

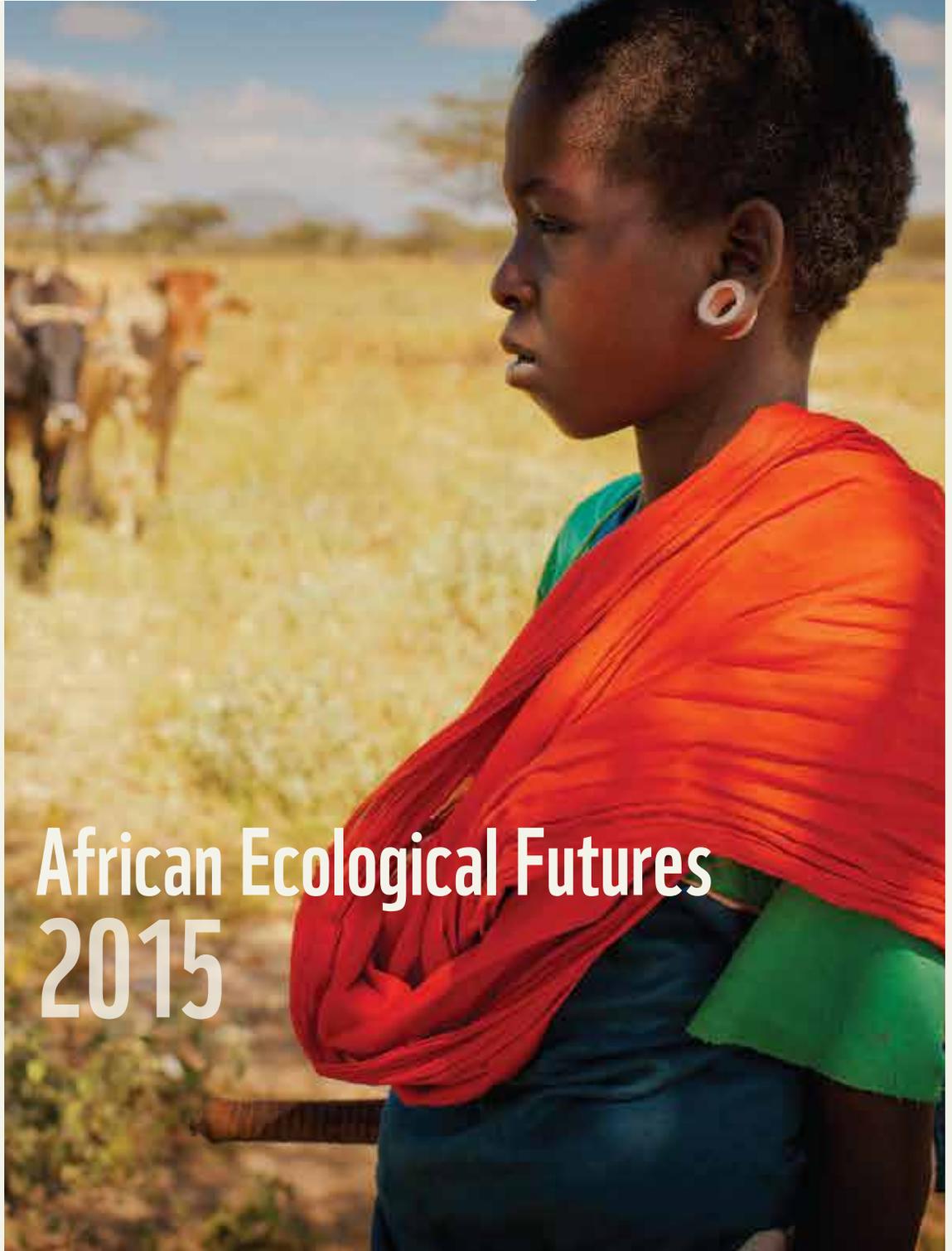


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African Ecological Futures 2015

African Development Bank

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African Ecological Futures 2015



Development planners must take these implications into account to ensure sustainable outcomes

FOREWORD AfDB & WWF

Africa's economic growth is already a defining global story and likely to remain so throughout the twenty-first century.

The past decade and a half has seen many countries sustain growth rates of five per cent and above. As the continent opens up to futuristic prospects, the narrative is rightly beginning to question the extent to which Africa's growth is sustainably transforming livelihoods while lifting millions from abject poverty.



While celebrating Africa's huge and diverse natural resource base, this report equally recognizes the continent's rich ecosystems – and the role both play in economic development. It notes that the current development trajectories and choices made by African countries both individually and collectively will have direct impacts on people and nature. These impacts will touch not only on inclusivity but also on the sustainability of the natural resources and ecosystem services that anchor economic growth.

The report shares well examined perspectives of the pressures and drivers of Africa's economic fortunes over the next 50 years. It provides detailed analysis of population trends, urbanization, changing consumption patterns, investment levels as well as the role of the global economy in both African agriculture and extractives. Trends in these areas, as well as in those in the infrastructure domain, will have implications on the quality and ecological sustainability of Africa's growth. It is our conviction that appreciation of the development trajectories and their relationship with primary resources; the water -agriculture-energy-extractives nexus and their impacts on natural resource endowments, is critically important for planning for inclusivity and sustainability.

It is pertinent to consider what Africa's economic development means for its ecological systems. Development planners must take these implications into account to ensure sustainable outcomes. This report has systematically treated this very fluid and dynamic subject by considering and analyzing critical drivers of various economic objectives in key development sectors that will steer Africa's progress in the next 50 years and beyond.

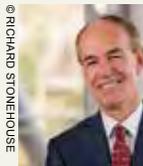
We would unreservedly like to recommend this report for both the readership and necessary action of all individuals and groups that are committed to balancing sustainable and inclusive development. The African Development Bank and WWF remain committed to ensuring the sustainability of Africa's growth, the inclusivity of its benefits, and the conservation of its rich ecological resources for the present and future generations.

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Donald Kaberuka
President
African Development Bank

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Marco Lambertini
Director General
WWF International



EXECUTIVE SUMMARY

Decision makers across Africa (and those outside it who have a stake in the continent's future) share the recognition that today Africa is at a critical juncture.

The continent has experienced significant and unprecedented growth across a host of development indices. In the course of the next few decades, Africa will increasingly assert its role as a global economic player, while simultaneously lifting millions of citizens out of poverty. As Africa transforms itself, it has the potential to alter dramatically its own ecological character, i.e. to change the nature and extent of its natural capital. As expanding economic activity converges with sensitive ecosystems, we are likely to witness the emergence of several ecological frontiers – areas where the ecological foundation of Africa's growth could be chipped away or destroyed altogether by this development.

This report is based on this premise that African ecological futures can be fundamentally altered by economic and development decisions made today. In order to better understand what these futures might be and how to manage their impacts, the report investigates key forces shaping Africa's today and tomorrow and draws a picture of how they come together across plausible scenarios to influence ecological futures. The report explores guiding principles for decisions and particular interventions by decision makers that may create the opportunity for more robust and resilient development.

Several forces are at play in Africa that are driving large-scale change, as discussed in Chapter One. Some are immediate drivers, while others create the broader context within which transformation is occurring. Immediate drivers on the continent's ecosystems stem from:

- population growth: the continent's population is expected to double by 2050, and by the close of this century half of all young people on the planet under the age of 18 will live in Africa;
- urbanisation: Africa currently has the highest rate of urban population growth worldwide
- consumption patterns: a burgeoning middle class in Africa is expected to grow from 355 million in 2010 to nearly 1.1 billion by 2060, with additional implications for the levels of food, energy, and infrastructure required to support this explosion;
- a sustained rise in investment by those keen to be a part of Africa's growth story, but with varying conditions on sustainability and ecosystem safeguards; and
- continued global demand for primary agricultural and mineral resources, albeit following a cyclical process of expansion and contraction.

Forces shaping Africa's broader context include political trends (such as armed conflict and civil strife, as well as the growth of democratisation); climate change (including variability and disasters) and global macro-economic health. One of the single most decisive factors shaping Africa's future is its relative lack of infrastructure, and thus its substantial potential for infrastructure growth. African countries putting in place infrastructure domestically and regionally must, however, do so judiciously because the infrastructure built today can result in dependencies and lock-in behaviours decades into the future.

The confluence of several key drivers – population, urbanisation, consumption, investment, and global resource demand – has an impact on Africa’s ecosystems through three key pressures, namely: (1) Economic activity (i.e. production related activities); (2) Human settlements (i.e. consumption related activity by populations); and (3) Supporting infrastructure – planned and unplanned/organic – to sustain both production and consumption (including the supply chains necessary for both types of activity). Chapter Two discusses these pressures and looks at their impacts on ecosystems and biodiversity. The location and intensity of the pressures are influenced by a country’s development trajectory. It identifies how, depending on their stage of economic development, the development of basic infrastructure, institutions, and regulatory and economic instruments become the priority. By and large, Africa is characterised by countries at earlier stages of economic growth and development, implying a heavy focus on building and putting into place infrastructure related to both production and consumption (i.e. catering to both economic activity and to human settlements).

Building on this, the understanding of ecological futures linked to development in Africa has a strong spatial element (i.e. location and intensity) reflecting the intersection between infrastructure-land development and ecosystem sensitivity; and (b) the temporal dimension (i.e. stage of development) reflecting the evolution of countries’ development trajectories and transition from infrastructure development to institutional management.

In addition to the spatial and temporal dimensions of development, the underlying resource endowment of a country also influences development trajectories (and, in turn, ecological futures). For instance, nations with significant mineral resources tend to adopt an extractive approach; nations with large amounts of arable land tend to become agrarian economies; and nations with rich ecosystem resources (and less of the other two endowments) turn towards conservation and tourism. Regardless of resource endowment and focus, most resilient economies require a strong combination of institutional flexibility, socio-economic empowerment, infrastructural robustness and ecological robustness. Ecological robustness is in many ways contingent on a country, region, or economy’s natural resource base and how it is managed, i.e. the approach taken towards natural capital (both renewable and non-renewable resources) for current and future development.

Chapter Two also highlights potential spatial dimensions of ecological impacts arising from previously discussed all the factors discussed. Mapping the proxy measures for agricultural expansion (areas suitable for agriculture), extractive sector development (unexploited oil and gas fields, and planned mining sites), infrastructure development (regional transport network corridors), and then integrating this with the most significant driver of change – population growth – reveals a clear spatial pattern. Further combining this with map of ecosystem assets (biodiversity richness, terrestrial organic carbon, freshwater resources) then reveals sensitive ecosystems. As a result of this mapping overlay, at least seven ecological frontiers emerge clearly (three of which are treated as case studies in the chapter):



THE UNDERSTANDING OF ECOLOGICAL FUTURES LINKED TO DEVELOPMENT IN AFRICA HAS A STRONG SPATIAL ELEMENT



THE SCENARIOS ARE CONSTRUCTED AROUND TWO CRITICAL UNCERTAINTIES, NAMELY: THE LOCUS OF GOVERNANCE - WHETHER CENTRALISED VS. DECENTRALISED; AND THE NATURE ECONOMIC PRODUCTION - WHETHER DRIVEN BY GLOBAL EXPORT OR REGIONALLY-DRIVEN

- West & Central African Coastal Rainforests
- Sudanese/Ethiopian Sahel
- Ethiopian Highlands
- Central African Montagne forest
- Albertine Rift Lakes
- East African Savannah
- Southern African Miombo woodlands
- Southern African Grasslands
- Madagascar coastal forests
- North-west Mediterranean coastal scrubland

Having identified a set of potential ecological frontiers, the report explores how developmental trends can manifest in different ways and influence ecosystems. Scenarios are a tool to construct narratives that explore how different development trajectories can impact ecosystems. Chapter Three presents a set of four scenarios. The scenarios in this report are constructed around two pivotal uncertainties, namely: the locus of governance and decision-making around infrastructure and land development and natural resource use – whether there is a centralized versus decentralized approach; and the focus of economic production and associated infrastructure and land development – whether production is export led (oriented towards global trade) or regionally-driven (oriented towards intra-African trade). These two continuums shape four distinct scenarios:

- **Going global:** Where resource rich regions take a planned export-driven path to developing extractive and agricultural commodities, based on centralised decision making and connected economic infrastructure. Under this scenario, large-scale resource extraction and development requires equally large-scale transport, energy and water infrastructure development. Spatial and cross-sector investment planning help to ensure that this infrastructure development limits ecological impacts, deals adequately with the trade-offs between different sectors, and creates resilience to the risks posed by climate variability. Additionally, both investment safeguards for foreign investors and internal/domestic government regulatory controls may be implemented to ensure that resource-led development is achieved in an environmentally sustainable manner. Furthermore, appropriate measures can be put in place to ensure that economies are sufficiently diversified. Failure to do so, and continued dependence on few resources without the necessary environmental regulatory structures, heightens the risk of key assets becoming stranded and ecological systems becoming degraded.

- **Helping Hands:** Where resource rich areas are the focus of extractive economic activities driven by local actors developing local resources for export through decentralised decision making and supported by local (off-grid) infrastructure. In this scenario, the abundant resource base provides an opportunity to accelerate economic development, but poses major long-term challenges to continued growth, diversification, natural resource availability and ecosystem integrity. Ensuring local resilient infrastructure and diversification through government-business-community partnerships and local spatial planning is critical to managing potential conflict and overcome longer-term constraints associated with global economic and climatic variability. Moreover, enabling national frameworks that promote decentralised regulatory mechanisms and incentives to business, while capturing the benefits of export, are critical to ensure inter-area coherence. Similarly, strong international investment safeguards and stewardship initiatives promote responsible business action in areas with limited regulatory capacity.

- **All In Together:** Where densely populated areas with renewable resources develop local agricultural industries through participatory decision making and local co-operative schemes driven by local actors. Within this scenario, the richness of natural resources provides the opportunity to develop community based small-scale agriculture for the local people, but poses a financial and technological resources challenge in scaling and diversifying these opportunities to support on-going development to support stable rural economies and associated urban centres. Creating local information and planning systems (supported by innovative technologies) to allow efficient and effective decentralised management of human settlement and agricultural impacts on ecosystems, maintains the natural resilience against a variable and changing climate. Strengthening local institutions and empowering local stakeholders is critical to enabling them to take control of the development and allocation of resources in an equitable, efficient and sustainable manner, including the interactions with and benefits from local conservation areas. Additionally, creating investment mechanisms that provide financial and technical support for small decentralised (potentially green) schemes and their linkage to markets is critical to enable these initiatives to flourish, but with appropriate planning safeguards that consider project and cumulative impacts.

- **Good Neighbours:** Where the future is characterised by a strong drive for African-based development to increase intra-regional trade. As countries begin to take a coherent domestic view with regards to their production and consumption, large regional infrastructure investments are needed. In this scenario, large scale infrastructure investments without coordination between investments pose a real risk to the environment through devastation of pristine environments or corridor access to previously inaccessible or sparsely populated areas. Capacitated and centralized regional planning in addition to the implementation and enforcement of plans is the cornerstone of this scenario. Joint regional infrastructure building on public sector anchored investment that achieves national priorities, enable comparative advantage and resource efficiency between countries for maximum economic growth, environmental protection and social development. Infrastructure investment safeguards are critical in ensuring that the long term impacts on ecosystems are considered, in the context of regional growth opportunities, as well as resilience to climate change.



The four scenarios are not necessarily mutually exclusive for any country or region (and in fact, different areas within any country may witness simultaneous existence of different scenarios for different sectors).

While the four scenarios reflect distinct trajectories for Africa and African nations based on the level of centralization or decentralization of decision making and governance, as well as the global orientation or African orientation towards production and trade, they all bring into sharp relief the biggest risks to Africa’s ecosystems. These risks emerge in the form of poor planning, design, coordination, operation, and management in the following areas, discussed in Chapter Four:

- Agricultural land development in sensitive areas, resulting in potential biodiversity loss, declining land productivity, and diminished climate resilience.
- Location of large infrastructure within sensitive ecosystems, disrupting connectivity of local ecosystems.
- Extractives operations with inadequate management at the point of closure, resulting in impacts both from the site itself as well as supporting infrastructure systems for water, energy, transport etc.
- Overuse and misuse of ecosystem services, such as exploitation of resources beyond their carrying capacity, towards production, consumption and for supply chains.
- Human settlement and urbanisation, including as a result of urban encroachment into surrounding areas, and the systems required to meet the needs for water, waste, food and other municipal services.

Having identified these risks, the report provides a set of response strategies. In the case of Africa's Ecological Futures, a framework brings together an overarching enabler, in the form of: effective natural resource governance through clarity of institutional roles and policy frameworks; three response imperatives – strategic planning capabilities, investment safeguards and frameworks, and new partnership models; and one foundational layer for all of these to rest on, in the form of data, management information, and decision support frameworks. These are elaborated on in Chapter Four.

Additionally, the framework is also underpinned by a broader set of principles to guide decision makers in Africa who wish to ensure that their decisions result in sustainable and responsible management of Africa's ecological assets. These four principles are:

- Ensuring that infrastructure policy, planning and implementation explicitly recognises the value of ecological assets;
- Using regional economic integration to build resilience;
- Exploiting the opportunities of the green economy; and
- Establishing transparent and simple 'rules of the game' to guide investment and encourage development of private sector guidelines on responsible activity.

In order to effectively translate the framework and guiding principles into everyday decisions made across the continent, there is a need for a call to action. Decision makers and influencers within different institutions and governments across Africa have the ability to shape ecological futures by considering the outcomes of their decisions today. Thus, it becomes incumbent on them to internalize the following as they engage in critical conversations and make determinations about key projects and programmes. As articulated in Chapter Five, decision makers must:

- Establish the capacity to support informed decision making with adequate tools;
- Analyse best available information to develop a comprehensive understanding of implications;
- Consider which plausible scenario best reflects the situation they are presented with, and consider how to intervene to effect positive or desirable outcomes and minimise the risks;
- Identify early the specific areas that are most likely to be impacted;
- Promote collective action and innovative partnerships by a range of stakeholders, especially around ecological frontiers or hot spots;
- Identify gaps in implementation and adopt measures to rectify such gaps;
- Support countries to develop indicators (such as the Sustainable Development Goal post-2015 agenda indicators) that integrate ecological robustness into development goals and programmes;
- Embrace collaboration and working together to support robust decision making across institutions; and
- Create a continent-wide collective of the willing who learn through experience and share lessons.

Endorsing these recommendations is an important first step and will provide the basis on which the decision making framework and guiding principles identified in this report can begin to be incorporated into institutional protocols. Forming a concrete programme of action to disseminate and refine the recommendations will help build momentum towards ensuring robust and resilient African ecological future, across a range of development pathways on the continent.

A final recommendation on orchestrated action focusses on three key areas to enable robust and effective decisions making that considers the ecological dependence and impacts of development trajectories:

- Improved access to continental ecological information in the appropriate format that can support robust decision making, with an emphasis on the ecological frontiers.
- Appropriate technical capacity (and tools) to analyse and interpret this ecological information in conjunction with social and economic information to enable robust decision making.
- Relevant policies that create the requirement for these types of analysis and information to be undertaken and used in decision making.

Ideally the mandate to drive these actions should be driven by appropriate African institutions leading on Africa's development (such as NEPAD, AU or AfDB), supported by a coalition of continental and regional development institutions. An important step forward would be an evaluation of progress and gaps across the continent, together with business cases for the suitability of key implementing partners to provide technical capacity to support these interventions.

PREAMBLE

The African Development Bank (AfDB) and WWF are fundamentally committed to nurturing an environment in which African governments and citizens develop symbiotic relationships with their natural resource base, ecosystems and supporting institutions. Building Africa in a sustainable manner lies at the heart of both the AfDB and WWF's mission statements. The AfDB works to spur sustainable economic development and social progress and contribute to poverty reduction in the continent. WWF works to stop the degradation of Africa's environment and help build a future in which humans live in harmony with nature. These common objectives have led to a collaborative project aimed at understanding the ways in which emerging African ecological scenarios will influence the quality of development on the continent.

In 2011, the AfDB and WWF entered into a formal partnership that celebrated their areas of mutual cooperation. Together, the two organisations agreed to focus on three main areas: to develop win-win partnerships with emerging economies and to strengthen South-South cooperation; to catalyse on knowledge sharing and knowledge products for green growth and sustainable development; and to collaborate on energy, water resource management and climate change. As a sign of this partnership, in 2012, the two organisations co-launched the Africa Ecological Footprint Report that assessed the health of Africa's ecosystems as well as laid out recommendations for implementing green development pathways for Africa.

The AfDB's Strategy for 2013-2022 reflects several of the areas of shared cooperation. The Strategy highlights the AfDB's central role in Africa's transformation and its desire to improve the quality of Africa's growth. The AfDB envisions this growth to be shared by African countries and citizens. The benefits, rooted in principles of inclusivity and environmental sustainability, will to be shared by all as African countries transition to a more sustainable use of natural resources.

The Africa Ecological Futures project is the second report to be produced as part of this collaboration between the AfDB and the WWF. It aims to engage key decision makers across Africa in a process that will identify and interrogate Africa's ecological and environmental future. The Africa Ecological Futures project investigates environmental pressures and identifies emerging scenarios as a means to engage African governments, citizens and decision makers in a process that examines the social, economic and environmental implications of these potential trajectories.

In developing scenarios for Africa's ecological future the report highlights the successful experiences that different governments across the continent have encountered in an effort to ensure integrated management of resources. As a result the report provides some evidence on how countries can ensure sustainable and equitable management of their resources, or ensure development in the absence of such resources, while considering the opportunities and constraints that these endowments imply for longer-term resilience.

This project began with an in-depth look at six major sectors – Energy, Water, Agriculture, Extractives, Trade and Investment, and Infrastructure Corridors – that are likely to shape Africa's development. Analytical papers on each of these areas helped to define the development pathways that Africa could follow over the next half century. Each of these papers adopted a 50-year, scenario-based exploration of Africa's potential development choices within each sector and highlighted the implications for the continent's ecological future. In keeping with the broader goals of the project, every paper highlighted potential points of intervention, and ways in which the sector could support a more sustainable, ecologically secure pathway of growth in Africa.



**THIS PROJECT
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TRADE AND
INVESTMENT, AND
INFRASTRUCTURE
CORRIDORS**



**A JOURNEY IN
UNDERSTANDING
THE PRESSURES AND
DRIVERS IN AFRICA'S
ECOLOGICAL
LANDSCAPE THAT
HELP LAY THE
FOUNDATION FOR
FOUR PLAUSIBLE
AFRICAN ECOLOGICAL
FUTURES**

The scenario planning method adopted for this project follows the "development scenario planning" approach, wherein it is assumed that planners and policymakers have some degree of control over outcomes. The scenarios are developed based on the types of choices that could be made by decision-makers and the resulting outcomes that would ensue. This approach allows for identification of critical turning points and decisions that would facilitate preferred outcomes.

These papers were used to inform two Scenario Planning Workshops, the first held in Cape Town, South Africa and the second in Cairo, Egypt. This was used as a platform to engage key decision makers from across Africa to develop a set of collectively owned scenarios for the evolution of Africa's ecological resource base. These meetings drew out the spatial implications of the sector scenarios.

The first workshop brought together WWF Africa team members from across the continent. Together, participants used scenario development to identify where, and how, decision makers can influence development trajectories and manage emerging risks. The workshop culminated in a shared understanding of which ecological regions across Africa are most vulnerable, and which processes are the most critical to influence in order to preserve the integrity of ecological spaces and the natural capital within them. The workshop had two central goals. First, the workshop used expertise developed through WWF experiences to build a collective understanding of how key trends and forces central to Africa's growth have profound implications for the continent's ecological resources. Second, the workshop sought to identify opportunities that could enable preferred outcomes for responsible, sustainable and both ecologically and economically resilient growth in Africa.

In a second workshop held at the 15th African Ministerial Conference on the Environment (AMCEN) in Cairo, WWF and the AfDB brought together partners at the forefront of development and environment challenges, including representatives from the Albertine Rift Conservation Society (ARCOS), Birdlife International, the International Union for Conservation of Nature (IUCN), the New Partnership for Africa's Development (NEPAD), the United Nations Economic Commission for Africa (UNECA), and the United Nations Environment Programme (UNEP). The participants discussed the dynamics that will determine Africa's ecological future and honed in on key uncertainties that will define plausible trajectories for the continent. Based on these uncertainties, the workshop then developed multiple scenarios that would assist decision makers in identifying areas of risk and opportunities for growth.

These collaborative scenario-building workshops served as the foundation for the project's final scenarios on African Ecological Futures. The report that follows is a journey in understanding the pressures and drivers in Africa's ecological landscape that help lay the foundation for four plausible African Ecological Futures.

African leaders and their governments, through participation in the African Union and the Regional Economic Communities, have acknowledged the importance of collectively developing a sustainable and inclusive development pathway for the continent. Decision makers across the continent are cognisant that Africa will be in a biocapacity deficit whereby the continent's footprint will exceed the biocapacity available within its borders. Through their work, and that of the AfDB and WWF, these leaders have shown a readiness to seize this unique moment in time to influence Africa's development trajectories.

Through scenario building, this report attempts to build a results-oriented dialogue focussing on critical risks facing the continent and key opportunities for intervention. This report is a resource for governments, members of the private sector, civil society leaders, and those with a keen interest in envisioning an inclusive, sustainable African ecological future.

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CHAPTER 1. AFRICA AT THE CROSSROADS

Chapter Summary

Understanding the drivers that have pushed Africa's growth provides insight into the potential trajectory of Africa's ecological future. In this chapter, we examine the immediate drivers that have shaped the continent: population growth, accelerating urbanisation, changes in consumption patterns, the nature and scale of investment on the continent and growing resource demands. We also examine a set of broader drivers that create challenges and opportunities for Africa. Here, we look at new phases of democratisation, global macroeconomic conditions and the effects of climate change, conflict, disasters and epidemics.

While these drivers will fundamentally shape the way in which Africa develops, the last section of this chapter is dedicated to one of the most critical challenges: infrastructure. Africa's infrastructure deficit is considerable and the financial and development-planning decisions made surrounding infrastructure are long lived. This means that the decisions made today create a legacy and path dependency that can be challenging to escape in the future. Understanding Africa's infrastructure deficit, the programmes that are being proposed to address it – and the impact of these programmes on ecology - is fundamental to ensuring that mistakes are avoided and opportunities to protect critical ecology are seized.



