NATIONAL CLIMATE CHANGE ACTION PLAN

REPUBLIC OF KENYA

Long-term National Low-carbon Climate Resilient Development Pathway

Climate Risk Assessment of Kenya's Flagship Projects

Rehabilitation and Protection of Indigenous Forests in Five Water Towers

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Climate Risk Assessment:
Rehabilitation and Protection of Indigenous Forests in Five Water Towers

To achieve its long-term vision of a globally competitive and increasingly prosperous Kenya, the Government of Kenya has developed Vision 2030 and identified over 100 flagship projects to be implemented during its First Medium Term Plan (2008 to 2012). A detailed review of the vulnerability of five of these flagship projects to climate change was undertaken in 2012 to inform development of Kenya's National Climate Change Action Plan and support integration of risk reduction strategies in Kenya's Second Medium Term Plan (2013 to 2017). The review was completed as part of Subcomponent 1, "Long-term National Low Carbon Climate Resilient Development Pathway," of the action plan process.

This brief presents outcomes of the review of one of these flagship projects, the "Rehabilitation and Protection of Indigenous Forests in Five Water Towers," and the key climate risks and possible risk reduction strategies identified. It contains:

- Overview of the methodology used to identify potential climate risks and risk reduction options
- Summary of the outcomes of the risk assessment
- Detailed presentation of the risk assessment process and outcomes
- Estimate of cost of investment for three options identified as being particularly feasible and with a high likelihood of contributing to Kenya's sustainable development goals

Overview of Methodology

To conduct this assessment, a tailored Climate Risk Assessment methodology[1] was developed through an iterative process. This methodology was composed of two modules:

Module 1: Deconstructed climate risk assessment

To gain a better understanding of the climate change vulnerability of the selected project, the potential implications of specific climatic changes on its planned activities was assessed. Potential climate risks (e.g. higher temperatures, more frequent heavy rainfall events) to the project were deconstructed in relation to its different sub-components. The potential direct impacts of these changes were listed and quantitatively assessed with regard to (1) their likelihood of occurrence out to 2050 and (2) their potential severity or consequence. Combining the likelihood and consequence scores allowed for identification of the climatic changes likely to pose the greatest risk to the project's successful implementation and for its beneficiaries.

Module 2: Identification and assessment of illustrative resilience building and risk reduction options

Illustrative options for reducing the vulnerability of the flagship project to the listed high risk climatic changes were identified. Structural (or hardware) options, non-structural (or software) options and policy options were identified for each risk. To provide guidance regarding how to prioritize amongst the myriad of potential vulnerability reduction actions identified, these illustrative options in turn are assessed with respect to their:

- Feasibility of implementation and
- Potential to contribute to Kenya's sustainable development.

The outcome of this process was a shortlist of potential strategies that could be used to reduce the vulnerability of the "Rehabilitation and Protection of Indigenous Forests in Five Water Towers" flagship project

[1] A full description of this methodology is provided in "Kenya's Climate Change Action Plan - Subcomponent 1: Long-term National Low-carbon Climate Resilient Development Pathway. Climate Risk Assessment of Kenya's Flagship Project." October 2012. The report is available at: http://www.kccap.info.

to the impacts of climate change. More information on the methodology used for the vulnerability assessment of Kenya's flagship projects is provided in the annex of this brief. The full report from the assessment of vulnerability of Kenya's flagship projects to the impacts of climate change may be found at: http://www.kccap.info.

Summary of Results: Rehabilitation and Protection of Indigenous Forests in Five Water Towers

<table>
<tr><td colspan="4">About the project</td></tr>
<tr><td colspan="2">Goals and objectives</td><td colspan="2">The Ministry of Environment and Mineral Resources is working to fully rehabilitate and protect Kenya's five water towers—the Mau Escarpment, Mt. Kenya, Aberdare Ranges, Cherangany Hills and Mt. Elgon. In MTP1 it set a goal of increasing forest cover and the volume of water flowing from the water towers' catchment areas.</td></tr>
<tr><td colspan="2">Progress to date</td><td colspan="2">In the Abedare Ranges, an assessment of the forest quality has been completed. Detailed forest surveys have also been completed for the Cherangany Hills and Mt. Elgon.</td></tr>
<tr><td colspan="4">Climate risks of greatest concern due to their potential likelihood and severity/consequence</td></tr>
<tr><td rowspan="4">Climate Risk</td><td>Increase in average annual temperature</td><td>• Shift in the location of species (move to higher elevations)
• Drying of the forest, leading to greater risk of fire</td><td rowspan="4">Potential Impacts</td></tr>
<tr><td>More frequent drought</td><td>• Higher risk of forest fires
• Decline in the productivity of deciduous and semi-deciduous closed canopy forests</td></tr>
<tr><td>Increase in mean annual precipitation in the highlands</td><td>• Shift in the location of species (move to higher elevations)</td></tr>
<tr><td>Decrease in mean annual precipitation in the highlands</td><td>• Decline in the productivity of deciduous and semi-deciduous closed canopy forests</td></tr>
<tr><td colspan="4">Illustrative vulnerability reduction options assessed to be most feasibility and have the greatest potential to contribute to Kenya's sustainable development</td></tr>
<tr><td colspan="2">Possible interventions for all five water towers</td><td colspan="2"><u>Vulnerability Reduction Options</u>
• Strengthen capacity of the forest service to engage in sustainable forest management
• Increase availability of locally appropriate firefighting capacity, equipment and practices, such as watch towers, rapid response units and fire-breaks
• Integrate climate change risks into forest management planning (including REDD+)</td></tr>
<tr><td colspan="2">Estimated investment cost for possible interventions</td><td>• Strengthen capacity of the forest service to engage in sustainable forest management
• Increase availability of locally appropriate firefighting capacity, equipment and practices, such as watch towers, rapid response units and fire-breaks
• Integrate climate change risks into forest management planning (including REDD+)</td><td>$0.252 per hectare per year
$0.45 per hectare per year
$812,381 per year</td></tr>
</table>

