

Tanzania 2019  
**Country  
Environmental  
Analysis**



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Tanzania 2019

# **Country Environmental Analysis**

**Environmental Trends and Threats,  
and Pathways to Improved Sustainability**



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# Foreword

## **Tanzania's rich and diverse natural capital is at the basis of the country's national wealth.**

As centuries of experience have shown, development should not be done at the expense of liquidating natural capital to build other assets but should be anchored around sound management and efficient use of this capital – renewable natural resources such as agricultural land, forests, water, protected areas or biodiversity, can produce long-lasting benefits and become an engine of growth and sustainability.

The good news is that Tanzania is both capable and determined to manage its natural resources sustainably and for the benefit of all Tanzanians. Multiple examples exist on how the country is pursuing this goal: from its renowned tourism sector, which manages to attract hundreds of thousands of visitors to world-class Protected Areas, to success stories such as the fight against poaching and the suppression of dynamite fishing along the coast; from water resources management and conservation efforts in Pangani and Rifuji basins, to improvements in solid waste disposal.

However, despite positive, localized efforts, the country is depleting its natural capital at speed. Tanzania has one of the highest deforestation rates in the world; quickly-degrading land resources; dwindling water resources threatening agriculture, hydropower and human consumption; increasing levels of environmental pollution (air, water and soil pollution); and high vulnerability to climate change impacts. These trends, combined with a rapidly-growing expanding population whose livelihoods depend, to a great extent, on the natural resources-base, place Tanzania in a challenging situation along its development trajectory.

*Penye nia pana njia.* As the Tanzanian proverb wisely says, when there is a will, there is a way. Trends can be reversed, and environmental degradation can be curbed. The country faces a fascinating, one-time opportunity to harness its unique natural resources to the long-term benefit of its economy and its people. The task might appear daunting given the magnitude of the challenge, but the Government of Tanzania remains fully determined to the environmental management agenda, and the World Bank remains fully committed to providing support along the way.



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# Acronyms

|                 |   |
|-----------------|---|
| <b>BMU</b>      | Beach Management Unit   |
| <b>BOD</b>      | Biochemical Oxygen Demand   |
| <b>BRT</b>      | Bus Rapid Transit   |
| <b>BWBs</b>     | Basin Water Boards  |
| <b>CBD</b>      | Convention on Biological Diversity  |
| <b>CBFM</b>     | Community-Based Forest Management   |
| <b>CEA</b>      | Country Environmental Analysis  |
| <b>CFMA</b>     | Collaborative Fisheries Management Area   |
| <b>CITES</b>    | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| <b>COD</b>      | Chemical Oxygen Demand  |
| <b>DoE</b>      | Division of Environment   |
| <b>DP</b>       | Development Partner   |
| <b>DSFA</b>     | Deep Sea Fishing Authority  |
| <b>EAC</b>      | East African Community  |
| <b>EEZ</b>      | Exclusive Economic Zone   |
| <b>EIA</b>      | Environmental Impact Assessment   |
| <b>EMA</b>      | Environmental Management Act  |
| <b>FAO</b>      | Food and Agriculture Organization (of the UN)                                   |
| <b>FYDP II</b>  | Tanzania's Second Five Year Development Plan                                    |
| <b>GDP</b>      | Gross Domestic Product  |
| <b>GHG</b>      | Greenhouse Gas  |
| <b>HCW</b>      | Healthcare Waste  |
| <b>ICT</b>      | Information and Communications Technology                                       |
| <b>IPPS</b>     | Industrial Pollution Projection System  |
| <b>ISIC</b>     | International Standard Industrial Classification (of All Economic Activities)   |
| <b>IWRMP</b>    | Integrated Water Resources Management Plan                                      |
| <b>IWT</b>      | Illegal Wildlife Trade  |
| <b>JFM</b>      | Joint Forest Management   |
| <b>LGA</b>      | Local Government Authority  |
| <b>LPG</b>      | Liquefied Petroleum Gas   |
| <b>MALF</b>     | Ministry of Agriculture, Livestock and Fisheries                                |
| <b>MNRT</b>     | Ministry of Natural Resources and Tourism                                       |
| <b>MOFP</b>     | Ministry of Finance and Planning  |
| <b>MoHCDGEC</b> | Ministry of Health, Community Development, Gender, Elderly and Children         |
| <b>MoHSW</b>    | Ministry of Health and Social Welfare   |
| <b>MoW</b>      | Ministry of Water   |
| <b>MSW</b>      | Municipal Solid Waste   |
| <b>NBS</b>      | National Bureau of Statistics   |
| <b>NCAA</b>     | Ngorongoro Conservation Area Authority  |
| <b>NEMC</b>     | National Environment Management Council   |

|                 |  |
|-----------------|--|
| <b>NEP</b>      | National Environmental Policy  |
| <b>NGO</b>      | Nongovernmental Organization   |
| <b>NTSCIU</b>   | National and Transnational Serious Crimes Investigation Unit           |
| <b>PCB</b>      | Polychlorinated Biphenyl   |
| <b>PFM</b>      | Participatory Forest Management  |
| <b>PM</b>       | Particulate Matter   |
| <b>PO-RALG</b>  | President's Office Regional Administration and Local Government        |
| <b>POPs</b>     | Persistent Organic Pollutants  |
| <b>PPP</b>      | Public-Private Partnerships  |
| <b>RCP</b>      | Representative Concentration Pathways                                  |
| <b>REGROW</b>   | Resilient Natural Resource Management for Tourism and Growth (Project) |
| <b>SDG</b>      | Sustainable Development Goal   |
| <b>SO2</b>      | Sulfur Dioxide   |
| <b>SWIOFish</b> | South West Indian Ocean Fisheries Governance and Shared Growth         |
| <b>SWM</b>      | Solid Waste Management   |
| <b>TaFF</b>     | Tanzania Forest Fund   |
| <b>TANAPA</b>   | Tanzania National Parks Authority                                      |
| <b>TAWA</b>     | Tanzania Wildlife Authority  |
| <b>TFS</b>      | Tanzania Forest Service Agency   |
| <b>UNESCO</b>   | United Nations Educational, Scientific and Cultural Organization       |
| <b>URT</b>      | United Republic of Tanzania  |
| <b>VPO</b>      | Vice President's Office  |
| <b>WHO</b>      | World Health Organization  |
| <b>WRG</b>      | Water Resources Group  |
| <b>WRM</b>      | Water Resources Management   |

# Executive Summary





Tanzania is endowed with valuable renewable natural resources such as forests, freshwater, fisheries, abundant land, and unparalleled wildlife. Over 50 percent of total land area in Tanzania is covered by forests and woodlands (URT, 2017), which provide vital habitat for biodiversity, protect watersheds and deliver ecosystem services. The Northern Highlands of Kilimanjaro and Mount Meru, and the Southern Highlands near Mbeya provide fertile soils for agriculture and species rich forests. The Eastern Arc and Coastal Forests are biodiversity hotspots that contain some of the highest densities of endemic plant and animal species in the world. Throughout the country, a network of freshwater rivers and lakes provide drinking water and nutrients, sustain agriculture and enable hydropower. Tanzania hosts diverse, distinct, and iconic ecosystems and species. Lake Victoria, the largest lake in Africa, is recognized for its high levels of endemic fish species, supports a large fishing industry and provides food security and jobs for surrounding residents. Tanzania's coastline hosts numerous fringing and patch reefs, important both ecologically and socio-economically as major fishing grounds and tourist attractions.

Natural resources form a core pillar of Tanzania's economy and play a pivotal role in sustaining the livelihoods of its population. Agriculture, forestry,

and fisheries represent about 30 percent of gross domestic product (GDP)<sup>1</sup> (NBS, 2017c). The total GDP contribution of the travel and tourism sector, which is largely based on biodiversity and wildlife, was about 13 percent in 2016, and is expected to grow by about 7 percent per year (WTTC, 2017). The sector's total contribution to employment, including jobs directly supported by the industry, was about 12 percent in the same year (WTTC, 2017). In addition, natural resources-based exports—including traditional goods (mainly tobacco, cashew nuts, and coffee), gold, metals, and other minerals—constituted more than 40 percent of total exports in 2017 (NBS, 2017c).

### **Natural resources form a core pillar of Tanzania's economy and play a pivotal role in sustaining the livelihoods of its population.**

This rich natural endowment, and the strong inter-linkages between the national economy and the environment, provide a unique, rapidly-shrinking opportunity for Tanzania to harness its natural resources in a way that enables sustained, long term benefits for its people. Existing land and water resources, if properly conserved and

<sup>1</sup> On February 15, 2019, NBS announced a new GDP series rebased to 2015 as the base year. Figures presented in this report are, however, pre-rebased.

managed, can boost Tanzania's ability to become the bread-basket of the region. Thriving wildlife and unspoiled protected areas can continue to bring significant profits from international nature-based tourism. Sustainably-harvested forest, forest products and fish stocks, and unspoiled coastal areas, can provide more and better livelihood opportunities for millions of Tanzanians. Clean water, clean air, and functioning cities and energy systems are necessary to sustain a healthy population and become catalytic to enable economic activity and development.

However, several trends suggest that the country might be shifting toward an unsustainable development trajectory. Tanzania hosts one of the largest poor populations in Africa, with approximately 21.3 million Tanzanians living below the global poverty line (World Bank, 2017b), many of which depend on natural resources for their livelihoods. While the poverty rate declined from 59.9 percent in 2007 to an estimated 43.0 percent in 2016 (World Bank, 2017b), the absolute number of poor is still rising due to population growth. Around 70 percent of the population live in rural areas and rely on natural resources for food, fuel, and fodder (World Bank, 2018). There are clear indications that natural resources are at serious risk, with four key forces identified as underlying causes of the country's natural resources degradation: rapid population growth, economic growth, increasing urbanization rate, and climate variability and change. The impact of these dynamic factors, which are geographically

differentiated and intensifying, have resulted in three key negative trends: loss of ecosystems, competing demands for land and water, and environmental pollution.

Tanzania's total wealth per capita—that is, the sum of all types of physical, human, and natural capital—has declined between 1995 and 2014, despite robust and sustained economic growth in absolute terms.<sup>2</sup> Tanzania is one of only 10 countries in Africa, and of only a few more countries in the rest of the world, that this holds true for (Lange, Wodon and Carey, 2018).

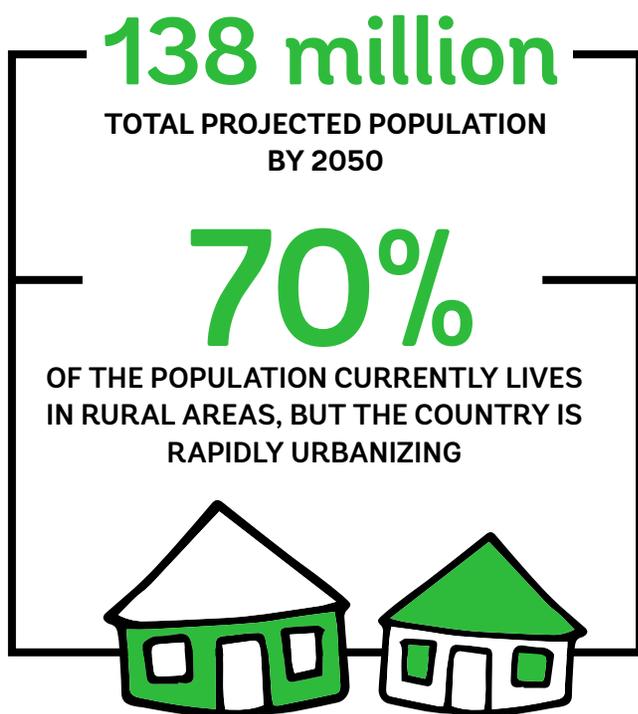
**Tanzania's total wealth per capita—that is, the sum of all types of physical, human, and natural capital—has declined between 1995 and 2014, despite robust and sustained economic growth in absolute terms.**

A positive growth rate for total wealth per capita is considered an indicator of sustainability, as it shows that a country is saving for the future.<sup>3</sup> However,

<sup>2</sup> Measuring national wealth is part of an ongoing effort by the World Bank to monitor the long-term economic well-being of nations. Comprehensive wealth is calculated by summing up estimates of each component of wealth: produced capital, natural capital, human capital, and net foreign assets. Observing changes in time of total wealth provides a comprehensive picture of the ability of nations to promote growth in a sustainable manner.

<sup>3</sup> This is one of the assumptions underlying the "wealth accounting framework," which the World Bank uses to assess a country's long-term





Tanzania's wealth per capita has declined because its rapid population growth has outpaced investment. This decline in wealth is almost entirely accounted for by its "renewable natural capital" loss, consisting of the country's agricultural land, cropland, forests, forest products, and protected areas. The country's human capital per capita is stable while its physical capital per capita has risen by 13 percent. Yet its degrading natural capital base clearly illustrates the magnitude of its sustainability problem: the total renewable natural capital per capita has fallen by 35 percent over the past 20 years, whereas the non-land renewable natural capital per capita has declined by 47 percent (that is, almost halved in 20 years). Tanzania cannot afford another 10 years of the same negative trends in resource degradation.

The opportunity Tanzania faces is to reconcile the use of natural resources to meet the demands of the population and economy with the need to maintain functioning ecosystems. Reaching this balance will catalyze sustained growth. However, the current trend in the use of natural resources is not sustainable, leading to persistent degradation and loss of ecosystems, which constitute the main cause of the natural capital

sustainability.

loss. This challenge is surmountable if tackled effectively and the underlying causes and drivers of environmental degradation are addressed strategically: connecting the dots between deforestation in upper catchments and a higher flood risk in a coastal city, or between illegal ivory trafficking and a lower number of international tourists visiting the country (and thus a lower GDP) requires multisectoral coordination and a common, integrated approach to development.

This CEA has identified spatially and temporally differentiated approaches and solutions toward ensuring sustainable resource management for long-term use. To achieve this goal, six key variables need to be understood and tackled:

- A. Sustainable natural forest management will help ensure continued forest resources and services. Tanzania has one of the highest deforestation rates in the world. It ranks among the top five countries with the highest annual forest net loss, with an estimated forest area loss of 483,859 ha per year (URT, 2017). The key contributing factors to deforestation are agricultural expansion and demand for wood fuels (such as charcoal).
- B. Land conservation and restoration are critical to achieving economic growth and conserving the biodiversity and ecosystems that are vital for ensuring human well-being. Land degradation, one of the most critical environmental issues both in Tanzania and worldwide, should be looked at in combination with biodiversity loss and climate change. Deforestation, poor farming practices, and overgrazing are some of the key causes of land degradation in Tanzania.
- C. With improved planning, management, and monitoring of water resources, the sustainability of Tanzania's water resources can be ensured. While the country still has a reasonable per capita water resource endowment, Tanzania recently became a water-stressed country (World Bank, 2017b). Projections suggest that the situation will get worse because of inadequate water management, increased agricultural demand, rapid population growth, and climate change

impacts. It is expected that the decreasing supply of water and the growing competing demands for it, will also negatively affect water quality. The gaps in the knowledge of water resources—related to quantity and quality, use, and hydrometeorology—and the limited availability of monitoring networks hinder informed decision making.

- D. The protection of ecosystems, biodiversity conservation, and the largely positive international reputation as a hotspot for wildlife are crucial for Tanzania to realize its full tourism potential. Despite being one of the most biodiverse countries in the world, Tanzania faces significant loss of biodiversity. This in turn affects a broad range of services critical to the supply of food, water, and energy, and that particularly the poor depend on for their livelihoods. The poaching of elephants and other species, the degradation and loss of habitat, climate change impacts, among others, have significantly reduced wildlife numbers, thereby threatening the long-term sustainability of the tourism sector and the livelihoods of many Tanzanians.
- E. As Tanzania approaches, or even surpasses, the sustainable limit of exploiting its fisheries resources, attention needs to be shifted toward livelihood opportunities in post-harvest value added, aquaculture, and recreational fisheries or other sectors. Approximately 10 million people depend directly on the integrity of coastal and marine natural resources for their livelihoods. However, environmental degradation, overfishing, and the use of illegal, destructive fishing methods are threatening Tanzania's fisheries.
- F. Tanzania is highly vulnerable to climate change due to its reliance on natural resources. Impacts caused by climate change are an additional pressure to already stressed systems. Tanzania has little influence over the global causes of climate change but urgently needs to adapt to its impacts. Trends show an increase in temperatures and changes in precipitation (although the extent of these changes is uncertain), and extreme weather

events becoming more frequent. Enhancing resilience to climate change is vital to protecting the country's food security (with an urgent need to further promote and implement climate smart agricultural practices), jobs, and economic growth, especially in the rural areas. Estimated economic costs of climate change to Tanzania could amount to 1 to 2 percent of GDP/year by 2030, in addition to existing costs resulting from climate variability (Watkiss et al., 2011).

Environmental pollution is an additional, overarching threat, which calls for anticipating impacts and combining stringent command and control measures with incentives: the right policies and technologies today can prevent—and minimize the cost of—future impacts. In Tanzania, the estimated economic cost of premature deaths attributed to pollution (i.e., ambient and household air pollution, and unsafe water and sanitation) was over \$28.7 billion in 2013 (Roy, 2016). This estimate factors in the risks associated with ambient and household air pollution from particulate matter (PM), unsafe water, and unsafe sanitation. These high pollution-related costs are an underestimation of the overall problem, as health impacts caused by other sources (for example, ozone exposure and lead exposure) are not included.

### **Preventing pollution today avoids tomorrow's costly cleanup and offers no-regret options toward alleviating poverty, and creating opportunities for a healthier and more productive population.**

Awareness of the negative impacts of environmental pollution has increased, but significant knowledge gaps in data and information persist about its causes, magnitude, and effects in Tanzania. Accurate and regularly updated data are critical for developing sustainable policies and management solutions. Additional research and systematic data collection on the sources,

distribution, dispersion, and health effects of pollution form the basis for better management.

Preventing pollution today avoids tomorrow's costly cleanup and offers no-regrets options toward alleviating poverty, and creating opportunities for a healthier and more productive population. Improved pollution management can enhance competitiveness through, for example, job creation, increased energy efficiency, sustainable development in Tanzania's urban and rural spaces, and improved infrastructure and transport. It can also be effective in contributing toward climate change mitigation.

The CEA has identified improved management activities toward addressing six key pollution-related challenges that need attention:

- A. A multipronged approach is needed to curb air pollution. A detailed study concluded that around 26,000 Tanzanians died prematurely in 2013 from causes attributable to air pollution (Roy, 2016). Most of these deaths (over 22,000) were caused by household air pollution, which is associated with the widespread use of solid biomass fuels (wood and charcoal) as domestic energy source. Curbing household air pollution requires increasing access to alternative energy sources, which in turn will contribute to reducing deforestation and land degradation.
- B. Providing the population with access to sustainable clean water and sanitation services reduces the spread of diseases such as cholera, diarrhea, dysentery, hepatitis A, and typhoid fever. In 2013, health-related costs associated with unsafe water and sanitation in Tanzania were estimated to be about \$10 billion and \$7.6 billion, respectively (Roy, 2016). It is estimated that food and waterborne diseases, as well as water-contact diseases, affect millions of people in the country's urban areas. Key causes of water pollution are rapid and unplanned growth of urban areas, untreated wastewater discharge from households, inadequate solid waste management, widespread and unplanned farming and cattle ranching, and industries' effluents.
- C. Improving pollution regulations and enforcement today is an early and cost-effective investment in preventing higher pollution loads in the medium term. Tanzania's industrialization is still in its early stages, however, there is growing concern of increased pollution if the process is not properly managed. An analysis at the regional and local levels revealed that the pollution load is concentrated in a few geographical areas, with Dar es Salaam producing about 88 percent of all industrial pollution. All other regions have industrial pollution loads well below those of Dar es Salaam. Using and effectively applying the Environmental Impact Assessment (EIA) tool is key to curb industrial pollution.
- D. Managing waste effectively and in an environmentally sound manner is critical to minimizing associated environmental and health impacts. It is estimated that in 2012, Tanzania generated 2,425 metric tons of municipal solid waste (MSW) per day. Even though solid waste management (SWM) is regulated, less than 40 percent of households are estimated to have access to waste collection services (Huisman, Breukelman, and Keesman, 2016). MSW is a root cause of the devastating floods witnessed in Dar es Salaam. These floods are not only caused by a changing climate or by the intensity of rains alone, but by upstream deforestation and land degradation, combined with insufficient and failing urban drainage, frequently clogged by MSW. Other types of waste, like e-waste and healthcare waste (HCW), are becoming a growing concern as more Tanzanians gain access to technology and more healthcare facilities become operational around the country. There is an opportunity to legislate and control these issues early-on, before they become a larger liability, more complex to tackle and more expensive to remediate.
- E. Other growing and increasingly more urgent issues to tackle refer to pesticide waste and mining pollution. Rapid population growth and growing demand for food result in increased pesticide use. Despite a comprehensive legal

framework, the safe handling of pesticides in Tanzania is not always ensured. The release of pesticides into the environment contaminates soil and water bodies, affecting nearby ecosystems, habitats, and wildlife species. Pesticides are frequently extremely toxic substances and take long to degrade. Establishing a mine requires clearing land, causing the loss of forests and biodiversity, which affects the local surroundings and communities. Mining operations can generate significant pollution through leakages and mineral waste that is dumped in nearby rivers, and by highly polluting additives required in the extraction process. Especially the use of mercury poses significant health and environmental risks. Tanzania has the opportunity to establish adequate regulations and management controls to prevent pollution from toxic chemicals (thus preventing significant impacts to human health and the environment), and to save resources, as avoiding emissions is significantly less costly than cleaning up later.

For Tanzania to realize its economic potential and achieve its ambitious development goals, it will have to give priority attention to these issues. The country will need to continue building on recent achievements, such as the fight against poaching and the suppression of dynamite fishing, and replicate these successes in other priority areas. Tanzania’s environmental priorities should be based on the structural transformation of its rich

natural capital into other forms of capital. At the same time, it should strictly limit the use of natural resources; try to halt ecosystem degradation; strongly regulate environmental pollution loads and the quality of water, air, and soil; and strictly enforce environmental regulations to prevent lock-in situations of “pollute now, clean up later.” In addition, there is a need for continued communication with the wider public about the effect individual behavior can have on the environment, and sensitization about low impact practices and lifestyles. Awareness raising on the interlinkages between an unspoiled nature and a higher quality of life, and advocacy campaigns on the importance of preserving healthy ecosystems, are fundamental parts of the process.

Four development paths are suggested for Tanzania, based on the drivers and characteristics of the environmental challenges discussed in this CEA. The first two paths relate to the more “traditional” environmental and natural resources challenges, which include degradation of land and water resources, deforestation, and biodiversity loss. These issues are most relevant for rural areas, where natural resources are subject to competing demands (biodiversity conservation, agricultural expansion, cattle raising, human settlements, hydropower production). If not properly addressed, they can have impacts across landscapes and watersheds—degrading ecosystems and the services they provide to rural and urban economies and livelihoods.



The other two paths relate to a set of pollution-related issues, more frequently associated with urban settlements, industrialization, and agglomeration, some of which have only recently started drawing concern, and the importance of strong institutions in the control and management of environmental performance.

Pathway 1 – Conservation of biodiversity and marine and freshwater resources

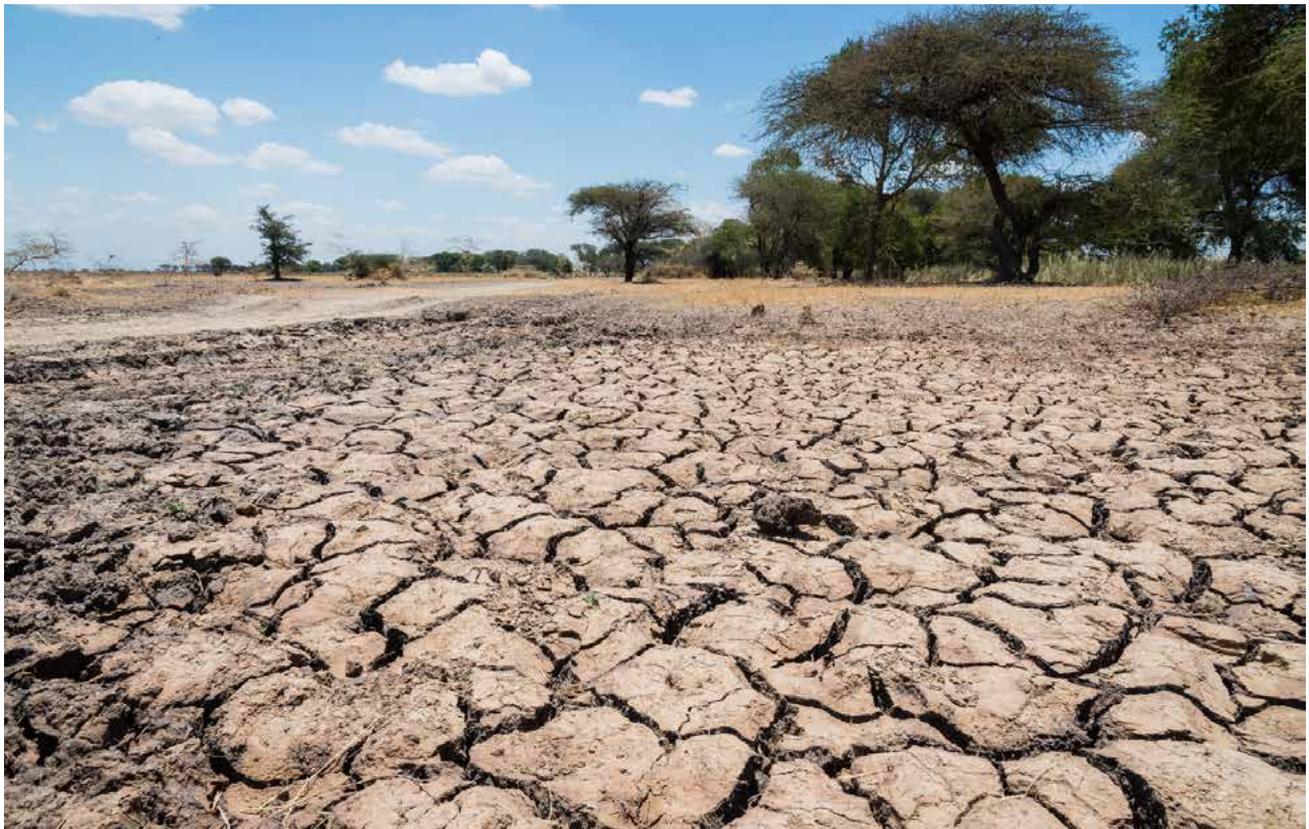
Pathway 2 – Promotion of resilient landscapes

Pathway 3 – Access to modern fuels and low impact urbanization

Pathway 4 – Strengthened institutions for pollution management

**Climate change emerges as a strong “multiplier” across all paths and dimensions of natural resource issues, and as a driver of more complex urban management issues such as flooding, poor sanitation, and the growing threat of water pollution and toxic waste.**

Climate change emerges as a strong “multiplier” across all paths and dimensions of natural resource issues, and as a driver of more complex urban management issues such as flooding, poor sanitation, and the growing threat of water pollution and toxic waste. Tanzania is highly vulnerable to climate change, and impacts will be felt across the board. There is, thus, an impending need to build resilience across all sectors, and promote healthy natural systems that act as buffers against those impacts. Of particular concern, given its importance for employment and wealth creation, is the agricultural sector. Tanzania is already implementing climate smart agricultural practices and approaches, and their consolidation and expansion is more urgent than ever. Climate change can be considered as a stand-alone priority that Tanzania needs to tackle, or as a conditioning factor that affects every aspect of development, imposing additional pressure on already stressed systems. This report takes the latter approach, mainstreaming climate change into the analysis of environmental challenges, instead of treating the issue as a stand-alone challenge.



# Four Pathways For Tanzania

1

## Pathway 1 Conservation of Biodiversity and Marine and Freshwater Resources



Wildlife-based tourism has the potential to become a key engine of growth and prosperity, bringing jobs and livelihoods to areas with few other options. The blue economy can facilitate the conservation and sustainable use of ocean resources for economic growth and prosperity to a large percentage of the Tanzanian population.

### TOWARDS THE WILDLIFE ECONOMY

Focus: Sustainable revenue from wildlife

- Curb deforestation and habitat loss
- Allocate additional sources of funding for conservation
- Diversify tourism locations and products
- Improve benefit-sharing with rural communities
- Support alternative livelihoods and rural development
- Improve business environment
- Promote Public-Private Partnerships

### TOWARDS THE BLUE ECONOMY

Focus: Sustainable revenue from oceans

- Conserve marine biodiversity and protect endangered species
- Reduce fisheries' post-harvest losses and add value
- Build the private sector, PPPs, and infrastructure business plans
- Better harness the value from deep sea fishing
- Prevent the reemergence of blast fishing and fight destructive fishing methods
- Remain engaged in regional cooperation
- Further promote co-management and improved coastal livelihood opportunities

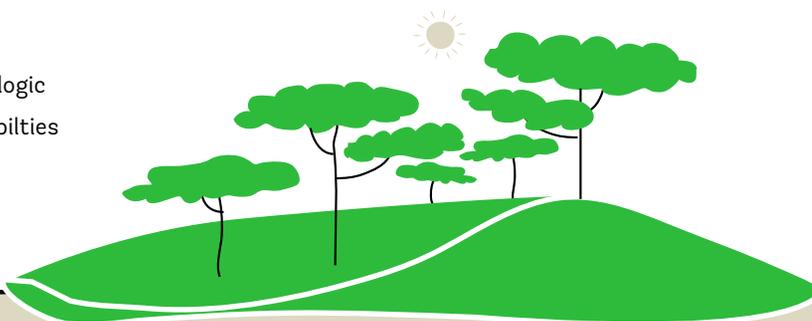
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## Pathway 2 Promotion of Resilient landscapes

The landscape approach is a powerful tool to address challenges in the rural space. Rural areas are undergoing transformative changes as natural resources such as forests, water, land, and biodiversity face increasing pressure and the ecosystem services they provide continue to degrade. Rural areas that successfully balance ecosystem, economic, and social functions are more resilient to shocks and uncertainties. Such a balanced approach can sustain livelihoods, address food security issues, protect vital ecosystem services, and enable humans and landscapes to adapt to current and future impacts of climate change.

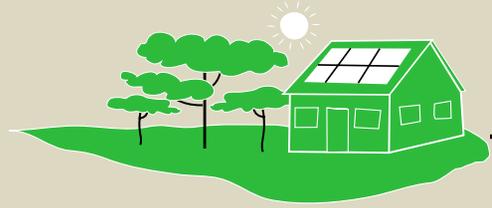
### LANDSCAPE APPROACH

- Adaptive Management
- Common Entry Point
- Multiple Scales
- Multi-functionality
- Multi-shareholder
- Negotiated and transparent change logic
- Classification of rights and responsibilities
- Participatory and user friendly monitoring
- Resilience
- Strengthened stakeholder capacity



3

### Pathway 3 Access to Modern Fuels and Low Impact Urbanization



Widespread use of firewood and charcoal has implications with multiple issues, including deforestation and forest degradation, erosion and land degradation, air pollution and human health, gender, and climate change. Due attention should be given to urban settlements, where most Tanzanians are expected to live (Dar es Salaam will become a mega-city by 2030), and where environmental conditions can either become a catalyst that empowers citizens, or an impediment to well-being. Environmental risks in urban settlements are potentially large and impacts rooted in agglomeration and poor environmental conditions bring about thousands of premature deaths per year attributed to air pollution, and millions of people affected by food and waterborne diseases or devastating urban floods, to name a few.

#### ACCESS TO MODERN FUELS

- Start with a focus on Dar es Salaam
- Establish multi-stakeholder platform
- Conduct detailed analysis of the value chain
- Prepare a plan to progressively limit charcoal utilization
- Promote sustainable charcoal production during the transition

#### LOW IMPACT URBANIZATION

- Improve urban planning
- Maintain healthy urban ecosystems and green space
- Promote the construction of low-impact housing
- Transition to modern energy sources for cooking to limit household air pollution
- Improve urban mobility and tackle outdoor air pollution
- Improve water supply and sanitation
- Improve solid waste management

4

### Pathway 4 Strengthened Institutions for Pollution Management

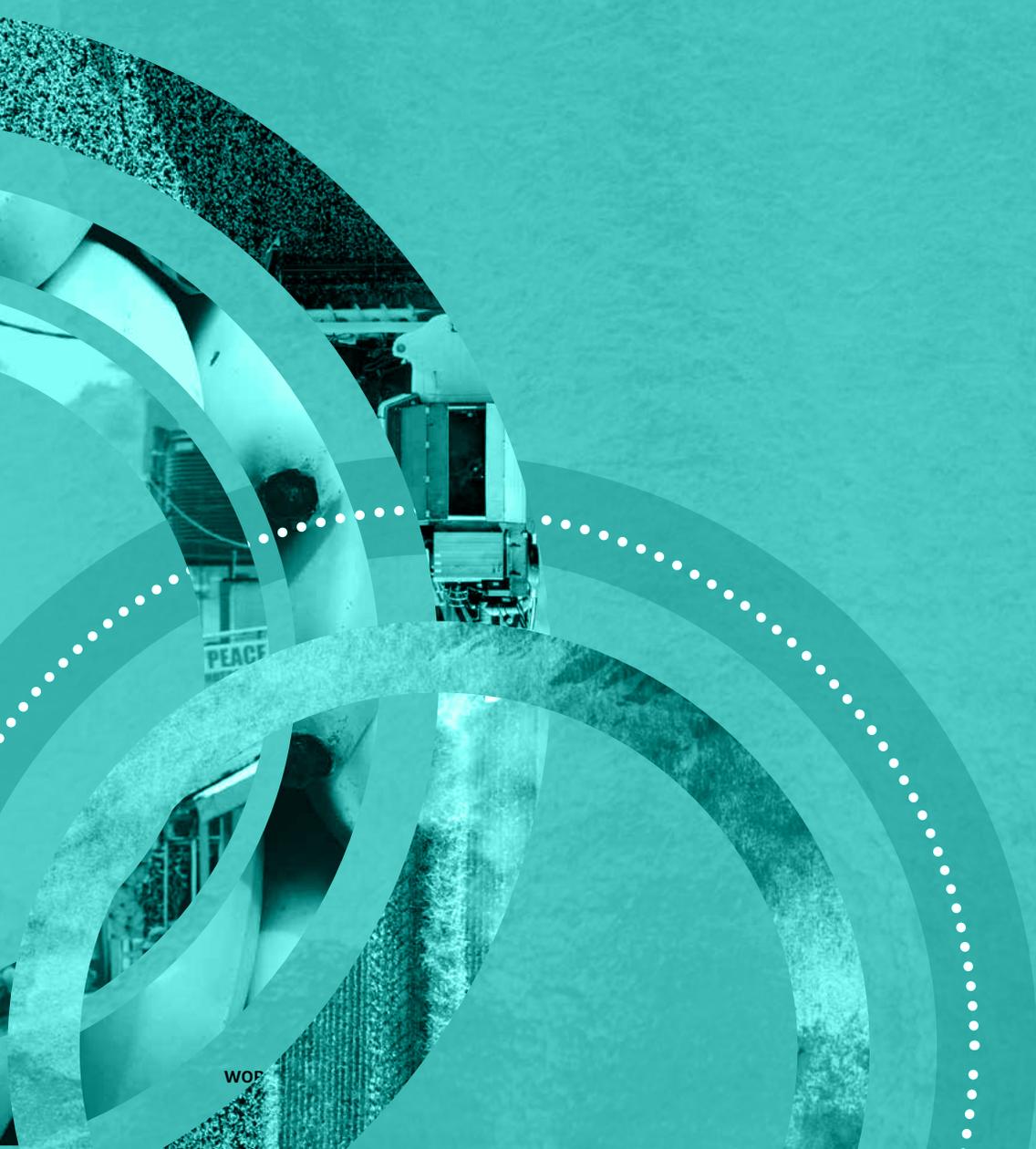
The importance of strong, well-trained and sufficiently-resourced institutions for sound environmental management cannot be overstated. A pathway towards improving the ability of institutions to regulate, monitor and control pollution, will lead to a reduction in environmental pollution loads, and thus, to better quality of public goods such as air, water, and soil. The benefits of a non-polluted environment are many, and become essential if the country is to further develop in a sustainable way.

- Further develop and fill in the gaps in the regulatory framework
- Promote cross-coordination and inter-government collaboration
- Boost enforcement capacity
- Continue capacity building efforts
- Implement / improve monitoring systems
- Strengthen quality control laboratories
- Seek citizen engagement and establish feedback systems



1

# Introduction





## 1.1 Tanzania's Unique Environmental and Natural Resources

Tanzania is endowed with valuable renewable natural resources such as forests, freshwater, fisheries, and coral reefs. The Northern Highlands of Kilimanjaro and Mt. Meru, and the Southern Highlands near Mbeya provide fertile soils for agriculture and species rich forests. The Eastern Arc and Coastal Forests are globally recognized biodiversity hotspots that contain some of the highest densities of endemic plant and animal species in the world. Forests and woodlands cover over 50 percent of mainland Tanzania and provide vital habitat for biodiversity, protect watersheds and deliver ecosystem services (URT, 2017).

**The country's biodiversity and unparalleled wildlife are globally renowned.**

Throughout the country, a network of freshwater rivers and lakes provides drinking water, sustains agriculture and provides hydropower. Lake Victoria, the largest lake in Africa and recognized for its high levels of endemic fish species, supports a large fishing industry and provides food security and jobs for surrounding residents.

Tanzania's coastline hosts numerous fringing and patch reefs, important both ecologically and socio-economically as major fishing grounds and tourist attractions. These resources are key to maintaining healthy and productive landscapes, and are intricately linked with energy generation, agriculture, and human consumption.