1.1. Introduction

Africa's growth story is likely to be one of the defining global narratives of the twenty-first century. Economic development in Africa has the potential to bring millions out of poverty, expand the ranks of the global middle class, and act as a site and source of new global economic growth. Despite the worldwide economy's sluggish recovery following the global financial crisis, Africa has shown substantial resilience. In 2013, African economies registered the fastest growth rates in the world with an average annual GDP growth rate of 5.6%, expected to continue to rise by 6% a year between 2013 and 2023¹. In 2013, East and West Africa had the fastest regional growth rates on the continent, above 6%².

As Africa has grown, its ecological resource base, on which future generations depend, is being impacted. Joint research by WWF and AfDB identified the Ecological Footprint of all African countries as increasing by 240% between 1961 and 2008. This year, in 2015, Africa is projected to be in a "biocapacity deficit"; the impact of the used resources will be greater than the capacity of Africa's ecosystems to produce useful biological materials and absorb waste materials generated by its populations³. While the basis for the continent's development is increasingly broad, extractive sectors still act as a major source of export earnings and account for a significant share of GDP and GDP growth in many countries across the continent.

If Africa continues to pursue its current production and consumption models, then compelling evidence suggests that its ecological systems will be undermined and the quality of growth on the continent may be limited. There is growing concern that "ecological frontiers" (hot spots) will emerge across the continent where expanding industrial, extractive and economic activity intersect with sensitive ecosystems. These hot spots will likely suffer from the cumulative impact of degraded natural resources and intensifying conflict over remaining stocks. These impacts could have disproportionate consequences for these often fragile ecosystems, as well as for the communities and activities that depend upon their sustained functioning.

For these reasons, Africa needs to find a new and sustainable growth path – one that meets the needs of today, without limiting the opportunities available to future generations.

Africa stands at a crossroads; the decisions that countries and regional economic communities take now will have enduring impacts on people, the opportunities they will be able to access, and the environment upon which they depend. What are the ramifications of such decisions for Africa's rich ecological base? How best can we reconcile and even integrate the preservation of its ecology with rapid development? Are there specific regions that must be protected immediately? And what are the opportunities to shift economies onto new sustainable development pathways?

1.2. Understanding the drivers that shape ecological scenarios

The evolution of Africa's ecological base depends on a variety of interrelated factors. Because ecological functioning is so intimately connected to human activity (be it where people settle, the economic activity they engage in, the energy they use, etc.), unpacking the relationship between these factors is far from straightforward. Drivers shed light on the socio-economic and socio-cultural forces that propel human activities. These drivers can, in turn, either increase or mitigate pressures on the environment⁵.

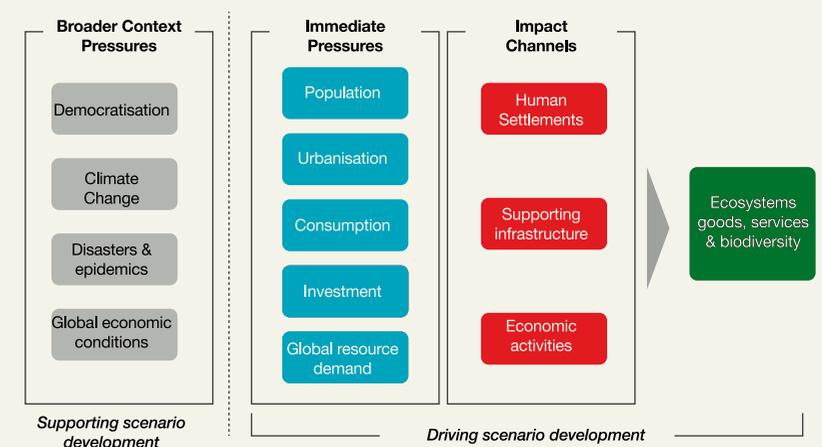
1. AfDB. *Annual Report 2013: Chapter 1, Africa's Socio-Economic Performance*. Tunis: Africa Development Bank, 2014.

2. AfDB/OECD/UNDP. *African Economic Outlook 2014: Global Value Chains and Africa's Industrialisation*. Paris: OECD Publishing, 2014.

3. AfDB and WWF. *Africa Ecological Footprint Report: Green Infrastructure for Africa's Ecological Security*. Tunis: AfDB and WWF, 2012.

5. The definition for drivers is based on the definition provided in UNEP's 2007 report "Vulnerability of people and the environment—challenges and opportunities: Background Report on Chapter 7 of the Fourth Global Environment Outlook (GEO-4)."

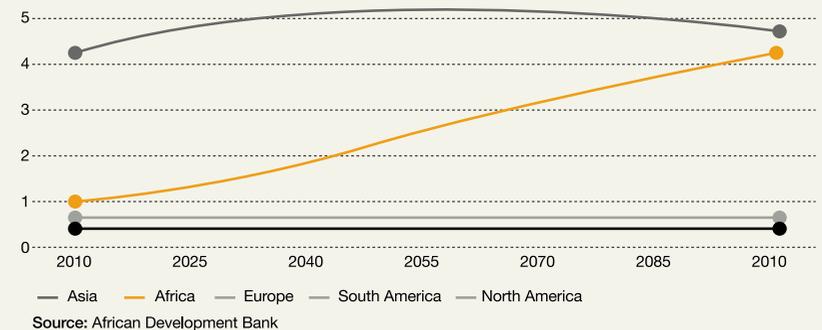
Figure 1: A visualisation of the drivers and pressures that have been used to inform ecological scenarios



1.2.1. Immediate Drivers

The following section highlights the immediate drivers that affect growth in Africa. These drivers have served as the basis for defining the evolution of Africa's ecological futures and developing scenarios.

Population, World regions 2010-2100



Population: By 2050, Africa's population is likely to more than double. By 2100, half of the people in the world under the age of 18 will be African⁷.

However, to help unpack the web of factors impacting ecological functioning the Africa Ecological Futures project has tried to distinguish between:

- 'Immediate Drivers: those which most directly drive our scenarios and include secular trends in population, urbanisation, consumption, investment and global resource demand;
- 'Broader Context Drivers: those which include trends in democratisation, global macroeconomic conditions, climate change, and disasters and epidemics.

The project has also differentiated between drivers and pressures (discussed in the following chapter). Pressures are the socio-economic stressors that human activities place on the environment from the drivers⁶. Crudely speaking, these pressures reflect where people live, the infrastructure that supports them and their level of economic activity. This simple structure has been used as a basis on which to construct scenarios. The immediate drivers are discussed in the section below with further analysis provided in the appendix.

Africa is in the midst of a dramatic demographic shift. In the 1980s, Sub-Saharan Africa had one working-age person for each economically inactive person⁸. Now, the potential for Africa's growing workforce is massive, with 617 million young Africans today and 1.6 billion expected in 2060⁹.

A growing population has implications for Africa's ecology. The impact of Africa's population growth will force the continent to deal with increasing demands in housing, transport, sanitation and security, among other basic necessities. While Africa has a uniquely small per person ecological footprint, a rapid increase in population will make it more difficult to sustainably manage Africa's ecological future.

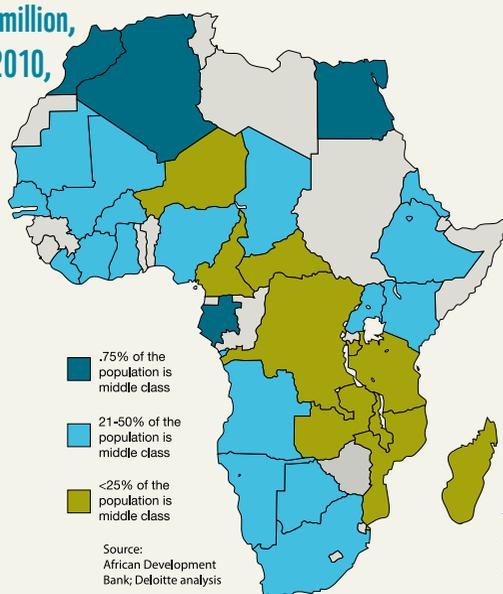
Urbanisation: Africa has the highest rate of urban population growth worldwide.

In 2014, Africa had 52 cities with a population of over a million, the same as Europe. By 2030, almost 48% of Africans, roughly 760 million, will be urban residents. By 2050, half of Africa's population, 1.2 billion people, will live in a city.

Urban migrants come to cities in hopes that cities will offer jobs, a better education for their children and access to health care for their families. Yet according to UN-Habitat, sub-Saharan Africa has a slum population of about 200 million people, 61.7% of its urban population. Much of African urbanization is also taking place without parallel planning and industrialisation. Large urban populations are seeking employment in the informal sector. This shift results in lower levels of revenue to municipalities and increased difficulties in providing the necessary infrastructure, including water supply and sanitation, for effective urban functioning.

Moreover, urban expansion has converted agricultural land into residential and industrial complexes. The increase in consumption in energy, land, food and water has also meant an increase in air pollution from cars and factories, water pollution from poor sewage management and noise and land pollution from industrialisation.

Consumption: The African middle class is expected to grow from 355 million, 34% of Africa's population in 2010, to 1.1 billion, 42% of the population, in 2060.



Distribution of Middle Classes in African Countries in 2010



BY 2050, AFRICA'S POPULATION IS LIKELY TO MORE THAN DOUBLE. BY 2100, HALF OF THE PEOPLE IN THE WORLD UNDER THE AGE OF 18 WILL BE AFRICAN.

8. *Ibid.*

9. AfDB. *Tracking Africa's Progress in Figures*. Tunis: African Development Bank, 2014.

10. AfDB. *Tracking Africa's Progress in Figures*. Tunis: African Development Bank, 2014.

11. "Urbanization recommended as key to improving living conditions." *African Development Bank*. 23 May 2014.

12. "Housing & slum upgrading." *UN-Habitat*, N.p.

13. AfDB. *Africa in 50 Years' Time: The Road Towards Inclusive Growth*. Tunis: AfDB, September 2011.

14. Deloitte. *Deloitte on Africa: The Rise and Rise of the African Middle Class*. Johannesburg: Deloitte, 2012.

15. "Why Kenya's Economy Is Now Africa's Powerhouse." *The Brookings Institution*. *The Brookings Institution*, 6 Jan. 2014. Web. <<http://www.brookings.edu/research/opinions/2013/12/30-kenya-economy-kimenyi>>.

16. "Lions on the Move: The Progress and Potential of African Economies." *The McKinsey Global Institute*. McKinsey & Company Insights & Publications. McKinsey Global Institute, June 2010. <http://www.academia.edu/4681174/McKinsey_Global_Institute_Lions_on_the_move_The_progress_and_potential_of_African_economies_The_McKinsey_Global_Institute>

17. Abdel Aziz, Mohamed Ould. "G20 Summit Can Boost African Agriculture." *The New Partnership for Africa's Development*. NEPAD,

18. *Ibid.*

19. "Africa's Agriculture and Agribusiness Markets Set to Top US\$ One Trillion in 2030." *The World Bank*. The World Bank, 4 March 2013.

Today, eight of the twenty fastest growing economies in the world are in Africa. By 2060, most African countries are projected to reach upper middle-income status¹³. As African economies grow and as people's purchasing power increases, demand for a variety of goods and services will also rise. A growing middle class with higher disposable income often spurs the generation of more goods and services. In turn, energy companies and African governments will be challenged to provide the growing consumer class with reliable and affordable access¹⁴ to energy. Health care providers, vehicle manufacturers, food and consumer product developers will need to match their marketing and production capabilities to the rising demands of the African middle class. The ways in which governments and companies sustainably or detrimentally manage this growth will directly impact Africa's ecological future.

Funders and financiers will play a central role in determining the prospects for investment patterns in Africa.

Investments: Funders and financiers will play a central role in determining the prospects for investment patterns in Africa.

The extent to which investors are technically able, and suitably incentivised, to factor ecological risks into their portfolio strategies will impact the types of projects that have ready access to capital. Trade and investment also has implications for every activity on the continent. It dictates discussions on national educational budgets, health care reform, infrastructure development, energy choices, agricultural spending and the trade flows coming in and out of the continent. In Lesotho, for example, the African Growth and Opportunity Act (AGOA), signed into US law in 2000, spurred the nascent textile industry. In Tanzania, farmers produced significantly more horticulture than their Kenyan counterparts. Higher freight charges and inadequate storage facilities, among other factors, at Kilimanjaro and Julius Nyerere International Airport, restrict their access to international markets¹⁵. In the Democratic Republic of Congo, China bid to access ten million tons of copper and two million tons of cobalt in exchange for a US\$6 billion package of infrastructure investment¹⁶.

Global resource demand: The potential of Africa's resources will be developed to meet growing demand both locally and globally.

Roughly 60% of all globally uncultivated arable land, approximately 600 million hectares, is in Africa¹⁷. By cultivating the undeveloped land, improving irrigation techniques — 80% of the cultivated land in Africa is rain-fed — and encouraging agricultural productivity, agriculture can contribute to improving unemployment rates, reducing poverty and feeding its people¹⁸.

In 2030, Africa's market for food stands to be valued at more than one trillion USD, compared to US\$313 billion in 2013¹⁹. While agriculture is a major driver of economic development, and will remain so for the foreseeable future, unsustainable agriculture can also be a major driver of ecosystem loss.

1.2.2. Broader Context Drivers

In addition to the immediate drivers, a range of broader context drivers plays a role in shaping Africa's ecological future.

Disasters and epidemics: Conflict and epidemics have a significant negative effect on development patterns.

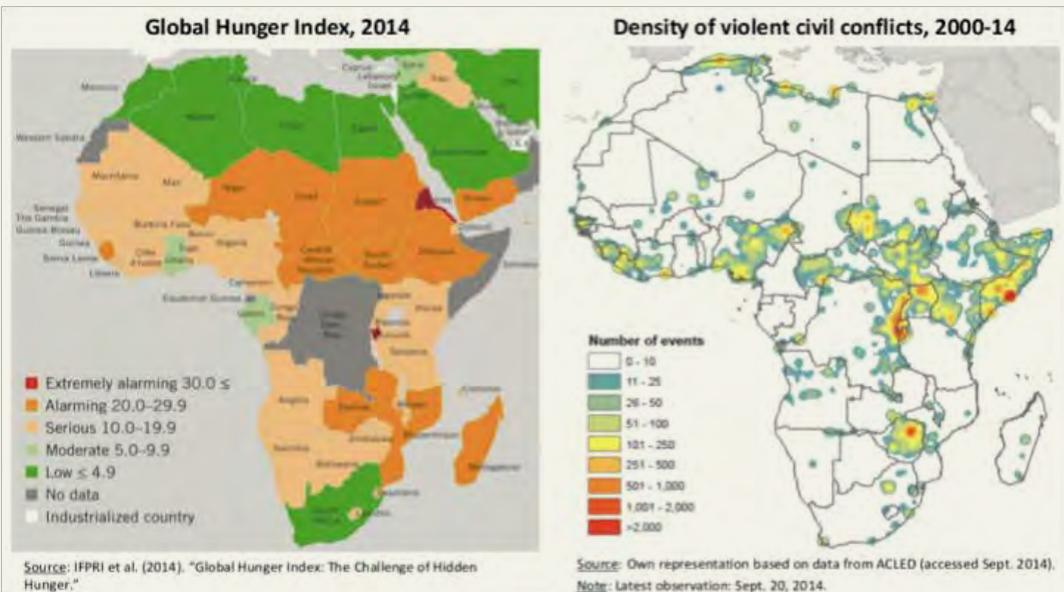
The Arab Spring, an escalating security situation in Mali and the crisis in the Central African Republic are all examples of conflicts that have engulfed the continent. On the health side, the Ebola epidemic wreaked havoc on the economies of Liberia, Sierra Leone, and Guinea²¹.

Armed conflict often has a direct and negative impact on local ecology, with rival groups fighting not only for a political objective but also over control of finite resources in a region. Indeed, uprisings throughout Africa have had their seeds in the exclusion of local people from the benefits of access to their own natural resources. Food insecurity can also result from civil conflict²². During times of civil unrest, household incomes and employment opportunities are markedly reduced, infrastructure is disrupted and food availability and access are restricted²³.

21. The World Bank estimates that the total fiscal impact is well over half a billion USD in 2014 alone.

22. International Food Policy Research Institute. *How to Build Resilience to Conflict*. Washington, D.C.: IFPRI, October 2014.

23. The World Bank. *World Development Report 2011; Conflict, Security, and Development*. Washington, D.C.: World Bank, 2011.



Climate change: No continent will suffer the impacts of climate change as severely as Africa.

Climate change impacts are already being felt across the world, but more so in Africa. According to the Intergovernmental Panel on Climate Change's 2014 Fifth Assessment Report (AR5), there has already been an observed temperature increase of 0.4-2.25°C in the region.

Increased droughts and unpredictable flooding put additional pressures on already stressed water resources. By 2020, an estimated 75-250 million people will be exposed to increased water stress as a result of climate change²⁴. These water risks have in turn placed agriculture in jeopardy. In some countries, yields from rain-fed agriculture could be reduced by up to 50% by 2020²⁵.

24. Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda, 2007: *Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge UK, 433-467.

Across the continent, governments have begun to develop adaptation policies to ensure that the impact of climate change is considered in long-term national planning. In 2010, the AfDB, the Commission of the African Union (AUC) and UNECA, launched the Climate for Development in Africa Program (ClimDev-Africa). Three elements sit under this programme: the ClimDev-Africa Special Fund (CDSF), the African Climate Policy Centre at UNECA and the Climate Change and Desertification Control Unit at the AUC. This continental initiative is a recognition by the African Heads of States and their governments on the imperative of climate change on Africa's present and future development.

Democratisation: African democratisation will drive governance, inclusivity and local expectations around quality of life.

Today, 20 countries in Africa are considered electoral democracies, compared to only 4 in 1991²⁶. In 2013, the participation rate of women in national-level parliaments increased to 21%, up from 10% in 2000²⁷. While many remain excluded from participatory democracy there are hopes that the emerging middle class and the expectation of popular representation will provide a stronger civil society the voice to change the economic and ecological trajectory of African countries. It is expected that this voice will grow stronger over time and reiterate the importance of sustaining ecosystems and inclusive growth.



**IN 2013
PARTICIPATION
WOMEN IN
NATIONAL-LEVEL
PARLIAMENTS
INCREASED TO 21%,
UP FROM 10% IN
2000**

Global economic conditions: Africa's economic future is integrally bound with the economic development of the rest of the world.

The sustained fall in global oil prices during 2014/15 is just one example of how international decisions affect local markets in Africa. Global oversupply of oil and weakening demand could have serious repercussions for oil-producing economies like Nigeria, Angola, South Sudan, Equatorial Guinea and the Democratic Republic of Congo. If oil revenues decline, oil-producing economies could experience changes in energy policies, public spending budgets, political stability and infrastructure spending.

In addition, external financial flows including both foreign direct investment and development assistance continue to play a major role in Africa. The growing role of Chinese and Gulf States as infrastructure investors, U.K. interest in Africa's telecommunications industry and growing interest by Japanese and Spanish investors, among others, has proven to be positive for Africa's balance sheets. Yet, when these economies falter, forcing foreign investors to withdraw capital, the impact on African remains pronounced.

25. *Ibid.*
26. *Ibid.*
27. *Ibid.*

1.3. The African Infrastructure Deficit

In constructing ecological scenarios the project has also looked to recognise the vital role that infrastructure can play in determining future impacts. The long lifespan of major infrastructure projects, often more than 20-50+ years, means that decisions taken over infrastructure today have impacts long into the future. The potential to 'lock-in' unsuitable behaviours as a result of poorly planned infrastructure means that any assessment of ecological scenarios needs to consider both the current state of Africa and how Africa will respond to its current infrastructure deficit.

Estimates of hard economic infrastructure needs compiled by the Africa Infrastructure Diagnostic Program suggest that US\$93 billion will be required each year to meet basic infrastructure needs across Africa. When current spending and efficiency gains are factored in, this implies that there is an infrastructure financing gap of close to US\$31 billion per year. These investment needs are greatest in the power sector (44% of total) but also substantial in the water and sanitation and transport sector.

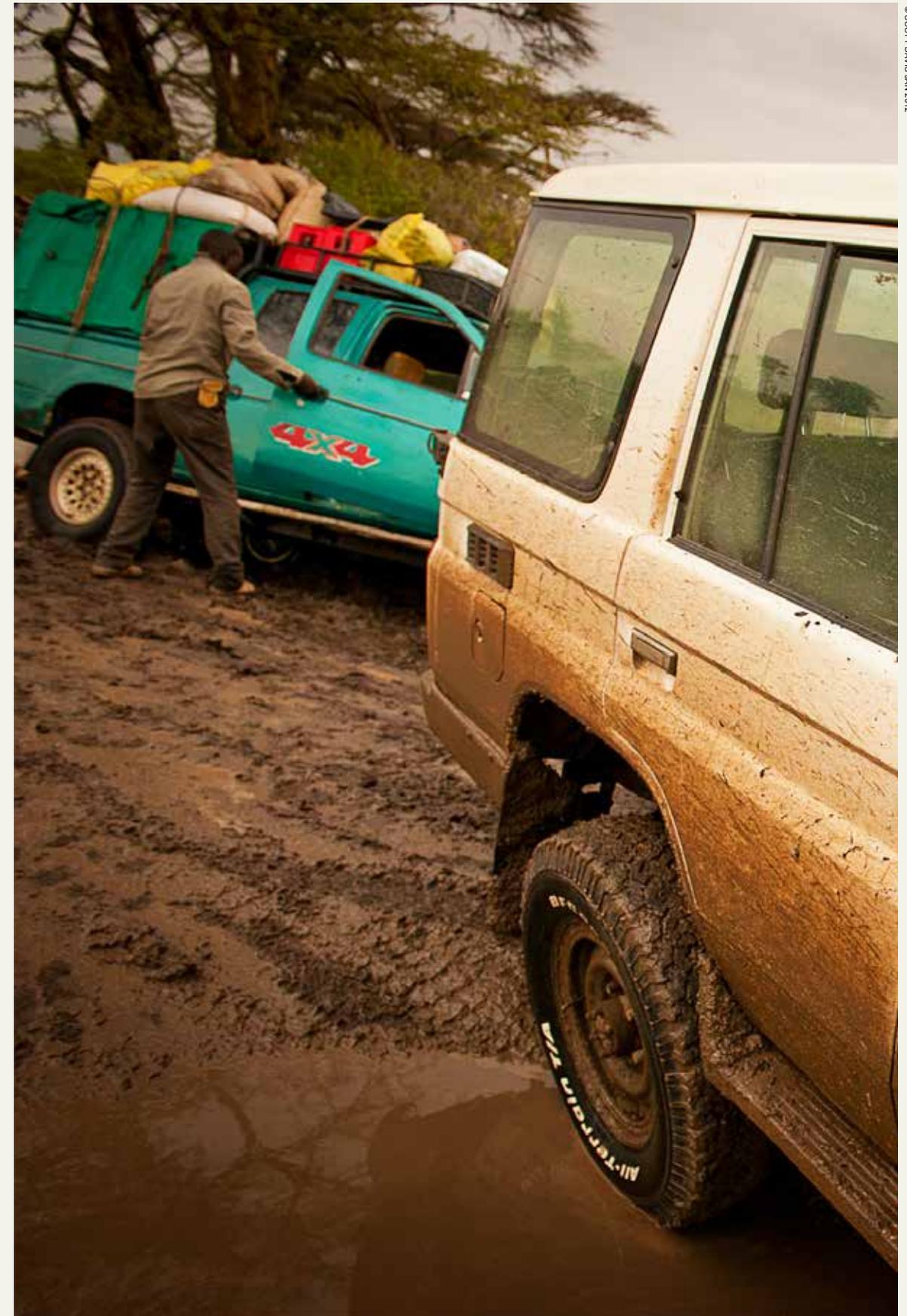
A vast number of major infrastructure corridors are being planned on the continent, although the ambiguity associated with infrastructure corridors makes accounting challenging. The Programme for Infrastructure Development in Africa (PIDA)'s Priority Action Plan has identified approximately 50 projects that will require around US\$360 billion in investment. The Southern African Development Community (SADC) has named its own 17 key transport corridors, while the East African Community (EAC) has named five priority transport corridors²⁹. Additionally, five major regional power pools and their associated generation and transmission infrastructure operate on the continent and are also expected to expand, while a series of agricultural growth corridors are also receiving increasing attention. Implementation of many of these planned corridors remains to be seen.

Stakeholders at local, national, regional and continental scales are making infrastructure decisions that have profound ecological implications. These organisations may determine the role of environmental safeguards during the planning and operational phases of a project. They can also influence the degree to which local communities will benefit from local resources and ecosystem services. These decision makers have the ability to ensure that spatial, social, and environmental considerations are taken into place when energy and water resources are leveraged for economic development.



