

**AFRICAN ECOLOGICAL FUTURES:  
SYNTHESIS PAPER**



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# 1. Introduction to the African Ecological Futures Process (Phase One)

## 1.1. Context for African Ecological Futures

**Africa is growing rapidly.** Its growth has the potential to draw millions out of poverty, expand the ranks of the global middle class and act as a site and source of new global economic growth. While the basis for the continent's development is increasingly broad, the primary and extractive sectors still serve as a major source of export earnings, and account for a significant share of GDP and GDP growth in many countries across the continent.<sup>1</sup>

**As Africa has grown, its ecological resource base, on which future generations depend, is being eroded.** Research by WWF identifies that the Ecological Footprint of all African countries increased by 240% between 1961 and 2008.<sup>2</sup> By 2015 Africa is projected to be in “bio-capacity deficit,” i.e. when the footprint (impact of a population that uses resources) is greater than the capacity of ecosystems to produce useful biological materials and absorb waste materials generated by humans.<sup>3</sup>

**If Africa emulates current production and consumption models then compelling evidence suggests that its ecological system will be undermined** and the quality of growth on the continent limited.<sup>4</sup> There is growing concern that hot spots (areas of heavy resource depletion and even potential conflict over finite resources) will emerge across the continent that are nexus points (regions of overlap or intersection) across the various rapidly growing sectors. These points will likely suffer cumulative impacts and their erosion could have disproportionate consequences for sensitive ecosystems, and the communities that depend on them.

For these reasons, Africa needs to find a way to shift onto a new and sustainable growth path – one that meets the needs of today, without limiting the opportunities available to future generations. **To ensure sustainable growth Africa needs to understand and respond to the erosion of its ecological base.**

## 1.2. Overview of WWF's African Ecological Futures (AEF) Project

What would a set of plausible scenarios for Africa's Ecological Future look like? What are the dynamics and trends that will determine their form and likelihood, and how can they either be achieved or avoided? These are the central questions that the African Ecological Futures (AEF) project sets out to answer. This research inquiry is being conducted in two key phases.

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<sup>1</sup> Lions on the Move, McKinsey, 2010 p.2 referencing AfDB and Global Insight data

<sup>2</sup> Africa Ecological Footprint Report, WWF, 2012

<sup>3</sup> WWF, Nature's Regenerative Capacity

<sup>4</sup> [http://wwf.panda.org/about\\_our\\_earth/all\\_publications/living\\_planet\\_report/2012\\_lpr/demands\\_on\\_our\\_planet/biicapacity/](http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/2012_lpr/demands_on_our_planet/biicapacity/)

<sup>4</sup> Africa Ecological Footprint Report, WWF, 2012





Phase One comprises of an in-depth look at **four major sectors – Energy, Water, Agriculture, and Extractives – and two cross-sectoral catalytic agents – Trade and Investment, and Infrastructure Corridors** – that will largely define the development pathways that Africa follows over the next half century. Each of these papers is a 50-year, scenario-based exploration of Africa’s potential development choices within the selected issue-area and the concomitant implications for the continent’s ecological future. In keeping with the broader goals of the project, every paper highlights **levers or potential points of intervention and influence that could help achieve a more sustainable, ecologically secure pathway for Africa.**

Phase One concludes with a synthesis paper that draws together the salient features and common or recurring themes of the six initial papers. Thereafter, in Phase Two, an ecological impacts paper, a white paper or backgrounder for a workshop, a collaborative scenario-building workshop, and a final ecological futures report will follow.

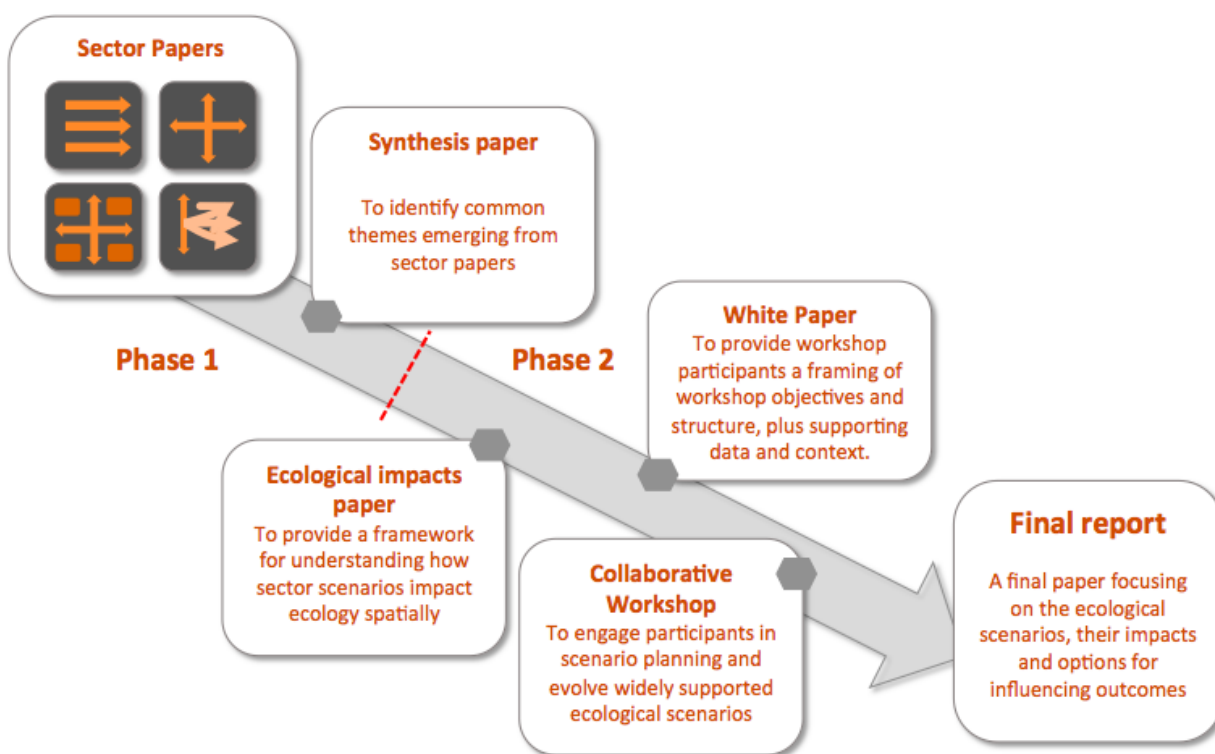


Figure 1: Components of Phase One and Two, AEF

In summary, WWF’s Regional Office for Africa has undertaken an effort to rigorously **investigate the forces that will affect the African continent’s ecological base in the future and identify means that would enable preferred outcomes.**



### 1.3. The Synthesis Paper

This synthesis paper is a critical milestone of Phase One of the African Ecological Futures (AEF) study. **It aims to capture the key commonalities and important differences between the six thematic papers and is both an introduction to and overview of Phase One, but is not a simplistic, traditional summary of the six papers.** This synthesis paper is a *starting point* for someone who wishes to understand the main outcomes of Phase One, the process undertaken, and the broad structure and framework of the six papers, so that it can then enable one to delve deeper into the findings of each of the individual papers. Thus it is intended to be a navigational tool to steer the exploration of one or more of the papers and its linkages to the other papers, rather than merely replicating and summarizing the work already captured in the individual papers. The other objective of the synthesis paper is that it should serve as an underlying reference on which subsequent work of the African Ecological Futures project can be built.

### 1.4. Scenario Development Methodology

**Each of the six individual papers in Phase One adopted a Scenario Planning approach** in order to create and describe the plausible futures for the continent within their issue-area. Scenario planning is a means of creating systemic narratives around distinctly different futures and their associated pathways.

**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 a variety of outcomes.** The scenarios are developed based on the types of choices that could be made by decision-makers and the resulting outcomes. This approach is typically a means of identifying turning points and decisions that will need to be made to move towards preferred outcomes, referred to in the six papers as “pivot points,” levers, or interventions.

Methodologically, this effort (along the lines of the scenario planning process for economic development pathways) began with the analysis and mapping of drivers and uncertainties. Narratives regarding the future uncertainties were then developed, taking into account different drivers. Relying on select “critical uncertainties” as axes, the authors created integrated and coherent futures which indicate distinct approaches to how each of the sectors could evolve in Africa over the next half century. The project recognises that for a continent as large and regionally diverse as Africa this is simplistic. Nevertheless, this approach provides a window onto possible pathways that different countries or regions in Africa could take.

Even prior to embarking on the scenario planning, however, each of the six papers first provided a robust picture of where Africa stands today in each of the six issue-areas. **This situation assessment helped inform the authors of the baseline from which potential futures are evolving and provided critical context about the development decisions to be made in each of the areas.** The following section of this synthesis paper captures some of the highlights of this valuable scene-setting information.



## 2. Africa Today: High Level Overview of the Current State

### 2.1. The Defining Trends

#### 2.1.1. Population growth

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 the year 2050. Between now and 2050, Africa will record the highest population growth of any region of the world, surpassing even Asia. According to one estimate, the continent's population is expected to grow from 1.1 billion at present to 2.4 billion by 2050.<sup>5</sup> 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.<sup>6</sup>

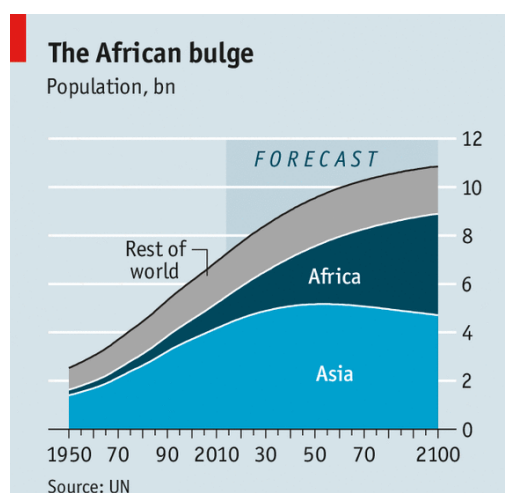
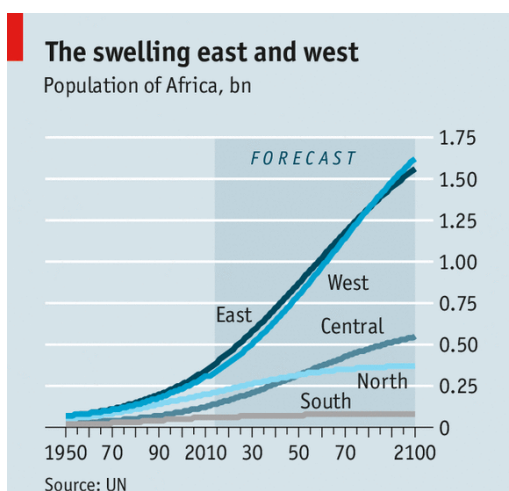


Figure 2: The African population bulge, based on UN data (The Economist)<sup>7</sup>



Within Africa, the biggest population surge is likely to be seen in East and West African nations. The biggest implication of this demographic transition is an increase in population of productive age. In the mid-1980s, Sub-Saharan Africa had one working-age person for each economically inactive person, posing a major constraint on economic development. While this has now reached a ratio of 1.2: 1, it is set to increase in the future with the massive youth bulge in the population.

Figure 3: African population growth by region, based on UN data (The Economist)<sup>8</sup>

<sup>5</sup> Population Reference Bureau, "World Population Datasheet 2013," September 2013.

<http://www.prb.org/Publications/Datasheets/2013/2013-world-population-data-sheet/data-sheet.aspx>

<sup>6</sup> The Economist, "Africa's Population: Can it Survive Such Speedy Growth?," August 23, 2014. <http://www.economist.com/news/middle-east-and-africa/21613349-end-century-almost-half-worlds-children-may-be-african-can-it>

<sup>7</sup> The Economist, *ibid.*

<sup>8</sup> The Economist, *ibid.*



Over the period to 2050, while the rest of the world will be on a downward trend, Africa will be seeing an increase in the ratio of its economically active population to the inactive population, offering an enormous opportunity for economic development. The challenge for Africa will be provide jobs for this growing youth population. The failure to do so has the potential for political instability and/or unregulated exploitation of natural resources in the drive for livelihoods and survival.<sup>9</sup>

### 2.1.2. Urbanisation

Across Africa, present-day urbanisation rates vary from country to country, ranging from 18% in Ethiopia to 50% in Nigeria, and are higher than 70% in some North African countries. In Africa today, an estimated 34% of population lives in cities and 66% in rural areas. But this is changing fast. Rapid urbanisation is underway, with nearly 20% more Africans expected to live in cities in 2050 than today. This also means that almost two-thirds of Africans (including more than half of SSA) will live in cities by 2050.<sup>10</sup> By 2030, half of Africa will live in cities.

**Projected Urban Population by Region, Year**

(%)	2008	2015	2030	2050
Central	39	44	53	66
East	22	25	33	47
North	53	55	62	72
South	44	47	55	66
West	44	48	57	68
Total	39	42	50	62

Figure 4: Urban population projections for Africa, based on UN data (IRENA)<sup>11</sup>

According to UN Habitat, Africa is currently experiencing the world’s fastest rate of urbanisation.<sup>12</sup> This is occurring at 3.2% per annum over the whole continent, and 3.5% in sub-Saharan Africa. North Africa and Southern Africa have much lower rates of urbanization, projected at around 1% to 2050.<sup>13</sup>

### 2.1.3. GDP growth and rising incomes

In 2013, Africa was the world’s fastest-growing continent at 5.6% a year, with GDP expected to rise by 6% a year between 2013 and 2023. Real GDP grew by about 4% in 2013, down two percentage points from 2012. Over 5% growth for the continent is predicted by the World Bank in 2014 and 2015. Driven by the price of oil, gas and other commodities, Africa’s exports grew faster than any other region in the world in 2012 at 6.1%.

<sup>9</sup> Losch B., Magrin G., Imbernon J. (eds.), 2013, *A new emerging rural world. An overview of rural change in Africa*. Atlas for the NEPAD Rural Futures programme, CIRAD.

<sup>10</sup> IRENA, *ibid* at p. 36.

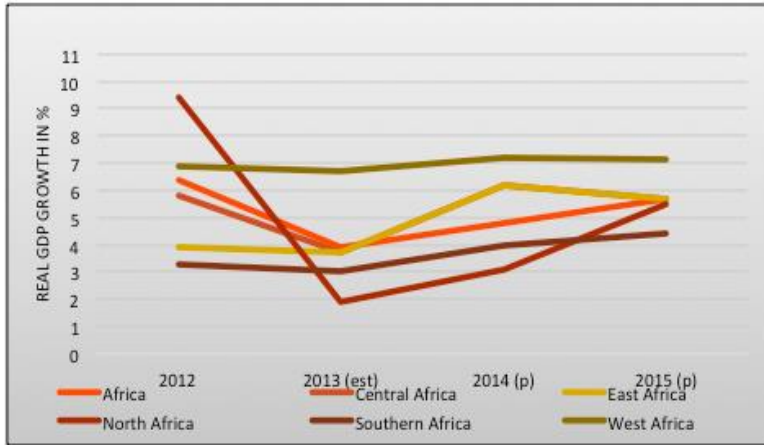
<sup>11</sup> IRENA, “Prospects for the African Power Sector: Scenarios and Strategies for Africa Project,” 2012, at p. 39.

[http://www.irena.org/DocumentDownloads/Publications/Prospects\\_for\\_the\\_African\\_PowerSector.pdf](http://www.irena.org/DocumentDownloads/Publications/Prospects_for_the_African_PowerSector.pdf)

<sup>12</sup> Alexandra Phillips, Harvard International Review, “African Urbanization,” March 23, 2104. <http://hir.harvard.edu/archives/6038>

<sup>13</sup> Losch B., Magrin G., Imbernon J. (eds.), 2013, *A new emerging rural world. An overview of rural change in Africa*. Atlas for the NEPAD Rural Futures programme, CIRAD.