The country's biodiversity and unparalleled wildlife are globally renowned. Tanzania hosts diverse, distinct, and iconic ecosystems and species. About a third of the country's total land area is officially under protection, one of the world's highest ratios. Tanzania boasts 19 national parks, including the Ruaha National Park – the largest national park in East Africa (with an area of 20,226 km<sup>2</sup>), the famous Kilimanjaro National Park, and the Serengeti National Park. The latter is well-known for its large herds of wildebeest, and their annual migration, one of Africa's most spectacular natural events. Tanzania also hosts 25 game reserves including the Selous game reserve, a UNESCO World Heritage Site and Africa's largest game reserve (with an area of over 50,000 km<sup>2</sup>). The country has three marine parks, 15 marine reserves, and multiple forest reserves and woodlands.

Tanzania also hosts a wide range of nonrenewable natural resources such as minerals and natural gas. It is endowed with a variety of mineral deposits including gold, tanzanite, diamond, nickel, copper, uranium, kaolin, titanium, cobalt and platinum. In 2016, a large liquefied natural gas deposit was found along the east coast. Tanzania is currently developing extraction and export capabilities for this energy resource (Deloitte, 2017).

## ECONOMIC DEPENDENCE ON NATURAL RESOURCES

Natural resources form a core pillar of Tanzania's economy and play a pivotal role in sustaining the livelihoods of its population. Renewable natural resources are a core asset for the achievement of growth in Tanzania. Agriculture, forestry, and fisheries represented 30 percent of gross domestic product (GDP)<sup>4</sup> in 2017 (NBS, 2017c). The total GDP contribution of the travel and tourism sector, which is largely based on biodiversity and wildlife, was about 13 percent in 2016, and is expected to grow by about 7 percent per year (WTTC, 2017),<sup>5</sup> The sector's total contribution to employment, including jobs directly supported by the industry, was about 12 percent in the same year (WTTC, 2017). In addition, natural resources-based exports—including traditional goods (mainly tobacco, cashew nuts, and coffee), gold, metals, and other minerals—comprised about 40 percent of total exports in 2017 (NBS, 2017c).

4 On February 15, 2019, the National Bureau of Statistics (NBS) announced a new GDP series rebased to 2015 as the base year. However, note that figures presented in this report are pre-rebased.

5 The direct contribution of travel and tourism to GDP reflects the 'internal' spending on travel and tourism (total spending within a particular country on travel and tourism by residents and non-residents for business and leisure purposes) as well as spending by government on travel and tourism services directly linked to visitors. The total contribution of travel and tourism includes its wider impacts on the economy. The 'indirect' contribution includes the GDP and jobs supported by (i) travel and tourism investment spending; (ii) government 'collective' spending, which helps travel and tourism activity in many different ways as it is made on behalf of the 'community at large' – e.g., tourism marketing and promotion, aviation, administration, security services; and (iii) domestic purchases of goods and services by the sectors dealing directly with tourists – e.g., purchases of food and cleaning services by hotels. The 'induced' contribution measures the GDP and jobs supported by the spending of those who are directly or indirectly employed by the travel and tourism industry (WTTC 2017).

Tanzania's economy has had a robust macroeconomic performance over the past 10 years. GDP per capita (at current prices) increased from \$661 in 2008 to \$910 in 2017 (World Bank 2019). Despite overall slow growth in Sub-Saharan Africa, Tanzania's GDP has grown at an average annual rate of 6.6 percent in real terms over the past decade according to the Government's official statistics (World Bank, 2019).<sup>6</sup>

## Agriculture, forestry, and fisheries represented 30 percent of gross domestic product (GDP) in 2017.

Despite this sustained positive macroeconomic trend, approximately 21.3 million Tanzanians are living below the global poverty line. Tanzania hosts one of the largest poor populations in Africa. While the poverty rate (based on the \$1.90 per day international poverty line) declined from 59.9 percent in 2007 to an estimated 43.0 percent in 2016 (World Bank, 2017b), the absolute number of poor is still rising due to population growth. It is estimated that the number of poor increased from 20.6 million in 2012 to 21.3 million in 2016 (World Bank, 2017b). Using the national poverty threshold, around 12 million people were living in poverty in 2012, earning less than US\$1.4 per day per capita (at 2011 PPP) (World Bank, 2017b).

Most of Tanzania's poor depend on natural resources. About 70 percent of the population live in rural areas and rely on natural resources for food, fuel, and fodder (World Bank, 2018). More than half of Tanzania's poor depend on agriculture for their livelihoods (AfDB, 2018). Only around 17 percent of the rural population have access to electricity, and about 85 percent of Tanzania's energy needs are met through biomass use in the form of charcoal and firewood, predominantly for cooking and heating (NBS, 2017a). The five coastal regions of Tanzania are home to approximately 10 million people who depend directly on the integrity of coastal and marine ecosystems. Most of the country's fish production is based on small-scale

6 On February 15, 2019, NBS announced a new GDP series rebased to 2015 as the base year. However, note that figures presented in this report are pre-rebased.

fishing, which accounts for about 10 percent of fish exports, making it one of the main occupations of the populations living in coastal areas and around

the major lakes (Lokina, 2009; Rothuis et al., 2014).

## 1.2 Environmental and Natural Resources Under Threat

Competing demands for and open access to many of Tanzania's natural resources are causing the resources' degradation and are limiting their ability to continue to provide goods and services. Demand for water is increasing faster than available supply, with conflicts over water becoming increasingly common as a result. Tanzania's renewable per capita freshwater resources have declined from more than 3,000 m<sup>3</sup> in the nineties to around 1,600 m<sup>3</sup> in 2014, which is less than 1,700 m<sup>3</sup> per capita, the threshold below which a country is considered water-stressed by the United Nations (World Bank, 2017b). Poor land use and watershed management practices have led to the degradation of forests and watercourses, threatening the very natural resource base upon which Tanzania's economy and the poor depend on. Deforestation rates are among the highest in the world, with an estimated annual net loss of 483,859 ha over the period 2002-13 (URT, 2017). The country's unique wildlife assets have experienced an unprecedented crisis due to poaching, overcrowding, and the associated degradation of biodiversity. Overfishing and uncontrolled small-scale fishing are threatening the sustainability of fisheries, the resource base that many poor coastal communities depend on for their livelihood.

**Tanzania is one of only 10 countries in Africa—and of only a few more countries in the rest of the world—where total wealth per capita has declined.**

Tanzania is one of only 10 countries in Africa—and of only a few more countries in the rest of the world—where total wealth per capita has declined

(Lange, Wodon, and Carey, 2018).<sup>7</sup> Growth of total wealth per capita is considered an indicator of sustainability that complements GDP, since it shows that the country is saving for the future.

<sup>7</sup> Measuring national wealth and changes in wealth is part of an ongoing effort by the World Bank to monitor the long-term economic well-being of nations. Comprehensive wealth is calculated by summing up estimates of each component of wealth: produced capital, natural capital, human capital, and net foreign assets. This method represents a shift from a 'top-down' approach used in earlier estimates to a 'bottom-up' approach, which is possible because human capital is now measured as an explicit component of the wealth accounts for each country. The World Bank has developed a unique global database of more than 1,500 household surveys, which provides the foundation for a first-of-its-kind global implementation of the well-known Jorgenson-Fraumeni lifetime earnings approach for human capital.



Tanzania’s total wealth per capita—the sum of all types of physical, human, and natural capital—has declined between 1995 and 2014, despite robust and sustained economic growth in absolute terms.<sup>8</sup> Countries raise their total wealth by reinvesting savings in all forms of capital, whether physical, human, or natural capital. Any country showing declining per capita wealth will find it increasingly difficult to grow or even maintain its per capita income (figure 1.1).

Tanzania’s decline in wealth is almost entirely accounted for by “renewable natural capital” loss, consisting of the country’s forests and forest products, protected areas, agricultural land, and cropland. The country’s human capital per capita is stable, and its physical capital per capita has risen by 13 percent over the past 20 years, but its degrading natural capital base clearly illustrates the magnitude of its sustainability problem. More

specifically, the total per capita renewable natural capital fell by 35 percent over the past 20 years. This number is somewhat distorted because it includes agricultural land whose value has gone up (which was to be expected, given the rising demand for agricultural products). The nonagricultural renewable natural capital per capita declined by 47 percent (thus was almost halved) in 20 years.

**Despite sustained positive macro-economic trends, approximately 21.3 million Tanzanians are living below the global poverty line.**

The poor are most affected by the degradation of natural resources. Land degradation has been found to increase the likelihood of household poverty, as it reduces agricultural productivity. Deforestation—among others caused by smallholder farmers’ shifting cultivation and tree cutting for fuelwood and charcoal production—reduces water availability, thereby worsening

8 Note that the natural capital estimates are not comprehensive—for instance, they do not include the value of fisheries and some minerals, and the protected area value estimates are very conservative (representing the opportunity cost of not converting that land to pasture land).

FIGURE 1.1: ANNUAL GROWTH OF WEALTH, BY COUNTRY



SOURCE: LANGE, WODON, AND CAREY, 2018.

poverty levels. Degraded fisheries, due to open access and insufficient regulation, limit the availability of fish protein for the coastal and great lakes' communities. Lake Tanganyika is a prime example of an area marked by a significant decline of fish catches due to overexploitation. Other forms in which the poor are disproportionately affected by natural resources degradation is through increased burden of disease: contaminated water, attributable to the lack of proper sanitation facilities, causes cholera outbursts (Penrose et al., 2010) and increases the proliferation of disease vectors such as mosquitoes. This is especially common in the burgeoning informal communities.

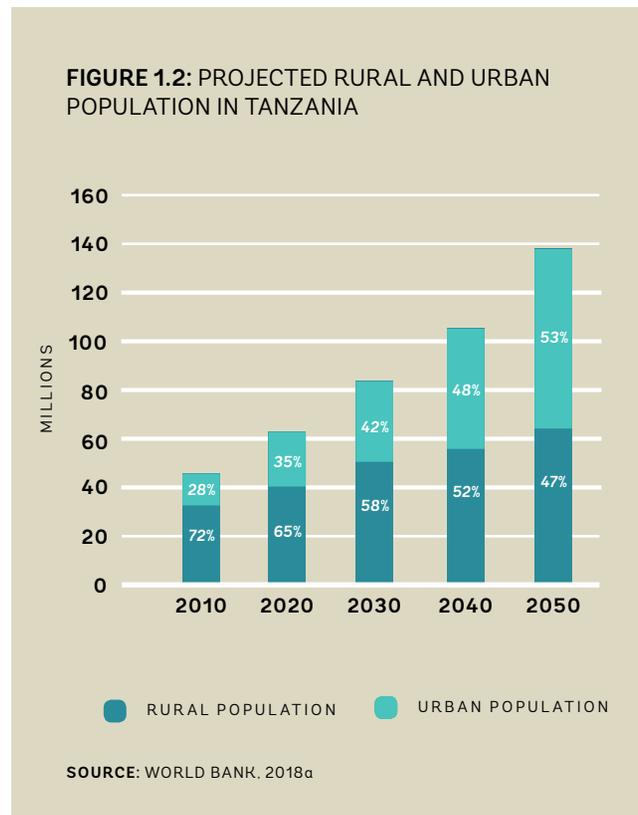
Yet sound management of and key investments in natural capital can stabilize and even boost economic growth. As a resource-based economy with a high urbanization rate, Tanzania's environmental degradation undermines economic growth and quality of life, and disproportionately affects the poor. Rapid economic growth through the liquidation of natural capital provides a temporary boost to the economy but fails to create a base for sustained advances in wealth and human well-being. On the other hand, development that focuses on the efficient and sustainable management of natural capital lays the foundation for long-term inclusive growth.

### 1.3 Trends That Compound the Need for Improved Environmental Management

Trends that emphasize the need for improving the management of Tanzania's environment and natural resources include: (i) rapid population growth; (ii) an increasing urbanization rate; (iii) a growing economy driven by the country's industrialization agenda; and (iv) climate variability and change. While Tanzania's dependence on natural resources and the need for improved environmental management have been discussed in the previous section, the following paragraphs discuss the trends that make this need even more important. Understanding these trends is the key to identifying and implementing innovative approaches to the sustainable management of environment and natural resources.

By 2050, Tanzania's rural population is expected to have grown by more than 80 percent, which will intensify pressure on natural resources. The share of the population living in rural areas is expected to drop from 72 percent in 2010 to 47 percent in 2050, as people continue to migrate to urban areas (figure 1.2). However, due to high population growth, the absolute number of people in rural areas is expected to increase from 33 to 65 million people over the same period. Since there is limited new land to absorb this increase in population, the productivity of existing land will

be sorely tested to support these figures—not to mention the increased numbers of livestock. The projected pressure on rural natural resources is probably a larger threat to the sustainability of Tanzania's economic growth than any other issue.



Tanzania's population growth will be most noticeable in its growing cities. The country's urban population is expected to grow from about 22 million in 2020 (35 percent of the total) to over 70 million, or 53 percent of the total, by 2050 (figure 1.2). Tanzania's total population is projected to reach 138 million by 2050 (almost triple its current level). New urban settlements are emerging, and existing cities and towns are rapidly developing. Dar es Salaam is expected to become a megacity by 2030, with a population projected to exceed 10 million (United Nations, 2014). Key related areas demanding immediate attention will be the increasing air pollution and poor water supply and sanitation. Air pollution has been identified by the World Health Organization (WHO) as the world's single largest environmental health risk, causing 3.8 million deaths each year from indoor air pollution and 4.2 million deaths from outdoor air pollution globally. Managing the expected increase of both air and water pollution in Tanzania's main cities could save many lives and prevent significantly higher future costs.

### **By 2050, Tanzania's rural population is expected to have grown by more than 80 percent, which will intensify pressure on natural resources.**

Economic growth is expected to be accompanied by structural changes in the economy, toward industries and services—but pressures on the environment will persist. If projections are realized and the current effort to industrialize the country succeeds, the share of agriculture and forestry will decline while the share of industry, construction, and services will rise and become the economy's dominating sectors. The share of agriculture, forestry and fishing in the country's GDP is projected to decrease from about 30 percent in 2010 to 23 percent in 2030 (NBS, 2017c).<sup>9</sup> Still, with a growing economy, this implies that total agricultural output would need to increase by 25 percent or more over that

same period. At the same time, the government projects that the industrial sector's contribution to GDP will increase from 20 percent in 2010 to 42 percent in 2030 (NBS, 2017c). To what extent the higher level of industrialization will be intensive in the use of natural resources will depend on the future profile of industrial growth. As the country industrializes, there is an opportunity to leapfrog toward cleaner production technologies. Doing so would minimize environmental degradation and limit the resulting pollution from industries.

### **Dar es Salaam is expected to become a megacity by 2030, with a population projected to exceed 10 million.**

Climate variability and change will exacerbate the environmental problems and tackling these issues will require comprehensive environmental planning and management tools. Rising temperatures and changing rainfall patterns will have multidimensional effects on the Tanzanian economy—affecting agricultural productivity, energy use, water availability and dynamics, ecosystems, and ecosystem services. With projections varying, temperatures in Tanzania are expected to be between +1°C and +3.4°C higher throughout the country by 2100, with warming being most pronounced in the Southwestern Highlands (URT-VPO, 2014a). Rainfall is projected to increase to up to 28 percent, particularly in the Lake Victoria Basin and North-Eastern Highland (URT-VPO, 2014a). Projected rainfall reductions inland could make water scarcer, meaning that Tanzania will need to feed more people with less rainwater in some key agricultural areas. Infrastructure and informal settlements along the coast are particularly vulnerable to heavier rains, storm surges, and flooding. Incorporating climate adaptation and mitigation measures into environmental management policies and practices will increase resilience to climate change and allow the climate-related risks to be managed.

<sup>9</sup> On February 15, 2019, NBS announced a new GDP series rebased to 2015 as the base year. However, note that figures presented in this report are pre-rebased.

## 1.4 National Legal and Institutional Framework for Environmental Management

Tanzania's Second Five Year Development Plan (FYDP II) sets positive environmental goals alongside development goals. By 2020, the FYDP II calls for expanding energy derived from renewable resources by 50 percent; increasing natural forest cover by 130,000 ha; planting 100 million trees countrywide; reducing charcoal consumption in urban areas by 60 percent; and increasing the proportion of districts with climate change and disaster risk reduction strategies to 60 percent (MOFP, 2016). All these goals are consistent with future growth that is clean, green, and resilient to climate change.

### **Tanzania's Second Five Year Development Plan (FYDP II) sets positive environmental goals alongside development goals.**

The overarching laws governing Tanzania's environmental management are the National Environmental Policy (NEP) of 1997 and the Environmental Management Act (EMA) of 2004. The NEP, which is currently under review, enables sectoral and cross-sectoral policy analysis to mainstream environmental considerations into all aspects of planning and development. The EMA outlines principles for management, impact and risk assessments, prevention and control of pollution, waste management, environmental quality standards, public participation, compliance, and enforcement. It assigns environmental management responsibilities to sector ministries and their departments and agencies, including regional and local authorities. A National Environmental Advisory Committee advises all sectoral ministries, while the Minister of Environment has the power to approve or disapprove projects on environmental grounds.

The key administrative responsibilities for environmental management in Tanzania rest with the Minister of Environment under the Vice President's Office. However, environmental

performance—that is, setting environmental standards and quality levels—also depends directly on the devolved responsibilities to key sector ministries in charge such as mining, transportation, agriculture, water, energy, natural resources, and tourism. The National Environmental Management Council (NEMC), under the Vice President's Office, is the command and control agency in charge of environmental compliance, while the President's Office Regional Administration and Local Government (PO-RALG) is responsible for coordinating the implementation of all governing policies, acts, and regulations regarding environmental conservation at the local government authorities (LGAs), and monitoring the performance of LGAs. Sector ministries are responsible for ensuring that all activities are carried out in an environmentally sustainable manner.

The NEP and EMA are implemented through secondary legislation, regulations, guidelines, standards, etc. However, not all the laws and documents necessary for implementation have yet been developed and/or adopted. While the EMA is the main instrument for environmental management, it is incomplete, with a significant number of secondary legislation pieces still required for its full implementation (e.g., regulations, rules, notices, orders, guidelines, and environmental quality standards). An analysis of the budgetary resources and gaps in capacity identified incomplete legal frameworks, inadequate cross-sectoral coordination, and insufficient funding as institutional barriers to the full implementation and enforcement of environmental policies. Recommendations include further analysis of, and investments in, the capacity needed for the implementation framework, along with developing and sharing of necessary environmental information and key performance indicators. The existing legislation also needs to be harmonized across sectors.

## 1.5 Objectives and Scope of the Country Environmental Analysis

The main objective of the country environmental analysis (CEA) is to support the government of Tanzania in analyzing the critical environmental and natural resources challenges that are influencing the country's development and poverty reduction efforts, and to provide policy recommendations on how to address these. The CEA has been conducted in close collaboration with the Government of Tanzania (the Department of Environment of the Vice President's Office) and reflects inputs from various stakeholders, including representatives from different government ministries and agencies, LGAs, nongovernmental organizations (NGOs), and civil society. It further draws on literature produced by the World Bank, government entities, academia, NGOs and development partners (DPs), and uses data and inputs collected during the process.



More specifically, the CEA analyzes various environmental and natural resource issues Tanzania faces and discusses their current status, main causes, drivers, and trends, as well as insights into their possible future developments. It includes an overall evaluation of existing institutions and policies, and suggestions for the strengthening of the enabling environment. Given the size of the country, the diversity of ecosystems and economies, and the wide range of challenges, this report focuses on the key relevant action areas, and singles out a few for immediate action.

This paper is structured as follows:

**SECTION 1:** Introduction. This section gives an overview of the contribution of natural resources and the environment to various sectors and discusses the country's growth trajectory by highlighting the economy's dependence on natural resources.

**SECTION 2:** Rural Environmental and Natural Resources Challenges. Given the importance of environmental and natural resources for the country's economy, this section first examines the current state of natural resources in rural areas and discusses how environmental degradation is stifling the growth of the rural economy. It goes on to review existing natural resources policies and management and institutional capacity, and finally offers recommendations for the sustainable development and use of these resources.

**SECTION 3:** Urban and Industrial Environmental Challenges. This section summarizes the country's pollution and environmental health issues, including air and water pollution, solid waste, and toxic waste issues.

**SECTION 4:** Toward Cleaner, Greener Development. This section proposes areas for action that can help pave the way toward inclusive and sustainable growth in Tanzania.



2

# Rural Environmental and Natural Resources Challenges





## 2.1 Significance of Environmental and Natural Resources and Key Challenges

Natural resources play a vital role in sustaining the livelihoods of Tanzania’s rural population. Currently, approximately 70 percent of the population live in rural areas and depend on the country’s natural capital in form of freshwater, productive land, forests, or biodiversity. In the next 30 years, the country’s rural population is expected to grow by more than 80 percent, reaching 65 million people by 2050 (World Bank, 2018a). Tanzania’s natural assets have the potential to support the needs of this growing population if sustainable practices and policies

are put in place to manage the resources provided by these assets. Conversely, the continued degradation and overexploitation of Tanzania’s natural capital will decrease resource availability, negatively affect the quality of life, and continue to lower per capita wealth.

Natural resources provide life-sustaining benefits. Ecosystem services are often “invisible” to people, but they are in fact critical to preserving livelihoods, through services such as air and water filtration, flood protection, or habitat for fisheries and wildlife (box 2.1).

### BOX 2.1: ROLE OF ECOSYSTEMS IN PROVIDING VITAL GOODS AND SERVICES

Degraded ecosystems cannot perform the following tasks as efficiently as robust ecosystems:



Most ecosystem goods and services have traditionally been considered “free” to society. This undervaluation can lead to environmental degradation and the disruption of important functions that rely on healthy, thriving ecosystems.

## TANZANIA’S ENVIRONMENT AND NATURAL RESOURCES ARE DEGRADING

Population and economic growth are driving the depletion of natural resources, and the degradation of ecosystems and habitats. The ecosystem services these resources provide are vital for the country’s population. Particularly rural communities will be negatively affected by their degradation and overexploitation, as natural resources are a primary source of food and energy for them.



The opportunity Tanzania faces is to reconcile the use of natural resources to meet the demands of the population and economy with the need to maintain functioning ecosystems. Reaching this balance will catalyze sustained growth. However, the current trend in the use of natural resources is not sustainable, leading to persistent degradation and loss of ecosystems, which constitute the main cause of the natural capital loss. This challenge is surmountable if tackled effectively and the underlying causes and drivers of environmental degradation are addressed strategically: connecting the dots between deforestation in upper catchments and a higher flood risk in a coastal city, or between illegal ivory trafficking and a lower number of international tourists visiting the country (and thus a lower GDP) requires multisectoral coordination and a common, integrated approach to development. This CEA has identified spatially and temporally differentiated approaches and solutions toward ensuring sustainable resource management for long-term use. To achieve this goal, six key variables need to be understood and tackled (see table 2.1):

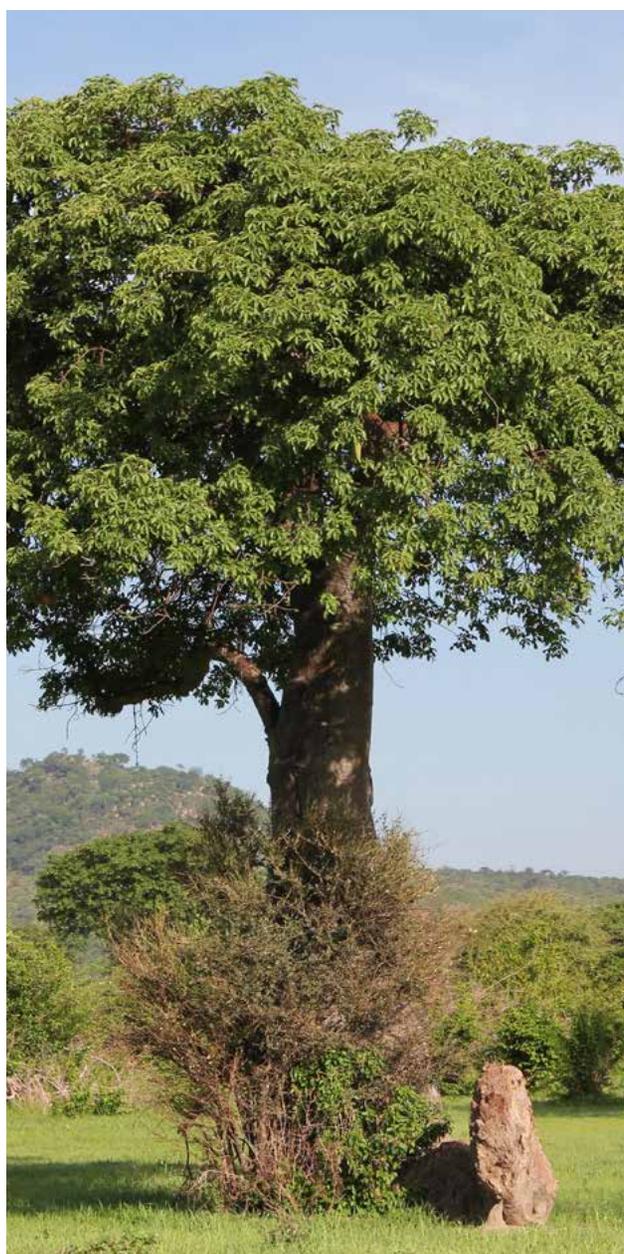
- A. Sustainable natural forest management will help ensure continued forest resources and services. Tanzania has one of the highest deforestation rates in the world. It ranks among the top five countries with the highest annual forest net loss, with an estimated forest area net loss of 483,859 ha per year (URT, 2017). The key contributing factors to deforestation are agricultural expansion and demand for wood fuels (such as charcoal). Forests provide over 85 percent of Tanzania’s energy supply (NBS, 2017a). The sector’s contribution to the economy is projected to go up further due to increased demand from a growing population. However, without major reinvestments in the country’s agricultural land and forests to offset the natural capital losses taking place across the country, continued deforestation will lead to significant national economic losses.
- B. Land conservation and restoration are critical to achieving economic growth and conserving the biodiversity and ecosystems

that are vital for ensuring human well-being. Land degradation, one of the most critical environmental issues both in Tanzania and worldwide, should be looked at in combination with biodiversity loss and climate change. Deforestation, poor farming practices, and overgrazing are some of the key causes of land degradation in Tanzania.

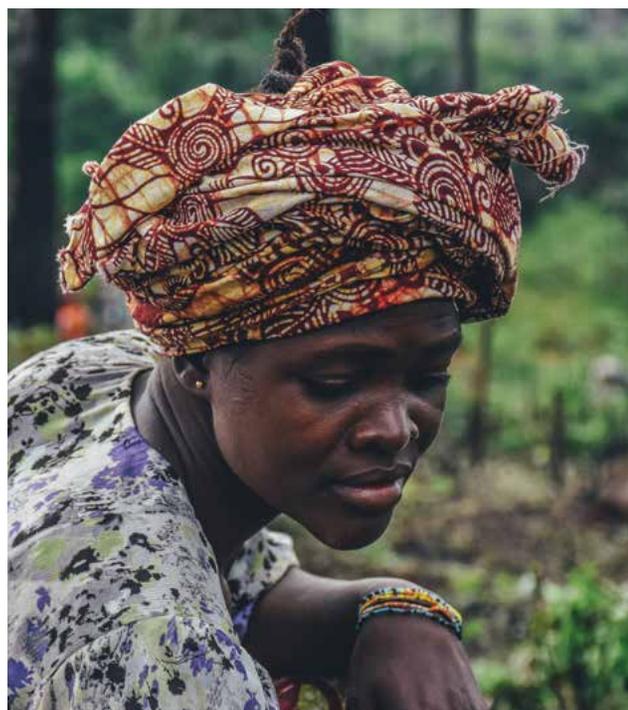
- C. The sustainability of Tanzania's water resources can be ensured with improved planning, management and monitoring. While the country still has a reasonable per capita water resource endowment, Tanzania recently officially became a water-stressed country. Projections suggest that the situation will get worse because of inadequate water management, increased agricultural demand, rapid population growth, and climate change impacts. It is expected that the decreasing water availability and the growing competing demands for it, will also negatively affect water quality. The substantial gaps in the knowledge of water resources—related to water quantity and quality, water use, and hydrometeorology—and the limited availability of monitoring networks prevent informed decision making.
- D. The protection of ecosystems, biodiversity conservation, and the largely positive international reputation as a hotspot for wildlife are crucial for Tanzania to realize its full tourism potential. Tanzania is one of the most biodiverse countries in the world, however it is experiencing a significant loss of its wildlife. This in turn affects a broad range of services critical to the supply of food, water, and energy, and that particularly the poor depend on for their livelihoods. The tourism industry, which is mostly based on wildlife, is an important and growing economic sector that accounted for about 13 percent of the country's GDP in 2016 (WTCC, 2017). The poaching of elephants and other mammals, the degradation and loss of habitat, climate change impacts, among others, have significantly reduced wildlife numbers, thereby threatening the long-term sustainability of the tourism sector and the

livelihoods of many Tanzanians.

- E. As Tanzania approaches, or even surpasses, the sustainable limit of exploiting its fisheries resources, attention needs to be shifted toward alternative livelihood opportunities in post-harvest value added, aquaculture, and recreational fisheries or other sectors. Approximately 10 million people depend directly on the integrity of coastal and marine natural resources for their livelihoods. However, environmental degradation, overfishing, and the use of illegal, destructive fishing methods are threatening Tanzania's fisheries.



F. Tanzania is highly vulnerable to climate change due to its reliance on natural resources. Impacts caused by climate change are an additional pressure to already stressed systems. Trends show an increase in temperatures for Tanzania and changes in precipitation (although the degree and extent of these changes is uncertain), and extreme weather events becoming more frequent. Enhancing resilience to climate change is vital to protecting the country's food security (crops, livestock, and fisheries), jobs, and economic growth, especially in the rural areas. Estimated economic costs of climate change to Tanzania could amount to 1 to 2 percent of GDP per year by 2030, in addition to existing costs resulting from climate variability (Watkiss et al., 2011).



**TABLE 2.1: KEY ENVIRONMENTAL CHALLENGES IN TANZANIA**

| ISSUE  | MAJOR CAUSES   | MAJOR CONSEQUENCES  |
|--|--|---|
| <b>Deforestation and forest degradation</b>      | <ul style="list-style-type: none"> <li>• Agricultural expansion</li> <li>• Fuelwood harvesting and charcoal production</li> <li>• Increasing demand / population growth</li> </ul> | <ul style="list-style-type: none"> <li>• Reduced environmental services</li> <li>• Loss of ecosystem services</li> <li>• Soil erosion, water loss, and water pollution</li> </ul> |
| <b>Land degradation</b>                          | <ul style="list-style-type: none"> <li>• Agricultural expansion</li> <li>• Inefficient farming practices</li> <li>• Overgrazing</li> <li>• Deforestation</li> </ul>                | <ul style="list-style-type: none"> <li>• Loss of soil fertility</li> <li>• Reduced food production</li> <li>• Desertification</li> </ul>  |
| <b>Degradation of water resources</b>            | <ul style="list-style-type: none"> <li>• Excessive agricultural use</li> <li>• Uneven distribution</li> <li>• Increasing competing water demand / population growth</li> </ul>     | <ul style="list-style-type: none"> <li>• Water scarcity</li> <li>• Reduced water quality</li> </ul>   |
| <b>Loss of biodiversity</b>                      | <ul style="list-style-type: none"> <li>• Habitat loss and degradation</li> <li>• Poaching</li> <li>• Overexploitation</li> </ul>   | <ul style="list-style-type: none"> <li>• Loss of tourism income</li> <li>• Reduction of food supplies</li> <li>• Loss of ecosystem services</li> </ul>                            |
| <b>Freshwater and marine fisheries depletion</b> | <ul style="list-style-type: none"> <li>• Overfishing</li> <li>• Degradation of aquatic environment</li> <li>• Destructive fishing methods</li> </ul>                               | <ul style="list-style-type: none"> <li>• Reduced food production</li> <li>• Economic losses</li> <li>• Unemployment</li> </ul>  |
| <b>Climate change</b>                            | <ul style="list-style-type: none"> <li>• Worldwide increase in emissions of greenhouse gases</li> <li>• Deforestation (removing carbon reservoirs)</li> </ul>                      | <ul style="list-style-type: none"> <li>• More frequent extreme weather events</li> <li>• Reduced food security</li> <li>• Environmental and human health issues</li> </ul>        |



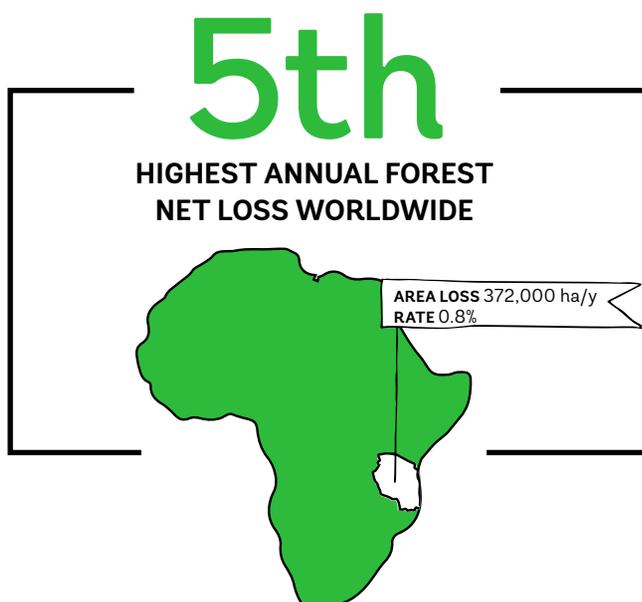
## 2.2 Deforestation and Forest Degradation

Forests are important to the population because they not only provide various direct and indirect benefits, they also contribute to the country's climate change mitigation and adaptation efforts. By sequestering and storing carbon, healthy forests are key for climate change mitigation. Forests also act as “natural infrastructure” that minimizes runoff, soil erosion, and nutrient loss, and provides communities with a safety net. From this perspective, they are also fundamental for climate change adaptation. By providing resources and services, forests contribute to long-term economic growth and environmental stability, and sustain sectors such as agriculture, energy, water, tourism, and transport. Forests also provide habitats for biodiversity, protect communities from natural disasters such as floods and landslides, and generally protect watersheds.

Tanzanians depend on the country's large forested areas for their livelihoods. Forests are an important source of energy for cooking, construction materials, traditional medicine, tourism, fodder, and water catchments protection. Total forested land is 48.1 million ha, representing over 50 percent of total land area (URT, 2017). The majority, or more than 90 percent, of Tanzania's forests consist of woodlands, followed by lowland and montane forests, forest plantations, and mangrove forests.

Tanzania's forests are also home to renowned biodiversity. About 28 million ha of the country's forests are considered critical as biodiversity hotspots or as water catchment areas. For example, the montane forests in the Eastern Arc Mountains are known for their biodiversity and high water catchment value for major rivers. The East Usambara forests are globally recognized for their unique biodiversity, including 27 vascular plant species and 40 vertebrate species endemic to the area (TFCG, 2017). Recognizing the value of these areas, the Government of Tanzania is protecting them to conserve their unique natural resource potential, and high carbon storage capacity — in 2017, 12 Nature Forest Reserves were declared and gazetted (TFCG, 2017).<sup>10</sup>

<sup>10</sup> Of the 12 Nature Forest Reserves, eight are found in the Eastern Arc Mountains, one is found in the coastal forests in southern Tanzania, one encompasses the forests of a recently dormant volcano, Mount Hanang, and another one includes areas of lowland swamp forest close to the Uganda border.



**TABLE 2.2: ANNUAL NET LOSS OF FOREST AREA – EAST AFRICA**

|            | FOREST AREA (THOUSAND HA) |        | AVERAGE ANNUAL CHANGE RATE (%) |           |           |
|------------|---------------------------|--------|--------------------------------|-----------|-----------|
|            | 1990                      | 2015   | 1990-2000                      | 2000-2010 | 2010-2015 |
| Kenya      | 4,724                     | 4,413  | -2.8                           | 1.7       | 0.9       |
| Malawi     | 3,896                     | 3,147  | -0.9                           | -0.1      | -0.6      |
| Mozambique | 43,378                    | 37,940 | -0.5                           | -0.6      | -0.5      |
| Tanzania   | 55,920                    | 46,060 | -0.7                           | -0.7      | -0.8      |
| Uganda     | 4,751                     | 2,077  | -2.0                           | -3.3      | -5.5      |

SOURCE: FAO, 2015

**TABLE 2.3: ANNUAL NET LOSS OF FOREST AREA – TOP COUNTRIES IN THE WORLD**

|           | ANNUAL FOREST AREA NET LOSS (2010–15) |          |
|-----------|---------------------------------------|----------|
|           | Area (thousand ha)                    | Rate (%) |
| Brazil    | 984                                   | 0.2      |
| Indonesia | 684                                   | 0.7      |
| Myanmar   | 546                                   | 1.8      |
| Nigeria   | 410                                   | 5.0      |
| Tanzania  | 372                                   | 0.8      |
| Paraguay  | 325                                   | 2.0      |
| Zimbabwe  | 312                                   | 2.1      |

SOURCE: FAO, 2015

The contribution of the forest sector to Tanzania's economy has been steadily rising. While it was estimated to account for about 2 percent of GDP in 2011 (i.e., \$613 million), it accounted for almost 4 percent in 2010 (FAO, 2014; NBS, 2017b). As the population continues to grow, and demand for forest resources along with it, the sector's contribution to the economy is projected to increase further.