STAKEHOLDERS AT LOCAL, NATIONAL, REGIONAL AND CONTINENTAL SCALES ARE MAKING INFRASTRUCTURE DECISIONS THAT HAVE PROFOUND ECOLOGICAL IMPLICATIONS

29. Programme for Infrastructure Development in Africa. Study Programme for Infrastructural Development in Africa, 2012.



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CHAPTER 2. WHERE AFRICA'S DEVELOPMENT TRAJECTORY MEETS ITS ECOLOGICAL FUTURE

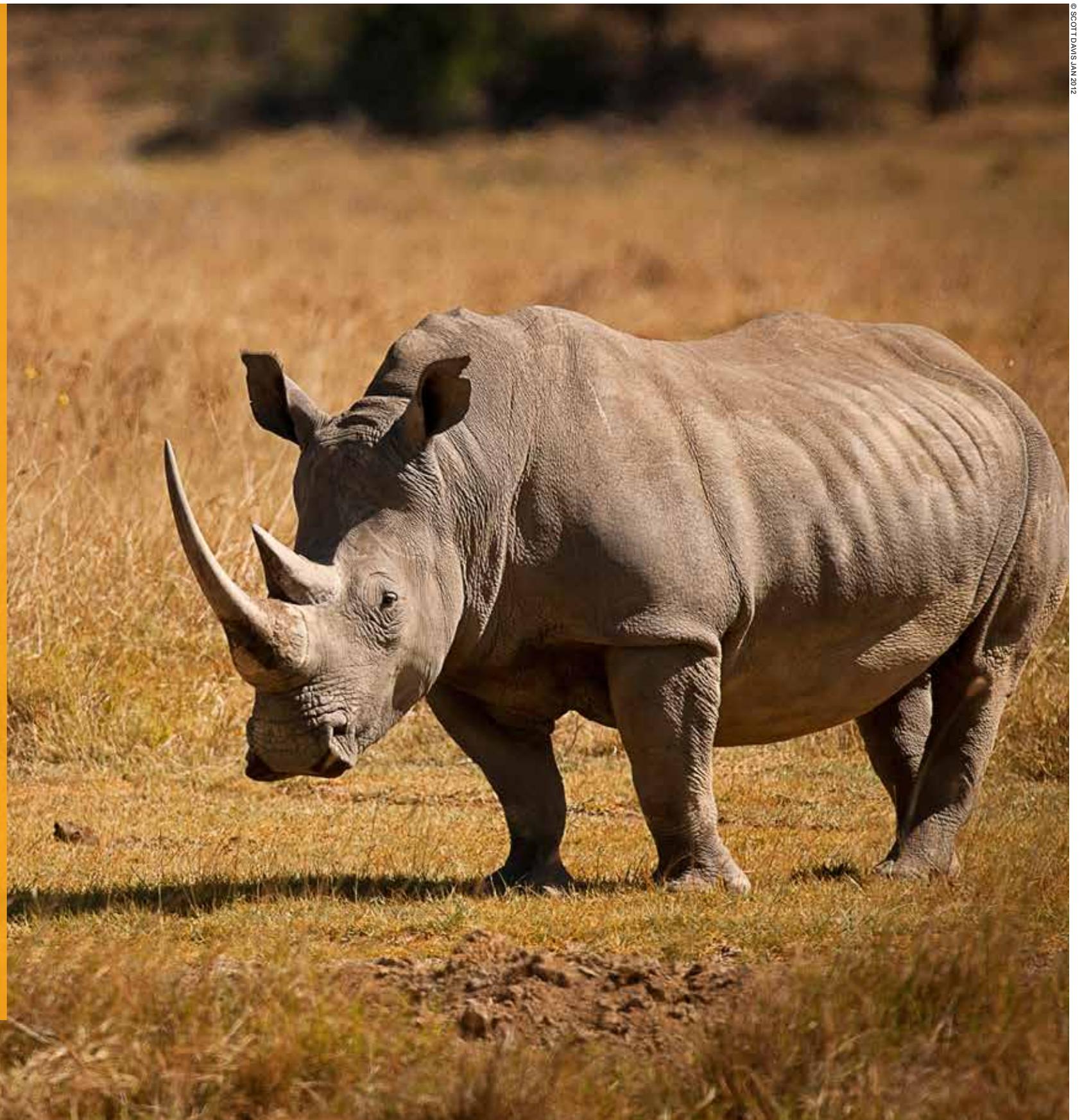
Chapter Summary

The greatest threats to the ecological future of the African continent arise when human activities occur in or near unregulated and sensitive ecosystems. These threats are due to productive human activities, their consumption of natural resources and the infrastructure that is associated with both. Understanding the dominant models of economic activity on the continent (production and consumption) provides a basis for anticipating where ecological pressures are likely to arise.

Ecosystem impacts are also a function of a country's stage in its development trajectory. In Africa, it is possible to identify countries where the primary developmental challenge relates to infrastructure development, in others the necessity is for institutional management of trade-offs between the use of renewables and non-renewables resources, or trade-offs between economic gains from resource use and the externalities associated with it. In turn, a country's stage of evolution in its development trajectory is often influenced by the country's resource endowment. Mineral-rich countries often begin on an extractive path, countries with abundant arable land often begin on an agrarian path, and countries with a wealth of biological and socio-cultural diversity often begin on a tourism and conservation path.

African economies have committed themselves to strong development in the face of environmental pressures like climate change and despite global economic volatility. Key characteristics of resilient economies are institutional flexibility, socio-economic empowerment and ecological robustness.

A spatial examination that overlays patterns of production and consumption with sensitive ecosystems reveals particular "ecological frontiers". These are places where there are real possibilities that valuable ecosystems may be severely degraded over the next few decades, with adverse impacts on the people who live there and the livelihoods activities that sustain them. A better understanding of these spatial dimensions could help manage and direct activity in ways that preserve ecological robustness, contributing to national resilience.



2.1. Introduction

In Chapter 1, we identified pressures that will continue to shape development on the continent. These pressures create change, but in and of themselves they do not have direct ecological impacts. Their influence on the environment is through two primary channels.

The first channel relates to the intensity of production and distribution of primary agricultural and extractive economic goods (and to a degree secondary manufacturing goods), including the impact of the input supply chains³⁰. The key determinant of this type of impact is the extent and scale of hard “economic” (water, energy and transport) infrastructure and land development (industrial, agricultural or extractive) required to support production, relative to the location and sensitivity of the natural resource base and associated ecosystems upon which it depends. Importantly, infrastructure and land development are either: (i) planned and networked (typically under the auspices of government); or (ii) organic and localised (constructed and operated by businesses).

The second channel relates to the density of people, together with their consumption patterns, supply chains for consumer goods, and waste disposal. The key determinant of this impact is the extent, scale, and adequacy (or absence) of hard “social” infrastructure (water supply, energy supply, food supply and transportation) and land development (human settlements and agricultural zones) to serve the consumption levels required (or demanded), relative to the environmental carrying capacity of the area in which people reside or the areas upon which they most depend. As with economic infrastructure, this social infrastructure and land development may be either: (i) planned and networked (formally distributed / traded from local, national or global sources); or (ii) organic and localised (determined and delivered by the communities / households themselves).

What this implies is that Africa’s ecological future is largely dependent on:

- **Economic activities** – the location and intensity of agricultural, extractive and manufacturing activity (production);
- **Human settlements** - the distribution and demands (or consumption) of human settlements, i.e., levels of population concentration and the goods and services they utilize or command; and
- **Infrastructure** - the nature and extent of infrastructure that supports production (such as infrastructure for extraction or irrigation), consumption (infrastructure for basic water, energy and transport services), and conservation (for waste water treatment plants and aquatic ecosystems) coupled with supply chains and trade systems required to sustain them.

The location and intensity of each of these three, while different for each country, are influenced by the type of development trajectory a country takes as well as the type of governance system steering development.



30. The impact of the tertiary services economy is largely uncoupled from production, but rather manifests through the consumption of the associated people and residential areas.

31. WWF SABMiller. The Water-Food-Energy Nexus: Insights into resilient development. 2014.

2.2. The Evolution of Development Trajectories

While every country follows its own unique development path, there are similarities between the issues that countries face at different stages of development. A global review of sixteen countries planning around water-energy-food resources and resilience³¹ identified three key stages in this evolution, namely: (i) developing countries focus on infrastructure development to enable primary economic activity and social development; (ii) emerging economies focus on institutional mechanisms to allocate resources between competing productive and consumptive demands; and (iii) developed countries focus on regulatory and economic instruments to achieve efficient and sustainable consumption and development patterns. These characteristics are not necessarily mutually exclusive and depend upon the country’s natural resource endowment (Section 2.2.1), but they do provide insights into the priorities and future challenges that may be faced.

Translating this into the African context suggests that most countries are still developing their infrastructure base to both enable primary resource development and provide reliable services to their populations. Only a few emerging economies and those that have very limited natural resource endowments have had to make institutional trade-offs in natural resource allocation, rather than in financial and human resource allocation to develop the infrastructure base.

This reinforces the proposition that in the short to medium term, Africa’s ecological future will largely be dependent upon the nature and location of productive and consumptive activities, and the infrastructure developed to support these. Thus the presence or absence of environmental safeguards on infrastructure and land development is hugely important. Safeguards have the ability to enable or constrain the use of natural resources and ecosystems.

However, it also needs to be recognised that the imperative of increasing development opportunities for African citizens will require trade-offs in the allocation and/or protection of these natural resources and ecosystems. While such trade-offs can be driven by the natural resource endowment itself, they largely remain a function of institutional decisions. The options, constraints and potential costs associated with the institutional management phase will be strongly influenced by the previous infrastructure development decisions and the degree to which ecosystems goods and services have been maintained.

In short, the stage of evolution of a country’s development trajectory plays a key role in determining the impact of a range of pressures on ecosystems. In conjunction with the insights drawn from section 2.1, it is therefore clear that the understanding of ecological futures linked to development in Africa should be based on (a) the spatial dimension (i.e. location and intensity) reflecting the intersection between infrastructure-land development and ecosystem sensitivity, and (b) the temporal dimension (i.e. stage of development) reflecting the evolution of countries’ development trajectories and transition from infrastructure development to institutional management.

2.2.1. The implication of resource endowment for development trajectories

To understand the linkages between resource endowments and development trajectories, it is useful to consider how different infrastructure demands create pressures on ecosystems. During the project, three distinct development trajectories have been identified. Each of these trajectories represents a distinct infrastructure system with accompanying ecological challenges and opportunities. They are as follows:

- **Areas with abundant mineral or petroleum resources tend to adopt extractive** -based development trajectories. These are energy intensive and require reliable transport corridors to move extracted products to international markets. This has significant implications for the environmental quality of terrestrial and water resources, around the mining areas and the corridors, as well as for energy production - typically through thermal or hydropower generation. Over time economic diversification may evolve as greater emphasis is placed on encouraging beneficiation and manufacturing. The non-renewable nature of these resources implies that the problem of stranded assets (assets becoming obsolete due to unanticipated or premature devaluation or conversion into liabilities, as a result of risks) and localised impoverishment (lack of distribution of benefits and/or concentration of damage) within the context of environmental degradation must remain an important consideration. Social development may be leveraged by appropriate redistribution of capital to settlements around the extraction nodes and along the transport corridors as well as into the broader society.
- **Areas with extensive arable or pastoral lands tend to follow agrarian development trajectories** that often become increasingly water intensive as irrigation expands in an effort to boost productivity. This model also creates some energy requirements for pumping and cultivation processes. This has significant aquatic and terrestrial environmental impacts through the use of water resources and the expansion of agricultural, especially along agricultural and regional trade corridors. While initially being focused on the production of food for domestic consumption, this tends to expand into food and cash crops for export, and ultimately value-addition through agro-processing (even as agriculture as a proportion of GDP tends to decline over time). While agriculture is dependent upon renewable resources, and thus may have a long-term outlook, a judicious management of land and water resources (as well as transport corridors and associated infrastructure) is required to avoid declining productivity, reduced access to the necessary renewable resources, and potentially isolated assets. Rural social development is often integral to agrarian economies, and may be linked to the export of cash crops, which is central to the concept of agricultural development corridors. However, global experience indicates that such rural social development is rare before agrarian economies transform into manufacturing or service-based economies with urbanisation drawing people and resources away from rural to urban areas, but concomitant pollution impacts.



SIGNIFICANT AQUATIC AND TERRESTRIAL ENVIRONMENTAL IMPACTS THROUGH THE USE OF WATER RESOURCES

32. *AMCEN, Gaborone Declaration on Climate Change and Africa's Development, 2013.*
http://www.unep.org/roa/amcen/Amcen_Events/5th_ss/Docs/K1353541%20-%20Gaborone%20Declaration%20by%20the%205th%20Special%20session%20of%20AMCEN%20-%20Final%2022102013%20EN.pdf

- **Areas that depend on their abundant ecosystem resources may prioritise resource conservation and eco-tourism**, with urbanisation as a means of concentrating services, manufacturing and household development. While this limits environmental impacts on areas under conservation, as economic production is decoupled from resource use, it may introduce some tension between the water, energy and food resource needs of human settlements as well as their impacts and any proximal conservation areas. This model evolves along the same lines, but with a strengthening of the infrastructural and institutional capacity and increasing linkage to global trade and tourist markets.

These trajectories are not necessarily mutually exclusive within a country, either spatially or over time, but there are inherent challenges and potential inconsistencies where these overlap in a given location at the same time.

2.2.2. Considerations for resilient development trajectories

The Gaborone Declaration on Climate Change and Africa's Development recognises Africa's vulnerability to climate change and the need to place sustainable development at the heart of efforts to build resilient economies. It goes further to indicate that Africa should follow an ecologically sustainable trajectory, given that a healthy environment is fundamental to agricultural productivity, poverty eradication and wealth creation, in the context of climate change, variability and disaster risk reduction. This highlights the African intention to maintain resilience of socio-economic development in the face of global economic and climatic variability.

Resilient development trajectories require diversification to hedge against risks in particular areas and adaptability to enable response to changing circumstances, and where possible to attenuate negative and amplify positive feedback processes. In this context, it is increasingly recognised that there are four inter-dependent cornerstones of resilience:

- **Institutional flexibility:** to enable effective and timely public (and private) sector understanding and response to changes in the physical, social, economic and political environment;
- **Socio-economic empowerment:** to ensure that households, communities, businesses and government have adequate resources and awareness to respond to changing circumstances;
- **Infrastructural robustness:** to provide effective, reliable and efficient services under changing climatic, demographic and economic conditions; and
- **Ecological robustness:** to sustain the goods and services that natural systems provide in attenuating disasters, assimilating waste and providing resources for people and production.

Thus, it is critical that Africa's development trajectories be cognisant of the potential implications on the ecological functioning of critical areas across the continent, to avoid either the degradation of ecosystems or the foreclosing of future options.

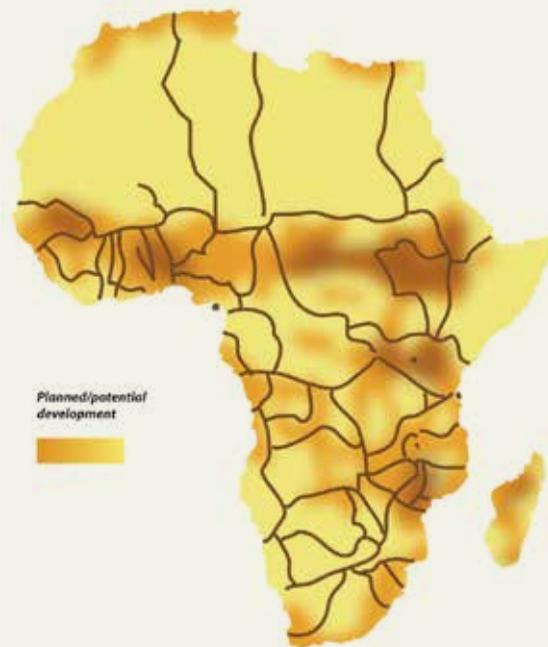
2.3. Spatial Dimensions of Ecological Impacts

A country's development trajectory is influenced by, and in turn influences, its natural resource endowment. In the short to medium term, the ecological future of much of Africa will largely be a function of the nature and location of productive and consumptive activities, as well as the environmental safeguards (or the lack thereof) on infrastructure and land development.

In this context, it is instructive to examine the location, or spatial character, of key development trends across Africa. As these development trends interact with one another, and in many cases overlay, the combined impacts have significant spatial implications.

This report's investigation of the location of development trends, i.e., where the trends are likely to be felt the most, is built on analysis by the United Nations Environment Program's (UNEP's) World Conservation Monitoring Centre (WCMC).

Spatial mapping of planned and potential development: Mapping proxies for agricultural expansion (areas suitable for agriculture), extractive sector development (unexploited oil and gas fields, and planned mining sites), infrastructure development (regional transport network corridors), and integrating this with the most significant driver of change – population growth – reveals a clear spatial pattern. While the category of development trends and pressures mapped here are not exhaustive, they represent major drivers of production and consumption. The spatial implications become even more apparent when visualized; the composite map below, depicting all these planned and potential development elements, brings out certain development hubs in sharp relief.



In the context of ecological futures, it becomes important to link the spatial dimensions of development trends with ecosystems that characterize the settings where such development is likely to take place. In other words, it is important to see where human activity will impact ecosystems.

In order to do this, conceptual clarity on what ecosystems are is imperative. As defined by the Millennium Ecosystem Assessment, an ecosystem is “a dynamic complex of plant, animal, and microorganism communities and the non-living environment, interacting as a functional unit.”³³ Ecosystems include human populations living within them. Such a definition remains incomplete without emphasizing the role that ecosystems play and their relevance to human society, including to human and economic development. This takes the form of ecosystem services – in its simplest form, this entails the benefits that people obtain from ecosystems, in the form of goods and services. The Millennium Ecosystem Assessment describes four categories of ecosystem services:

- *Provisioning services:* products obtained directly from ecosystems such as food, medicine, timber, fuel wood, and freshwater.
- *Regulating services:* benefits obtained from the regulation of natural processes such as water filtration, waste decomposition, climate regulation, and crop pollination.
- *Supporting services:* basic ecological functions and processes that are necessary for the production of all other ecosystem services such as nutrient cycling, photosynthesis, and soil formation.
- *Cultural services:* non-material benefits such as recreational, educational, aesthetic, and spiritual benefits from the existence of ecosystems, and the inherent value of biodiversity.

Ecosystem goods and services (and thus ecosystems) are intrinsic to human development, providing the resource base, i.e., the natural capital, for current and future development. A recognition of the role of ecosystems and the environment as a whole in development is visible in the widely accepted definition of sustainable development, “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”³⁴ For Africa, this means development trajectories or models that do not deplete natural capital in the immediate or short term, such that future development can continue to be supported by the ecosystem goods and services that present societies and economies benefit from.

This is especially critical in the context of non-renewable resources. Non-renewable resources, such as most fossil fuels (coal, oil, gas) and mineral deposits, are resources of economic value that cannot be readily replaced by natural means at a level comparable to the level of consumption. In contrast, renewable resources are those that can be replaced in a similar amount of time as the time taken for consumption, or less time than it takes to draw the resource down. Renewable resources include solar energy, wind energy, and geothermal energy. Soil and freshwater, though renewable, are currently being consumed or depleted or otherwise transformed by human society at a rate that is faster than the rate of replenishment, diminishing their renewable nature. Similarly, forests, though renewable (and a key source of ecosystem goods and services), are also being degraded or cut down at rates faster than the rate of regrowth. Diminishing ecosystem assets cannot be expected to support future growth and development in the manner they do now.

Spatial mapping of ecosystem assets: What do ecosystem assets look like in Africa today and where are they concentrated? A spatial investigation of Africa's ecosystem, conducted by WCMC, looks at assets including biodiversity richness as well as ecosystem services such as terrestrial organic carbon and freshwater resources.

33. <http://www.millenniumassessment.org/en/index.html>

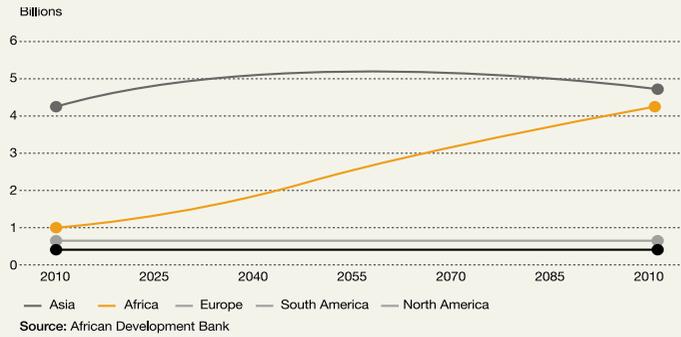
34. <http://www.afdb.org/en/rio20/background/>

A composite map of ecosystem assets in Africa illustrates their distribution.

To understand better how Africa's ecosystem assets may be impacted by development trends, and to better comprehend the spatial implications of the interaction between development forces and ecosystems, an overlay of the two is instructive.

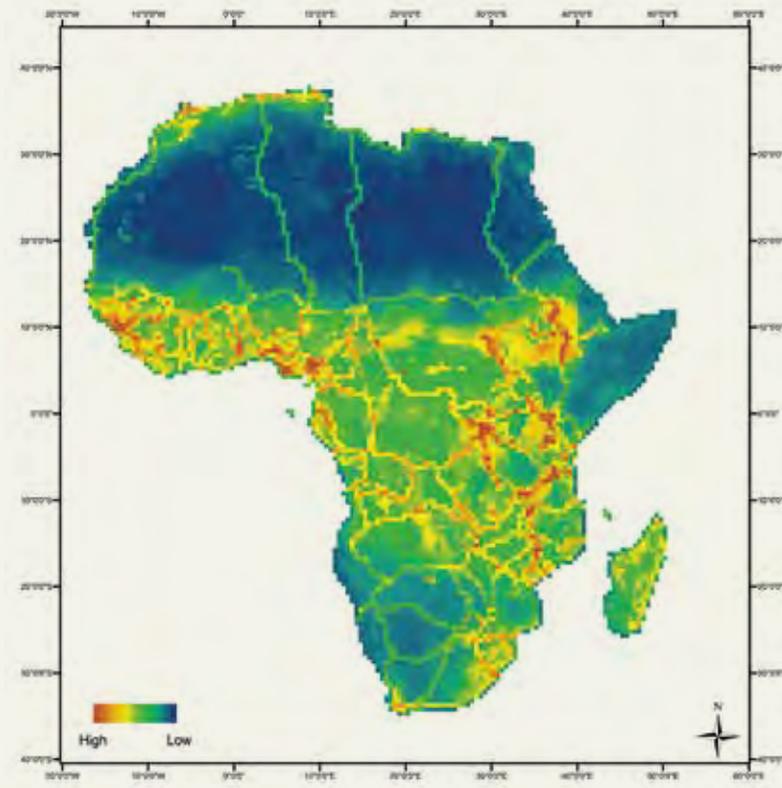
A number of flash points where developmental pressures are likely to impact Africa's richest ecosystem assets emerge from this interaction. These areas are, in essence, the ecological frontiers for the preservation, efficient use, and management of ecological or natural capital. Broadly, the areas of significance are:

- West & Central African Coastal Rainforests
- Sudanese/Ethiopian Sahel
- Ethiopian Highlands
- Central African Montagne forest
- Albertine Rift Lakes
- East African Savannah
- Southern African Miombo woodlands
- Southern African Grasslands
- Madagascan coastal forests
- North-west Mediterranean coastal scrubland



Ecosystem assets

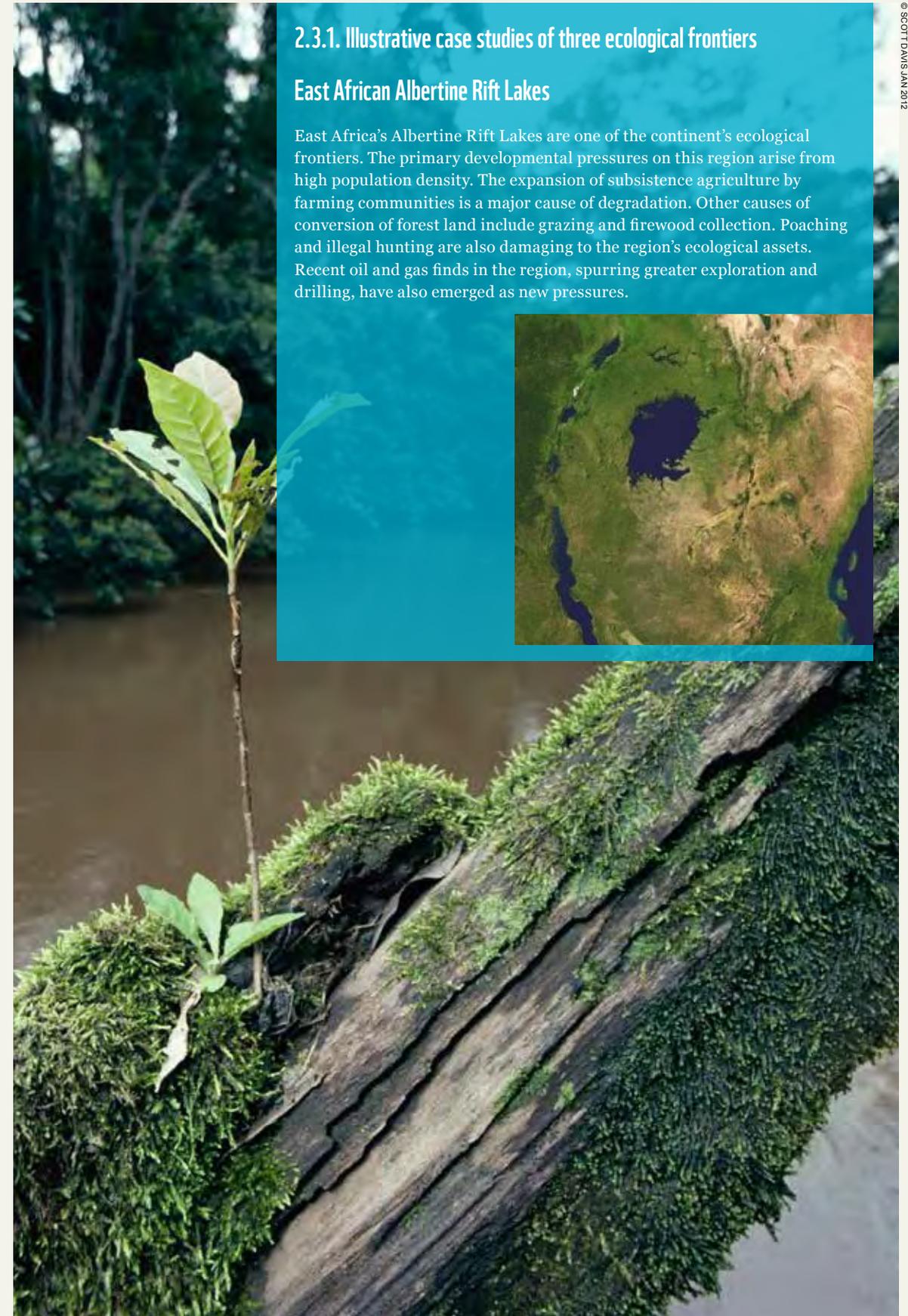
High Low



2.3.1. Illustrative case studies of three ecological frontiers

East African Albertine Rift Lakes

East Africa's Albertine Rift Lakes are one of the continent's ecological frontiers. The primary developmental pressures on this region arise from high population density. The expansion of subsistence agriculture by farming communities is a major cause of degradation. Other causes of conversion of forest land include grazing and firewood collection. Poaching and illegal hunting are also damaging to the region's ecological assets. Recent oil and gas finds in the region, spurring greater exploration and drilling, have also emerged as new pressures.



