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FOREWORD

Many people across the globe rely on the natural environment for food, water, energy and building materials. As society grows, so do the demands for ecosystem services. Humankind is therefore compelled to find a delicate balance between the demand for resources and their sustainable supply. When this balance is lost, ecosystems become degraded and less productive, providing fewer of the resources that we depend on for survival. In Kenya, we are familiar with this cycle. While we have a wealth of natural ecosystems and resources, we have also seen how quickly they can be depleted. In addition, climate change is amplifying these effects, making it harder for us to plan for the future. In an effort to address these pressures, the Government of Kenya has enacted a number of laws and policies that aim to restore landscapes so that they can continue to provide valuable services. The constitutional mandate to maintain at least 10% tree cover, the National Climate Change Response Strategy, and Kenya’s Vision 2030 development roadmap are all examples of these efforts.

In order to be successful in these initiatives and achieve the targets we have set for ourselves, there is need for collaboration and coordination amongst all stakeholders. This is not the sole responsibility of one agency or ministry, but the responsibility of all of us. Landscapes encompass vast areas, and cut across political and social boundaries. Because of this, the County and National government, universities, NGOs, community groups, and the private sector will all need to be involved if we are to reverse the direction of ecosystem degradation, and live in a more verdant and productive world.

The process described in this report presents a critical milestone by the Government of Kenya in enhancement of such a multi-stakeholder effort as we scale up our restoration work. This assessment brought together experts from land based sectors, especially forests, agriculture, wildlife and rangelands, to form a Landscape Restoration Technical Working Group. With leadership from the Kenya Forest Service, the Landscape Restoration Technical Working Group carried out an in depth analysis of the forest and landscape restoration opportunities in the country. The report highlights the large area of land that can potentially support restoration interventions in Kenya. While this vast area of land may seem daunting, it should be seen as a tremendous opportunity for Kenya to address its development goals by restoring ecosystem services. Restoring forests and landscapes, and the services they provide, is paramount to improving livelihoods for and ensuring we all live in a food secure world. The aim of this assessment is to identify where the opportunities for forest and landscape restoration are located, an important starting point for us as a country to begin working together to achieve large scale changes in our landscapes. This will require broad stakeholder engagement and cooperation, and has the potential to greatly improve the quality of life for millions of Kenyans.

I am hopeful that all of us will put into good use the findings presented in this report as we embark on this important forest and landscape restoration journey together. I urge each one of us to rise to the challenge and chart a path forward for Kenya as we launch the restoration of 5.1 Million hectares of degraded land by 2030. This will be difficult endeavor, but it is important to note that this will not be only about sacrifices, but about the opportunities that lie ahead.

Prof. Judi Wakhungu
Cabinet Secretary
Ministry of Environment and Natural Resources
ACKNOWLEDGMENTS

This assessment of forest and landscape restoration opportunities in Kenya was made possible through the contributions and support of the Ministry of Environment and Natural Resources and the Kenya Forest Service. Their leadership role throughout this process was key in ensuring its success. In addition, contributions from the Landscape Restoration Technical Working Group, which spent many hours discussing and determining the appropriate assessment criteria and data needed to generate the ensuing maps and area statistics, was also crucial in producing this report.

The Ministry of Environment and Natural Resources wishes to acknowledge the important roles played by the World Resources Institute, the Clinton Climate Initiative, and the Green Belt Movement, in this assessment.


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**LIST OF ABBREVIATIONS AND ACRONYMS**

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<thead>
<tr>
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<th>Full Form</th>
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<tbody>
<tr>
<td>ACC</td>
<td>Africa Conservation Centre</td>
</tr>
<tr>
<td>AEZ</td>
<td>Agro-Ecological Zone</td>
</tr>
<tr>
<td>AFR100</td>
<td>African Forest Landscape Restoration Initiative</td>
</tr>
<tr>
<td>BMUB</td>
<td>German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety</td>
</tr>
<tr>
<td>CCI</td>
<td>Clinton Climate Initiative</td>
</tr>
<tr>
<td>CO2</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>DRSRS</td>
<td>Department of Resource Surveys and Remote Sensing</td>
</tr>
<tr>
<td>FAO</td>
<td>Food &amp; Agriculture Organisation of the United Nations</td>
</tr>
<tr>
<td>GBM</td>
<td>Green Belt Movement</td>
</tr>
<tr>
<td>GEF</td>
<td>Global Environment Facility</td>
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<tr>
<td>GoK</td>
<td>Government of Kenya</td>
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<tr>
<td>ICRAF</td>
<td>World Agroforestry Centre</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
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<tr>
<td>KARI</td>
<td>Kenya Agricultural Research Institute</td>
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<td>KFS</td>
<td>Kenya Forest Service</td>
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<tr>
<td>KWS</td>
<td>Kenya Wildlife Service</td>
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<tr>
<td>LRTWG</td>
<td>Landscape Restoration Technical Working Group</td>
</tr>
<tr>
<td>MALF</td>
<td>Ministry of Agriculture, Livestock, and Fisheries</td>
</tr>
<tr>
<td>MENR</td>
<td>Ministry of Environment and Natural Resources</td>
</tr>
<tr>
<td>Mt</td>
<td>Megaton</td>
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<tr>
<td>PNV</td>
<td>Potential Natural Vegetation</td>
</tr>
<tr>
<td>REDD+</td>
<td>Reduce emissions from deforestation and forest degradation, and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks</td>
</tr>
<tr>
<td>ROAM</td>
<td>Restoration Opportunities Assessment Methodology</td>
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<tr>
<td>RUE</td>
<td>Rain-Use Efficiency</td>
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<tr>
<td>SRTM</td>
<td>Shuttle Radar Topography Mission</td>
</tr>
<tr>
<td>UNCCD</td>
<td>United Nations Convention to Combat Desertification</td>
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<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<tr>
<td>WCMC</td>
<td>World Conservation Monitoring Centre of the United Nations</td>
</tr>
<tr>
<td>WRI</td>
<td>World Resources Institute</td>
</tr>
<tr>
<td>WRMA</td>
<td>Water Resource Management Authority</td>
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</table>
DEFINITIONS

In the context of this assessment, “national forest and landscape restoration potential maps” was defined as follows:

- **National**: Supporting national-level decision-making. While it is recognized that counties may have priorities other than those defined nationally, these maps were produced with the aim of supporting national level decision-making processes. Counties are encouraged to produce their own maps in order to tailor them to their specific development agendas and circumstances.

- **Landscape**: Social-ecological system that consists of a mosaic of natural and/or human-modified ecosystems. (Buck and Bailey, 2014);

- **Restoration**: Long-term process of regaining ecological functions and enhancing human well-being in degraded landscapes. This process may or may not result in the reestablishment of the original vegetation.

- **Potential maps**: Mapping where landscape restoration opportunities could potentially be implemented. These maps do not show where each landscape restoration option should be implemented, rather, they indicate where restoration potential criteria are met and guide where to conduct further assessment and stakeholder engagement. The decision of which restoration option to implement where lies with the local stakeholders as they will be the ones managing the land, reaping the benefits and bearing the costs of implementing these options.

- **Tree-based**: Adding more trees into landscapes. This may be as a forest or, in other cases, as agro- or silvo-pastoralism and other land uses.

- **Forest**: Kenyan forests are defined as land spanning more than 0.5 hectares with trees of at least 2 meters and a minimum canopy cover of 15%, and include natural and planted plantation forests on state, community and private land. (KFS, 2016).