**Tanzania's Forest Reference Emission Level submission to the United Nations Framework Convention on Climate Change (URT 2017) reported an estimated annual loss from deforestation of 483,859 ha over the period 2002–13.**

However, despite their crucial role in development, the country's forest areas have declined significantly. Tanzania's Forest Reference Emission Level submission to the United Nations Framework Convention on Climate Change (URT, 2017) reported an estimated annual loss from deforestation of 483,859 ha over the period 2002–13.<sup>11</sup> FAO (2015) reports slightly lower, yet still significant data, with forest areas in Tanzania having declined with an estimated annual forest area net loss of 372,000 ha, from nearly 56 million ha in 1990 to 46 million ha in 2015. Using the latter and comparing it with other countries in the world, Tanzania has the highest annual forest area net loss in East Africa (table 2.2), and the 5th highest annual forest area net loss worldwide (table 2.3).

<sup>11</sup> Note that Tanzania's Forest Reference Emission Level submission to the United Nations Framework Convention on Climate Change measures gross deforestation, which excludes regeneration, afforestation, etc.

## EXPANDING AGRICULTURAL ACTIVITY AND FUELWOOD HARVESTING ARE KEY DEFORESTATION DRIVERS

Expanding agricultural activity—for subsistence crops, livestock, and cash crops—is considered the key driver of deforestation and forest degradation in Tanzania. Between 70 and 80 percent of the country’s deforestation is estimated to result from converting forest land to agricultural land. Driven by the insufficient use of agricultural inputs needed to increase farm yield and productivity (e.g., limited extension services, challenges in accessing affordable credit, and limited access to inputs), traditional shifting cultivation commonly takes advantage of virgin forest soils<sup>12</sup> and has a significant impact on Tanzania’s forest resources. About 30 percent of Tanzania’s land is used for agriculture, with about 7 percent of the land area being classified as shifting cultivation (TFS, 2015). Shifting cultivation areas contain forests in various stages of regrowth, which are often not expected to recover fully (TFS, 2015). The cultivation of major agricultural cash crops—primarily maize but also cassava, cotton, and tobacco—have led to vast clearances of the miombo woodland over the past decades. Land is also converted for raising livestock. Tanzania encompasses large herds of cattle that often exceed the area’s carrying capacity and negatively affect the country’s forests and woodlands through overgrazing.

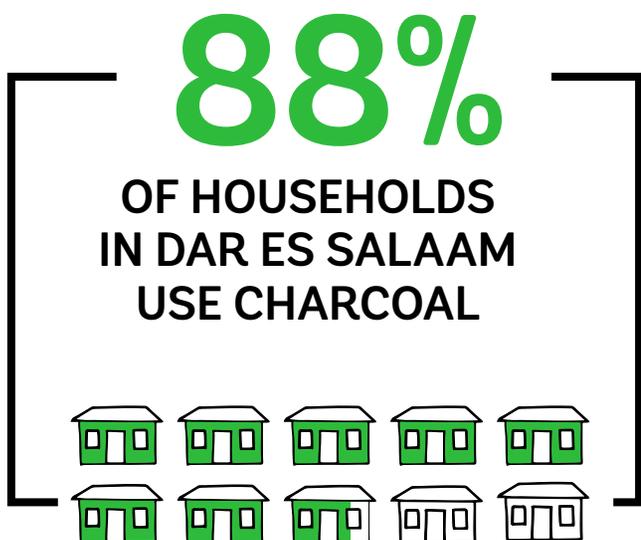
**An estimated 85 percent of Tanzania’s energy needs are met through biomass use in the form of charcoal and firewood, predominantly for cooking and heating.**

Fuelwood harvesting, and charcoal production, especially if followed by agriculture, further drive forest degradation and in some cases deforestation and biodiversity loss. An estimated 85 percent of Tanzania’s energy needs are met through biomass use in the form of charcoal and

firewood, predominantly for cooking and heating (NBS 2017a). Nationally, about 79 percent of urban households use charcoal as their largest source of household energy, as it is considered cheap and easy to transport, distribute, and store. In Dar es Salaam, this number is higher with approximately 88 percent of households using charcoal (NBS, 2017a). Charcoal is currently produced either illegally in forest reserves or from forests/woodland on village land for which no sustainable harvesting is in place (TFCG, 2018). Charcoal consumption levels are expected to increase further due to population growth coupled with urbanization and relative price increases of other fossil fuel-based energy sources (World Bank, 2009). According to Tanzania’s National Energy Policy (2015), demand for charcoal will double by 2030, from approximately 2.3 million metric tons in 2012.

Tanzania has taken important steps toward reforming the forestry regulatory framework in the past. Following a global shift toward decentralized forest management in the 1990s, Tanzania conducted a major review of its forest policy and legislation to transfer forest resource ownership and management responsibilities to local communities.<sup>13</sup> The Forest Act No 14, Cap 323, which was enacted in 2002 and became operational through the Forest Regulations

<sup>13</sup> The preparation of a National Forest Policy in 1998 enabled the establishment of new institutions. New institutions include for example the Tanzania Forest Service Agency (TFS), the Tanzania Tree Seed Agency (TTSA), the Eastern Arc Mountains Conservation Endowment Fund (EAMCEF), and the Tanzania Forest Fund (TaFF).



<sup>12</sup> Virgin soils are considered more fertile and productive, thus requiring less weeding, pesticides, and tillage before planting.

Government Notice 153 of 2004, subsequently allowed participatory forest management (PFM), a community-based approach toward securing and managing forests, to emerge as a central element in promoting the sustainable management of forest resources.<sup>14</sup>

## **Tanzania has taken important steps toward reforming the forestry regulatory framework in the past.**

But despite these efforts, uncontrolled forest exploitation continues to be widespread, and structural governance issues remain. Insufficient coordination of policy implementation across sectors, and across the different government institutions responsible for forest management, has led to continued uncontrolled access of forest resources.<sup>15</sup> In addition, the Tanzania Forest Service Agency (TFS) is largely dependent on revenue generated from forest products, often unsustainably harvested from village land forests, while having no mandate to manage or reinvest revenue in those forests. Implementation of community-based forest management has not yet received the required investment and prioritization. Tanzania initiated the REDD+ Readiness process in 2007, and prepared a National Framework Strategy and Action Plan, and created the National Carbon Monitoring Centre for monitoring, reporting, and verifying greenhouse gas (GHG) emissions from deforestation and forest degradation. The REDD+ process has not yielded significant results to date. The National Forest Policy is currently being reviewed, with an update expected in 2019.

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14 Two PFM models are being applied in Tanzania—community-based forest management (CBFM) and joint forest management (JFM). Both transfer local forest tenure to communities or share the costs and benefits of state-owned forests between the government and communities.

15 Responsibility for the management of forests lies with the TFS, a parastatal government agency. Forests at the district level are under the mandate of the Prime Minister's Office for Regional Administration and Local Governance, with the District Forest Officers managing the sector. Finally, according to the National Forest Monitoring Assessment (TFS 2015), about 22 million ha, or 46 percent of the country's forests and woodlands, are owned by villages, and about 2.7 million ha (or 5.7 percent) forests are on general land.

## **SUSTAINABLE NATURAL FOREST MANAGEMENT WILL HELP ENSURE CONTINUED FOREST RESOURCES AND SERVICES**

Forests and woodlands will continue providing resources and services to support Tanzania's growing population if managed and harvested sustainably. Improved forest and woodland management will require investment and commitment toward sustainable natural forest management, in addition to improving agricultural practices. Tackling these issues at a landscape level—from local to regional—and involving stakeholders working at different scales, will support the transition to sustainable practices in an integrated way. The involvement of village representatives and communities is particularly crucial considering most deforestation occurs on village land. Tanzania's National Five Year Development Plan (MOFP, 2016) has set ambitious energy and forestry goals, which should be built on; by 2020, energy derived from renewable resources should be 50 percent higher; natural forest cover should be 130,000 ha larger; an additional 100 million trees should be planted countrywide, and charcoal consumption in urban areas should be 60 percent lower. These goals, although hard to achieve, set the stage toward improved forest management.

The development of additional institutional and operational policies combined with strengthened enforcement will improve the effective management of forest resources. These policies include the establishment of an effective biomass policy, a framework governing the sustainable production of charcoal (with an emphasis on strengthening afforestation and reforestation), and detailed forest fire management guidelines, and the integration of climate change effects into forest policy and planning (MNRT, 2018). Strengthening the capacity of the institutions responsible for forestry management, coordinating the implementation of national plans and programs, and clearly defining land tenure and protection status will further facilitate the overall effectiveness of new and existing policies.

National financial allocations toward effective forest management and conservation mechanisms need to be increased, and donor support aligned to address Tanzania's national priorities. While community-based forest management is considered a key policy tool toward reducing deforestation and safeguarding ecosystem services for local communities, only about 13 percent (i.e., 4.1 million ha) of the country's forests are under such management, due to insufficient national funding allocations. In addition, the financial sustainability of the country's national forest reserves should be strengthened. To ensure sustainable sources of revenue for both the management of the reserves and to help support the development needs of surrounding communities, the development of business plans should be encouraged to attract private sector investment for tourism and recreational activities. Potential revenue through public-private partnerships can be reinvested in the reserves (TFCG, 2017).

### **National financial allocations toward effective forest management and conservation mechanisms need to be increased, and donor support aligned to address Tanzania's national priorities.**

Charcoal production that uses sustainably-managed resources and improved technologies offers further opportunities for reducing deforestation. Banning charcoal is considered ineffective in the absence of affordable, accessible alternatives for communities to cook with, hence there is a need to sustainably produce charcoal from natural woodlands, alongside other strategies to reduce charcoal dependence in the medium- to long-term. Research has shown that miombo woodlands can be managed for charcoal production with regeneration occurring rapidly and maintaining the original tree species. The Mjumita present a sustainable charcoal model that has succeeded in producing charcoal at a price that is competitive in urban markets; reducing deforestation in the participating villages; establishing a harvesting protocol in line with

ecologically sustainable woodland management principles; and generating funds for villages and local government (box 2.2).

Sustainable forest management needs to be integrated into the development decision-making process. Protecting and optimizing the use of forests is key to sustaining livelihoods and generating economic opportunities and jobs. Investments in sectors such as agriculture, energy, mining, and transport should reinforce and encourage sustainable forestry practices. The establishment of forest nature reserves should be prioritized in terms of forest protection.

Improving agricultural efficiency and productivity will decrease the pressure to convert forested lands to agriculture. This is a clear example of a solution that meets the needs of both farmers and the environment. Tanzania is already engaging in numerous sustainable agricultural projects and is well situated to build on the success of these projects and implement them on a wider scale.



## **BOX 2.2: SUSTAINABLE CHARCOAL PRODUCTION AND USE - THE MJUMITA SUSTAINABLE CHARCOAL MODEL**

Since 2012, the Tanzania Forest Conservation Group and Mjumita have successfully assisted 30 villages in the Morogoro Region toward integrating sustainable charcoal production into the management of village forest reserves.

### **HOW DOES IT WORK?**

The villages prepare a village land use plan that includes a village land forest reserve. Approximately 10 percent of the area of each village forest reserve is designated for charcoal production. The remaining 90 percent is for protection, beekeeping and, in some cases, selective timber harvesting. Grazing of livestock is controlled, and agriculture is prohibited. The harvesting rotation period is 24 years. This means that an area harvested in the first year will only be harvested again after 23 years. The charcoal areas are divided up into 50m x 50m blocks known as 'coupes'. 4.17 percent of these coupes can be harvested each year. The average yield per coupe is calculated based on an assessment of available biomass. The sustainable yield per coupe multiplied by the number of coupes harvestable per year establishes the annual charcoal quota and potential revenue for the village. Potential annual village revenues range from about \$4,000 to \$23,000 per village. Trees are cut at knee height (~50 cm) leaving behind a stump and the roots, encouraging coppicing.

### **WHAT ARE THE BENEFITS?**

Sustainable charcoal producing villages earned a cumulative revenue of \$200,000 between June 2013 and September 2018 from the fees (this is in addition to the income earned by the producers). How the revenue to the village is spent, is decided in village assembly meetings. Some revenue will be used to cover the costs of managing the village forest reserve and overseeing the sustainable charcoal model, while the remainder is invested in community development projects. For example, Ihombwe Village constructed a house for the doctor working in their health clinic; whilst Ihombwe and Ulaya Mbuyuni villages purchased health insurance for all residents of the village.

*"We were taking charcoal and wood from various areas without regulation. This practice created several problems. But now we are operating sustainably, and we receive great benefits from our forest in this village. For example, the construction of a school, classrooms, houses for teachers, teachers' colleges, hospitals, and health insurance for every individual. All this is now possible thanks to our sustainable measures."*

#### **SHABANI K. KINGAIRE**

Farmer in Kilosa, Morogoro



**SOURCE:** TFCG 2018.

## 2.3 Land Degradation

Land degradation is one of the world's most pressing environmental issues. Land degradation results in soil erosion, and may lead to desertification, salinization, or acidification. As the soil loses its water-holding capacity, surface water runoff is accelerated, which in turn leads to siltation downstream, further soil erosion, and decreased groundwater recharge. Degraded lands have lost their life-supporting capacity, affecting food production and associated livelihoods, forest cover and associated energy provision, biodiversity support, and overall degradation of ecosystem services.

**Tanzania's third report on the implementation of the United Nations Convention to Combat Desertification showed that nearly two thirds of the country's drylands are seriously degraded.**

Rapid expansion and unsustainable management of agricultural land is considered the most critical direct driver of land degradation. At least 3.2 billion people worldwide are estimated to be affected by land degradation impacts and, by 2050, this number is expected to reach 4 billion (IPBES 2018). Decreasing land productivity is projected to make global communities more vulnerable in the future, particularly in dryland areas. Africa's drylands, which comprise about 43 percent of land surface and account for about 75 percent of land used for agricultural activities, are particularly affected by land degradation, with associated communities being extremely vulnerable ecologically, economically, and socially (World Bank, 2017c).

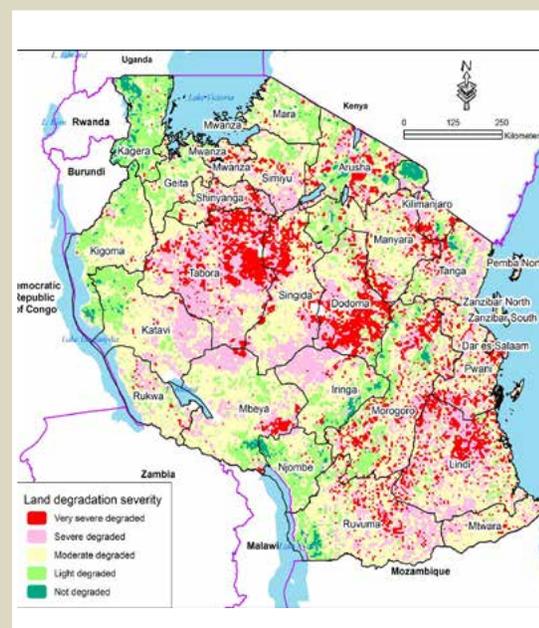
Biodiversity loss and climate change are closely interlinked with land degradation. Agricultural land covers more than one third of the world's land surface, mostly at the expense of forests, grasslands, and wetlands. Land degradation substantially contributes to climate change, given the importance of the soil's carbon

absorption and storage functions. Deforestation is responsible for about 10 percent of all human-induced GHG emissions (IPBES, 2018). A negative feedback mechanism is at play because climate change impacts may also exacerbate land degradation.

### TANZANIA'S LAND IS DEGRADED MAINLY DUE TO AGRICULTURAL EXPANSION

In Tanzania, the percentage of land considered degraded increased from 42 percent in 1980 to almost 50 percent in 2012 (URT-VPO, 2014b). Tanzania's third report on the implementation of the United Nations Convention to Combat Desertification (UNCCD) showed that nearly two thirds of the country's drylands are seriously degraded. The extent and magnitude vary across regions, depending on the type and intensity of the economic activities that drive the degradation.

**FIGURE 2.1: DEGREE OF LAND DEGRADATION IN HOTSPOT AREAS IN TANZANIA**



SOURCE: MODIFIED FROM MAJULE, 2017

For example, the agroecological zones in the plateau, semiarid, and southern highlands, are far more degraded than the other agroecological zones in the country, as illustrated in figure 2.1.

The area under permanent cropland increased by almost 73 percent between 2000 and 2010, with the data suggesting that, among other factors, land for crop production is increasing at the expense of forest lands, often because farmers encroach on forest land as they develop their agricultural activities (Majule, 2017). In line with global trends, deforestation, agricultural expansion coupled with poor farming practices, and overgrazing are among the key causes of land degradation in Tanzania. High deforestation rates and unsustainable agricultural practices—including slash and burn and steep slope cultivation—have degraded the land in many areas of the country (National Audit Office, 2018b). Soil fertility is being lost, which in turn undermines smallholder farmers' food security. Soil samples from different parts of the country show significant weathering, exposing the land's inability to support plant growth to sustain subsistence agriculture (Funakawa et al., 2012).

Tanzania has one of the largest livestock populations in Africa, with over 100 million livestock in 2016 (MoLF in NBS, 2017b), marked by low productivity rates. Keeping large herds of livestock, coupled with seasonal movements



in search of greener pastures, is considered detrimental to drought-prone, semi-arid environments and can lead to desertification through soil compaction, and wind and water erosion (Pietikäinen, 2006).

## LAND CONSERVATION AND RESTORATION

Tanzania has taken important steps toward addressing land degradation. The government enacted new policies and strategies to address land degradation following the United Nations Conference on Environment and Development (UNCED), the Earth Summit held in 1992 in Rio de Janeiro. The National Action Program to Combat Desertification (2000) was developed, and relevant policies and action programs were reviewed and updated to include environmental and land degradation issues.<sup>16</sup> In addition, the REDD+ National Strategy (URT-VPO, 2012a) and the Climate Change National Strategy (URT-VPO, 2012b) were enacted with a view to addressing land degradation in combination with the impacts of climate change.<sup>17</sup> Tanzania is also part of the African Forest Landscape Restoration Initiative (AFR100), an effort to restore 100 million hectares of deforested and degraded landscapes across Africa by 2030, but is yet to prepare its commitment.

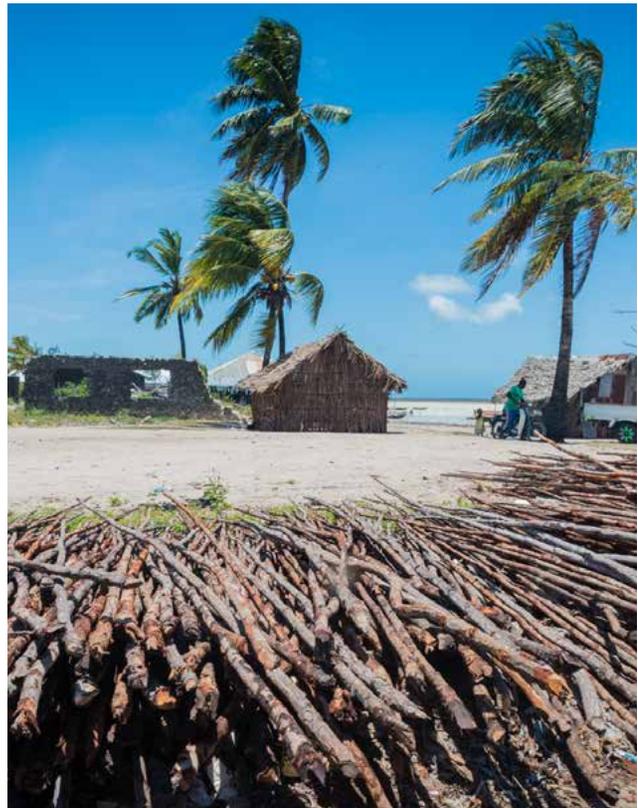
### **Continued efforts are needed as land conservation and restoration are critical to achieving economic growth.**

Continued efforts are needed as land conservation and restoration are critical to achieving economic growth. Attaining sustainable land management includes not only avoiding further agricultural expansion into native habitats by promoting more sustainable agricultural practices and less

<sup>16</sup> Updated and reviewed policies and action programs include the National Strategies for Growth and Poverty Reduction (NSGRP), the National Environmental Policies (1997), the National Land Policy (1997), the National Forest Policy (1998), the Agriculture and Livestock Policy (ALP) of 1997, and the National Water Policy (2002).

<sup>17</sup> This included the Agricultural Sector Development Strategy (ASDS) of 2001 and the Strategy for Urgent Actions on Land Degradation and Water Catchments (SUALDWC) of 2006.

land-degrading activities, but also emphasizing the importance of land restoration. Efforts should focus on supporting farmers in reducing soil loss and improving soil health, and in using integrated crop, livestock and forestry management systems (box 2.3). The application of appropriate fire regimes and the development of local livestock management practices and institutions have proven successful in rangelands with traditional grazing (IPBES, 2018). When it comes to wetlands, the improved management of polluting sources and integrated landscape approaches have shown to be effective. In urban areas, the development of green infrastructure, urban spatial planning, river channel restoration, and the remediation of contaminated soils constitute effective measures (IPBES, 2018). Working closely with communities that are directly affected is fundamental when updating policies and designing on-the-ground interventions.



**BOX 2.3: PROTECTING THE ENVIRONMENT THROUGH SUSTAINABLE AGRICULTURE**

The challenge facing farmers today, and in the coming decades, is how to increase production levels to feed a rapidly growing population. Currently, agricultural expansion is the main driver of deforestation, land degradation and water use. Sustainable agricultural methods provide effective tools to strengthen food security by growing crops within the means of the local ecosystem without degrading the soil, water, and biodiversity that support that growth.

There are a number of successful programs and projects in Tanzania and throughout Africa that focus on the pillars of sustainable agriculture, including:

**BUILDING AND MAINTAINING HEALTHY SOILS**

- Crop rotation, intercropping, cover crops
- Agroecology (integrating livestock and crops) and agroforestry (integrating trees and shrubs into farming systems)
- Integrative pest management techniques to control pests while minimizing the use of chemicals

**INCREASING PRODUCTIVITY AND ECONOMIC GAINS**

- Incentives such as providing low cost access to improved seed and livestock breeds, agricultural intensification and irrigation



## 2.4 Degradation of Water Resources

Tanzania boasts multiple rivers and lakes that are economically and ecologically unique. Some of the major lakes in Tanzania include the Lake Victoria, the largest tropical lake in the world by extension, Lake Tanganyika, the deepest lake in Africa and the second largest freshwater body in the world by volume, or Lake Nyasa/Malawi. Important river lifelines include the Rufiji, Ruvuma, and Great Ruaha. Lakes and rivers are critical for the country's economic activities such as fishing and farming. They are fundamental to sustain rural livelihoods, for water supply and irrigation purposes, nutrient and sediment movement, hydropower generation, and transportation. They also provide the required habitats for various flora and fauna. Lake Manyara, Lake Rukwa, or the Great Ruaha river, are fundamental sources of water on which unique, world-renowned biodiversity hotspots depend. Adequate quantity and quality of water in these lake and river systems is the cornerstone that enables these hotspots to exist and thrive.

Water is at the center of sustainable development. Its availability and quality are critical for socioeconomic development, energy and food production, job creation, healthy ecosystems, and human health. Unless the management of water resources is improved, it will be difficult to achieve the Sustainable Development Goals (SDGs) targeting human development, livable cities, climate change, food security, and energy security.

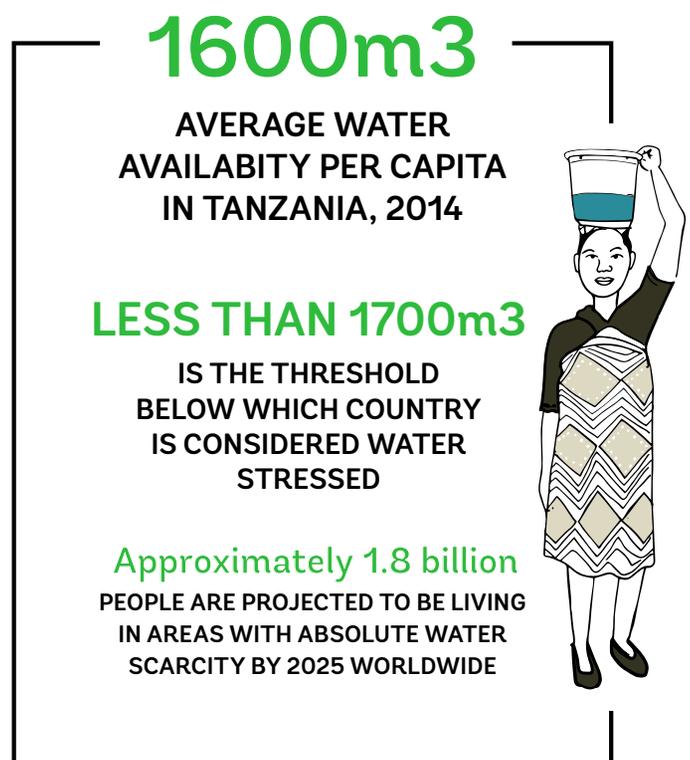
### TANZANIA IS CONSIDERED WATER-STRESSED

Water resources are under unprecedented pressure worldwide, with more than 40 percent of the global population being affected by water scarcity. By 2030, it is estimated that the world will be facing a 40 percent shortfall between the increased demand for and available supply of water. By 2025, it is projected that approximately 1.8 billion people will be living in areas with absolute water scarcity. Climate change is compounding

this stress by altering hydrological cycles, making water availability more unpredictable, and increasing the frequency and intensity of floods and droughts. Damage incurred by floods is estimated at \$120 billion per year globally, and droughts disproportionately affect the rural poor, who depend on rainfall variability for subsistence.

**Tanzania is considered water-stressed, as its water resources are currently estimated to be less than 1,700 m<sup>3</sup> per capita.**

Tanzania is no exception. There is a common misconception that the country has sufficient and abundant water resources, given its annual renewable water resources are estimated at 96 million cubic meters per year. However, as the country's population and economy grow, freshwater demand increases and availability per person inevitably declines. Tanzania's renewable per capita freshwater resources have declined from more than 3,000 m<sup>3</sup> in the nineties to around 1,600 m<sup>3</sup> in 2014, which is less than 1,700 m<sup>3</sup> per



capita, the threshold below which a country is considered water-stressed by the United Nations (World Bank, 2017b). Tanzania still has a higher per capita water resource endowment than its neighboring countries; however, it is rapidly declining because of its growing population (figure 2.2). In addition, water and development are unevenly distributed across Tanzania's nine river basins. Water stress differs geographically, which means that water is not always available when and where people, businesses, and the environment need it. Storage and retention of

water in the country's various lakes and wetlands are important.

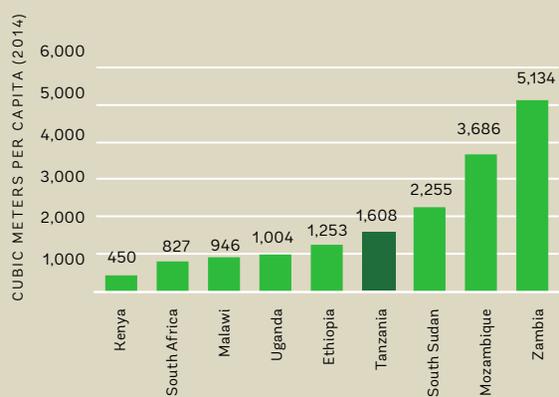
## Agriculture is the main user of water in Tanzania.

The amount of groundwater extracted in Tanzania is unknown but expected to be high and, in some cases, above the recharge rate. The hydrogeology of Tanzania has not been thoroughly studied and therefore the quantity and quality of groundwater resources is unknown (Kashaigili, 2010). Problems associated with exploitation of water resources have already been witnessed, and include depletion of the groundwater table, land salinization, groundwater contamination (e.g., from arsenic, fluoride, and ammonium), and saline intrusion. Climate change impacts may put further pressure on groundwater resources—both directly, by affecting the recharge rates and indirectly, by increasing groundwater demand due to increased variability of precipitation.

Agriculture is the main user of water in Tanzania. The estimates vary slightly, depending on the source, but around 89 percent of Tanzania's water is used by the agricultural sector (to put this into perspective, the global average is around 70 percent). Domestic consumption uses around 10 percent, and only 1 percent is used by industry (World Bank, 2017b).

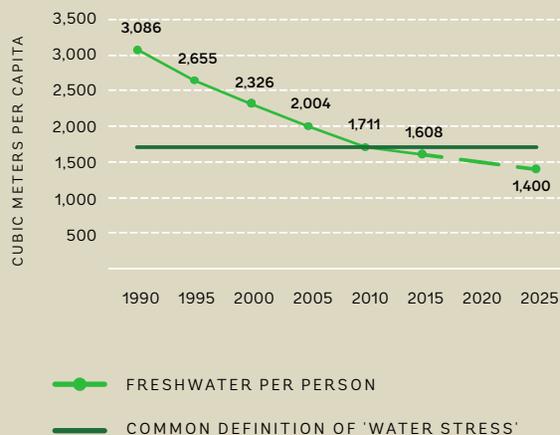
The sustainable management of water resources in Tanzania is not only threatened by depletion of water sources, increasing competing water demands, and climate change impacts, but also by pollution. To date, little is known at the national level about the quality of water resources and its evolution over time. There are no networks and only limited control points, making systematic assessments challenging. More information is needed on the effects of concentrations of organic matter resulting from industrial discharges, fertilizers and pesticides (associated with poor farming practices), and other sources of pollution. Artisanal mining, often unregulated, inefficient, and marked by poor or inexistent handling and disposal of effluents, uses high concentrations of

**FIGURE 2.2 RENEWABLE FRESHWATER PER CAPITA BY COUNTRY**



SOURCE: WORLD BANK, 2017b

**FIGURE 2.3: RENEWABLE FRESHWATER RESOURCES PER CAPITA IN TANZANIA**



SOURCE: WORLD BANK, 2017b

significantly toxic substances, such as mercury and cyanides (see also section 3.3). Some of these bio-accumulate and increase their concentration along the food chain.

### **Tanzania’s limited water resources will come under further pressure as demand increases with a rapidly growing population and high urbanization rates.**

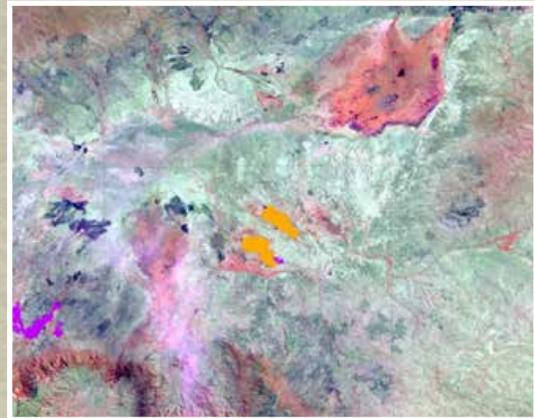
Projections show that per capita availability of water resources will continue to decrease, and water quality may deteriorate because of both natural and human pressures. Generally, river flows and lake levels in Tanzania are declining. This is reportedly due to a range of natural and man-made factors such as declining rainfall, unsustainable water uses (e.g., operational rules at hydropower plants and over abstraction of rivers), and unsustainable agricultural expansion (2030 WRG, 2014). It is estimated that by 2025, water availability in Tanzania will be 1,400 m<sup>3</sup> per capita, only slightly above the 1,000 m<sup>3</sup> per capita—the internationally accepted threshold for absolute scarcity (figure 2.3).

Tanzania’s limited water resources will come under further pressure as demand increases with the rapidly growing population and high urbanization rates. The population is projected to more than triple by 2050 and domestic water use is set to significantly rise. In addition, the experience of many other countries shows that as the quantity of water becomes stressed, the quality deteriorates more rapidly because multiple users compete to extract the most from the water they have (World Bank, 2017b). The Great Ruaha River is running dry several months a year due to unregulated water abstraction upstream (box 2.4), and key watersheds that act as supply sources for Dar es Salaam such as the Pangani or Wami Ruvu, are under stress due to periodic shortages and water quality challenges. As the city continues to grow and demand for human consumption increases, the use of water resources in these basins will have to be significantly improved.

#### **BOX 2.4: THE COMPETING WATER NEEDS OF THE GREAT RUAHA RIVER**

The Great Ruaha River once flowed year-round, feeding the Ruaha National Park, one of the last strongholds of major elephant and lion populations in Africa, before flowing into the Mtera-Kidatu hydropower system (which constitutes around 50 percent of the country’s installed hydropower capacity).

Large, unregulated water abstraction for agricultural irrigation upstream caused the river to start drying up a few weeks per year in the 90s. The situation, today, is dramatic, with up to several months of zero-flows in the river, causing disease and death of animals in the park (with consequent impacts on tourism, a key source of income for the country), and significant challenges to electricity production in the dam (World Bank, 2015c).



Satellite picture of water uses and widespread irrigation consumption in the Ihefu Wetlands, upstream Ruaha National Park



Ruaha National Park (left, forested side of the picture) and rice paddy plots (right side of the picture)

## IMPROVED PLANNING, MANAGEMENT, AND MONITORING TO PROMOTE SUSTAINABILITY

Tanzania has a comprehensive regulatory framework related to water resources management (WRM). This framework includes the National Water Policy (2002), the Water Resources Management Act (2009), and several policies and laws for water-related sectors (wetlands, lands, forestry, fisheries, agriculture, livestock, and energy). An important principle of the water policy is the requirement that each basin (the country has been divided into nine of them), catchment, and sub-catchment prepare an integrated water resources management plan (IWRMP) and that all water uses within that geographical space comply with said plan. The 2009 Act is at the core of WRM in Tanzania, and its objective is “to ensure that the nation’s water resources are protected, used, developed, conserved, managed and controlled to meet the basic human needs of present and future generations”. The Ministry of Water (MoW) has the legal mandate for core WRM tasks, while the authority for planning, monitoring, and enforcement is devolved to the nine basin water boards (BWBs).

Improvements to the regulatory framework, such as specifying the role of LGAs and creating stronger implementation and enforcement mechanisms

will significantly upgrade water management. LGAs play a central role in WRM and development in their areas of jurisdiction. However, said role is not explicitly emphasized under the existing framework and consequently, most LGAs regard WRM as the responsibility of BWBs. Given the technical and financial challenges of BWBs, WRM functions are best implemented by legally allocating distinct, but mutually reinforcing roles to various levels of government. Insufficient staffing, especially at the BWBs and LGAs, limits the ability to deal with water allocation, monitoring, and development. Areas that require strengthening include monitoring, financial management, environmental management and social sciences, conflict resolution, and transboundary waters. Several committees, associations, and community groups have been established at the village level<sup>18</sup> to deal with WRM.

Noncompliance with water permit regulations occurs frequently and is caused by inadequate technical and financial capacity of the BWBs, inadequate water users’ awareness of their rights and obligations under the Act, lenient penalty structures that are insufficient to deter offenders, weak water user associations unable to monitor illegal water use, and the limited availability of monitoring networks and information systems.

<sup>18</sup> These include land committees, forest committees, environmental committees, and water management committees.



**Improved government intersectoral coordination for planning, management, and monitoring of water resources will be needed to ensure the sustainability of the country’s water resources.**

Robust data on water availability, water use, and water quality are indispensable to plan effectively for the future. Reliable and objective information about the state of water resources, and their use and management are often limited or unavailable. There is inadequate technical capacity and financing at the BWBs to operate water resources monitoring networks and regulate water resources. There are also gaps in the availability of hardware and software for collection and management of hydrometeorological data. According to the MoW, the country’s estimated 500 operating rainfall stations, 60 climatic stations, 12 agrometeorological stations, 2 marine weather stations, and 2 radar stations are only partly operational (due to equipment breakdown, vandalism, and poor maintenance) and most catchments within basins lack gauging stations (MoW, 2014). There is also an overall lack of water quality monitoring. Most of the basins lack water pollution control programs for effectively abating point and non-point pollution sources.

Improved government intersectoral coordination for planning, management, and monitoring of water resources will be needed to ensure the sustainability of the country’s water resources. Tanzania’s WRM institutions need to strengthen coordination based on more and higher-quality information, capacity, resources, and authority on the one hand, and investment prioritization through budgetary allocations and multisectoral planning on the other hand. Water pricing will need to meet Tanzania’s social, environmental, and economic objectives (box 2.5). Major water users—such as agriculture, energy, environment, fisheries, livestock, and industry—should play a major role in WRM and ensure that during the preparation of their respective sector development plans, a thorough consultation and coordination process takes place.

As the agricultural sector continues to expand,

particularly given the government’s ambitious plans to duplicate the extension of land under cultivation, large gains in efficiency will need to be achieved to secure sufficient allocation for other uses (hydropower production, water supply, industrialization, ecological flows). With such increasing competing water demands, environmental flows will need to be carefully captured in water allocation processes. Rivers with sufficient flow will have to provide water for ecosystems; wetlands and estuaries should be able to maintain a minimum flow volume to perform their natural functions; underground aquifers need to be recharged at least to a balance point if they are to be used sustainably; and lakes must maintain their volume and extension to continue to provide services.

**BOX 2.5: WATER PRICING**

Efficient water pricing can increase the sustainability of the water supply by creating incentives for saving water and disincentives for wasting it.

There is considerable scope for progress in Tanzania, as water is currently sold at a rate far below its value. In fact, bulk water costs are so low that running a tap for an entire year would cost around \$2.60.