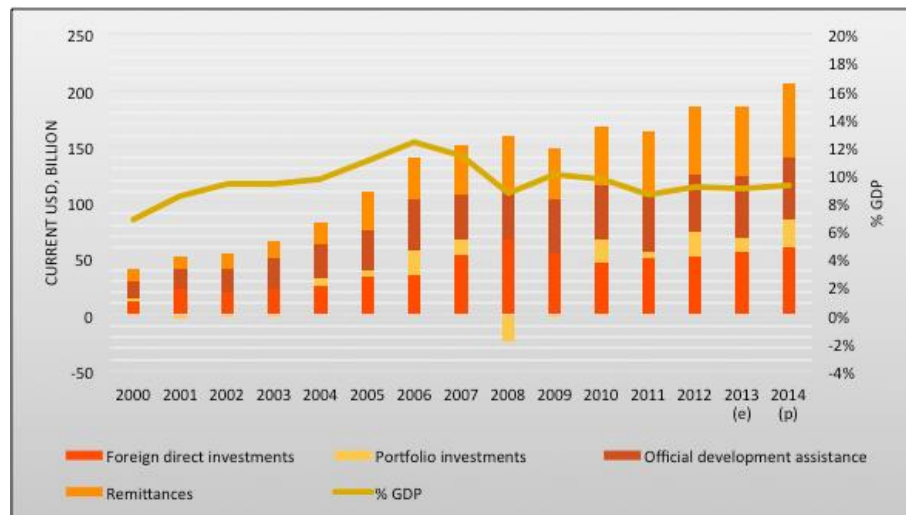
The African Development Bank projected in 2011 that by 2060, “most African countries will attain upper middle income status.”<sup>14</sup>

Figure 5: GDP growth by regions in Africa (AfDB)<sup>15</sup>

### 2.1.4. Attractive investment climate

In Ernst and Young’s 2014 annual Africa attractiveness survey, Africa was ranked as the second-most attractive investment destination in the world (up from third-from-last position in 2011). In 2014, only North America ranked ahead of Africa in terms of investment attractiveness.<sup>16</sup> Since 2000, external financial flows in Africa have quadrupled and are projected to reach over US\$ 200 billion in 2014. In 2013, total external flows generated 8.9% of Africa’s GDP. Total external flows increased nominally by 5% in 2013, excluding the continent’s largest recipient of investment, South Africa. Private financial flows, such as investment and remittances, rose to 71% of total external flows over 2010-14.

Figure 6: Break down of foreign investment in Africa (AfDB)<sup>17</sup>



<sup>14</sup> Paige McClanahan, “Africa Rising: Continent’s Income to Triple, Extreme Poverty Gone by 2060?” *Christian Science Monitor*, October 19, 2011. <http://www.csmonitor.com/World/Africa/Africa-Monitor/2011/1019/Africa-Rising-Continent-s-income-to-triple-extreme-poverty-gone-by-2060>

<sup>15</sup> The African Development Bank, Statistics Department, <http://www.afdb.org/en/knowledge/statistics/>

<sup>16</sup> EY’s attractiveness survey. *Africa 2014: Executing Growth*. Available at: [http://www.ey.com/Publication/vwLUAssets/EY-attractiveness-africa-2014/\\$FILE/EY-attractiveness-africa-2014.pdf](http://www.ey.com/Publication/vwLUAssets/EY-attractiveness-africa-2014/$FILE/EY-attractiveness-africa-2014.pdf)

<sup>17</sup> African Economic Outlook, the African Development Bank <http://www.africaneconomicoutlook.org/en/> (based on data from OECD and UNDP)



Increased investment will drive growth over the medium term. Foreign direct investment to the region is expected to remain strong, with FDI inflows projected to increase to record levels each year reaching \$54 billion by 2015.

### **2.1.5. Climate change**

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 most of this warming expected to occur in Algeria, Mali, Niger, Sudan, Namibia, Angola, and Botswana.

Overall, annual precipitation is projected to decline over dry northern and southern Africa, especially in Mozambique, but increase in wet areas of East Africa (Uganda, Rwanda, Burundi, Democratic Republic of the Congo). Over the mid-term (2046–2065) there will likely be a 20% decrease in December – February precipitation across much of the already dry northern and southern portions of the region, but with a potential increase of up to 50% in East Africa during the already wet season. Over the long-term (2081–2100) there may be a 50% decrease in December – February precipitation, focused mostly in the dry northwestern portion of the region (Mauritania, Western Sahara, Morocco, Algeria, Tunisia, Mali, and Niger) and up to a 50% increase in East Africa during the already wet season. 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 southwestern coast of the region (Namibia, Angola, Botswana, Zambia, South Africa).

Annual mean soil moisture, which affects how well plants can grow is projected to decrease across much of southern Africa (-2 mm), and potentially increase in East Africa. Annual runoff, that is the amount of water discharged from major rivers, is projected to increase by up to 40% in Mauritania, Western Sahara, Mali, Niger, Sudan, Kenya, Uganda, Ethiopia, and Tanzania and decrease by up to 30% in the already dry southwestern portion of the region (Namibia, Angola, Botswana, Zambia, South Africa).

Climate change has and will continue to increase the vulnerability of agricultural systems throughout Africa, but 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 this could occur include West African Sahel, coastal and mid-



altitudes areas in eastern and southeastern Africa, which currently support 35 million people and are already chronically food insecure. Climate change is also expected to compound existing environmental and socio-economic drivers, such as land use change, increased damage from agricultural pests, weeds and diseases. This would make it increasingly more difficult to feed the continent's growing population. Fisheries, a major source of protein for many countries, are also closely linked with climate change and are projected to be negatively impacted, especially in West Africa.

### 2.1.6. Civil Wars and Conflict in Africa

Levels of violence, conflict, and political insecurity have a significant effect on development patterns in Africa. During periods of civil war, 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. During such times, 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 many-a-time also over finite resources in a region. According to the United Nations Environment Programme, "conflict undercuts or destroys environmental, physical, human, and social capital, diminishing available opportunities for sustainable development."<sup>18</sup> On the whole, governance structures and institutions are weakened during periods of strife, lowering capacity for economic growth and environmental management.

On the flip side, the cessation of violence 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 expand, pressure on natural capital increases. 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.<sup>19</sup>

The pattern of conflict and civil war in Africa has changed over the last few decades. In the 1980s and early 1990s, the vast majority of the continent was a theatre of minor or major wars and other armed conflicts.<sup>20</sup> However, in the twenty first century, there have been fewer large-scale regional or pan-national conflicts as well as fewer civil wars. Noting this shift, The Economist wrote, "What is remarkable is how many civil wars have ended since the fall of the Berlin Wall."<sup>21</sup> Today the primary conflicts in Africa are long-simmering ones in Somalia, the Congo, and the Central African Republic. In addition, the threat of terrorism and extremism exists in Nigeria, Somalia, and parts of Kenya, Algeria and Mali.

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<sup>18</sup> United Nations Environment Programme, "Africa Environmental Outlook 2 – Environmental and Socioeconomic Impacts of Armed Conflict," last viewed December 2014. <http://www.unep.org/dewa/Africa/publications/AEO-2/content/203.htm>

<sup>19</sup> United Nations Environment Programme, Rwanda Report Shows Successes and Challenges of Post-Conflict Sustainable Development," November 16, 2011. <http://www.unep.org/newscentre/default.aspx?DocumentID=2659&ArticleID=8944>

<sup>20</sup> The Air University, "1997 Strategic Assessment – Flashpoints and Force Structure: Sub Saharan Africa," adapted and updated from Raymond W. Copson, "Africa's Wars and Prospects for Peace." <http://www.au.af.mil/au/awc/awcgate/sa97/sa97ch13.htm>

<sup>21</sup> The Economist, "Civil Wars: The Picture in Africa," November 13, 2013. <http://www.economist.com/blogs/baobab/2013/11/civil-wars>

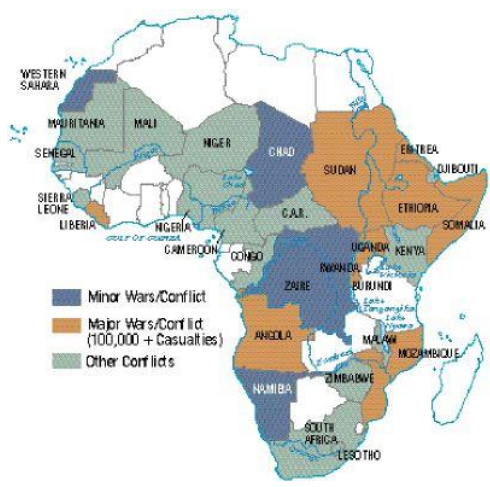


Figure 7: Conflicts and wars in Africa 1980-1996<sup>22</sup>

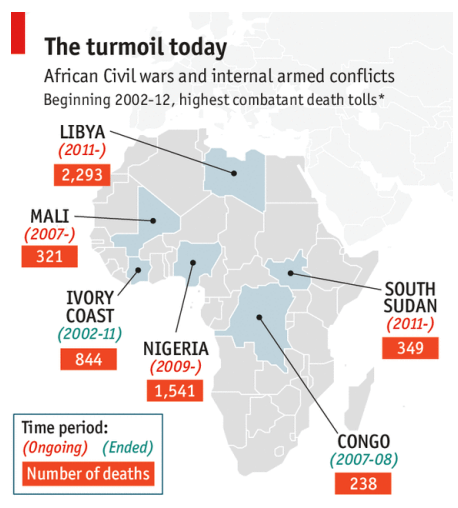


Figure 8: Conflicts in Africa as of late 2013<sup>23</sup>

## 2.2. Key Sectors and Catalysts

### 2.2.1. Energy

Africa faces an enormous challenge in the energy sector. It is characterised by immense energy poverty, i.e. the population’s lack of access to modern sources of electricity and cooking fuels. According to the International Energy Agency’s (IEA) 2011 estimates, **nearly 57% of Africa – or roughly 600 million people – did not have access to electricity**, while 67% of the continent – approximately 696 million Africans – did not have access to improved cooking fuel. The problem is particularly acute in Sub Saharan Africa (SSA), which represents only 12% of the world’s total population, but accounts for almost 45% of the global population without access to electricity, and nearly 60% of Africa’s own population without access.<sup>24</sup>

Of even more concern is the bleak outlook of providing universal energy access in the coming decades. The IEA projects that due to population growth, **the number of people without access to electricity and modern cooking fuel will likely grow from 600 to 645 million and from 696 to 881 million respectively between 2011 and 2030**, even taking into account existing policies and plans that aim to expand

<sup>22</sup> The Air University, “1997 Strategic Assessment – Flashpoints and Force Structure: Sub Saharan Africa,” adapted and updated from Raymond W. Copson, “Africa’s Wars and Prospects for Peace.” <http://www.au.af.mil/au/awc/awcgate/sa97/sa97ch13.htm>

<sup>23</sup> The Economist, “Civil Wars: The Picture in Africa,” November 13, 2013. <http://www.economist.com/blogs/baobab/2013/11/civil-wars>

<sup>24</sup> International Energy Agency, World Energy Outlook 2011, “Energy for All – Financing Access for the Poor,” October 2011, at p. 10. [http://www.worldenergyoutlook.org/media/weowebsite/energydevelopment/weo2011\\_energy\\_for\\_all.pdf](http://www.worldenergyoutlook.org/media/weowebsite/energydevelopment/weo2011_energy_for_all.pdf)



access.<sup>25</sup> Thus, a concerted effort will be necessary to address this challenge and bring energy to the vast majority, if not all, of Africa.

Such a goal is, however, attainable. The International Renewable Energy Agency (IRENA) estimates that ensuring full electricity access in Africa requires – between 2010 and 2030 – the creation of additional capacity capable of generating another 900 Terawatt-hours (TWh). This is roughly one year’s worth of present-day global power consumption at current demand rates.<sup>26</sup> In terms of the additional investment that this type of ramp-up needs, estimates suggest this translates into **an additional \$21-\$23 billion more every year in the energy sector in Africa.**<sup>27,28</sup>

Africa has the resources to fuel this type of expansion in electricity coverage over the coming two to four decades. **It is blessed with adequate solar, wind, geothermal, and hydro potential to power the whole continent**, and even has sufficient oil, natural gas, and coal reserves to rely on for this period while extending electricity access. It remains to be seen what choices it makes as it grows the energy sector, which fuel combinations it chooses to invest in and prioritise, and the impacts of such choices.

## 2.2.2. Water

**Africa’s 3,931 km<sup>3</sup> of renewable water resources represent around 9% of the world’s total, while the African population makes up about 15% of the global population.** These water resources are unequally distributed across the continent, with the vast bulk of water resources present in Central Africa (51%), followed by West Africa (23%).<sup>29</sup> The unequal distribution is due both to variable rainfall as well as topography and temperature. **Water availability per capita also varies significantly from region to region**, with North Africa having the least water per-capita and Central Africa having the most.

Certain regions of Africa have been identified as critical “water towers” that contribute disproportionately to the total flow in major rivers as a result of higher rainfall than the surrounding areas. These are typically in mountainous areas, and **protection of these water towers is an important part of ensuring sustainable water use in the continent.** These include the Ethiopian Highlands, the Kenyan Highlands, the Lesotho Highlands, the Angolan Plateau, the Jos Plateau, amongst others.

The freshwater resources of Africa are strongly transboundary in nature, with 63 shared basins across the continent. There are a number of transboundary aquifers across the continent as well. This means that **protection of freshwater ecosystems is often dependent on co-operation between two or more countries.**

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<sup>25</sup> International Energy Agency, “Energy Access Projections to 2030,” last accessed September 2014.

<http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessprojectionsto2030/>

<sup>26</sup> IRENA, “Africa’s Renewable Future: The Path to Sustainable Growth,” January 2013 at p. 5.

[http://www.irena.org/DocumentDownloads/Publications/Africa\\_renewable\\_future.pdf](http://www.irena.org/DocumentDownloads/Publications/Africa_renewable_future.pdf)

<sup>27</sup> International Energy Agency, “Energy Access Projections to 2030,” last accessed September 2014.

<http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessprojectionsto2030/>

<sup>28</sup> Mafalda Duarte et al., African Development Bank, “Financing of Sustainable Energy Solutions,” 2010 at p. 2 and 5.

[http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/C-10%20Note%203%20English%20\(final\)\\_for%20posting.pdf](http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/C-10%20Note%203%20English%20(final)_for%20posting.pdf)

<sup>29</sup> UNEP. (2010). “Africa Water Atlas”. Division of Early Warning and Assessment (DEWA).





Groundwater is an extremely important source of water in Africa, particularly in the arid and semi-arid areas. Despite only making up 15% of the renewable water resources of the continent, **groundwater is the source of domestic water supply for nearly three quarters of the population.**<sup>30</sup>

While available data shows that water quality is declining across the continent, water quality monitoring and assessment across the continent is inadequate, resulting in lack of data and poor information on the actual state of affairs.<sup>31</sup> **Agriculture is a significant source of water pollution through pesticide and fertilizer runoff.**

As with water quality, there is little overall information available on the status of freshwater ecosystems across Africa. **There are some extremely rich freshwater ecosystems on the continent**, including estuaries, the great lakes (such as Lake Victoria and Lake Malawi), floodplain systems (such as the Barotse floodplain in Zambia and the Makhathini Flats in South Africa). Wetlands are also important since they are highly productive, have nutrient rich soils, are biologically rich, and often support large numbers of people who live on or near the wetlands or floodplains. Many wetlands and floodplains in Africa are at risk from large-scale irrigation schemes and other water management activities.

**Water use in Africa is largely dominated by the agricultural sector**, with municipal use the next highest, and relatively small amounts of water used for industrial purposes. Monitoring of water use in many African countries is weak and thus available figures are probably indicative rather than totally reliable.

### 2.2.3. Agriculture

Agriculture is a critical source of earnings and employment in Africa. It is the largest provider of employment across the continent. In 2010, more than half of the population in Africa made a living from agriculture. **Agriculture accounts for 60% of employment across Africa, 20% of the GDP and 20% of total merchandise exports.**<sup>32</sup> This contribution to employment varies regionally within Africa; in sub-Saharan Africa, agriculture provides 59% of employment and 13% of value added to GDP in 2009. In East Africa, agriculture contributes almost 70% of employment.<sup>33</sup> Agriculture is also a key sector for value addition in the African economy, representing 14% of total value added (in contrast to the 2% share agriculture has in global value addition).<sup>34</sup>

**In Africa, agriculture accounts for 43% of the land area**, and forests 27%. Compared to the rest of the world, a greater proportion of land area in Africa is occupied by agriculture. This is largely due to the balance of land use in East Africa (29% agriculture vs. 17.5% forest). It is also due to the significant areas of Southern Africa (55%) and West Africa (47%) used for agriculture. In North Africa however, only a small percentage of total area (17.6%) is used for agriculture while approximately 1.4% is forests.<sup>35</sup> West

<sup>30</sup> UNEP. (2010). "Africa Water Atlas". Division of Early Warning and Assessment (DEWA).

