IUCN

Towards Nature-based Solutions in the Mediterranean

Contents

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Why this Booklet?

THE PURPOSE of this booklet is to clarify how the Nature-based Solutions concept (NbS) can be applied in different types of Mediterranean ecosystems, using 14 examples of interventions proposed by IUCN Members and partners in the region as a part of a collective effort. Each of these practical experiences showcases both the weaknesses and strengths of a model that is still in the process of being consolidated and accepted by a wide community of experts.

DESPITE the recent origin of the NbS concept, the learnings extracted from this exercise can contribute to the ongoing development of NbS guidelines in IUCN, and mostly importantly, they can illustrate what is currently understood by NbS in the Mediterranean context.

THIS PROCESS has highlighted the main difficulties of understanding the NbS concept, especially when it comes to designing project and actions, both in the socio-political and conservationist spheres.

IN LIGHT of the environmental and climate challenges faced by the Mediterranean region, exploring the application of the NbS has become vital to improve the well-being of Mediterranean communities and to ensure long-term sustainability.

INTRODUCTION

In the past few years an array of global and regional initiatives have been promoting its dissemination and encouraging to implement Nature-based Solutions (NbS). Particularly in the Mediterranean and Europe, the French and Spanish IUCN National Committees, as well as the European Regional Office of IUCN (Brussels) and the IUCN Centre for Mediterranean Cooperation (Malaga) have promoted various activities to this end. At the same time, the European Union set up a research and innovation programme as part of the political agenda, aiming to position Europe as a leader in the creation of innovative Nature-based Solutions for more sustainable and resilient societies.

In 2016, the Centre for Mediterranean Cooperation, following IUCN's "One programme approach", launched an initiative involving IUCN's members, commission experts and strategic partners in the region. The main goal was to identify the best "Nature-based Solutions" initiatives which already existed in the Mediterranean. This booklet is the result of this collective effort to showcase sound project actions/interventions that help to explain the concept of NBS in the Mediterranean context.

Following a general call, over a one-year period IUCN-Med received 23 examples identifying a wide range of projects and related practices, each of which illustrated the idea of Nature-based Solutions to a greater or lesser extent at different levels. The reviewed proposals were excellent conservation projects and offered very good examples of "Valuing and conserving nature", a core area of the IUCN's Global Program to make progress in both conserving biodiversity and properly managing ecosystems and natural resources.

However, not all of the proposals received included actions explicitly designed to respond to societal challenges, as for example disaster risk reduction, water and food security, climate change adaptation, thereby contributing to poverty reduction, and enhancing climate resilient economies and overall human well-being.

The initiative resulted in this compilation of 14 examples raised by IUCN members and partners in the Mediterranean.

The initiative resulted in this compilation of 14 examples raised by IUCN members and partners in the Mediterranean, where the geographical balance of the Mediterranean basin has also played a decisive role. In fact, these examples show how NbS are being or have been applied in different types of ecosystems and in different countries in the Mediterranean region. In some of them we have described the results, whereas in others we explain the expected outcome. Additional editing work has been done to link them with a societal challenge - directly or indirectly expected to be addressed- and with the type of ecosystem-related approach within IUCN's current scope. Therefore, the compiled examples are presented using the same NbS-related nomenclature and concepts as used in the "Nature-based Solutions to address global societal challenges" publication, to enable a better integration and synergy with IUCN's global process, as well as supporting the understanding and dissemination of this concept, and guiding its future effective and appropriate application in the Mediterranean.

GENERAL BACKGROUND

The goal of Nature-based Solutions is "to support the achievement of society's development goals and safeguard human well-being in ways that reflect cultural and societal values and enhance the resilience of ecosystems, their capacity for renewal and the provision of services".

In practice, Nature-based Solutions consist in promoting the use of ecosystems through conservation or restoration interventions **to address global societal challenges, such as climate change, natural disasters risk reduction** (e.g. floods, avalanches, fires…), **food and water supply, energy security,** or even the issues of **urban growth.** They are real-world applications that demonstrate the benefits of nature and healthy ecosystems, providing a tangible return on investment and making a substantial contribution to human wellbeing.

Nature-based Solutions demonstrate the benefits of nature and healthy ecosystems, providing a tangible return on investment and making a substantial contribution to human wellbeing.

IUCN has continued to define its position on NbS, also planning specific actions and establishing the NbS conceptual framework that best matches IUCN's mission and vision from a nature conservation perspective. As a result, in September 2016, IUCN published an official report (Cohen-Shacham 2016), which was presented at the 6th World Conservation Congress held in Honolulu (USA). In this report, IUCN proposed a definitional framework for NbS, as well as a series of general principles for any NbS intervention. The report also defined the scope of NbS as an umbrella-like concept covering different ecosystem-based concepts. Furthermore, during the Congress in Hawaii, Members approved Resolution 69 (Motion 77) on Defining Nature-based Solutions that contributes to strengthening the NbS framework for action; as well as Recommendation 107 (Motion 62) *Integration of nature-based solutions into strategies to combat climate change,* and RESOLUTION 39 (Motion 42) *Protected areas as natural solutions to climate change.*

Furthermore, in the framework of COP21 in Paris, the IUCN French Committee highlighted the need to promote the role of ecosystems in the fight against climate change and to provide specific, ambitious investments in Nature-based Solutions. In this framework, a publication compiling the projects carried out in France to implement Nature-based Solutions was presented.


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DEFINITIONS OF THE NATURE-BASED SOLUTIONS CONCEPT

IUCN
Nature-based Solutions are understood to be the *"actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".* (Cohen-Shacham et al, 2016).

European Commission
"Living solutions continually inspired and supported by nature, which use the design based on the same to address various societal challenges in an efficient manner that is adapted to the resources, at the same time providing economic, social and environmental benefits" (Maes & Jacobs, 2015). There is already an EU Research and Innovation policy agenda on Nature-based Solutions and Re-Naturing Cities which aims to position the EU as leader in "Innovating with nature" for more sustainable and resilient societies.

The EU R&I policy agenda for Nature-based Solutions and Re-naturing Cities focuses on two main thematic and spatial areas, namely:

- Re-naturing Cities
- Territorial resilience

The EU R&I agenda is implemented and funded through Horizon 2020, the EU Framework Programme for Research and Innovation, but also through other means to enhance the awareness and engagement of end-users, stir the supply and demand towards the market and develop an EU-wide knowledge base on Nature-based Solutions.

This European framework is also an opportunity for the Mediterranean region and all cooperation programmes to advance in the development, uptake and upscale of Nature-based Solutions, as well as to mainstream NbS within the overall design of national and regional policies, measures and actions.

IUCN STANDARD FOR NbS

As a last phase in the process of establishing NbS criteria, which can be approved at the next IUCN World Conservation Congress in Marseille in 2020, IUCN is holding in 2019 a public consultation to build consensus around a common understanding of Nature-based Solutions that applies globally. It is intended to be a simple yet robust hands-on tool that provides information about the planning, design and implementation of a NbS, especially as an alternative or complement to other types of development interventions such as hard infrastructure. In doing so, the standard will support greater acceptance and use of the NbS concept.

The users of this standard are intended to be governments and authorities at all levels, non-governmental organisations, private companies, the financial sector and local communities – that is basically all parties that may be the creators or implementers of NbS.

List of icons

To standardise the cases, we have used the same iconography that appears in the journal *Nature-based Solutions to address global societal challenges* by Cohen-Shacham et al. (2016) presented during the World Conservation Congress held in Hawaii in 2016.

Societal Challenge/s:

- Climate Change
- Food Security
- Water Security
- Disaster Risk
- Human Health
- Economic and Social Development

Case Studies: Nature-based Solutions in the Mediterranean

Ebro Delta, Catalonia (Spain)

CAS EbA EbM EbMgt

Abarán, Cieza, Calasparra y Moratalla (Murcia, Spain)

ER Eco-DRR GI

Praia da Maria Luisa, Albufeira (Portugal)

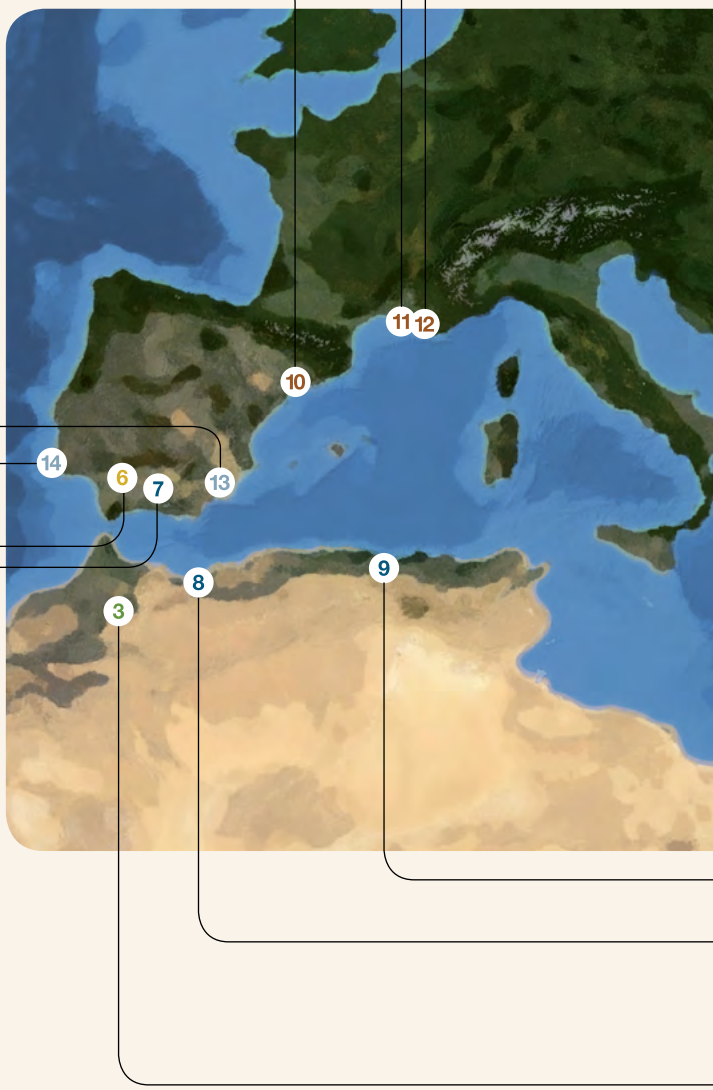
EE EbMgt ER

Andalusia (Spain)

AbC

Andalusia (Spain)

EbM AbC



NbS Concepts:

- ER Ecological Restoration
- EE Ecological Engineering
- FLR Forest Landscape Restoration
- GI Green Infrastructure
- NI Natural Infrastructure
- EbMgt Ecosystem-based Management
- EbA Ecosystem-based Adaptation
- EbM Ecosystem-based Mitigation
- Eco-DRR Ecosystem-based Disaster Risk Reduction
- CAS Climate Adaptation Services
- AbC Area-based Conservation

Camargue, Bouches-du-Rhône (France)

EbA Eco-DRR

Petit Saint-Jean farm, Saint-Laurent d'Aigouze, La Camargue (France)

EbMgt

Seyhan Basin (Turkey)

EbA CAS FLR

Konya (Turkey)

EbA CAS Eco-DRR

Zarqa River Basin (Jordan)

ER EbMgt

Matrouh (Egypt)

ER AbC

Commune of Corso, W. Boumerdes (Algeria)

ER

Marine Protected Area for the purposes of fishing of Alborán, Mar Chica Lagoon, Al Hoceima National Park (Morocco)

EbA EbMgt

Ait Hamad Rbiaâ, El Hajjaj and Sahb; Laghnam / Ifrane Province (Morocco)

EbMgt

FOREST

CASE STUDIE 1

THE ADAPTATION OF FOREST ECOSYSTEMS AND FORESTRY TO CLIMATE CHANGE IN THE SEYHAN BASIN

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based adaptation
- Climate adaptation services

LOCATION
- Seyhan Basin (Turkey)

ECOSYSTEM TYPE
- Forest

CHALLENGES
- Assessing climate change impacts towards developing adaptation measures on forest ecosystems
- Succeeding in transforming research findings into management propositions at different scales

CASE STUDIE 2

ADAPTING MEDITERRANEAN FORESTS TO CLIMATE CHANGE

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based adaptation
- Climate adaptation services
- Ecosystem-based Disaster Risk Reduction

LOCATION
- Konya (Turkey)

ECOSYSTEM TYPE
- Forest

CHALLENGES
- Making forests resilient to climate change
- Maintain healthy forests as a natural solution to avoid impact of catastrophes

CASE STUDIE 3

PARTNERSHIPS IN SOCIAL FORESTRY: THINNING OPERATIONS, CARRIED OUT BY THE LOCAL ASSOCIATIONS

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based management

LOCATION
- Ait Hamad Rbiaâ, El Hajjaj and Sahb; Laghnam / Ifrane Province (Morocco)