SOURCE: WORLD BANK, 2017b



## 2.5 Loss of Biodiversity

Tanzania is one of the most biodiverse countries in the world. The country has a variety of ecosystems including rivers, mountains, wetlands, drylands, grassland savannahs, coastal and marine ecosystems, islands and sandbanks. Hundreds of endemic species and subspecies of primates, antelopes, reptiles, amphibians, and invertebrates thrive in these ecosystems, as well as over 11,000 species of plants, mostly endemic (IUCN, 2017). The Eastern Arc Mountain forests for example are an area of high endemism, with about 100 vertebrates that can only be found there. Recognizing this wealth, about a third of the country's total area is officially under protection, one of the world's highest ratios. Tanzania boasts 19 national parks, including the world-renowned Serengeti National Park, the Kilimanjaro National Park, and the Ngorongoro Conservation Area, the three of which are United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites and in most people's bucket list to visit. It is also home to the Ruaha National Park—the largest national park in East Africa. In addition, Tanzania hosts 25 game reserves including the Selous Game Reserve, also a UNESCO World Heritage Site and Africa's largest game reserve. The country has further established

3 marine parks, 15 marine reserves, and multiple forest reserves and woodlands, of great ecological, social, and economic importance to the country, and providing life-enabling ecosystem services to the country's population.

Large numbers of tourists visit Tanzania each year to experience the country's wildlife. The number of international visitors has significantly increased over the past two decades, reaching over 1.2 million in 2016 (figure 2.4). The direct GDP contribution of travel and tourism, which is largely nature-based, stood at about 5 percent in 2016, while its total contribution was about 13 percent in the same year (WTCC, 2017). Tourism continues to be a critical component of Tanzania's economic strategy, and the sector's contribution to GDP is expected to continue to grow (WTTC, 2017). The sector also accounted for over 21 percent of total export earnings in 2016. In terms of employment, travel and tourism's direct contribution to employment was about 4 percent, and total contribution nearly 12 percent (WTTC, 2017).

**FIGURE 2.4:** NUMBER OF INTERNATIONAL VISITORS TO TANZANIA



SOURCE: WORLD BANK, 2018b

## IN LINE WITH GLOBAL TRENDS, PRESSURES ON BIODIVERSITY HAVE BEEN INCREASING IN TANZANIA

Habitat degradation, fragmentation and destruction, invasive species, overexploitation of biological resources, and pollution, have been on the rise worldwide, including in Tanzania (Secretariat of the Convention on Biological Diversity, 2010). Despite the country's efforts under various international instruments to reverse these trends,<sup>19</sup> increasing pressures on and threats to biodiversity are gradually driving species to extinction. According to the IUCN Red List of Threatened Species (IUCN, 2018), Tanzania has the second highest number of threatened species in Africa with 511 (figure 2.5). Between 1996 and 2018, the number of mammals and reptiles under threat increased substantially (figure 2.6).

<sup>19</sup> Tanzania is party to the Convention on Biological Diversity (CBD), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Migration Species (CMS), the Ramsar Convention on Wetlands, and the World Heritage Convention.

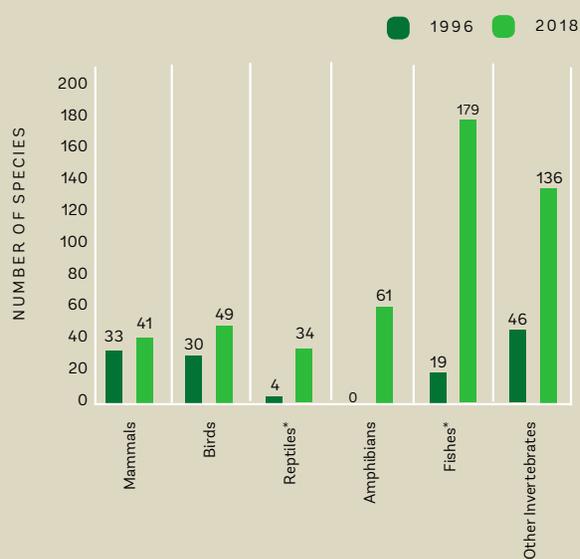
**FIGURE 2.5** OVERVIEW OF IUCN RED LIST CATEGORIES - TOTAL FOR SELECT AFRICAN NATIONS



SOURCE: IUCN, 2018

NOTE: the categories summarized are: Extinct, Extinct in the Wild, Critically Endangered, Endangered, and Vulnerable.

**FIGURE 2.6** COMPARISON OF NUMBER OF THREATENED SPECIES IN TANZANIA



**SOURCE:** IUCN, 2018

**NOTE:** The species have been grouped by taxonomic groups between 1996-2018.

\*These groups have not been fully assessed. Their number is based on those that have been assessed so far (applies only to the 2017 data).

Biodiversity loss degrades and disrupts a broad range of services on which people, particularly the poor, depend for their livelihoods, since rich biodiversity and diverse ecosystems supply food, water, energy, health, and other livelihood options. Climate change is expected to exacerbate these negative impacts. Even if the Paris Agreement 2°C target is met, some of the world’s most naturally rich areas, including the Miombo Woodlands in Southern Africa, are at risk of losing about 25 percent of their species (Warren et al., 2018).

**Tanzania has the second highest number of threatened species in Africa with 511.**

**BOX 2.6: THE RUFJI HYDRO-ELECTRIC POWER PROJECT IN THE SELOUS GAME RESERVE**

With a view to meeting the country’s energy needs, Tanzania is planning to double its electricity generation through the construction of the Rufiji hydro-electric power project. The hydropower dam, which would generate a lake spanning approximately 1,500 km<sup>2</sup>, is planned to be built in the Selous Game Reserve. This reserve is a UNESCO World Heritage Site, and home to elephants, rhinos, lions, giraffes, and other species, constituting the world’s largest game reserve and one of the last remaining wilderness in Africa. The project will dam the Rufiji river in the area known as Stiegler’s Gorge.

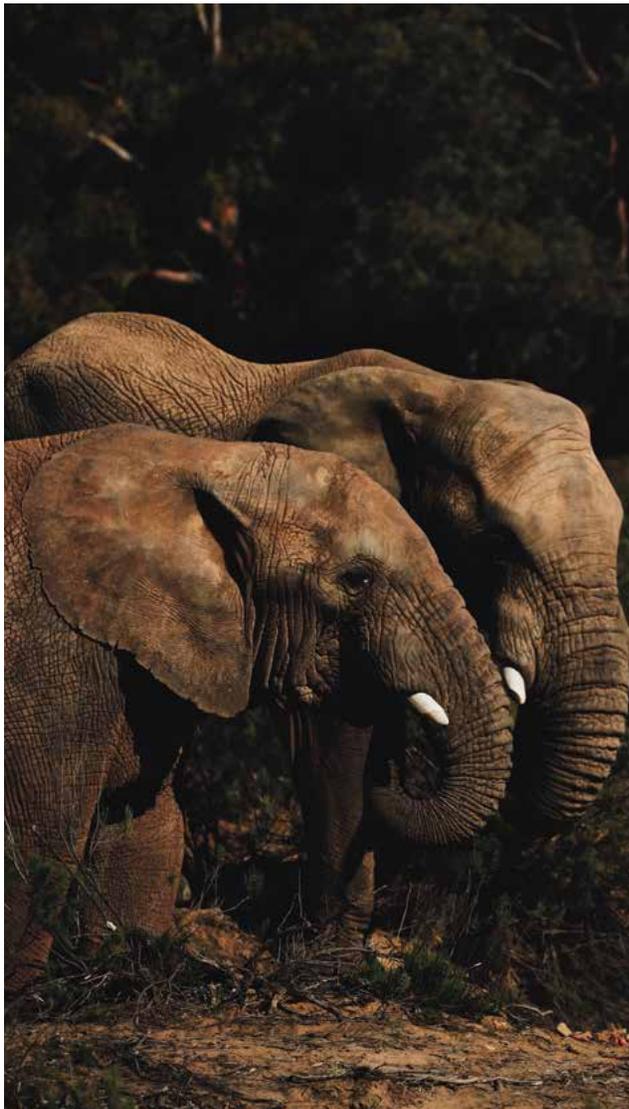
The Rufiji river forms the largest of Tanzania’s river basins, covering around 184,000km<sup>2</sup> (about 20 percent of Tanzania’s area and 30 percent of its water runoff). Despite its envisaged positive contribution to Tanzania’s electricity production capacity, the project is likely to have significant impacts on the Selous Game Reserve during the construction period (both direct and indirect), and thereafter through improved access roads, power lines, and human presence. The reservoir is also expected to affect downstream water flows as it will trap large amounts of sediment and nutrients which are currently deposited downstream and in the Rufiji delta. Changing flows will in turn affect downstream livelihoods and sensitive environmental sites—for example, a recent report has estimated potential downstream impacts on the livelihoods of about 200,000 people who depend on the natural river regime for their subsistence (UNESCO, 2018).

For these types of large infrastructure investments, state-of-the-art Strategic Environmental and Social Assessments need to be carried out, and it becomes crucial that they are implemented with high standards, to mitigate potential impacts as much as possible.



## HABITAT DEGRADATION AND OVEREXPLOITATION OF ANIMAL SPECIES AMONG DRIVING FORCES

The largest threat to biodiversity is the conversion, degradation, fragmentation, and loss of natural ecosystems. Tanzania's growing population increasingly requires natural resources to support its subsistence and economic needs. Population density and growth rates are high around many protected areas, where some of the country's poorest communities have settled. This may well be because the availability of resources around protected areas attracts individuals who have few other employment opportunities (World Bank, 2015c). Agricultural expansion and the



use of unsustainable agricultural practices, as well as the harvesting of forestry and other environmental products have reduced or are threatening the habitat available to wildlife. Human expansion into natural areas for infrastructure contributes to the conversion, loss, degradation, and fragmentation of natural ecosystems. Conflicts for water and land between pastoralists and farmers also frequently lead to additional land degradation and habitat loss. The Selous Game Reserve, one of the world's last remaining wilderness, represents an example of where infrastructure projects such as uranium mining, potential oil and gas concessions, or the construction of the Rufiji hydro-electric project, are threatening the ecosystem (box 2.6).

**Tanzania lost two-thirds of its elephant population in a period of only five years: from about 109,000 in 2009 to about 43,000 in 2014.**

Driven by the demand for ivory, poaching has significantly reduced Tanzania's elephant herds. Tanzania lost two-thirds of its elephant population in a period of only five years: from about 109,000 in 2009 to 43,000 in 2014 (EIA, 2014). Most of this decline in the elephant population, around 60 to 90 percent, was attributed to poaching in wildlife reserves (EIA, 2014), with the Mikumi-Selous ecosystem registering the highest decline. The situation in Tanzania is worse than that of its regional neighbors—Rwanda, Uganda, and Kenya—where elephant populations have remained stable or even increased since 2006 (CITES, 2017). A study using DNA methods to assign population of origin for 28 large ivory seizures made in Asia and Africa found that most came from South East Tanzania (Wasser et al., 2015). South Eastern Tanzania and northern Mozambique were considered major poaching hotspots and critical components of the global illegal ivory trade.

Harvesting wildlife for meat is widespread, particularly around national parks. The wildlife

that resides in and around protected areas provides readily accessible protein to the rural population living there. Primarily motivated by subsistence needs, bushmeat is an essential source of protein of the diet of the rural poor living close to protected areas.

Illegal wildlife trade (IWT) of animal parts and trophies is also severely affecting other animal populations, driving some of them toward endangered status. This is the case, for example, of the pangolin, which is illegally sold in China as traditional medicine because of the belief that its scales have special properties. Aggressive commerce of pangolin has driven all eight species to the brink of extinction. The Oxford Martin Program on the IWT estimates that “the illegal and unsustainable wildlife trade is a major and growing threat to biodiversity, estimated to be worth \$8–10 billion (excluding fish and timber), making it one of the highest valued illicit trade sectors in the world.”

The Government of Tanzania is devoting significant efforts to the fight against poaching and IWT, and a reduction of poaching incidences is already apparent. Under the auspices of the Ministry of Natural Resources and Tourism (MNRT), the staff of the three main institutions in charge of conservation—the Tanzania National Parks Authority (TANAPA), the Tanzania Wildlife Authority (TAWA), and the Ngorongoro Conservation Area Authority (NCAA)—have been transformed into “paramilitary” officials, after receiving intensive training and serious capacity building efforts around anti-poaching. The MNRT has also set up a dedicated wildlife crime unit, which operates with the National and Transnational Serious Crimes Investigation Unit (NTSCIU). By using an integrated multi-agency approach to wildlife protection, the NTSCIU investigates and prosecutes environmental crimes. Efforts include intelligence-based tactics to uncover criminal syndicates, the implementation of sniffer dogs at ports and airports, and training for investigation and prosecution of IWT cases. Positive results are noted, with both TANAPA and TAWA reporting decreases in the incidence of poaching.

## MAINSTREAMING CONSERVATION INTO DEVELOPMENT OPERATIONS

Increased financial resource allocations are needed toward effective conservation. Tanzania’s adherence to international conventions and other instruments has helped the country to mobilize resources. These instruments are critical to consolidating the financial, staffing, and technological resources the country needs to reverse its biodiversity loss trend (Debonnet and Nindi 2017), and allow the setting of ambitious biodiversity targets to ensure sustainable utilization and sound conservation.<sup>20</sup> Despite political commitment, conservation efforts are highly underfunded. In total funding, Tanzania only received about \$176/km<sup>2</sup>, compared to South Africa with \$3,014/km<sup>2</sup>, Kenya with \$1,688/km<sup>2</sup>, Malawi with \$690/km<sup>2</sup>, and Uganda with \$418/km<sup>2</sup> (Lindsey et al., 2018). Given the exceptionally large contribution of land to conservation in Tanzania, additional donor support is needed to help fill these gaps. Without significant funding increases, protected areas will struggle to fulfill their ecological, economic, or social objectives (Lindsey et al., 2018).

Higher investments in conservation will pay off in the form of increased tourism revenue for the country. Facing competition from agriculture and other land uses, the pressure on protected areas to provide economic returns is growing. Given the high rate of population growth, it is prudent that protected areas be well managed to provide support to wildlife species and their habitats, whilst also ensuring they encourage the development and bring about benefits to surrounding communities. For instance, investing in the protected areas in the Southern Circuit to open tourism opportunities is a step in the right direction to generate funds that can be used to protect wildlife biodiversity in these areas. It is equally important to support the livelihoods of the surrounding communities, creating employment

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20 For example, under the auspices of the Convention on Biological Diversity (CBD), Tanzania has committed to 20 ambitious Aichi Biodiversity Targets through the National Biodiversity Strategic Action Plan (2015–20) to address the underlying causes of biodiversity loss (URT 2015).

and economic opportunities in activities that drive them away from intensive and unsustainable natural resources use. Beyond investments that generate economic opportunities, complex land management, land tenure issues, and building resilience to climate change need to be addressed.

Mainstreaming conservation into the design and operation of infrastructure projects can both substantially reduce the associated cost to and impact on the environment and facilitate conservation. The use of sustainable designs, innovative engineering construction and operational techniques, can reduce the affected area, minimize the extend of unavoidable impacts, and mitigate the remaining impacts. Additional actions that can be integrated into infrastructure projects should be based in the "avoid, minimize, mitigate, compensate" principle, and could include restoring affected areas, preparation of endangered species conservation

plans, environmental education and awareness programs, or the promotion of environmental offsets to counterbalance specific impacts caused by infrastructure.

While tourism provides important benefits to the Tanzanian economy, its proceeds do not adequately trickle down to local communities. Creating strategic policies and economic incentives that enhance local capacity for providing goods and services to the tourism industry will promote a more equitable sharing of revenue. Namibia is internationally recognized for its successfully implemented community-based conservation model. By empowering communities to manage the country's natural resources, supported by legislation that created linkages between conservation and economic opportunity, Namibia was able to significantly increase its wildlife numbers and benefits from tourism (box 2.7).

#### **BOX 2.7: NAMIBIA'S SUCCESS WITH SUSTAINABLE COMMUNITY-BASED WILDLIFE CONSERVATION**

In 1990, when Namibia became independent, the country's wildlife numbers were at historical lows. Wildlife was a state-controlled asset which local communities did not benefit from. Human-wildlife conflict was prevalent.

However, in 1996, the government took the strategic decision to pass legislation, the Nature Conservation Act, which legally authorized communities to manage their own local natural resources including wildlife and benefit from it. Under the Act, communities can establish and register a communal conservancy, and generate income from it through for example tourism, trophy hunting, harvesting, and marketing natural products. Communal conservancies are self-governing, democratic entities, run by their members with fixed boundaries, recognized but not governed by the government.

Today, Namibia has about 80 registered conservancies covering nearly 20 percent of the country. This community-based natural resources management model allowed wildlife numbers to recover, and now the country has some of the largest free roaming black rhino and cheetah populations worldwide. Wildlife is seen as an economic asset to be managed, as communities are benefiting from it. Conservancy activities have become a major source of income for communities in the form of cash, employment and others.



## 2.6 Degradation of Freshwater and Marine Fisheries

Fisheries play an important social, economic, and nutritional role. The fisheries sector in Tanzania directly employs over 200,000 fishers, and another 4 million people are obtaining an income through fisheries-related jobs such as boatbuilding or fish processing (MALF, 2016). About 363,000 metric tons of capture fisheries products were produced in 2016, with most of the production coming from inland fisheries (85 percent) (MALF, 2016). The fisheries sector contributes about 2 percent to GDP, while the fishery industry accounts for about 10 percent by value of national exports (Economic Survey Report 2016 in MALF, 2016). While this contribution may appear limited, the sector is

a vital source of food security, employment and income, and, combined with agriculture, is a mainstay of livelihoods.

Approximately 10 million people depend directly on the integrity of coastal and marine natural resources for their livelihoods. Most communities along Tanzania's 1,424 km coastline are engaged in fishing to some extent. The country has rich fishing grounds, where more than 1,755 species have been recorded, of which 46 are commercially important (Froese and Pauly, 2019). Marine fisheries primarily occur within 40 miles of the coast, using handlines, gillnets, and drag nets, and in water depths of less than 500 meters.

### BOX 2.8 TANZANIA AND THE GREAT LAKES

Tanzania is the only African country where all three of the African Great Lakes—Victoria, Tanganyika, and Nyassa/Malawi—are found. These are some of the largest lakes in the world and they contain the largest numbers of endemic fish species. At the same time, these lakes are a prime example of how pressures on natural resources mount with an increasing population, both in terms of increasing pollution loads within the lake basins and direct pressure on the important fisheries that these lakes sustain.

The Lake Victoria Basin is a major population center in Africa, home to around 35 percent of the East African Community (EAC) population, even though it covers less than 12 percent of the EAC's land area. The basin would be the 6th largest country in Sub-Saharan Africa (SSA), with over 46 million inhabitants, and its mean population density is an order of magnitude higher than that of SSA as a whole. 50 percent of the basin's population (around 23 million)—approximately 32 percent of EAC's total poor population—are living on less than \$1.25/day. The poor are concentrated in the densely settled areas (especially uplands) and around lake shores (drawn by fishery opportunities). Given these high numbers, the importance of thriving ecosystems and a healthy lake cannot be overstated.



Inland freshwater bodies comprise about 37 percent of Tanzania's land area and support both domestic consumption and international exports. Tanzania has thirteen major lakes, including the Lake Victoria, Lake Nyasa/Malawi, and Lake Tanganyika. Lake Victoria is the second largest freshwater body in the world and supports the largest fishery in the country and one of the largest in East Africa, with fishing operations ranging from small-scale subsistence fishing to large-scale operators selling both locally and internationally. Poverty levels are high around Lake Victoria, with most people relying on the basin's natural resources for their livelihoods (box 2.8).

## ENVIRONMENTAL DEGRADATION, OVERFISHING, AND THE USE OF ILLEGAL, DESTRUCTIVE FISHING METHODS ARE THREATENING TANZANIA'S FISHERIES

Inland pollution and degradation of coastal and aquatic environments are threatening the sustainability of Tanzania's fisheries resources, and their capacity to provide food and generate income. The coastal areas of mainland Tanzania

and Zanzibar encompass about 15 percent of the country's land area and are home to approximately 25 percent of the population, which is growing at a steeper rate than the rest of the country. Environmental degradation coupled with pollution along the coastlines and in the marine areas (box 2.9), together with a decline in biodiversity, are both evidenced by decreasing yields of fish, deteriorating conditions of coral reefs, and a steady reduction of the coastal areas covered by mangroves and forests. Inland, Lake Victoria's watershed has one of the highest population densities in the world. The Basin's population has grown from 35 million in 2006 to 45 million in 2017. Urbanization is driving populations to cities along the lakeshore, with the population of Mwanza, for example, having increased by 40 percent in the 10-year period of 2002–12. Pollution from industrial and agricultural sources has increased, as their waste is discharged untreated into the lakes, degrading water quality and affecting aquatic life. Water pollution is further exacerbated by the high sediment load caused by unchecked erosion in upper catchments and the discharge of untreated municipal and industrial waste associated with unsustainable land management, rural subsistence livelihoods, and dense population centers.

### BOX 2.9: MARINE LITTER AND PLASTIC POLLUTION

Marine pollution comes from a wide variety of sources, from non-point sources (e.g., agriculture) to point sources such as wastewater, solid waste, and lost fishing gear. There are currently an estimated 150 million metric tons of plastics in the oceans worldwide, with 5 to 13 million metric tons added every year. Marine plastic pollution has become a global concern. International institutions, countries, and multiple non-governmental organizations recognize the severity of this issue, and the European Union, G20 and G7 have made specific commitments and/or adopted action-plans on combatting marine litter.

Marine pollution and marine plastics have adverse impacts on fish populations, coral reefs, ocean health, and possibly human health, food chains and other essential economic and social systems, as they have on human livelihoods through tourism, fisheries, and access to water. Solutions to tackle this global issue require new policies, behavior change by consumers and industries, investments, innovation and private sector interventions, customized to each country and with an essential role given to communities.

Detailed data on marine litter is limited in Tanzania. There is a need for baseline studies to identify the sources and pathways of plastic pollution, policy reviews toward strengthening the regulatory framework, and establishing a circular economy by reducing, recycling, and reusing plastic waste.

Overfishing, both by industrial vessels and by uncontrolled small-scale fishing, progressively undermines the resource base that many poor communities depend on. While Lake Victoria-wide Nile perch production was estimated at 400,000–500,000 metric tons in the 1990s and early 2000s, the catch has probably declined to about 230,000 metric tons (MALF, 2016). Several fish-processing factories have closed, and fishing is shifting to lower-value species and local markets. Similarly, marine fisheries have declined, and there is evidence of fishermen noting poor catches and smaller fish. There is little room for expanding capture fisheries production, as more fishing effort is unlikely to increase catches. Some increase may be gained from fishing deeper ocean waters and from improved efficiency in the smaller pelagic fisheries. The limited potential of many coastal fisheries requires that fishing efforts be reduced to become sustainable.

**Overfishing, both by industrial vessels and by uncontrolled small-scale fishing, progressively undermines the resource base that many poor communities depend on.**

Pressure from overfishing and the use of destructive fishing methods have greatly undermined the marine ecology and changed species composition. Destructive fishing techniques, such as blast fishing or beach seines, have significantly contributed to degrading fish habitats and ecosystems (box 2.10). It is estimated that about a third of regional marine fish stocks are overexploited or depleted, while a further 40 percent are fully exploited. About 20 percent of the Lake Victoria Basin's 651 freshwater species are currently threatened with extinction. Of the 204 fish that are endemic to Lake Victoria, 76 percent are presently at risk of extinction. Many of these species are important to local livelihoods as they provide food and generate income. The country is implementing measures to better monitor, control, and surveil its vast resources, but many challenges related to limited funding, staffing, equipment, and others remain. The difficulty of monitoring compliance coupled

with growing pressure from coastal communities increase the occurrence of illegal, unreported, and unregulated fishing, which in turn might further deplete stocks and incur in further revenue loss for the country.

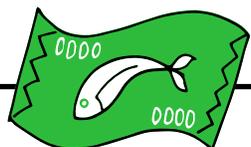
**ALTERNATIVE LIVELIHOOD OPPORTUNITIES ARE NECESSARY TO REDUCE PRESSURE ON FISHERIES**

The development of the fisheries sector faces several constraints on harnessing its full potential. These need to be tackled by strengthening the legal and institutional frameworks; developing human capacity and infrastructure; establishing strategic coordination between the mainland and Zanzibar legislations, policies, and programs; improving knowledge of the environmental, social, and economic state of the fisheries; improving the business climate and raising private investments; and improving maritime safety.



# Over 10 million

PEOPLE DIRECTLY DEPEND ON THE  
INTREGITY OF COASTAL AND MARINE  
RESOURCES FOR THEIR LIVELIHOODS



As Tanzania approaches, or even surpasses, the sustainable limit of exploiting its fisheries resources, attention needs to be shifted toward alternative livelihood opportunities in post-harvest value added, aquaculture, and recreational fisheries or other sectors. There is large potential for increasing the efficiency of current systems and for value addition, rather than continue increasing the fishing effort. Post-harvest losses amount to 20 percent of the total catch due to insufficient infrastructure and capacity

constraints. Knowledge and capacity gaps, combined with deficient transportation, storage, and processing facilities and markets limit the sector's potential development.

Part of the domestic demand not covered by capture fishery can be supplemented by aquaculture activities. Tanzania's aquaculture sector remains underdeveloped and has significant potential for expansion in both small-scale inland ponds and coastal locations. There are sufficient water resources in many areas to support fish production. Policy and technical support of programs that encourage smallholders to work together will empower communities and give access to larger markets. Seaweed cultivation is also growing and over 15,000 women are engaged in this activity, producing 5,000 metric tons (dry weight) per year. Capacity building, investments in infrastructure, inputs, and technology, and reliable access to finance are fundamental for this sector to realize its potential.

## BOX 2.10: SUCCESSFUL ERADICATION OF BLAST-FISHING IN TANZANIA

Blast-fishing refers to the use of explosives to kill or stun fish, for food. Globally, it has mostly been prevalent in south-east Asia, notably the Philippines, Indonesia, and Malaysia. In the western Indian Ocean, the only country where the practice has significantly taken root is Tanzania. Blast-fishing in Tanzania dates from the mid-1960s and was first made illegal in the Fisheries Act of 1970. Nonetheless, blast-fishing became increasingly widespread during the 1980s and 1990s, causing significant damage to coral reef habitats and fish communities (Bryceson, 1978; UNEP, 1989).

Blast-fishing was successfully suppressed for a 5-year period (from 1998–2002), thanks to government enforcement action led by the Tanzania Navy, with support of project-based initiatives in Mtwara, Tanga, and Mafia Island. As those initiatives wound down, blast-fishing resurged from 2002 onward along the entire mainland coast, particularly around the urban centers of Tanga, Dar es Salaam, Lindi, and Mtwara. By 2014–15, when monitoring initiatives started, sites in Kilwa and Mtwara, for example, were averaging 10–20 blasts per day, with a high of 90 recorded blasts in a single day in Songosongo Islands (Rubens, 2016).

The period 2015–16 witnessed several turning points, including the establishment of a government Multi-Agency Task Team (MATT) on environmental crime in June 2015 under the leadership of the Tanzania Police; related enforcement capacity building; and the announcement of a zero-tolerance policy by the government in August 2016. A series of interventions followed along the mainland coast over a 16-month period. By December 2017, the incidence of blast-fishing had been reduced by 88 percent since the peak levels during mid-2016 (Tanzania Blast Monitoring Network). Interventions ranged from public assertions of authorities by national, regional, and district leaders to intelligence-led enforcement operations by relevant national agencies, with financial support from the government and the World Bank through the South West Indian Ocean Fisheries Governance and Shared Growth (SWIOFish) Project. A highly destructive and illegal fishing practice that had flourished for most of the past 50 years, has been brought under control, at least for the time being.

If Tanzania is to sustain growth and development in the fisheries and aquaculture sectors, it is important to protect the natural resource base on which these depend. Efficient management, supervision, and enforcement of legislation to avoid overexploitation and destruction of the aquatic resource base in the country are mandatory. A good example on how this can be achieved is given by the government's aforementioned success in effectively combatting blast fishing (box 2.10). Investments to help strengthen the country's capacity to sustainably manage priority fisheries can further increase productivity and foreseeable opportunities for adding value in the sector for the benefit of the national economy.

As fisheries are not considered a Union matter, mainland Tanzania and Zanzibar manage their fisheries resources separately. The Deep Sea Fishing Authority (DSFA) is responsible for the management of fisheries in the country's Exclusive Economic Zone (EEZ), including the issuing of tuna fishing licenses to foreign vessels. Coordination between mainland and Zanzibar legislations and programs on fisheries must also be improved, for example by defining common management measures of shared stocks (a prime example is the anchovy fishery, whose stocks are shared by both), sharing information on

monitoring, control and surveillance, patrolling, and data on fishing statistics.

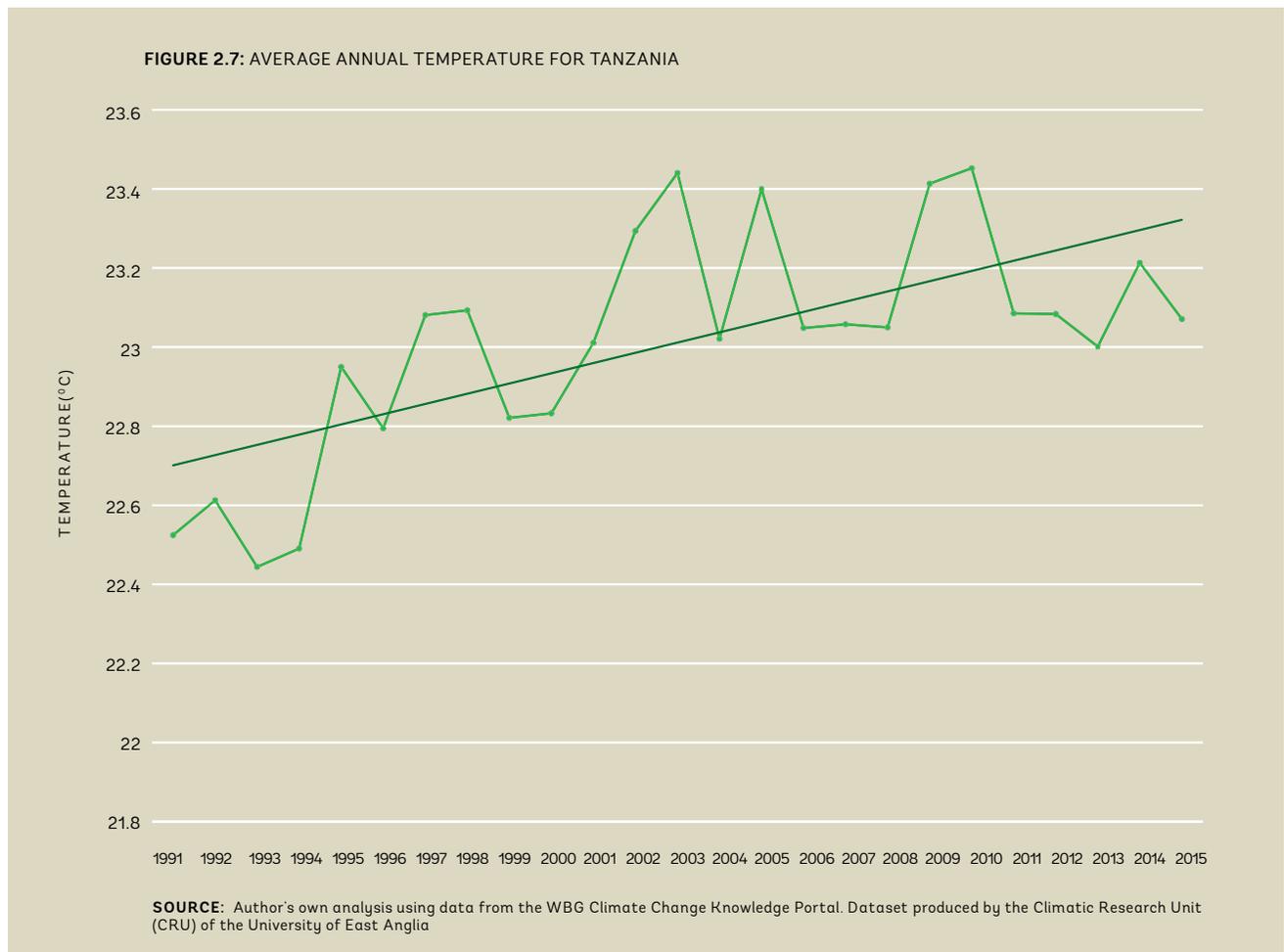
Greater regional cooperation will be needed to reinforce sustainable growth in the sector. Tanzania's fisheries sector is part of an even larger marine ecosystem—the South West Indian Ocean. The whole region can benefit from activities that help protect and sustain that sector. Regional coordination is therefore essential to ensure that the responsibilities and benefits are shared by the countries concerned. This is especially relevant for highly migratory species such as tuna and tuna-like, where one large stock migrates from country to country. Integrated management of these stocks at the regional level is crucial to prevent overfishing, and Tanzania is part of regional bodies and treaties that facilitate this regional integration (such as the Indian Ocean Tuna Commission). Furthermore, countries can profit from economies of scale through a more cohesive approach in terms of monitoring, control and surveillance, joint patrolling, and safety at sea. A more regionally coordinated fisheries sector can likewise provide platforms for sharing of knowledge and technology, which can help countries address national constraints and other issues that significantly affect the region.



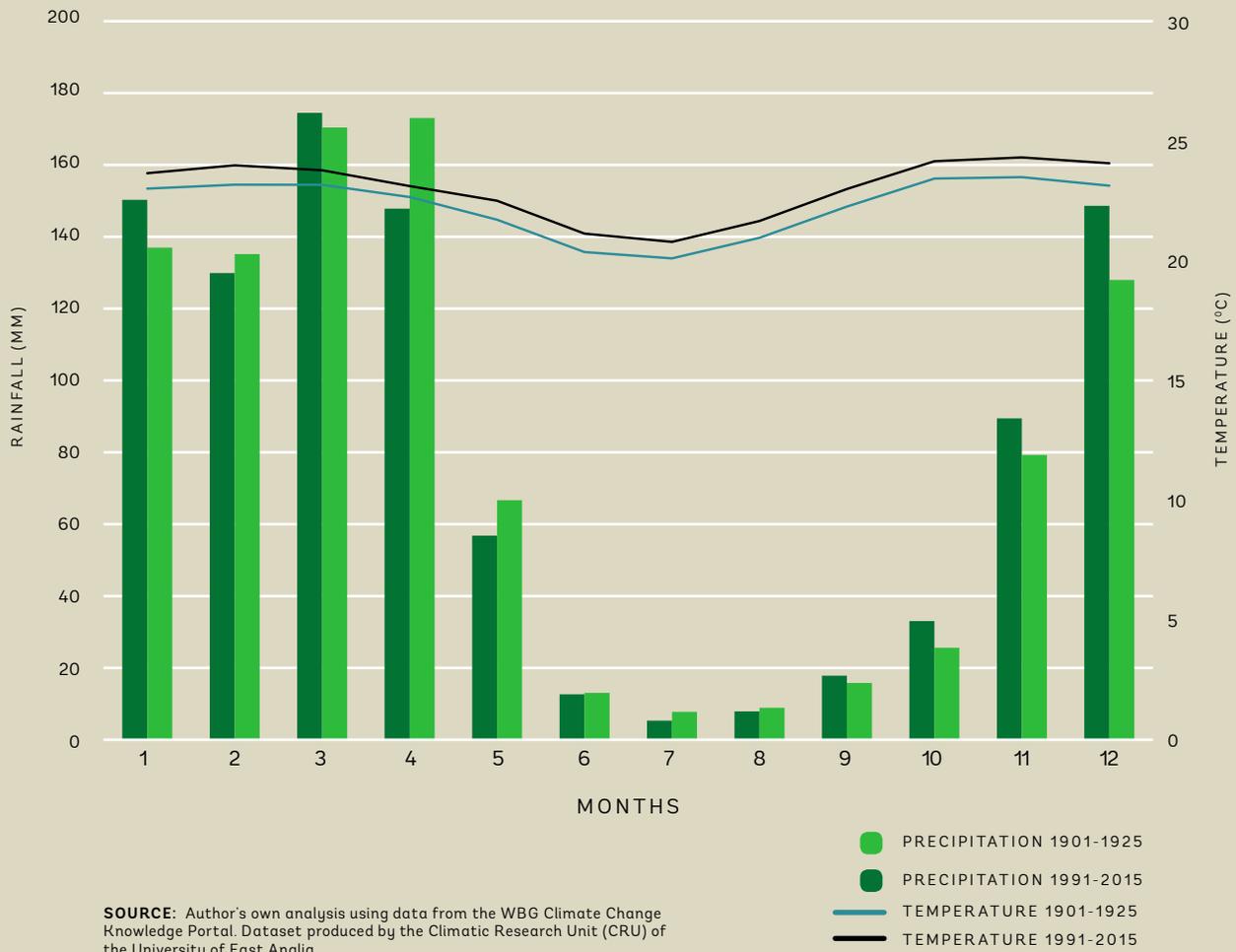
## 2.7 Climate Change and Tanzania's development

Tanzania is highly vulnerable to climate change, imposing an additional risk to already stressed natural resources. As temperatures continue to rise globally, drought conditions that already affect Tanzania are likely to become worse, affecting water availability. Erratic rainfall patterns and higher frequency of intense rainfalls with large inter-seasonal variability will affect smallholder farmers, pastoralists and local economies. Over the long term, sea level rise threatens coastal areas and infrastructure. Climate change is a “multiplier” of existing challenges, as its effects cut across all aspects of natural resource productivity and management. Efforts to promote climate resilience in key natural asset-based sectors will be essential to protect rural livelihoods, food security, jobs, and economic growth. Fortunately, the cost of investments in climate resilience are lower than the cost of disaster recovery and fully aligned with good development practices.