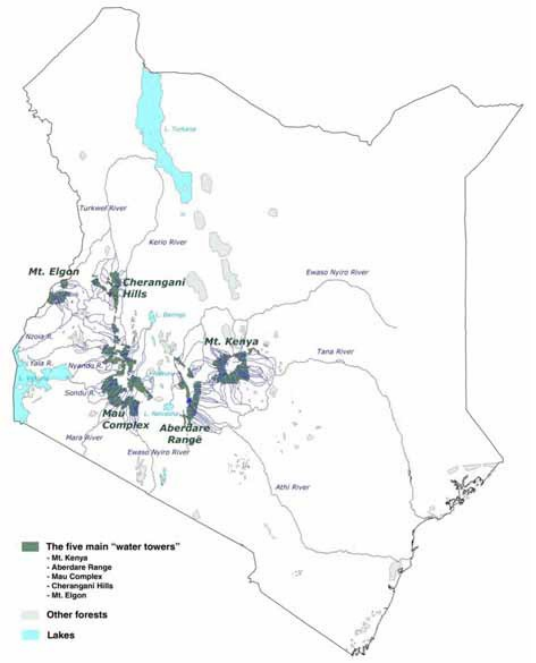
Detailed Project Description and Risk Assessment Results:

1. Project Description

Under the leadership of the Ministry of Environment and Mineral Resources, the Government of Kenya is working to achieve full rehabilitation and protection of its five critical water towers—the Mau Escarpment, Mt. Kenya, the Aberdare Ranges, the Cherangany Hills and Mt. Elgon through the project "Rehabilitation and Protection of Indigenous Forests in Five Water Towers." The project supports achievement of the target set in *Kenya Vision 2030* of increasing forest cover in Kenya to 4 percent by 2012 (from less than 3 percent) and to 10 percent by 2030. In MTP1, the government sought to increase forest cover and increase the volume of water flowing from these catchments.

A fuller description of the "Rehabilitation and Protection of Indigenous Forests in Five Water Towers" project is presented in the table below.

Figure 1: Location of the Five Water Towers



Source: Interim Coordinating Secretariat (2011)

Overview of project goals and components	*Vision*: Full rehabilitation and protection of the five water towers of the Mau Escarpment, Mt. Kenya, Aberdare Ranges, Cherangany Hills and Mt. Elgon. *MTP1*: Increased forest cover and increased volume of water from the catchment areas.		
	Project Components	*Mau Escarpment*	
		Mt. Kenya	
		Aberdare Ranges	Assessment of forest quality to be completed in [2012]
		Cherangany Hills	Detail survey of forest cover to be undertaken.
		Mt. Elgon	Detail survey of forest cover to be undertaken.
Location(s)	*Vision*: Mau Escarpment, Mt. Kenya, Aberdare Ranges, Cherangany Hills and Mt. Elgon *MTP1*: Mau Escarpment, Mt. Kenya, Aberdare Ranges, Cherangany Hills and Mt. Elgon		
Status	Commenced		

Expected Benefits	• Increased forest cover. • Increased volume of water from the catchment areas.
Restriction on the analysis	Kenya's Medium Term Plan notes that the "Five Water Towers" flagship will also "introduce high-value tree species at farm level" and "introduce commercial tree species in ASALs." These elements of the flagship project have not been included in this assessment.

2. General Description of Project Context and Rationale

Kenya Vision 2030 has set as a target increasing forest cover in Kenya to 4 percent by 2012 (from less than 3 percent) and to 10 percent by 2030. One of the projects initiated to obtain this goal is the "Rehabilitation and Protection of Indigenous Forests in Five Water Towers" flagship project. Its goal is to increase forest cover in the catchment areas of Kenya's five water towers: the Aberdare Ranges, Cherangany Hills, Mau Escarpment, Mt. Elgon and Mt. Kenya. These water towers cover more than 1 million hectares and are the source of all but one of Kenya's major rivers, including the Tana River,[2] which in turn flow into Lakes Victoria, Turkana, Baringo, Nakuru, Natron and Naivasha. Significant deforestation has occurred in the water towers in recent decades due to rising populations, conversion to agriculture, forest fires and illegal tree felling for fuel use and timber. The result has been "increased runoff, flash flooding, reduced infiltration, soil erosion, and siltation in the dams and other water reservoirs" (GOK, 2008). Rehabilitation and restoration of the five water towers is expected to increase the volume of water in their catchment areas, protect threatened flora and fauna, increase the availability of traditional medicines and preserve cultural sites. The value of restoring the water towers in terms of reducing the impacts of climate change and for carbon sequestration[3] also has been identified by the GOK.

