PART 4
ENVIRONMENTAL GOVERNANCE — NOW AND IN THE FUTURE

CHAPTER 10
KENYA ENVIRONMENTAL FUTURES: PATHWAYS TO REALIZING VISION 2030 AND BEYOND

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Introduction

Background to environmental scenarios

The challenges of environmental management such as degradation of ecosystems, climate change, biodiversity loss and unsustainable natural resources use have long-term implications which require long-term policy solutions. To make informed strategic decisions and actions, it is desirable to anticipate the future trends in the state of the environment. This is better done by understanding the ongoing, emerging and latent developments that will drive the future. By exploring more than two development planning and legislative cycles, we are better able to explain the long-term costs of our actions on the environment. Tools that offer an insight into the future (like environmental scenarios and outlooks) help to explain the discontinuity and uncertainties of future developments (Alcamo 2008, Raskin 2005).

Scenarios are consistent and coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present, and future developments, which can serve as a basis for action and a means of handling uncertainty (van Asselt et al 2007). Contemporary scenario practise varies and is indicated by a wide range of use in many aspects of socio-economic development, including environmental assessment. Environmental scenario analysis is becoming a commonly used approach for supporting forward-looking assessments in integrated environmental assessments. They offer a framework for bringing together insights from a range of perspectives and disciplines to assess the complex interactions between socio-economic and environmental developments (Alcamo and Henrichs 2008, Börjeson et al 2006). In doing so, scenario exercises provide a structure within which to reflect on and think through the possible implications of alternative decision pathways, bringing expert knowledge and stakeholder perspectives to bear. Indeed, environmental scenario analysis has become one of the key tools for bridging environmental science and policy. Well-thought out scenarios are therefore vital to sensitizing the breadth of actors about potential risks or critical thresholds, to eliciting positive paradigm shifts (Jäger et al 2007), identifying the drivers and symptoms of emerging trends and to prioritizing policy formulation or adaptation in order to achieve desired outcomes such as delivering the Vision 2030 promises.

Many recent international assessments have conducted high-profile scenario exercises to combine the latest understanding of environmental research with society's concerns about environmental changes. For example, many assessments regarding climate change (IPCC 2007), the future of ecosystem services (MA 2005) or the interplay between environment and development (UNEP 2006 and 2007) have been undertaken. Further, at national and regional levels, a host of environmental scenarios have been developed and analysed, and many current environmental outlooks make use of scenario analysis. A growing number of countries in Africa now include scenario analysis as part of their environment outlook reports (UNEP 2007). They are no longer developed and applied on an ad hoc basis, but have become an integral part of state of the environment reporting in order to inform policy option formulation and assessment.

A process-oriented environmental scenario development procedure functions to promote: learning, communication, and the improvement of observational skills (De Vries and Petersen 2009). It seeks to inform resource users and policy makers by deciphering the often confusing overload of information and integrating possible future events and developments into consistent pictures of the future (Zurek and Henrichs 2007). Making sense of the future in this way can challenge mental models and prevailing mind-sets, and can involve learning from the past and investigating fundamental uncertainties about the future. Product-oriented environmental scenario studies are more concerned with the nature and quality of the output than with how it was arrived at. They function to: identify driving forces and signs of emerging trends, policy development, and to test policy. Scenarios can be used to identify and prioritize the dangers and opportunities in emerging environmental states, trends and processes. The signs of these are sometimes referred to as 'weak signals', 'early warnings', 'seeds' or 'traces'. Scenarios may also be a tool for evaluating decisions and testing policy options by doing 'practise runs' of possible future situations which indicate the possible effects of decisions.

The aim of conducting scenario analysis is to attempt to anticipate possible consequences of current developments and options to either prevent, counter, prepare for, enhance or benefit from future changes —and to better understand the implications of the uncertainties that surround our assumptions about how the future may unfold (Girod et al, 2009, Grooves and Lampert 2007). According to Jäger et al 2007, scenarios aid in:

- Recognition of 'weak signals' of change
- Avoiding being caught off guard by 'living the future in advance'
- Challenging 'mental maps'
- Raising awareness about future risks or critical thresholds
- Testing strategies for robustness using 'what if' questions

- Providing a common language by, for instance, unveiling different perceptions and beliefs
- Stimulating discussion and creative thinking
- Providing better policy or decision support, and
- Stimulating engagement in the process of change.

The purposes of undertaking any environmental scenario exercise fall into three overarching clusters: research and scientific exploration, education and public information, and decision support and strategic planning.

Objectives of Kenya SoE scenarios

The objectives of conducting outlook scenarios for the Kenya state of the environment process were to:

- Follow through the emerging issues, challenges and opportunities presented by the natural resources that are of socio-economic importance
- Identify and track changes in key environmental drivers in order to isolate major thresholds and tipping points for negotiating tradeoffs that would inform policy and environmental management at different scales
- Track progress, under different pathways, towards the realization of key development outcomes including MDGs, the Vision 2030 national development goals and other related environmental targets like the NEPAD environmental action plan for 2020
- Perform sensitivity analyses of alternative policy options in order to generate a range of policy actions that would fast-track progress towards key environmental goals, and
- Create awareness among key stakeholders especially policy makers and local communities on salient environmental management options as well as the costs and benefits of alternative environmental management schemes.

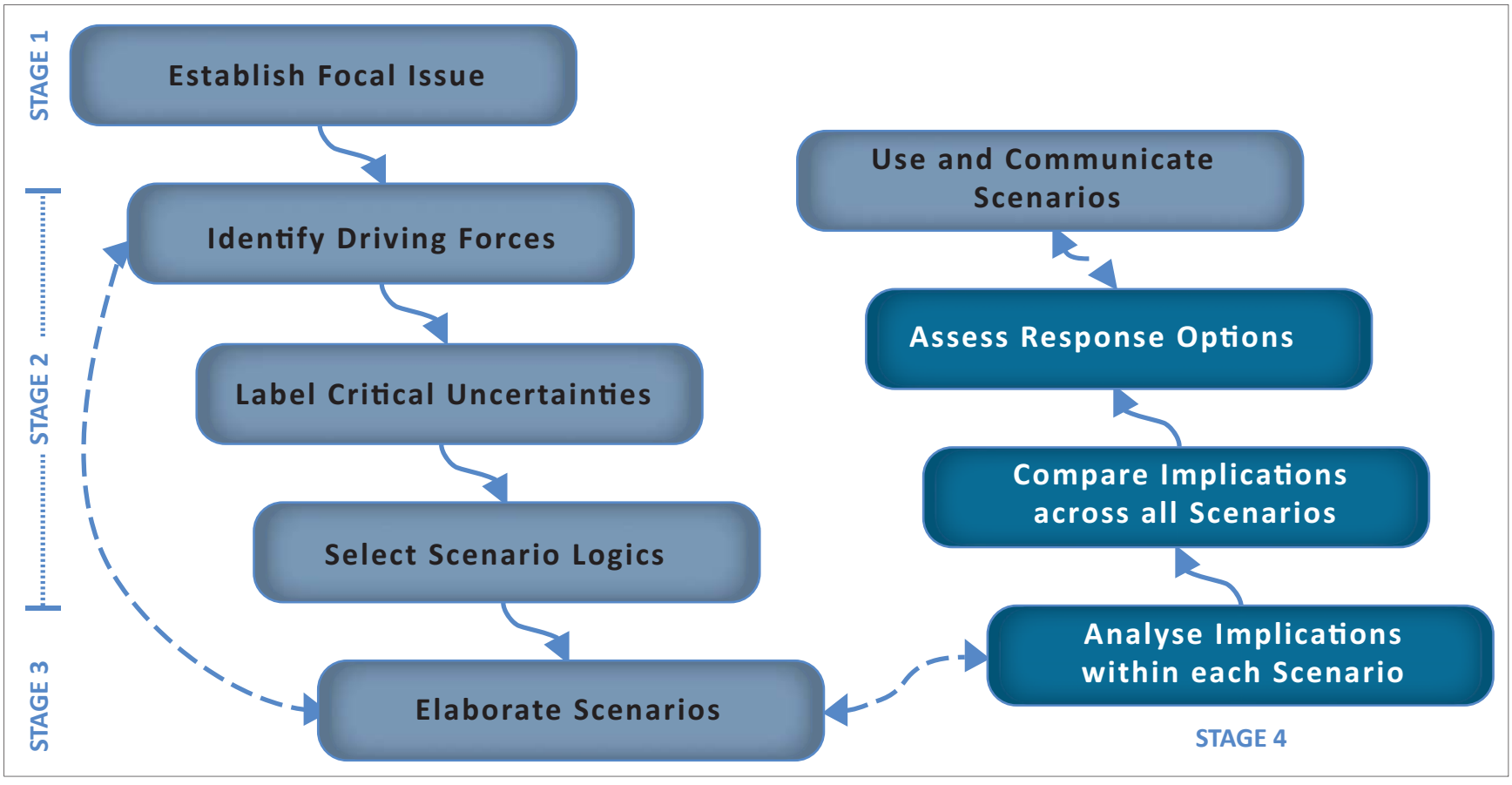
Process of building the scenarios

This SoE report adopted a deductive scenario analysis approach depicted in Figure 10.1.