ECOSYSTEM TYPE
- Oak Forest

CHALLENGES
- Finding a solution to the local population's problem of supplying firewood and fodder for their cattle in a period of scarcity and helping them contribute to the silviculture of the oak grove through a win-win cooperation formula

RANGELANDS

CASE STUDIE 4

SECURING RIGHTS AND RESTORING LANDS FOR IMPROVED LIVELIHOODS

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based management
- Ecological restoration

LOCATION
- Zarqa River Basin (Jordan)

ECOSYSTEM TYPE
- Rangelands

CHALLENGES
- Recovering of the traditional Bedouin's rangeland management systems to avoid land degradation and biodiversity loss

CASE STUDIE 5

COLLECTING AND PRESERVING SCARCE NATURAL RANGE SEED PLANTS

NBS APPROACHED USED (MAIN; SECONDARY)
- Area-based conservation
- Ecological restoration

LOCATION
- Matrouh (Egypt)

ECOSYSTEM TYPE
- Rangelands

CHALLENGES
- Restoring large areas of natural pastures by recovering extinct and endangered plant species, based on the Bedouin's traditional knowledge and a participatory approach

CASE STUDIE 6

CONSERVATION AND MANAGEMENT IN THE SPECIAL PROTECTION AREAS FOR THE STEPPE BIRDS OF ANDALUSIA

NBS APPROACHED USED (MAIN; SECONDARY)
- Area-based conservation

LOCATION
- Andalusia (Spain)

ECOSYSTEM TYPE
- Rainfed crops/steppe

CHALLENGES
- Compatibility of agricultural activity with the conservation of steppe birds threatened by extinction in special bird protection areas (SPA)
- Implementation of innovative techniques for farmers, which allow for the conservation of steppe birds and improvement of farmers' incomes

MARINE AND COASTAL ECOYSTEMS

CASE STUDIE 7

LIFE BLUE NATURA ANDALUCÍA (LIFE 14/CCM/ES/000957): POSIDONIA OCEANICA AS A CARBON SINKN

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based mitigation
- Area-based conservation

LOCATION
- Andalusia (Spain)

ECOSYSTEM TYPE
- Seagrass meadows *(Posidonia oceanica)*

CHALLENGES
- Establishment of valid scientific methodologies to measure carbon fixation in the Posidonia seagrass meadows
- Inclusion of the Posidonia seagrass meadows in CO_2 emissions offset projects

CASE STUDIE 8

SUSTAINABLE MANAGEMENT OF MOROCCO'S MARINE RESOURCES

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based adaptation
- Ecosystem-based management

LOCATION
- Marine Protected Area for the purposes of fishing of Alborán
- Mar Chica Lagoon
- Al Hoceima National Park (Morocco)

ECOSYSTEM TYPE
- Sea, estuary, seagrass beds, cliffs

CHALLENGES
- Destruction of the marine biotope
- Decline of the local osprey population
- Decline of the demersal stock

CASE STUDIE 9

REHABILITATION OF THE COASTAL DUNE ECOSYSTEM OF THE COMMUNE OF CORSO

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecological restoration

LOCATION
- Commune of Corso (W. Boumerdes) (Algeria)

ECOSYSTEM TYPE
- Sand dunes

CHALLENGES
- Protect and prevent the degradation of the dune ecosystems

DELTAS

CASE STUDIE 10

ADAPTATION AND MITIGATION MEASURES TO CLIMATE CHANGE IN THE EBRO DELTA. LIFE EBRO-ADMICLIM

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based adaptation
- Ecosystem-based mitigation
- Ecosystem-based management

LOCATION
- Ebro Delta, Catalonia (Spain)

ECOSYSTEM TYPE
- Wetlands, Rice fields and coastal sand dunes and beaches

CHALLENGES
- Respond to several mitigation and adaptation needs linked to climate change in a delta area:
  - Avoid coastal erosion in delta areas with subsidence
  - Improving water quality that has strong use by agriculture before returning it to nature
  - Reducing greenhouse gas emissions by means of appropriate agriculture practices in rice fields

CASE STUDIE 11

AGRO-ECOLOGICAL PROJECT OF PETIT SAINT-JEAN

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based management

LOCATION
- Petit Saint-Jean farm, Saint-Laurent d'Aigouze, La Camargue (France)

ECOSYSTEM TYPE
- Agricultural fields

CHALLENGES
- Create a showcase of agro-ecology locally and in the whole of the French Mediterranean area, in order to transfer the agronomic achievements to a wide variety of actors

CASE STUDIE 12

ADAPTATION OF THE ORIGINAL CAMARGUE SALT MARSHES TO CLIMATE CHANGE

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecosystem-based Adaptation
- Ecosystem-based Disaster Risk Reduction

LOCATION
- Camargue, Bouches-du-Rhône (France)

ECOSYSTEM TYPE
- Lagoons and other coastal habitats

CHALLENGES
- Depolderisation of 4000 ha and abandonment of the coastline defence works
- Restoration of coastal ecosystems

FRESHWATER

CASE STUDIE 13

ECOLOGICAL RESTORATION OF THE SEGURA AND MORATALLA RIVERS; PROJECT OF ACTIONS FOR THE CONTROL OF ALIEN INVASIVE NON-TREE SPECIES AND RESTORATION OF PRIORITY HABITATS OF COMMUNITY INTEREST

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecological restoration
- Green infrastructure
- Ecosystem-based Disaster Risk Reduction

LOCATION
- Abarán, Cieza, Calasparra y Moratalla (Murcia, Spain)

ECOSYSTEM TYPE
- Riparian forest

CHALLENGES
- Demonstrative project that might serve as an example for recovery of water quality of other Mediterranean rivers and green infrastructure for natural flood prevention
- Restoration of plant communities that make up indigenous riparian forests, while controlling expansion of invasive alien species *(Arundo donax)*

CASE STUDIE 14

BIOLOGICAL SWIMMING POOL

NBS APPROACHED USED (MAIN; SECONDARY)
- Ecological restoration
- Ecosystem-based management

LOCATION
- Praia da Maria Luisa, Albufeira (Portugal)

ECOSYSTEM TYPE
- Freshwater pond/wetland

CHALLENGES
- Mantaining good water quality in a swimming pool by means of a natural ecosystem.

FORESTS

Climate change adaptation is a challenge for the management of any kind of ecosystem on the planet. However, the specificities for each type of ecosystem are huge, not only in terms of action implementation, but also in terms of knowledge and science research needs to support these actions. Additionally, updating public policies to incorporate the new approaches is a big challenge, especially for ecosystems that require long-term investments to show results.

This is the case of forests in all Mediterranean countries.

The projects "Adaptation of Forest Ecosystems and Forestry to Climate Change in the Seyhan Basin"and "Adapting Mediterranean Forests to Climate Change in Konya" both implemented in Turkey, provide a positive approach on how to proceed to collect data and implement methodologies to identify the most suitable measures to promote forest adaptation to climate change. At the same time, the projects will have a direct impact on the Turkish forest policies that will allow expanding the pilot actions to larger areas under the same adaptation approach.

These are not yet fully accomplished Nature-based Solutions. However, both projects are relevant because they show the right way to move towards the establishment of NBS methodologies and national policies to promote the adaptation of Mediterranean forests to climate change.

NATURE-BASED SOLUTION 1 / ECOSYSTEM TYPE: FOREST

The Adaptation of Forest Ecosystems and Forestry to Climate Change in the Seyhan Basin

Location:
Seyhan Basin (Turkey)

Leading institution
Doğa Koruma Merkezi
(Nature Conservation Centre)

Period:
2009 - 2010

Scale:
Local, regional and national.
By influencing the forest planning process in a specific region through the responsible administration (General Directorate of Forestry), the project has a national impact

Involved institutions/stakeholders
Doğa Koruma Merkezi
(Nature Conservation Centre)
Adana Regional Directorate of Forestry

EbA FLR CAS

Summary:

The likely effects of climate change on four main forest types in the Seyhan Basin; an area of 20,450 km² in southern Turkey was modelled. Using GIS analysis and spatial modelling techniques, models were developed for the present distribution of the four main forest types in the study area: Turkish pine *(Pinus brutia)*, Black pine *(Pinus nigra)*, Cedar of Lebanon *(Cedrus libani)*, and Taurus fir *(Abies cilicica* subsp. *cilicica).* Using global climate predictions, these models were adjusted to illustrate future scenarios and analyse the predictions for changes in the region, in the forested area, and in present stands in order to determine the vulnerable areas and vulnerabilities of forest.

The amount of change of habitat suitability between 2009 and 2050 is considered as the degree of vulnerability for each pixel. As it is impossible to take precautions in the whole basin, these vulnerable sites were considered as hotspots to develop further implementation actions in forestry. These vulnerability hotspots were identified for field studies in order to better understand issues on the ground. Through field surveys, literature studies and expert consultations, the likely effect of climate change on these forests and their biodiversity was compiled, and possible adaptation measures were developed focusing at four levels:

- General silvicultural measures,
- Species specific measures,
- Location-Vulnerability based measures,
- Complete adaptation measures, including socio- economic and resource use for the most highly vulnerable areas.

Forestry management recommendations were identified for the entire Seyhan Basin to support and maintain the health of ecosystem services and biodiversity under the projected climate change scenarios. Those adaptation recommendations included:

- Considering the migration speed of trees,
- Supporting expected change in tree species selection,
- Assisted migration,
- Supporting the migration of understory,
- Transforming disturbances to opportunity,
- Building stand islands for the future,
- Building monitoring system,
- Building stand hubs for protection,
- Using participatory approaches to support the adaptation management,
- Building decision support systems,
- Carrying out the timber production in small scales,
- Supporting diversity to increase the resistance of ecosystem.

The project focuses on sustainable use of forest resources by putting in its centre the long-term impacts of climate change on forests. With this aspect, it is the first study carried out in Turkey and will have important social impacts, since the forest management plans in the country have always objectives at three levels: economical, ecological and socio-cultural.

Forests in Turkey are state owned and managed by the General Directorate of Forestry of the Ministry of Agriculture and Forestry. If adopted as a model in Turkey by the General Directorate of Forestry, this project has the potential to be carried out in other forest management units in the Mediterranean Region and others in Turkey.

The management plans will have two levels of propositions of measures to integrate in, that will be updated every 10 years:

1- General adaptation recommendations considering migration of species (North-south) such as: assisting migration, stand islands for the future, build monitoring systems.
2- Site and species recommendations. Geographic separate recommendations for all the species, e.g. from where the seeds should come for each species.

Volunteers and students were actively involved in research aspect of the project through academia and non-governmental organizations. Forestry sector was directly involved in the project as project partners.

The project was carried under the UN Joint Programme, Enhancing the Capacity of Turkey to Adapt to Climate Change, supported by the Millennium Development Goals Achievement Fund (MDG-F) and conducted in partnership with Adana Regional Directorate of Forestry.

Societal challenge/s:

Economic and social development:

- The project will respond by maintaining the economic activity of forest production and its biodiversity.

Climate change adaptation:

- By assessing climate change impacts towards developing adaptation measures on forest ecosystems,
- Translating research outcomes successfully to management propositions at different scales.

NbS concepts used:

Ecosystem-based adaptation,
Forest landscape restoration,
Climate adaptation services.

© Ugur Zeydanli, Seyhan Basin, 2009

NATURE-BASED SOLUTION 1 / ECOSYSTEM TYPE: FOREST


© Uğur Zeydanlı, Seyhan Basin, 2009

Objectives:

To change and strengthen the approach of forests management plans regarding climate change adaptation in Turkey.

To develop tools and specific recommendations for adapting forestry techniques and practices to climate change through determining the likely effects of climate change on four main forest types in the Seyhan Basin (a big basin in the Southern part of the country in which 97% of forests belong to government and are state managed).

Impacts:

Specific recommendations were developed for adaptation at various levels, including recommendations for all Mediterranean forests, as well as species-specific recommendations and ideas for forestry practices specific in the vulnerable areas determined through the analysis. The recommendations were developed in a format which can readily be incorporated into forestry management and silvicultural practices detailed in forest management plans. This will support and maintain the health of ecosystem services and biodiversity under the projected climate change scenarios.

Therefore, the management solutions suggested in the project do directly address conservation and management of natural resources in the Mediterranean Region. In the long term, once implemented, the impacts of management suggestions can be monitored successfully. Some direct effects of integrating silvicultural measures in to forestry management plans are:

- Increase in the climate change adaptation capacity of forestry sector in the region,
- Increase in the resilience of the region's forests to climate change,
- Integration of climate change, biodiversity and ecosystem services into the forest management,
- Sustainability of life quality of the population in the basin,
- Prevention of changes causing natural disasters like flood, erosion etc.,
- Prevention of threats by dense forest fires near settlements,
- Sustainability of the economy of forest villagers based on wood production.

The project is the first of its kind in Turkey, where research findings were successfully translated to management propositions at different scales. It also is the first study where the impacts of climate change were assessed towards developing adaptation measures on forest ecosystems.