The Albertine Rift, stretching between Lake Albert in the north and Lake Tanganyika in the south, is a mountainous region of immense endemism of animal species, and to a lesser extent of plant species. The rift region is the core of Africa's montane rainforest areas (tropical and sub-tropical). The region is also characterised, in sections, by Guineo-Congolese rainforest, and by forest-savannah mosaic habitat.³⁵ Countries in the region include Burundi, the Democratic Republic of Congo, Rwanda, Tanzania, Uganda, and Zambia.³⁶

The region is one of the most-species-rich regions of the world, although still poorly documented. Over 50% of birds, 39% of mammals, 19% of amphibians, and 14% of reptiles and plants found in mainland Africa occur within the Albertine Rift.³⁷ Currently the total number of endemic plants is estimated at around 1000-1200 species. In terms of fauna, the region is estimated to have 32 endemic amphibian species, and 25 endemic mammal species. One of the most widely recognized species living in the region is the Mountain Gorilla. Others include the owl-faced monkey, several varieties of frogs, toads, birds, and rodents.³⁸ The lakes themselves are famous for the diversity of cichlid fish species.

One of the biggest pressures this region faces is population. Its rural population density is already amongst the highest in Africa. The Albertine Rift region has an average regional population growth of about 2.6%, and more than 50% of the population live in extreme poverty. The drive for agricultural development to achieve food security is intense.

Subsistence farming accounts for about 75% of agricultural production and over 75% of employment in the region. Because most families survive on subsistence farming, this places considerable pressure on the forests, often leading to land being cleared for cultivation or settlement. Political challenges such as the conflict in the Democratic Republic of Congo and the past genocide in Rwanda have also significantly hampered efforts to manage the region's resources. Hunting and poaching compounds the existing threat from cultivation and fragmentation due to human activity.⁴⁰

The conversion of forests into agricultural land has serious impacts on both terrestrial and aquatic biodiversity. Encroachment from expansion of small-scale agriculture is the major cause of forest loss in the montane and sub-montane forests of the region. It is also leading to erosion and sedimentation of lakes and watercourses, including those that provide hydro-electric power.

35. <https://www.worldwildlife.org/ecoregions/ato101>

36. http://wwf.panda.org/who_we_are/wwf_offices/regional_office_for_africa/our_solutions/albertine_rift_forest/

37. http://wwf.panda.org/who_we_are/wwf_offices/regional_office_for_africa/our_solutions/albertine_rift_forest/

38. <https://www.worldwildlife.org/ecoregions/ato101>

39. http://wwf.panda.org/what_we_do/where_we_work/africa_rift_lakes/

40. <https://www.worldwildlife.org/ecoregions/ato101>

41. http://wwf.panda.org/who_we_are/wwf_offices/uganda/wwf_uganda_our_solutions/index.cfm?uProjectID=UG0031

42. <http://www.macfound.org/grantees/23/>

43. <http://www.albertinerift.org/>

44. http://www.iucn.org/about/work/programmes/species/our_work/climate_change/species/climate_change_initiatives/albertine_rift/

45. <http://drp.dfcentre.com/project/spatial-pattern-forest-degradation-dry-miombo-woodland-southern>

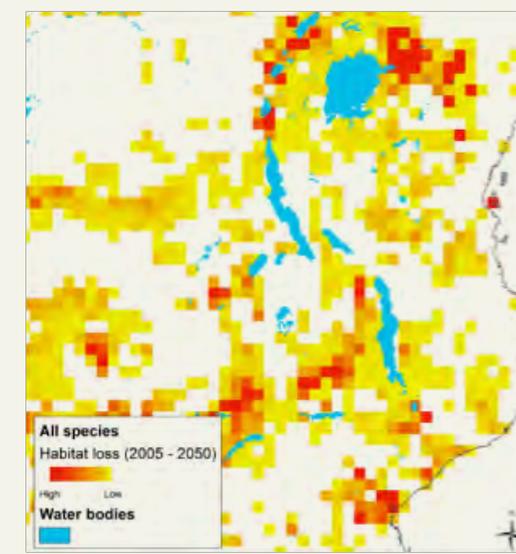
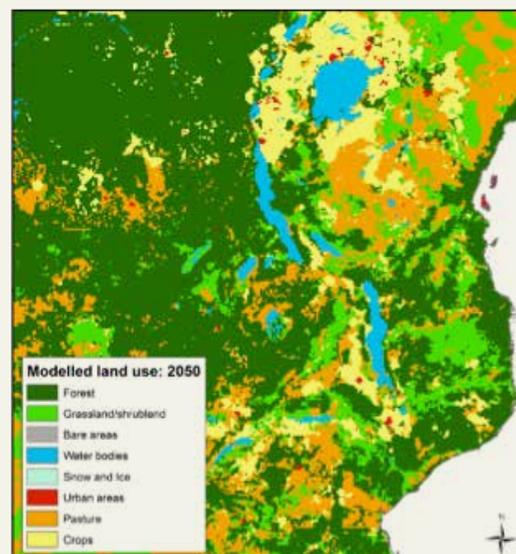
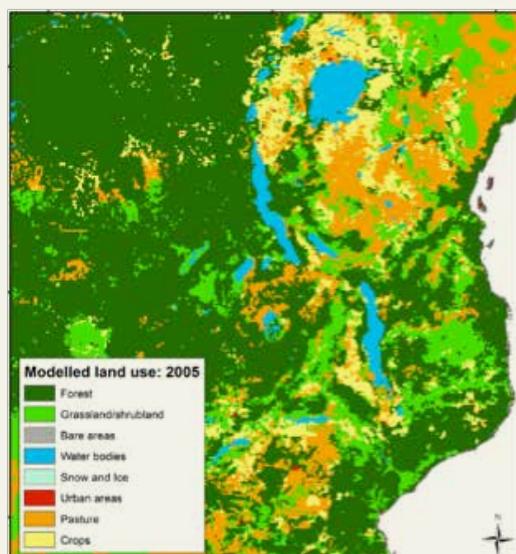
WCMC projections of land use in the region by 2050 suggest significant forested area being lost to pasture and crop land, which indicates that the existing trends of deforestation are likely to continue.

Loss of forested area has important implications for the species richness in the region. Based on the projected land use changes, models suggest that there is likely to be significant species loss in areas around the rift lakes.

Mining and oil and gas extraction represents another significant challenge in parts of the Albertine rift forest region. The DRC accounts for 53% of the world's cobalt reserves. Furthermore, there is an enormous amount of mineral wealth throughout the south and east of the Congo. Cobalt, copper, cadmium, industrial and gem-quality diamonds, golds, silver, zinc, manganese, tin, germanium, uranium, radium, bauxite, iron ore and coal are all found in plentiful supply, especially in the Congo's south-eastern Katanga region. Additionally, oil exploration has been taking place around the Lake Albert Basin for the last decade and exploratory drilling for gas is now beginning as well. In fact, several protected areas including Queen Elizabeth, Semliki, Murchison Falls and Virunga National Parks and Budongo, Bugoma and Itwara Forests fall within the concessions for oil exploration. The governments of Rwanda and the DRC have also started extraction projects of methane gas from Lake Kivu.

Several initiatives are already underway by different organisations to help maintain the ecosystem assets of the region. The government of Uganda (including the Ministry of Agriculture, Ministry of Animal Industry and Fisheries, the Uganda Wildlife Authority, the National Forest Authority, the National Environmental Management Authority), along with UNDP and WWF have a biodiversity conservation program in the region funded by the Global Environmental Facility (GEF).⁴¹ The Albertine Rift Conservation Society is supported by MacArthur Foundation grants. Groups like the Wildlife Conservation Society⁴³ and IUCN⁴⁴ are also active in the region.

However, it is countries in this region that have the greatest ability to influence land use in the area, and to protect and conserve the region's incredibly rich ecological capital. This is especially critical as new development pressures emerge, compounding existing population pressures. For instance, new oil and gas finds in the area may have to be taken into account, as well as plans for transportation corridors and energy infrastructure in the surrounding area.





Miombo Woodlands

Like the East African Albertine Lake region, the Miombo woodlands also represent an ecological frontier where the primary threat stems from population pressures, manifested in particular through the expansion of subsistence agriculture in the species-rich ecological zone. Fuelwood collection, land clearing for ranching, and charcoal extraction also contribute to the region's ecological challenge.⁴⁵ Fires are also an increasing threat.



The Miombo woodlands (often referred to as the Central Zambesian Miombo woodlands) cover approximately 70 % of the land area of central and northern Zambia. It also covers areas of Botswana, the south-eastern third of the Democratic Republic of Congo (DRC); western Malawi, much of Tanzania; and parts of Burundi, north-eastern Angola, Mozambique, Namibia, Zimbabwe, and South Africa. The woodlands consist mainly of broadleaf, deciduous savannahs and woodlands. The area spans 3.6 million square kilometres. They are home to over 85,000 plant species, of which about 300 are trees. Of the 98 major tree species known in Africa, nearly 86 are found in this area.⁴⁶

The Miombo woodlands are a region of very high endemism, especially of trees and plants. The Miombo woodlands are habitat for some of the largest elephant populations in Africa, and home to antelope, rhinos, giraffes, antelopes, lions and other diverse wildlife.⁴⁷

Several factors including low soil fertility, political instability (such as the conflict in Burundi), and the lack of infrastructure have helped keep much of the Miombo intact. Population density in this region is low and human settlements are sparse.⁴⁸

However, human activities have started changing the Miombo woodlands.⁴⁹ In recent years, the woodlands are being cleared to make way for cultivation, charcoal, and ranching. Illegal hunting and poaching are also major threats, especially to elephants and rhinos.⁵⁰

Despite poor soil quality, the Miombo woodlands have seen land use change (outside of protected areas) in the form of expanding agriculture.⁵¹ The woodlands are further degraded due to the rural population's dependence on fuel wood.⁵² One study found that the closer a part of the Miombo woodlands to a human settlement, the greater the degradation.⁵³

Subsistence agriculture is practiced by as much as 75% of the population. Growing staple and cash crops such as maize, cassava, sorghum, millet, and tobacco, pose significant threats to areas of the ecoregion, such as in Zambia, Tanzania and Malawi. Deforestation trends have been exacerbated by growing demands in the region for large-scale agriculture for cereals and grains. Growing tobacco for export has led to large losses of woodland.

46. http://wwf.panda.org/who_we_are/wwf_offices/tanzania/wwf_tanzania_our_solutions/?uProjectID=9Fo753

47. http://wwf.panda.org/what_we_do/where_we_work/miombo_woodlands/

48. http://wwf.panda.org/who_we_are/wwf_offices/tanzania/wwf_tanzania_our_solutions/?uProjectID=9Fo753

49. http://wwf.panda.org/who_we_are/wwf_offices/tanzania/wwf_tanzania_our_solutions/?uProjectID=9Fo753

50. http://wwf.panda.org/what_we_do/where_we_work/miombo_woodlands/

51. http://www.cifor.org/publications/pdf_files/books/miombo.pdf

52. <https://www.worldwildlife.org/ecoregions/ato719>



MINING ALSO CONTRIBUTES TO DEGRADATION OF THE WOODLANDS

53. <http://drp.dfcentre.com/project/spatial-pattern-forest-degradation-dry-miombo-woodland-southern>

Furthermore, the curing of tobacco requires the use of charcoal, thus compounding the problem. In Tanzania, increased clearing of land for agriculture and grazing is a growing challenge, as is illegal encroachment of people and livestock on protected areas in Zambia.

Mining also contributes to degradation of the woodlands. In fact, mining in Zambia and the DRC poses one of the greatest threats to the Miombo. The effects include land degradation and water pollution. For instance, reports suggest that there is pollution to the Kafue headwaters from mining and that the copper content in rivers of the copper belt is higher than levels considered safe. Mining in the Katanga region of the DRC also affects species, animals and plants specific to these habitats. While hydropower is not yet the major threat to the Miombo woodlands, it is expected to become a far greater pressure in the area as the Zambezi River sees further development.

In addition to development pressures, the woodlands have also been at risk from increased fires, exacerbated by drought and climate change.⁵⁴

Loss of the woodlands has negative implications for livelihoods, as well as lost opportunities for forest carbon storage.⁵⁵ Some efforts are underway by groups like as the Mpingo Conservation and Development Initiative,⁵⁶ and UNDP⁵⁷ to protect the Miombo woodlands, but many such initiatives focus on the eastern woodlands in Tanzania. The southern Miombo woodlands have received attention from WWF, which has designated it as a critical ecoregion.

As the countries in the region – particularly Zambia, Zimbabwe, Malawi, and southern Tanzania – weigh decisions about the future of agriculture, and explore whether and how they promote either more decentralized, small-scale, community-driven agriculture or more large-scale, commercial, export-oriented, market-driven agriculture, they must be cognizant of the pressures that agriculture and land use puts on the Miombo ecosystem. They would be well advised to examine the costs of further degradation to the Miombo woodlands, including to species dependent on the woodlands and in the form of loss of stock of key natural resources.

Central and West African Coastal Rainforests

The coastal region of West Africa is an area of evergreen rainforests, rich in animal and plant biodiversity. The major threats in the region are commercial logging, plantation agriculture, illegal poaching and hunting for bush-meat, as well as extractive activities for oil, gas, and minerals.



The coastal region of much of West Africa, and adjoining inland areas close to the coast, is covered by evergreen rain forests. While not a fully continuous network, these moist broadleaf forests run in several large blocks from Sierra Leone and Guinea in the west to the Sanaga River of Cameroon in the East. These are also known as the Guinean forests of West Africa. Some classifications divide these into two regions, the upper Guinean forests (from Guinea, through Liberia, Cote D'Ivoire, Sierra Leone, Togo and Ghana) and the lower Guinean forests (from Benin through Nigeria and Cameroon). Some consider these contiguous with the Atlantic equatorial coastal forests in Cameroon and Equatorial Guinea, extending south towards Gabon and the Republic of Congo. Much of this region is captured within WWF's Cross-Sanaga-Bioko forest ecoregion, which is the focus of this case study (See region in map below).



The region's flora includes high numbers of endemic species, which suggests a long history of forest cover. In fact, these forests contain some of the highest densities of animal species richness of any African forest, especially in terms of forest-restricted mammals, birds and butterflies. Many of these animals are endemic to this ecoregion.⁵⁹

There is exceptional species richness in the rain forests of this ecoregion. These forests support about 50 % of the 7,000 to 8,000 plants endemic to Tropical West Africa, mainly in the coastal portion of Cameroon. The forests of the Cameroon-Nigerian border are also known for being home to the highest forest butterfly species richness in Africa. They also display very high vertebrate species richness, and contain the highest figures for forest restricted birds and mammals in Africa. These forests are of particular importance for the conservation of primates. In fact, the forests of the Cross River National Park in Nigeria are a key conservation area for populations of the lowland gorilla and chimpanzee. Korup National Park in Cameroon holds one of the priority populations of forest elephants.⁶⁰

The major threats to this region are commercial farming, logging, and plantation agriculture, followed by subsistence agriculture, which often occurs after the logging has opened up an area. Lowland forest habitats on Bioko have also been lost through conversion to plantations, and farming activities. Overhunting of mammal species for bushmeat is also a threat to the fauna of the forests. In some areas, this trade is fully commercialized, and supplies protein to major towns. In other areas, certain species such as lowland gorillas are hunted for their religious, magical, and supposed medicinal properties. The wildlife trade is also a cause of species depletion of reptiles. Another threat is the pressure to establish rubber, wood pulp, oil and palm plantations in the forest zone of Nigeria.

59. <https://www.worldwildlife.org/ecoregions/ato107>

60. <https://www.worldwildlife.org/ecoregions/ato107>



The threat from mining and oil and gas exploration has also grown. Ogoniland in Nigeria is an example of the devastation caused by contamination from oil spills.

Although more than 10 % of the ecoregion is officially protected in national parks, in reality, these parks do not adequately protect fauna and flora because of low staffing, inadequate budgets and lack of political will. Some species of larger mammals in the Korup and Cross River National Parks are severely threatened and populations of elephant, drill and red colobus have been seriously reduced. The national and international conservation community has not been effective in protecting fauna in this ecoregion, especially the primates and other large forest mammals.⁶¹

WWF's SAWA program is active in the Cameroon section of this ecoregion.⁶² Other initiatives in the region include the West African Rainforest Network,⁶³ and the West African Primate Conservation Action.⁶⁴ However, more concerted action from governments is necessary to safeguard the region from development pressures in the region, including population growth, expansion of human settlements, commercial logging and plantations, as well as extractive industries.

61. <https://www.worldwildlife.org/ecoregions/ato107>

62. http://wwf.panda.org/what_we_do/where_we_work/project/projects_in_depth/cfp/

63. http://www.earthisland.org/journal/index.php/eij/article/west_africa_rainforest_network/

64. <http://www.wapca.org/05.htm>

Understanding Plausible African Ecological Futures

Summary

Scenarios are a useful tool to construct narratives that explore the impact of different development trajectories on the ecosystems within which people live and work. They can also help spot pitfalls which we may want to avoid.

Through a collaborative scenario planning process four distinct ecological scenarios for Africa have been identified. Each scenario describes a world in which a different approach is being taken to two critical issues:

The first relates to the locus of governance and decision making around infrastructure-land development and natural resource use, contrasting centralised coordinated planning versus decentralised organic decision-making. The second relates to the focus of economic production and associated infrastructure-land development, contrasting export-led global trade in resources and goods versus intra-African trade enabled by increasing consumption by both urban and rural inhabitants. Together these forces create the basis for four scenarios the details of which have been deductively derived by addressing some critical questions

This has provided us with four scenarios:

- **Going global:** in which resource rich regions take a planned export-driven path to developing extractive and agricultural commodities, based on centralised decision making and connected economic infrastructure.
- **Helping hands:** in which resource rich areas are the focus of extractive economic activities driven by local actors developing local resources for export through decentralised decision making and supported by local (off-grid) infrastructure
- **All in together:** in which densely populated areas with renewable resources develop local agricultural industries through participatory decision making and local co-operative schemes driven by local actors
- **Good neighbours:** in this scenario the future is characterised by a strong drive for African-based development to increase intra-regional trade. As countries begin to take a coherent domestic view with regards to their production and consumption, large infrastructure investment are needed.

CHAPTER 3. UNDERSTANDING PLAUSIBLE AFRICAN ECOLOGICAL FUTURES

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3.1. Introduction

Africa is diverse, dynamic, vast and complex, so discussions about its development and the associated ecological consequences must by necessity be only partial. Despite this, it is possible to identify plausible development pathways that have similar characteristics and may impact on the natural environment in foreseeable ways. Unfortunately the longer-term consequences of our current-day actions are not always known or entirely clear, particularly when they involve indirect issues such as ecosystem degradation.

Storytelling is an ancient African tradition, used to pass on wisdom and teach lessons. In this tradition we have used scenarios to construct alternative stories about the impact of different development trajectories on the ecosystems within which people live and work. These are not predictions, nor roadmaps, but rather informed speculation about the meandering paths that may take Africans to different plausible futures. The strength of scenarios is that they provoke thought about what is possible and help identify options and pitfalls that we may want to choose or avoid. As such, scenarios provide a platform for introspection and debate about obstacles that must be overcome and dreams that may be achieved in creating a vibrant and sustainable African century. The selected scenarios describe pathways to the mid-century (2050) as a point within many of our lifetimes, but far enough away to realise the expected growth and transformation of Africa.

A deliberate attempt has been made to avoid more desirable (best-case) or less desirable (worst-case) scenarios. Similarly, possible but highly unlikely outliers (“black swan events”) have been omitted to ensure that each scenario demonstrates a specific plausible pathway with its own internal logic and assumptions, as well as distinct decision points that would fundamentally impact on the long-term ecological future. Importantly though, each scenario represents a combination of drivers and conditions that underlie the ecological frontiers outlined above, and therefore the projected evolution of the scenarios and associated events all have their roots in current 2015 realities. While each scenario attempts to highlight the key pivot points and the implications of decisions, there is no doubt that the actual future could be far worse than the most pessimistic elements of any one of these scenarios, or much better than the most optimistic elements. As such they provide a means of thinking about long-term planning and the translation of policy into action to embrace the continent’s vast potential and avoid catastrophe.

3.2. Four Scenarios of Africa’s Ecological Future

The scenarios have been built on an extensive process of research and input from a range of people with understanding of Africa’s development and ecology. Through this process the drivers and pressures outlined earlier in the document were identified from a far greater list of factors relevant for different sectors. In discussion with these groups it emerged that there was considerable consensus that many of these drivers and pressures may be clustered and captured by two uncertain underlying forces with significant impact on the development-ecological future.

The first relates to the locus of governance and decision making around infrastructure-land development and natural resource use, contrasting centralised coordinated planning versus decentralised organic decision-making. This does not make assumptions around the strength or weakness of government, but rather the degree of intentional or opportunistic devolution there is in decision making, which in turn influences the type of infrastructure that is possible.

The second relates to the focus of economic production and associated infrastructure-land development, contrasting export-led global trade in resources and goods versus intra-African trade enabled by increasing consumption by both urban and rural inhabitants. This does not imply there is no global trade in the latter, but rather influences the type of goods and services that are produced and the provision of services to households.

Together these forces create the basis for four scenarios the details of which have been deductively derived by addressing some critical questions:

What is the underlying premise for the development trajectory? How does a country’s natural resource endowment influence the trajectory? What is the natural long-term diversified outcome of the development trajectory that reflects the expected transition in Africa?

What is the primary mechanism by which rural and urban people are provided services? What infrastructure is necessary to enable this trajectory and how is this developed?

How do the economic activities, infrastructure and people impact on ecological systems? What are the key environmental obstacles to the achievement of this trajectory? What are the critical pivot points that will influence the protection or degradation of critical the ecosystems?

In interpreting these scenarios it is important to note that the scenarios are not necessarily mutually exclusive within a country or region. In fact, different areas within a country may even take alternative development trajectories. Each scenario is also anchored around a current context in terms of natural resource opportunities and governance arrangements, in an attempt to reflect the diversity that is Africa.

The diagram is a 2x2 matrix with 'Centralised planned development' at the top and 'Decentralised organic development' at the bottom. The left side is labeled 'African trade focus' and the right side is labeled 'Global export focus'. Each quadrant contains a small image and a text label in a colored oval:

- Top-left (Centralised planned, African trade focus): Image of a group of people, label 'Good neighbours'.
- Top-right (Centralised planned, Global export focus): Image of a road, label 'Going global'.
- Bottom-left (Decentralised organic, African trade focus): Image of people in a meeting, label 'All in together'.
- Bottom-right (Decentralised organic, Global export focus): Image of a person in a field, label 'Helping hands'.

Illustrative case studies have been presented for some of the scenario descriptions. These are intended to provide a perspective on some of the key tensions and trade-offs associated with the scenarios, as well as emerging responses that are being explored by local role-players. While there is some alignment between these cases and the scenarios, they is not intended to imply that all the issues have been resolved nor that they are necessarily replicable best practice. In fact some of the cases actually have aspects of more than one scenario, as may be expected with the complexity and diversity of real world situations. This reiterates the point that scenarios are not predictions of actual futures, but rather plausible stories that allow us to explore complex situations to guide our current actions.

3.3. Going global

Global Starting Point: Planned export corridors and large infrastructure

This scenario is most likely to begin in situations with stronger central government capacity and significant mineral, oil or even agricultural resources that can drive export-driven primary resources economic growth.

The natural asset base of a given country is a key impetus behind how its development trajectory unfolds. Global demands for minerals and other natural resources have been growing rapidly over the past few decades, alongside rapid economic development and population growth. While this growth has waned more recently, driven particularly by a global economic slow-down including China, it can be reasonably assumed that the demand for resources will continue to grow into the future, in ebbs and flows.

Africa is touted to be a primary buoy of this growth given its large reserves of untapped resources, both mineral and agricultural-based. A number of countries have already capitalised on this demand but there remains significant scope for further development. These countries, and particularly those with abundant natural resources, will need to navigate their development paths very carefully, drawing on the lessons learnt from other, more developed economies, in order to ensure that they do not end up with stranded assets and degraded ecological systems.

Export-led extractive and mining growth will require robust infrastructure planning and development that deals adequately with current and future climate shifts and variability. The infrastructure becomes additionally robust when interlinked with key development nodes and corridors that extend beyond national boundaries. This is particularly pertinent in the case of land-locked countries that are dependent on other countries and corridors to facilitate trade. Countries with valuable land and water resources will also require infrastructure investment to meet the growing agricultural demands for local consumption and export. Careful consideration will be needed in addressing the trade-offs between the provision of water (and) infrastructure to agricultural and extractives sectors.

Central to the successful development of growth corridors is centralized, coordinated planning and effective bilateral negotiations that address economic, social and ecological trade-offs between sectors and across countries, while leveraging opportunities for sustainable growth. Decentralised, “organic” decision making will not do justice to the complexities that underlie cross-sectoral and cross-boundary negotiations. And, importantly, planning will need to be made possible by government political will and sufficient human capacity.

Infrastructure development in support of economic zones or growth corridors will therefore need to be underpinned by coherent spatial planning across borders. Countries at earlier stages of development will have more capacity to explore regulatory and institutional setups that align with cross-border, robust spatial planning. More developed economies, on the other hand, will face additional challenges around adapting their well-established regulatory and institutional structures to more adaptable spatial plans that can accommodate or adapt to climate uncertainty. Indeed, climate variability will create maintenance issues in corridors and further reduce the reliability of large infrastructure networks if planning is not done with adaptability in mind.



