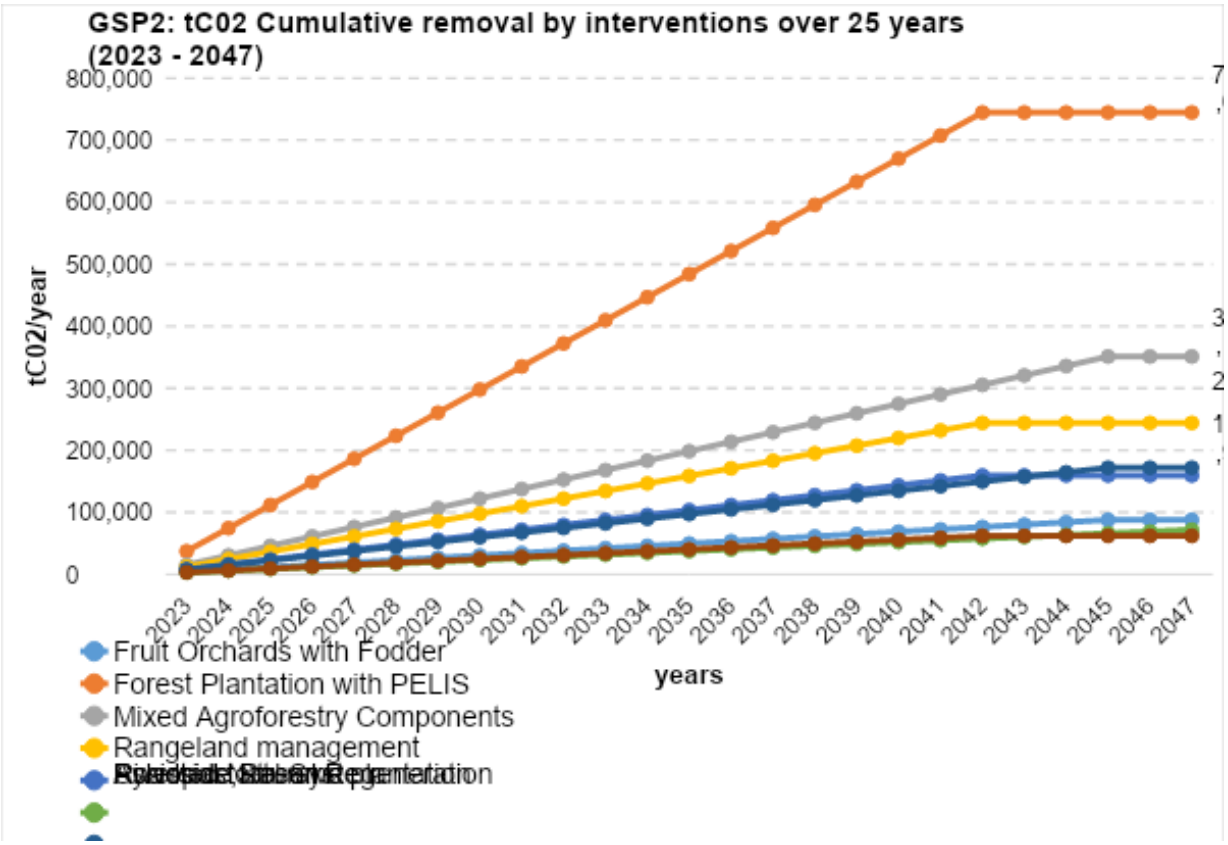


Figure 44. Cumulative carbon abatements by interventions for a period of 25 years (2023-2047) in the project GSP2

7. Conclusions and Recommendations

This assessment provides robust data and information on degradation, opportunities, interventions, cost benefits, key social economic considerations (food security, livelihood, gender and culture), success factors and enabling conditions. Though done at the sub-county level, the assessment has plummeted the outcomes to two alternative project areas (referred to as geoscopes) for AREECA with a target of 25,000 ha each. This was done within a region that is seen as a priority area for restoration due to water catchment importance.

From degradation analysis, the level of degradation in Kajiado South is appalling. A total of 176,668 hectares (about 28.2 % of the total land) are highly or severely degraded. This is spread across the sub-county with Lenksim ward (in and around the Amboseli national park) worst hit. About 352,087 hectares are moderately degraded. This is equivalent to half of Kajiado South land (56.2%) and if nothing is done in the coming years, the severity of degradation in these areas is likely to increase. Some of the drivers linked to this degradation include deforestation, soil erosion (largely characterized by gullies), overgrazing, population pressure, low soil carbon and invasive weeds (*ipomea solanum, lantana, Mexican poppy*) - especially in rangelands. Further, water scarcity occasioned by frequent droughts and increasing dependency on natural goods and services is an overwhelming challenge across the sub-county. Bare lands are common especially in Lenksim and Imbirikani due to overstocking and overgrazing.

There are seven restoration objectives considered and mapped in this assessment namely; (i) increased carbon sequestration, (ii) improved food security, (iii) resilience to climate change, (iv) improved biological diversity, (v) soil erosion control (vi) increased water yield and (vi) enhancing technical and financing capacities. The overall restoration opportunity mapping combines the first six objectives with degradation to generate a restoration opportunity map. The total opportunity area (for multiple benefits) is about 72,770 hectares.