Temperatures are rising. Past climate records show an increasing trend in average annual temperature for Tanzania (figure 2.7). This is consistent with the latest Intergovernmental Panel on Climate Change (IPCC) Report, which establishes that temperatures in Africa, including East Africa, have seen an increase in seasonal mean values in many areas. Projections of future temperatures vary across the different models, but there is strong agreement that temperatures will continue to increase. The URT-VPO (2014a) projects that temperatures across Tanzania will increase by 2100, though to varying degrees. Temperatures are projected to increase by up to 3.28°C in the northern coast regions and northeastern highlands, by up to 3.3°C in the Lake Victoria zone, and by up to 3.18°C in the southern coast. Temperature increases will be most pronounced in the southwestern highlands (up to +3.4°C).



**FIGURE 2.8** AVERAGE MONTHLY TEMPERATURE AND RAINFALL FOR TANZANIA



Precipitation is expected to change, but to what extent is uncertain. Historical records point at decreasing trends nationally for mean annual rainfall and increasing dry spells (figure 2.8). Parts of northeast and southern Tanzania have become drier, central Tanzania has become moderately wetter, and the northwest has been experiencing stronger wet trends. While precipitation is increasingly unpredictable, projections suggest some parts of the country may experience an increase in mean annual rainfall of up to 18-28 percent by 2100, especially pronounced over the Lake Victoria Basin and North-Eastern Highlands with up to 28.3 percent, and 16.3 percent, respectively. An increase in mean annual rainfall is also projected in the south western highlands and western zones, and the north and southern

coast zones, even though to a lesser extent (URT-VPO, 2014a).

Extreme weather events are becoming more frequent, and they need to be considered during strategic planning. As climate evolves, an overall increase in the frequency and intensity of heatwaves is expected. The number of days exceeding 35°C, signifying heat stress, is predicted to increase. There will also be a higher likelihood of dry spells and intense rainfall events is also expected, as well as higher potential for flooding.

Climate change is already having significant impacts on marine and coastal ecosystems in Tanzania and on related fisheries. Impacts of climate change on fisheries can be grouped into: acidification, sea level rise, higher water

temperatures, and changes in ocean currents. While our understanding is constantly improving, these impacts, however, are unequally known and hard to model, both in terms of scope—where they will occur and where they will be felt the most—and severity. Impacts will be felt at two fundamental levels: first on fish stocks themselves, and second, and perhaps more important, on the critical marine and coastal ecosystems fish depend on.

The agriculture sector will be affected by changing weather patterns. Using Coupled Model Intercomparison Project Phase 5 (CMIP5) data under the scenario of fastest growth of GHG

concentration (Representative Concentration Pathways (RCP) 8.5), areas classified as drylands in East and Central Africa are likely to be 20 percent larger by 2050 (Cervigni and Morris, 2016; World Bank, 2017c). Under these scenarios, rain-fed agriculture will be affected. Some places will experience more rainfall than usual, while other areas might experience longer dry spells punctuated by intense rainfall (World Bank, 2015a). Pastoralists will also be adversely affected, being forced to move to other areas in search of greener pastures, adding to possible land conflicts. Projections show that a 2°C increase in temperature by 2050 will reduce yields of important grain crops—such as maize, sorghum, and rice—by 13 percent, 8.8 percent, and 7.6 percent respectively (Rowhani et al., 2011). Further, temperature increase and erratic rainfall both cause increases in pests and diseases, and a shortening of the growing seasons.

Wildlife will be affected by climate change and thus translate into impacts on the tourism sector. Prolonged droughts affect availability of food and water necessary for survival. In Tarangire National Park, for instance, severe drought conditions led to the death of a high number of elephant calves, affecting subsequent generations (Foley et al., 2008). This adds further pressure on animal species that are already facing anthropological threats. A study on 321 reptile species in Tanzania found that over 99 percent of the species were highly vulnerable to climate change, based on the RCP 8.5 emissions scenario for the period of 2071–2100. In turn, species extinction due to climate change would be detrimental to Tanzanian ecosystems and its economy.

While uncertain, aggregate models suggest that net economic costs from climate change could be equivalent to 1 to 2 percent of GDP per year by 2030, in addition to existing costs resulting from climate variability (Watkiss et al., 2011).

**BOX 2.11: INCREASING CLIMATE RESILIENCE IN AGRICULTURE**

Climate-smart agriculture is an approach to developing the necessary technologies, policies, and investments to achieve sustainable agricultural development for food security under climate change. Examples include the following:

- Soil management and erosion control
- Promoting intercropping, low-tillage farming, and mulching
- Improved, efficient irrigation systems, water conservation, rainwater harvesting
- Exploring drought-tolerant crop varieties
- Supporting alternative livelihoods such as beekeeping.

Agroweather tools improve farmers' and pastoralists' access to climate and weather information. This enables them to make more informed decisions about the timing and type of crops to plant and when and where to graze their herds.



## EARLY ACTION TO BETTER MANAGE CLIMATE IMPACTS IS IMPORTANT AND COST-EFFECTIVE

The cost of avoiding climate impacts is typically much lower than that of projected associated damages. In dryland Africa, mitigating climate impacts demonstrated that the benefit-cost ratio of resilience investments in most cases exceeds 5 (Cervigni and Morris, 2016). The climate adaptation responses that were modeled covered three different pathways toward improving resilience—raising rural productivity, introducing safety nets, and facilitating alternative actions such as economic diversification or internal migration. There is a wealth of knowledge and experience accumulated around climate resilience in key sectors such as agriculture, transport, water resources or human settlements. These experiences point at the importance of mainstreaming climate change considerations during the identification and design of activities. Climate change adaptation should be heavily promoted in Tanzania, and be fully consistent with

good natural resources management. Current and future impacts of climate change make the case for prompt action stronger than ever.

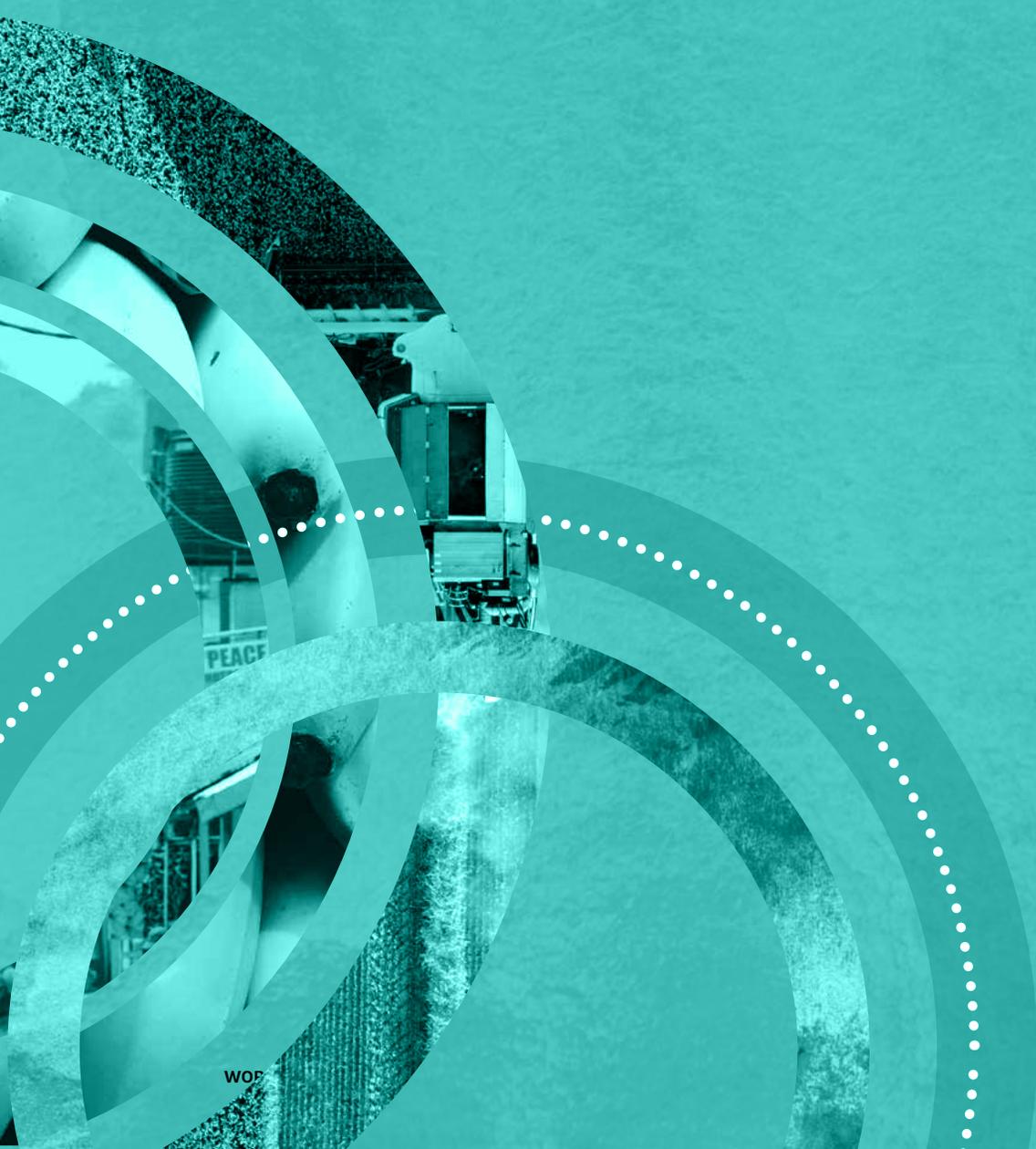
Using climate-smart agriculture and landscape approaches together can address multiple environmental issues, increase agricultural productivity, and contribute to enhanced food security and incomes. These will help build resilience to climate change among the poorest households. As per FAO definition, pursuing climate-smart techniques and technologies would require a transformation of agricultural systems to effectively support development and ensure food security in a changing climate (box 2.11). If effectively implemented, climate-smart agriculture has proven to be a win-win solution in many countries, increasing productivity and minimizing losses. Tanzania has also significant potential to better harness renewable energy solutions. Exploring ways to increase the country's access to climate finance from a variety of sources is recommended to help meet the increasing demand for (renewable) energy.





3

# Urban and Industrial Environmental Challenges





### 3.1 Environmental Pollution and Key Trends

Environmental pollution has increased globally over the past few decades, and nowhere more rapidly than in developing countries. In 2015, approximately 9 million premature deaths, or 16 percent of all deaths worldwide, were attributed to diseases caused by air, land, and water pollution – significantly more than those caused by AIDS, tuberculosis, and malaria combined (Landrigan et al., 2017). Over 90 percent of pollution-related deaths occur in low- and middle-income countries (Landrigan et al., 2017). The poor, the marginalized, the elderly and the young are particularly vulnerable groups. Despite its significant impact on human health and the environment, pollution is still often neglected in policy- and decision-making processes.

**In Tanzania, the estimated economic cost of premature deaths attributed to pollution (i.e., ambient and household air pollution, and unsafe water and sanitation) was over \$28,700 million (\$28.7 billion) in 2013.**

The estimated economic cost of premature deaths attributed to pollution in Tanzania (i.e., ambient

and household air pollution, and unsafe water and sanitation) was over \$28,700 million (\$28.7 billion) in 2013 (Roy, 2016). This estimate factors in the risks associated with ambient and household air pollution from particulate matter (PM), unsafe water, and unsafe sanitation. These high pollution-related costs are an underestimation of the overall problem, as health impacts caused by other sources (for example, ozone exposure and lead exposure) are not included. In addition, environmental pollution impacts are often not directly attributed to their source and remain hidden in other statistics.

Awareness of the negative impacts of environmental pollution has increased, but significant knowledge gaps in data and information persist about its causes, magnitude, and effects in Tanzania. Accurate and regularly updated data are critical for developing sustainable policies and management solutions. Additional research and systematic data collection on the sources, distribution, dispersion, and health effects of pollution are needed, they constitute the basis from where Tanzania should further build improved management systems. The main sources and effects of specific environmental pollutants are explained in table 3.1.

**TABLE 3.1: SOURCES AND EFFECTS OF POLLUTANTS IN TANZANIA**

| POLLUTANT  | MEDIUM               | PRIMARY SOURCES  | ENVIRONMENTAL/HEALTH EFFECTS   |
|--|----------------------|--|--|
| <b>Sulfur dioxide (SO<sub>2</sub>)</b>   | Air                  | <ul style="list-style-type: none"> <li>• Industry (cement, lime, plaster)</li> <li>• Fossil fuel combustion (thermal plants, vehicle exhaust)</li> </ul>   | <ul style="list-style-type: none"> <li>• Respiratory problems, eye irritant</li> <li>• Converts to sulfuric acid in the atmosphere (acid rain), which damages plants, aquatic life and concrete structures</li> <li>• Precursor of particulate matter (PM)</li> </ul>  |
| <b>Particulate matter (PM)</b>   | Air                  | <ul style="list-style-type: none"> <li>• Biomass burning (such as cooking with charcoal or wood, but also forest fires or solid wasteburning)</li> <li>• Industrial emissions (cement, lime, and plaster)</li> <li>• Fossil fuel combustion</li> </ul> | <ul style="list-style-type: none"> <li>• Respiratory problems</li> <li>• Cardiovascular diseases</li> <li>• Carcinogenic</li> </ul>  |
| <b>Heavy metals (mercury, arsenic, cadmium)</b>  | Air<br>Water<br>Soil | <ul style="list-style-type: none"> <li>• Industrial emissions (iron and steel)</li> <li>• Gold mining</li> <li>• E-waste</li> </ul>  | <ul style="list-style-type: none"> <li>• Damaging to nervous system, carcinogenic</li> <li>• Mental and physical birth defects</li> <li>• Bioaccumulates (builds up) in organisms over time</li> <li>• Biomagnifies in food chain, leading to significantly higher concentrations in predators (including humans)</li> </ul> |
| <b>Chemicals (including a wide range of chemicals that have varying health effects and risks and should be individually evaluated)</b> | Air<br>Water<br>Soil | <ul style="list-style-type: none"> <li>• Industry (particularly plastic production)</li> <li>• Agriculture (pesticides, herbicides, and fungicides)</li> </ul>   | <ul style="list-style-type: none"> <li>• Carcinogenic</li> <li>• Endocrine disruptors</li> <li>• Mental and physical birth defects (particularly in children of agricultural workers)</li> </ul>   |
| <b>Organic waste</b>   | Air<br>Water<br>Soil | <ul style="list-style-type: none"> <li>• Agricultural waste and runoff</li> <li>• Sewage runoff</li> <li>• Industrial emissions</li> </ul>   | <ul style="list-style-type: none"> <li>• Eutrophication of water bodies (leading to depletion of oxygen in water)</li> <li>• Waterborne diseases such as cholera, dysentery, hepatitis A, and typhoid fever</li> </ul>   |

Preventing pollution today avoids tomorrow's costly cleanup actions and offers no-regret options toward alleviating poverty and creating opportunities for a healthier and more productive population. Improved pollution management can enhance competitiveness through, for example, job creation, increased energy efficiency, sustainable development in Tanzania's urban and rural spaces, and improved infrastructure and transport. It can also be effective in contributing toward climate change mitigation. The CEA has identified improved management activities toward addressing six key pollution-related challenges that need attention:

A. A multipronged approach is needed to curb air pollution. A detailed study concluded that around 26,000 Tanzanians died prematurely in 2013 from causes attributable to PM air pollution (Roy, 2016). Most of these deaths

(over 22,000) were caused by household (sometimes referred to as indoor) air pollution, which is associated with the widespread use of solid biomass fuels (wood and charcoal) as domestic energy source. Curbing household air pollution will require increasing access to alternative energy sources, which in turn will contribute to reducing deforestation (one of the key precursors of forest degradation is fuelwood collection and charcoal production). Outdoor or ambient air pollution, primarily in the form of vehicle exhaust, industry emissions, and forest fires, should be monitored and properly regulated to keep it from getting worse.

B. Providing the population with access to sustainable clean water and sanitation services reduces the spread of diseases such as cholera, diarrhea, dysentery, hepatitis A, and typhoid

fever. In 2013, health-related costs associated with unsafe water and sanitation in Tanzania were estimated to be about \$10 billion and \$7.6 billion, respectively (Roy, 2016). It is estimated that food and waterborne diseases, as well as water-contact diseases, affect millions of people in the country's urban areas. Key causes of water pollution are rapid and unplanned growth of urban areas, untreated wastewater discharge from households, inadequate solid waste collection and disposal, widespread and unplanned farming and cattle ranching, and industries' effluents.

- C. Improving industrial pollution regulations, monitoring and enforcement are highly cost-effective investments to prevent higher pollution loads in the medium term. Tanzania's industrialization drive is still in its early stages, however, there is growing concern of increased pollution if the process is not properly managed. An analysis at the regional and local levels revealed that industrial pollution loads are concentrated in a few geographical areas, with Dar es Salaam producing about 88 percent of all industrial pollution. All other regions have industrial pollution loads well below those of Dar es Salaam. Using and effectively applying the Environmental Impact Assessment (EIA) tool is key to curb industrial pollution.
- D. Managing municipal solid waste (MSW) effectively and in an environmentally sound manner is critical to minimizing associated environmental and health impacts. In Tanzania, projections suggest a significant increase from current MSW levels. It is estimated that in 2012, Tanzania generated 2,425 metric tons of MSW per day—a higher amount, in absolute terms, than generated by Kenya and Uganda. Even though solid waste management (SWM) is regulated, less than 40 percent of households are estimated to have access to waste collection services (Huisman, Breukelman and Keesman, 2016). In urban areas, as much as 80-90 percent of MSW is not collected (NBS, 2017b). In addition to significant effects on the environment and health, poor solid waste management is one

of the main causes of the devastating floods witnessed in Dar es Salaam. Floods are not only caused by a changing climate or by the intensity of rains alone, but by upstream deforestation and land degradation, combined with insufficient and failing urban drainage, frequently clogged by MSW.

- E. While e-waste generation is relatively low in Tanzania in comparison with other African countries, low collection rates and informal disposal points pose significant environmental and health risks. Tanzania generated around 38,000 metric tons in 2016, with a rising trend (Baldé et al., 2017), most of which is disposed of informally (Magashi and Schlupe, 2011). Informal recycling practices, for example open-air burning to retrieve valuable components such as gold, pose significant health risks and are common in Tanzania. Developing an adequate regulatory and management framework is important in view of the rapidly increasing use of electronics.
- F. As healthcare waste (HCW) is more likely to cause an infection and/or injury than any other type of waste, and its nature requires very specific collection and disposal practices, its adequate management is critical. In its absence, HCW can not only be expected to have serious public health effects, but also significant environmental impacts—in terms of air, water, and land pollution. Given the rapidly growing population and the expanding provision of healthcare, the environmental and health risks stemming from inadequate HCW management will become larger and need to be addressed. No reliable data are available on the amounts of HCW generated in Tanzania, and despite the National Standards and Procedures for HCW Management requiring that records be kept on HCW generation and disposal, most of the estimated 3,760 healthcare facilities fail to do so. While Tanzania has a solid regulatory HCW framework, its implementation needs strengthening.
- G. Rapid population growth and the associated growing demand for food have resulted in increased pesticide use worldwide, Tanzania

being no exception. Despite a comprehensive legal framework, the safe handling of pesticides in Tanzania is not always ensured. The release of pesticides into the environment may contaminate soil and water bodies, affecting nearby ecosystems, habitats, and wildlife species. In addition, pesticide exposure can cause a variety of adverse human health effects, from simple skin and eye irritation to more severe effects on the nervous system. Training farmers on safe usage and handling of pesticides can significantly reduce the associated environmental and health risks.

H. Mining and quarrying activities include the extraction of metals, industrial minerals,

and fuel minerals. By their very nature, small- and large-scale mining operations are unsustainable, and inherently detrimental to the environment. Establishing a mine requires clearing land, causing the loss of forests and biodiversity, which in turn affects the local surroundings and communities. Once established, mining can generate significant pollution through leakages and mineral waste that is dumped in nearby rivers, mine tailings, and by highly polluting additives required in the extraction processes. Use of toxic substances such as mercury poses significant health and environmental risks.

## 3.2 Air Pollution

The World Health Organization (WHO) states that air pollution is the largest single environmental health risk, causing millions of deaths annually around the globe. Air pollution, defined by WHO as “contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere,” represents one of the biggest environmental challenges to development. Pollutants of major public health concern include particulate matter (PM), carbon monoxide, ozone, nitrogen dioxide, and sulfur dioxide.

**In Tanzania, over 3,845 and 22,729 premature deaths were attributable to outdoor and indoor PM air pollution, respectively, in 2013.**

PM is among the most harmful air pollutants. PM is a mixture of extremely small solid particles and liquid droplets that are suspended in the atmosphere. The sources of PM can be natural (dust, forest fires, marine aerosol) as well as anthropogenic (residential wood and charcoal burning, agricultural burning, trash incineration, fossil fuel combustion, vehicle emissions, industrial emissions).

PM is classified based on its size. PM10 particles can pass through the respiratory system into the lungs while the smaller PM2.5 particles are even more dangerous because they can enter the blood stream. The adverse health effects from PM exposure are well documented and include respiratory problems, cardiovascular disease, and cancer. Prolonged exposure causes sickness and premature death. Globally, between 1990 and 2013, the total number of annual deaths attributed to outdoor PM pollution rose by 36 percent, to around 250,000 worldwide, while the total number of deaths attributed to indoor household air pollution rose by 18 percent, to over 450,000 (Roy, 2016). For all countries in Africa where data was available, in 2013, the estimated economic cost of premature deaths from outdoor pollution was approximately \$215 billion, and from household air pollution about \$232 billion.

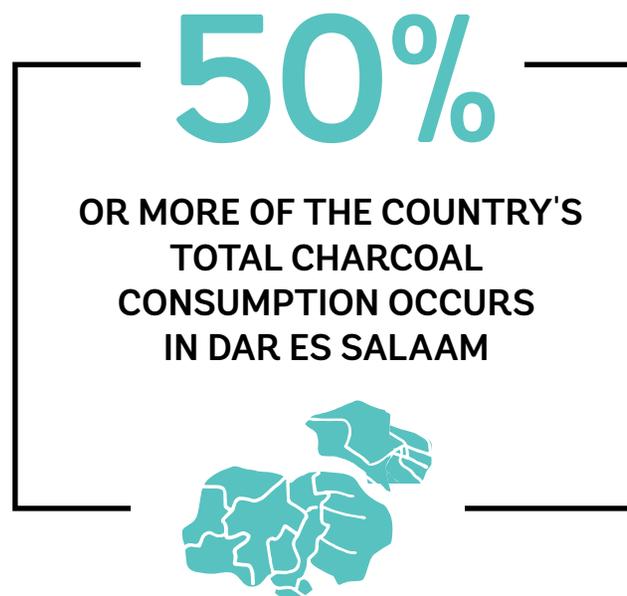
### AIR POLLUTION IN TANZANIA IS MOST SEVERE INDOORS

Global estimates suggest the impact of air pollution caused by PM is high in Tanzania. Over 3,845 and 22,729 premature deaths were attributable to outdoor and indoor PM air pollution, respectively in 2013 (table 3.2). These mortality figures are

higher than those of neighboring countries (table 3.3). In economic terms, this costed the country around \$11 billion in 2013.

Household air pollution is mainly caused by widespread use of solid biomass fuels (such as charcoal and fuelwood) for cooking. Poor housing conditions, with limited ventilation, and traditional, inefficient cookstoves compound the problem. Tanzanian households, as in most of Sub-Saharan Africa, continue to depend on solid fuels — for instance, wood, dung, charcoal, and agricultural residues—for their energy needs. An estimated 85 percent of Tanzania’s energy needs are met through biomass use in the form of charcoal and firewood, predominately for cooking and heating (NBS, 2017a). Dar es Salaam accounts for approximately half of Tanzania’s total annual consumption of charcoal and its consumption is expected to increase, thus

exacerbating the problem. Women and girls, traditionally the most involved in household tasks, are particularly exposed to smoke and PM.



**TABLE 3.2:** ESTIMATED PREMATURE DEATHS FROM POLLUTION AND ECONOMIC COST IN 2013

|  | AMBIENT PM POLLUTION | HOUSEHOLD AIR POLLUTION | UNSAFE WATER | UNSAFE SANITATION |
|--|----------------------|-------------------------|--------------|-------------------|
| Premature deaths (in 2013)                       | 3,845                | 22,729                  | 23,919       | 18,384            |
| Economic cost of premature deaths (\$, millions) | 1,603                | 9,477                   | 9,973        | 7,665             |

SOURCE: ROY, 2016.

**TABLE 3.3:** PREMATURE DEATHS FROM PM POLLUTION IN TANZANIA AND OTHER COUNTRIES 2013

| COUNTRY    | AMBIENT PM POLLUTION | HOUSEHOLD AIR POLLUTION |
|------------|----------------------|-------------------------|
| Tanzania   | 3,845                | 22,729                  |
| Kenya      | 3,952                | 15,440                  |
| Mozambique | 1,117                | 11,750                  |
| Uganda     | 5,933                | 16,630                  |

SOURCE: ROY, 2016.

## A MULTIPRONGED APPROACH IS NEEDED TO CURB AIR POLLUTION IN TANZANIA

More systematic data collection and knowledge creation are essential for better informed decision making. The government has signed several global initiatives to reduce air pollution—among others, the Clean Air Initiative of Sub-Saharan Africa—but given the range of issues faced by developing countries, including Tanzania, concrete action to tackle air pollution has so far received limited attention. This is at least in part due to insufficient knowledge about the magnitude of the problem. As previously stated, ambient and household air pollution combined caused over 26,000 premature deaths in 2013 alone. These estimates are based on global data and firmly anchored in well-known air pollution science. However, more specifics are needed for Tanzania: What are the main sources of PM pollution in the country? What is their concentration in the air in different areas of the main cities? How do they vary between day and night? What type of emissions do different fuels generate? These and many other questions are fundamental for a better understanding of the air pollution challenge in Tanzania. With more systematic assessments of the magnitude of the air quality problem—for instance, based on the use of online air pollution monitoring systems—better and more comprehensive data can be generated, and consequently, targeted and tailored policy actions can be taken.

A network of air quality monitoring stations, strategically placed in and around the major population centers, is needed to collect long-term real data on the concentration of pollutants in the outdoor environment. Due to the lack of monitoring stations, the data used in this section are collected through remote sensing. Given the rapidly evolving context, decisions made today, especially those related to hard infrastructure and the associated planning processes, will determine future exposure risks. Effectively prioritizing interventions requires dealing with issues such as the respective contributions to air pollution of vehicles, road dust resuspension, biomass burning, the use of backup generators (to mitigate

the impact of the unreliable electricity supply), the combustion of coal or petroleum products by industries and power stations, and the seasonality and spatial distribution of air quality.

Limiting the use of solid biomass fuels is the key to solving the main air pollution challenge that Tanzania faces. Fuelwood and charcoal are the main sources of energy at the household level. Combustion of these two solid fuels is inefficient and generates large quantities of smoke, particulate matter, soot, and other harmful products. Households use these fuels indoors, thus causing the inhalation of the smoke, which in turn causes morbidity and, in the long term, mortality. Helping households transition from biomass to modern fuels, such as gas bottles or cylinders of liquefied petroleum gas (LPG), or natural gas, is a key step toward reducing mortality and the associated costs.

Charcoal use for cooking is deeply rooted in Tanzanian households, and any strategy to reduce its use would need to consider technical, economic, and cultural aspects. Estimates vary, but the National Bureau of Statistics' data on charcoal use in Dar es Salaam show that around 88 percent of households use charcoal at some point for cooking. While the reasons for this vary, price seems to be a major one, as charcoal is the cheapest fuel currently on the market. The pricing system, the taxation regime on charcoal production, transportation, and wholesale, and the royalty system would have to be reviewed to gain insights into existing loopholes and facilitate the adoption of more environmentally friendly cooking methods. Charcoal is going to remain part of the energy mix for years to come, and any strategy that tries to limit its use should also consider an improvement in the cooking conditions of those households that still use it: improved cookstoves for better combustion efficiency and less emissions, and improved ventilation within households, are relatively easy measures that can yield immediate positive results.

While limiting charcoal use will have significant benefits, it may also have negative impacts that need to be considered. On the one hand, less charcoal production will alleviate the pressure on

forests and help reduce the country's alarming deforestation rate. It might also contribute to climate change mitigation, by curbing deforestation and preventing the release of CO<sub>2</sub> into the atmosphere. On the other hand, the charcoal business is large and currently sustains thousands of people, from producers to transporters to sellers. Careful consideration of alternative livelihoods and options for those making a living out of charcoal will need to be a part of the transition to other fuels. Some of Tanzania's forests are still in place because communities derive a livelihood from them by producing charcoal. If charcoal demand decreases, the forest loses its value and may ultimately be lost to agricultural expansion. Tanzania is already exploring ways to bring value to the forest, for example, through the production of sustainable charcoal, obtained by using only a fraction of a well-managed forest to produce charcoal, as featured in section 2 (box 2.2).

Ambient air pollution causes less damage in Tanzania than household air pollution, however it might increase rapidly. Sources of ambient air pollution include vehicle exhaust, industrial emissions, power generation, and others. As the country develops, the economy expands, and the government pursues its industrialization strategy, more airborne pollutants will be released into the atmosphere. Ambient air pollution is already a major public health concern in many megacities

worldwide, and Tanzania is in a position to plan ahead to prevent costly abatement measures in the future. This would include improved traffic measures and promotion of mass public transit systems (such as the Bus Rapid Transit system), control of vehicular emissions and fleet management, adoption of industrial technologies that minimize gas emissions, and promotion of alternative energy sources such as wind and solar, which generate virtually no gas emissions, compared to other power generation options such as diesel and coal, both of which generate large quantities of airborne pollutants.

More strategic collaboration across government authorities and improved enforcement is needed. The Vice President's Office (VPO) is the institution responsible for dealing with pollution, through its Division of Environment (DoE), as a crosscutting issue. Other ministries also have direct or indirect competencies related to the environment and human health. Enforcement of the legal provisions related to air pollution, however, is weak. While the 1997 environmental policy framework still applies today, it needs to be updated. Developing a sustainable urban energy strategy for Dar es Salaam (the main charcoal consumer in the country) would provide a useful framework for stakeholders to work together to achieve a more economically, environmentally and socially sustainable energy mix for the city.



### 3.3 Water Pollution

Providing the population with access to sustainable clean water and sanitation services reduces the spread of diseases such as cholera, diarrhea, dysentery, hepatitis A, and typhoid fever. It is estimated that the cost of poor sanitation to countries runs in the billions of dollars—representing the cost of premature deaths and healthcare treatment, time and productivity lost due to the need to seek medical treatment.

Tanzania has made significant progress in improving access to drinking water and sanitation services, but a large proportion of the population still has no access to these services. In 2015, about 50 percent of the country's 53 million people still lacked access to basic water supply and 76 percent had no access to sanitation services (WHO and UNICEF, 2017).

Further increasing access to improved and sustainable drinking water and sanitation services (box 3.1 for definitions) is vital for rural and urban residents. Access to at least basic drinking water increased from 21 percent in 2000 to 37 percent in 2015 for rural areas, while that figure increased from 69 percent to 79 percent in urban areas over the same period (WHO and UNICEF, 2017). However, in urban unplanned settlements, access to water is limited and sold at high prices by residents with access to water, kiosks, cart operating vendors, and delivery tankers. These

#### **BOX 3.1: WATER ACCESS AND SANITATION DEFINITIONS**

##### **WATER ACCESS**

*Basic:* drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing.

*Limited:* drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing.

*Unimproved:* drinking water from an unprotected dug well or unprotected spring.

*Surface water:* drinking water directly from a river, dam, lake, pond, stream, canal, or irrigation canal.

##### **SANITATION SERVICES**

*Safely managed:* use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite.

*Basic:* Use of improved facilities that are not shared with other households.

*Limited:* use of improved facilities shared between two or more households.

*Unimproved:* use of pit latrines without a slab or platform, hanging latrines, or bucket latrines

*Open defecation:* Disposal of human feces in fields, forests, bushes, open bodies of water, beaches, or other open spaces, or with solid waste.

**SOURCE:** WHO & UNICEF, 2017

services tend to be unreliable, delivering water of varying quality, depending on its source.

Access to basic sanitation facilities lags further behind; it has increased from 12 percent in urban areas in 2000 to 37 percent in 2015 (WHO and UNICEF, 2017). Access for the rest of the population however, remains fairly limited. Only 10 cities in Tanzania are considered having a sewerage system, covering approximately 20 percent of the population (MoWI, 2016). In addition to the public health risks associated with the lack of sewerage systems, water resources and associated ecosystems are also severely affected by pollution resulting from wastewater and fecal sludge.

**In 2013, health-related costs associated with unsafe water and sanitation in Tanzania were estimated to be about \$10 billion and \$7.6 billion.**

While systematic monitoring of water quality at the national level is limited, various case studies point to low water quality levels in Tanzania's urban areas. Water is often polluted by a variety of substances (including toxic substances such as lead, arsenic, cyanide, and cadmium). An emblematic example is the Msimbazi. This river is a critical water source for Dar es Salaam's population, but analyses have shown significant pollution levels and high organic and nutrient concentrations. In addition, some studies found heavy metals such as cadmium and lead in vegetables grown along its banks, posing a health risk for nearby residents (Leonard et al., 2012). Another study found heavy metal contamination in water and sediment downstream of municipal wastewater treatment plants in Dar es Salaam. This situation might cause prolonged pollution and potential adverse health effects in humans through their consumption of vegetables and animals that drank polluted water, washing with polluted water, and fishing (Kihampa, 2013).

In 2013, health-related costs associated with unsafe water and sanitation in Tanzania were estimated to be about \$10 billion and \$7.6 billion, respectively (Roy, 2016). It is estimated that food and waterborne diseases such as bacterial

diarrhea (e.g., dysentery and cholera), hepatitis A, and typhoid fever, as well as water-contact diseases, affect millions of people in the country's urban areas. Sewers, pit latrines, and other areas with stagnant wastewater are breeding grounds for malaria-transmitting mosquitoes, and malaria control is estimated to have cost the health system in Tanzania approximately \$2.87 per capita (in 2013 U.S. dollars), between 2011 and 2015 (Shretta, Avanceña, and Hatefi, 2016). The main sources of contaminants that affect water quality in Tanzania's urban settings are presented in table 3.4.

Poor people living in informal settlements are especially vulnerable to heavy rains and diseases that spread in the wake of floods. Heavy rains increase the runoff of pollutants—such as leachate from dumpsites and sewage from septic tanks or pit latrines—into storm water that flows into streams and rivers and pollutes water basins. Poor drainage systems allow the polluted water to remain undrained in settlements for extended periods and further contribute to the spread of infectious diseases. The magnitude and occurrence of pollution in the water is therefore highly influenced by the season (World Bank, 2016a).

**Poor people living in informal settlements are especially vulnerable to heavy rains and diseases that spread in the wake of floods.**

The increasing frequency and intensity of climate-related events exacerbate water pollution and need to be considered. Climate change does not only affect water availability by causing floods and droughts, but also water quality. Heavier rains, expected in parts of the country because of climate change, will increase flooding and runoff and the associated water quality deterioration. Conversely, extended hot and dry periods will boost water demand and decrease water supply. The depletion of aquifers lowers the water table and leads to the intrusion of salt water into fresh water bodies, degrading water quality and threatening their long-term viability as a water source.

The provision of sanitation and hygiene services in Tanzania involves multiple actors, and thus effective coordination is key. The National Water Policy of 2002 promotes the sustainable development of the sector and its expansion to reach more Tanzanians. In 2006, the government adopted the National Water Sector Development Strategy, the biggest sector-wide approach to planning in Sub-Saharan Africa, which led to the reorganization of the sector. Four ministries bear the fiscal and implementation responsibility for sanitation and hygiene at the national level.<sup>21</sup> To improve

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21 The Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) is responsible for setting water monitoring regulations and standards and for drafting legislation to manage the water sector. It also provides guidelines and technical assistance to local authorities on the provision of sanitation and hygiene services. The Ministry of Education, Science and Technology coordinates science and hygiene services in schools, while the President's Office of Regional Administration and Local Government (PO-RALG) handles the provision

of sanitation and hygiene activities in schools. PO-RALG is responsible for LGAs to be entrusted with providing sanitation and hygiene at the local level, in consultation with MoHCDGEC. At the LGA level, water supply and sewerage authorities provide sewerage services. For example, the Dar es Salaam Water and Sanitation Authority (DAWASA) is responsible for providing water supply and sewerage services in Dar es Salaam, previously through the Dar es Salaam Water and Sewerage Corporation (DAWASCO).

22 Through the agreement, different working groups were formed to support the work. The National Sanitation and Hygiene Sanitation Committee provides policy directions, while the National Sanitation and Hygiene Technical Committee provides support for the implementation of policy and strategic programs.