- **Forest Landscape**: A landscape where trees or forests play a key role in ecosystem health and productivity, providing multiple ecological functions and benefits to human well-being. (Adapted from IUCN and WRI, 2014)

SUMMARY

The purpose of this report is to document the process taken by the Government of Kenya to identify and map potential areas suitable for different landscape restoration options in the country. The report describes the data and analysis carried out by the Landscape Restoration Technical Working Group, with technical support from the World Resources Institute, the Clinton Climate Initiative and the Green Belt Movement. The methods, maps and statistics presented in this report will inform the implementation of the constitutional target of reaching at least 10% tree cover. In addition, the report provides a summary of the area statistics for potential landscape restoration options and proposes three potential scenarios for consideration by the Government of Kenya to inform its restoration commitment to the Bonn Challenge, New York Declaration on Forests and the African Forest Landscape Restoration Initiative (AFR100). Finally, the report provides the carbon sequestration potential for each of the proposed restoration scenarios.
INTRODUCTION

Much of the planet's lands and landscapes are becoming degraded, causing a myriad of different challenges to people and wildlife alike. Restoring these landscapes is paramount to improving human livelihoods, long-term food security, biodiversity conservation and climate stability. Trees play an important role in landscapes across the world, helping to provide multiple ecosystem services such as stabilizing soils, providing important habitat for wildlife, as well as keeping soils fertile for our agricultural use. By introducing more trees into landscapes, whether as natural forests or as mixed agroforestry systems, and through better land management practices, degradation can be reversed, restoring productivity and resilience (Buckingham et al, 2016). This holds true for the drier regions as well, where rangelands are very important ecosystems for both people and nature. Here, holistic rangeland management, which in some cases may include allowing more trees to regenerate across the landscape, has been shown to revitalize ecosystems and improve livelihoods.

In Kenya, forest restoration is a high priority on the government's agenda, and is reflected in a number of different legislations and policies. The Government of Kenya has put in place several high level initiatives and laws that are strongly linked to restoring lands and their associated ecosystem services. These include:

- The 2010 Constitution calls for reforesting and maintaining a tree cover of at least 10% of the country (GoK, 2010a);
- The National Climate Change Response Strategy calls for growing 7.6 billion trees on 4.1 million hectares of land during the next 20 years (GoK, 2010b);
- Kenya's Vision 2030 has a flagship project underway for rehabilitating and protecting indigenous forests in the five water towers (Mount Kenya, the Aberdare Range, the Mau Forest Complex, Mount Elgon and the Cherangani Hills), with the goal to increase forest cover and volume of water flowing from the catchment areas (GoK, 2007);
- The Trees-for-Jobs Programme intends to plant one billion trees to increase forest cover and at the same time create employment for youth (GoK, 2008).

In addition to these restoration initiatives, Kenya is also deeply involved with REDD+ Readiness Preparation. One of the priority topics in the national REDD+ Readiness process focuses on the enhancement of forest carbon stocks and proposes several strategy options to restore forests, including support to the Government target to increase tree cover on 10% of Kenya's land, and promote forest protection that increases carbon stocks, livelihood benefits and improves biodiversity (UNEP-WCMC, 2015).

It is clear from the initiatives mentioned above that Kenya has a strong commitment to landscape restoration and has been putting in place the building blocks for improving its tree cover and restoring its landscapes and associated ecosystem services. Landscape restoration will be an important tool in helping the country meet its economic, development, and environmental goals. Scaling up these restoration initiatives requires a proper assessment of the existing opportunities, planning and resources to support implementation on the ground. In September 2014, the Government of Kenya established a multi-stakeholder Technical Working Group led by the Kenya Forest Service (KFS) to carry out this assessment of potential restoration opportunities – a critical first step towards forging a coordinated strategy for scaling up landscape restoration in Kenya. The Landscape Restoration Technical Working Group includes a broad range of stakeholders from multiple sectors. Over the subsequent two years, the LRTWG held a series of landscape restoration workshops that focused on analyzing different landscape restoration options for the country. The group identified the most pressing land use challenges currently affecting Kenya, as well as a list of restoration options that could help address these challenges and restore the ecosystem services that are currently lacking. The various landscape restoration options identified include:

- Reforestation and rehabilitation of degraded natural forests
- Agroforestry and woodlots on cropland
- Commercial tree and bamboo plantations
- Tree-based buffers along waterways, wetlands and roads
- Silvo-pastoral and rangeland restoration

These restoration options can potentially help restore ecosystem services associated with trees, such as erosion control, regulation of water flows and soil quality, as well as forest habitat for wildlife.

In addition, the LRTWG was tasked with mapping and quantifying where these different restoration options could potentially be implemented in order to help inform a national restoration target that will contribute to the many national priorities. Through extensive work and stakeholder engagement, the LRTWG produced several maps and associated area statistics that are presented in this report as potential areas for landscape restoration. These maps can help various state and non-state actors identify:

- Opportunities to scale up agroforestry to reduce erosion, increase livelihood diversification, fodder production and soil fertility;
- Existing forests that can be restocked, as well as where new natural forests can be established, to increase carbon sequestration, biodiversity habitat, and prevent landslides and flooding;
- Areas where trees can stabilize river banks and control sedimentation;
- Where to invest in commercial plantations;
- Where trees can be planted along roadways to help reduce water runoff and air pollution; or
- Where rangelands might benefit from improved management practices.

Because of the multi-sector, multi-stakeholder nature of the LRTWG, these priorities cover a wide range of landscapes,

1. Please see Appendix 1
including forest lands, agricultural lands and rangelands. It is important to note that this has been an iterative process focused on national level planning and opportunities. Once priority landscapes are identified, similar mapping exercises will need to be carried out at the landscape level to ensure local-level plans meet the specific needs of the local communities and biodiversity, and use the best available data for these areas. This report also incorporates feedback from the High-level Landscape Restoration Working Group, which was organized jointly by the Secretary of Natural Resources and Secretary of Environment within the Ministry of Environment and Natural Resources.

METHOD

DATA AND LIMITATIONS

This assessment was conducted using the best readily available data sets that covered the entire country. Where national-level data was not available, global data sets were used. While more data may exist, it was not made readily available during the time this assessment was being conducted. Many of the data sets used are national or global in scope, and therefore set limitations on how the assessment and corresponding maps should be used. The results of this assessment are meant to provide an overview of potential restoration opportunities across all of Kenya in order to inform discussions and help start a dialogue on how best to proceed with landscape restoration activities. The maps should not be used to inform local-level planning of restoration interventions, as the data does not account for all of the specific contexts on the ground. Once a potential project area has been identified, a local-level assessment and community consultations need to be carried out to ensure that planned activities are aligned with local-level objectives. Local-level assessments may choose to use this national-level technical report as an example of how to proceed at the sub-national level.

OVERALL PROCESS

The process of producing the national forest and landscape restoration potential maps and developing restoration commitment scenarios followed five steps (Figure 1) adapted from the mapping module of the Restoration Opportunity Assessment Methodology (ROAM) (IUCN and WRI, 2014).

While the steps are presented in a linear fashion they were revisited as need arose based on stakeholder engagement, new knowledge, and new data.

STAKEHOLDER ENGAGEMENT

Throughout the process of mapping national landscape restoration opportunities in Kenya, multi-sector stakeholder engagement and feedback was key in providing guidance on the analysis and results. Landscapes transcend political and jurisdictional boundaries, often times encompassing many different land uses. Because of this, it was important to include representatives from these different sectors to ensure that the concerns and expectations of each group were reflected in the analysis.