The situation in each of these watersheds is described below:

- *The Mau Forest Complex:* The largest forest in Kenya (at 416,000 ha), it is the largest remaining closed canopy (montane) forest block in Eastern Africa. Of the five water towers, it is the most degraded, with large sections in which all trees have been removed. A five phase recovery plan for the forest has been developed.[4] As of December 2011, approximately 7,000 hectares of the Mau had been replanted or rehabilitated.
- *Aberdare Ranges:* The main catchment area for the Tana River, it is 125 kilometers in length and composed of a combination of closed canopy forest and bamboo forest. Between 2005 and 2010, forest cover in the area increased by 20.6 percent in part due to establishment of the fenced in Aberdare Conservation Area.
- *Cheranganyi Hills:* the extensive forests on these hills have been moderately to highly degraded.
- *Mt. Kenya:* a World Heritage Site, most of its indigenous forest is protected within a national reserve while small areas fall within Mt. Kenya National Park. Rehabilitation efforts in the area have resulted in most of the forest sections being well stocked except in plantation forests where poor replanting took place.

[2] These rivers are used generate about 57 percent of Kenya's electricity supply (ICC, 2011).
[3] Carbon projects have been initiated by the MEMR in the Mau Forest Complex and Aberdares Ranges.
[4] The second phase included removal of illegal squatters from South Western Mau Forest Reserve; and the third involved repossession of forest lands for which some title deeds had been issued.

- *Mt. Elgon:* Supplying the Nzoia and Turkwel Rivers, the area is composed of a National Park (16,900 hectares) and a Forest Reserve (73,706 hectares) that contains most of the area's montane forest. The forests have been widely cleared.

Rehabilitation of the water towers is to be accomplished through joint management in collaboration with communities living near the forests and other stakeholders (such as through forest preservation committees), in accordance with the 2005 Forest Act and new Constitution. The GOK has also established the Water Towers Conservation Fund and a Kenya Water Towers Agency (Kenya Central, 2012). Current forest management policy promotes adopting an ecosystem based approach to forest management and the provision of incentives for sustainable use and management.

3. Climate Context

Historic/current climate

- Climatic conditions—specifically the amount of rainfall—is a key determinate of the location and types of forests that grow in Kenya.
- The western and central portion of Kenya experiences more temperate conditions, with areas near Lake Victoria and in the central highlands east of the Rift Valley receiving between 1200 to 2000 millimetres of rain annually (MENR, 2002: 36). In contrast, the valleys and basins of the highlands can be dry (AEA Group, 2008).
- Floods seasonally affect the Tana River and Lake Victoria drainage basins; and parts of Nyanza and Western Provinces.
- Landslides are a concern in provinces such as Western, Nyanza and the north Rift Valley, particularly in locations where slopes are steep. The conversion of forested areas to agriculture has increased the number of landslides occurring in the region.
- Forest fires are currently responsible for the loss of more than 5,700 hectares of forested land per year.

Projected climate:

- While Kenya is expected to experience an increase in temperatures in all regions, the plateaus and mountain ranges could remain much cooler than the lowlands.
- The highlands might experience an increase in mean annual precipitation; the greater increases may be in the vicinity of Mt. Elgon, while mild increases occur in the area extending from Lake Victoria to the central highlands east of the Rift Valley.
- Projected changes in rainfall patterns are likely to significantly affect forest resources.
- There is limited knowledge at present of the potential consequences of climate change for Kenya's forests (LTS International & Acclimatise, 2012).

4. Climate Risk Assessment

To gain an understanding of the potential vulnerability of the "Rehabilitation and Protection of Indigenous Forests in Five Water Towers" to projected climate change, a general climate risk assessment was completed. Drawing upon existing literature, potential changes in climatic conditions in the location where the flagship project is being implemented were identified. The potential *direct* impact of these changes was then identified. Each of these potential impacts was then quantitatively assessed on a scale of 1 to 5 with respect to their likelihood of occurrence per year in the 2050s and their potential severity to generate an overall climate risk assessment score. Climate risks with high scores were flagged for further analysis.

