

Scoping report

conducted for the

Sicily Environment Foundation



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INTRODUCTION

Sicily, located in the south of Italy, is the most extended region of Italy and the widest island in the Mediterranean. For a long time, it has been a territory of conquest due to its climate, soil fertility and geographical position in the Mediterranean basin, between the European and African continents. Historical events have defined cultural complexity as a distinctive feature of this land, which together with its natural beauty, diverse landscapes and high biodiversity call for greater conservation effort.

Sicily, at the center of the Mediterranean basin - recognized as a biodiversity hotspot – offers a great diversity of habitats and ecosystems: marine, coastal, inland and high-mountainous. Notably one of the regions with the most marine protected areas in Italy, the island is one of the major reservoirs of coastal and marine biodiversity. Land use is dominated by agriculture, about 63% of the territory; while 31% is characterised by semi-natural and natural vegetation, including broadleaved and coniferous forests, maquis and garrigue communities, as well as grasslands and rock outcrops. About 5% is occupied by human settlements.

Over the years, there have been efforts of environmental activists, scientists, institutions and civil society organisations to protect the natural heritage and raise awareness on the main environmental challenges that are threatening the region. Yet, numerous issues need further support in order to be overcome and achieve effective conservation targets. The EU 2030 Biodiversity Strategy and Farm to Fork, two key components of the EU Green Deal, propose a comprehensive set of targets that will need a concerted effort in order to be achieved through specific actions on topics such as protected areas, ecosystem restoration, organic farming and reduction of agricultural chemicals. Undoubtedly, the Sicily Environment Foundation will play a key role in supporting local projects and grassroots organisations who are not able to sustain themselves or provide funding for long-term sustainability of the initiatives.

There is great potential for the Sicily Environment Foundation to establish close collaborations within the Conservation Collective network with the Tuscany Environment Foundation at national level, but also with the other foundations in the Mediterranean region. Such cross-border cooperation for conservation, enabled through the sharing of best practices and project frameworks, will strengthen the Conservation Collective network and will increase the potential impacts of initiatives: at a local level, by benefitting from the exchange of best practices between foundations, and at a regional level, by sharing effective methods and frameworks that can be replicated in different contexts. Once again, Sicily's central location in the Mediterranean could be strategic: the largest island in the Mediterranean Sea may become the center for the conservation of this biodiversity hotspot.

This report highlights the main environmental challenges, priorities and opportunities for conservation in Sicily and was informed by an extensive literature review and interviews with key informants from NGOs and academia.

"Italy without Sicily leaves no image in our spirit, here is the key to everything.

The purity of the contours, the softness of everything, the exchange of soft colors,

the harmonious unity of the sky with the sea and the sea to the land...

Who saw them once, shall possess them for a lifetime"

Johann Wolfgang von Goethe.

1.1 SICILY REGION: AN OVERVIEW OF ITS NATURAL ENVIRONMENT

Geography

Sicily, the largest and most densely populated island in the Mediterranean Sea, extends for 25,707 km². Its position at the center of the Mediterranean Sea makes the island a bridge between the European and African continents. It is located between the Strait of Gibraltar and the Suez Canal, just 140 km from the North African coast and is separated from the mainland by the Strait of Messina (3.4 km). The Sicilian territory is complex and irregular: 62% hilly, 24% mountainous and 14% flat. It has the characteristic shape of an isosceles triangle, thus earning the name of *Trinacria*. The north is mainly mountainous, the central-south area is mainly hilly, the south-east is typical of the highlands, whereas the north-east section is characterized by the mountain chain of the highest active volcano in Europe, Mount Etna, which rises 3,350 meters over the sea. Sicily is characterised by a Mediterranean climate, with long, hot and dry summers and mild winters with temperatures rarely going below 7-8 °C. It is inhabited by 5 million people, with a density of 190 people per km² (values refer to 2019). The main industries are agriculture, wine industry and fisheries. Agriculture is the principal economic activity producing olives, citrus fruit, almonds, wine grapes, wheat, barley; while cattle, mules, donkeys, and sheep are also present. Petroleum, natural gas and sulfur are produced and managed by foreign companies.



Volcanism

The Sicilian channel, between Sicily and Tunisia, is the result of the African and European continental plates, compressing the crust both on the seabed and mainland. This activity, which has lasted for at least 25 million years, is still ongoing and results in three large volcanic districts: the Aeolian Arch, with 8 emerged islands (Aeolian and Ustica) and numerous submerged volcanoes; the Etno, mainly Mount Etna; the Sicilian channel

with 2 islands of volcanic origin (Pantelleria and Linosa) and numerous submarine volcanoes to which is connected the recent formations of Ferdinandea and Foerstner, ephemeral islands that emerged briefly.

Coastline and small islands

Sicily has 1.039 km of coastline. The Tyrrhenian coast is generally high jagged, sandy or pebbly and there are numerous gulfs. The coast of the Sicilian Sea, from north-west to south-east, is low and sandy with a hilly hinterland. The dune system, now discontinuous, favors the formation of various marshes. There are a large number of islands, islets and rocks different in origin and landscape: Pantelleria; Ustica; the Aeolian archipelago (Vulcano, Lipari, Salina, Panarea, Stromboli, Alicudi, Filicudi); the Egadi archipelago (Favignana, Levanzo, Marettimo); the Stagnone archipelago (Formica, Macaone, Mozia, Isola Grande); the Pelagie archipelago (Lampedusa, Linosa, Lampione); others little ones close to the mainland like Isola Bella, Isola Lachea, Isola delle Femmine, Isola delle Correnti, Isola di Capo Passero. Many are of volcanic origin or are still active volcanoes, others are calcareous. The islands are important resting places for migratory birds and host large colonies of species of community importance, such as Shearwaters in Linosa, the European storm petrel (*Hydrobates pelagicus*) in Marettimo, the Eleonora's Falcon (*Falco eleonora*) in the Aeolian islands and Lampedusa.

Flora and fauna

With **3.252 specific and intraspecific taxa of vascular plants**, Sicily has one of the highest floristic diversity values in Italy and in the entire Mediterranean region. Over 4% (137 species), are protected by national and international regulations. There are 500 endemic taxa, equal to about 16% of the overall vascular flora of Sicily, including rare or relict species such as *Abies nebrodensis*, *Zelkova sicula*, *Fraxinus excelsior subsp siciliensis*, *Taxus baccata*, *Quercus cerris subsp. gussonei*, *Celtis tournefortii subsp. asperrima*, *Pyrus sicavorum*. From the analysis of the conservation status of autochthonous vascular flora it appears that 403 taxa, equal to 12.4% of the Sicilian flora, are subject to a concrete risk of extinction (IUCN categories CR, EN, VU), while another 220 (equal to 6.8%) are potentially close to be (IUCN category NT).



