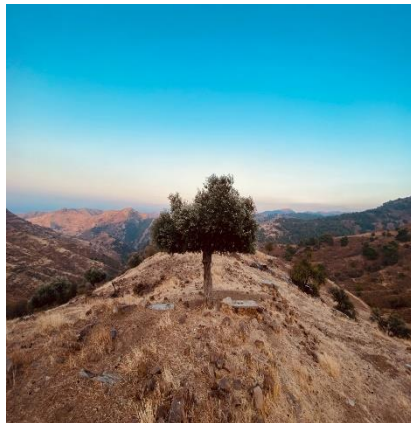
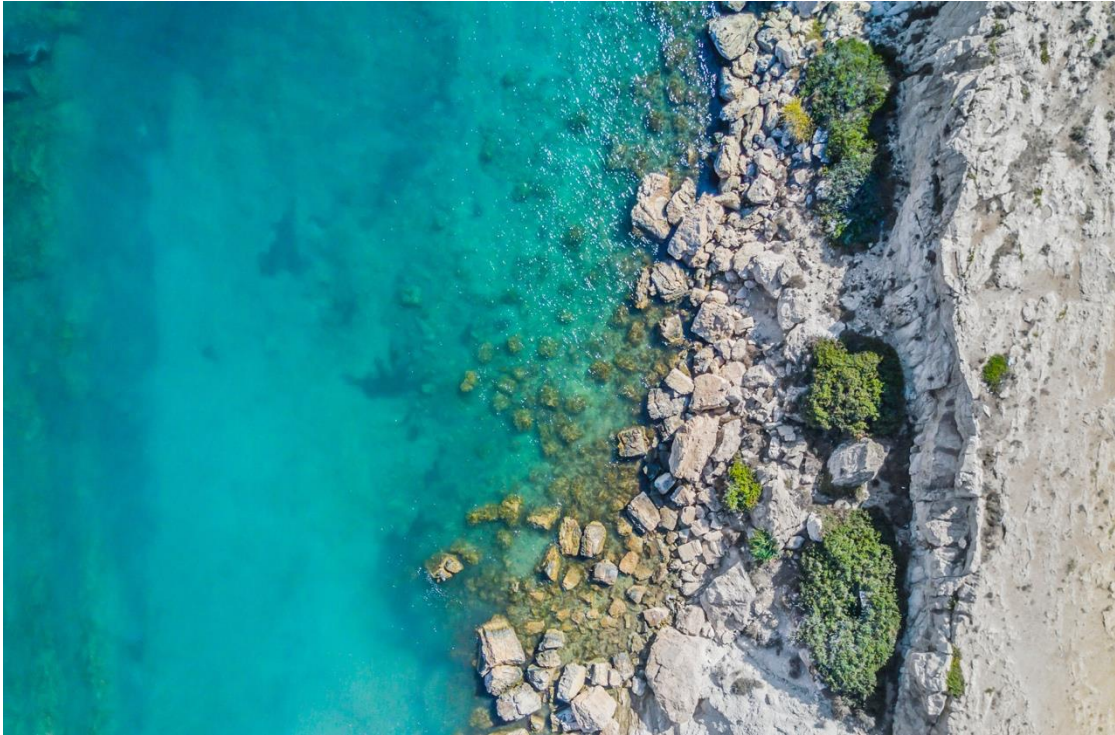


Cyprus Environment Foundation

SCOPING REPORT



Conducted by
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CEF	Cyprus Environment Foundation
DFMR	Department of Fisheries and Marine Research
EIA	Environmental Impact Assessment
GHG	GreenHouse Gas
GFCM	General Fisheries Commission for the Mediterranean
IAS	Invasive alien species
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
IWS	International Waterbird Sensus
MPA	Marine Protected Area
Natura 2K	Natura 2000
NIS	Non-indigenous species
RES	Renewable Energy Sources
SAC	Special Area of Conservation
SCIs	Sites of Community Importance (s)
SPAs	Special Protection Areas
SRF	Solid Recovered Fuel
WFD	Water Framework Directive

1. Overview of the Environment of Cyprus

Cyprus is the third largest island in the Mediterranean both in terms of area and population, with an area of 9,250 Km² and a total population of 1.2 million. Due to the island's strategic place, Cyprus was subsequently occupied by several major powers, including the Assyrians, the Egyptians, the Persians, and the Roman and Ottoman empires. Starting from 1878 and up until 1960 when the island became an independent republic, Cyprus was colonized by the British. During that time the two prominent ethnic communities in Cyprus were Greek Cypriots, making up the majority of the island's population and Turkish Cypriots. For a long time, the two communities lived and prospered peacefully together, yet disagreements over the island's desired political policy brought about frictions and intercommunal violence between the two communities leading to the island's de facto partitioning into two regions: the Northern Turkish-Cypriot community and the South-Western Greek-Cypriot community.

Due to its placement spanning three continents, diverse geography and convoluted geological history, the Mediterranean Sea is a global biodiversity hotspot in both its marine and terrestrial realms (Myers *et al.*, 2000; Coll *et al.*, 2010). The island rose from the Mediterranean as a mass of both volcanic and sedimentary rock never connected to the mainland. Around 5 million years ago, when the Mediterranean Sea periodically evaporated, many species colonized the island and became isolated. Many other colonization and speciation events together with its rich geological diversity, led to a unique assemblage of flora and fauna. However, since the first human settlements established on the island during the Neolithic period (8800-8600 B.C), biodiversity was led to great reduction which has continued in recent decades leading to the extinction of apex predator bird species. If not for the efforts of local conservation organizations, other species (such as the audouin's gull (*Larus audouinii*) and green turtle (*Chelonia mydas*), may well have been lost as well.

The island's terrain is characterized by the Mesaoria plain located in the center of the island and enclosed in between the two mountain ranges of Troodos and Pentadaktylos, with their highest peaks located at 1,952 and 1,024 m respectively. Agricultural and forested and semi-natural areas make up the largest land cover of Cyprus, accounting for 47 and 42 percent accordingly of the island's total area (Copernicus, 2021). Most forested areas are located on Troodos Mountain range and the rest are distributed across the areas of Akamas, Kormakitis and Karpasia (Karpaz) Peninsulas and Pentadaktylos.

