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GOOD PRACTICES IN CLIMATE ACTION IN AFRICA



FOREWORD

The consequences of climate change are evident across Africa. Recent years have seen higher temperatures, rising sea-levels, more variable rainfall, and increased extreme weather events. This threatens inclusive socio-economic development across the continent, including food security, health, and livelihoods. Impacts are also most severe for those vulnerable populations least able to cope.

The cost of future inaction is clear. The World Meteorological Organization estimates that by 2030, up to 118 million extremely poor people on the continent may be exposed to drought, floods, and extreme heat. These effects will constrain national efforts for poverty alleviation, economic growth, and SDG achievement. As negative consequences increase, national capacity to adapt and build resilience will also become increasingly more challenging. There is thus an urgent need for action. Putting in place impactful responses requires evidence of what is already working.

The UN system is proud to present this compilation of good practices in climate action from across Africa. The report focuses on initiatives where national governments have partnered specifically with UN entities, often together with other international partners, local stakeholders, and the private sector. The examples provided are diverse, cutting across countries, sectors, approaches, and implementing partners. They cover successful practices in climate-sensitive sectors in need of urgent and scaled up responses: energy, agriculture, land restoration, water and sanitation, coastal restoration, tourism, waste, and transport.

The report also identifies important cross-cutting lessons. While tailored and context-driven approaches are crucial to success, some takeaways emerge from across the full set that are relevant for further action across sectors.

First, climate initiatives are more likely to be successfully scaled if the appropriate policies, regulations, political support, and partnerships are aligned. To this end, nearly all the examples included in the report link implementation with policy support and capability building. Second, partnerships at the local level can help increase impact and sustainability. This involves working closely through community groups, business associations, and local governments. Third, the integration of gender-sensitive planning and women's empowerment objectives is also a feature of effective design for responding to the needs of all people.

Moving forward, the key will be replicability and scalability. For this reason, the synergy report targets especially the identification of examples that have already been replicated or taken to scale. It also highlights those with strong potential to do so. To help support scaled up action, several priorities for the future are also identified: decreasing the gap between available funds and scale of needs, linking climate action to the structural transformation of African economies, and scaling up research and data.

The report has been developed under the overall guidance of H.E. Yasmine Fouad, Minister of Environment of Egypt and her team. It is the result of collaboration from across the UN system in Africa under the co-leadership of the Economic Commission for Africa and UN in Egypt. The report benefited significantly from the contributions of the Opportunity and Issue-Based Coalition on Climate Change (OIBC-5), including its co-conveners UNDP and FAO. This regional UN mechanism facilitates increased cooperation between UN entities and other partners on regional priority issues. The case studies included here represent partnerships for climate action involving more than 20 UN entities. The coordinating team is also grateful to the consultant who facilitated the compilation, Kate Rivett-Carnac for her consistent and determined efforts to source the information and her experience in bringing it all together in a compelling narrative.

This report does not cover all good practices in Africa. It instead offers a snapshot of what is working. We hope this approach to collect evidence may also inspire similar exercises, such as reviewing good practices led by a different set of partner institutions or those taking place in other regions.

The report provides important evidence of how targeted actions are already delivering positive developmental and climate change returns. We believe this study and others like it can be catalytic, helping unlock results beyond those described here. This report serves as a contribution to the global call to action on climate change.

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INTRODUCTION

Africa is a diverse continent of 1.2 billion people, spanning 55 countries, and many different ecological systems, cultures, and economies. Over the past two decades, the continent's average annual economic growth rate has been about 3.4%. Much of this growth has been reliant on climate-sensitive sectors such as water, agriculture, energy, transport, and tourism. But climate impacts in Africa have already led to loss and damage in key sectors and to critical infrastructure. COVID-19 has exacerbated these impacts, impeding socio-economic development progress and increasing debt levels. Some estimates show African countries potentially losing 5% of GDP per annum by 2030 based on an increase in temperature of 2 degrees¹. Climate action must confront the vulnerabilities experienced on much of the continent among people who bear a disproportionate share of climate impacts despite contributing relatively little to global emissions (approximately 4%). There are already many examples of good practices in climate action in Africa. This compilation of case studies demonstrates what is possible. In some instances, these good practices are already beginning to be replicated across countries on the continent.

The focus of this compilation is on projects where international organisations are partnering with national government and local stakeholders in implementation through funding, technology transfer, and capacity building. The case studies have also focused on opportunities to replicate at scale with the right investment.

Despite the lack of resources relative to identified needs, African countries have been able to pursue implementation which has brought meaningful action to communities. These impacts include expanded access to water and clean energy; improved livelihoods, incomes, and profits; enhanced access to job opportunities and new skills; improvements in health and education; reduced consequences from climate events; avoided emissions and sequestered carbon; and restored ecosystems, including of key species.

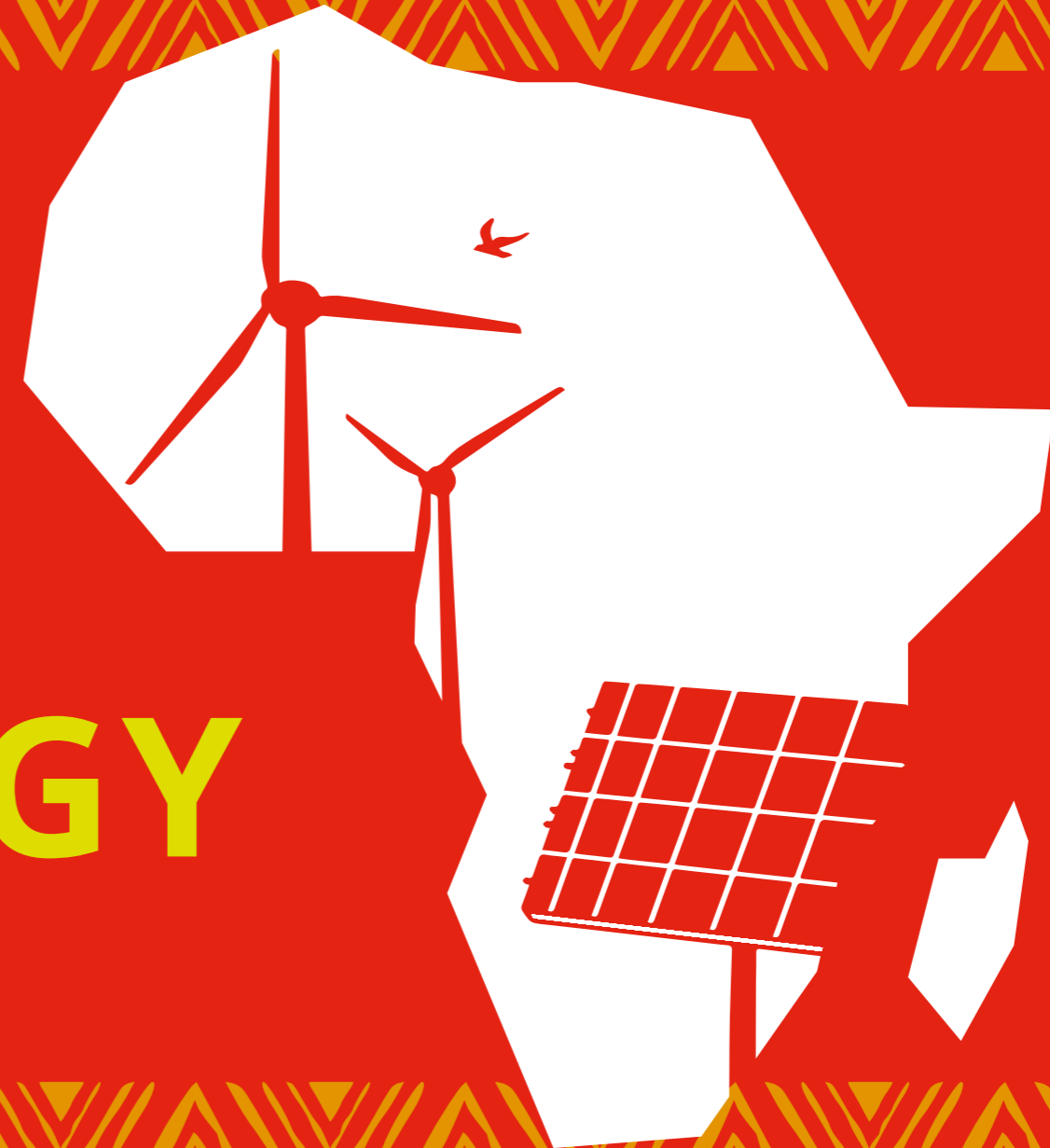
Selected projects cover a variety of countries, approaches, and partners. Taken together they demonstrate that socio-economic development can be supported through the expansion of climate-compatible infrastructure and activities. Underpinning transformative climate-resilient development are inclusive, equitable approaches that build upon local knowledge and strengthen existing institutions, networks, and capabilities. Demonstrating this, the compilation of good practices provides examples of partnerships and projects that are strongly informed by and designed to respond to local contexts and vulnerabilities. The case studies also show that, in practice, adaptation and mitigation nearly always go hand-in-hand.

It is hoped that this non-exhaustive list of case studies may provide inspiration for further climate action and partnerships across the continent.



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ENERGY





Nearly half of all Africans lack electricity access in their homes and 80% of companies in Africa face regular disruptions to their electricity supply². Energy access is central to addressing developmental challenges, such as poverty, inequality, climate change, food security, health, and education. While there are variations from country to country in Africa, in many places traditional biomass fuels, such as wood, charcoal, and some animal waste, remain major sources. Not only can burning biomass have negative health impacts, but it also drives deforestation. There is also an opportunity cost (time and distance travelled to access energy), particularly for women who are often expected to source biomass fuel far from home.

At the same time, Africa has many sources of renewable energy including abundant sunshine and wind. These resources could meet the region's current and future electricity needs.

Investing in major electricity generation, transmission, and distribution infrastructure is expensive and not always viable for relatively sparsely populated and remote regions. In order to increase energy access in a major way, there

will need to be a dramatic increase in investment – as much as USD \$500 billion by 2030³. There will also need to be more investment in off-grid and smart-grid solutions, including Solar Photovoltaic mini and microgrids, and energy from existing waste streams. Improved cookstoves are also part of the solution and many rural off-grid energy projects combine these with clean energy provision.

CASE STUDIES DESCRIBE:



In Egypt, multiple clean energy and energy efficiency projects are underway.



In Eritrea, solar photovoltaic-diesel hybrid minigrids create energy access for 40,000 people.



In Sierra Leone, 94 solar minigrids cover 14 districts.



In Uganda, solar dryers are being used to prolong food shelf-life.



In Morocco, solar photovoltaic infrastructure has been developed for Bus Rapid Transit in Marrakesh.



In Mozambique, farmers' clubs and agribusinesses are supported with renewable energy.





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MULTIPLE RENEWABLE ENERGY AND ENERGY-EFFICIENCY INITIATIVES

Examples of energy projects in Egypt include⁴:

 **Energy efficiency:** With financing from the Global Environment Facility, the United Nations Development Programme initiated a comprehensive programme with the Ministry of Electricity and Renewable Energy to help Egyptians embrace energy-efficient appliances and lighting systems. The project catalysed the large-scale transformation of energy efficient lighting systems in Egypt. The government has also launched a national programme to convert street lighting systems into LED efficient lighting systems. 200 million LED Lamps have since been connected to the grid for buildings in different sectors providing an annual estimated energy savings of 20.177 GWh and 2.7 million LED street lighting fixtures have been introduced since 2015. Altogether the LED lighting investments amount to USD \$1.5 billion.

 **Small-Scale renewables:** The Grid-Connected Small Scale Photovoltaic Systems “Egypt-PV”, implemented by the United Nations Development Programme in partnership with the Industrial Modernization Center, Ministry of Trade and Industry and funded by the Global Environment Facility, supports the development of decentralised, grid-connected small-scale PV systems. Small-scale solar power stations can be seen today in cities on the rooftop of schools, supermarkets, car parks, hotels, and government buildings. Egypt PV won the British Energy Institute Award for Low Carbon Category in 2020. 100 MW of small-scale solar power systems have been connected to the grid since 2018.

 **Applications in agriculture:** The Food and Agriculture Organisation working with Ministry of Water Resources and Irrigation delivered several solar-powered surface water pumping stations for irrigation across governorates. Solar irrigation water pumping contributes significantly to the reduction of water losses caused by evaporation in the canals, provides a more sustainable source of energy for irrigation, and reduces the negative impact on the environment, soil pollution from diesel spills, and greenhouse gas emissions. 75% targeted energy savings have been achieved through solar water pumping and a 30% increase in water use efficiency.



Egypt brochure at COP26/ UN



UNDP/ UN

SOLAR PV MINI GRIDS FOR RURAL TOWNS



This energy project, which started in 2016 and where power was 'switched on' in June 2020, has both strengthened social services and contributed to climate change mitigation. The design of rural electrification responded to the difficult topography of the land and dispersed rural settlements. A 2.25 MW solar PV-Diesel hybrid generation system has been installed in Areza (of 1.25 MW) and in Mai_dma (of 1.0 MW) at a total cost of Euro 11.762.778. The project is jointly financed by the European Union, United Nations Development Programme, the Government of the State of Eritrea, and local communities.



With training, 20 installers and 56 energy agents are empowered to support the system, while over 40.000 people in the two rural towns and 33 surrounding villages now have access to energy. 500 enterprises, 15 schools (serving about 12.000 school age children), 2 kindergartens (500 children), 2 community hospitals (34.000 people), 5 health stations (25.000 people), and 10.000 households now have access to power. These energy interventions helped to ensure better illumination, better health service including at night, higher quality of education, and safe drinking water to disadvantaged communities. Local communities were involved in the project, such as digging holes and putting up power poles.

It is the first PV battery diesel mini-grid of this scale in the country. The project has addressed energy poverty and reduced the use of traditional biomass fuels, saving in kerosene for lighting. This has also reduced the emission of greenhouse gases that would have resulted from a purely diesel generator, estimated at 3.000 tons of CO₂.

While it costs considerably less than extending the existing national electrification grid, more battery inverters are required for the power plants to fully exploit their potential and similar projects will need international co-financing to be replicated. This indicates that while small grids are good technical solutions, different kinds of concessional finance is needed to roll-out these solutions at scale.