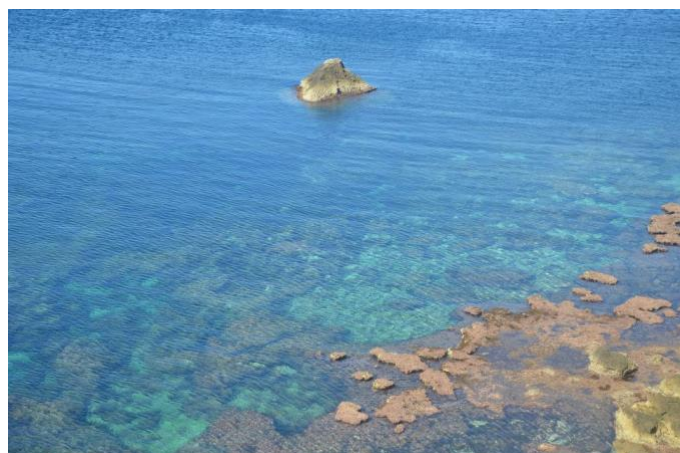
Altogether, there are **207 terrestrial vertebrate species** distributed as follows. **Mammals** are 23 species plus 20 species of Chiroptera (bats). Four species were introduced by man: the wild boar, the fallow deer, the nutria (river Irminio) and the mouflon (on the island of Marettimo). Between XVIII and the mid XX century, fallow deers, roe deers, red deers, boars, wolves and otters were definitively extinct in Sicily, primarily due to land-use change and hunting. Historical information on the distribution of the Monk seal (*Monachus monachus*) along the coasts of Sicily and small islands, report its presence up to the XVIII century. This species should be considered extinct throughout the Italian territory, although recently erratic individuals have been observed in the southern Tyrrhenian and along the Sicilian coasts. The 20 species of Chiroptera are protected (Habitat Directive, Bonn Convention, Bern Convention) and more than half fall into the EN or VU categories of the IUCN.



Sicily is an important transit and wintering land for many bird species. Many of the important habitats for these birds are now strictly protected. There are 155 species of **nesting birds**: 23 declining species, 68 stable species and 60 recently increasing species. Two extinct species (*Porphyrio porphyrio* and *Gyps fulvus*) have been reintroduced and two others (*Sterna hirundo* and *Sterna sandvicensis*) are occasional nesters. As regards to the raptors, the residual populations of Red Kite (*Milvus milvus*) and Egyptian Vulture (*Neophron percnopterus*) in the Sicani Mountains are now on the verge of extinction.

There are 22 species of **reptiles**, several of conservation interest. For example, the Sicilian pond turtle, *Emys trinacris*, is an endemic species assessed for the IUCN Red List as data deficient in 2004; and the land turtle or Hermann's tortoise, *Testudo hermanni*, near threatened for the IUCN Red List, is considered an umbrella species. Both are strictly protected by regional law; and included in the Bern Convention (Appendix 2), in the Washington Convention (CITES) (Annex A) and in Directive 92/43 (Appendices 2 and 4). The loggerhead turtle, *Caretta caretta*, assessed as endangered for the IUCN Red List, is protected by regional, national laws and by international conventions. It has been regularly observed in the seas surrounding Sicily and nests regularly in Pelagie Islands and along the southern coast of Sicily.

There are 6 species of **amphibians**, the majority are protected and/or of conservation interest. The Sicilian green toad (*Bufo siculus*) is an endemic species recently discovered (2008). The Mediterranean painted frog (*Discoglossus pictus*) is found in Sicily, Malta and Mediterranean Africa; it is protected by the Habitat Directive and considered of conservation interest. The Italian tree frog (*Hyla intermedia Boulenger*) is an Italian endemic species, once very common in freshwater marshes, orchards and gardens the inevitable decline of the populations can be avoided only with strict conservation policies and protection measures.



The Sicilian **marine environment** is among the richest and most populated of marine species in the whole Mediterranean. Habitats protected by the Habitat Directive include: Sandbanks which are slightly covered by sea water all the time (1110); *Posidonia oceanica* meadows (1120); Large shallow inlets and bays (1160); Cliffs (1170); Submerged or partially submerged caves (8330). Several species are protected under Annex IV, such as the echinoderm *Centrostephanus longispinus*, the date shell *Lithophaga lithophaga*, and the fan mussel *Pinna nobilis*. While the endolithic

invertebrate *Pholas dactylus* is a species of conservation interest reported only in Greece, Balari Islands and the Italian Adriatic coasts.

Coralligenous habitats are some of the most complex and rich marine ecosystems in the Mediterranean, with different species of seaweeds, coralline and brown algae, as well as bryozoans, sponges, corals and ascidians;

while semi-dark caves, dominated by encrusting organisms, are important breeding areas and nurseries of numerous species of crustaceans, fish and echinoderms, including the lobster *Palinurus elephas* and groupers (e.g. *Epinephelus marginatus*, *Hyporthodus haifensis*, *Epinephelus caninus*); the maërl and rhodolite seabed is made up of red algae on the bottom. Habitats in superficial and deep hydrothermal environments host rare species such as the giant foraminifer *Spiculosphon sp* and the carnivorous sponge *Asbestopluma hypogea*.

The reefs in the Strait of Sicily are characterised by a remarkable biodiversity. Posidonia meadows and seaweeds, such as sargassum and Dictyotaceae, dominate the more superficial reefs, which in some cases are also densely populated by gorgonaceous (e.g. *Eunicella singularis*) and laminaria corals, around 50/60 meters deep. Over 80 meters deep, the rocky bottoms are populated by red coral (*Corallium rubrum*), different species of black coral (*Antipathella subpinnata*, *Antipathella subpinnata*, *Parantipathes larix e Leiopathes glaberrima*), gold coral (*Savalia savaglia*) and other calcified corals (*Dendrophyllia ramea e Dendrophyllia cornigera*).

Cetaceans are protected by Habitat Directive and international conventions. Some of the species known to occur are: fin whale (*Balaenoptera physalus*), long-finned pilot whale (*Globicephala melas*), the sperm whale (*Physeter macrocephalus*), Cuvier's beaked whale (*Ziphius cavirostris*), striped dolphin (*Stenella coeruleoalba*), short-beaked common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), Common bottlenose dolphins (*Tursiops truncatus*). The Mediterranean Sea is also an elasmobranch-rich area with 88 species, but at the same time is the area in the world with the highest proportion of threatened species (at least 53% due to overfishing). Some species of conservation interest known to occur are: the common eagle ray (*Myliobatis aquila*), the sandbar shark (*Carcharhinus plumbeus*), the shortfin mako shark (*Isurus oxyrinchus*).

POLICY

Sicily is one of the five Italian autonomous regions, referred to as Regione Siciliana. It is composed of several departments, including Department of Territory and Environment, Department of Agriculture, Rural Development and Mediterranean Fisheries and Department of Energy and Public Utilities.

2.1 PROTECTED AREAS

Protected areas were envisaged with regional law no. 98 of 1981, which established the first natural reserve, Zingaro Natural Reserve. In 2016, Pantelleria was established as the first National Park in Sicily. There are 245 Natura 2000 sites and about 40% of the network is in agricultural areas. With the Biodiversity Strategy 2030, the expansion of the Network is expected to reach 30% of the regional territory. For example, the Alcantara River Regional Park will be extended up to 30.000 ha. The multitude of National and Regional Parks, marine protected areas and Natura 2000 - for a total of **270.724 ha of protected land** and **79.304 ha of protected sea** - constitute the articulated expression of the Sicilian environment and landscape. The table below presents the different types of protected areas in Sicily.