Information:

Project description by DKM: The Adaptation of Forest Ecosystems and Forestry to Climate Change in the Seyhan Basin

Adapting Mediterranean Forests to Climate Change in the Konya Region

Location:
Konya, Karaman, Ermenek Turkey

Leading institution
WWF-Turkey

Period:
2013 - 2016

Scale:
Local

Involved institutions/stakeholders
Project in partnership with the General Directorate of Forestry, WWF-Turkey and Nature Conservation Centre (DKM). Other stakeholders of the project include domestic and foreign NGOs, local forest villagers, research institutions, universities and international organizations.

EbA CAS Eco-DRR

Summary:

The main goal of this project is to enhance resilience of the Mediterranean forest ecosystem in the Konya region, hence increasing its capacity to withstand and adapt to the changing climatic conditions.

The geographic location of the project is in the transition zone between the Mediterranean and continental climates. Being in a transitional zone, the climate is drier compared to the Mediterranean climate (which is expected to be even drier as a result of climate change). Furthermore, due to long term human management, these forests face especially high levels of threat from climate change.

Because these forests are the primary source of subsistence and have important cultural element for the forest villagers, by contributing to the long term sustainability of these forests, this project provides economic, social and ecological benefits.

Through this project, future impacts of climate change on selected species have been assessed and adaptation strategies have been developed and integrated into the forest management plans in the region. These strategies planned to be implemented in the next 20 years will contribute to improve the ecosystem and species resilience in the region.

Main project recommendations are:

Enhancing species diversification in forest stands: As different species are better adapted to different climates, having a variety of species at one site increases the likelihood that some of these species will be well adapted to the future climatic conditions. This approach is especially important due to the uncertainty of the magnitude of change in climate. In a diverse forest, the likelihood of maintaining a forest cover at the site in the face of climate change is higher compared to a less diverse forest. The managed forests tend to have single or few species compared to natural forests. This project works with the Directorate of Forests (DoF) to increase the species diversity of the managed forests. In order to achieve this goal, meetings were held with the forest managers to discuss the importance of species diversity and come up with a decision to increase this diversity. As a result of these meetings a higher variety of species are now used while planting and more species are kept on site during site preparations before cuttings. In addition to this decision, the goal to increase species diversity was added to the management plan which means that the decision will be implemented in the most vulnerable sites for the next ten years and beyond.

Supporting genetic diversity: In addition to species diversity, genetic diversity is also important for increasing resilience to climate change. Within a species, diversity of genes acts in a similar way to increase the likelihood of sustaining a forest cover at the site in the face of climate change. The project recommends acquisition of the seeds and seedlings used for reforestation from a diverse set of "seed stands" in order to ensure a more genetically diverse and healthy forest. This recommendation is also integrated into the management plan.

Enhancing species migration needs: In addition to recommending a higher diversity of genes, the project also recommends to support a shift of genes northward and towards higher altitudes. In most of the site, it is foreseen that the average temperatures will increase and the climate will resemble that of the sites at lower altitudes and in more southern parts. Climate change is expected to be faster than natural rates of climate change and the tree species are expected to be slower in migrating to more favourable locations. Therefore, the project recommendations include acquisition of seeds from more southern locations and from lower altitudes from trees that are already well adapted to the future climate conditions of the site at hand, increasing the rate of migration of the tree species northwards and to higher altitudes. This recommendation is also integrated into the management plan with specific guidance on the locations where the seeds ought to originate from.

Supporting species with higher resilience to draught: In most of the subunits of the project site, the climate is expected become drier. Therefore, it is important to ensure draught resilient species or individuals with better adaptations to draught are present in the forest. In the case of this site, native species such as oak and juniper species are better adapted to draught compared to the species most preferred for planting by the DoF such as black pine and cedar. Instead of recommending a complete change of species, this project recommends no-risk actions such as creating small islands of draught resilient species in existing low diversity stands. This way, it can be ensured that the individuals of draught resilient species take root in these stands and can keep the site forested in the case of a decrease in health of the dominant species that are less resilient to draught.

Fir-juniper mixed forest in the Konya Region in Turkey.

Reducing water stress and dieback events in forest stands: As draught events are expected to increase in number and severity, the projects recommends managing forests to be more resilient to draught conditions. In many cases this can be achieved through thinning of stands and increasing the number of draught resilient species in the stands. This recommendation was integrated into the management plans for the stands with higher numbers of trees per square meter.

Improving forest soil conservation: Protection of the soil is of utmost importance to ensure maximum level of moisture is retained for the vegetation, an important consideration for when water is an increasingly scarce resource in the face of climate change. Currently most management decisions are taken based on the condition of the vegetation cover and the level of soil degradation is not considered during decision making. This project recommends that more attention is paid to the condition of the soil while taking management decision and that more actions are taken to protect the soil. Soil protection measures include avoiding use of heavy machinery and avoiding all forestry activities at sites with already poor soil conditions.

This project also includes an analysis of forest ecosystem services that are important for the economic and cultural uses of the local forest villagers. WWF-Turkey is using this analysis to improve the management of the forests to better cater to the needs of the forest villagers.

Enhancing resilience of these forests to climate change and ensuring the continuity of forest cover in the region will help reduce the impacts of catastrophes such as storms, floods and droughts expected to increase in intensity due to climate change. The project is being conducted in close cooperation with the forestry sector. This project also has high acceptance by the local forest villagers. Discussions with the villagers show strong support for the project as the villagers understand and readily observe the impacts of climate change such as higher rates of soil degradation and dieback events.

Juniper forest near the Beyşehir Lake in the Konya Region in Turkey.

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NATURE-BASED SOLUTION 2 / ECOSYSTEM TYPE: FOREST

Societal challenge/s:

Climate change,
Risk disaster reduction.

NbS concepts used:

Ecosystem-based Adaptation,
Climate Adaptation Services,
Ecosystem-based Disaster Risk Reduction.

Objective:

The main goal of the project is to contribute to the long term preservation of Turkish Mediterranean forests against climate change and their capacity of delivering ecosystem services, a crucial element to the wellness of people.

Impacts:

Climate change adaptation measures integrated into the forest management plans directly address the challenges of management of the natural resources in the region. These measures include soil and understory protection techniques, prioritization of adapted species and assisted migration of species to ensure the continuity of the forest cover. Selected measures are currently being implemented in two pilot sites in the region. The results of these adaptation measures are planned to be measured, quantified and testified using readily available and tested tools developed for dry zone landscapes.

In Turkey, nearly all forests are owned by the government (the Directorate of Forestry-DoF) and managed through management plans prepared generally for ten year intervals. The management plans are prepared by the planners of the Department of Planning at the DoF in coordination with the managers at the subunits of forest management and implemented by the forest managers at these subunits. These management plans are important tools delineating the goal of management for each stand of forest for the next decade and beyond.

In this project, WWF-Turkey worked with the forest planners to integrate climate change adaptation considerations into these management plans for the most vulnerable forest subunits. Integrating these considerations into the management plans meant that the precautionary actions to help the forests adapt to climate change will be implemented for the next ten years and beyond by the forest managers implementing these plans. By working with the planners, this project ensured that the climate change adaptation was considered for the most vulnerable forest subunits and precautionary actions were taken.

Information:

Project description – WWF Turkey

FOREST MANAGEMENT in certain areas of Morocco demands a clearing activity which is expensive for forest managers, but fundamental for the good health of the forest. Communities around those forests have often scarcity of resources and are in need of firewood and fodder. To face both situations, the High Commission for Water and Forests and the Fight against Desertification (HCEFLCD, in its French acronym) established a win-win contract between them, as forest managers, and the local traditional users of these forests. The contract allows providing cattle food supply and firewood for domestic consumption by means of a proper forest management in which the benefiting parts are involved on the clearing tasks. This approach does not apply any new nature-based solution, but deliberately favours a traditional use of the forest resources (linked to food and energy security), also known to benefit forest management if implemented in a sustainable way.

Additionally, it provides local community with small income benefits.

Partnerships in social forestry: Clearing operations, carried out by the local associations

Location:
Ait Hamad Ribâa,
El Hajjaj and Sahb Laghnam /
Ifrane Province (Morocco)

Leading institution
Ifrane National Park (Morocco)
AFD / FFEM

Period:
2010 - 2014

Scale:
Local/Provincial

Involved institutions/stakeholders
Provincial Waters and Forestry Service of Ifrane (HCEFLCD)

EbMgt

Summary:

The Holm oak clearing operation was initiated with the "Ait Hammad Ribâa" association, within the scope of the rural commune of Tizguite and the Ifrane region, after having invited, via the association's office, all of the interested right holders.

The participants (comprising thirty to fifty people from the associations), are all beneficiaries belonging to the ethnic fraction concerned (Ait Mouli, Ait Yahya ou Alla, Ait Amar, Ait Benhcine, Ait Mhamed, Ait Benyacoub, Ait Mhand ou Lahcen, El Hajjaj, Ait Hammad Ribâa, Ait Hammad Adghagh) and are divided into groups. Each group is supervised by the forestry personnel in the presence of members of the association's office.

The operation was the subject of a hands-on demonstration that covered the method for implementing the thinning operation. The silvicultural obligations require approximately 33% of the sprigs to be removed from each clump. In such a situation, it would be logical to mark the sprigs to be reserved with paint. The Water and Forests technicians have been entrusted with marking the stems that are to be kept with red paint. In technical terms, stems with a diameter over 20 cm are reserved and marked. The users removed the stems at non-market value and the products thereof were given away free-of-charge to meet their family needs (firewood, fodder).

Societal challenge/s:

Food and energy security: The project provides cattle food supply and firewood for domestic consumption.

NbS concepts used:

Ecosystem-based management.

Objective:

Clearing of Holm oak with the participation of the local population.

Impacts:

The clearing of green oak provides neighbouring populations with significant amounts of firewood and fodder, as well as some economic benefits:

a) Firewood:
Although the dimensions of the strands targeted by the clearings must not exceed a circumference of 20 cm, their energy value is very appreciable. The estimate of these products collected by the three associations is approximately 300 steres (m^3), 515 steres and 615 steres respectively for Ait Hamad Rbiâa, El Hajjaj and Sahb Laghnam, which corresponds to a total of 1430 steres for all the associations. The average quantity removed per household is estimated at 6.8 t / household. The result is that the rate of coverage of fuelwood needs by clearing is around 62%.

b) Fodder:
The green oak leaves constitute in the mountain regions, providence for the livestock in winter period. Taking into account bibliographical work and field surveys, the forage values generated by the clearing for the benefit of the 3 associations are of the order of 3,024, 1,487 and 1,386 fodder units (FU) respectively for Ait Hamad Rbiâa, El Hajjaj and Sahb Laghnam.

c) Economic benefits:
The economic spin-offs of forest clearing for neighbour population were evaluated on the basis of the average prices of fuelwood and barley. Assuming that one kg of wood and barley is worth respectively 1 DH and 2.5 DH, the monetary values of pruning products for the three associations were around 972.742 DH.

An examination of the results obtained highlights the vital interest of the clearing operations for the neighbouring populations. Considering their silvicultural interest, this operation, which is expensive for forest managers, is feasible within the framework of a win-win contract between the users and the water and forest administration. The new approach of concerted developments, involving the populations in this kind of culture, has double rewards, because it responds to both the forestry concerns as well as the immediate interest of the populations.

Information:

Video: Ifrane Cedar forest – A project cofinanced by AFD and FFEM

RANGELANDS

Dry rangelands ecosystems are present in a huge extension of the Mediterranean basin and are relevant for biodiversity and traditional livelihoods and agricultural practices. Besides two Mediterranean examples, we have extracted a specific case in Zarqa river basin (Jordan) from the publication Nature-based Solutions to address global societal challenges, due to its IUCN membership in the Mediterranean region and since it's a good example of pre-desert ecosystems that can inspire similar good practices in landscapes and communities in North Africa.

NATURE-BASED SOLUTION 4 / ECOSYSTEM TYPE: RANGELANDS

Securing rights and restoring lands for improved livelihoods

Location:
Zarqa River asin (Jordan)

Leading institution:
IUCN-Regional Office for West Asia, Amman, Jordan

Period:
2009 - 2010

Scale:
Subnational

Involved institutions/stakeholders:
Ministry of Agriculture, Ministry of Environment, and the Arab Women Organization

ER EbMgt

Summary:

The Zarqa river basin in northern Jordan, where about half of the country's population live, has seen severe land degradation, which has in turn resulted in high levels of poverty and unemployment. The biodiversity loss, land use changes and ground water extraction can be traced to unsustainable development and mismanagement of natural resources. Grazing land is now very scarce and range management for grazing has become a marginal activity.

Livelihood strategies have shifted to high-intensity agriculture – including poultry, cattle and irrigated crop production – which now uses most of the available water resources (Haddad, 2014). In addition, the region is subject to desertification and unpredictable precipitation, further increasing the pressures on the ecosystems and people of the river basin.

Traditionally, land management followed the Hima ('community conserved area') system. Used by the Bedouin tribes since ancient times, this grazing system seasonally sets aside heavily grazed rangeland for regeneration and recovery. Tribes wandered across political borders, migrating through Jordan, Syria, Saudi Arabia and areas around the Iraqi borders to allow for this regeneration. Sites were thus governed and managed by a particular village, clan or tribe through consensus rather than through legislation or institutional control. However, this traditional grazing system has declined over the years, and Bedouins in Jordan now live permanently within the country's borders.