In September 2014, a multi-sector consultation workshop was conducted to introduce the concept and benefits of landscape restoration, and to gain an understanding of the land use challenges affecting Kenya. The workshop participants identified the key land use challenges as well as a list of

---

2. Please see Appendix 1

Figure 1: Steps followed in producing national forest and landscape restoration potential maps
restoration interventions that could potentially mitigate these challenges and these became the focus of the national restoration opportunity mapping efforts. At the conclusion of the workshop, the LRTWG was established in order to carry out the national mapping process.

Throughout the mapping process, the LRTWG engaged with the Secretary of Environment and Secretary of Natural Resources within the Ministry of Environment and Natural Resources, along with representatives from other ministries. This High-level Landscape Restoration Working Group served to review the progress and results of the LRTWG and provided valuable feedback that helped improve the final maps and results.

Upon completion on the data analysis for this assessment, a national stakeholder workshop was convened in March 2016. The objective of this workshop was to ensure that all stakeholders understood the process and results of the maps and that they were in agreement with the assumptions and assessment criteria that were used.

STEP 1: IDENTIFICATION OF NATIONAL LAND USE CHALLENGES AND LANDSCAPE RESTORATION OPTIONS TO ADDRESS THESE CHALLENGES

Identification of national land use challenges

Land use challenges are defined as problems arising from the way land is used and/or managed. Based on how socio-economic factors (e.g., increase in population density, land tenure, shifting cultivation, lack of land use planning and policy) as well as environmental factors (e.g., changes in climatic patterns, availability of rainfall, wildlife habitat) affect the way land is used and managed, the experts who attended the first consultation workshop identified the following land use challenges as roadblocks to achieving Kenya’s national economic, social, and environmental goals:

- Habitat fragmentation/loss of biodiversity
- Forest degradation
- Loss of soil fertility
- Overgrazing/free grazing
- Deforestation
- Soil erosion
- Siltation and sedimentation of waterbodies
- Water stress (on water bodies and soils)
- Flooding
- Landslides
- Climate change

3. Land use challenges specific to counties may differ from those listed here, and should be identified and addressed at the county level following a similar process as the one conducted at the national level.

Identification of national landscape restoration options

Trees supply ecosystem services that can directly and indirectly help address the land use challenges identified above (Figure 2). By increasing the number of trees in Kenyan landscapes, these ecosystem services have the potential to be restored.

There are many ways to bring trees back into landscapes depending on the main ecosystem services desired to be

Figure 2: Trees, ecosystem services, and national land use challenges

<table>
<thead>
<tr>
<th>NATIONAL LAND USE CHALLENGES</th>
<th>TREE-RELATED ECOSYSTEM SERVICES</th>
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<tbody>
<tr>
<td>1. Habitat fragmentation / loss of biodiversity</td>
<td>Forest habitat and corridors</td>
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<tr>
<td>2. Forest degradation</td>
<td>Woody biomass</td>
</tr>
<tr>
<td>3. Loss of soil fertility</td>
<td>Regulation of soil quality</td>
</tr>
<tr>
<td>4. Overgrazing</td>
<td>Non-timber tree products</td>
</tr>
<tr>
<td>5. Deforestation</td>
<td>Erosion control</td>
</tr>
<tr>
<td>6. Soil erosion</td>
<td>Regulation of local climate</td>
</tr>
<tr>
<td>7. Siltation / sedimentation of waterbodies</td>
<td>Regulation of water timing and flows</td>
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<tr>
<td>8. Water stress</td>
<td>Regulation of landslides</td>
</tr>
<tr>
<td>9. Flooding</td>
<td>Carbon sequestration</td>
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<tr>
<td>10. Landslides</td>
<td></td>
</tr>
<tr>
<td>11. Climate change</td>
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restored. The following national landscape restoration opportunities were identified as the most relevant to Kenya:

**Option 1: Restoration Opportunities for Afforestation or Reforestation of Natural Forests**

Potential opportunity areas where forests could be established on land that had recent forest cover (reforestation) or on land that has been without forest cover for a much longer period (afforestation) (adapted from IPCC, 2000). The term forest refers to a climax ecosystem that can support trees. These forest areas were divided into four distinct types based on KFS forest classifications:

- Montane forest, western rainforest and bamboo
- Coastal forest
- Mangrove forest
- Dryland forest

**Option 2: Restoration Opportunities for Rehabilitation of Degraded Natural Forests**

Potential opportunity areas for rehabilitating existing natural forests. These differ from option 1 in that these are currently existing forests showing signs of degradation, and option 1 identifies areas that have no current forest cover and need to be reestablished. For the purpose of this national mapping exercise, forest degradation was determined by using distinct tree canopy cover thresholds for the four forest types. The LRTWG recognizes that tree canopy cover alone cannot determine the health of a forest, but in the absence of detailed national data on other factors such as tree species, land productivity, and carbon stocks, tree canopy cover has been used as a proxy.

**Option 3: Restoration Opportunities for Agroforestry on Cropland**

Potential opportunity areas where on-farm trees or the use of agroforestry could be increased. This can be done through a number of different interventions such as field border plantings, woodlots, agroforests, and inter-planting trees with crops. Two distinct areas were identified for this option:

1. **Agriculture areas with less than 10% tree canopy cover.** Under the Agriculture (Farm Forestry) Rules, 2009 (GoK, 2009), all agriculture lands need to maintain a minimum of 10% tree canopy cover. Areas with less than 10% tree canopy cover are thus not meeting the Agriculture (Farm Forestry) Rules, 2009 and could be targeted as priorities in order to bring them into compliance with the law.

2. **Agriculture areas with more than 10% but less than 30% tree canopy cover.** While 10% is the minimum threshold under the Agriculture (Farm Forestry) Rules, 2009, some areas may be able to increase tree canopy cover above that, particularly on farmlands that have degraded soil quality. 30% tree canopy cover was determined to be the upper threshold for using agroforestry to regenerate degraded land successfully without negatively impacting overall agricultural production. While these areas may have potential to increase tree canopy cover based on the assessment criteria, feasibility will need to be assessed at individual sites before implementation, as current site productivity may already be high.

**Option 4: Restoration Opportunities for Commercial Tree and Bamboo Plantations on Potentially Marginal Cropland and Un-stocked Plantation Forests**

Potential areas where commercial tree plantations could be established for the production of wood products for income generation. The LRTWG determined that on potentially marginal cropland that may currently have lower levels of productivity, it may be more beneficial to switch to a tree plantation or agroforest management scheme, including the use of bamboo. In the absence of available data on national cropland productivity, a proxy was used to determine what areas might have marginal agricultural productivity. It is important to recognize though that some of these areas may in fact be producing adequate crop yields and it may not be desirable for alternative land management options. The decision to change land management practices will need to be assessed at the local level. This option also considers areas of officially designated plantation forests that are currently unstocked or have very low levels of tree canopy cover.

**Option 5: Restoration Opportunities for Tree-based Buffer Zones along Water Bodies and Wetlands**

Potential areas along water bodies and wetlands where tree buffers can be established, and where currently there are no trees. These areas are very critical due to the importance of trees in helping to reduce erosion and sedimentation into waterways, and because of such, several laws and policies in Kenya require these buffers. It is important to note that while the total area where tree buffers could be established is relatively small, these areas play a key role in managing sediment and water quality and have the potential to provide high levels of ecosystem services and benefits to society and the environment.

**Option 6: Restoration Opportunities for Tree-based Buffer Zones along Roads**

Potential areas along roads where tree buffers can be established. These buffers are important for controlling local air and noise pollution, as well as run off from road surfaces. While the reserves required under the current law (The Kenya Gazette, 2003) are not specifically intended are tree buffers, the LRTWG agreed that they could accommodate tree plantings to provide ecosystem services until roads are widened or modified in the future.