Type of Protected Area	Number	Name	Surface (hectares)
National Park	1	Island of Pantelleria	6.560
		Madonie Regional Park	39.941

<i>Regional Park</i>	4	Nebrodi Regional Park	85.587
		Etna Regional Park	59.000
		Alcantara River Regional Park	1.900
<i>Marine Protected Areas</i>	7	Island of Ustica	15.951
		Capo Gallo	2.173
		Isole Egadi	53.992
		Isole Pelagie	4.136
		Plemmirio	2.429
		Isole Ciclopi	623
		Capo Milazzo	754
<i>Natura 2000 Network</i>	16	SPAs (terrestrial & marine)	370.994
	217	SACs (terrestrial & marine)	469.022
	12	SCLs (terrestrial & marine)	19.477
<i>Natural reserves</i>	74	Terrestrial	85.181
<i>RAMSAR</i>	4	Biviere di Gela	336
		Oasi di Vendicari	1.512
		Riserva naturale integrale Saline di Trapani e Paceco	910
		Riserva naturale integrale Lago Preola e Gorgi Tondi	335

Coordination of actions and resources for the Natura 2000 network is entrusted to the Sicilian Region Authority. Complying to the Ministerial Decree of 17 October 2007, only the SACs falling within National Protected Areas (Pantelleria National Park and the 7 MPAs), formally, have a managing body. The remaining SACs are formally managed by the Regional Department of the Environment; of which, only the portions of SACs and SPAs that fall into regional Protected Areas (Regional Parks and Nature Reserves) see active management in terms of surveillance and coordination of activities, while for the rest management is limited, such that has led to issuing opinions in the Incidence Assessment procedures. A Network of the Sicilian Marine Protected Areas (RAMPS) has been established to promote exchange of best practices, harmonization of methodologies adopted in the 7 MPAs and to carry out interventions aimed at the protection of the seabed and the sustainability of tourism.

2.2 UNESCO

UNESCO has initiated different conventions and programs aiming to protect natural and cultural heritage. Sicily, with its treasures of historical, cultural and natural importance boasts 7 sites listed in the Tangible World Heritage list, 3 cases of Intangible Culture Heritage and 2 Global Geoparks. The scientific and conservation value of some of these are reported below:

1. **Aeolian Islands** (listed in 2000) provide outstanding records of volcanic island-building and ongoing eruption (Vulcanian and Strombolian). The vegetation, with 900 species, include 4 endemics. Most areas are man-modified landscape with steppe vegetation and abandoned olive and vines. About 40 bird species have been recorded and 10 are under the Sicilian Red List of threatened bird species. The islands, Important Bird Area identified by Birdlife International, are crucial for migrant bird species and congregatory species. As for the mammals, there is one endemic subspecies (*Eliomys quercinus leparensis*) and 7 species of bat. There are 7 species of reptiles, including the newly described *Podarcis raffonei* and 4 subspecies, and 2 subspecies of *Podarcis siculus*. Invertebrate fauna includes over 15 endemic species described.
2. **Syracuse and the Rocky Necropolis of Pantalica** (Listed in 2005) is composed of the Ancient city of Syracuse and the Necropolis. Pantalica is a naturalistic-archeological site, also designated as a natural reserve, with over 5,000 tombs cut into the rock near open stone quarries, most of them dating from the XIIIth to VIIth centuries BC. It conserves an extraordinary landscape as it was in a precise historical period. The property is protected under national provisions of the Legislative Decree 42/2004, Code of Cultural Heritage and Landscape, a safeguarding measure that ensures any activity on the site must be authorized by the Superintendence of Environmental and Cultural Assets of Syracuse.
3. **Mount Etna** (listed in 2013) is the highest Mediterranean island mountain and the most active stratovolcano in the world. It comprises the most strictly protected and scientifically important area of Mount Etna, and forms part of the Etna Regional Park. Mount Etna is renowned for its exceptional level of volcanic activity over at least 2,700 years. Its notoriety, scientific importance, and cultural and educational value are of global significance.
4. **“Vite in Alberello” of Pantelleria** (listed in 2014) is an agricultural practice introduced by Phoenicians. It is a unique pruning system that makes the plant grow low and horizontally, repaired by a basin dug into the ground that protects from the wind and collects the water enabling the production of grape in adverse weather conditions.
5. **Traditional art of dry-stone walls** concerns the construction of stone structures by piling stones on top of each other and not using any other element. In perfect harmony with the environment, the technique exemplifies a harmonious relationship between man and nature. The practice is transmitted mainly through manual application adapted to the particular conditions of each place.

Furthermore, two UNESCO Global Geoparks have been designated in Sicily: Madonie Geopark (listed in 2004) and Rocca di Cerere Geopark (listed in 2001).

2.3 ENVIRONMENTAL LEGISLATIONS AND PROGRAMMATIC FRAMEWORKS

Legal instruments and tools for environmental protection and biodiversity conservation are listed below.

National Tools:

- Decrees of the President of the Republic in compliance with European directives;
- N.L. 394 06.12.1991 principles for the establishment and management of protected natural areas;
- N.L. 11 February 1992 n. 157 Rules for the protection of homoeothermic wildlife and for hunting;
- DGR n.1075 of 5 December 2011 National strategy for biodiversity. Approval and signing of the memorandum of understanding;

- Dlgs. n. 152_2006 Environmental regulations (T.U. ambiente), a law of the Italian Republic which constitutes a single text of the rules on environmental protection and waste management;
- D.Lgs. 03.04.2018 n. 34 e s.m.i. Consolidated Law on forests and forestry chains;
- N.L. 30.11.2020 n. 353 e s.m.i. Framework law on forest fires;
- N.L. 8.11.2021 n. 155 Provisions for fighting forest fires and other urgent civil protection measures;
- National Forest Strategy for the forest sector and its supply chains;
- N.L. 23.02.2010 n. 49 Implementation of the relative directive 2007/60 / EC the assessment and management of flood risks.

Regional Tools:

- PSR Sicilia 2023-2027 for rural development programming;
- PO FESR Sicilia 2021-2027, for European funding programming, developed based on the analysis of needs, problems and opportunities in Sicily through public consultation;
- Regional Forest Plan 2009-2013, entrusted with D.P. n. 158/S.6/S.G. 10 April 2012 for planning, programming and management of regional forest and agroforestry territory;
- Regional program of silvicultural and infrastructural interventions;
- L.R. 6 April 1996, n. 16 Reorganization of forestry and vegetation protection legislation;
- L.R. 14 April 14, 2006 Amendments and additions to the regional law April 6, 1996, n. 16, Reorganization of the forestry and vegetation protection legislation;
- Guidelines on Hydrogeological Risks of the Civic Protection Department of the Sicilian Region.

Alongside these legislative measures, regional offices have developed a series of integrative tools for environmental protection:

- **ARPA Sicilia**, the Regional Agency for Environmental Protection, together with ISPRA and the other regional agencies is part of the National System for Environmental Protection (SNPA). <https://www.arpa.sicilia.it/>
- **Regional Observatory for Biodiversity** established by the Department of Territory and Environment of the Sicilian Region as part of an agreement with ARPA, ISPRA and CNR. It aims at gathering biodiversity data, monitoring ecosystems' health, supporting decision making and raising awareness.
- **Regional Informative Territorial System (S.I.T.R.)** <https://www.sitr.regione.sicilia.it/>
- **Geoportal of Sicily Region**, to search datasets and spatial data services based on the content of the corresponding metadata loaded into the geoportal <https://www.sitr.regione.sicilia.it/geoportale>
- **Prioritized Action Frameworks (PAFs)** are multi annual planning tools, intended to provide overview of the measures needed to implement the EU's Natura 2000 network and related green infrastructure, specifying the financial needs and linking them to corresponding EU funding programs. PAF is based on Article 8 (paragraph 1) of the Habitats Directive, under which Member States are required to submit to the Commission, where appropriate, their estimates of EU co-financing that they deem necessary in order to fulfill the obligations in relation to Natura 2000.