To address the landscape challenges (halting or reversing degradation) six restoration interventions were identified, designed, mapped and their cost-benefit was analysed.

a) Agroforestry is predominantly potential in Kuku, Rombo, Loitoktok and some [parts of Lenkism. The suitability analysis indicates that 48,253 hectares are suitable for agroforestry as described in chapter 2. Intersecting these areas with opportunities shows a priority (for multiple benefits) of 7,232 hectares.
b) Forest plantation - also known as PELIS is most suitable in and around Loitoktok. The total potential is about 9700 ha while the priority areas (for multiple benefits) is 2,600 ha
c) Rangeland management is suitable in most parts of Lenkism, Imbirikani/Eselenkei and some patches in Rombo and Kuku. The total potential is around 250,000 Ha while priority area totals to 42,000 Ha.
d) Soil and water conservation is largely springs and rivers protection. There are a total of 78 springs in the area. Their contribution to the total acreage will be defined once specific surveys are done – which may include civil design and bills of quantities. Rivers/stream protection on other hand has a total potential of 3,722 Ha.
e) Assisted Natural Regeneration is suitable within protected areas (Amboseli National Park, and Loitoktok Natural Forest Reserve). The total potential is about 19800 ha and

covers a 30m protective buffer.

f) Greening populated areas though roadside protection has a total potential of 871 Ha.

For the proposed rotation periods, all FLR interventions are profitable and provide a positive NPV and a favourable return on investment at a discount rate of 8%. This means that implementation costs are relatively small compared to the benefits they provide throughout rotation periods. It is also important to note that all proposed interventions are a carbon sink. Sensitivity analysis showed good results for all the interventions considering different ranges of discount rate. Fruit orchards and PELIS systems are more recommended for private farmers' lands as they provide higher Return on Investment while riverside plantation and roadside reserve protection are recommended for the public lands.

Kajiado South is the food basket for Kajiado County. With more than 47% of the population living below poverty tremendous pressure is being put on land use as evidenced by the recent push for land subdivisions, degradation of vegetation due to rampant cutting of trees for firewood and charcoal production and other environmental problems occasioned by human population pressure. Further hardships in terms of water scarcity and grazing land availability puts greater challenges to livelihoods. Regaining ecological functionality and or achieving its equilibrium through FLR can immensely contribute to livelihoods by enhancing food system resilience, increasing crop production and diversity, increasing water yield and income.

In regards to culture, Maasai communities value trees and shrubs, as they are a source of medicine and provide shade and fodder to cattle. Communities collect dead woods for domestic use and charcoal production is for commercial activities. Bylaws to manage where to graze are based on indigenous knowledge and support conservation activities around both wildlife and forestry. For example, communities believe that killing a wild animal may attract a curse on one's cattle and that culprits are given a shaming name to connote the act. In summary, despite the recent integration with other communities who are mainly doing crop farming, the Maasai culture supports key FLR aspects and should be mainstreamed during restoration. On gender, women have high participation in FLR activities at various scales. For example, the majority of the members of the Loitoktok Conservancy forum are potential partners in FLR implementation activities. They have 612 women (53%), 362 men (31%) and 182 youth (16%). Another potential partner group could be ALOCA, which has 317 men (73%), 86 Women (20%), and 30 youth (7%). Other FLR stakeholders include youth and women groups such as Mazingira Safi Women Group, Kajiado Environment Conservation Group, Naveta self-help group and Naretungishu self-help group. The existence of these groups and their involvement in FLR indicates that there are existing efforts to mainstream their participation in FLR.

Kenya has several sectoral policies and laws relevant to forest landscape restoration (FLR) whose synergies and institutional collaboration will ensure restoration success. Specifically, for the subnational ROAM, Kajiado County regulatory and implementation frameworks would be very important for fast tracking the law enforcement and policy implementations with regard to landscape restoration. This assessment observes that the existing policy framework both at national and county level fully supports and can significantly spur or guide restoration efforts. County integrated development plan as well as the county spatial plan provides vital support for FLR as they both prescribe formidable measures for environmental protection. For example, on deforestation and encroachment in forest areas, the county government is planning to promote agro-forestry tree planting and enforce the policy on 'Farm Forestry Rules' in 2010. This

supports the proposed agroforestry system in this assessment. There are also plans to conserve and protect environmentally sensitive areas such as national parks and catchment/riparian areas. This is fully supported by the proposed natural regeneration as soil and water conservation system.

Recommendations

This assessment recommends a raft of strategic actions aimed at enhancing the uptake of the assessment report, catalysing restoration, and stimulating the scaling up of the restoration, area:

1.1. FLR involves the science of what, where, and how. It is noted that it will require a certain level of technical capacity for ROAM results to be implemented and scaled up (at the site or landscape level). This report recommends capacity development among local players in critical ROAM components such as GIS for FLR, intervention design, and cost-benefit analysis.

1.2. Farmers and landowners continue to struggle with poor farming practices. There is a need to establish a grassroots FLR training initiative aimed at sensitizing and educating farmers and pastoralists on the best practices. This may include peer-to-peer learning within the county.

1.3. Community mobilization at the ranch/conservancy level: The role of communities in the implementation of FLR activities should be strengthened. If support mechanisms throughout the process are to be put in place, communities must play their part. They can easily contribute to the production of a local seed and plant production chain, as well as to watering. Funds from the sales could be capitalized, among other things, for the maintenance of the plots in the framework of AREECA project. Community mobilization is key in ensuring the uptake of the assessment and systematic restoration that respects the landscape approach. This report recommends periodical community mobilization based on group ranches and conservancies to collectively define restoration targets and ambitions.

1.4. Improved extension service: It is observed that inadequate forest extension is partly to blame when it comes to poor land use management as well as unsustainable farming. The report recommends an increased number of forest extensions as well as an agronomist to not only support the uptake of the assessment but also provide accurate guidance on the implementation of the proposed interventions.

