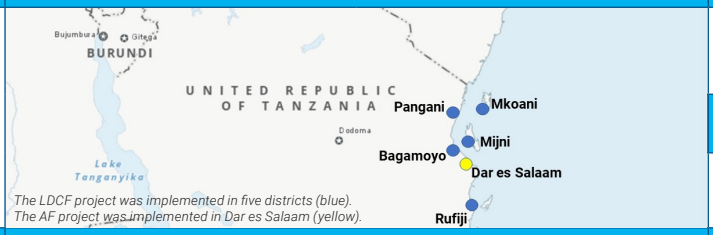
LESSONS LEARNED

Climate Adaptation in Tanzania with Ecosystem Restoration & Flood Defence Infrastructure

UNEP Lessons in Climate Change Adaptation

PROJECT NAME	LOCATION	EXECUTING AGENCY
1. Developing core capacity to address adaptation to climate change in productive coastal zones (GEF ID 4141) 2. Implementation of concrete adaptation measures to reduce vulnerability of livelihoods and economy of coastal communities (AFB 2G48)	 *The LDCF project was implemented in five districts (blue). The AF project was implemented in Dar es Salaam (yellow).*	Vice President's Office, Government of Tanzania
		FUND
		Least Developed Countries Fund (GEF) & Adaptation Fund
IMPLEMENTING AGENCY	**MAIN APPROACHES**	**SDGs**
UNEP	Flood defence infrastructure; Ecosystem-based adaptation; Scientific & technical capacity; Public engagement & awareness raising	
BUDGET		**TIMEFRAME**
GEF: $3.36m, plus co-finance of $41.9m AF: $4.62m		2012-2019

Summary

In 2012, the Government of Tanzania secured funding from the Adaptation Fund and the Global Environment Facility's Least Developed Country Fund to reduce the negative impacts of climate change on vulnerable communities in coastal areas. The country is facing the impacts of climate change on the coasts through rain-induced flooding and sea-level rise.

A major approach of the projects was to build the resilience of coastal communities by restoring and building concrete infrastructure, such as seawalls and urban drainage systems, which are expected to withstand climate change and protect communities and assets. To complement the grey infrastructure, the projects restored mangrove and coral habitats, both of which act as natural barriers and buffers against wave surges. The use of nature-based solutions for adapting to climate change is known as ecosystem-based adaptation (EbA).