Among the most important biomes of Cyprus are the black pine forests located on the higher elevations of the Troodos mountains, the East Mediterranean pine forests of *Pinus brutia* primarily defining the composition of Cyprus' forests, extended areas of maquis and garrigue vegetation, rocky areas such as inland

cliffs and mountain tops, riparian vegetation along the banks of rivers and streams, wetlands such as salt marshes, lagoons and salt lakes and sand dunes.

The island features a diversity of landscapes and habitat types. According to Annex I of the Habitats Directive (92/43/EEC), 52 habitat types are located in Cyprus out of which five are endemic to the island, such as habitat 9390 of scrub and low forest vegetation with *Quercus alnifolia*, habitat 93A0 of Woodlands with *Quercus infectoria* and habitat 9590 of *Cedrus brevifolia* forests (Andreou, 2012). Four marine habitat types are recorded in Cyprus including the marine seagrass of spermatophyta on soft bottom habitats (habitats 1110 and 1120), the *Posidonia oceanica* meadows (priority habitat 1120), the macroalgae forests on reefs (habitat 1170) and the vegetation of macroalgae in submerged or partially submerged sea caves (habitat 8330).

Flora of Cyprus consists of 1649 indigenous taxa with 8.5 percent of them (141 species and subspecies) being endemic to the island (Hand, R., Hadjikyriakou, G. N. and Christodoulou, 2011). Troodos mountain range hosts 72.3 percent of all endemics while 43 percent of them are located on Pentadaktylos mountains (Forestry Department, 2021b) while others are more widely distributed. About 14 percent of species recorded in the Red Data Book of the Flora of Cyprus are endemic, while the conservation status of most recorded species is considered vulnerable as seen in Table 1. Furthermore, 7 species of Cyprus' flora are included among the 50 most rare and threatened species of the Mediterranean species according to IUCN's "The Top 50 Mediterranean Island Plants" publication (Andreou, 2012).

Table 1 Conservation status evaluation of 328 Cyprus flora species based on International Union for Conservation of Nature (IUCN) criteria – Red Data Book of the Flora of Cyprus (2007) – source: (Andreou, 2012)

a/a	IUCN Red List Category	Number of Cyprus flora species under IUCN category
1	Regionally Extinct	23
2	Critically Endangered	46
3	Endangered	64
4	Vulnerable	128
5	Data Deficient	45
6	Near Threatened	15
7	Least Concern	7

The fauna of Cyprus is relatively understudied, evidenced by the fact that a Cyprus fauna Red data book does not yet exist. Interest in zoology and taxonomy is increasing however, with studies announcing records of new or previously unrecognised endemic species. Until today, 35 species of mammals have been recorded in

Cyprus (including 4 species of dolphins, 1 seal and 19 bats), 250 species of fish and about 6,000 species of insects (Andreou, 2012; Forestry Department, 2021a). Among the 25 species of amphibians and reptiles recorded on the island, 3 species of turtles inhabit Cyprus, with some of the most important turtle nesting sites of the Mediterranean being located in the North of Cyprus in areas such as Ronnas beach and Alagadi (Kasperek, Godley and Broderick, 2001; Mongabay, 2021). Cyprus hosts around 11 percent of the entire area of Mediterranean breeding grounds for the marine loggerhead turtle *Caretta caretta*, while beaches of green turtles (*Chelonia mydas*) are of particular importance, hosting around 30 percent of the Mediterranean populations nesting (IUCN, 2021b). Due to Fisheries law, regulation amendments and activated conservation plans, specifically the protection of turtle nests with protective cages against predation by stray dogs and foxes, significant increases in both the populations of loggerhead and green turtles have been recorded in the last decade (DFMR, 2019b; Ozkan *et al.*, 2020).

Over 400 species of birds have been recorded in Cyprus, with 53 permanent resident species including three endemic species: the Cyprus Wheatear (*Oenanthe cyprica*), the Cyprus Warbler (*Sylvia melanothorax*) and the Cyprus Scops Owl (*Otus scops cypricus*) and three endemic sub-species: the Cyprus Jay (*Garrulus glandarius glaszneri*), the Cyprus Coal Tit (*Parus ater Cypristes*) and the Short-toed Treecreeper (*Certhia brachydactyla dorotheae*). A 100 million birds are estimated to pass through Cyprus during spring migration and 150 million during autumn migration. This results in the island being one of the most important migratory corridors and biodiversity hotspots within Europe and globally, while at the same it is considered a unique spot when it comes to endemic bird species, attracting many birdwatching tourists. Data on wetland, migratory and breeding bird species of Cyprus are abundant due to systematic monitoring of BirdLife Cyprus, KUŞKOR and the Game & Fauna Service, with a joint census undertaken of the Kleides Islands seabird colonies since 2008, resulting to the designation of this site as the island's only Marine Important Bird and Biodiversity Area.

As part of the Levantine Sea, temperatures and salinity levels on the island's surface waters are higher than the rest of the Mediterranean, with the island's marine ecosystems characterized as ultra-oligotrophic, featuring low nutrient concentrations and low productivities. While the Mediterranean monk seal's largest Mediterranean breeding populations are located in Greece and Turkey, a small number of approximately 20 individuals are considered to use the coast of Cyprus, long term systematic surveys well established across the island to assess their status, breeding and resting sites (DFMR, 2019a; Beton *et al.*, 2021). Until today, very few studies existed on the presence, distribution and abundance of cetaceans with species such as the sperm whale (*Physeter macrocephalus*), the false killer whale (*Pseudorca crassidens*), the rough-toothed dolphin (*Steno bredanensis*) and the common bottlenose dolphin (*Tursiops truncatus*) within the marine environment of Cyprus (Snape *et al.*, 2018; DFMR, 2019a).