Key Climate Risks	Potential Direct Impacts	Future Likelihood (1-5)[5]	Potential Future Severity / Consequence (1-5)[6]	Overall Risk Assessment (Low/Moderate/High)	Flagged for Deeper Assessment
Increase in average annual temperature	Increase in the growth rate of particular tree species	4	3	Moderate	
	Decrease in the growth rate of particular tree species	4	3	Moderate	
	Shift in the location of species (move to higher elevations)	5	4[7]	High	✓
	Drying of the forest, leading to greater risk of fire	5	4	High	✓
	Increase in the population of particular pest species	4	3	Moderate	
	Decrease in the population of particular pest species	4	3	Moderate	
More frequent drought	Higher risk of forest fires	4	5	High	✓
	Decline in the productivity of deciduous and semi-deciduous closed canopy forests	4	4	High	✓
Increase in mean annual precipitation in highlands	Shift in the location of species (move to higher elevations)	5	4[8]	High	✓
	Increase in the growth rate of particular tree species	4	3	Moderate	
	Increase in the prevalence of particular pathogens and diseases	4	3	Moderate	
	Increase in the number of invasive species	4	3	Moderate	
Decrease in mean annual precipitation in highlands	Decline in the productivity of deciduous and semi-deciduous closed canopy forests	3	5[9]	High	✓
Unpredictable precipitation during both the short and long rains	Disruption of ecosystem inter-linkages	4	3	Moderate	
	Loss of forest productivity	3	4	Moderate	
More frequent heavy rainfall events	Loss of soil and surface vegetation	3	3	Moderate	
	Greater risk of landslides	3	4	Moderate	

[5] Likelihood: 1 = Rare – Event not expected to occur, but possible (<5 percent probability of occurrence per year in 2050s); 2 = Unlikely – Event unlikely to occur, but not negligible (5-33 percent probability of occurrence per year in 2050s); 3 = Possible – Event less likely than not, but still appreciable change of occurring (33 – 66 percent probability of occurrence per year in 2050s); 4 = Likely – Event more likely to occur than not (66 – 95 percent probability of occurrence per year in 2050s); 5 = Almost certain –Event highly likely to occur (>95 percent probability of occurrence per year in 2050s)

[6] Consequence: 1 = insignificant; 2 = minor; 3 = reasonable/moderate; 4 = major; 5 = severe

[7] A shift in vegetation to higher elevations could result in the possible extinction of certain tree species such as *Metia volkensii*, *Terminalia spinosa* and *Delonix elata* (GOK, 2010).

[8] A shift in vegetation to higher elevations could result in the possible extinction of certain tree species such as *Metia volkensii*, *Terminalia spinosa* and *Delonix elata* (GOK, 2010).

[9] "Recent research assessing biome sensitivity in Africa shows forests to be highly sensitive to climate change. Deciduous and semi-deciduous closed canopy forests, for instance, may be very sensitive to small decreases in the amount of precipitation that plants receive during the growing season" (Seitz & Nyangena, 2009, p. 19-20).

Key Climate Risks	Potential Direct Impacts	Future Likelihood (1-5)[5]	Potential Future Severity / Consequence (1-5)[6]	Overall Risk Assessment (Low/Moderate/High)	Flagged for Deeper Assessment

5. Options for Reducing Selected Risks

In the next phase of the climate risk assessment process, possible measures for reducing the vulnerability of the "Rehabilitation and Protection of Indigenous Forests in Five Water Towers" to the high ranking climate risks were identified. For each risk, illustrative options were identified that fit within the following categories:

- Structural options – defined as physical or landscape level interventions that serve to modify or prevent the threat, or that involve a change in use or change in location
- Non-structural options – defined as interventions that build human capacity through actions such as research, education, institutional strengthening and social change
- Policy options – defined as the introduction or modification of existing government policies, strategies and/or measures.

The possible benefits of these intervention options were noted. The resulting list presented in the table below is not exhaustive; a range of other vulnerability reduction options could be considered.

Key Climate Risk	Potential Direct Impacts	Intervention Description	Expected Key Impacts of Intervention Option	Timeframe	
				When Action Needed[10]	Estimated Time for Implementation[11]
Increase in average annual temperature	Shift in the location of species as they move to higher elevations	Structural:			
		Large scale reforest with indigenous, heat-tolerant and/or water efficient species	Increased survivorship of reforestation efforts	Longer-term	Long
		Link isolated forest stands to provide connectivity between indigenous forests	Maximize size of management units; facilitates natural migration of species	Immediate	Long
		Non-structural:			
		Improve species monitoring	Greater capacity to undertake planned management in a changing climate	Immediate	Long
		Strengthen capacity of Kenya Forest Service and Kenya Wildlife Service to engage in sustainable forest management	Increase ecological integrity and genetic diversity, which reduces current and future threats	Immediate	Long
		Policy:			
		Regulatory: Strengthen protection of forests and endangered forest species	Protection of genetic diversity; promotion of ecosystem health	Immediate	Middle
More frequent drought	Drying of the forest, leading to greater risk of fire	Structural:			
		Increase availability of locally appropriate fire fighting capacity, equipment and practices: such as watch towers, rapid response units and fire-breaks	Greater capacity prevent and manage forest fires	Immediate	Short to Long, depending on equipment and replacement requirements
		Non-structural:			
		Public education around forest fire prevention and response	Lower risk of forest fires that originate in buffer zones	Immediate	Long
		Improved training in fire	Greater capacity prevent and	Immediate	Long