**Option 7: Restoration Opportunities for Rangelands**

Potential opportunities for restoration of degraded rangeland and grassland areas. While not one of the original restoration options selected for mapping, throughout the process, the LRTWG and the stakeholders it consulted decided to include rangeland restoration in the analysis because of the large land area it covers (roughly 70% of the country) and because of its importance to livelihoods and...
biodiversity. Due to the lack of sufficient data on the current health and productivity or degradation of rangelands, the LRTWG used Rain Use Efficiency (RUE) and tree canopy cover to identify potentially degraded rangelands. RUE measures the long-term changes in net primary productivity, and all rangelands with declines in RUE are assumed to be showing signs of degradation. Areas with the greatest increases in RUE and less than 15% tree canopy cover are assumed to be degraded as this may be a sign of bush encroachment. These areas identify where improved management practices on rangelands could be used to encourage the restoration of silvo-pastoral systems and grasslands to improve grazing quality and wildlife habitat.

It is important to note that by including rangelands in this analysis, the LRTWG is not promoting the establishment of forests or woodlands across Kenya's rangelands, but rather, that some rangeland restoration will use silvo-pastoralism as a strategy, while others will incorporate more holistic management practices to improve grassland productivity. The intended use of the land after restoration would remain for grazing.

These landscape restoration options can potentially address multiple land use challenges as trees and grasslands supply multiple ecosystem services. However, some restoration options may be more appropriate than others in helping address specific land use challenges (Table 1). For example, establishing natural forests and rehabilitating degraded natural forests are more relevant to addressing habitat fragmentation and loss of biodiversity than commercial tree plantations.

**STEP 2: IDENTIFICATION OF CRITERIA TO ASSESS POTENTIAL TO SCALE UP LANDSCAPE RESTORATION OPTIONS SELECTED FOR MAPPING AND COMPILATION OF BEST READILY AVAILABLE NATIONAL SPATIAL DATA**

In order to perform the spatial analysis, detailed assessment criteria need to be developed and spatial data need to be collected. The LRTWG went through each restoration option, defining what each restoration option was aiming to identify, and then developing detailed assessment criteria, taking a multi-sector approach. Once assessment criteria were developed, experts on the team helped identify specific national level spatial data that was readily available. This was an iterative process, and once the first draft of the maps were developed, the LRTWG analyzed the maps and made revisions to the assessment criteria to address any issues. The detailed assessment criteria and spatial data for each option can be found below. Note that some spatial data for specific assessment criteria was unavailable and was thus excluded from the current analysis.

### Table 1: Landscape restoration options and their potential to partially address identified land use challenges – summary table

<table>
<thead>
<tr>
<th>NATIONAL LAND USE CHALLENGES RELATED TO TREES</th>
<th>AFFORESTATION OF NATURAL FORESTS</th>
<th>REHABILITATION OF DEGRADED NATURAL FORESTS</th>
<th>AGROFORESTRY ON CROPLAND</th>
<th>COMMERCIAL TREE &amp; BAMBOO PLANTATIONS</th>
<th>TREE-BASED BUFFER ZONES ALONG WATER BODIES AND WETLANDS</th>
<th>TREE-BASED BUFFER ZONES ALONG ROADS</th>
<th>RANGE LAND RESTORATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat fragmentation/loss of biodiversity</td>
<td>X</td>
<td>X</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>(X)</td>
</tr>
<tr>
<td>Forest degradation</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
<td>(X)</td>
<td>(X)</td>
<td>(X)</td>
<td>X</td>
</tr>
<tr>
<td>Loss of soil fertility</td>
<td></td>
<td>X</td>
<td>X</td>
<td>(X)</td>
<td>(X)</td>
<td>(X)</td>
<td></td>
</tr>
<tr>
<td>Overgrazing</td>
<td>(X)</td>
<td>(X)</td>
<td>X</td>
<td>(X)</td>
<td>(X)</td>
<td>(X)</td>
<td></td>
</tr>
<tr>
<td>Deforestation</td>
<td>(X)</td>
<td>(X)</td>
<td>X</td>
<td>(X)</td>
<td>(X)</td>
<td>(X)</td>
<td></td>
</tr>
<tr>
<td>Soil Erosion</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Siltation/sedimentation of water bodies</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Water stress</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Flooding</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Landslides</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Climate change</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Legend:**

- X: this restoration option is important to address this land use challenge
- (X): this restoration option is secondarily important to address this land use challenge
The individual potential natural vegetation classes were grouped into four main forest classes. These groupings serve as an estimation of the type of forest that would occur naturally. The Potential Natural Vegetation classes used are those which the LRTWG and other experts identified as having the potential to support forests or woodlands.

1. Montane Forest, Western Rainforest, and Bamboo:
   - Afromontane moist transitional forest (Fe)
   - Afromontane rain forest (Fa)
   - Afromontane undifferentiated forest (Fb)
   - Afromontane bamboo (B)
   - Afromontane dry transitional forest (Fh)
   - Complex of Afromontane undifferentiated forest with wooded grasslands and evergreen or semi-evergreen bushland and thicket at lower margins (Fb/Be/wd)
   - Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest (Fi)
   - Lake Victoria transitional rain forest (Ff)
   - Moist Combretum wooded grassland (Wcm) – (North of Kisumu)
   - Single-dominant Hagenia abyssinica forest (Fd)

2. Coastal Forest:
   - Zanzibar-Inhambane lowland rain forest (Fo)
   - Zanzibar-Inhambane coastal mosaic (CM)

3. Mangrove:
   - Mangrove (M)

4. Dryland Forest:
   - Acacia tortilis wooded grassland and woodland (WdK)
   - Acacia-Commiphora deciduous wooded grassland + Combretum wooded grassland (compound) (Bdw/Wc)
   - Catena of North Zambezian Undifferentiated woodland + edaphic grassland on drainage-impeded or seasonally flooded soils (Wn/g)
   - Edaphic woodlands on drainage-impeded or seasonally flooded soils (wd)
   - Moist Combretum wooded grassland (Wcm) – (South of Kisumu)
   - Riverine wooded vegetation (r)
   - Somalia-Masai Acacia-Commiphora deciduous bushland and thicket (Bd)
   - Transitional zone Somalia-Masai Acacia-Commiphora deciduous bushland and thicket and Dry Combretum wooded grassland (Bd/Wd)
   - Upland Acacia wooded grassland (with sometimes rocky outcrops with evergreen bushland) (We)