<sup>31</sup> Africa's Water Quality: A chemical science perspective. Report by the Pan Africa Chemistry Network March 2010. [http://www.rsc.org/images/RSC\\_PACN\\_Water\\_Report\\_tcm18-176914.pdf](http://www.rsc.org/images/RSC_PACN_Water_Report_tcm18-176914.pdf)

<sup>32</sup> Economic Commission Agriculture Review

<sup>33</sup> FAO Statistical Yearbook: Africa. 2014. <http://www.fao.org/3/a-i3620e.pdf>

<sup>34</sup> FAO Statistical Yearbook: Africa. 2014. <http://www.fao.org/3/a-i3620e.pdf>

<sup>35</sup> FAO Statistical Yearbook: Africa, 2014. <http://www.fao.org/3/a-i3620e.pdf>



Africa represents the highest percentage of land under permanent crops (4.3%), followed by East Africa (3.7%), North Africa (2.8%), Central Africa (2.4%) and Southern Africa (0.5%).<sup>36</sup> Africa has roughly 11% of the world's population but accounts for about half the world's cropland. The vast majority of this is in Sub Saharan Africa (SSA). **It is believed that African agricultural output could almost double by 2020, reaching \$500 billion from \$280 billion in 2010.**<sup>37</sup> Coastal countries with large areas of uncultivated land account for around 70% of this growth potential. These include Angola, Cameroon, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Mozambique, Nigeria, and Tanzania.<sup>38</sup> Egypt, Sudan, and South Africa have the most irrigated area in Africa. In terms of percentage of total agricultural land that is irrigated, the leading countries are Egypt, Ethiopia, South Africa, Tanzania, and Zambia.

**Cereals, followed by oil crops, then roots and tubers, dominate crop production in Africa.** There are regional variances in total land area used to grow different crops, but by and large cereals take precedence in all regions of Africa. Of all cereals, maize is a particularly important staple crop. This is especially true for smallholder farmers in Africa, who cultivate the majority of the crop in the continent. Livestock and fisheries also play a role in the overall agricultural profile of the continent.

**On the whole, productivity of agriculture in Africa is extremely low.** Yield improvements in Africa are often hampered by low technology adoption, poor rural infrastructure development, (including roads and irrigation), high prices for fertilizers and a host of climatic and demographic factors.<sup>39</sup> The distance of farming produce to markets is also a factor; in SSA, only 50% of arable land is within six hours of a major market. There are also a host of inefficiencies along the value chain. Post-harvest losses significantly reduce the profitability of many crops. Corn yields in Africa are only 20% of the potential globally, while average grain yields are a third to one half of the world's average yield. Low yields can be attributed to low fertilizer use, the types of seed varieties in use, inadequate irrigation, and poor mechanisation.<sup>40</sup> Other factors for low productivity include infrastructure constraints, insecure land tenure, unfavorable price policies, and weak agricultural research.<sup>41</sup>

**Land used for agriculture, as well as total agricultural production, is projected to grow in Africa.** In relative terms, livestock rearing is expected to grow faster than crop production, driven by changing demand patterns and urban consumption resulting from higher incomes. While intensification of agriculture is expected to increase, a major trend until mid-century is the expansion of cropping and pasture land. Models suggest that this could lead to a 20% reduction in natural vegetation in Africa.<sup>42</sup> In Africa, about 3% of the total renewable water resources are used for irrigation, lower than the global average of 5%. This, however, is likely to change as agriculture expands.

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<sup>36</sup> FAO Statistical Yearbook: Africa, 2014. <http://www.fao.org/3/a-i3620e.pdf>

<sup>37</sup> Lions on the move. McKinsey Global Institute. November 2012

<sup>38</sup> World Bank, Deutsche Bank, 2011.

<sup>39</sup> Africa Agriculture Status Report: Focus on Staple Crops. Nairobi, Kenya, Alliance for a Green Revolution in Africa (AGRA). 2013

<sup>40</sup> Africa Agriculture Status Report: Focus on Staple Crops. Nairobi, Kenya, Alliance for a Green Revolution in Africa (AGRA). 2013

<sup>41</sup> Deutsche Bank Research, Agricultural Value Chains in Sub-Saharan Africa, 2014

<sup>42</sup> LandShift model, [http://www.iemss.org/iemss2006/papers/s3/110\\_Schaldach\\_0.pdf](http://www.iemss.org/iemss2006/papers/s3/110_Schaldach_0.pdf)



**It is critical for African agriculture to become more robust and productive, in particular to meet the challenge of food insecurity in Africa.** Currently, domestic food demand is not being met in Africa, with Sub-Saharan Africa being the second-most food insecure region in the world. Large numbers of people are undernourished, with the rate of undernourishment being highest in Central Africa (at over 50% of the total population in the region).<sup>43</sup> Between 1998 and 2008, the number of hungry people in SSA increased 20%, while farm output per person fell in 25% between 1967 and 2007. The African annual growth rate of food production is, at 1.5%, lower than the population growth rate of 2.73%.<sup>44</sup> This has led to high levels of food deficit and insecurity.

#### 2.2.4. Extractives

Africa's extractive industries remain far less developed than those of Asia or Latin America.<sup>45</sup> Nevertheless, Africa is a globally significant producer of several commodities. **The continent's resource profile is dominated by oil and gas, which together account for 85% of overall production.**<sup>46</sup> Africa's total oil output stood at 12.2% of global production in 2010.<sup>47</sup> In addition, Africa accounts for 78% of world diamond production, 54% of world output of platinum group metals, 51% of world vanadium production, 40% of chromium production and 28% of manganese production.<sup>48</sup>

Despite highlights such as these, and frequent media and academic characterizations of Africa as "immensely rich in resources", **the continent's proven mineral reserves are actually much lower than the global average.** According to one expert, a square kilometer of land in the OECD region will, on average, hold \$114,000 worth of known resources below it, while an average square kilometer of land in SSA has only about \$23,000 of known resources below it.<sup>49</sup> This does not mean that Africa is resource-poor, but it means **it is likely much of Africa's resource deposits are yet to be discovered.**

Geographically, African resource distributions are diverse. South Africa holds 77% of the world's known platinum-group reserves and 46% of its chromite, whilst the Democratic Republic of Congo accounts for 53% of the world's known cobalt reserves.<sup>50</sup> Guinea has over 25% of world bauxite reserves.<sup>51</sup> Africa's oil

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<sup>43</sup> FAO <http://www.fao.org/hunger/en/>

<sup>44</sup> Economic Commission for Africa, *Africa Agriculture Review*

<sup>45</sup> *Minerals and Africa's Development*, Economic Commission for Africa, 2011.

[http://www.africaminingvision.org/amv\\_resources/AMV/ISG%20Report\\_eng.pdf](http://www.africaminingvision.org/amv_resources/AMV/ISG%20Report_eng.pdf)

<sup>46</sup> *Lions on the Move*, p.45, McKinsey Global Institute, June 2010. [http://www.mckinsey.com/insights/africa/lions\\_on\\_the\\_move](http://www.mckinsey.com/insights/africa/lions_on_the_move)

<sup>47</sup> *Africa's Oil and Gas Potential*, Christina Katsouris, Energy Intelligence.

<https://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Africa/161111katsouris.pdf>

<sup>48</sup> *Africa Review Report on Mining*, United Nations Economic Commission for Africa, p2.

<http://www.uneca.org/sites/default/files/publications/africanreviewreport-on-miningsummary.pdf>

<sup>49</sup> *The Case for Investing in Africa*, Paul Collier, June 2010.

[http://www.mckinsey.com/insights/economic\\_studies/the\\_case\\_for\\_investing\\_in\\_africa](http://www.mckinsey.com/insights/economic_studies/the_case_for_investing_in_africa)

<sup>50</sup> *2014 African Transformation Report*, African Centre for Economic Transformation, 2014. <http://acetforafrica.org/wp-content/uploads/2014/03/2014-African-Transformation-Report.pdf>

<sup>51</sup> *Guinea Country Mining Guide*, KPMG, 2014. <http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/mining-country-guides/Documents/guinea-mining-guide.pdf>



deposits are concentrated in the north and west of the continent. Over 90% of African oil reserves are shared between Algeria, Angola, Libya, Nigeria, Sudan and South Sudan.<sup>52</sup>

Historically, East Africa has been comparatively under-explored. However, since the mid-2000s this has changed. Mozambique's proven gas reserves jumped to 100 trillion cubic feet in 2014 (up from 4.5 trillion in 2013), giving the country the third largest reserve in Africa, after Algeria (159 trillion feet) and Nigeria (180 trillion feet) and 13th in the world. This trend is not unique in the region. Successive oil and gas finds in Uganda, Tanzania and Mozambique collectively accounted for 50% of all new global oil and gas finds in 2012.

Most mining companies active in Africa are large multinational corporations. **Several medium and small-sized international companies also operate throughout the continent.** There are few locally owned private sector mining companies in Africa, though there are some state-owned firms. Much of the local African presence in the continent's mining industry is in the form of artisanal and small-scale projects. In contrast, state-owned companies largely control the oil and gas sector in Africa. These state companies tend to partner with international firms on a project-by-project basis. In certain mineral sectors, particularly gold, artisanal and small-scale mining contribute a large portion of overall production. In Ghana, for example, artisanal and small-scale mining accounts for 30% of the sector,<sup>53</sup> whilst in Ethiopia, where industrial mining is more nascent, it accounts for 79.5% of production overall.<sup>54</sup>

**In total, extractive sector revenues account for approximately 28% of Africa's overall GDP.**<sup>55</sup> Compared to the global average, Africa's known deposits are heavily under-exploited. Africa holds 42% of global gold reserves, but accounts for only 20% of annual global gold production. Forty-five percent of the world's known bauxite reserves are in Africa, but the continent accounts for just 4% of global production. Thus, **the continent has the potential for a huge increase in extractive activities**, provided that necessary political, infrastructure, security and demand-side conditions are met.

### 2.2.5. Trade and Investment

In Ernst and Young's 2014 annual Africa attractiveness survey, Africa was ranked as the second-most attractive investment destination in the world (up from third-from-last position in 2011). In 2014, only North America ranked ahead of Africa in terms of investment attractiveness.<sup>56</sup> **In 2013, Africa was the world's fastest-growing continent at 5.6% a year**, with GDP expected to rise by 6% a year between 2013

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<sup>52</sup> *African Futures 2050*, Jakkie Cilliers, Barry Hughes and Jonathan Moyer, Institute for Security Studies, 2011. <http://www.issafrica.org/uploads/Mono175.pdf>

<sup>53</sup> *Ghana: Small Scale Mining Useful to Economy*, The Africa Report, 2.11.2013. <http://www.theafricareport.com/West-Africa/ghana-small-scale-mining-useful-to-economy.html>

<sup>54</sup> *Ethiopia: Artisanal Miners Achieve 52.9 Percent of Plan Set By Ministry of Mines*, Addis Fortune, 7.04.2013. <http://allafrica.com/stories/201304080229.html>

<sup>55</sup> *Africa's Pulse*, World Bank, October 2012. [http://siteresources.worldbank.org/INTAFRICA/Resources/Africas-Pulse-brochure\\_Vol6.pdf](http://siteresources.worldbank.org/INTAFRICA/Resources/Africas-Pulse-brochure_Vol6.pdf)

<sup>56</sup> *EY's attractiveness survey. Africa 2014: Executing Growth*. Available at: [http://www.ey.com/Publication/vwLUAssets/EY-attractiveness-africa-2014/\\$FILE/EY-attractiveness-africa-2014.pdf](http://www.ey.com/Publication/vwLUAssets/EY-attractiveness-africa-2014/$FILE/EY-attractiveness-africa-2014.pdf)



and 2023. Real GDP grew by about 4% in 2013, down two percentage points from 2012. In 2013, East and West Africa had the fastest growth rates on the continent, above 6%.<sup>57</sup>

**West Africa is the fastest growing region on the continent, with its economies largely driven by extractive industries.** Similarly, growth prospects for Central Africa rest almost entirely on extractive industries. East Africa's growth, on the other hand, is driven by agriculture, industry and services. North Africa's economies are rooted in both agriculture and oil and gas exports, but they are still in recovery mode after the Arab Spring uprisings. Southern African countries are currently experiencing uneven growth (and in the case of South Africa, even depressed growth).

Driven by the price of oil, gas and other commodities, **Africa's exports grew faster than any other region in the world in 2012 at 6.1%.** This growth, however, is largely driven by volatile commodity prices and has yet to translate into job creation. While new natural resource projects are on the rise throughout the continent, Africa will need to maintain average growth rates of above 7% in the medium to long term to generate the employment and incomes required to reduce mass poverty. **In 2012, African exports represented an estimated 3.4% of total world exports, dominated by a raw material based-export portfolio.** Commodity price fluctuations will heavily influence growth potential. Though export diversification into manufactured goods and services has helped to protect against market fluctuations, Africa still accounts for only 3.5% of the world's merchandise exports. Travel and tourism dominate 50% of Africa's service exports. On the imports side, in 2012, Africa was the only region to experience double digit import growth of 11%, growing nearly double the rate of exports.

**Intra-African trade still remains weak, particularly in comparison to intraregional trade throughout the world.** Unleashing Africa's internal economic potential is dependent on regional fiscal integration. In 2013, the share of Foreign Direct Investment (FDI) projects in Africa with other African countries as their source reached an all-time high of 22.8%. The billions of dollars in potential trade every year have spurred economic gains in other regions, especially East Asia, but have yet to come to fruition in Africa. Although intra-African trade has increased in both nominal and real terms, there has been a significant decline in the share of intra-African trade in total African trade, with external trade growing faster.

**External financial flows continue to support Africa's financial ecosystem.** Since 2000, external financial flows in Africa have quadrupled and are projected to reach over US\$ 200 billion in 2014. In 2013, total external flows generated 8.9% of Africa's GDP. If current growth is maintained, FDI and portfolio investments will soon account for the lion's share of Africa's financial flows.<sup>58</sup> **In 2014, foreign investments are predicted to reach over US\$ 80 billion, making it the largest financial flow to Africa.** Private financial flows, such as investment and remittances, rose to 71% of total external flows over 2010-14. This rapid increase from 63% over 2000-2005 has helped facilitate energy and transportation development whilst removing general infrastructure bottlenecks. FDI has increased in value by 12.9%, with the average size of an FDI project increasing to \$70.1 million. **Sub-Saharan Africa's share of FDI**

<sup>57</sup> OECD/AfDB/UNDP (2014), African Economic Outlook 2014: Global Value Chains and Africa's Industrialisation, OECD Publishing.

<sup>58</sup> OECD/AfDB/UNDP (2014), African Economic Outlook 2014: Global Value Chains and Africa's Industrialisation, OECD Publishing.





**projects reached an all-time high in 2013.** Though official development assistance (ODA) has increased in Africa, its share in total inflows has declined since 2000. Despite waning commitments, ODA still accounts for the largest external financial flow to low-income, conflict-affected and post-conflict countries in Africa. In these 27 countries, representing half of the continent's one billion people, ODA contributes to more than 40% of total budgets and a sizable part of public sector capital spending.

## 2.2.6. Infrastructure Corridors

**Across a range of measures Africa's infrastructure appears to be inadequate, lagging the development seen in low and middle-income countries outside the continent.** For example, despite having three times the energy generating capacity of South-East Asia in the 1970's Africa is now behind on this, as well as other measures of infrastructure density.<sup>59</sup> South of the Sahara, Africa's infrastructure services are twice as expensive as those in comparable regions.<sup>60</sup> The continent's road freight, for example is almost four times as expensive as that in low-income countries outside the continent.<sup>61</sup>

Estimates of hard economic infrastructure needs compiled by the Africa Infrastructure Diagnostic Program suggest that \$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 \$31 billion per year.** These investment needs are greatest in the power sector (44% of total) but also substantial in the water & 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) has identified at least 40<sup>62</sup> transport corridors, with 24 being named as priority projects. The Southern African Development Community (SADC) has named its own 17 key transport corridors<sup>63</sup> while regional economic communities have also identified their own priority projects with the East African Community (EAC) naming five priority transport corridors.<sup>64</sup> 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.

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<sup>59</sup> For example the majority of Africa's rural populations do not live within reach of all-season roads, 76% lack access to reliable energy and one in nine people lack access to clean and potable water.