1.5. Integrated water resource management: Water is an important resource in Kajiado County and sensationally a transboundary issue. The report recommends a transboundary programme looking at water resource management.

1.6. Flood risk: Flooding is an emerging challenge threatening both humans and wildlife in most of the areas in and around Amboseli national Park. This report recommends a detailed study on flood risk situations to propose both short-term and long-term flood control measures.

1.7. Local restoration task force for enhanced restoration coordination: Noting the lack of proper/structured restoration coordination at the local level (particularly on FLR) this report recommends the formation of a cross-sectoral to enhance restoration efforts at the local level this assessment proposes

1.8. Community Forest Associations (CFAs): CFA remains the most powerful

restoration vehicle at the local level. Given their robust management system and the support in the county's forestry policy and regulatory framework, this assessment recommends their engagement at all levels of FLR decision-making at the local level and during the implementation.

1.9. The private sector plays an important role in augmenting the restoration efforts through various initiatives including normal corporate social responsibilities. This report recommended a county-level private sector forum to be convened by Amboseli Ecosystem Trust (AET)

1.10. To ensure restoration information consistency this assessment (in its scope and approach) should be replicated in the assessment to be done in the future.

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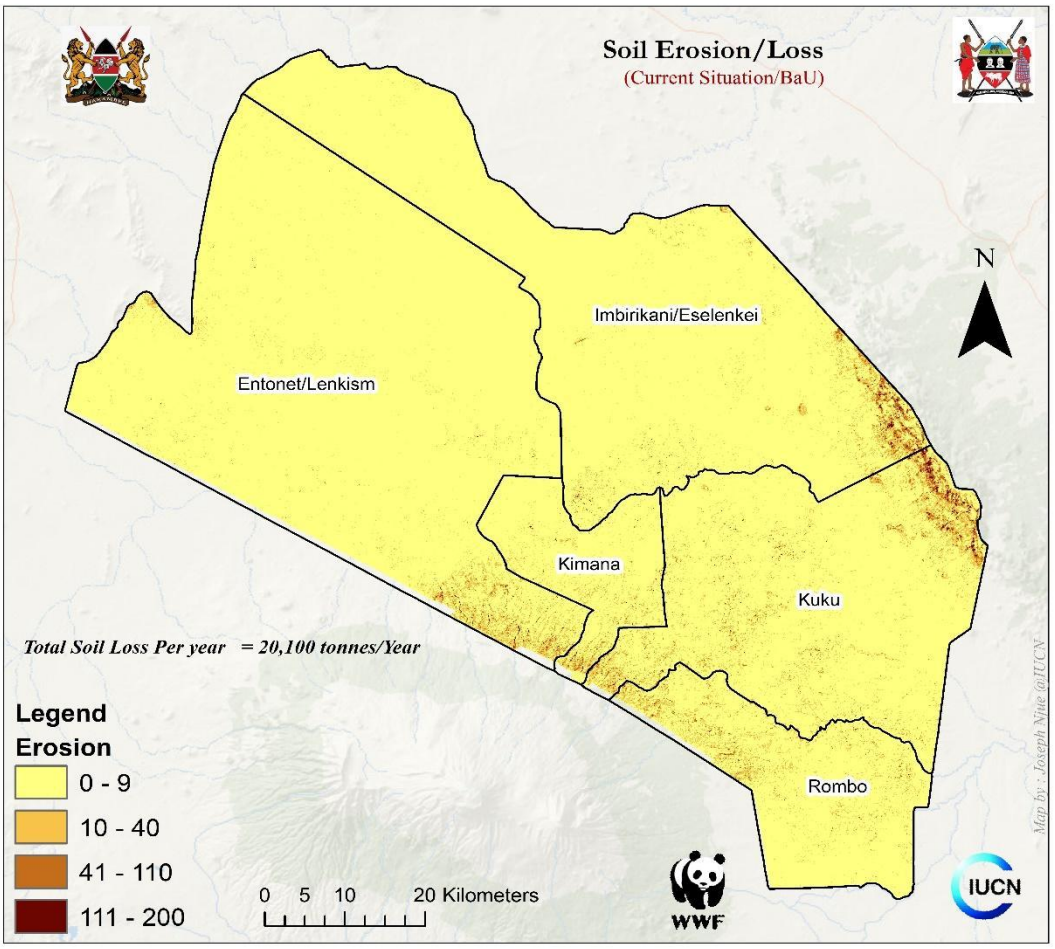
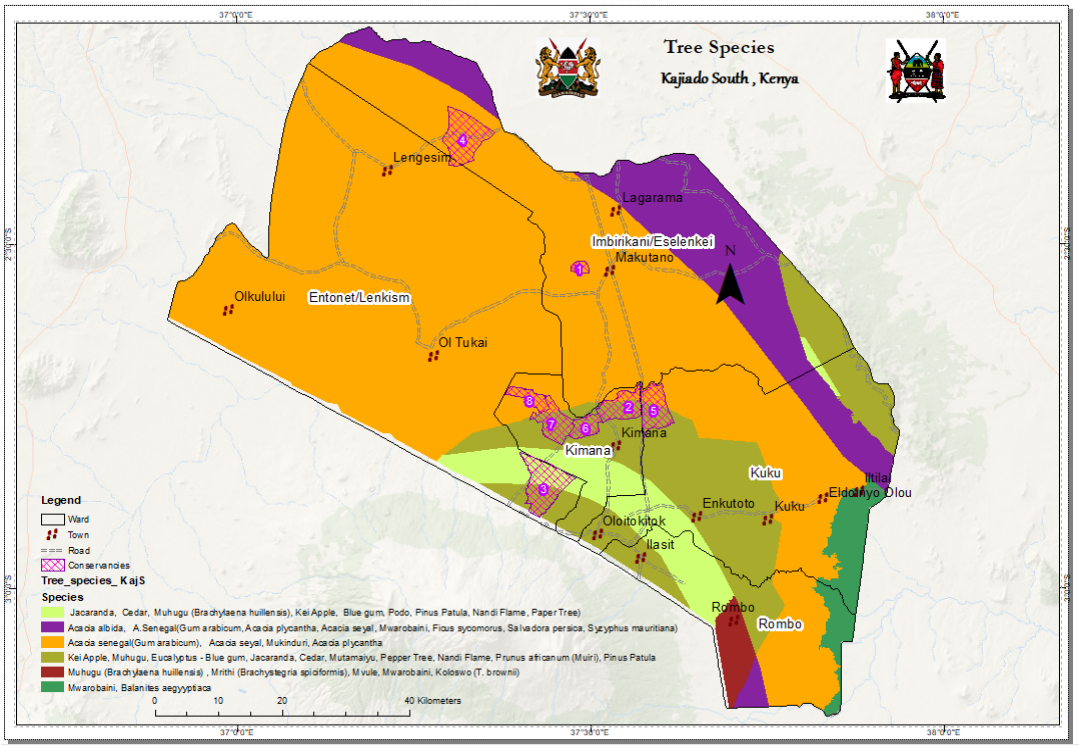
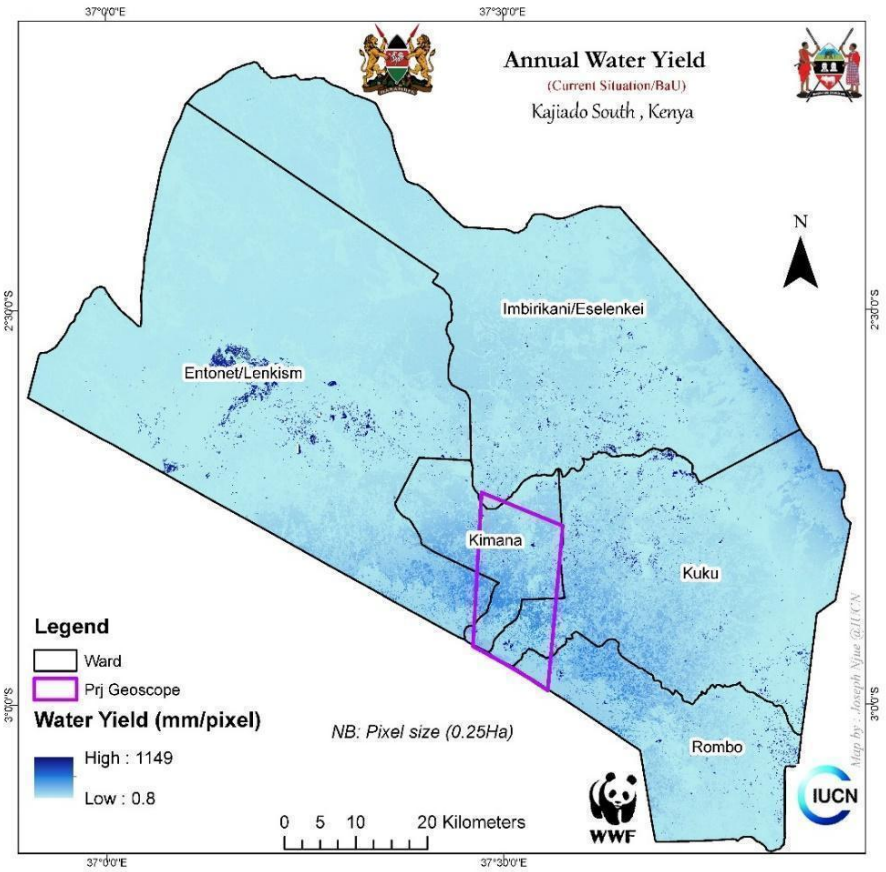
Annexes



