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

Setting up of Five Livestock Disease-free Zones in the ASAL Regions

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Climate Risk Assessment: "Setting up of Five Livestock Disease-free Zones in the ASAL Regions"

To achieve its long-term vision of a globally competitive and increasingly prosperous Kenya, the Government of Kenya has developed *Kenya 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, "Setting up of Five Livestock Disease-free Zones in the ASAL Regions," 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

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 "Setting up of Five Livestock Disease-free Zones in the ASAL Regions" project 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

[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.info.kccap.info.

vulnerability of Kenya's flagship projects to the impacts of climate change may be found at: http://www.info.kccap.info.

Summary of Results: "Setting up of Five Livestock Disease-free Zones in the ASAL Regions"

<table>
<tr><th colspan="4">About the project</th></tr>
<tr><td>Goals and objectives</td><td colspan="3">The aim of this project led by the Ministry of Livestock Development is to improve the quality of Kenya's livestock products through the establishment of disease-free zones in Coast, Laikipia, Isiolo and North Rift. By enabling international marketing standards to be met, the project is expected to increase Kenya's competitiveness and improve access to high-value markets worldwide. The project involves six main components:
• Improve animal health through measures to control and eradicate trade-sensitive diseases, zoonoses and pests
• Infrastructure development for disease control, animal handling and marketing, such as quarantine stations
• Improve animal productivity through breeding programs
• Improve rangelands through dedicated management efforts
• Improve livestock marketing
• Institutional strengthening through training of staff and enhancing capacity of laboratories and offices</td></tr>
<tr><td>Progress to date</td><td colspan="3">A study of the feasibility of establishing a disease-free livestock area in the Laikipia-Isiolo area concluded that this project was not environmentally appropriate and the plan has been abandoned. In Coast Province, social and environmental impact assessments, a baseline survey, rehabilitation of a foot and mouth laboratory at Embakasi and designs for a veterinary fence and Level 3 BioSafety laboratory have been completed (GOK, n.d.).</td></tr>
<tr><th colspan="4">Climate risks of greatest concern due to their potential likelihood and severity/consequence</th></tr>
<tr><td rowspan="4">Climate Risk</td><td>Increase in average annual temperature</td><td>• Increase in the abundance, distribution or rate of development of some pathogens and parasites
• Increased risk of heat stress, particularly for dairy cattle derived from temperate-breed genetic stock, with associated negative impacts on physiological processes and production
• Decline in grasslands productivity, leading to declines in animal health and productivity
• Greater need for refrigeration at quarantine stations and other facilities used for disease control and animal handling</td><td rowspan="4">Potential Impacts</td></tr>
<tr><td>More frequent drought</td><td>• Greater migration of livestock herds could promote the spread of diseases
• Decline in growth and poor reproductive performance of livestock if drought is more frequent than once every five years
• Long-term degradation of grazing resources</td></tr>
<tr><td>Decrease in mean annual precipitation in the ASALs</td><td>• Change in the distribution or abundance of disease vectors
• Less water availability or declines in grasslands productivity, leading to declines in animal health and productivity</td></tr>
<tr><td>More frequent heavy rainfall events</td><td>• Increased probability of wide-spread outbreaks of Rift Valley Fever</td></tr>
<tr><th colspan="4">Illustrative vulnerability reduction options assessed to be most feasibility and have the greatest potential to contribute to Kenya's sustainable development</th></tr>
<tr><td rowspan="3">Vulnerable Project Components</td><td>Improving animal health by controlling and eradicating trade sensitive diseases, zoonoses and pests</td><td>• Improve infrastructure for disease control, animal handling and marketing, including quarantine stations
• Strengthen early warning systems for the outbreak of diseases</td><td rowspan="3">Vulnerability Reduction Options</td></tr>
<tr><td>Improving animal productivity through livestock-breeding programs</td><td>• Increase research into the development of drought-tolerant livestock
• For small-scale production systems, improved access to shade such as through reforestation</td></tr>
<tr><td>Improve rangeland through enhanced management</td><td>• Promote rotational grazing
• Construction of bunds, sand dams and other water retention structures</td></tr>
</table>