**RESOURCE RICH
REGIONS TAKE
A PLANNED
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Access to sufficient energy will be needed to support extractives-led growth. Major agricultural zones will also be increasingly dependent on energy supply to support irrigation systems and trade processes. Large-scale energy development will be driven by hydropower, oil, gas and coal. However, increasing environmental pressures (both direct and indirect) around the detriments of fossil fuel-generated energy may see relatively reduced coal investments as economies progress from emerging to developed status. In countries with growing economies, low levels of household electrification and large coal reserves, access to basic services will likely trump the environmental consciousness around carbon generation, at least in the short term. Yet for all countries, this infrastructure development will impact on local ecological systems to lesser or greater degrees.

A large portion of African infrastructure is currently enabled by foreign direct investment, a phenomenon that is likely to continue into the foreseeable future. There are significant risks inherent in foreign investment without the necessary regulatory structures to ensure that the infrastructure both pays due respect to sensitive ecological systems and is integrated into a wider network of resilient, cross-sectoral (and potentially cross-border) infrastructure.

Balancing social expectations

Global resource prices are cyclical in nature. Current oil and mineral price movements are illustrative of the rapid shifts that can occur in these sectors. While the private sector is typically able to respond quickly to these movements (an example being Shell’s recent withdrawal from fracking exploration in South Africa’s Karoo region – as a result of the oil price drop), the same isn’t always true of governments.

Well-developed regulatory and institutional structures can make governments less flexible to changing global pressures. Climate variability – an increasingly evident global pressure - will create challenges in growth corridors and heighten the need for adaptive responses. Uneven or unchanging application of regulations will potentially inhibit the translation of economic or resource booms into social services. This will be particularly relevant to emerging economies undergoing industrialisation and expanding and/or mechanising their agricultural production. For these economies, there are challenges around ensuring that there is sufficient access to resources by local communities, over and above the resources being channelled into the growing domestic productive economy. This requires governments to intervene in order to build institutional capacity to support both unserved local communities (providing access to water supply, energy and food) while not inhibiting economic growth. These local-level trade-offs can also be mitigated by putting in place strong smallholder policies and driving an agenda for local investment. Centralised decision making and bilateral government engagement around infrastructure development will need to be cognisant of the impacts on local ecosystems as well as the natural resources upon which local communities depend.

From a global, external perspective, poor management of underlying resources and ecosystems, including disregard for the basic needs of communities, is likely to invoke market response. This may be in the form of boycotts of certain products, or even trade with countries. Initiatives such as the Forest Stewardship Council (FSC), Marine Stewardship Council (MSC), Bonsucro, Fair Trade, and Roundtable on Sustainable Palm Oil are examples of product-based market responses already in play. It will thus be imperative for governments to focus on effective regulatory responses that ensure sustainability for global consumer awareness while protecting their local industries.

Diversification for resilience

The thinking around the development of large infrastructure systems built over the past forty years can no longer be applied to planning of infrastructure projects over the next forty years. Two key drivers of this shift relate to climate uncertainty and fluctuating global market prices (the latter not a new phenomenon). Infrastructure and spatial planning, and the regulatory systems that govern them, need to be flexible and adaptive to changing external pressures. Adaptability and flexibility can be facilitated through diversification.

By 2050, a number of African resource bases will be either exhausted or depleted to the point of economic unfeasibility (or for carbon-associated products, globally or regionally adopted carbon constraints may increasingly limit their competitiveness). This will cause nodes and corridors that are orientated around the resources to fall into decline. This in turn will bring about new waves of remigration and cause remaining assets to be stranded. Effective local-level regulation that identifies opportunities for diversified development will help to reduce the probability of corridors falling into this socio-ecological decline. Planning needs to focus on developing local industries that are self-supporting without the node or corridor's primary resources, while also being adaptable to remigration. Planning of this nature will ensure that economies remain resilient and well placed through diversified growth.

Stranded assets and degraded systems

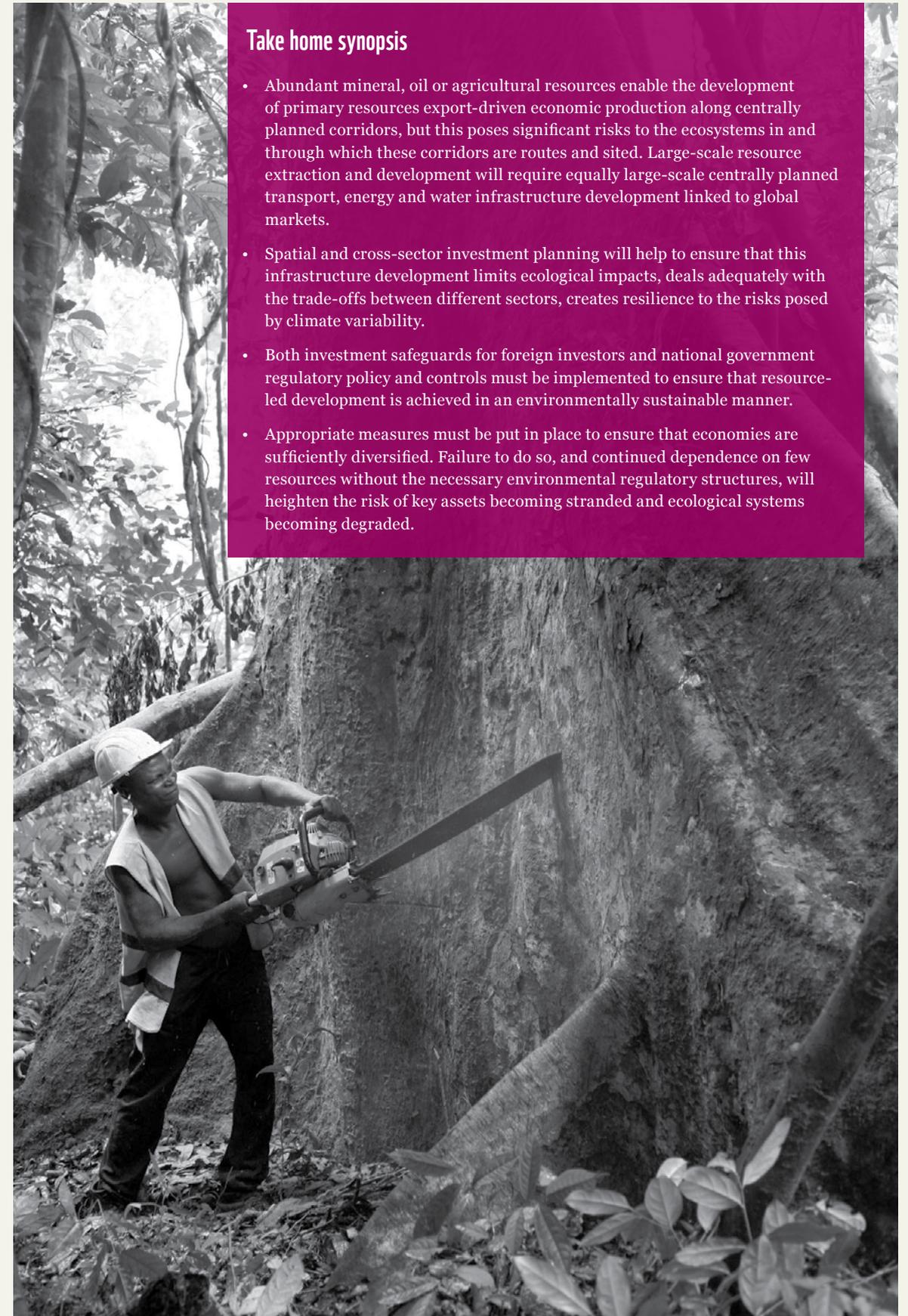
Economies that do not diversify out of their fossil or limited resource dependency, and/or fail to give adequate attention to the ecological impacts of resource extraction, will face the challenge of stranded assets, increasingly competitive global markets, and degraded ecological and infrastructure systems in the future. For example, the Zambian economy has historically been based on the copper-mining industry which today still accounts for around two-thirds of revenue generated from exports (together with cobalt). However, the remaining life-span of the country's northern copper belt is forecast to be less than twenty years. It is thus imperative that its economy becomes more diversified over the next two decades in order to sustain future export-driven growth.

In countries where mining forms an important component of economic growth, measures need to be implemented to ensure that mining practices do not cause detriment to the local ecological systems. For instance, unmonitored acid mine drainage can cause mining regions to become defunct to other uses once mining is halted.

Finally, large-scale urbanisation is expected to persist into the foreseeable future. This will be further boosted by remigration once resource-based operations in corridors or nodes start to wane. In these situations governments will need to address the trade-offs between resource demands of urban development (increased urban water and energy supply in particular), and resource demands of local industries, as well as the associated environmental challenges.

Take home synopsis

- Abundant mineral, oil or agricultural resources enable the development of primary resources export-driven economic production along centrally planned corridors, but this poses significant risks to the ecosystems in and through which these corridors are routes and sited. Large-scale resource extraction and development will require equally large-scale centrally planned transport, energy and water infrastructure development linked to global markets.
- Spatial and cross-sector investment planning will help to ensure that this infrastructure development limits ecological impacts, deals adequately with the trade-offs between different sectors, creates resilience to the risks posed by climate variability.
- Both investment safeguards for foreign investors and national government regulatory policy and controls must be implemented to ensure that resource-led development is achieved in an environmentally sustainable manner.
- Appropriate measures must be put in place to ensure that economies are sufficiently diversified. Failure to do so, and continued dependence on few resources without the necessary environmental regulatory structures, will heighten the risk of key assets becoming stranded and ecological systems becoming degraded.





Copperbelt Mining and the Kafue, Zambia

The Kafue River Basin covers 20 % of Zambia's land mass. The Kafue is home to the mineral-rich Copperbelt Province, capital city Lusaka, Kafue National Park and Ramsar wetlands. It is also the agricultural heartland of the country with the agriculturally important Mazabuka region where sugar is cultivated. Finally, the Kafue is also responsible for 50% of hydropower generated in the country through the Kafue Gorge Dam.

Since the opening of the first mine in Zambia's Copperbelt in 1928, the country has relied on the mineral for significant economic growth and development. In response to the development of the mining industry in the north of the Kafue, construction of the Kafue Gorge Hydropower Dam and Itezhi-Tezhi (ITT) began in the early 1970s. ITT is a balancing dam to regulate the flow to the Kafue Gorge Hydropower Station built upstream of the Ramsar-accredited Kafue Flats. Changes in the natural functioning of the Kafue River Basin ecosystem has been due to infrastructure investments made in the basin to drive economic growth. Ecosystem functioning in wetlands is fundamentally linked to changing high and low flows

to support fauna and flora lifecycles. Following the construction of the ITT Dam, the operating rules of the dam have been updated in an effort to mimic the high and low flows in the river in order to ensure ecosystem function is maintained.

Following independence (1964), little value was being reinvested into Zambia through the private mines. In response, all mines were nationalised in 1969. Significant social investments were made through earnings from the mining industry. Developments began to slow when the price of copper collapsed after the first oil crisis in 1974. After the second oil crisis in 1979, Zambia was thrown into a severe debt crisis. Between 1974 and 1994, per capita income declined by 50%. Financial limitations during this period restricted the environmental controls during closure of mines in the Copperbelt and around Kabwe in the middle Kafue. This has had legacy ecological impacts on the surrounding land and water resources, with health challenges and significant potential clean-up costs. Fortunately the Lukanga Swamp is still functioning in assimilating the majority of these pollutants, releasing good quality water downstream into the remainder of the Kafue River.

The hydropower generated from ITT and the Kafue Gorge Dam is used primarily in the Copperbelt region for the mines. In contrast, local communities around ITT and Kafue Gorge Dam do not have access to electricity, and are thus forced to collect biomass in the form of firewood or charcoal as a source of energy for lighting and cooking. As a result, deforestation of the Miombo woodlands for charcoal and fuelwood and the resultant land degradation through soil loss cover are negatively effecting both land and water ecosystems. Following heavy rainfall, erosion takes place, further silting the hydropower dam, reducing capacity for electricity production.

The hydropower generated from the Kafue Gorge Dam is also used to power the service economy of Zambia, which is primarily based in the Capital city. A further connection to the basin is the fact that 46% of water supply to Lusaka is sourced from the Kafue River. The capital city has developed rapidly due to the growing economy and migration of people from the rural areas of the country. Wastewater is not adequately managed in the city, further polluting the groundwater aquifers, necessitating increased water withdrawals from the Kafue River in competition

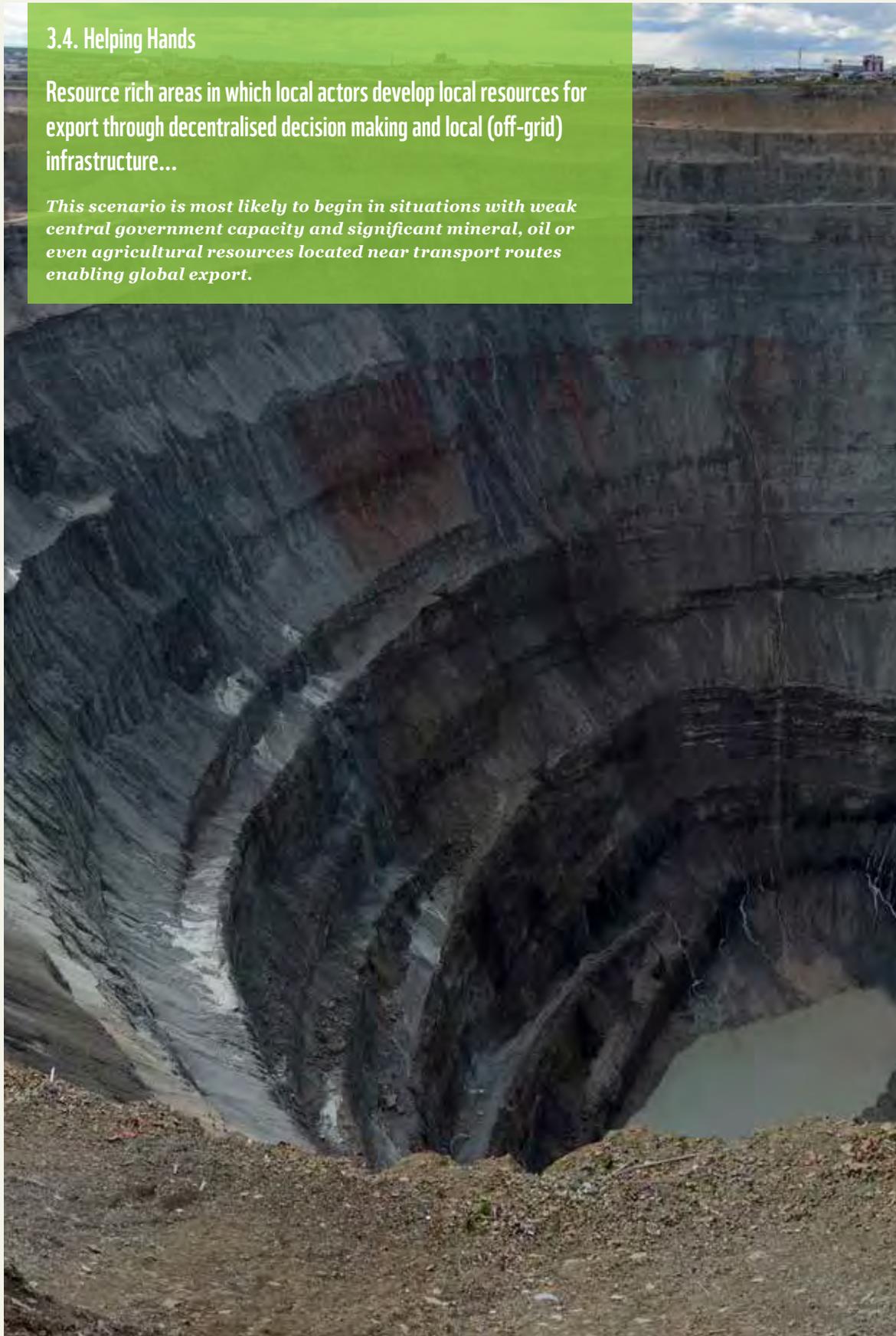
with the increasing demand for hydropower for the increasing electricity demand. Finally, the Kafue Basin is also home to the majority of irrigated agriculture in Zambia, which also demands water supply to grow economically important crops such as sugar, both for domestic demand and export.

Historically the resource abundance of the Kafue River Basin has been a source of significant economic opportunities for the country in the form of mining, water supply, agriculture and hydropower. However, as each of these sectors continues to grow and expand, infrastructure development alone is unable to manage the resources. With natural resources under threat from future development, novel approaches to managing the resource needs within the different sectors are critical. Recent initiatives by the Government of Zambia with donor support have recognised these challenges and the need to manage the trade-offs in ensuring that the Kafue and its natural resources continue to be the economic heartland of Zambia.

3.4. Helping Hands

Resource rich areas in which local actors develop local resources for export through decentralised decision making and local (off-grid) infrastructure...

This scenario is most likely to begin in situations with weak central government capacity and significant mineral, oil or even agricultural resources located near transport routes enabling global export.



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Starting Point: Business moves in

The abundance of natural resources in the area draws international (or large African) companies with access to skills and finance to develop large mines and commercial farms where they can obtain permission or influence local leaders. The focus is on primary resources (minerals or high-value crops) for global markets, with largely unprocessed goods being shipped through local airports or along regional transport routes. This is an organic process where the opportunity for profit outweighs the risks of limited regulation and transport infrastructure.

These enterprises build their own local water and energy infrastructure, again with limited controls and typically only providing services to their employees. There is however a distinction between the mining initiatives with significant energy requirements and local socio-environmental impacts, and the agricultural initiatives with significant irrigation water requirements. Because these organic opportunities tend to be located in resource-rich areas with some transport facilities, the first business movers are typically followed by numerous others, thereby creating a concentration of similar enterprises. The resulting investment and economic growth around the node provides a kick-start to local development, but has some downside in the absence of strong local governance.

This creates the major ecological challenge, namely that each enterprise has a relatively localised impact, but cumulatively this becomes significant, particularly as it is usually not coordinated (or planned); where they are required, environmental assessments focus on individual facility impacts not the cumulative impacts of broader area. The resource richness is often associated with biodiversity and local communities that depend upon the resources for their livelihoods. People are drawn to the opportunities these areas provide, with clustering of unplanned and unserved settlements. This compounds the ecological impacts or the facility production, through intensive use of local ecosystems to support their energy (biomass), food and water requirements. The transport corridors for moving products to international markets also pose ecological risks, as they typically use routes that were planned for local purposes and are not designed for significant commercial traffic and the proliferation of settlements that usually occurs around commercial routes. Because these enterprises feed large conglomerates, profits are repatriated out of the area and decision making resides in distant cities by people who are neither aware of nor impacted by local conditions.

Cost of doing business

As production and in-migration increases, the demand on natural resources increases, while their local availability decreases through overuse and ecosystems begin to deteriorate. Conflicts begin between local communities and the enterprises over access to these resources and the infrastructure that provides reliable access. This is exacerbated by the export focus that does not support local demand for food and livelihoods, so a parallel economy for local consumption develops, thereby exacerbating the conflict over natural resources. The distinction between those with formal employment and serviced housing and the surrounding communities in peri-urban settlements becomes greater and also contributes to socio-political conflict. Social tensions around resource access become extreme, with local political leaders taking populist positions against the companies. The lack of strong governance and central infrastructure that was an opportunity becomes a risk and hindrance to further development and investment.

These conflicts and associated pressure from investors and consumers in the companies' home offices over reputational risk and threats to continued operation result in exit of some companies, leaving shell companies, abandoned assets or stripped operations, without adequate closure or legacy management. Domestic companies and local people take over the operations in an attempt to generate income, but their lack of management capacity, financial resources and international market contacts result in inadequate environmental protection thereby exacerbating the ecosystem impacts. Even for those companies that are willing to stay, the cyclical nature of resource export prices causes the companies to take short-cuts in environmental management and resource use to cut costs in the downturns.

Increasingly the impacts of climate change are felt on these local resources, either as reduced resource availability related to increasing temperature and declining rainfall or as increased disasters (extremes) related to flooding, fire, drought and epidemics. The localised nature of infrastructure and resource use makes these areas even more vulnerable to climate variability, particularly where there is limited diversification of economic activity.

Innovative partnerships

The convergence of corporate-investor pressure and local discontent creates the space for decentralised government to strengthen its regulatory and economic position. Innovative partnerships flourish, bringing government, business and civil society together to manage resources effectively, provide greater access to services and share the benefits of the commercial mining or farming initiatives. Strengthening of out-grower schemes and company-community partnerships provide mechanisms to bring local inhabitants into the production process as more than workers. This is particularly important where communal lands and informal tenure constrains expansion by the companies.

The greatest opportunity and challenge to building local resilience to global economic and climatic variability is the diversification of the economy to include activities that are not directly dependent on local resources. This requires that the emerging partnerships promote effective local governance, empower communities and build local skills, by proactively channelling a portion of the income from the initial resource intensive activities into local development.

These partnerships with the decentralised infrastructure model also provide the opportunity for the adoption of inclusive green growth initiatives, which leverage the companies' global access to technology and financing, and continue to make exports competitive as the world adopts a low-carbon pathway. This can tap the urbanisation trend by building sustainable local towns and cities to provide tertiary economic services to local business and efficient municipal services to its population. While strong national government can provide the enabling regulatory frameworks and support for the emergence of this trajectory, it implies more devolved governance arrangement built on the original conditions.

The local focus of this development pathway depends upon functioning local ecosystems, to provide sustained natural resource use, to help assimilate impacts and to attenuate natural disasters. A significant risk to its long-term viability is ecosystems that were irreversibly degraded during the early phases of its development and are therefore not able to provide these services once the transition has occurred. This includes the interaction between different areas that impact on each other (externalities) by water, land or air, as well as transport corridors. The cumulative impacts of individual enterprises should be managed by coherent local planning, but now potentially gets scaled up to impacts between different neighbouring areas. This highlights the importance of effective federal coordination between areas, preferably facilitated by legitimate and effective national government.

Lost opportunities

For those areas in which resources were irreversibly degraded or the opportunities for partnership were not leveraged in time, the future is bleaker. Deterioration of local ecosystems, overuse of natural resources or exhaustion of available reserves results in economic stagnation or decline, with out-migration to other areas. This occurs at the same time that potential long-term liabilities begin to mount, particularly where mine closure has not been adequately managed or agricultural land has degraded or desertified. The cost of rehabilitation of these areas is typically beyond the capabilities of local government. The environmental consequences are particularly severe for those who remain in these ghost towns and as climate conditions become more extreme.

The challenge to the country and even the broader region is that these desperate rural inhabitants (with limited resources and skills) flood into the already over-stretched peri-urban areas around the major cities. The pillaging of the country's natural resources, without adequate central capture of benefits to return to social and municipal services, leaves a massive human and infrastructure deficit, with few options to recover lost ground. The conflicts over access to resources and opportunities that were apparent in the early days of this scenario now manifest at a national scale, with increasing political instability.

Take home synopsis

- The abundant resource base provides an opportunity to accelerate economic development, but poses major long-term challenges to continued growth, diversification, natural resource availability and ecosystem integrity.
- Ensuring local resilient infrastructure and diversification through government-business-community partnerships and local spatial planning is critical to manage potential conflict and overcome longer-term constraints associated with global economic and climatic variability.
- Enabling national frameworks that promote decentralised ecologically-relevant regulatory and planning mechanisms and incentives to business, while capturing the benefits of export, are critical to ensure inter-area coherence.

Strong international investment safeguards and stewardship initiatives promote responsible and sustainable business action in areas with limited regulatory capacity.

HORTICULTURE IN LAKE NAIVASHA, KENYA

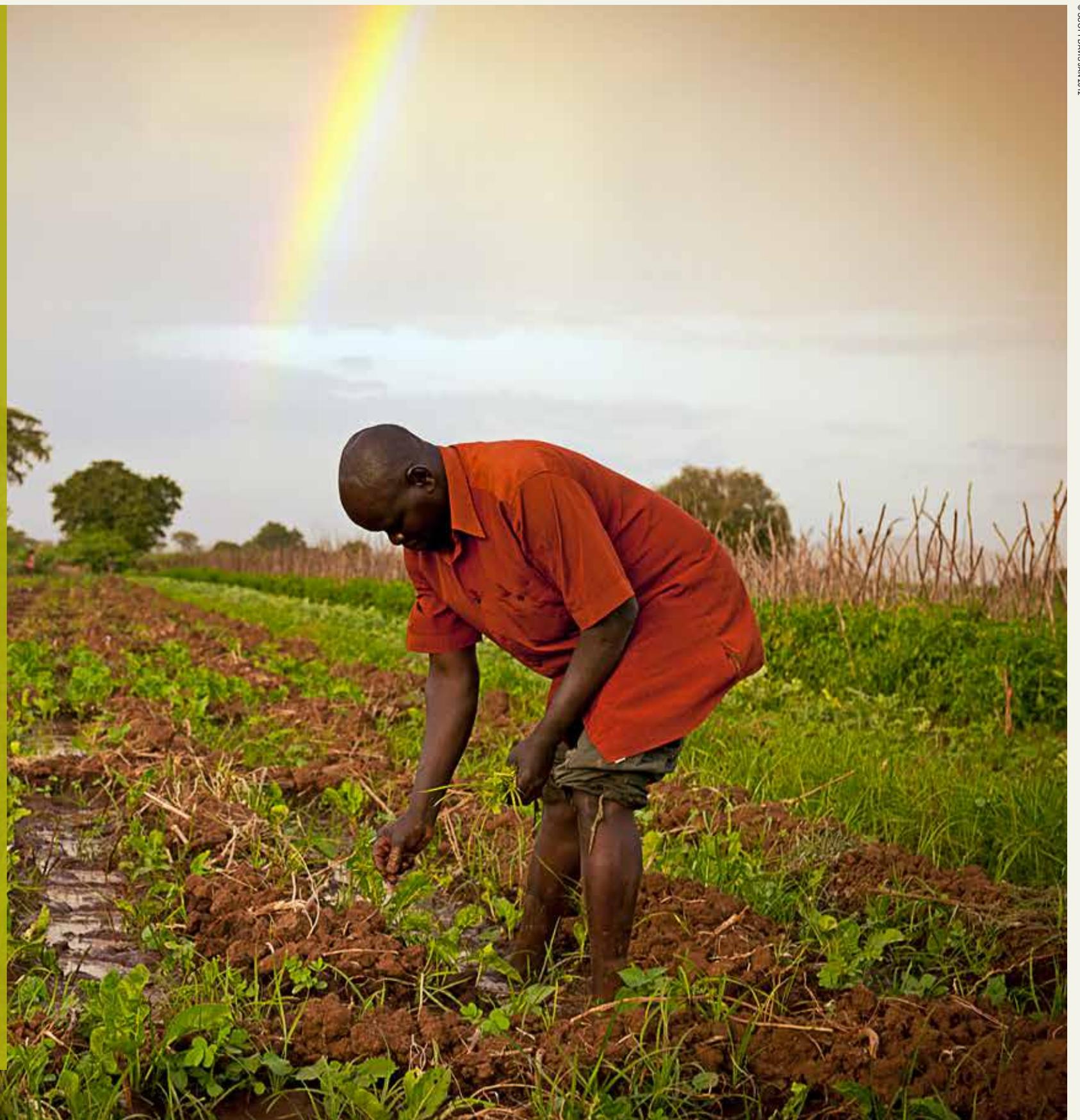
Lake Naivasha is a Ramsar wetland in Kenya. It is also home to a lucrative flower and vegetable export industry in addition to domestically consumed vegetables. Following a long period of growth compounded by a drought in 2009, the region began to experience significant water stress, catalysing action from the private sector and local communities to improve the resource management.