[10] Immediate = in next MTP; Longer term = after 2016

[11] Short = less than 3 years; Middle = 3 to 5 years; Long = more than 5 years

Key Climate Risk	Potential Direct Impacts	Intervention Description	Expected Key Impacts of Intervention Option	Timeframe	
				When Action Needed[10]	Estimated Time for Implementation[11]
		prevention, early warning and fighting for KFS and other forestry services	manage forest fires		
		Policy options:			
		Information-based: Strengthen fire early warning planning and response systems	Greater capacity prevent and manage forest fires	Immediate	Medium
		Regulatory: Integrate climate change risks into fire management policies	Identification of future risks to facilitate planned adaptation	Longer-term	Medium
Decrease in mean annual precipitation in highlands	Decline in the productivity of deciduous and semi-deciduous closed canopy forests	Structural:			
		Reforest with indigenous, water efficient tree species	Increased survivorship of reforestation efforts	Longer-term	Long
		Non-structural:			
		Strengthen capacity of KFS and community forest associations to engage in sustainable forest management	Increase ecological integrity and genetic diversity, which reduces current and future threats	Immediate	Long
More frequent drought		Policy:			
		Regulatory: Integrate climate change risks into forest management planning (including REDD+)	Identification of future risks to facilitate planned adaptation	Immediate	Short
		Public investment: Strengthen institutional capacity to engage in Payments for Ecosystem Services	Increase capacity to finance sustainable forest management activities	Longer-term	Long

6. Outcomes of the Analysis

Using expert judgement, each of the illustrative vulnerability reduction options identified was then assessed on a quantitative basis in terms of their:

- Potential feasibility, taking into consideration factors such as consistency with existing risk management activities, potential negative spin-offs, and attractiveness to donors and partners
- Potential contribution to Kenya's sustainable development, looking at factors such as employment generation potential, establishment of (grey and green) infrastructure, possible number of direct beneficiaries, and advancement of equity.

By combining the scores from this assessment, an overall assessment of an option's potential value as a risk reduction strategy was identified. Options receiving the highest scores (as indicated by check marks in the table below) were judged to be worth considering as possible ways in which to reduce the vulnerability of the "Rehabilitation and Protection of Indigenous Forests in Five Water Towers" to the impacts of climate change.

Key Climate Risk	Potential Direct Impacts	Intervention Description	Feasibility Subtotal	Sustainable Development Subtotal	Outcome score	Priority Options
Increase in average annual temperature	Shift in the location of species as they move to higher elevations	Structural:				
		Large scale reforest with indigenous, heat-tolerant and/or water efficient species	8	13	68%	
		Link isolated forest stands to provide connectivity between indigenous forests	7	12	61%	

Key Climate Risk	Potential Direct Impacts	Intervention Description	Feasibility Subtotal	Sustainable Development Subtotal	Outcome score	Priority Options
		Non-structural:				
		Improve species monitoring	9	8	55%	
		Strengthen capacity of KFS and KWS to engage in sustainable forest management	10	9	61%	
		Policy:				
		Regulatory: Strengthen protection of forests and endangered forest species	9	13	71%	
More frequent drought	Drying of the forest, leading to greater risk of fire	Structural:				
		Increase availability of locally appropriate fire fighting capacity, equipment and practices: such as watch towers, rapid response units and fire-breaks	9	15	77%	✓
		Non-structural:				
		Public education around forest fire prevention and response	10	10	65%	
		Improved training in fire prevention, early warning and fighting for KFS and forestry services	10	8	58%	
		Policy options:				
		Information-based: Strengthen fire early warning planning and response systems	9	12	68%	
		Regulatory: Integrate climate change risks into fire management policies	9	9	58%	
Decrease in mean annual precipitation in highlands	Decline in the productivity of deciduous and semi-deciduous closed canopy forests	Structural:				
		Reforest with indigenous, water efficient tree species	8	7	48%	
		Non-structural:				
		Strengthen capacity of forest service to engage in sustainable forest management	10	15	81%	✓
More frequent drought		Policy:				
		Regulatory: Integrate climate change risks into forest management planning (including REDD+)	9	15	77%	✓
		Public investment: Strengthen institutional capacity to engage in Payments for Ecosystem Services	8	15	74%	

7. Estimate of Cost of Investment

An estimate of the investment cost associated with each of the vulnerability reduction options identified as being particularly feasible and with a high likelihood of contributing to Kenya's sustainable development goals was subsequently determined. A three step, bottom-up methodology was used for this process: identification of analogous projects implemented in Kenya or similar circumstances; determination of the average per unit cost of these analogous projects; and estimation of the total investment cost over the period of 2015 to 2030 based on an assumption that the project would be undertaken on 3.467 million hectares of land in the Five Water Towers. Results from application of this methodology are presented in the table below.