Through government approval and the transfer of management rights to communities in the project area, land was allocated by the government as Hima rangelands to the communities.

Various government and community partnerships thus emerged in support of sustainable rangeland management.

Societal challenges:

Recovering of the traditional Bedouin's rangeland management systems to avoid land degradation and biodiversity loss.

Climate change adaptation and mitigation.

NbS concepts used:

Traditional ecosystem management,
Ecological restoration.

Objective:

The revival of Hima as a mean to strengthen local community capacities and customary laws, to protect and manage land resources for social economic growth and conservation of natural resources in the Zarqa River Basin.

Impacts:

A revolving fund was established at two of the sites to offer loans for income-generating projects to improve community livelihoods.

Employment opportunities were created for Hima participants, as technical veterinarians or assistants. In Bani-Hashem, a marketing study identified several microenterprise development opportunities, such as in the spice market. Local women were hired to organise the collection, drying and packaging of indigenous medicinal herbs, providing additional income for their families.

Information:

IUCN Publication: Nature-based Solutions to address global societal challenges – Case Study 6.

LOCAL CONTEXT OF THE CASE STUDY

The climate in the area of Sidi Barani - Matrouh Governorate is arid Mediterranean, with an average rainfall of 138 mm at Marsa Matrouh, 162 mm at Barani and 106 mm at Saloum and rainfall declines rapidly to the South, down to 100 mm within the first 15 Km, and about 50 mm at 50 Km (*). Thus, the decrease in water resources was the most significant challenge that the local Bedouin community had to face.

The area witnessed significant decrease in the amount of rain due to climate change impacts (high temperature). Accordingly, the community suffered from the decrease in livestock (sheep and goats) due to the degradation of the natural range and the heavy grazing by some breeders, and this has definitely affected their food security.

The community was considered a threatened vulnerable community and most of the families were willing to move to other areas to secure food and water, which will lead to internal displacement.

Through this nature-based initiative, thanks to the rangeland ecological restauration, the community was convinced not to wait or depend on the government and the local authorities to provide solutions to their problems. Instead, following a participatory approach and establishing effective partnerships between concerned stakeholders in the area such as research centres, NGOs, cooperatives, community leaders, etc… was a much better way to contribute to the development of this natural range area and overcome their challenges.

Collecting and preserving scarce Natural Range seed plants and restoring natural pastures in large areas to improve Bedouin community livelihoods

Location:
Sidi Barani - Matrouh Governorate (Egypt)

Leading institution:
Al Ramis Society for Local Community Development of Barrani (an Egyptian NGO).
GEF/Small Grants Programme - Egypt

Period:
July 2012 - June 2015

Scale:
Local

Involved institutions/stakeholders:
Involved institutions arranged based on their roles and contribution to the initiative as follows:
• Desert Research Center (DRC) – Ministry of Agriculture
• Sustainable Development Centre for Matrouh
• Center of Agriculture
• Faculty of Agriculture

AbC ER

Summary:

The project aimed at increasing and consolidating the Bedouin community participation in this area, not only towards achieving sustainable environmental development, but towards preserving their natural range and plants through seed collection activities, propagation and re-cultivating them.

Within this initiative, the NGO succeeded in the preservation of six endangered types of natural grassland seeds.

The initiative was considered unique because it witnessed the active involvement of all segment of Bedouin community; especially women, youth and children since the planning and designing phases throughout the implementation phase.

Furthermore, the initiative succeeded in establishing strong and effective collaboration between local authorities, NGOs, academia, and community members.

Five tribes were involved in this initiative namely: Al Hafyan, Mubarak, Al Magroon, Al Goweida and Al Mawalek.

The involved institutions provided the necessary technical support to farmers and breeders, in addition to training and

building the capacities of community members on seed collection, management and re-cultivation based on the quantity of rain in each area.

Ecosystem Type:

Rangelands. The total rangeland area of Egypt is about 4 million hectares distributed among three sub-ecological zones as follows (*):

2,300,000 Ha in the North West Coast (NWC) sub-zone.
1,100,000 Ha in Sinai Peninsula.
600,000 Ha in Shalateen – Halayeb region.

Societal challenges:

Water and food security.

NbS concepts used:

Area-based conservation,
Ecological restoration.

Objective:

1- Collecting the indigenous and rare natural rangelands plant seeds from their original locations;
2- Initiating seeds breeding farm using supplemental irrigation with low quality water;
3- Collecting of perennial fodder shrubs seeds and production of seedlings to be planted in contour lines;
4- Providing training for sheep herders in rangeland management and improvement, sustainable use of rangelands and regulation of livestock grazing;
5- Increasing public awareness regarding the importance of rangelands and their positive impact.

Impacts:

The project had a very positive impact on the area and on the Bedouins as well. Its main impact was on the development of natural pasture in a large area of land. Of course it varies from one area to the other according to the amount of rain in each area, however,

(*) Ref. “Sustainable Development of the Egyptian Rangelands to Combat Desertification”, by Dr. Mostafa Sabry El-Hakeem, Prof. of Range Management, Egypt 2017

the most important thing is that they convinced the Bedouins to have only light grazing during the plantation of seeds and not severe grazing as they used to do before, and they were cooperative, which led to this development. In addition to that, the initiative contributed to the conservation of 6 significant kinds of extinct species (which are fodder for animals) and nurseries were established. The adoption of the idea by the community led to re-planting of those species, as well as the cultivation of new trees and shrubs. Those activities were also replicated in other areas due to their positive and considerable impacts on improving the livelihoods of community members.

The positive results were also reflected on the residence interest in attending seminars which were organized aiming to raise their awareness, and also enhanced their participation in breeding sites and training, especially women (which in not considered familiar in Bedouin conservative community).

- 275 community members from 5 tribes attended the awareness raising seminars.
- 102 participants were involved in the trainings (68 men & 34 women).

A lot of shepherds and breeders of sheep adopted the idea of the project and began implementing it even after the projects activities have officially ended. The NGO also received several requests to implement the activities in other places, including Halayeb and Shalatin in southern Egypt. Exchange of experience between both communities is taking place.

During the first year, there were only 3 sites, but due to the success of the project, they reached 15 sites in the second year, in 4 areas (Sidi Barani, AlNakhila, Foukah, AlMatani).

- 3 areas = 23 Feddans in total = 96,600 meters (Feddan = 4200 meters)
- 15 areas = 115 Feddans in total = 483,000 meters

The project was included among the projects implemented by Egypt in the updated Egyptian National Report to Combat Desertification (2014-2024) due to its importance.

Information:

Project description – SGF

PPT – Collecting and Preserving Scarce Natural Range Seed Plants by Ms. Ghada Ahmadein, Technical Coordinator (Arab Office for Youth and Environment), Egypt. (AOYE)

Steppe-land birds make up one of the most threatened groups, especially due to the changes that human activity is causing in the environment: deterioration and loss of habitat, non-natural mortality (due to electrocution, combine harvesters, collision…), etc.

Andalusia is the region in Spain and in Europe with the greatest variety of steppe-land birds with 25 species, 15 of which are threatened. In 2008, this led to the declaration of the only two Special Protection Areas for Birds (SPA) in Andalusia, justified by their importance for steppe-land birds: Alto Guadiato (Cordoba) and Campiñas de Sevilla.

The designation of land used for human activities (in use as farmland) as a natural protected area led to a response from the local population that was mainly motivated by the uncertainty that this created. This meant that the promotors of the designation were faced with a scenario in which it was necessary to draft and develop a management model that would make it possible to visualise both: the compatibility and the positive aspects derived from living in a Natura 2000 area, and provide solutions for the farming industry that were not only compatible with biodiversity but would also reinforce it. In view of all of this, attempts were always made to manage crops based on ecosystem functionality.

Conservation and management in special protection areas for steppe-land birds in Andalusia

Location:
Andalusia Special protection areas for birds in Alto Guadiato, in the province of Cordoba, Campiñas de Sevilla, Laguna de Fuente Piedra and Lagunas de Campillos in Malaga

Leading institution:
Regional Ministry for the Environment and Territorial Planning Junta de Andalucía

Period:
2010 - 2016

Scale:
Sub-national

Involved institutions/stakeholders:
ASAJA, COAG, UPA, SEO/BirdLife, Group of Municipalities, AGAPA, AMAYA

AbC

Summary:

The overarching objective was the conservation of steppe-land birds, especially from the most threatened species. To do this, a management model for the habitat was implemented that allowed farmers to understand that farming is an activity that is compatible with and necessary for the conservation of birds. At the same time, the local population was able to see the advantages of living in a Natura 2000 area.

The project has allowed improvement of the habitat of steppe-land birds by implementing a management model based on the creation of crop patchworks. The farmers have applied new, more sustainable farming techniques focused on four areas:

1. Management of crops and pastures
Crop diversification on farmland, establishing rotations of cereals, sunflowers and legumes is a good practice for diversification of the steppe-land habitat. Furthermore, it was considered appropriate to delay the harvesting of the cereals until the end of June, to raise the harvest cutting height to a minimum of 25 cm, and leave the stubble in the field until the end of August in at least 30% of the cereal area, thus following the criteria of the agro-environmental measures.

Rain-fed legumes were sown, both winter (vetch, sulla, etc.) and spring (peas, chickpeas, etc.), crops highly appreciated by a wide spectrum of steppe-land birds as food; along with other crops such as wheat, barley and sunflowers.

Other practices to benefit the habitat were the establishment of vegetation cover between the rows of olive groves with species to encourage steppe-land birds, such as legumes or some grasses; and the creation of pastures, a good practice to establish one of the habitats selected by several species of steppe-land birds. For its implementation, species native to the environment were used, with preference given to subterranean clover, allowing only the traditional livestock use of the area.

2. Fence markers
Some of the traditional livestock fences were topped with barbed wire which can be dangerous for bird flight. To avoid this problem, they were marked out with long-lasting plastic items (e.g. expanded polystyrene). They are rectangular slats in a bright white colour that are arranged 2 metres away from each other and at different heights to give heterogeneity.

3. Maintenance of boundaries
For the conservation of wildlife in general, it is very important, in addition to the crop patchwork--where cereal crops alternate with wood and fallow land-- for there to be small strongholds of natural vegetation on boundaries, hedges, roads, riverbanks, etc. among the crops.

4. Construction of ponds or birdbaths
The scarce availability of water points is a limiting factor for steppe-land birds, even more so in the critical summer periods of the harsh Mediterranean climate when they are in the middle of the breeding season.

The preparation and construction of ponds and birdbaths in areas with scarce water availability is a key measure in these latitudes. Steppe-land birds usually use water points with very specific characteristics: areas clear of vegetation, located halfway up hills, far away from infrastructures such as roads, paths, rural houses, etc.

In addition, and to encourage a change of habits among the farmers, the **Purchasing of harvests and stubble production was applied.** In the first case, the measure aims to leave unharvested crop plots of interest in the nesting areas of the most emblematic steppe-land birds (Montagu's harrier, bustard, little bustard), helping to ensure the proper reproductive development of these species, in addition to offering cover and food.

The owner receives financial compensation for making the agreed area available to the project, as stipulated in the corresponding collaboration agreement, in addition to including the design of the crops that will be left unharvested, depending on the ornithological importance they have (housing a breeding colony of Montagu's harrier, confirmed reproduction of bustard or little bustard, etc.).

In the case of purchase of the stubble production, it is a case of obtaining, through purchase, a cereal crop that has already been harvested (for grain production) but from which the straw has not yet been removed. It will remain in these conditions throughout the summer until the time of the tasks prior to sowing.

Unlike traditional stubble, this system maintains greater vegetation cover, which provides shelter to steppe-land birds while facilitating the feeding of adults and especially chicks, by keeping the grain that has fallen from the ear -naturally or during harvesting--, and also preserves more suitable conditions for the development of the insect fauna that is the basis of their diet at this time of year.

As a result, greater awareness and involvement of the local population has been achieved, as they have actively participated and have verified the suitability of the applied model to make living in a protected area (SPA) compatible with maintaining an income from farming activities.

The project has also a trial of innovative techniques to monitor certain species of birds, such as pilot thermal remote sensing for the detection of great bustard nests. However, this was not successful.

Societal challenges:

Secure food supply based on sustainable farming practices.

The specific challenges of the project were:

- Making farming activity compatible with the conservation of threatened steppe-land birds in special protection areas (SPA) for birds.
- The implementation of innovative techniques for farmers, which allows conservation of the steppe-land birds and improves income for the farmers.

NbS concepts used:

Conservation based on the area.

Objectives:

The main objective was the recovery of the steppe-land bird habitats through two groups of actions:

1. Management of the environment to improve the habitat of steppe-land birds.
2. Communication and dissemination to people so that they would no longer be concerned about the declaration as a SPA.