<sup>60</sup> Evidenced by power tariffs in the range of 0.02-0.46 \$ per kWh compared to other developing regions which experience 0.05-0.10 \$ per kWh, quoted in the Africa Infrastructure Diagnostic, 2010

<sup>61</sup> ACID, 2008, Transport Prices and Costs in Africa: A Review of the Main International Corridors

<sup>62</sup> PIDA, 2012, Study Programme for Infrastructure Development in Africa

<sup>63</sup> Identified as part of the SADC Regional Infrastructure Development Master Plan

<sup>64</sup> These are: 1. Mombasa – Malaba – Kigali – Bujumbura, 2. Dar es Salaam – Rusumo with branches to Kigali, Bujumbura and Masaka, 3. Biharamulo – Sirari – Lodwar – Lokichogio, 4. Nyakanazi – Kasulu – Tunduma with a branch to Bujumbura, 5. Tunduma – Dodoma – Namanga – Isiolo – Moyale



### 3. What Shaped the Scenarios?

Several factors or forces played a central role in defining the evolution of the scenarios within each paper. Some of these are common through two or more papers, while some others were unique to the issue-area (see also Appendix A).

#### 3.1. Drivers

In varying ways, the four sector papers (Energy, Water, Agriculture, and Extractives) touched on the major drivers that would likely influence the evolution of the sectors (the cross-sectoral papers on Trade and Investment and Infrastructure Corridors do not have drivers since they are in fact drivers themselves, i.e. catalysts that shape growth or change in the other sectors). Given the nature of the exercise, the papers' discussion of drivers took a high-level approach. The identification of drivers was intended not to be exhaustive effort, but rather an effort to call out the most evident of forces that influence sectoral growth and planning.

**Population growth** emerged as a relevant driver for both the energy and water sectors. Similarly, **urbanisation** too was identified as a driver in both the energy and water papers. While the articulation differed from paper to paper, another common driver was **changing consumption patterns**, sparked by growing affluence and higher incomes. This appeared as a common thread across the energy, water, and agriculture sectors. **Change in investment patterns or levels of investment** was a driver in both the water and agriculture papers. **Increasing global and African demand** appeared as a driver in both the agriculture and extractives papers.

Some drivers were sector-specific. For instance, a **commitment to expanding energy access in Africa** was a driver for the energy sector. While it could be argued, of course, that a commitment to expanding access to water supply and sanitation might be relevant to the water sector, or a commitment to expanding food and nutritional security might be relevant to the agriculture sector, the fact that they did not necessarily emerge as the most dominant drivers is indicative of a different discourse about energy access and the prominent institutional frameworks that have emerged to put the spotlight on universal energy access (for instance, the UN's Sustainable Energy for All initiative). There may potentially be a lesson in there for policymakers and those looking to drive investment or overseas development assistance (ODA), although it is unclear whether this distinction actually translates into different levels of prioritization between energy access, water access, and food security in Africa.

Another driver unique to one sector was the **attractiveness of investment in the extractives sector**, due to the rate of returns on mining and minerals or oil and natural gas.

Interestingly, the agriculture paper explicitly identified **changes in infrastructure** (such as the growth of agricultural corridors) and **changes in trade and investment** (such as the sources and targets of investment), as drivers. This underscores the nature of the two cross-sectoral papers as being about drivers themselves. Changes in investment were also referenced in the energy paper, but in the context



of this being a lever or pivot point to influence the trajectory of energy development in Africa. Once more, this is illustrative of the role of trade and investment as an overarching agent of influence.

### 3.2. Uncertainties

Several common themes emerged within the uncertainties identified by the four sector papers and the two cross-sectoral papers. One of the most oft-repeated uncertainty or unknown is **climate change**, for instance the impacts of climate change on water resources and on agricultural cropping patterns, water availability for irrigation, soil fertility etc. **Climate change** also emerged as an uncertainty in the trade and investment paper, but in the form of uncertainty about how investment in certain sectors in Africa could be affected by projections of the likely impacts of climate change in the continent. Certain projections could make some sectors seem relatively unattractive or high-risk for future investors, while others types of investments (especially ones that lower climate risk or are unaffected by it) could become relatively more attractive in comparison. The future **level of regional market integration** emerged as a common theme across the energy and agriculture papers, given that the ease of trade and commerce across countries and regions in Africa is most relevant for these sectors. Regional political and economic integration was also, interestingly, an uncertainty in the infrastructure corridors paper, highlighting how little confidence there is that the underlying regional cooperation and coordination needed for the corridors to materialize actually exists. The extractives paper's identification of the **availability of investment capital** as an uncertainty echoes the energy paper's identification of the **availability and direction of finance** in the same context. Both the extractives and trade and investment papers identified the **level of corruption** (or probity) as an uncertainty. Similarly, the agriculture and trade and investment papers identified the **availability of (or delay in) adequate, large infrastructure** as uncertainties in both areas. **Changes in future demand** were called out as uncertainties in the water and extractives paper.

In the political arena, two threads emerged from multiple papers. One was **uncertainty over political stability and security** and how this could impact the evolution of the sectors, for instance trade and investment, and extractives. The other was an uncertainty over the **nature of political decision-making**, i.e. the type of values and objectives that would be prioritized by governments when making key decisions about the direction of growth. In the extractives paper this was presented as an uncertainty over political decisions about exploiting resources now versus later versus never, while in the trade and investment paper this emerged as uncertainty over the type of national development strategy a government would adopt. Other political uncertainties were institutional stability and capacity (in the water paper), enabling policy environments and frameworks (in the agriculture paper), and the level of political will to deliver on commitments, plans, or targets (in the infrastructure corridors paper).

The uncertainties that were unique to individual papers include the transition to sustainable biomass – in the energy paper, level or nature of future resource discoveries – in the extractives paper, degree of social and environmental responsibility and respect by investors – in the trade and investment paper,



and the integration of comprehensive cost-benefit evaluations (including non-market values) in decision-making – in the infrastructure corridors paper.

### 3.3. Scenario Axes: Critical Uncertainties or Tradeoffs

Every paper identified a range of uncertainties that could affect or shape the scenarios therein, but also honed in on the most critical uncertainties or trade-offs that were most relevant when investigating how the development pathway of that sector or area could have ecological implications. These critical uncertainties then became the axes for the scenarios. The chosen uncertainties were often the factors with the greatest degree of uncertainty, but over and above that the axes were chosen based on which factors had the greatest relevance to and impact on the issue of concern for the project, i.e. the ecological future of Africa.

The next chapter will examine in more depth the larger themes that seem to emerge from the scenario structures, but an initial description of the similarities and dissimilarities is provided here.

Both the energy and agriculture papers chose an axis that represents the **continuum between small-scale, dispersed production that is more within the control of individuals and communities, and large-scale, highly coordinated production that is more within the control of corporations or firms.**

The water and infrastructure corridors papers both chose an axis that represents the **continuum between fully integrating environmental values and internalizing the cost of natural resources, and completely ignoring sustainability imperatives.** In fact, two of the three axes in the infrastructure corridors paper reflect these trade-offs in some manner.

The water, extractives, and trade and investment papers all chose an axis that covers the **spectrum of institutional nature and orientation, from strong, well-governed, inclusive institutions (which, by implication, would integrate a wide range of interests and concerns into their decision-making, including sustainability) to weak, poorly governed, extractive institutions.** It could be argued that a strong, inclusive institution necessarily enables civil society to engage with it and shape its decision-making, in which case the infrastructure corridors paper also has an axis that conforms to this theme.

Finally, another common thread amongst the critical uncertainties underpinning the scenarios is the **continuum between an all-out, no-holds barred, unfettered approach to production that is geared towards the most profitable market, and a more restrained, strategic approach informed by certain priorities and developmental goals.** While the nomenclature used to describe this type of axis (and the binary choices) in the agriculture and extractives paper differs markedly, on closer examination both appear to be adopting a version of this continuum.

The axes that do not appear to have a parallel amongst the other papers scenario axes are the energy paper's choice of fuel carbon-intensity, and the trade and investment paper's choice of infrastructure interconnectedness (although interconnectedness as a feature of the scenarios – not the axes – is in fact a theme reflected in multiple papers).



## 4. Framing of the Scenarios

Even though different researchers produced the six thematic papers independently, and even though the project was consciously designed to not engineer active cross-pollination between the papers, some very interesting similarities have emerged. The scenarios in several papers have found common ground, and there are some clear collective trends emerging from them.

*(NOTE: for a description of the scenarios themselves please refer to the relevant sector paper for an in-depth discussion).*

### 4.1. Devolution, Equity and Access

The energy paper's "Clean Energy by All" scenario (Scenario 1) represents a future with predominantly distributed electricity generation and supply systems. This is due in large part to the abundance and easy accessibility of the fuel sources, but also motivated by the need to bring modern electricity to communities that are remote, located in rural areas far from any current or planned grid infrastructure. This scenario envisions universal or near-universal electricity access through small-scale systems, and the nature of such systems is such that it is easier for communities, small municipalities, and even households to control their generation than in the case of large, utility-scale power projects (although it should be noted that this scenario also includes utility-scale renewables). Since biomass is likely to remain an important part of Africa's energy profile, whether it be sustainable or business-as-usual (unsustainable), this also contributes to the element of decentralised, dispersed energy sources.

In the agriculture paper, both scenarios 3 and 4 (indigenous smallholder production for "fair trade" exports; and indigenous smallholder production for food security) represent futures where the decision-making power over agricultural production and the target markets rest with individual farmers, farming households, or farming communities. An example is farming cooperatives. A great deal of focus is on establishing resilient farming communities.

**The underlying characteristics of these scenarios, across both papers, are devolution, equity and access.**

### 4.2. Integrating True Values / Internalizing True Costs

The "Green and Blue" future of the water paper represents a future where a green growth paradigm guides economic and development decisions. In this future, natural resources accounting is used in annual budgeting processes and sustainable water resources management is well integrated into decisions about growth. In particular, this scenario envisions the recognition of the economic value of ecosystem services and natural infrastructure. (While many of the same guiding principles exist in the "Wandering in the Swamp" future too, in that scenario they remain in the realm of theory rather than implementation as a result of poor institutions.)





Similarly, in the infrastructure corridors paper, the “Green and Sensitive Corridors” future, the preservation of natural capital becomes a central economic debate. Some countries may attach specific values to their ecology in their national accounting. Others create entities or institutions that act as stewards of long term natural capital and as asset managers investing natural resource wealth in the economy. Investors are environmentally conscious, and environmental assessments become central to planning decisions. For example, Environmental Full Cost Accounting (EFCA) and related approaches help evaluate project costs and benefits in a more holistic and realistic way.

**The underlying characteristics of these scenarios, across both papers, are the recognition, assessment, and integration of the value of natural capital, and the costs to the environment from mismanagement.**

### 4.3. Empowered Institutions and Good Governance

In the water paper, both the “Green and Blue” future and the “Big Infrastructure” future are predicated on the existence of inclusive institutions in the water sector. The former envisions strong water resources regulatory capacity, and that water infrastructure is financed and constructed within a legal and institutional framework that ensures protection of water resources. In the latter scenario, the state is able to regulate natural resources management exploitation and also mobilize investment for the development of water resources, along with effective delivery of water and sanitation services.

In scenario 1 of the extractives paper (“Africa’s extractive sector evolves to be predominantly environmentally sustainable”), resource-rich countries “play by their own rules.” The scenario envisions the existence of local laws that regulate global corporations and protect local environments. There is greater regional cooperation, and sound policy frameworks underpin growth in the extractive sector. Civil Society also has a key role in influencing decision-making, and ensures companies’ adherence to environmental standards by naming and shaming violators before global audiences.

In parallel, within the trade and investment paper, both the “Africa for All” future and the “Africa for Strong Nations” future represent scenarios with the existence of effective and inclusive institutions. In the former, inclusive institutions are built through creating rules, regulations, and policies that guarantee property rights, develop an impartial legal and judicial system, create new businesses, and foster an ecosystem of choice. These institutions then drive technological progress and education. In the latter scenario, some countries and regions have inclusive institutions while others don’t. The ones that do benefit from a transition from being fragile states to strong ones, because the institutions break the cycle of conflict and political instability. The institutions also manage national level macroeconomic stability.

Reflecting a similar ideal, the “Green and Sensitive Corridors” future of the infrastructure corridors paper envisions an empowered civil society that engages in productive dialogue with policy makers and the private sector. This Civil Society is focused on identifying opportunities to maximize total value for citizens and users. While this scenario does not explicitly mention institutions or legal frameworks, one



might view this as implicit in order for an empowered Civil Society to exist and be effective, and that one of the outcomes of such involvement is good governance.

**The underlying characteristics of these scenarios, across all four papers, are strong and empowered institutions, good governance, and an engaged Civil Society.**

#### **4.4. Putting Africa First**

Another key theme that emerged is the idea of Africa for Africa, versus Africa for the Rest of the World, i.e. the trade-off between orienting sectoral growth towards Africa's own needs compared to growth that is driven by and caters to external markets.

In the agriculture paper, both scenarios 1 and 4 (domestic capacity is developed and production is for food security; and indigenous smallholder production for food security) represent futures where agricultural production is guided by developmental imperatives. In the case of these scenarios, food security is a paramount objective, and the agriculture sector is therefore attuned to creating domestic capacity and self-sufficiency. Whether the production takes place on a commercial scale (scenario 1) or through smallholder farmers (scenario 4), the production benefits Africans first before other consumers (such as the potentially more lucrative export market).

Simultaneously, scenario 1 of the extractives paper ("Africa's extractive sector evolves to be predominantly environmentally sustainable") represents a future where African governments choose extractive policies that maximize long-term growth and prioritize overall benefits for their citizens. Unlike scenario 2 ("Africa's extractive sector evolves to be predominantly environmentally unsustainable") where the primary driver for extractives is trade with other, mainly industrialized countries, global corporations are not at the steering wheel in scenario 1, and are governed by local laws that look out for the long-term interests of those living in Africa's resource-rich countries. In fact, in this scenario many in Africa reject China's interest in Africa's mining sector as "neo-colonialism." In this future, relationships are defined by tangible, practical political agreements and commercial contracts, drawn up by ever more competent and assertive African negotiating teams. Whoever the bilateral partner is, Africa generally gets a good deal for its resources.

**The underlying characteristics of these scenarios, across both papers, are "Putting Africa First," and the notion of economic growth being guided by developmental imperatives that are important to Africa.**

At a slightly broader level, the primacy of African economic growth and development – with Africa meeting its own needs before turning to external markets – is also reflected in some of the other sector papers. In the energy paper, water paper, and trade and infrastructure paper, this takes the form of enhanced interconnectedness and effective regional cooperation to better manage and share Africa's resources.



## 5. Levers – Areas of Convergence

Each of the four sector papers and the two cross-sectoral papers identified levers for the scenarios, i.e. factors that could enable or determine the emergence of one scenario (or group of scenarios) over the others. Knowing what these factors are is essential to identifying how we can potentially influence the outcome of African ecological scenarios and effect changes that bring about a desired future while diminishing the prospects of an undesirable future. In essence, this points us to where we might be best served directing our energy and resources.

As it happens, the discussion of levers was where the six papers differed the most. Each paper had its own unique approach to identifying these factors, and all of the six land at distinctly different points in the spectrum in terms of the level of specificity and granularity of the lever identified. Some very highly context-specific to the sector in question, while others identified broader categories of interventions that are not, by their general nature, sector-specific. Thus it is a challenging task to sieve through these to look for commonalities, but nevertheless an examination of the range of levers and pivot points does highlight some unifying themes. In several cases, the levers manifest differently but underlying the levers is the same family of theoretical approaches that allows for wide-ranging examples.

For instance, the energy, water, extractives, and trade and investment paper all identified **enabling or supportive policies, regulatory frameworks, and incentives** as a key lever (in different terms). The extractive paper was highly specific when it enumerated “lobbying to strengthen disclosure requirements to be listed in stock exchanges,” but viewed broadly this too is about policies and regulatory actions, since disclosure requirements – whether domestically or internationally – typically emerge out of policy instruments. If this lever is widened to also include enabling programmes or campaigns, then the Sustainable Energy for All Programme – which the energy paper identified as being a lever if effectively and successfully implemented – can be viewed as falling within this ambit as well.

Similarly, the infrastructure corridors paper lists market mechanisms that protect ecologically sensitive area from infrastructure development, and the energy paper lists pricing carbon and phasing out fossil-fuel subsidies. But these three levers can be distilled into the more generic approach of **utilising market mechanisms and forces**.

One can also view the water paper’s lever of improving the understanding of water limits or thresholds for ecosystem functioning, and the infrastructure corridors paper’s lever of better understanding and mapping the ecological impacts of infrastructure development through the common lens of **enhanced information-availability to inform decision-making**. In fact, the infrastructure corridors paper’s lever of providing decision-support tools that incorporate market values falls within this broad category too, and also the water paper’s improved understanding of the impacts of climate change.