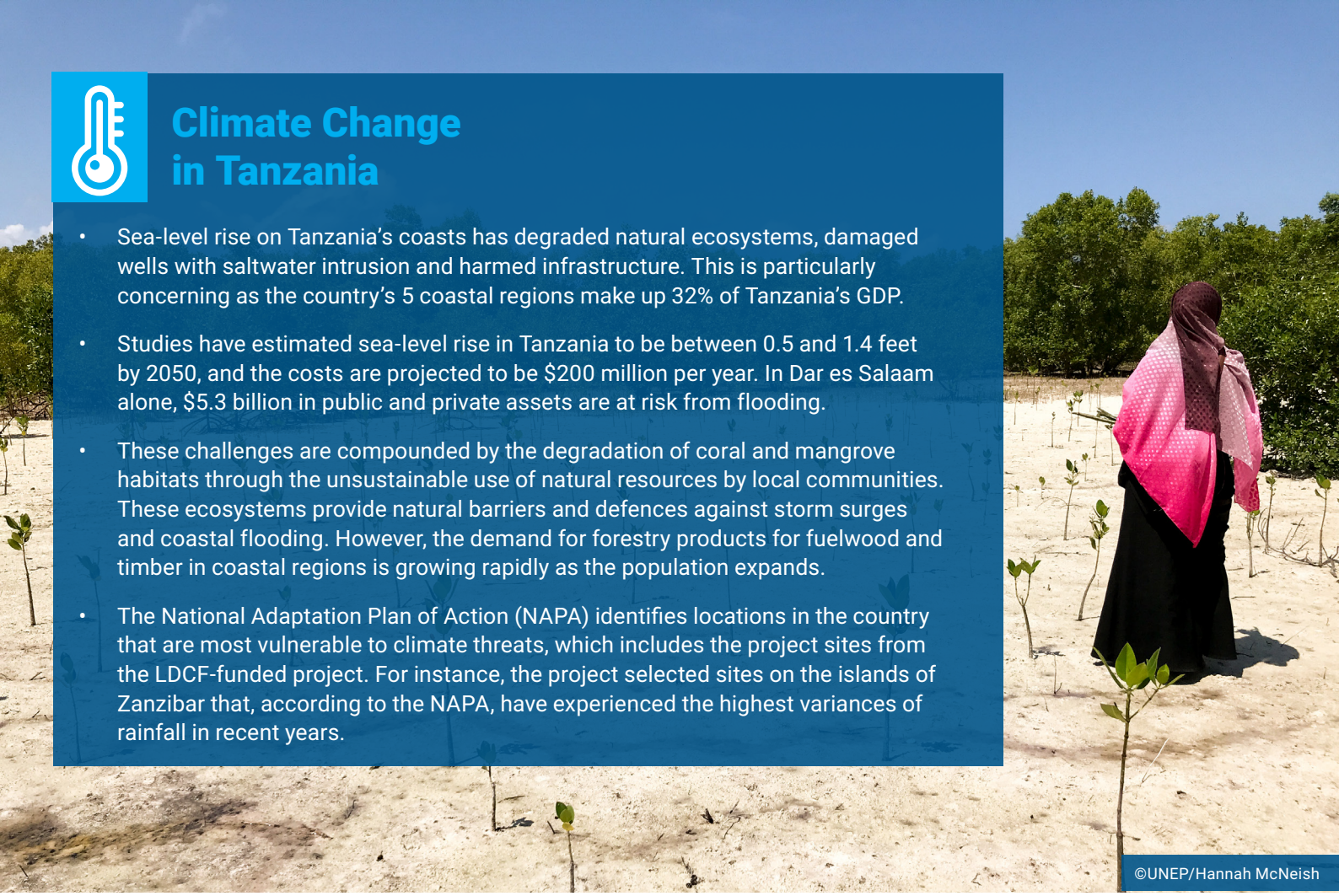
Both projects have reduced climate vulnerability in critical coastal areas, assisted the country to implement its National Action Programme for Adaptation (NAPA), restored key ecosystems, and are estimated to have directly benefitted a total of at least 58,000 people, in addition to the economic benefits to the local economies in the coastal areas covered in the project.

In all components of the project, key lessons were learned for best practices for monitoring and evaluation, sustainability and upscaling, EbA implementation and project design.

UN environment programme | gef | ADAPTATION FUND

Climate Change in Tanzania

- Sea-level rise on Tanzania's coasts has degraded natural ecosystems, damaged wells with saltwater intrusion and harmed infrastructure. This is particularly concerning as the country's 5 coastal regions make up 32% of Tanzania's GDP.
- Studies have estimated sea-level rise in Tanzania to be between 0.5 and 1.4 feet by 2050, and the costs are projected to be $200 million per year. In Dar es Salaam alone, $5.3 billion in public and private assets are at risk from flooding.
- These challenges are compounded by the degradation of coral and mangrove habitats through the unsustainable use of natural resources by local communities. These ecosystems provide natural barriers and defences against storm surges and coastal flooding. However, the demand for forestry products for fuelwood and timber in coastal regions is growing rapidly as the population expands.
- The National Adaptation Plan of Action (NAPA) identifies locations in the country that are most vulnerable to climate threats, which includes the project sites from the LDCF-funded project. For instance, the project selected sites on the islands of Zanzibar that, according to the NAPA, have experienced the highest variances of rainfall in recent years.