COMMON ISSUES OF CONCERN

Environmental challenges in Sicily are represented mainly by illegal fishing, marine litter and pollution for the marine ecosystems, and from fires, poachers, unauthorized building, petrochemical poles, fossil fuel power plants, mismanagement of waste and eco-mafias for the terrestrials. In the following sections we highlight common issues of concern affecting the region.

3.1 MARINE BIODIVERSITY

Unsustainable exploitation, invasive alien species and pollution are pressing issues in Sicily. **Industrialised fishing** has increased harvest at a rate that exceeds reproductive capabilities of species, leading to the collapse of the more sustainable artisanal fishing. The Atlantic Bluefin Tuna (*Thunnus thynnus*), with spawning grounds in the Mediterranean, has been historically harvested in Sicily with the traditional trap fishing *tonnara*: a selective trap organised around tuna's biological processes. Trap fisheries have been replaced with industrialised and tuna-ranching operations to maximise profits leading to the decline of tuna populations.



Commercial fishing methods such as longlining, trawling and gillnets targeting swordfish and tuna, often result in **bycatch**, the incidental capture of non-target species in fishing gear (e.g. loggerhead turtles, cetaceans, marine birds, sharks and rays). It has been estimated that 44,000 *Caretta caretta* turtles die every year in the Mediterranean Sea, and that longline fishing is one of the most significant causes of mortality. During spring and summer seasons, loggerhead turtles are rescued mainly along the north and eastern coast - a total of 482 specimens were rescued from 2014 to 2016, of which only 66 were successfully rehabilitated and released. Furthermore, recreational fishing is a common activity in summer with an elevated use of longlines; whilst this activity is regulated by Italian law, enforcement is inadequate.

More than 1000 **alien species** have been recorded in the Mediterranean Sea, many of these also in Sicilian seas. Some non-indigenous species that can now be observed are: the blue crab (*Callinectes sapidus*), sally lightfoot (*Percnon gibbesi*), silver-cheeked toadfish (*Lagocephalus sceleratus*), bluespotted cornetfish (*Fistularia commersonii*), and dusky spinefoot (*Siganus luridus*). Of particular concern is the rapid geographical expansion of the lionfish (*Pterois miles*), native to the Red Sea; it has been observed along the Sicilian coasts and further expansion is expected. Invasive seaweeds cause severe impacts on natural habitats, for example: *Asparagopsis taxiformis*, *Caulerpa cylindracea*, *Lophocladia lallemandii*. *Ostreopsis ovata* causes high biomass blooms and pose threats to marine biodiversity, human health and aquaculture. The occurrence of this species might be related to microbiological pollution.

Other marine threats are related to increased **pollution**, such as marine litter, microplastics and chemical contaminants. Marine litter data gathered by ARPA Sicilia show that litter belonging to the macro-category of artificial polymers are the most present. Microplastic has a significant impact on fish with toxicological consequences in the food chain. At least 116 different species in the Mediterranean have ingested plastic, of which more than half (59%) are bony fish and include those of commercial interest (sardines, mullets, sea bream, cod, anchovies, tuna, red prawns). Chemical contaminants (e.g. nickel, mercury, arsenic, tributyltin-compounds) are present in seawater and sediment matrices of the marine environment and are monitored by ARPA Sicilia annually in several sampling stations.

Marine protected areas (MPAs) are a powerful tool for biodiversity conservation and climate change adaptation and mitigation, however, in order to be effective, conservation and management measures have to be implemented. In many cases initiatives fail in including local communities in the planning and management processes, losing support for conservation efforts and potentially rising stakeholders' conflicts. Stakeholder engagement and the adoption of interdisciplinary approaches are essential to understand people's attitudes and perceptions and to co-create effective conservation initiatives. Further effort is needed to engage with, and empower fishers to manage sustainably marine resources: they should be better informed on MPAs regulations and included in the management processes, so as to strengthen collaboration with MPAs managers. For example, a study has shown that crews of large fishing vessels would be willing to use bycatch reduction technologies in months with a high probability of turtle captures if an economic incentive was provided and there was also public acknowledgement of their efforts.

3.2 TERRESTRIAL BIODIVERSITY

Originally, the island was largely covered with forests, however, over time, the natural landscape has been profoundly altered by anthropic activities. Forest landscape extends from the north-eastern to the western parts of Sicily across the Peloritani Mountains, the Nebrodi Mountains and the Madonie Mountains; it also covers Mount Etna and the Sicani Mountains, including Bosco della Ficuzza, and is broken down as follows: 122.600 ha of broadleaved forest, 27.000 ha of conifer forests, and 35.999 ha of mixed forest. Notably, natural forests only cover 86.000 ha with: Turkey oak (*Quercus cerris*), downy oak (*Quercus pubescens*), cork oak (*Quercus suber*), holm oak (*Quercus ilex*), beech forests, chestnut and Corsican pine (*Pinus laricio*).

In 1948, an important reforestation programme started in Sicily and forest areas increased from 86.00 hectares to about 200.000 hectares in 2003. **Reforestation** has been often planned without a careful assessment of the biotic (e.g. viral and fungal diseases, bark beetles) and abiotic factors (fire and soil erosion), and the techniques used have contributed to reducing plant and animal diversity, especially when interventions were made on natural vegetation (e.g. pastures and garrigue) rather than former crops. Most of the reforestation was done with exotic plants: approximately 130.000 hectares were made with various species of *Eucalyptus* and *Pinus spp.* (*Pinus halepensis*, *Pinus pinea*, *Pinus nigra*), causing a decrease in wildlife diversity and in pre-existent species. Reforestation had two main objectives: wood production using rapidly growing species; and slopes stabilization using Mediterranean conifers which guarantee better protection of the soil. Furthermore, reforestation was seen as a means to protect the environment while offering the opportunity to alleviate the employment crisis.

Very little has been done after 2003, due to the **fires** that burn every year. Fires continue to devastate the Sicilian territory, destroying protected areas, threatening inhabited centers and damaging economic and social activities, particularly those related to rural areas, parks and nature reserves. The occurrence of fires has very deep roots and structural causes: the surveillance and control activities are not adequate; there is no effective

prevention, which would imply modern silvicultural management and constant surveillance of the territory (now totally absent); and there is no effective enforcement and deterrents, such as the use of men and investigative specialisations.