The extractives paper identifies as a lever lobbying to encourage adherence to existing voluntary guidelines, and the infrastructure corridors paper lists as a lever supporting the investor community to effectively value costs of poor environmental and social management. While ostensibly very different



approaches, both rest on a common foundation of **advocacy and public pressure for corporate responsibility**. The concept of corporate responsibility is also reflected in the water sector paper, which mentions **water stewardship** as a key lever.

Across multiple sectors - the water, agriculture, extractives, and trade and investment papers - **Strengthening institutions** (at a national, regional, or even continental level) emerged as a very strong lever. In the same vein, the agriculture, extractives, and infrastructure corridors papers underscored **institutional capacity building – including strengthening and empowering Civil Society** – as a critical lever.

Both the energy and agriculture paper included **regional cooperation, or regional markets and trade**, as a lever. The same two papers also identified as a lever **investment in improved or sustainable technologies (and practices)**.

The relatively unique levers that don't appear to have equivalents across the sector papers include the energy paper's reduction in transaction costs, and the existence or materialization of the international community's commitment to climate change obligations; the agriculture paper's improving productivity of agriculture in Africa, and the lever of reducing rural vulnerability and insecurity; the trade and investment paper's lever of taking a measured, sustainable approach to extractive industries and practices; and the infrastructure corridors paper's lever of proof of concept, i.e. demonstrating that infrastructure corridors can be developed sustainably and in an ecologically responsible manner.



## 6. Scenario Linkages and Overlay – Spatial Implications

Each of the sectors is a key component of Africa's future, and each of the themes in the cross-sectoral papers is an important catalyst or accelerator for the four sectors. Thus by their very nature they are characterised by interdependencies. For instance, the energy sector in Africa requires the use of the continent's water resources and thus water availability will impact energy scenarios across the board. On the flip side, all four of the energy scenarios also have the ability to impact the quantity and quality of Africa's water resources, each to a different degree. The energy-water connection is, of course, a two-way relationship in that the water sector itself uses a great deal of energy to pump and heat water or to treat wastewater. Similarly, the extractives sector uses water and energy as an input, but the products of the extractives sector are often inputs in the energy sector in the form of fuel. Moreover, the extractives sector has implications for water quality as a result of contamination or spills. In the same vein, agriculture uses both energy and water as inputs, and has significant impacts on water quality and quantity since it is the biggest user of Africa's water. The water, energy, extractives and agriculture sectors in turn all depend on infrastructure, trade, and investment to grow, and are shaped by the level of nature of these forces.

These types of interdependencies are numerous and are dealt with in detail in the individual papers. Thus this section will not devote itself to an examination of these types of inter-linkages. It will instead investigate whether there are any synergies between different scenarios in the different papers, and whether a scenario in any one paper exacerbates or ameliorates scenarios in any of the other papers.

There are several synergies between the water paper's Green and Blue Future scenario, the energy paper's Clean Energy by All Scenario, the infrastructure corridors paper's Green and Sensitive Corridors scenario, the extractive paper's Predominantly Sustainable scenario, and the trade and investment paper's Africa for All scenario. Most of these scenarios are characterised by strong and inclusive institutions that value sustainable management of natural resources. Many are also characterised by strong regional cooperation and good governance. The availability of adequate credit – such as in the form of micro-credit loans for low-income families – as envisioned in the Africa for All scenario is much more likely to enable the realisation of the Clean Energy by All scenario where households, communities, and even individuals can set up energy generation units based on renewables. This is also more likely because the Green and Sensitive Corridors scenario envisions funding and financing coming from a diversity of new sources and pools, and drawing upon untapped institutional finance.

The energy paper's Carbon-Light Energy for All scenario and the water paper's Big Infrastructure scenario also link up very closely. Both of these scenarios envision the exploitation of water resources for economic growth. In fact, the Big Infrastructure scenario explicitly states that governments are able to mobilize investment for the development of large water resources infrastructure for storage and hydropower.

The trade and investment paper's Africa for Strong Nations scenario is most likely to perpetuate the energy paper's Business as Usual scenario where some nations have strong, environmentally sound



policies and others don't, resulting in fragmentation of the energy sector and vastly different levels of energy access in different countries. Similarly the Two Track World scenario for infrastructure corridors is also likely to contribute to a similar outcome. The water paper's Somewhere in the Middle scenario is also reflective of fragmentation and the co-existence of both ecologically sound and unsound practices.

Both the Africa for the Elites scenario and Africa for Strong Nations scenario in the trade and investment paper dovetail with the Predominantly Unsustainable future scenario in the extractives paper, since the absence of inclusive institutions and interconnected infrastructure make intra-African trade costly and less prominent than export-oriented trade.

## 6.1. Spatial Trends

In their respective scenarios, the sector and cross-sectoral papers do not identify specific countries or regions that are more likely than others to experience rapid growth, development, exploitation, or other transformative activity. However, a reading of all six papers allows for some patterns to emerge. Maps best depict these spatial trends (see further below), but a brief summary is also provided here.

Depending on the energy trajectory Africa chooses, energy development is likely to occur in several distinct regions. North Africa and the Sahel (mainly Algeria, Libya, Morocco, and parts of Egypt and Niger) would be the likely location for solar; Western Africa (primarily Mauritania, Senegal, Guinea, Mali, Sierra Leone, and Liberia), Southern Africa (western South Africa and Namibia), and the Horn of Africa (Somalia, Ethiopian, Eritrea) would be likely locations for wind power growth; and Kenya and Ethiopia would likely see geothermal development. Hydropower development will likely be concentrated in Central Africa (mainly Cameroon, the Democratic Republic of Congo, and parts of Angola), as well as the upper Nile basin (the White Nile in Sudan and South Sudan). Oil resources are likely to be developed in North Africa (Algeria and Libya), parts of Western Africa (Nigeria and the Angolan coastline), and the Lake Albert basin (Uganda). Natural Gas exploration and drilling is most likely to grow in East Africa (particularly Tanzania, Mozambique, and offshore towards Madagascar).

In terms of extractives development, the spatial implications are less clear since mines and mineral deposits of different types are spread throughout Africa. However, the extractives paper does call out the Democratic Republic of Congo as a particular flashpoint as more of its minerals are exploited. The extractives paper also highlights the expected future development of oil and gas reserves in East Africa (Tanzania, Mozambique, Kenya, and Madagascar), suggesting that greater development is likely offshore than onshore.

The trade and investment paper examines growth all across the continent, but notes that the potential for future growth in trade is greater in West and Central Africa, because trading activity there today is relatively low and thus there is a lot of room for increase in trade in this region (relative to comparatively more robust trading activity in Southern and Eastern Africa).





If the “big Infrastructure” scenario of the water paper is realised (as well as the “Shotgun Growth” scenario), Africa will likely invest in large water infrastructure projects such as dams – for instance, the Grand Inga. Once more, the geographies implicated for large hydro development of this nature are Central Africa (Cameroon, the Democratic Republic of Congo, and parts of Angola) and the Upper Nile basin (Sudan, South Sudan).

The infrastructure corridors paper draws attention to planned infrastructure development under the Programme for Infrastructure Development in Africa (PIDA), namely the transportation and energy corridors. While the transportation corridors are expected to increase connectivity all across the continent, relatively less activity is planned for North Africa and the Saharan nations, while more activity is likely along the major corridors and the areas identified for hub ports, such as in Western Africa (Senegal, Guinea, Cote D’Ivoire, Sierra Leone, Liberia, Ghana, Benin, Burkina Faso, and Nigeria); Central Africa (Gabon, Cameroon, Central African Republic, and western regions of the Democratic Republic of Congo); Southern Africa (primarily South Africa, Namibia, Botswana, and Zimbabwe); and Eastern Africa (Kenya, Tanzania, and Mozambique). The energy corridors (pipelines and transmission corridors) are largely concentrated along coastlines, with a larger footprint across the North African coast (Morocco, Algeria, Tunisia, Libya), Western Africa (Senegal, Guinea, Cote D’Ivoire, Sierra Leone, Liberia, Ghana, Benin, Burkina Faso, and Nigeria), Coastal West Africa in the Peninsular region (mainly Cameroon, Gabon, Angola, Namibia), and East Africa (Ethiopia, Kenya, Mozambique, Tanzania, and Zambia). The infrastructure paper also highlights two key planned Agricultural corridors, Tanzania’s Southern Agricultural Growth Corridor (in the Highlands), and the Beira Agricultural Corridor (connecting Zambia, Malawi, Zimbabwe, and Mozambique).

Three principal trends from the agriculture paper appear to be of interest while exploring future development. First, areas for potential agricultural growth – in terms of significant percentages of uncultivated cropland – exist across Eastern Africa (Ethiopia, Kenya, Tanzania, Mozambique, Madagascar), in pockets of Western Africa (Cote D’Ivoire, Ghana, and parts of Mali), and in Central Africa (the Democratic Republic of Congo, the Central African Republic, and Uganda). Second, areas with potential irrigation growth (small and large scale) cover mostly Western Africa (Senegal, Guinea, Mali, Burkina Faso, Benin, Nigeria, and Cameroon), as well as Eastern Africa (Kenya, Uganda, Tanzania, Zambia, Zimbabwe, and Mozambique, plus eastern regions in the Democratic Republic of Congo). Third, areas that have seen a steep rise in foreign transactions on agricultural land (presumably with a view to future growth and increased cultivation) display a similar trend, and are concentrated in Eastern Africa (Ethiopia, Kenya, Uganda, Mozambique, Tanzania) and Western Africa (Guinea, Sierra Leone, Liberia, Cote D’Ivoire and Ghana).

When one compares these trends with Africa’s current population density (which are also likely areas of population growth, especially in Sub Saharan Africa), much of Western Africa (Senegal, Guinea, Sierra Leone, Liberia, Burkina Faso, Cote D’Ivoire, Ghana, Benin, and Nigeria) and Eastern Africa (especially Ethiopia and Uganda but also Kenya, Mozambique, Tanzania and Madagascar) emerge as key regions of interest. Similarly, when one compares these trends to as well as recent economic growth (measured by

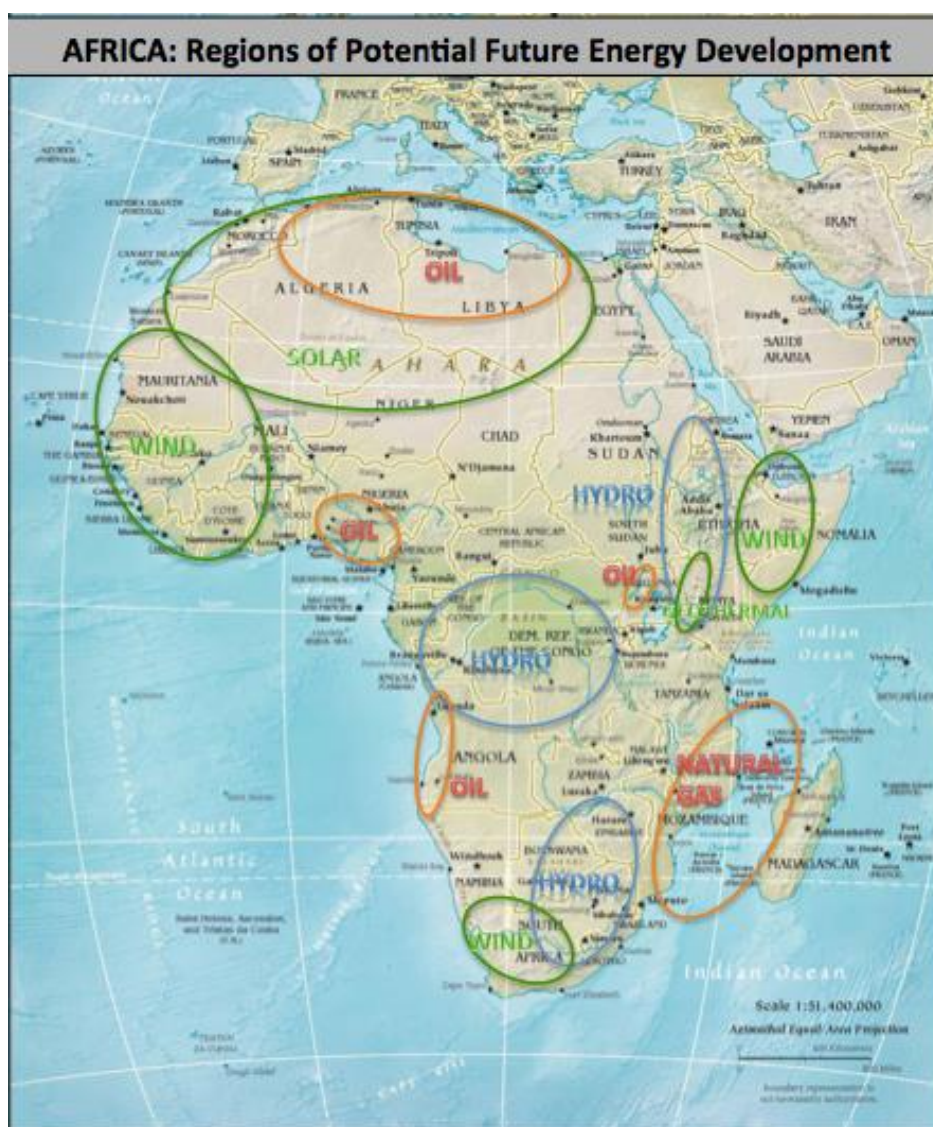


average annual growth between 1996 and 2013 in real per capita GDP), the countries that appear in sharp relief are Sierra Leone, Liberia, Nigeria, Angola in the West; Uganda, Tanzania, and Mozambique in the East, and Ethiopia in the Horn of Africa.

Stepping back to absorb all of this, one is able to identify at least three very critical regions in Africa where significant future development across sectors is likely to overlap: Western Africa, Eastern Africa, and a core region of Central Africa (chiefly the Democratic Republic of Congo and Angola). Additionally, the Rift Lakes region and northern Africa also stand out as areas of interest.

The discussion above is mirrored in select maps below that allow the spatial overlap to be seen.