Detailed Project Description and Risk Assessment Results:

1. Project Description

To increase the capacity of Kenya to meet international standards and thereby increase its potential to export high-quality beef and other livestock products (such as leather goods) to markets in the Middle East and Europre, *Kenya Vision 2030* calls for the establishment of at least four strategically-placed Disease-Free Zones in which trade-sensitive diseases will be controlled (ROK, 2008). The Ministry of Livestock Development is supporting achievement of the goal through implementation of the flagship project "Setting up of Five Livestock Disease-free Zones in the ASAL Regions." Although it was originally expected that the project would establish disease free zones in Coast Province and at the Isiolo-Laikipia Complex, research completed during MTP1 led to a decision to not pursue this initiative in the Isiolo-Laikipia Complex.

A fuller description of the "Setting up of Five Livestock Disease-free Zones in the ASAL Regions" project is presented in the table below.

Overview of project goals and components	*Vision:* To improve the quality of livestock and products thereof in order to make Kenyan livestock products competitive and access high-value markets worldwide. Disease-free status will allow Kenya to sell its meat, hides, skins etc. to meet international marketing standards. *MTP1:* Establish two disease free zones—one in Coast Province and a second at the Isiolo-Laikipia Complex. However, plans to establish a disease free zone in the Isiolo-Laikipia Complex were cancelled due to environmental concerns.	
	Project Components	• Improve animal health through measures to control and eradicate trade-sensitive diseases, zoonoses and pests
		• Infrastructure development for disease control, animal handling and marketing, such as quarantine stations
		• Improve animal productivity through breeding programs
		• Improve rangeland through dedicated management efforts
		• Improve livestock marketing
		• Institutional strengthening through training of staff and enhancing capacity of laboratories and offices
Location(s)	*Vision:* Nationwide *MTP1:* Coast Province and Isiolo-Laikipia Complex	
Status	• Not started / Behind schedule	
Expected Benefits	• Disease free zones created • Quality of beef/dairy products improved • Jobs and incomes increased from livestock activities	

2. General Description of Project Context and Rationale

The livestock sector (which in part is composed of cattle, goals, sheep, chickens and camels) is a significant component of Kenya's economy, contributing 7 percent of its Gross Domestic Product (ROK, 2010). Livestock is grown to support household needs and for sale either into the dairy industry or the meat industry (primarily beef). More than 70 percent of livestock production takes place in the Arid and Semi-Arid Lands of Kenya (GOK, 2007). Livestock production to support the dairy industry occurs primarily in medium- to high-rainfall areas such as Coast Province (ROK, 2010), primarily by small-scale producers (KOPC, n.d.).

A significant constraint on further development of Kenya's livestock sector is the prevalence of livestock diseases, including rinderpest, Rift Valley Fever, foot-and-mouth disease, anthrax, bovine tuberculosis, worms, chronic bovine pleuropneumonia, contagious caprine pleuropneumonia, lumpy skin disease, Newcastle disease, Gumburo disease, peste des petit ruminants and Trypanosomiasis (GOK, 2010; Kenya Beehive, n.d.). In response, Vision 2030 calls for the establishment of at least four strategically-placed Disease-Free Zones in

which trade-sensitive diseases will be controlled (ROK, 2008). Through the creation of these zones, it is anticipated that Kenya will be able to create livestock products that meet international standards, thereby increasing its capacity to export high-quality beef and other livestock products (such as leather goods) to other parts of Africa, the Middle East and Europe (GOK, n.d.). Economic losses due to disease estimated to be over KSh 21 billion per year are expected to be overcome through establishment of these zones (MOLD, 2011).