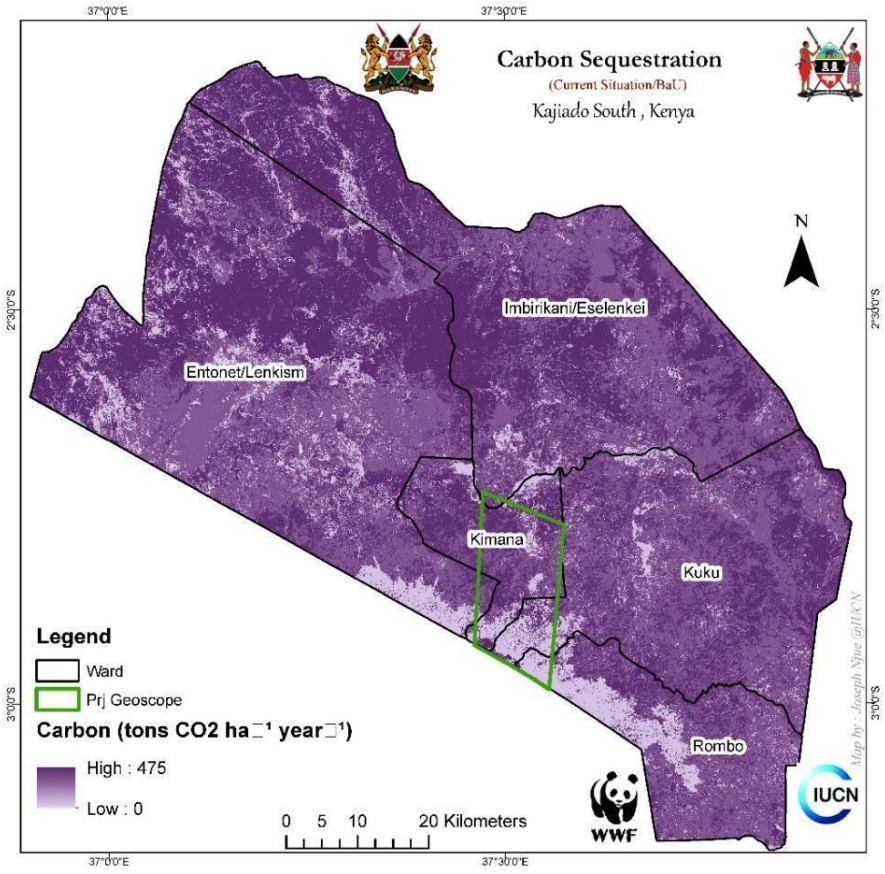
Annex 1. Map showing potential sediment export in Kajiado South – Sediment transport (tons ha-1 Year-1)