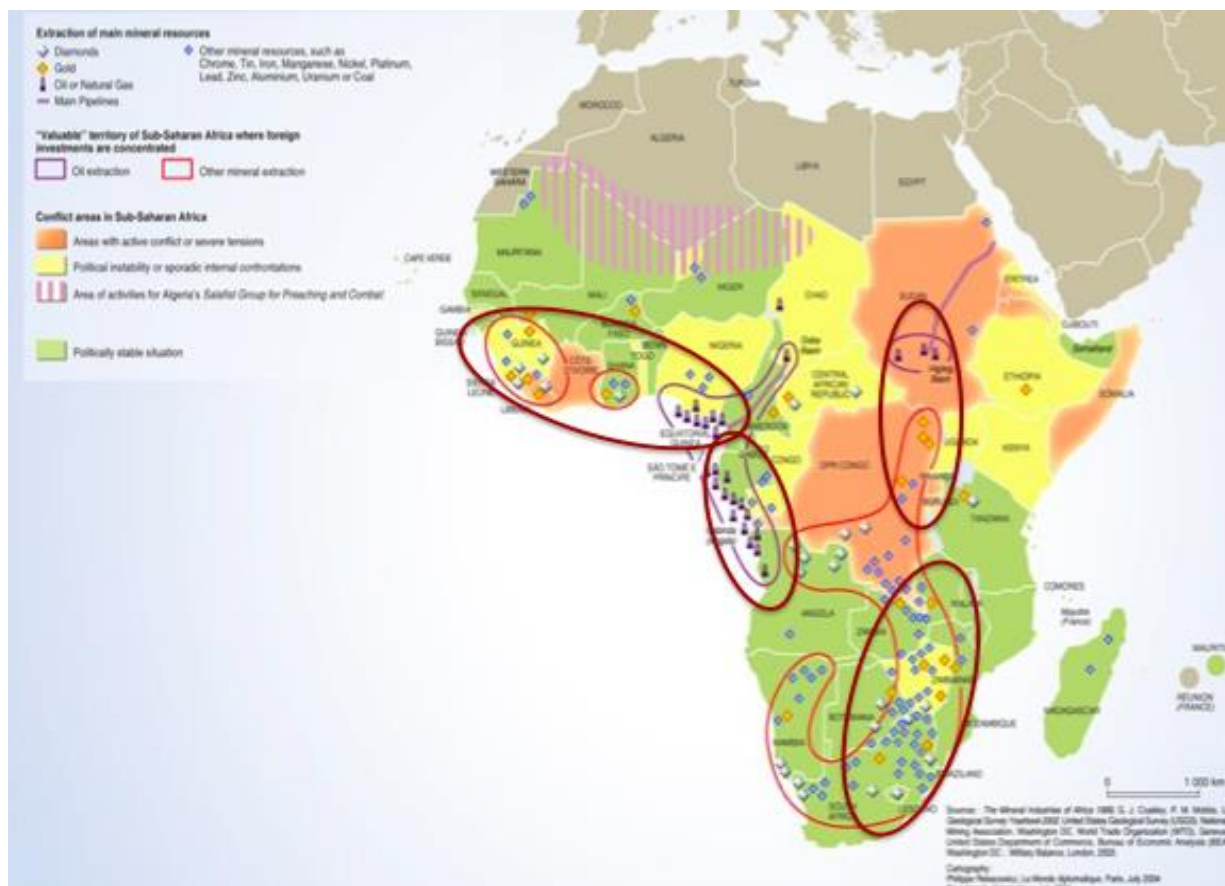
**Map 1: Regions of Potential Future Energy Development in Africa<sup>65</sup>**



<sup>65</sup> African Ecological Futures - Energy Scenarios Paper, Annex 1



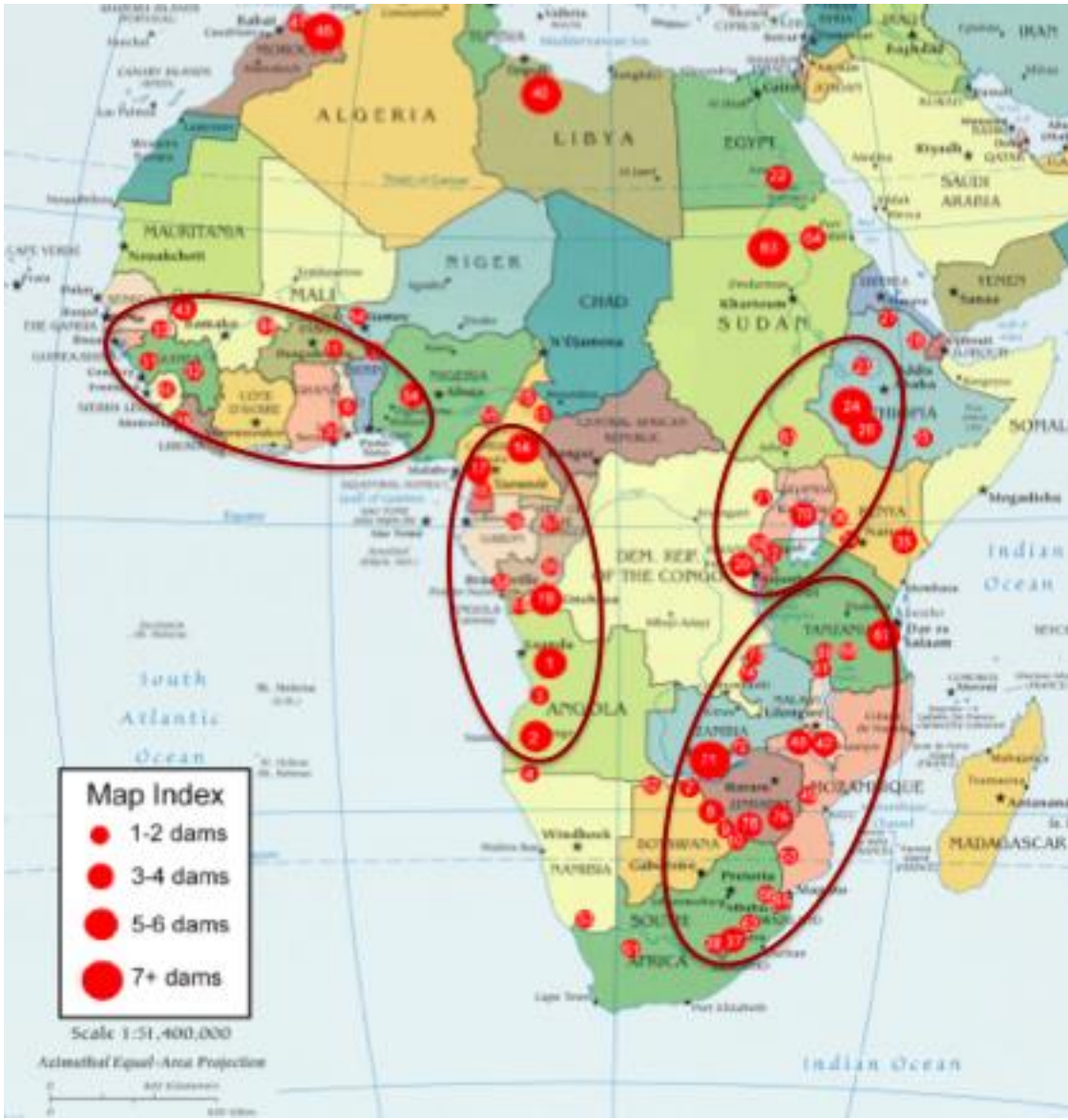
Map 2: Sub-Saharan Africa – Mineral Resources and Political Stability<sup>66</sup>



<sup>66</sup> Philippe Rekacewicz, Le Monde Diplomatique, GRID Arendal-UNDP (2006). [http://www.grida.no/graphicslib/detail/sub-saharan-africa-mineral-resources-and-political-instability\\_1408#](http://www.grida.no/graphicslib/detail/sub-saharan-africa-mineral-resources-and-political-instability_1408#)



Map 3: Proposed Dams in Africa<sup>67</sup>

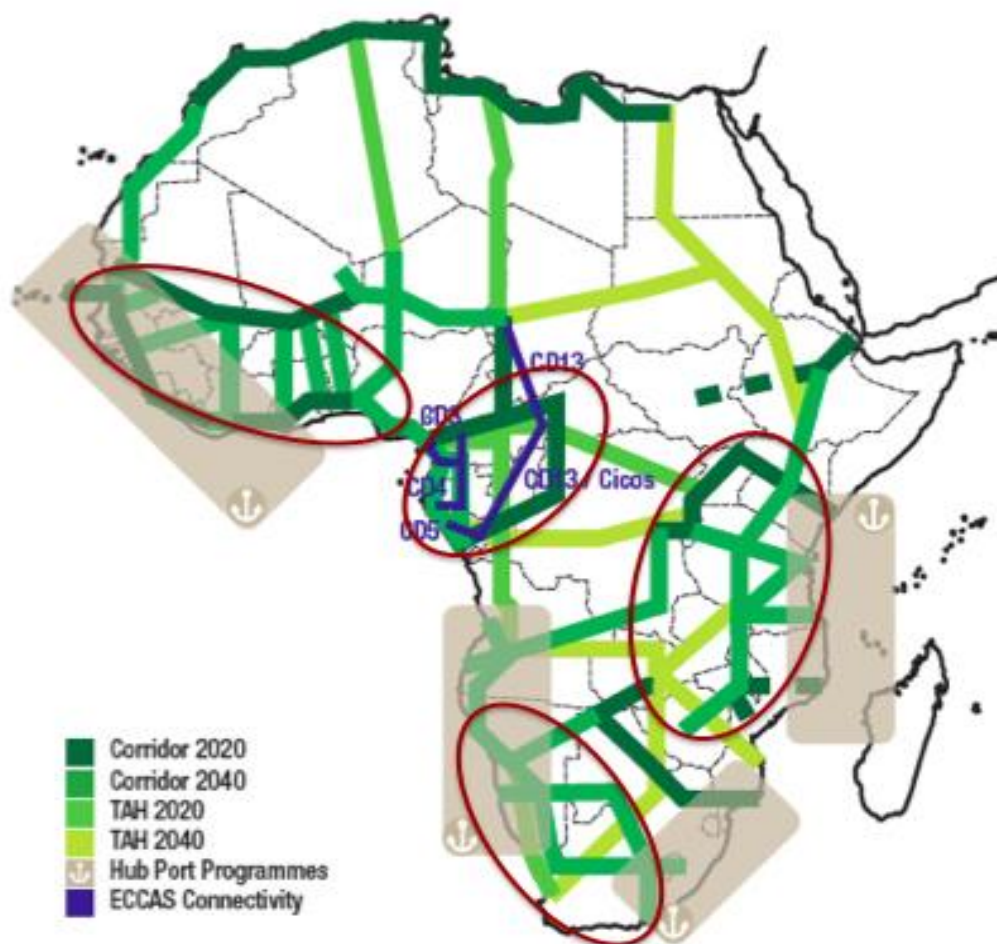


<sup>67</sup> International Rivers, Africa Dams Briefing and Map (2010) <http://www.internationalrivers.org/resources/african-dams-briefing-map-4037>





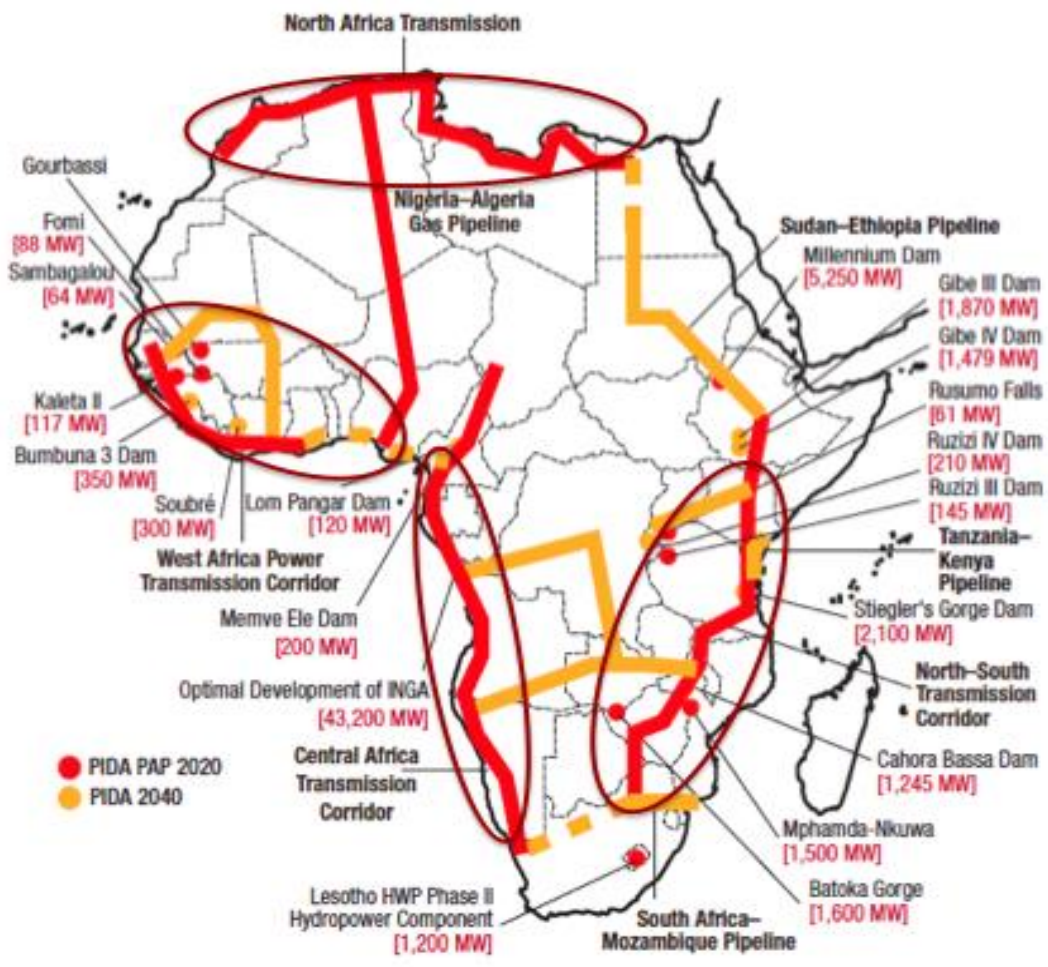
Map 4: PIDA Transportation Corridors<sup>68</sup>



<sup>68</sup> Programme for Infrastructure Development in Africa <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/PIDA%20note%20English%20for%20web%2020208.pdf>



Map 5: PIDA Energy Corridors<sup>69</sup>



<sup>69</sup> Programme for Infrastructure Development in Africa, *ibid.*  
African Ecological Futures





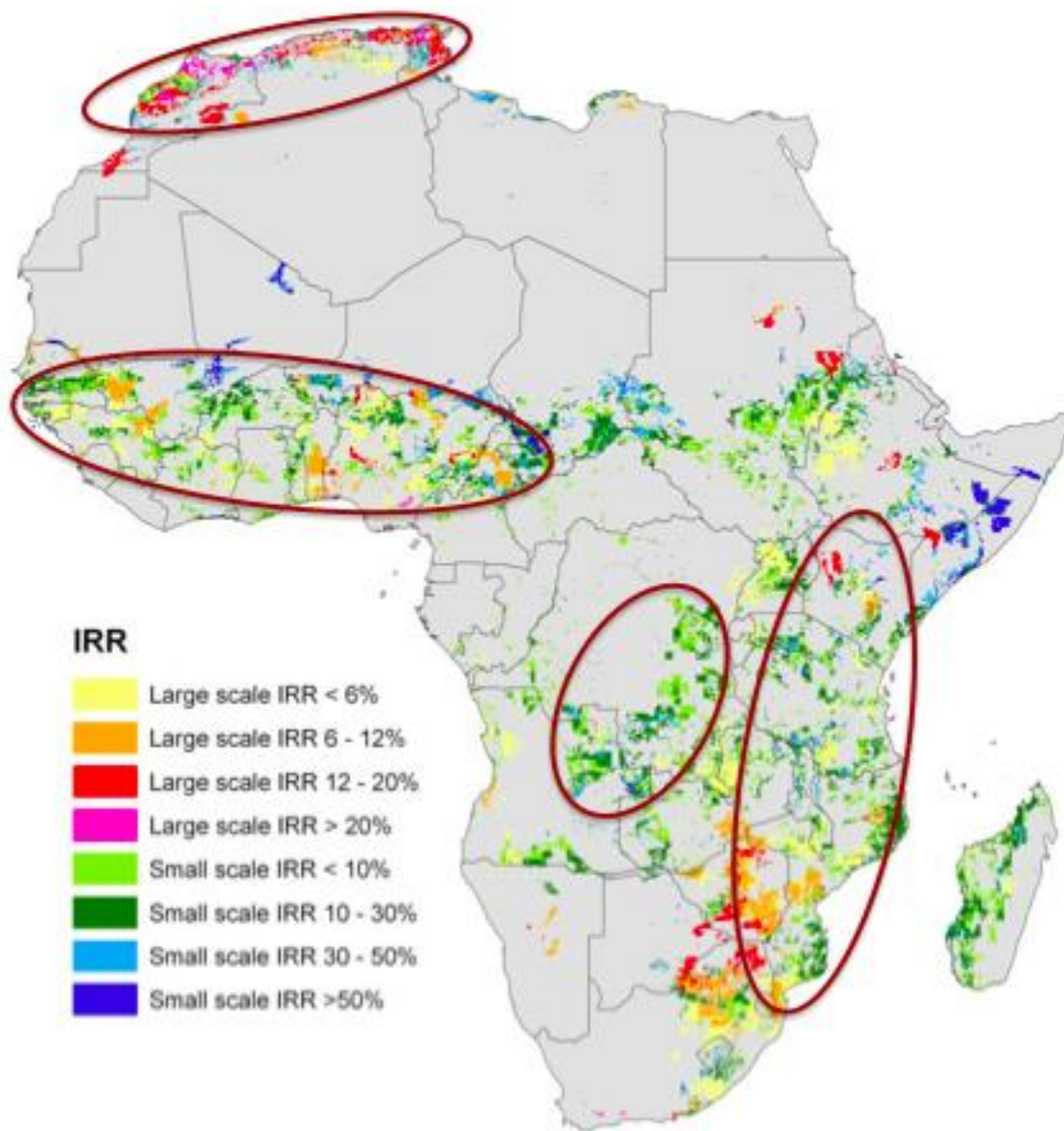
Map 6: Agricultural Potential in Africa<sup>70</sup>



<sup>70</sup> Deutsche Bank, Agricultural Value Chains in Sub-Saharan Africa (2014). [https://www.dbresearch.com/PROD/DBR\\_INTERNET\\_EN-PROD/PROD000000000333152/Agricultural+value+chains+in+Sub-Saharan+Africa%3A+From+a+development+challenge+to+a+business+opportunity.pdf](https://www.dbresearch.com/PROD/DBR_INTERNET_EN-PROD/PROD000000000333152/Agricultural+value+chains+in+Sub-Saharan+Africa%3A+From+a+development+challenge+to+a+business+opportunity.pdf)