As part of the EU, Cyprus has an active role in the formulation and implementation of EU legislation on the protection and conservation of the natural environment, as a result it has ratified and proceeded with the implementation of important international conventions and directives such as the *Community Directive 92/43/EEC for the Conservation of Natural Habitats and the Wild Flora and Fauna* (Habitats Directive), the *Convention on the International Trade of Endangered Species of Wild Fauna and Flora* (CITES) and the *Directive 2009/147/EC on the Conservation of Wild Birds* (Bird Directive). Special provisions have been made in Cyprus’ legislative framework resulting in legislations and regulations which aim to protect and preserve the country’s natural heritage and environment (examples are featured in Table 2.)

Table 2 *Examples of environmental legislation and regulation framework of Cyprus*

a/a	Theme of legislation	Legislation
1	Access to Environmental information	The Public’s access to Information Relating to the Environment Law (n. 119(I)/2004)
2	Environmental Impact Assessment (EIA)	The Assessment of the Impacts on the Environment from Certain Projects Law (L. 127(I)/2018)
3	Pollution regulation	The Control of Water Pollution Law (L. 106(I)/2002)
4	Pollution regulation	The Industrial Emissions Law (Integrated Prevention and Control of Pollution) (L. 184(I)/2013)
5	Waste management	The Packaging and Packaging Waste Regulations (Reduction of the Consumption of the Thin Plastic Transportation Bag) (RGL. 375/2017)
6	Waste management	The Solid and Hazardous Waste Law (L. 215(I)/2002)
7	Biodiversity protection	The Protection of European Wild Life and Natural Habitats Law (L. 24/1988)

Applying the European Directives 92/43/EEC (Protection of Habitats) and 2009/147/EC (Conservation of Wild Birds), Cyprus proceeded to design and implement the Natura 2000 (Natura2K) network, designating 40 areas as *Sites of Community Importance* (SCIs) out of which 20 are characterized as *Special Areas of Conservation* (SACs) and 31 regions as *Special Protection Areas* (SPAs), for the protection of birds. Cyprus has one of the highest proportions of land covered in Natura2K areas among EU members, with a Natura2K network exceeding 28 percent of its total area, the majority of which is terrestrial (93 percent) and only a small percentage (7 percent) is located within the marine environment (Environment Department, 2016). Specifically, 7 marine areas have been introduced within the Natura2K network, including the areas of Akamas, Akrotiri, Cavo Greco and the most recently introduced region of Oceanis (2019), extending over an area of 8,317 Km² and designated for the protection of cetaceans and marine turtles that use Cyprus as a migration corridor (DFMR, 2019b). So far, 39 administration plans have been prepared for the management of habitats and species within these regions.



Figure 1 Natura 2000 network in Cyprus: Green – Sites of Community Importance (SCIs), Yellow – Special Protection Areas (SPAs), Red – SCIs & SPAs (Department, 2021)

Apart from the Natura 2K Network, areas in Cyprus are protected under other national legislative frameworks and are conserved in the form of National Forest Parks, Marine Protected Areas (MPAs), Permanently Prohibited Hunting Areas, Protected Landscapes and others. At present, 11 National Forest Parks have been established in Cyprus accounting for a total area of over 20,000 ha (Forestry Department, 2021c) while the total protected area under these regimes is approximately 400,000 ha (Environment Department, 2016). MPAs in Cyprus make up 19 percent of the island’s entire marine area, including 7 artificial reef MPAs. The neighboring biodiversity rich area of Eratosthenis Seamount, located 100 Km south of Cyprus and featuring a uniquely rich environment in the Levant Basin with high faunal diversity and density, is declared as a Fisheries Restriction Area according to General Fisheries Commission for the Mediterranean (GFCM).

Although the Turkish Cypriot community lies outside of the EU community aquis, with support of the EU Aid Package for the Turkish Cypriot Community, seven SPAs have been identified and delineated according to Natura 2000 guidelines. These sites are set to join the Natura 2000 network on EU aquis in the Turkish Cypriot community, should a resolution on the ongoing Cyprus dispute be found. The seven sites are Agia Irini (Akdeniz), Alakati (Alagadi), Akanthou (Tatlisu), North Karpasia (North Karpaz), South Karpasia (South Karpaz), Pentadaktylos (Beşparmak) and Famagusta Wetlands. The management plans for six of the seven potential Natura 2000 sites have been incorporated into the Environment Law of Northern Cyprus, with the exception of Pentadaktylos, while one additional SPA has been created for the Gypsos (Akova) area of Karpasia peninsula, thus seven sites are under active management by the Department for Environmental Protection of Northern Cyprus. All SPAs except Gypsos and Famagusta Wetlands include a coastal MPA to 1.5 km offshore or to the 30 m bathymetric contour, within which set netting and anchoring are prohibited to protect posidonia meadows, and, for instance, a 200 m exclusion zone around the Kleides islands seabird

colony (Figure 2). However, regulations in these marine areas are not yet implemented and more than a decade has passed since they were developed. During this time, studies have become available to refine and make the marine areas more manageable, since in their current form they may cause significant loss of income to small-scale fisheries in rural areas. Work is underway to amend fisheries regulations in order to protect nesting sea turtles and breeding seals, meanwhile a ban on landings at the Kleides Islands Marine Important Bird Area (IBA) is observed (Snape and Beton, 2017).