As part of the scoping process to identify the scenario focus and foundation, the participants established 2030 as the temporal scale in line with the Vision 2030 targets. They also agreed to capture major socio-economic development milestones including the MDG target year of 2015 and the NEPAD environmental action plan target year of 2020. Key drivers including demography, economic development,

Figure 10.1: The four-stage scenario analysis adopted for production of Kenya environmental scenarios

Source: Adapted from Alcamo and Henrichs (2008)



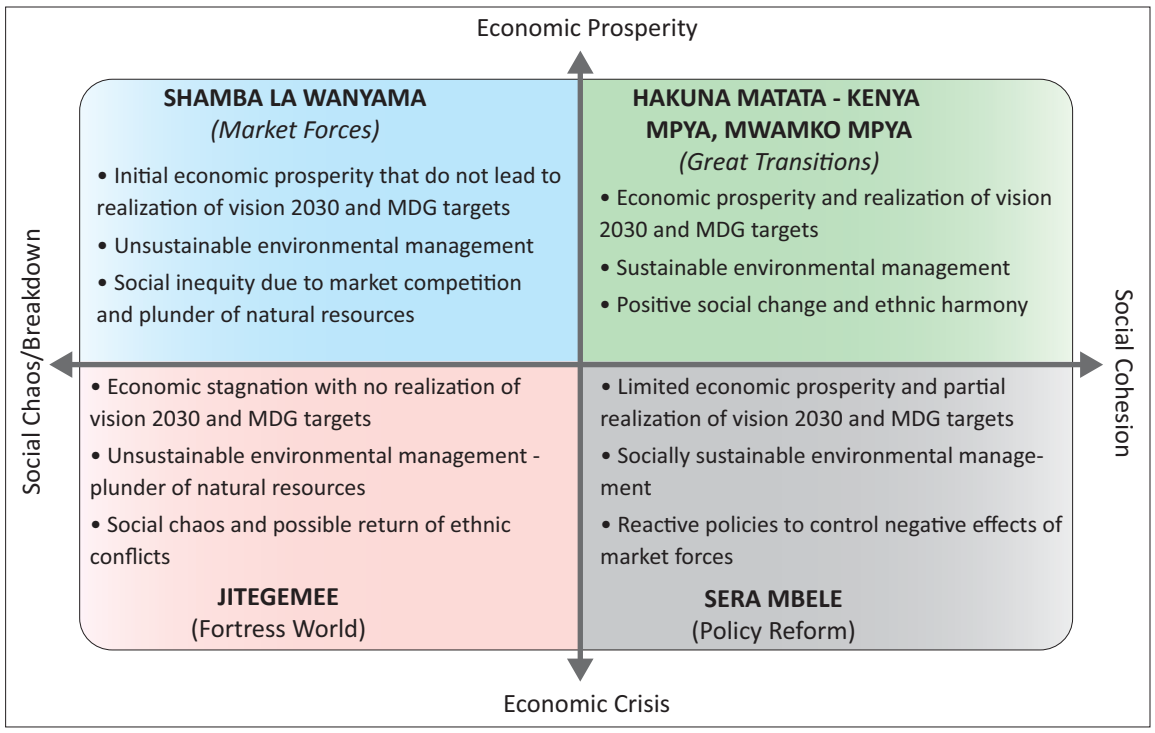


Figure 10.2: Scenario logic for Kenya's environmental futures

social change, culture and tradition, technology, environment as well as climate change and governance were identified and explored as antecedent factors that would effect change in Kenya's environment towards 2030. By focusing on the most important but least certain environmental drivers (the critical uncertainties namely economic development and social change), the scenario logic in Figure 10.2 was created to define the scenario exploration framework and logic.

Realizing Vision 2030

The government has over the past few years recognized that short-term strategies have to be put in the context of long-term development planning. Environmental changes are largely long-term and must be overlaid on the broader socio-economic development landscape. Vision 2030, whose primary goal is to transform Kenya into a globally competitive and prosperous nation, was launched in 2007 and has become the reference point for all government policy activities including those on the environment. Central to this effort has been a reconsideration of the manner in which the state engages in development policy and, which models of development to emulate.

The environmental scenarios in this chapter will be used to provide stakeholders with key lessons from plausible development pathways. These scenarios are pegged to the 2010-2030 temporal scale and use the aspirations of Vision 2030 as targets to measure the impact of environmental action over this period.

Environmental concerns are mainstreamed into programmes and activities that underpin Vision 2030's social, economic and political pillars (GoK 2007). This development philosophy takes cognizance of the emerging global and national environmental challenges including climate change, skewed land distribution and environmental degradation in rural and urban areas. Soil erosion and loss of soil fertility resulting in lower yields for rain-fed agriculture, deforestation, encroachment into forests and reserves, and settlement and agriculture on important wildlife corridors and dispersal areas are examples of the challenges that require urgent attention if the Vision 2030 aspirations are to be realized.

This chapter provides various options for tackling the environmental challenges that have been highlighted throughout the document. It takes a positive approach by presenting alternative pathways with differing solution sets and laying out opportunities for entrenching progress towards the various development targets. These include tradeoffs for avoiding pitfalls along the way. The chapter underscores the principle of Vision 2030 which is that the country should embark on a broad environmental programme aimed at conserving watersheds, terracing fragile agricultural lands, managing invasive alien species, and reforesting both public and private land. Taking note of the lessons provided will offer opportunities to reengineer action towards Vision 2030.

Overview of the scenarios

The scenarios are couched in Kiswahili (which is Kenya's only national language and is alongside English, one of country's official languages) and range from *Shamba la wanyama* (Kiswahili for 'animal farm'), *Sera mbele* (which literally translates as 'policy first'), *Jitegemee* ('you are on your own') which is the most pessimistic scenario and *Hakuna Matata, Kenya mpya—mwamko mpya* ('no problem, new Kenya—new beginning') which is the most optimistic scenario.

Shamba la Wanyama

This is a national reflection of the Market Forces scenario in the Africa Environment Outlook (AEO) (UNEP 2006). It assumes a continued emphasis on profit-making and exploitation of key environmental assets. In this scenario, competition and market trends dictate the pace of environmental utilization. Since government structures do not support controlled exploitation of natural resources, plunder and social chaos result with far-reaching implications on socio-economic inequity and resource-driven conflicts. The scenario has the following key attributes:

- Inequity and inequality in access to ecosystem goods and services
- Overexploitation of natural resources driven by profit goals
- Disempowerment of communities and gender inequality
- Poor provision of social services
- Increased globalization and privatization

Sera Mbele

In this scenario, the government and other actors put in place reactive policies and regulations in an attempt to reverse the negative effects of uncontrolled market-driven exploitation in the *Shamba la Wanyama scenario*. These policies are primarily top-down in nature and thus fail to entrench participatory conservation. They do not lead to the establishment of sustainable and equitable environmental management institutions. The efforts are too little too late. This scenario mirrors the Africa Environment Outlook's Policy Reform Scenario and is symbolized by the following attributes:

- Cohesive society working in unity
- There is ownership of environmental protection irrespective of social class

- High level of environmental compliance and enforcement regulations
- Presence of powerful groupings and political parties that are pro-conservation
- Little resource exploitation since local entrepreneurship is not dynamic and vibrant
- Sluggish economic growth
- Controlled economy

Jitegemee

The basic assumption in the *Jitegemee Scenario* is a total breakdown in social systems coupled with unprecedented economic crises. In this world, a select elite group of individuals, communities and institutions take control of the lion's share of national environmental assets at the expense of the majority for their own selfish economic gains. There occurs wanton plunder of natural resources, a drastic increase in environmental degradation and escalation of poverty and environmental conflicts. In this most pessimistic scenario, the future of Kenya is characterized by inefficient institutions, and a failure to address environmental degradation, slow economic growth, unemployment and poverty. The political dilemma is characterized by poor policy formulation and weaknesses in the oversight institutions. In this scenario Kenya slides systematically into an 'abyss of underdevelopment and hopelessness.' The assumptions are similar to those guiding the AEO Fortress World Scenario and are characterized by the following:

- Poor infrastructural development
- Inability to adapt to climate change and manage its impacts on society and the environment
- Economy controlled by a few people
- Inequity and insecurity
- Negative ethnicity
- Low life expectancy
- Massive plunder of environmental resources occasioned by impunity
- Poorly functioning public institutions for supporting agriculture and market development
- Unfavourable market barriers (internal and external) and poor market infrastructure
- Policy environment that stifles innovation in both rural and urban economies.