The establishment of disease-free livestock zones programme is to consist of the following elements (ROK, 2010):

- Improving animal health through measures to control and eradicate trade-sensitive diseases, zoonoses and pests
- Developing infrastructure for disease control, animal handling and marketing, such as quarantine stations
- Improving animal productivity through breeding programs
- Improving rangeland through dedicated management efforts
- Improving livestock marketing
- Institutional strengthening through training of staff and enhancing capacity of laboratories and offices.

Originally, disease free zones were expected to be established in Coast, Laikipia, Isiolo and North Rift. However, subsequent assessment concluded that development of a disease-free zone in Laikipia-Isiolo was not environmentally appropriate and this plan has been abandoned. In the coast zone, a program proposal has been created and designs for 13 offices and laboratories prepared. Additional steps to be taken towards the development of a disease-free zone in this area include completion of social and environmental impact assessments, baseline survey on range and water resources, design of a veterinary fence for the zone, design of a Level 3 BioSafety laboratory at Kabete, and rehabilitation of the foot and mouth laboratory at Embakasi (GOK, n.d.). The Ministry of Livestock Development estimated that the cost of improving livestock production and access to markets, including the establishment of disease free zones, would have required KSh 13.464 billion between 2008 and 2012 (MOLD, 2010).

3. Climate Context

A. Historic/current climate

- The coastal areas of Kenya are generally warm and humid, and the ASALs arid and dry
- Rift Valley Fever outbreaks are more likely to occur during periods when humidity is particularly high, such as abnormally long rains and associated flooding (GOK, 2010). Following the 1997/98 floods, this disease killed an estimated 80 percent of livestock in northern Kenya (Kandji & Verchot, n.d.). More recently, a significant break-out took place in 2006-07 following flooding, affecting eastern and southern Kenya (Duse, 2009).

B. Projected climate

- Mean annual temperatures are expected to increase in all parts of Kenya over the remainder of this century. Projections suggest that mean annual temperatures could increase by 1^{o}C by 2020s and by 4^{o}C by 2100 (AEA Group, 2008).
- Rainfall patterns are likely to change, with an increase in precipitation likely to occur during the short rains of October to December. The volume of rain falling during a single event may increase, leading to greater probability of more frequent and severe flooding events (AEA Group, 2008).
- Droughts are projected to occur with similar frequency but potentially with increased severity (AEA Group, 2008).

- Livestock production in Kenya is highly sensitive to the impacts of current climate variability and long-term climate change (Kabubo-Mariara, 2008).
- The impacts of climate change on livestock production have not been well studied internationally or in Kenya. Moreover, as stated by Thornton and Gerber (2010, p.172): "the impact of climate change on the spread of [livestock] diseases, let alone the emergence of new ones, are as yet basically unknown." Moreover, climate change will differentially affect pathogens, hosts, disease vectors and epidemiology, and will indirectly be affected by changes in ecosystems, production patterns and human settlement patterns (Thornton et al., 2009). The complex dynamics of livestock diseases therefore makes determining the likely consequences of climatic change for Kenya's livestock production quite challenging. As such, low confidence should be given to the assessed risk assessment of the potential consequences of climate change on livestock diseases in Kenya.
- In considering the potential consequences of climate change on disease prevalence in Kenya, it should be noted that these consequences are expected to be "muted" over the next 20 to 30 years (King et al., 2006, cited in Thornton and Gerber, 2010, p.172).

4. Climate Risk Assessment

To gain an understanding of the potential vulnerability of the "Setting up of Five Livestock Disease-free Zones in the ASAL Regions" to projected climate change, a general climate risk assessment was completed. Drawing upon existing literature, potential changes in climatic conditions in the locations 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.