Project Outcomes & Achievements

- The two projects have successfully contributed to implementing the country's National Adaptation Plan of Action (NAPA), and they have reduced the vulnerability of coastal communities, ecosystems and infrastructure to climate change threats, such as floods, rising tides and degradation.
- Around **2,800m** of sea defence structures were built, including seawalls and groynes, much of which protect vital economic hubs from rising sea levels Some of the new seawalls also include lighting and park benches for recreation, while others have had the effect of recuperating **3** hectares of land that is now cultivated with coconut, cassava and bananas. In addition to the seawalls, the construction of **5** groynes has protected **60** households in Zanzibar by breaking the incoming waves.
- The projects restored **3,000m2** of coral reefs and **1,245** hectares of mangroves, benefitting around **8,600** people by providing flood defences and a habitat for fish species. Community groups were created to manage the mangroves, and 'no-take zones' were established to reduce deforestation.
- **3,000** efficient cook stoves were purchased and distributed to households to address the issue of deforestation of mangroves and forests for fuel and charcoal. This intervention also reduced the time spent by women on cooking activities.
- At least **2,300m2** of drainage channels were cleaned and restored to prevent cholera and typhoid outbreaks from flooding. The drainage improvements are directly benefitting 1,500-2,000 households and small businesses, and annual floods have ceased since their construction.
- **10** boreholes were successfully drilled and **15,000** litres of storage tanks were constructed for each borehole. The relocation of wells and the construction of rainwater harvesting devices have benefitted over **10,000** people in Bagamoyo District alone. In particular, the rainwater harvesting system built at Kingani Secondary School is channelling rainwater into **9** tanks that hold **8,000** litres each, significantly improving the supply of clean water during the dry season. An additional **7** rainwater harvesting systems were installed at Matipiwili Secondary School with strong results.
- At least **140** people were trained in coastal and climate vulnerability mapping. **3** coastal vulnerability assessments and **4** participatory

vulnerability assessments were used to identify climate-vulnerable communities.

- Assessments of the economic viability and practical feasibility of various adaptation measures were produced, which include cost-benefit analyses.
- One Ecosystem-based Integrated Coastal Area Management (EBICAM) Action Plan was approved for the coastal regions of the country.
- By the end of the project, a total of **38** community-based organizations had been registered or were in the process of registration.
- In collaboration with the University of Dar es Salaam's Department of Geography, **29** undergraduate and **12** graduate students performed field research at the project sites and documented their findings.
- Both projects have shown high levels of complementarity in their design and implementation approaches, and have strengthened linkages (horizontally and vertically) between different stakeholders, for example, between the Division of Environment, District Municipal Councils, NGOs and community-based organizations.
- The Terminal Evaluation estimates that the total number of beneficiaries is likely to reach or exceed **30,000** for the LDCF project and around **28,000** for the AF project.

A man poses next to a mangrove sapling at a reforestation project site in the Kisakasaka community in Zanzibar. ©UNEP/Hannah McNeish

Lessons Learned

Stakeholder Participation

- Among the contributing factors that have increased project success, the evaluation highlights the consistent engagement of district and community stakeholders in the implementation of project activities (Navajas and Mkali 2019). This has encouraged commitment and ownership on the part of district council focal points, NGOs and community organizations.
- Community participation was particularly strong under the LDCF project, which supported a larger number of ecosystems restoration initiatives and facilitated the registration of community organizations for the purpose of creating local networks.
- The projects were significantly helped by having the highest office of the land, The Vice President's Office, function as the executing agency of the project, which ensures meaningful commitment at the highest level, engenders commitments and eases implementation.
- The Joint Project Steering Committee members have successfully supported project coordination and oversight, but this could have been strengthened even further with the inclusion of the Tanzania Forest Service and the Office of the President's Regional Administration and Local

Ecosystem-based Adaptation

- Adaptive management was used to test different varieties of mangrove plants and the spacing requirements for planting them. This improved the survival rate of the mangroves and allowed excess seedlings to be diverted for planting elsewhere.
- For projects that include planting activities, some of the risks that should be identified and mitigated include incidences of cattle encroachment, conflict between communities, extreme weather events and illegal logging.
- The restoration activities selected plant species that grow and reproduce rapidly (e.g. mangroves) to improve chances of success.
- There was consistent engagement and cooperation on the part of the District and Municipal Council environmental officers, NGOs and community organizations for the mangrove restoration, which future projects should attempt to replicate.
- It is important to note that the restoration of 1,000 hectares of degraded mangrove forest is unlikely to have impact on the vulnerability of the larger ecosystem, unless it is replicated on a broader scale (Navajas & Mkali 2019). A more comprehensive and longer-term approach is needed to address the broader conservation and land-use issues that require policy decisions, institutional coordination and sustained support for alternative livelihoods.
- Non-climate drivers that affect the resilience of coastal ecosystems to climate change should be addressed in the design of adaptation initiatives.
- On the one hand, the environmental sustainability of the ecosystem restoration initiatives is likely to be high, given the dynamic growth and reproduction cycles of the mangroves that were planted. On the other hand, the long-term survival of restored mangrove sites may be threatened by untreated sewage, cattle encroachment and illegal logging.