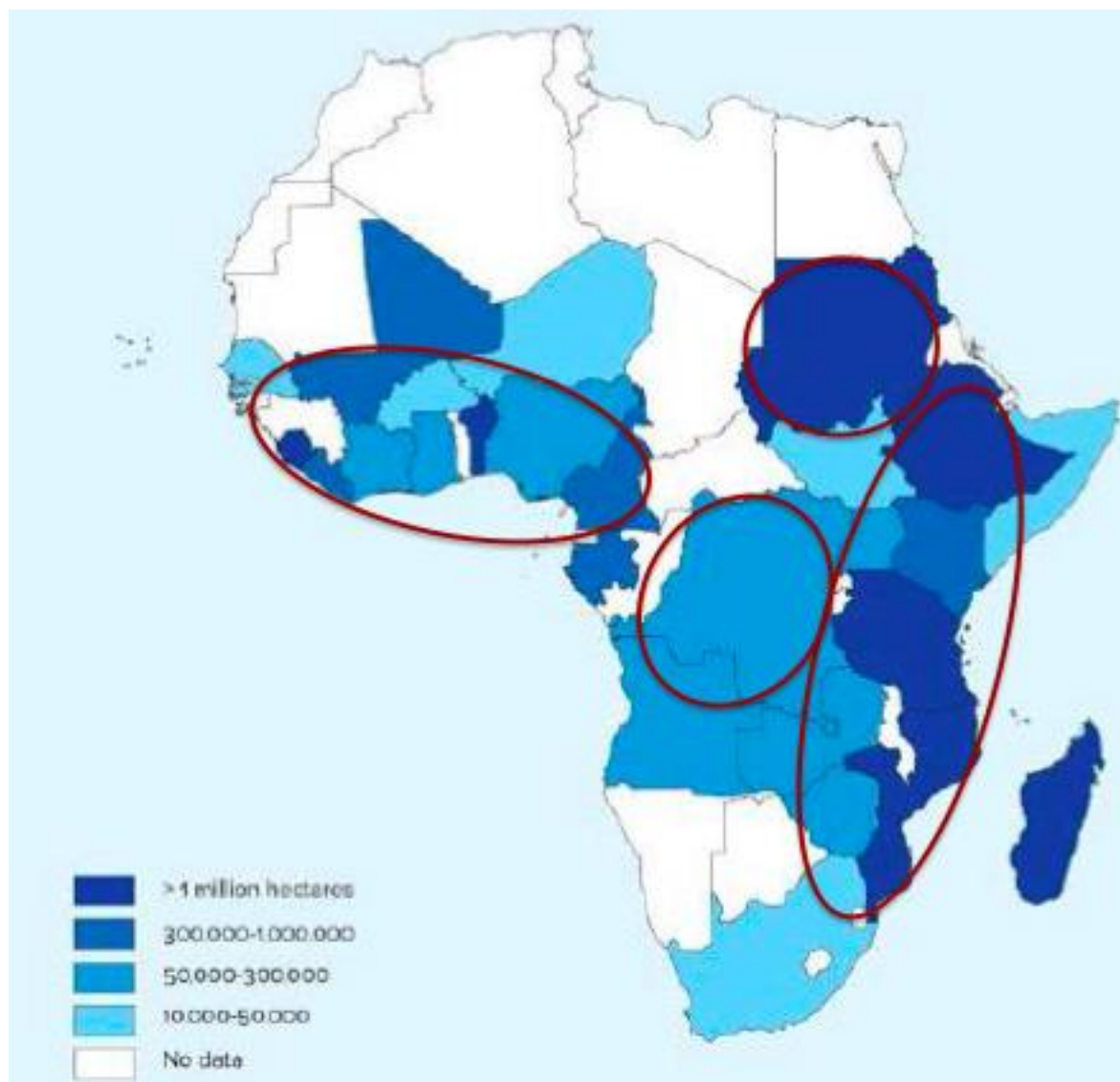
Map 7: Irrigation Potential in Africa<sup>71</sup>



<sup>71</sup> IFPRI, What is the Irrigation Potential for Africa (2010). <http://www.ifpri.org/sites/default/files/publications/ifpridp00993.pdf>  
African Ecological Futures



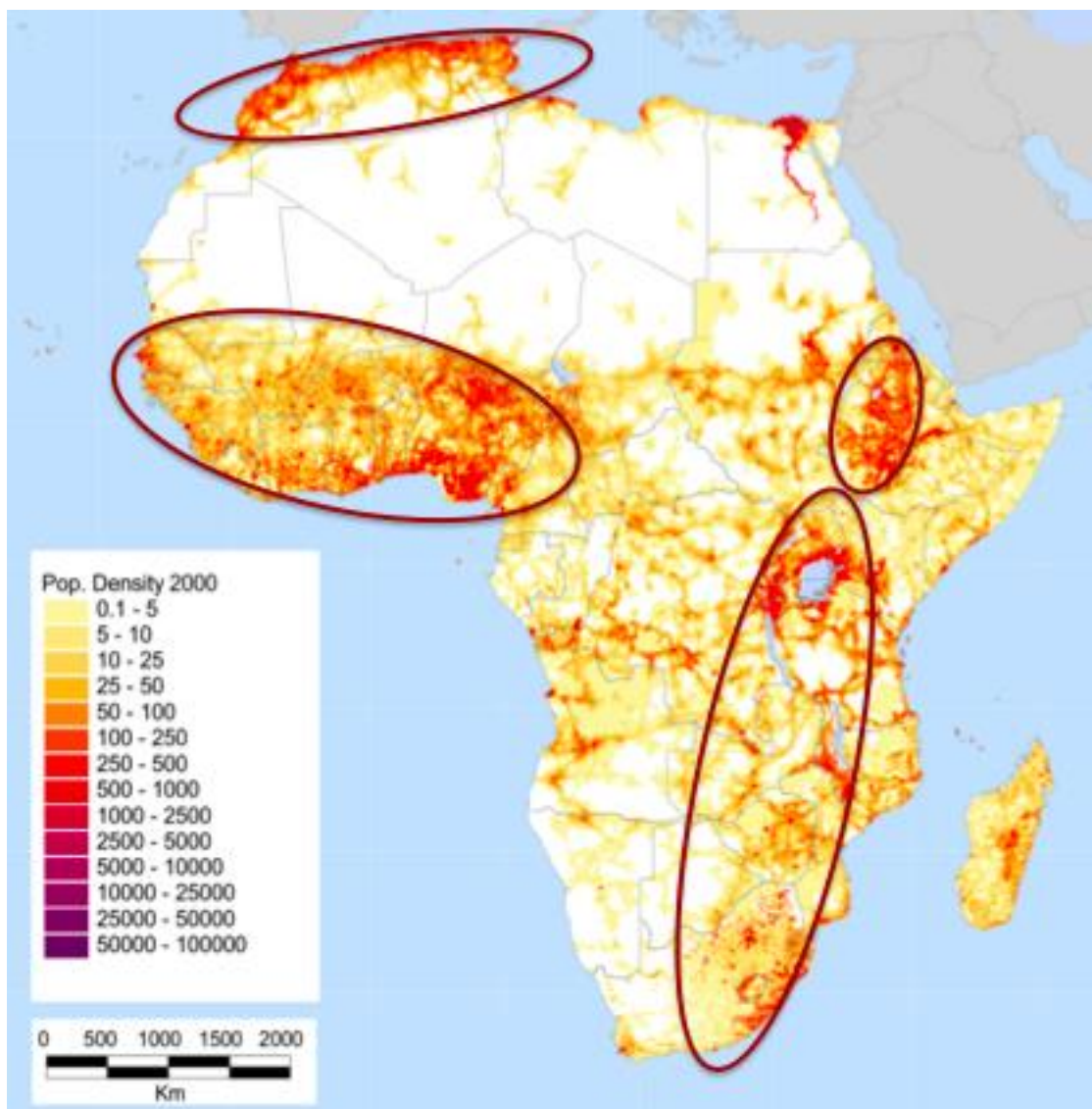
Map 8: Foreign Transactions on Agricultural Land in Africa<sup>72</sup>



<sup>72</sup> African Ecological Futures, Agriculture Scenarios Paper  
African Ecological Futures



Map 9: Africa Population Density<sup>73</sup>

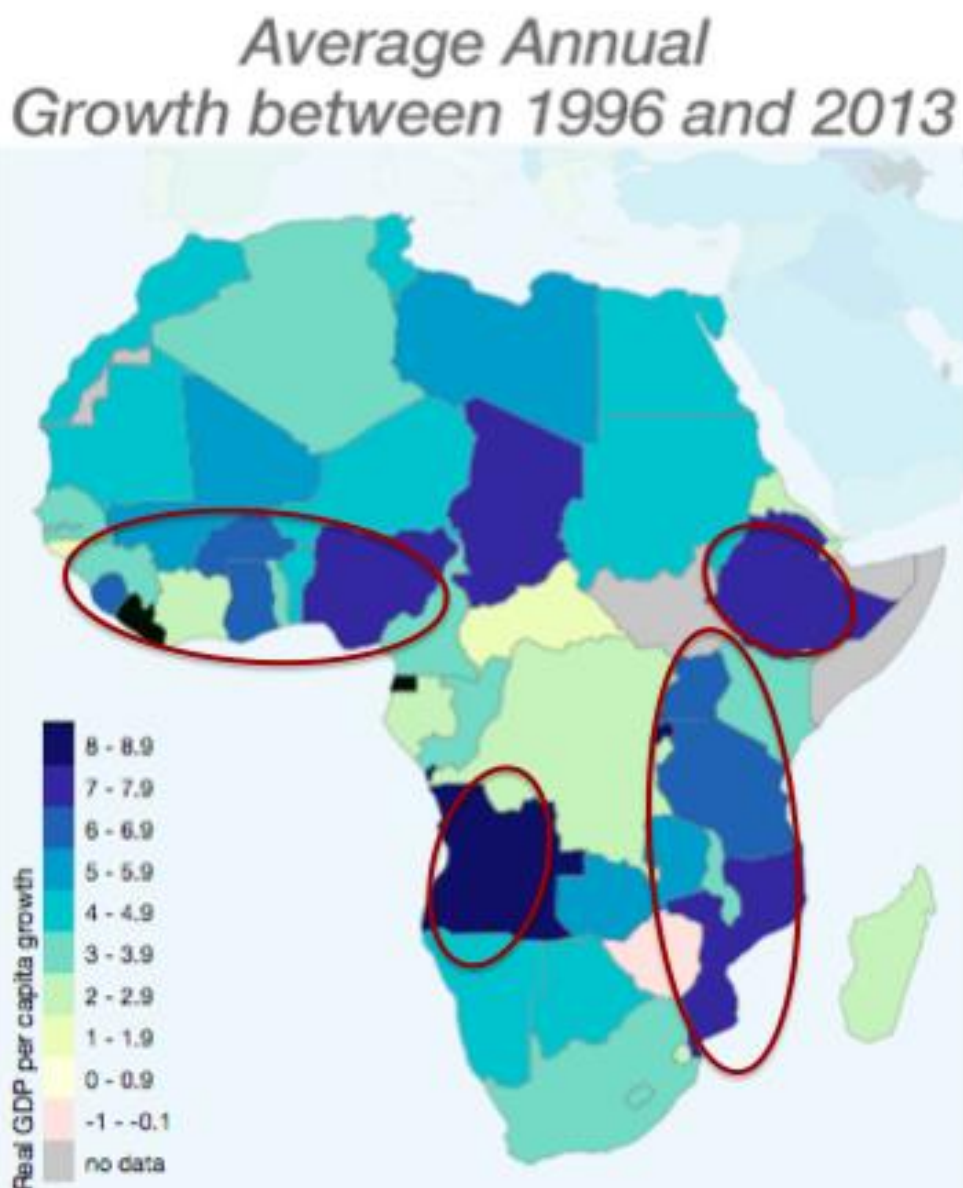


<sup>73</sup> Brett Keller, African Population Density (2013). <http://www.bdkeller.com/2013/07/african-population-density/>  
African Ecological Futures





Map 10: Africa – Average Annual Growth Rate in Real Per Capita GDP<sup>74</sup>

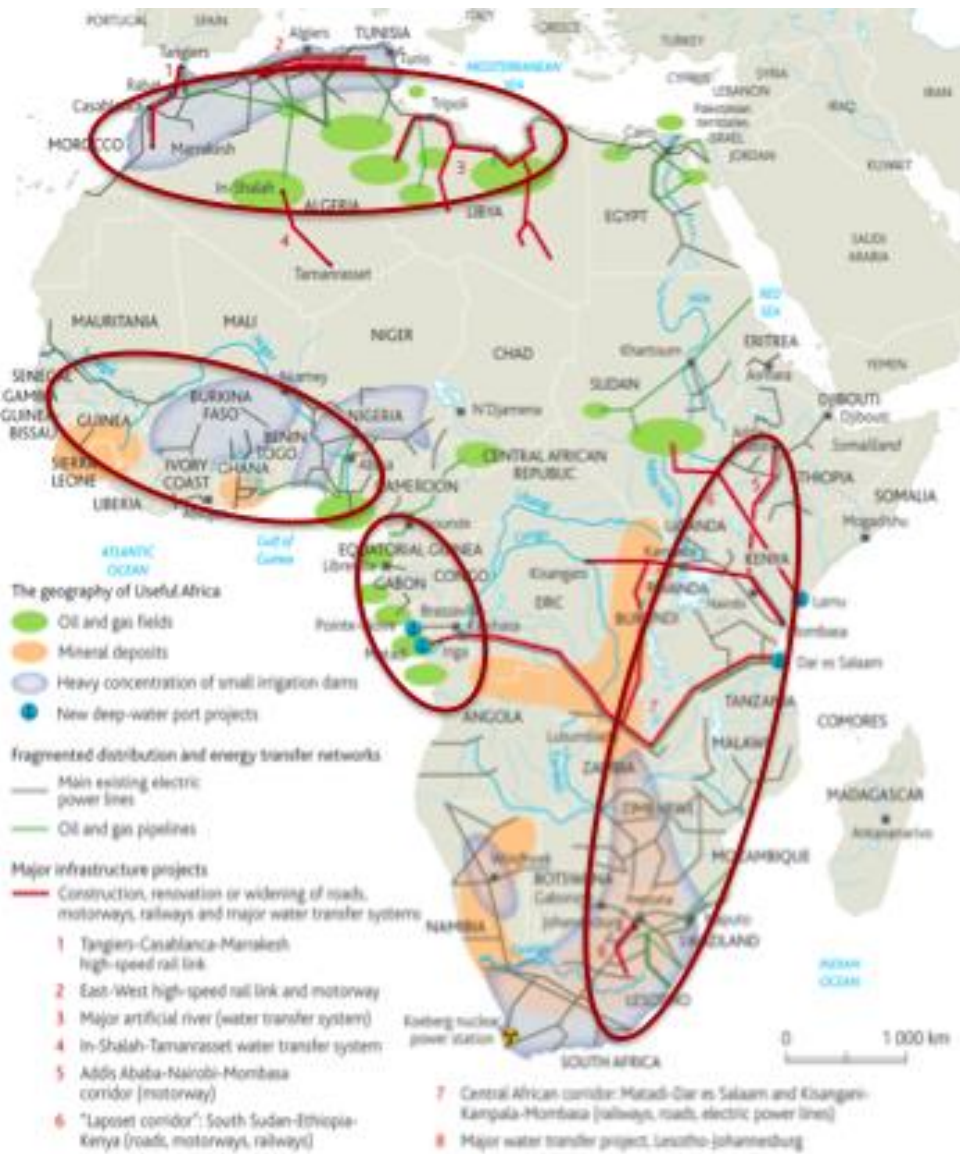


<sup>74</sup> Max Roser, Trends in Africa, Our World in Data <http://www.ourworldindata.org/data/economic-development-work-standard-of-living/trends-in-africa/>



Map 11: "Useful Africa"<sup>75</sup>

NOTE: This existing map provides a useful approximation of the type of spatial implications of several sectors (particularly extractives and infrastructure), and is indicative of the overlap discussed above.