Vulnerability Reduction Option	Estimated Average Unit Cost (in 2011$US)	Estimated Total Cost (2015 to 2030, in 2011$US)
Increase availability of locally appropriate fire fighting capacity, equipment and practices: such as	$0.252 per hectare per year	$13,968,717

watch towers, rapid response units and fire-breaks		
Strengthen capacity of forest service to engage in sustainable forest management	$0.45 per hectare per year	$24,686,524
Integrate climate change risks into forest management planning (including REDD+)	$812,381 per year	$12,998,106

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Annex: Detailed Methodology

The climate risk assessment of Kenya's flagship projects was undertaken by completing the following steps:

1. Identification of Vulnerable Flagship Projects

The first step in the risk assessment process was to determine which, if any, of Kenya's flagship projects are particularly vulnerable to the impacts of climate change. A list of 71 flagship projects identified for execution within Kenya's first Medium Term Plan was therefore complied, drawing upon information provided by the Ministry of State for Planning, National Development and Vision 2030. Basic information about the objectives and accomplishments to date of each flagship project were obtained by reviewing the Kenya Vision 2030 web page (http://www.vision2030.go.ke/index.php).

An initial screening of each of these flagship projects was then completing using a draft climate risk screening tool developed by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The draft GIZ screening tool assesses a project's vulnerability to climate change against the following four questions:

1. Is the project active in one of the following sectors: agriculture and rural development; forests/forestry; natural resources management and biodiversity; water; disaster management; urban, municipal or regional development; health; or energy? (Yes or No)
2. Is the project situation in one of following geographic regions: coastal zones; floodplains; areas affected by hurricanes or typhoons; arid areas; or mountain regions? (Yes or No)
3. Does the impact of the project depend on important climate parameters such as temperature, precipitation or wind? (Yes or No)
4. Does the project provide opportunities to significantly increase the adaptive capacity of the target group(s) or ecosystem(s)? (Yes or No)

If the response to any one of the above questions was "yes," the flagship project was tagged for further assessment. A total of 41 projects were thereby tagged for further examination. To further refine this list, a secondary screening was applied. Specifically, projects were prioritized for deeper screening if, in the expert opinion of the evaluators:

- The activities to be undertaken as part of the flagship project are likely to be significantly affected by either current climate variability and/or long-term climate change; and
- Implementation of the project could be expected to increase Kenyans adaptive capacity.

Based on completion of this deeper screening process, 13 projects were identified as being particularly vulnerable to the impacts of climate change while simultaneously having potential capacity to contribute to building adaptive capacity in Kenya.

2. Selection of Priority Projects for Detailed Analysis

Each of the 13 projects identified through the initial screening process could have been assessed for their vulnerability to the impacts of climate change and options for reducing this vulnerability. However, in light of the scope and mandate of SC1, a further screen was applied in an effort to narrow down the list of particularly vulnerable projects to a maximum of five. To accomplish this goal, the identified projects were assessed with respect to their potential to provide benefits to a significant number of Kenyans. Each project was therefore screened against the following questions:

1. What is the expected number of direct beneficiaries of the flagship project? Responses to this question were ranked as follows:
    - Low if less than 500,000 Kenyans are expected to directly benefit from the project. (Allocated 1 point)

- Moderate if 500,000 to 1 million Kenyans are expected to directly benefit from the project. (Allocated 2 points)
- High if more than 1 million Kenyans are expected to directly benefit from the project. (Allocated 3 points)

2. Are the expected beneficiaries of the project members of vulnerable groups (e.g. women and children, indigenous peoples, pastoralists, individuals living in arid and semi-arid lands)? Responses to this question were ranked as follows:
    - If "no," then assigned zero points.
    - If "some," then assigned 1 point.
    - If the expected primary beneficiaries of the flagship project, then it was assigned 2 points.
3. Is the flagship project likely to be carried over into Kenya's second MTP? Responses to this question were ranked as follow:
    - If "no," then assigned zero points.
    - If "yes," then assigned 1 point.

Based on use of these assessment questions, projects that received a total number of points equal to or greater than 4 were identified as priority projects for deeper assessment. Seven priority projects were identified following application of this secondary screening process. From this list, the reviewers identified five priority projects for in-depth assessment, taking into consideration a desire to achieve a balance between "Economic," "Social" and "Enablers and Macro Projects," and to examine projects from different sectors and/or to be implemented in different regions of the country. Based on these considerations, the following five projects were selected:

- "ASAL Development Projects"
- "Setting up of Five Livestock Disease-free Zones in the ASAL Regions"
- "Installation of Physical and Social Infrastructure in Slums in 20 Urban Areas"
- "Rehabilitation and Protection of Indigenous Forests in Five Water Towers"
- "Energy Scale up Programme and Rural Electrification: Generation of 23,000 MW and Distributed at Competitive Prices."

3. Climate Risk Assessment

A general climate risk assessment was completed for each of the flagship projects by completing the following steps:

1. Identification of potential changes in climatic conditions. Drawing upon existing literature sources as well as draft reports produced as part of Sub-component 3 (SC3) of the Kenya Climate Change Action Plan process (development of a National Adaptation Plan), potential changes in climatic conditions (or climate risk factors) were identified. These climate risks included: an increase mean annual temperatures; an increase in the frequency of drought conditions; more frequent heavy rainfall events; a decline in mean annual precipitation; and changes in the timing of the short and long rains.