In the early 1980s the first evidence of floriculture began in Naivasha due to the reliable source of water for irrigation and the relative proximity to Nairobi for export. Over time this industry has grown in the region, making it home to one of the largest cut-flower producing areas in the world. The economic growth in floriculture has drawn people from around the region in search of employment. In addition, the lake is home to a significant number of small holder vegetable farmers who supply the local area and markets in Nairobi for domestic consumption.

The significant growth in population (64%) in addition to horticulture development in the past 30 years has put pressure on the catchment water resources. This is of particular importance not only because of the environmentally important Ramsar wetland status recognised in 1999, but also because of the importance of the horticulture sector to Kenya's export earnings and vegetable production for domestic consumption – this area represents 80% of Kenya's flower exports.

Prior to the drought in 2009, there had been a number of private and civil society initiatives to improve water resources management in the region. Although aligned, these activities were not coordinated, and therefore did not derive the maximum benefit possible. During the drought, lake levels dropped to a record-low (since 1941). The reduced rainfall was compounded by the high water demands due to the burgeoning population and rapid economic growth witnessed by the region. Through facilitation by WWF and others, export and local growers began to work together, recognising the shared risks that they faced with regard to water supply from the lake.

This was a catalyst to forming solutions that brought the private and civil sectors together with government. Different stakeholders were urged to communicate their risks, enabling a common, shared vision of the challenge facing Lake Naivasha. The importance of the export flowers and vegetables to Kenya's foreign exchange and the importance of the local growers for food security heightened government awareness of the issue at hand. The Prime Minister's office started the Imarisha Naivasha Initiative, which gave support to the stakeholders already engaging in the catchment through devolution of water management authority under the Water Act and the opportunity for downstream commercial farmers to support actions by smallholder farmers in the upper catchment. Imarisha Naivasha is formulating a five-year Sustainable Development Action Plan (SDAP) that will initiate the reversal of the negative influences that have contributed to the current state of affairs in the basin, recognising the importance of sustainable water management to the economy.



3.5. All in together

Starting Point: Donor enabled local development

This scenario is most likely to begin in situations with weak central government capacity and local agricultural resources productivity that can catalyse small-holder farming initiatives.

Areas that are rich in rainfall and agricultural resources, such as savannahs and lakes, have tended to attract people and support increasingly dense rural African communities. Limited mineral resources, densely populated lands and communal tenure systems tend to reduce these areas' attractiveness for large multi-nationals. However, another development pathway may be initiated around local cooperation to develop agrarian livelihoods and potentially supply to domestic markets.

These local initiatives may be organically initiated by local cooperative development through community based organisations or regional government, but are also often catalysed by donor development programmes. They tend to be based on localised water and/or energy infrastructure development, to support expansion and productivity of rainfed farming supplemented by irrigation to improve livelihoods and household water, food and energy security. Cereal crops necessary for food security such as rice, cassava, maize and wheat, as well as locally consumed vegetables and fruit, are more likely to be grown over crops for export such as sugar, citrus or deciduous fruit. However, crop selection to suit local tastes is critical, as some more traditional staples have different resource requirements in terms of growing periods, water needs, fertilizer use and labour requirements relative to export cash crops and even "exotic" crops such as wheat and rice. They therefore have differing resilience to climate change and impacts on local ecosystems, noting that these initiatives depend upon concurrent use of local ecosystems resources to supplement livelihoods. As an example, livestock rearing tends to be through indigenous breeds that are well adapted to ranging in local conditions, but with their ecological impacts depending upon stock density relative to carrying capacity.

The challenge is that the natural conditions that support humans and agriculture typically also create rich ecosystems, so these are often critical ecological frontiers. The uncoordinated nature of these initiatives is potentially its greatest ecological threat, namely that local organic decision making, while relatively small at an individual scale, can cumulate to have profound impacts on land and water based ecosystems when repeated. On the one hand this may be through the direct use of sensitive land and water resources for expansion, but on the other hand may be due to inadequate holistic intervention – for example crop lands may be dealt with in the project while household energy is ignored, so fuel wood collection intensifies. Where initiatives tap into local knowledge, the understanding of human-ecological inter-dependency can guide the process to avoid the worst local impacts, even without complex environmental assessments.

Where conservation and eco-tourism areas are proclaimed to protect these ecological frontiers, the community demands for access to natural resources can create tension, particularly where there are limited opportunities outside the conservation area. Community-based management initiatives to build local livelihoods together with an interest in the employment, channelling of financial benefits or development of economic opportunities from conservation and tourism help defuse this tension and enable sustained conservation of these refugia for critical ecosystems.



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**DENSELY POPULATED
AREAS WITH
RENEWABLE
RESOURCES
DEVELOP LOCAL
OPPORTUNITIES
THROUGH
PARTICIPATORY
DECISION MAKING
AND LOCAL SCHEMES
BY LOCAL ACTORS...**

Difficulties catalysing scale

The localised nature of these initiatives, which is initially its strength, is potentially its greatest longer-term weakness, namely they tend to have limited access to managerial, financial and technical resources that enable organic scaling, transferability and consolidation. In the worst cases, the sustainability of the initiative is jeopardised, either because it becomes too dependent upon external financial or technological support or because the local natural resources and ecosystems are too stressed by the cumulative local activities. In the medium-term increasing climate variability increases the vulnerability of small local infrastructure in the context of limited central support, because increasingly frequent floods, droughts and fires devastate the limited local resources of communities and the surrounding ecosystems upon which they depend. The critical issue is that these communities can withstand occasional extreme events, but as their frequency increases there is inadequate time for people or nature to build resilience for the next event.

At the same time, these rural communities tend to have some of the highest population growth rates on the continent. The perceived relative resources richness also attracts people from other conflict and more ecologically stressed areas, particularly as these local initiatives begin to gain traction and climate change devastates more marginal areas. Rapidly increasing population results in the encroachment onto marginal land with lower carrying capacity as well as the consolidation rural peri-urban communities. Local initiatives are seldom capable of ensuring adequate services for these people so the dependence and resulting cumulative impact on local ecosystems is inexorably intensified, with little capacity to manage these dynamics effectively or coherently. These challenges contribute to the movement of young people and men to larger centres looking for job opportunities, thereby leaving the women, elderly and children to manage the local initiatives.

Over time, the carrying capacity of the local natural resource base and ecosystem is exceeded and the impacts (externalities) from other neighbouring areas that are also densifying results in declining productivity of natural and agricultural systems, such as crop cultivation, livestock rearing, fishing and wood collection. The lack of regional planning frameworks and service provision poses the greatest threat to the underlying ecosystem resources in these densifying areas, and therefore the sustainability of the economic and social structures upon which people depend.

The Innovative approaches support local integration

Where the risks of decentralised small-scale farming within the context of population density is recognised early enough, innovative approaches can be developed to overcome the planning fragmentation and limited access to resources. Local institutional strengthening of farmer associations, community based organisations, water user associations and local government provides a platform to local spatial and strategic planning, particularly when supported by empowerment of key participants such as women. When these groups have the appropriate access to technology and information, they become a critical mechanism for managing the development of the area, the allocation of resources, development of infrastructure and the maintenance of services.

The decentralised nature of the water and energy infrastructure for production and household use lends itself to low carbon alternatives, such as micro-hydro, solar and wind. The fundamentally inclusive nature of this development trajectory provides associated opportunities to leverage “green growth” funding and support, which may also provide a link between the agricultural opportunities and local conservation initiatives. However, this requires appropriate mechanisms to facilitate the planning, financing and technological support for green opportunities, given that the amounts of finance are relatively small and not attractive to financial institutions.

The number of potential projects across these areas provides scale which development agencies and development financial institutions may support by providing financing facilities. While these may be leveraging other more conventional financing sources by innovative guarantee or financing mechanisms, it should be noted that this has significant challenges in practice and is an area requiring particular attention. It is critical that these facilities also adopt appropriate environmental safeguards to restrict ecological degradation, while not being so onerous that they become ineffective. This implies that support to early project identification and preparation with local stakeholders must be a fundamental aspect of these mechanisms.

The ability of these communities to leverage their access to the local resources endowment for their own development will increasingly depend upon their ability to trade with domestic, regional and even global markets, as well as to diversify into value added agro-processing. Again technical and financial support is required through government, donor or commercial private sector initiatives to support diversification and access to these markets. Partnerships with domestic or international food and beverage companies provides an important means of upscaling production, particularly where these companies have limited access to private agricultural land for their supply chains. In all of these, careful assessment and management of the impacts on local ecosystems becomes critical to the sustained use of the natural resources, as well as resilience against an increasingly challenging climate.

Urbanisation will be a characteristic of Africa during the 21st century, but there are opportunities to densify and develop sustainable rural towns and secondary cities supported and driven by strengthening rural agricultural economies, rather than centring on a few large mega-cities. These are only viable with the diversification and market access described above, but have the risk of concentrated ecological impacts if not adequately served. Where the local economy has adequate resources to enable the urban infrastructure development required for households, as well as business, this is achievable, or will require central government (or donor) support. The ideal outcome for this trajectory is an overarching policy regime driven by democratic local government and empowered communities, supported by local business linked with large multinational company supply chains.



**URBANISATION
WILL BE A
CHARACTERISTIC OF
AFRICA DURING THE
21ST CENTURY**



**THE GREATEST
THREAT TO THIS
TRAJECTORY IS
THE FAILURE OF
THE LOCAL SOCIAL
COHESION**

Things fall apart

The greatest threat to this trajectory is the failure of the local social cohesion upon which the development depends, which would be strongly influenced by deteriorating ecosystems productivity and resilience for the reasons highlighted above. In this case, development stagnates and there is out-migration to peri-urban settlements in large cities, with the consequent social, economic and environmental impacts in these areas. Unfortunately this leaves the most vulnerable people in the rural areas, who are increasingly dependent upon the degraded ecosystems and natural resources that caused the problems. A downward spiral of poverty and deteriorating ecosystems is then created, including greater pressure on neighbouring conservation areas in which the ecosystems are still functioning. This can only be halted by injections of resources from the national economy or international donors. Therefore, instead of being “lighthouses” around which rural development can be sustained, they become economic sinks and cause accelerated migration to the few urban centres.

Take home synopsis

- The richness of natural resources provides the opportunity to develop community based small-scale agriculture for the local people, but poses a financial and technological resources challenge in scaling and diversifying these opportunities to support on-going development that supports stable rural economies and associated secondary cities and towns.
- Creating local information and planning systems (supported by innovative technologies) to allow efficient and effective decentralised management of human settlement and agricultural impacts on ecosystems, maintains the natural resilience against a variable and changing climate.
- Strengthening local institutions and empowering local stakeholders is critical to enabling them to take control of the development and allocation of resources in an equitable, efficient and sustainable manner, including the interactions with and benefits from local conservation areas.
- Creating investment mechanisms that provide financial and technical support for small decentralised (potentially green) schemes and their linkage to markets is critical to enable these initiatives to flourish, but with appropriate planning safeguards that consider project and cumulative impacts.

AGRICULTURAL DEVELOPMENT IN SAGCOT CORRIDOR, TANZANIA

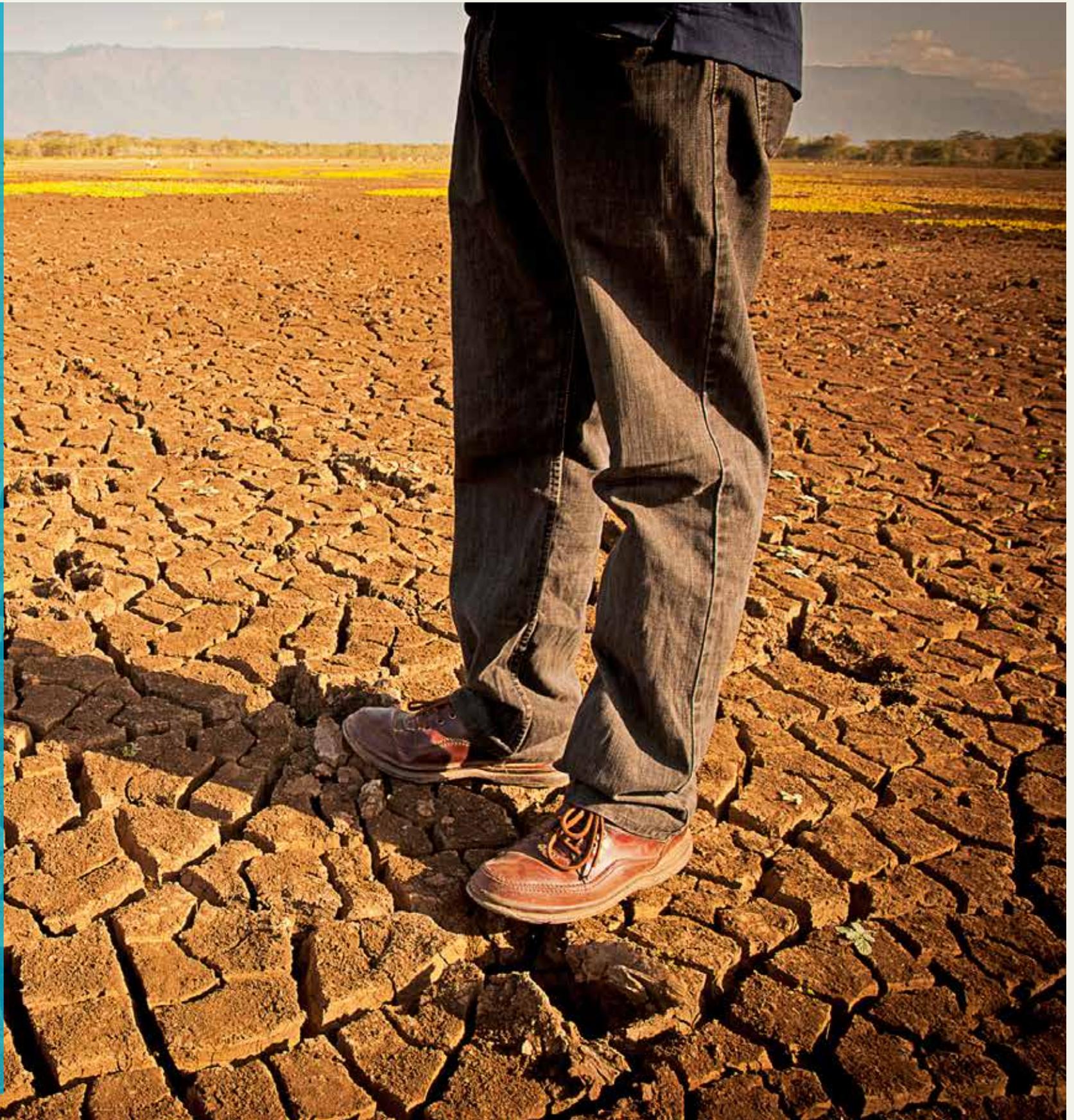
Launched in 2010 the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) initiative focuses on improving the agricultural productivity of Tanzania's Southern Highlands. The initiative seeks to; attract investment, increase production, deliver employment, benefit small-scale farmers, and establish southern Tanzania as a regional food exporter. Activity focuses on, but is not restricted to, the Rufiji Basin in Tanzania.

The Rufiji Basin is of strategic importance to the Tanzanian economy. As well as being home to over 1.7m people who are largely dependent upon agriculture for their livelihoods, its agricultural productivity is high and it makes a major contribution to national GDP and export earnings. Agriculture has historically been based on smallholder farmers and pastoralists, with some largely domestic commercial agriculture.

Since 2010 the Rufiji has also been at the heart of the SAGCOT initiative, which has received sustained presidential and broad political support. The program seeks to triple the area's agricultural output and build effective networks of agricultural production that link small-holders and out-growers with larger international conglomerate's, bring with them US \$1.2 billion of investment and 420,000 new jobs. International agri-business is increasing its attention in the area, often based on outgrower schemes in partnership with local communities. For example, Illovo Sugar plans to expand production in the area through massive investment in smallholder outgrowers on communal land, supported by local partnership arrangements.

However Rufiji is also a water stressed basin. Increasing agricultural production has led to net in-migration and a pronounced expansion in total population putting pressure on community services and encroaching on sensitive ecosystems. At the same time, Rufiji is home to 80% of Tanzania's national hydropower production (the dominant source of power in the country), as well as four national parks and specific biodiversity in the Ruaha and surrounding wetlands. Both hydropower and national parks have specific water demands, which create tensions with upstream community and agricultural requirements.

Increasingly Tanzania is being forced to recognise the trade-offs in the use of its finite water, land and ecosystem resources. These challenges could increase given projected climatic changes, which will increase the volatility in annual receipt and timing of rainfall across the country and within the Basin. Various initiatives by international development agencies (including IUCN) are attempting to assess the underlying ecosystem resources and guide development that balances development imperatives with sustainability requirements. Other development partners and financial institutions are exploring innovative financing facilities to catalyse climate resilient infrastructure development in the region, supported by institutional strengthening of local actors.



3.6. Good neighbours

This scenario is most likely to begin in situations with strong transboundary and national government capacity and agricultural and energy resources with distinct production comparative advantage between neighbouring countries.

Starting Point: Infrastructure for Africa

As neighbouring countries develop and regional economic communities strengthen, there is a strong political and economic imperative for African-based development to increase intra-regional trade. Emerging economies with centralised financial and technical capacity begin to take a coherent domestic view with regards to their production and consumption, considering issues of comparative advantage, national security and infrastructure investment. Economic activity and development tends to be initially based on agricultural production and coordinated trade of primary resources. Increased intra-African trade requires the development of effective transport corridors including road, rail and pipelines to service the movement of food, energy, water and manufactured products.

Larger scale infrastructure development poses a significant threat to sensitive ecosystems if not planned with social, economic and environmental sustainability in mind. The extent of infrastructure investments, and the concentration of the impact, particularly through the secondary impacts or ribbon development can be particularly damaging to the environment. Ribbon development takes place following the investment of infrastructure into an area, making it more accessible. The economy provided through the initial infrastructure investment results in a migration of people to the area in search of opportunities. Without adequate planning and further investments, this migration of activity may have negative consequences for the region, particularly environmentally.

An uneven playing field

It is expected that neighbouring countries will continue to grow their internal production and consumption patterns at different rates. One country may focus on developing significant electricity production, while a neighbouring country continues to focus on agriculture instead. Uncoordinated and large-scale development across a number of countries will result in significant cumulative ecological impacts. Countries that develop rapidly may also face resource constraints and limitations to further growth. Without coordinated development there will be a lack of efficiency as countries miss the opportunities to harness regional resource endowment at a larger scale. For instance energy production at a regional scale may be more resilient when incorporating hydropower, coal and/or nuclear sources together.

The different rates of development may also become a source of tension as unplanned large scale investment in one region may foreclose potential development options in another region or country. Larger scale regional development will help improve the comparative advantage of particular countries in addition to helping countries develop beyond purely their internal resources.

An internally focussed domestic demand trajectory will ensure that the provision of services for social use and benefit are more likely to be met. This further stimulates demand for African products and services within Africa.



**AFRICAN CENTRED
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ADVANTAGE AND
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CENTRALISED JOINT
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AND ASSOCIATED
ECONOMIC
INFRASTRUCTURE ...**

However, a balance needs to be maintained between investment in development for social benefit and economic infrastructure for commercial purposes, given limited availability of financial resources with countries at early stages of development.

Developing large regional infrastructure networks, whether transport, energy, water or food will require significant capital. The internal focus within Africa will mean that there may be a greater dependency on African capital formation. This places particular attention on the need for domestic and continental economic, social and environmental safeguards and conditions related to investment. Initially, African countries will be unable to fund such initiatives alone. Funding bodies, institutions or countries outside of Africa have highly divergent financing conditions, ranging from stringent safeguards through to relatively lax requirements. This inconsistency in financing requirements may pose ecological challenges, particularly where there is limited domestic or regional regulatory requirement for considering the impacts of these large developments on sensitive ecological frontiers.

African resources for Africans

In recognition of the comparative advantage, resource efficiency and increased development potential, an increase in regional power pools, joint water infrastructure and agricultural trade zones are the likely longer term outcomes of this future. Joint Integrated Development Zones (IDZs) may be developed as countries increasingly begin to take a regional perspective to development, the ecological impact of which will be governed by the effectiveness of spatial environmental planning and investment safeguards.

As the manufacturing and service economies grow on the continent, the dependence of local communities on local and primary resources will diminish. Household impacts on local resources are reduced as a result, particularly as household services are centrally provided. Instead, environmental impacts are concentrated in generation and distribution areas such as manufacturing or industry. The larger and more concentrated scale of environmental impacts may be managed as long as appropriate ecosystem protection and conservation is incorporated into the development and operations of these infrastructure systems.

The Africa focus of this trajectory may provide some immunisation of trade in products from global carbon limitations and taxes that are likely to be implemented in the longer term. However, global export trade is likely to be affected, obviously depending upon the carbon intensity of the energy sector and the African negotiations. The global trade difficulties will further support the transition internally to manufacturing and service economies as domestic demand continues to grow. This may result in the adoption of large renewable energy investments. These will become increasingly popular once on-grid challenges have been overcome. Climate change resilience of large-scale investments is a particular challenge that needs to be dealt with, since the entire region of interest is likely to be at risk.

The ability to plan and execute large-scale infrastructure investments across a region will result in strong economic communities with trade corridors and production according to their relative comparative advantage. Resource use, if planned in a sustainable manner will be most efficient when taking into account neighbouring countries and their endowment of resources too.



Failed promises and white elephants

Centralised and planned development at a national level will require increased implementation of policies and legislation. At a regional level, centralised planning will need to balance the strong sovereignty concerns many countries have within Africa. Currently it is not palatable for many countries to forgo some of their sovereignty as many countries are on different development trajectories with distinct social or economic goals.

Large infrastructure investments are also vulnerable to climate change due to the large proportion of people or industries dependent on a single piece of infrastructure. The threshold of resilience to climate change may be higher than smaller localised investments, however, when breached, the effects are wider reaching (e.g. a large dam providing water to many people vs. smaller localised dams). This may result in the risk of stranded assets, if not resilient to variability of future climate scenarios. The same is also true of political instability, where a number of countries may be dependent on a single generation point within the unstable country.

In light of the vulnerability of regionally-focused infrastructure, it is important that strategic spatial infrastructure planning is carried out. This needs to be carried out nationally, but enabled at a Regional Economic Community (REC) level. The plans need to be underpinned through data and information to ensure uncertainties are reduced. Investment safeguards are critical, and need not only be required by large multi-national funding agencies.

From an ecological perspective, this scenario is dependent on the ability of centralised regional planning processes to consider and act upon strategic spatial investment and management of the development pathway. Plans may be in place, and intent may be correct, but without implementation and enforcement, this scenario has potentially drastic impacts. A lack of cooperation between regions or countries will be detrimental.

Large scale infrastructure corridors not only introduce damage through construction, but they also provide easier access for more extractive and damaging activities to take place. These range from increased deforestation for energy to cook or increased marginal lands to support subsistence livelihoods. These are particularly the risks if centralised planning is unable to adequately deliver services to communities in the region of large infrastructure investments. If services are managed appropriately, ecosystems are at risk from the high rate of urbanisation that will likely take place. This risk can be mitigated if areas are set aside that conserve and protect the ecological resources of the area.



Take home synopsis

- Large scale infrastructure investments without coordination between investments pose a real risk to the environment through direct development impacts on sensitive ecosystems or through corridor access and development near previously inaccessible or sparsely populated areas.
- Capacitated and centralized regional strategic spatial planning and implementation through appropriate routing and siting of investment is the cornerstone of this scenario, based on sound ecological information and appropriate tools for assessing spatial impacts of development on sensitive ecosystems.
- Enforcement of infrastructure investment safeguards linked to the spatial planning frameworks is critical in ensuring that the long term impacts on ecosystems are considered, in the context of regional growth opportunities, and that these are robust to climate change challenges.
- Joint regional infrastructure development, building on public sector-anchored investment and transboundary cooperation aligned to national priorities, enables comparative advantage and resource efficiency between countries for maximum economic growth, environmental protection and social development.

3.7. Observations on the Scenarios

While the situations and drivers underlying these scenarios are quite distinct, it is compelling that each scenario identifies similar response themes, albeit with different focus and scale. These include the need for:

- information and understanding of the spatial and cumulative impacts of development on sensitive ecosystems and its inclusion in spatial planning and project development;
- effective and implementable investment safeguards required by regulators and financial institutions, from large regional corridor projects down to small-scale local initiatives; and
- appropriate partnerships and the strengthening of relevant institutions at different levels to articulate the need for and adopt decisions around sustainable development, linked to the natural ecological resources upon which it depends and impacts.