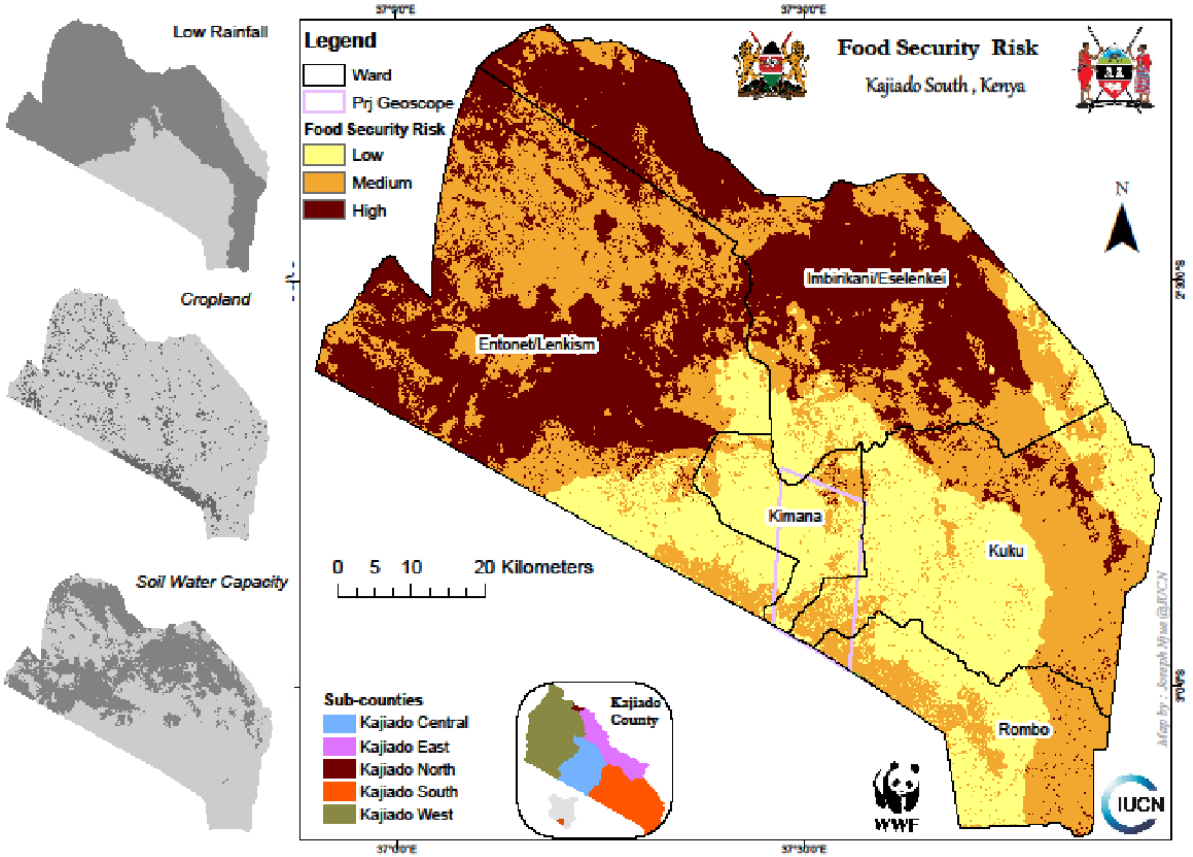
Annex 2. Tree species in Kajiado



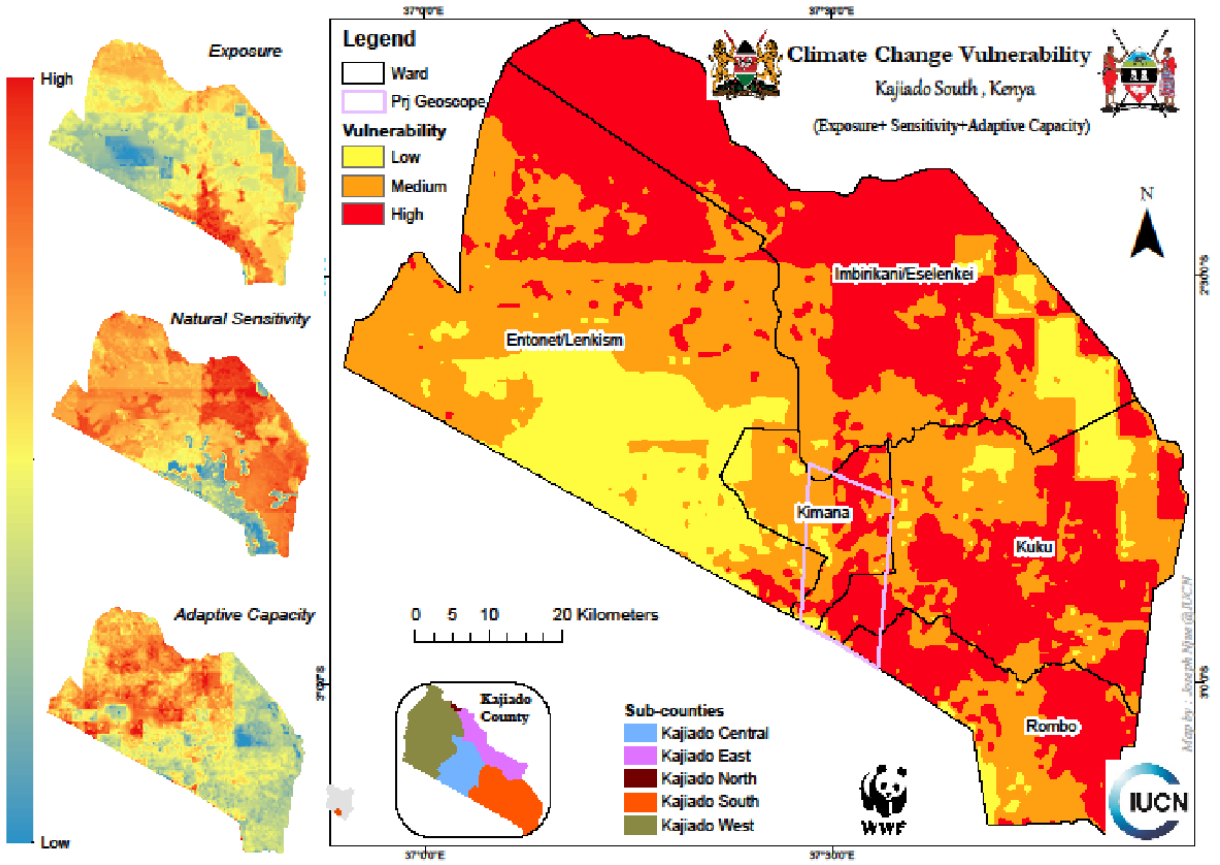
Annex 3. Annual Water