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>VALUE</th>
<th>JUSTIFICATION AND SOURCE OF SPATIAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential natural vegetation (PNV)</td>
<td>Include vegetation classes that can be classified as forest. (See list of included PNV classes and their Kenya forest grouping below.)</td>
<td>These classes serve as ecological enabling conditions indicating where the natural vegetation is a forest ecosystem. Data source: van Breugel et al 2015</td>
</tr>
<tr>
<td>Cropland on steep slopes</td>
<td>Exclude cropland areas with slope less than 35%</td>
<td>“Protection of land with slope exceeding 35 per cent. Any person who cultivates, cuts down or destroys any vegetation, or depastures any livestock on any land of which the slope exceeds 35 per cent shall be guilty of an offence.” (GoK, 1965) Cropland below 35% slope should not be converted to forest. Data sources: SRTM, DEM; KFS 2013, Cropland</td>
</tr>
<tr>
<td>Current land cover</td>
<td>Exclude all existing forests</td>
<td>These areas are already forested, but might need restocking or rehabilitation. Data sources: KFS 2013, Forestland; KFS 2013, Forest Legal Status</td>
</tr>
<tr>
<td></td>
<td>Exclude wetlands</td>
<td>It is not desirable to convert wetlands. They provide important ecosystem services and need to be conserved. Data source: KFS 2013, Wetlands</td>
</tr>
<tr>
<td></td>
<td>Exclude natural grasslands and rangelands. In the absence of national data on natural grasslands and rangelands, this analysis excludes rangelands that intersect with the potential natural vegetation classes that form the dryland forest class.</td>
<td>These areas are primarily used for grazing. We make the assumption that not all of the rangelands are natural, and those that intersect with non-dryland potential forests may represent converted natural forests, and thus could be considered for potential afforestation and reforestation efforts. Data sources: KFS 2013, Grasslands; van Breugel et al 2015</td>
</tr>
<tr>
<td></td>
<td>Exclude settlements</td>
<td>Opportunity costs are too high to promote afforestation or reforestation activities in settlements. Data source: KFS 2013, Settlements</td>
</tr>
<tr>
<td>Protected Areas</td>
<td>Exclude cropland outside the following protected area classes:</td>
<td>No agriculture should be promoted in these protected areas. Data sources: KWS undated, Wildlife Parks; KFS 2013, Forest Legal Status; IUCN &amp; UNEP-WCMC 2015, WDPA</td>
</tr>
<tr>
<td></td>
<td>• National parks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• National Reserves</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• National Sanctuaries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Gazetted Forests</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Community and Private Conservancies</td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>Exclude areas above 3,800 m</td>
<td>Trees cannot grow above the tree line (3,800m). Data source: SRTM undated</td>
</tr>
</tbody>
</table>

The individual potential natural vegetation classes were grouped into four main forest classes. These groupings serve as an estimation of the type of forest that would occur naturally. The Potential Natural Vegetation classes used are those which the LRTWG and other experts identified as having the potential to support forests or woodlands.

1. Montane Forest, Western Rainforest, and Bamboo:
   - Afromontane moist transitional forest (Fe)
   - Afromontane rain forest (Fa)
   - Afromontane undifferentiated forest (Fb)
   - Afromontane bamboo (B)
   - Afromontane dry transitional forest (Fh)
   - Complex of Afromontane undifferentiated forest with wooded grasslands and evergreen or semi-evergreen bushland and thicket at lower margins (Fb/Be/wd)
   - Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest (Fi)
   - Lake Victoria transitional rain forest (Ff)
   - Moist Combretum wooded grassland (Wcm) – (North of Kisumu)
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   - Catena of North Zambezian Undifferentiated woodland + edaphic grassland on drainage-impeded or seasonally flooded soils (Wn/g)
   - Dry combretum wooded grassland (Wcd)
   - Edaphic wooded grassland on drainage-impeded or seasonally flooded soils (wd)
   - Moist Combretum wooded grassland (Wcm) – (South of Kisumu)
   - Riverine wooded vegetation (r)
   - Somalia-Masai Acacia-Commiphora deciduous bushland and thicket (Bd)
   - Transitional zone Somalia-Masai Acacia-Commiphora deciduous bushland and thicket and Dry Combretum wooded grassland (Bd/Wd)
   - Upland Acacia wooded grassland (with sometimes rocky outcrops with evergreen bushland) (We)
<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>VALUE</th>
<th>JUSTIFICATION AND SOURCE OF SPATIAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degraded natural forests</td>
<td>Categorize all existing forests into four forest types based on which Potential Natural Vegetation class they overlap with.</td>
<td>In the absence of forest degradation data, tree canopy cover and agro-ecological zones were agreed to be acceptable proxies. Each forest type was given different tree canopy cover thresholds to identify forest degradation. Data sources: van Breugel et al 2015; KFS 2013, Forest Type; Hansen et al 2013; KARI undated</td>
</tr>
<tr>
<td>Non-dryland gazetted forests with no current forest cover (less than 15% tree canopy cover) and all dryland gazetted forests.</td>
<td>These thresholds were determined by the working group based on best knowledge of these forests. Data sources: KFS 2013, Forest Legal Status; Hansen et al 2013</td>
<td></td>
</tr>
<tr>
<td>Natural forests in the ILEMI triangle were categorized as degraded using the criteria listed below.</td>
<td>In the absence of Potential Natural Vegetation data in the ILEMI triangle, agro ecological zones and tree canopy cover were used instead. Data sources: KFS 2013, Forest Type; KARI undated; Hansen et al 2013</td>
<td></td>
</tr>
<tr>
<td>Natural grasslands and glades</td>
<td>Exclude natural grasslands within forests</td>
<td>Some forests have natural glades and these should not be reforested because they are important for biodiversity. Data source: no national data available</td>
</tr>
<tr>
<td>Non-natural forests</td>
<td>Exclude plantation forests</td>
<td>This option focuses only on natural forests. Data source: KFS 2013, Forest Type</td>
</tr>
<tr>
<td>Current rehabilitation activities</td>
<td>Exclude areas under current rehabilitation programmes</td>
<td>These areas are already being rehabilitated. Data source: no national data available</td>
</tr>
</tbody>
</table>

1. Montane Forest, Western Rainforest, and Bamboo:
   a) 40-65% Canopy Cover – (Slightly Degraded)
   b) 15-45% Canopy Cover – (Moderately Degraded)
   c) Less than 15% Canopy Cover – (Severely Degraded)

2. Coastal Forests:
   a) 40-65% Canopy Cover – (Slightly degraded)
   b) 15-49% Canopy Cover – (Moderately Degraded)
   c) Less than 15% Canopy Cover – (Severely Degraded)

3. Mangrove Forests:
   a) 15-40% Canopy Cover – (Moderately Degraded)
   b) Less than 15% Canopy Cover – (Severely Degraded)

4. Dryland Forests: It was agreed that dryland forests are unlikely to achieve canopy cover greater than 65%. Because of the variability in forest classes within the dryland forest type, it was agreed that a combination of agro-ecological zone (AEZ) and tree canopy cover would be used to determine the level of degradation of each forest.
   a) AEZ ≤ 3 and Canopy Cover = 30-40% – (Moderately Degraded)
   b) AEZ = 4 and Canopy Cover = 30-40% – (Moderately Degraded)
   c) AEZ = 5 and Canopy Cover = 15-30% – (Moderately Degraded)
   d) AEZ = 6 and Canopy Cover = 0-15% – (Moderately Degraded)
   e) AEZ = 4 and Canopy Cover = 30% – (Severely Degraded)
   f) AEZ = 5 and Canopy Cover = 0-15% – (Severely Degraded)
   g) AEZ = 7 – (Severely Degraded)

5. Natural Forest in the ILEMI Triangle:
   a) AEZ ≤ 3 and Canopy Cover = 30-40% – (Moderately Degraded)
   b) AEZ = 4 and Canopy Cover = 30-40% – (Moderately Degraded)
   c) AEZ = 5 and Canopy Cover = 15-30% – (Moderately Degraded)
   d) AEZ = 6 and Canopy Cover = 0-15% – (Moderately Degraded)
   e) AEZ = 4 and Canopy Cover = 30% – (Severely Degraded)
   f) AEZ = 5 and Canopy Cover = 0-15% – (Severely Degraded)
   g) AEZ = 7 – (Severely Degraded)
### Option 3: Restoration Opportunities for Agroforestry on Cropland