These themes are the cornerstone of the opportunities to create resilient African ecological futures outlined in the next chapter.

CHAPTER 4. OPPORTUNITIES FOR RESILIENT AND SUSTAINABLE AFRICAN DEVELOPMENT

Developing Each of the four scenarios gives rise to different risks and vulnerabilities for the ecosystems and the ecological frontiers within which they occur. However, insight can also be built into the risks that arise across multiple scenarios. We call these critical risks and the report identifies five associated with:

- The expansion of agricultural land development into sensitive areas
- The location of large infrastructure in sensitive ecosystems
- Poorly designed and operated extractives sector operations with weak management at closure
- The overuse and misuse of ecosystems goods and services
- The encroachment of human settlement and urbanisation in areas of ecosystem sensitivity

The scenarios also highlight appropriate and specific response options that play a central role in managing ecological impacts and/or propel Africa onto a more desirable trajectory. These have been grouped into five broad elements:

- Strategic Planning Capabilities that enable effective and judicious use of finite ecological resources
- Investment Safeguards and Frameworks that limit and change the nature of investment in ecologically damaging projects
- New Partnership Models that promote management of ecologically sensitive assets through collective action and reconfigure the relationship between the state, business and civil society.
- Clear Institutional Mandates that support coherent management of natural resources



Developing scenarios provides a tool to explore potential impacts in an uncertain world. However, while a useful conceptual approach to provide insight and provoke debate, developing scenarios is not enough. In order to understand how to influence the direction of the future, we must first identify responses that – if pursued – would have a material impact on shaping a sustainable and inclusive future for Africa.

4.1. Critical Ecological Risks of Africa's Development Future

Each of the four scenarios gives rise to different risks and vulnerabilities for the ecosystems and the ecological frontiers within which they occur. Synthesising the key observations associated with these vulnerabilities results in a clustering of the following fundamental risk areas:

Agricultural land development into sensitive areas

Extensive land use change from natural conditions to agricultural crop cultivation is likely to affect swaths of savannah, woodlands and forests. If this change is unplanned and uncoordinated, it could affect the most sensitive ecosystems in terms of human use and biodiversity degradation. Moreover, this change threatens the most marginal land, causing soil and water resources deterioration. In addition to the biodiversity losses, declining productivity and reduced climate resilience are direct consequences in the long-term. Improved management practices and innovative technology can influence productivity thereby reducing the total amount of land required to cultivate crops.

Large commercial farming or state irrigation schemes pose a threat due to the scale at which they tend to be implemented, while small-scale farming encroaches more gradually with significant cumulative impacts. Both carry ecological risks associated with expansion and intensification, the management of which requires proactive, coherent and coordinated planning.

Location of large infrastructure through sensitive ecosystems

The development of transport, energy and water infrastructure to support economic development and human settlements has direct impacts on the environments within which the infrastructure is located. Poorly planned, designed and operated infrastructure changes the immediately adjacent ecosystems and can disrupt connectivity between linked ecosystems. If managed properly, these corridors could provide local communities with livelihood opportunities and protect ecosystems through planned development pathways.

Transport corridors, large dams and electricity generation are likely to be an important part of Africa's development, but also depending upon the way they are constructed and operated probably represent the greatest infrastructure threats to Africa's ecosystems. They may also be the most likely stranded assets, depending upon global political-economic and physical-climatic shifts. This is most relevant to the two scenarios reflecting centralised decision making.

Poorly designed and operated extractives operations with insufficient management at the point of closure

The lifecycle of the non-renewable mining, oil and gas developments pose particular challenges to ecosystem integrity, as long-term legacy impacts (costs) may remain after closure when no further economic benefit is generated. The nature of these impacts relates to the nature of the product, the operational and closure practices, and the sensitivity of the environment within which it is located. While this is understood, inadequate regulatory safeguards and fluctuating global resource prices may incentivise companies to ignore good design, operational and closure practice.

Both the extraction site (facility) and the transport road, rail or pipeline pose threats to the ecosystems and communities that they pass through, together with the livelihoods challenge for people remaining after closure, particularly where diversification has not been successful. This is most relevant to the two globally focused resource export scenarios that are strongly built around extractives.

Overuse and misuse of ecosystems goods and services

Excessive use of terrestrial and aquatic ecosystems for water, energy and food beyond their renewable carrying capacity, degrades these systems long-term ability to sustain ecosystems goods and services. This use may be for productive activities (such as monoculture farming), supply chains (such as water abstraction) or livelihoods use by local communities (such as fuel wood harvesting). This deterioration of the land and water ecosystems reduces resilience to climate variability associated with flood attenuation, flow availability and waste assimilation, and the possibility for sustained and diversified agricultural productivity.

While the impacts of productive activities and supporting infrastructure are relatively clear, they are often compounded by the impacts of densifying human settlements and in-migration in which people do not have access to adequate municipal services. The continued overuse of resources is enabled by large infrastructure, extensive development and corridor settlement in the centralised decision scenarios and may also take place in the more decentralised organic scenarios.

Human settlement and urbanisation

The final risk area that emerged through the scenario development relates to the nature and evolution of human settlements during these development trajectories and their linkage to surrounding ecosystems. Urbanisation is an accepted trend that Africa will undergo over the next few decades. However, there is uncertainty about whether urbanisation will primarily be centralised in the large capital cities or decentralised and built around rural economies. For the latter to occur, these rural economies must be embedded in agricultural development and thus typically require functioning ecosystems. Without this development, the long-term prognosis is for rural settlements to be decreasingly unproductive economic sinks with migration of the working age population to large cities.

The critical factors in assessing the impact of human settlements on ecosystems relate to access to municipal services, such as water, energy and waste removal, as well as access to affordable food with adequate employment opportunities. These factors jointly influence the behaviour of the urban inhabitants. In some cases, urban encroachment into surrounding ecosystems may occur, but this encroachment traditionally occurs in already transformed agricultural land. This risk around human settlement and urbanisation crosses all four scenarios.

| Key Ecological Risk | Going Global | Helping Hands | All in Together | Good Neighbours |
|---|--------------|---------------|-----------------|-----------------|
| Agricultural land development into sensitive areas | ** | ** | *** | *** |
| Location of large infrastructure through sensitive ecosystems | *** | * | * | *** |
| Poorly designed, operated and closed extractives | *** | *** | * | * |
| Overuse of ecosystem goods and services | *** | *** | ** | ** |
| Human settlement and urbanisation | * | ** | *** | ** |

4.2. Response Opportunities

The scenarios have highlighted appropriate and specific response options that play a central role in managing ecological impacts and/or propel Africa onto a more desirable trajectory. These have been grouped into five broad elements, each of which is expanded upon below.

a) Strategic Planning Capabilities

Strategic planning can enable more effective and judicious use of finite ecological resources, including ecological resources. By understanding ecological sensitivity, especially the spatial nature of this, and the activities that erode ecological assets, the continent can work towards establishing a framework for interrogating values that strengthen traditional economic, industrial and spatial planning processes.

Central to the development of appropriate strategic planning is an ability to ensure that decision makers develop and deploy appropriate frameworks based on credible information for assessing ecological impacts. Policy makers will also need to adopt a long-term outlook to ensure planning considers sector dynamics, ecological impacts and climatic change. This will help ensure that ‘no-regrets’ measures – ones that are attractive under multiple development trajectories - are selected.

Strategic planning is a core management response under multiple scenarios and at multiple scales. At the regional and national level, industrial and economic spatial planning plays a central role and sets the context in which integrated land-use and infrastructure planning programs can be developed.

b) Investment Safeguards and Frameworks

Establishing appropriate investment safeguards can limit and change the nature of investment in ecologically damaging projects. Clear regulations can provide legislative recourse and create a disincentive for those transgressing codes of practice. The adoption of voluntary codes and principles (such as the Equator Principles) by major lending institutions can help establish clear guidelines for assessing and evaluating the ecological impacts of investments. These regulations can drive increased transparency, while reducing the capital available for those who do not meet performance criteria.

Simultaneously, establishing an appropriate enabling environment for investment, one that provides transparency, longevity and certainty can encourage investment in ecologically sensitive goods and services. In order to develop an ecologically conscious investment climate, clear national regulatory safeguards and protocols are needed. These regulations should set expectations for the impact of Foreign Direct Investment and Overseas Development Assistance. Such frameworks should also provide clear and enforceable standards for non-traditional and emerging market investors operating in Africa.

In order to encourage the financial sector to evaluate and prioritise ecologically sound investments, simultaneous efforts will be required to establish enabling frameworks and tools. These frameworks will allow ecological concerns to be integrated in traditional financial risk assessments. By developing valuation methodologies that allow investors to respond to clear market signals, the value creation opportunities inherent in preserving and creating ecological and natural capital will emerge.

c) New Partnership Models

The management of ecologically sensitive areas and assets in Africa is often a problem of collective action. Safeguarding Africa’s ecological future will require new models of partnership to emerge, which reconfigure the relationship between the state, business and civil society.

These partnerships may focus on reforming or creating new institutional structures. For instance the creation of Water User Associations across Africa, which engage civil society and local communities in the management of their own water resources provides an example of how institutional structures are being recast. At an international level the creation of new Basin, Catchment or Lake Management Authorities show how new structures are emerging to tackle trans-boundary natural resource issues.

New opportunities for public-private partnership are also emerging and are likely to play an increasing role under multiple ecological scenarios. Across Africa there are examples of how protected ecological zones can be established in a way that simultaneously provides opportunities to create jobs and attract investment for eco-tourism. Domestic and international businesses are already increasingly aware of their responsibilities and commercial interest in acting as a responsible steward of natural resources and open to finding new models of partnership that can help it respond.

The integrity of these new partnerships will depend on ensuring civil society engagement. New communication platforms increase the imperative and the potential to secure civil society contributions. By ensuring a plurality of groups can contribute to the formulation of development plans and infrastructure priorities the legitimacy of African governments can be enhanced. Greater participation and accountability can provide an important check-and-balance to centralised planning, supporting inclusivity in-design and maximising opportunities to increase the number of beneficiaries. To ensure civil society is involved appropriately it’s necessary to ensure transparency over decision making processes and provide opportunities to engage and influence decision making. Support should also be provided to ensure civil society has the capacity and capability to provide clear input.

d) Clear Institutional Mandates

The coherence and competence of African governance will play a major role in determining how natural resources are managed, regardless of the future scenario Africa encounters. In order to support effective response, governance needs to be built on the foundations of clear institutional mandates. This means clarity at all levels of government - from the regional to the local – on roles and responsibilities. Should a new mining enterprise appear in remote areas in Central Africa, there needs to be a clear framework to notify and engage local communities and allow concerns to be raised and a framework provided for this to be escalated. Where communities are excluded conflict and violence may potentially ensue. In certain situations appropriate governance can also mean devolving management responsibility from central line ministries to local and district level authorities.

In designing the ‘rules of the game’ for natural resource management, appropriate regulatory requirements need to be introduced to ensure that there is clarity for investors, businesses, and local communities to operate within. It also means that access to natural resources, and the terms through which businesses acquire rights, needs to be carefully managed. Extractive mineral activity is likely to continue, if not accelerate, across the continent. This expansion requires formal legislative and governance institutions to respond proactively to ensure these resources are developed responsibly, while ecological and social impacts are managed carefully. It also requires careful consideration be given to how profits are retained in-country and how that natural wealth is distributed both in society and across the generations.

e) Support Tools for Ecological Assessment

The ability to articulate the benefits of natural resources and ecosystems is a crucial pre-requisite for effective strategic planning at a regional, national, and local level. Decision makers also need practical tools that help them assess the impacts of developmental choices on the ecological system within which they operate.

Traditional decision support tools, and their practical application, can be argued to be inadequate on a number of levels. Traditional application of cost-benefit analysis (CBA) or cost effectiveness analysis (CEA) may provide inadequate consideration of environmental and ecological benefits because there are innate value-based and political judgments associated with assumptions over their value. Their focus on monetising benefits and calculating total economic value can be argued to be conceptually inadequate because it gives little consideration to the intrinsic value of natural assets. Multi-criteria analysis as well as other approaches such as natural resource accounting have taken steps forward in allowing consideration of qualitative and quantitative data together, and exploring optimal outcomes against a range of desired criteria. However, these too can be critiqued as giving insufficient consideration to ecological issues or failing to support decision making in the face of the significant uncertainty likely to be caused by climate change and ecological change.

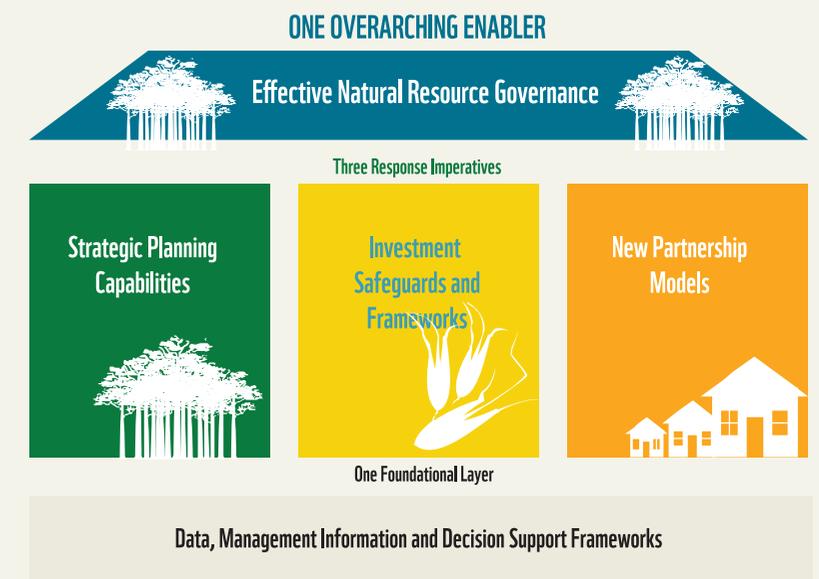
There are other tools available. Some, such as robust decision making approaches can support decision making and evaluation of trade-offs under conditions of significant uncertainty. However these too do not necessarily bring consideration of ecological issues to the forefront of policy, planning and decision making.

Strategic environmental assessments and ecological risks assessments, as well as other participatory approaches provide useful analytical tools. These processes can provide an approach to develop and present scientific information so that it is relevant to decision makers. They can be used to identify vulnerable and valued ecological resources, and link human activities to their impacts on ecosystems. This provides a basis for comparing different management options, supporting decision-makers to make better informed choices. They also acknowledge the need to balance qualitative and quantitative insights and reflect the need to involve multiple stakeholders. However the fragmented way in which these approaches are used means they don't present simple 'off-the-shelf' tools to support decision makers. They can be technically complex and costly.

Further work is needed to consolidate existing approaches and develop commonly accepted decision support tools that are based on ecological considerations. These tools should avoid the pitfalls of attempting to be conceptually perfect but attempt to emulate the kind of useable management heuristics used in other domains.

4.3. A Framework for Thinking about Response Opportunities

The sections above identify that, while each ecological scenario is distinct, there are commonalities in both the risks that will be faced and the response options available. To help stakeholders think through the challenges and response options open to them a simple framework has been developed, based on insights from the scenario process.



The framework identifies five areas that are at the core of a positive response to managing and maintaining ecological assets.

Effective Natural Resource Governance: acts as an overarching enabler by setting the legislation and regulatory rules under which resources are extracted and managed. Effective governance can provide clarity for communities, local government and businesses as to their roles and constraints as well as providing mechanisms to identify and redress negligent activities.

The framework also identified three Response Imperatives:

- **Strategic planning capabilities:** that allow judicious decisions to be made over the development and management of resources and associated infrastructure, while considering ecological impacts
- **Investment safeguards and frameworks:** that provide an enabling environment that encourages sustainable investments to be made while curtailing negligent behaviours
- **New Partnership Models:** that enable government, civil society (including community based organisations) and businesses to collaborate to find solutions to collective action challenges associated with natural resource management

These responses are founded on the development of **clear data, management information and decision support frameworks**. In order to understand ecological vulnerability and make decisions that are sensitive and reflect the value of Africa's ecology, data is needed. Decision makers need to understand where sensitive areas are, how they are threatened by economic activities and have access to suitable frameworks that allow decisions about trade-offs to be made.

This model can be used to help identify – based on the particular scenario being considered – which response option is the priority. The model can also be used as a diagnostic tool, to help stakeholders identify where progress is being made and where there is more to do.⁶⁵

4.4. Principles for Securing a Resilient African Future

Following the framework outlined above, a set of principles have emerged from the scenario analysis that can help decision makers across the continent put ecological considerations at the heart of decision making.

Ensuring infrastructure policy, planning and implementation explicitly recognises the value of ecological assets: The impact of development plans and infrastructure corridors on Africa's ecology is not fully understood. In developing strategies and spatial plans organisations should map and evaluate the ecologically sensitive areas that may be impacted and identify the relative cost-benefits of proposed plans in light of the impact on human, social, financial, manufactured and natural capital. Conducting such analyses would equip decision makers with the information to have an informed debate about trade-offs between developmental objectives and ecological implications.

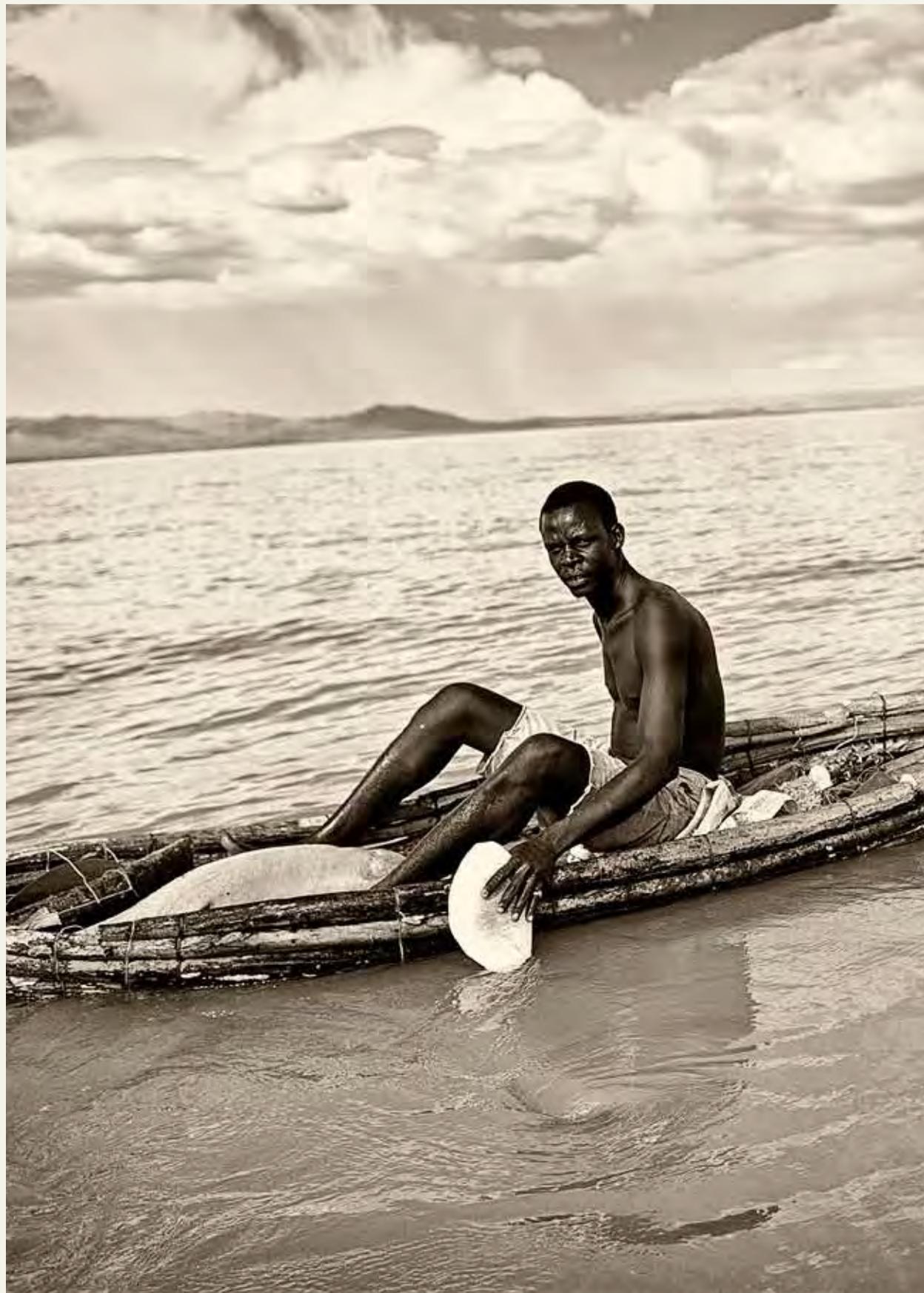
Using regional economic integration to build resilience: opportunities to deliver more effective and sensitive management of shared natural resources through establishing trans-boundary institutions and covenants should be explored. Effective collaboration between neighbours will be essential to preserve ecological systems on which multiple communities and countries depend. Example activities: (1) enhanced support for trans-boundary water management approaches, for example the Lake Victoria Basin Commission (2) enhanced international efforts to understand how fisheries in the Great Lakes region can be managed and resilience to climate change assured. (3) Strategic expansion of energy power pools in areas where a bigger spatial footprint would have a lower ecological impact.

65. The AfDB's Strategy for 2013-2022 focusses on two objectives to improve the quality of Africa's growth: inclusive growth, and the transition to green growth. The Strategy outlines five main channels for the Bank to deliver its work and improve the quality of growth in Africa. They are as follows: infrastructure development, regional economic integration, private sector development, governance and accountability and skills and technology. Lastly, the Bank's strategy places an emphasis on three particular areas: fragile states, agriculture and food security, and gender. For a summary of the Strategy, please visit: http://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/AfDB_Strategy_for_2013_2022_-_At_the_Center_of_Africa's_Transformation_-_Executive_Summary.pdf.

Exploiting the opportunities of the green economy: efforts should be made to exploit development opportunities that represent a simultaneous win for the economy, jobs, inclusivity and the environment. Example activity: support for the development of enterprises that act as effective stewards of ecosystems and provide ecosystem services that can be monetised. For instance the development of schemes that protect and rehabilitate wetlands and provide economic and financial benefits for businesses in the area should be up scaled.

Establish transparent and simple 'rules of the game' to guide investment and encourage development of private sector guidelines on responsible activity: establishing regulatory guidelines for investment that are consistent, transparent and have longevity can help attract capital. Developing shared industry standards for water, energy and ecological impacts can also help businesses show leadership and realise the benefits of productive dialogue with regulators, helping avoid the risk of punitive regulation and with communities.

Example activities: (1) expansion of Sustainable Banking principles being established by the Nigerian Central Bank; (2) wider adoption of the King III Code; (3) wider adoption of the Equator Principles into commercial bank lending; (4) further adoption of corporate standards for water management, stewardship and ecological impact.



5. CONCLUSION

5.1. Recommendations for Key Decision Makers

The previous chapter highlighted the key threats, opportunities and responses to Africa's development futures and their consequences and dependencies on the ecological resources of the continent.

The following series of recommendations are intended to guide the following institutions and role-players in their efforts to build a more sustainable and inclusive Africa.

Governments have a central role to play in establishing the legislative and regulatory framework in which other actors operate and ensure an appropriate enabling environment for investment. Governments should ensure that institutions are empowered to oversee natural resource management and have sufficient mandate, incentives and capacity to do so. Government should also, where appropriate, provide resources to ensure there is institutional capability and act as a catalyst to promote active engagement in decentralised partnerships, linked to strategic planning and monitoring capacity. Government can also play a direct role in helping to fund and support the generation and dissemination of ecological information to support effective spatial planning.

Regional Economic Communities and Continental Bodies have a central role to play in ensuring that spatial planning and corridor development is robust and considers ecological impacts. They should also support the development of appropriate investment protocols and safeguards and work to support greater alignment between different national resources policies and regulatory controls.

Transboundary entities have an increasingly prominent role to play in managing natural resources and need to ensure they are able to facilitate cooperation among government, business and civil society actors. In many instances, transboundary entities also need to increase their managerial capability to ensure they can engage in effective spatial planning and define realistic investment plans.

Financial institutions, both African and international, have a major role to play in the economic development of the continent, although their investment approaches may be very different. Private investors need to strengthen their investment safeguards and consider opportunities to adopt voluntary principles to protect them from exposure to ecologically negligent projects and businesses. Financial institutions need to develop new tools to evaluate ecological risks and provide them with new investment mechanisms. These mechanisms can unlock investment for small and distributed infrastructure by allowing investors to aggregate projects.

Companies and corporations, should recognise their role as stewards of natural resources and take steps to minimise the impact of both their direct operations and broader ecological footprint. Internalising the concept of shared value and recognising the negative impacts of negligent ecological behaviour on shareholder value can help move companies towards more enlightened business practices. To inform effective action new approaches to estimating ecological impact and supporting effective management decisions will be needed. Companies will also need to develop new skills and capabilities to engage as partners in collective action with communities, government and sector peers.

Development agencies still play an important role in supporting national development priorities. Both multi-lateral and bi-lateral support should continue to focus on strengthening institutions to provide African nations with the capacity to shape their own responses. Farsighted investment in developing the approaches, tools and systems to generate insight into ecological sensitivity is important and can play a major role in focussing infrastructure development plans. Development agencies can also play a catalytic role in supporting the development of innovative local partnerships and approaches to ecological management.

Environmental Non-Governmental Organisations play a vital role in providing consistent and vocal advocacy that establishes the value of protecting and managing ecology in Africa. This advocacy role can be extended to the provision of targeted information and the convening of key decision makers to ensure planning processes consider environmental and ecological sensitivity.