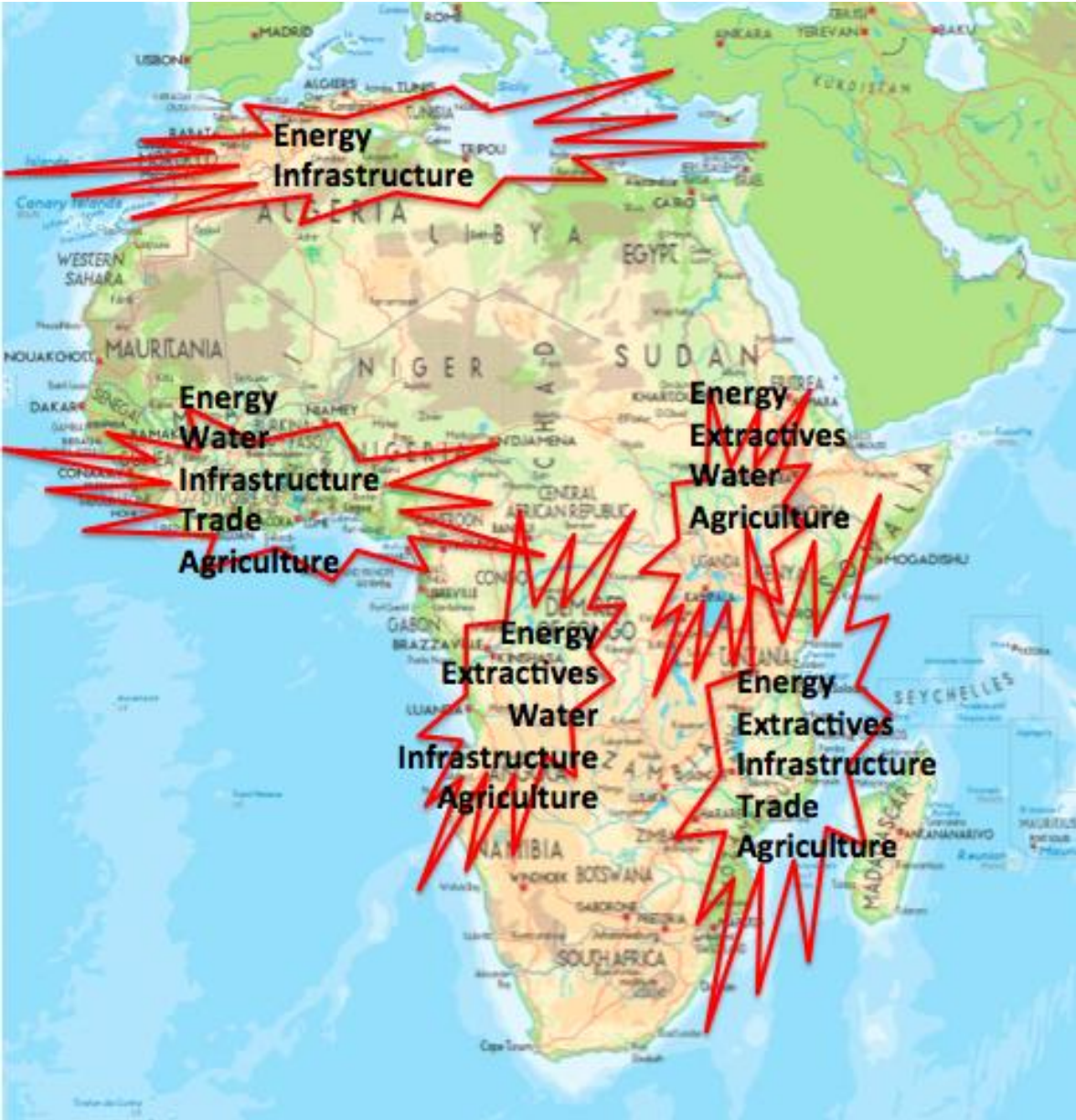
<sup>75</sup> Philippe Rekacewicz, Le Monde, "Useful Africa" (2011) <http://mondediplo.com/maps/usefulafrica>  
African Ecological Futures





**Map 12: Potential Development Flashpoints**

NOTE: This map captures some potential flashpoints in Africa where there is spatial overlap of multiple sectors and cross-sectoral drivers of growth.





## 6.2. Ecological Implications

A comparison of the flashpoints identified above and Africa’s ecological zones offers some insight into areas that merit closer scrutiny and study, in terms of future ecological threats and potential conservation responses.

WWF’s list of global priority places in Africa offers a starting point for such an investigation. One finds that several of WWF’s current priority places are, in fact, spatially correlated with one or more flashpoints. These regions include Madagascar (region 19 in the figure alongside), the African Rift Lakes Region (region 1), the Congo Basin (region 12), sections of the Miombo Woodlands (region 22), parts of the West African Marine Region (region 33) and the North African strip of the Mediterranean region (region 20).



Figure 9: WWF – Global Priority Places (Africa)<sup>76</sup>

Conservation International’s Critical Ecosystem Partnership Fund (CEPF) invests in several biodiversity hotspots around the world, including in Africa. Several of the ecologically sensitive regions it has identified display some spatial overlap with the flash points described in this paper.

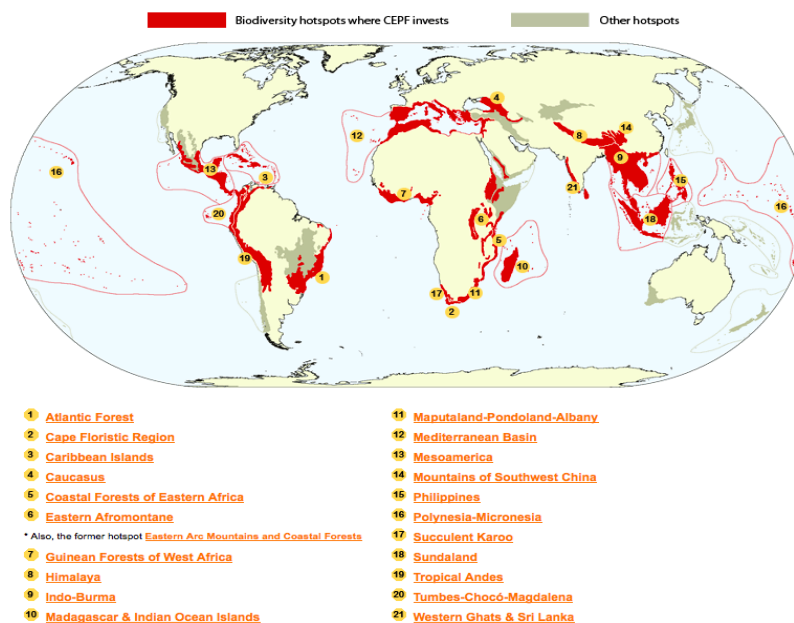


Figure 10: CEPF – Global Biodiversity Hotspots<sup>77</sup>

<sup>76</sup> WWF – Earth’s Most Special Places, [http://wwf.panda.org/what\\_we\\_do/where\\_we\\_work/](http://wwf.panda.org/what_we_do/where_we_work/)

<sup>77</sup> Conservation International and CEPF, Global Biodiversity Hotspots, <http://www.cepf.net/resources/maps/Pages/default.aspx>

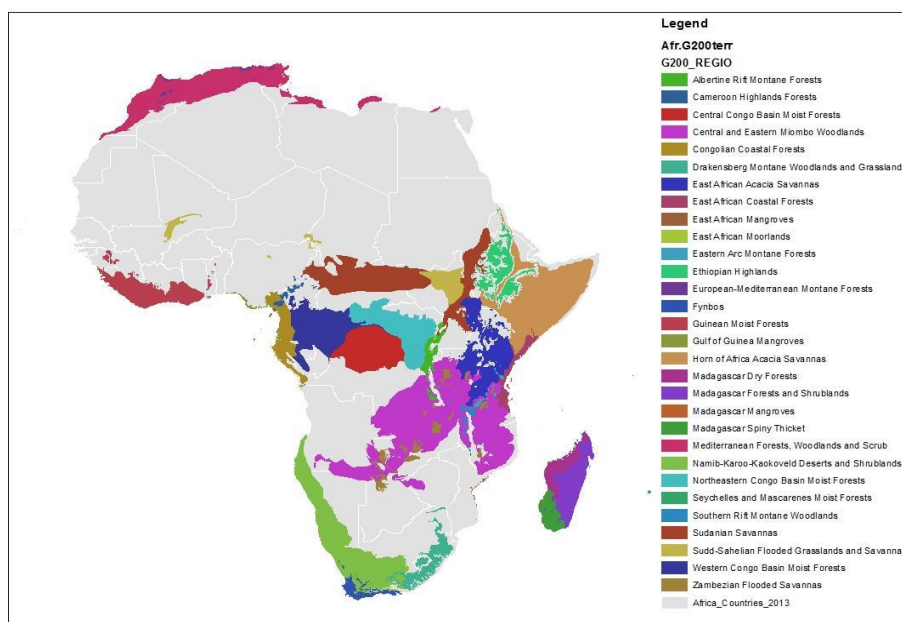


These include the Guinean forests of West Africa, Madagascar and the Indian Ocean islands, coastal forests of Eastern Africa, the Eastern Afromontane, and the North African part of the Mediterranean.

The concept of “biodiversity hotspots” was first developed by Russell Mittermeier in the late 1980s, and given concrete form in his 2000 publication in *Nature*. Of the 25 biodiversity hotspots identified in the seminal paper, some overlap with the flashpoints identified by the African Ecological Futures: the Eastern Arc and Coastal Forests of Tanzania and Kenya, Madagascar, the Western African Forests (in addition, the succulent Karoo and Cape floristic province of South Africa were also highlighted).<sup>78</sup>

A comparison with the G200’s list of sensitive ecological zones in Africa indicates spatial connections with Madagascar’s forests and shrublands, Madagascar’s dry forests, Madagascar’s spiny thicket, the East African Acacia Savannas, the Southern Rift Montane forests, the Ethiopian Highlands, the East African Coastal Forests, the Sudanian Savannas, Cameroon’s Highland Forests, Congolian Coastal Forests, Central Congo Basin Moist Forests, Northeastern Congo Basin Moist Forests, Guinean Moist Forests, and Mediterranean forests etc.

Figure 11: G200 Africa Sensitive Ecological Zones<sup>79</sup>



A detailed exploration of the ecological implications of these flashpoints in Africa is beyond the scope of this paper, and requires a focused, technical investigation. Within the scope of such a study, it would also be interesting to overlay projected climate change impacts across Africa (in terms of changes in temperature and precipitation) and determine whether there is an additional threat of degradation in the same areas.

<sup>78</sup> Myers, Mittermeier et al., “Biodiversity Hotspots for Conservation Priorities” *Nature*, 403, 853-858 (24 February 2000)

<sup>79</sup> African Ecological Futures – Infrastructure Corridors Paper



### 6.3. Conclusion

Given the emergence of clear spatial trends from the six African Ecological Futures scenario papers, it is evident that the interplay between the scenarios has ecological implications. A thorough investigation is necessary to pinpoint the exact ramifications, the more precise locations, and the extent of the impacts from the confluence of multiple scenarios – especially the ones that create a larger burden on Africa’s natural resources. Thus, we recommend that such a study be undertaken and be accompanied – to the extent resources allow – by comprehensive modeling projections.

Additionally, we recommend that development planners, conservation experts, natural resource managers, and economic decision makers use the current study as a starting point to examine how different levers can be used to influence the development trajectory of the various sectors addressed by this project. Many of the scenarios, for instance, point to the critical role of good governance, strong institutions, and an empowered civil society in order to effect futures that promote inclusive growth and sustainable use of natural capital. Those invested in the emergence of more benign or sustainable pathways can therefore take a deeper look at how they can strengthen governance through their work. This is just one example of how the work begun by the African Ecological Futures project can have continuity and become a foundation for future efforts to safeguard the continent’s natural resources.



## APPENDIX A

The TABLE below showcases some of the key elements that shape each paper’s scenarios and allows for some of the common elements to become apparent.

Key Element	Energy	Water	Agriculture	Extractives	Trade and Investment	Infrastructure Corridors
<b>Drivers</b>	Population growth; Changes in consumption patterns; Urbanisation; Commitment to energy access;	Population growth; Economic growth; Urbanisation and migration; Trade and Investment; Technology, science and innovation	Increasing global and African demand for food (including changing preferences); Market signals; Changing investment patterns and sources; Infrastructure changes such as agricultural corridors.	Increasing global and African demand for extractives; Attractiveness of investment in mining, minerals, oil and gas sector.	N/A	N/A
<b>Uncertainties or Unknowns</b>	Availability and direction of finance; Transition to sustainable biomass; Regional energy market integration	Climate change impacts; Future water use and demand; Future innovation and technology; Institutional stability and capacity	Climate change impacts; Improvements in productivity and efficiency; Regional market integration; Enabling policy environments; Inter-sectoral competition for inputs	Future resource discoveries; Resource discoveries in ecologically sensitive areas; Demand changes; Supply changes from rest of the world; Availability of investment capital; Availability of infrastructure; Security and	Climate change projection impacts; Effect of political stability; Degree of corruption; Differences in national development strategies (diversified economies / oil exporters / transition economies / pre-transition economies); Delays in large infrastructure projects; Degree to	Level of political will to deliver; Uncertainty over pace and degree of regional political and economic integration; Extent to which corridors support fundamentally extractive and export-oriented economic



political stability; Political decisions about exploiting now vs. later vs. never; Levels of corruption or probity; Resource nationalism vs. relinquishment to foreign entities

which infrastructure gap is closed; Extent of social and ecological responsibility of investors to communities.

activities over inclusive and diversified sector development; Integration of comprehensive cost-benefit evaluations in strategic decision-making about the spatial location of infrastructure corridors and nodes.

<b>AXES: Critical Uncertainties or Trade-offs</b>	(1) Degree of reliance on centralized grid systems, i.e. small-scale, distributed generation and supply vs. large-scale, grid-connected generation and supply. (2) Carbon intensity of fuel source, i.e. low-carbon energy sources vs. hydrocarbon-based fuels.	(1) Degree of sustainability of growth, i.e. growth at all costs exploiting natural resources vs. sustainable, green growth with a recognition of the value of resources; (2) Nature of institutional capacity, i.e. extractive vs. inclusive institutions.	(1) Mode of agriculture, i.e. commercial vs. smallholder and subsistence-oriented farming; (2) Target market, i.e. production for food security and consumption within Africa vs. production for export globally.	(1) Degree of resource production, i.e. extractive, high production vs. non-extractive, low production; (2) Nature of governance and its attention to sustainability or environmental concerns, i.e. well governed vs. poorly governed extraction.	(1) Degree of inclusiveness and the quality and strength of institutions, i.e. inclusive vs. extractive institutions; (2) Degree of interconnectedness and extent of infrastructure, i.e. unconnected, basic national infrastructure vs. transnational and intra-African infrastructure.	(1) Extent to which environmental assessments inform decisions about location, prioritization of infrastructure; (2) Degree to which civil society is empowered to actively engage in decision-making processes; (3) Degree to which investors are able and motivated to evaluate environmental, ecological, and social costs of infrastructure corridors.
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<b>Levers or Pivot Points / Interventions that can influence outcomes</b>	Fossil fuel subsidies; Pricing carbon; National energy targets; Enabling regulatory frameworks and incentives; Finance flows and investment; Reduction in transaction costs; International climate commitments; Regional cooperation; Investment in improved technology; Implementation of Sustainable Energy for All Programme.	Strengthening regional and national institutions; Strengthening policies and frameworks; Improving understanding of climate change impacts; Improving understanding and implementation of water limits or thresholds for aquatic ecosystem functioning.	Investing to ensure agricultural expansion is sustainable; Facilitating agricultural markets and trade; Improving productivity; Investing in capacity across the agricultural value chain plus skills training; Public infrastructure for agricultural growth; Reducing rural vulnerability and insecurity; Improving policies and institutions.	Lobbying to strengthen disclosure requirements to be listed on stock exchanges; Strengthening African civil society and building capacity to monitor companies; Lobbying to encourage adherence to existing voluntary guidelines; Supporting African governments to strengthen legal and regulatory frameworks and capacity.	Strengthening regional and continental organisations; Strengthening policies and regulatory frameworks to attract investors; Measured, sustainable approach to extractive industries and practices.	Mapping ecological impacts (such as studies on impacts of infrastructure, tied to ecologically sensitive areas); Providing decision support tools that incorporate non market values; Demonstrating sustainable infrastructure corridors; Advancing market mechanisms that protect areas from infrastructure; Empowering civil society through information-sharing and location-specific grassroots initiatives; Supporting the investor community to effectively value costs of poor environmental and social management.
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