

Fighting for coastlines devoured by climate change in Tunisia

The progressive erosion of the coastline is not only a danger to Tunisia's coastal infrastructure, but it also threatens nature reserves and dune systems with their important ecosystem functions. A KfW Development Bank project relies on a combination of grey infrastructure and nature-based solutions to combat deterioration – and on public participation and cross-sector cooperation.

By Sandra Wegner and Kai Wiegler

Tunisia's coastal region is the demographic and economic backbone of the country. Population is dense there, and tourism, industry, fisheries and agriculture are intense. It is home to two thirds of all Tunisians and generates 87 per cent of the country's industrial and economic activity. Seventy-six per cent of tourism accommodation and an important share of export-oriented irrigated agriculture are concentrated in the coastal zones. Major water resources are located there as well, including half of Tunisia's shallow groundwater resources. But the coasts are not only productive, they are also pretty. Out of the 2,300 kilometres of coastline, close to 700 kilometres consists of pristine sandy beaches of which about one sixth are dune zones worthy of protection. There are also numerous marine nature reserves along the coast and a total of 137,000 hectares of ecologically valuable and sensitive lagoons and salt marshes (also see upper Box). In essence, it is not exaggerated to say that the coasts are Tunisia's lifeline.

Coastal infrastructure and dune systems at threat

The cities along the coast, however, exert strong pressure on many of the ecologically fragile areas. In numerous places, development close to the coast, sometimes directly in the dunes, disturbs the natural balance between coastal erosion and sedimentation processes originating from the hinterland. As a result, the coast is eroding more and more and the coastline is shifting further inland, by approximately 0.2 to 1.35 metres a year. As a matter of fact, 13 per cent of the entire Tunisian coastline is at high risk of erosion. The sandy beaches, which are the basis of the country's tourism, are particularly affected and threaten to disappear at an increasing rate. This erosion process endangers not only coastal infrastructure, but also nature reserves and dune systems, which thus can no longer perform their ecosystem functions.

This situation is exacerbated by climate change, particularly by the rise in sea level, set to reach around 0.3 to 0.5 metres by 2050, and the increasing frequency and intensity of storms. The high socio-economic importance of the coast makes Tunisia one of the countries most vulnerable to sea-level rise world-wide. The consequences also include flooding of soils and salinisation of aquifers and estuaries. The latter is to be expected especially where they are overexploited owing to high population pressure. The lowering of groundwater levels increases the danger of rising saltwater intrusion as coastal erosion continues. Precious water resources are being lost.

Combining “hard” protection measures with nature-based solutions

The Tunisian Agency for the Protection and Development of the Coastline (*Agence de Pro-*



Lessons learnt from an ecosystem approach to Tunisia's El Bibane lagoon fisheries sector

With an area of 25,000 hectare, the El Bibane lagoon in the South of Tunisia is not only the largest of Tunisia's five coastal lagoons, but also the most productive one. It is especially well known for the quality of its fish. The El Bibane lagoon has likely been exploited since ancient times by fishers using dams and traps. Today, fish are still caught by these 'bordigues' – catch rooms where fish migrating from the lagoon to the sea can be trapped – as well as by lines and nets.

Fishing regulations in Tunisia are based on 1994 legislation prohibiting fishing areas and prescribing items such as fishing gear and mesh size, minimum authorised landing size, fishing seasons and protected species. But despite these laws, a decline in fish stocks in the lagoon lasting more than 50 years has not been halted. Some species have almost disappeared, catches are low, and the fish caught are getting smaller.

Therefore, at the initiative of the National Institute of Marine Sciences and Technologies (INSTM) and with support of the UN Food and Agriculture Organization (FAO), a management plan for the sustainable artisanal fishery of the lagoon was developed. It was based on the ecosystem approach to fisheries (EAF) which was adopted by the FAO in 2003 in accordance with its Code of Conduct for Responsible Fisheries (CCRF). The process started in 2016 and brought together the El Bibane actors and stakeholders: the concessionaire (a private

individual who pays money to the state to rent the lagoon each year and who employs 38 fishers and workers), the 87 private fishers who operate with fishing licences in the lagoon, and the administration at regional and central level, including, in addition to the INSTM, the regional body of the General Directorate of Fisheries and Aquaculture (DGFA), the Interprofessional Group of Fishery Products (GIPP) and the Coastal Protection and Management Agency (APAL). The management plan for the lagoon was adopted in June 2018 and comprises a fishing "Charter" defining the modalities of the fishing activity and good practices to be respected.

Some lessons learnt for the successful implementation of an EAF based on experience gained with El Bibane were published by FAO early in 2022. They include conducting a sound baseline study; the documentation of local fishery techniques and traditional knowledge/ traditional management rules; considering the opinions of all stakeholders (fishers, operators, managers, scientists, associations, groups, the young, the old, the more experienced, the optimists and the pessimists); and the collection of as many ideas as possible in order not to exclude any details or information. According to FAO, the work at El Bibane has prompted the neighbouring regions of Djerba island and Zarzis to request the implementation of the EAF principles.