Hakuna Matata, Kenya mpya—mwamko mpya

A new renaissance of Kenya is assumed in this scenario which would see the country meet all the MDG targets, realize the Vision 2030 aspirations and sustainably manage its environmental assets. The assumptions are akin to those underlying the AEO Great Transitions Scenario (UNEP 2006). As a result of carefully thought out policies and institutional arrangements, the environment is fully mainstreamed in national development planning. Well-functioning public institutions support environmental management, agriculture and market development. Market barriers are reduced, infrastructure improved and the prevailing policy environment facilitates environmentally sensitive innovation in both urban and rural economies. The impact of climate change is adequately addressed through low carbon growth, vibrant adaptation strategies and technologies. This is the most optimistic scenario and Kenya witnesses political, social and economic reforms in line with the Vision 2030 aspirations. The policy and institutional environment is characterized by functioning institutions, policies and a strong regulatory environment that is able to address issues to support economic growth and environmental sustainability. Under this scenario, the Economic Recovery Strategy for Wealth and Employment Creation is fully and successfully implemented and the following prevail:

- Increase in agricultural productivity and sufficiency in food supply accompanied by environmental benefits due to less pressure on land and other resources
- Vibrant economy with the majority of households able to produce, eat, save, and invest in a clean, secure and sustainable environment
- Enhanced equity and wealth creation opportunities for the poor
- Laws, institutions and systems working at their optimum
- Positive social change with social cohesion and positive ethnicity
- Environmental governance is at the centre of development planning at the national and devolved levels

Grazing wildebeest.

Curt Carnemark / World Bank

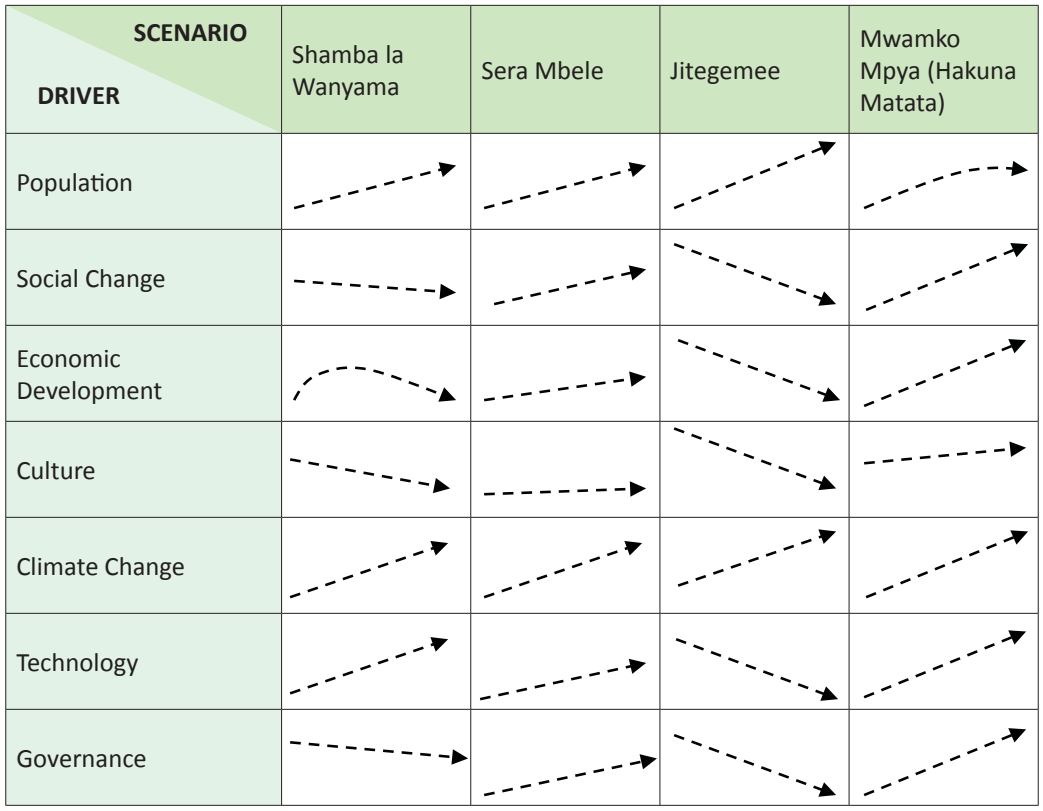
Driver	Elements/Issues
Demography	Total population size, growth rate, mortality rates, fertility rates, spatial distribution, population structure, rate of urbanization
Economy	GDP, infrastructure, growth rate, per capita income, poverty index, equity, wealth distribution, industrialization, trade, markets, inflation
Social change	Literacy and illiteracy levels, education, household sizes, gender, social cohesion, social services, change in dietary habits/ lifestyles/consumption patterns, globalization
Culture	Indigenous knowledge, language and ethnicity, religion, traditional protection, sacred sites, cultural practices, traditional beliefs, taboos, values
Climate change (and variability)	Weather extremes (floods, drought), change in rainfall patterns, length of growing period, species relevance, alien and invasive species, change in disease trends, livestock deaths, national, regional and international negotiation processes, tidal changes
Technology	ICTs, environmental management technologies, clean development mechanisms (CDM), technology transfer issues, early warning systems, indigenous traditional knowledge, outreach and dissemination
Governance	Political will, policies (policy nesting), poor negotiation skills, environmental governance capacity, accountability, corruption, integrity, nepotism, institutional structures/frameworks, compliance and enforcement, access and benefits, leadership, community based management, transboundary resource management, popular participation, discourse, disclosure, financing environmental management/ mainstreaming

Table 10.1: Drivers of environmental change in Kenya

The scenario drivers

The Kenya SoE process identified seven major drivers of environmental change, namely: demography, economic development, social change, culture, climate change, technology and governance. The elements of these drivers that are highly likely to influence environmental change are summarized in Table 10.1 while Figure 10.3 presents a summary of the qualitative assumptions of these drivers by scenario.

Figure 10.3: Qualitative assumptions of key drivers of environmental futures



Demography

Demography is one of the main drivers of environmental change. The subsequent paragraphs will highlight how the different elements of demography are expected to evolve under the different scenarios. Each of the other drivers will also influence environmental change in different ways and to differing extents.

The population stood at 38 610 097 million in 2009 (KNBS 2009) and is growing at 2.9 percent per year. At this rate, the country's population is expected to increase and will likely reach 70.4 million in 2030, exerting more pressure on the environment. The difference in the impact of population change will vary depending on the extent to which population, environment and health are integrated in development planning. Only under the *Hakuna Matata Scenario* will the anticipated wide range of environmental problems be managed despite the population increase. With approximately 20 percent of the land surface suitable for cultivation, a rapidly growing population will continue to put tremendous pressure on land and water resources. Furthermore, continued deforestation, loss of natural habitats, and illegal poaching would escalate as the population increases especially under *Jitegemee* and *Shamba la Wanyama scenarios* leading to a decline in most wildlife species in the country, including large mammals such as the African elephant, rhinoceros and wildebeest.

