# Natural Capital Atlas of Africa

**Catalyzing the Achievement of Africa's Agenda 2063**

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# INTRODUCTION TO THE REPORT

## 1. Background

The African Development Bank, in collaboration with the United Nations Environment Programme (UNEP), seeks to develop a Natural Capital Atlas for Africa. The atlas will provide a detailed geo-locational inventory of Africa's natural resources in addition to identifying the challenges and opportunities in catapulting the region's need to harness the resources for its current and long-term development priorities.

The African Development Bank (AfDB) supports its regional member countries (RMCs) in managing their natural assets efficiently and sustainably for greater social and economic impact. In the context of its 'High 5' strategic priorities, the Bank focuses on upstream governance, environmental protection and value addition through interventions that increase institutional capacity and effectiveness of public and private stakeholders. Similarly, United Nations Environment Programme (UNEP), being the lead United Nations entity on environmental matters, uses science-policy interventions to accelerate the sustainability of natural resource endowments in the continent through its Africa Regional Office.

Through an envisioned Natural Capital Atlas for Africa, both the African Development Bank and UNEP Africa Regional Office seek to strengthen the availability of data and information that will aid in the identification of the natural resources endowments as the assets underpinning the region's socio-economic development. The resulting data and information will uncover the challenges and opportunities associated with sustainable management of these resources. This is in addition to looking at the impacts of unsustainable exploitation of some of these resources on livelihoods, economies, and the environment at regional and national levels.

## 2. Rationale for the Atlas

**The integrity and functionality of the continent's natural assets are increasingly compromised.** The main drivers include growing global and domestic demand for natural resources and their unsustainable management. Ecosystems are degrading faster than they can recover, and the mismanagement of natural resources results in significant illicit outflows, economic losses, and adverse social and environmental impacts. This may irreversibly reduce their benefits and their availability to future generations.

**Effective management of natural capital is currently constrained both by a lack of quantitative and qualitative information concerning natural capital and by the failure to use existing information in management decisions**. Countries are in a better position to seize growth opportunities inherent to their natural capital, weigh degradation costs and climate risks, and understand the repercussions of policy and investment choices to support sustainable development when they are equipped with evidence and data. The atlas seeks to strengthen the availability of data on Africa's natural capital endowment and related key issues to support national and regional planning and decision making, including strategic investments. The atlas will convey natural resources, environmental and socio-economic data in a cartographic format so that information is represented in its respective geographic location, supported by satellite image change pairs, illustrations, and ground photographs.

**The need to support and catalyse the implementation and achievement of Agenda 2063's broader transformative vision of environmentally sustainable development** by serving as an indicator roadmap highlighting challenges and opportunities in the natural capital assets and actions that countries can target for the creation of multiple benefits towards inclusive and sustained growth.

## 3. Scope of the Atlas

This first Atlas of its kind, provides information, baseline data and changes in natural capital across all 54 African countries using short narrative in a simple language, maps, satellite images and infographics. This is a science-based tool that sheds light on the risks faced by all countries due to loss of natural capital, designed to support decision-making.

We all are aware that the planet is changing, however, "seeing is believing" and 'a picture is worth a thousand word' therefore the atlas will help to connect complex scientific information to the public by harnessing the potential of information technology tools.

The atlas is a tool for knowledge through thematic examination of the various components of the natural capital, their distribution, state, and change over time and change visualization by site specific change studies from different areas of the continent based on visual presentation of current and historical remote sensing imagery, maps, and photographs. The key will be the integration of data sets from multiple sources and package scientifically credible information to enhance understanding of policy makers and public. The book will attempt to answer the following questions:

- What is the status and trend of important natural capital?
- What are the transboundary issues which need bilateral international cooperation?
- What is the "scientific evidence" of significant local level changes in natural capital in Africa for place-based policy interventions?

The Atlas will provide a hard evidence base for strategic intervention by organizations and communities.

## 4. Methodology

**The development of the atlas employs a multi-stakeholder and multi-step approach** including (i) a definition of the scope and structure of the report. This will involve identification of the relevant themes, stocktaking of available data, and consultations at a regional level with experts and end-users of the atlas; (ii) data collection, analysis, and visualisation, based on agreed scope and structure of the report; and (iii) map development using geographic information system (GIS) and remote sensed data.

**Environmental data visualization a key strategy used in this atlas**. At a time when policy makers are striving to identify the impacts of human actions on natural life support system (air, land and water), this Atlas will employ high impact visuals such as graphs, charts and powerful, time-sequenced before after satellite images, maps, ground photos and **develop story lines from all parts of Africa covering all ecosystems to provide unique, visible and scientifically-convincing evidence** where human actions are causing substantial constructive as well as harmful changes to the environment and natural resource base.

This provides visual and compelling evidence of the rapid changes taking place in critical ecosystems. Side-by-side display of historical and current remote-sensing images. Maps and other visuals highlight air pollution, forest degradation, wetland loss, changes in water bodies, impacts of urbanization and settlements on fragile ecosystems and signs of coastal degradation. They also highlight the stories of positive change. Indicating where action has led to improvement in the state of the environment.

# 5. Framework for Assessment

The assessment uses the Drivers, Pressures, State, Impact and Response (DPSIR) approach to assess, measure, and provide a guide to managing natural capital. The DPSIR assesses the environmental conditions and trends, the pressures on natural resources, the impacts of human activities on ecological goods and services and propose societal responses to environmental problems that both assist to prevent further environmental degradation and restore unhealthy ecosystems.

The step-by-step process and methodology used during the atlas preparation process is depicted in the figure below:

**Data compilation, screening and analysis**

Extensive desk review of published literature, government documents, international organisations reports, scientific papers
- Screening and analyis of statistical data, maps and satellite data analysis
- Stakeholders consultations
- Peer review process

**Framework for analysis and monitoring**

- Drivers-Pressure- State- Impact- Response
- Key indicators

**Assessment and reporting**

- The state of natural capital
- Impacts

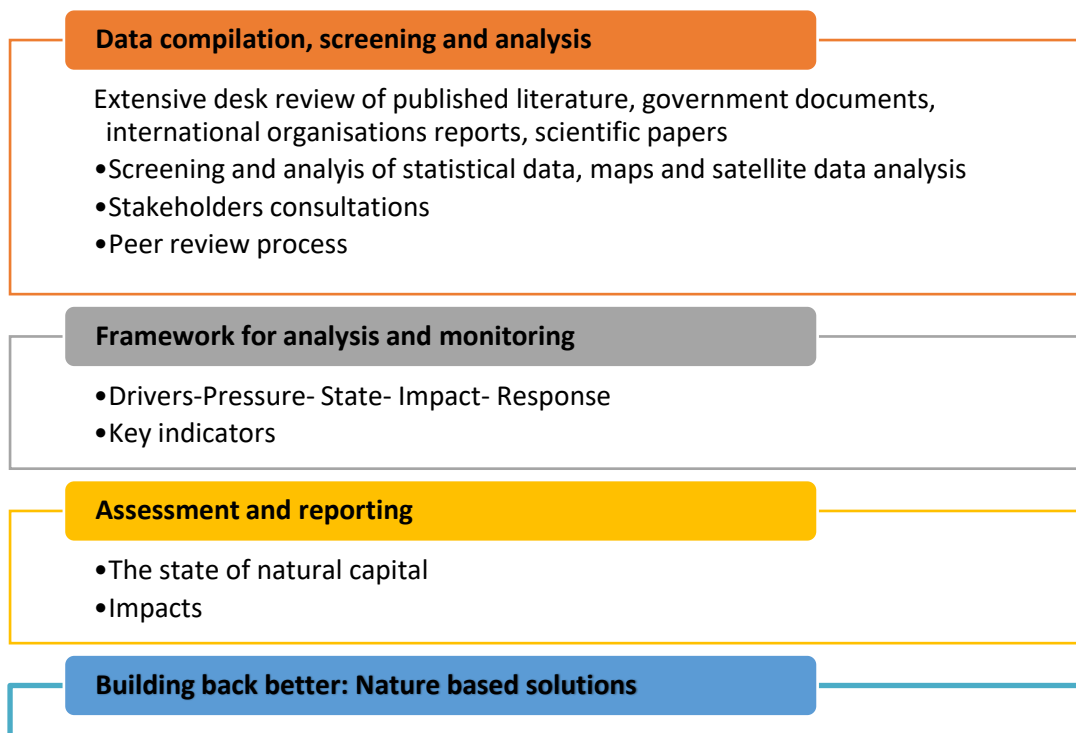**Building back better: Nature based solutions**

**Fig: Analytical framework and methodology to be used in the Atlas**

# CHAPTER 1: INTRODUCTION

## 1.1 Overview of Natural Capital of Africa

Africa is the second largest continent after Asia in the world with a total land area approximately 30,365,000 square km, and the continent measures 8,000 km from north to south and about 7,400 km from east to west.

It is geographically diverse and endowed with landscapes ranging from mountains to lush green tropical forests, a rich variety of flora and fauna and long coast lines. It has a variety of terrestrial ecosystems such as mountains, valleys, plains, peninsular plateau, deserts, coastal plains, Islands, rain forests, savanna and as well as diverse aquatic ecosystems such as corals, estuaries, lakes, marine mangroves, wetlands, and rivers. The continent is gifted with various types of resources such as fertile agricultural land, forests, minerals, fossil fuels and water.

However, these resources are unevenly distributed. The world population increased from 1 billion in 1800 to around 8 billion today. Africa has also rapid population growth. The striking change between now and 2100 is the expected growth in the African population. Today, its population is around 1.4 billion; by 2100 it's projected to reach just under 4 billion.

With the impact of population explosion, is exhaustion of natural resources and environmental degradation. Environmental challenges relate to rapid urbanization, decline of food production due to land degradation, air pollution, scarcity of surface and ground water, loss of biodiversity, and impact of climate change.
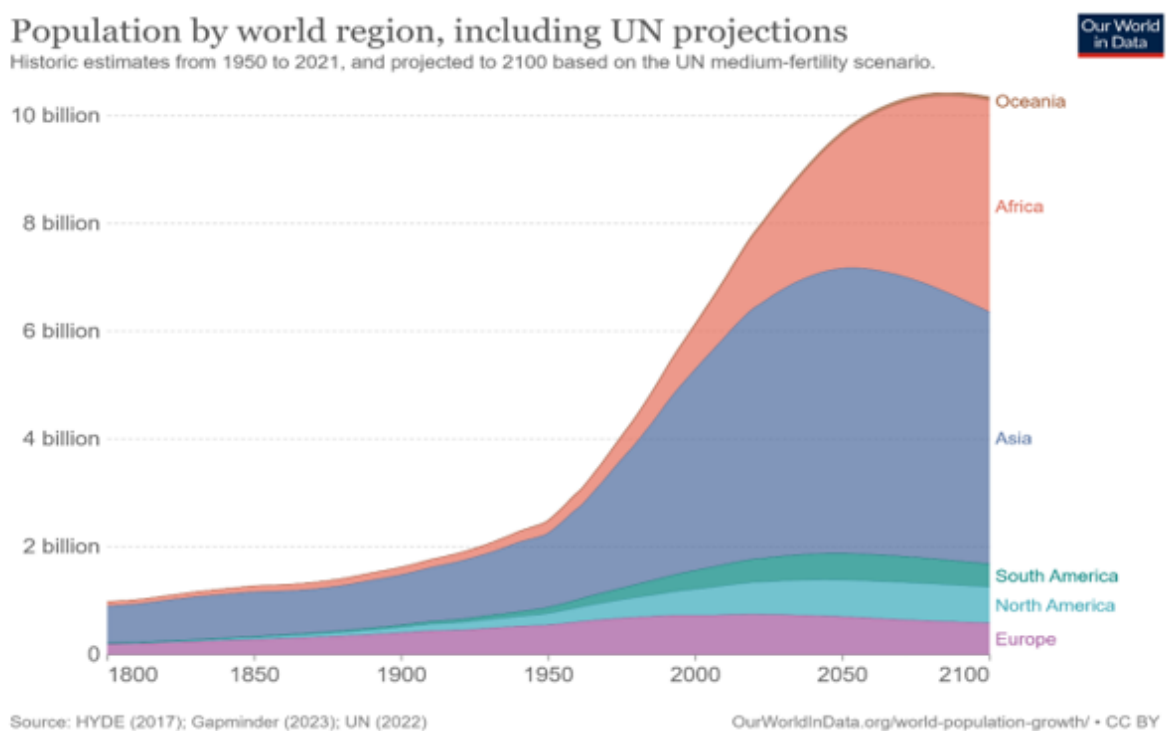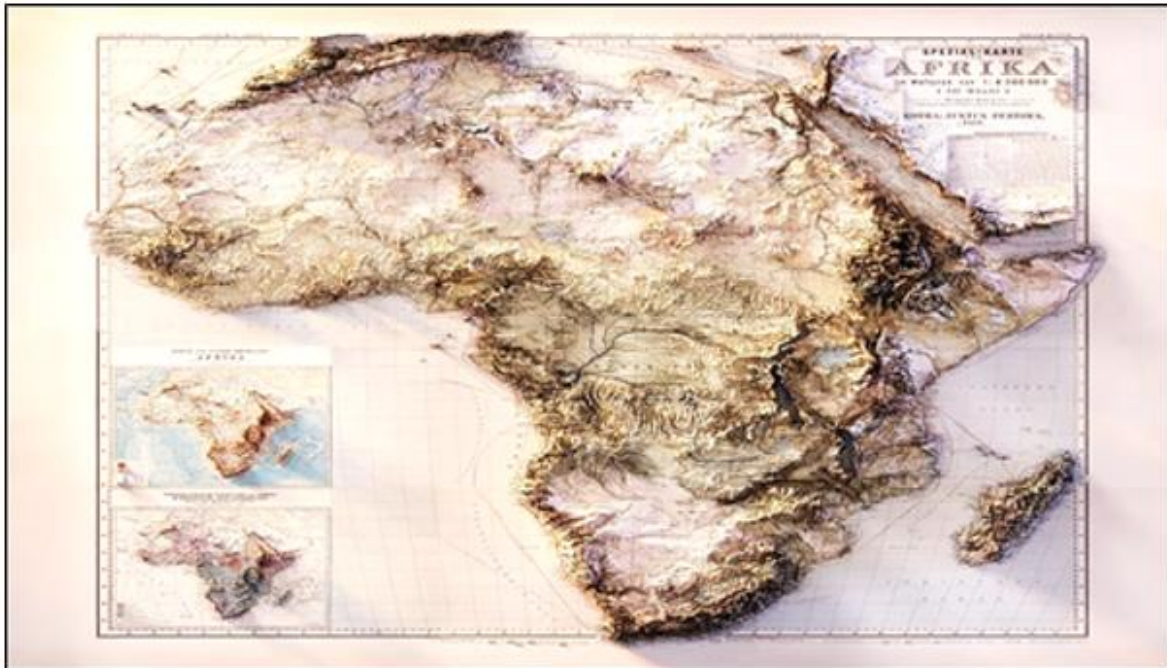


**Fig: Population by world region**

Fig: Africa topography . Note: This is a digitally rendered map (printed in 2D) of Africa derived from a vintage topographic map from 1885 ("Special-Karte von Afrika", Hermann Habenicht, 1885). Digital Elevation Data (DEM), obtained from the Shuttle Radar Topography Mission is processed and digitally rendered to create a highly detailed elevation profile (printed on a flat surface.

Africa has immense potential in terms of natural capital, including fresh water, forests, and extensive mineral deposits to attract investment and accelerate economic growth. The continent is home to the world's second largest rainforest, and its living organisms comprise 25% of global biodiversity.
Africa also holds 7% of the world's natural gas and oil reserves. The continent also has more than 60% of the world's undeveloped arable land. Around 30% of global mineral reserves are in Africa, including 60% of world cobalt reserves and 90% of platinum-group metals. The continent contributes substantially to the world's annual production of six key minerals: 80% of platinum, 77% of cobalt, 51% of manganese, 46% of diamonds, 39% of chromium and 22% of gold.

## 1.2 Natural Resources Contribution to African Economies

In this section, the importance or weight of natural resources in African economies would be discussed including their contribution to GDP (at continental and regional levels). This is a science-based tool that sheds light on the risks faced by all countries due to loss of natural capital. So, on the flip side, there will also be discussions on the opportunities presented of not losing natural resources and the implications for decision making and policy.

## 1.3 Nexus between Continental and Global Agenda: High 5s, SDGs and Africa's Agenda 2063

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for

action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go together with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests (UN, 2015).

AGENDA 2063 is Africa's blueprint and master plan for transforming Africa into the global powerhouse of the future. Out of 20 goals of the agenda 2063 this atlas contributes towards the "*Goal 7 Environmentally sustainable and climate resilient economies and communities*".

Both Agenda 2063 and Agenda 2030 contain common elements for a development trajectory that will provide Africa with a healthy living environment while ensuring good health and quality of life for her people. The two are also critical to preserving and valuing Africa's natural capital for the benefit of its citizens and their livelihoods.



**Fig: The 17 Sustainable Development Goals (SDG**) **(UN, 2015)**

African Development Bank's High 5 priority areas are intended to support African countries' achievement of the SDGS. They are **Feed Africa; Light up Africa; Industrialize Africa; Integrate Africa; and Improve the Quality of Life for the people of Africa** (ADB, 2021)**.**

These High5's priority areas succinctly capture the following challenges in achieving these goals (UNDESA, n.d.):
1. **Light up & Power Africa:** Over 640 million Africans have no access to energy, corresponding to an electricity access rate for African countries at just over 40 percent, the lowest in the world. Per capita consumption of energy in sub-Saharan Africa (excluding South Africa) is 180 kWh, compared to 13,000 kWh per capita in the United States and 6,500 kWh in Europe. Africa's energy potential, especially renewable energy, is enormous, yet only a fraction of it is being currently employed. Hydropower provides around a fifth of current capacity but not even a tenth of its total potential is being utilized. Similarly, the technical potential of solar, biomass, wind and geothermal energy is significant.

**Fig: Night light image of the world as observed by satellite, Africa looks much darker than other parts of the world (NASA, 2017)**

2. **Feed Africa:** Access to food – in quantity and quality – is a fundamental human right. It is also essential for ending hunger and malnutrition and ensuring a healthier and productive workforce. Although agriculture employs over 60 percent of the African workforce and accounts for roughly a third of the continent's GDP, Africa is the most food-insecure region in the world with more than 232 million under-nourished people, or approximately one in four (ADB, 2021).

   Africa's potential for agricultural production is enormous, with 60 percent of the world's unused arable land. Increased food demand and changing consumption habits are leading to rapidly rising net food imports, which are expected to grow from US $35 billion in 2015 to over US $110 billion by 2025, which could be offset by increased African production (ADB, 2021). Export of primary agricultural production is still very high in Africa compared to other regions of the world. Therefore, agriculture offers a realistic prospect for large-scale job creation, especially in fragile economies. Given the importance of food and nutrition, promoting agricultural value chains, and improving market access have the potential to diversify economies, raise incomes, increase food security and macroeconomic stability, contribute to mitigating conflict and prevent internal and external migration.

3. **Industrialize Africa:** Africa is at the bottom of the global value chain with its share of global manufacturing at around only 1.9 percent. African economies still rely too heavily on raw commodities; between 2011-2013 manufactured goods made up only 18.5 percent of exports, while 62 percent of total imports were manufactured goods, a commercial imbalance that drains wealth away from the continent (ADB, 2021).

   There is a real opportunity, for Africa to create jobs and promote inclusive economic transformation through domestic manufacturing and a commodity-based industrialization process, capitalizing on the continent's resources and opportunities presented by the changes in the structure of global production. Exploiting Africa's opportunities for industrialization involves adding value to domestic products, soft and hard commodities and developing forward and backward linkages to the regional and international value chains.

4. **Integrate Africa:** Africa's regional integration challenges are well known. Intra-African trade is the lowest globally – approximately 15 percent compared to 54 percent in the North America Free

Trade Area, 70 percent within the European Union and 60 percent in Asia. The continent's difficult physical landscape makes connection between communities, countries, and even entire regions challenging.

There is also very limited integration of regional markets for infrastructure services, particularly in power, energy, water, and sanitation sectors. This is further complicated by weak regional economic communities (RECs) that are poorly structured and lack the capacity to make or even attract necessary regional investments. This is especially significant for fragile countries, as they stand the most to gain from greater integration.

5. **Improve the quality of life for the people of Africa:** Despite the encouraging economic development enjoyed by many African countries during the last decade, many of them are still characterized by widespread poverty and inequality. Health and education outcomes are among the lowest in the world and the continent's population has insufficient access to sanitation and safe drinking water. Weak institutions make it difficult, especially in fragile economies, to deal with calamities such as pandemics or the serious droughts.

Since the United Nations Conference on Environment and Development in Rio (1992), sustainable development remained elusive for many African countries, with poverty being a major challenge and desertification, deforestation and climate change its main threats. A growing emphasis is being placed on the *nexus approach to sustainable development*, seeking to realize synergies from the links between development factors such as energy, health, education, water, food, gender, and economic growth (UNDESA, n.d.).

# CHAPTER 2: NATURAL CAPITAL TYPOLOGY

## 2.1 Overview

In brief, this chapter will start by giving a definition of natural capital. It will then discuss how natural capital underpins the economy and human wellbeing. It will use material from the Millennium Ecosystem Assessment and the Dasgupta Review, along with other studies at national level. It will attempt to help decision makers understand how the multiple components of natural capital interact to deliver ecosystem services.

## 2.2 Natural Capital

Natural capital is the stock of natural resources, which includes geology, soils, air, water, and all living organisms. Some natural capital assets provide people with free goods and services, often called ecosystem services. Two of these (clean water and fertile soil) underpin the economy and society, and thus make human life possible.

Africa, the world's second-largest continent holds a huge proportion of the world's natural resources, both renewable and non-renewable. According to the African Development Bank:
- About 30 per cent of the world's mineral reserves are in Africa. The continent has 8 per cent of the world's natural gas reserves, 12 per cent of its oil reserves, 40 per cent of its gold, and 80–90 per cent of its chromium and platinum (AMCEN, 2016).
- The largest cobalt, diamond, platinum and uranium reserves in the world are in Africa.
- Africa holds 65 per cent of the world's arable land and 10 per cent of internal renewable fresh water sources.
- The African fisheries sector is estimated to be worth $24 billion (AMCEN, 2016).
- Africa is home to the second largest tropical forest in the world and to some of the highest annual rainfall in the heart of the Congo basin (AMCEN, 2016)

Africa is home to vast natural capital, unique biodiversity, and ecosystems such as forests. This offers significant opportunities for social and economic development and can contribute to lasting nature-based solutions to climate change mitigation and adaptation. At the same time, there is a risk of overexploitation and depletion in addition to the threats posed by unsustainable fishing and management of water resources, pollution, desertification, and, in the case of coastal areas, rising sea levels (EC, 2020).

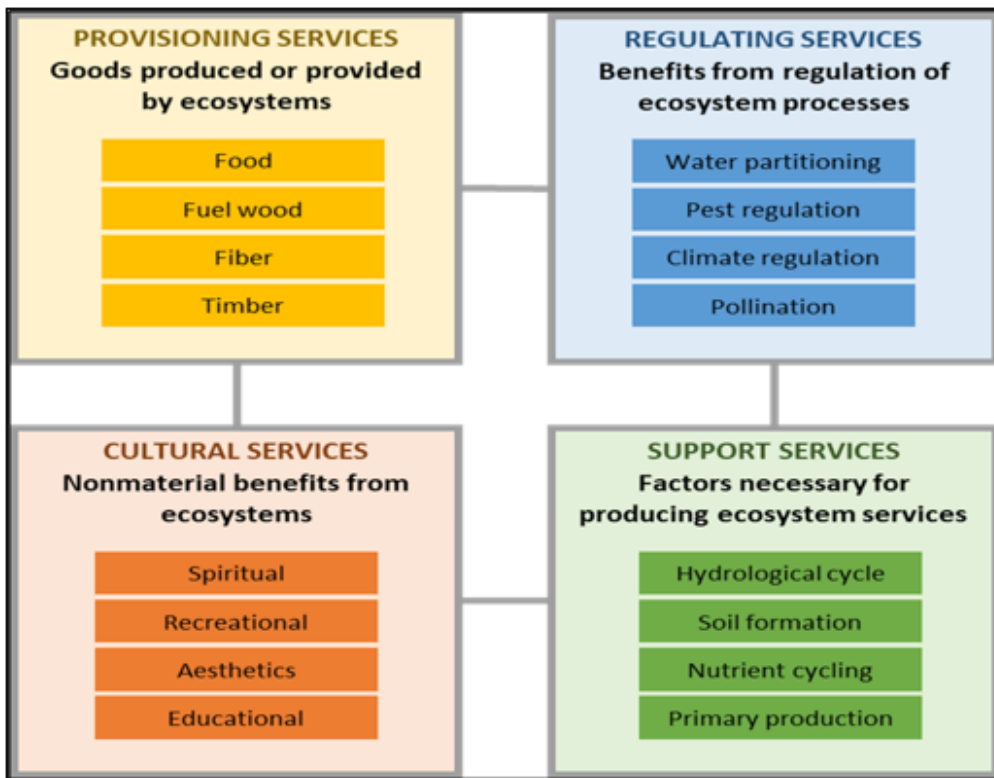## 2.3 Biodiversity and Ecosystems Services

### *Ecosystem Services*



| PROVISIONING SERVICES<br>Goods produced or provided by ecosystems | REGULATING SERVICES<br>Benefits from regulation of ecosystem processes |
| --- | --- |
| Food<br>Fuel wood<br>Fiber<br>Timber | Water partitioning<br>Pest regulation<br>Climate regulation<br>Pollination |
| CULTURAL SERVICES<br>Nonmaterial benefits from ecosystems | SUPPORT SERVICES<br>Factors necessary for producing ecosystem services |
| Spiritual<br>Recreational<br>Aesthetics<br>Educational | Hydrological cycle<br>Soil formation<br>Nutrient cycling<br>Primary production |

**Fig: Ecosystem services for human well being (MEA, 2005)**

### *Ecosystem Accounting*

The Gaborone Declaration for Sustainability in Africa (GDSA) was launched in 2012 following the Summit for Sustainability held in Gaborone, Botswana. This summit – attended by ten African governments and their heads of state – launched a vision for sustainable development that has helped highlight the issue of natural capital depletion across a growing continent. The resulting Declaration commits member countries to make progress towards the following three commitments:

- Commitment 1: Integrating the value of natural capital into national accounting and corporate planning and reporting processes, policies, and programs.
- Commitment 2: Building social capital and reducing poverty by transitioning agriculture, extractive industries, fisheries, and other natural capital uses to practices that promote sustainable employment, food security, sustainable energy and the protection of natural capital through protected areas and other mechanisms.
- Commitment 3: Building knowledge, data capacity, and policy networks to promote leadership and new models in the field of sustainable development, and to increase momentum for positive change (GDSA, 2021).