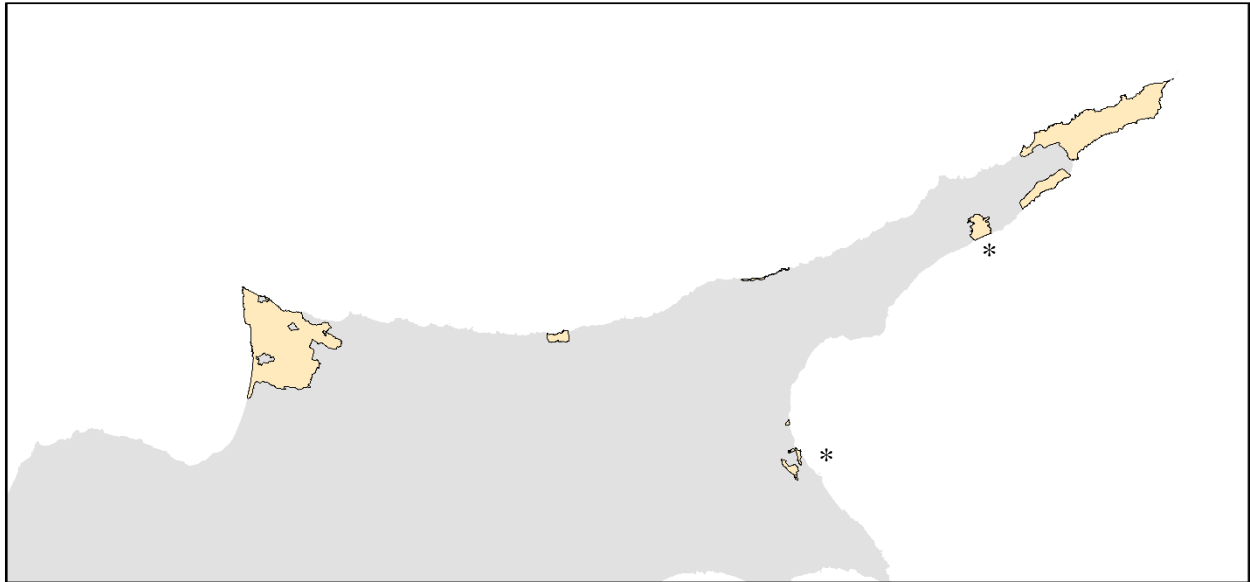


Figure 2 Actively managed SEPAs in Northern Cyprus with Famagusta wetlands and Gypsos (*) not yet having assigned Marine Protected Areas – Source: KUŞKOR



Figure 3 Marine protected areas in Cyprus including: MPAs with fisheries restrictions and Marine Natura 2000 –Source: Department of Fisheries and Marine Research

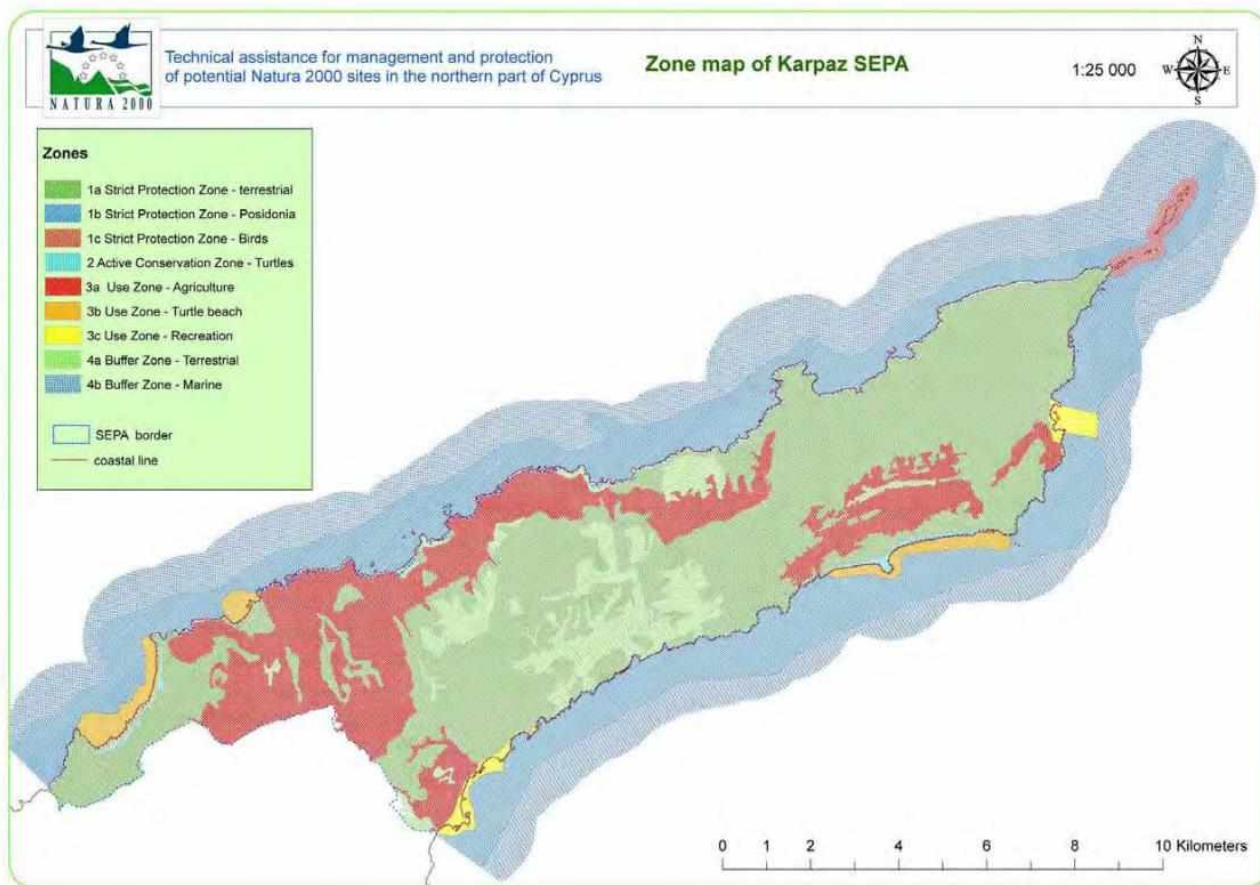


Figure 4 North Karpasia SPA/Potential Natura 2000 site showing land and sea use zones with only the terrestrial zones yet implemented – Source: (Fuller et al., 2009)

Cyprus’ climate ranges from subtropical and Mediterranean in the south-western and central part of the island to semi-arid in north-eastern Cyprus and is characterized by mild and moist winters and hot and dry summers of high temperatures and prolonged droughts. Precipitation on the island ranges between 300 mm on the central plain to 1000 mm on Troodos mountain range. Overall, Cyprus has 20 groundwater bodies and 261 designated surface water bodies, including 216 rivers, 18 lakes and 27 coastal water bodies (European Commission, 2015).