Sub sector	Key Climate Risks	Potential Direct Impacts	Future Likelihood (1-5)[2]	Potential Future Severity / Consequence (1-5)[3]	Overall Risk Assessment (Low/Moderate/High)	Flagged for Deeper Assessment
Improving animal health through controlling and eradicating trade sensitive diseases, zoonoses and pests	Increase in average annual temperature	Increase in the rate of development of some pathogens and parasites	5	4	HIGH	✓
		Decrease in the rate of development of some pathogens and parasites	5	2	MODERATE	
		Change in the distribution and/or abundance of disease vectors	5	4	HIGH	✓
	More frequent drought	Greater migration of livestock herds promotes the spread of diseases	4	4	HIGH	
	Decrease in mean annual precipitation in the ASALs	Change in the distribution and/or abundance of disease vectors	4	4	HIGH	
		Change in the abundance and/or distribution of	4	3	MODERATE	

[2] 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)

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

Sub sector	Key Climate Risks	Potential Direct Impacts	Future Likelihood (1-5)[2]	Potential Future Severity / Consequence (1-5)[3]	Overall Risk Assessment (Low/Moderate/High)	Flagged for Deeper Assessment
		competitors, predators and parasites of vectors				
	Increase in mean annual precipitation in the highlands	Change in the distribution and/or abundance of disease vectors	4	3	MODERATE	
		Change in the abundance and/or distribution of competitors, predators and parasites of vectors	4	3	MODERATE	
	More frequent heavy rainfall events	Increased probability of wide-spread outbreaks of Rift Valley Fever	4	5	HIGH	
Developing infrastructure for disease control, animal handling and marketing, including quarantine stations	Increase in average annual temperature	Greater need for refrigeration, increasing energy demand (and potentially higher costs)	5	3	HIGH	
	More frequent drought	Less water available for use in quarantine stations	4	3	MODERATE	
	Decrease in mean annual precipitation in the ASALs	Less water available for use in quarantine stations	4	3	MODERATE	
	More frequent heavy rainfall events	Greater risk of flash flooding, with the potential for loss of livestock	3	2	MODERATE	
Improving animal productivity through livestock-breeding programs	Increase in average annual temperature	Increased risk of heat stress, with associated negative impacts on physiological processes and production	5	5	HIGH	✓
		Greater vulnerability to heat stress of dairy cattle that have been breed using temperate-breed genetic stock.	5	4	HIGH	
	More frequent drought	If drought becomes more frequent than once every five years, then decline in growth and poor reproductive performance of livestock	5	4	HIGH	✓
	Decrease in mean annual precipitation in the ASALs	Less availability of water, leading to declines in animal health and productivity	4	4	HIGH	
		Shift from dairy cows to beef cattle, and from sheep to goats	3	3	MODERATE	
	More frequent heavy rainfall events	Greater risk of flash flooding, with the potential for loss of livestock	4	3	MODERATE	
Improve rangeland through enhanced	Increase in average annual temperature	Decline in grasslands productivity, leading to declines in animal health and productivity	5	4	HIGH	✓

Sub sector	Key Climate Risks	Potential Direct Impacts	Future Likelihood (1-5)[2]	Potential Future Severity / Consequence (1-5)[3]	Overall Risk Assessment (Low/Moderate/High)	Flagged for Deeper Assessment
management	More frequent drought	Long-term degradation of grazing resources	4	4	HIGH	
	Decrease in mean annual precipitation in the ASALs	Decline in grasslands productivity, leading to declines in animal health and productivity	4	5	HIGH	✓
	More frequent heavy rainfall events	More erosion of grasslands, leading to less availability of pasture	3	4	MODERATE	
Improve livestock marketing	Increase in average annual temperature	None anticipated			LOW	
	More frequent drought	None anticipated			LOW	
	Decrease in mean annual precipitation in the ASALs	None anticipated			LOW	
	More frequent heavy rainfall events	None anticipated			LOW	
Institutional strengthening	Increase in average annual temperature	None anticipated			LOW	
	More frequent drought	None anticipated			LOW	
	Decrease in mean annual precipitation in the ASALs	None anticipated			LOW	
	More frequent heavy rainfall events	None anticipated			LOW	

5. Options for Reducing Selected Risks

In the next phase of the climate risk assessment process, possible measures for reducing the vulnerability of the "Setting up of Five Livestock Disease-free Zones in the ASAL Regions" 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.