Natural Capital Accounting (NCA) refers to the use of an accounting framework to provide a systematic way to measure and report on stocks and flows of natural capital, analogous to accounts for other forms of capital. It is a broad term that includes accounting for individual environmental assets or resources, both biotic and abiotic (such as water, minerals, energy, timber, fish), as well as accounting for ecosystem assets and ecosystem services. (SANBI, 2021).

Recently UN adopted the System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA) framework. The framework's focus is on natural capital, a monetary representation of the value of nature—and its ability to provide food, air, water, and income for humans. Proponents of natural capital say that it can help countries, businesses, and other organizations make more informed decisions about how they use natural resources. However, some criticize the idea that nature should be measured this way (Johnson, 2021).

The SEEA Ecosystem Accounting (SEEA EA) constitutes an integrated and comprehensive statistical framework for organizing data about habitats and landscapes, measuring the ecosystem services, tracking changes in ecosystem assets, and linking this information to economic and other human activity.

## *Ecosystem Accounting – How it works*

The SEEA EA is built on five core accounts. These accounts are compiled using spatially explicit data and information about the functions of ecosystem assets and the ecosystem services they produce.

The five ecosystem accounts are  (UN, 2021):
**1. Ecosystem Extent** accounts record the total area of each ecosystem, classified by type within a specified area (ecosystem accounting area). Ecosystem extent accounts are measured over time in ecosystem accounting areas (e.g., nation, province, river basin, protected area, etc.) by ecosystem type, thus illustrating the changes in extent from one ecosystem type to another over the accounting period.
**2. Ecosystem Condition** accounts record the condition of ecosystem assets in terms of selected characteristics at specific points in time. Over time, they record the changes to their condition and provide valuable information on the health of ecosystems.
**3. & 4. Ecosystem Services** flow accounts (physical and monetary) record the supply of ecosystem services by ecosystem assets and the use of those services by economic units, including households.
**5. Monetary Ecosystem Asset** accounts record information on stocks and changes in stocks (additions and reductions) of ecosystem assets. This includes accounting for ecosystem degradation and enhancement (UN, 2021).

## *The Economics of Biodiversity: The Dasgupta Review*

The Dasgupta Review (Dasgupta, 2021), which was recently commissioned by UK Treasury, presents the first comprehensive economic framework of its kind for biodiversity. The objective was to
- Assess the economic benefits of biodiversity globally
- Assess the economic costs and risks of biodiversity loss
- Identify a range of actions that can simultaneously enhance biodiversity and deliver economic prosperity

It calls for urgent and transformative change in how we think, act and measure economic success to protect and enhance our prosperity and the natural world. The Dasgupta Review grounded in a deep understanding of ecosystem processes and how they are affected by economic activity, sets out the ways in which we should account for nature in economics and decision-making. The Review emphatically concluded that truly sustainable economic growth and development means recognizing that our long-term prosperity relies on rebalancing our demand of nature's goods and services with its capacity to supply them. It also means accounting fully for the impact of our interactions with nature across all levels of society. COVID-19 has shown us what can happen when we don't do this. Nature is our home. Good economics demands we manage it better.

## 2.4 Economic Measures for Natural Capital

### *Inclusive Wealth Index*

The biennial Inclusive Wealth Report (IWR) tracks progress on sustainability of economy and wellbeing of people across the world. The IWI is the UN Environment Programme's metric for measuring intergenerational human well-being. The IWR 2018 cover 140 countries.

According to the World Commission on Environment and Development "Our Common Future" (1987) report Sustainable development meant "... development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This means that, relative to their respective demographic bases, each generation should bequeath to its successor at least as large a productive base as it had inherited from its predecessor. But how do we measure this? How do we measure the productive base of a nation and the sustainability of development programmes over time?

Focusing on gross domestic product (GDP) alone is clearly not the answer when it comes to measuring human wellbeing. The correct measure of a nation's opulence is its inclusive wealth. Inclusive wealth is the dynamic version of income. It is the accounting value of an economy's stock of manufactured capital, human capital, and natural capital (hence the qualifier "inclusive"). An economy's inclusive wealth is the accounting value of its stock of assets. (i) manufactured capital (roads, buildings, machines, equipment), (ii) human capital (knowledge, aptitude, education, skills), and (iii) natural capital (forests, agricultural land, rivers and estuaries, the atmosphere and the oceans – ecosystems more generally – as well as subsoil resources). Durable assets like knowledge institutions, culture, religion – a nation's social capital – are taken to be enabling assets; that is, assets that enable the production and allocation of a nation's manufactured, human and natural capital. Wealth is a stock, whereas income is a flow. In a stationary economy the two amounts to the same thing, but they can point in different directions when an economy is not in a stationary state. This is what the authors of the Inclusive Wealth Report 2018 show. They find that 44 out of the 140 countries in their sample have experienced a decline in inclusive wealth per capita since 1998 even though GDP (read, "income") per capita increased in all but a handful of them. It is clear, then, that GDP is a poor measure of a country's well-being because a nation's well-being can decline even though its GDP is rising (UNEP, 2018b).

# CHAPTER 3: KEY DRIVERS OF CHANGE

## 3.1 Overview

The drivers of environmental change will be discussed in this chapter to set the foundation for the upcoming discussion on how these are impacting and changing Africa's natural capital. These are the rapidly growing population, urbanization, economic growth, technology development and innovations and lastly climate change.

Human population dynamics especially population pressure, and economic development are well documented as the primary drivers of environmental change. Rapid urbanization and accelerating technological innovation have been emerging as additional influences. There are wide disparities with Africa in the consumption and production patterns that lie behind those drivers. These drivers are also complex and strongly interconnected and spread widely and unevenly across Africa. The speed of development of each of the drivers also varies at the different levels– urban and rural, local, national, and continents. Climate change is the underlying priority issue complicating all these interactions. It is in Africa's interest to prioritize low-carbon, resource-efficient practices to gain a competitive advantage in the global economy.

## 3.2 Growing Population

Africa's population is growing rapidly, with predictions placing the continent's population at 2.4 billion by 2050. By 2100, more than half of the world's growth is expected to come from Africa, reaching 4.1 billion people by 2100 to claim over 1/3 of the world's population. Most countries will at least triple in population as the region has very high fertility rates and very little family planning in most regions. The rapid population growth rate will make Africa more important than ever to the global economy. Nigeria is currently one of the most populous countries on earth, and as China's population shrinks and India plateaus, Nigeria will reach nearly 1 billion people by 2100 and come close to surpassing China. Nigeria is set for one of the biggest population booms in world history and it's expected to increase by a factor of eight in just two or three generations (WPR, 2021a). Some of the statistics are given in the table below (UNDESA, 2022).

### *Cartogram of Africa*

1-in-6 people in the world live in Africa. The second most-populous continent is home to almost 1.3 billion people. Two countries have a population of more than 100 million: Nigeria with 195.9 million and Ethiopia with 107.5 million. Population density varies hugely on the African continent. The largest African country by land area is Algeria, but it is relatively sparsely populated. At the other end of the spectrum are Rwanda and Burundi. The two neighboring countries are densely populated.
One way to understand the distribution of people across the world is to reform the world map, not based on the area but according to population. This is shown here in a population cartogram: a geographical presentation of the world where the size of the countries is not drawn according to the distribution of land, but according to the distribution of people. The cartogram shows where in the world the global population was at home in 2018. The cartogram is made up of squares, each of which represents half a million people of a country's population.

**Fig: Relative size of countries in 2018 based upon population (OWD, 2023)**

**Table: Selected African Statistics (thousands) (UNDESA, 2022)**

| Aspect | 2020 | 2025 | 2030 | 2100 |
|---|---|---|---|---|
| Total population | 1,340,598 | 1,508,935 | 1,688,321 | 4,280,127 |
| Total population by sex: Female | 670,720 | 754,479 | 843,875 | |
| Total population by sex: Male | 669,878 | 754,456 | 844,447 | |
| Annual Africa Population at Mid-Year: Urban | 587,738 | 698,149 | 824,014 | |
| Annual Africa Population at Mid-Year: Rural | 764,884 | 824,101 | 879,524 | |

**Africa: Total population**

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United Nations, DESA, Population Division. *World Population Prospects 2022*. http://population.un.org/wpp/
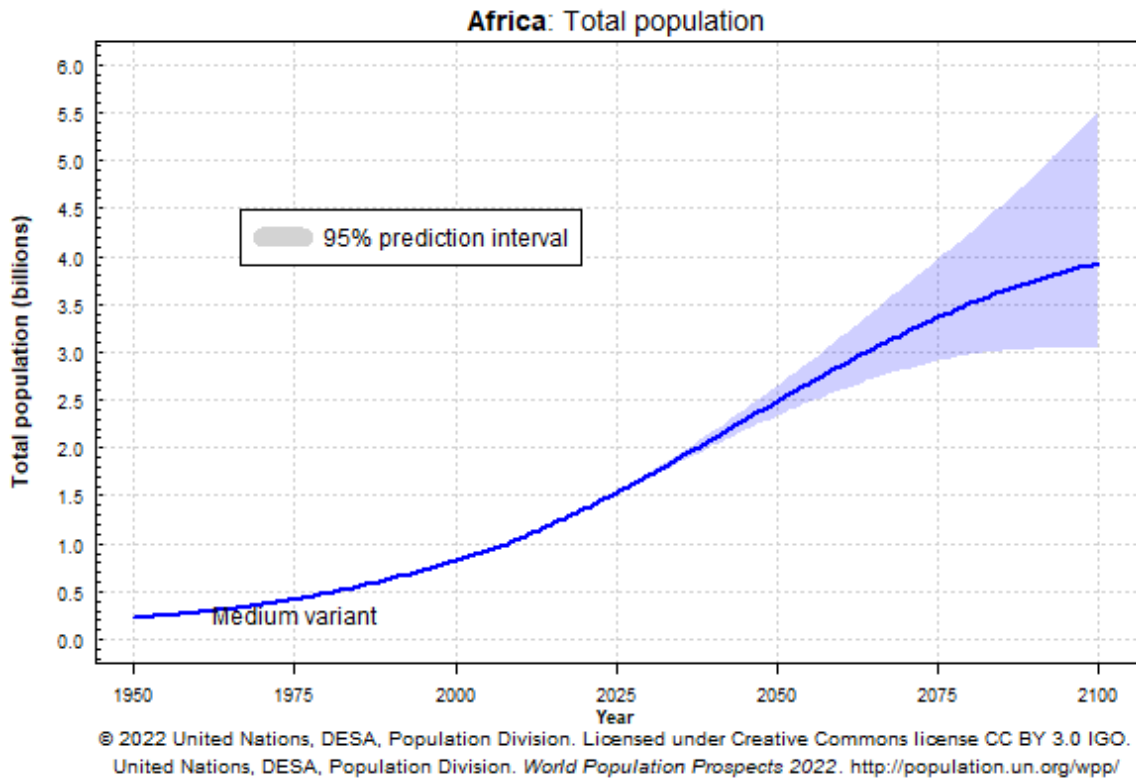
**Fig: Africa population 1950-2100 (UNDESA, 2022)**



**Africa: Population by broad age groups**

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United Nations, DESA, Population Division. *World Population Prospects 2022*. http://population.un.org/wpp/
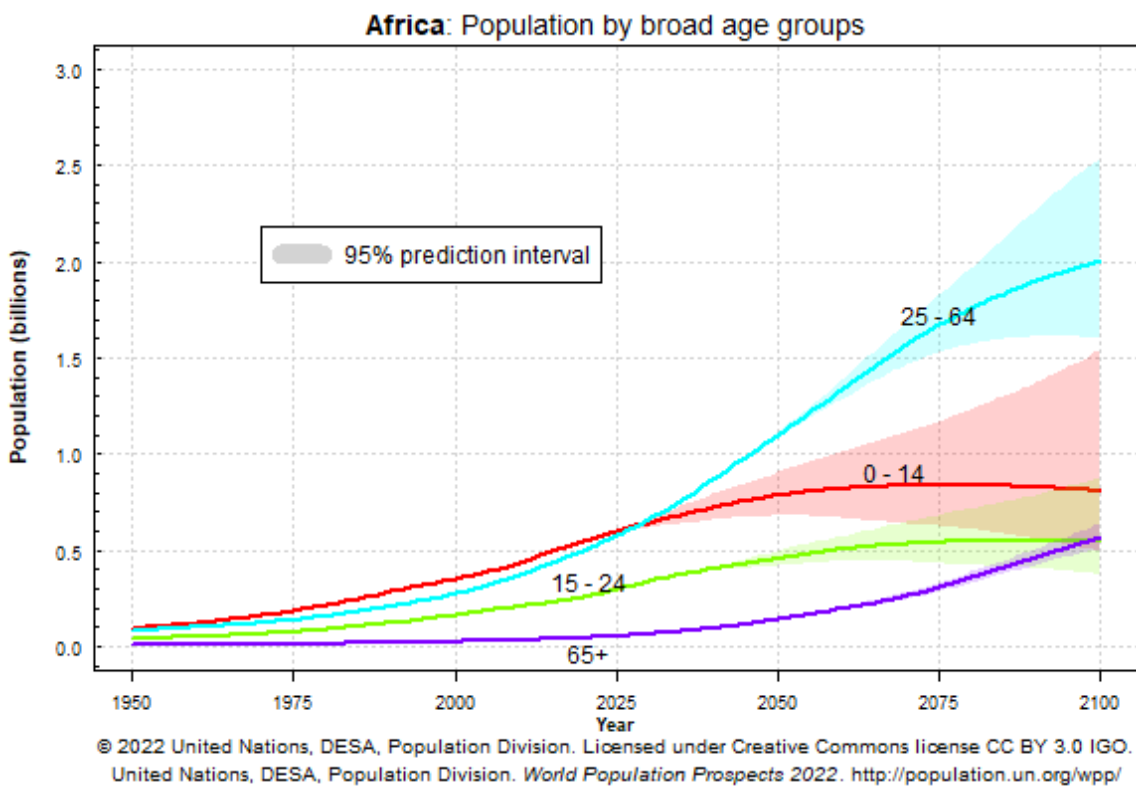
**Fig: Africa population by age groups 1950-2100 (UNDESA, 2022)**
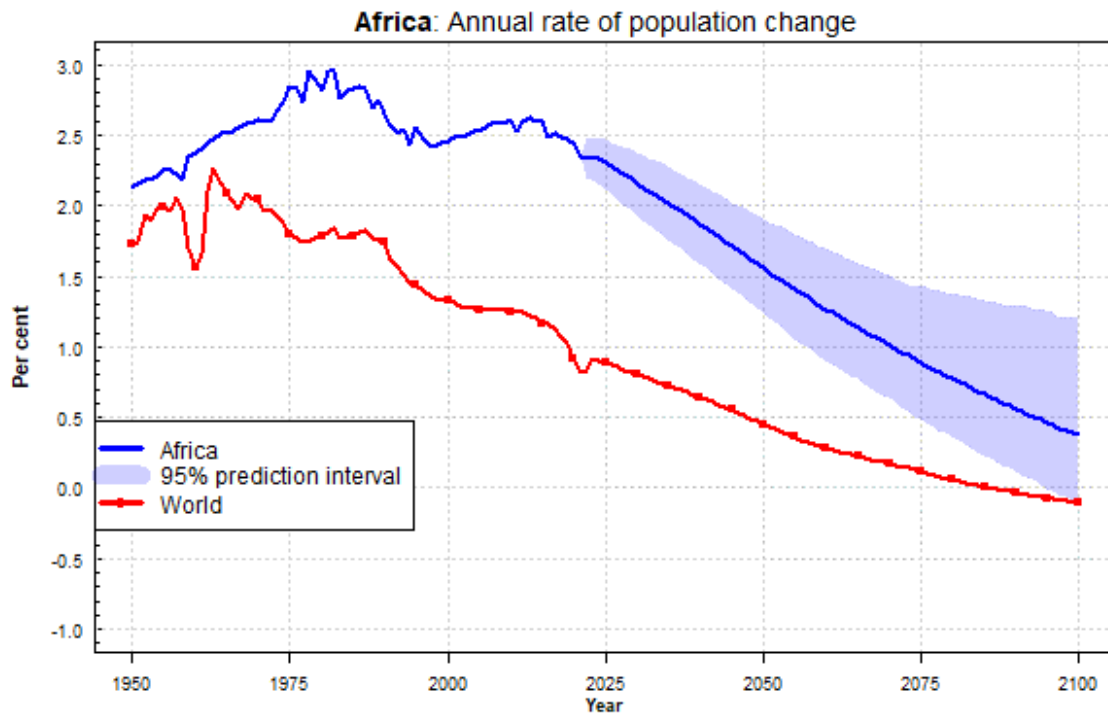
**Fig: Africa population by sex and age in 2020 (UNDESA, 2022)**
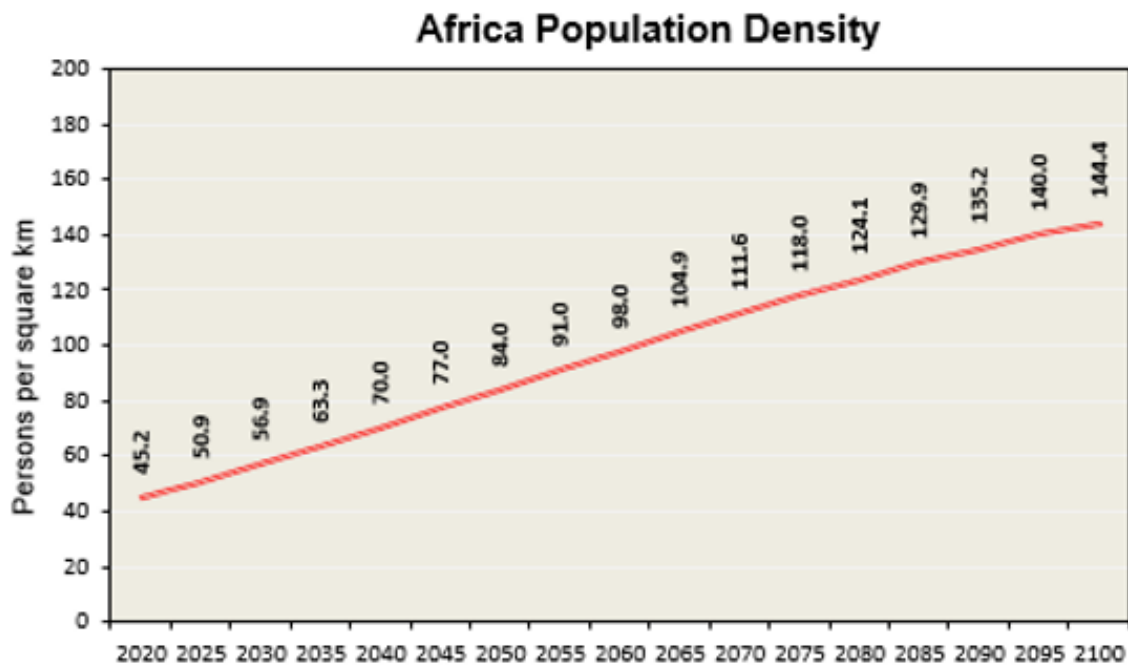


**Fig: Africa population density 2020-2100 (UN DESA, 2019)**

## 3.3 Rapid Urbanization

The future of the world's population is urban. Urban growth is closely related to the three dimensions of sustainable development: social, economic, and environmental. Globally, more people live in urban areas than in rural areas, with 55 per cent of the world's population residing in urban areas in 2018. In 1950, 30 per cent of the world's population was urban, and by 2050, 68 per cent of the world's population is projected to be urban. Growth in the urban population is driven by an overall population increase and by the upward shift in the percentage living in urban areas. Together, these two factors are projected to add 2.5 billion to the world's urban population by 2050, with almost 90 per cent of this growth happening in Asia and Africa.

The region has six of the world's top ten countries experiencing rapid urbanization, and therefore faces far reaching changes in settlement patterns in the years ahead. The movement of an estimated 450 million people from rural to urban areas by 2050 will place enormous strains on urban institutions, infrastructure, and financial and other resources, while also exacting huge demands on land for settlement. Combatting this challenge will require good spatial planning at all levels of government to ensure that cities have the capacity to cope with growing populations. Making rural areas more attractive to the youth through investment in rural development is another important intervention (UNEP, 2016).

With the urban transition ongoing, most Africans are projected to live in urban areas by 2035. Urbanization brings big opportunities, such as a rising domestic market for both labor and consumption. It can also catalyze productivity gains, green jobs and innovation in the economy.
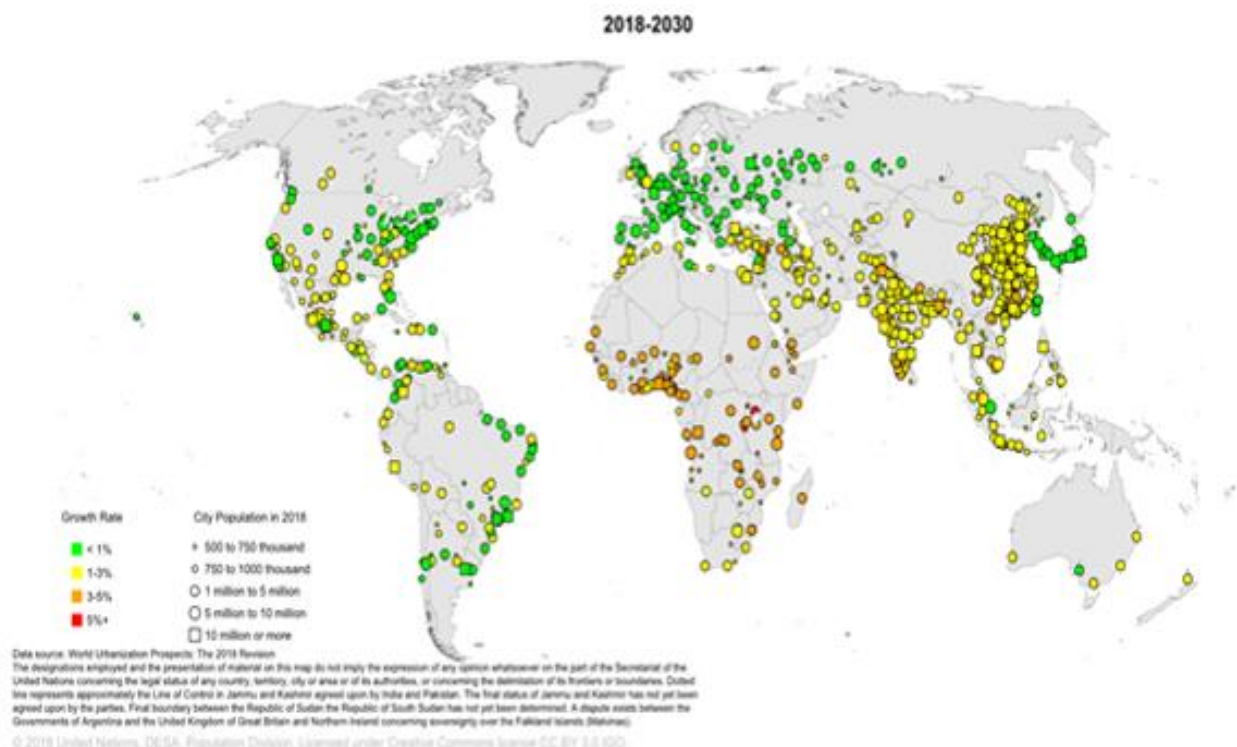


**Fig: Growth rates of urban agglomerations by size class**

## 3.4 Economy and Wildlife Tourism

The economy of Africa consists of the trade, industry, agriculture, and human resources of the continent. Agriculture is the biggest industry in Africa, and it employs 60 percent of the workforce in Africa. Africa boasts huge number of natural resources such as oil, diamonds, gold, iron, cobalt, uranium, copper, bauxite, silver and petroleum and also timber and fruits.

Currently, land productivity remains low in the region; a result of mineral poor soils and land degradation caused by inappropriate farming practices, deforestation, mining activities, and desertification. Africa is therefore called upon to embrace the Comprehensive Africa Agriculture Development Programme and its associated technologies for irrigation and fertilizer use, whilst nurturing the continent's agro-biodiversity and agro-ecological knowledge, to result in higher yields per unit area (UNEP, 2016). Similarly, transition from raw material exports to value added industrial products needs to be accelerated.
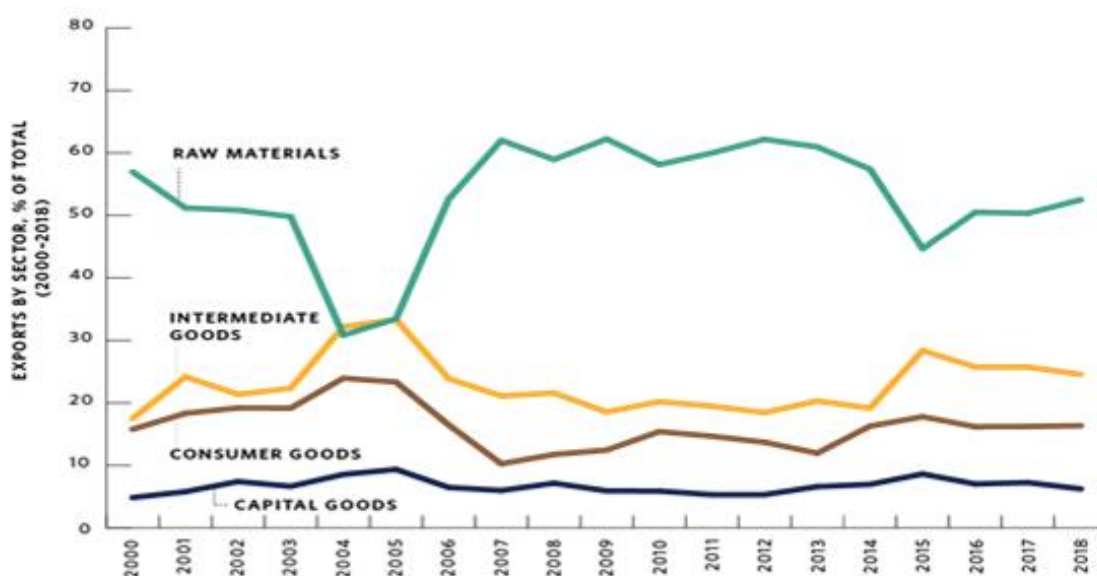


SOURCE: Authors' calculations using data from the World Integrated Trade Solution database, https://wits.worldbank.org/, accessed July 12, 2020.