2. Identification of how the anticipated change in climatic conditions might directly impact the flagship project. For example, the reviewers asked the question "how might a decline in mean annual precipitation directly impact the activities planned as part of the ASAL Development Projects?" Potential impacts were then listed in the appropriate table. In order to limit the scope of the analysis, care was taken during this process to explicitly focus on the direct impact of the anticipated climate risk on the flagship project. For example, a decline in mean annual precipitation was identified as having the potential to make less water available for irrigation. The potential secondary impacts of this anticipated direct impact, such as a decline in crop production, were not considered in the analysis.

3. Assessment of the likelihood of the anticipated direct impact occurring. Based on the background information gathered and expert judgement, the likelihood (or probability of occurrence) of an anticipated event taking place was assessed. For consistency, the likelihood scale used within the analysis was the same as applied in the draft documents prepared as part of SC3, namely:

   1 = Rare – Event not expected to occur, but possible (<5 percent probability of occurrence per year in 2050s);

   2 = Unlikely – Event unlikely to occur, but not negligible (5-33 percent probability of occurrence per year in 2050s);

   3 = Possible – Event less likely than not, but still appreciable chance of occurring (33 – 66 percent probability of occurrence per year in 2050s);

   4 = Likely – Event more likely to occur than not (66 – 95 percent probability of occurrence per year in 2050s); or

   5 = Almost certain –Event highly likely to occur (>95 percent probability of occurrence per year in 2050s).

4. Assessment of the consequence of the anticipated direct impact. For each of the anticipated direct impacts on the assessed flagship project, the potential outcome was assessed using expert judgement as to being either:

   1 = insignificant;

   2 = minor;

   3 = reasonable/moderate;

   4 = major; or

   5 = severe.

5. Overall climate risk assessment. The degree of vulnerability of the flagship project to the climate risk factors identified was determined by adding together the likelihood and consequence scores, for a potential scoring range of 2 to 10. Based on this analysis, the risk posed by the projected change in climate for the examined flagship project was deemed to be:
   - *Low,* if the total score was between 2 and 4;
   - *Moderate,* if the total score was between 5 and 7; and
   - *High,* if the total score was between 8 and 10.

Climate risk factors ranked as "high" were flagged for more detailed consideration with respect to how the flagship project's vulnerability to their projected occurrence might be reduced. Using the above steps, a number of high risk climate events are identified for each projects (and/or sub-component). When necessary, the number of priority climate risks flagged is limited to two risks per project sub-component and a total of six risks per flagship project.

4. Identification of Illustrative Options for Reducing Climate Risks

The next phase of the climate risk assessment process involved the identification of possible measures that could be taken to reduce the vulnerability of the individual flagship projects to the highest ranking climate risks. Illustrative examples of possible vulnerability reduction options were identified and assessed. In all cases, a wide range of additional risk reduction strategies could have been considered. The options identified therefore are not necessarily the best strategies available, or ones that might be considered for implementation by Kenya.

In seeking measures to reduce vulnerability to climate change, a wide variety of possible actions may be considered. Some of these actions may involve changes to natural or human-generated physical structures. Others might focus on building the human, social, financial and/or political capacity of individuals, communities and businesses to prepare for and respond to the impacts of climate change. Additional options may focus on government-led policy initiatives that serve to strengthen adaptive capacity. Based upon this understanding, options for reducing vulnerability to priority climate risks were identified that fit within each of the following categories:

- *Structural options* – defined as physical or landscape level interventions that serve to modify or prevent the threat, or that involve a change in use or change in location;
- *Non-structural options* – defined as interventions that build human capacity through actions such as research, education, institutional strengthening and social change; or
- *Policy options* – defined as the introduction or modification of existing government policies, strategies and/or measures. To further convey the types of policy instruments that could be used to reduce vulnerability to identified climate risks, drawing on UNEP (2011), potential options were identified as being either market-based, regulatory, public investment, information based, international cooperation, or institution based instruments.

To further define the identified climate risk management options, the expected key impact of the proposed intervention was named. In essence, this description outlines how the proposed risk management option is anticipated to reduce the flagship project's vulnerability to one of the key climate risks to which it is projected to be exposed.

The proposed options' characteristics with respect to two time bound measures were also described:

- When the identified option likely would need to be implemented given projected changes in Kenya's climate, with the parameters for consideration being either:
    - Immediately, defined as being during the next Medium Term Plan (2013 to 2016); or
    - Longer term, defined as needing to occur after 2016.
- The estimated length of time to implement the illustrative option, with the parameters for consideration being either:
    - A short amount of time, defined as the option potentially be implemented in less than 3 years;
    - A middle length of time, defined as the option potentially be implemented in 3 to 5 years; or
    - A long length of time, defined as the option potentially requiring more than 5 years to implement, and including those action that may be viewed as needing to take place indefinitely.