Population distribution is expected to remain uneven under all the scenarios. The patterns will be linked to the agricultural potential of the land and hence regional population densities will become more pronounced. The pace of rural-urban migration is expected to be stepped up under the *Jitegemee Scenario*. Inter-censal population growth rates are likely to decline systematically under the *Hakuna Matata Scenario* from the current 2.9 to under 2 percent by 2030. Additionally, total fertility rates will continue to fall in this scenario. Such a rapidly increasing population is expected to limit the government's ability to satisfactorily provide social services and invest in productive sectors, create employment and deal effectively with serious environmental concerns. In all scenarios, except the *Hakuna Matata Scenario*, if climate change results in reduced precipitation in Kenya, then the area of land classified as arid and semi-arid would increase while the high potential land would diminish. Consequently, the existing population would have to rely on a constricted resource base. This might increase migration to urban areas, result in environmental degradation, deforestation for settlement and wood fuel. Increased numbers of migrants to urban areas would further stress urban facilities beyond their carrying capacities in terms of provision of water, education, health, housing, energy and transport.

The environment towards 2030

This section is an integrated assessment of three sectors under the different development pathways highlighted in the earlier section. These are land, agriculture and livestock; freshwater, marine and coastal resources; and biodiversity.

Integrated assessment of alternative pathways

Land, agriculture and livestock

Under the *Shamba la Wanyama* scenario, the anticipated exponential increase in population, which stabilizes towards 2030, occasions the fragmentation of arable land, diminishing available agricultural land per capita and leading to widespread soil and rangeland degradation, land cover changes and conversions especially in livestock concentration areas. Social systems including the provision of services such as health, education, security, extension services and water provision are weakened, making it harder to meet the targets of Vision 2030's social pillar. This contributes to decreased productivity from agriculture and livestock and frequent conflicts over natural resources such as grazing areas, watering points and forest reserves. Other developments towards 2030 which are occasioned by these trends include a decline in the economic growth rate towards 2030 due to the weakening social systems and fluctuations in the international oil and food prices and erosion of cultural practises which cannot compete with more profit-driven approaches. This contributes to a rapid decline in species, genetic and ecosystem diversity. A major contributor to this state especially after 2020 is poor leadership, institutional structures and policies, an increase in corruption, nepotism, negative ethnicity and unsustainable management of land and water resources.

Under the *Hakuna Matata Scenario*, Kenya's land resources are sustainably managed owing to availability of skilled labour, increased agricultural and livestock production through increased uptake of technologies and markets for agricultural produce and livestock products. In 2030, there is a marked reduction in resource-based conflicts and land degradation due to increased environmental awareness and the increased use of sustainable land management practises. Systematic policy review, reform and changes between 2010 and 2025 address the gaps in the scenario. These efforts also target the agricultural institutions that provide services to farmers such as extension, training, research and regulatory services ensuring that they serve farmers efficiently and more cost effectively. Additionally institutional, legal and regulatory reforms encourage individual farmers to shift from subsistence to market-oriented production, and to adopt modern farming practises. Similar successes are not possible in both *Jitegemee* and *Sera Mbele scenarios* in which there is likely to be an increase in land fragmentation and diminishing agricultural land per capita and degradation.

Freshwater, coastal and marine resources

As 2030 approaches, the *Hakuna Matata scenario* witnesses increased access to improved water and sanitation because of favourable conditions for water resources management and development. By 2030, there is a 25 percent expansion of irrigated land for food security and commercial farming with the pace of degradation (pollution, overuse, destruction and deterioration) of water and coastal marine resources being brought under control. The achievements are largely due to effective implementation of the national policy on water resources management and development. The policy, based on the Sessional Paper No. 1 of 1999, was reformed early after 2010 to ensure efficient mobilization of resources for water resources management and development. The implementation of the policy was well coordinated and regulated with participation of all water sector actors. The economic boom after 2020 supported investments required for the infrastructural development for water storage and for water schemes to improve water accessibility. Restoration and community based coastal management also benefit from the policy reforms bolstered by better governance at all levels. These enable the implementation of the principle of integrated water resources management (IWRM) as well as integrated coastal and marine resources management (ICMRM) allowing the following to be achieved or consolidated:

- Effective river basin management systems and water conservation programmes
- Clearly defined support roles and functions of various water actors at all levels
- Integrated Water Resources Management (IWRM) approaches to help reduce competition and conflict among water uses and users
- Strengthened legal framework through a review of the current law (Water Act 2002), policy and various strategies to harmonize them with prevailing and future aspirations and goals including the new Constitution
- Water projects that are undertaken in an environmentally sustainable manner
- An end to water degradation (in terms of pollution and overuse)
- Water resources assessment and monitoring, research and information systems are in place
- Financing mechanisms for the water sector are instituted
- An increase in access to water from the current average of 59 to 100 percent is recorded by 2030, meeting the relevant social pillar goals of Vision 2030. Access to sanitation likewise improved to 100 percent from the current average of 31percent.

Under the current trajectory, the national water endowment is expected to decline from the current level of 548 m^3 to about 235 m^3 per capita per annum by 2020. This is likely to occur under the *Jitegemee* and *Shamba la Wanyama scenarios*. The reduction in national water endowment is expected to be slightly halted under *Sera Mbele scenario* but efforts could still fail to halt the decline after 2025. The decline would be effectively altered under *Hakuna Matata scenario* as the Vision 2030 flagship projects in the water sector are fully implemented and a national master plan for intensive large-scale and small-scale irrigation is rolled out in 2012. Economic exploitation of rivers, lakes, rainwater and ground water resources are realized by 2020 with a resulting significant reduction in the cost of water resources degradation.

Water Resource Development Outcome Indicator	2009	2015				2030			
		S1	S2	S3	S4	S1	S2	S3	S4
Urban households with access to piped water (per cent)	61.0	65.0	67.5	60.0	75.6	65.0	70.0	45.0	94.5
Rural households with access to water from a protected source (per cent)	42.0	48.0	52.0	40.0	65.3	47.0	59.0	25.0	89.2
Water storage per capita (m^3)	5.3.0	6.3	7.5	5.2	17.5	8.2	14.5	5.0	24.0
Urban households with individual or shared access to sewerage facility (per cent)	32.0	47.0	52.3	29.0	58.0	55.0	60.4	25.0	87.0
Rural households with individual or shared access to sewerage facility (per cent)	6.0	8.5	15.0	4.0	45.0	12.5	25.0	3.0	78.0
Hectares under irrigation for food production ('000)	123.2	142.0	176.0	122.0	375.0	175.0	224.5	115.0	445.0

Table 10.2: Projected outcome indicators of water resources development in 2015 and 2030 in each scenario

Key to scenario labels: S1 (shamba la wanyama), S2 (Sera Mbele), S3 (Jitegemee), and S4 (Hakuna Matata – Kenya mpya, mwamko mpya)

Note: Computed in MS Excel macro-based model according to Vision 2030 flagship projections and scenario population and economic growth assumptions

Under the different scenarios, the levels of achievement of water resources development outcomes are likely to change as shown in Table 10.2. This will occasion varying daily water demands by sector as shown in Figure 10.4.