**Fig: Raw materials continue to dominate African countries' exports (Usman & Landry, 2021)**

The African continent has experienced strong growth since 2000, leading to a "rising Africa" narrative. Between 2000 and 2016, Africa enjoyed higher growth rates (4.6 percent) than Latin America and the Caribbean (LAC) (2.8 percent), though not as high as developing Asia (7.2 percent). However, the economic impact of the COVID-19 shock in Sub-Saharan Africa is severe. Economic activity in Sub-Saharan Africa is estimated to have contracted by 2 percent in 2020, reflecting a slower-than-expected spread of the virus and lower COVID-19-related mortality in the region, strong agricultural growth, and a faster-than-expected recovery in commodity prices. Nevertheless, COVID-19 has plunged the region into its first recession in over 25 years, with activity contracting by nearly 5 percent on a per capita basis. This situation could push up to 40 million people into extreme poverty, erasing at least five years of progress in fighting poverty (World Bank, 2021b).
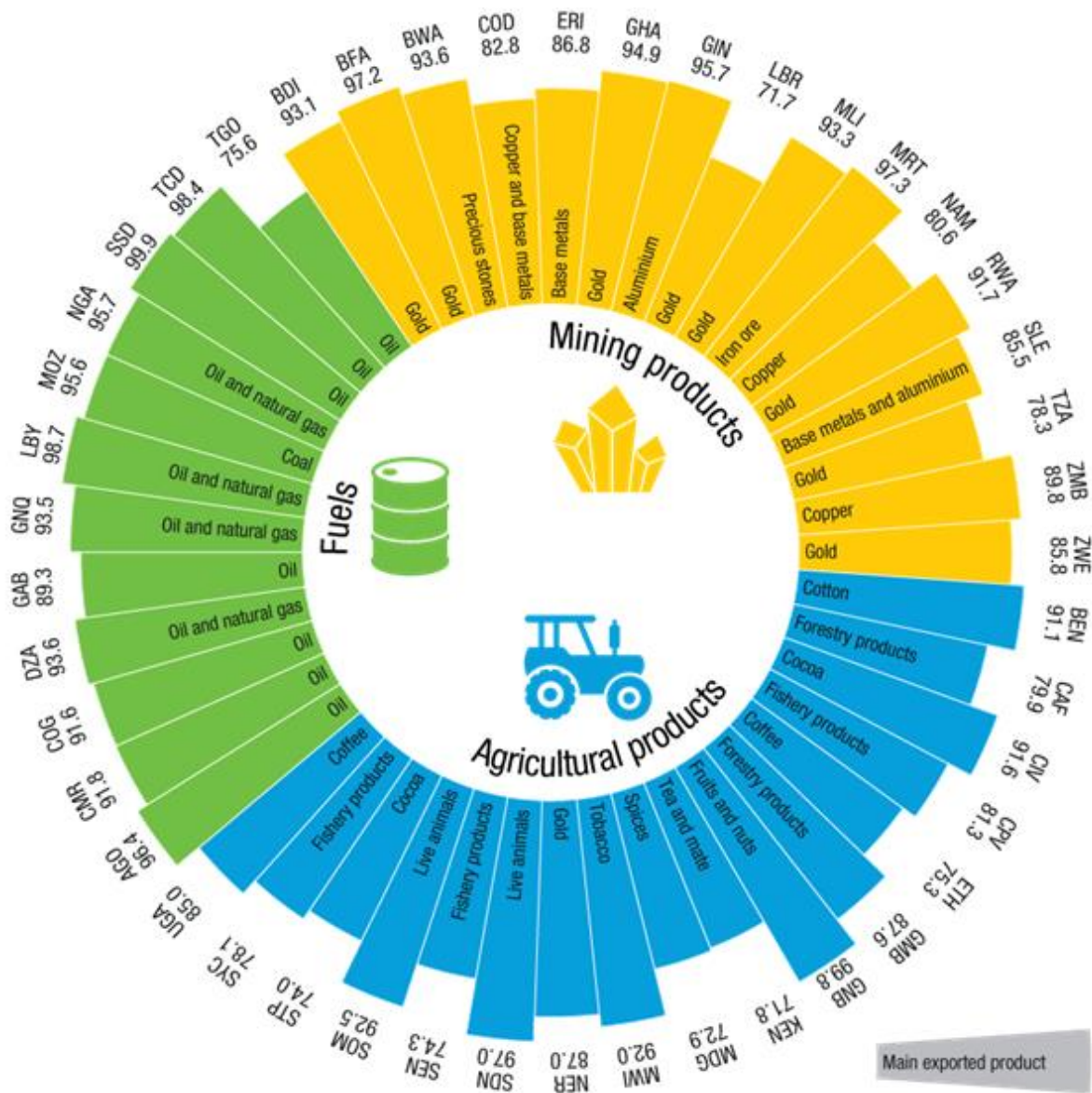
**Fig: 83% of African countries are highly dependent on commodities (UNCTAD, 2022)**

The continent's demographic growth could bring a "demographic dividend" if the local economies can supply enough jobs and basic services to meet the growing demand. Between 2015 and 2050, Africa's working age population (defined as 15- 64-year-olds) will increase by 902 million people, about 69 percent of the total increase across the world. Africa's demographic dividend could contribute 10-15 percent of gross GDP volume growth by 2030. However, the formal economy must create millions of additional jobs: on average between today and 2030, 29 million additional young people turn 16 years old every year. Access to quality education must also improve, particularly for girls. Many African youth lack the technical and managerial skills to succeed in the labor market. Only 10.5 percent of secondary students are enrolled invocational programmes, and these are often underfunded.

"Green growth" strategies can enable Africa to develop new economic activities, create new jobs and save on future adaptation cost. African countries can tap the potential of renewable energy, with its costs decreasing rapidly. That of solar energy declined by 80 percent between 2008 and 2015. Half of sub-Saharan Africa's growth in electricity generation is likely to come from renewable energy by 2040.

The African Union Agenda 2063 stipulates foster green growth by (AUC/OECD, 2018)**:**
- ✓ Promoting the circular economy
- ✓ Greening existing economic activities

**Goals are**
- ✓ Modern agriculture for increased productivity and production
- ✓ Blue/ocean economy
- ✓ Environmentally sustainable and climate-resilient economies and communities

## *Wildlife Tourism*

Wildlife tourism is incredibly important in Africa and makes up 36.3 percent of the continent's travel and tourism economy. As home to arguably the most captivating and recognizable collection of wildlife on the planet, including elephants, lions, cheetahs and gorillas, it is no wonder that many tourists seek Africa as a place to get closer to nature. In total, wildlife tourism directly contributes $29.3 billion to the African economy and employs 3.6 million people. Those numbers are more than twice as high when indirect effects factor in (Jordan, 2021).
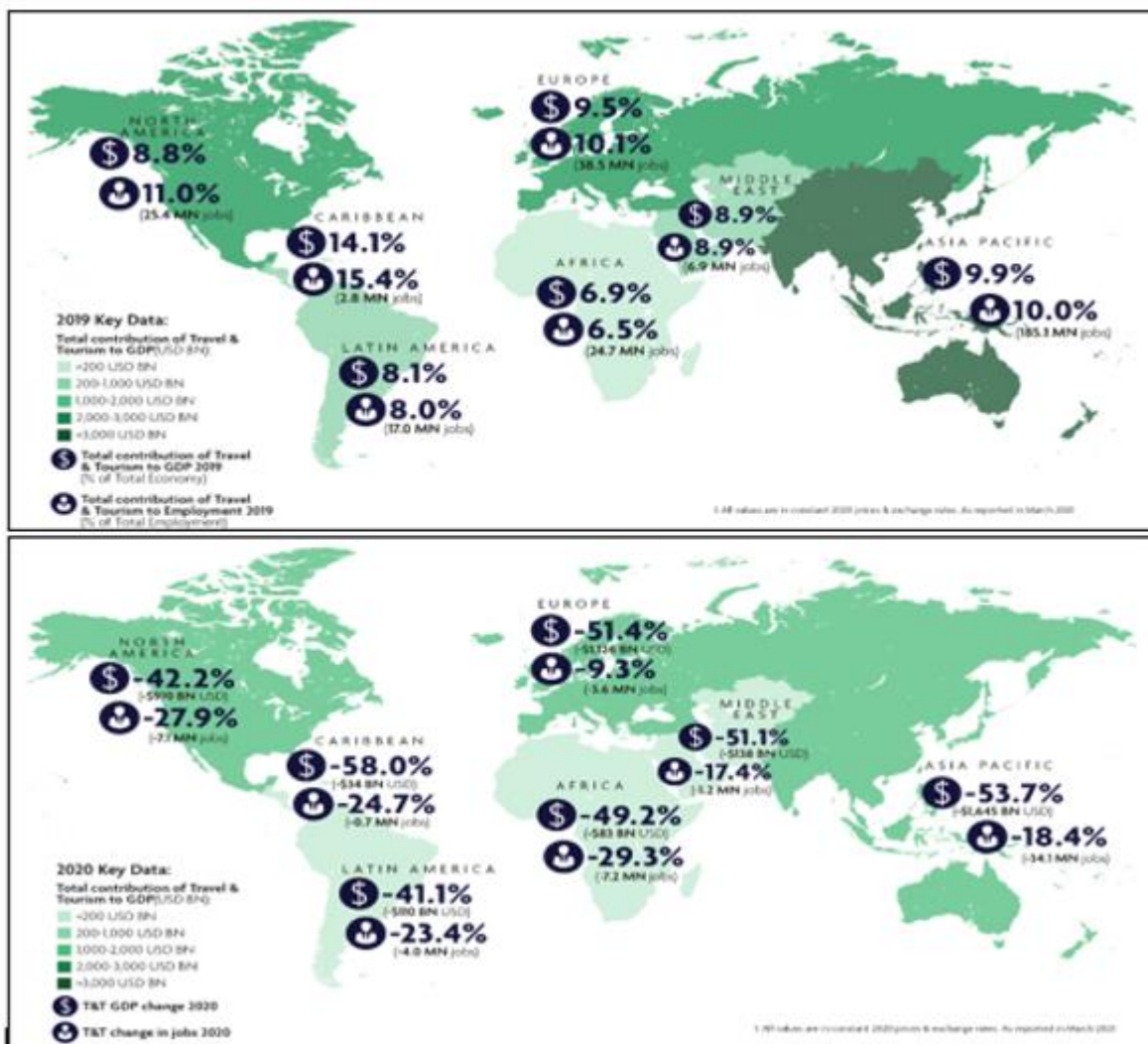


**Fig: Regional impact on tourism industry between 2019 (upper map) and 2020 (lower map) due to COVID-19 pandemic (WTTC, 2021)**

## 3.5 Connectivity: Growth in Information and Communication Technologies

Nearly 300 million Africans live more than 50 km from a fiber or cable broadband connection, hence the lack of widespread availability of high-speed (broadband) internet remains a significant hurdle for Africa to fully harness the full potential of digital transformation. Mobile devices remain the primary way by which people access internet today, and dedicated internet connections to homes and offices (such as with fiber-to-the-premise) are mostly absent, except in some capital cities. Dependence on mobile rather than fixed-line broadband means that unmetered pricing, or unlimited data use, is not very common in Africa (AU, 2020).

Access to the internet remains out of reach for most people in the continent, with only 22 percent reporting having access in 2017. Too few citizens have digital IDs or transaction accounts – locking them out of access to critical services and e-commerce. Digital startups struggle to attract funding and 'traditional' businesses are only slowly adopting digital technologies and platforms to boost productivity and sales. Few governments are investing strategically and systematically in developing digital infrastructure, services, skills, and entrepreneurship.
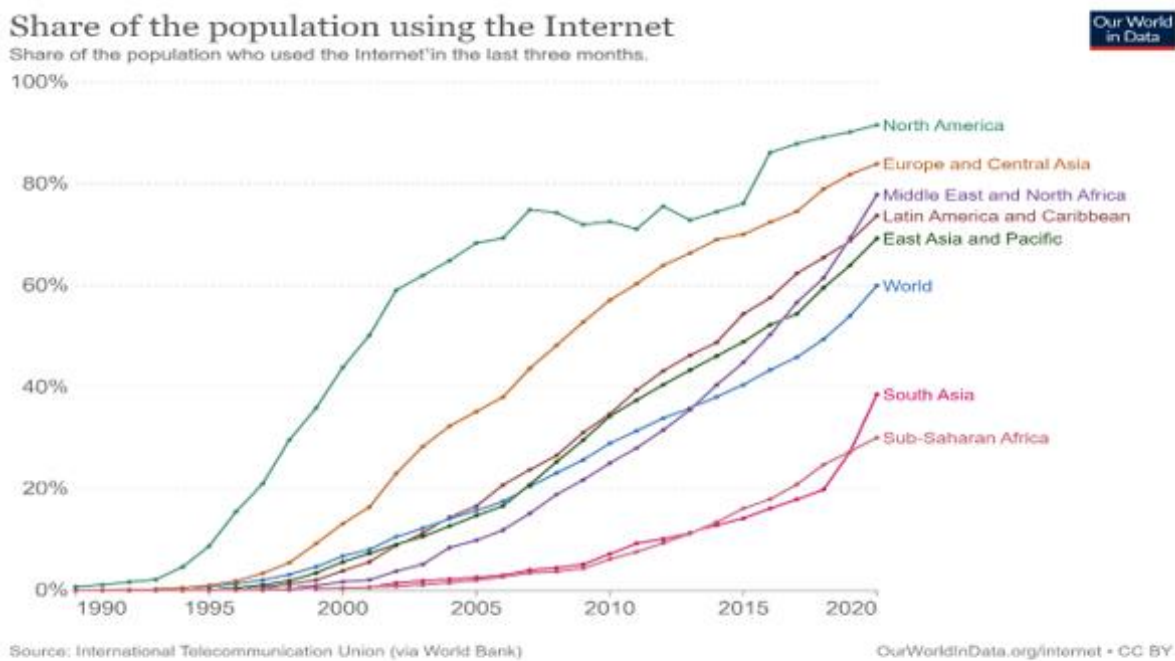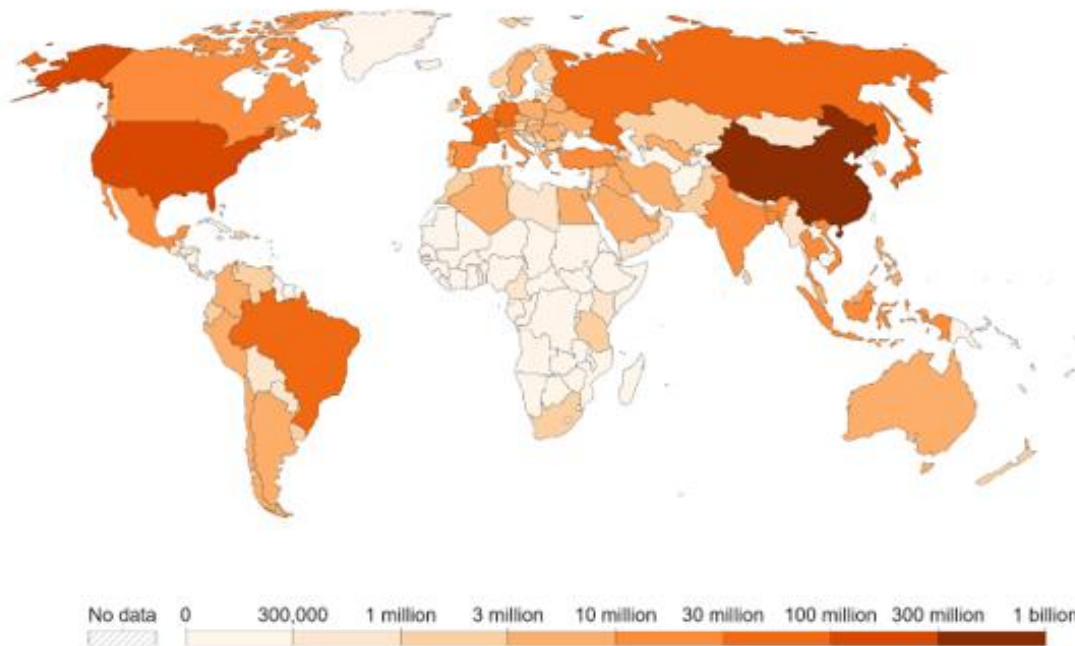


Fig: Share of the population using the Internet

To become tomorrow's innovators, entrepreneurs and leaders, Africa's youth need to be empowered with the digital skills and access to technology and markets that are essential to thrive in an increasingly digitized global economy. Governments need to find more nimble and effective means of delivering services and interacting with citizens. Businesses need to utilize digitally centered business models to connect with the hundreds of millions of customers previously out of reach due to geography or low income.

## Landline Internet subscriptions, 2020

Subscriptions to fixed access to the public Internet with a download speed of at least 256 kbit/s.



No data   0   300,000   1 million   3 million   10 million   30 million   100 million   300 million   1 billion

**Fig: Landline Internet subscription in 2020**

At the current, incremental pace of economic and social advancement, too many of Africa's expanding youth population will be denied the opportunity to live up to their potential. Digital technologies offer a chance to disrupt this trajectory – unlocking new pathways for rapid economic growth, innovation, job creation and access to services which would have been unimaginable only a decade ago. Yet there is also a growing 'digital divide', and increased cyber risks, which need urgent and coordinated action to mitigate  (World Bank, 2021a)**.**

The COVID-19 pandemic has  the inequalities inherent in the digital divide. Those without access to the internet or mobile technologies are unable to access essential health-care information, potentially leaving them in a life-or-death situation. There is a positive link between the expansion of Information and Communication Technologies (ICT) usage and progress in sustainable development, particularly due to improved connectivity and efficiency. ICT can accelerate development through education, skill development, and innovation in services, among others. As witnessed during the pandemic, accelerated digitization has played a critical role in improving the lives of people during a crisis.

In the coming years, ICT will play a more important role in addressing environmental issues related to air pollution, biodiversity, cities, climate change, GHG monitoring, food systems, oceans and water resources, and sanitation. A newly established Coalition for Digital Environmental Sustainability (CODES) is part of the UN Secretary-General's Roadmap on Digital Cooperation, in which he underlines the importance of digital technologies for accelerating environmental action.

## 3.6 Climate Change and other Shocks

The recently released Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) delivers its starkest warning yet about climate change. The overarching takeaway from the climate accounting exercise is that limiting human-induced global warming requires limiting cumulative CO2 emissions to at least net zero by 2050. The Paris Agreement of 2015, with an ambitious target of keeping global warming below 1.5 degrees Celsius, has a conservative budget of 500 billion more metric tons of CO2 to be emitted to achieve the target. However, at the current rates of industrial emissions, it would take about 15 years to exhaust this budget. World leaders, including those from Africa, have a pressing task in reaching that goal.
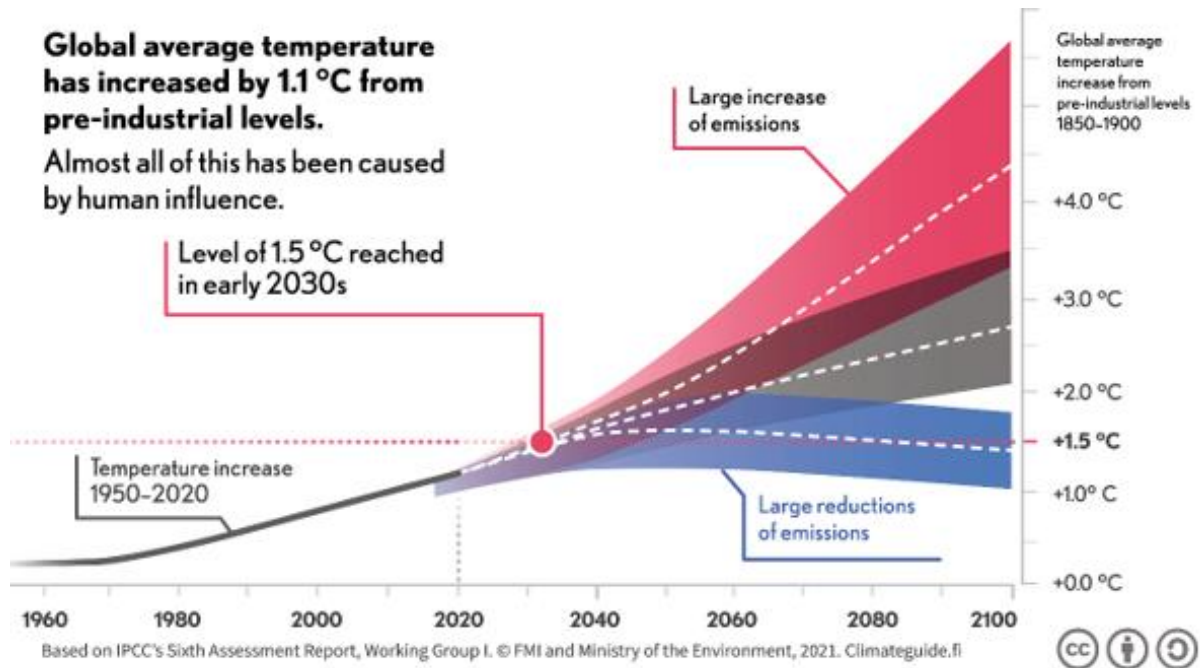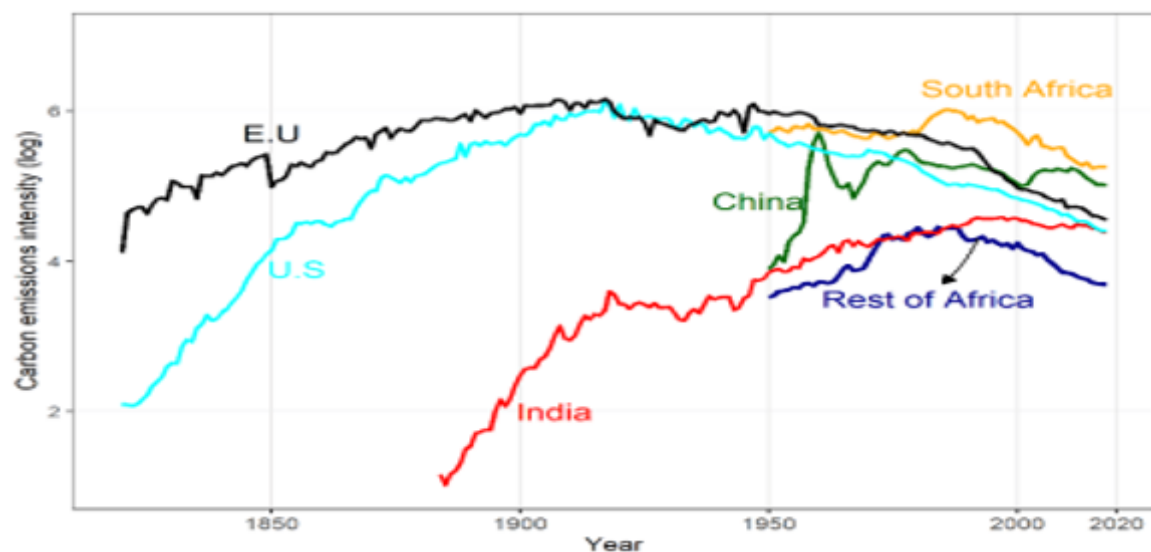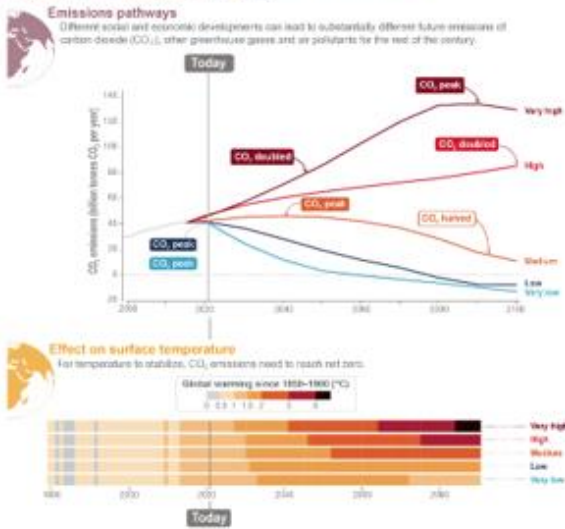


**Fig: Global average temperature increase**



**Fig: Africa carbon emissions intensity versus the rest of the world (GCP, 2021)**
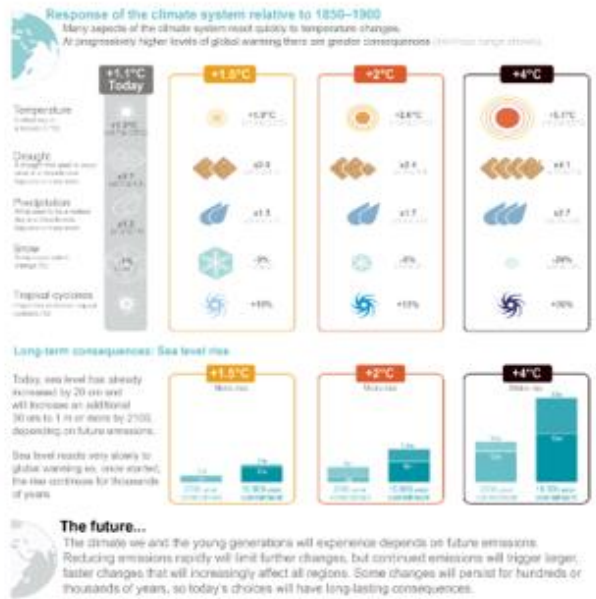
**Fig: Climate future**

Although African countries are not a major source of GHGs emission yet, they are disproportionally impacted by climate change. From droughts, floods, heatwaves and sea level rise, to dwindling food supplies and threats to tourism show how severely climate change will hit the African countries. From coastal erosion to the spread of tropical diseases, every country is at risk from the impacts of climate change. The research shows that rising temperatures and intense heatwaves could cause severe droughts, threatening essential water supplies for agriculture, causing huge loss of human life and increasing the chance of fires. Given its economic constraints, Africa's capacity to adapt to climate change is relatively low rendering the region exceptionally vulnerable to potential impacts. In many areas, even small changes in precipitation and water availability could have a devastating effect on agricultural output and therefore on food security. As climate change intensifies and its impacts deepen, adaptation will become increasingly difficult. Correspondingly, achieving SDG targets and Agenda 2063 will become more challenging.
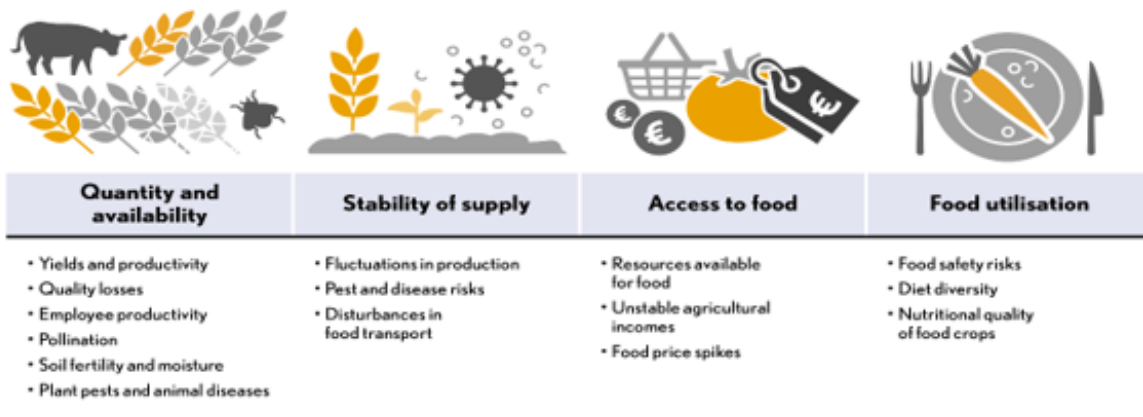


**Fig: Climate change impact on food security**

Climate change adaptation is a critical issue for coastal cities and Small Island Developing States (SIDS), as these are places where exposure to climate change impacts is increasing dramatically because of sea level rise. This is combined with dense populations and infrastructure along the coasts, rapid and often unplanned urbanization of low-lying areas, loss of ecosystems and environmental degradation, unsustainable management.