5. Assessment of Climate Risk Options

The selected, illustrative options were then assessed with respect to their suitability and viability from two different perspectives: the feasibility of their implementation and their potential contribution to Kenya's sustainable development. To assess the feasibility of the proposed option, a slightly modified version of the assessment criteria and indicators used within the climate risk screening tool ORCHID (Opportunities and Risks of Climate Change and Disasters) was applied (Tanner et al., 2007, p.118). Using this approach, each proposed option was assessed against the following five questions:

1. Does the proposed risk management option support win-win or no regrets actions by:
    - Increasing capacity to address current or future climate risks? If so, then 1 point scored.
    - Increasing capacity to address current and future climate risk? If so, then 2 points scored.
2. Is the proposed risk management option consistent with existing risk management activities?
    - If no, then 1 point scored.

    - If yes, then 2 points scored.
3. Can the cost effectiveness of the proposed risk management option be easily determined?
    - If no, then 1 point scored.
    - If yes, then 2 points scored.
4. Are their potential negative spin-off impacts associated with the proposed risk management option?
    - If a high likelihood for negative spin-off impacts exists, then 1 point scored.
    - If a low likelihood of negative spin-off impacts exists, then 2 points scored.
5. Is the proposed risk management option practical and feasible for a donor, partners and project implementer?
    - If no, which was defined as the option being impractical and not attractive to donors, then zero points scored.
    - If difficult, defined as being practical (i.e. there is experience with its implementation and the cost is not exorbitant) but not attractive to donors, or not practical but potentially attractive to donors, then 1 point scored.
    - If yes, defined as being practical and likely to be attractive to donors, then 2 points scored.

The points assigned in response to these questions were then totaled to determine the assessed feasibility of the examined climate risk management option. The total points earned ranged from four to 10.

In the second stage of this analysis, the potential contribution of the proposed climate risk management option to sustainable development was assessed using expert judgement. The following questions were used within this assessment:

1. Does the option promote employment opportunities?
2. Does the option promote access to appropriate information, skills/capacity, technology or practices?
3. Does the option build, or help to build, relevant (physical) infrastructure (green or grey) that facilitates the movement of goods, people and/or (ecosystem) services?
4. Does the option build, or remove barriers to, relevant policy/information infrastructure?
5. Does the option have the potential to promote equity (e.g., gender, age or socio-economic)?
6. What is the expected number of direct beneficiaries of the project?:
    - Low, defined as being less than 500,000 people? If yes, scored as 1 point.
    - Moderate, defined as being between 500,000 and 1 million people? If yes, scored as 2 points.
    - High, defined as more than 1 million people? If, yes, scored as 3 points.
7. Does the option have benefits for water quality, air quality and/or biodiversity?

With the exception of question 6, each of these questions was ranked against the following scale:

- If expected to have a negative impact, scored as -1 point.
- If expected to have a neutral impact, scored as zero points.
- If expected to have a low positive impact, scored as 1 point.
- If expected to have medium positive impact, scored as 2 points.
- If expected to have a high positive impact, scored as 3 points.

The scores for each question were then totaled to estimate to proposed risk management option's contribution to sustainable development (a range of -6 to 21 points).

The overall assessed feasibility and appropriateness of the proposed options was determined by averaging of the percentage scores received for the assessed feasibility of the option (that is, X out of a total possible score of 10, expressed as a percentage) and its potential contribution to Kenya's sustainable development (X out of a total possible score of 21, expressed as a percentage). The options which received the highest scores were

judged as being worth being considered for implementation by the Government of Kenya as it strives to integrate climate change considerations into its next MTP.

Costing of Selected Options

For the vulnerability reduction options deemed to be most feasible and with the greatest potential contribution to Kenya's sustainable development, an estimate of the investment costs that might be required over the 2015 to 2030 time period was subsequently determined. Investment cost was defined as including all capital costs and program costs that would be incurred to implement the shortlisted vulnerability reduction options. In this regard, the investment cost analysis completed represents the total level of investment; it does not represent the net present value of the investments or marginal costs related to a baseline.

The following three steps were completed to determine the estimated investment required to implement each of the highest scoring vulnerability reduction options:

1. Bottom-up analysis to determine total investment costs. Cost data was gathered from the literature for projects similar to each of the identified high ranking vulnerability reduction options. As possible, preference was given to cost estimates for actions that are or were implemented in Kenya or in situations that faced similar circumstances and barriers to implementation. Cost data from each analogous project was presented on a per unit basis (e.g. cost per hectare of forest affected per year of project implementation). The per unit investment cost were expressed in US dollars and all costs were converted to 2011 US dollars based on the Purchasing Power Parity index and current currency exchange rates.

2. Estimate of the average per unit investment costs per year. The average value of the per unit investment cost figures identified for each of the analogous projects through the bottom-up assessment was determined.

3. Estimate of the total investment costs over the 2015 to 2030 time-period. This figure was determined by multiplying the average per unit investment cost by an appropriate unit of analysis (e.g. number of hectares of forest to be rehabilitated) and the number of years in which the activity will be implemented (e.g. 16 years if undertaken continually throughout the 2015 to 2030 time-period).