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tection et d'Aménagement du Littoral – APAL) and KfW Development Bank are working against this deterioration with a coastal protection programme (see Box below). The programme addresses in particular coastal erosion and flooding. This is to be achieved by providing "hard" protection measures such as rubble mound seawalls and breakwaters as well as nature-based solutions, like beach nourishment and refilling or the protection, growth and stabilisation of sand dunes. The latter is done mainly by fencing off sensible areas, planting

of protecting vegetation and installing sand fencing for sand-trapping. This is accompanied by additional "soft" measures, such as supply and installation of public equipment regulating beach access (like fences and pathways), and participatory measures at municipal level, ranging from public consultations to co-management of the beaches with user group involvement.

So far, 27 kilometres of Tunisia's coastline has been rehabilitated at different sites in the mu-

nicipalities of Sousse, Soliman and Raf Raf, and on the island of Kerkennah. For this purpose, planting biodiverse and endemic vegetation in order to stabilise sands and dunes has been encouraged, whereas enabling natural rejuvenation has a priority in the project design. Furthermore, groynes, rubble mound seawalls and underwater breakwaters as well as beach nourishment have been constructed; they protect the respective coastal area against future erosion. To facilitate and improve the management of the beaches, public infrastructure has been established, including new dustbins, information panels, access control to beaches and parking spaces.

Tunisia's coastal protection programme

The Tunisian Agency for the Protection and Development of the Coastline (*Agence de Protection et d'Aménagement du Littoral* – APAL) initiated the coastal protection programme (*Programme de Protection du Littoral Tunisien* – PPLT) in collaboration with and financed by KfW Development Bank on behalf of the German government and the government of Tunisia.

The first and the second phases of the programme started in 2013 and 2015, respectively, financed by grants, and have been completed. The third phase started in 2019 and is financed by a loan. The fourth phase is expected to start in 2022, financed by a grant. APAL is also the project executing agency for PPLT. So far, it has signed agreements with the municipalities of Kerkennah, Raf Raf, Sousse, Hammam Sousse, Hergla, Chott Mériem, Soliman and Hammam Chatt. In the course of the project, in the next few years, another 45 kilometres of coastline is to be protected, including in the municipalities of Kantaoui Sud, Sousse, Bizerte, Chatt Mami, and Jerba.

All project phases have been accompanied by technical assistance supporting the APAL. In particular, the agency was provided with a Manual of Procedures that has helped strengthen and empower it with respect to managing the challenges. Training measures have been introduced for APAL staff as well as communal staff and civil society on various topics, such as sustainable infrastructure and participatory working methods. The creation of grievance mechanisms, including their management, has been supported, and civil society is now guaranteed participation in the monitoring of works and in the municipal institutions responsible for the seashore.

A participatory approach for ensuring sustainability

For the sustainable and proper maintenance of the infrastructure of each site, agreements have been concluded with the local municipalities (eight so far). The latter have been supported in installing a temporary commission for coastal protection (*Commission Non-permanente de Protection du Littoral Municipal, CNPPLM*) and preparation of beach management plans. The municipalities receive a budget for ensuring, together with the local population, the proper use, valorisation and maintenance of the structures (especially for the smaller components such as benches, parking spaces, information boards and rubbish bins). The CNPPLM can feed information on the status of maintenance work and detected shortcomings into the geographic information system that has been developed for the monitoring and management of infrastructure maintenance. Public participation is institutionalised by means of so-called *Comités Locaux des Sites (CLS)*, in which residents, users and site associations are represented. Through their permanent presence on site, the CLS ensure continuous monitoring of the coastal protection structures. Together with the CNPPLM, they play an important supporting role in ensuring the sustainability of the project.

Benefits for nature and people

The above described and implemented coastal protection measures are in line with the “nature-based solutions” approach defined by the European Commission (see Box), as they provide a range of environmental, social and economic benefits. The measures are locally adapted and promote biodiversity. Dune sta-

Nature-based solutions

The EU Commission defines nature-based solutions as follows: “Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions.” Nature-based solutions must therefore benefit biodiversity and support the delivery of a range of ecosystem services.



Coastal protection project close to Hergla and Hammam Sousse. Ancient roman settlements are protected from further erosion via coastal walls and groyne.

Photo: Jonas Wresch/ KfW

bilisation measures preserve the specific habitat for flora and fauna. And maritime life is supported by enabling fish spawning areas within the breakwaters and groyne. Furthermore, the measures support the delivery of ecosystem services, such as erosion and flood control, provision of clean soil and freshwater resources by preventing saltwater intrusion and provision of places for recreation.

Future project activities are meant to continue building on the above-mentioned ecosystem services, promote more biodiversity and protect the respective natural habitat. Besides the dunes referred to above, already protected coastal areas = AMCP (*aires marines côtières protégées*) and the “*sabkhas*” (salty marshes) would be a field of activity in the future. These coastal and intertidal habitats provide a “natural barrier”, together with the coral reefs, kelp forests and seagrass meadows in front of coastlines. Their loss increases erosion patterns. If intact, they can help to decrease the need for “grey” infrastructure, i.e. human-induced infrastructure such as dams or seawalls.