Constructing Adaptation Infrastructure

- The sea defence structures built by the LDCF project were very well designed and landscaped, and are now protecting Pangani town (8,000 people) from rising tides while protecting hundreds of village residents on the island of Kisiwa Panza. However, the planned rehabilitation of 660m of collapsed seawall along the southern bank was not implemented due to cost factors. The reconstruction of the south seawall continues to be a local priority.
- The rehabilitated seawalls and drainage canals are expected to withstand the elements and last for a century before major repairs are needed. However, some of the seawall and drainage sites may require further planting of deep-rooting vegetation to stabilize soils.
- External factors, like extreme weather events, can impact the timeliness of infrastructure activities. The initial construction of the Temeke canal collapsed shortly after completion due to heavy rains and inadequate design but was rebuilt with an improved design, without additional cost to the project. Likewise, the drilling of boreholes in Bagamoyo was also delayed due to heavy rains and could not be completed on schedule.
- Projects that support physical construction or rehabilitation of infrastructure should incorporate engineering and feasibility studies in the design

Around 2,800m of sea defence structures were built by the two projects. ©UNEP/Marcus Nield

stage to ensure realistic costing and avoid budget shortfalls (Navajas & Mkali 2019).

- For most of the approved project period, the inefficient and slow-moving government procurement system undermined the timeliness and efficiency of output delivery for both projects

Community-based Organizations

- The project attempted to create district networks of CBOs as a means to enhance public engagement in adaptation initiatives. Although the number of CBOs registered surpassed initial targets, the Terminal Evaluation in 2019 found that the creation of networks was in early stages at most sites and engagement mechanisms were not yet operational. This was influenced by slow legal registration processes and inconsistent CBO capacity levels, as well as by the costs and logistical challenges of working in geographically dispersed areas.
- Registrations were additionally delayed by the suspension of project activities in Rufiji Delta due to security challenges.
- Several of the community organizations that were registered with support from the LDCF-funded project are likely to be sustained over the following years, although further training is needed to enable their effective engagement in adaptation activities.

Monitoring & Evaluation

- To understand the 'true' impact of the project activities, monitoring plans should be extended beyond the project cycle, and the mechanisms for tracking the longer-term impacts of adaptation interventions should be in place in the country.
- The projects successfully demonstrated adaptive management with M&E, for instance by scaling back outputs based on the funding available or by re-programming unspent balances.
- Costs were saved by combining the Mid-term Review and Terminal Evaluation arrangements across the two projects.
- SMART indicators should be disaggregated by factors such as gender and age, and the actual collection of data should also be disaggregated.
- Outputs addressing training and capacity building were delivered as planned, yet have had limited effect on local monitoring and assessment capabilities. According to most of the interviewed participants, these limitations underscored the need for a more operational "hands-on" approach (i.e., focusing the GIS training on satellite images of the pilot districts to improve its relevance).

Sustainability & Replicability

- There is a high likelihood of institutional sustainability as a result of the lead role given to District Councils for the coordination of activities at the project sites. Several of the NGOs and community-based organizations (CBOs) that participated in the ecosystem restoration initiatives are established entities with prior experience in conservation activities (Navajas & Mkali 2019).
- For training activities, projects should identify the specific training and awareness needs of partner CBOs and focus the design of trainings on those needs. Training products should be tailored to each district level. This key lesson has been carried forward in a more recent adaptation project in Tanzania, also supported by UNEP.
- The site vulnerability assessments and maps that were generated by external contractors offer an important input for district-level adaptation planning, although their utility is expected to decline over time.
- The replication of adaptation interventions and the extension of Integrated Coastal Area Management can be undermined by limited local government budgets and the lack of climate financing mechanisms.
- It is well known that committed future funding ensures sustainability. This project also increased its sustainability because the assets were successfully handed over to districts that have the mandate to budget for the operation and maintenance of such assets.
- A regional framework for integrated coastal management is lacking, and district governments have limited budget resources for project implementation. The coastal planning and policy frameworks that are needed to replicate adaptation interventions on a broader scale must be considered in the early stages of the project.