Community Based Organisations are the vehicles for collective community action and articulation of their interests, and as such are critical for enabling local stewardship of ecological resources by the people who most directly depend upon them. Strengthening these bodies to consider strategic issues and engage effectively with other role-players around sustainability provides an important building-block for local resilience. They have an equally critical responsibility to inform and guide local households around adaptive and sustainable practices.

5.2. A Call to Action

While the preceding individual institutional action is important, collaboration between different institutions is needed to promote robust decision-making that ensures resilient development under any scenario. This is particularly important for the continent's ecological frontiers that are under greatest threat of being impacted over the next decade. To achieve this, broader acknowledgement of their importance is necessary, as is agreement about their location and sensitivity.

Robust and effective decisions need clear and relevant information, as well as the ability to analyse and synthesise this information to support management decision making. Urgent intervention is necessary in the following areas:

- Improved access to continental ecological information in the appropriate format that can support robust decision making, with an emphasis on the ecological frontiers – relating both to ecosystem sensitivity and development pressures.
- Appropriate technical capacity (and tools) to analyse and interpret this ecological information in conjunction with social and economic information to enable robust decision making – both for strategic spatial planning and individual project evaluation.
- Relevant policies that create the requirement for these types of analysis and information to be undertaken and used in decision making – whether through land use planning, river basin management, infrastructure investment frameworks or financial safeguards

Ideally the mandate to drive these actions should be with appropriate Africa institution leading on Africa's development (such as NEPAD, AU or AfDB), supported by a coalition of continental and regional development institutions. An important step forward would be an evaluation of progress and gaps across the continent, together with business cases for the suitability of key implementing partners to provide technical capacity to support these interventions. There is a clear vision for a sustainable African future to underpin this intent, which may be refined by experience through implementation over the next decade.

To be effective, these interventions must firstly take place at a country level, thereby enabling either local attention or regional cooperation. An important mechanism to strengthen these processes is likely to emerge from the Post-2015 Sustainable Development Goal (SDG) process, in which countries are expected to develop their own sustainable development indicators. Associated planning and monitoring of resilient development around ecological frontiers at local, national or regional scales should be supported by coalitions of development partners with adequate technical support capacity.

The Post-2015 SDG process has highlighted the need for innovative partnerships with the private sector and civil society to support the achievement of development goals. This potentially links these technical support coalitions with the types of partnerships required for effective development under each of the scenarios. However it must be recognised that the information and analysis requirements differ for the different situations highlighted through the scenarios.



For the more centralised decision based scenarios, this will specifically need to involve financial institutions, development partners, regional economic communities to promote strategic corridor development and associated project safeguards build on relevant information about the sensitive ecosystems across which they are being developed.

On the other hand, for the more decentralised decision based scenarios, these partnerships may involve local community organisations, private sector businesses and local government, supported by frameworks developed by national governments, development partners and financial institutions around cumulative impacts of dispersed projects.

The time is now ripe for these types of interventions across the Continent. This is motivated by the increasing appetite of African leaders to adopt more sustainable development pathways as economic opportunities expand. It is also required because the development decisions to use Africa's natural and ecological resources that are made over the next two decades, will determine the Continent's ecological and associated development futures for its people and economies through to the middle of the century and beyond.

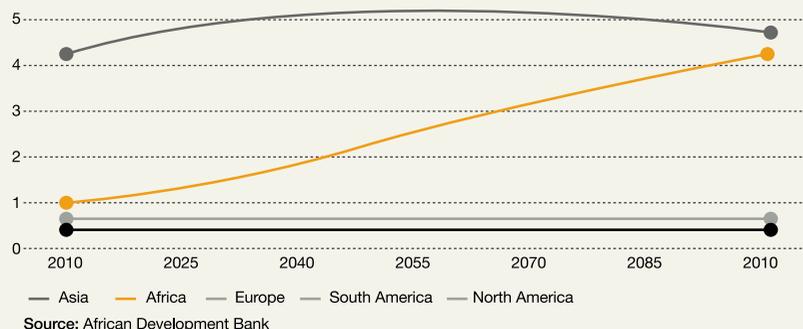
6. APPENDIX

6.1. Pressures

6.1.1. Population growth and its constraint on energy, water and agricultural sectors

Africa is in the midst of one of the most dramatic demographic shifts in history. Projections suggest Africa's population is likely to more than double by 2050, reaching 2.4 billion people. Between now and 2050, Africa will record the highest population growth of any region of the world, surpassing even Asia. UNICEF's projections for the end of the century indicate that if present demographic trends continue through 2100, Africa would go from 1.1 billion people today to an astounding 4.2 billion at the close of the century. If that happens, half the people in the world under the age of 18 in 2100 would be African.⁶⁷

Population, World regions 2010-2100



Within Africa, the biggest population surge is likely to be seen in East and West Africa. The biggest implication of this demographic transition is an increase in population of people who are of productive age. In the mid-1980s, sub-Saharan Africa had only one working-age person for each economically inactive person, posing a major constraint on economic development.⁶⁸ The potential for Africa's growing workforce is massive, with 617 million young Africans today and 1.6 billion in 2060.⁶⁹ Access to education, skill building opportunities, the quality of public and private investments in business and jobs will all dictate how this powerhouse is catalysed.

The impact of Africa's population growth will also mean an increased demand for water, food, energy and other natural and manufactured resources. Recent estimates indicate that as many as 620 million Africans do not have access to electricity and 730 million do not have access to modern cooking facilities.⁷⁰ If current conditions remain unchanged for the next decade and a half, in 2030, this could mean an estimated 655 million Africans without access to electricity (42% of the population) and 866 million people (56% of the population) without access to clean cooking facilities.⁷¹

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70. OECD/International Energy Agency. *Africa Energy Outlook: A Focus on Energy Prospects in Sub-Saharan Africa*. Paris: OECD/IEA, 2014.

71. International Renewable Energy Agency. *Africa's Renewable Future: The Path to Sustainable Growth*. Abu Dhabi: IRENA, 2013.

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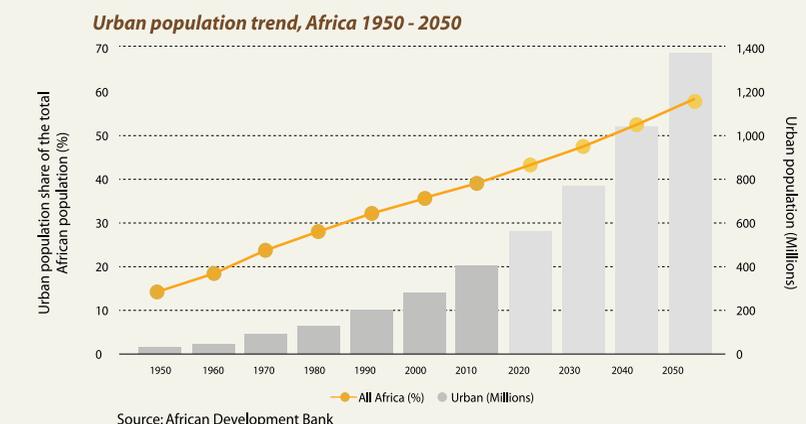
73. "Urbanization recommended as key to improving living conditions." *African Development Bank*. 23 May 2014.

74. "Housing & slum upgrading." *UN-Habitat*. Available at: <http://unhabitat.org/urban-themes/housing-slum-upgrading/>

Despite significant progress over past decades, Africa remains the continent with the greatest challenges in ensuring universal access to safe drinking water and sanitation. In most countries in Africa, less than 50% of the population has access to improved sanitation facilities (with an average in sub-Saharan Africa of 30%) and less than 75% of the population have access to improved drinking water sources. This means that large parts of the population, particularly the urban and rural poor, must collect water from rivers, streams and wells, often some distance from the home. Only 54% of households in sub-Saharan Africa have water within 15 minutes from the household (42% in rural areas and 74% in urban areas).

6.1.2. Urbanisation

In 2014, Africa had 52 cities with populations of one million or higher, the same as Europe.⁷² Africa has the highest rate of urban population growth worldwide. By 2030, 760 million Africans will be urban residents. By 2040, half of Africa's population will live in a city. By 2050, that number will reach 1.2 billion.⁷³



According to UN-Habitat, sub-Saharan Africa has a slum population of 199.5 million people, 61.7% of its urban population. Much of African urbanization is taking place without parallel industrialization, with large parts of the urban populations having to seek livelihoods in the informal sector. This results in low levels of revenue to municipalities, and difficulties in providing the necessary infrastructure, including water supply and sanitation, for effective urban functioning. While urbanisation is often motivated by a desire to increase income status, the process must be managed properly to ensure that water supply and sanitation services are available to all.

Africa has also seen significant migration due to conflict and environmental challenges, which may well be exacerbated by climate change, leading not only to further urbanization, but also due to environmental refugees moving between countries and regions. As natural disasters like flooding and droughts increase throughout the continent, it is of paramount importance to ensure that cities have long-term comprehensive planning and disaster mitigation strategies in place.

Africa has also seen migration out of the continent and out of specific countries, resulting in a skills loss, exacerbated by population losses arising from diseases such as HIV/AIDS. One of the major factors that will influence the future of Africa is the institutional response to a number of challenges and drivers of change. This institutional capacity is dependent, in large part, on the human capacity available. While the impact of the skills drain is significant, it does also generate remittances, create international business, trade and knowledge networks, and bring increased knowledge and experience if migrants return home.

6.1.3. Changing consumption patterns, sparked by growing affluence and higher incomes.

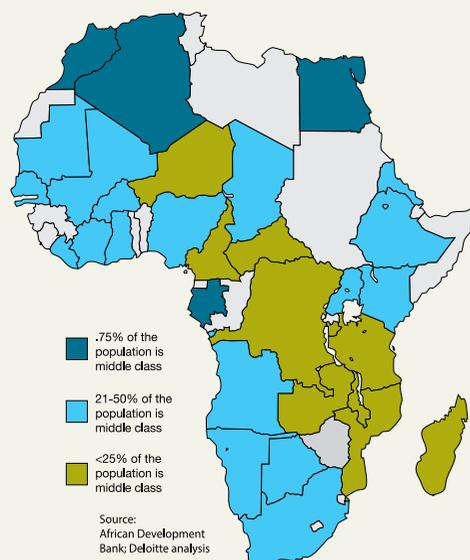
Today, eight of the twenty fastest growing economies in the world are in Africa. One-third of all African nations have maintained GDP growth rates of 6% or more in the last decade. By 2060, this growth rate would mean a GDP increase to over US\$15 trillion, up from US\$1.7 trillion in 2010. Also by 2060, most African countries are projected to reach upper middle income status⁷⁵ with a trebling of per capita income increase to over US\$5,600.⁷⁶ Though this increase would demonstrate a substantial standard of living increase for most of Africa, today's baseline still pales in comparison to, for example, the 2011 South Korean per capita GDP of US\$17,000.

The African middle class (those that earn between US\$2 and US\$20 a day) is expected to grow from 355 million, 34% of Africa's population in 2010, to 1.1 billion, 42% of the population, in 2060. The proportion of the population living on less than US\$1.25 a day is expected to decline from 44% in 2010 to 33.3% in 2060.⁷⁷

As African economies grow and as people's purchasing power increases, demand for a variety of goods and services will also rise. A growing middle class with higher disposable income often spurs the generation of more goods and services, which will in turn fuel a demand for more energy. In 2010, consumer spending, fuelled largely by the middle class, reached an estimated US\$1.3 trillion—60% of Africa's GDP. By 2030, consumer spending is expected to double.

According to a study by Deloitte, the African middle class is well-educated, lives in urban centres, and has salaried positions in the formal economy or run their own small businesses. Many select private health services, send their children to private school or university overseas, and have fewer children than previous generations.⁷⁸ A strong middle class with increased economic security and better education is critical for holding governments accountable, demanding better public services, and insisting on a rule of law.⁷⁹

Distribution of Middle Classes in African Countries in 2010



75. AfDB. *Africa in 50 Years' Time: The Road Towards Inclusive Growth*. Tunis: AfDB, September 2011.

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6.1.4. Changes in investment patterns

The extent to which investors are technically able, and suitably incentivised, to factor ecological risks into their portfolio strategies will impact the types of projects that have ready access to capital.

Trade and investment has implications for every activity on the continent. It dictates discussions on national educational budgets, health care reform, infrastructure development, energy choices, agricultural spending and the trade flows in and out of the continent. In Lesotho, for example, the African Growth and Opportunity Act (AGOA), signed into US law in 2000, spurred the nascent textile industry. In Tanzania, farmers produced significantly more horticulture than their Kenyan counterparts. Higher freight charges and inadequate storage facilities, among other factors, at Kilimanjaro and Julius Nyerere International Airport, restrict their access to international markets.⁸⁰ In the Democratic Republic of Congo, China bid to access ten million tons of copper and two million tons of cobalt in exchange for a US\$6 billion package of infrastructure investment.⁸¹

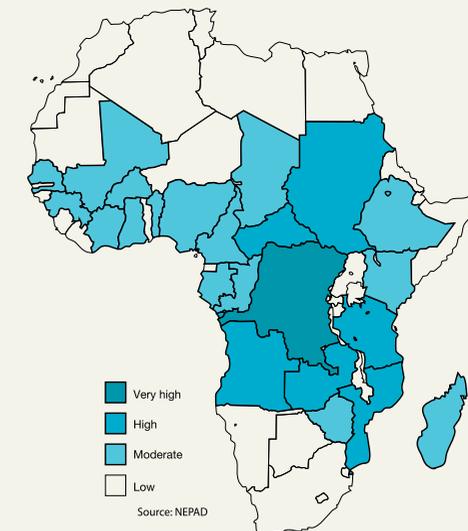
6.1.5. Increasing global resource demand

As populations increase globally, the demand for food continues to increase. Africa represents the last remaining continent where significant optimisation of the agricultural sector is possible. Expanding agricultural production in Africa is perceived to be central to feeding the world in the future, as there remain large tracts of land available for agricultural expansion.

Roughly 60% of all globally uncultivated arable land, approximately 600 million hectares, is in Africa.⁸³ By cultivating the undeveloped land, improving irrigation techniques — 80% of the cultivated land in Africa is rain-fed — and encouraging agricultural productivity, agriculture can contribute to improving unemployment rates, reducing poverty and feeding its people.⁸⁴

In 2030, Africa's market for food stands to be valued at more than one trillion USD, compared to US\$313 billion in 2013.⁸⁵

Potential for unused land for agriculture



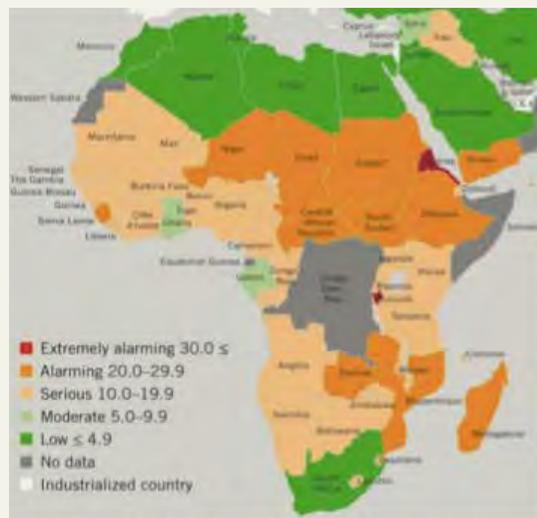
South Sudan, for example, has an estimated 50% of its total land suitable for cultivation. However, only an estimated 4% is cultivated today. Major forest and shrub-land areas are at risk as the hectares under cultivation expand. Political instability and lack of access to finance, however continue to hamper agricultural expansion in countries such as South Sudan. Other ecosystems with arable land potential include Mali, Chad, the Democratic Republic of Congo, and Congo Brazzaville. At present, South African commercial farmers are developing approximately 100,000 hectares of land in the DRC through a model called “Parc Agro Industriel.” The first sector development under the new “Parc Agro Industriel” initiative has commenced in the district of Bukanga-Lonzo, some 260km South-East of Kinshasa. This 80,000 hectare farm and village development will be using raw prime land to maximum advantage for all concerned largely through the production of maize and some livestock. In Katanga Province (DRC) and the Congo Brazzaville, Chinese commercial farmers have also secured large concessions.

Without increased food production, internal food security in Africa will become a challenge, needing to compete in an increasingly food constrained world. Not only is demand increasing internally within Africa, but global food requirements are also rising with increasing affluence and numbers of people. Because of inadequate access to resources such as technology, machinery, irrigation and information, productivity within Africa remains low. There remains significant scope for increasing the productivity of yields achieved in Africa, in addition to the increasing land brought under agricultural production.

6.1.6. Conflicts and epidemics have a negative impact on development

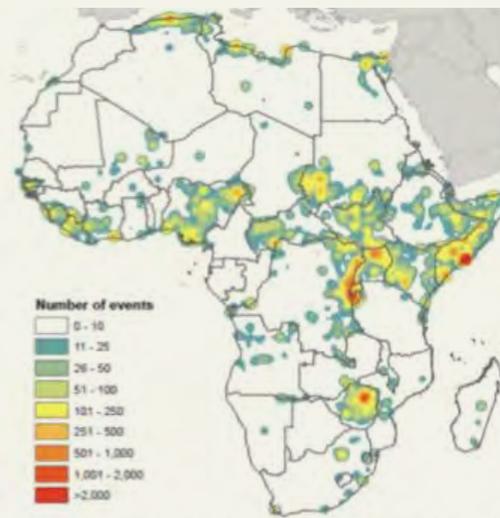
Levels of violence, conflict, and political insecurity have a significant negative effect on development patterns in Africa. Three years after the uprisings in Egypt, Libya and Tunisia, North Africa’s stability has not yet been restored and the continent has yet to recover from the financial losses in Libya and Egypt. Although the security situation in Mali and the surrounding region seems to have improved after the support of international troops, the escalated crisis in the Central African Republic has further engulfed the continent in turmoil.

Global Hunger Index, 2014



Source: IFPRI et al. (2014). “Global Hunger Index: The Challenge of Hidden Hunger.”

Density of violent conflicts, 2000-14



Source: Own representation based on data from ACLED (accessed Sept. 2014). Note: Latest observation: Sept. 20, 2014.

Food insecurity is not only linked to civil conflict, but is often directly caused by it.⁹⁰ During times of civil unrest, household incomes and employment opportunities are markedly reduced, infrastructure is disrupted, and food availability and access are restricted.⁹⁰

During periods of conflict, African nations have received various forms of aid (typically humanitarian aid), but on the whole trade and investment suffer badly due to a negative, high-risk investment climate. Infrastructure growth (including energy, transport, or water infrastructure) comes to a standstill or slows markedly. Armed conflict between two or more factions (tribes, clans, communities) often has a severely damaging impact on local ecology, with rival groups fighting not only for a political objective but often also over control of finite resources in a region. Indeed, quite a number of uprisings throughout Africa have their seeds in the exclusion of local people from benefitting from their own natural resources or the devastation of the local environment in the development and use of the natural resources.

The recent Ebola epidemic wreaked havoc on the economies of Liberia, Sierra Leone, and Guinea. The World Bank estimates that projected 2014 growth in Liberia is now 2.2% (versus 5.9% before the crisis); projected 2014 growth in Sierra Leone is now 4.0% (versus 11.3% before the crisis); and projected 2014 growth in Guinea is now 0.5% (versus 4.5% before the crisis). Moreover, with cuts made to public investment in order to mobilise resources to combat the epidemic, the total fiscal impact is well over half a billion USD in 2014 alone.

On the flip side, the cessation of violence in many parts of Africa and the emergence of African countries into post-conflict periods has proven to be beneficial for economic growth. But unless such growth is managed sustainably, it has the potential to result in rapid environmental degradation. As societies return to normalcy and the resource needs of populations and the pressure to accelerate growth expands, resulting in particular pressure on natural resources. As has been seen in the case of post-conflict Rwanda, establishing enabling frameworks for a green economy helps restore degraded ecosystems and accelerate sustainable development.⁹²

6.1.7. Climate change and disasters exacerbate challenges

Climate change impacts are already being felt across the world, including in Africa. According to the IPCC’s Fifth Assessment Report (AR5) of 2014, there has already been an observed temperature increase of 0.4-2.25°C in the region, with most of the warming having occurred in Western Sahara, Mauritania, Mali, and Niger. Over the mid-term (2046–2065), an increase of 2-3°C is projected for Africa and over the long-term (2081–2100), an increase of 3-6°C is projected, with Algeria, Mali, Niger, Sudan, Namibia, Angola, and Botswana being particularly affected.

Over the mid and longer-term, dramatic changes in precipitation are predicted. Overall, annual precipitation is projected to decline in the dry northern and southern regions of Africa, but increase in the wet areas of East and Central Africa. Over the mid-term (2046–2065) there will likely be a 20% decrease in wet season December – February precipitation across much of the already dry northern and southern portions of the region, with a potential increase in precipitation of up to 50% in East Africa during the wet season. Over the long-term (2081–2100) there may be a 50% decrease in December – February precipitation, focused mostly in the dry north-western portion of the region (Mauritania, Western Sahara, Morocco, Algeria, Tunisia, Mali, and Niger) and up to a 50% increase in precipitation in East Africa during the wet season.

90. “International Food Policy Research Institute. *How to Build Resilience to Conflict*. Washington, D.C.: IFPRI, October 2014.

91. The World Bank. *World Development Report 2011: Conflict, Security, and Development*. Washington, D.C.: World Bank, 2011.

92. “Rwanda Report Shows Successes and Challenges of Post-Conflict Sustainable Development,” UNEP, 16 November 2011.

During June – August the IPCC projects a 10 to 50% increase in precipitation in Egypt, Sudan, and Chad and a 50% decrease mostly on the relatively dry south-western region (Namibia, Angola, Botswana, Zambia, South Africa).

Climate change has and will continue to increase the vulnerability of agricultural systems throughout Africa, most particularly in the semi-arid regions. Warming temperatures and a shorter wet season could lead to a reduction in cereal crop productivity, which would have strong negative effects on food security. There could also be a shift from mixed crop-livestock to more livestock production due to longer droughts. This would result in a decrease in crop production, putting millions of additional people at risk of food insecurity. Regions where decreased crop production could occur include the West African Sahel, and coastal and mid-altitudes areas in eastern and south-western Africa, which currently support 35 million people who are already chronically food insecure. Climate change is also expected to compound existing environmental and socio-economic drivers, such as land use change, and increased damage from agricultural pests, weeds and diseases. Fisheries, providing a major source of protein for many countries, are also closely linked with climate change and are projected to be affected adversely, especially in West Africa. In short, the compounded results of projected climate change much of Africa would make it increasingly more difficult to feed the continent's growing population.

Across the continent, governments have begun to develop adaptation policies to ensure that the impact of climate change is considered in long-term national planning. In 2010, the AfDB, the Commission of the African Union (AUC) and UNECA, launched the Climate for Development in Africa Program (ClimDev-Africa). Three elements sit under this programme: the ClimDev-Africa Special Fund (CDSF), the African Climate Policy Centre at UNECA and the Climate Change and Desertification Control Unit at the AUC. This continental initiative is a recognition by the African Heads of States and their governments on the imperative of climate change on Africa's present and future development.

6.1.8. The opportunities and implications in Africa's democratisation and inclusivity

On his first official visit to Africa in a speech to the Ghanaian parliament, U.S. President Barack Obama said, "Africa doesn't need strongmen, it needs strong institutions." Obama argued that good governance was the "change that [could] unlock Africa's potential."⁹³ These institutions are intrinsically tied to Africa's economic dynamism. Improvements in governance have brought the continent a more robust business environment while building better macroeconomic management. From 2000-2012, 89% of African countries improved their capacity to deliver economic opportunity and human development while 67% of countries made progress in fostering political participation, gender equality, and human rights.⁹⁴

Today, 20 countries in Africa are considered electoral democracies, compared to only 4 in 1991.⁹⁵ In 2013, the participation rate of women in national-level parliaments increased to 21%, up from 10% in 2000.⁹⁶ As more citizens play a role in democratic elections, witness peaceful transitions to power and take part in representative governments, there are many still absent from the debate.

However the emerging middle class and expectation of popular representation provides a stronger civil society voice to the economic and ecological trajectory of African countries. It is expected that this voice will grow stronger over time and reiterate the importance of sustaining ecosystems and inclusive growth within the continent's development decisions.

⁹³ *Remarks by the President to the Ghanaian Parliament.* *The White House*, 11 July 2009.

⁹⁴ *AfDB. Tracking Africa's Progress in Figures. Tunis: African Development Bank, 2014.*

⁹⁵ *Ibid.*

⁹⁶ *Ibid.*

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Maps

UNEP/WCMC

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LIST OF ABBREVIATIONS

| | |
|-----------------------|--|
| AfDB | African Development Bank |
| AGOA | The African Growth and Opportunity Act |
| ARCOS | Albertine Rift Conservation Society |
| AUC | The Commission of the African Union |
| CDSF | The Climate for Development in Africa Program Special Fund |
| ClimDev-Africa | The Climate for Development in Africa Program |
| EAC | The East African Community (EAC) |
| FSC | Forest Stewardship Council |
| GEF | The Global Environmental Facility |
| ITT | Itezi-Tezhi |
| IUCN | The International Union for Conservation of Nature |
| MSC | Marine Stewardship Council |
| NEPAD | The New Partnership for Africa's Development |
| PIDA | Programme for Infrastructure Development in Africa |
| REC | Regional Economic Community |
| SADC | The Southern African Development Community |
| SAGCOT | Southern Agricultural Growth Corridor of Tanzania |
| SDG | Sustainable Development Goal |
| UNECA | The United Nations Economic Commission for Africa |
| UNEP | The United Nations Environment Programme |
| WCMC | World Conservation Monitoring Centre (WCMC) |

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African Ecological Futures 2015

BIOCAPACITY

It takes 1.5 years for the Earth to regenerate the renewable resources that people use, and absorb the CO2 waste they produce, in that same year

BIODIVERSITY

Biodiversity, ecosystems and ecosystem services - our natural capital - must be preserved as the foundation of well-being for all



BETTER CHOICES

Living within ecological boundaries requires a global consumption and production pattern in balance with the Earth's biocapacity.

EQUITABLE SHARING

Equitable resource governance is essential to shrink and share our resource use.



Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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