Yield Map of Kajiado South



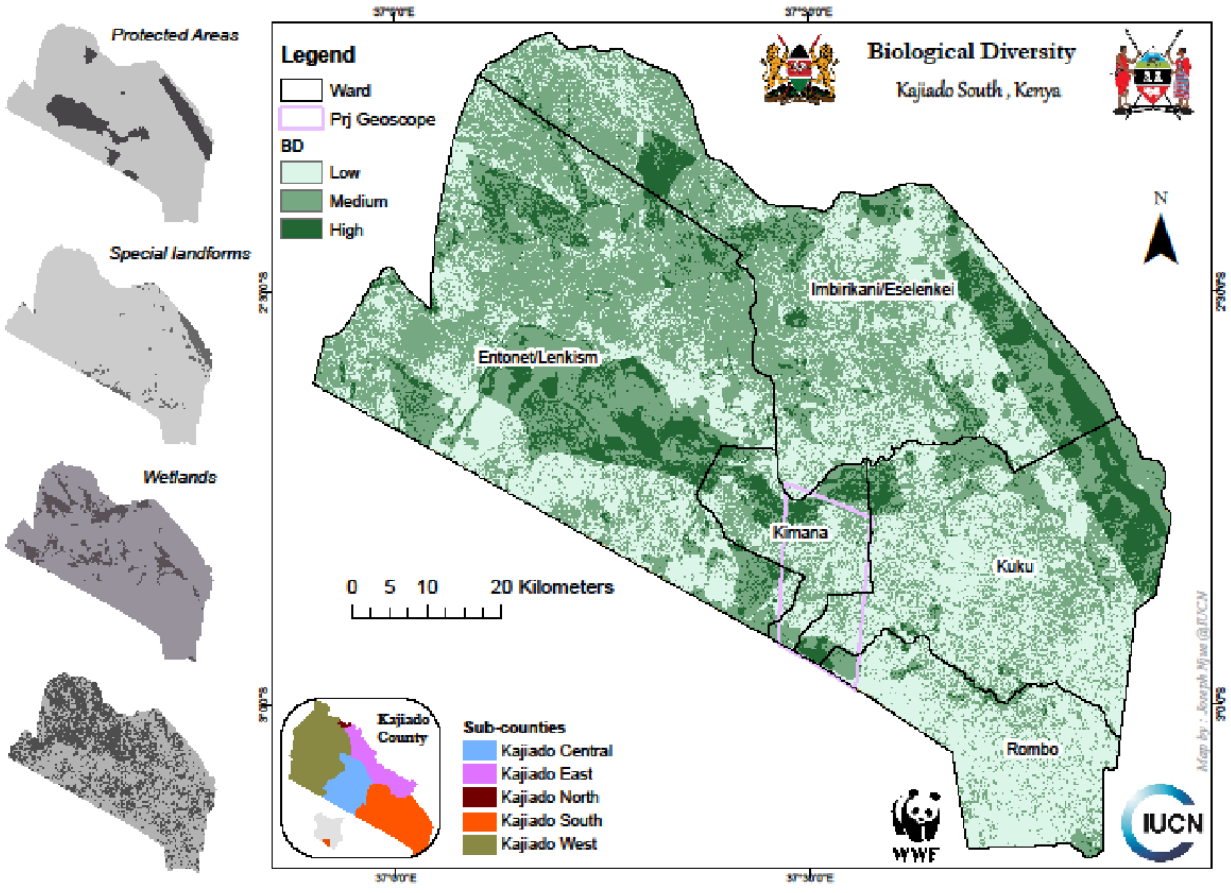
Annex 4. Map showing carbon sequestration (below and above ground)