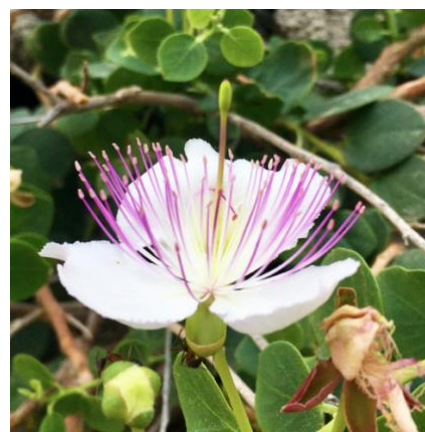
Poaching and illegal wildlife trafficking particularly threaten some bird species, especially birds of prey. Poaching still represents a serious threat to the safety of migrant birds while crossing the Strait of Messina, a key step for the migration of birds of prey. Anti-poaching camps are organised every year and are attended by activists, volunteers from several organisations (e.g. LIPU) in collaboration with forest police. An increasingly common wildlife crime is the removal from the wild of endangered diurnal and nocturnal birds of prey, increasing their extinction risk. For example, the Bonelli's Eagle (*Aquila fasciata*), of which Sicily hosts the only breeding population in Italy; the Lanner falcon (*Falco biarmicus*); the Peregrin falcon (*Falco peregrinus*); but also, the Egyptian and the Griffon vultures, which collectors linked to falconry take from the nests.

The **conservation of landscapes** is particularly important for Sicily, where historical events, customs and natural heritage have resulted in many traditional rural landscapes. These can be classified as agroforestry, characterised by small spatial scale, limited technology, low use of fertilisers and pesticides, a mosaic of wildlife habitats and biodiversity. A preliminary study identified 8 traditional landscapes in Sicily: the open land and the



mixed cropping being the most widespread. The heterogeneity of rural landscapes, determined by multi-crop productive models, is threatened by degradation and increase of modern agriculture. Open arable land is dominated by annual herbaceous crops, mostly wheat, often in rotation with forage crops. Its structural simplicity and uniformity cause low biodiversity levels and high vulnerability due to the erodable nature of substratum. Elements to enhance biodiversity are small strips of natural vegetation, hedges, rows of trees, isolated trees, dry stone walls and heaps of stones.

Mixed crop landscapes host species of economic, environmental and cultural importance. **Olive trees** play a crucial role in preventing soil erosion, particularly in marginal and degraded areas, both in intensive plantations or semi-abandoned where oldest specimens can be found. **Citrus orchards** are typical of the coastal and sub-coastal landscapes due to water abundance and mild climate. Once a component of historic landscape, nowadays are subject to degradation caused by expansion of urban centers and construction of infrastructures. **Almond trees** easily adapt to different pedoclimatic conditions, thus playing an important role for soil conservation in hilly areas. **Hazelnut trees**, forming forests with high degree of cover and green landscapes in Messina, play a crucial role in preventing hydrogeological risks in the slopes of Nebrodi and Peloritani mountains. **Pistachio nut** typically in the western slopes of Mount Etna and southern Sicily form a cover composed by: cultivated (*Pistacia vera*) and wild pistachio (*Pistacia terebinthus*); cultivated trees such as olive, almond and prickly pear; natural shrubs (*Genista sp pl.*, *Euphorbia sp pl.*, *Quercus ilex*, etc.); dry stone walls; rocky outcroppings. **Manna ash** (*Fraxinus ornus*, *F. oxycarpa*) plays an important role in local population's culture. Its lymph is a natural sap extracted by tapping the trunk of the trees. Manna has become a Slow Food Presidium and is certified by the Italian Minister of Agriculture and Forests as a Traditional Agricultural Food Product. The cultivation of **capers** has become increasingly common, particularly in the islands of Pantelleria and Salina, thanks to the growing interest in this crop also from an economic perspective.



3.3 WASTE MANAGEMENT

Waste management is a critical problem. Efforts towards waste recovery and recycling have started, however, landfill is still the most common method used, despite it cannot be considered environmentally sustainable. In 2019, ARPA Sicilia data highlighted that the regional production of municipal waste in Sicily amounted to approximately 2,233,278 tons, with a per capita production of 449.50 kg per inhabitant per year. Separate waste collections stand at very low percentages, 38.52% of regional production. Last is the province of Palermo with 29.04%. The highest percentages are registered in Ragusa (57.78%) and Trapani (56.74%) and small towns reach up to 80%. Castelbuono, a small medieval town in the Madonie Park, has implemented an interesting solution to municipal waste management: being built on a hill with many streets, often with stairs, the municipal cleansing department uses mini trucks and donkeys to pick up waste.

In 2019, urban waste disposed in landfills was 58% of the total waste managed by 11 landfills. Up to 2019, the following were operational: 21 composting plants that treated 379,706 t of urban waste; 1 integrated aerobic and anaerobic treatment plant that treated 31,801 t and 8 TMB plants that treated 791,446 t. No urban waste incinerators and anaerobic digestion plants are present in Sicily. In 2019, the regional production of special waste amounted to 7,373,000 tons. The 95.6% is made up of non-hazardous waste and the remaining 4.4% from hazardous waste. The main types of waste produced are represented by waste from construction and demolition operations and from waste and water treatment. Waste management is a complex sociological and behavioral problem, and as such it should be tackled. Firstly, aiming to progressively reducing waste and the use of landfills.

3.4 CLIMATE AND ENERGY

Climate change and natural disasters

Sicily is particularly vulnerable to climate change and the intensification of extreme weather conditions and natural disasters. On the one hand, the increased frequency of intense heat waves, especially in rural contexts, on the other hand, floods occur more and more frequently. Human activity, such as over farming and

monocultures, excessive irrigation, deforestation, and erosion trigger the risks of drought, aridity and desertification, influencing the ability of the land to hold water. The increase in annual average temperatures, the alteration of precipitation and the increasing occurrence of extreme weather events such as heat waves and droughts increase water stress of the vegetation, making it highly flammable and exposing it to fires more and more frequently. In the last decade, intense rainfall events have led to urban flooding with several damages that can get worse with climate change. Sea level rising makes Sicily particularly vulnerable to the risk of coastal cities flooding. While climate change can and should be mitigated (e.g. reduction of greenhouse gas emissions), it is also necessary to provide forms of adaptation to climate change implementing actions to protect people and the environment and to build resilience. Adaptation and resilience concern both the physical and cultural spheres.

Ecological Transition

Sicily starts its ecological transition with PEARS (Environmental Energy Plan of the Sicilian Region), a document developed by the Sicilian Region to manage and regulate interventions in the energy field. This tool aims to ensure innovation and energy autonomy, transforming Sicily into the most important energy hub in the Mediterranean. The goal is to reach 69% of renewable sources by 2030 through the use of renewable energy, such as photovoltaics, solar thermal, wind and wave motion. A series of interventions are planned mainly concerning the installation of new photovoltaic systems. The Sicilian Region is committed to the establishment of guarantee funds, the elaboration of public tenders, the mapping of buildings with asbestos and eternit so that removal of harmful materials leaves room for new photovoltaic systems. Key actions of PEARS are: the "revamping", or the updating of existing plants to reach the target of 300 MW of more energy; the installation of new photovoltaic systems on abandoned areas of quarries, mines, exhausted landfills and agricultural land that is no longer productive; the maximum adoption of renewable sources on the smaller islands.

3.5 TOURISM

Sicily's potential for tourism, particularly nature-based tourism, is significant and should be unleashed in a way that is also sustainable. The island's natural and cultural resources are important determinants of tourism demand. Tourism attractiveness is mainly related to the seaside, cuisine and wine, art, culture and nature with increasing demand for wine tours and agriturisms. In terms of accommodation structures, it has become very common to combine the demand for new forms of tourism with renovation projects to host tourists in castles, country homes, "bagli" (stone manors), villas, aristocratic residences, ancient convents, farms and farmhouses. Thermal tourism, is another potential attraction that could enhance nature-based tourism, with at least 7 thermal sites: Segesta, Vulcano, Sciacca, Acqua Pia Montevago, Termini Imerese, Aliterme Messina, Acireale.