Biodiversity

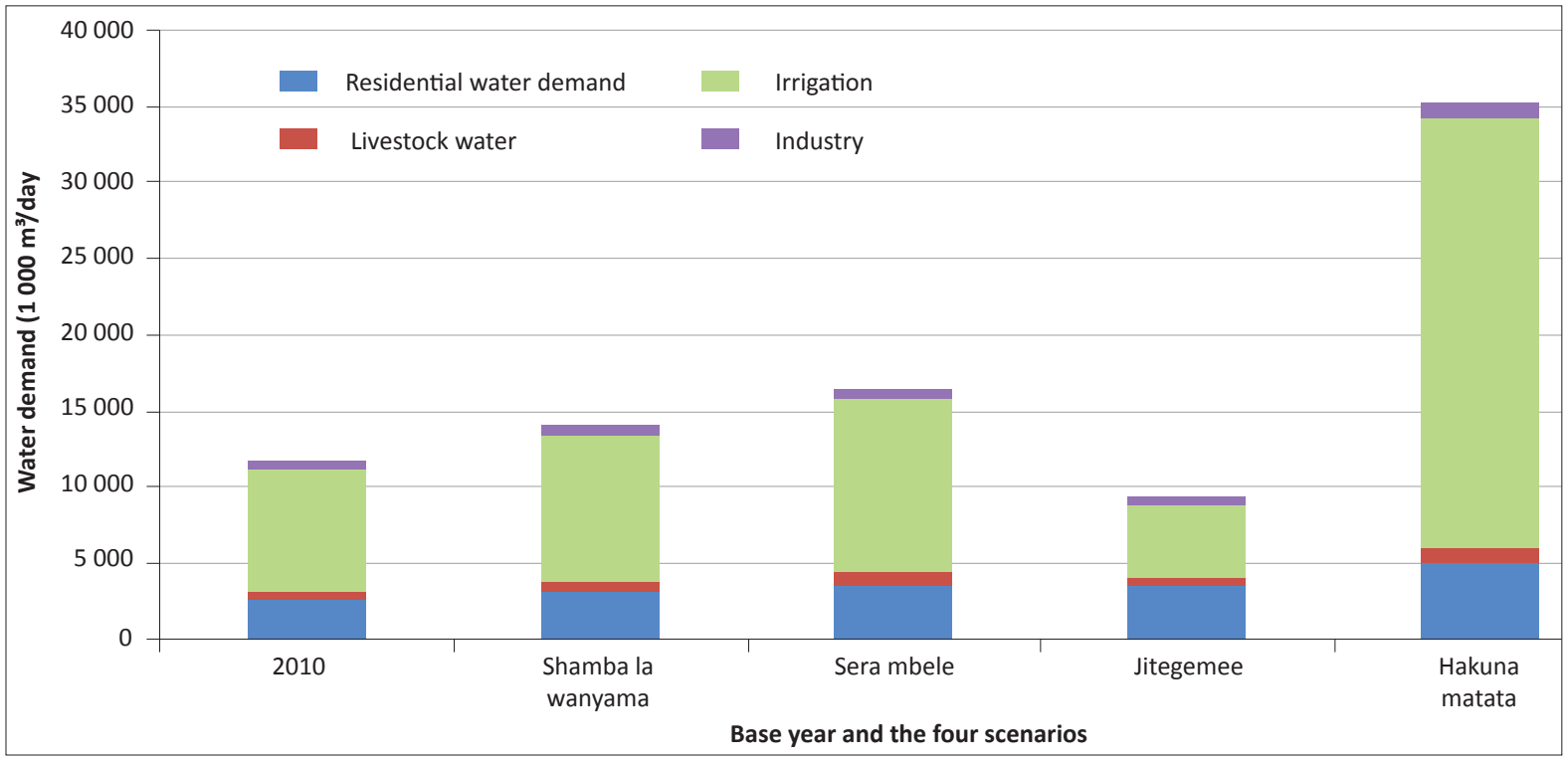
The challenge in all scenarios is to design, implement and monitor the large scale conversion of forest reserves, pastures and croplands, and effectively manage climate change impacts or invasive alien species. The loss of biodiversity would be critical under *Jitegemee* and *Shamba la Wanyama scenarios* owing to a breakdown of regulatory systems with some species projected to decrease in abundance or decline in their ranges with a possible substantial increase in the risk of extinctions. The efficient management or otherwise of land use change, river flows, freshwater pollution and exploitation of marine resources are expected to drive biodiversity change. However, climate change will be the definitive factor; and how its impacts are managed will ultimately determine the fate of biodiversity under all scenarios.

Developments under the *Hakuna Matata Scenario* present an optimistic outlook but would require fundamental changes in development paradigms within the known constraints of economics, resource use and national development goals. This would have to take into account the fact that Kenya's biodiversity is complex and that most of it occurs outside protected areas where it faces the highest ecological threats.

Many global (GLOBIO3) and local projections of changes in biodiversity show continuing and, in many cases, accelerating species extinctions, loss of natural habitats, and changes in the distribution and abundance of species and biomes over the next few decades. In Kenya, a combination of changes in land use, exploitation of forests and marine resources, climate change and eutrophication are highly likely to be the key drivers of biodiversity change towards 2030 and beyond. The four scenarios would therefore have varying changes and trends in the distribution and abundance of species, species groups and biomes. Some of these transformations would involve the main protected areas and marine and fresh water bodies.

By 2015, under the *Hakuna Matata Scenario*, the country finds lasting solutions for dealing with current invasive alien species. Examples include the common carp (*Cyprinus carpio*) which, left unchecked, could cause loss of local species of fish and invertebrates

Figure 10.4: Differential daily water demand in 2030 in different environmental scenarios



A cleared section within the Mau Complex: If allowed to continue, forest encroachment will negatively affect the attainment of Vision 2030 targets.

especially in Lake Naivasha. The water hyacinth (Eichhornia crassipes) is another species whose rapid spread in Lake Victoria is left unchecked in *Jitegemee Scenario* and could cover up to 25 000 ha of the water body with increasing fisheries and navigation losses. A cross-scenario assessment reveals that forest cover in 2030 would mainly persist in the current forest reserves. However there is likely to be marked farm-level afforestation improvement to nearly 10 percent of small holder farmland in the *Hakuna Matata Scenario* (comparable to estimates by Ogweno et al 2009). The highest deforestation is under *Shamba la Wanyama*. The mean species abundance values would decrease from 0.5 in 2010 to under 0.2 in 2030 for the *Shamba la Wanyama*, *Jitegemee* and *Sera Mbele scenarios*. In addition, the estimated area with a high threat to biodiversity obtained from simulated Kenya land use maps (GRID-Arendal) would increase two-fold in these scenarios. Conservation measures put in place between 2010 and 2015 under *Hakuna Matata Scenario* minimize the impacts of deforestation on biodiversity.

The challenges and achievements towards 2030

Under the *Hakuna Matata Scenario*, a positive trend in social change is anticipated. The sustainable development envisaged through this scenario entails improved livelihoods indicated by good health, decreased mortality and improved life expectancy. This social change will avail equitable social development for holistic human development, better recreational facilities and improved waste management due to the increased accountability of public institutions and officials. The positive trends and vibrancy in economic development create a favourable environment for sustainable fiscal and monetary policies. The stable economy then avails adequate financial resources to support developmental devolution to the counties epitomized by increased industrial and infrastructural development in all regions. This will obviously exert increased pressure on natural resources and increase demand on environmental services but with improved governance, the effects on the environment will be addressed.

To achieve the Vision 2030 goal of transforming Kenya into a middle income country with a high quality of life, emphasis should be put on employment creation, poverty reduction, better income distribution and gender equity. Vision 2030 is founded on the premise of macroeconomic stability, reforms in the governance sector, equity and wealth creation opportunities, infrastructure, energy, science technology and innovation, including human resources development, security and public sector reforms. In the *Hakuna Matata Scenario*, the country zealously implements the provisions of the new Constitution that call for major sectoral and institutional reforms. Major strides will have been achieved with the restoration of the five main water towers: the Mau Forest Complex, Mount Kenya, Aberdares, Mount Elgon and the Cherangani Hills. Reasonable efforts are also made in the restoration of Nairobi River. In the area of waste management, the notorious Dandora dump site is relocated to Ruai. The scenario envisages economic, industrial and infrastructural growth largely attributable to the counties that were not clearly identified in Vision 2030 although the theme of decentralization was visualized. After 2015, adjustments are made in Vision 2030 to cater for environmental legislative, policy and institutional reforms. In particular, EMCA is amended to provide for the establishment of devolved environment management institutions such as county environment committees and county environment officers.

The MDG targets are realized only under the *Hakuna Matata Scenario*. There is increased environmental sustainability with greater integration of the principles of sustainable development into country policies and programmes. This leads to a reversal in environmental degradation and reduces biodiversity loss by half by 2015. There is also

Goal	Target	Achievement of MDG goal/ target by 2015			
		S1	S2	S3	S4
1. Eradicate extreme poverty and hunger	1a: Halve the proportion of people whose income is less than US$ 1 per day				
	1b: Achieve full and productive employment and decent work for all				
	1c: Halve the proportion of people who suffer from hunger				
2. Achieve universal primary education	2a: Ensure that children will be able to complete a full course of primary schooling				
3. Promote gender equality and empower women	3a: Eliminate gender disparity in all levels of education				
4. Reduce child mortality	4a: Reduce by two-thirds the under-five mortality rate.				
5. Improve maternal health	5a: Reduce by three-quarters the maternal mortality ratio.				
	5b: Achieve universal access to reproductive health				
6. Combat HIV/AIDS, malaria and other diseases	6a: Have halted and begun to reverse the spread of HIV/AIDS.				
	6b: Achieve universal access to treatment for HIV/AIDS for all those who need it				
	6c: Have halted and begun to reverse the incidence of malaria and other major diseases.				
7. Ensure environmental sustainability	7a: Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources.				
	7b: Reduce biodiversity loss, achieving a significant reduction in the rate of loss				
	7c: Halve the proportion of people without sustainable access to safe drinking water				
	7d: Have achieved an improvement in the lives of at least 100 million slum dwellers				
8. Develop a global partnership for development	8a: Develop further an open, rule-based, predictable, nondiscriminatory trading and financial system				
	8b: Address the special needs of the least developed countries				
	8c: Address the special needs of landlocked countries and small island developing States	N/A	N/A	N/A	N/A
	8d: Deal comprehensively with the debt problems of developing countries through national and international measures to make debt sustainable in the long term.				
	8e: In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.				
	8f: In cooperation with the private sector, make available the benefits of new technologies, especially information and communications.				