Climate change is already affecting the Mediterranean region, transforming it’s Mediterranean climate to arid. Cyprus is located in a hot spot of global climate change: Rises in temperature, reduction in annual precipitation, more extreme rain events and extended droughts are some of the anticipated climatic phenomena on the island. Mean annual temperatures in Cyprus have already increased by at least 1.5°C in the last hundred years (MOA, 2017) with days exceeding 38°C anticipated to increase by another two weeks within the next thirty years (Michael, 2020). While only 10 days of heatwave were recorded in Nicosia 50 years ago, by 2100 the number of heatwave days is anticipated to increase to 210 (Cyprus Institute, 2020). Average annual precipitation between the years 1971-2000 was 462 mm, a 17 percent reduction compared to years 1901-1930 where mean annual precipitation was 559mm (MOA, 2017). A 15 percent increase in the areas in Cyprus at high risk of desertification is anticipated in the next 30 years, putting 72 percent of the

entire island in this category (Michael, 2020). Perhaps most alarming are the predictions that within the next 100 years, the island’s ability to produce food will be greatly impaired (see Figure 5) (Cyprus Institute, 2020).

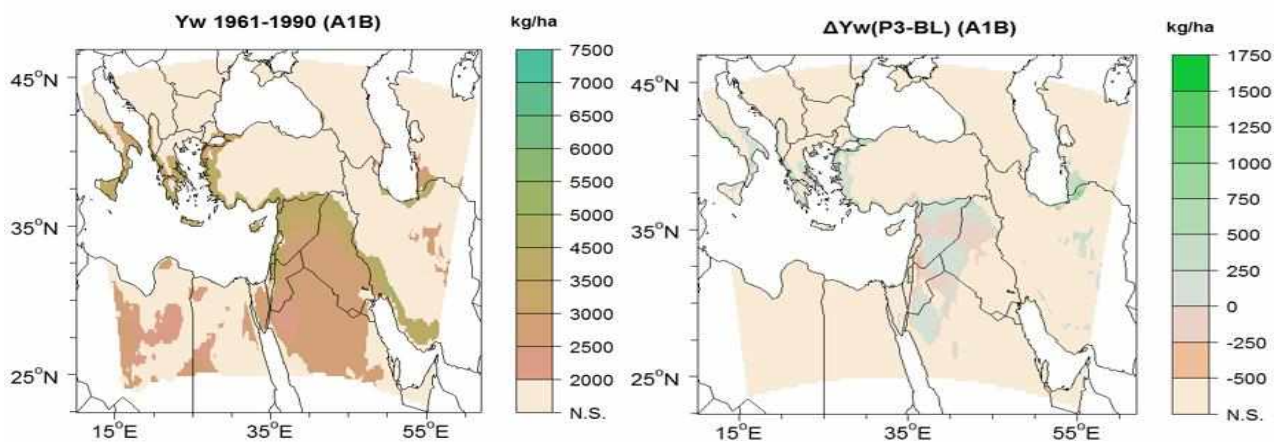


Figure 5 Left: Yields within the period 1961-1990 and Right: Anticipated differences in yields between the periods 2070-2100 and 1961-1990 – Source: The Cyprus Institute

2. Environmental Challenges of Cyprus

Cyprus used to be known as the “Green Island” of the ancient world since it was once covered in diverse forests and maquis and scrubland vegetation, consisting of cedar, pine, oak, cypress, juniper, pistachio, carob, myrtle and arbutus species clothing even “the driest slopes with a thick canopy” (P. G. Medon – 1881) (Thirgood, 1987). Since the first settlements were recorded on the island though, the island has felt the effect of both natural and anthropogenic impacts. The exploitation and removal of mature forests strands for the purposes of ship-making, mining, resin extraction, construction and the expansion of settlements and agriculture, extensive and uncontrolled grazing, as well as climate change stress, are some of the factors that shaped and continue to shape the natural environment of Cyprus.

Today, unsustainable resource exploitation including fishing, inefficient waste management mechanisms, land take for urban development and intensified agricultural practices alongside insufficient biodiversity conservation measures, are some of the factors threatening the fine equilibrium of Cyprus’ natural habitats. The major sources of contemporary pressure on the island’s terrestrial, marine and freshwater systems follow.

2.1 Biodiversity of Cyprus: Terrestrial, Marine and Freshwater systems

Due to long and continuous anthropogenic and natural pressures, the island’s forests today are primarily composed of *Pinus sp.* strands with only a few representatives of climax species such as *Quercus infectoria*,

Cupressus sempervirens and *Juniperus spp.* - a forest composition regarded as premature in terms of its succession stage, with significant areas of the Akamas and Karpaz (Karpasia) peninsulas allocated for conservation of *Juniperus* dominated woodland. Extensive pine composed forested areas though make them more susceptible to pest infestations such as pine processionary moth and wildfires as well as the anticipated climate change pressures.

Regarding bird populations in Cyprus, both long and short-term trends in reproducing and migrating bird taxa of Cyprus, show that 10 percent of them are declining while for 15-20 percent of them there is an insufficient amount of data (Environment Department, 2016). While according to Birdlife Cyprus, some species that use farmland such as the Kestrel and the Chukar, seem to be maintaining stable populations, certain species that make extensive use of farmland habitats, like the European Roller, seem to have declining populations as seen in Table 3. Such patterns could possibly be linked to changes in farming practices such as agricultural intensification and the use of synthetic pesticides and heavy machinery (DFMR, 2019a). Nest box projects are underway in both communities with Barn Owl and European Roller status improving, both of which are considered beneficial to agriculture, feeding on pest species.