The road infrastructure, railway system and urban mobility lack strong interventions, representing one of the main issues for sustainable tourism development. The demand of tourism goods and services pushes local operators for new economic activities and infrastructures that will influence attractiveness of Sicily over time and the number of tourism arrivals. Thus, future development of tourism may have several impacts at both economic and environmental level. Luckily, the interest in environmentally friendly holidays is a common trend and accordingly, is becoming increasingly common in Sicily. The enhancement of natural, cultural and gastronomic capital and the promotion of sustainable tourism is a strategic asset for sustainable development in Sicily. However, concrete support is needed for the realisation of sustainable tourism.

3.6 OTHER KEY ENVIRONMENTAL CHALLENGES AND THREATS

Illegal construction, typically done by mafia, leads to housing construction on mountain slopes and in protected coastal areas.

Air quality data on nitrogen oxides and benzene detected during COVID lockdown confirmed that vehicular traffic is the main cause of air pollution in urban agglomerations. Data collected by ARPA Sicilia monitoring stations in urban agglomerations, significantly reduced during lockdown, tell us that the reduction in traffic has brought down the concentrations in the atmosphere, confirming the provisions of the regional air quality plan aiming to reduce traffic by 40%, as the main measure that municipalities must adopt to lower emissions.

The **largest petrochemical center in Europe** is in Syracuse and includes the municipalities of Augusta, Priolo Gargallo and Melilli. Main activities are oil refining, processing of oil derivatives and energy production. The indiscriminate discharge of pollutants into the atmosphere, underground and into the sea, has caused the ecological imbalance of the area, both in land and sea. The alteration of Syracuse’s coasts and seabed is undeniable, as well as odour pollution. Lengthy and costly operations of environmental restoration are carried out at the expense of public funds. Environmental disasters have been ascertained, for example, the pollution of the aquifers of the surrounding area and their progressive lowering due to the pumping for the cooling systems. In 2017, the continuous complaints for bad smells and pollution, led at the Syracuse Public Prosecutor’s Office and the investigating judge to place Esso refinery and the ISAB refineries under seizure, ordering to provide an adequate time schedule of interventions aimed at significantly reducing emissions.

MAPPING THE CHAMPIONS

4.1. ASSOCIATIONS AND COMMITTEES

A list, not to be considered as exhaustive, of associations and committees active at the local level is provided in the following sections, highlighting relevant projects aimed at improving conservation efforts and promoting awareness raising campaigns.

- **Marevivo:** many schools joined Marevivo “Dolphin Guardians” educational program to learn how to become guardians of the sea, and the “Plastic free schools for a sustainable future” network. School are the ideal place to build a sustainable future more attentive to environmental issues. Drinking fountains have been installed and reusable water bottles have been delivered. EmergenSea Educational Campaign provided eco-compactors for plastic bottles in market areas and schools to reduce pollution and raise awareness on the benefits of recycling. <http://www.marevivosicilia.it/>
- **Legambiente Sicilia:** promotes important environmental campaigns focused on sea, land and biodiversity protection, waste management, and ecological transition. Recent projects include: **PantAid**, a project co-funded by Fondazione del Sud, on the management and prevention of environmental risks in Pantelleria National Park with the aim of involving the community in activities aimed at increasing resilience and awareness. **Giardini sul Mare**, funded by Unipol in the framework of the initiative Bellezza Italia, in collaboration with Pantelleria Island National Park and the Department of Agricultural and Forestry

Sciences of University of Palermo, aimed at mapping the dry-stone wall 'Giardino pantesco' - traditional agricultural technique for adaptation to water deficit conditions - and identifying new thematic itineraries to enhance nature-based tourism. <http://www.legambientesicilia.it/>

- **WWF Sicilia:** is organised in 4 local organisations (the North-western, North-eastern, Central and Mediterranean Area). They are involved in different activities: managing 4 natural reserves (Capo Rama, Saline di Trapani e Paceco, Lago Preola e Gorgi Tondi, Torre Salsa); organising national events and environmental education campaigns for schools, such as Earth Hour and La Giornata delle Oasi. Particularly relevant is their volunteer network involved in: surveilling Caretta caretta nests along the coast; tackling hunting poaching through the WWF Hunting Guards; and programmes such as WWF Young and WWF SUB. <https://www.wwf.it/chi-siamo/presenza-sul-territorio/sicilia/>
- **MuMa Milazzo:** a museum where interdisciplinarity allows one to find new methods and solutions to reach the correct relationship between man and the environment. Positioned in the historic stronghold, a church and also a castle, MuMa was created to exhibit the skeleton of the sperm whale known as Siso. The tail flukes of this young, ten-meter-long, male was entangled in an illegal drift net in the summer of 2017 in the Aeolian Islands. <https://www.mumamilazzo.com/site/index.php/en/home-en/>
- **Sea Shepherd:** their missions to fight illegal fishing in the Aeolian Islands and in Plemmirio MPA every year contributes to confiscating and removing illegal driftnets and FADs (Fishing Aggregating Devices). <https://www.seashepherd.it/>
- **Healthy Seas:** two diving missions recovered around 20 tons of ghost nets involving local diving and fishermen in the Aeolian Islands. Nets have been recycled and transformed into sustainable textiles for fashion houses across the globe. <https://www.healthyseas.org/>
- **Filicudi Wildlife Conservation (Eolie):** the association is aimed at the study and conservation of marine resources of the Aeolian Archipelago through an integrated approach and actions throughout the area. Research and monitoring of marine vertebrates include cetaceans (bottlenose dolphin, striped dolphin and sperm whale) and sea turtles (loggerhead sea turtle Caretta caretta) with a First Aid for Sea Turtles in Filicudi island. Environmental education involving tourists, fishermen, and schools contributes to increasing the protection of the Aeolian marine species. Grotta del Bue Marino in Filicudi and Grotta del Cavallo in Vulcano in the Aeolian islands have been secured through eco-friendly cables and buoys to preserve the habitats. <https://www.filicudiconservation.com/index.php?en/1/home>
- **MPA Committee Salina:** created with the aim of representing the needs of the territory and providing correct information on the operation and management of a Marine Protected Area (MPA) to raise awareness of the issue and the importance of preserving the sea of Salina island and the activities depending on the sea. <https://www.facebook.com/cpampsalina/>
- **Slow food Sicilia:** the NGO runs educational programs for local schools focusing on sustainable agriculture also through edible gardens and awareness raising campaigns involving producers and restaurants and promoting the sustainable consumption of local food. <https://www.slowfoodsicilia.it/>