UNDP/ UN



RURAL RENEWABLE ENERGY PROJECT

Covering 14 districts (out of a total of 16) in Sierra Leone, this cross-cutting project which started in October 2016, and is currently winding down at the end of 2022, has delivered 94 solar mini-grids. Its aims are to provide access to clean energy, improve the welfare of rural communities in terms of saved fuel costs, more income, better health, and education outcomes, and lower CO₂ emissions.

This USD \$49 million project has been a successful partnership between the Government of Sierra Leone through the Ministry of Energy and the United Nations Office for Project Services. Funded by the Foreign, Commonwealth and Development Office of the United Kingdom, and private sector partners include PowerGen, Power Leone, and Winch Energy.



The 94 mini-grids have provided electricity access to 17,496 households, around 477,000 people, 97 community health centres, 140 schools, and 1,944 commercial enterprises. The project has resulted in a savings of 641 tonnes of CO₂ from up to 4 MW of installed clean electricity generation capacity. Additionally, foreign direct investment of over USD \$13 million has been raised through a public-private partnership.

Lessons learned include the need to use standardised equipment to improve energy efficiency; that project design and approach should improve the economic viability for private sector participation; and sustainable subsidies must be explored for rural consumers in light of the high costs associated with small or large-scale rural electrification. A further lesson is to support demand stimulation activities in rural areas in other projects that require electricity access.

Part of the project's success relates to the creation of an enabling environment and regulatory framework for mini-grids. In addition, the Ministry of Energy and other government departments now have the skills and support to operate and maintain the mini-grids. Other projects and additional commitments have been catalysed from both donors and the private sector alike, estimated at over USD \$30 million.





SOLAR DRYER CENTRES

The Ecosystems-Based Adaptation for Food Security Assembly (EBAFOSA) policy-action framework Initiative is active in over 20 countries. In the Buganda kingdom of Uganda, this cross-cutting project links together agriculture with clean energy. Reskilling, innovative finance, product development, and access to markets have all been supported. This creates inclusive income opportunities and enhances food security to address socioeconomic causes of climate vulnerability, and ensure these benefits are achieved while enhancing ecosystems and abating carbon. In these ways, EBAFOSA brings together mitigation and adaptation, with mitigation powering adaptation.



Through this project, young people now have the skills to manufacture affordable solar dryers made from locally available materials. Working with informal sector actors involved in the agro-value chain, such as communal cooperatives, the use of these dryers has been decentralised on a 'pay as you go' model at shared centres. The dryers work to enable the processing of agricultural products to increase the shelf-life of perishable commodities. In practice, this means that farmers experience fewer postharvest losses and increase their incomes. As a result, farmers can pay a small fee to enable the maintenance of the dryers and young people running these centres receive income for their services.



During the initial pilot, farmers were able to reduce their pumpkin losses by 28%, and earnings from high-quality dried cassava increased by USD \$50, while the youth who decentralised these dryers as a service earned a total of USD \$40 from offering these dryer services, all in less than one month.

Project partners were the Buganda kingdom's local government and a local cooperative. This pilot study has demonstrated the advantage of working through local social structures and communal cooperatives. The project was implemented in 2020 and is currently being expanded to more people through the structure of communal cooperatives.



RENEWABLE ENERGY FOR THE CITY OF MARRAKECH'S BUS RAPID TRANSIT SYSTEM

This USD \$57 million clean energy and transport project was implemented between late 2016 and the end of 2018 by the Secretariat of State for Sustainable Development and supported by the United Nations Development Programme. It was partly funded by the Global Environmental Facility⁵.



The project was designed to facilitate the low-carbon integration of Marrakech's Bus Rapid Transit (BRT) system.



It involved the installation of a 0.75MWp solar park that uses photovoltaic panels and an innovative solar tracker technology. Infrastructure development, capacity building, awareness raising, and improved governance were also part of the project's design. The creation of the Transport Local Development Corporation before the project assisted in galvanising political support, and supported an effective decision-making process.

The project reduced the carbon footprint of the city's public transport by 27.327 tonnes of CO₂, while also resulting in cleaner air, improved social inclusion, readier access to public services, the creation of new green jobs, and the enhanced tourism appeal of the city. More than 1 million people were direct and indirect beneficiaries: the BRT opened up access to transport for women, people with low incomes, people with reduced mobility, and tourists, among other groups.

Three specific lessons include:

- ◆ Policy and regulatory environment support must be in place for small or medium-sized solar power plants to immediately connect to the grid or bus station straight after the project development phase
- ◆ Gender-sensitive planning should be fully integrated into all project activities
- ◆ Effective communication policy be adopted from the outset

Plans are in place to extend the Bus Rapid Transit network to three additional lines covering major axes of the city with a similar design: a solar power plant connected to each new BRT electric bus line. Electric buses will also need to be purchased, with financing costs estimated at USD \$82 million (in 2019).



PRIVATE SECTOR AGRIBUSINESS ADOPTION OF RENEWABLE ENERGY

The 'Towards sustainable energy for all: Promoting market-based dissemination of integrated renewable energy systems for productive activities in rural areas in Mozambique' project seeks to promote the market-based adoption of integrated renewable energy systems (solar PV for irrigation and waste-to-energy) in small to medium-scale farms and rural agro-food processing industries. It started in 2016 and will end in 2023.

From 2018 to 2019, the United Nations Industrial Development Organisation partnered with ADPP Mozambique, a nonprofit organisation, to implement a Farmers' Club program in the Provinces of Zambezia, Sofala, and Tetetargeting. 2.250 small-scale farmers were organised into 45 farmers' clubs and are now registered as associations. They have received capacity building and development courses. 4.000 small-scale farmers (55% women) also have access to solar-powered irrigation systems for a total area of 31 ha of land enabling them to be productive all year around.

In addition, 3 agribusiness companies have received funding from a credit line implemented by the BCI bank in partnership with UNIDO and Fundo de Energia with funding from the Global Environment Facility:

- ◆ Tsangano Agrifarms for a 6 kW solar photovoltaic system. The company is involved in agricultural production, agro-livestock, and agro-processing.
- ◆ Frangos de Mahubo Agropecuária for a 50kW solar photovoltaic system.
- ◆ SUPERKWICK for submersible solar pumps for the irrigation of a 30-ha macadamia farm and for a solar-powered food processing and conservation system.

Furthermore, in October 2021, the project signed contracts with three local private-sector organisations to extend renewable energy systems:

- ◆ AFORAMO, to install renewable energy systems in Maputo, Matola, Inhambane and Manica provinces (total installed capacity of 63kW).
- ◆ MAKOMANE-ADM, a local farmers' association, to install a total capacity of 23.9kW of integrated systems for irrigation and conservation in Zavala district (Inhambane province).
- ◆ CHARIS, a local solidarity association, to install 93m³/day biogas production systems for local farmers and businesses in Inhambane province.

The total Global Environment Facility project financing is USD \$2.851.384. Partners are the Ministry of Land, Environment and Rural Development; the Ministry of Mineral Resources and Energy; the SADC Centre for Renewable Energy and Energy Efficiency; Eduardo Mondlane University; Fundo de Energia, and BCI Bank.

There are multiple takeaway lessons, including in structuring concessional finance for private business uptake of renewable energy in agro-processing. The University partnership will advance knowledge generation and dissemination. The various private sector partnership models provide significant demonstration for broader application.

AGRICULTURE





Over 50% of people in Africa are involved in agricultural activities. Growth in agricultural productivity in Africa has declined by 34% since 1961, making livelihoods increasingly tenuous. One major challenge is that, at present, 95% of cropland in Africa is rain-fed, meaning farmers are vulnerable to droughts. Furthermore, as many farmers in Africa are smallholders, in addition to water they also struggle with accessing inputs like climate-resilient seeds, climate-smart agricultural practices and information, and, critically, markets. Support measures need to address all of these challenges together, as well as respond to extreme droughts and floods, exacerbated by climate change.

Agriculture also has a strongly gendered dimension: while women actively participate in agriculture, they seldom control assets or decision-making. Adopting climate-smart agriculture and nature-based solutions must not only improve productivity but also lives, and create opportunities for empowerment.

Research on agriculture in Africa shows that, depending on contextual vulnerabilities, effective options for climate resilience can include agroforestry, agricultural intensification,

climate information services, and crop/livestock and fisheries management. Effective market development is also important.

There are real examples of good agricultural adaptation projects in practice, using different context-specific approaches. These extend access to water services, improve soil health, reduce forest encroachment and rehabilitate lands, addressing drought-stricken areas, resulting in positive impacts for both climate mitigation and adaptation:



In Ghana, dynamic agro-forestry and climate smart-cropping systems effectively diversified and improved livelihoods for cocoa farmers and reduced encroachment of forests.



In the Ethiopian highlands, a variety of soil and water conservation measures were adopted on 3.630 hectares to protect and rehabilitate degraded lands.



In Namibia, hydroponic fodder production systems together with veterinary inputs improved livelihoods and addressed immediate vulnerabilities in support of more than 3250 drought-stricken farmers.



In Malawi, early warning systems were developed for 14 food insecure districts, enhancing the access of smallholder farmers to agro-weather information to improve productivity and incomes.



In Kenya, irrigated crop production was introduced to pastoralists who were previously dependent on climate-risk-prone livestock-based livelihoods in drought-stricken communities, also affected by an influx of many refugees.



In Senegal, Farmer Field Schools and Dimitra Clubs supported participatory learning for climate resilience.



Nana Anquah, Sarah Charles (ITC Alliances for Action)/ UN

COCOA VALUE CHAINS AND DIVERSIFIED AGRICULTURAL COMMODITIES

Known as the Ghanaian Sankofa Project, the project utilised the Alliances for Action approach of the International Trade Centre to invest in upgrading agricultural value chains. This bottom-up approach works with farmers and cooperatives to empower them to be better placed and competitive so that they can negotiate with buyers and take the sustainability of their businesses into their own hands.

Climate resilience was addressed through dynamic agroforestry, climate-smart cropping systems, and a carbon compensation scheme. Crops and tree species were combined to ensure continuous income and food production until the cocoa trees start producing. Climate-smart production was also undertaken in associated crops (such as yam, cassava, plantain, and chili peppers, among others) in their present or future cocoa plot, starting with a lower density of shade trees.

The project's ambition is for private sector partners to source as many products as possible from the project farms, including dried mango, cashew nuts, palm oil, pineapple, and coconut, through collaboration with local and exporting companies in Ghana.

Carbon objectives include the in-setting of 75.000 tons of CO₂ within the value chain of the co-operative. Broader socio-economic objectives include 17.400 community members indirectly benefitting through improved nutrition and income diversification. Furthermore, the capacities of staff and agricultural extension officers of Kuapa Kokoo Farmers Union will be strengthened (among 86.000 members).

Nature, and Development Foundation, Worldwide Fund for Nature Switzerland, Yam Development Council, Ghana Forestry Commission, Cocoa Research Institute of Ghana, and Niche Cocoa Industries Ltd.

Work is underway with the government to ensure the translation of the best practices into policy for the sector at large.

In terms of impacts:



The number of farmers adopting sustainable climate-smart farming practices grew from 343 in 2018 to 2.400 in 2021



The value of cocoa sales grew from USD \$3 million to USD \$5 million



Women farmers transacting international business grew from 150 in 2018 to 1.120 in 2019 to 511 in 2021



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CCA GROWTH - IMPLEMENTING CLIMATE RESILIENT AND GREEN ECONOMY PLANS IN THE HIGHLAND AREAS IN ETHIOPIA

Ethiopia endorsed a Climate Resilient Green Economy (CRGE) strategy in 2011. Within this context, the national Green Legacy Initiative was launched in June 2019 with a target of planting 20 billion seedlings within a period of four years. Already more than 120,000 nurseries have been created nationwide. Also within the context of this CRGE strategy, in April 2017, a highlands project was started to support climate-smart agricultural practices. It also supports the diversification of livelihoods and climate-smart integrated watershed management for improved rainwater harvesting and retention. Also, critically, the project has an objective to integrate climate change risk adaptation measures into all levels of government development planning, budgeting, and execution. It also aims to improve the availability of climate information products. In this way it links practice to policy, to complete the feedback loop.

For this project, just over USD \$6 million has been made available through the Least Developed Countries Fund grant. Project partners are the United Nations Development Programme, the Ministry of Environment, Forest and Climate Change of Ethiopia, and the Environmental Protection Agency of Ethiopia.

More than 60,000 people have benefitted from the project interventions (of which 32,650 are male and 27,072 are female). In particular:



51 farming communities now access climate-smart and knowledge-based extension services across all the project sites.



16 tree nurseries have been established and upgraded with over 11 million indigenous and other multi-purpose tree species raised.



8 Automatic Weather Stations are operational.



Practical training has been provided on small-scale bankable business plan development, including to women. 26 business plans have been developed further by the technical and mentorship support of the project.



Watershed management interventions have included 2,061.132 kilometres of hillside and farmland terraces; 20,142 trenches; and 63,530 eyebrow basins. 1,693.6 m³ gabions have also been constructed as soil and water conservation measures.

All in all, 29,031 beneficiary farmers have put in place climate-smart agricultural practices to diversify their income-generating base and improve their livelihoods.

The potential for replication and scalability is considerable based upon integrated approaches to livelihoods, watershed management, and agriculture. Successful principles for project design and delivery relied heavily on extensive stakeholder involvement. District experts and extension agents have actively been involved by providing technical and advisory support and mentoring beneficiaries. Communities have also participated through the existing structures at local or village levels. This has included women's associations.



EMERGENCY LIVELIHOOD SUPPORT TO DROUGHT-AFFECTED COMMUNITIES IN NAMIBIA

In 2020 a drought relief project was implemented in Oshanaana, Omusati, Hardap, Kunene, Kharas, Omaheke and Erongo in Namibia. The project was funded by the United Nations Central Emergency Response Fund with partners from multiple national departments and farmers' unions (such as the Namibia National Farmers Union and Namibia Commercial Farmers Union), and the Food and Agricultural Organisation.

The project was designed to include, at the outset, consultations with farmers on the applicability of the systems in their local contexts. Suggestions from farmers included the multiple utilisation of the hydroponic structures for other farming purposes and for vegetable production.

3.250 drought-stricken farming households (approximately 14.300 people) accessed supplementary livestock feed through the introduction of hydroponic fodder production systems. The project made a deliberate effort to reach women-headed households that owned livestock as well as households with persons living with disabilities.