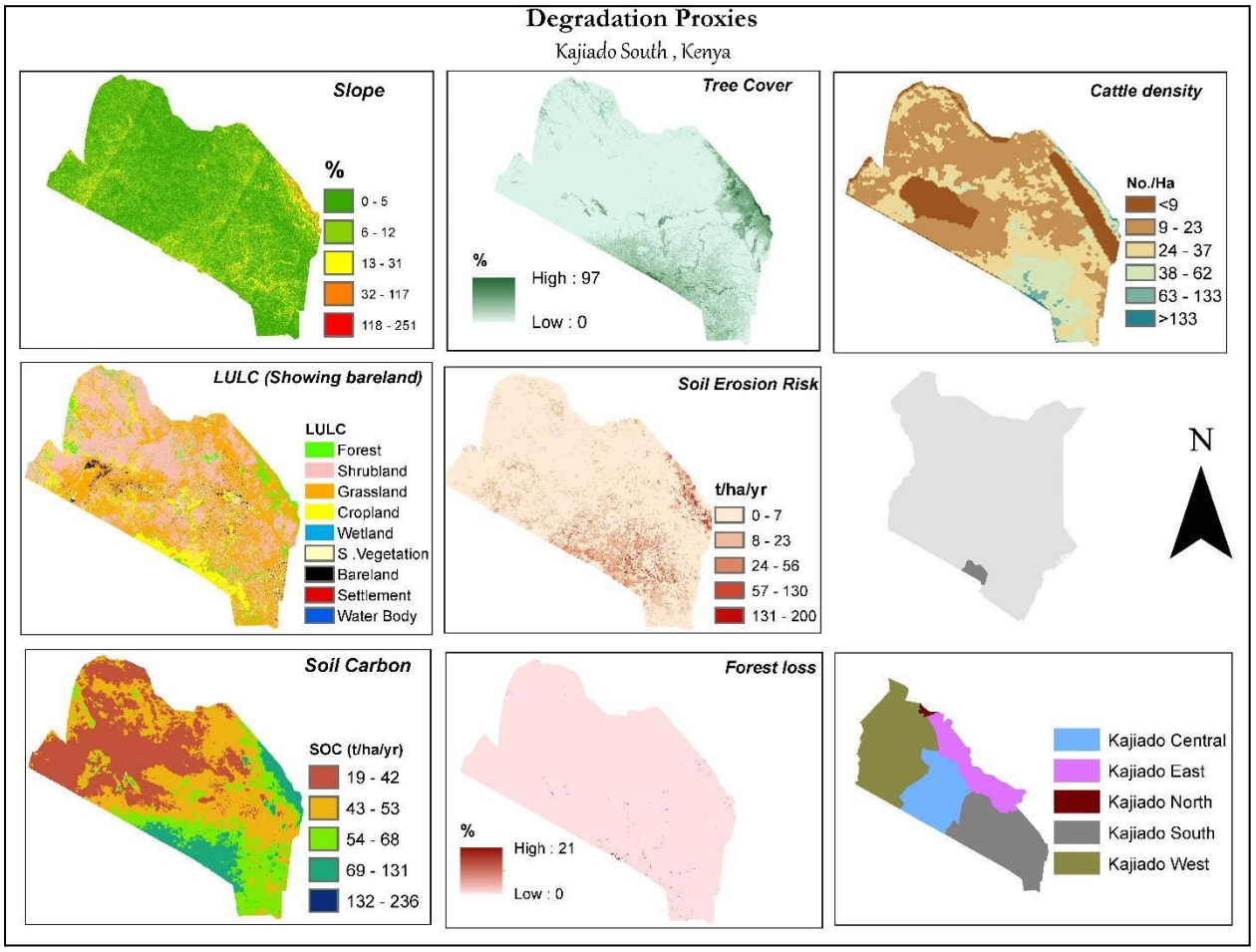
Annex 5. Map showing restoration potential for food security objective in Kajiado South