- **Attiva Stromboli:** a social olive oil mill in Stromboli, in the frame of the Èolio project involving and uniting the community of the island of Stromboli, and preserving an iconic part of the Aeolian landscape, the olive tree, by promoting local sustainable produce. <https://www.attivastromboli.net/>
- **DottEolie:** projects to recover the historic paths of Alicudi rediscovering natural heritage and terraced landscapes, together with the Institute of Atmospheric Sciences and Climate (CNR-ISAC) and the patronage of ITLA Italia. Dry stone walls courses have been also organized in Panarea and Lipari building and restoring the traditional walls, a unique cultural and environmental heritage. <https://www.facebook.com/dotteolie/>
- **Sustainable Islands Observatory:** promoted by Legambiente and CNR-IIA to quantify what is happening in the smaller Italian islands related to the energy, water, waste and mobility sectors. The main point is to encourage an acceleration to achieve a sustainable transition and focused on these natural and fascinated territories through reports, workshops, conferences, and news. <https://www.isolesostenibili.it/>
- **Greening the Islands:** an organization based in Palermo supporting self-sufficiency and sustainability of islands worldwide, matching islands needs with innovative solutions and facilitating the origination of projects for the sustainable transition of islands and their replicability on the mainland by acting as a catalyst between governments, business, academia and citizens, disseminating knowledge and best practices. The GTI Observatory was also launched to assess and monitor islands progress towards sustainability. <http://www.greeningtheislands.net/index.php/observatory-home/>
- **Wildlife Recovery Center LIPU Bosco della Ficuzza:** is equipped with an ambulatory, a surgical room and a nursery. A series of aviaries are used for rehabilitation, quarantine, setting before release, research and education. The center hosts rescued wildlife from all over Sicily. <http://www.lipu.it/centro-recupero-fauna-bosco-di-ficuzza-pa>
- **Orto Capovolto:** a social cooperative that promotes urban agriculture for environmental, economic and social sustainability. Through participatory planning and creation of gardens and implementation of food and environmental education projects, the cooperative promotes urban gardens as an opportunity to transform a city and lifestyles of citizens by cultivating it. <http://www.ortocapovolto.com/>
- **Palma nana:** a cooperative promoting the discovery and protection of natural sites in Sicily. A multidisciplinary team of professionals working with environmental education centers, nature reserves, neighbourhoods, schools, public and private entities to offer people opportunities for travel, walks, camps and holidays, and to engage with projects on responsible tourism, for both schools and adults, that respect nature, cultures and local communities. <https://www.educazioneambientale.com/>
- **Fondo Ambiente Italiano (FAI):** the Kolymbethra Garden was entrusted in concession to FAI by the Sicilian Region in 1999. The garden is an archaeological and agricultural site located in the ancient Greek Valley of the Temples in Agrigento, UNESCO Heritage site since 1998. In the last decades of the twentieth century, due to the disappearance of farmers, the Kolymbethra fell into neglect until the intervention of FAI which restored it to its former glory. <https://fondoambiente.it/luoghi/giardino-della-kolymbethra>

- **Comitato Salviamo l'Oreto** (Save the Oreto Committee): was established to advocate for the protection and restoration of the Oreto river and its valleys, symbol of decay, abusiveness and lack of nature protection. The candidacy to the initiative led by FAI "I luoghi del cuore" provided local communities with an opportunity to draw attention to the river and its state which laid the foundation for a collaboration between citizens and associations aiming at raising awareness on the river. The campaign Salviamo l'Oreto, launched to restore the Oreto river, is a great opportunity for the redevelopment of an entire neighborhood. <https://www.facebook.com/fiumeOreto/>
- **Associazione Simenza:** was created to bring together farmers, breeders, processors, researchers and professionals with the aim of protecting and enhancing the heritage of Sicilian agrobiodiversity. The idea stems from the need to guide Sicilian farmers towards the management of agrobiodiversity with the creation of short supply chains by applying a model of regenerative agriculture and sustainable distribution systems. <https://rsr.bio/simenza>
- **Associazione Rifiuti Zero Sicilia:** promotes a change of mindset, advocating for the use of sustainable practices from the beginning of the production process, linking "the responsibility of communities" to the "responsibility of industries" in a conscious way. <https://www.facebook.com/RifiutiZeroSicilia/>
- **EcoMuseo Mare Memoria Viva:** is a space for communities created together with the inhabitants of the seaside villages. It offers cultural and non-formal education activities, urban explorations, workshops, exhibitions, conferences and public meetings on topics of collective interest: citizenship, art, education, marine sciences, migration, environment, placemaking. <https://www.marememoriaviva.it/>
- **Abys Cleanup:** aims at safeguarding the conditions of coastal and marine environment, with specific interest in combating abandonment of waste in water habitats such as rivers, lakes and oceans. They perform on-site interventions for the improvement and restoration of coastal and marine environment, in collaboration with local authorities, territorially competent authorities and with public and private companies and institutes for scientific and technological research also through the application of new technologies. <https://abyss-cleanup.com/en/homepage/>

4.2 RESEARCH PROJECTS FOR ENVIRONMENTAL ACTION AND PUBLIC AWARENESS

This section highlights relevant projects (not to be seen as a comprehensive list) with a conservation and social impact that actively engage communities and are carried out by different research groups across Sicily.

- The **LIFE DELFI** project, led by CNR-IRBIM (National Research Council - Institute for Marine Biological Resources and Biotechnology), focuses on the conservation of dolphins, mainly bottlenose dolphins, and the negative economic consequences on the fishery sector due to interactions of these species with fishing activities. The Aeolian and Egadi islands are target areas of the project. <https://lifedelfi.eu/?lang=en>
- **Marine Hazard**, led by CNR-IAS (National Research Council - Institute of Marine Research) and SZN Napoli (Anton Dohrn Zoological Station), aims to create an integrated system of skills on the territory able to deal with environmental risk on the marine-coastal system. The project will take care of restoring degraded seabed through reforestation interventions with *Posidonia oceanica* through the use of a system made of bioplastic for fixing, in rapid and effective form, *Posidonia oceanica* cuttings on the seabed, in order to

ensure rooting and growth of the plant and to facilitate natural development dynamics of the prairie.
<https://www.marinehazard.cnr.it/en/>

- **LIFE SEPOSSO** (Supporting Environmental governance for the *POSidonia oceanica* Sustainable transplanting Operations), coordinated by ISPRA (Italian Institute for Environmental Protection and Research) and SNPA (National System for Environmental Protection), focuses on the monitoring of *Posidonia oceanica* transplants. 15 transplants along the Italian coasts were monitored, which represent about 30,000 sqm of transplanted meadows. Special focus is dedicated to one of the 4 largest transplants in Augusta Priolo Gargallo in Sicily. <https://lifeseposso.eu/>
- Every year, sandbar shark, classified as Endangered by IUCN, aggregate around the small and remote island of Lampione. A growing number of tourists visit this islet to have a shark watching experience. The project **ProSharkMed** (Increasing protection of endangered sandbar sharks in their Mediterranean hotspot aggregation sites) led by the Stazione Zoologica Anton Dohrn (SZN) and supported by National Geographic Society aims to increase awareness of boaters and scuba divers and promote the sustainable use of this site. The **SharkNoise** project, led by SZN and supported by Blue Marine Foundation, will assess the effects of tourism-generated noise on the aggregation of sandbar sharks around Lampione. By characterizing anthropogenic soundscapes, the project will contribute to build a long-term strategy for managing tourism, limiting impacts of anthropogenic noise. <https://www.facebook.com/ProSharkMed>
- **Elife** (Elasmobranchs Low-Impact Fishing Experience), European funded project led by SZN Naples aims at improving the conservation of elasmobranch species (sharks and rays) promoting best practices in the context of EU professional fishing. Targeted area in Sicily involves both bottom trawl and longline fisheries to reduce shark by-catch and mortality in the area of Lampedusa. <https://www.elifeproject.eu/en/>
- The **BOSE** project in the Egadi Islands MPA, led by UNIPA-DISTEM (University of Palermo Department of Earth and Sea Sciences) and supported by Blue Marine Foundation, aims at reducing numbers of endangered sharks and rays by-caught by small scale fishing activities, and at increasing protection of a rare ray aggregation within the MPA borders. These objectives will be achieved through awareness-raising and training campaigns for fishers, tourists and other stakeholders, and by developing new management and control measures to increase the chances of survival of sharks and rays within the MPA.
- The **SenHAR** project, led by UNIPA-DISTEM, promotes awareness campaigns on the issues related to protected areas in Capo Gallo and Capo Passero. It will disseminate easy and technical-free science on biodiversity conservation and management, using ITC tools and creative ideas, in order to generate attention, encourage action and the desire to change habits that threaten biodiversity. <https://italiamalta.eu/progetti/funded-projects/senhar/?lang=en>
- **PlasticBusters MPAs** is an Interreg Med project focused on preserving natural ecosystems in pelagic and coastal protected areas by consolidating Mediterranean efforts to address marine litter. It covers the whole management cycle of marine litter, from monitoring and assessment, to prevention and mitigation through a multidisciplinary strategy and common framework of action developed by University of Siena and the Mediterranean Sustainable Development Solutions Network. The team organises actions in the