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>VALUE</th>
<th>JUSTIFICATION AND SOURCE OF SPATIAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current land cover</td>
<td>Include agricultural land only</td>
<td>The goal of the Agriculture (Farm Forestry) Rules, 2009 is to increase tree cover in agricultural land. <em>Data sources: KFS 2013, Cropland</em></td>
</tr>
<tr>
<td></td>
<td>Exclude large-scale irrigation agriculture</td>
<td>These agricultural practices are not compatible with higher tree cover. <em>Data sources: FAO and DRSRS undated, Rice fields; Wheat and sugar cane, no national data available</em></td>
</tr>
<tr>
<td>Tree canopy cover</td>
<td>Include areas with tree canopy cover &lt; 10% Include areas with tree cover density between 10-30%</td>
<td>The law requires at least 10% tree canopy cover on all agricultural land holdings (GoK, 2009). In addition, agriculture plots that already have 10% tree canopy cover may be able to increase their tree cover even further. The LRTWG estimated that 30% tree canopy cover would be acceptable on some croplands before having a negative impact on production. <em>Data source: Hansen et al 2013</em></td>
</tr>
<tr>
<td>Steep slopes</td>
<td>Exclude cropland areas with slope more than 35%</td>
<td>“Protection of land with slope exceeding 35 per cent. Any person who cultivates, cuts down or destroys any vegetation, or depastures any livestock on any land of which the slope exceeds 35 per cent shall be guilty of an offence.” (GoK, 1965) <em>Data sources: KFS 2013, Cropland; UNEP-WCMC 2015</em></td>
</tr>
<tr>
<td>Protected areas</td>
<td>Exclude the following classes: • National parks • National Reserves • National Sanctuaries • Gazetted Forests • Community and Private Conservancies</td>
<td>No agriculture should be promoted in these protected areas. <em>Data sources: KWS undated, Wildlife Parks; KFS 2013, Forest Legal Status; IUCN &amp; UNEP-WCMC 2015, WDPA</em></td>
</tr>
</tbody>
</table>
Option 4: Restoration Opportunities for Commercial Tree and Bamboo Plantations on Potentially Marginal Cropland and Un-stocked Plantation Forests

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>VALUE</th>
<th>JUSTIFICATION AND SOURCE OF SPATIAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commercial Tree and Bamboo Plantations on Potentially Marginal Cropland</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Current land cover | Include potentially marginal cropland Cropland within a 10km buffer along the boundary between agro-ecological zones 4 and 5, as well as zones 2 and 3 for the area surrounding Lake Victoria. | Agriculture areas that fall within this buffer potentially have marginal yields due to ecological stress and low levels of precipitation. Tree plantations may be a viable economic alternative.  
Data sources: KFS 2013, Cropland; KARI undated |
| | Exclude natural grasslands and rangelands. In the absence of national data on natural grasslands and rangelands, this analysis excludes rangelands that intersect with the potential natural vegetation classes that form the dryland forest class. | Natural grasslands should not be converted into tree plantations.  
Data sources: KFS 2013, Grasslands, van Breugel et al 2015 |
| Protected areas | Exclude the following classes:  
- National parks  
- National Reserves  
- National Sanctuaries  
- Gazetted Forests  
- Community and Private Conservancies | No agriculture should be promoted in these protected areas.  
Data sources: KWS undated, Wildlife Parks; KFS 2013, Forest Legal Status; IUCN & UNEP-WCMC 2015, WDPA |
| Steep slopes | Exclude cropland areas with slope more than 35% | “Protection of land with slope exceeding 35 per cent. Any person who cultivates, cuts down or destroys any vegetation, or depastures any livestock on any land of which the slope exceeds 35 per cent shall be guilty of an offence.” (GoK, 1965)  
Data sources: KFS 2013, Cropland; UNEP-WCMC 2015 |
| Proximity to roads | Only include areas within a 10km buffer of all road classes | Access to markets is an important factor for commercial plantation success, and proximity to roads ensures that wood products can be transported.  
Data source: KRB undated |
| Rainfall | Only include areas with more than 400 mm of precipitation per year | Tree plantations necessitate a minimum of 400 mm of precipitation to have acceptable survival rates.  
Data source: Hijmans et al 2005 |
| **Commercial Tree and Bamboo Plantations in Un-stocked Plantation Forests** | | |
| Un-stocked plantations forests | Include plantation forests with less than 15% tree canopy cover | These are un-stocked or understocked plantation forests.  
Data sources: KFS 2013, Forest Type; Hansen et al 2013 |
Option 5: Restoration Opportunities for Tree-based Buffer Zones along Water Bodies and Wetlands

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>VALUE</th>
<th>JUSTIFICATION AND SOURCE OF SPATIAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from water bodies and wetlands</td>
<td>30 m buffer zone along lakes, dam reservoirs</td>
<td>There are a number of different policies that refer to the importance of buffer zones: (GoK, 2013), (GoK, 1999), (GoK, 1986), and (GoK, 2002). The buffer distances were developed using these polcieis and best practices in Kenya. Data sources: DRSRS undated, Lakes; MWI undated, Rivers; WRMA 2011, Wetlands; Dams, no national data available</td>
</tr>
<tr>
<td></td>
<td>20 m buffer zone along wetlands</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 m buffer zone along main rivers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 m buffer zone along secondary rivers</td>
<td></td>
</tr>
<tr>
<td>Current land cover</td>
<td>Exclude existing natural forests, bamboo and mangroves</td>
<td>These areas are already forested. Data source: KFS 2013, Forest Type</td>
</tr>
</tbody>
</table>

Option 6: Restoration Opportunities for Tree-based Buffer Zones along Roads

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>VALUE</th>
<th>JUSTIFICATION AND SOURCE OF SPATIAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road buffers</td>
<td>Class A and B reserves 60 metres, Class C= 40 metres, Class D= 25 metres, Class E= 20 metres.</td>
<td>Class A and B reserves 60 metres, Class C= 40 metres, Class D= 25 metres, Class E= 20 metres. The current law regarding encroachment on classified reserves (The Kenya Gazette, 2003) stipulates the following: Class A and B reserves 60 metres, Class C= 40 metres, Class D= 25 metres, Class E= 20 metres. Data source: KRB undated</td>
</tr>
<tr>
<td>Current land cover</td>
<td>Exclude all existing forests and wetlands</td>
<td>Forested areas already have tree cover. It is not desirable to convert wetlands as they provide important ecosystem services and need to be conserved. Data source: KFS 2013, Forestland and Wetlands</td>
</tr>
</tbody>
</table>
Option 7: Restoration Opportunities for Rangelands

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>VALUE</th>
<th>JUSTIFICATION AND SOURCE OF SPATIAL DATA</th>
</tr>
</thead>
</table>
| Current land cover   | Include only grassland land cover class, as this is the only class that encompasses rangelands. | Silvo-pastoralism, livestock and wildlife grazing occurs on rangelands.  
*Data source: KFS 2013, Grassland* |
| Exclude all cropland, wetlands, settlements, and otherland. | These land cover classes do not include rangelands.  
*Data source: KFS 2013, Cropland, Wetlands, Settlements, and Otherland* |
| Exclude all existing forests | Silvo-pastoral and grassland restoration should only occur in rangelands. Forests should not be substituted for rangelands.  
*Data sources: KFS 2013, Forest; KFS 2013, Forest Legal Status* |
| Land degradation | All rangelands with negative RUE are assumed to be showing signs of degradation. Areas with the highest increases in RUE and less than 15% tree canopy cover are assumed to be degraded, as these are non-forest/woodland areas that are showing high increases in net primary productivity which may represent bush or invasive species encroachment. | RUE shows the long-term changes in net primary productivity. Areas with negative RUE values show a long-term decline in net primary productivity with relation to rainfall, whereas positive RUE values represent a long-term increase in net productivity. In the absence of national data on invasive species, woody biomass and grazing pressure, it is difficult to determine if increases or decreases in RUE represent degradation. Local level assessments will be needed.  
*Data sources: FAO 2008; Hansen et al 2003* |