Overall:



3.343 farmers received training on hydroponic fodder production and basic animal health for project sustainability. They have been able to maintain their core breeding herds.



148.910 small stock (goats and sheep) and 25.580 cattle of farmers were rescued.



79 greenhouse structures were set up at various selected sites across regions hardest hit by protracted drought conditions.



In terms of replicability, this project shows that low-cost climate-smart solutions such as hydroponic fodder production are a viable option to safeguard livelihoods and build resilience.



M-CLIMES PROJECT - SAVING LIVES WITH EARLY WARNINGS AND SEVERE WEATHER ADVISORIES

This project involves the expanded coverage of meteorological and hydrological infrastructure as well as capacity building to hydro-met staff and many national, district, and community level stakeholders in Malawi.

The approach has been to scale-up community-based Early Warning Systems in flood-disaster-prone areas. One specific component, the Participatory Integrated Climate Services for Agriculture (PICSA), is an agricultural extension approach that supports smallholder farmers. Training incorporates gender elements and through the project, a total of more than 16,000 women have participated in PICSA which in turn reached over 300,000 women across 14 districts. Similarly, over 200 women Agricultural Extension Officers were trained in PICSA and will pass on their learnings to others.



Tailored weather or climate-based agriculture advisories for 14 food-insecure districts have been disseminated through digital, print, and radio channels, including community radio stations. This includes advisories for fishing communities. With this improved information over three years, the project reached 1.2 million beneficiaries. Impact assessments indicate that farmers who received agro-weather inputs through the project have increased their farm production and income.

This United Nations Development Programme USD \$16 million project, largely funded by the Green Climate Fund, has been under implementation since 2017 through existing systems and networks of partner agencies. These include the Department of Agriculture Extension Services and the National Smallholders Farmers' Association of Malawi.

There is enormous potential for scaling this project and its approaches to building early warning systems into community-based and government structures and services, as well as working with local media to routinely disseminate information. This project connected to a current United Nations Office for Disaster Risk Reduction programme which is supporting early warning systems and capabilities in the Horn of Africa.





RESTORATION AND STABILISATION OF LIVELIHOODS FOR DROUGHT AFFECTED AND HOST COMMUNITIES

Implemented between 2012 and 2014, this project targeted the counties of Turkana and Garissa in Kenya. These counties have been badly affected by drought and are also hosting many refugees mainly from Somalia and South Sudan.

The primary focus of this USD \$4.5 million project was to enable pastoralists to adapt to the impacts of cyclic droughts through sustainable agriculture to enhance food security. The project took a multi-dimensional approach to address the complex challenges facing people living in the area, including support for water, renewable energy, and education infrastructure.

Specific project elements included:



The development of 5 community irrigation schemes, 24 earth dams, 12 solar-powered boreholes, 24 water harvesting sites for crop production, and 28 water harvesting tanks for domestic supply



8 schools have been rehabilitated to enhance skills for the job market



7 value chain interventions have had significant impacts in the area

All of the above has benefitted about 377,000 people in total (with more than half of these being women). Project partners included the National Drought Management Authority County Government of Turkana, the Government of Japan, and the United Nations Development Programme.

One of the key successes of the project was the adoption of irrigated crop production by pastoralists who were previously dependent on climate-risk-prone livestock-based livelihoods. This approach to alternative livelihoods for adapting to climate disasters has already been extended to four other counties.





FARMER FIELD SCHOOLS AND DIMITRA CLUBS

In Senegal, farmers and agro-pastoralists are exposed to the risks faced by reduced food and forage crop yields due to climate change. To build resilience, this project supports climate change mainstreaming and integration of the Farmer Field School (FFS) and Dimitra Clubs' approaches in national policies and programmes. FFS involve hands-on group learning in the field to build local knowledge systems, test and validate scientific concepts, and improve group cohesion and community decision-making. The Dimitra Clubs constitute a community-led and gender-transformative approach that facilitates rural community empowerment.

Activities included training and capacity building, agro-climate information communications, and setting up a climate resilience fund for scaling up project achievements.

The project achieved the following impacts:



12.576 farmers and herders were trained in climate change adaptation techniques and tools, including 7.335 women. Household incomes and productivity of field school participants had increased up to 20%.



503 Dimitra Clubs were created in 142 villages across 11 municipalities with 15.000 members and over 1.000 leaders, the majority of them women.



An information management and exchange system of agro-climatic data were developed under the technical coordination and supervision of the National Agency of Civil Aviation and Meteorology. Around 10.000 farmers and breeders received agro-climatic information, including through voice messages in local languages



A National Climate Change Resilience Fund was operational and has doubled available funds by collaborating with an existing funding mechanism, the National Fund for Agro-Sylvo-Pastoral Development.

Key lessons learned from this project include the effective participatory approaches of both the FFS and Dimitra Clubs, as well as the alignment between them. Strong partnerships were critical to ensuring the project's success. For example, while the Global Environment Fund-administered Least Developed Countries Fund was the main resource partner of the 6-year project (2015-2021), a great number of national and local partners were involved. At the national level, the Ministry of Agriculture and Rural Equipment as well as the Ministry of Environment and Sustainable Development and the Ecological Monitoring Center co-executed project activities (engaging institutes such as Agence nationale de l'Aviation Civile et de la Météorologie, Agence Nationale du Conseil Agricole et Rural, Direction de l'Environnement et des Etablissement Classés and Fonds National de Développement Agrosylvopastoral). Furthermore, the project Mobilised local NGOs and farmer organisations, increasing participation in community action and decision-making.

In terms of scalability, the project was developed based on successful approaches in neighbouring countries (Mali, Niger, and Burkina Faso) to mainstream climate-resilient approaches through the FFS methodology.

Since the project, the National Agency for Agricultural and Rural Council in Senegal has adopted the project's FFS methodology for its activities. This will lead to the institutionalisation of some of the project approaches to building resilience.

LAND RESTORATION





Africa's enormous forests, grasslands, and coastal areas, not only provide important carbon sequestration for the world but also ecosystem services for local people, often in areas where formal infrastructure services do not exist. Careful management of these ecosystems and the reintroduction of forests, mangroves, and grasslands, can slow down and reverse land degradation, so long as viable alternative livelihoods are created. In the best examples, the interventions provide more secure, sustainable, and rewarding livelihood opportunities. Here, ecotourism and other biodiversity-based businesses can support economic opportunities and diversification of incomes.

Examples of adaptation option approaches using nature-based solutions include watershed management together with livelihood support; reforestation paired with agroforestry; rangeland restoration through regenerative approaches to livestock management, including livestock farmers and pastoralists; and the reintroduction of mangroves to protect coastal areas (see the section on Coastal restoration for example mangrove projects).

THE CASE STUDIES THAT FOLLOW INCLUDE:



In Burundi, as a disaster risk management response, land regeneration and restoration enhance biodiversity and supports watersheds, while improving livelihoods and food security.



In the Republic of Congo, ecosystem restoration includes reduced encroachment into protected areas and adjacent areas to protect key species.



The multi-country Sahel Integrated Resilience Programme has adopted a participatory watershed planning approach, triggering a variety of land restoration activities paired with livelihood opportunities.



WFP/UN



Watershed management activities included the planting of millions of forest seedlings, and grass stump shards on more than 720km of anti-erosion ditches. In addition, close to 2 million seedlings were planted in the farms on the targeted hills in the project area. Anti-erosion ditches were also built and a buffer zone was developed. At Ntakangwa River, a 314 m setback stabilised the river for one kilometre on both sides of the banks. This means that schools, churches, and houses have been protected from floods.



Women, youth, and vulnerable groups from local communities earned income from this watershed stabilisation for the provision of terracing, anti-erosion ditching, and tree planting. Other ongoing income-generating assets also received investment, including improved stoves, motorised pumps, and tanks to develop irrigation techniques outside the buffer zone. The lake buffer zone has also allowed increased production in the fishery value chain at Rweru Lake while a water tank provides for irrigation of 700 ha of fields as an alternative to agriculture taking place in the lake buffer zone. All of the above means that 25.000 households are now more resilient to climate change. Systems, technologies, and training have also been put in place for early warning systems.

Given the success of the overall project, the government of Burundi is mobilising USD \$10 million for a second phase of landscape restoration at Ntakangwa River.

COMMUNITY-BASED RESILIENCE FOR DISASTER RISK MANAGEMENT

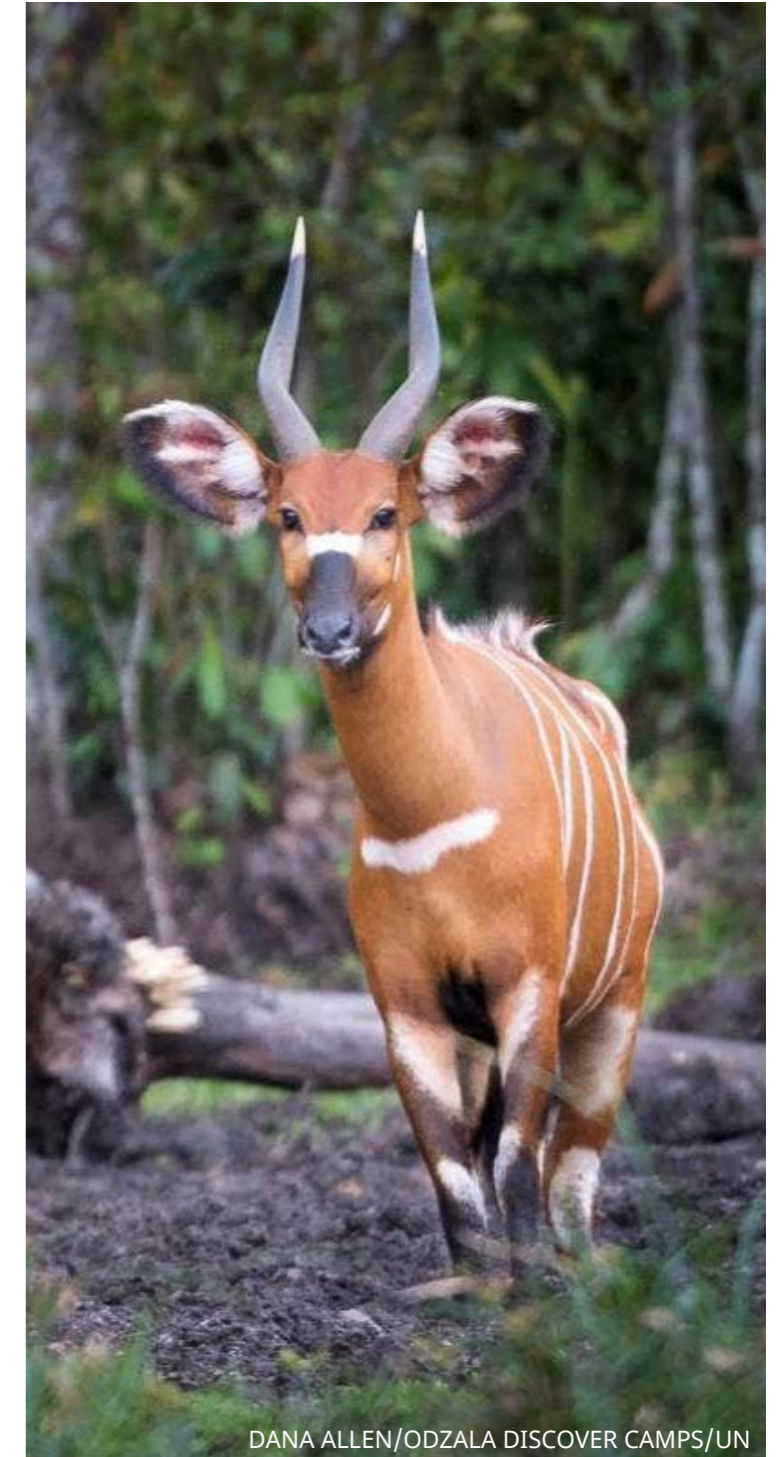


In 2007, almost 25% of the population of Burundi was hit by floods and needed assistance. With over 90% of the population depending on agriculture, these extreme climate events had serious consequences for food and livelihood opportunities. A USD \$35 million project, funded by the Government of Burundi, with co-funding from the United Nations Development Programme and the Global Environment Facility, was implemented between 2016 and 2021 to address disaster risk management through a community resilience programme.





A plan was developed and operationalised to create ecological connectivity between village lands adjacent to the North-East and East periphery of the Odzala-Kokoua National Park and to the High Conservation Value Forests of neighbouring forest concessions. Sustainable food crops, pig meat production and sharecropping, and valorisation of non-timber forest products were invested in to provide income for local communities. 7 out of 10 villages now have a piggery for communal production and septic tanks to recover waste to be used as organic fertiliser in the vegetable gardens. Furthermore, small processing equipment reduces women's workload. This included fofou grinders⁶, cassava kneading machines, and milling machines. An average of 25 heads of households per village benefited from the above.



ECOLOGICAL CONNECTIVITY AND ALTERNATIVE LIVELIHOODS



This small project, funded through the Global Environmental Facility's Small Grants facility, was implemented in 2021 and 2022. It is a useful example of how to address landscape and sustainable utilisation opportunities in a defined yet important area of biodiversity. The project aims to reduce hunting and slash-and-burn agriculture, in order to support the recovery of biodiversity, including elephants and gorillas. This has been achieved by replacing those activities with other livelihood activities more compatible with biodiversity conservation.



Early project results show a reduction in hunting, an absence of elephant and gorilla poaching in the support area, and a progressive reduction in "human-animal" conflict. There have also been reports of the closure of meat trading posts in urban centres.

This small-scale project shows what's possible with a focused effort around building livelihood opportunities and assets in order to create real, viable alternatives to slash-and-burn agriculture and hunting. In time, ecotourism income might also create alternative livelihoods for local people.



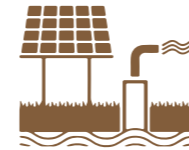
This large regional project in the Sahel countries of Burkina Faso, Chad, Mauritania, Mali, and Niger addresses many local (and regional) vulnerabilities through a multipronged programme. The approach is based on participatory watershed planning, triggering a variety of land rehabilitation activities. These have been linked to school meals, nutrition programmes, and support for smallholder farmers. The overarching goal is that targeted Sahel communities have their food security and nutritional resilience enhanced and sustained in the face of multiple vulnerabilities, risks, and shocks, including climate change.