The main specific objectives were:

- Conservation of biodiversity, in this particular case, of the steppe-land birds and their habitat.
- Diversification of the farming landscape.
- Involvement of the local communities in the conservation of biodiversity.
- Involvement of the local authorities, either directly or through groups of municipalities.

Impacts:

The project has had a positive impact on the various species of steppe-land birds: Great bustard: the main nesting areas in the SPA have remained stable. This situation of stability undoubtedly contributes to the viability of the species in the regional context.

Little bustard: in terms of quantity there are no significant changes to the number of little bustards. However, like the great bustard, the little bustard requires a great variety of farming practices and therefore the farming diversification measures were highly positive.

Lesser kestrel: Control of the different populations revealed stability in all SPAs except in Fuente de Piedra. Generally, the colonies increased in number but housing few pairs and being more widespread throughout the area as a result of the continuous deterioration of breeding grounds. Therefore, the construction of kestrel nestboxes turned out to be a very beneficial action, as they quickly welcomed the first breeding pairs.

Montagu's harrier: This species, which is not great in number in the SPAs, decreased in Fuente de Piedra and Campillos, but not in Campiñas de Sevilla and Alto Guadiato, where it remained stable. The purchase of the harvest was revealed to be a fundamental measure to guarantee its reproduction, avoiding the negative effect of the combine harvesters in the places where the nests were located.

European roller: Like the Lesser kestrel, it uses human constructions for breeding. It has a large population in Campiñas de Sevilla, and a stabilised one in Alto Guadiato. The kestrels also moved a few months after construction.

Black-bellied sandgrouse: it is rare in the two SPAs in which it is present: Alto Guadiato and Campiñas de Sevilla, with an unknown breeding population but which does not exceed 25 pairs in both areas. With the data available, in none of the cases was it possible to establish a significant trend, which appears to point to a certain amount of stability.

Throughout the project, several infrastructures were built in each of the SPAs and over 300 events were held with the total attendance of approximately 10,500 people. As well as the direct impact on biodiversity, the project had led to:

- Maintenance of farmers' income at the same time as contributing to the conservation of biodiversity.
- Boosting the local economy through eco-tourism (thanks to the project, routes and paths have been developed and marked out, an information point has been built by restoring an old olive press, information has been published for visitors and two bird observatories have been built).

Lessons learned:

The most relevant learning, which may be of use in other similar initiatives, can be summarised as follows:

1. It is difficult for the local population to identify and incorporate a sense of belonging to the Natura 2000 network. The dissemination and communication activities aimed in this direction should be ongoing.
2. Both the dissemination and communication actions and those for developing and managing the conservation measures together with the farmers have led to greater social acceptance of the SPAs, especially in Alto Guadiato.
3. Steppe-land birds have become more visible for the local population and for the farmers who live among them.
4. It is necessary to combine and clarify communicative messages correctly when several partners are involved in a project. Training is essential, especially when working in an educational environment.
5. The tools for evaluating the dissemination actions are basic, but their weakness lies in not having good, powerful indicators.
6. The existence in the territory of basic tourist infrastructures constitutes an excellent starting point for revitalising the territories with visitors specialising in ornithological tourism.
7. Given the environmental benefits of new agricultural practices (e.g. direct sowing) and crops (e.g. rain-fed alfalfa fodder), it is highly recommended to implement them within the framework of the CAP, so that the farmers can see the advantages that they bring to their farms. The implementation of innovations of this type requires a time for farmers that exceeds the execution period of the Life project.
8. The livestock activity should be integrated in the management of the agricultural habitat, with appropriate use of the stubble (in head numbers and time spent on the crops).
9. The Life project has been perceived by most of the farmers as another community aid and not so much as a nature conservation project.
10. The active commitment of the farmers once the project has ended will be maintained for now, pending further economic incentives.
11. Perhaps the most important key of the project has been the mutual trust that has been built with the farmers, a habit that should be maintained over time.
12. The Life experience has made it possible to adequately design measures that could be developed within the framework of the CAP, in particular, the Rural Development Programme, which is a way of continuing with the essence of the project in the future.

Information:

LIFE08 NAT/E/000068 – Conservation and Management in Special Protection Areas for Steppe Birds in Andalusia

MARINE AND COASTAL

Mediterranean marine and coastal zones host some of the most vulnerable ecosystems to climate change and overexplotation coming from tourism, pollution, fishing, and other human activities. Nature-based Solutions can play an important role in conserving them and restoring those that have been degradated, as well as contributing to both climate change adaptation and mitigation.

NATURE-BASED SOLUTION 7 / ECOSYSTEM TYPE: COAST AND MARINE HABITATS (*POSIDONIA OCEANICA* SEAGRASS MEADOWS AND SALT MARSHES)

LIFE Blue Natura – Andalusian blue carbon for climate change mitigation: quantification and valorization mechanisms for marine and coastal habitats

Location:
Andalusia (Spain)

Leading institution:
Ministry of Agricultura, Fishery, and Sustainable Development of the Junta de Andalucía
(Regional Government of Andalucía)

Period:
2015 to 2019

Scale:
Subnational

Involved institutions and interested parties:
Agency of Environment and Water of the Junta de Andalucía, the Spanish National Research Council (CSIC), IUCN Centre for Mediterranean Cooperation, Asociación Hombre y Territorio

AbC EbM

Summary:

Forests are not the only ecosystems that absorb carbon dioxide, also certain coastal habitats such as marshes and seagrass, such as Posidonia oceanica meadows, play a role of sequestration of carbon dioxide.

The inclusion of Blue carbon programmes in climate change strategies of Mediterranean countries still lacks knowledge on the extent of the capacity and variability of these ecosystems, the development of policy instruments, such as carbon offsets frameworks, and the ability on how to best develop coastal environmental management frameworks at local and national scales. The Life Blue Natura project is currently developing the necessary tools for designing offset projects that could be included in the future Climate Change Act of Andalusia, since no tools for marine ecosystems exist to date.

The project completed thecalculations of the carbon sink inmarshes and seagrass habitats of the Bay of Cadiz, the Strait, and the Odiel Marshes. The current focus is set on feasibility studies for the preparation of NBS-carbon offsets projects in salt marshes and Posidonia meadows. The most threatened areas and/or those of greatest value are in the process to be selected in order to define conservation and revegetation projects.

The LIFE PROJECT BLUENATURA is an innovative European project that aims to find the mechanisms, tools and the knowledge to address all these challenges in order to improve ecosystem management and restoration projects using carbon financing mechanisms.

Last but not least, it seeks to build a network of trust, to ensure the involvement of companies and authorities in the carbon

voluntary market, which promotes the reduction of emissions through the protection of the best blue carbon sinks in the Andalusian territory on a mid-term basis.

This project started in August 2015 and will finish by March 2020.

Societal challenges:

Climate change mitigation
Establishing valid scientific methodologies to measure the carbon fixation in the posidonia seagrass meadows and salt marshes. These metholodogies are intended to offset carbon emissions through future conservation and restoration actions in these blue carbon habitats.

NbS concepts used:

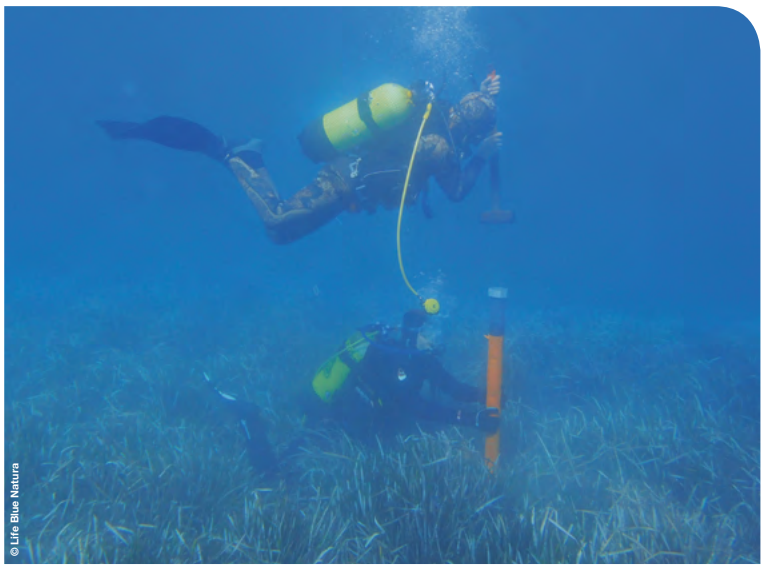
Ecosystem-based mitigation,
Area-based conservation.

Objectives:

The project is contributing towards a better understanding of the carbon stocks and flows of the *Posidonia oceanica* sinks in the Andalusian Mediterranean, the seagrass beds in the Bay of Cádiz, the salt marsh sinks in the Bay of Cádiz and the Odiel salt marshes. How much carbon they have retained, how much they incorporate annually and what economic benefits derive from their maintenance, restoration or protection. The main objectives are:

1. Filling knowledge gaps on Blue Carbon ecosystems along the coast of Andalucía – The scientific studies on the emission/sequestration ratio of damaged and healthy ecosystems with an economic analysis is completing the work to define and make an approximate evaluation of the environmental services delivered by these habitats to mitigate climate change.

2. Incorporating Blue Carbon ecosystems into climate strategies – The development of key regulations in Andalusia under a new regional law on climate change that include blue carbon ecosystems will allow the implementation of strategies for the conservation of carbon sinks.



3. Addressing existing policies and requirements to maintain healthy ecosystems – The project is working to develop the Andalusian Verification Standard of Carbon Credits generated by projects for the offsetting of emissions of local industries based on the conservation of marshes and seagrass meadows. The drafted carbon offset projects will then be offered within the Andalusian System of Emission Compensation (SACE).

NATURE-BASED SOLUTION 7 / ECOSYSTEM TYPE: COAST AND MARINE HABITATS (*POSIDONIA OCEANICA* SEAGRASS MEADOWS AND SALT MARSHES)

Impacts:

Between 2016 and 2018 the team measured carbon stocks and fluxes in the designated areas. They also improved mapping of the areas and assessments of their dynamics or changes affecting them.

The team found that globally the Andalusian seagrasses currently stock 13.4 megatons of CO_2 in their top 1m of sediment, and sequester around 14,384 tonnes of CO_2 each year. 95.5% of this carbon sink is attributed to Posidonia meadows.

The project will allow by the end of the implementation phase (March 2020):

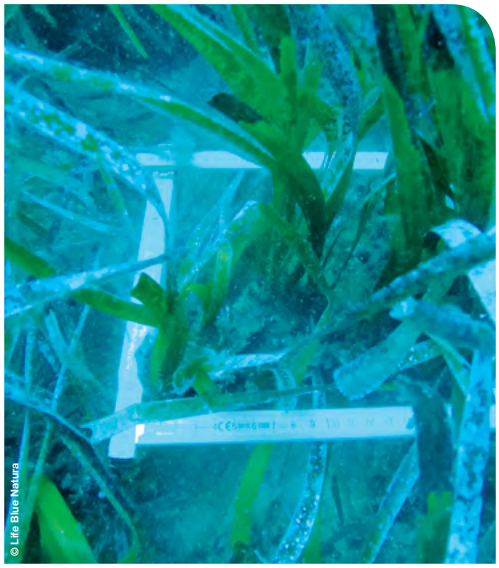
- To define and prioritise criteria for the definition of Blue Carbon projects and selection of specific criteria for wetlands and Posidonia;
- To develop a catalogue of projects for restoring coastal and marine habitats that can be offered within the Andalusian Emission Offsets System (SACE). This will help to finance conservation projects and the restoration of habitats of blue carbon sinks in Andalusia.

This catalogue will include NbS based on carbon offset projects (additions + avoided emissions). This could potentially help the conservation of Blue Carbon ecosystems, particularly if included in national carbon offset inventories and/or strategies with private industries.

The team is making serious efforts to share their results, tools and methodologies with other regions, especially in the Mediterranean, by attending the most important forums on the subject, and organising dedicated meetings with partners running similar initiatives in other European countries like Italy or Greece. Other regions could also apply the same methods used by the project including a carbon credit certification standard and a guide on how to offset certification of blue carbon projects around seagrasses and salt marshes.

Information:

LIFE Blue Natura – Andalusian blue carbon for climate change mitigation: quantification and valorization mechanisms LIFE14 CCM/ES/000957



Sustainable management of Morocco's marine resources

Location:
Marine Protected Area for the purposes of fishing (AMP-P for its French initials) of Alboran
Mar Chica Lagoon
Al Hoceima National Park (PNAH)

Leading institution:
Association of Integrated Resource Management (AGIR)

Period:
2014 - 2019

Scale:
Local

Supported by:
FEM / SGP, MAVA Foundation, CEPF Critical Ecosystem Partnership Fund

EbA EbMgt

Summary:

Implementation of a broad programme of participatory planning following an ecosystem approach, for the benefit of 3,000 artisanal fishermen operating in the Moroccan Mediterranean and in the aforementioned areas.