Sub component	Key Climate Risk	Potential Direct Impacts	Intervention Description	Expected Key Impacts of Intervention Option	Timeframe	
					When Action Needed[4]	Estimated Time for Implementation[5]
Improving animal health	Increase in average annual	Increase in the rate of development	**Structural:**			
			Enhance research facilities	Strengthen national capacity to undertake	Longer Term	Long

[4] Immediate = in next MTP; Longer term = after 2016
[5] Short = less than 3 years; Middle = 3 to 5 years; Long = more than 5 years

Sub component	Key Climate Risk	Potential Direct Impacts	Intervention Description	Expected Key Impacts of Intervention Option	Timeframe	
					When Action Needed[4]	Estimated Time for Implementation[5]
through controlling and eradicating trade sensitive diseases, zoonoses and pests	temperature	of some pathogens and parasites		research on potential changes in pathogens and parasites as temperatures rise		
			Non-structural:			
			Improve systems for monitoring the occurrence of livestock diseases	Increased capacity to identify changes in the prevalence of particular diseases	Immediate	Long
			Policy:			
			Public Investment: Strengthen research on vaccines against priority livestock diseases	Increased access to vaccines that might be needed in the future	Immediate	Long
			International Cooperation: Undertake integrated research (through partnerships) on potential impact of CC on key pathogens and parasites (e.g. Rift Valley Fever)	Increased understanding of the potentlal consequences of climate change on pathogens, hosts, disease vectors and epidemiology	Immediate	Long
		Change in the distribution and/or abundance of disease vectors	**Structural:**			
			Improve infrastructure for disease control, animal handling and marketing, including quarantine stations	As called for under Agricultural Sector Development Strategy 2010-2020, as key intervention to establish disease-free zones	Immediate	Long
			Non-structural:			
			Improving systems for monitoring the occurrence of livestock diseases	Increased capacity to identify changes in the prevalence of particular diseases	Immediate	Long
			Strengthen early warning systems for the outbreak of diseases	Improved capacity to identify and response to the occurrence of livestock diseases	Immediate	Long
			Policy options:			
			Institution Based: Increase funding to the Ministry of Livestock Development	Increase capacity of MOLD to support the establishment of disease-free zones	Immediate	Long
Improving animal productivity through livestock-breeding programs	Increase in average annual temperature	Increased risk of heat stress, with associated negative impacts on physiological processes and production	**Structural:**			
			For small-scale production systems, improved access to shade such as through reforestation	Reduced exposure to high temperatures	Immediate	Long
			For large-scale production systems, increase incentives to build sheds with fans or air conditioning	Reduced exposure to high temperatures	Longer Term	Long
			Non-structural:			
			Promotion of species and/or breeds that are more heat tolerant	Maintenance of level of livestock production	Longer Term	Long

Sub component	Key Climate Risk	Potential Direct Impacts	Intervention Description	Expected Key Impacts of Intervention Option	Timeframe	
					When Action Needed[4]	Estimated Time for Implementation[5]
			Policy:			
			Public Investment: Increase research into the development of genetic strains of heat-tolerant livestock	Improved knowledge to support the selection of appropriate species for rearing in different regions of Kenya under higher temperature conditions	Immediate	Long
	More frequent drought	If drought becomes more frequent than once every five years, then decline in growth and poor reproductive performance of livestock	**Structural:**			
			Investment in water capture and retention infrastructure (sand dams etc.).	Decreased water stress amongst farmers and pastoralists.	Immediate	Middle
			Non-structural:			
			Expanded use of weather-index insurance	Increase farmers ability to spread and transfer climate change risks	Immediate	Long
			Policy:			
			Regulatory: Restrict the raising of certain types of livestock species in particularly vulnerable regions	Increase potential to maintain levels of productivity as ensure that selected breeds of livestock breeds are raised in areas where greatest potential for success	Longer Term	Middle
			Public Investment: Increase research into the development of drought-tolerant livestock	Improved knowledge to support the selection of appropriate species for rearing in areas at particular risk of experience drought conditions	Immediate	Long
Improve rangeland through enhanced management	Increase in average annual temperature	Decline in grasslands productivity, leading to declines in animal health and productivity	**Structural:**			
			Construction of bunds, sand dams and other water retention structures	Increase retention of water received during the short and long rains seasons	Immediate	Long
			Non-structural:			
	Decrease in mean annual precipitation in the ASALs		Promote rotational grazing	Reduced impact on pasture lands and improved control of worms	Immediate	Long
			Expansion of awareness campaigns on the need to balance stocking rates with rangeland productivity	Improved health of rangeland resources, increase landscape's capacity to cope with higher temperatures, less rainfall	Immediate	Long
			Policy:			
			Regulatory: Strengthen wetlands policy to ensure the preservation of seasonal wetlands	Improved ecological well-being of rangelands	Longer Term	Short