For the first phase of the programme (2018-2023), the aim was to reach 2 million people across the five countries. Project activities included the restoration of ecosystems through food assistance for assets (FFA) investments designed along landscape continuums, using different soil conservation and water harvesting techniques. Asset creation has been used to restore or build community and market infrastructure, such as feeder roads, bridges, or storage facilities, among others.



Access to education has been incentivised through nutritious school meals and take-home rations. The project has also integrated lean season food/cash and nutrition support to safeguard resilience gains during peak hunger. Moreover, in terms of livelihoods, smallholder agricultural market support has included the use of assets and produce generated from rehabilitated or developed lands, created (agri-) businesses, reduced post-harvest losses, developed value chains, and connected farmers to markets.



Energy investments have also led to improved stoves at homesteads and construction of school canteens (reducing tree-felling for charcoal). Solar-powered pumps have been installed to extract groundwater through boreholes, facilitating irrigation and hydraulic organic fertilisation. This has been used at market gardening sites to allow households to grow crops for consumption and marketing. Biodigesters have also been provided to market gardening sites and school canteens.



Local food processing (with cereals, legumes, and oil extraction) has been strengthened through training, equipment, and the construction of processing units for women's organisations. During the past six months, some 46.800 megatonnes of compost were produced by communities across the different resilience sites.

In terms of impacts, the programme has reached more than 2.5 million people (more than hoped for) with the package of integrated activities across the five countries. This has significantly reduced vulnerabilities and built resilience in the face of future shocks. In only four years, the World Food Programme and communities have together:

- ◆ Rehabilitated nearly 180.000 hectares of degraded land in the G5 Sahel countries.
- ◆ Created 2.440 ha of gardens for vegetable and fruit production at community, school or household level.
- ◆ Enhanced access to water for irrigation and livestock: 610 wells and shallow wells, 340 boreholes and 2.250 ponds have been constructed or rehabilitated.

◇ Rehabilitated lands which now also serve as carbon sinks: it is estimated that each hectare of rehabilitated land sequesters 6 tons of CO₂ equivalent per year. Based on this, the 190,000 hectares rehabilitated by the World Food Programme in Niger now sequesters 1.14 million tons of CO₂ each year.

Strengths of the programme include that it has been government-led and government-owned. Capacity building has also involved local stakeholders including local communities. Local decentralised technical services have been strengthened with broad benefits for everyone, and the project has fostered a network of resilience experts.

Convergence has also been achieved in different partners' interventions and these have been sustained over time (such as the Food Assistance for Assets, School Feeding, and Nutrition programmes) rather than as once-off. This has addressed the various dimensions and multifaceted nature of vulnerabilities and risks. The positive results include better agricultural yields, surplus for sale, and benefits for the community. This has led to the replication of this activity.

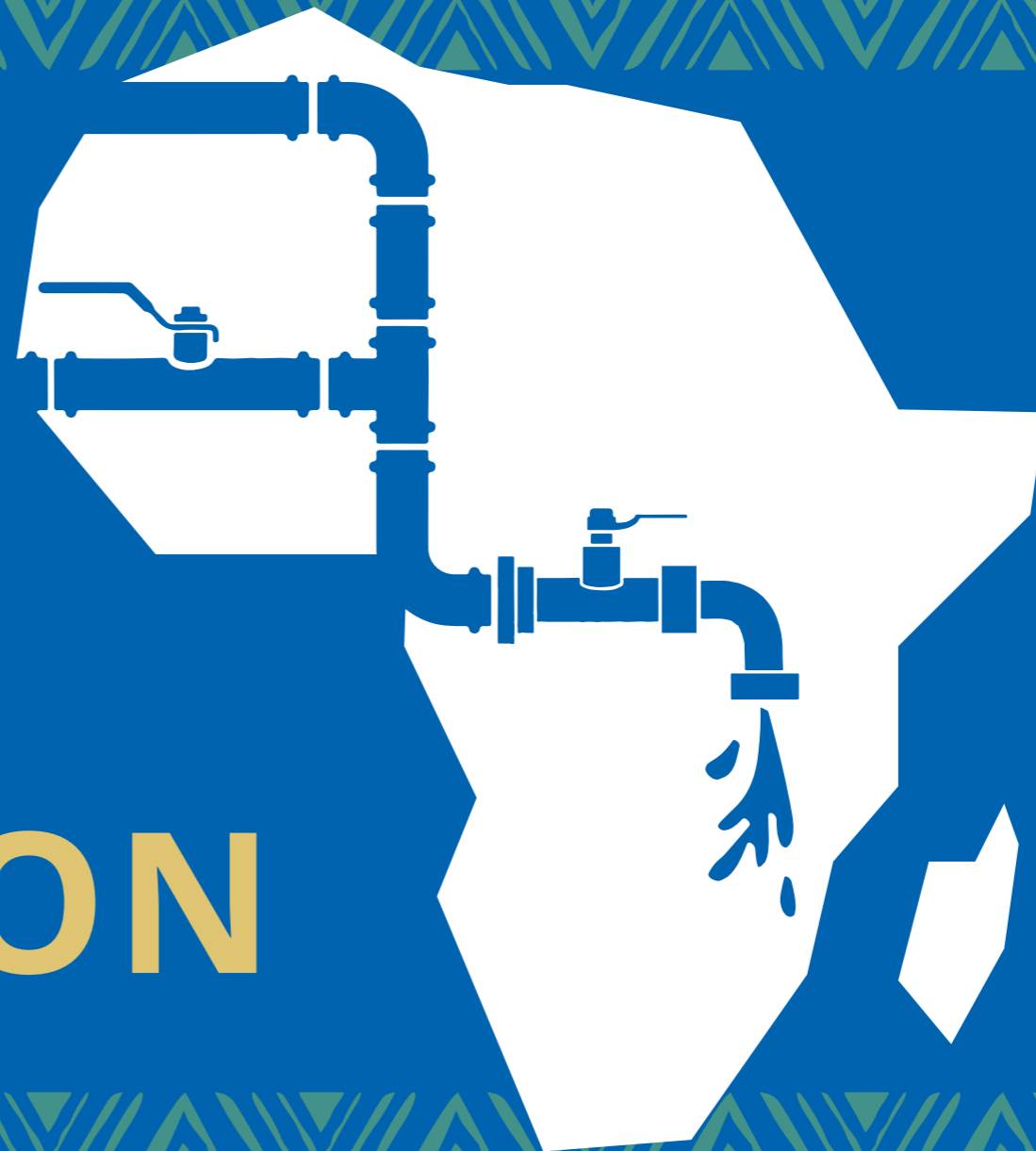
Coverage or scale to match the scale of the challenge has been achieved in this project given its regional scope. Despite the regional scale, community-focused participatory planning methods generated context-specific, needs-based, and inclusive solutions, building upon local innovation and solidarity.

Since 2017, the World Food Programme has been actively promoting its partnership with local universities in the Sahel. The Sahel University Network for Resilience (REUNIR) has since been established and a book published on graduate students' experiences and lessons learned of good resilience practices implemented in Sahelian countries.



WFP/UN

WATER AND SANITATION





Across Africa, there is significant variation in access to water sources and quality. Some countries face actual water scarcity; others face 'economic water scarcity' – that is, lack of access to water sources due to underdevelopment. On top of this, climate change is exacerbating droughts and flooding. For Africa at large, projections are for more variable rainfall, and river discharge. For this reason, the resilience of water investments is very important. Water availability also impacts the water-energy-food-nature nexus. This requires complex planning decisions to be taken across spaces and projects to accommodate various water needs. Water stress has already pushed people to migrate. This could increase without appropriate responses.

The spectrum of water and sanitation planning includes the protection of water source areas, water system and riverine system health, infrastructural access to water (including for households, agriculture, and industry), and dignified sanitation services.

Many smallholder farmers do not have access to irrigation. To address this need, small-scale water infrastructure services can be explored, including micro and mini-irrigation, rainwater harvesting,

small dams, and investments in ecological infrastructure. The Land Restoration and Agriculture case studies point to these sectors' integrated nature, as do those showcased here under Water.



Nature-based solutions, land-use planning, and flood and drought risk management also need to be factored into planning choices. Many water resources cross over national boundaries, which requires transnational coordination and planning, adding to the complexity. From a gender perspective, in certain rural areas, women are expected to fetch water for domestic use. Long travel times and risks from fetching water are further challenges requiring appropriate responses.

THE WATER CASE STUDIES SHOWCASE VARIOUS APPROACHES TO ADDRESSING THESE DIFFERENT VULNERABILITIES:



In the Comoros, water sources are being diversified and watersheds are managed to support access for 450.000 residents.



In Guinea, water supply has been created for many healthcare facilities – supporting clean, reliable water supplies for improved health outcomes. Renewable energy is also part of the project's design.



And in Ethiopia, innovative hydrogeological survey methods are being combined with a roll-out of test wells and boreholes, already creating widespread access to water in several regions.

We also include a case study on the Local Climate Adaptive Living Facility (LoCAL), which invests through local governments in adaptation projects in many countries in Africa. Water (and Sanitation) feature prominently in this infrastructure planning and financing. LoCAL projects in Mozambique, The Gambia, and Lesotho are featured as examples.



PNUD/ NASSER YOUSOUF/ UN

ENSURING CLIMATE-RESILIENT WATER SUPPLIES

This Comoros water project seeks to support 450.000 residents with year-round access to reliable and safe water supplies. To achieve this, several activities have been undertaken, including integrated watershed management in 32 watersheds and the diversification of water supply sources. In addition, infrastructure is being constructed based on a design informed by climate change risk information. Furthermore, supportive enabling activities include the integration of climate change adaptation into national and sectoral processes, institutional and technical capacity building, legislative drafting, and support for the introduction of water tariffs.

The estimated total cost of the project is set at USD \$41 million for the implementation period of 2019 to 2027. Together with the Government of Comoros, and the United Nations Development Programme, a range of other partners support this project including China Geo-Engineering Corporation, Arab Fund for Economic and Social Development, and the Stockholm International Water Institute,



Access to resilient water sources is key to livelihood improvement.



Water storage technologies such as 136 micro-basins and 4 eco tanks are currently being delivered to support livelihood activities in farmers' groups and households in rural areas. Many of these farmers' groups are women-led and the plan is for women to also lead Water Management Committee discussions, to ensure project design, delivery, and use are gender-sensitive.

While the project is fairly new, and under development since November 2020, the preliminary work for the drilling of boreholes has been launched in order to mobilise 17.280 m³ /day of underground water⁷.

Critical to the project's success to date – and holding lessons for successful replication – have been adaptation solutions tailored to specific, unique features for the three islands of the Comoros: for Ngazidja island, groundwater extraction was the chosen approach; while Anjouan and Moheli islands relied on water abstraction coupled with water storage solutions. Furthermore, an essential piece of enabling legislation was the adoption of a new national Water Code in 2021. Core to this revised Water Code are principles of Integrated Water Resources Management, addressing climate change impacts and resilience, gender, and human rights.



JULIEN SIMERY/ UN

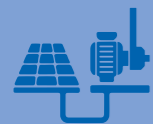


The infrastructure delivery partners on this project are all local, which ensured greater sustainability and local economic benefits. Other partners include United Nations Children Fund, the Ministry of Health, the World Bank, and the Rural Water Agency.

Linking solar pumps to boreholes for water access demonstrates how mitigation and adaptation responses can go hand in hand to deliver improved health and hygiene access and outcomes. Support from local committee structures will enhance the successful ongoing operation of the project. The government of Guinea is hoping to expand the project into further phases.

ACCESS TO SOLAR-POWERED SAFE WATER IN HEALTH CARE FACILITIES

This recently completed project in the Kindia and Kankan regions of Guinea, costing just over USD \$3 million, ran between April 2020 and September 2022. It is the second phase of a successful project, which provided 48 healthcare facilities with 20 solar systems and 28 boreholes equipped with handpumps.



The second phase has delivered access to a sustainable supply of water to 81 healthcare facilities. Infrastructure work involved the construction of 43 boreholes and 81 solar-powered water systems that have supported 22,000 people to have access to a safe water supply both for health facilities and for use in surrounding communities. Linked to this infrastructure development, 81 water and hygiene committees are now operating and supporting improved hygiene practices amongst patients and community members.





The project has arisen through a partnership between the United Nations Children Fund (UNICEF); the Ministry of Water, Irrigation and Electricity; and the Joint Research Centre of the European Commission. This approach is also reflected in the Government's national programme. It is currently in a second phase, from 2019 to 2024.



More than 90 Multi-Village Water Schemes have been formed to date, bringing piped water to approximately 300.000 people. This has improved hygiene and decreased morbidity; led to better quality healthcare; significantly reduced time spent collecting water; and reduced the need for large-scale migration during the dry season.

CLIMATE RESILIENT WATER, SANITATION AND HYGIENE PROJECT



Many Ethiopians rely on surface water or shallow groundwater. These sources are highly vulnerable to drought, and costs are high for water trucking when there are gaps in supply. Against this backdrop, the project sought to provide a sustainable and drought-resilient water supply to rural communities. Part of the approach was to develop an open-source scientific method to identify groundwater sites of adequate quality. This new technology combines conventional hydrogeological surveys with satellite remote sensing. Its impacts have been significant - the success rate of locating durable sources of groundwater has increased from under 50% to over 90%.

Once water is confirmed through drilling, multi-village water supply schemes are developed which provide water to communities. These water points create access to households, health facilities, schools, and livestock. The infrastructure includes an electromechanical system and a storage and distribution system comprised of a pump house with a generator, reservoirs, a pressure and distribution pipeline, and water points.

A similar approach is currently being scaled up in Angola, Somalia, and Kenya by UNICEF. In Ethiopia, its being extended by the Ministry of Water and Energy to an additional 51 Woredas (districts).



THE LOCAL CLIMATE ADAPTIVE LIVING FACILITY

LoCAL is a mechanism for channelling climate finance to local governments for locally-led adaptation to climate change, designed by the United Nations Capital Development Fund. The main objective of the LoCAL approach is to improve the resilience of districts (and municipalities) to climate change using Performance-Based Climate Resilience Grants that work hand in hand with technical and capacity-building support. LoCAL is designed to reinforce existing national and sub-national financial and fiscal delivery systems.