Figure 10.5: Qualitative indications of the degree of achievement of MDG goals and targets under each scenario

*** The colour schemes (ranging from orange: off-target to green: on-target) show qualitative indications of extent of achievement of specific MDG targets for each of the eight goals under the four scenarios – S1 (shamba la wanyama), S2 (Sera Mbele), S3 (Jitegemee), and S4 (Hakuna Matata – Kenya mpya, mwamko mpya)*

an increase in the proportion of people with access to drinking water and a significant improvement in the lives of the informal settlement dwellers. To actualize the achievements, the Vision 2030 department in the Ministry of State for Planning, National Development and Vision 2030 is revamped and adequately funded to monitor and steer the developments. Figure 10.5 summarizes the achievements towards 2015 under each scenario for the MDG targets.

Selected scenarios of emerging environmental issues

Climate change

Projections indicate that by 2020, between 75 and 250 million people in Africa will be exposed to increased water stress due to climate change (IPCC 2007). The IPCC report also notes that by 2020, yields from rain-fed agriculture could reduce by up to 50 percent in some countries. Agricultural production, including access to food, in many African countries is projected to be severely compromised (Parry et al 2007, Ziervogel et al 2008). This is expected to further adversely affect food security and exacerbate malnutrition. Towards the end of the 21st century, projected sea level rises will affect low-lying coastal areas. The cost of adaptation could amount to at least 5-10 percent of GDP. By 2030, the area occupied by ASALs in Africa is projected to expand by 5-8 percent under a range of climate scenarios.

According to SEI (2009), Kenya already has a complex existing climate, with wide variations and very strong seasonality across the country. Regardless of the scenario, this is expected to continue towards 2030. The current projections of future climate change based on downscaled global models for Kenya indicate future increases in mean annual temperature (average monthly temperatures) of 1-3.5 ^{o}C over the range of models beyond 2030 (by the 2050s). The changes in precipitation are anticipated to be most uncertain. Many climate models show that rainfall regimes will change based on the season and region. Extreme events (mainly floods and droughts) are expected to intensify over the scenario period with heavy rainfall in the wet seasons and thus greater flood risks while droughts are likely to intensify in the already affected counties.

The scenario pathways towards 2030 are expected to only diverge based on the strategies the country is putting in place for understanding the economic cost of climate change, designing sustainable adaptation strategies and mainstreaming low carbon growth in all sectors. The specific evolution of these measures across the four scenarios is presented below.

Dust storms are more likely with increasing drought events if climate change is not adequately addressed

Economic cost of climate change across scenarios

It is emerging that existing climate change and variability have significant economic costs. Under the *Jitegemee* and *Shamba la Wanyama scenarios*, periodic flood and drought extremes are expected to intensify and have major macro-economic costs and reductions in economic growth. Additional net economic costs (on top of existing climate variability) could be equivalent to a loss of almost 3 percent of GDP each year by 2030 under these scenarios. The costs include potential threats to coastal zones through the sea-level rise, health burdens, increased energy, land and water demand and loss of ecosystem services. These costs will be best reduced under the *Hakuna Matata scenario* through effective adaptation and mitigation strategies.

The study by SEI (2009) estimates potentially large economic costs from climate change in Kenya if adequate adaptation mechanisms are not instituted. By considering a range of projections and current literature on sea level rise, the SEI analysis shows that coastal flooding from sea level rise is estimated to affect 10 000-86 000 people a year by 2030. The current assessment projects this to happen in all scenarios but with differences in coastal wetland loss and coastal erosion. The associated economic costs in 2030 are estimated to be US$7-58 million per year.

Adaptation to climate change impacts

Although adaptation mechanisms can reduce the economic costs of climate change, as financial resources must be set aside to invest in these, they are not free. The costs of adaptation will be high in all scenarios but the sectoral benefits and tradeoffs will differ. *Hakuna Matata scenario* is expected to usher in a sustainable balance between development and climate change through adaptation. Under all scenarios, the initial estimated cost of addressing Kenya's current climate-related impacts as well as preparing for future climate change is expected to top $500 million per year by 2012. The cost of adaptation by 2030 is expected to increase differentially in different scenarios. The highest estimate is likely to be in the range of US$1-2 billion per year especially under *Jitegemee scenario*. Figure 10.6 shows these indicative costs. The effectiveness of policies in both *Sera Mbele* and *Hakuna Matata scenario*s may reverse this trend through prioritization of early adaptation across the sectors. Adaptation, under whichever scenario, is expected to continue presenting potentially large benefits in reducing present and future damages. Under the *Hakuna Matata Scenario*, the government puts in place adaptation strategies targeting:

- Immediate needs and capacity building including expanded research into the effects, adaptation and economics of climate change. Other areas should include early capacity building and early warning systems, development of a national climate change policy and enactment of a climate change law and screening of sectoral and regional plans for climate risks and adaptation opportunities. Vision 2030 should be reviewed in order to incorporate long-term climate policies. A national climate change adaptation authority should be set up to improve sectoral coordination, link to international finance, support the private sector and enhance links between adaptation and low GHG emissions.

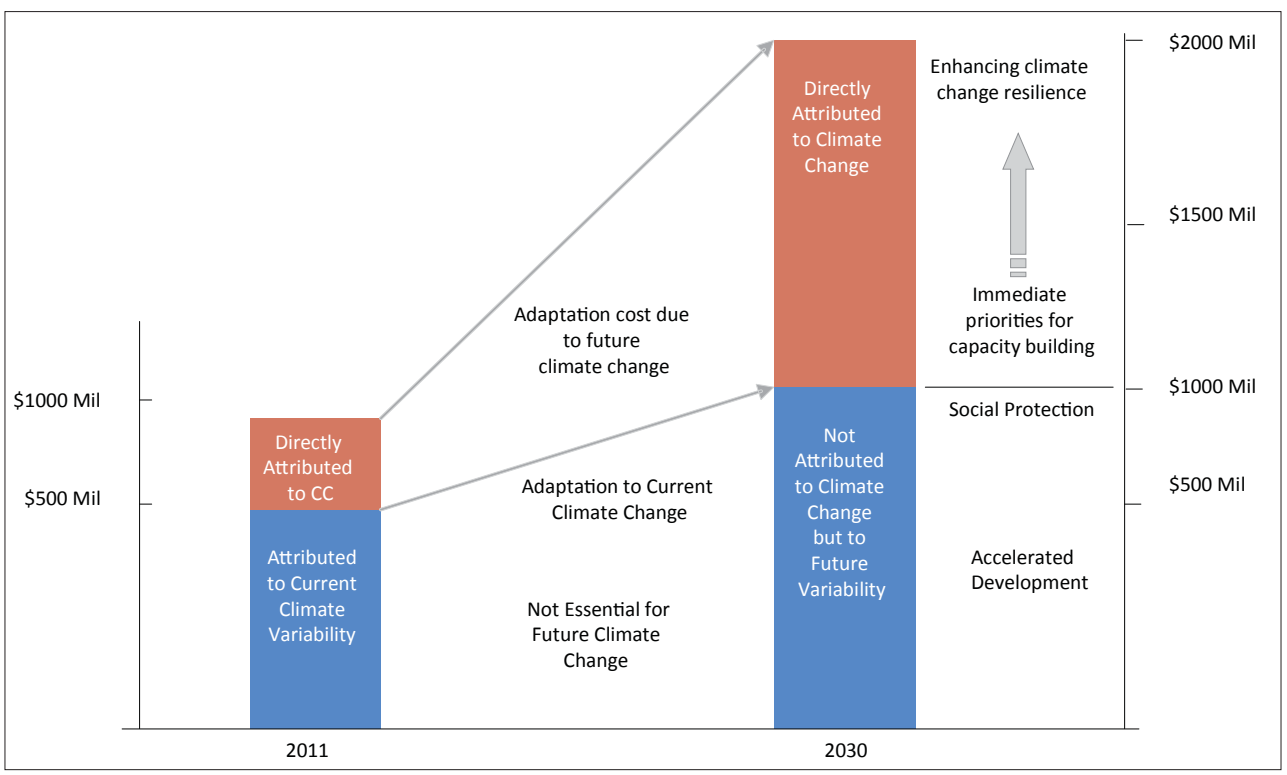
- Climate resilience by designing robust strategies that, for example, link cross-sectoral climate monitoring with exposure, impacts and adaptation actions, enhance knowledge management, health and vector-borne disease responses and institute drought and flood risk screening for new projects. Prototypes of sectoral actions (pilots) and pathways for scaling up to cover all vulnerable regions and populations as well as adaptation costs should also be developed for all scenarios.