Table 3 Changes in populations of farmland habitat-based bird species in Cyprus – Based on data by Birdlife Cyprus

a/a	Species	Short-term decline (%) 2001-2013	Long-term decline (%) 1980-2012
1	Goldfinch	10-20	
2	Linnet	10-20	
3	Spanish Sparrow	30-70	
4	Roller	30-50	
5	Swallow	25-40	
6	House Martin	stable	10-20
7	Turtle Dove	stable	10-30

Illegal trapping is another threat for bird species in Cyprus, practiced primarily for the capturing of Blackcaps. Such practice results in the trapping and killing of more than 40 different songbird species and over 150 different species overall. Estimates suggest that the non-selective methods of mist nets and limesticks may result in as many as 2.5 million birds being killed illegally every year, placing Cyprus among the 5 worst Mediterranean countries in illegal bird killing (Birdlife Cyprus, 2020). Hunting on the other hand poses a significant pressure on local biodiversity, with 50,000 hunting permits distributed across the island – entailing one hunter for every 0.1 Km² of land. Additionally, it has been observed that almost 80 percent of stray animals present today in shelters are hunting dogs, a result of insufficiently regulated reproduction and distribution mechanisms of hunting dogs taking place in the country. State funding designated for volunteer-based animal shelters is minimal, while the recently established force of “Animal Police,” is considered

severely understaffed and needs more support for the efficient regulation of animal welfare in Cyprus. High numbers of stray dogs in turn, result in ecological damage through disturbance and predation of waterbirds and their nests and predation of sea turtle nests. As they affect livestock farming and other businesses too, this results to the wide and “underground” control of their numbers through distribution of poisoned meat baits. As a result though significant numbers of birds of prey are killed through direct and secondary consumption of poison.

A lack of sufficient data to evaluate the status of certain local species seems to be the common narrative for all ecosystems in Cyprus: terrestrial, marine and freshwater. Despite the fact that a Red Data Book was created for endangered and rare species of Cyprus flora, such a publication does not yet exist for the local fauna. Little information exists today on the distribution and abundance of cetaceans (whales, dolphins) and elasmobranchs (sharks, batoids) in Cyprus, with data limitations particularly affecting areas deeper than 50 meters below sea level. The absence of long-term monitoring protocols and lack of access to advanced monitoring techniques, make the efficient management of Cyprus’ protected areas challenging. Recent gains have been made in elasmobranch research and conservation through the island-wide Cyprus Bycatch Project and Cyprus Elasmobranch and Conservation Networks establishing onboard observer schemes in small-scale fisheries. One result has been the Sub-Regional Action Plan for Angel Sharks (Gordon, Trust and Giovos, 2020; Bengil *et al.*, 2021) as it was realised that Cyprus is a regional hotspot with important numbers and breeding areas for Mediterranean Angel Shark species, which are extinct in many other countries.

Extensive urbanization of coastal areas, touristic accommodation development and increased human traffic on beaches have adverse effects on terrestrial and marine species. Intense aquaculture activities, erroneous waste management practices, untreated sewage and polluted urban rainwater runoff directed to the sea, are some of the most common human stressors causing adverse effects on Cyprus’ marine habitats. In some cases the exact impact of anthropogenic activities is not yet known, such is the case of desalination brine release in the sea: an activity noted to have increased by 65 percent between the years 2010 and 2019 (DFMR, 2019a). Traffic on beaches and disturbance of nesting sites, lighting of beaches as well as bycatch mortality in fisheries, are all major threats for the vulnerable and endangered marine species such as *Caretta caretta*, *Chelonia mydas*, cetaceans and Mediterranean shags. In the case of “Polis Yialia” beach for example, insufficient measures imposed by the authorities, led to the destruction of several turtle nests (Republic of Cyprus Audit Service, 2018). On the other hand, the most endangered seal species in the world, *Monachus monachus*, with only around 20 individuals occurring in Cyprus, are mainly at risk due to the destruction and disturbance of their breeding grounds, illegal killing and entrapment in fishing equipment.

Overfishing is one of the fundamental causes of extinction for Cyprus' marine biodiversity, with 800 registered professional and over 5,000 amateur fishing licences currently active on the island. Illegal fishing, including the killing of endangered and threatened species, an activity that often takes place within territories of established MPAs, puts increased pressure on Cyprus' limited fishing stocks (Figure 6). Across the island the existing fisheries legislation is not sufficiently implemented and, in many areas, outdated official landings are significantly underestimated or not declared and in the face of declining fish stocks, fishers are increasing their fishing effort to maintain landings (Ulman *et al.*, 2015). This situation is not sustainable for many protected marine vertebrate species.



Figure 6 Spatial distribution of illegal professional fishery in Cavo Greco MPA as reported by professional fishers - Bold colors indicate the highest percentage of fishing intensity - (Moutopoulos *et al.*, 2021)

Noise pollution poses a considerable threat to marine organisms, especially cetaceans, with major sources being the extensive shipping activity, military sonars and seismic air guns used in oil and gas surveying (DFMR, 2019a). What is interesting though is that no marine noise monitoring schemes are currently employed in Cyprus.

An estimated 229,000 tonnes of plastic leak into the Mediterranean Sea every year (IUCN, 2021b), with 760 tonnes originating from Cyprus although this estimate does not include the Turkish Cypriot community. This accounts for an average of 106 kg of plastic waste per capita per year – 63 percent higher than the overall average in the Mediterranean (IUCN, 2021a). The dominant marine litter materials, both on beaches (58 percent) and seafloor (95 percent), are plastic and polystyrene (DFMR, 2019a) with the greatest contributors being the sectors of packaging, tourism and fishing (IUCN, 2021a). Beaches along the north coast, especially north Karpaz (Karpasia) beaches are worst impacted. Most concerning is Ronnas Bay, the island's most

important green turtle nesting beach, where concentrations of plastic in the sand are among the highest for any sediment observed globally (Figure 7).