Three examples of national programmes are provided below.






Mozambique has the largest portfolio among the countries in which LoCAL operates: 33 of the 154 districts of Mozambique, plus one municipality, are covered by LoCAL in 5 of the country's 11 provinces. Over USD\$30 million in funding has been generated for climate change adaptation in the form of performance-based and capacity development grants. LoCAL in Mozambique has directly benefitted about 3 million persons.


Financing through the LoCAL has delivered more than 70 adaptive development infrastructures:




Solar-run multifunctional water and irrigation systems to provide continuing water for local households, livestock, agricultural livelihoods, and communal use.




Community-chosen public infrastructures such as classrooms with sanitation blocks, health centres, maternity wards. All have been built with strong foundations, climate/weather resilient roofing (including water harvesting mechanisms), and temperature-regulation, among other adaptive elements.



Construction of climate adaptive access routes: (small) bridges and roads have increased access and reduced travel time and risks.



Nature-based solutions like the planting of mangroves to reduce sea-soil erosion, restore ecosystems and stimulate sea-life growth, and the introduction of bee-keeping and hives to reduce deforestation and also enhance food and job creation.



Climate-smart agriculture including climate-resilient seed distribution, low-cost-climate-conscious farming technologies, and poultry. The diversification of crop production has been promoted too, with the surplus being sold in the community and at markets.

Within LoCAL, the process of the identification and selection of public adaptive infrastructures always involves the community including youth, women, civil society, and community leaders/ elders through a participatory process together with the local government and technical teams. Women have selected approximately 65% of the adaptive development infrastructure and services. Civil society organisations undertake much of the local-level implementation.






Awa L Jagne/ UNCDF

LOCAL - “JOBS, SKILLS AND FINANCE FOR WOMEN AND YOUTH” PROGRAMME

This project started in 2019 and, to date, 12 million Euros of the 16 million allocated by the European Union has been spent. The Government of The Gambia’s vision is to restore economic activity, address needs across the country, seek scalable solutions, and enable the private sector to thrive and be a source of employment and growth. The LoCAL mechanism responds to these imperatives.

 In terms of infrastructure, this LoCAL mechanism focuses on adaptation in water and sanitation including solar-powered boreholes for increased water supply. Vegetable gardening and farming have also been supported through agro-processing equipment and skills. Support has also been provided to Technical and Vocational Education and Training organisations to improve the quality, and accessibility, of vocational training schemes offered to youth and women. Targeted financial services and products have also been developed for women and youth.

To date, the programme has reached:

- ◆ 32 wards in four regions and resulted in 66 locally led adaptation projects.
- ◆ 45.878 people have benefitted directly.
- ◆ 3.351 women and youth have since completed skills training in various areas.
- ◆ 42.000 beneficiaries now have access to financial literacy, banks, wallets, and account services.

The Government of The Gambia has committed to scaling up the programme as part of a new government-owned ‘LoCAL+’ action. This increases the current activities from 32 wards to 48 wards with expansion into two new regions and later a nationwide roll-out.



Awa L Jagne/ UNCDF



A total of USD \$214.000 is allocated to LoCAL over 3 years. Institutionally, LoCAL-Lesotho relies on the National Climate Change Committee for overall coordination, the Ministry of Local Government and Chieftainship, and the district's team for regular support. The Ministry of Finance provides the financial transfers to community councils and holding of the LoCAL special account at the central bank. The Accountant General department and the Office of the Auditor General provide support to ensure good governance and financial management. Implementation is a joint effort between the District Technical Team and Community Councils.

COMMUNITY-COUNCIL DRIVEN, RISK-INFORMED PLANNING

LoCAL has been piloted in Mohale's Hoek district in Lesotho since 2020. In 2021, nine water supply infrastructures and one range management project were implemented in the four community councils of Khoelenya, Lithipeng, Qhoasing, and Senqunyane. These benefitted close to 2.000 households.

Through LoCAL, districts, community councils and communities have all delivered on investment plans. Community councils formulate risk-informed local adaptation plans and investment plans grounded on improved climate information services and resilience planning tools and incorporating gender-sensitive priorities. They also monitor implementation and expenditure and ensure compliance with minimum conditions and performance measures.

Community councils have received the second batch of grants in 2022 to implement another set of priority projects, mainly water supply infrastructure projects which will be completed in December 2022.



COASTAL RESTORATION





Many people both live in and are moving to coastal areas where they often rely on nature's services for livelihoods and commerce (like fishing, for example) as well as for the provision of basic services (such as access to water from rivers). But sea levels could rise 100 cm by 2100, creating serious challenges for Africa's coastlines and the people living near them. By 2030, 108-116 million people in Africa will likely be exposed to risks from rising sea levels⁸. Increasing sea surface temperatures also bring more violent storms.



Traditional infrastructure responses to coastal floods involve constructing barricades and defenses, but green infrastructure solutions can also provide a natural defense: mangroves, for example, slow down surges and are also typically less expensive than traditional or 'grey' infrastructure solutions. But mangrove coverage is diminishing in many countries; so too are coral reefs and seagrasses equally pressured by climate events and human impacts. Other than for shoreline protection, coral reefs, mangroves, and seagrass beds function as a nursery for fish species. This supports fishing and food security, as well as being important for biodiversity. These coastal features are also enjoyed for recreation

and tourism by locals and tourists alike, bringing income to coastal communities. Furthermore, they play a critical role as carbon sinks.

Adaptation and mitigation options for coastal areas include economic diversification (away from fishing and tourism), further formal protection of ecosystems, various grey and green infrastructure solutions, and reintroducing mangroves and seagrass.

THE CASE STUDIES THAT FOLLOW EXPLORE THESE OPTIONS AS WELL AS INNOVATIVE FINANCE FOR COASTAL RESTORATION:



In Egypt, work is well underway to reinforce the Nile delta.



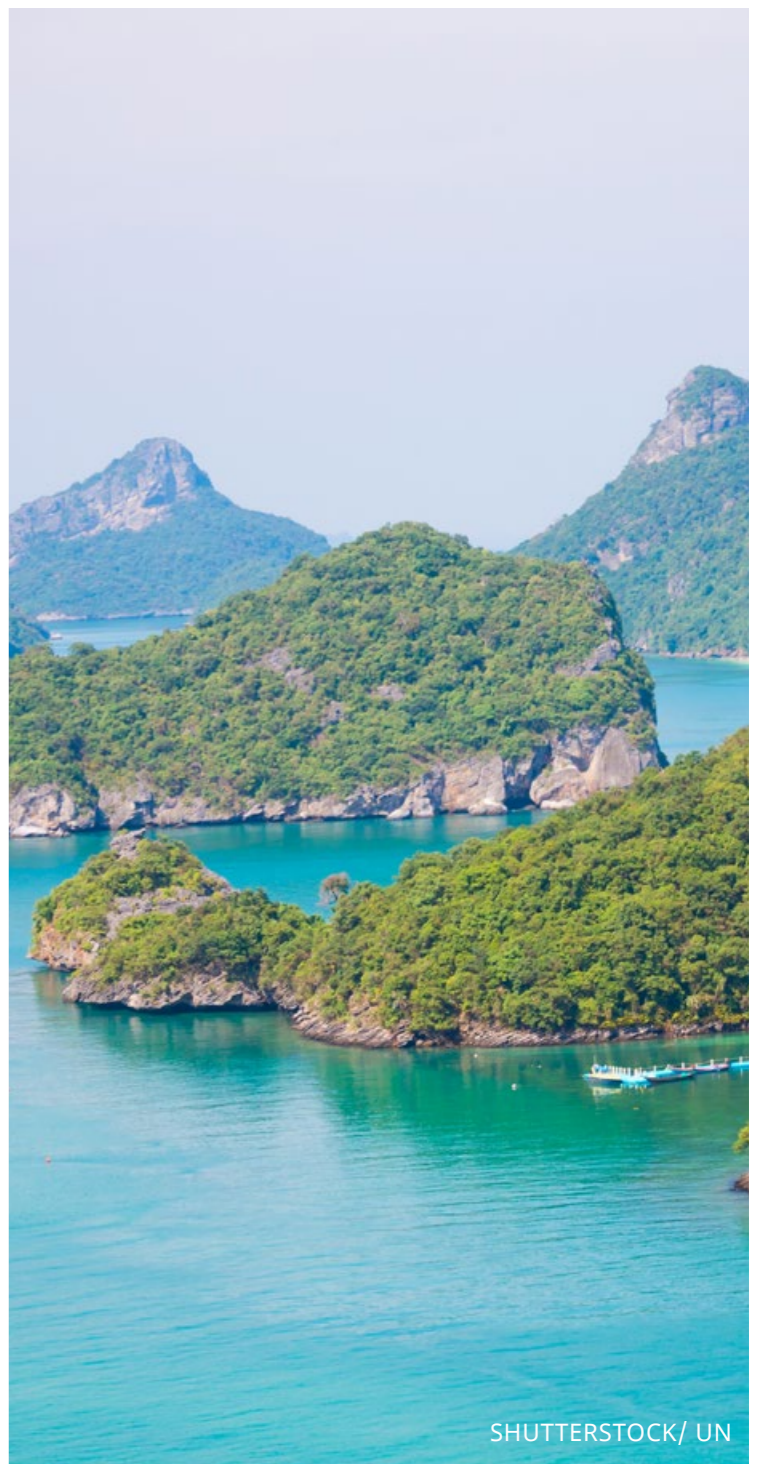
The Seychelles Blue Bonds have raised finance for a range of marine protection activities.



In Kenya, a community-based mangrove restoration project has earned carbon market income which has been reinvested in community assets.



In Liberia and Tanzania, traditional infrastructure (in the former) and green infrastructure (in the latter) have been put in place to provide coastal defences and support local livelihoods.



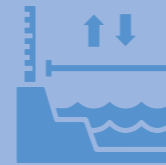
SHUTTERSTOCK/ UN



ENHANCING CLIMATE CHANGE ADAPTATION IN THE NORTH COAST AND NILE DELTA

This project supports coastal adaptation efforts in the Nile Delta, identified by the Intergovernmental Panel on Climate Change in its Fourth Assessment Report as one of the world's three "extreme" hotspots vulnerable to climate change. A one-metre rise in sea level is expected to submerge 20% of the low-lying Delta land area—home to 25% of the Egyptian population—by the end of the 21st century. Salinisation of land and water resources also has significant impacts on agriculture, fishing, and the availability of freshwater resources. Egypt's national reliance on the Nile Delta for agriculture also means that coastal inundation or saline intrusion will have a direct impact on Egypt's entire economy and food security.

A USD \$105 million project partnership over seven years (2019-2025) between the Government of Egypt and United Nations Development Programme with funding from the Green Climate Fund has provided important support to help reduce coastal flooding risks on Egypt's North Coast. It has also facilitated transformational change by linking short-term physical adaptation measures together with long-term strengthened planning and capacity, thereby representing a comprehensive approach to building risk resilience.



Specifically, the project has expanded the use of a sand dike system to prevent the flooding of low-lying lands from sea surges during extreme weather events. This includes constructing 69 km of sand dune dikes along five vulnerable hotspots in the Nile Delta identified by a scoping assessment and technical feasibility study.

Long-term resilience-building has also been supported by the development of an Integrated Coastal Zone Management (ICZM) plan for the North Coast. This has helped provide the means to manage long-term climate change risks and increase resilience to flooding. Linked to this, an observation system will monitor sea changes and the impact of different shore protection scenarios on coastal erosion and shore stability. This focus on resilience planning is also critical to the long-term impact of the project.

The project's successes are also directly linked to strong national government commitment across multiple agencies, including especially the Ministry of Water Resources and Irrigation and its Shore Protection Authority. Leadership has also been provided by the Egyptian Environmental Affairs Agency—national focal point for environmental issues. Important contributions have also been made by the National Water Research Center and Coastal Research Institute.

This project provides an illustrative model of combining short- and long-term focused interventions for effective and sustainable risk reduction.



BLUE BONDS AND MARINE PROTECTED AREAS

Seychelles has developed an innovative financial model to support its marine protected areas. Two bonds have been launched in the past five years⁹– one is a debt for nature swap, and the other is a sovereign blue bond. In the case of the first bond, government debt was purchased by The Nature Conservancy and refinanced for the government at a lower rate, with the repayment savings flowing to marine conservation activities. This includes extending its marine protected area (which has since happened) to cover a total area in excess of 400,000 square kilometres. In the case of the sovereign bond, the interest rate is reduced as the bond is partially guaranteed by the World Bank and blended with a concessionary loan from the Global Environmental Facility. This bond will be used to support more sustainable fisheries. Both of these bonds provide low-cost ways of financing conservation and related climate mitigation and adaptation, with clear environmental returns.

The Seychelles Conservation and Climate Adaptation Trust is responsible for administering both of these funds. Activities funded by the bonds include a marine spatial plan, and a wide range of projects on marine protection topics, from fisher-led seasonal fishery closures to boost species' stocks, to a

blue economy entrepreneurship assessment, and tracking of the migration patterns of the native sooty tern. Research indicates that climate change is already having an enormous impact on species with increasing heat changing access to water and food supply, threatening different species.

This innovative finance approach has already been replicated. For example, the Nordic Investment Bank and the World Bank have since launched marine-related blue bonds. The Nature Conservancy, for its part, aims to undertake debt-restructuring deals with 20 countries in the next five years and has recently announced a blue bond in Barbados. Over the next few years, an international blue bond market might emerge, similar to the existing one for green bonds.

Building on the Seychelles experience, several countries of the Western Indian Ocean have come together to propose a Great Blue Wall Initiative¹⁰, to raise additional financing for investment in ocean-based climate resilience and to create a network of marine protected areas. The Great Blue Wall Initiative aims to assist countries in raising grants and investment through blue bonds for this purpose.





ENHANCING RESILIENCE OF VULNERABLE COASTAL AREAS

This project provides coastal revetment for the purpose of reducing the vulnerability and strengthening the resilience of local communities and socio-economic sectors to the threats of climate change on coastal areas, particularly in Montserrado County, in New Kru town, one of the most vulnerable areas.