field (e.g. MPA of Capo Milazzo) to investigate marine litter on the beaches. <https://plasticbustersmpas.interreg-med.eu/>

- **REsPoNSo** is a project aimed at reducing the impact of ghost nets in Sicily. Led by SZN Sicily (Anton Dohrn Zoological Station), it focuses in the areas of Portorosa, Licata-Gela e Lampedusa-Linosa, by actively involving the fishermen. <http://www.marevivosicilia.it/2021/04/29/progetto-responso-inizia-in-sicilia-un-progetto-integrato-per-recuperare-e-ridurre-i-rifiuti-in-mare/>
- **Aliens in the Sea** is a citizen science project led by UniPa (STEBICEF Department) aiming to collect data on 19 alien species (plants and animals) in Sicilian waters including small islands, in order to monitor diffusion and create a database on distribution and threat levels. The project also aims to raise awareness, particularly of key stakeholders (fishermen, sportsmen, boaters), on the problem of biological invasions through correct information. <https://www.unipa.it/Progetto-di-Citizen-Science-Aliens-in-the-sea/>
- **NOSE (Network for Odour Sensitivity)** is a citizen science project led by ARPA Sicilia (Regional Environmental Protection Agency) and CNR-ISAC (National Research Council – Institute of Atmospheric and Climate Science), aimed at supporting the management of odour pollution in Sicily. It involves communities in proximity of 3 Areas at High Risk of Environmental Crisis, whereby the olfactory disturbances caused by productive activities are a continuous source of discomfort. Through the use of the web-app, citizens report odour pollution in real time, georeferenced and anonymous. Reporting odour pollution is essential to identify the backward path performed by odorous. <https://nose-cnr.arpa.sicilia.it/>
- **CORALLO** is an Interreg Italy-Malta Project aiming to raise awareness on Natura 2000 sites and its biodiversity, through the creation of services, innovative systems and the use of advanced technologies. A wide diversified range of edutainment tools - gaming, virtual reality, underwater CCTV, educational cross-border boat - will be used to engage with end users of Natura 2000 sites.
- **LIFE SIMETORES** aims to increase resilience against the impacts of climate change in the urbanized area of the Simeto river valley. <http://lifesimetores.it/>

EDUCATION, PUBLIC AWARENESS, AND OUTREACH OPPORTUNITIES

5.1 CITIZEN SCIENCE

Citizen science, the active engagement of citizens in the collection, analysis and interpretation of data for scientific purposes, has become increasingly common worldwide thanks to the role it plays at environmental, social, educational and political levels. Citizen science programmes include a wide variety of activities from almost all scientific disciplines, allowing for different levels of participation by citizens. In the last decade, international associations were established worldwide, such as the European Citizen Science Association (ECSA), to promote cooperation and networking among practitioners. In addition, national coordination networks have also been established in several countries. In Italy, Citizen Science Italia, an informal group of scientists and supporters of citizen science, has created a space for sharing existing initiatives and good

- Engage in seabed and beach clean ups and marine litter monitoring.
 - Engage in biodiversity monitoring and MPAs co-management.
 - Engage fishers in reporting bycatch.
 - Engage fishers in sharing "local ecological knowledge", historical memories and perception of change provide crucial information to understand impacts of fishing and long-term trends of species.
 - Engage surfers (surfers, windsurfers, kite surfers, paddle surfers) in new approaches for marine and coastal conservation and sustainable community development by mobilizing their interest and support in protecting surf breaks. A dedicated growing community of surfers, steadily increasing, go out in the sea throughout the year in Sicily and are motivated to protect the ecosystems.
- Actions to tackle invasive alien species:
 - Monitoring species populations to inform eradication and control programmes.
 - Engage artisanal and recreational fishers in monitoring and managing alien species, acting as "early warning systems", they can play a key role in adaptive management.
 - Encourage consumers, fishers, restaurants to commercialise invasive alien species to help reduce abundance and provide an additional source of income for fishermen.

Terrestrial biodiversity

- Restoration and implementation of green infrastructure to tackle biodiversity loss, reduce habitat fragmentation, and improve connectivity of the Natura 2000 network even in urbanised areas, such as in abandoned areas.
- Rewilding projects on private or public areas.
- Actions for fire prevention, suppression and management:
 - Disseminate best practices and alternatives to burning among farmers through information campaigns.
 - Environmental education as part of school teaching programs.
 - Disseminate easily legible maps with burnt areas so as to make data publicly available.
 - Support environmental associations, activists and volunteers increasingly operating in the territory.
 - Work towards new forms of citizen's and local communities' involvement (e.g. farmers) to employ fire fighters with alternative methods, such as assignment of areas and incentives according to lower incidence of fires.
- Actions for landscape conservation addressing it as a productive system and advocating for the adoption of agroecology as an integrated and holistic approach:
 - Build capacity for participatory action-oriented practices (permaculture and agroforestry), with great potential for empowering communities and providing environmental, economic and social benefits.
 - Technical and financial support to small farmers (*heroic agriculture*) to protect traditional rural landscapes threatened by land abandonment and modern agriculture.
 - Engage producers (e.g. vineyards) to increase sustainability and support ecological transition.
 - Support the creation of a register of traditional Sicilian landscape as a tool to incentivise sustainable agriculture and support small farmers, local producers and municipalities.

- A steering committee reviewing and deciding on grant recommendations and contributing to the fund-raising effort. Steering committee members pledge to donate €10,000 per year, for a minimum of three years.
- An advisory board supporting in sourcing and assessing grant proposals.

7.2 ROADMAP AND FUNDRAISING

We're looking for donors, projects, and Sicily lovers to make it happen!

We're aiming to raise a minimum of €100,000 per year and are about half-way there, with Ben Goldsmith (the founder of Conservation Collective), and a further group of five who have committed funds so far.

A group of 5-10 founding donors will join the steering committee.

You can help preserve Sicily's beautiful natural environment and conserve key wildlife by contributing to the Sicily Conservation and/or supporting its projects by supporting with an annual donation and/or making introductions to those in a position to do so.

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