STEP 3: PRODUCTION OF MAPS AND AREA STATISTICS FOR NATIONAL LANDSCAPE RESTORATION OPTIONS SELECTED FOR MAPPING

Once assessment criteria was developed for each of the restoration options selected, spatial analysis and mapping were conducted. Multiple drafts of the maps were developed and revised by the LRTWG. Each revision process further refined the assessment criteria and identified additional spatial data that would be useful in developing a thorough analysis. The maps of each restoration option can be found below.
RESULTS

MAP 1A: RESTORATION POTENTIAL FOR AFFORESTATION OR REFORESTATION OF NATURAL FORESTS
MAP 1B: RESTORATION POTENTIAL FOR AFFORESTATION OR REFORESTATION OF NATURAL FORESTS BY FOREST TYPE
MAP 2A: RESTORATION POTENTIAL FOR REHABILITATION OF DEGRADED NATURAL FORESTS

[Map showing restoration potential for rehabilitation of degraded natural forests in Kenya, with symbols for restoration potential, area not meeting criteria for potential, existing forestland, water bodies, national boundary, and county boundary.]
MAP 2B: RESTORATION POTENTIAL FOR REHABILITATION OF DEGRADED NATURAL FORESTS BY DEGRADATION LEVEL
MAP 3A: RESTORATION POTENTIAL FOR AGROFORESTRY ON CROPLAND

![Map of Restoration Potential for Agroforestry on Cropland]

Legend:
- Orange: Restoration Potential
- Light grey: Area not meeting criteria for potential
- Green: Existing Forestland
- Blue: Water Bodies
- Black: National Boundary
- Light grey with tick: County Boundary

[Map Image]
MAP 3B: RESTORATION POTENTIAL FOR AGROFORESTRY ON CROPLAND BY TREE CANOPY COVER
MAP 4A: RESTORATION POTENTIAL FOR COMMERCIAL TREE AND BAMBOO PLANTATIONS ON POTENTIALLY MARGINAL CROPLAND AND UN-STOCKED PLANTATION FORESTS
MAP 4B: RESTORATION POTENTIAL FOR COMMERCIAL TREE AND BAMBOO PLANTATIONS ON POTENTIALLY MARGINAL CROPLAND AND UN-STOCKED PLANTATION FORESTS BY LAND USE
MAP 5: RESTORATION POTENTIAL FOR TREE-BASED BUFFER ZONES ALONG WATER BODIES AND WETLANDS
MAP 6: RESTORATION POTENTIAL FOR TREE-BASED BUFFER ZONES ALONG ROADS
MAP 7: RESTORATION POTENTIAL FOR RANGELANDS
MAP 8: POTENTIAL FOR ALL RESTORATION OPTIONS COMBINED

Potential for Afforestation of Natural Forest
Potential for Rehabilitation of Degraded Natural Forest
Potential for Agroforestry on Cropland
Potential for Commercial Tree and Bamboo Plantation
Potential for Tree Buffers Along Water Bodies & Wetlands
Potential for Tree Buffers Along Roads
Potential for Rangeland Restoration
Potential for 2 Options
Potential for More Than 2 Options
Area not meeting criteria for potential
Existing Forestland
Water Bodies
National Boundary
County Boundary
DISCUSSION AND RECOMMENDATIONS

After reviewing the results of the spatial analysis, the LRTWG suggests a phased approach for meeting national restoration commitments. A proportion of the restoration opportunity areas could be targeted for a 2030 timeline, and the remaining areas would be restored in the future. The tables below represent three scenarios, which represent different proportions of each restoration option to be implemented by 2030. The tables should be read in the following manner:

- The first column lists the restoration options, grouping them into land use categories.
- The second column lists the total area in millions of hectares of each land use type. This is meant to provide the reader with context as to the size of each of the different land cover types.
- The third column represents the total area extent in millions of hectares for each restoration option. The numbers in bold are sums of all of the restoration options within that land use type.
- The fourth column represents the proportion of each restoration option that would be implemented by 2030.
- The fifth column represents the restoration target in millions of hectares.

### CONSERVATIVE SCENARIO

<table>
<thead>
<tr>
<th>RESTORATION OPPORTUNITY</th>
<th>TOTAL AREA (MILLION HA)</th>
<th>RESTORATION POTENTIAL (MILLION HA)</th>
<th>PROPORTION IMPLEMENTED BY 2030</th>
<th>TOTAL RESTORATION TARGET FOR 2030 (MILLION HA)</th>
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</thead>
<tbody>
<tr>
<td>Forest Lands</td>
<td>4</td>
<td>5.2</td>
<td>1.0</td>
<td></td>
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<tr>
<td>Afforestation/reforestation of natural forests and tree-based ecosystems</td>
<td>1.3</td>
<td>10%</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation of degraded natural forests</td>
<td>3.5</td>
<td>20%</td>
<td>0.7</td>
<td></td>
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<tr>
<td>Buffer zones along water bodies and wetlands</td>
<td>0.1</td>
<td>50%</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Commercial tree and bamboo plantations in unstocked forests</td>
<td>0.3</td>
<td>25%</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Croplands</td>
<td>9.9</td>
<td>7.6</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Farm forestry with less than 10% tree cover</td>
<td>2.7</td>
<td>50%</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>Farm forestry with tree cover between 10% and 30%</td>
<td>2.2</td>
<td>20%</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Commercial tree and bamboo plantations or agroforests on cropland</td>
<td>2.7</td>
<td>10%</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Rangelands</td>
<td>42.6</td>
<td>25.7</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Silvo-pastoral and grasslands restoration</td>
<td>25.7</td>
<td>7.5%</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>0.3</td>
<td>n/a</td>
<td>0.2</td>
<td></td>
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<tr>
<td>Tree buffers along roads</td>
<td>0.3</td>
<td>50%</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Other (Wetlands, Settlements, Barelands)</td>
<td>2.7</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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<tr>
<td>TOTAL</td>
<td>59.2</td>
<td>38.8</td>
<td>5.1</td>
<td></td>
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</table>

This conservative scenario represents a target where a relatively low proportion of each restoration option would be committed to being restored. The final target of 5.1 million ha would increase Kenya’s total tree cover by 9%, bringing the total tree cover of the country over the constitutional mandate.