Figure 7 Plastic accumulation on Ronnas Bay where despite regular beach cleans, tones of plastic continue to wash ashore – Source: SPOT

Even though multiple marine areas have been proposed for conservation, there is a great need for the evaluation and improvement of existing MPA management plans. Better MPA management plans through enhanced awareness and participation of stakeholders, a more efficient spatial design and greater data accumulation on present species and their habitats, will ensure the effectiveness of established MPAs. Until a unified national strategy for the management of Cyprus' MPAs is formed, any efforts for the monitoring and management of Cyprus' most vulnerable marine habitats will be impaired (Republic of Cyprus Audit Service, 2018).

Non-indigenous species (NIS) are species that, with the direct or indirect help of humans, cross biogeographic boundaries and manage to survive and reproduce in new regions. When NIS demonstrate an invasive behaviour, then these invasive alien species (IAS) can pose serious ecological and socioeconomic impacts on the new areas they arrive in. In the marine environment, out of 179 NIS recorded in Cyprus, six are classified as invasive, including the species of *Caulerpa cylindracea*, *Lagocephalus sceleratus* and *Pterois miles* who's dominant introduction pathway is the Suez canal (DFMR, 2019a). The invasion of NIS equally affects freshwater habitats as it does marine systems. NIS introduced into rivers and dams of Cyprus primarily for commercial and recreational reasons are now finding their way into well-isolated locations across Cyprus.

Common carp is having a devastating effect on wetland biodiversity. At Kukla Wetlands, a recent introduction has been attributed to a transition of the IBA wetland to a turbid lake with low water quality and resulting reductions in numbers of wintering ducks and freshwater plant and invertebrate life.

According to the EU's latest report, Cyprus is failing to meet its Water Framework Directive (WFD) goals in both surface and ground-water bodies (European Commission, 2015). Industrial pollutant release and contaminants originating from runoff and human land-use practices, such as agriculture and livestock farming, seem to be the main causes for the pollution of Cyprus' water bodies with phosphate levels often reaching 100 times higher than threshold limits. Mining activities also seem to be negatively affecting freshwater systems with cadmium found to be highest pollutant of Cyprus' waterways (European Commission, 2015). The situation is similar in the Turkish Cypriot Community, where the abandonment of the Cyprus Mining Company remains unresolved with widespread pollution in the Lefke area.



Figure 8 An introduced non-native *Carassius* sp. identified in a very remote valley location situated along the Amathus river – 2020 – Source: The Freshwater project

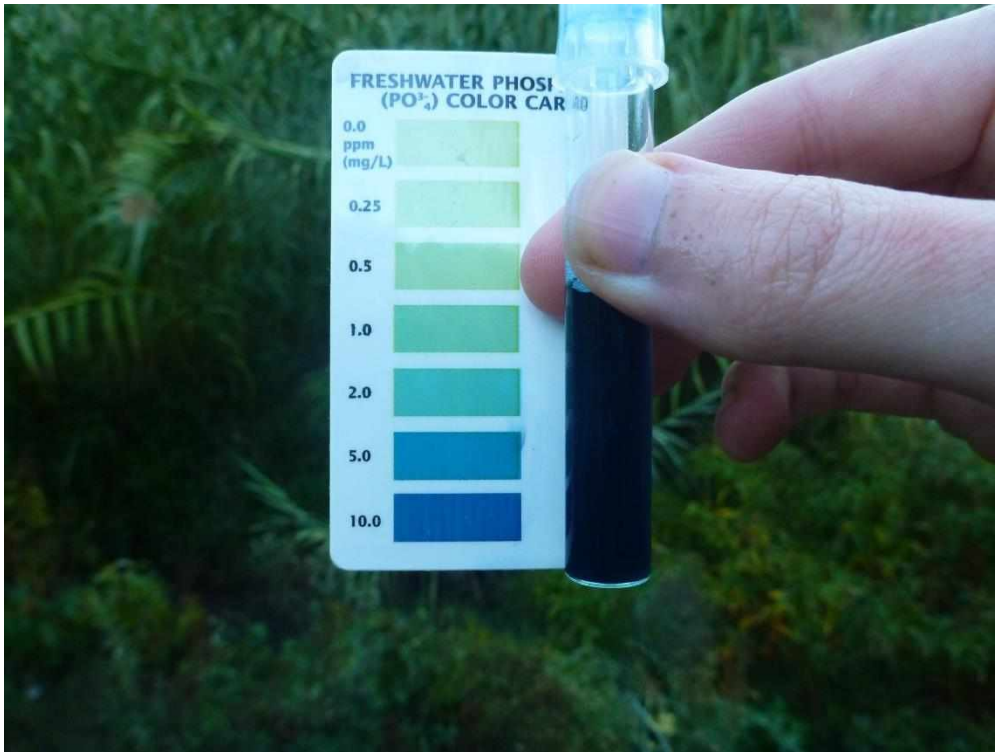


Figure 9 Identified phosphate levels in a water sample taken from a stream passing through agricultural land far exceeding the 0.1mg/L phosphate limit – Amathus river watershed, 2018 – Source: The Freshwater Project

2.2 Land use and Land take

2.2.1 Land take for urban and artificial areas development

The majority of land take that took place in Cyprus between the years 2002 and 2006 for development of urban and artificial areas was on the expenditure of pastoral and agricultural land (Figure 7). The encouragement of projects such as the development of wind farms, marinas, golf courses and extensive photovoltaic parks within or in the proximity of protected areas inevitably leads to the loss and degradation of Cyprus' important habitats (DFMR, 2019a). In the case of Peyia's sea caves for example, in an area where the protected species *Monachus monachus* pup, the competent authorities approved the construction of 6 private villas (Republic of Cyprus Audit Service, 2017).