**To keep global warming under 1.5 °C, adaptive measures are needed in many sectors.**
The feasibility of adaptation measures depends on technological, economic, socio-cultural, institutional and geophysical factors and various environmental factors.

**Fig : Climate adaptation measures**

## *The COVID-19 pandemic*

Africa faces a triple shock- public health, economic and environmental- that risks overwhelming healthcare systems, destroying livelihoods, posing environmental threats and slowing the region's growth prospects in the future. Before the COVID-19 pandemic was reported in 2019, the continent had already experienced a slowdown in growth and poverty reduction overall, although with large differences between countries. The current crisis could erase years of development gains. For Least Developed Countries (LDC) due to graduate from the "least developed" category by the middle of this decade, the timetable now looks uncertain having been hit hard by the impacts of COVID-19. This situation is of significant concern because diseases, such as malaria, HIV-AIDS, TB and in more recent years, the Ebola Virus Disease (EVD), have severely burdened the health infrastructure of Africa. The 2016 Ebola outbreak in West Africa killed more than 11,000 people directly, but knock-on effects, such as diverting medical resources away from other non-communicable diseases (NCDs), the economic impact of lockdowns, and killed thousands more.

Impact on Ecosystem and Wildlife Conservation
• Decline in tourism revenue has disrupted wildlife conservation, anti-poaching programmes and lives and livelihoods of indigenous communities surrounding nature reserves sustained by tourism revenues; increase in illegal logging and charcoal production reported.
• Local wildlife parks have reported a surge in bush meat poaching. Bush meat poaching cases have doubled in Uganda compared to 2019 as people struggle to fend for their families. The Kenya Wildlife Service (KWS) has reported a 56 percent increase in bushmeat seizures since the start of the pandemic.
• There has been a major increase in illegal logging and charcoal production as people struggle to find ways of generating income.
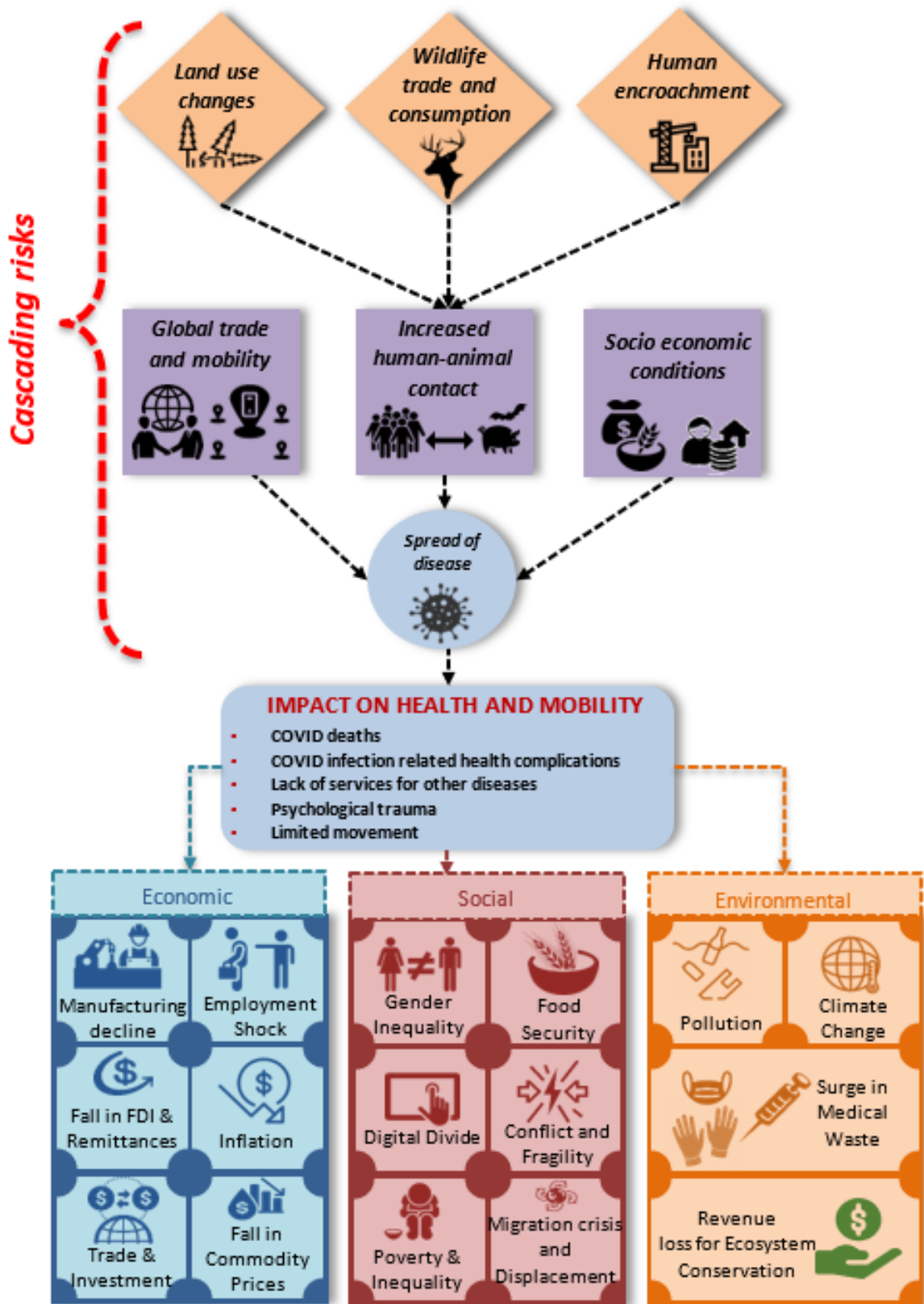
**Figure 16: Cascading risks of COVID-19 pandemic (NOTE: while the source of Covid-19 is still to be confirmed, increased human-animal contact has hastened the spread of the disease)**

# CHAPTER 4: CHANGING NATURAL CAPITAL AND IMPACT ON PEOPLE: HOT SPOTS AND HOPE SPOTS

## 4.1 Overview

Periodic monitoring of changes in the condition of natural resources and their sustainable use is fundamental to generating information for planning and policy making. Natural resource monitoring is undertaken to provide timely and relevant information to assist policymakers and program managers in formulating prudent policies and implementing effective interventions to reduce the degradation of the natural resource base and to improve its sustainable use over time.

## 4.2 Place-based Monitoring

The SDGs are highly dependent on geospatial information and Earth observations (EO) as the primary data for relating people to their location and place, and to measure 'where' progress is, or is not being made, particularly at 'disaggregated' sub-national and local levels.

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**What is Geospatial Information?**

Geospatial information is a nation's 'digital currency' for evidence-based decision-making. It is a critical component of a national infrastructure and knowledge economy that provides a nation's blueprint of what happens where, and the means to integrate a wide variety of government services that contribute to economic growth, national security, sustainable and equitable social development, environmental sustainability and national prosperity. In providing the integrative platform for all digital data that has a location dimension to it, all countries must leverage their national geospatial information system to enable informed national development and decision

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**What are Earth Observations?**

Earth Observations (EO) are an all-encompassing term for planetary scale, space-borne, airborne and in-situ observations of the Earth's surface. EO data is borderless, impartial and inclusive for all. It is also a crucial data source for many of the SDG indicators describing the environmental aspects of the planet. Designed for planetary-scale coverage, satellite EO has some key characteristics which make it an indispensable source of data for a number of SDG indicators and a supporting source of data for many others. However, while the data has a potential global coverage, there are significant demands for the consummate skills and resources to fully realize its potential.

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**What is disaggregation by Geographic Location?**

 While the initial development of the Global Indicator Framework largely constituted a statistical data approach, the need for 'disaggregation by geographic location' is now well recognized to ensure that no one is left behind. Development is no longer only knowing about 'people' as national aggregations, but also their 'place' and their environment, and consequently their

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The Working Group on Geospatial Information (WGGI) of the United Nations Inter-Agency and Expert Group on the SDG indicators was established to directly support and complement the ongoing work of the IAEG-SDGs and its implementation of the Global Indicator Framework, where the geospatial data acquisition, integration and statistical disaggregation is most needed. The SDGs Geospatial Roadmap is addressed to National Statistical Organizations (NSOs) who are primarily responsible for the implementation of the various frameworks that enable for the integration of data across the national data ecosystem; an ecosystem that extends beyond the NSO, but which the NSO is a key actor. Significantly, innovations within the geospatial information and EO communities, and their enabling technologies, can be leveraged to transform the measurement, monitoring and production of indicators to support the 'leapfrogging' of countries that currently lag behind. SDGs Geospatial Roadmap is a means of supporting Member States in improving the application of geospatial information and EO to produce indicators, and of fostering the development of "story telling" mechanisms to better visualize, communicate, promote and disseminate information. (UN, 2023)

The Atlas paints a vivid picture of the rapid, and in some cases dramatic, transformations taking place on the lands and waters that sustain Africa's people. These include land degradation and desertification, water stress, declining biodiversity, deforestation, increasing dust storms, rising pollution and rapid urbanization. In addition to conveying natural resources, environmental and socio-economic data, the ecosystem accounting, and the Dasgupta review will be used to show economic cost-benefit analysis. This will help bridge the gap between quantitative and qualitative information concerning natural capital.

A tentative list of HOT SPOTS is given in the **Annex 1**. It will in addition highlight some HOPE SPOTS as areas of opportunity that countries can focus on. The two lists will be further developed and agreed upon with the African Development Bank to ensure adequate representation.

## 4.3 Land

Land in Africa is becoming increasingly degraded. Erosion and/or chemical and physical damage has degraded about 65 per cent of agricultural lands. This has forced farmers in many places to either cultivate marginal and unproductive soils, further degrading the land, or to migrate to cities and slums. Some areas in Africa are said to be losing over 50 metric tonnes of soil per hectare per year. Thirty-one per cent of the region's pasture lands and 19 percent of its forests and woodlands are also classified as degraded (Mansourian & Berrahmouni, 2021).
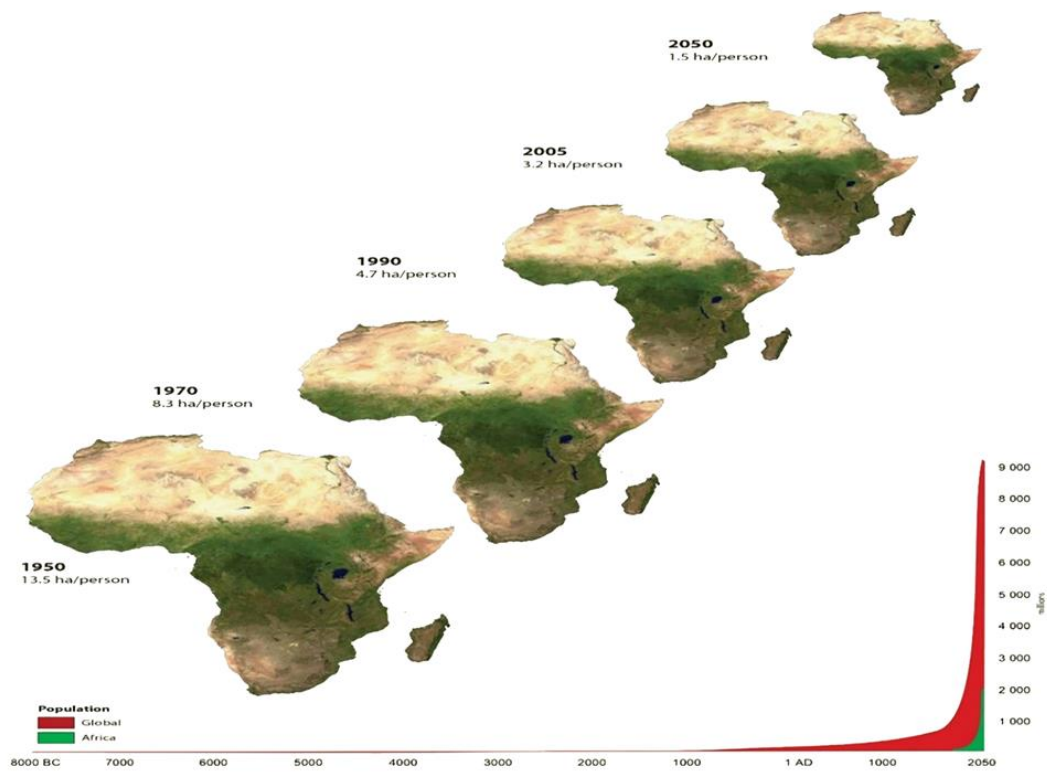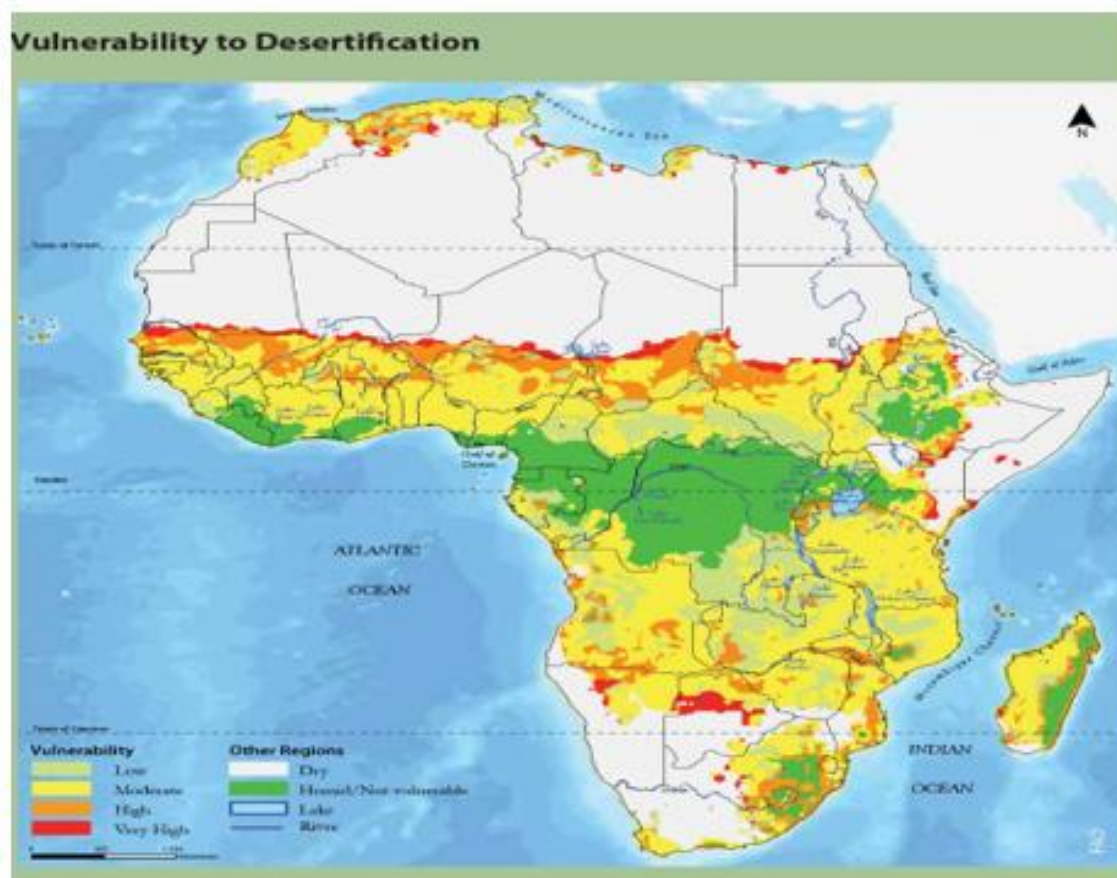
**Fig: Shrinking Africa's land base**



**Fig: Vulnerability to desertification**

## 4.4 Cropland

Agriculture is by far the single most important economic activity in Africa. Arable land and land under permanent crops occupy only about 6 percent of Africa's total land area. Desertification affects around 45 % of Africa's land area, with 55 % of this area at high or very high risk of further degradation. Degraded soil diminishes food production.

## 4.5 Forests

Forests account for over 20 per cent of Africa's 30 million km$^2$ of land area but are being destroyed and degraded by logging and conversion to plantations, agriculture, roads, and settlements. As a region, Africa is losing more than 4.4 million hectares of forest every year—twice the world's average deforestation rate.
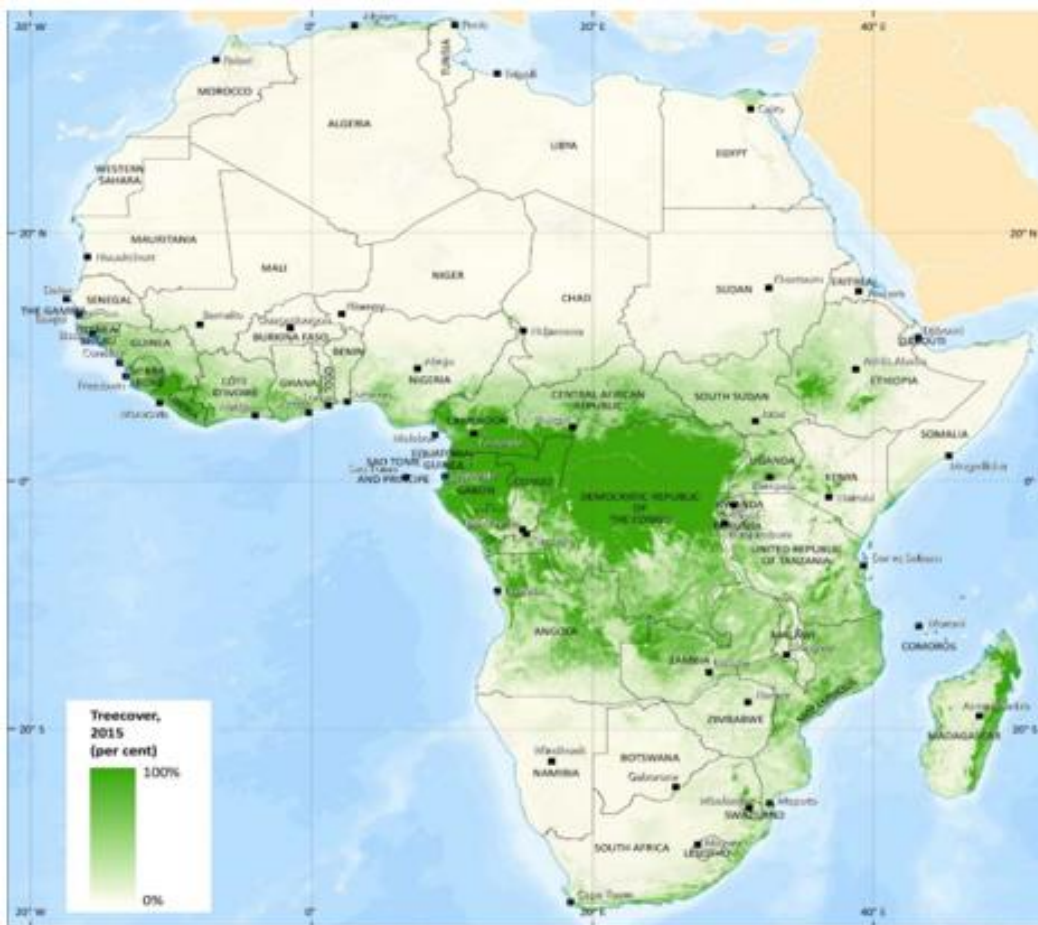


**Fig: Tree Cover map**

**POTENTIAL BIOMASS STOCKS**

**ACTUAL BIOMASS STOCKS**

Credit: Future Earth

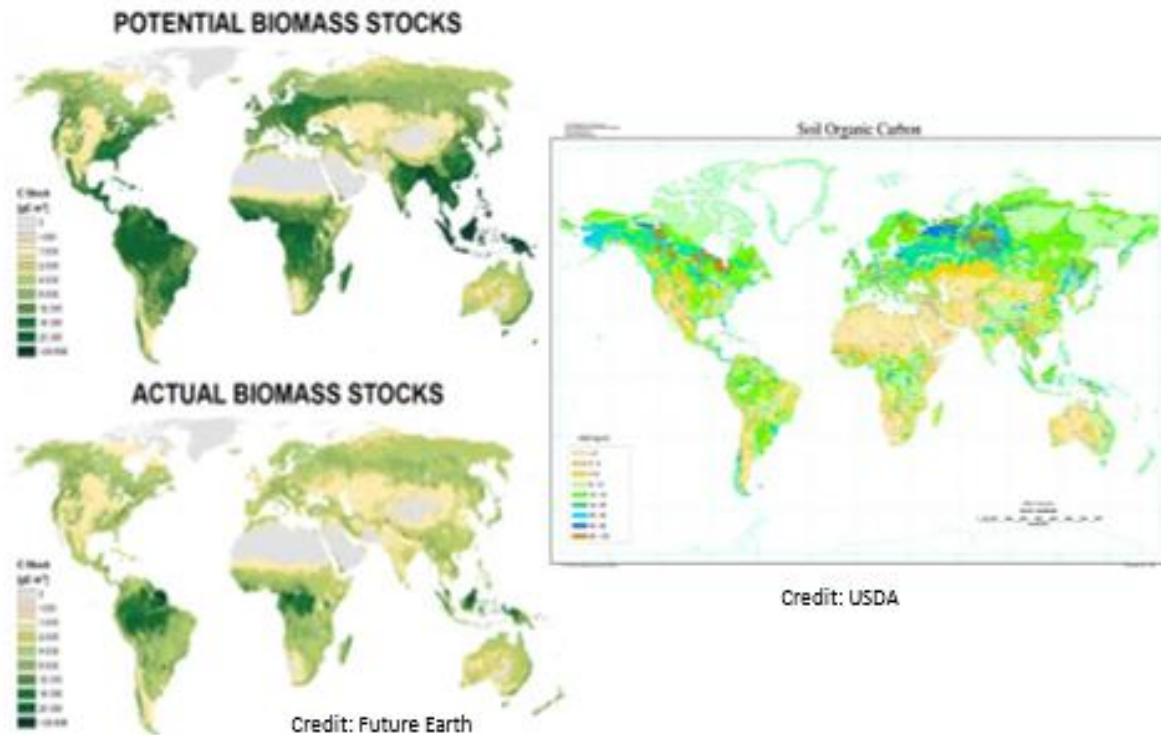Soil Organic Carbon

Credit: USDA

**Fig: Potential for carbon sequestration in Land**

Before and after satellite images will be used to show changes in following:
- ✓ Deforestation, degradation
- ✓ Afforestation

# 4.6 Rangelands

Rangelands include grasslands, shrublands and savanna in Africa. Rangelands cover some 43 percent of Africa's land area. While there have been some recent efforts to raise the importance of rangelands and their restoration the challenges facing these marginal areas continue to be neglected in policy and research forums. This is largely attributed to the fact that rangelands are home to mostly poor and marginalized populations, but it means that degradation will continue, and the economic and climate change mitigation potential of these vast lands will remain unrealized.