**TABLE 3.4: SOURCES OF CONTAMINANTS AFFECTING WATER QUALITY IN TANZANIA**

|  |   |
|--|---|
| <p style="text-align: center;"><b>1</b></p> <h3 style="text-align: center;">Rapid and unplanned growth of urban areas</h3> <p>New and unplanned settlements and roads built along the rivers around Dar es Salaam affect water quality through deforestation, river bank erosion, sediment, sand, and onsite sanitation systems that flood during the rainy season. It is anticipated that the footprint of unplanned development will cause water quality to deteriorate further, including because of the lack of drainage and sewerage infrastructure in unplanned settlements (World Bank 2016a).</p>  | <p style="text-align: center;"><b>2</b></p> <h3 style="text-align: center;">Domestic wastewater</h3> <p>In many informal settlements, wastewater is often discharged directly into streams due to lack of sewerage facilities and/or pit latrines (World Bank 2016a). This blackwater is often contaminated with coliforms and other infectious microorganisms, leading to outbreaks of waterborne diseases such as cholera and typhoid (NBS and MOFP 2015). In 2007, 60–80 percent of the diseases requiring hospital attendance in Tanzania were caused by poor water and sanitation (NBS and MOFP 2015). A 2014 study compared the number of coliforms upstream and downstream of Dar es Salaam. At the entry point (Kisarawe), the water quality was relatively high, with only 75 to 100 coliforms per 100 mL, but further downstream the coliform count reached between 250,000 and 400,000 per 100 mL—that is, 1,000 times the level considered safe for swimming (NEMC and UNEP cited in World Bank 2016a).</p> |
| <p style="text-align: center;"><b>3</b></p> <h3 style="text-align: center;">Inadequate solid waste management</h3> <p>In Dar es Salaam, the high organic composition of the city's solid waste is a major driver of water quality degradation, leading to high levels of organic nutrients in rivers (World Bank 2016b). In 2014, about 60 percent of Dar es Salaam's solid waste remained uncollected and uncontrolled, often ending up in rivers (World Bank 2016a). Dumpsites are also potential hazards to water quality, especially when located close to water sources.</p>  | <p style="text-align: center;"><b>5</b></p> <h3 style="text-align: center;">Farming</h3> <p>Runoff from agricultural fields contains nutrients such as nitrogen and phosphorus. When these nutrients reach water bodies, excessive algae growth follows, harming aquatic life through eutrophication. Carbon-based, organic compounds from different agricultural activities—such as pesticides, polychlorinated biphenyls (PCBs), and animal waste—are also serious pollutants. Animal excreta released into the water pose additional health risks.</p>   |
| <p style="text-align: center;"><b>4</b></p> <h3 style="text-align: center;">Industrial effluents</h3> <p>A 2011 study showed that annual pollution loads in the Msimbazi River from industries that discharged their effluents directly into the river ranged from 17.7 to 141.56 metric tons. Heavy metal leachates from dumpsites and industries, for example, have made the Msimbazi River toxic, with pollutant levels exceeding both WHO and Tanzania potable water standards. As several agricultural activities take place along the river's flood plain, these heavy metals are likely to contaminate produce for human consumption (Leonard et al. 2012).</p> |   |



## 3.4 Industrial Pollution

Tanzania's industrialization is still in its early stages, however, given the current industrialization drive, there is growing concern of increased pollution if the process is not properly managed. The government of Tanzania has an interest in better understanding the environmental and health related implications of the industrialization agenda, and in defining steps toward its integrated management. This CEA report has thus made an attempt to provide initial figures and estimates of this growing environmental challenge. To quantify the current scale of industrial pollution is challenging because very limited data is available. Several studies have attempted to estimate it within specific regions and areas.<sup>23</sup> While these studies give useful insights in parts of the country, none have looked across regions, industry types, and specific pollutants to derive nationwide industrial pollution figures. To address this gap, a World Bank industrial pollution projection system (IPPS) model has been used in the preparation of this study to

23 Mwanuzi (2000) estimated organic matter loads released in Pangani River from Arusha and Kilimanjaro industries. Mato (2002) illustrated that more than 122 industrial establishments in Dar es Salaam generate about 127 tonnes/day of hazardous waste which is about 40% of the total industrial solid waste production. Blinker (2006) assessed industries in Tanga for estimating water pollution. Mwenda (2014) conducted a study estimating the levels of industrial pollution in Arusha. Elisante and Muzuka (2017) found concentrations of nitrate higher than 400mg/l in some aquifers in urban areas of Dar es Salaam, Dodoma and Tanga.

estimate the amounts and types of pollution generated by the country's industrial sector.

**In terms of overall pollution, the five “dirtiest” sectors in Tanzania are: (i) basic iron and steel; (ii) plastics products; (iii) basic chemicals; (iv) vegetable and animal oils and fats; and (v) cement, lime and plaster.**

Five industrial sectors were found to account for the highest pollution loads. Using 2013 Tanzania industrial census data, estimates were made at the district level for five pollutant clusters (two air pollutants, one water pollutant, and two types of toxic waste),<sup>24</sup> as shown in table 3.5. In terms of overall pollution, the five “dirtiest” sectors in Tanzania are: (i) basic iron and steel; (ii) plastics products; (iii) basic chemicals; (iv) vegetable and animal oils and fats; and (v) cement, lime and plaster.

24 The purpose of this modeling was twofold: (i) to estimate the most prevalent types of industrial pollution, by type of industry and size; and (ii) to compare pollution loads across districts to better identify industrial pollution hotspots. Five pollutants are estimated—SO<sub>2</sub>, PM<sub>10</sub>, BOD, toxic chemicals, and toxic metals. Emission standards are based on U.S. industry data, so results are only partially applicable to the Tanzanian industry. Nevertheless, it is assumed in this context that (i) the model's parameters are still useful because the technologies used in Tanzania are not the most advanced ones; and (ii) what matters in this context is not the absolute level of air, water, and toxic pollution (which is unknowable), but rather the approximate relative pollution intensities for different districts and industries.

**TABLE 3.5: POLLUTING INDUSTRIAL SUBSECTORS IN TANZANIA<sup>a</sup>**

| ISIC | ISIC DESCRIPTION  | SHARE OF EMPLOYMENT | SO <sub>2</sub> <sup>b</sup> | PM <sub>10</sub> <sup>c</sup> | BOD <sup>d</sup> | TOXIC CHEMICALS <sup>e</sup> | TOXIC METALS <sup>f</sup> | # OF POLLUTANTS CONTRIBUTING >5% |
|------|---|---------------------|------------------------------|-------------------------------|------------------|------------------------------|---------------------------|----------------------------------|
| 1040 | Vegetable and animal oils and fats  | 5.02                | 16.88                        | 24.51                         | 2.58             | 5.14                         | 1.45                      | 3                                |
| 2220 | Plastics products   | 8.40                | 7.52                         | 0.01                          | 2.51             | 38.75                        | 15.26                     | 3                                |
| 2410 | Basic iron and steel  | 3.05                | 5.69                         | 3.63                          | 0.03             | 5.48                         | 52.01                     | 3                                |
| 2394 | Cement, lime, and plaster   | 2.01                | 34.49                        | 66.24                         | 0.00             | 0.10                         | 0.46                      | 2                                |
| 2011 | Basic chemicals   | 0.70                | 1.69                         | 0.13                          | 4.73             | 10.55                        | 5.96                      | 2                                |
| 1920 | Refined petroleum products  | 0.56                | 7.32                         | 0.17                          | 0.75             | 4.61                         | 1.27                      | 1                                |
| 1072 | Sugar   | 4.18                | 4.98                         | 0.24                          | 13.50            | 0.61                         | 0.04                      | 1                                |
| 1701 | Pulp, paper, and paperboard   | 1.09                | 4.39                         | 0.58                          | 19.30            | 2.76                         | 0.18                      | 1                                |
| 1702 | Corrugated paper and paperboard and of containers of paper and paperboard | 1.00                | 4.01                         | 0.53                          | 17.62            | 2.52                         | 0.17                      | 1                                |
| 1104 | Soft drinks; production of mineral waters and other bottled waters        | 6.15                | 3.35                         | 0.11                          | 11.77            | 0.61                         | 1.18                      | 1                                |
| 2029 | Other chemical products n.e.c.  | 0.50                | 1.21                         | 0.09                          | 3.38             | 7.54                         | 4.26                      | 1                                |
| 2012 | Fertilizers and nitrogen compounds  | 0.41                | 0.98                         | 0.08                          | 2.75             | 6.13                         | 3.46                      | 1                                |
| 2420 | Basic precious and other non-ferrous metals                               | 0.15                | 0.73                         | 0.02                          | 0.46             | 0.51                         | 5.56                      | 1                                |
| 1050 | Dairy products  | 1.38                | 0.04                         | 0.00                          | 18.83            | 0.22                         | 0.00                      | 1                                |
|      | Totals  | 34.59               | 93.27                        | 96.33                         | 98.21            | 85.53                        | 91.25                     |                                  |

*Note:* BOD = biological oxygen demand; ISIC = International Standard Industrial Classification (of All Economic Activities); n.e.c. = not elsewhere classified; PM10 = particles that have aerodynamic diameters less than or equal to 10 microns (µm); SO<sub>2</sub> = sulfur dioxide.

1. All figures shown represent percentages.
2. SO<sub>2</sub> in the air affects the respiratory system and irritates the eyes.
3. PM10 in the air raises mortality and morbidity rates.
4. BOD is a measure of the amount of organic compounds in water (and a proxy for the degree of organic pollution of water).
5. The toxic chemicals indicator is an aggregate indicator of the industrial outflows of over 240 chemicals that are toxic to humans.
6. The toxic metals indicator is an aggregate indicator of the industrial output of toxic metals that bioaccumulate in humans and often lead to mental and physical birth defects.

These five most polluting industrial sectors account for over 90 percent of PM10 emissions; over 75 percent of toxic metals; 66 percent of SO<sub>2</sub> and 60 percent of total toxic emissions. However, they release only 10 percent of BOD (a measure of organic pollution), which is much more prevalent in the effluent of the food and paper industries<sup>25</sup> (table 3.5).

Further analysis of the results shows that:

- For air pollution, the cement, lime, and plaster sector contributes an estimated 66 percent of total PM<sub>10</sub> and 34 percent of total SO<sub>2</sub>;
- For organic water pollution, the pulp, paper, and paperboard sector contributes 19 percent of total BOD;
- For total toxic chemicals, the plastics products sector contributes about 39 percent; and
- For toxic metals, the basic iron and steel sector contributes about 52 percent.

<sup>25</sup> The sugar, dairy, and soft drink industry emits about 44 percent of total national BOD, while the paper/container industry emits about 37 percent.

## INDUSTRIAL POLLUTION IS CONCENTRATED IN A FEW GEOGRAPHICAL AREAS

An analysis of industrial pollution at the regional and local levels revealed that the pollution load is concentrated in a few geographical areas. Dar es Salaam produces about 88 percent of all industrial pollution in Tanzania, reflecting the high concentration of industries that are located in the area. It also shows the highest pollution intensity across all five pollutants (defined as the total pollution load per unit of area). All other regions have industrial pollution loads well below those of Dar es Salaam. For example, PM10 emissions in Tanga are only 6 percent of Dar es Salaam's; BOD effluent in Kilimanjaro is likewise only 6 percent of Dar es Salaam's; and the remaining pollutant loads of all other regions individually are less than 3 percent of Dar es Salaam's.

There are important variations across the three Dar es Salaam municipal councils (Temeke, Ilala, and Kinondoni). Temeke has the highest concentration of SO<sub>2</sub> (50 percent of the district total), toxic chemicals (65 percent), and bioaccumulative metals (65 percent). The “refined petroleum products,” the “plastics products,” and the “basic iron and steel” subsectors are the heaviest polluters in Temeke. For PM10, Kinondoni emits 57 percent of the total and the “cement, lime and plaster” industry is the main contributor. For BOD, Ilala emits 52 percent, primarily driven by the “corrugated paper and paperboard and containers of paper and paperboard” industry. In both Temeke and Kinondoni, large firms

(with more than 300 employees) emit more than half of all pollutants except for BOD—more than half of BOD is emitted by firms with fewer than 300 employees. In Ilala, large firms emit more than half of all pollutants except for toxic metals, which are primarily emitted by smaller firms in the “basic iron and steel” subsector.

Overall, the modeling not only shows that Dar es Salaam is the primary hotspot for industrial pollution in Tanzania, but it also estimates a profile of firm and pollution type by subdistrict as a basis for improving the government's industrial pollution monitoring and enforcement systems. The analysis

**Dar es Salaam produces about 88% of all industrial pollution in the country reflecting high concentration of industries and agglomeration.**

of pollutants by sectors and regions facilitates the prioritization of measures, tailoring them to those sectors with a higher weight in the total pollution load. The National Development Plan for the period 2016/17–2020/21 targets expansion in the petroleum, petrochemicals, pharmaceutical, building and construction, agro and agroprocessing (cotton to clothing, textiles and garment, and leather), coal, iron, and steel subsectors. Therefore, as the country's industry scales up, the regulatory authorities have a good idea of its technical capacity and hardware needs to improve its monitoring and compliance activities.



## EARLY AND EFFECTIVE INVESTMENTS CAN CURB POLLUTION

Improving pollution regulations and enforcement today is an early and cost-effective government investment in preventing even higher pollution loads in the medium term. It is easier to have adequate industrial pollution regulations in place before new investments are made, as opposed to trying to get firms to retrofit at a later stage. In the Dar es Salaam area, efforts should be focused on: (i) promoting self-reporting by industries, especially those with the size and resources to do it; (ii) improved monitoring of polluting emissions, both at the source and in key areas; (iii) clean production promotion, using a variety of command and control mechanisms, and also well-designed incentives; and (iv) exploring principles of the “circular economy” through which the byproducts of an industry become the inputs of another. Facilitating access to cleaner fuels, offering solid and liquid waste collection and processing solutions, and requesting end-of-pipe technologies in cases where pollution cannot be avoided, are key to reducing industrial pollution impacts in Dar es Salaam, which is the largest settlement in the country. In other less-developed regions, efforts should be focused in clean production technologies, and supporting

new industries to adopt sound environmental performance practices and processes.

Using and applying the Environmental Impact Assessment (EIA) tool is key to curb industrial pollution. Each industry is mandated to prepare an EIA to obtain an operating license. These EIAs analyze the possible impacts to humans and the environment, identify alternatives that are less impactful, define mitigation measures, and establish monitoring and evaluation programs. Ensuring an appropriate implementation of the mitigation measures defined in the EIA is a fundamental task of the environmental management agency (the National Environmental Management Council, NEMC). Another task is to periodically monitor the environmental and social performance of the industry, and to implement penalties and fines whenever the EIA license and its details are not appropriately followed. For NEMC to carry out this important mandate, it is thus fundamental to ensure sufficient staffing, with well-trained inspectors that carry out visits to polluting facilities, and who are equipped with state-of-the-art instrumentation and technology for the control and measurement of effluents. A combination of command-and-control through the establishment of emission limits and monitoring, together with incentives for self-reporting, have proven to give good results when controlling industrial pollution.



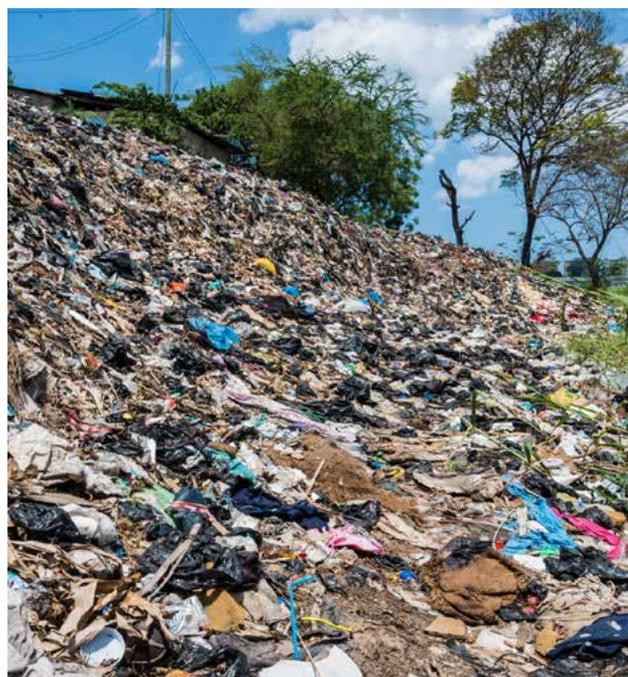
## 3.5 Solid Waste

### MUNICIPAL SOLID WASTE

As the global population grows, countries urbanize, and their economic wealth increases, the amount of municipal solid waste (MSW) generated also increases. While in 2002 about 0.68 billion metric tons of MSW were estimated to have been generated globally per year (or about 0.64 kg/capita/day), by 2012, this estimate had increased to 1.3 billion metric tons per year, or 1.2 kg/capita/day (Hoornweg and Bhada-Tata, 2012). By 2025, 2.2 billion metric tons of MSW are expected to be generated globally per year. Globalization has facilitated the rapid movement of goods to places that are least equipped to manage such an increase in waste. Moreover, the proliferation of the use of packaging materials and the dramatic decrease in the lifespan of products, together with the sizeable amount of imported cheap but inferior goods, have all added to MSW generation in developing countries.

In Tanzania, projections suggest a significant increase from current MSW levels. It is estimated that in 2012, Tanzania generated 2,425 metric tons of MSW per day (0.26 kg/capita/day)—a higher amount, in absolute terms, than generated by Kenya (2,000 metric tons) and Uganda (1,179 metric tons), but a lower amount when the countries' per capita figures are considered (table 3.6).

Other studies suggest even higher amounts, with for example Breeze (2012) reporting that in 2011, Dar es Salaam alone generated approximately 4,200 metric tons per day (0.92 kg/capita/day), and NBS (2017b) referring to 4,700 metric tons per day in 2017. As the country continues to record high rates of economic growth, projections suggest total MSW generation in Tanzania will reach about 12,000 metric tons per day by 2025, almost five times the 2012 estimated amount.



**TABLE 3.6: MSW GENERATION BY COUNTRY – AVAILABLE DATA AND PROJECTIONS FOR 2025**

|          | AVAILABLE DATA FROM 2012                  |                                 | PROJECTIONS FOR 2025                      |                                 |
|----------|---|---------------------------------|---|---------------------------------|
|          | MSW generation per capita (kg/capita/day) | Total MSW generation (tons/day) | MSW generation per capita (kg/capita/day) | Total MSW generation (tons/day) |
| Tanzania | 0.26                                      | 2,425                           | 0.55                                      | 11,566                          |
| Kenya    | 0.30                                      | 2,000                           | 0.60                                      | 10,171                          |
| Uganda   | 0.34                                      | 1,179                           | 0.65                                      | 6,313                           |

SOURCE: EDITED FROM HOORNWEG AND BHADA-TATA, 2012.

## EFFECTIVE MANAGEMENT OF MSW IS CRITICAL

Managing MSW effectively and in an environmentally sound manner is critical to minimizing associated environmental and health impacts. In most Sub-Saharan African countries, only 30–60 percent of MSW is collected, leading to high environmental and health-related risks from informally disposed MSW. Solid waste often includes infectious and hazardous waste, which can contaminate the soil, groundwater, and surface water through leachates and pollute the air with toxic gases released when such waste is burned. In addition, uncollected MSW serves as breeding ground for insects and scavenging animals and generates vectors of air- and waterborne diseases. In areas where MSW is collected infrequently or not at all, the incidence of diarrhea is twice as high and acute respiratory infections six times higher than in areas with regular collection (UN-Habitat 2009 cited in Hoornweg and Bhada-Tata, 2012).

A reliable MSW collection and transportation system is critical for good-quality waste management services. In Dar es Salaam, the largest waste producer in the country, waste collection services and disposal facilities are insufficient, putting communities at risk. Even though solid waste management (SWM) is regulated,<sup>26</sup> less than 40 percent of households are estimated to have access to waste collection services (Huisman et al., 2016). In urban areas, as much as 80–90 percent of MSW is not collected (NBS, 2017b). This is because waste collection is unaffordable for many residents, the waste

management infrastructure is poor, and urban planning is limited—over 70 percent of Dar es Salaam’s population lives in unplanned or underserved areas (DMDP, 2011; Breeze, 2012). Only one dumpsite serves the city, the 65-hectare Pugu Kinyamwezi site, and basic environmental standards for formal landfill design and development, leachate management, landfill gas management, fencing, and regular monitoring of waste by type and source are often not met (Breeze, 2012). Nearby communities are at risk, as are those who are encroaching and scavenging for waste (Prime Minister’s Office, 2013, cited in World Bank, 2014). Landfills in the Dar es Salaam region that have been closed, pollute the environment through leachate flowing into nearby watercourses (World Bank, 2014). Data and information on economic impacts of MSW in Tanzania are currently not available.

Improved waste collection and disposal will significantly decrease environmental and health risks from waste. In 2006, the Ministry of Health and Social Welfare (MoHSW) reported that between 60 and 80 percent of hospital admissions were due to sanitation-related diseases (Palfreman, 2014). In addition, MSW primarily consists of organic waste, representing a source of nutrients. In Dar es Salaam, as a result of MSW being dumped in open areas, rivers and water bodies across the city show high nutrient concentrations, further degrading water quality (NEMC and UNDP 2014 in World Bank, 2014).

Poor SWM is one of the main causes of the devastating floods witnessed in Dar es Salaam. Contrary to popular belief, floods are not only caused by a changing climate or by the intensity of rains. These floods, in urban centers, are also caused by upstream deforestation and land degradation, combined with insufficient and failing urban drainage (box 3.2). The built environment (house roofs, paved roads) is not permeable, hence rainwater fails to seep into the ground, running to the surface toward the urban drainage system. This system, if properly designed and maintained, manages to accumulate rainwater and carry it into natural water bodies downstream of the city.

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26 SWM comprises essential services “provided to protect the environment and public health, promote hygiene, recover materials, avoid waste, reduce waste quantities, decrease emission and residuals and prevent spread of diseases” (URT 2004, p. 17). The President’s Office -Regional Administration and Local Government (PO-RALG) is responsible for drawing up and instituting the SWM system that is used by LGAs. The Department of Prevention of the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) formulates environmental health control, hygiene, and sanitation policies that address SWM, among other health-related challenges. Moreover, mandated by the Public Health Act, the Department of Prevention is responsible for monitoring and assessing the status of environmental health and sanitation aspects. The Bureau of Standards (TBS) oversees the setting of standards for SWM while the Division of Environment (DoE) under the Vice President’s Office develops environmental policies and regulations for SWM in the country. SWM services are coordinated at the LGA level. The authorities can outsource activities they are responsible for to private companies or community organizations.

### BOX 3.2: REHABILITATING THE MSIMBAZI RIVER FOR DAR ES SALAAM

The Msimbazi River Valley in Dar es Salaam is important for the city's infrastructure, mobility, commerce, and flood control. Two of Dar es Salaam's main traffic arteries cross the main flood plain near the river's discharge to the sea.

One of them, the bus rapid transit (BRT) corridor, supports communities at the lower reaches of the river. These communities depend on close access to Dar es Salaam's central business district for their livelihoods, and benefit from social services within walking distance. The river catchment is also important due to its significant environmental assets, including forests in the headwaters down to wetlands and mangrove forests in the lower reaches.

However, Dar es Salaam has experienced rapid and unplanned growth over the last three decades, as have many other African cities. Encroachment in the river valley poses a significant challenge, trees are being cut down as land use changes, soils are eroding, and the basin cannot naturally retain water the way it used to. In addition, solid waste and industrial effluents find their way into the river, clogging the city's drainage systems and polluting the water.

The environmental degradation in combination with a changing climate and more intense rainfall, has resulted in a higher risk of extreme weather events. Floods have become more frequent and severe in Dar es Salaam, often bringing the city to a standstill. In April 2018, for example, Dar es Salaam experienced heavy rains and extensive flooding, with at least 15 people killed and more than 2,000 families in the Msimbazi Basin displaced. Dar es Salaam's population is expected to reach 10 million by 2030. It is thus critical that the river be rehabilitated so that the benefits of its many services can be restored. A healthy river is an efficient natural "infrastructure" able to drain water and buffer extreme rains. The Msimbazi Basin could perform at least eight vital functions for the city of Dar es Salaam: (i) discharge stormwater; (ii) provide drinking water and grey water; (iii) offer space and suitable conditions for biodiversity rich coastal forest and mangrove vegetation; (iv) provide safe and healthy locations for settlement; (v) include space for public and private infrastructure assets; (vi) provide space for serviceable roads and bridges that cross the basin as essential transport corridors; (vii) offer lands for growing healthy food in the flood plains; and (viii) provide public and open spaces for sports and leisure activities. PO-RALG, in partnership with the World Bank through the Tanzania Urban Resilience Program, have been championing the Msimbazi Charrette initiative, an urban design process that draws on the views and experiences of various stakeholders, including community leaders, engineers, planners, and high-level government officials, who foresee a more resilient basin. The initiative is expected to produce a framework to guide a basin investment program, and a detailed plan for the lower basin, to help catalyze investment from government, private sector, and development partners to restore the highly-vulnerable flood plain, and turn it into a city asset.

*"I have lived in this area for 28 years. I have seen the increase of the amount of rubbish as the population increases. Along with it, various diseases appear. When the flood comes, the whole area is filled with water like an ocean. It becomes a big problem, workers and families struggle a lot. My thoughts about tackling this issue are that greater education needs to be given to the public; also, strong laws should be put in place so that people can be aware."*

#### ELIZABETH MASAWO

Chairperson Kawawa Local  
Government Hananasifu Ward, Dar es Salaam



However, the indiscriminate dumping of solid waste clogs drainage canals and sewers, rendering the storm water drainage systems ineffective and leading to devastating floods in the rainy seasons, causing the destruction of houses, death, sickness, and millions of dollars' worth of damages. Stagnant water around clogged drains is ideal breeding ground for mosquitoes, which spread diseases such as malaria, further adding to the health hazards caused by improper disposal of solid waste.

Multilateral and bilateral donors, and NGOs, have been working with PO-RALG and Dar es Salaam to strengthen SWM. UN HABITAT/ UNEP, the World Bank, JICA, and others have helped prepare strategic plans that support the development of institutions, a legislative and regulatory framework, infrastructure (collection and transportation systems, transfer stations, material recovery facilities and landfills) and overall capacity. Various examples of creating incentives or disincentives through fiscal policy measures have demonstrated positive results in SWM across Africa (box 3.3).

## E-WASTE

The rapidly advancing information technology sector and the increasing number of technology users worldwide has resulted in a growing amount of e-waste. In 2017, about half of the

global population had access to mobile networks and services and used the Internet (Baldé et al., 2017). Disposable incomes are rising and the growing middle class in developing countries is spending more on electronics, with the use of information and communications technology (ICT) devices constantly on the rise. At the same time, the replacement cycles of cell phones, computers, and other electronic devices are becoming shorter, thus raising the volume of e-waste (see box 3.4 for definition).

**In comparison with other African countries, Tanzania is among those generating the least e-waste. However, the overall trend of e-waste generation is rising.**

Globally, around 44.7 million metric tons of e-waste are generated annually, or an equivalent of 6.1 kg per person. Of those, only 8.9 million metric tons, or 20 percent of all e-waste generated, are collected and recycled, and it is estimated that 1.7 million metric tons are disposed of as residual waste in high-income countries. The remaining 34.1 million metric tons, or 79 percent of all e-waste, are informally disposed of—dumped, traded, or recycled under inadequate conditions. The global amount of e-waste is expected to increase to 52.2 million metric tons, or 6.8 kg per person by 2021 (Baldé et al., 2017).

### BOX 3.3: MITIGATING POLLUTION INITIATIVES THROUGHOUT AFRICA

Creating incentives or disincentives through fiscal policy measures has demonstrated positive results in solid waste management and other environmental management priorities:

**Plastic bag levies:** This levy has been successfully implemented in several African nations. In Botswana, overall plastic bag use fell by 50 percent in just 18 months after its introduction.

**Pollution charges:** These include disposal fees, effluent permit fees, and emission fees. A waste discharge levy can act as a deterrent to waste discharge, while a waste mitigation charge can provide funding for waste mitigation measures.

**Tax exemptions on alternative fuels:** The value added tax (VAT) on liquid petroleum gas (LPG) has been removed in several African countries including Uganda, Senegal, and Botswana. In Senegal, the lifting of import duties on gas canisters and cookers, and of subsidies on LPG, has resulted in a decline in wood fuel dependence and annual savings of approximately 70,000 metric tons of wood fuel and 90,000 metric tons of charcoal.

**Payment for ecosystem services:** The Equitable Payments for Watershed Services (EPWS) scheme in the Uluguru Mountains of Tanzania involves major industrial water consumers paying upstream villages to adopt water-friendly agricultural practices to protect downstream water quality and help cover treatment costs in Dar es Salaam. The productivity of participating farmers has increased threefold and sediment levels in the catchment have fallen.

SOURCE: WHITE, TURPIE, AND LETLEY, 2017.

### BOX 3.4: DEFINITION OF ELECTRONIC WASTE

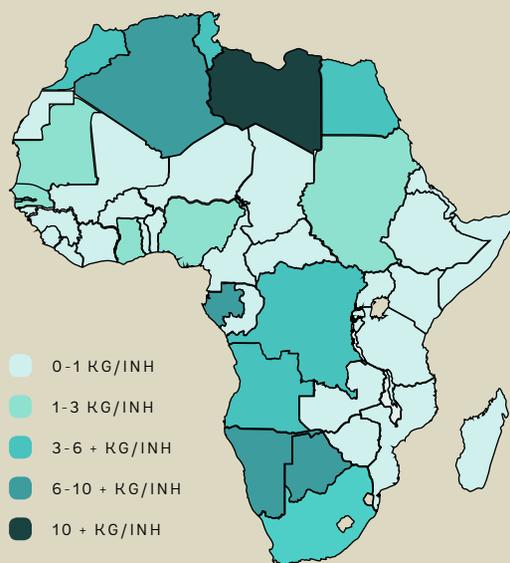
Electronic waste (e-waste) refers to all electrical items and electronic equipment that have been discarded as waste without the intent of reuse. It includes a diverse array of equipment such as cell phones, air conditioners, computers, and refrigerators. E-waste often contains hazardous materials and improper disposal poses significant human health risks from direct contact or inhalation of toxic elements and from the accumulation of chemicals in soil, water, and food.

SOURCE: BALDÉ ET AL., 2017.

## E-WASTE GENERATION IS RELATIVELY LOW BUT INFORMAL DISPOSAL POSE SIGNIFICANT RISKS

E-waste generation in Tanzania is relatively low. It is estimated that Africa generates 2.2 million metric tons of e-waste per year, while Tanzania generated around 38,000 metric tons of e-waste in 2016, or 0.8 kg per person. In comparison with other African countries, Tanzania is among those generating the least e-waste (figure 3.1). However, the overall trend of e-waste generation is rising.

FIGURE 3.1: ESTIMATED E-WASTE GENERATION IN AFRICA



SOURCE: MODIFIED FROM BALDÉ ET AL., 2017.  
NOTE: inh= inhabitant

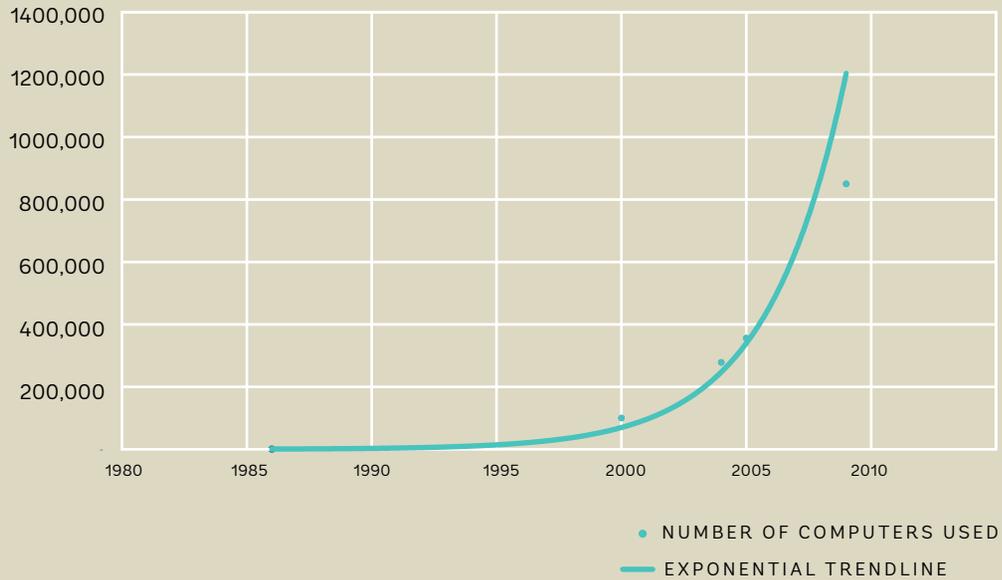
Despite the relatively small amounts of e-waste, the low collection rates and informal disposal points pose significant environmental and health risks. Only 4,000 of the 2.2 million metric tons of e-waste generated in Africa, or less than 0.5 percent, are documented as collected (Baldé et al., 2017). Tanzania is no exception. Most e-waste is disposed of informally—dumped, traded, or recycled (Magashi and Schlupe, 2011). Informal recycling practices, for example open-air burning to retrieve valuable components such as gold, pose significant health risks and are common in Tanzania.

The health risks derive from direct contact with lead, cadmium, chromium, brominated flame retardants, or polychlorinated biphenyls (PCBs), or through inhalation of the toxic fumes released when e-waste is burned (WHO, 2017). In addition, the dismantling of e-waste containing hazardous materials such as lead, mercury, and cadmium causes chemicals to accumulate in soil and water, thereby posing significant environmental risks.

### Despite the relatively small amounts of e-waste, the low collection rates and informal disposal points pose significant environmental and health risks.

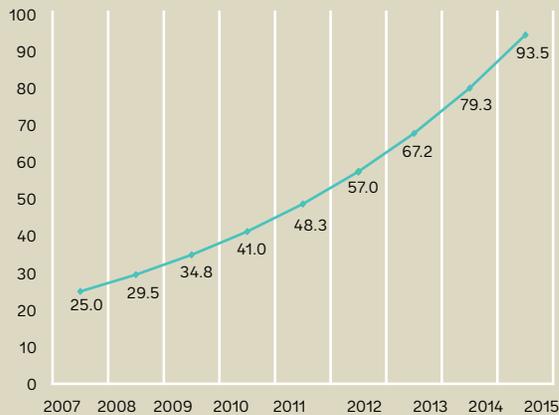
The use of ICT equipment has been rising rapidly in Tanzania, meaning that e-waste generation is expected to increase in the near future. While it is estimated that the global average annual growth rate of e-waste generation is 4 to 5 percent, Tanzania's growth rate could be as high as 33 percent (URT, 2013; Baldé et al., 2015). The lifting of a computer taxation system in 1984, which included the removal of all taxes and duties on computers and their components, contributed to the increase in computer use—from approximately 700 computers and three computer vendors in 1986 (Ndamagi, 1988) to more than 800,000 computers and hundreds of computer vendors in 2010 (figure 3.2) (Magashi and Schlupe, 2011). The number of cell phone subscribers increased by a factor of 100 between 2000 and 2005. Approximately 94 percent of Tanzanians owned a cell phone in 2015, representing millions of cell

**FIGURE 3.2:** NUMBER OF COMPUTERS USED IN TANZANIA, 1986–2009



**SOURCE:** OWN ESTIMATES USING SEVERAL DATA POINTS

**FIGURE 3.3:** ESTIMATED PERCENTAGE OF POPULATION OWNING CELL PHONES IN TANZANIA



**SOURCE:** AUTHORS' OWN CALCULATIONS BASED ON NBS HOUSEHOLD BUDGET SURVEY REPORT.

phones, batteries, and chargers (figure 3.3). The Consumer Technology Association<sup>27</sup> estimates cell phones have a lifespan of 4.7 years at best, implying that cell phones and accessories are most likely the main drivers of e-waste growth in the country.

## DEVELOPING AN APPROPRIATE REGULATORY AND MANAGEMENT FRAMEWORK IS KEY

Developing an adequate regulatory and management framework to ensure the effective management of e-waste is important in view of the rapidly increasing use of electronics. In Africa, only Madagascar (2015), Kenya (2016), and Ghana (2016) have formally passed draft e-waste bills into law. While Tanzania has a few policies and regulations aimed at protecting the environment and human health, a specific policy or regulation related to e-waste management is still forthcoming. In addition to an overall lack

<sup>27</sup> <https://www.cta.tech/News/Blog/Articles/2014/September/The-Life-Expectancy-of-Electronics.aspx>.

of adequate disposal facilities for waste, there is also no designated facility for environmentally sound treatment and/or disposal of e-waste in the country (URT, 2013). Creating a good data portal and monitoring mechanism would be of value as the country designs a suitable framework to manage the e-waste.

## HEALTHCARE WASTE

As healthcare waste (HCW) is more likely to cause an infection and/or injury than any other type of waste, and its nature requires very specific collection and disposal practices, its adequate management is critical. In its absence, HCW can not only be expected to have serious public health effects, but also significant environmental impacts—in terms of air, water, and land pollution (see box 3.5 for definition). Factors that contribute to poor HCW management include insufficient waste management and disposal systems or the lack thereof, limited awareness of the health hazards, and inadequate training of relevant workers in safely handling waste.<sup>28</sup> The lack of landfills prepared for HCW leads to it often being dumped in uncontrolled areas, contaminating the soil and water sources.

No reliable data are available on the amounts of HCW generated in Tanzania. In 2007, the MoHSW estimated that approximately 4,745 metric tons were generated nationwide, with an estimated 0.41 kg per bed per day generated in the country's healthcare facilities (National Audit Office, 2014). For 2017, it was estimated that healthcare facilities generated approximately 0.75 kg per bed per day (Minoglou et al., 2017). The actual amounts are probably much higher, given that healthcare facilities often operate above full capacity. Despite the National Standards and Procedures for HCW Management requiring that records be kept on HCW generation and disposal, most of the estimated 3,760 healthcare facilities fail to do so. In 2014, it was established that only 3 out of 33 surveyed healthcare facilities recorded the amount

of waste generated per bed per day. None of them had a waste management plan in place, and waste segregation principles, as outlined in national guidelines, were not followed to the extent required (National Audit Office, 2014).

### No reliable data are available on the amounts of HCW generated in Tanzania.

As the number of central waste collection points is limited, HCW is often disposed of through open pit burning, burying, or incineration. Of the 33 healthcare facilities surveyed in 2014, more than 50 percent did not have central waste collection points to allow for secure and adequate storage. Waste was often stored in open and unfenced areas on the health facilities' premises.