Preliminary conservative analysis suggests that under this scenario, the carbon sequestration potential could be more than 130MtCO2-e by 2063.6

6. Figures provided by System for Land-based Emissions Estimation in Kenya (SLEEK)
## Restoration Opportunity

<table>
<thead>
<tr>
<th>Restoration Opportunity</th>
<th>Total Area (Million ha)</th>
<th>Restoration Potential (Million ha)</th>
<th>Proportion Implemented by 2030</th>
<th>Total Restoration Target for 2030 (Million ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forest Lands</strong></td>
<td>4</td>
<td>5.2</td>
<td>15%</td>
<td>0.2</td>
</tr>
<tr>
<td>Aforestation/reforestation of natural forests and tree-based ecosystems</td>
<td>1.3</td>
<td></td>
<td>15%</td>
<td>0.2</td>
</tr>
<tr>
<td>Rehabilitation of degraded natural forests</td>
<td>3.5</td>
<td></td>
<td>30%</td>
<td>1.1</td>
</tr>
<tr>
<td>Buffer zones along water bodies and wetlands</td>
<td>0.1</td>
<td></td>
<td>75%</td>
<td>0.1</td>
</tr>
<tr>
<td>Commercial tree and bamboo plantations in unstocked forests</td>
<td>0.3</td>
<td></td>
<td>38%</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Croplands</strong></td>
<td>9.9</td>
<td>7.6</td>
<td>75%</td>
<td>3.1</td>
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<tr>
<td>Farm forestry with less than 10% tree cover</td>
<td>2.7</td>
<td></td>
<td>75%</td>
<td>2.0</td>
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<tr>
<td>Farm forestry with tree cover between 10% and 30%</td>
<td>2.2</td>
<td></td>
<td>30%</td>
<td>0.7</td>
</tr>
<tr>
<td>Commercial tree and bamboo plantations</td>
<td>2.7</td>
<td></td>
<td>15%</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Rangelands</strong></td>
<td>42.6</td>
<td>25.7</td>
<td>11.25%</td>
<td>2.9</td>
</tr>
<tr>
<td>Rangeland Restoration</td>
<td></td>
<td>25.7</td>
<td></td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Rocks</strong></td>
<td>0.3</td>
<td></td>
<td>75%</td>
<td>0.2</td>
</tr>
<tr>
<td>Tree buffers along roads</td>
<td></td>
<td>0.3</td>
<td>75%</td>
<td>0.2</td>
</tr>
<tr>
<td>Other (Wetlands, Settlements, Barelands)</td>
<td>2.7</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>59.2</td>
<td>38.8</td>
<td></td>
<td>7.6</td>
</tr>
</tbody>
</table>

The intermediate scenario is more ambitious, multiplying the fractions in the conservative scenario by 1.5. This target would achieve 75% of the Agriculture (Farm Forestry) Rules, 2009 (GoK, 2009) of 10% tree cover on farms, 75% of the required buffer zones along water bodies and roads, as well as 11.25% of the potentially degraded rangeland area.

Preliminary conservative analysis suggests that under this scenario that the carbon sequestration potential could be more than 260MtCO2-e by 2063.7

---

7. Figures provided by System for Land-based Emissions Estimation in Kenya (SLEEK)
### AMBITIOUS SCENARIO

<table>
<thead>
<tr>
<th>RESTORATION OPPORTUNITY</th>
<th>TOTAL AREA (MILLION HA)</th>
<th>RESTORATION POTENTIAL (MILLION HA)</th>
<th>PROPORTION IMPLEMENTED BY 2030</th>
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<tr>
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<tr>
<td>Afforestation/reforestation of natural forests and tree-based ecosystems</td>
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<td></td>
<td>20%</td>
<td>0.3</td>
</tr>
<tr>
<td>Rehabilitation of degraded natural forests</td>
<td>3.5</td>
<td></td>
<td>40%</td>
<td>1.4</td>
</tr>
<tr>
<td>Buffer zones along water bodies and wetlands</td>
<td>0.1</td>
<td></td>
<td>100%</td>
<td>0.1</td>
</tr>
<tr>
<td>Commercial tree and bamboo plantations in unstocked forests</td>
<td>0.3</td>
<td></td>
<td>50%</td>
<td>0.2</td>
</tr>
<tr>
<td>Croplands</td>
<td>9.9</td>
<td>7.6</td>
<td></td>
<td>4.1</td>
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<tr>
<td>Farm forestry with less than 10% tree cover</td>
<td>2.7</td>
<td></td>
<td>100%</td>
<td>2.7</td>
</tr>
<tr>
<td>Farm forestry with tree cover between 10% and 30%</td>
<td>2.2</td>
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<td>40%</td>
<td>0.9</td>
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<tr>
<td>Commercial tree plantations and agroforests (including bamboo)</td>
<td>2.7</td>
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<td>20%</td>
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<tr>
<td>Rangelands</td>
<td>42.6</td>
<td>25.7</td>
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<tr>
<td>Silvo-pastoral and grasslands restoration</td>
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<td>3.9</td>
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<td>Roads</td>
<td>0.3</td>
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<td>0.3</td>
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<tr>
<td>Tree buffers along roads</td>
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<td>100%</td>
<td>0.3</td>
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<td>Other (Wetlands, Settlements, Barelands)</td>
<td>2.7</td>
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<td>n/a</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>59.2</strong></td>
<td><strong>38.8</strong></td>
<td><strong>n/a</strong></td>
<td><strong>10.2</strong></td>
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</table>

This scenario represents the most ambitious target, completely achieving all of the Agriculture (Farm Forestry) Rules, 2009 (GoK, 2009) and buffer zone requirements as well as restoring 15% of the potentially degraded rangelands. This is a doubling of the fractions used in the conservative scenario, and represents 17% of the area of the country and would be one of the largest restoration targets pledged to the Bonn Challenge, the New York Declaration on Forests, or AFR100.

Preliminary conservative analysis suggests that under this scenario the carbon sequestration potential could be more than 320MtCO2-e by 2063.\(^8\)

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8. Figures provided by System for Land-based Emissions Estimation in Kenya (SLEEK)
REFERENCES


APPENDIX 1

HIGH-LEVEL LANDSCAPE RESTORATION WORKING GROUP

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE AND ORGANISATION</th>
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</thead>
<tbody>
<tr>
<td>Mr. Gideon Gathaara</td>
<td>Secretary of Natural Resources, Ministry of Environment and Natural Resources</td>
</tr>
<tr>
<td>Dr. Alice Kaudia</td>
<td>Secretary of Environment, Ministry of Environment and Natural Resources</td>
</tr>
<tr>
<td>Mr. Emilio Mugo</td>
<td>Director, Kenya Forest Service</td>
</tr>
<tr>
<td>NAME</td>
<td>ORGANISATION</td>
</tr>
<tr>
<td>--------------------</td>
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<tr>
<td>Rose Akombo</td>
<td>Kenya Forest Service (KFS)</td>
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<tr>
<td>Jackson Bambo</td>
<td>Kenya Forest Working Group (KFWG)</td>
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<tr>
<td>Dennis Garrity</td>
<td>World Agroforestry Center (ICRAF)/United Nations Convention to Combat Desertification (UNCCD)/World Resources Institute (WRI)</td>
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<td>Alfred Gichu</td>
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<td>Safi Ibrahim</td>
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<td>Betty Kendagor</td>
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<tr>
<td>Jackson Kimani</td>
<td>Clinton Climate Initiative (CCI)</td>
</tr>
<tr>
<td>Robert Kimtai</td>
<td>Department of Resource Surveys and Remote Sensing (DRSRS)</td>
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<tr>
<td>Mwangi Kinyanjui</td>
<td>Karatina University</td>
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<td>Diana Kishiki</td>
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<td>Nkirote Koome</td>
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<td>Florence Landsberg</td>
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<td>Yasin Mahadi</td>
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<tr>
<td>Eunice Maina</td>
<td>Kenya Forest Service (KFS)</td>
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<tr>
<td>Joseph Makanga</td>
<td>Regional Centre For Mapping Of Resources For Development (RCMRD)</td>
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<td>Aaron Minnick</td>
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<td>Nancy Neema</td>
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<td>Lucy Waruingi</td>
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<tr>
<td>Robert Wild</td>
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APPENDIX 2: GIS DATA

6. IUCN and UNEP-WCMC. 2015. The World Database on Protected Areas (WDPA) [On-line], [October, 2015], Cambridge, UK: UNEP-WCMC. Available at: www.protectedplanet.net
17. UNEP-WCMC. 2015. 90m resolution slope model derived from SRTM.

PHOTO CREDITS

Cover photo, Aaron Minnick/WRI.
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