Case studies of degraded rangelands that have been restored are an opportunity to highlight how holistic solutions comprising grazing systems informed by traditional knowledge, science and the power of markets can combine to kickstart recovery on areas devastated by various levels of degradation. An example is Umzimvubu, in South Africa, a highly biodiverse, critically important water catchment area, which due to unsustainable livestock practices had undergone years of degradation. Conservation South Africa and other partners under the Umzimvubu Catchment Partnership Platform have been working with communities since 2015 to transition to more sustainable rangeland management (Thiongo, 2021).

## 4.7 Biodiversity

Africa is home to a rich and diverse animal, plant, and marine biodiversity that provide critical ecosystem services, driving the continent's economy and serving as buffers to climate change. The range of species and genetic diversity is great. For instance, Africa's biomes include mangroves, deserts, tropical forests, temperate, sub-tropical and montane grasslands and savannahs, and ice-capped mountains. The diversity at genetic level is also huge with examples of genetically diverse livestock, cultivated plants and wild relatives. For example, Africa's unique cattle diversity supports more than 70 per cent of the rural poor. But there are threats to the domesticated animals through crossbreeding with commercial breeds among others. A total of 1,184 breeds have been reported in Africa, including 839 local breeds and 345 transboundary breeds (UNEP, 2016).

There are many examples of success and innovation in the conservation of Africa's biodiversity, yet the content is also experiencing unprecedented rates of population growth, urbanization, and agricultural development, which create huge challenges in reconciling human well-being with environmental and economic prosperity. For instance, in 2014, 6,419 animals and 3,148 plants in Africa were recorded as threatened with extinction on the IUCN Red List (UNEP, 2016). However, much is being done to protect this natural capital. Africa contains over 3,000 protected areas including 198 Marine Protected Areas, 50 Biosphere Reserves, and 80 Wetlands of International Importance. Eight of the world's 34 international biodiversity hotspots are in Africa.

There will be some discussion on weaknesses in knowledge and information in relation to supporting ecosystem services such as pollination, and the prevention of zoonoses. What is not so evident in the public arena is that the spread of infectious diseases is a two-way street between animals and humans. Humans have been found able to transmit 21 bacterial, 12 viral and seven fungal pathogens to animals. Wild animals are the most affected, followed by livestock and pets. Reverse zoonoses gain in importance when they affect economically important animals eg scabies in mountain gorillas in Uganda, and Covid-19 in lions and pumas in South Africa (Zikusooka, Kock, & Macfie, 2002), (Koeppel, et al., 2022)

**Before and after satellite images along with a short narrative will be used to show changes in following:**
- ✓ **Changes in Ecosystems**
- ✓ **National parks, Protected areas, Biosphere reserves**
- ✓ **Wildlife, issue of bush meat, conflicts with humans?**
- ✓ **Invasive species**

## 4.8 Water Resources

Africa's water resources are continuously affected by persistent droughts and changes in land use. At the same time, a growing population is increasing the demand on already limited water supplies, particularly in areas which suffer from water shortages. Currently, it is estimated that over 300 million people in Africa face water scarcity conditions. About 75 per cent of the African population relies on groundwater as the major source of drinking water, particularly in northern and southern Africa. However, groundwater represents only about 15 per cent of the continent's total renewable water resource.

However, there are opportunities. Africa holds 10 per cent of the worlds internal renewable fresh water sources. The fisheries sector is estimated to be worth $24 billion (AMCEN, 2016). The importance and opportunities presented by the blue economy will be highlighted.



**Fig: Water resources map of Africa**
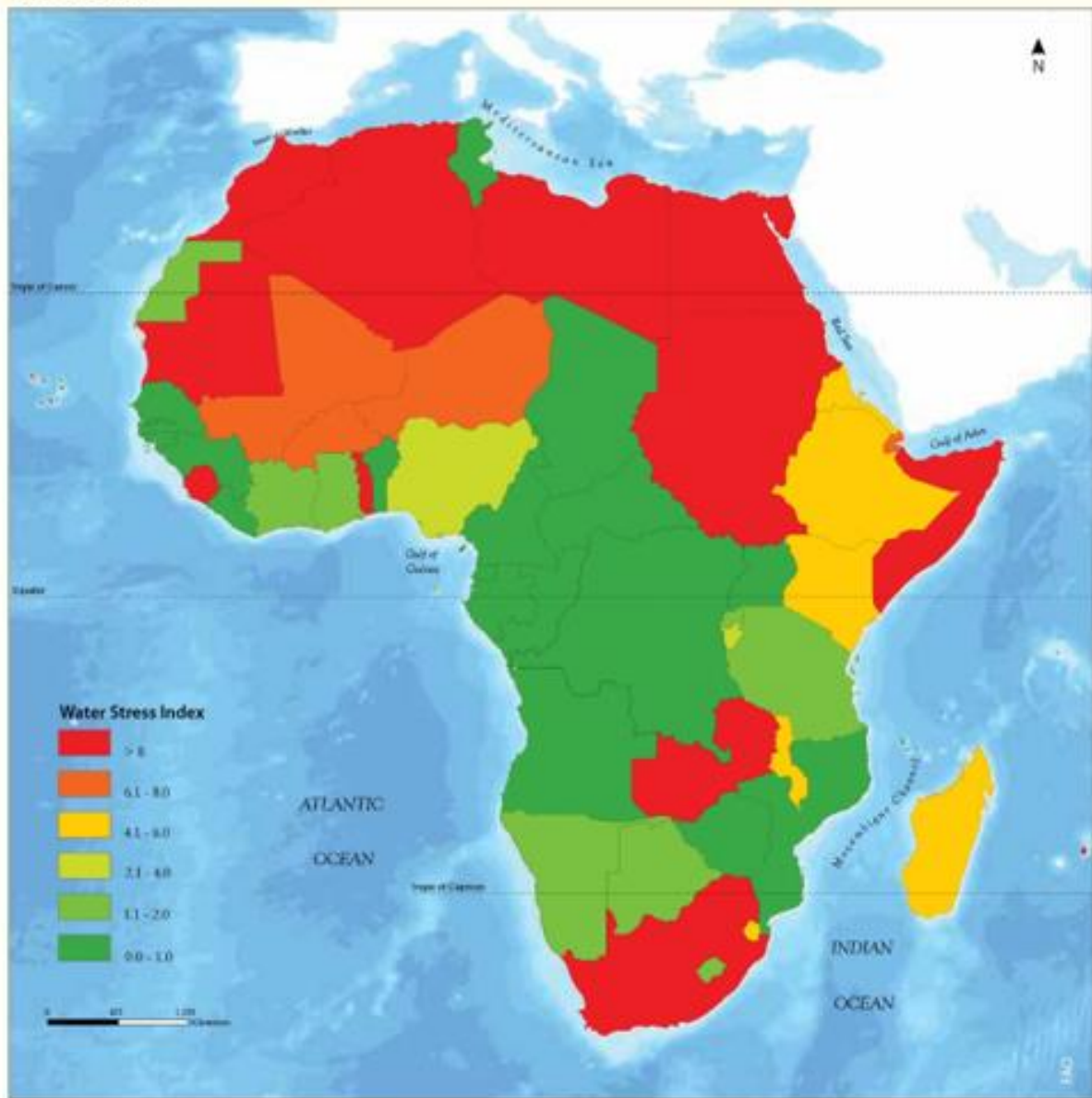


**Fig: Sud wetland in South Sudan**

**Water Stress**



**Fig: Water stress map**

**Before and after satellite images will be used to show changes in following:**
✓ **Rivers, lakes, wetlands**

## 4.9 Marine and Coastal Zones

Many of Africa's fisheries, both inland and marine, face overexploitation from illegal, under-reported and unregulated fishing in the Exclusive Economic Zones (EEZ). Piracy and illegal drug trafficking threatening the economies of affected countries especially in the Gulf of Guinea and the southwest Indian Ocean. Illegal fishing has led to losses of valuable catch estimated at US $42 billion per year (UNECA, 2016) (AU-IBAR, 2019). Pollution through dumping of toxic wastes and single use plastics also undermine the realization of Africa's Blue Economy Growth. Climate change and climate variability are also affecting Africa's aquatic systems and food production overall.

Aquaculture holds great promise for exploiting this potentially sustainable source of protein, but it is a necessary pre-requisite to take biodiversity and other environmental implications into account when promoting this industry. Other opportunities come from untapped resources. For example, Kenya's blue economy currently contributes only 2.5 per cent to its GDP, but there is opportunity in the country's expansive 200,000-nautical-mile EEZ (Axworthy, 2019).

- ✓ **Degradation in coastal zones, hot spots of eutrophication will be presented**
- ✓ **Mapping of the natural capital in the EEZ**
- ✓

## 4.10 Energy

Energy access for all is one of the key drivers of inclusive growth as it creates opportunities for women, youths, children both in urban and rural areas. Access to electricity in Africa is about 40 per cent, the lowest in the world. In absolute terms this translates to over 640 million Africans. Per capita consumption of energy in sub-Saharan Africa (excluding South Africa) is 180 kWh, compared to 13,000 kWh per capita in the United States and 6,500 kWh in Europe.

Access to energy is a key input underpinning the attainment of health and education goals and for supporting the economy and jobs. There is huge energy potential in Africa, but only a small proportion of it is being utilized (ADB, 2021).
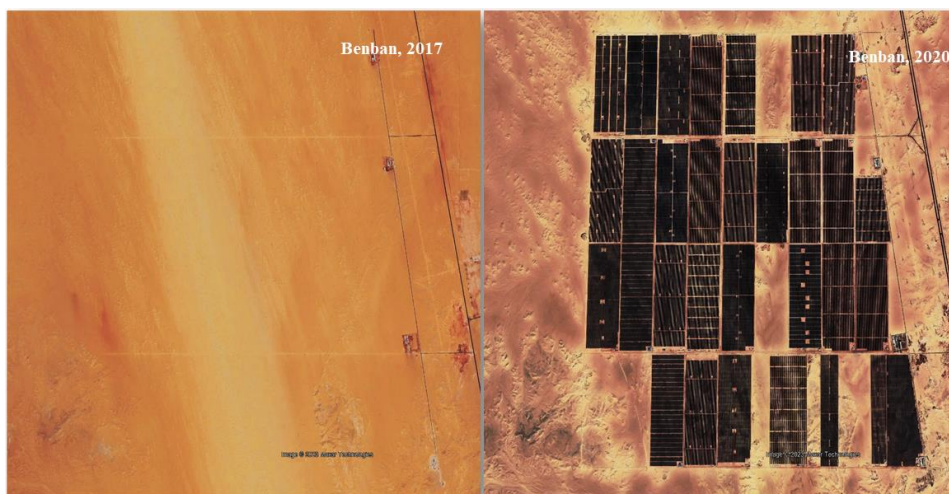


Satellite image in 2017 and 2020 showing solar energy park in Benban, Egypt

## 4.11 Minerals and Mining

About 30 per cent of the world's mineral reserves are in Africa. The continent has 8 per cent of the world's natural gas reserves, 12 per cent of the world's oil reserves, 40 per cent of its gold, and 80 to 90 per cent of its chromium and platinum. The largest reserves of cobalt, diamonds, platinum, and uranium in the world are in Africa (AMCEN, 2016). These minerals are part of the continent's natural capital, which is critical to financing development. However, these don't always translate into quality of life. Some countries with much mineral wealth, are at the bottom of the global Human Development Index. Poor governance and corruption are some of the challenges facing the sectors. The Africa Progress Report 2013 highlights some of these issues and contains comprehensive recommendations on how to stem these losses and recoup the resources for Africa's development (Bafana, 2019).

Growing climate change and the ensuing low-carbon transition means that Africa's mining sector is facing serious risks, and some opportunities. Opportunities as the continent is rich in renewable energy options. Risks because several African countries are discovering new deposits of coal, gas and oil which revenues might be difficult to realize due to stranding (a situation where natural assets become commercially unviable around the world because of climate change and the inability of countries to exploit them). This is an emerging policy issue especially since about 70 percent of exports in Africa are minerals.

✓ **Hot spots related to resources extraction will be covered in this section.**
✓ **Hope spots for instance restoration of derelict landscape, resulting from excavation for limestone required for the Bamburi cement factory in Mombasa, Kenya**

## 4.12 Impact of Climate Change and Natural Hazards

Recently, the World Bank Group released the October edition of its Africa's Pulse report, its biannual macroeconomic analysis for sub-Saharan Africa. According to the report the year 2020 was the fourth-warmest year for the African continent since the year 1910. The rises in temperature and changes in rainfall patterns have led to the increase in frequency and intensity of extreme weather events across the continent. In fact, natural disasters (including drought) have increased at a much faster pace than in the rest of the world. The report states: "Relative to 1970-79, the frequency of droughts in sub-Saharan Africa nearly tripled by 2010-19, it has more than quadrupled for storms, and it has increased more than tenfold in the case of floods."

Climate change and the impacts on natural capital will be discussed. These resources are critical to human wellbeing, but climate change is accelerating the depletion of natural capital. The changes in temperature and rainfall affect economic activity especially in sectors like agriculture, fishing, and tourism, which are severely sensitive to climate shocks. These will be explored in the discussions. For instance, climate change is responsible for reducing agricultural yields by 33 per cent in Africa over the last 60 years with impacts on food security, malnutrition, and hunger (CSIS, 2021). Further, pests, diseases, and infestations were the second highest cause of crop and livestock production loss between 2008-2018. Warming and changing patterns of temperature can expand pests' habitats, affecting pest population sizes, metabolism, and maturation rates, resulting in more pests that are hungrier and mature and reproduce faster— with greater destructive impacts. Two pests that have caused considerable damage in Africa, and whose destructiveness is linked to climate change are the Desert locust and Fall army worm (CSIS, 2021). Other examples may include the melting of mountain ice caps is affecting fresh water supply, floods pose risks to human populations, among others.

The discussions will touch on how African Risk Capacity facility (under the African Union) through collaboration and innovative financing is helping countries strengthen their disaster risk management systems and to enable improved response to extreme weather events and disasters.



**Number of deaths from disasters, 2022**
Disasters include all geophysical, meteorological and climate events including earthquakes, volcanic activity, landslides, drought, wildfires, storms, and flooding.

No data | None | 1 | 10 | 100 | 1,000 | 10,000 | 1 million | 10 million
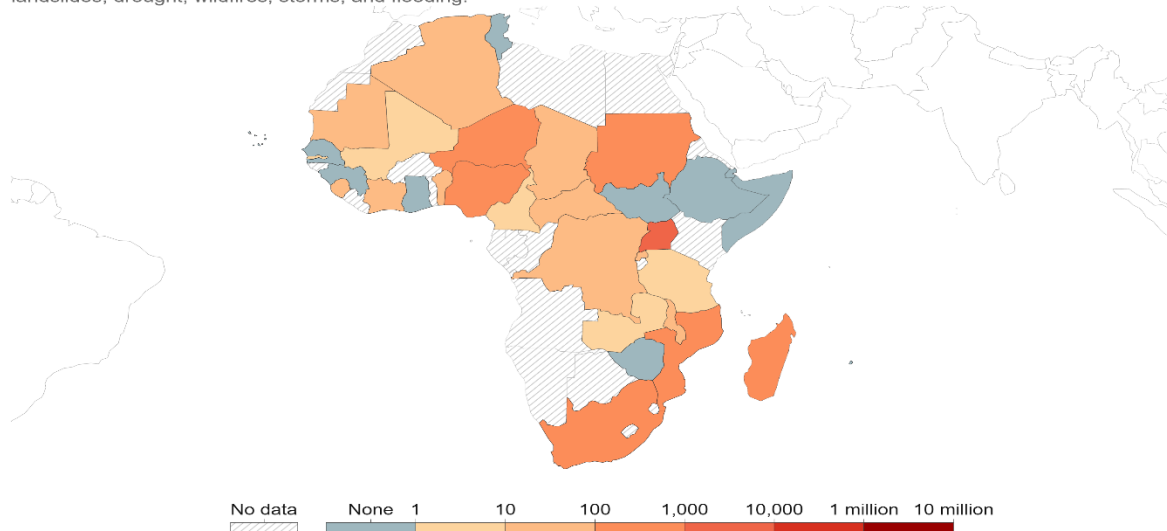
Source: Our World in Data based on EM-DAT, CRED / UCLouvain, Brussels, Belgium – www.emdat.be (D. Guha-Sapir)      CC BY

**Fig: Map shows number of deaths due to natural disasters across Africa.**

## 4.13 Environmental Burden of Diseases

Environmental factors contribute 28 percent of Africa's disease burden, with the biggest threats to human health according to **(UNEP, 2013)** being mosquitoes, water and air pollution. However, there are emerging health risks from other areas such as e-waste. Informal e-waste recycling in African countries is a serious public health threat and has health impacts on people, animals, and the environment (Orisakwe , Frazzoli, Ilo , & Oritsemuelebi, 2019). Many times, we tend to consider the environmental burden of disease on humans only, yet humans, animals and plants are all influenced by disease and by the health of each other and these combine to contribute to the overall economic burden of disease.

### *Human Health*

Malaria, one of the biggest environmentally related causes of mortality in Africa, thrives in warm climates and is spread as individuals are bitten by infected mosquitos. Its range has historically been well defined but it's now spreading into the cooler highlands of countries like Kenya and Rwanda which have little previous experience with it. The link between growing malaria prevalence and climate change is well established. Malaria is spread only by a specific type of mosquito, and only when the mosquitos live long enough to allow the parasite which causes malaria to fully mature. Warmer temperatures allow this kind of mosquito to spread and lengthen its lifespan. Also "deforestation raises sunlight, temperature, and surface water availability," allowing mosquitoes to breed more easily.

A broader range for malaria is bad enough, but on top of that some of the efforts to curb the spread have created health problems of their own. Pesticides like DDT are used for malaria prevention in 13 countries, but such chemicals "have been implicated in a range of terminal and chronic ailments," like cancer and reproductive health problems. Some countries, like Mauritius, spray DDT at their ports to prevent the disease from entering the country, but since the chemical is poisonous, it can destroy fragile ocean ecosystems and subsequently impact the nutrition and food security of coastal inhabitants.

Lack of access to adequate clean water, sanitation, and hygiene accounts for 10 percent of the disease burden in Africa and that many of the affected are children. For many African countries, the quantity of water is just as crucial as quality. Overall, Africans have access to less water than the global average (4,008 cubic meters annually vs. 6,498) and scarcity is increasing in many regions. Africa is projected to account for three out of every four people added to world population over the next century, which means more people are drawing on the same scarce resources, and urbanization clusters many of these people closer and closer together. Meanwhile, Africa is expected to bear some of the most damaging effects of climate change, including more irregular rainfall patterns.

Air pollution is another common cause of morbidity and mortality in Africa. According to a recent study Air pollution was responsible for 1.1 million deaths across Africa in 2019. Household air pollution accounted for 697,000 deaths and ambient air pollution for 394,000. Ambient air pollution-related deaths increased from 361,000 in 2015, to 383,000 in 2019, with the greatest increases in the most highly developed countries. Most deaths due to ambient air pollution are caused by non-communicable diseases. The loss in economic output in 2019 due to air pollution-related morbidity and mortality was $3·02 billion in Ethiopia (1·16 percent of GDP), $1.63 billion in Ghana (0.95 percent of GDP), and $349 million in Rwanda (1·19 percent of GDP). PM2·5 pollution was estimated to be responsible for 1.96 billion lost IQ points in African children in 2019  (Fisher, et al., 2021).

### Plant Health

Plant diseases have always been a challenge to plant growth and crop production. They can be caused by different types of pathogens and can have serious consequences on plant health, and even on human health. For instance, there is the likelihood of direct effect of plant pathogens on humans, several plant pathogens can affect humans by reducing the available food or by contaminating human food with toxic compounds. For instance, the secretion of toxic metabolites 'mycotoxins' by fungi such as *Aspergillus flavus*, *Fusarium* spp. and *Penicillium* spp. infecting plant products can lead to disease and death in humans and animals. Plant diseases are well known to reduce the food available to humans by interfering with crop yields in the long run, reduction of fruit quality and nutritional value among others. Efforts should be directed towards avoiding plant disease epidemics through food diversification and the development of effective plant disease management strategies (Al-Sadi, 2017).

### Animal Health

Poor animal health has social and environmental consequences. Livestock are critical to the human food chain and livelihoods in both the low-, and middle-income countries of Africa. Productivity losses occur due to diseases, inadequate access to feed and clean water, injuries, and predation. The emerging field of the economics of animal health, specifically the Ethiopian case study could provide more information on animal disease and health burdens (GBAD, 2022) (Temesgen, Knight-Jones, Awoke, Huntington, & Rushton, 2021).

Poor animal health especially in the rural areas, is linked to poverty, malnutrition, and risk of zoonotic disease exposure, leading to poor human health. Environmental degradation makes the emergence of zoonosis more likely. Drivers of disease include deforestation, intensive farming, the illegal and poorly regulated wildlife trade, antimicrobial resistance, and climate change.

See an initial list of potential hot spots in Annex.

## 4.14 Transboundary Ecosystems

Transboundary ecosystems include aquatic ecosystems such as rivers, lakes, wetlands, and marine systems; and terrestrial ecosystems such as forests, wildlife and mountains which are shared by two or more countries. Examples of transboundary environmental issues to be presented will be related to shared lands and waters, migrating animals and people, and pollutants that drift over borders of neighboring countries. It will highlight both emerging challenges and success stories in addressing these issues.

Africa also has 59 international transboundary river basins, which cover about 64 per cent of the region's land area, contain 93 per cent of its total surface water, and are home to 77 per cent of the population. Multinational approaches are essential to conserving these shared areas, underscoring the need for cooperative management strategies among bordering countries.

Another transboundary issue of particular significance is the movement of air pollutants. Africa experiences the most extensive biomass burning in the world. Gaseous molecules emitted as a byproduct of biomass burning can travel across national boundaries far from their original source. Fires contribute as much as 35 per cent to ground level ozone formation in Africa, bringing negative health consequences such as respiratory illnesses. The deserts contribute to dust storms that can drift over large areas. Following transboundary ecosystems, water systems, transboundary movements of

pollutants and dust storms will be covered showing their importance and linkages with the natural capital.

## *Transboundary Terrestrial Ecosystems*

Africa has several large transboundary ecosystems—areas of land or sea that straddle one or more political boundaries. Some of these are officially protected areas which are extremely important for safeguarding Africa's remarkable animal populations and their habitats. The importance of transboundary protected areas is especially obvious for migratory species, for example the Great Limpopo Transfrontier Park which connects South Africa's Kruger National Park, Mozambique's Limpopo National Park and Zimbabwe's Gonarezhou National Park; and the Ai-Ais/ Richtersveld Transfrontier Park along the cost of South Africa and Namibia. Other areas to highlight include, but not limited to:

- ✓ The Congo Basin Forests
- ✓ Transboundary Protected Areas (*criteria for selection to be decided*)
- ✓ Maasai Mara – Serengeti Protected Areas in East Africa
- ✓ W-Arly-Pendjari Parks Complex
- ✓ The Great Limpopo Trans frontier Park
- ✓ Mountain Gorilla Conservation in the Virunga Heartland
- ✓ South Sudan: migration of antelope

## *Transboundary Water Resources*

- ✓ Transboundary River Basins – *criteria for selection will be developed*
- ✓ Transboundary Lakes – *criteria for selection will be developed*
- ✓ Transboundary underground aquifers – *criteria for selection will be developed*
- ✓ Immediate examples include Lake Victoria: Africa's Largest Freshwater Lake; Lake Chad: Africa's Shrinking Lake; and Okavango: The World's Largest Inland Delta
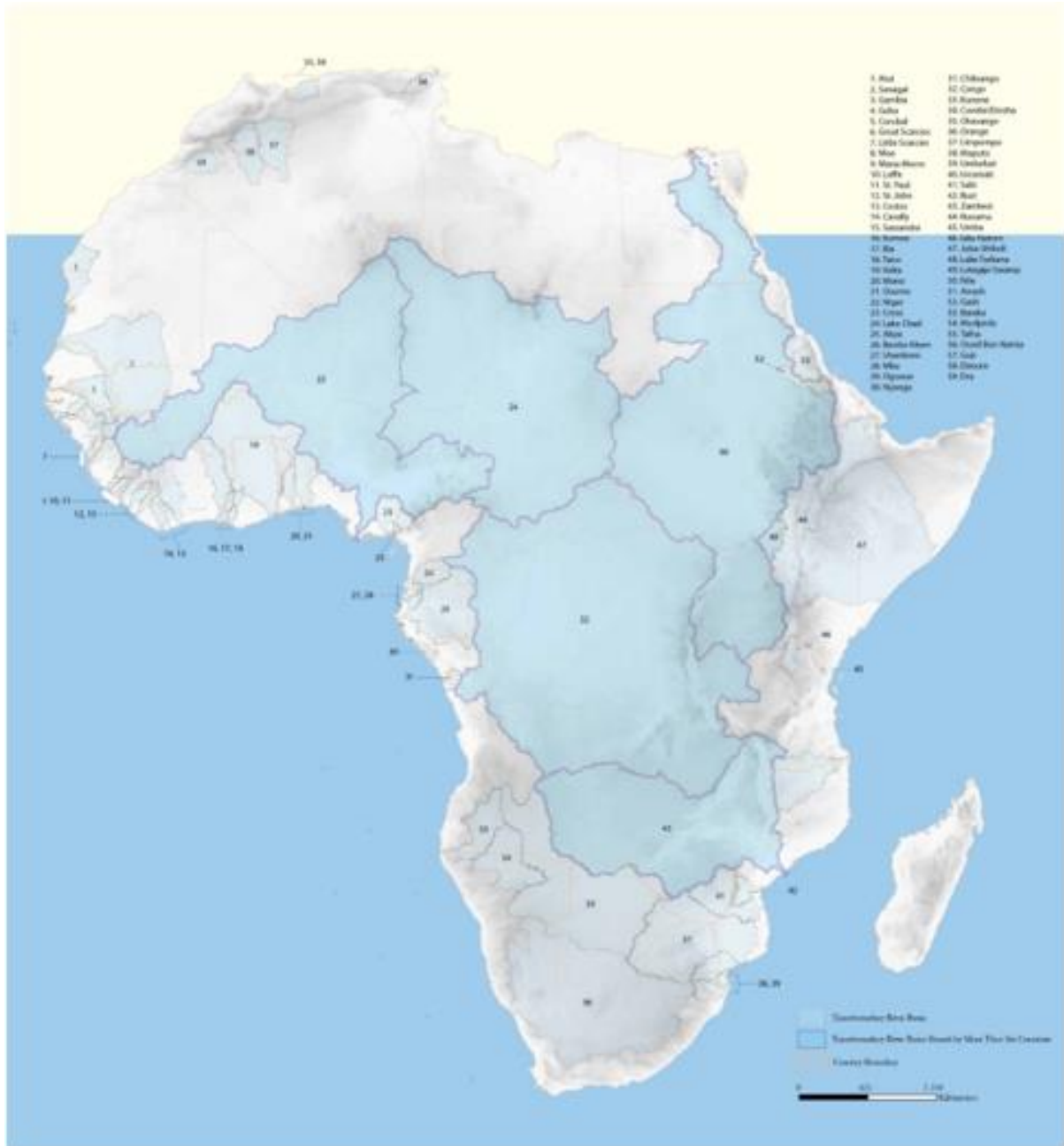
**Fig: Transbundary River  Basins**

### An example of Lake Chad (USGS, 2021)

Lake Chad was once the sixth largest lake in the world, but prolonged drought and increased water use have shrunk the lake dramatically. It now spans less than a tenth of the area it covered in the 1960s. Back then, the lake covered about 25,000 square kilometers.The fluctuations in lake water levels have stabilized in recent years, but it is still a dynamic environment. These Landsat images show the overall transition of Lake Chad from open water to wetland. The desert appears tan,

wetlands are green, and open water is blue. The black and white 1963 image is from the film-based Argon reconnaissance satellite program, declassified in the 1990s.