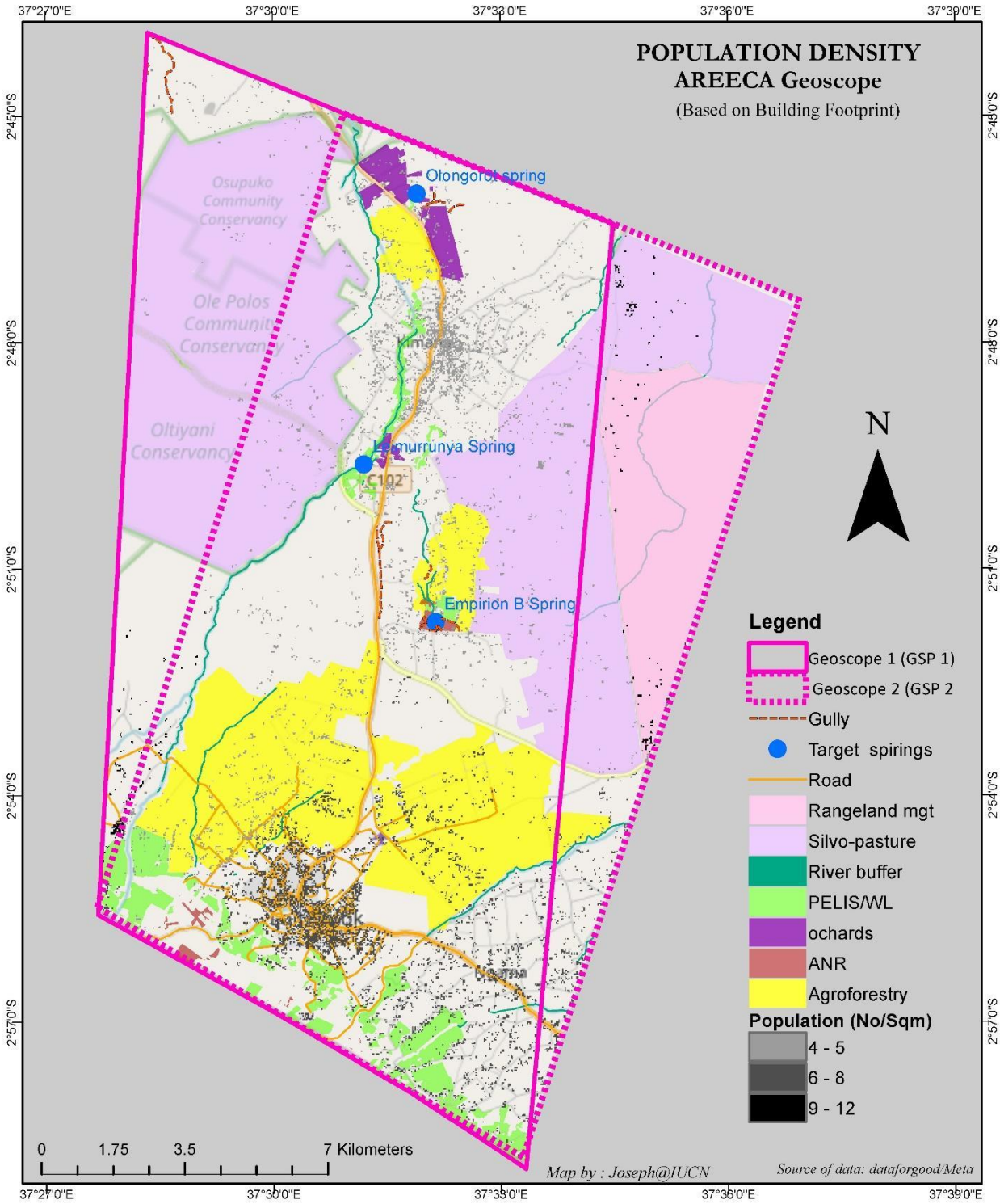
Annex 6. Map showing restoration potential for climate change vulnerability map of Kajiado South



Annex 7. Map showing the restoration potential for biological diversity objective in Kajiado South



Annex 8. Map showing GIS layers/proxies used in mapping degradation



Annex 8. Map showing the restoration potential for biological diversity objective in Kajiado South

Annex 9. Rapid Restoration Diagnostic Tool

WRI and IUCN published a “Rapid Restoration Diagnostic” that helps identify which success factors already exist and which are currently missing within landscapes being considered for restoration. It is designed to help decision-makers identify factors that must be addressed before investing large amounts of human, financial, or political capital in forest landscape restoration.

The preliminary version of this diagnostic was used in Rwanda. Key success factors for forest landscape restoration is shown in Table 1.

Annex10. Key success factors for forest landscape restoration

Theme	Feature	Key success factor
Motivate	Benefits	• Restoration provide economic, environmental, social and cultural benefits
	Awareness	• Benefits of restoration are publicly communicated • Opportunities (e.g., where, how much) for restoration are identified
	Crisis event	• Crisis events are leveraged
	Legal requirements	• Law requiring restoration exists and is enforced
Enable	Ecological conditions	• Soil, water, climate, and fire conditions are suitable for restoration • Plants and animals that can impede restoration are absent • Native seeds, seedlings, or source populations are readily available
	Market conditions	• Competing demands for alternative use for degraded lands are declining • Accessible markets for products from restored areas exists
	Policy conditions	• Land and natural resource tenure are secure • Policies affecting restoration are aligned and streamlined • Restrictions on clearing natural forests exits and is enforced
	Social conditions	• Local people are empowered to make decisions about restoration • Local people are able to benefit from restoration
	Institutional conditions	• Responsibility for restoration is clearly defined • Effective institutional coordination is in place
Implement	Leadership Knowledge	• National and/or local restoration champions exist • Sustained political commitment exists • Restoration “know-how” relevant to candidate landscapes exists • Restoration “know-how” transferred via peers or extension services
	Technical design Financing and incentives	• Restoration design is technically grounded and climate resilient • “Positive” incentives and funds for restoration outweigh “negative” incentives for status quo • Incentives and funds readily accessible

Theme	Feature	Key success factor
	Feedback	• Effective performance monitoring and evaluation in place • Early wins are communicated

Source: IUCN and WRI (2014). A guide to the Restoration Opportunities Assessment Methodology (ROAM): Assessing forest landscape restoration opportunities at the national or sub-national level. Working Paper (Road-test edition). Gland, Switzerland: IUCN. 125pp