Starting in 2018 and since completed, some of the key activities in the project include:

- ◇ The construction of a 1km coastal revetment
- ◇ Enhancing entrepreneurs' and petty traders' skills in business management
- ◇ Strengthening communities awareness of practices to protect coastal areas against human-related drivers of coastal vulnerability

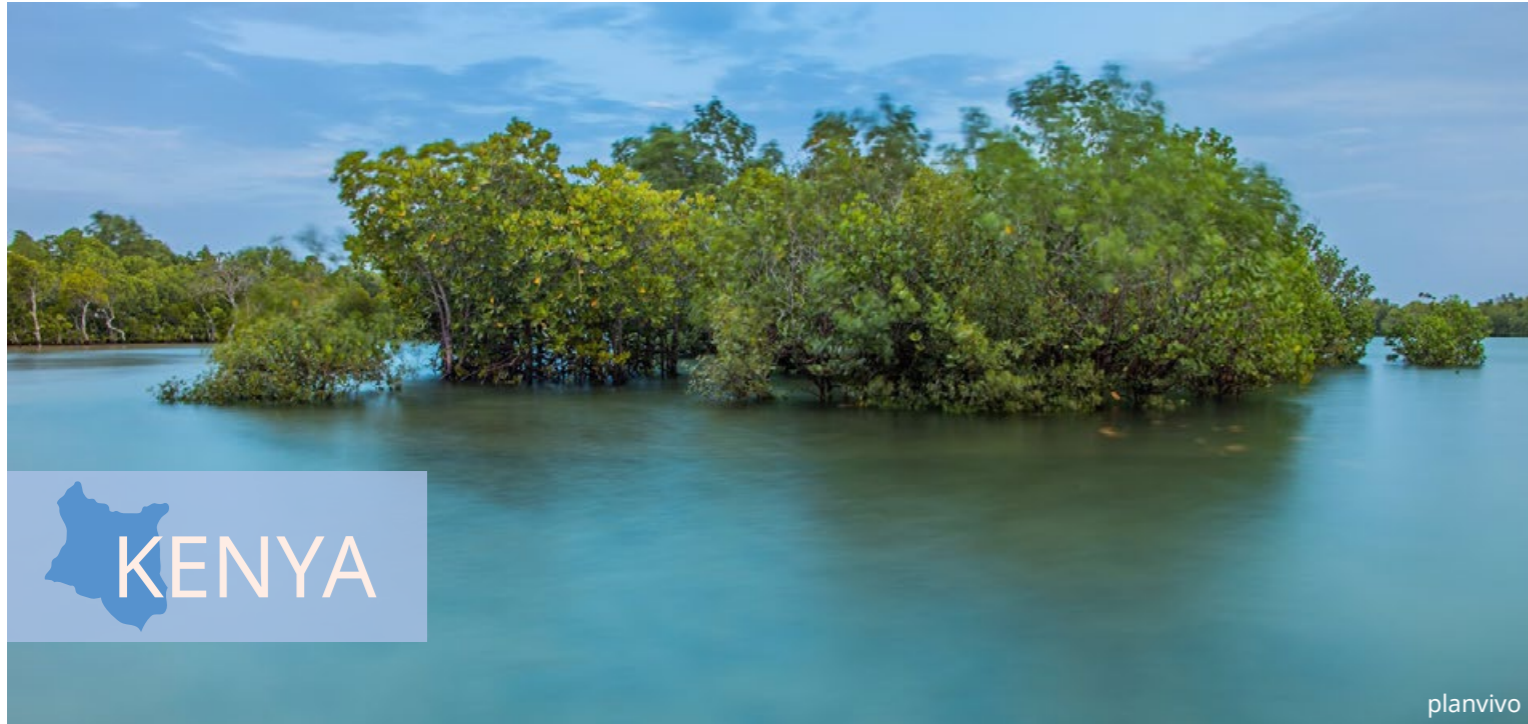
The revetment has protected important infrastructures such as schools, clinics, and businesses. It also has helped to protect the population of more than 70.000 who were at high risk from coastal flooding and the destruction of key socio-economic infrastructures.

A further positive impact has been the establishment of Coastal Protection Units which provide improved capacity at the local level for the maintenance of the coastal defence wall. 75 local people have been trained for this. A further 100 youths have been supported with livelihood and business skills.

In total the project cost was close to USD \$2 million, provided by the government and the Global Environmental Facility. The Ministry of Mines & Energy, Ministry of Public Works, and the Environmental Protection Agency were also all active project partners.

While the project originally planned to construct a 500m coastal revetment, the impacts of the project resulted in the government providing additional co-financing to allow for its extension. In this way, the project has already been scaled up and a similar approach could be replicated elsewhere.





MIKOKO PAMOJA MANGROVE PAYMENT FOR ECOSYSTEM SERVICES

Mikoko Pamoja is the first mangrove Payment for Ecosystem services project in the world¹¹ and is located in Gazi Bay, Kenya where it supports two communities. Mikoko Pamoja is community-led and has been in operation since 2014. The main activities involve the reforestation of degraded mangrove areas, with 5.614 mangrove seedlings planted to date, and avoiding deforestation (through the surveillance of the forest against illegal activities). In addition, to provide alternatives to mangrove extraction, community woodlots have been developed. Activities also include education and awareness creation.

With 1.081 households involved in the project, 117 ha of mangroves are protected with avoided deforestation of 107 ha, and replantation has been achieved of 10 ha. Verified by Plan Vivo standards, carbon sold into the voluntary market is equivalent to 16.000 tCO₂ – this is the saleable emissions reduction achieved by the Mikoko Pamoja project. The sale of mangrove credits generated about USD \$120.000 in total between 2014 and 2021. These proceeds have been used to support local development projects in water and sanitation, education, health, and environmental conservation. From a gender perspective, the project requires that the Community Organisation has a minimum of 40% representation by women.

The project's success relies on a strong combination of community commitment, science, government support, and an international network. The project is managed by three groups: The Mikoko Pamoja Community Organization consisting of representatives of Gazi Bay, specifically Gazi and Makongeni villages; The Mikoko Pamoja Steering Group which provides technical support; and The Association for Coastal Ecosystem Services, a charity registered in Scotland. Other project supporters and partners include the United

Nations Environment Programme, Blue Forests, the Global Environmental Facility, Kenya Forest Service, and Edinburgh's Napier University.

The Mikoko Pamoja project won the Equator Prize in 2017. It has had an important demonstration effect, including in Tanzania (see next case study). Within the project, consideration is now being given to seagrass protection too. Further community socio-economic development activities include exploring improved waste management and cooking stoves for the communities.





COASTAL PROJECTS ADDRESSING CLIMATE SERVICES AND ADAPTATION

The “Developing core capacity to address adaptation to climate change in productive coastal zones of Tanzania” and “Implementation of concrete adaptation measures to reduce the vulnerability of livelihoods and economy of coastal communities of Tanzania” are two complementary projects undertaken in the United Republic of Tanzania between 2012 and 2019. The former was funded by the Global Environment Facility administered Least Developed Countries Fund (LDCF), with a project value of USD \$3.4 million. It was implemented in five districts: Pangani, Bagamoyo, Rufiji, Mijini, and Mkoani. The latter project, funded by the Adaptation Fund (AF), for USD \$4.4 million, was implemented in Dar es Salaam.

The AF project objectives were to reduce the vulnerability of livelihoods, ecosystems, infrastructure, and the economy in Tanzania, while the LDCF project focused on building institutional capacities to manage climate change impacts. The activities for improved institutional capacities included improved climate information, technical capacities, and the reduction of climate change vulnerability at selected sites with adaptation measures.

Adaptation activities included:

- ◆ The restoration of 3.000m² coral reefs and reforestation of 1.000ha of mangroves has benefitted 31.500 people by providing flood defenses and habitat for fish species. 87 community groups manage the mangroves.
- ◆ Skills for at least 100 people in coastal and climate vulnerability mapping. 3 coastal vulnerability assessments and 4 participatory vulnerability assessments were used to identify climate-vulnerable communities.
- ◆ Development of 2.400m of sea-defense structures- walls, groynes, and dikes - much of which protect vital economic hubs.
- ◆ Installation of 10 boreholes with 15.000 litres each of storage tanks, benefiting over 10.000 people in Bagamoyo District.

The LDCF project benefitted 26.000 people, while the AF project benefitted 430.000 directly and 500.000 indirectly. Local demand for charcoal has declined and the projects have strengthened capacities and built relationships between project partners including Rufiji, Pangani, and Bagamoyo District Councils; Zanzibar Administration; University of Dar es Salaam; United Nations Environment and NGOs Network/Consortium; Ministry of Water; Ministry of Works; and Dar es Salaam City Council.

This consistent engagement of district and community stakeholders in the implementation of project activities has encouraged local commitment and ownership.

TOURISM





Tourism is an important source of foreign exchange earnings, jobs, and business opportunities for most countries around the world, including in Africa. While women tend to dominate employment, they are less likely to own businesses than men. Youth are often active in tourism and within the creative industries linked to tourism (arts, crafts, film, marketing, etc.).



In 2019, prior to covid, travel and tourism in Africa contributed about 7% to the overall Gross Domestic Product (GDP), or USD 182 billion, and 25 million jobs across the continent. In 2020, tourism plummeted. It is now beginning to recover - in 2021, travel and tourism's GDP contribution grew to USD 119 billion and jobs increased to 21.3 million¹².



Many leisure tourists travel to and in Africa to experience nature-based tourism. For this reason, tourism has become an important source of income for protected areas, helping to fund biodiversity conservation. In fact, the value of the wildlife safari industry in Africa was estimated to be as much as USD \$49 billion in 2018¹³. Beyond protected areas, coral reefs for diving, pristine beaches, and mountains all provide recreational opportunities. While tourism is an important

source of income and opportunities, it has to be implemented and managed responsibly. Protected areas require management plans to ensure that tourism remains a positive force. COVID-19 has also demonstrated that to build resilience, diverse income streams are required for protected areas and people living in surrounding areas.

As indicated in previous sections, climate change is impacting ecosystems and biodiversity as well as coastlines, where many tourism experiences are located. Floods, heat waves, and wildfires threaten heritage. Multiple heritage sites, including World Heritage Sites of Outstanding Universal Value, are located in such low-lying coastal zones. It is estimated that there are 56 cultural and natural heritage sites in Africa at risk from extreme sea levels and erosion¹⁴.

The case studies considered here explore innovative approaches to supporting tourism destinations - and the natural habitats, ecosystems, and species they rely upon - through cross-border initiatives, innovative finance, and the diversification of income and economies.



The Southern African Development Community is home to a set of cross-border parks, the Transfrontier Conservation Areas, which support regional ecosystem planning, tourism development, and community-based livelihoods.



In South Africa, a species-specific conservation bond has been issued to raise funds to protect Rhinos. It will diversify and expands two parks' income streams, which will allow them to extend additional support to both conservation and community development.



Each TFCA has made several strides toward the achievement of these objectives. Examples of high-level impacts include:

- ◆ Taken together TFCAs protect a combined area of more than 1 million square kilometres, which is over 50% of SADC's total area of all protected areas. These protected areas support many livelihoods and act as carbon sinks. They are also critical for species diversity.
- ◆ Thousands of animals have been translocated through the years into depleted wildlife areas within TFCAs and these animals now have larger spaces to roam.
- ◆ Countries are collaborating and coordinating their law-enforcement activities, specifically in poaching hotspots.
- ◆ Numerous formal and informal shared cross-border governance and management systems have been developed involving many partners across the region.
- ◆ A regional SADC TFCA network supports practitioners to build strong relationships and exchange best practices.

TRANSFRONTIER CONSERVATION AREAS

Considerable planning and infrastructure development work has taken place since the start of the Transfrontier Conservation Areas (TFCA) programme 20 years ago. 18 TFCAs now exist in the SADC region, at different stages of development. TFCAs are a territorial approach to drive integration using shared ecosystems as the basis for geographical logic. Tourism is one of the seven key components of the SADC TFCA Programme. Others include enhanced financing, capacity building, improved local livelihoods, reduced vulnerabilities, and the development of marketable tourism products.

There are multiple partners to the programme and its in-country components. German Development Cooperation is one of the main partners; others include United Nations Environment, United Nations Development Programme, World Food Programme, African Development Bank, European Union, Global Environment Facility, and the Japan International Cooperation Agency. On the ground, NGOs play a significant role in the implementation of the activities.

Many tourism-specific activities have been undertaken. Examples include:

- ◇ The introduction of special border posts which connect parks on either side of national boundaries. This includes the tourist access facilities at Giriyondo between Mozambique and South Africa in the Great Limpopo Transfrontier Park and at Mata Mata and Tweerivieren in the Kgalagadi Transfrontier Park between Namibia and South Africa and Botswana.
- ◇ A univisa system has been piloted between Zambia and Zimbabwe.
- ◇ Support to various World Heritage Sites as many fall within the TFCAs. This includes Mosi-oa-Tunya (Victoria Falls), the Okavango Delta, and the Mapungubwe National Park.

A recent project which brings together tourism, heritage, and environmental management is the 'Supporting community-based activities for COMPACT (Community Management of Protected Areas Conservation Programme) in Maloti-Drakensberg Park World Heritage Site'¹⁵. This TFCa is situated in South Africa and Lesotho. The project seeks to conserve biodiversity as well as cultural and natural heritage features of the mountainous region, which is also home to important rock art and living heritage.

Project objectives include enhancing the area's spiritual significance and sense of place, as well as sustainable eco-cultural tourism opportunities. The COMPACT approach disburses small grants to support clusters of community-based activities. Funded by the United Nations Development Programme and the Global Environmental Facility Small Grants Programme, UNESCO is the institutional host of the programme. Planned activities include improving rangeland conditions, training on veld condition assessments, development and implementation of grazing and fire management plans, wool and mohair improvement, and wetlands rehabilitation.

The TFCAs provide lessons on how to, over time, build cross-border initiatives to support protected areas and, linked to this, broader socio-economic development. While progress across the TFCAs differs, the 20-year commitment to the programme from the governments of SADC and many project partners continues to deliver improved impacts. This systematic and deliberate approach to shared conservation, development and improved management is impressive in its scale, ambitions, and achievements.



Ko Hon Chiu Vincent/UNESCO/UN



Black rhinos are critically endangered mainly due to poaching and habitat loss. With the funds from the bond, South Africa can extend its ongoing rhino conservation efforts and livelihood support. For example, in the Great Fish River Nature Reserve, the funding will support increased staffing and training, improved national and regional coordination, as well as investments in equipment, infrastructure, and technology.