**Fig: Image of 1963, Image of May 2003, Image of May 2021**



## Transboundary movement of pollutants

### Fires

Hundreds of fires light up Central Africa as a thick blanket of smoke shrouds the sky in late July 2021. Each red "hot spot" marks an area is detected as high temperatures. When combined with typical smoke, as in this image, such hot spots mark actively burning fire. Countries captured in this image, all speckled with hot spots, include Angola, Zambia, and Malawi in the south and the Democratic Republic of the Congo (DRC) in the north. The shroud of smoke over DRC is so thick that in many areas it completely obscures the land from view.

Farmers in this region have used fire for thousands of years to clear fields of old crops, prepare fields for new plantings, clear underbrush, and renew pasture or savanna grasslands. While fire is a cheap and efficient way to manage land, especially in the African savanna lands where the ecosystem depends on periodic fires for health, fire also creates hazards, such as pollution from the smoke, release of greenhouse gasses, and degradation of ecosystems. In Central Africa, the fire season typically begins by May and peaks in August.



https://modis.gsfc.nasa.gov/gallery/individual.php?db_date=2021-08-02 (NASA, 2021)

### Dust storms

Dust storms have major public health impacts and also affect the environment, agriculture, transport, and infrastructure. In the Middle East and North Africa, welfare losses from dust are

approximately US $ 150 billion and over 2.5 percent of Gross Domestic Product (GDP) on average (World Bank, 2019).
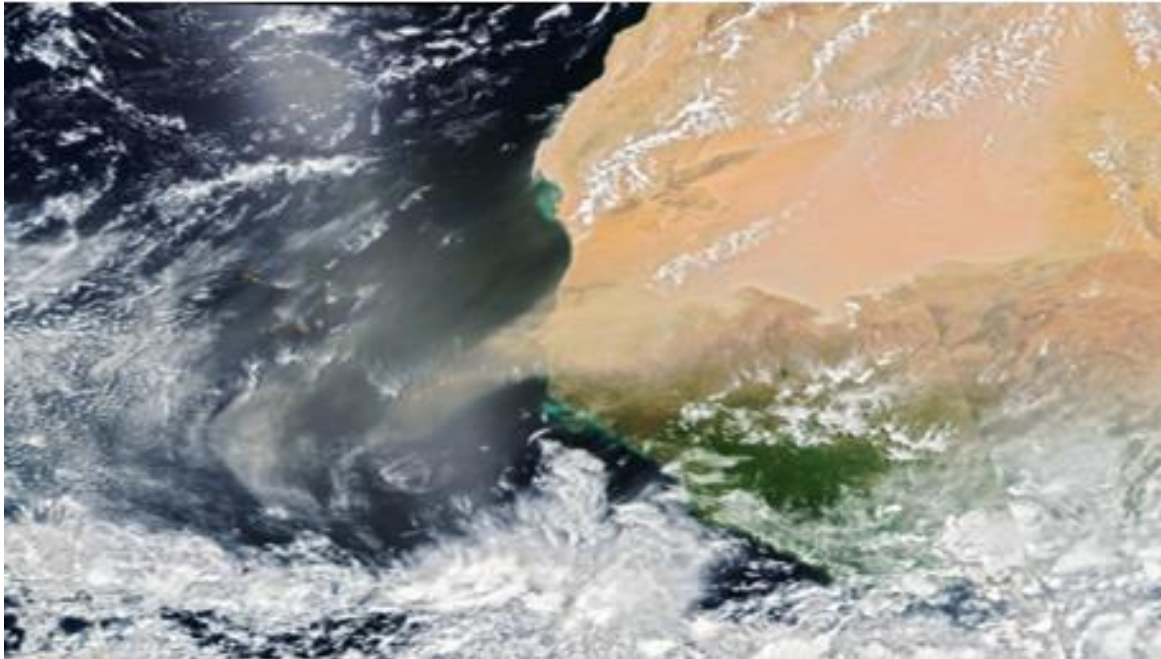


**Fig: Africa sheds some dust (Carlowicz, 2021)**
*Note: The millions of tons of dust lofted out of northwest Africa each year are a visual reminder of how Earth's systems are interconnected. Dust blowing out of the Sahara fertilizes the surface waters of the Atlantic and the soils of the Americas. It influences the development of hurricanes and other weather systems. The airborne particles reflect and block sunlight, affecting the planet's radiation budget. In heavy doses near the ground, dust plumes can hamper air quality, harm breathing, and reduce visibility.*

# CHAPTER 5: COUNTRY PROFILES

## 5.1 Overview

The country profiles in this chapter (mostly tables following the format in Annex 2) will provide detailed data and information about the environment and natural resources endowments for each of the 54 countries of Africa. They will highlight the key environmental assets of the environment essential for the long-term provision of national wellbeing. The key country data indicators are highlighted in Annex 2 and will also provide a baseline for measuring change in natural capital enabling these assets to be linked to ecosystem services and benefits; and to UNEPS's Inclusive Wealth Index and the World Bank Wealth of Nations summary. The tables would be part of the database foundation for this report which could be built upon in subsequent years.

The table will be adjusted depending upon the scope agreed.

## 5.2 Country Profiles

**See sample country data sheet to be populated in Annex 2**

# CHAPTER 6: BUILDING BACK BETTER: PROMOTING NATURE-BASED SOLUTIONS

## 6.1 Overview

Nature-based Solutions are designed to address major societal challenges, such as food security, climate change, water security, human health, disaster risk, and social and economic development. They are essential for addressing global challenges such as reducing carbon emissions and protecting biodiversity.

### *Description of Nature-based Solutions*

Nature-based Solutions (NbS) are defined by the International Union for Conservation of Nature (IUCN) as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN, 2021).



**Fig: The Benefits of Nature-based solutions (Dasgupta, 2021)**

**Investment in nature-based solutions would be cost-effective and offer a triple dividend of benefits- economic gains, avoided losses and social and environmental benefits.** Some specific actions could be to:

- **Restore agricultural land:** Such efforts could boost smallholder farmers' incomes and provide additional food amidst rising concerns about food insecurity due to economic dislocation.
- **Restore forests:** Restoring degraded forests has significant economic potential in many countries' forests and the fundamental role they play in climate change mitigation, by removing $CO_2$ from the atmosphere and storing it in biomass and soils. This also means that when forests are cleared or degraded, they can become a source of greenhouse gas (GHG) emissions by releasing that stored carbon. It is estimated that globally, deforestation and forest degradation account for around 11 percent of $CO_2$ emissions. Halting deforestation is a cost-effective action that has a clear impact in reducing global GHG emission.
- **Leverage existing jobs programmes:** Major public works and rural employment programmes in many countries, like Ethiopia's Productive Safety Nets Programme include a strong focus on land and water management, reforestation, and soil conservation. They are a good existing platform from which to generate rural jobs that restore degraded ecosystems and increase climate resilience.
- **Link economic support with environmental management:** Governments can adopt innovative approaches that link direct economic support to rural communities and natural resource users with improvements in environmental management.
- **Manage and protect natural areas:** Alongside restoration, there are strong employment and other economic benefits to directing recovery funds to the management and conservation of natural areas. Protected areas directly generate jobs associated with protection and management of those areas, as well as indirectly in the tourism sector.

## 6.2 Natural Capital Contribution Towards the Net Zero Goal

By 2050, $CO_2$ emissions will need to reach net zero—where emissions are in balance with removals. To achieve this goal, businesses, organizations, and individuals alike need to act and implement measures to reduce or mitigate their carbon footprint. Common strategies include the following:
- Carbon offsets and credits
- Consumption reduction
- Renewable energy generation

### *Carbon Offset*

A carbon offset broadly refers to a reduction in greenhouse gas (GHG) emissions or an increase in carbon storage through land restoration or the planting of trees. Carbon offsetting is possible because climate change is not a localized problem. GHG mix throughout the atmosphere; hence, reducing them anywhere contributes to overall climate protection. It does not matter where GHG emissions are reduced. The effects are the same whether organizations cease emission-causing activities or enable an equivalent emission-reducing activity anywhere in the world. Carbon offsets are meant to reduce greenhouse gas emissions to the atmosphere, and can be facilitated using methods such as:
- Planting trees which take in $CO_2$ and store it.
- Capturing and burning methane produced by farms or landfills.
- Improving energy efficiency to reduce emissions output.

Generally, carbon offsets are measured by the number of metric tonnes reduced, and the standard unit for quantifying carbon offsets is $CO_2$ equivalent ($CO_2e$). Purchasing a single offset from a project is equivalent to buying one metric tonnes of $CO_2e$ that is removed from the atmosphere. There are several natural resource management strategies to address climate change that future projects should incorporate:

- Adaptive grazing management (rotating grazing)
- Sustainable cropping (fertilizer management)
- Ecosystem preservation & restoration
- Engineered soil conservation methods (terracing)

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**A case of Central African Forests for Carbon Sequestration**

Rainforest's stock and absorb carbon and are home to more than 50 percent of terrestrial biodiversity, while only covering 6 percent of the Earth's surface. No other ecosystem or economic sector has the same capacity to revert the unfolding climate and biodiversity crisis. Central African forests comparable in size to Western Europe (covering Cameroon, the Central African Republic, the Democratic Republic of the Congo, Equatorial Guinea, Gabon and the Republic of Congo) are the second largest in the world. Each year they absorb about 4 percent of the worlds carbon emission. It is home to more than 10,000 plant and animal species, many of which are endemic.

This forest is the source of food, energy, shelter and spirituality for over 40 million people living in and around it, in countries with some of the lowest Human Development indices and conflict areas and with the highest number of people in urgent need of food security assistance in the world.

However, the Central African forest has been mostly spared from loss so far but is under increasing pressure. While trends and causes vary widely with national contexts, the Central African region has totaled a loss of over 6 million hectares of humid primary forest since 2001 and the trend is largely accelerating. Because of this loss and of national development contexts, the land-use and forestry sector are the main contributor to greenhouse gas emissions in the region (CAFI, 2021).

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## *Harnessing renewable energy potential*

Africa has huge potential in solar, wind and hydro power. As an example, Morocco has built the Noor-Ouarzazate complex, the world's largest concentrated solar power plant, an enormous array of curved mirrors spread over 3,000 hectares which concentrate the Sun's rays towards tubes of fluid, with the hot liquid then used to produce power.



**Morocco solar park - the project is one of the largest concentrated solar plants in the world. (ECOHZ, 2018)**

## Contributing towards the clean tech revolution though supply of minerals; sustainable mining

In the digitized world the engines that run this hidden network are built from materials extracted from the earth. This extraction process, as well as the production process to turn the minerals into cell phones, computers, and servers, comes with its own environmental footprint across the lifecycle. Similarly, the increasing level of green energy technologies that power digital technologies also have supply chains based on extensive use of metals and rare earth minerals. In many cases, the global reserves for these key minerals overlap with areas that experience fragility, conflict, and violence. Cobalt, graphite, copper, and rare earths are of particular concern as significant deposits are concentrated in vulnerable regions.

A mismatch in the supply and demand for critical minerals for key clean energy technologies—cobalt, lithium, nickel, copper—presents a business case for Africa's engagement. The demand for lithium is expected to grow over 30 times by 2040 but supply from existing mines and projects under construction can only meet about half the projected demand. To address these supply chain bottlenecks, governments must lay out their long-term commitments for emission reductions/clean energy, which would provide the confidence needed for suppliers to invest in and expand mineral production. Clear commitments are important because, unlike the variety of fossil fuels that are produced in many countries, the mining of clean energy minerals is concentrated in a few countries. The Democratic Republic of the Congo, for example, produced about 70 percent of the world's cobalt in 2019.

## Great green wall in Africa: Growing a World Wonder

The Great Green Wall is an African-led movement with an epic ambition to grow an 8,000km natural wonder of the world across the entire width of Africa. A decade in and roughly 15 percent underway, the initiative is already bringing life back to Africa's degraded landscapes at an unprecedented scale, providing food security, jobs, and a reason to stay for the millions who live along its path. The Wall promises to be a compelling solution to the many urgent threats not only facing the African Continent, but the global community as a whole – notably climate change, drought, famine, conflict, and migration. Once complete, the Great Green Wall will be the largest living structure on the planet, 3 times the size of the Great Barrier Reef.



**Fig: The Great Green Wall (GGW, 2019).** This image will be recreated to ensure the key indicators (the green wall of trees 15km wide, 7,775km long, through 11 countries from Senegal to Djibouti, and the benefits i.e. reduction of livestock deaths, boost food security etc.) are well illustrated for easy comprehension and appreciation.

**Fig: The Great Green Wall participating nations (Andree, 2015)**

Note: The nations involved are Burkina Faso, Chad, Djibouti, Eritrea, Ethiopia, Mali, Mauritania, Niger, Nigeria, Senegal, and Sudan. Through the African Union, from the original 11, there are now 20 countries involved in this collaborative action.

The Great Green Wall isn't just for the Sahel. It is a global symbol for humanity overcoming its biggest threat – our rapidly degrading environment. It shows that if we can work with nature, even in challenging places like the Sahel, we can overcome adversity, and build a better world for generations to come.

When it comes to solutions to climate change, such as forest conservation, we need to recognize that environmental policies can make winners and losers. For instance, forests can help local people survive, through [using trees for] activities such as charcoal making. When people are dependent on a forest, they need to be empowered to make economic use of it, or else need to be compensated [for instance, by wealthy nations paying them not to use the resources]. If not, they will be among the losers of global climate policies. We all know that conserving forests is important if we are going to tackle climate change and reduce emissions, because trees are locking up carbon. But there is a trade-off between forest conservation and development to which we need to draw more attention.

Nature-based solutions such as forest conservation are crucial, but we must carefully consider the social costs and any possible trade-offs with development.

## *Case Studies*

Some of the challenges and opportunities in nature-based solutions would be illustrated by followings and case studies (UNEP, 2018a):

✓ **Fouta Djallon, Guinea**: Valley bottom cropping was practiced in the past by some indigenous communities but has now been partly given up because of their difficulties in controlling water cycles, setting up and maintaining the necessary schemes and monitoring the quality of the cropping environment. The abandonment of several valley bottoms has increased pressure on the slopes and hillsides which suffer constant degradation because of bushfires, deforestation, soil impoverishment and mining activities which cause the silting and sanding up of watercourses. The drastic fall in crop yields, repeated water stress and moves by farmers to other activities posing a greater threat to the environment are some of the constraints faced by communities who now wish to develop these valley bottoms.

- ✓ **Lake Faguibine, Mali**: The ecosystem around Lake Faguibine has shifted from the livelihoods of a lake, fishing and livestock keeping to a livelihood that is forest-based as a new system to help combat climate change and its negative impact on the Faguibine community.

- ✓ **Mount Elgon, Uganda:** Mount Elgon's ecosystem is vulnerable to the impacts of climate change largely because of the mountain's high population density. This puts pressure on the mountain ecosystem, particularly given the fact that the main source of livelihoods for Mount Elgon communities is agriculture and that hilly areas are being cleared for settlements and farming.

- ✓ **Southern Burkina Faso**: The area faces major challenges in reaching a balance between preserving its natural resources and feeding its growing population. Southern Burkina Faso has experienced rapid population growth, mostly driven by immigration of farmers. Migrant people progressively convert forest land to cropland. If rural migration is not checked and lands not preserved, it will seriously degrade the environment.

- ✓ **Xai-Xia, Mozambique:** Constraints include loss of fertile land caused by flooding and salinization in the Limpopo river plain and high growth and concentration of population and refuges within the District's coastal area resulting in pressure and over-exploitation of natural resources.

- ✓ **Gishwati-Mukura, Rwanda** (REMA, 2021): Finding a tree in the rangelands around the Gishwati-Mukura National Park a few decades ago was not that easy. In 2015, the Government launched the Landscape Approach to Forests Restoration and Conservation (LAFREC) Project. It is being implemented by REMA and supported by development partners including the World Bank through the Global Environment Facility. The project aimed to demonstrate the viability of a landscape management approach in enhancing environmental services and climate resilience in one priority landscape of Gishwati and Mukura. It resulted in visible improvement in the restoration of the highly degraded Gishwati-Mukura landscape, enhancing both productive and environmental values. The introduction of silvopastoralism was one of the approaches used to improve livelihoods around Gishwati-Mukura National Park. Silvopasture is a tree-based livestock production system, where trees, shrubs and other vegetation planted on pasturelands provide fodder as well as other multiple benefits. The change in landscape in Gishwati reserve between 2006 and 2019 is shown in the satellite images below (REMA, 2021).



**Fig: Transforming a degraded forest to a Biosphere reserve  (REMA, 2021)**

# Annex 1: Environmental Change Hotspots and Hope Spots by Country

## A1.1. Hotspots by Country

*List of hot spots and hope spots to be updated*

**Table: Hotspots by county to be updated with recent data and list to be expanded** (UNEP, n.d.)

| Country | Hotspots | Theme |
|---|---|---|
| **Algeria** | *Algiers* | *Ecosystems* |
| **Algeria** | *El Kala region and environs are also noteworthy as a hotspot of micro-endemics for aquatic insects and amphibians* | *Ecosystems* |
| **Algeria** | *Global methane hotspot* | *Disasters and Conflicts* |
| **Algeria** | *Hassi R'Mel Oil Fields* | *Resource Extraction* |
| **Algeria** | *Mediterranean Sea* | *Ecosystems* |
| **Algeria** | *North-eastern Algeria is a hotspot of freshwater biodiversity* | *Ecosystems* |
| **Algeria** | *Ouargla Oasis* | *Ecosystems* |
| **Algeria** | *Skikda* | *Ecosystems* |
| **Algeria, Tunisia** | *Lake Tonga* | *Ecosystems* |
| **Angola** | *Angola is a biodiversity hotspot in southern Africa, with 291 known species of native mammals* | *Ecosystems* |
| **Angola** | *Catoca Diamond Mine* | *Resource Extraction* |
| **Angola** | *Huambo Province* | *Ecosystems* |
| **Angola, Namibia** | *Kavango Region* | *Ecosystems* |
| **Benin** | *Ouemé Flood Plain* | *Ecosystems* |
| **Benin** | *Pendjari National Park* | *Ecosystems* |
| **Botswana** | *Jwaneng* | *Resource Extraction* |
| **Botswana** | *Okavango Delta & Lake Ngami* | *Ecosystems* |
| **Burkina Faso** | *Arly National Park* | *Ecosystems* |
| **Burkina Faso** | *Ouagadougou* | *Ecosystems* |
| **Burundi** | *Bujumbura* | *Ecosystems* |
| **Burundi** | *Kibira Forest* | *Ecosystems* |
| **Cameroon** | *Campo-Ma'an Forest* | *Ecosystems* |
| **Cameroon** | *Mt. Cameroon* | *Disasters and Conflicts* |
| **Cameroon, Chad** | *Waza Logone Floodplain* | *Ecosystems* |
| **Cameroon, Chad, Nigeria, Niger** | *Lake Chad* | *Climate Change and Atmosphere* |
| **Canary Islands** | | |
| **Cape Verde** | *Pico de Fogo* | *Disasters and Conflicts* |
| **Central African Republic** | *Bangassou Forest* | *Ecosystems* |
| **Ceuta** | | |
| **Chad** | *Doba Oil Fields* | *Resource Extraction* |
| **Chad** | *Lake Chad Basin* | *Ecosystems* |
| **Comoros** | *Anjouan Island* | *Ecosystems* |
| **Comoros** | *Karthala Volcanic Eruption* | *Disasters and Conflicts* |
| **Comoros** | *Mutsamudu* | *Ecosystems* |
| **Comoros** | *Offshore East African Rift and the Comoros 'hotspot' of coral reef biodiversity for the Western Indian Ocean.* | *Ecosystems* |
| **Congo** | *Congo Roads* | *Ecosystems* |

| Congo | Ouesso | Ecosystems |
|---|---|---|
| Cote d'Ivoire | Beki Forest Reserve | Ecosystems |
| Cote d'Ivoire, Liberia | Taï National Park | Ecosystems |
| Democratic Republic of the Congo | Bumba | Ecosystems |
| Democratic Republic of the Congo | Kisangani | Ecosystems |
| Democratic Republic of the Congo, Rwanda | Lake Kivu | Disasters and Conflicts |
| Democratic Republic of the Congo, Rwanda, Uganda | Virunga National Park | Ecosystems |
| Democratic Republic of the Congo, Uganda | Rwenzori Glaciers | Climate Change and Atmosphere |
| Democratic Republic of the Congo, Zambia | Copperbelt | Resource Extraction |
| Djibouti | Djibouti City | Ecosystems |
| Djibouti | Lake Assal | Ecosystems |
| Djibouti | Musha and Maskali Islands | Ecosystems |
| Egypt | Cairo | Ecosystems |
| Egypt | Dakhla Oasis Irrigation | Ecosystems |
| Egypt | Damietta Promontory | Ecosystems |
| Egypt | Ismailia | Ecosystems |
| Egypt | Lake Burullus | Ecosystems |
| Egypt | Natron Valley | Ecosystems |
| Egypt | Nile Delta | Ecosystems |
| Egypt | Rosetta Promontory | Ecosystems |
| Egypt | Toshka Project | Ecosystems |
| Equatorial Guinea | Punta Europa Oil Facility | Resource Extraction |
| Eritrea | Manzanar Mangrove Project | Ecosystems |
| Eswatini | Swaziland Sugar Plantations | Ecosystems |
| Ethiopia | Addis Ababa | Ecosystems |
| Ethiopia | Lake Alemaya | Ecosystems |
| Ethiopia | Mer Awi | Resource Extraction |
| Ethiopia | Tekezé Dam | Ecosystems |
| Ethiopia, Kenya | Lake Turkana | Ecosystems |
| Gabon | Forest Resources | Ecosystems |
| Gambia | Banjul | Ecosystems |
| Ghana | Ghana's Tropical Forest Zone | Ecosystems |
| Ghana | Wassa West District | Resource Extraction |
| Guinea | Conakry | Ecosystems |
| Guinea | Sangaredi Bauxite Mine | Resource Extraction |
| Guinea, Liberia, Sierra Leone | Guinea Refugee Camps | Disasters and Conflicts |
| Guinea-Bissau | Balanta Rice Farming | Ecosystems |
| Kenya | Aberdare Mountain Range | Ecosystems |
| Kenya | Dandora | Ecosystems |
| Kenya | Kimana Wetland | Ecosystems |
| Kenya | Lake Amboseli | Ecosystems |
| Kenya | Lake Naivasha | Ecosystems |
| Kenya | Lake Nakuru | Ecosystems |
| Kenya | Lake Ol Bolossat | Ecosystems |
| Kenya | Loita Plains | Ecosystems |
| Kenya | Mau Forest Complex | Ecosystems |
| Kenya | Mt. Kenya | Ecosystems |