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 "Setting up of Five Livestock Disease-free Zones in the ASAL Regions" to the impacts of climate change.

Sub component	Key Climate Risk	Potential Direct Impacts	Intervention Description	Feasibility Subtotal	Sustainable Development Subtotal	Outcome score	Priority Options
Improving animal health through controlling and eradicating trade sensitive diseases, zoonoses and pests	Increase in average annual temperature	Increase in the rate of development of some pathogens and parasites	**Structural:**				
			Enhance research facilities	9	9	66%	
			Non-structural:				
			Improve systems for monitoring the occurrence of livestock diseases	9	11	71%	
			Policy:				
			Public Investment: Strengthen research on vaccines against priority livestock diseases	10	8	69%	
			International Cooperation: Undertake integrated research (through partnerships) on potential impact of CC on key pathogens and parasites (e.g. Rift Valley Fever)	8	12	69%	
		Change in the distribution and/or abundance of disease vectors	**Structural:**				
			Improve infrastructure for disease control, animal handling and marketing, including quarantine stations	10	14	83%	✓
			Non-structural:				
			Improving systems for monitoring the occurrence of livestock diseases	9	10	69%	
			Strengthen early warning systems for the outbreak of diseases	10	12	79%	✓
			Policy options:				
			Institution Based: Increase funding to the Ministry of Livestock Development	10	11	76%	
Improving animal productivity through livestock-breeding programs	Increase in average annual temperature	Increased risk of heat stress, with associated negative impacts on physiological processes and production	**Structural:**				
			For small-scale production systems, improved access to shade such as through reforestation	10	12	79%	✓
			For large-scale production systems, increase incentives to build sheds with fans or air conditioning	8	6	54%	
			Non-structural:				
			Promotion of species and/or breeds that are more heat tolerant	9	11	71%	
			Policy:				
			Public Investment: Increase research	10	11	76%	

Sub component	Key Climate Risk	Potential Direct Impacts	Intervention Description	Feasibility Subtotal	Sustainable Development Subtotal	Outcome score	Priority Options
			into the development of genetic strains of heat-tolerant livestock				
	More frequent drought	If drought becomes more frequent than once every five years, then decline in growth and poor reproductive performance of livestock	**Structural:**				
			Investment in water capture and retention infrastructure (sand dams etc.).	9	13	76%	
			Non-structural:				
			Expanded use of weather-index insurance	8	11	66%	
			Policy:				
			Regulatory: Restrict the raising of certain types of livestock species in particularly vulnerable regions	5	3	32%	
			Public Investment: Increase research into the development of drought-tolerant livestock	10	13	81%	✓
Improve rangeland through enhanced management	Increase in average annual temperature	Decline in grasslands productivity, leading to declines in animal health and productivity	**Structural:**				
			Construction of bunds, sand dams and other water retention structures	9	14	78%	
			Non-structural:				
	Decrease in mean annual precipitation in the ASALs		Promote rotational grazing	10	12	79%	✓
			Expansion of awareness campaigns on the need to balance stocking rates with rangeland productivity	8	14	73%	
			Policy:				
			Regulatory: Strengthen wetlands policy to ensure the preservation of seasonal wetlands	9	13	76%	

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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.