In the framework of this programme, the fishermen were able to identify a significant number of direct and critical threats that urgently affected target species, such as poaching of nestlings and osprey eggs, whose population was declining within the marine zone of the Al Hoceima National Park, or other critical and permanent threats such as dynamite and copper sulphate fishing, which irreversibly destroyed both marketable and non-marketable marine resources as well as its biotope. Besides, this was coupled with the devastating effect of illegal bottom trawling activity in the shallow areas within the National Park. This project aimed to eliminate direct and critical threats, through the strengthening of control and monitoring of species through the involvement of artisanal fishermen. The creation of a committee to monitor and tackle the aforementioned threats, has allowed them to participate in tackling these themselves in a subsequent stage.

On the other hand, the strategy also acted in parallel on the main factors that were at the origin of the direct threats, such as the low level of awareness, via awareness campaigns against the fishing of the juveniles; and the implication of the fishermen in the co-management of the marine area of the Al Hoceima National Park through the creation of no take zones.

Finally, newly-created cooperatives have had the effect of improving their overall income through a better commercial management of the fishing product without increasing the fishing effort.

The sustainable management put in place to manage marine resources is a clear example of Nature-based Solutions dealing with food security and disaster risk reduction linked to the potential collapse of fisheries as a consequence of the marine ecosystem mismanagement.

Societal challenges:

Food security, by avoiding:
- Destruction of the marine biotope,
- Decline of the local osprey population,
- Decline of the demersal stock.

NATURE-BASED SOLUTION 8 / ECOSYSTEM TYPE: SEA, ESTUARY, SEAGRASS BEDS, CLIFFS

Disaster Risk Reduction
(due to fisheries near to collapse).

NbS concepts used:

Ecosystem-based adaptation,
Community-based ecosystem management.

Objectives:

Protection of resources included in 3 Marine Protected Areas, equivalent to a marine surface area of 100,000 ha.

Impacts:

After the project: Responsible fishing has emerged within the protected marine area of Al Hoceima National Park (ZMPNAH) and this is thanks to:

- The eradication of copper sulphate and dynamite fishing.
- A significant reduction in the disturbance of osprey nests and the doubling of the number of Osprey chicks leaving the nest.
- The eradication of illegal trawling inside the ZMPNAH. The awareness campaigns used against the fishing of juveniles have contributed towards the establishment of a law in 2013/2014, obliging trawlers to fit devices with Vessel Monitoring Systems (VMS) geolocation.
- An increase in the abundance of marine resources, estimated at 20 to 30% depending on the species and ecosystems: local and national stakeholders have been involved in the restoration of the biotopes and species.
- A 30% poverty reduction for approximately 1,200 artisanal fishermen.
- Assurance of the project's financial viability, through participatory planning and the use of a sustainable marketing strategy for fish products emanating from the project's area of application.

Information:

Blue Solution Template in French: 'Sustainable management of marine resources of Morocco' (in French)

Rapport : Bonnes pratiques au sein des aires marines protégées à des fins de pêche dans la Méditerranée (in French), June 2015

Recherche et planification participative du secteur de la pêche artisanale à travers l'analyse systémique et prospective de durabilité dans la Zone Marine du Parc National d'Al Hoceima. (in French), June 2010.

Rapport final global : « Appui et accompagnement à la création/post création d'activités génératrices de revenus et de coopérative les pêcheurs néo-alphabétisés au sein du littoral du Rif centrale et orientale Marocain » (in French)

Rapport thématique final: « Activité de Sensibilisation et participation » (AGIR Project) (in French)

LOCAL CONTEXT OF THE CASE

The coastal dune ecosystem rehabilitation project of the Corso Commune in Algeria responds to the profile of Nature-based Solutions among the protection and restoration of a coastal dune ecosystem that plays an important role in reducing the risk of natural disasters caused by climate change; and which in addition, is of great value for the biodiversity of the area.

NATURE-BASED SOLUTION 9 / ECOSYSTEM TYPE: SAND DUNES WITH A VARIETY OF PLANT COMMUNITIES

Corso Commune coastal dune ecosystem rehabilitation project

Location:
Corso Commune
(W. Boumerdes) Algeria

Leading institution:
Association Ecologique de Boumerdes

Period:
2012 - 2014

Scale:
Local

Involved institutions /stakeholders:
Algerian Ministry of Foreign Affairs (MAE), UNDP, Wilaya de Boumerdes, Corso Commune and decentralised government departments

ER

Summary:

The project is financed by the Micro-financing Programme (GEF Small Grants Programme) from the Global Environment Fund (MFP/GEF), carried out by the UNDP on behalf of the 3 GEF Action Agencies – the UNDP, the UNEP and the World Bank – and executed by the UNOPS. The project is part of the SGP funded by the GEF according to the arrangements (80% GEF, 20% Association Ecologique de Boumerdes).

The pilot project aims to safeguard the protected natural area, consisting of a vulnerable coastal dune ecosystem that is particularly exposed to strong urban and socio-economic (tourist) pressures and the biodiversity of which is threatened. In fact, this dune ecosystem, characteristic of the Algerian coast, is composed of vegetation that grows in a narrow belt along the coast and is represented by these groups: *Pancratium maritimum, Ammophila arenaria, Lotus creticus, Urginea maritima, Chamaerops humilis.*

These plant formations are subject to climatic pressures (erosive marine and wind action) and human pressures (extraction of sand, deterioration of vegetation and soil, deposits of household waste. This protected area suffers from human action, particularly during the summer months, such as its use for amenities (motorised tracks and car parks).
The soil, which is relatively saline, is generally poor in organic matter. Added to this poor environment is the harmful action of violent winter winds and sea spray. All of these factors place a lot of restrictions on animal and plant life.

It is therefore a question of diagnosing the ecosystem in place, especially the coastal dune system, identifying the causes and pressures it is under, and the deterioration observed, to propose an integrated approach for protecting the biodiversity and rehabilitating the ecosystem and the site to achieve an effective ecological restoration.

NATURE-BASED SOLUTION 9 / ECOSYSTEM TYPE: SAND DUNES WITH A VARIETY OF PLANT COMMUNITIES

The project has a significant local partnership component and integration of the various stakeholders, as well as reinforcement of the local players.

Societal challenges:

Reduction of the risks of disasters associated with climate change through protection and restoration of dune ecosystems.

NbS concepts used:

Ecological restoration of dune ecosystem.

Objectives:

Diagnosis of the coastal dune ecosystem, identification of the causes and pressures suffered and the deterioration observed in biodiversity and rehabilitation of the ecosystem and the site.

To meet the protection requirements for these various factors of deterioration of the vegetation of the maritime dunes, and in order to protect and conserve this natural and plant environment, actions and activities of rehabilitation and protection of the site, some reflections on the development plan of this site and urgent measures to be taken have been identified:

- Develop a multiannual revegetation action programme, on the dune belt.
- Carry out the defence of certain deteriorated portions of the dunes; where biological recovery is noted and the recovery rate of the vegetation is maximal.
- Monitor the area during the summer season.
- Protect parts of the dune and the forest, currently subject to a strong human influence (frequent trampling by agricultural users (tractors, trucks, etc.) and use by citizens (holidaymaker vehicle traffic, hikers).
- Develop the access paths and routes to the beach.
- Regulate grazing in the dune area where herbaceous species are abundant.
- Reinforce appropriate signage prohibiting any form of deterioration of the dune environment and the vegetation as set out by the regulations in force.
- Prohibit the deposit of waste and aggregates anywhere on the site.
- Provide caretaking services, awareness raising and public information (summer visitors, local residents and farmers) through seasonal employment of young people and local work.
- Start work on repopulating the dunes.

Ammophila arenaria

NATURE-BASED SOLUTION 9 / ECOSYSTEM TYPE: SAND DUNES WITH A VARIETY OF PLANT COMMUNITIES

Impacts:

To allow restoration and rehabilitation of the dunes, the Ecological Association of Boumerdes, in agreement and cooperation with the local public authorities concerned, has taken urgent protective measures which have allowed:

- The defence of certain lithological formations which undergo intense natural erosion due to the insufficiency of the vegetation cover in place, rare biotopes that are very rich from a floristic point of view, on the one hand, and on the other hand, deterioration due to the action of humans that it regularly suffers from.
- The revegetation with native species that anchor dunes such as marram grass *(Ammophila arenaria)*
- Rehabilitation and protection of the site against human action by implementation of actions for cleaning and development of spaces.

Information:

Project description – AEB

Project snapshot – Small Grant Programme

Pancratium maritimum

DELTAS

Delta areas in the Mediterranean are among the most fragile zones affected by climate change impacts. The following group of cases refer to projects or actions implemented in the second and fourth largest Mediterranean deltas (Rhone and Ebro) that have in common the presence of wetlands, rich agricultural and fishing activity and sea-level rise risks. In each of the three projects specific local societal challenges were identified and Nature-based Solutions were proposed.

All the solutions relied on proper ecosystem-based management, including ecological restoration measures, and area-based conservation actions.

Additionally, they all received the active support of local actors and relevant socio-economic stakeholders.

Based on research findings, the Ebro's Delta project was designed to test how wetland management could provide specific Nature-based Solutions to reduce disaster-risk linked to climate change impacts in coastal areas. Moreover, it intended to improve water quality linked to rice agriculture practices and mitigate climate change by means of reducing greenhouse gas emissions by taking advantage of both, rice fields and wetlands. The Camargue project was specifically designed to face sea level rise risks by means of applying ecosystem-based management solutions in coastal wetlands and lagoons. Thanks to the restoration measures it had a direct impact improving ecosystem and water quality as well as fisheries.

The agro-ecological project of Petit Saint-Jean, also in Camargue, promotes agro-ecological techniques that are both productive and environmentally-friendly, particularly in terms of water resources and the exploitation of renewable resources and have a positive impact on wetlands conservation.

NATURE-BASED SOLUTION 10 / ECOSYSTEM TYPE: WETLANDS, RICE FIELDS AND COASTAL SAND DUNES AND BEACHES

Adaptation and mitigation measures to climate change in the Ebro Delta

Location:
Ebro Delta (Catalonia, Spain)

Leading institution:
IRTA (Institute of Agrifood Research and Technology)

Period:
2014 - 2018

Scale: Local

Involved institutions/stakeholders:
IRTA, ACA (Catalan Water Agency), CAT (Tarragona Water Consortium), CRSAE (Community of irrigators of the Ebro Delta), ICGC (Cartographic and Geological Institute of Catalonia), OCCC (Catalan Office for Climate Change), UCO (University of Cordoba). It is worth mentioning that the most important stakeholders are involved as project partners (e.g. farmers, water managers and public administration)

Summary:

The project LIFE EBRO-ADMICLIM (ENV/ES/001182) puts forwards pilot actions for adaptation to and mitigation of climate change in the Ebro Delta (Catalonia, Spain), an area vulnerable to sea level rise and subsidence. The project began in 2014 and ended in May 2018. The Ebro Delta is an internationally recognised wetland area. It is considered to be one of the most vulnerable coastal ecosystems regarding the effects of climate change in the Mediterranean and in the European Union. At present the Delta is experiencing a loss of wetlands and rice fields due to coastal regression, caused by the lack of input of fluvial sediments – which are retained by the river dams along the Ebro basin (the sediment flow is 1-2% of what was before the construction of the dams). This problem is augmented by the reduction in the average elevation or height of the Delta, due to the rise in sea level and subsidence affecting the Delta.

Both coastal regression and elevation loss can only be compensated in the long term with measures aimed at recovering the input of inorganic river sediments and the generation of organic matter in the wetlands and rice fields.

NATURE-BASED SOLUTION 10 / ECOSYSTEM TYPE: WETLANDS, RICE FIELDS AND COASTAL SAND DUNES AND BEACHES

CAS EbA EbM EbMgt

General view of a constructed wetland in the Ebro Delta.

These natural processes can be optimised through innovative techniques of environmental engineering.

Within this context the project allowed for the development and application of new adaptation strategies to cope with this elevation loss caused by sea level rise and coastal regression in the Delta. Furthermore, the adaptation measures were combined with mitigation measures designed to reduce the emissions of greenhouse gases (GHG) and increase the amount of carbon stored in rice fields and wetland areas. Rice cultivation in flooded fields is considered to be a significant source of greenhouse gases (GHG) – especially of methane (CH_4). It is also known that one of the most efficient ways to reduce these emissions without affecting rice production is by airing the soil at specific times. In this sense, the management of soil organic matter is an important tool for both adaptation (through carbon storage and raising the ground level) and for mitigation (through reductions in GHG emissions).

The project applied an integrated approach for managing water, sediment and habitats (rice fields and wetlands), which acted on multiple levels, such as:

- optimizing ground elevation (through inputs of inorganic sediment and organic matter) to gain accretion and progradation to compensate for the relative sea level rise (taking also into account the subsidence and low sediment flow),
- reducing coastal erosion,
- increasing the accumulation (sequestration) of carbon in the soil,
- reducing emissions of greenhouse gases (GHG) by means of an appropriate management of rice fields (they can release carbon or act as carbon sinks),
- improving water quality by means of constructed wetlands.