Students at Bagamoyo Secondary School now have more time to study and less days off sick thanks to the rainwater harvesting system providing fresh water. ©UNEP/Hannah McNeish

Project Stakeholders

i) Government

Stakeholder/organization	Role in the project
Division of Environment, Vice President's Office of Tanzania	National executing agency
Ministry of Tourism & Natural Resources (MTNR)	Served on the Tanzania National Climate Change Steering Committee and was represented on the joint Project Steering Committee. It played a support role in adaptation interventions for mangrove reforestation, energy efficiency and coastal rehabilitation
Ministry of Water & Irrigation (MWI)	Served on the Tanzania National Climate Change Steering Committee and is represented on the joint project Steering Committee. It played a support role in adaptation interventions for water conservation
Ministry of Works, Transport & Communication (MWTC)	Served on the Tanzania National Climate Change Steering Committee, and was represented on the joint project Steering Committee. It played a support role in adaptation activities, including the rehabilitation of coastal infrastructure
Ministry of Lands, Water, Energy & Environment (MLEE)	MLEE's Division of Environment was represented on the joint project Steering Committee and supported adaptation interventions and project activities in Zanzibar
Pangani, Rufiji, Kibiti and Bagamoyo District Council	Support and oversight of project activities in the respective districts
Dar es Salaam City Council, and Kinondoni, Temeke and Ilala Municipal Councils	Support and oversight of project activities in the respective cities and municipalities
Dar es Salaam Regional Secretariat	Support and oversight of project activities in Dar es Salaam region

ii) NGOs

Forum CC	National executing agency
JUMKISA (NGO	Community-based organization focal point for adaptation interventions
JSEUMA (NGO)	NGO focal point for adaptation interventions
ZACEDY	NGO focal point for adaptation interventions
CHAWAWAMI (fishers' association)	NGO focal point for adaptation interventions

iii) Academic institutions

Mwalimu Nyerere Memorial Academy (MNMA)	Focal point for adaptation intervention
University of Dar es Salaam	Coordinator of GIS training activities and student internships
Institute of Marine Studies	Technical advice on mangrove restoration
Kingani Secondary School	Focal point for rainwater harvesting interventions

iv) Communities & community-based organizations (CBOs)

Pangani Magrhibi and Pangani Bweni Beach Management Units	CBO focal point for adaptation intervention
Kibiti Kiomboni village	CBO focal point for adaptation intervention
Women & Environmental Group, Mbweni	CBO focal point for adaptation intervention
Sheha Kilimani Residents	CBO focal point for adaptation intervention
Sheha Kisiwa Panza	CBO focal point for adaptation intervention
Bagamoyo Water Management Boards	CBO focal point for adaptation intervention

Adapted from Navajas and Mkali 2019.

Resources & Multimedia

- Terminal Evaluation 2019 - link
- Project factsheet – link
- UNEP's climate adaptation web portal – link
- Story: How to Stop a City Sinking - link
- Story: New Walls Aim to Hold Back Rising Seas off Tanzania - link
- Story: Drink Salty Water or Go Thirty? Climate change hits Tanzanian Schoolchildren – link
- Story: 'Seawater is coming into our farms and killing the plants' - link
- UN Decade on Ecosystem Restoration – link
- Podcast episode: Sponge cities that fight flooding - link

Contact

Jessica Troni
Head, Climate Change Adaptation Unit, UNEP
Jessica.Troni@un.org

Dr Kanizio Manyika
Country Team Contact
kanizio.manyika@vpo.go.tz

Cletus Shengena
Country Team Contact
cletus.shengena@vpo.go.tz

Reference: Navajas, H. and Mkali, F., 2019. Terminal Evaluation of the UNEP/Adaptation Fund Project 'Implementation of Concrete Adaptation Measures to Reduce Vulnerability of Livelihoods and Economy on Coastal Communities of Tanzania' and the UNEP/GEF Project 'Developing Core Capacity to Address Adaptation to Climate Change in Productive Coastal Zones of Tanzania'. *UNEP Evaluations Office, Nairobi.*

The projects restored 3,000m2 of coral reefs and 1,245 hectares of mangroves. ©UNEP/Marcus Nield

UN environment programme | gef | ADAPTATION FUND