- Social protection through cushioning of vulnerable livelihoods and strengthening existing social protection programmes. Such could include mechanisms such as insurance for vulnerable production systems like livestock in the ASALs. Pilot projects of these are discussed in detail in Chapter 3.

- Accelerated development to adapt existing development projects to include 'no regret' measures that reduce climate risks. It should also seize any opportunities to develop adaptive capacity as well as to scale up successful prototypes at the sectoral, national and county levels.

Figure 10.6: Indicative costs of adaptation to current and future climate change

Source: SEI 2009



Disease group	World's lowest country rate	Country rate	World's highest country rate
Diarrhoea	0.2	24	107
Respiratory infections	0.1	13	71
Malaria	0.0	13	34
Other vector - borne diseases	0.0	0.4	4.9
Lung cancer	0.0	0.1	2.6
Other cancers	0.3	0.9	4.1
Neuropsychiatric disorders	1.4	1.7	3.0
Cardiovascular disease	1.4	1.9	14
COPD	0.0	0.6	4.6
Asthma	0.3	1.7	2.8
Musculoskeletal diseases	0.5	0.6	1.5
Road traffic injuries	0.3	3.6	15
Other unintentional injuries	0.6	6.8	30
Intentional injuries	0.0	1.4	7.5

Table 10.3: Global incidence rates of selected diseases

Source: WHO 2009

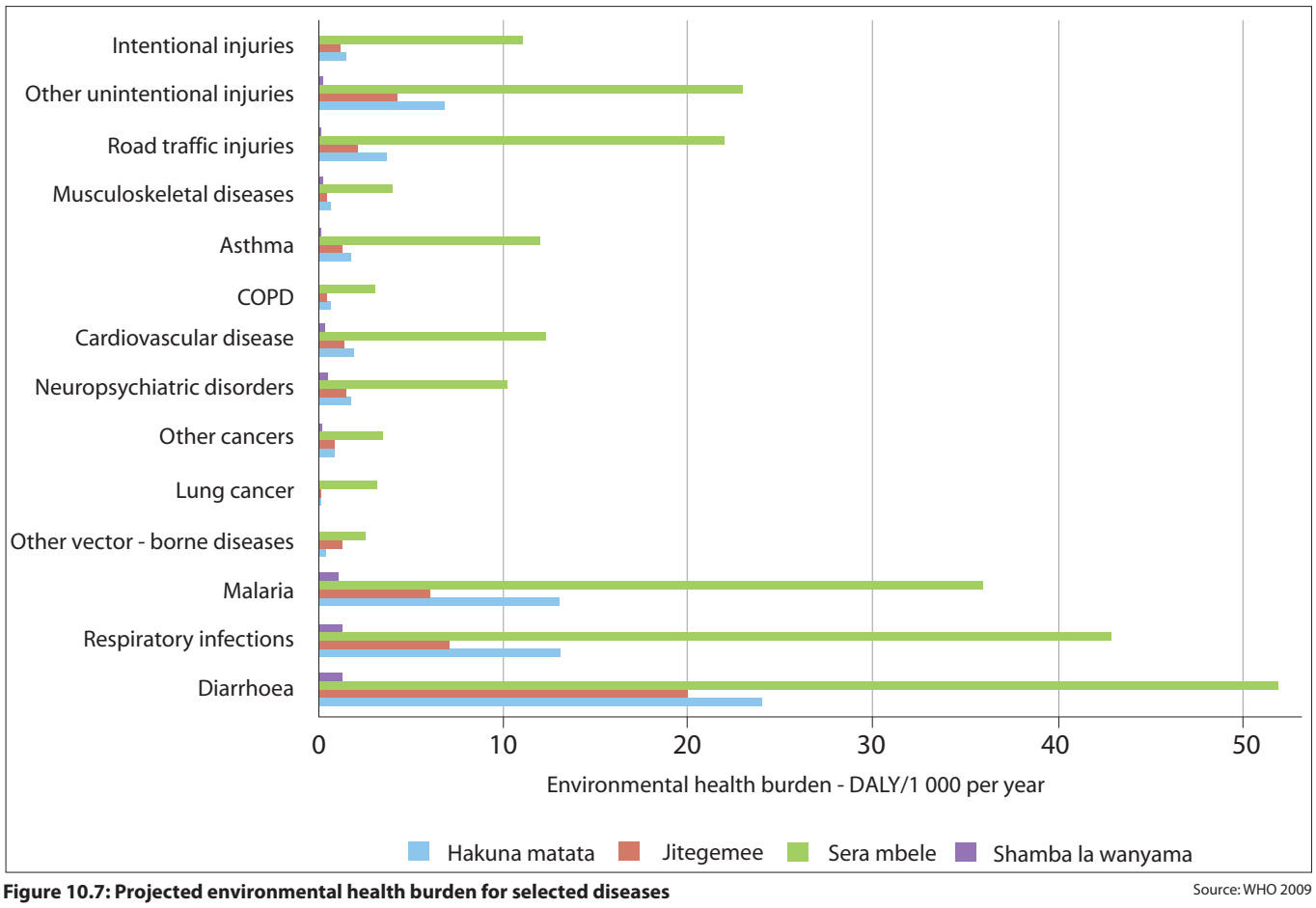


Figure 10.7: Projected environmental health burden for selected diseases

Source: WHO 2009

Engaging a low carbon growth

In both *Jitegemee* and *Shamba la Wanyama scenarios*, future GHG emissions in Kenya could double between 2010 and 2030. Moreover, if the economy is not climate-proofed, the Vision 2030 targets, particularly under the economic pillar, could lock Kenya into a higher emissions pathway. A low carbon alternative pathway is best reflected under the *Hakuna Matata scenario* which envisions 'no regrets' options that would enhance economic growth while enabling Kenya to access international carbon credits. The development pathways in this scenario are also expected to foster economic benefits from greater energy security and diversity, reduced air pollution and reduced negative environmental impacts. There are clear options for this target to enable energy-related emission savings of up to 22 percent by 2020, relative to the comparable figures for 2010. As more carbon credits are incorporated, these savings are expected to grow as 2030 approaches.

These plausible pathways highlight the importance of preparing for current and future climate change and variability. Kenya has a unique location, resource endowment and socio-economic conditions which position her to realize significant economic, environmental and social benefits. According to SEI (2009), pursuing the recommended pathways is in Kenya's self interest as they could stimulate extra investment in the potentially lucrative carbon trading. This would produce real economic, environmental and social benefits, including ancillary benefits of reduced fuel imports, improved air quality, improved energy security, and reduced pressure on natural resources.

Health and environment

Over the next two decades, Kenya's environment will continue to be closely intertwined with human health. As reported in Chapter 8, the environment influences human health in many ways but particularly

Evidence of lack of waste management infrastructure.

through interlinked changes in human behaviour in response to environmental factors and exposure to degraded environments. The current environmental health burden in Kenya is reflected by the fact that 80 percent of hospital attendance is linked to preventable diseases, 50 percent of which are water, sanitation and hygiene-related. Table 10.3 and Figure 10.7 illustrate changes in the environmental health burden as measured by the Disability-Adjusted Life Year (DALY) under the four scenarios.