This type of approach has not been applied so far in the European Union, and it is clearly innovative internationally.

NATURE-BASED SOLUTION 10 / ECOSYSTEM TYPE: WETLANDS, RICE FIELDS AND COASTAL SAND DUNES AND BEACHES

Societal challenge/s:

Respond to several mitigation and adaptation needs linked to climate change in a delta area:

Disaster risk Reduction. By acting to avoid coastal erosion and salt intrusion.
Water Security. By improving water quality that has strong use by agriculture before returning it to nature.
Climate Change. Reducing greenhouse gas emissions by means of appropriate agriculture practices in rice fields.

NbS concepts:

Climate change adaptation services,
Ecosystem-based adaptation,
Ecosystem-based mitigation,
Ecosystem-based management.

Objectives:

Development of pilot actions of mitigation and adaptation to climate change in the Ebro Delta.

The pilot actions were focused on the integrated management of water, sediments and habitats (rice fields and wetlands) with the following multiple objectives:

- Optimizing increases in land elevation.
- Reducing coastal erosion.
- Increasing the accumulation (sequestering) of carbon in the soil.
- Reducing greenhouse gas (GHG) emissions.
- Improving water quality.

The principal pilot actions of adaptation were focussed on transferring sediments from the river Ebro to the Delta. The aim was to demonstrate the viability of restoring sediment flow permanently, from both the CAT (Consorci d'Aigües de Tarragona, Tarragona Water Consortium) water treatment plant and from the reservoirs on the lower stretch of the river. To this end, an assessment of the transportation capacity of the river and canals was carried out.

Pilot test of injection of sediment into the Ebro Delta irrigation network.

The pilot actions in the rice fields and wetlands were aimed at optimizing GHG emissions, carbon and nutrient sequestration and increasing the ground level of the Delta.

The results are being used to draw up the directives of the programme of mitigation and adaptation measures, with emphasis on the rice production sector, and to develop an official strategic document regarding climate actions in the Ebro Delta. Improving the GHG emission and carbon sequestration rates via a change in management practices (for example, a more efficient water use management) can represent a significant improvement which could be applied to other wetland and rice cultivation areas in the European Union.

NATURE-BASED SOLUTION 10 / ECOSYSTEM TYPE: WETLANDS, RICE FIELDS AND COASTAL SAND DUNES AND BEACHES

In the LIFE EBRO-ADMICLIM project we performed an operational optimization of two constructed wetlands to maximize carbon sequestration, soil elevation and, assimilation of nutrients and pollutants from the rice fields' drainage water.

Impacts:

Successful integration of research and innovation goals under a sound scientific paradigm with practical application (Nature-based Solutions).

- Effective integration of a complex team of diverse institutions: research institutes, universities, public administrations, water managers, private companies, farmers, etc.
- Strong interaction with the local rice sector and irrigation communities, as well as NGO's aimed to preserve the Ebro Delta.
- Relevant outcomes in terms of innovation: new system of sediment recycling from a water purification plant (CAT), new agronomic practices to reduce GHG emissions (rice sector), new sediment management guidelines (hydropower companies, water managers), new sediment transport model (universities, irrigation communities).
- The interest of several private companies has been attracted: some consulting and engineering companies related to water management are interested in implementing some of the ideas developed within the project, such as the techniques to by-pass sediments through the reservoirs.
- The outcomes of the project have a great potential to generate future R+D projects with the private sector and leading research groups, especially in the field of water and sediment management and climate change adaptation.
- Real impact on Catalan and Spanish policies: creation of a Technical Commission on Sediments (Generalitat de Catalunya); votes in the national and regional Parliments (Parlament de Catalunya and Congreso de los Diputados) to ask the governments for action to by-pass sediments; the European Union is considering the convenience of setting some sediment management guidelines.

Results of the project will be taken into account to develop the Catalan Strategy for Climate Change Adaptation.

The Life EBRO-ADMICLIM project has been the first at EU level to implement a series of Nature-Based Solutions that integrate the objectives of both adaptation and climate change mitigation in a coastal area, which is highly vulnerable to flooding, erosion and salt intrusion.

Information:

The project LIFE EBRO-ADMICLIM – Mitigation and adaptation measures to climate change in the Ebro Delta (Life 13 ENV/ES/001182)

Agro-ecological project of Petit Saint-Jean

Location:
Petit Saint-Jean farm,
Saint-Laurent d'Aigouze,
La Camargue (France)

Leading institution:
Tour du Valat (Research Institute for the conservation of Mediterranean wetlands)

Period:
2012 - on-going

Scale:
Local

Involved institutions/stakeholders:
Fondation de France.
Agroof.

In order to put in place the activities and ensure the sustainability of the project, a strong emphasis has been placed on creating a network of partners for the project. The partners range from regional, political partners to local farmers. Together, they are working with several agricultural and forestry schools to test new techniques and to train future land managers, as well as with different agro-ecological networks to share experiences and test innovated practices. With several hundred visitors per year, the Petit St. Jean is able to gain insight from a variety of stakeholders (scientists, farmers, land managers, students…) and to share the experiences.

EbMgt

Summary:

Since 2012, the Tour du Valat has been leading an innovative agro-ecological project in Petite Camargue, on the land of Petit Saint-Jean, which is located in the Gard Camargue, mid-way between Arles and Montpellier, and a few kilometres away from the historic city of Aigues-Mortes.

The Petit Saint-Jean estate covers 100 hectares made up of three main components: pine forests (which have mostly disappeared from the rest of the territory) a mosaic of wetlands and sandy agricultural land.

The Tour du Valat aims to put in place a showcase of land management practices that demonstrate the compatibility and advantages of integrating agricultural and nature conservation activities. The showcase also includes social and economic components to ensure the sustainability of the actions.

The project is based on the principles of agro-ecology and permaculture; two complementary approaches founded on respect of the functioning of natural ecosystems, and in particular taking into account the rich and complex interactions that characterize them, in order to make agricultural production more respectful of the environment as well as more efficient in the long-term.

At Petit Saint-Jean, chemical inputs are reduced to a minimum, while the use of renewable energies and materials are favoured (animal traction, solar pump, reuse of biomass, etc.)

In the context of climate change, special attention is also given to water use for agricultural irrigation. The use of traditional and innovative water retention practices (mulching, drip, etc.) are being implemented as well as the selection of drought resistant varieties (southern France grape varieties for the vines, fruit trees adapted to Mediterranean climate, for example).

Societal challenge/s:

Climate change adaptation and food security.

The project create a showcase of agro-ecology locally and in the entire French Mediterranean area, in order to transfer the agronomic practices to wide variety of actors.

NbS concepts:

Ecosystem-based management.

NATURE-BASED SOLUTION 11 / ECOSYSTEM TYPE: AGRICULTURAL

Objectives:

Experimentation and development of agro-ecology project locally and in the entire French Mediterranean area, and showcase it in order to transfer the agronomic practices to wide variety of actors.

Impacts:

The project has developed and tested agro-ecological techniques that are both productive and environmentally-friendly, particularly in terms of water resources and the exploitation of renewable resources, given the forecast for a high level of global warming in the Mediterranean area.

The project also protects natural environments of high value (wetlands in particular) in a French Mediterranean region that is subject to strong anthropogenic pressures (agriculture, urbanisation, etc.). Regular monitoring has been put into place to determine the impact of the activities on biodiversity (insects, mammals, birds, reptiles, amphibians and plants), as well as monitoring the long-term agronomic (soil quality), ecological (carbon sequestration capacity) and economic (cost-benefit analysis) impacts of the project.

Information:

Project description – Tour du Valat

Brochure: Le Domain du Petit Saint-Jean – Tour du Valat

Adaptation of the Camargue's former saltworks to climate change

Location:
Camargue, Bouches-du-Rhône, France

Leading institution:
Conservatoire du littoral, Parc naturel régional de Camargue, Tour du Valat, Société nationale de protection de la nature

Period:
2011 - on-going

Scale:
Local

Involved institutions/stakeholders:
Municipality, SYMADREM (public organization in charge of flood risk management), local NGOs and stakeholders

EbA Eco-DRR

Summary:

The area now owned by the Conservatoire du littoral was dyked between 1950-1970 and converted into salt pans. A restoration process through adaptive management was put in place by the Regional Natural Park of the Camargue working in partnership with the Tour du Valat Research Institute, the National Society for Protection of Nature, and the Conservatoire du Littoral. The management methods being set up are intended to create a buffer zone to the sea level rise process induced by climate change and to restore the functionality of the lagoon habitats, taking into account coastal dynamics, restoration of ecosystems (coastal lagoons, Mediterranean halophilous scrubs), the conservation of colonial waterbirds, and the regulation of human activities. It is an opportunity to reinforce the wildness of the coast (rare case in the Mediterranean coastline). An economic benefit is to re-establish the fish migrations, including those of exploited and threatened species such as the European Eel. The on-going restoration and management project started in 2011. Hydraulic works were made in 2014-2015 and in 2019.

Societal challenge/s:

Adaptation to climate change through coastal zone protection. Infrastructures to prevent sea floods are maintained inland but dykes on the coastline are abandoned, resulting in depolderisation of 4000 ha. The site will act as a buffer zone to adapt to sea level rise, raising the question of social acceptability to the management change as the site which is culturally strongly appropriated and used for recreational activities becomes less accessible.

Fisheries in the surrounding wetlands are expected to benefit from the lagoon restoration process as hydrobiological connexions and fish migration between the sea, the former salt pans and the surrounding wetlands are being restored.

NbS concepts:

Adaptation to climate change using:
Ecosystem-based Adaptation,
Ecosystem-based Disaster Risk Reduction (ecoDRR).

Objectives:

Adaptation to coastal erosion and sea level rise, coastal wetlands restoration.

NATURE-BASED SOLUTION 12 / ECOSYSTEM TYPE: COASTAL LAGOONS, MEDITERRANEAN HALOPHILOUS SCRUBS, BEACHES

The main objective were to restore the natural hydrological processes by reconnecting the lagoons within the site and with the surrounding aquatic ecosystem and the sea. The management objectives set were:

– restore a more natural hydrological functioning;
– restore the natural ecosystems characteristic of coastal lagoons and sandy coastlines;
– maintain or increase the carrying capacity for breeding colonial water birds;
– implement adaptive management to sea level-rise, including controlled coastal retreat in areas affected by erosion;
– contribute to sustainable developments, including facilitating the development of green tourism and recreational activities.

Impacts:

To evaluate the effectiveness of NbS in the former saltworks restoration project, the implementers identified the challenges, actions and impacts based on the EU guideline EKLIPSE for Nature-based Solutions. They also assessed the environmental, economic and social aspects of the project.

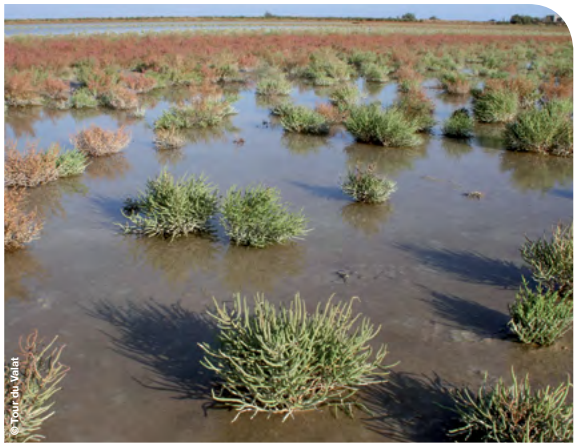
The project improves the state of conservation of a significant portion of the region's coastal ecosystems. Large surfaces of Mediterranean halophilous scrubs are already restored; the functionality of the coastal lagoons and connexions for fish migration are progressively improved. Beaches are being restored along 4Km of coastline where this ecosystem had previously completely disappeared because coastal defence infrastructures were impeding the natural retreat of the coastline.

This innovative strategy avoids the maintenance and reinforcement of grey infrastructures located along the coastline (investment estimated at c. 30 millions €) but foresees the adaptation of the inner dike (estimated at c. 10 millions €).

Furthermore, this strategy means that there are no longer ecological impacts related to rock quarry operations and rock transport from the mining area to the saltwork coast.

The project includes making frequentation of the beaches comply with the existing regulations. More than 10 km of beaches previously open to motorised traffic and the parking of vehicles are now only accessible on foot and by bike.

The restoration of the former saltworks generate social benefits such as protection against climate change, the production of scientific knowledge, recreations and tourism opportunities and inspiration for art and design.



Restoration of salicornia

Information:

Project description: The restoration of the former saltworks in the Camargue: a Nature-based Solution to adapt to sea-level rise.

Brochure: Nature-based Solutions in the Camargue's former saltworks

FRESHWATER

The ecological restoration of the Segura and Moratalla Rivers respond to the concept of Nature-based Solutions linked to Disaster-Risk Reduction because of flooding, by means of the restauration of natural ecosystems as well as Water Security by improving water quality thanks to the recovery of the riparian forest. In addition to respond to those societal challenges, the project allowed to create a strong social network of people involved in the continuity of the actions.