#### BOX 3.5: HCW IN A NUTSHELL

Healthcare waste (HCW) is waste generated by hospitals and other healthcare facilities, research centers and laboratories, related to medical procedures, mortuary and autopsy centers, blood banks and collection services, and individual households engaged in healthcare. Most HCW is comparable to municipal solid waste, and non-hazardous. It is mostly generated by administrative, kitchen and housekeeping functions at healthcare facilities, and does not pose a higher risk than municipal or general waste. About 15–25 percent of HCW is, however, considered hazardous material that may be infectious, toxic, or radioactive, and may pose a variety of substantial environmental and health risks, if managed improperly. Hazardous materials include infectious waste, pathological waste, sharps, chemicals, pharmaceutical waste, genotoxic waste, and radioactive waste.



28 Direct health-related risks range from harmful microorganisms that can infect hospital patients, health workers, and the general public, to radiation burns, sharps injuries, and poisoning caused by pharmaceutical products or waste water (WHO 2015).

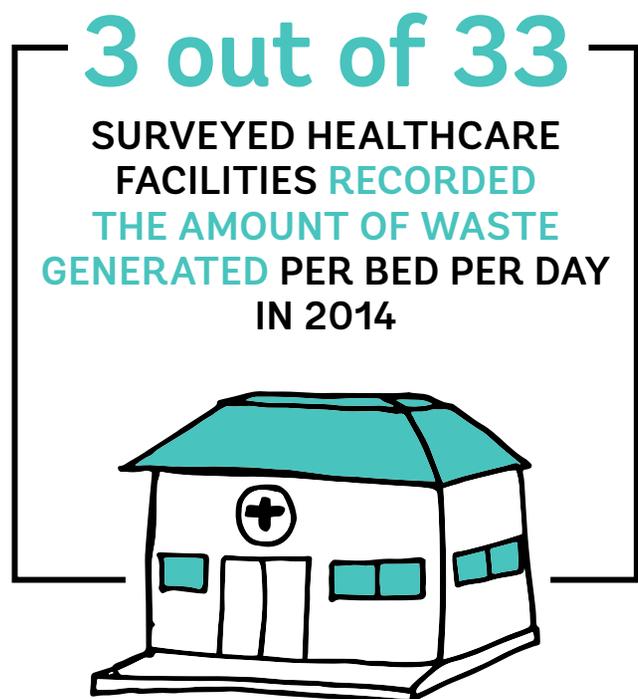
The risks associated with waste being dispersed to nearby communities and/or water and soil through wind, were considered high. In addition, average storage times of different kinds of HCW, including hazardous waste, prior to incineration, were considered high (up to a week), posing a high risk of waste decaying and polluting the air (National Audit Office, 2014). The dedicated incinerators are often out of service and, as a result, HCW is dumped in pit latrines and open pits, or buried (Manyele and Lyasenga, 2010). As open pit burning releases chemical pollutants, including heavy metals, it contributes to air pollution and the incidence of respiratory diseases. In addition, the ashes and residue from incinerators are disposed of in open spaces or in unlined sections of dumpsites that remain uncovered, posing significant risks to the environment and nearby communities.

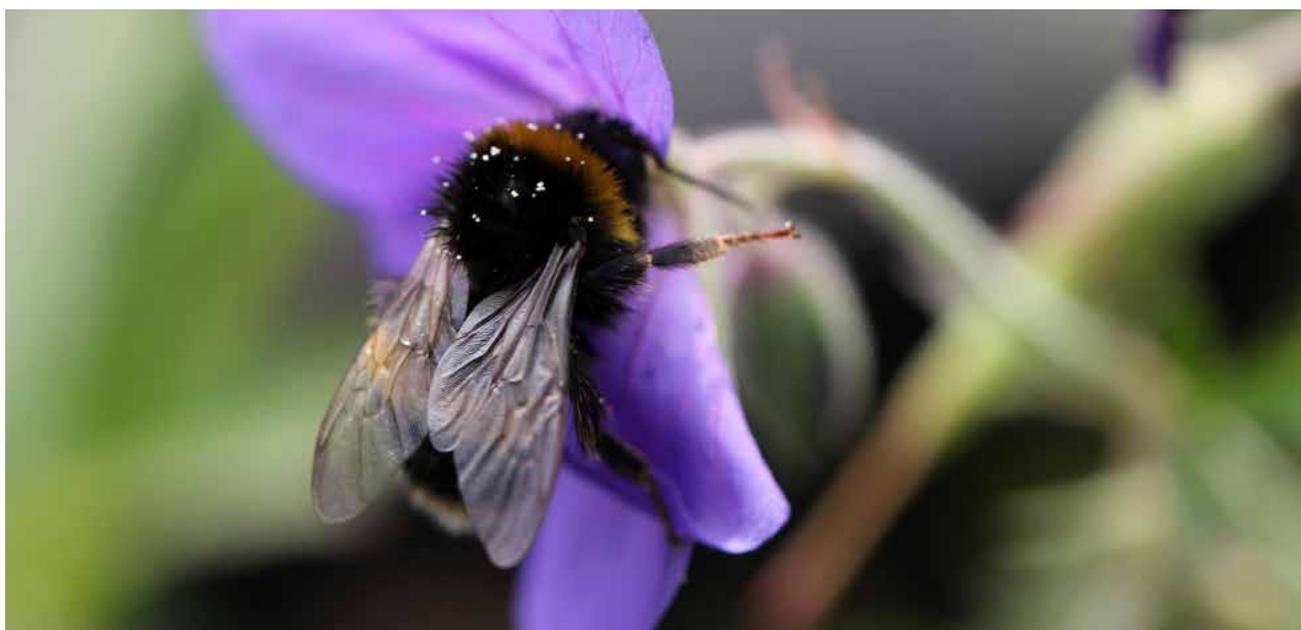
While Tanzania has a solid regulatory framework to guide the management of HCW, its implementation needs strengthening. HCW management is subject to a comprehensive set of laws and regulations that provide clear guidance on the safe and adequate handling of HCW.<sup>29</sup> The MoHSW and PO-RALG are expected to ensure an appropriate monitoring and control system for HCW management is in place. They are also responsible for monitoring the management of HCW at the different levels, and for ensuring that all relevant stakeholders prepare and implement monitoring plans. In practice, however, such plans are often not developed or lack the critical information necessary to comprehensively assess the management of HCW nationwide (National Audit Office, 2014). In addition, limited information is available on how the LGAs, regional administrations, and others monitor HCW management in their respective areas.

<sup>29</sup> MoHSW and PO-RALG are jointly responsible for the management of HCW, more specifically, policy formulation and the development of guidelines to facilitate policy implementation. The LGAs (through the Council Health Management Team), are responsible for planning, implementing, supervising, monitoring, and evaluating HCW management, while the Regional Secretariat plays a coordinating role. In addition, Tanzania is a signatory to three international treaties that aim to ensure the adequate management of hazardous waste: the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Their Removal, the Stockholm Convention on Persistent Organic Pollutants, and the Minamata Convention on Mercury

LGAs are tasked to carry out inspections and visit healthcare facilities but fail to do so regularly. The chance of HCW containing hazardous waste being illegally dumped together with other municipal wastes is therefore high across the country (National Audit Office, 2014).

Given the rapidly growing population and the expanding provision of healthcare, the environmental and health risks stemming from inadequate HCW management will become larger and need to be addressed. The government of Tanzania is increasingly aware of this and taking action. In November 2016, the National Environment Management Council (NEMC) conducted a preliminary evaluation of healthcare facilities in Dar es Salaam, specifically assessing their HCW management. The scope of this evaluation is planned to be extended to other cities. Strengthening the monitoring of healthcare facilities' compliance with the requirements laid out in the regulatory framework would generate data on the generation, segregation, transport, and disposal of HCW. Sufficient funding to facilities should be allowed, and continued capacity building implemented, to better manage the risks associated with HCW.





## 3.6 Pesticide Pollution

Pesticides are potentially toxic to humans and the environment and should be safely used and disposed of. Pesticides are a key agricultural input, fundamental to the modernization of agriculture. In a rapidly expanding population, well-applied pesticides play a key role in food security. However, given their toxic nature, they also pose a severe risk if not properly handled. Approximately 5 billion kg of pesticides are used worldwide annually, threatening environmental and human health through their effects on biodiversity, nontarget organisms, and the food chain. The release of pesticides into the environment may contaminate soil and water bodies, thereby indirectly affecting nearby ecosystems and wildlife. Pesticide exposure can cause a variety of adverse human health effects, ranging from simple skin and eye irritation to more severe effects on the nervous system. Farm workers are particularly exposed to pesticides and the associated risks, through inhalation and skin contact during the preparation and application of pesticides to crops.

Rapid population growth and the associated growing demand for food have resulted in increased pesticide use worldwide, Tanzania

being no exception. Most pesticides in Tanzania, about 80 percent, are used in the agricultural and livestock sector. The remainder is used in the public health sector, about 20 percent—mainly for malaria vector control—and in other sectors. The rising demand for food and the implementation of government extension programs have led to an increase in imports and use of pesticides and agrochemicals in agricultural activities. Following the agrochemical trade liberalization in 1992, the value of pesticide imports increased from \$10 million in 2001 to \$34.3 million in 2013. The registration of pesticide products has also increased, from 448 products in 2007 to a total of 1,390 in 2015 (TPRI, 2015). Pesticide application varies across Tanzania's regions and types of crops. While some regions apply more pesticides than the national average (e.g., Shinyanga and Iringa), the reverse applies to other regions.

**Despite the critical role pesticides play in the agriculture and health sectors, they are potentially toxic to humans and the environment, and should be safely used and disposed of.**

Despite a comprehensive legal framework, the safe handling of pesticides in Tanzania is not always ensured.<sup>30</sup> Tanzania has ratified the Stockholm Convention on Persistent Organic Pollutants (POPs)<sup>31</sup> and the Basel Convention on Transboundary Shipment of Hazardous Wastes and Their Removal. The Plant Protection Act (1997) and its Regulations (1998), describe the roles of and requirements for all relevant stakeholders in view of the management of quality of pesticides, import requirements, registration, certification, and approval, as well as requirements associated with licensing and labeling, packaging, and storage. However, despite statutory obligations being imposed on registered retailers,<sup>32</sup> unregistered pesticides are found across the country, especially in regions and districts bordering other countries (National Audit Office, 2018a; Lekei et al., 2014a). Illegal pesticide imports due to a lack of modern control tools at the country's borders and infrequent inspections are considered key underlying reasons, together with a significant shortage of skilled and qualified inspectors, weak implementation of sanctions to pesticide sellers and importers that do not comply with legislation, and registered pesticides not being available to key users (National Audit Office, 2018a).

Training farmers on safe usage and handling of pesticides can significantly reduce environmental and health risks. The widespread lack of awareness

of the risks stemming from the improper use of pesticides exposes farmers and the environment to significant risks (National Audit Office, 2018a; Lekei et al., 2014b). For example, in a case study conducted among Arumaru farmers in the Arusha region, Lekei et al. (2014a) found that 79 percent of their sample reported keeping pesticides inside their homes, often in rooms used by several family members, while 5 percent used drinking water containers to mix pesticides in, and more than 40 percent applied pesticides without proper personal protection equipment. Many farmers discard leftover pesticides on their farms—pouring them on the ground or burying them. In addition, 55 percent of the sample left empty pesticide containers behind on their farm or threw them in waste pits and most farmers washed the sprayers in a river at the end of the exercise. Ngowi et al. (2007) found that about 68 percent of farmers reported sometimes feeling sick after routine application of pesticides, with symptoms including skin and neurological problems.

### **Training farmers on safe usage and handling of pesticides can significantly reduce environmental and health risks.**

Significant pollution levels are attributed to pesticides in Tanzania. Comprehensive national data on pesticide residues and contamination is not available, however, several case studies have recorded pesticide residues in various parts of Tanzania,<sup>33</sup> with pesticides often severely deteriorated, poorly stored, and close to urban and rural settlements and public infrastructure, including water supplies. Despite pesticides and (obsolete) pesticide stockpiles presenting a serious risk, environmental impact assessments

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30 The responsibility for pesticides management lies with the Tanzania Pesticides Research Institute (TPRI). TPRI registers and inspects pesticide business entities, provides pesticide importation permits, inspects and registers the imported pesticides, and monitors/manages the handling and disposal of unwanted/obsolete pesticides and empty containers. The National Plant Protection Advisory Committee (NPPAC) consists of members from various government, nongovernment, and research institutions provides guidance on and approves the disposal of obsolete/unwanted pesticides; the Occupational Safety and Health Authority (OSHA) controls and monitors occupational safety and health in workplaces, including safe use and handling of pesticides.

31 POPs are chemical substances that persist in the environment, bioaccumulate through the food chain, and pose a risk for human health and the environment.

32 For example, registered retailers must have premises for the storage of pesticides that are adequate and well-equipped—with the necessary storage facilities to prevent exposure of humans, animals, and the environment and suitable for preserving the pesticides' properties. Other requirements are to distribute only authorized products and to maintain safe practices when handling and distributing pesticides. Finally, the retail firm must have sales staff with sufficient knowledge about pesticides, allowing them to safely handle the products and advise end users appropriately.

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33 Pesticide residues have been recorded in rivers and lakes in the Kilimanjaro Region (Henry and Kishimba 2003, Hellar and Kishimba 2005), in several districts south of the Lake Victoria Basin (Henry and Kishimba 2003), in the Kilolo District in the Udzungwa Mountains in the Iringa Region and in the Eastern Usambara Mountains in the Tanga Region (Henry and Kishimba 2003). Pesticide residues in soils from leaking storage facilities were also found in the Manyara Region, Zanzibar, the Mbarali and Mbozi Districts in the Mbeya Region, and the Kibaha District in the coast region (Mihale and Kishimba 2004). Pesticide residues including DDT and higher than the recommended environment permissible limits for soil standards, were also reported in Morogoro and Tengeru (National Audit Office 2018a).

are not systematically carried out by the relevant government institutions (National Audit Office, 2018a). A stocktaking of obsolete pesticides and associated wastes conducted in 2009 recorded nearly 600 metric tons of obsolete pesticides and more than 2,500 metric tons of associated waste (particularly contaminated soils). While the government of Tanzania successfully disposed of most of the obsolete pesticides under the Africa Stockpiles Program in 2012, large amounts of contaminated soil remain. Adequate technical, institutional, and financial capacity are needed to effectively manage the cleanup of such wastes.

Investing in better management practices and technologies can significantly reduce the costs of pesticide pollution. The first principle is to minimize the need to apply pesticides, through

appropriate integrated pest management practices. These practices target the suppression of pests below the level termed as economic injury level, by applying a set of measures based on systematic monitoring of the pest, its life cycle, and its precursors. Integrated pest management uses traditional knowledge, for example by combining different types of crops able to suppress each other's pests, or by rotating them; good prevention strategies; and pest control and suppression using the least impactful methods. Spraying or widespread use of pesticides are used as last resort. When application of pesticides is unavoidable, these should be applied in the correct dosage, and in a way that minimizes exposure to humans and all other forms of life not targeted by the pesticide.



## 3.7 Degradation from Mining

By their very nature, small- and large-scale mining operations are inherently detrimental to the environment. In developing countries, mining companies are not only attracted by the wealth of mineral resources, but also by the relatively low safety and environmental standards under which they are required to operate. Establishing a mine requires clearing land, causing the loss of forests and biodiversity, which in turn affects the local surroundings and communities. Once established, mining can generate significant pollution through leakages and mineral waste<sup>34</sup> that is dumped in nearby rivers, and by highly polluting additives required in the extraction process (for example, the extraction of gold requires the use of cyanide, which can have particularly severe effects on the environment).

### **The use of mercury by artisanal and small-scale mining poses significant environmental and health risks.**

In Tanzania, mining and quarrying activities include the extraction of metals, industrial minerals, and fuel minerals. Mining is an important foreign exchange earner. Between 2005 and 2015, the sector on average represented 36 percent of the total value of Tanzania's exports, with gold accounting for 90 percent of the total (NBS, 2015); the contribution of mining to GDP over the same period has averaged 4 percent.<sup>35</sup> According to Tanzania's Development Vision 2025, the mining sector is planned to account for 10 percent of the country's GDP by 2025. Mining operations are conducted both on a large and small scale, with informal, small-scale gold mining estimated to account for 10 percent of total national production (UNEP, 2012). Large reserves of

34 Mining waste includes tailings (also called mine dumps, culm dumps, slimes, tails, refuse, or leach residue)—the materials left over after the process of separating the valuable fraction from the uneconomic fraction of an ore. Tailings are distinct from overburden, which is the waste rock or other material that overlies an ore or mineral body and is displaced during mining without being processed.

35 This percentage fluctuates due to the uncertain nature of mineral extraction and the price of gold on global markets.

natural gas were recently discovered, accounting for a total of 55.08 trillion cubic feet in 2015, and extraction for domestic electricity and commercial and industrial activities has started. This is likely to further increase the contribution of the mining sector to the economy.

Large-scale mining generates considerable amounts of toxic waste. In Tanzania, large-scale mines mainly extract gold, tanzanite, coal, and diamonds (MEM, 2015).<sup>36</sup> Because of practices such as open-pit mining and cyanide heap leaching,<sup>37,38</sup> about 60 metric tons of toxic waste are produced for every ounce of gold, with the waste including cyanide and toxic heavy metals.<sup>39</sup> Mines construct tailing dams where toxic waste is stored, but the waste often leaches into the groundwater and nearby streams and water bodies, affecting available drinking water for neighboring communities. Around 90 percent of the gold produced in Tanzania originates from the Lake Victoria region, and the pollution generated poses major problems not only in the surrounding areas but also in the lake itself. Large mines also affect the air quality—through particulate emissions<sup>40</sup>—and contribute to land degradation and deforestation because of the expansive nature of mining activities and related infrastructure.

The use of mercury by artisanal and small-scale mining poses significant environmental and

36 Large-scale mining is done by large corporations and is often labor-intensive and dependent on advanced extraction technology. These companies tend to mine at large sites and usually operate until the mineral is completely extracted.

37 Open-pit mining is a type of mining in which the ore deposit lies at a substantial depth (underground) and necessitates the removal of several layers of rock, creating a pit that extends deep underground.

38 Cyanide heap leaching is a technique commonly used to extract gold, where the ore is first crushed into fine particles and then heaped into large piles that are sprayed with cyanide, which trickles down through the ore and bonds with the gold.

39 Large- and medium-sized mining activities generate mining waste in the form of overburden, tailings, and waste rock that can be toxic and contaminate the environment, as they can include hazardous chemicals and highly toxic metals.

40 Mining operations emit gaseous pollutants and dust through their operations. These particles may fall within the respirable dust range that can be hazardous to human health and cause dust-related diseases.

health risks.<sup>41</sup> In Tanzania, small-scale mining has boomed in recent years, particularly around Lake Victoria in the central and southwestern regions, where between 0.5 and 1.5 million people are estimated to be involved in small-scale mining (World Bank, 2012; UNEP, 2012; Mdee, 2015).<sup>42</sup> Open air burning of gold amalgam produces mercury fumes, while in other instances, the amalgam is burned in poorly ventilated rooms, exposing miners to the dangers of mercury contamination (URT-VPO, 2014c). Gold processing through amalgamation is usually done near rivers, which entails health risks for residents further downstream, as mercury contaminates water sources and ultimately the food chain. Mercury exposure can lead to neurological and cognitive disorders in miners and physical and mental disabilities in children. Tanzania ranks among the 10 leading countries in mercury consumption for artisanal and small-scale gold mining, with an estimated annual consumption of 45 tons per year. Assuming an emission factor of 0.75, these figures suggest that 33.75 metric tons of mercury are released every year through artisanal and small-scale gold mining in Tanzania (AMAP/UNEP, 2013).

Ensuring that both large-scale mining and small-scale and artisanal mining operations comply with environmental regulations is critical. The sector is regulated by the Environmental Management Act of 2004, the Mining Act of 2010, the Petroleum Act of 2015, and the Environmental Impact Assessment Guidelines, which fall under the mandates of the Ministry of Energy and Minerals and the NEMC. Most large-scale mining companies conduct the required environmental impact assessments (EIAs) before starting mining activities. However, once mining begins, companies do not necessarily follow nor take into account the recommendations and results

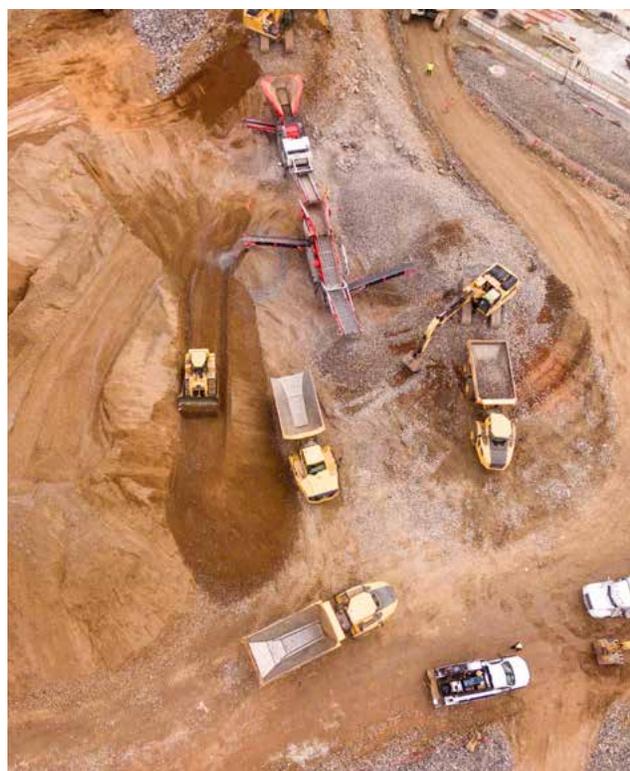
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41 Gold extraction at artisanal and small-scale mining is done in a rudimentary fashion, and mercury amalgamation is the most commonly used method. The process involves mixing mercury with gold-containing materials and then heating the resulting mercury-gold amalgam to obtain the gold. For every gram of gold, about two grams of mercury are released into the environment.

42 Artisanal and small-scale mining involves small groups of people engaged in simplified forms of exploration, extraction, processing, and transportation, at low cost, and using low technologies and labor-intensive methods.

of those EIAs systematically. In addition, mining projects are often geographically concentrated, as is the case of the Lake Victoria Basin, yet every project is subject to a separate EIA, which means the cumulative impacts are not considered. Most artisanal and small-scale mining is of a subsistence nature and driven by immediate concerns rather than potential long-term consequences and impacts. Small-scale miners often cannot conduct their activities in a sustainable way due to the lack of resources and knowledge, and their failure to meet all relevant legal requirements.

Mining operations can mitigate their environmental impact through sustainable practices. Globally, mining operations are increasingly conducted in a way that minimizes the environmental impacts and rehabilitates the land to the extent that it can be reused by the population or ecosystems. Tanzania has an opportunity to manage the sector in a way that promotes appropriate technologies and practices for limited water and energy consumption and land degradation, reduced waste production and adequate decommissioning. Command and control mechanisms and incentives for good performance should be thoroughly implemented.





4

# Toward Cleaner, Greener Development





Tanzania is making significant strides toward growing its economy with a view to reducing poverty and improving its citizens' quality of life. Considering the economy's dependence on natural resources, maintaining functional ecosystems and safeguarding the environment can provide a sustainable path toward this goal. Tanzania has already made headway by implementing important environmental laws, policies, and actions, and by protecting large areas of land.

**Tanzania has already made headway by implementing important environmental laws, policies, and actions, and by protecting large areas of land.**

The previous sections have systematically assessed the key environmental challenges Tanzania needs to consider when planning its future development. Each challenge has been discussed in terms of its magnitude, recent trends, and future projections as well as its possible impacts and costs (quantified whenever possible),

together with specific policy recommendations, where relevant. The results of the assessment and the recommendations are based on consultations with multiple practitioners from different disciplines and organizations. During the consultations, attempts were made to prioritize the subsectors requiring more urgent, concerted action.

However, priorities are best set by each government agency with some responsibility for environmental management. Identifying priority issues is not a "zero-sum" game, where directing attention to one set of natural resource issues (e.g., land degradation) implies that agencies cannot in parallel also address other issues (e.g., industrial pollution). All relevant agencies—from municipalities responsible for SWM to regulatory agencies responsible for conducting EIAs to those responsible for managing land use in and around national parks—can take steps to improve their contribution to environmental management. Therefore, this study does not propose a prioritized list of issues requiring attention in decreasing order—all issues can have large environmental and social impacts—but, instead, proposes development pathways that include building

blocks of Tanzania’s development strategy.

Four development paths are suggested, based on the drivers and characteristics of the environmental challenges discussed in this CEA. These paths are: (1) conservation of biodiversity and marine and freshwater resources; (2) promotion of resilient landscapes; (3) access to modern fuels and low impact urbanization; and (4) strengthened institutions for pollution management. The first two paths relate to the more “traditional” rural environmental and natural resources challenges, which include degradation of land and water resources, deforestation, and biodiversity loss. These issues are most relevant for rural areas, where natural resources are subject to competing demands (biodiversity conservation, agricultural expansion, cattle raising, human settlements, hydropower production). If not properly addressed, they can have impacts across landscapes and watersheds—degrading ecosystems and the services they provide to rural and urban economies and livelihoods. The other two paths relate to a set of pollution-related issues, more frequently associated with urban settlements, industrialization, and agglomeration, some of which have only recently started drawing concern.

Climate change emerges as a strong “multiplier” across all paths and dimensions of natural resource issues, and as a driver of more complex urban management issues such as flooding, poor sanitation, and the growing threat of water pollution and toxic waste. Climate change can be considered as a stand-alone priority that Tanzania needs to tackle or as a conditioning factor in each of the environmental challenges. This report takes the latter approach, mainstreaming climate change into the analysis.

The four paths are useful to match policies and investments with the root causes of environmental degradation and in the areas where the challenges are acute. They cover the most pressing environmental issues identified through extensive consultations and literature research. Addressing these issues is key to boosting Tanzania’s development without jeopardizing the livelihoods of generations to come. Doing so will

make it easier for the country to preserve its natural capital and thereby safeguard current growth as well as its future sustainability.

**Climate change emerges as a strong “multiplier” across all paths and dimensions of natural resource issues, and as a driver of more complex urban management issues such as flooding, poor sanitation, and the growing threat of water pollution and toxic waste.**

This CEA highlights that the environmental challenges are significant, widespread, and gaining urgency as the country develops. However, given the needs in basic sectors such as health and education, and the country’s limited financial resources, oversight and stewardship of natural resources are often insufficiently considered and budgeted for. While the call for action on environmental conservation and management may appear daunting to policy makers, integrated approaches that simultaneously tackle the causes of the identified challenges must be formulated. Moreover, the necessary interventions will need to be properly sequenced and multi-agency and multi-stakeholder partnerships and approaches will have to be developed.





# Pathway 1 Conservation of Biodiversity and Marine and Freshwater Resources

## Conservation of biodiversity – The Wildlife Economy

...there are mounting pressures on the sector, arising from poaching and illegal wildlife trade, human-wildlife conflict, deforestation and illegal timber logging, land degradation, coastal degradation, overfishing and destructive fishing, expansion of the agricultural frontier, and other threats associated with a growing economy.

One possible pathway for Tanzania's development would be to give an additional impulse to the "wildlife economy" and the "blue economy."

As pointed out elsewhere, wildlife-based tourism represents an important share of Tanzania's economy. Acknowledging this importance, around one third of the country's land area is under some form of environmental protection (national parks, game reserves, forest reserves, etc.). Significant resources are already being spent on maintaining the system of protected areas and combatting illegal activities. However, there are mounting pressures on the sector, arising from poaching and illegal wildlife trade, human-wildlife conflict, deforestation and illegal timber logging, land degradation, expansion of the agricultural frontier, and other threats associated with an expanding population and a growing economy. Moreover, poverty is pervasive in many of the communities surrounding protected areas and nearby rural communities see protected areas as a barrier to their development and livelihood rather than as a source of wealth.

One possible pathway for Tanzania's development would be to give an additional impulse to the "wildlife economy." Wildlife-based tourism has the potential to become a key engine of growth and prosperity, bringing jobs and livelihoods to areas with few other options.



If Tanzania wishes to further benefit from the wildlife economy, additional efforts will need to be directed at the sector, in particular:

**A. CURB DEFORESTATION AND HABITAT LOSS.** As previously stated, Tanzania is one of the fastest deforesting countries in the world. Forests are a key habitat for wildlife and species of critical importance, their degradation and loss affect the health of protected areas and their ability to continue to produce ecosystem services. The root causes of deforestation in Tanzania are many, but the expansion of the agricultural frontier is one of the main ones. Effective command and control mechanisms should be put in place, combined with monitoring and incentives and climate-smart agriculture, to curb the current, unsustainable deforestation trend. In addition, a factor causing forest degradation (frequently the step preceding complete deforestation) is the extraction of fuelwood and charcoal for cooking, as discussed in more depth in pathway (3). Charcoal and fuelwood extraction are among the environmental challenges most often mentioned by stakeholders, not surprisingly given that current estimates show fuelwood and charcoal are the primary fuels in over 85 percent of all households. The use of fuelwood,

and especially charcoal, threaten protected areas such as forest reserves and can easily lead to forest degradation and eventual deforestation. A dedicated study on how to effectively reduce the share of charcoal in the energy mix is recommended, together with the creation of a multi-stakeholder platform to oversee the process and guide decision making.

**B. FUNDING FOR CONSERVATION.** The Ministry of Natural Resources and Tourism (mainly through its Wildlife Division), together with TANAPA, TAWA, NCAA, and TFS, manage the system of protected areas. The latter four parastatal agencies rely mostly on their own ability to raise resources for their operations. Most of these agencies face multiple funding challenges (for example, the bulk of TANAPA's national parks run at a loss and are "subsidized" by the profits of just three parks—the Serengeti, Kilimanjaro and Tarangire National Parks). For Tanzania to continue reaping benefits from this system, adequate funding is essential to manage and protect its resources. However, pressures on the already stressed system are mounting, including the oscillating (and probably declining) nature of the hunting business, and the growing demand for resources due

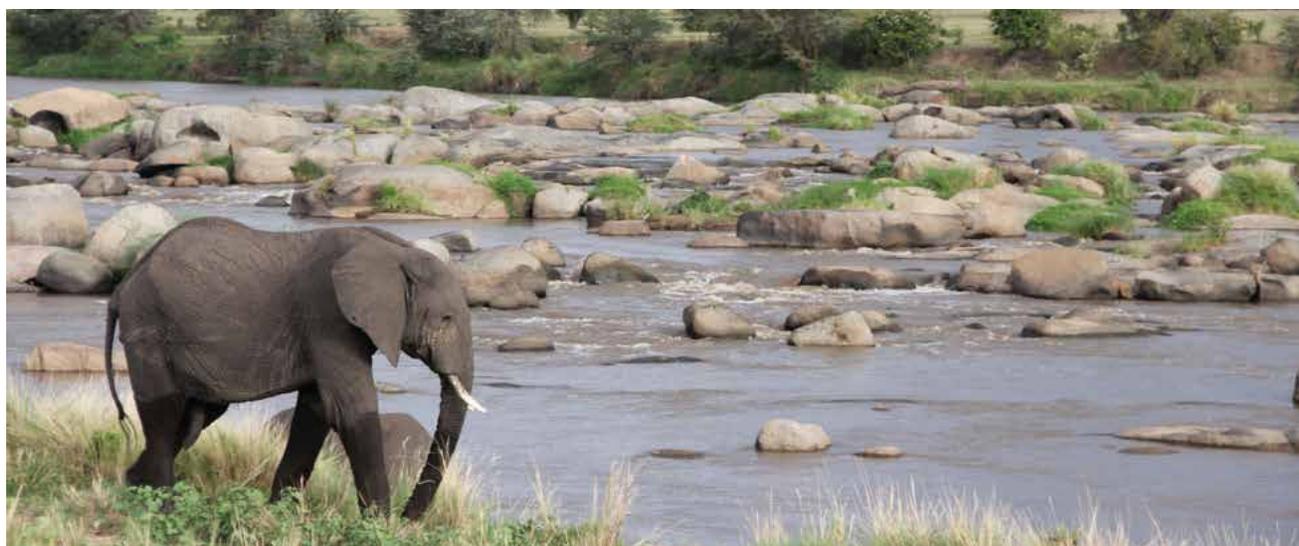
to economic development and population growth. The situation calls for the creation of additional funding sources for wildlife conservation, for example, government-led and/or independent conservation funds. These funds could be capitalized through different mechanisms—taxes or environmental fines, offsets, tourism levies, international donors, and even philanthropists. Many such funds exist, with Brazil being a world leader and neighboring Mozambique offering some good examples of how these can be established and implemented to maintain and innovate conservation toward a “wildlife economy.”

**C. DIVERSIFICATION.** Tanzania’s most popular tourist destinations—among others, the Serengeti and Ngorongoro Crater (in the so-called Northern Circuit)—are already showing signs of overcrowding and degradation (World Bank, 2015c). If the country aims to continue increasing revenue from tourism by increasing the number of tourist arrivals and nights spent in-country, while maintaining its successful high-value low-density model,<sup>43</sup> diversification is needed. If tourism in the Northern Circuit continues to increase, there is a risk of ecosystem degradation. Instead, tourism should be diversified in terms of geographic

location and product offering. There are good examples of how to pursue diversification, such as the REGROW Project, which allows Tanzania to develop destinations and attractions in the lush but unknown and underdeveloped Southern Circuit (box 4.1). Diversification into the south of the country requires investments, infrastructure, and the promotion of Iringa as a “gateway” city to the area, similar to the role Arusha plays in the north. Developing other tourism products such as beach tourism, adventure tourism, or cultural tourism, can complement the main, existing activities.

**D. BENEFIT-SHARING.** Some of the poorest communities in Tanzania live around protected areas, giving rise to pronounced inequality between protected areas hosting tourists who pay large sums of money to spend a few nights and adjacent communities living in poverty and not directly benefiting from those revenue sources. This gives rise to encroachment, poaching, bush-meat hunting, human-wildlife conflicts and other tensions. For wildlife to survive outside the protected areas and for protected areas to thrive, communities must have strong incentives to embrace (or at least tolerate) wildlife as a land use. Approaches need to be adopted that seek to capture multiple benefits from wildlife conservation on state, private, and communal lands. Existing benefit-sharing mechanisms (such as wildlife management areas or the

43 This model is based on Tanzania’s strategic decision to avoid mass tourism and charge higher fees per tourist because visitors are willing to pay a premium for avoiding (over)crowding at the country’s principal attractions.



government's support for community-based projects) need to be improved, in terms of the share of revenue that is made available to communities, participation of beneficiaries in decision making on revenue collection and, ultimately, a more effective devolution of power to beneficiaries. Innovative mechanisms for communities to own and operate resources exist elsewhere (box 2.7), and Tanzania has an opportunity to design its own initiatives toward a more inclusive tourism sector.

**E. ALTERNATIVE LIVELIHOODS AND RURAL DEVELOPMENT.** While Tanzania's population is booming, economic progress and livelihood opportunities tend to be concentrated around development poles. Communities living around protected areas continue to rely heavily on natural resources and regard protected areas as a competitor for the same resource. If Tanzania is to succeed in preserving its unique wildlife and ecosystems, less natural resource-intensive rural livelihoods need to be promoted. The government is already moving in this direction, for example, through TANAPA's support for community-based projects, but more efforts are needed. Investing in modern agricultural practices, promoting climate-smart agriculture and agroforestry, or shifting to intensive cattle farming will provide alternatives in areas where economic options are limited. Skills development in areas such as hospitality and environmental conservation

can contribute to changing the perception of protected areas as a competitor to a partner and engine of rural development.

**F. BUSINESS ENVIRONMENT.** As already established, the protected areas system in Tanzania offers sanctuary to world-renowned ecosystems, and a rich and varied wildlife that attracts thousands of tourists from around the world. Tourism is a key contributor to the country's GDP and the largest source of foreign currency. But tourism will only thrive if the tourism-related private sector also thrives. The contribution of the private sector to the development of the industry cannot be overstated. Yet studies show that tourism in Tanzania is subject to multiple, fragmented taxes and levies. For example, tourism operators alone are subject to more than 20 different taxes and fees (World Bank, 2015b; World Bank, 2015c); the taxes and fees in the tourism sector are unpredictable, uncertain, and often duplicative, reducing Tanzania's ability to compete with the industry in neighboring countries and attract additional investments. If Tanzania is keen to ensure the conservation of its wildlife to secure income and jobs from tourism, the business environment needs to be improved. Key elements in this context are establishing a level playing field for local and foreign investors, setting taxes and fees on a rational basis, and introducing efficient collection mechanisms.



**G. PUBLIC-PRIVATE PARTNERSHIPS (PPPs).**

Setting up robust and clearly defined PPP arrangements has proven to be an efficient and effective way to deliver quality services. While few PPPs exist in Tanzania in relation to protected areas and wildlife-based tourism, they are popular elsewhere (Brazil's protected areas offer some leading examples) and range from specific concessions awarded to the private sector to offer services (restaurants, shops, tours) to arrangements for infrastructure maintenance within protected areas. Exploring mechanisms to efficiently deliver services through partners and the private sector will open new possibilities in the management of Tanzania's extensive natural assets.