When the Bond matures, the rhino growth rate will be independently calculated by Conservation Alpha and verified by the Zoological Society of London. The World Bank will then pay investors a success payment, funded by a performance-based grant from the GEF. This creative approach means that project risks are being passed on to capital market investors.



THE RHINO BOND

A five-year USD \$150 million Wildlife Conservation Bond was issued in March 2022 by the World Bank¹⁶. It includes a potential performance payment from the Global Environment Facility after its five-year term. The bond will help protect and increase black rhino populations in two protected areas in South Africa: the Addo Elephant National Park (which is part of South African National Parks) and the Great Fish River Nature Reserve (part of Eastern Cape Parks). The amount of the Conservation Success Payment will be determined based on the rhino population growth rate with a maximum payment of USD \$13.76 million.

The 'Rhino Bond' is the world's first financial instrument dedicated to protecting a species. Rhinos are a critical species in ecosystem health and their protection helps other species that share their habitat. This ecosystem contributes to South Africa's national economy through tourism, job creation, and as an important source of foreign exchange. In 2019, before covid hit, the tourism revenue at South African National Parks was R1.9 billion or about USD \$137 million dollars. SANParks has over 4.000 employees and with its concessionaires, another 2.100 employees. They are mainly drawn from surrounding communities¹⁷.

WASTE





Many African countries face interconnected waste management challenges that directly impact human health and the environment. Rapid urbanization is one of the factors linked to growing waste; so too are the limited waste services which means that much waste is disposed of in an uncontrolled manner. Open dumping, which is usually associated with burning, produces methane and black carbon with very negative impacts on the climate.

Plastic waste is also growing in Africa and has high rates of leakage into the environment, as recycling is limited. Recognising the severity of the global plastic crisis, African countries have recently taken the lead in pushing for a global treaty on plastic by 2024¹⁸. Waste dumping impacts on land, riverine and marine health as rivers act as conduits. Blocked-up rivers also create the environment for urban flooding as well as poor health impacts from waterborne diseases.

In many countries, informal waste pickers provide the critical service of waste collection and sorting. Their health and livelihood need protection too as waste processing becomes more formalised. There are already many examples of small businesses in Africa creating value from waste - where it is transformed into fashion, building

materials, organic compost, energy, and protein in animal feed, for example.

There is an opportunity to unleash far more value from these waste streams by unlocking viable polymers, fibre, metals, and nutrients. In particular, organic waste has many possible uses. Domestic cooking energy and biofertilizer are particular technologies to drive circular economy adoption.

The case studies consider some of the opportunities to derive value from waste.



In Côte d'Ivoire and Senegal, strategies explore waste recovery options along with demonstration projects and capacity building.



In Nigeria, a major e-waste initiative is underway to address the risks of this harmful but lucrative waste.



In Ghana, a biogas project from sludge has become a successful business opportunity.



In South Africa, pilot projects on biogas demonstrate its potential applications.





In terms of demonstration, in Senegal, this involved the distribution of 2,000 bins for organic waste collection to generate compost feedstock. These bins are placed in strategic locations such as standardised collection points, markets, and public spaces.



In Cote d'Ivoire, a 100m³ biodigester was developed and installed in the site of the Société Ivoirienne d'Abattage et de Charcuterie, an abattoir. This enabled the abattoir to reduce costs associated with the purchase of butane gas, empty the slaughterhouse manholes and septic tanks, and generate income from organic compost.



This resulted in a projected net annual income of USD \$50,000 which proved the financial business case for the adoption of the biodigester.

The total project cost across both countries was USD \$1.5 million. In Cote d'Ivoire, the project was undertaken by the Ministry of Environment and Sustainable Development; in Senegal, the Ministry of Urban Planning, Housing, and Public Hygiene led the project. Environment Canada, the Stockholm Environment Institute, and the United Nations Development Programme were project partners.

Lessons from these two projects include that business specific solutions can deliver tangible results – as well as profits – for participants while achieving climate mitigation. Small-scale household solutions such as composting bins can also play a role in supporting livelihoods. These lessons have already been shared with over 200 young people drawn from Nigeria, Togo, Kenya, Uganda, and the DRC who have begun to replicate practices in their countries.

A regional workshop with other ECOWAS member states was held to share the experience of Nationally Determined Contributions' implementation in the waste sector. This has resulted in the development of a digital platform to publish all the outputs of the project and for use as a collaborative platform for promoting and sharing knowledge in the ECOWAS and the African French-speaking countries in the region.

WASTE SECTOR INNOVATIONS

Tools, strategies, and demonstration projects were developed in 2019 and 2020 in Côte d'Ivoire and Senegal to support innovation in the waste sector. The intention was to catalyse increased investments in waste in order to mitigate dangerous emissions while unlocking socioeconomic benefits to improve communities' resilience.



In Senegal, the project supported the development of strategies for waste recovery to compost and biogas. In Cote d'Ivoire, two guidelines were developed for composting. These strategies provide the legal basis for diverse stakeholders to invest in waste recovery actions particularly waste recovery to biofertilizer and biogas.



To date, the Government of Nigeria and producers have finalised and are jointly implementing the Extended Producer Responsibility legislation for the electronics sector. Training has been completed for regulators, collectors, and producers, and a project communication strategy is being rolled out. A national Electronics and Electrical Equipment regulation is also being updated to support the enabling environment. 30 collection sites have been identified as collection pilots and work is underway to contract recyclers to deliver services. Linked to this, a training module will be rolled out for informal workers in the electronics sector. This training element is supported by the International Labour Organisation.

There is much potential for the scalability of this approach. The project has been chosen as a demonstration project in the electronics sector convened by the World Economic Forum under the Platform for Accelerating the Circular Economy, a public-private collaboration.

E-WASTE PROJECT



A lack of formal electronic waste recycling in Nigeria creates many health challenges including toxic fumes and water contamination. It is estimated that over half a million tonnes of discarded appliances are processed in the country and up to 100,000 people work in the informal electronic waste sector, with women accounting for about 40% of the total.

A project launched in 2019 between the Nigerian Government, the Global Environment Facility, and UN Environment Programme is supporting the emergence of a circular electronics system in Nigeria as electronics have multiple reuses and contain high-value materials. The project is led by the National Environmental Standards and Regulations Enforcement Agency. Along with promoting the recycling of usable components of electronic products, the project will develop systems for the disposal of non-usable and toxic waste. It also aims to collect, treat and dispose of more than 270 tonnes of e-waste contaminated with persistent organic pollutants and 30 tonnes of mercury-containing waste¹⁹.





Activities in the project included:

- ◇ The demonstration of biogas plant construction in schools
- ◇ Data collection on household and public school waste management practices
- ◇ A review of the legal framework on renewable energy
- ◇ A baseline assessment of existing biogas plants
- ◇ Participants were trained on how best to calculate optimal plant size relative to the amount of waste available



PROMOTION OF BIOGAS TECHNOLOGIES

SWITCHAfrica Green, an EU-funded programme implemented by the United Nations Environment programme, supports countries in Africa to transition to an inclusive green economy. It works with the private sector to assist them to adopt more resource-efficient, environmentally sound business practices²⁰.

One such project involves the promotion of biogas technologies in Ghana, in a project driven by the Ghana National Cleaner Production Centre within the Greater Accra Metropolitan Area²¹. This particular project focused on the use of biogas technology to manage domestic faecal sludge as an income-generating opportunity that also supports the adoption of clean domestic energy. At present, nearly 95 percent of the residents in Ghana use septic tanks. This requires the waste to be dislodged when tanks fill up and disposal is dangerous for the environment and people, as well as costly.

A direct result of the programme is the uptake of the technology by an entrepreneur who has built a successful enterprise developing and rolling out biodigesters for commercial use in schools. The business case in Ghana is clear: the production of biogas allows for savings on the discharge costs associated with septic tanks, as well as providing fuel for cooking.

With more training, demonstration, and access to resources, this business model could have significant replication potential across the country and elsewhere for entrepreneurs.



These projects include, in the Gauteng Province, an abattoir project which has replication potential for all abattoirs, and in the Limpopo Province, the co-digestion of dairy animal waste and milk processing. In the Free State Province, the viable generation of bio-CNG (a renewable fuel obtained by purifying biogas) for use in the transport industry from agro-waste is also a highly replicable offering. It involves the local farming community, the district municipality, provincial government departments and private-sector corporate investors and offtakers. The project has successfully improved investment prospects for integrated biogas technologies. It has also improved institutional capacity to support the Biogas industry in South Africa and in the sub-region.

Although scaling-up runs throughout all project activities, a specific project component is dedicated to the establishment of a replication mechanism to mainstream the application of biogas for SMMEs. This will assist additional biogas projects with technical assistance and help to establish financial mechanisms targeted at promoting the use of integrated biogas technology in SMMEs. In addition to the technical lessons and demonstration effect of the pilots, and an improved enabling environment, further sustainability and replication are likely given the involvement of financial institutions that now have first-hand experience in structuring finance for the biogas markets.

The United Nations Industrial Development Organisation has been working in collaboration with several partners, including the Department of Forestry, Fisheries, and the Environment; the Department of Mineral Resources and Energy; the Department of Trade, Industry, and Competition; as well as several academic and research institutions. Project developers have also played an important role in the project's success together with local and regional development financial institutions, such as the Development Bank of Southern Africa.

DEVELOPMENT OF THE BIOGAS MARKET



This project started in 2016 and is due for completion in July 2023, with a total project financing of USD \$4.2 million. It promotes organic waste-to-energy by accelerating biogas market development, specifically targeting Small, Medium, and Micro-Scale Enterprises (SMMEs). The project design responds to the urgent energy needs in South Africa and growing waste management challenges and aligns with the country's National Communication Technology Needs Assessment.

Among the main objectives, the project promotes technical capacity training and the development of knowledge products, and strengthens the biogas regulatory framework to effectively promote and support SMMEs to invest in integrated organic waste-to-energy technology. A separate project component is dedicated to the support of five selected SMMEs integrated biogas projects to demonstrate the technical feasibility and commercial viability of biogas technology.

TRANSPORT





Transport infrastructure enables economic and social development: transport links people to work, education, health facilities, and leisure; it also moves goods. But in Africa, only one-third of rural inhabitants live within two kilometres of an all-season road²² and many residents are unable to access reliable, safe, and affordable transport services. Travel lengths of time are also major inhibitors to development. Increasing urbanisation is adding to these pressures on transport systems.

For decades, Africa's transport systems have experienced major underinvestment. The African Development Bank's Programme for Infrastructure Development in Africa estimates priority transport investments in its portfolio to cost about USD \$25 billion dollars²³. This is only a fraction of the total infrastructure investment required.



Globally, the sector's emissions are on the rise as most transport energy still comes from fossil fuels. Africa is currently the largest importer of used vehicles worldwide, with consequential impacts on the environment and road safety²⁴. For this reason, while transport backlogs need to be rapidly addressed in Africa, low-carbon alternatives

are simultaneously needed. These must also be climate resilient as damage from storms and storm surges can reduce transport infrastructure life. Incorporating existing forms of informal transport into planning is necessary for an inclusive low-carbon transport future in Africa.

In this context, Africa has significant opportunities to transition to low-emission transport (such as electric vehicles) for both public and private transport. Existing, well-established auto manufacturing industries in South Africa and Morocco could, with a suitably phased electric vehicle transition, also be a driver of intra-regional value chains associated with this transition, and improve value addition in the sector. Nine African cities (Accra, Addis Ababa, Cape Town, Dakar, Dar es Salaam, Durban, Johannesburg, Lagos, and Tshwane) have already committed to carbon neutrality by 2050, but there remains a big gap in research and the policy environment to support this transition²⁵, as well as a funding gap. Introducing major low-carbon transport infrastructure is capital intensive.

The Energy sector case study on Morocco's solar photovoltaic infrastructure for electric Bus Rapid Transit routes demonstrates the links between clean energy and transport.

The case study which follows describes the Africa-wide United Nations Environment programme on e-mobility which has a number of entry points into sustainability mobility on the continent.



UNEP/UN

UNITED NATIONS ENVIRONMENT PROGRAMME: E-MOBILITY IN AFRICA

This global e-mobility programme supports more than 50 low-and-middle-income countries around the world with the shift from fossil fuel to electric vehicles²⁶. The programme has four Regional Support and Investment Platforms and four Global Thematic Working Groups. The United Nations Environment Programme (UNEP) is leading the Africa Platform and the Global Working Groups on electric 2 and 3-wheelers, and zero and low-emission buses.



UNEP/UN



ELECTRIC 2 & 3-WHEELERS

Motorcycles and 3-wheelers underpin transport systems in many countries in Africa and are mainly used commercially to transport passenger and goods travelling long distances each day. As they are predominantly fossil fuel powered, coupled with limited maintenance habits, they are highly pollutive and a major source of particulate matter and black carbon emissions. The UN Environment Programme is currently working on the electrification of 2 and 3-wheelers in Togo, Kenya, Rwanda, Uganda, Burundi, Madagascar, Sierra Leone, and Tanzania.



According to calculations made using the UNEP's e-Mobility (eMob) calculator, converting to 90% battery electric motorcycle sales globally by 2030 could result in CO₂ emissions reductions of about 11 billion tons between now and 2050²⁷. While purchase costs for e-vehicles are higher, their operating costs are lower in terms of fuel and maintenance. This could lead to savings of USD \$350 billion by 2050.



In collaboration with national stakeholders, e-motorcycle demonstration projects have been carried out in Kenya and Uganda²⁸. In both countries, the annual uptake of conventional motorcycles has grown considerably and led to a 3-fold increase in motorcycle imports compared to car imports over the last twenty years. The objective of these demonstration projects is to show that electric technology is viable and can play a significant part in making the African transport sector more sustainable.

In March 2021, the pilot was launched in Kenya, with forty-nine electric bikes being deployed in four locations to test the vehicles in different use cases and operating conditions. The pilot is implemented together with a number of stakeholders including government entities (national and local) such as the Energy and Petroleum Regulatory Authority, Academia (University of Nairobi), Non-Governmental Organisations such as Sustainable Transport for Africa and the private sector (Shenzhen Shenling Car Company Limited), which donated the e-bikes. It is being replicated in Uganda, the Philippines, Thailand, and Vietnam²⁹.