NATURE-BASED SOLUTION 13 / ECOSYSTEM TYPE: RIPARIAN FOREST

Ecological restoration of the Segura and Moratalla Rivers, control of non-tree invasive alien species and restoration of Priority Habitats of Community interest

Location:
T.M. of Abarán, Cieza, Calasparra and Moratalla (Murcia, Spain)

Leading institution:
Confederación Hidrográfica del Segura (CHS)

Period:
2013-2017 (LIFE+SEGURARIVERLINK)
2014-2019 (LIFE+RIPISILVANATURA)

Scale:
Local

Institutions involved and interested parties:
Office to boost the socio-economic development of the Environment (OISMA) - Autonomous Community of the Murcia Region; Naturalists Association of the Southeast (ANSE)

ER Eco-DRR GI

Summary:

The actions described was implemented in the context of two EU LIFE Projects:

- Ecological restoration of the Segura and Moratalla Rivers in the scope of the LIFE+SEGURARIVERLINK project (LIFE12ENV/ES/1140);
- Control of non-tree invasive alien species and restoration of Priority Habitats of Community interest, within the LIFE+RIPISILVANATURA project (LIFE13/BIO/ES/001407)

The actions allowed the restoration of the riparian forest in both rivers, to foster the creation of a green infrastructure and connect different ecosystems in order reduce flooding and restore habitats' fragmentation. The actions of SEGURARIVERLINK were developed along 57 km length included in a longer sector of 80 Km corresponding to RIPISILVANATURA.

Both projects include actions to control expansion of invasive alien species and promote the colonization of the riparian forest by native species. Actions involve the permanent removal of the giant reed *(Arundo donax),* once introduced as a building material to be used in agriculture and housing, but seldom used nowadays. Since its great capacity for regrowth, giant reed displaces native species. IUCN considers it as one of the 100 most dangerous animal or plant species in terms of its ability to invade and alter the habitats it colonizes. Among its impacts is the capacity of this species to exclude by competition for the space the autochthonous species until its total substitution and the consequent impoverishment of plant and animal communities. Therefore, apart from reducing biodiversity, it also reduces the water flow, promotes sedimentation and clogging of water courses and promotes

evapotranspiration. These impacts can be summarized into a global decrease in the availability of water resources. Finally, it modifies the fire regime, due to its ability to burn and the high amount of biomass that it accumulates.

Once removed, the area has been replanted with native trees, shrubs and herbaceous plants to recover the original riparian forest, restore transversal connectivity and improve the ecological condition of waters.

The restoration and creation of a land stewardship network have gone hand-in-hand, working alongside owners of adjacent lands. Many Environmental Volunteering activities have been performed, aimed at different sectors (general public, fishermen, rice growers, etc.) as well as an Environmental Education campaign with schools and colleges in the area.

In addition of flood zones- that reduce damage during floods- the project contributed to improve biodiversity and liveability thanks to its effects trough the ecological corridor, an attractive landscape, microclimatic regulation, decrease in water temperature, water purification, decrease of water consumption, decrease of fire risk and increase of water quality. Furthermore, tourism and recreational activities were organized, such as fishing, hunting, gathering plants, hiking, water activities and sports, among others.

Societal challenge/s:

The main societal challenges were **disaster risk reduction** and **water security.**

It can serve as an example for other Mediterranean rivers on how to create green infrastructure for natural flood prevention and recover water quality.

The density of the giant reed reduces the penetration of light and prevents the development of a diverse shrub layer, so that a less heterogeneous habitat is generated.

It also negatively affects hydrology and hydromorphology. The giant reed fields in the margins of the rivers work in practice as walls, concentrating the energy of the water flow in the channel, which leads to its excavation and collapse on the banks during floods. During these events, giant reeds and rhizomes can accumulate forming dams and functioning as barriers.

Additional societal challenges were also relevant in the project, such as:

1. Recreational: Elimination the giant reed allows stress relief and enjoyment as well as activities such as fishing, cycling and watching wildlife.
2. Increase awareness: Both projects were implemented in a participatory way which increased awareness and made key stakeholders feel they were also responsible for the river.
3. Aesthetic: restoring autochthonous vegetation creates a nicer surrounding and improves social behaviour (ej reduces littering).
4. Cultural, spiritual: rivers have always being part of our culture and many people find direct mental well-being benefits (e.g. stress and mental ill-health).

Objectives:

Restoration of the riparian forest to foster the creation of a green infrastructure and connect different ecosystems.

Impacts:

The main expected outcome is to apply the techniques validated in the project to the rest of the basin through the Hydrological Plan of the Segura Basin, to help connect protected areas and to maintain the good condition of the ecosystems, to thus comply with the requirements of the Water Framework Directive (WFD). Although the WFD does not specifically mention invasive alien species (IAS), in the context of the directive's objectives IAS represent an important pressure since they can modify the native biological structure and ecological functioning of aquatic systems. The assessment of IAS as a biological pressure should therefore be considered as part of a catchment management policy together with other pressures and should receive particular focus when assessing whether a water body is characteristic of reference status (REFCOND 2003; IMPRESS 2003).

Information:

LIFE+ SEGURA RIVERLINK (LIFE12 ENV/ES/1140)

LIFE+ RIPISILVANATURA (LIFE13 BIO/ES/1407)

Tourism is an important component of the economy in many Mediterranean countries, but often tourism is, as well, a spoiling factor for landscape, abusing many kinds of resources. A common example is water pollution by using small and big chlorine pools in resorts, hotels and holiday houses. Offering places with water for swimming and recreation is an essential condition for a tourism to achieve economic success, especially in the Mediterranean climate. However, the common use of chlorine (cheapest treatment) has a strong impact in biodiversity as and the ozone layer deterioration, apart from affecting people's health (its use is forbidden for babies).

Biological swimming pool is a Nature-based Solution that approaches water and health security for bath waters from an ecosystem approach. It applies natural processes as the basis to keep pool water in optimal conditions for bath and reduces all the impacts of standard treatments at the time that contributes to maintain fresh water biodiversity by restoring aquatic ecosystems. Despite its size, the spread of this model among the hotels and resorts business community, would have a great impact in the short term on water consumption, pollution as well as in the reduction of CO_2 emissions captured by the ecosystem.

NATURE-BASED SOLUTION 14 / ECOSYSTEM TYPE: FRESHWATER POND/WETLAND

Biological swimming pool

Location:
Praia da Maria Luisa, Albufeira (Portugal)

Leading institution:
CLUB MED da Balaia

Scale:
Local, national and international

Involved institutions/stakeholders:
Bio Piscinas, Lda., Club Mediterrannée

EE EbMgt ER

Summary:

Water security and public health are crucial in society. Those, water use require a set of treatments to ensure its potability, either for drinking or bath water. Conventional swimming pools contribute to the degradation of ecosystem services, since the purification of water requires besides chlorine, other products for pH adjustment and algicides, toxic for a large number of species. On the other hand, biological pools are built lakes that mimic and recreate the ecological processes that occur in natural systems, constituting a natural engineering solution, which allows creating aquatic leisure spaces with low environmental impact. In these systems, water purification, with the objective of having quality for bathing purposes, is performed by biological filters and aquatic plants (use of ecosystem services). As no chemical is added to the water these systems are quickly colonized by plankton, macroinvertebrates and some vertebrates, promoting the maintenance of biodiversity and increasing the aesthetic value of the environment (conservation and restoration of ecosystem services). Biological pools also function, on a landscape scale, as habitats that facilitate the flow of some species between different watercourses and as reservoirs of water.

The users of the natural swimming pool (NSP) of CLUB MED da Balaia will remember it as a show case of good water practice (no additives, only biological processes are cleaning) and a place of natural beauty and biotope for wetland species like amphibians and water insects. Considering that the new model has been incorporated by a hotel chain, it is expected to be easily spread in the near future. In fact, this is just the biggest case of a new practice that is spreading along Portugal, with

more than 200 biopools; and is more common in other European countries (Austria, Germany, Czech Republic or Slovakia) including some Mediterranean ones as Slovenia.

Societal challenge/s:

Water security and Public health:
This practice deals with water management and water security, especially in terms of water quality and public health. The challenge is, how to offer places with recreational water -fulfilling quality standards- which are not harmful for human health, provide human well-being and, at the same time, restore natural or modified wetland ecosystems and have biodiversity benefits.

NbS concepts:

Ecological Restoration,
Ecological Engineering,
Ecosystem-based Management.

Objectives:

The objective is to substitute conventional swimming pools by an ecosystem (artificial wetland/lake) that act as Natural Swimming Pools, able to purify bathing water without using any additive. The methodology allows keeping good water quality standards avoiding the use of chlorine, as well as the complete renewal of pool water once a year. So, specific objectives are water starvation and chlorine pollution reduction (avoiding its health problems). The process is done means of plankton and biofilm organisms; that are complemented by vascular plants allowing creating a well oxygenized environment for those microorganisms.

The main focus is to show and to give direct experience that a swimming pool of a Hotel Resort can be a hot spot of biodiversity and, at the same time, raises awareness about the quality of water and its importance for human health. This combination gives an example of good environmental and healthier techniques (use and treatment of water) and the experience of “swimming with the frogs” will be transmitted by the users to many people.


Crédito foto Lorem ipsum

To create these conditions, the designers6 have to stay more or less close to all the examples natural wetlands offer (in terms of biological interaction in-between living beings and between living beings and non-living natural compounds).

The results offer a lot of possibilities for the users to have encounters with all kind of organisms being attracted as well by the new water spot: all kinds of amphibians, water related reptiles like water snakes and tortoises, a lot of insects and their larvae like dragonflies and songbirds coming to drink or having a quick bath.

Impacts:

A natural swimming pool has many different kinds of impacts:

- Contributes for the wellbeing of its users by offering a much healthier form for swimming than conventional solutions for cleaning swimming water.
- Starves water by using inland water with techniques of bioeconomy.
- Reduces energy consumption per bather or square meter compared to conventional solutions.
- Reduces the impact to the ozone lack in the atmosphere, partly caused by chlorine gazes.
- Captures CO_2, acting as a sink (like most wetlands)
- It is resource efficient because natural swimming pools do not produce any liquids harmful for the environment because the water quality is equal to water of meso- to oligotrophic shallow lakes8.
- Natural swimming pools can act as step-stone habitats for a lot of wetland related organisms like amphibians and water insects. In the Mediterranean landscape they are much more attractive for organisms than irrigation dams9 because those often have constant clay turbid water.

The promotion of this kind of natural swimming pools along Portugal has encouraged the draft of new regulations as those existing in other EU countries (North Italy, Germany and Austria) to be applied in public and private initiatives.

Information:

Further information on Biopiscinas

Performance of Natural Swimming Pools

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List of acronyms

ACA	Catalan Water Agency
AEB	Association Ecologique de Boumerdes
AFD	French Agency of Development
AGIR	Association of Integrated Resource Management
ANSE	Naturalists Association of the Southeast (Murcia, Spain)
ASAJA	Agrarian Association of Young Farmers,
CAT	Tarragona Water Consortium
CBD	Convention on Biological Diversity
CHS	Confederación Hidrográfica del Segura
COAG	Coordinator of Organisations of Farmers and Livestock Owners
CREAF	Ecological and Forestry Applications Research Centre
CRSAE	Community of irrigators of the Ebro Delta
CSIC	Spanish National Research Council
DKM	Nature Conservation Centre (Turkey)
EC	European Commission
EU	European Union
FFEM	French Global Environment Found
GEF	Global Environament Facility
GHG	Greenhouse gases
GIS	Geographic information System
GIZ	German Agency for International Development Cooperation
HCEFLCD	High Commission for Water and Forests and the Fight against Desertification of Morocco
HEPCA	Hurghada Environmental Protection and Conservation Association
ICGC	Cartographic and Geological Institute of Catalonia
IMTA	Integrated multi-trophic aquaculture
IRTA	Institute of Agrifood Research and Technology of Catalonia
IUCN	International Union for Conservation of Nature
LIFE EBRO-ADMICLIM	Adaptation and mitigation measures to climate change in the Ebro Delta
MDG-F	Millennium Development Goals Achievement Fund
MedPAN	Mediterranean Network of Marine Protected Areas
NbS	Nature-based solutions
OCCC	Catalan Office for Climate Change
OISMA	Office to boost the socio-economic development of the Environment. Autonomous Community of Murcia
PNAH	Al Hoceima National Park
R&I	Research and Innovation
RAC	Regional Activity Centre of UNEP/MAP
SACE	Andalusian Emission Offsets System
SDG	Sustainable Development Goals
SDG 14	Sustainable Development Goal 14
SEO/BirdLife	Spanish Ornithological Society
SGP	Small Grants Programme
SPA	Special Protection Areas
UCO	University of Cordoba
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNEP/MAP	Mediterranean Action Plan of United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Project Services
UPA	Union of Small Farmers and Livestock Owners
VMS	Vessel Monitoring System
WWF	World Wildlife Fund

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Resolution 69 (Motion 77) on Defining Nature-based Solutions

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