The Coastal Protection Programme is encouraging stronger cooperation between the municipal institutions dedicated to the management of the shorelines and their respective neighbouring Marine Protected Areas (MPAs).

The latter also pursue a participatory management approach – only if the fishers have a say in at which locations they will no longer be allowed to fish will they comply with the corresponding regulations in the long term. Ideally, municipal coastal management can address decisions regarding marine habitats and shorelines with beaches, dunes and salty marshes taking into consideration what they really are: connected and interdependent.

The rising sea-level and flooding remain a threat for Tunisia's Mediterranean coast. With the coastal protection programme, around 30 kilometres of shoreline is expected to last 50 years. At least.

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Sustainable funding for the Mediterranean's marine protected areas

The Mediterranean represents roughly one per cent of the Earth's sea surface, but it is home to ten per cent of marine species known to date. It is also a breeding area for many key pelagic species. But like in other marine regions across the world, human activities and the effects of climate change are putting intense pressure on these marine resources. Founded in 2015 and headquartered in Monaco, the non-profit organisation The MedFund has set itself the goal of countering this development. By 2025, it seeks to support an area of 7,000 square kilometres of marine and coastal protected areas (referred to as MPAs or MCPAs).

MPAs are an essential tool for the conservation and sustainable use of marine and coastal biodiversity. They describe defined marine and coastal spaces where uses are limited and regulated in order to protect fauna, flora and ecosystems and to enable activities such as sustainable fishing and responsible tourism. In this manner, MPAs not only preserve the marine ecosystems and biodiversity, they also contribute to enhancing the marine environment by ensuring sustainable economic development for local communities.

According to the database Mapamed, as of 2019, marine protected areas represent eight per cent of the Mediterranean basin. However, as a consequence of a lack of sufficient funding, many of the roughly 1,200 existing Mediterranean MPAs cannot carry out their essential missions. Therefore, the MedFund aims at providing long-term funding to promote the development and effectiveness of these MPAs. Via a hybrid funding mechanism, composed of an endowment fund, a sinking fund and a revolving fund, it directly supports local NGOs and national agencies in charge of MPA management in Morocco, Albania and Tunisia. Items the money is intended for include the restoration of key habitats, scientific monitoring, maintenance of equipment and facilities, and improvement of surveillance.

In Tunisia, the initiative supports four of a total 19 MPAs: Kneiss Islands in the Gulf of Gabes, a Ramsar site and important marine nursery for the reproduction and development of fish and shellfish as well as a refuge for wintering and migrating avifauna; Kuriat Islands, a privileged place for the nesting of the loggerhead sea turtle – a vulnerable species in the Mediterranean; La Galite, a natural nursery for many vulnerable marine species; and Zembra-Zembretta, a Biosphere Reserve and the main Mediterranean nesting area for the Shearwater and the Peregrine Falcon. The aim is to promote sustainable artisanal fishing and ecotourism in the MPAs. For this purpose, the MedFund is cooperating with Tunisia's Agency for the Protection and Development of Coastlines (APAL), which is in charge of the management and development of the MPAs, and local NGOs.

The platform was initiated by France, Monaco and Tunisia with support of the Prince Albert II of Monaco Foundation and has currently 15 members, including six Mediterranean countries as well as regional civil society organisations.

More information: themedfund.org

IN BRIEF

Hardly any intact coastal regions left

Scientists at the Universities of Queensland, Australia and California, USA have performed a comprehensive stocktaking of coasts worldwide in the course of which, for the first time, the parts of the coastal zones lying below and above the water have been integrated. In the course of their survey, they noted that a mere approximately 15.5 per cent of coastal regions worldwide were exposed to low anthropogenic pressure, lying above all in Canada, Russia and Greenland as well as parts of Chile, Australia and the USA. In contrast, on a world average, nearly 48 per cent of coastal regions were already heavily affected – predominantly by human intrusions. In more than 84 per cent of countries, over 50 per cent of coastal regions were degraded. These strongly harmed and degraded areas also include habitats especially rich in biodiversity, with sea grass meadows or coral reefs in the sea and savannahs on the land side. Even in conservation areas, around 43 per cent of the coasts were exposed to high human pressure, the researchers found.

Paris Agreement limits still catastrophic for coral reefs

A team of researchers led by the University of Leeds, United Kingdom, have discovered that more than 90 per cent of tropical coral reefs will suffer frequent heat stress – their number one threat – even under Paris Agreement climate warming limits. In the past few decades, 84 per cent of the world's tropical coral reefs have had enough time to recover between heat waves that cause bleaching mortality. But the research team have found that even at warming temperatures of 1.5°C above pre-industrial levels – the level of maximum warming sought under the Paris Agreement – only 0.2 per cent of reefs will have sufficient recovery time between heat events and 90.6 per cent of reefs will suffer intolerable thermal stress. Heat stress causes the decline of all reef species and reduces food and livelihood opportunities for people.