The key to getting e-vehicles at scale will also be the roll-out of battery charging infrastructure. In Kenya, in rural areas, where demand for motorcycles is high, electricity distribution networks are often inadequate. There is an opportunity to link electric motorcycle charging infrastructure to solar power installations and battery storage. If 2 and 3-wheeler charging stations are linked to mini-grids, they could improve their profitability³⁰. A pilot project in Kisumu is currently exploring this potential.



Under the Global Fuel Economy Initiative, UNEP has established baselines and policy strategies for the introduction and shift to electric vehicles in Ghana, Mauritius, Mozambique, Tunisia, Cote d'Ivoire, and Zambia. This work highlighted that planning and policy work for a shift to zero emission mobility needs to start with the establishment of a fuel economy baseline to provide data points to guide decision-making.

UNEP together with its partners is supporting a shift to clean bus fleets in Cote d'Ivoire, Senegal, Seychelles, South Africa, and Tanzania.

An example of this subprogramme is a cost-benefit analysis conducted in 2021 by UNEP, the African Association of Public Transport, and the Executive Council of Urban Transport in Dakar. This determined the expected revenue from full electric bus implementation on two of the city's routes. It found that an electric bus fleet could deliver a return on investment within 10 years. UNEP and the African Association of Public Transport have also recently supported a similar in-depth cost-benefit analysis in Lagos, Nigeria.

Across all three focus areas - buses, light-duty vehicles, and 2 and 3-wheelers - the development of technical knowledge, introduction of supportive policies, industry partnerships, awareness raising, access to finance and practical insights from demonstration, are critical steps toward an e-mobility transition in Africa.

Training and events are being carried out as part of the Regional Support and Investment Platforms. These regional platforms focus on creating communities of practice around lessons and best practices. They also establish marketplaces to mobilise finance, increase vehicle availability and provide technical assistance, and a help desk for queries from countries regarding electric mobility.

CONCLUSION

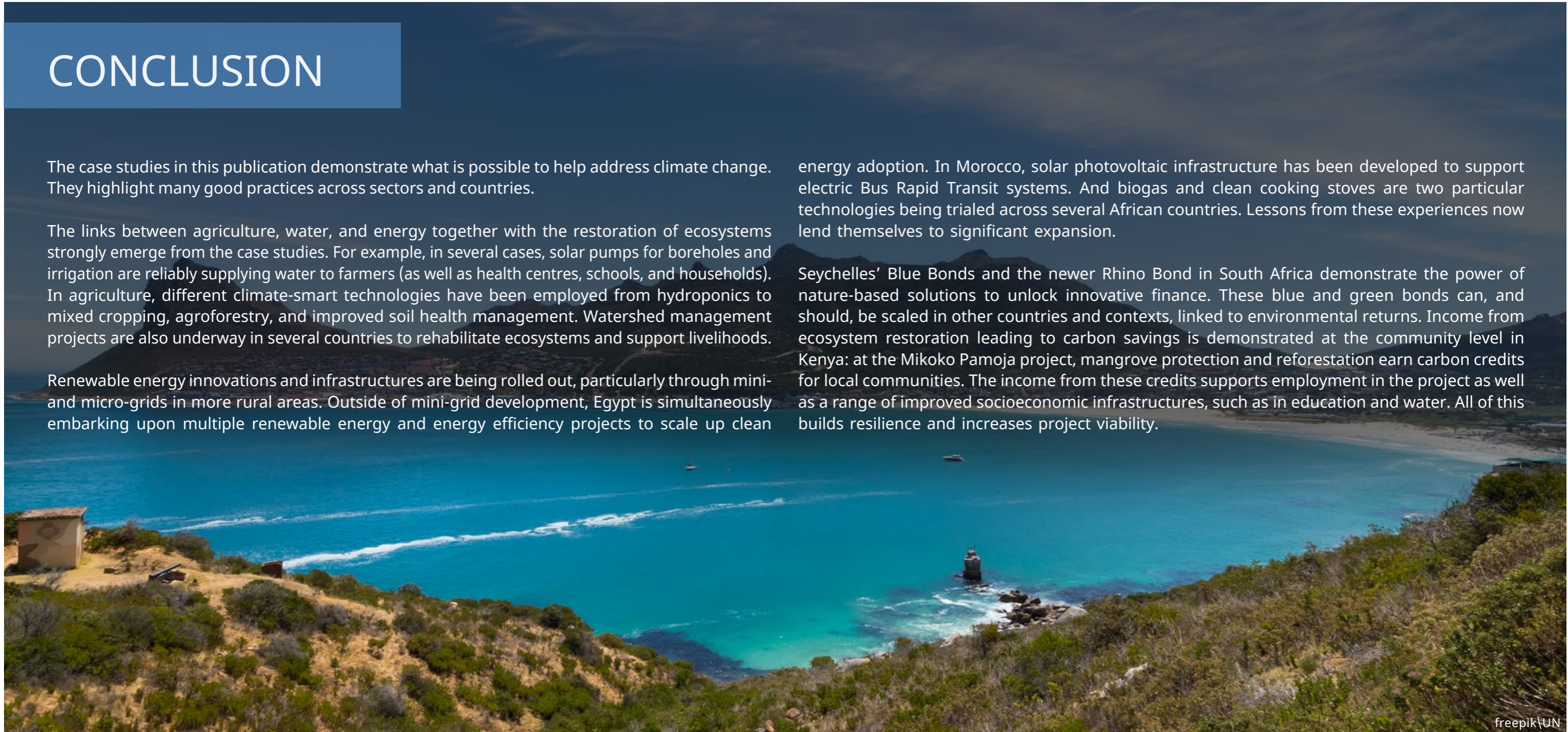
The case studies in this publication demonstrate what is possible to help address climate change. They highlight many good practices across sectors and countries.

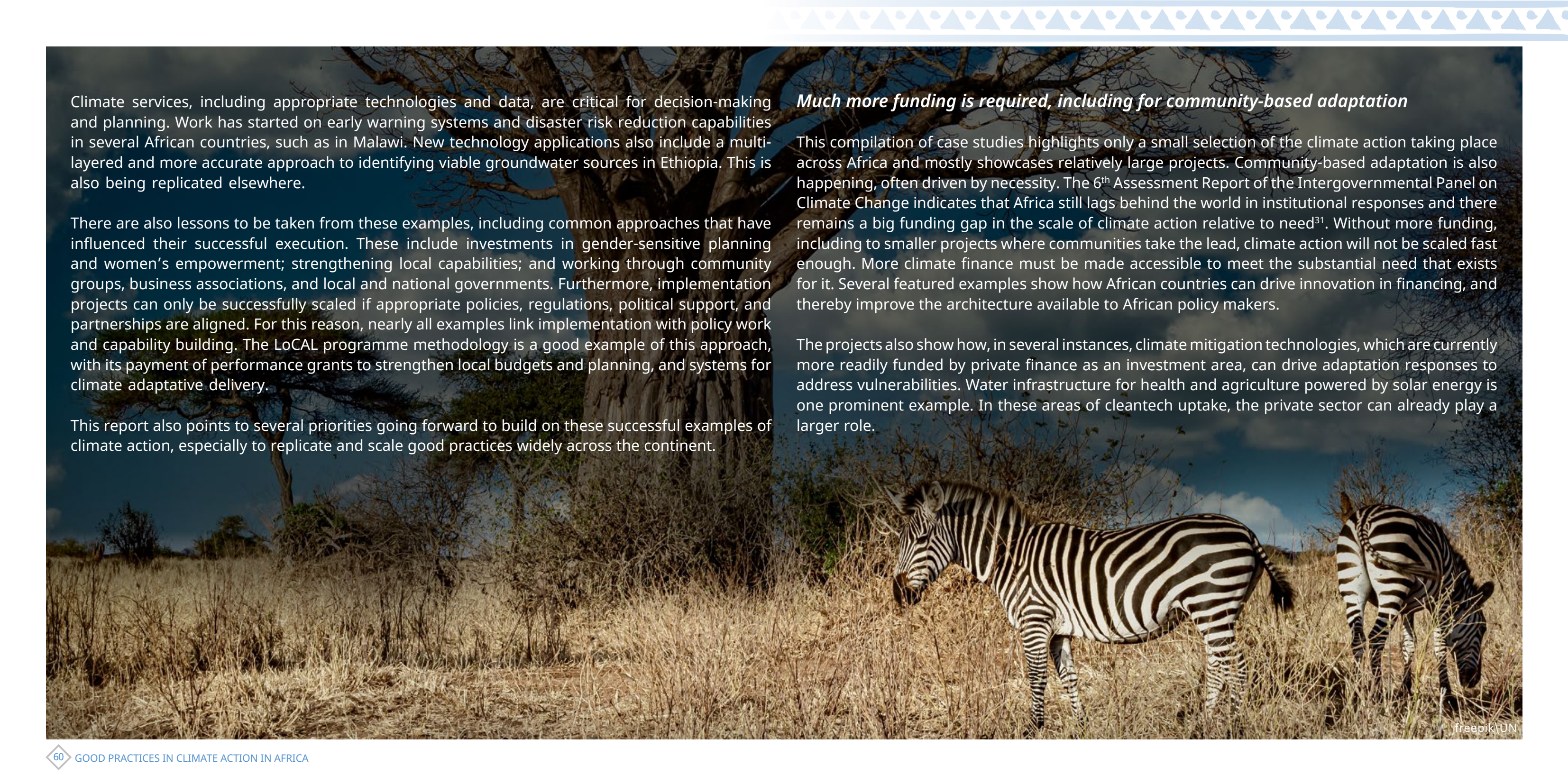
The links between agriculture, water, and energy together with the restoration of ecosystems strongly emerge from the case studies. For example, in several cases, solar pumps for boreholes and irrigation are reliably supplying water to farmers (as well as health centres, schools, and households). In agriculture, different climate-smart technologies have been employed from hydroponics to mixed cropping, agroforestry, and improved soil health management. Watershed management projects are also underway in several countries to rehabilitate ecosystems and support livelihoods.

Renewable energy innovations and infrastructures are being rolled out, particularly through mini- and micro-grids in more rural areas. Outside of mini-grid development, Egypt is simultaneously embarking upon multiple renewable energy and energy efficiency projects to scale up clean

energy adoption. In Morocco, solar photovoltaic infrastructure has been developed to support electric Bus Rapid Transit systems. And biogas and clean cooking stoves are two particular technologies being trialed across several African countries. Lessons from these experiences now lend themselves to significant expansion.

Seychelles' Blue Bonds and the newer Rhino Bond in South Africa demonstrate the power of nature-based solutions to unlock innovative finance. These blue and green bonds can, and should, be scaled in other countries and contexts, linked to environmental returns. Income from ecosystem restoration leading to carbon savings is demonstrated at the community level in Kenya: at the Mikoko Pamoja project, mangrove protection and reforestation earn carbon credits for local communities. The income from these credits supports employment in the project as well as a range of improved socioeconomic infrastructures, such as in education and water. All of this builds resilience and increases project viability.





Climate services, including appropriate technologies and data, are critical for decision-making and planning. Work has started on early warning systems and disaster risk reduction capabilities in several African countries, such as in Malawi. New technology applications also include a multi-layered and more accurate approach to identifying viable groundwater sources in Ethiopia. This is also being replicated elsewhere.

There are also lessons to be taken from these examples, including common approaches that have influenced their successful execution. These include investments in gender-sensitive planning and women's empowerment; strengthening local capabilities; and working through community groups, business associations, and local and national governments. Furthermore, implementation projects can only be successfully scaled if appropriate policies, regulations, political support, and partnerships are aligned. For this reason, nearly all examples link implementation with policy work and capability building. The LoCAL programme methodology is a good example of this approach, with its payment of performance grants to strengthen local budgets and planning, and systems for climate adaptive delivery.

This report also points to several priorities going forward to build on these successful examples of climate action, especially to replicate and scale good practices widely across the continent.

Much more funding is required, including for community-based adaptation

This compilation of case studies highlights only a small selection of the climate action taking place across Africa and mostly showcases relatively large projects. Community-based adaptation is also happening, often driven by necessity. The 6th Assessment Report of the Intergovernmental Panel on Climate Change indicates that Africa still lags behind the world in institutional responses and there remains a big funding gap in the scale of climate action relative to need³¹. Without more funding, including to smaller projects where communities take the lead, climate action will not be scaled fast enough. More climate finance must be made accessible to meet the substantial need that exists for it. Several featured examples show how African countries can drive innovation in financing, and thereby improve the architecture available to African policy makers.

The projects also show how, in several instances, climate mitigation technologies, which are currently more readily funded by private finance as an investment area, can drive adaptation responses to address vulnerabilities. Water infrastructure for health and agriculture powered by solar energy is one prominent example. In these areas of cleantech uptake, the private sector can already play a larger role.

Link climate action to the structural transformation of African economies

As climate action must be developmental, it should also be more purposively linked to the structural transformation of industrial capabilities on the continent. African countries need to be supported to develop the capabilities to participate in green industrialisation. This means that the private sector, including small businesses, needs support to play its critical role in advancing climate-resilient development. The involvement of energy companies and waste entrepreneurs in delivering climate action, as highlighted in the case studies, points to what is possible, but far more technology transfer, supportive trade conditions, and finance are required.

Scale-up research and climate services

Funding for research on and in Africa also needs a boost. Currently, only 3.8% of global research funding between 1990 and 2019 was spent on Africa; only 14% of this went to African institutions³². Datasets need to be strengthened and dataflows supported across countries. This includes improvements in weather station, agriculture, population and economic data. Work is underway but more resources are required to rapidly enhance these critical capabilities.

A Call to Action

This publication points to evidence of climate action delivering positive developmental and climate change returns. The focus now needs to turn to far more substantive programmatic responses built upon these good practices. This will support successful case studies becoming standard practice, and yielding far larger development dividends.



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ENDNOTES

1. UNECA models show that African countries are likely to lose up to 5% of warming based on an increase in temperatures of 2 degrees. In some regions such as the Sahel, and in higher warming scenarios the losses may be as high as 15% of GDP. Source: , <https://repository.uneca.org/handle/10855/43948> and <https://www.afdb.org/en/documents/climate-change-impacts-africas-economic-growth>
2. Source: https://au.int/sites/default/files/documents/41959-doc-CC_Strategy_and_Action_Plan_2022-2032_23_06_22_ENGLISH-compressed.pdf
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