| | | |
|---|---|---|
| **Kenya** | *Nairobi River* | *Ecosystems* |
| **Kenya** | *Shompole Swamp* | *Ecosystems* |
| **Kenya** | *Sondu Miriu River* | *Ecosystems* |
| **Kenya** | *Winam Gulf* | *Ecosystems* |
| **Kenya** | *Yala Swamp* | *Ecosystems* |
| **Kenya, Uganda, United Republic of Tanzania** | *Lake Victoria* | *Ecosystems* |
| **Kenya,United Republic of Tanzania** | *Lake Jipe* | *Ecosystems* |
| **Lesotho** | *Lesotho Highlands* | *Ecosystems* |
| **Liberia** | *Harbel Rubber Plantation* | *Ecosystems* |
| **Liberia** | *Sapo National Park* | *Ecosystems* |
| **Madagascar** | *Itampolo* | *Ecosystems* |
| **Madagascar** | *Lake Alaotra* | *Ecosystems* |
| **Madagascar** | *Mikea Forest* | *Ecosystems* |
| **Madagascar** | *Morondava* | *Ecosystems* |
| **Madeira** | | |
| **Malawi** | *Lake Malawi* | *Ecosystems* |
| **Malawi** | *Mulanje Massif* | *Ecosystems* |
| **Mali** | *Inner Niger Delta* | *Ecosystems* |
| **Mali** | *Lake Faguibine* | *Climate Change and Atmosphere* |
| **Mali** | *Lake Manantali* | *Ecosystems* |
| **Mauritania** | *Foum Gleita Barrage* | *Ecosystems* |
| **Mauritania** | *Nouakchott* | *Ecosystems* |
| **Mauritania** | *Rosso-Nouakchott Highway* | *Ecosystems* |
| **Mauritania, Senegal** | *Diawling National Park* | *Ecosystems* |
| **Mauritania, Senegal** | *Lake Djoudj* | *Ecosystems* |
| **Mauritania, Senegal** | *Senegal River Irrigation* | *Ecosystems* |
| **Mauritius** | *Coral Reefs of Mauritius* | *Ecosystems* |
| **Morocco** | *Al Wahda Reservoir and Dam* | *Ecosystems* |
| **Morocco** | *Casablanca* | *Ecosystems* |
| **Morocco** | *Rabat* | *Disasters and Conflicts* |
| **Morocco** | *Souss-Massa Valley* | *Ecosystems* |
| **Mozambique** | *Beira Fire Scars* | *Ecosystems* |
| **Mozambique** | *Lake Cahora Basa* | *Ecosystems* |
| **Mozambique** | *Mutarara-Sena Conflict Agriculture* | *Disasters and Conflicts* |
| **Namibia** | *Okavango Delta* | *Ecosystems* |
| **Namibia** | *Succulent Karoo of the Namib Desert* | *Ecosystems* |
| **Namibia** | *Walvis Bay* | *Resource Extraction* |
| **Niger** | *Baban Rafi Forest* | *Ecosystems* |
| **Niger** | *Tahoua Province* | *Ecosystems* |
| **Nigeria** | *Challawa Dam* | *Ecosystems* |
| **Nigeria** | *Niger Delta Oil* | *Resource Extraction* |
| **Réunion** | | |
| **Rwanda** | *Gishwati Forest* | *Ecosystems* |
| **Rwanda** | *Mukura Forest Reserve* | *Ecosystems* |
| **Rwanda,Uganda, United Republic of Tanzania** | *Akagera National Park* | *Ecosystems* |
| **Saint Helena** | | |
| **SãoTomé and Príncipe** | *São Tomé* | *Ecosystems* |
| **Senegal** | *Dakar* | *Ecosystems* |
| **Senegal** | *Leboudou Doue* | *Ecosystems* |
| **Senegal** | *Peanut Basin* | *Ecosystems* |
| **Senegal** | *Revane* | *Ecosystems* |

| | | |
|---|---|---|
| **Senegal** | *Saloum River Estuary* | *Ecosystems* |
| **Senegal** | *Velingara* | *Ecosystems* |
| **Seychelles** | *Mahe Island* | *Ecosystems* |
| **Sierra Leone** | *Freetown* | *Ecosystems* |
| **Sierra Leone** | *Rutile Mining in Moyamba District* | *Resource Extraction* |
| **Somalia** | *Hargeysa* | *Ecosystems* |
| **Somalia** | *Juba River Flooding* | *Disasters and Conflicts* |
| **Somalia** | *Mogadishu* | *Ecosystems* |
| **Somalia** | *Southern Somalia* | *Ecosystems* |
| **South Africa** | *Amatole Mistbelt Forests* | *Ecosystems* |
| **South Africa** | *Fynbos* | *Ecosystems* |
| **South Africa** | *Lake Sibaya* | *Ecosystems* |
| **South Africa** | *Midrand* | *Ecosystems* |
| **South Sudan** | *Boma National Park Jabel Lado County, Kapoeta, Imatong Forest* | *Ecosystems* |
| **South Sudan** | *Sudd Swamp* | *Ecosystems* |
| **Sudan** | *Khartoum* | *Ecosystems* |
| **Sudan** | *Korti* | *Ecosystems* |
| **Sudan** | *Merowe Dam* | *Ecosystems* |
| **Sudan** | *Sugar Plantation Agriculture* | *Ecosystems* |
| **Togo** | *Nangbeto Reservoir* | *Ecosystems* |
| **Tunisia** | *Bou Hertma Dam* | *Resource Extraction* |
| **Tunisia** | *Lake Ichkeul* | *Ecosystems* |
| **Tunisia** | *Sfax* | *Ecosystems* |
| **Tunisia** | *Sidi Toui National Park* | *Ecosystems* |
| **Tunisia** | *Tunis* | *Ecosystems* |
| **Uganda** | *Budongo Forest Reserve* | *Ecosystems* |
| **Uganda** | *Dams of Uganda* | *Resource Extraction* |
| **Uganda** | *Kampala* | *Ecosystems* |
| **Uganda** | *Lake Kyoga* | *Disasters and Conflicts* |
| **Uganda** | *Lake Wamala* | *Ecosystems* |
| **Uganda** | *Mabira Forest Reserve* | *Ecosystems* |
| **Uganda** | *Mount Elgon* | *Ecosystems* |
| **United Republic of Tanzania** | *Mt. Kilimanjaro* | *Climate Change and Atmosphere* |
| **United Republic of Tanzania** | *Shume Magamba* | *Ecosystems* |
| **Western Sahara** | *Bou Craa* | *Resource Extraction* |
| **Zambia** | *Kafue Wetlands* | *Ecosystems* |
| **Zimbabwe** | *Lake Chivero* | *Ecosystems* |
| **Zimbabwe** | *Mashonaland Central Province* | *Ecosystems* |

## A1.2. Hot Spots Examples

Figure Satellite Image near Twifo Praso on River Pra 2011 and 2021 showing major change landscape in 10 years



Satellite image of Gishwati forests in 2006 and 2019 showing the major change in landscape in 13 years. One can see greening of areas along white arrows

The landscape management for improved environmental services and climate resilience in a priority for landscape of Gishwati and Mukura. Over the years, efforts in rehabilitation of these lands resulted in a major breakthrough in the restoration of the heavily degraded landscape of Gishwati-Mukura, improving both productive and environmental values.

**Gold mining in Burkina Faso**



Satellite image in 2016 and 2023 showing establishment of gold mining operation in Houndé, Burkina Faso

**Cement plant in Nigeria**

# Annex 2: Country data collection template

## A2.1. Statistics by Type

- ✓ **Carbon sequestration potential for Net Zero**
- ✓ **Valuation of ecosystem services (results of case study if any)**
- ✓ **Inclusive wealth Index**

| Type Year | | 1990 | | 2000 | | 2010 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| **Fossil fuels** | | | | | | | | | |
| **Coal** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **Natural gas** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **Oil** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **Renewable energy** | | | | | | | | | |
| **Solar** | | | | | | | | | |
| **Wind** | | | | | | | | | |
| **Tidal** | | | | | | | | | |
| **Hydro** | | | | | | | | | |
| **others** | | | | | | | | | |
| **Metal and Mineral wealth for clean green technologies and Rare Earth Minerals** | | | | | | | | | |
| **Cobalt** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **Copper** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **Nickel** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **Lithium** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **others** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **others** | Reserve (Tons) | | | | | | | | |
| | Extraction (Tons) | | | | | | | | |
| **Agriculture** | | | | | | | | | |
| **Quantity of crops produced (Tons)** | | | | | | | | | |
| **Price of crops produced (USD)** | | | | | | | | | |
| **Harvested area in crops (Hectare)** | | | | | | | | | |
| **Permanent cropland area (Hectare)** | | | | | | | | | |
| **Permanent pastureland area (Hectare)** | | | | | | | | | |
| **Forest** | | | | | | | | | |
| **Forest stocks (Hectare)** | | | | | | | | | |
| **Wood production (Tons)** | | | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Value of wood production (USD)** | | | | | | | |
| **Value of non-timber benefits (USD)** | | | | | | | |
| **Total Carbon Stock** | | | | | | | |
| **Fisheries** | | | | | | | |
| **Fish catch (Tons)** | | | | | | | |
| **Value of fish catch (USD)** | | | | | | | |

## A2.2. Country Profiles

**Selected country profiles (draft not to be quoted)**

## *BURKINA FASO*

### 1. Impact of economic growth on natural capital depletion in Burkina Faso

The backbone of Burkina Faso economy is its agriculture as it employs around 80% of the population. Hence, GDP growth in Burkina Faso heavily depended on this sector that accounts for approximately 30% of its GDP. In addition, the mining sector, especially gold production, has become increasingly important for Burkina Faso's economy in recent years. As one of Africa's largest gold producers, the performance of the mining industry has a substantial effect on GDP growth.

However, pursuit of GDP has resulted in an emphasis on short-term economic gains at the expense of long-term sustainability. As the country invests in agriculture, mining, and infrastructure development, it often does so without adequate consideration for the depletion of natural resources and the associated loss of natural capital.

For instance, deforestation has been driven by the expansion of agricultural land, logging for timber and fuelwood, and urbanization (Pouliot et al., 2012). As forests are cleared to make way for agricultural lands or infrastructure, the country lost valuable natural capital in the form of ecosystem services such as trees, natural river, and clean air. Soil degradation is another significant consequence of pursuing high GDP at the expense of natural capital. Intensive agricultural practices, such as monocropping and overuse of chemical fertilizers, can lead to soil nutrient depletion, erosion, and reduced fertility (Coulibaly, 2022).

### 2. Previous estimations of natural capital in Burkina Faso

Figure 1 shows that prior assessments valued Burkina Faso's Inclusive Wealth Index (IWI) at approximately $100 billion in 2019. The lion's share of this wealth was attributed to human capital, which swelled from $23 billion to $58 billion, dwarfing produced capital's modest $4 billion value. Notably, natural capital—a significant component of the IWI—has been the sole category to experience a decline over the years, slipping from $45 billion to $37 billion over the past three decades.

It is important to note that earlier estimates of Burkina Faso's IWI may have undervalued the true worth of the country's natural capital due to scarce data on natural mineral resources. Given the nation's substantial gold and manganese production, experts believe that natural capital could, in fact, be the most valuable asset in Burkina Faso. Nevertheless, current estimates show that ecosystems services in the country provide significant benefit that have decrease over time.

As illustrated in Figure 2, the value of ecosystem services in Burkina Faso experienced a significant 30% decline between 1992 and 2019, amounting to a 62% per capita reduction. The rapid population growth in the country poses significant risks to the availability of these services for local communities, as well as to the nation's overall Inclusive Wealth—particularly as per capita measurements have dwindled over the past three decades.

Interestingly, this trend runs counter to the positive growth observed in both GDP and GDP per capita during the same period. This pattern points to inadequate investment in and protection of the country's natural capital, suggesting a short-term economic growth focus. Moreover, Figure 3 reveals that the decline of natural capital in Burkina Faso is reflective of a broader trend across the African continent. However, Figure 4 shows that the country fair worse than other African countries in the efficiency of use of their natural capital in improving their productivity.

### 3. Keys for protecting the natural capital and devising a sustainable development in Burkina Faso

The government of Burkina Faso has taken significant strides to counteract the depletion of its natural capital, with its participation in the Great Green Wall Initiative being a noteworthy example. Launched in 2007, this collaborative effort among 11 Sahelian nations demonstrates a heightened awareness of the importance of protecting vital ecosystem services

Although the dividends from this project may take time to materialize, it is crucial to support these efforts, given the growing Burkinabe population and the potential risks to natural capital availability. In a country where the primary sector provides the majority of jobs, safeguarding natural capital is of paramount importance.

Moreover, past estimates of natural capital decline in Burkina Faso may not accurately reflect the situation on the ground, as data on the country's mineral reserves has often been incomplete. As mineral resource extraction has become a significant driver of development in Burkina Faso, it is essential to account for the depreciation of these reserves over time. The limitations of the country's current development trajectory may ultimately be shaped by the availability of these valuable resources.
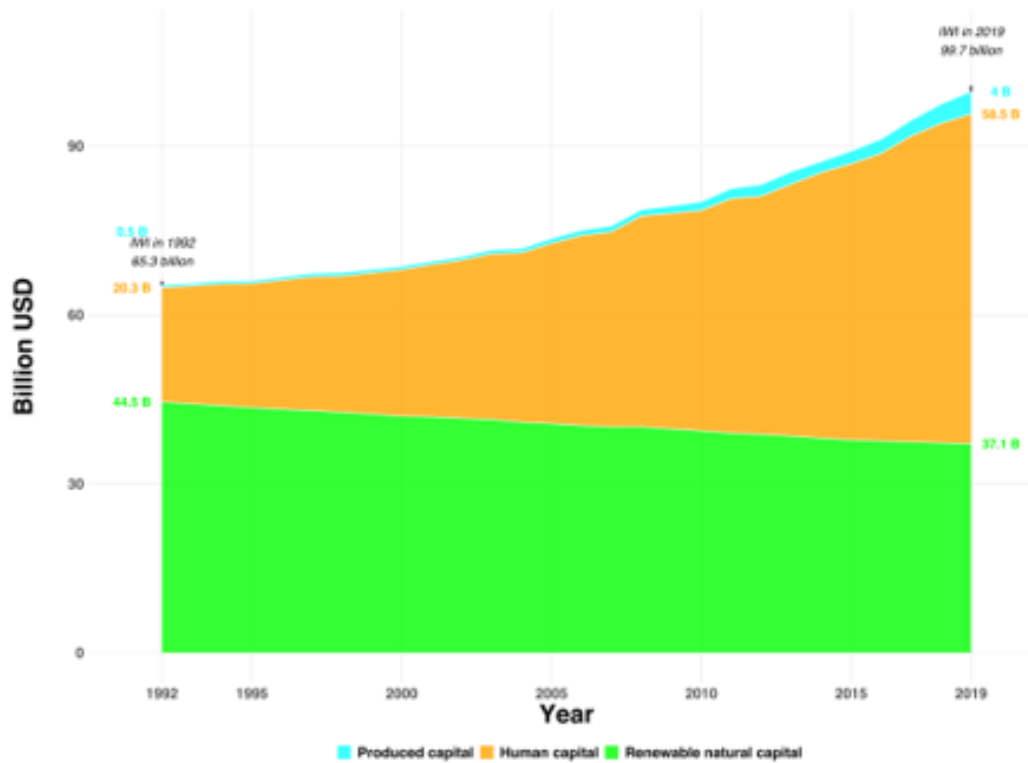


Fig: Capital composition over the year in Burkina Faso
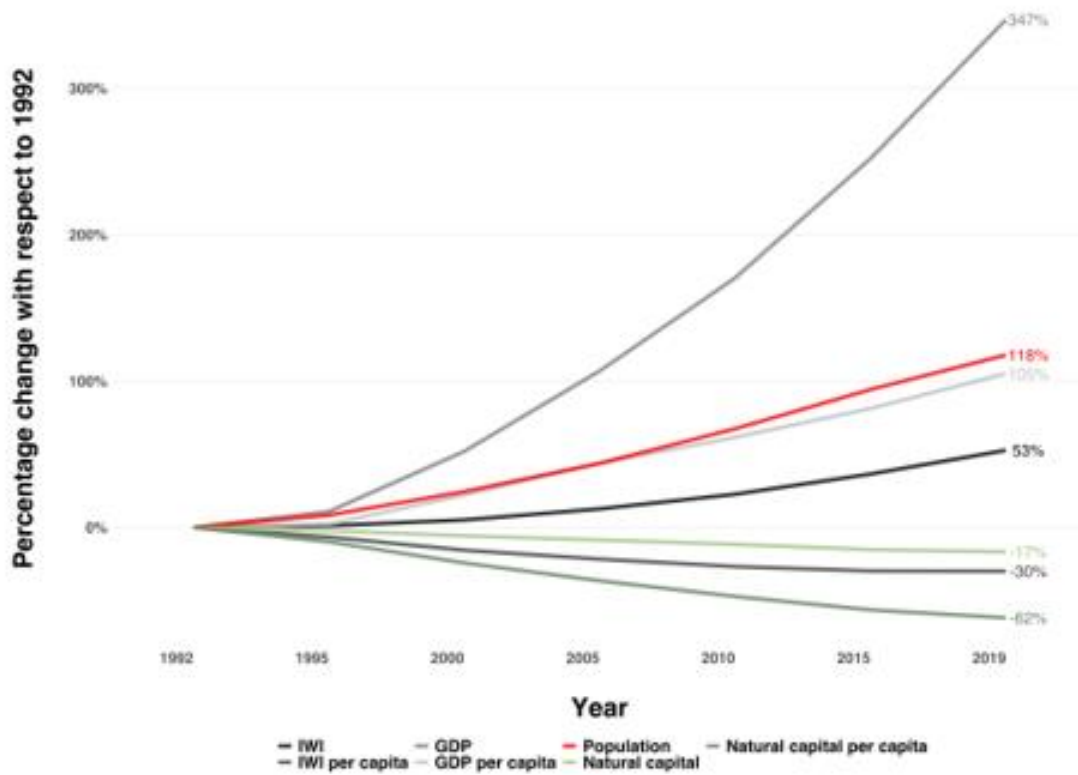
**Fig: Capital Growth**
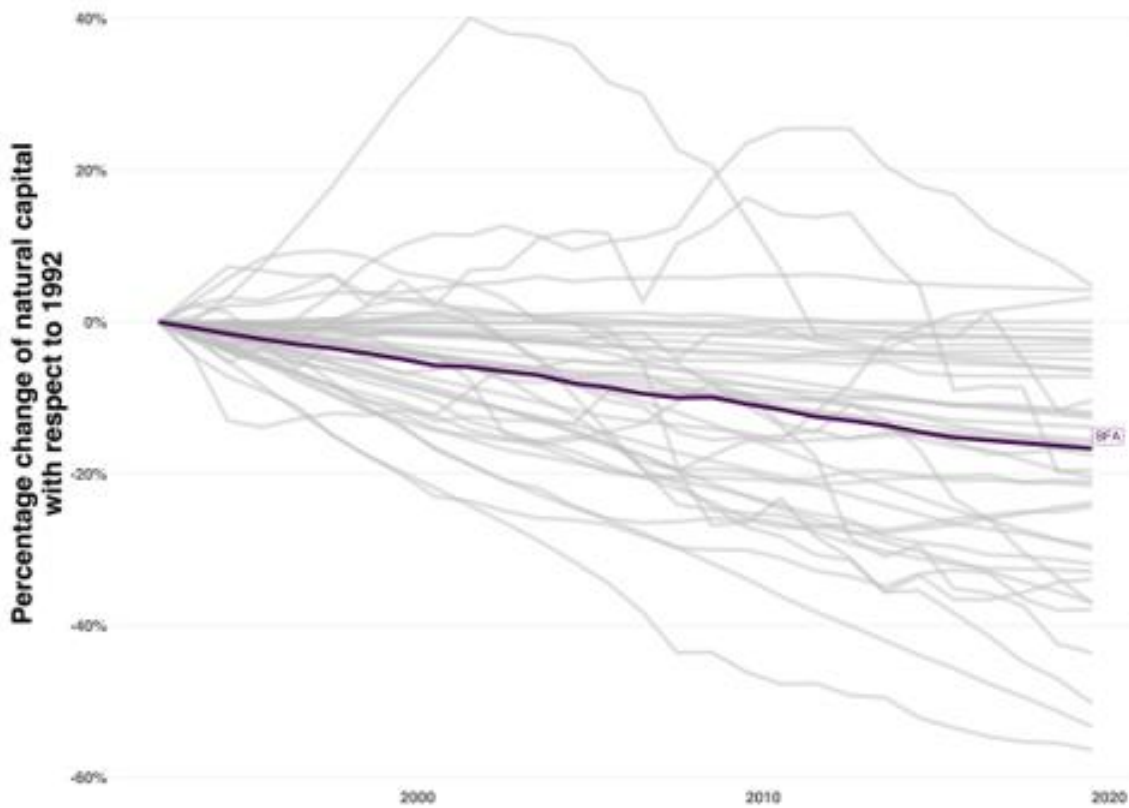


**Fig: Natural capital growth relative to other countries**
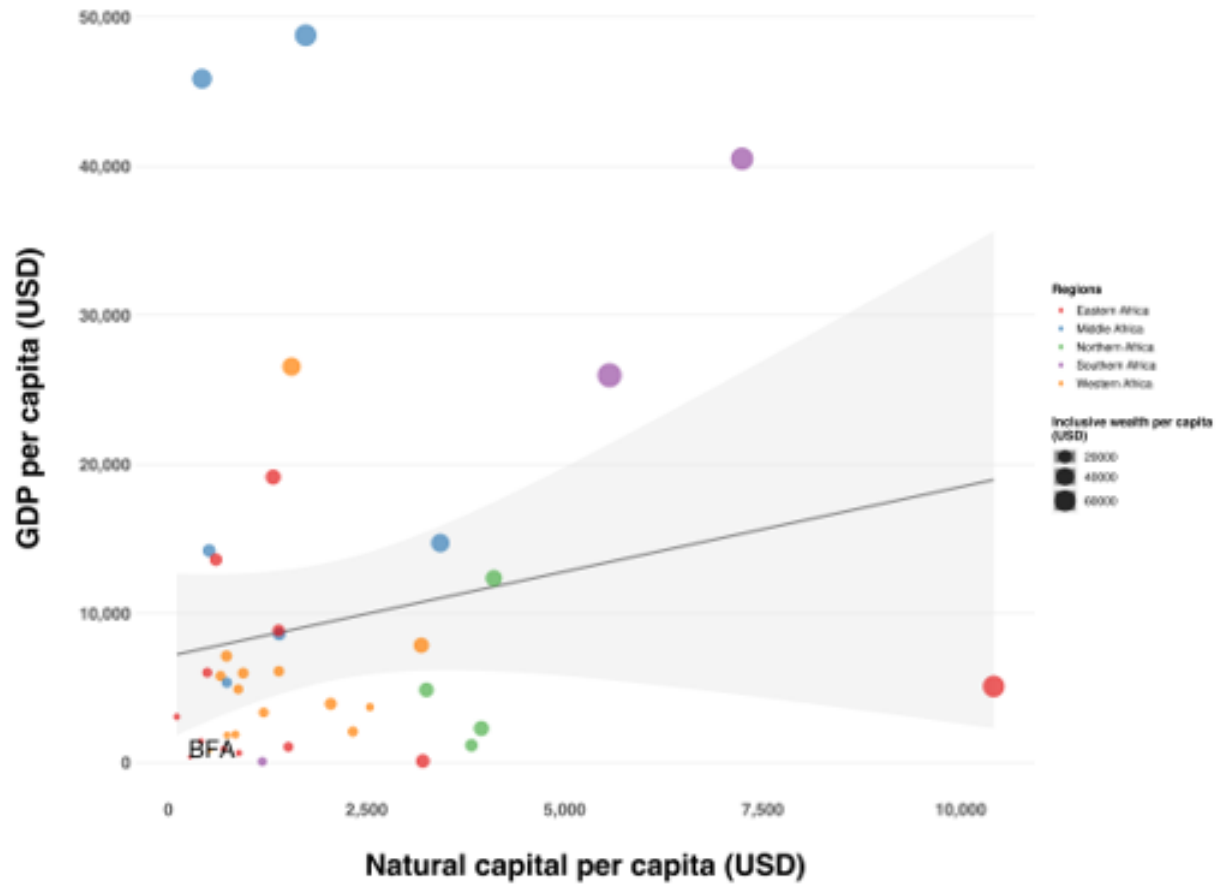
**Fig: Relationship between natural capital and GDP**

# NIGERIA

### 1. Nigeria natural capital and GDP growth

Nigeria, Africa's most populous nation, boasts a wealth of assets, with its people at the forefront. The country has enjoyed rapid economic growth, fueled by a range of factors, including its heavy reliance on the oil and gas sector—a significant contributor to both GDP and government revenue. Additionally, agriculture plays a crucial role in Nigeria, employing over 70% of the population, primarily at the subsistence level. The country's agricultural output spans staple crops as well as globally recognized cash crops like cocoa.

However, Nigeria's pursuit of high GDP has often emphasized short-term gains at the expense of its natural capital, resulting in substantial depreciation in recent years. This decline has taken various forms, such as deforestation, biodiversity loss, soil degradation, and pollution. Factors driving deforestation include agricultural expansion, timber logging, and urbanization. Biodiversity loss, another critical aspect of Nigeria's natural capital depreciation, stems from unsustainable practices in agriculture, forestry, and fisheries, leading to the decline of numerous species and ecosystems. Such losses not only diminish the country's ecological resilience but also jeopardize the long-term productivity and sustainability of these sectors. Lastly, oil spills, gas flaring, and the release of untreated industrial waste have had dire consequences for human health and the overall well-being of ecosystems and Nigeria's natural capital.

### 2. Previous estimations of natural capital in Nigeria

According to recent data, Nigeria's Inclusive Wealth Index (IWI) was valued at approximately $1,250 billion in 2019, representing a decline from its estimated value of around $1,300 billion in 1992. This drop can be attributed to the significant depletion of Nigeria's natural capital, the country's most valuable resource. As natural capital loses ground in Nigeria's wealth composition, human capital and produced capital have gained prominence, although the latter's growth has been relatively slow.

Over the past 30 years, both renewable and non-renewable components of natural capital, including wealth from fossil fuels, have experienced declines in Nigeria. On a per capita basis, Figure 4 highlights the alarming decrease in natural capital, with nearly two-thirds of its value lost since 1992. While rapid population growth has contributed to this decline, the total value of natural capital has also decreased by almost 30%, suggesting that other factors are at play.

These concerning figures stand in stark contrast to Nigeria's overall productivity, as measured by GDP, which has grown by nearly 58% from 1992 to 2019. Figure 5 underscores the severity of natural capital depletion in Nigeria, revealing that it is among the fastest declines in Africa. It suggests that Nigeria need to act stop this decrease and improve the use of its natural capital as Figure 8 shows that it less efficient than other countries in using this resource for productivity.

### 3. Keys for protecting the natural capital and devising a sustainable development in Nigeria

The Nigerian government has made notable strides in safeguarding its natural capital and fostering sustainable development through various initiatives and projects. These efforts include the National Biodiversity Strategy and Action Plan (NBSAP), participation in the Great Green Wall Initiative, implementation of the National Forest Policy, and establishment of the Niger Delta Development Commission (NDDC).