# THE WILDLIFE ECONOMY

**IS A KEY ENGINE OF GROWTH AND PROSPERITY, BRINGING JOBS AND LIVELIHOODS TO AREAS WITH FEW OTHER OPTIONS**





## Marine and Freshwater Resources – The Blue Economy

Tanzania is endowed with rich coastal and marine environments, and large, productive freshwater bodies. If properly managed, these can be turned into a sustainable engine of development and job creation, by amplifying the positive initiatives that are already underway and minimizing the negative impacts and destructive methods. It was estimated that lost economic benefits from poorly managed fisheries worldwide stood at about \$83 billion in 2012 (World Bank, 2017d). While Tanzania’s marine resources can provide larger benefits than they currently do, the sector needs careful planning, improved governance, and sustained funding. The great Tanzanian lakes, in turn, support some of the most productive freshwater fisheries in Africa, but urgent measures are needed to curb overfishing and revert the degradation of water quality and water basins.

The following actions and recommendations are key for Tanzania to unlock its potential to further pursue and benefit from the blue economy<sup>44</sup> and its lakes:

- A. Conserve marine biodiversity and protect endangered species.** A first, necessary step toward pursuing the blue economy is to better maintain the rich marine and lake resources the country is endowed with. The Marine Parks and Reserves Unit (currently managing Tanzania’s three marine parks and 15 marine reserves) needs to remain a strong institution, with adequate funding to ensure ongoing future protection of high priority biodiversity habitats, including the potential

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<sup>44</sup> Blue economy in this context refers to the range of economic sectors and related policies that together determine whether the use of oceanic resources is sustainable. Certain aspects of the blue economy—such as coastal tourism, marine transportation, and energy generation—are not discussed in this section.

extension of the system to offshore areas. In parallel, continued efforts should be directed to bridging research gaps about Tanzania's marine biodiversity, including in topics such as distribution of coral reef biodiversity or status of vulnerable species' groups such as sharks, rays, and marine mammals, as well as other relevant freshwater biodiversity.

**B. Reduce fisheries' post-harvest losses and add value.** Contrary to popular perception, Tanzanian marine waters are not an inexhaustible source of fish. Estimates suggest that many of the species of commercial importance are fully exploited or overexploited. Therefore, the objective should be to reduce post-harvest losses, instead of continuing to increase fishing effort. Some of the root causes of the high post-harvest losses that characterize the sector are current artisanal fishing practices; lack of cold chain; poor landing, auctioning, and wholesale facilities; and the lack of storage infrastructure. A concerted effort is needed to reduce losses by promoting access to ice and cold storage and improving landing facilities. There is also a need to shift attention from increasing fishing efforts to improving post-harvest value addition and access to markets. Value addition is challenging, as it requires governance,

infrastructure, and market environments to function properly. Yet there are opportunities in some of Tanzania's priority fisheries and the country is already exploring several of these through the World Bank-funded South West Indian Ocean Fisheries Governance and Shared Growth Project (SWIOFish).

**C. Strengthen the private sector, PPPs, and infrastructure business plans.** International best practices suggest that the private sector is well equipped to run and operate fisheries enterprises, provided the government levels the playing field and acts as a regulator. Efforts should focus on promoting private sector participation and/or the establishment of PPPs, because these measures have proven to yield economic benefits and create jobs. Although building new infrastructure (markets, landing sites, cold storage) seems to be an obvious first step, it is fundamental to identify and agree on the arrangements for the operation and maintenance (as experience has shown that improved landing and market infrastructure, or even ice production, alone, will be neglected and underused if the operations and maintenance are not well defined and formally agreed, with participation of private sector) and to understand the incentives and disincentives for fishermen to





use the available infrastructure. The market structure often forces fishermen to sell all their produce to boat/ fishing gear owners who would rather not see the fish auctioned. And these transactions tend to take place away from landing sites and markets, to avoid paying taxes.

**D. Better harness the value from deep sea fishing in the Exclusive Economic Zone (EEZ).**

Tanzania should adopt a double strategy. On the one hand, continue using taxes and levies to collect revenue from foreign fleets fishing in Tanzania's EEZ. The licensing of foreign fishing vessels is subject to peer competition, and Tanzania should ensure that the conditions in its licenses do not impose unsurmountable burdens but remain competitive and attract activity. The government is finalizing the review of a new policy framework (Deep Sea Fishing Policy, Act and Regulations), and its final, timely approval is crucial. On the other hand, Tanzania should start planning for the medium-term aspiration of having Tanzanian vessels fishing tuna and other offshore fisheries stocks and/or encouraging foreign vessels to land their catch in Tanzania. This is a complex process requiring careful

planning, sustained investment, appropriate landing infrastructure and market chains, partnerships with national and global private sector, and a solid understanding of regional and global market dynamics. A first step could be conducting a comprehensive feasibility assessment of the sector, and find entry points to become a player in a very competitive regional and global environment.

**E. Prevent the reemergence of blast fishing and fight destructive fishing methods.**

Tanzania has recently succeeded, after a long history of illegality dating back to the 1960s, to curb one of the most destructive nearshore fishing methods—the use of explosives to kill or stun fish (box 2.10). Blast-fishing was effectively controlled once before, from 1998 to 2002, only to re-emerge thereafter. A monitoring system needs to be put in place so as to quickly identify if, when and where the practice might take root again. Continued training on awareness as well as on investigation and prosecution are key in this regard. The current monitoring, control, and surveillance system to prevent illegal fishing should be reviewed and be made more efficient. Lessons can be drawn from anti-poaching efforts, where

patrolling is conducted in response to specific, intelligence-based information. The strong political will at the highest levels to end this kind of destructive, illegal behavior needs to be maintained.

**F. Remain engaged in regional cooperation.**

As some of the most significant Tanzanian fisheries are regional in nature, their monitoring, control, and surveillance could benefit from economies of scale (for example joint patrolling, data-sharing, joint enforcement of safety at sea regulations, and technology). Adoption and implementation of international protocols and agreements, such as the Port State Measures Agreement, are key to fight illegal, unreported and unregulated fishing activity. The country should continue participating actively in regional fora (such as the Indian Ocean Tuna Commission and the South West Indian Ocean Fisheries Commission) to further strengthen relations and improve collaboration. The environmental problems faced by the Lake Victoria Basin are of a similar regional nature. Disease vectors and oxygen-depleting nutrients that enter the lake through one nation's discharge of untreated wastewater affect the water quality of all countries that share the lake, ultimately depleting fish stocks because of deteriorating water quality. Addressing these challenges requires both local and national efforts in all countries concerned, jointly undertaken and coordinated at the regional level. Efforts under the Lake Victoria Basin Commission and the East African Community toward jointly managing the lake's resources are essential, as are regional water quality and ecosystem monitoring platforms.

**G. Continue supporting co-management and improved coastal livelihood opportunities.**

The fisheries sector is an important source of jobs and livelihoods for coastal and lake communities, and Tanzania has been promoting co-management of resources for several decades. An additional impetus is needed for this process to be successful—supporting the creation and operationalization

of beach management units (BMUs) and their further aggregation into collaborative fisheries management areas (CFMAs). This approach strengthens the ownership of decision making, improves the governance of fisheries resources, and empowers communities to drive their own development. A factor that commonly affects coastal fishing communities is the lack of diversity of income-generating opportunities outside of harvesting marine resources. A further factor that constrains entry into other types of livelihood such as trading, agriculture and livestock, as well as secondary and tertiary education, and vocational training, is limited access to credit. Access to small loans can frequently make the difference between dependency on a hand-to-mouth existence as a primary resource-harvester, and gaining an entry-point into other livelihood options. Tanzania has a tradition of microfinance and self-savings groups, and the so-called village savings and loan associations have shown promise in the fisheries sector.





# PATHWAY 2 Promotion of Resilient Landscapes

**Rural areas that successfully balance ecosystem, economic, and social functions are more resilient to shocks and uncertainties.**

**A key feature of the landscape approach is the establishment of a multi-stakeholder platform.**

The second pathway proposed under the CEA is a spatial one, a strategic work methodology aimed at considering all environmental resources available in a determined area (a landscape) and optimizing their use in a sustainable manner. As such, recommendations in this section are broader than in the previous ones, more focused on ensuring that the overall risks and opportunities offered by landscapes are appropriately captured. A key feature of the landscape approach<sup>45</sup> is the establishment of a multi-stakeholder platform.

The importance of this platform cannot be overstated, as it is the basis for identifying challenges and opportunities in a comprehensive way, a task that cannot be accomplished by a single group. These platforms help stakeholders share information, develop a common understanding of their landscape, build trust, negotiate trade-offs, monitor progress, and learn from each other's experience. It is recommended that Tanzania carefully plans and implements these platforms, especially in remote and rural areas where community engagement and collaboration are fundamental to success.

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<sup>45</sup> Landscape approach refers to the management of multiple land uses in an integrated manner, considering both the natural environment and the human systems that depend on the landscape in question.



The landscape approach is a powerful tool to address challenges in the rural space. Rural areas are undergoing transformative changes as natural resources such as forests, water, land, and biodiversity face increasing pressure and the ecosystem services they provide continue to degrade. A growing body of evidence shows that rural areas that successfully balance ecosystem, economic, and social functions are more resilient to shocks and uncertainties. Such a balanced approach can sustain livelihoods, address food security issues, protect vital ecosystem services, and enable humans and landscapes to adapt to current and future impacts of climate change.

The key aspect of the natural resources-related challenges is their fundamental interconnectivity. Land degradation, water scarcity, deforestation, and biodiversity loss, are all linked at the landscape level. Multiple pressures on the landscape often combine into larger, more detrimental impacts. For example, deforestation can lead to biodiversity loss, soil erosion, pollution of nearby waterways, and a decrease in stream flow. All these effects can have economic and social consequences for the people who rely on these resources for their livelihood. A landscape approach considers the complex interactions between human activities and the environment, including their physical and

socioeconomic repercussions and opportunities. The essence of this approach is to focus on the connection between the needs of people and the environment on the one hand and the need to build the resilience of the overall system for the benefit of the ecosystem and the community on the other hand.

Successful and sustainable interventions must involve collaborative actions by a multi-stakeholder platform that includes agriculture, forestry, rural infrastructure, fisheries, water resources, and tourism.



Ecological and social processes interact on multiple spatial scales—from local practices and conditions (such as communities producing food) to broader influences and effects (such as upstream water use or water policy). Managing these interlinked landscape systems thus requires collaboration among stakeholders from different sectors, interests, and levels. These stakeholders contribute knowledge of best practices in their field as well as an understanding of the functions of ecosystems, the water cycle, land management, and the interaction between these processes.

More efficient management of land and water resources at the landscape scale is critical to achieving green and resilient growth. Agriculture

is a key driver of the economy, and an activity that needs to be promoted. However, should be carefully managed as it is not only the main driver of deforestation and land degradation, but also the largest freshwater consumer in Tanzania. Future demand for these resources will increase significantly. Meeting these demands while maintaining functional ecosystems requires complementary measures such as optimizing land use, raising crop yields, protecting soils and watersheds, recharging aquifers, restoring land, and reducing climate risks. These measures can be adapted to the ecological and social needs of communities and the environment. Widespread implementation of climate smart practices and approaches is a priority for the sector.

#### **BOX 4.1: IMPLEMENTING THE LANDSCAPE APPROACH IN TANZANIA THROUGH THE REGROW PROJECT**

Tanzania's diverse natural resources, especially wildlife, form the basis of its tourism development. However, limited infrastructure and management capacity, environmental degradation, land-use conflicts, climate change, and wildlife poaching are threatening the health of these natural assets and undermining the potential for tourism growth. Additionally, tourism remains heavily concentrated along the Northern Circuit, leading to overstress and carrying-capacity limitations. The Resilient Natural Resource Management for Tourism and Growth Project (REGROW) aims to improve the country's capacity to protect and manage its rich natural resources in the Southern Circuit, by developing key tourism assets to promote activities in the area. The project includes a landscape approach to the challenge of the Great Ruaha River: to reduce the number of days the river runs dry—through short-, medium-, and long-term interventions—a factor that is significantly affecting the environmental services that the river provides. At the same time, the project is assisting the government in addressing rural poverty around the Southern Circuit by enhancing the participation of communities in nature-based economic activities and exploring alternative livelihoods.

The World Bank is partnering with the government of Tanzania to promote environmental sustainability and safeguard biodiversity in Ruaha, strengthen water resources management at the national and regional level, foster climate-smart agriculture practices, and facilitate dialogue and coordination among stakeholders. A landscape approach has been adopted and different stakeholders are involved in the activities being implemented across the watershed: (i) human settlements and livestock in the upper catchment areas, to reduce land degradation; (ii) farmers in the agricultural plains, to promote efficient water use in irrigation in the rice paddy plains, on-farm and drainage management, and water governance; and (iii) protected areas and tourism stakeholders in the Ruaha National Park, to implement infrastructure that will increase water availability during the dry season in the Ruaha National Park, in preparation for extremely dry years.



Improving landscape productivity also requires strengthening property rights and motivating individuals, households, and communities to invest and manage resources in the most productive and sustainable way possible. A large body of evidence from international case studies shows that the design of user rights directly affects investment and productivity in both agriculture and forestry. Tanzania can also draw on its own history of community forestry reform, which clearly shows the need to ensure communities are actively involved in the sustainable and productive management of forests and plantations. The integrated water and land management practices being implemented by REGROW (box 4.1) are suitable in this context and represent a good example of how Tanzania is implementing the landscape approach.

Another fundamental step toward landscape-scale investments is improved valuation of environmental services. As shown in section 2, current deforestation trends mainly reflect the fact that a mere fraction of the total value of forests is currently recognized. In addition, the fact that very few estimates exist of the nonmarket value of forest services, biodiversity, and broader ecosystem services accounts for the drastic undervaluation of the actual costs of environmental degradation.

Tanzania has multiple opportunities to implement resilient landscape-based interventions across the country. Specific suggestions include:

**A. Watersheds around the great lakes.** As shown in box 2.8, lakes such as Victoria and Tanganyika are a key source of livelihoods and development for the surrounding communities because they sustain a rich and productive fishery and provide transportation opportunities. However, human-induced changes across the watersheds are deteriorating water quality and threatening their ability to provide services. Deforestation, runoff from agriculture, and untreated wastewater, as well as small and irregular mining activities are all linked to jobs and livelihoods, and limiting or eliminating them, in isolation, would be socially challenging.

Establishing a multi-stakeholder platform to jointly identify challenges, define a vision for what the area should look like in the future and what services it should provide, and agree on an implementation plan makes it much more likely that efforts to improve environmental conditions and access to sustainable jobs will succeed. The government has a long history of engagement in the area and the Lake Victoria Environmental Management Project, implemented in partnership with the World Bank, offers valuable lessons on how to improve landscape management—for example, by encouraging sustainable, climate-resilient land and WRM through effective and well-targeted livelihood support, ecosystem monitoring, and natural resource management.

**B. Msimbazi River and similar water courses.**

As illustrated in box 3.2, some of the problems caused by the Msimbazi River as it flows through Dar es Salaam (such as floods, pollution, and siltation) originate outside the city, in the upper areas of the catchment. Deforestation, land degradation, sand mining, and other anthropogenic activities at different geographical locations of the water course are root causes of the problematic downstream situation. Bringing all stakeholders together; defining a joint vision; and reconciling human activity, environmental services, and their trade-offs would facilitate the management of what is a critical water source for Dar es Salaam.

**C. Arid and semi-arid areas, including the surroundings of Dodoma.**

As Tanzania gives renewed impetus to Dodoma as the country's capital city and government's headquarters, the city is expected to experience rapid growth. Its dependence on environmental services from its surroundings (additional land for agriculture, clean water for human consumption, food and fodder) will be more acute than ever. The area is also vulnerable to climate change. Identifying priorities for action now through a resilient landscapes lens is recommended, recognizing that it is easier to plan ahead and prevent problems than address them when they arise.

#### D. Implementing climate smart agriculture.

This recommendation has been included under the landscapes pathway, but it could have been discussed in several other pathways and sectors. Agriculture remains a key contributor to GDP, and growth in agriculture is essential to the improvement of food security and nutrition, and job creation, especially in rural areas. However, many traditional agriculture systems in Tanzania are currently extensive, with practices that lead to deforestation and land degradation. Climate change is expected to have the greatest impact through the agriculture sector, and hence on the rural poor. Increased irrigation, especially small-scale efficient irrigation, can partially offset the impacts of climate change. It will be important to ensure that the agriculture sector adopts climate-smart strategies in order to achieve

resilience through boosting productivity and reducing emissions.

Incentivizing and encouraging investment in sound, resilient landscape-based projects will further accelerate the adoption of environmentally beneficial actions. Incentives provided through policy, governance, and funding will promote the transition to sustainable practices. For example, incentivizing farmers to plant trees through the adoption of conservation agriculture and other agroforestry practices will reduce deforestation while providing income and access to the resources they require. Several windows of financing could be explored, including those under the Global Environment Facility, the Green Climate Fund, and REDD+, all of which are familiar to Tanzania.

Finally, designing and implementing the right set of policies for each context is a powerful tool to promote resilience and reconcile trade-offs.

When weighing policy options, each government agency with responsibility for the environment should consider the four “I’s” and assess them for each priority issue within the landscape:

1

### Information

How information can be collected and made available, including the environmental data needed to design policies; the alternative cost and benefit streams of competing land, water, and energy uses; and the future environmental liabilities that could affect private investment in various sectors.

2

### Institutions

How institutions can be strengthened and effectively coordinate their activities with relevant agencies to build an environment supportive of the vision agreed by stakeholders.

3

### Incentives

How incentives can be brought to bear at all levels—individuals, firms, agencies, and civil society—to ensure that they act in support of a sustainable and growing economy.

4

### Investments

How investments by the government, domestic and foreign firms, and individuals—physical, natural, productive, and human—can be promoted. This requires careful planning and the relevant institutions to provide the necessary incentives.



# PATHWAY 3 Access to Modern Fuels and Low Impact Urbanization

## Access to modern fuels

A recurrent environmental challenge identified in stakeholder consultations was the use of firewood and charcoal as the main fuel for domestic consumption (primarily for cooking). Widespread use of these two biomass fuels has implications for deforestation and forest degradation, air pollution and human health, erosion and degradation, gender, and climate change.

Tanzania is rapidly urbanizing, and it is important for this expansion to be compatible with environmental targets to limit pollution, promote sustainable living conditions, and create infrastructure and transport systems that are resilient to climate change.

Widespread use of fuelwood and charcoal as biomass fuels has implications and interlinkages with multiple issues already analyzed in this CEA, including deforestation and forest degradation, erosion and land degradation, air pollution and human health, gender, and climate change. Addressing this issue therefore arises as one of the most salient and immediate recommendations of this CEA, as limiting the amount of biomass fuel consumed by households would have an immediate positive impact on ecosystems and human health.

There have been multiple efforts in the past to address this challenge, with uneven results. To date, most have focused on offering more efficient or more sustainable charcoal, promoting improved biomass cookstoves or internal ventilation and gas exhaust systems, or a combination of these. Some initiatives such as the Tanzania Forest Conservation Group and Mjumita's approach to sustainable forest and charcoal production practices show positive results and potential for scale-up in the production of sustainable charcoal (box 2.2).



Sustainably produced charcoal guarantees the forests concerned are managed properly; the charcoal produced brings value to the community that owns it; and the process does not lead to deforestation or forest degradation. However, most of the charcoal produced in Tanzania does not follow those principles. Traditional cooking in Tanzania is based on the use of a few stones (usually three) and the adoption of more modern technologies would not only reduce the amount of fuel needed but also the amount of exhaust gas produced. Unfortunately, the country's adoption rate of efficient cookstoves remains low.

Applying command and control methods only to manage charcoal demand could prove counterproductive. Charcoal production may have two, opposite kinds of impacts on Tanzanian forests. On the one hand, indiscriminate charcoal production and the installation of earth kilns will contribute to forest and land degradation; and once the forest is degraded, pressure for new lands for agriculture and other uses may result in complete deforestation. On the other hand, the production of charcoal accords forests a certain value, as producers derive their livelihood from it. Consequently, a ban or heavy taxation of charcoal production or consumption would eliminate the current value of a forest, increasing its vulnerability to other destructive uses (logging,

agriculture, and so on). Therefore, the adoption of any policy measure aimed at regulating charcoal use should be carefully considered in advance.

A steady, progressive decline in the country's use of charcoal, steadily reducing the share of biomass in the overall domestic energy mix, is recommended to avoid forest degradation and the related deforestation. Given Tanzania's vigorous economic growth, and especially considering its steep population increase and acceleration of economic activities, long-term forest degradation and the related deforestation can only be prevented by transitioning to a smaller reliance on charcoal consumption for cooking.





To this end, the following steps are suggested:

**A. Focus initially on Dar es Salaam and expand to other cities once solutions prove viable.**

Although estimates vary, studies conducted to date estimate Dar es Salaam's overall charcoal consumption represents over 50 percent of the country's total consumption. In addition, around 88 percent of the capital's households use charcoal as part of their cooking energy mix. Therefore, reducing the share of households using charcoal to cook in Dar es Salaam would significantly alleviate the situation. Promoting alternatives to charcoal in a dense urban center like Dar es Salaam would benefit from economies of scale and could result in a quicker uptake of alternative cooking fuels in the capital than in rural or small urban centers. Once solutions in the capital have been proven valid, expansion to other cities would be easier.

**B. Convene a multi-stakeholder platform.**

Charcoal consumption is deeply rooted in Tanzanian culture. Despite decades-long attempts to reduce charcoal consumption in the city, charcoal has remained popular. Traditionally, attempts to tackle the situation have been led by departments responsible for forestry and natural resources, and the

Division of Environment. These stakeholders are critical, as it is vital to obtain high-level buy-in and leadership from the Ministry of Energy, since technically feasible and affordable energy alternatives to charcoal must exist for charcoal to become less prevalent in the energy mix. National, regional and local governments, producers, users, forest and biodiversity stakeholders, NGOs, consumers' associations, health professionals, development partners, and academia should be convened regularly and consulted as the government charts a path toward the progressive reduction of charcoal use. End users (heavily dominated by women) should also be engaged in this conversation.

**C. Conduct a detailed analysis of the value chain.**

Limiting the share of charcoal that is used in Tanzania will affect production, transportation, wholesale, and retail. Several hundreds of thousands of people participate in this trade and they must be part of the solution. Understanding the value chain will provide valuable insights in the political economy and existing incentives and disincentives for charcoal consumption in Dar es Salaam.

**D. Conduct an in-depth review of the fiscal policies,**

incentives, and loopholes related to biomass fuels and their alternatives. Fiscal

measures are an efficient way to send signals to producers and consumers and can gradually bring charcoal use down to the desired levels. The government currently generates revenue from charcoal primarily through the fees collected by TFS from transporters and traders. Fees are also collected by district and village governments in producer areas as well as by municipal governments in consumption areas (business license fees are due by those involved in retail and wholesale). However, no VAT (of 18 percent) is paid on charcoal, one of the reasons mentioned by stakeholders is that many enterprises involved in the charcoal trade remain below Tanzania Revenue Authority's revenue thresholds. Some preliminary estimates suggest that Tanzania collects only about 10 percent of the total amount related to the charcoal business it could collect. A proactive enforcement of the VAT would level the playing field with other sources of energy for cooking.

- E. Prepare and reach consensus on a comprehensive plan to progressively limit the amount of charcoal used in Dar es Salaam.** The plan should define a specific pathway toward fuel substitution, focusing on fuels

that have lower environmental and health impacts. Immediate, obvious alternatives seem to be LPG (the gas bottle already widely used in Dar es Salaam), for the short and medium term, and electricity and natural gas, for the medium and long term. However, a detailed analysis of the alternatives is still lacking. This plan, ideally, should be based in a sustainable urban energy strategy, to be prepared by a multi-stakeholder group.

- F. Promote sustainable charcoal production practices.** Based on current consumption patterns, cultural preferences, and the causes of past failures, charcoal is likely to remain a major component of the energy mix for years to come. Unsustainable charcoal production is already adversely affecting forests, while its benefit for the surrounding communities is unclear. Efforts should be made to ensure that current and future (hopefully decreasing) charcoal demand in Dar es Salaam is met by sustainably produced charcoal—in accordance with good forestry practices, generating benefits for communities, and in compliance with current fiscal policies. Tanzania already has experience in this area and merely needs to scale up current practices (box 2.2).

## Low Impact Urbanization

Tanzania is rapidly urbanizing, and it is important for this expansion to be compatible with environmental targets to limit pollution, promote sustainable living conditions, and create infrastructure and transport systems that are resilient to climate change. The country's urban population is expected to grow from about 22 million in 2020 (35 percent of the total) to over 70 million, or 53 percent of the total, by 2050 (as shown in figure 1.2), making Tanzania the fastest urbanizing country in Africa. New urban settlements are emerging while existing cities and towns are rapidly developing. Dar es Salaam is expected to become a megacity by 2030, its population projected to exceed 10 million

(United Nations 2014). Traditionally, Tanzania's environmental agenda has been dominated by the urge to protect the country's rich and unparalleled natural resources. Equal attention should be given to urban settlements, where most Tanzanians are expected to live, and where environmental conditions can either become a catalyst that empowers citizens and promotes good development, or an impediment to progress and citizen well-being.

**Urbanization is largely informal and unplanned, with a large fraction of inhabitants residing in areas lacking basic services such as clean water, sanitation, roads, and electricity.**

Environmental risks in urban settlements are potentially large and impacts rooted in agglomeration and poor environmental conditions have been extensively documented. Some stark figures have already been mentioned in this document—an estimated 26,000 premature deaths per year due to air pollution, millions of people in urban areas affected by food and waterborne diseases or devastating urban floods. A single flood in April 2018, for example, claimed the lives of 15 people and displaced more than 2,000 families living in the Dar es Salaam Msimbazi River basin.

Urbanization is largely informal and unplanned, with a large fraction of inhabitants residing in areas lacking basic services such as clean water, sanitation, roads, and electricity. Urban planning and reliable, quality services provision (modern domestic energy sources, water supply and sanitation, solid waste collection and disposal) would go a long way in addressing pressing environmental and public health issues. The recommendations regarding this pathway are cross-cutting, as they relate to services provision, planning, and development. High-level suggestions are offered below.

**A. Improve urban planning.** Municipalities across Tanzania need to develop strategies to curb degradation, prevent urban sprawl and encroachment on risk-prone areas, and address current development that is blocking natural drainage systems. Unplanned settlements tend to form in the urban periphery, expanding the urban area while at the same time settling in lands not suited for habitation such as river valleys, rocky hillsides, and wetlands, which are cheaper but particularly vulnerable to extreme weather events. Promotion of urban densification is key, as vertical growth of cities facilitates densification and offers economies of scale. In a country so vulnerable to climate events and given their overarching intensification due to climate change, building resilience should be an integral part of urban planning. Mainstreaming resilience into current planning systems should be combined with technical assistance for approaches such as green infrastructure and urban upgrading.

The government is already taking important steps in the preparation of plans—with 29 LGAs developing Master Plans/General Planning Schemes, and the emphasis should now be given on how to translate these plans into effective implementation (Huang et al., 2018).

**B. Maintain healthy urban ecosystems and green space.** Cities such as Dar es Salaam have a significant degree of informality, with unplanned settlements quickly arising. In addition to other evident shortcomings, illegal settlements may cause the loss of open green areas and other environmental zones that play an important role in sediment retention, water infiltration and flood prevention, recreational use, and others. Limiting the loss of open green spaces, both from legal and illegal settlements, is essential for natural systems to be able to perform their regulating functions.

**C. Promote the construction of low-impact housing.** There are well-known architectural solutions that minimize the energy and material consumption of housing. For example, tropical architecture can use natural ventilation, traditional and locally sourced materials, and even alternative (green) sources of energy to provide affordable, low-impact and sustainable housing solutions. Given the location and weather conditions prevalent in Tanzanian cities, it is important to avoid structures that require copious quantities of energy for air conditioning. Rainwater harvesting for nondrinking water uses (toilet flushing, garden watering, and others), solar systems to heat and store water, and the use of roofs with a natural cover, are all relatively simple technologies that could be fostered and mainstreamed in urban centers.

**D. Transition to modern energy sources for cooking to limit household air pollution.** This priority has been documented in the previous pathway and is directly relevant to urban planning. The widespread use of biomass fuels significantly deteriorates air quality, affecting human health and raising mortality and morbidity rates. Improved housing, better

and more efficient cooking stoves, and most important, access to alternative, modern fuels is fundamental to reducing household air pollution. This is one of the main priorities identified in this CEA.

**E. Improve urban mobility and tackle outdoor air pollution.** Although only incipient in Tanzania, outdoor air pollution is a prominent environmental challenge in urban centers around the world. Vehicle exhaust is usually one of the main contributors to outdoor air pollution, through the generation of PM and polluting gases. Given the rapid growth of Dar es Salaam and the emergence of secondary cities, improving urban mobility is fundamental. Tanzania is a regional leader in mass transport, best illustrated by the implementation of its bus rapid transit system (BRT). The BRT is a potentially transformative investment, supporting pro-poor urban mobility. However, to capitalize on this investment, the network needs to be expanded and transport and land-use planning integrated. Enhancing overall urban mobility will improve air quality and save travelers time and money. Another significant advantage of mobility improvements and mass transport systems is that they reduce GHG emissions, which are the main cause of climate change.

**F. Improve water supply and sanitation.**

Although this CEA does not intend to elaborate on this recommendation as the sector already receives plenty of attention and resources from the government, it is still important to highlight the negative feedback mechanisms that exist. Lack of access to safe water forces communities and families to drink polluted water, a main source of environmental damage worldwide. Improving access to clean water is thus a priority and constitutes one of the United Nation's SDGs and targets of the 2030 Agenda for Sustainable Development. In addition, agglomeration causes the concentration of human waste, and insufficient sanitation services lead to polluted water being discharged into the open, contaminating aquifers and other water bodies. This in turn causes environmental degradation and acute episodes such as algal blooms and anaerobic conditions, which are detrimental to aquatic life and biodiversity, and frequently have a direct negative effect on coastal areas. These polluted water bodies are the sources for water that citizens use—either directly, contributing to morbidity and mortality or indirectly (after being treated to human consumption standards), implying costly potabilization processes that drain an already meager budget.



**G. Improve solid waste management.** The benefits of sound solid waste management cannot be overstated, and Tanzania is already making significant efforts in the right direction, with the construction of 7 sanitary landfills through the World Bank-financed Tanzania Strategic Cities project. Efficient solid waste management has multiple environmental benefits, including reduced soil, water, and air pollution (as solid waste often gets dumped in irregular dumpsites leaching into water bodies, or burnt along the street producing highly

toxic substances); reduced flood risks (as solid waste clogs the drainage systems, reducing their efficiency); prevention of the propagation of pests (such as the Indian crow, an invasive species that feeds on human garbage) and vector-borne diseases; and reduced spread of garbage in sensitive areas (e.g., beaches) and of plastics in the ocean (box 2.9). The latter is a key emerging environmental emergency that affects marine life, fisheries, and coral reefs, as well as beach tourism.





# PATHWAY 4 Strengthened Institutions for Pollution Management

The benefits of a non-polluted environment are many, and become essential if the country is to further develop in a sustainable way.

A pathway towards improving the ability of institutions to regulate, monitor and control pollution, will lead to a reduction in environmental pollution loads, and thus, to better quality of public goods such as air, water, and soil.

The importance of strong, well-trained and sufficiently-resourced institutions for sound environmental management cannot be overstated. In this CEA, each environmental challenge has been analyzed from different angles, including from the description of mandates and institutions tasked to addressing them. Environmental conservation and management are crosscutting topics, demanding high levels of coordination of stakeholders. Given the large amount and complexity of government bodies and institutions involved in the management of the more traditional “rural environmental and natural resources challenges”, highlighted in section 2 of this report, this pathway focuses on pollution prevention, a mandate that is more narrowly entrusted to the Vice President’s Office (VPO) and National Environment Management Council (NEMC), and that was thoroughly discussed in section 3. A pathway towards improving the ability of institutions to regulate, monitor and control pollution, will lead to a reduction in environmental pollution loads, and thus, to better quality of public goods such as air, water, and soil. The benefits of a non-polluted environment are many, and become essential if the country is to further develop in a sustainable way.



Tanzania's government is boosting the country's industrialization process. Other sources of pollution—mining, quarrying, solid waste, e-waste, pesticides, among others—are all expected to increase as a result. It has often been argued that the “pollute first, clean up later” principle is economically less savvy than environmentally responsible practices and policies. It is always easier to implement adequate industrial pollution regulations before new investments are made, as opposed to trying to clean-up a polluted environment at a later stage. Therefore, improving pollution regulations and compliance is an early and highly cost-effective approach for governments to avert even higher pollution loads in the medium term. Tanzania is in the privileged position of being able to plan its development in a way that reduces the overall negative impact by capturing the benefits associated with cleaner industries, such as greater resource efficiency, improved worker health, technological innovation, and greener jobs.

Current research points to Dar es Salaam as the center of pollution. The city and its surroundings account for 88 percent of air, water, and soil pollution, primarily from industrial outputs and urban waste production. Of concern are also the emissions from vehicles, which continue to grow. A concentrated monitoring and enforcement effort would significantly reduce pollution and the

negative health effects associated with exposure to degraded air and water. Reducing pollution is vital, as industrialization and population growth are expected to accelerate in and around Dar es Salaam over the next few decades.

### **Improving pollution regulations and compliance is an early and highly cost-effective approach for governments to avert even higher pollution loads in the medium term.**

Strong institutions and strengthened capacity to manage environmental pollution are at the heart of sound environmental performance. The VPO has the mandate to take the lead in environmental compliance aspects. The Division of Environment (DoE) within the VPO and NEMC are the ones fulfilling this mandate. The recommendations below focus on how VPO-DoE and NEMC can be strengthened to further improve environmental management and pollution control in Tanzania.

**A. Regulatory framework.** The overarching laws governing Tanzania's environmental management are the National Environmental Policy (NEP) of 1997 and the Environmental Management Act (EMA) of 2004. The EMA is undergoing a review and has not yet been fully developed (a significant number of pieces of

secondary legislation is still required for its full implementation, including regulations, rules, notices, orders, guidelines, and environmental quality standards). Elaborating these tools is key for the EMA to be fully effective and for DoE and NEMC to be fully empowered to carry out their mandate.

**B. Cross-coordination and inter-government collaboration.**

The implementation of EMA requires the support and proactiveness of all levels of government. To date, limited awareness of the sector ministries, LGAs, and the public of their role and responsibility in implementing EMA is a challenge that needs to be overcome. A comprehensive capacity-building and awareness-raising campaign targeting sector ministries, LGAs, and government institutions on their roles and responsibilities under the EMA in environmental management, enforcement, and compliance is recommended.

**C. Enforcement.**

The VPO-DoE and NEMC play a leading role in carrying out inspections of polluting facilities. However, their ability to enforce legislation is jeopardized by insufficient resources, insufficient/obsolete tools and inspection kits, and a significant shortage of environmental inspectors needed to do the work. It is estimated that around 1,000 additional inspectors are needed. The DoE has the ability to train and appoint environmental inspectors from other parts of the government and has the ambition to train and appoint 100 environmental inspectors from sector ministries, 300 from government institutions, and another 600 from LGAs. This important step is necessary, and DoE will need to have access to the resources and staffing required to do so.

**D. Capacity building.**

The EMA has introduced new, specific requirements regarding environmental management in the country that require either the consolidation and upgrading of existing capacities and/or new capacities among environmental actors in government, LGAs, NGOs, and the private sector. As regulatory agencies, the ability

of VPO-DoE and NEMC to carry out their mandate needs to be boosted, given current and rapidly emerging new challenges (such as large infrastructure projects, oil, gas and alternative energy sources, medical waste, and climate change). The VPO-DoE and NEMC, as well as other sector ministries with a role in environmental performance, require sound institutional capacity in terms of competent technical personnel, a conducive working environment, regulatory environmental tools, and well-functioning systems. An ambitious training program should be implemented on topics ranging from environmental impact assessments and strategic environmental and social assessments to operational health and safety, pollution control and monitoring techniques, and clean production technologies, to name a few.

**E. Monitoring systems.**

The establishment and upkeep of a centralized environmental information system is recommended. This system would enable data storage and retrieval, allowing analysis and sharing of environmental parameters and data collected across the country. This system could also become an important tool for data sharing and engagement with civil society. In addition, field-based monitoring networks are in dire need. Filling large data gaps of important parameters for air and water pollution, land pollution, and industrial effluents should be a priority. Investing in monitoring networks has elsewhere proven to be cost-effective and a key aspect of smart development planning. These monitoring networks would feed the central information system and permit the analysis of baseline levels and trends, and exposure risks; facilitate compliance and enforcement; and provide incentives for effective policy implementation.

**F. Quality control laboratories.**

Emissions from vehicles should be regularly monitored and the government has an array of measures at its disposal to regulate and limit pollution from exhausts. Sufficient and adequate facilities to measure emissions are key to the preparation

of programs such as end-of-pipe requirements (exhaust filters); quality requirements for the fuels (limiting sulfur or nitrogen content, octane rating, and others); regulations on the types of engines allowed and their environmental performance; and measures that allow or limit driving certain polluting vehicles in specific areas or during specific periods. Some vehicle groups are generally more polluting than others and targeted programs could be considered to, for instance, facilitate access to better engines for public buses or other initiatives that have proven successful elsewhere. Facilities to measure other types of pollution (water, soil), and for quality control of food and consumption products, are key for the government to better regulate and legislate to minimize emission loads and reduce exposure.

**G. Citizen engagement and feedback mechanisms.** A key component of a dynamic, constructive, and modern environment is the proactive participation of civil society in the analysis, discussion, and decision making on environmental issues. Fostering feedback and reporting of grievances by affected stakeholders is also internationally considered good practice, as it strengthens institutions and accountability as well as good governance. The VPO-DoE's plans to establish a citizen engagement tool for reporting environmental information is a step in the right direction and such a system should be built, tested, and implemented countrywide.







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