Only under the *Hakuna Matata scenario* can the country hope to achieve the sanitation MDG which promises to halve the proportion of people without access to basic sanitation by 2015. In both *Jitegemee* and *Shamba la Wanyama scenarios*, major disasters in the country are expected to be exacerbated by climate change and variability and poor environmental policies. The implementation of the recommendations of the Situation Analysis and Needs Assessment (SANA), supported under the Libreville Declaration on Health and Environment in Africa in 2008 (UNEP and WHO 2009), is expected to be most fruitful under the *Hakuna Matata scenario*. This initiative would yield benefits from 2012 after the consolidation of efforts to design guidelines for implementing the SANA national plan of action, completion of guidelines for the development of national plans for the integration of health and environment issues into development plans and policies, and the development of a standardized data management system for health and environment. By 2013 a Health and Environment Strategic Alliance (HESA) will be created as recommended by the Libreville Declaration.

Health related challenges that would continue especially under *Jitegemee Scenario* include food contamination by aflatoxins during prolonged rains. Contamination by pesticide residues on horticultural and other products would only be contained by the sustained enforcement of chemical use standards and awareness campaigns. This can be expected under both *Sera Mbele* and *Hakuna Matata scenario*s. The key emerging health-environment issues that would unfold under the scenarios towards 2030 include waste generation and management and communicable diseases principally linked to poor sanitation and water supply systems.

In all scenarios, waste including plastics, e-waste (a result of the escalation of ICT use in development), waste tyres and other rubber products, chemical waste from agriculture and industry are expected to remain critical towards 2030. By 2025, Kenyan economic prosperity would be white-washed by an environmental backlash under the *Shamba la Wanyama* scenario, due to an increase in consumption and poor disposal of plastics. After 2015, e-waste is expected to more than double with 25 500 tonnes of this from refrigerators, 6 000 tonnes from TVs, 7 000 tonnes from personal computers, 3 000 tonnes from printers and 700 tonnes from mobile phones annually. The hazardous components of the e-waste would adversely affect human health particularly under the *Jitegemee scenario*. Strategic compliance and stronger national chemical safety standards are top priorities in the *Hakuna Matata scenario*.

Gradually, the *Hakuna Matata scenario* ensures that institutional mechanisms for the management of waste, such as community education, are in place. The capacity of local authorities charged with urban waste management, is upscaled and they are facilitated to operate modern sewage treatment systems. There is equitable

As part of the slum upgrading programme, the government is constructing new and better housing to replace those presently available in the slums such as those shown here in Kibera.

access to improved drinking water sources after 2015. This drastically reduces deaths due to poor sanitation and hygiene of children aged less than 5 years to less than 200 000. Policies and practises regarding land use, deforestation, water resources management, location of human settlements and modified house design as well as improved drainage are instituted as early as 2011. The result is a marked decline in the incidence of malaria from 30.8 percent in 2010 to less than 10 percent by 2015 and to a negligible proportion by 2030. The *Hakuna Matata scenario* is also characterized by a phenomenal decline in informal settlements and slums. In contrast, the *Jitegemee scenario* is associated with serious public health and environmental risks due to poor housing, overcrowding, indoor air pollution, lack of sanitation, water supply and waste management infrastructure, poor access to healthcare services and education, poor surface drainage and vulnerability to intermittent fires.

Other environmental challenges that worsen under *Jitegemee* and *Shamba la Wanyama scenarios* are occasioned by overreliance on biomass fuels for cooking and heating in poorly ventilated dwellings as well as an escalation of pollution from particulate matter and persistent organic pollutants. The effectiveness of policy under *Hakuna Matata Scenario* is underpinned over the years by the determination to reorient the health sector's focus to preventive rather than curative measures, while enhancing inter-sectoral partnerships in addressing the environmental causes of injury and disease. More specifically, the following are instituted:

- A revitalization of the national population policy for sustainable development and minimal environmental strain in order to mitigate waste accumulation, depletion and ecosystem degradation and straining of urban infrastructure
- A robust National Healthcare Waste management plan and guidelines to address medical waste and its associated health risks
- Considering investments in conventional sewage treatment infrastructure as flagship projects under the water and sanitation sector of the social pillar of Vision 2030
- Environmental and health monitoring schemes introduced and sustained throughout the scenario period to especially support systems for enforcement and compliance
- Integration of water and sanitation hardware systems (toilets and washing facilities) alongside software through education and awareness programmes in slums and rural settlements
- Introduction of the Integrated Solid Waste Management (ISWM) initiative for all urban centres including recycling and use of modernized landfills
- Reinvigoration of the National Housing policy of 2007 to fast track slum upgrading by 2015 by upscaling the Kenya Slum Upgrading Programme (KENSUP) in order to replicate the successes recorded in upgrading the Kibera informal settlement.

Policies towards 2030

The scenario analysis in this chapter presents evidence from the future necessitating continued appreciation and understanding of the fact that Kenya's economy is based on the environment and natural resources. Policy processes should therefore highlight the importance of the environment for the country's economic growth, social development and political stability. The ongoing efforts to strengthen the policy and legal framework in the environment sector should encompass land, water, mining, biodiversity, wildlife, forestry and other natural resources and ecosystems. Lessons for policy action that could help the country stay on track in realizing the ambitious Vision 2030 goals are highlighted below:

- Achievement of water sector reforms would ensure attainment of the desired 90 percent access to safe and reliable water for

urban areas and 70 percent for rural areas, while reducing levels of unaccounted-for-water to below 30 percent. In order to achieve this target, the following should be considered:

- Increase the national per capita capacity for water storage and harvesting to over 15 m^3 through facilitation of current and new Water Services Boards and diffusion of low-cost technologies
- Adoption of market principles in water management in order to bring down the cost of water in unplanned settlements, where the cost of water is extremely high.
- Strategic implementation of major water catchment management strategies for the five water towers in the country (Mount Kenya, Aberdares Range, Mau Forest Complex, Cherangani Hills and Mount Elgon).

- Effective management of water resources will be achieved through enforcing regulations by the Water Resources Management Authority (WRMA), encouraging formation of water users' associations by local communities to assist in self regulation and promoting fair allocation of water among users for sustainability.
- Consolidation of water sector reforms arising from enactment of the Water Act 2002. This will provide an opportunity for improving water management.
- Completion of the Vision 2030 flagship projects which include improved water resource information and management through establishment of a sustainable hydro metrological network, increased water storage and harvesting for irrigation, flood control and water supply, increased national coverage of water supply and sanitation, and improved irrigation and drainage infrastructure.

Conclusion

The above scenario analyses demonstrate that fighting poverty, improving environmental management and realization of Vision 2030 as well as the achievement of the MDGs are intricately interlinked. The future alternative pathways to economic and social development are fraught with many environmental pitfalls and opportunities. The benefits and costs of current and future actions are likely to be sustained, aggravated or reduced depending on the local context and execution of strategies for exploitation of the natural resources. Getting the goals of Vision 2030 to inform national policy formulation is highly recommended because the exploitation of natural resources triggers heavy demand for energy, water as well as solid and hazardous waste management facilities. An optimistic scenario like *Hakuna Matata* offers tipping points and policy trade-offs that can help Kenya to strike a balance between environmental concerns and economic growth. Indeed, policy makers and environmental stewards will need to be armed with information on the opportunities and challenges that lie ahead if the GDP annual growth rate target of 10 percent that is envisaged by Vision 2030 is to be achieved.

An emerging lesson from the scenario analysis points to the far reaching implications that the combined effects of land use change and climatic uncertainty are likely to have for the country's people and ecosystems. Any adaptation strategy must integrate local action with development. The establishment of appropriate national policies, legal frameworks and support systems will also enhance economic, social and ecological resilience. These need to be built on a sound foundation of traditional and scientific knowledge. Both short and long-term costs and benefits of climate change adaptation must be considered in line with the targets set for various sectors under each of the three pillars of Vision 2030. Adaptive strategies that also improve local livelihoods would be most effective in the face of increasing climatic uncertainty. To this end, the environmental issues explored in this and other chapters of this SoE Report call for more resources to be directed to them and adoption of a multi-sectoral approach to addressing these enormous environmental challenges. Chapter 11 provides a succinct treatment of the various policy options for addressing the raft of environmental challenges and opportunities that have been tracked into the future in this chapter.

This scenario approach can enable stakeholders to take a long-term view of trends in natural resource use and environmental and social quality and to identify the changes in selected drivers necessary to bring anticipated environmental trends to within sustainable limits. In addition, the approach can help to establish a management framework to encourage the actors to achieve development goals. However, the analysis is not a blueprint as contextual differences will ultimately dictate the application of the lessons to the various sectors, institutions and counties.

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