However, limitations in the implementation and effectiveness of these initiatives persist, often due to inadequate funding, weak enforcement of regulations, and conflicting priorities. With 40.1% of the population living below the poverty line  in 2018 and a rise in terrorist activities in the Sahel region—where environmental protection is most urgently needed—the government and private sector appear compelled to prioritize economic growth, industrialization, and peace.

Nevertheless, Nigeria has the opportunity to improve and protect its natural capital, particularly in the fossil fuel industry. Currently, efforts to mitigate environmental damage from this sector do not correspond to the substantial revenues it generates. By addressing this disparity, Nigeria can take further steps towards preserving its invaluable natural resources.
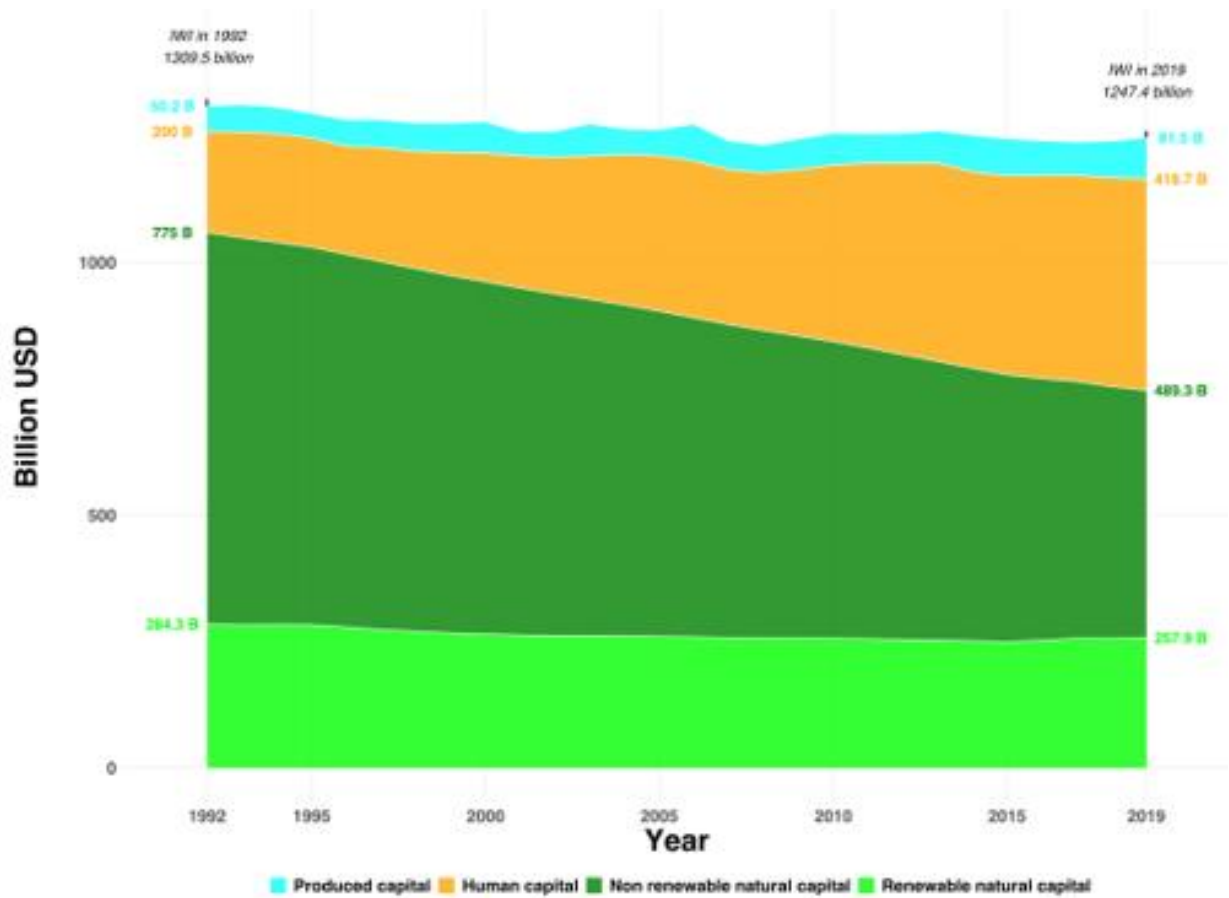


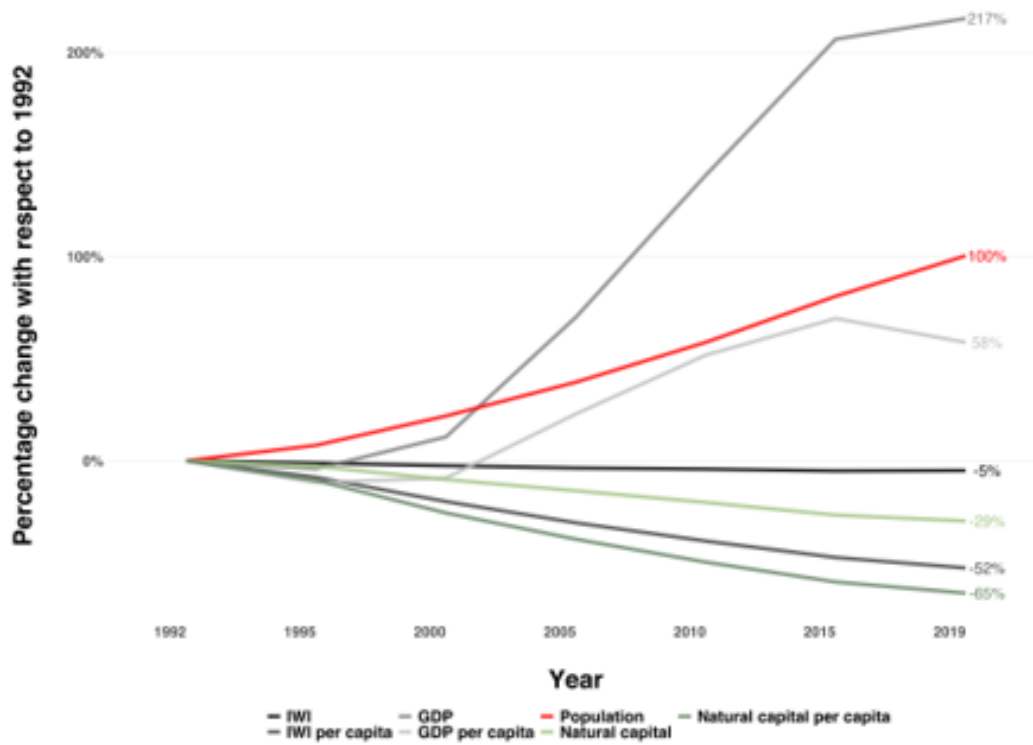**Fig: Capital composition over the year**
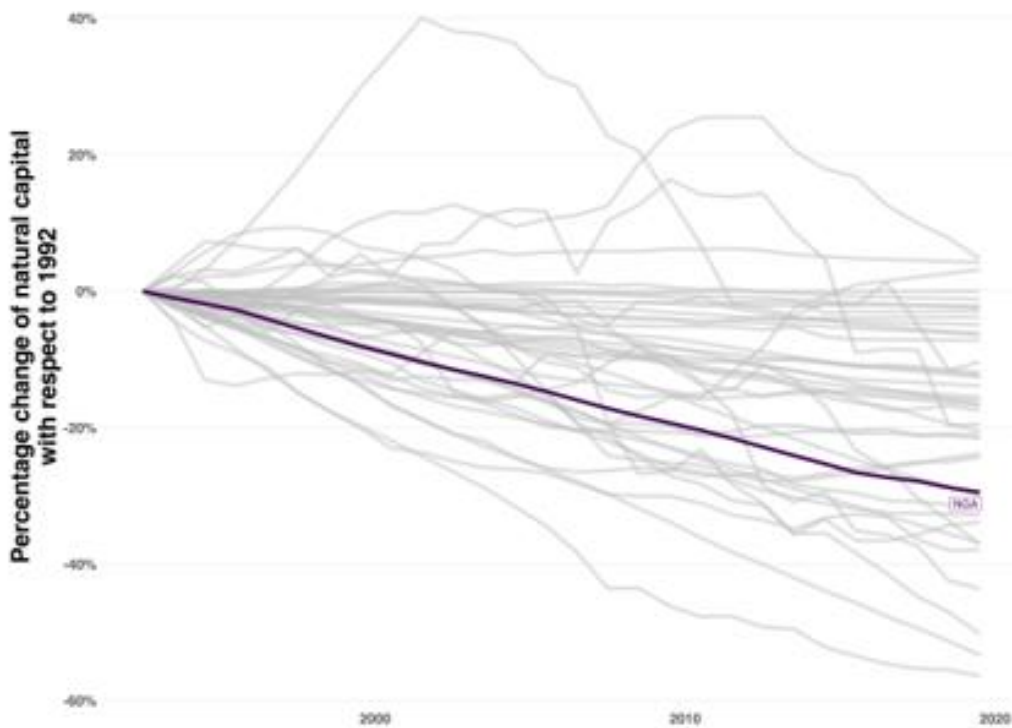
Fig: Capital composition over the year

**Fig: Capital Growth**



**Fig: Natural capital growth relative to other countries**
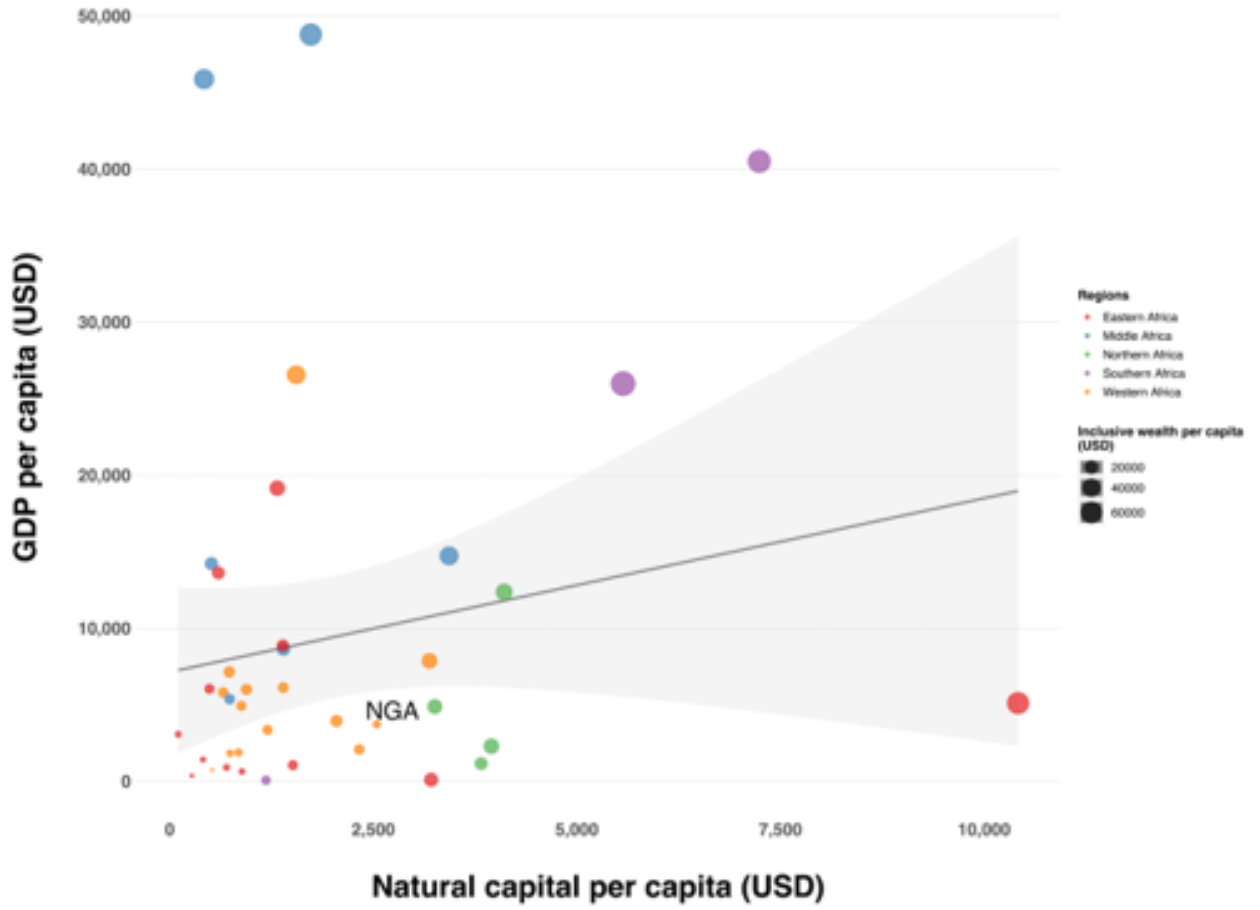
Fig: Relationship between natural capital and GDP

## RWANDA

### 1. Rwanda natural capital and GDP growth

Following the 1990's, Rwanda experience one of the strongest GDP growths in Africa. The Government and private sectors were able to improve their agricultural system that account for around 30% of its GDP and provides about 70% of jobs of the economy. Modernization, and export diversification in this sector have highly contributed to the country's GDP growth. Also, supported by a strong governance, services sector, including tourism, manufacturing, and construction as well as foreign aid and investment facilitated this economic growth.

The pursuit of high GDP in Rwanda has led to a complex relationship between economic growth and the loss of natural capital. Rwanda is a densely populated, landlocked country with limited natural resources. As the government pursues high GDP growth, policies and investments have focused on expanding agricultural productivity, infrastructure development, and promoting the services sector, often without adequate consideration for the long-term sustainability of natural resources. The loss of natural capital in Rwanda can be observed in deforestation, biodiversity loss or water scarcity caused by the expansion of agricultural land, infrastructure development, and the growing demand for timber and fuelwood.
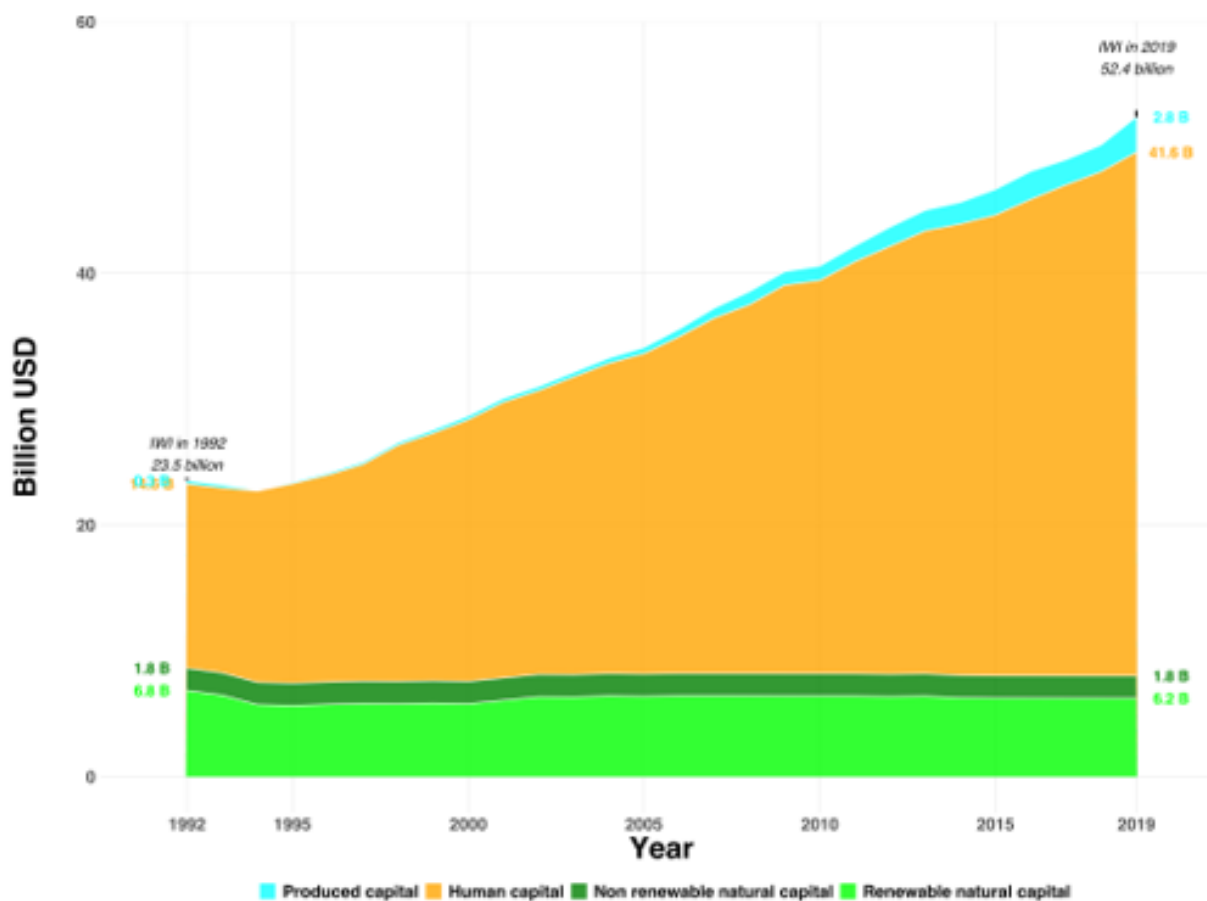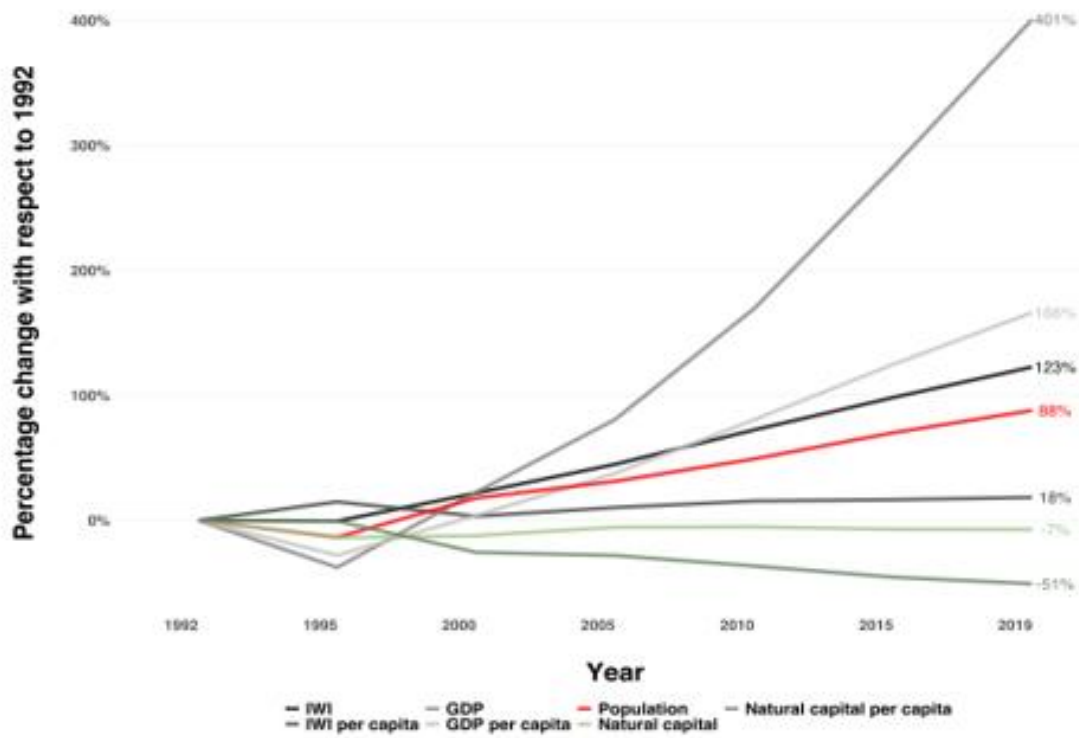


Fig: Capital composition over the year
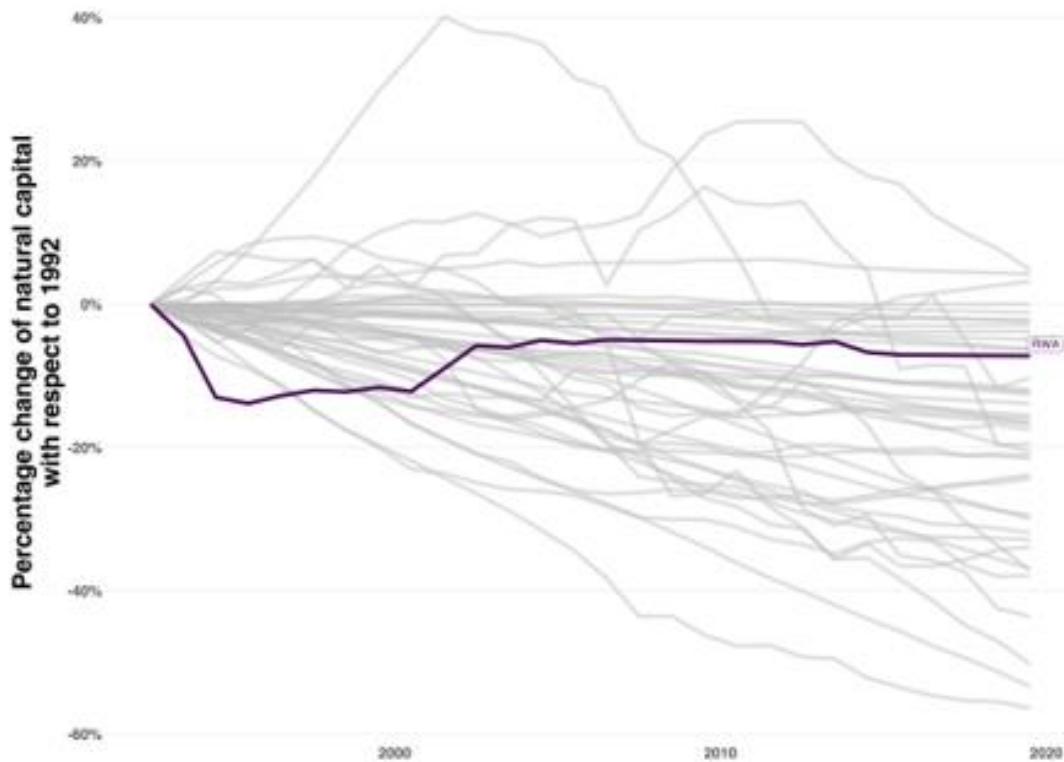
**Fig: Capital Growth**



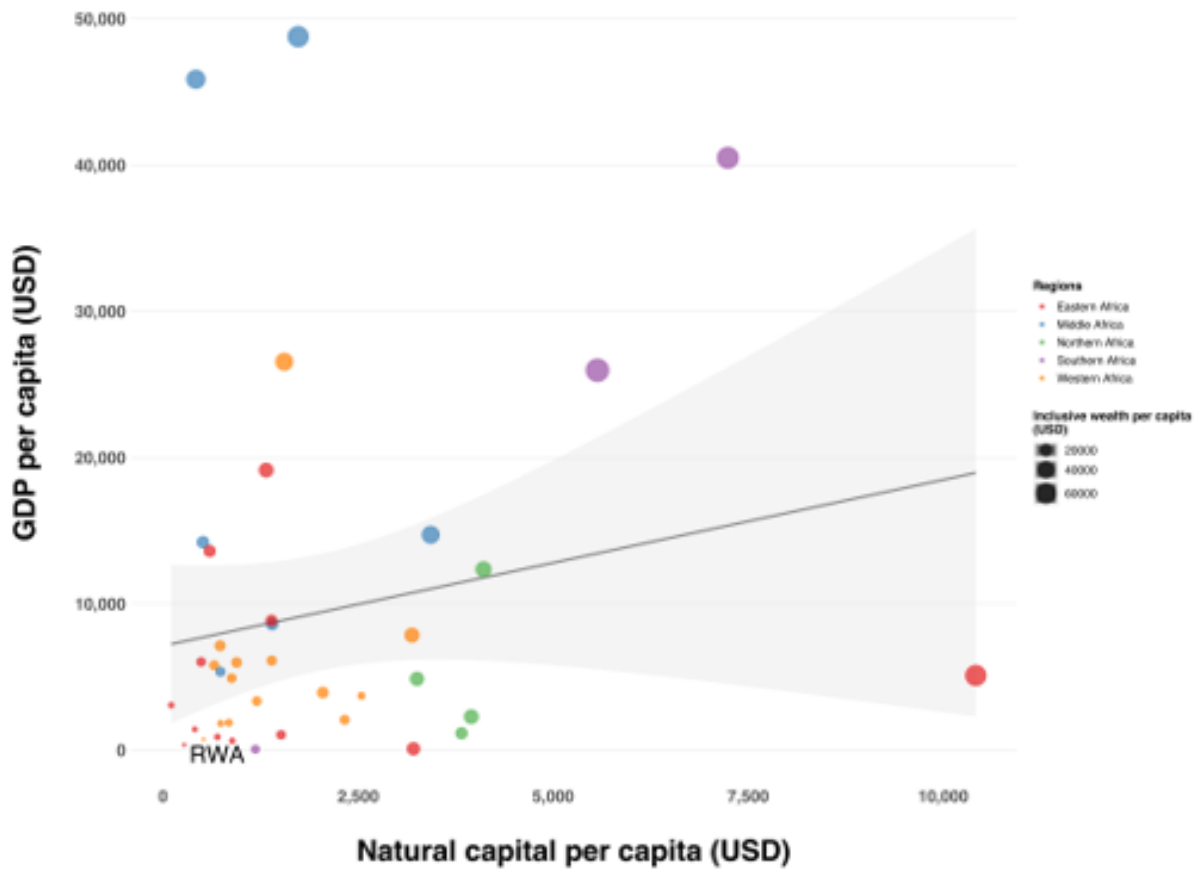**Fig: Natural capital growth relative to other countries**

**Fig: Relationship between natural capital and GDP**

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