In the island's city centers ground sealing is unsustainably transforming the urban environment, with agricultural and pastoral land progressively being transformed into building lots, hotels, tall buildings, and overall impervious surfaces. Unsustainable urban development creates elevated risks for flooding, massive ground sealing and constant shrinking of urban green spaces, inevitably leading to an accentuated heat island effect. Higher frequency of hot days due to climate change means that in the near future, heat waves could

last for weeks or even months instead of days (Michael, 2020) putting the most vulnerable groups of Cyprus' population, the elderly, the very young and the poor, at a higher risk of mortality.

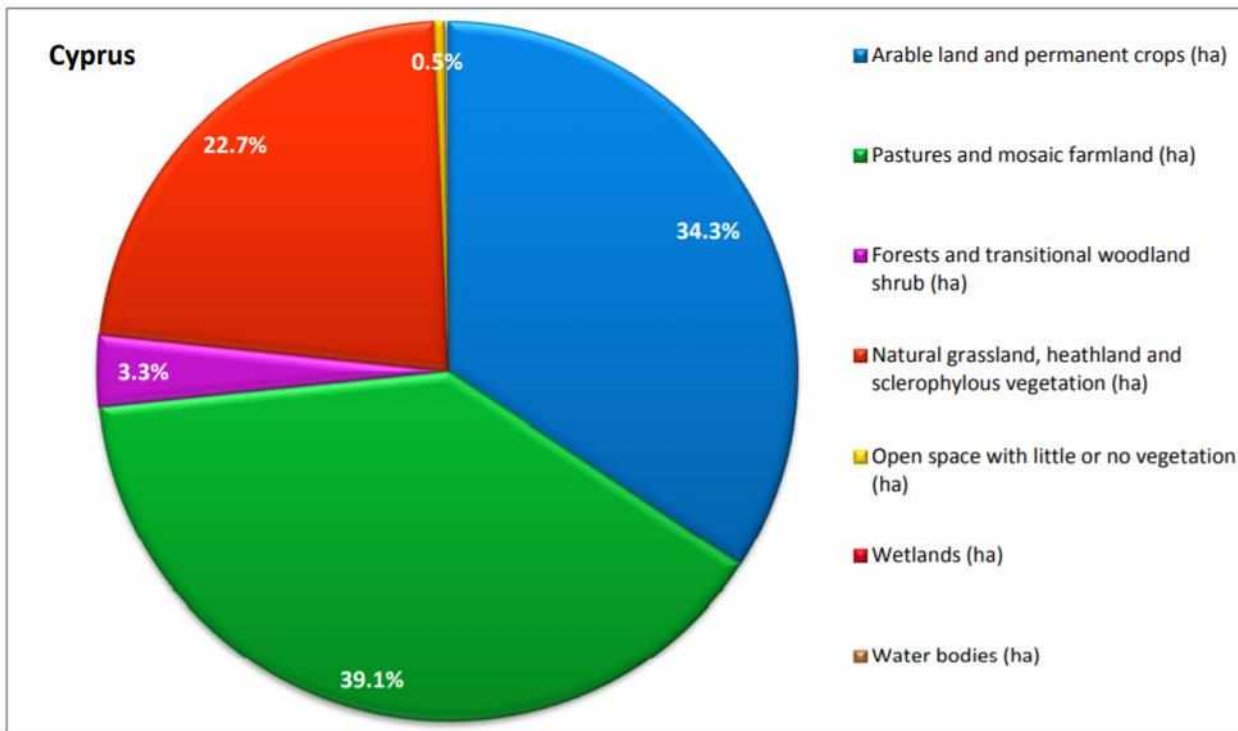


Figure 10 Land take in Cyprus for the development of urban areas or other artificial areas (2000-2006) - (Environment Department, 2016)

The unregulated expansion of road networks is a factor well recognized for having adverse effects on local biodiversity and protected areas. In the last 20 years, the road network of Cyprus has expanded by 88 percent, with road density found to be comparable to that of larger and more populated Mediterranean countries such as France, Spain and Italy, leaving only 4.5 percent of the island as roadless areas (Zomeni and Vogiatzakis, 2014). On the other hand, isolated housing units located outside rural community centers, can lead to habitat fragmentation as well as elevated risk for forest fires. A lack of a concrete development plan for Cyprus' rural areas, inevitably leads to the extensive licensing of such developments all across Southern Cyprus rural region. What is alarming though, is that this phenomenon still continues to perpetuate in Northern Cyprus, where legislative framework lacks the necessary regulative mechanisms.

2.2.2 Land take for farming purposes

Today, among the most important anthropogenic pressures causing land degradation in the Mediterranean are intensive agriculture and abandonment of agricultural land (Merino *et al.*, 2019). Intensified agricultural systems heavily rely on non-renewable resources and have elevated irrigation and fertilization needs, especially in the case of degraded soils and climate change pressures. High production cost compared to

other EU countries due to high dependence on non-renewable resources, means that Cyprus holds a lower competitive advantage on the production of food. Mainstream conventional farming practices applied in Cyprus depend greatly on synthetic fertilizers and pesticides as well as fossil-fueled heavy machinery used for the tillage and manipulation of soil.

Among the intensive agricultural methods applied in Cyprus today are monocultures, chemical farming, soil tillage and the incorporation of non-locally adapted species. While an overall decrease in pesticide sales is noted in Europe in the past 8 years, Cyprus presents the highest increase in pesticide sales between the years 2011 and 2019 among 18 other EU Member States (Figure 8) (Eurostat, 2021). While the application of synthetic fertilizers and pesticides is undermining the provision of multiple ecosystem functions, Cypriot farmers have widely adopted the application of repetitive tillage as a means of cultivating their plots and controlling the growth of weeds – a method greatly promoted and subsidized by the government during the last few decades. Soil tillage though is known to cause adverse effects to agroecosystems such as the degradation of soil, threatening of local biodiversity and the increase of total surface area under a high risk of desertification (Figure 9). On the Mesaoria plain, remaining salt marsh habitats are being ploughed and converted for agriculture. Despite these areas being designated as part of a recognised IBA, this habitat destruction continues. Similar encroachment of agriculture has been seen in scrubland habitats, even in the north Karpaz (Karpasia) SPA (Figure 13).

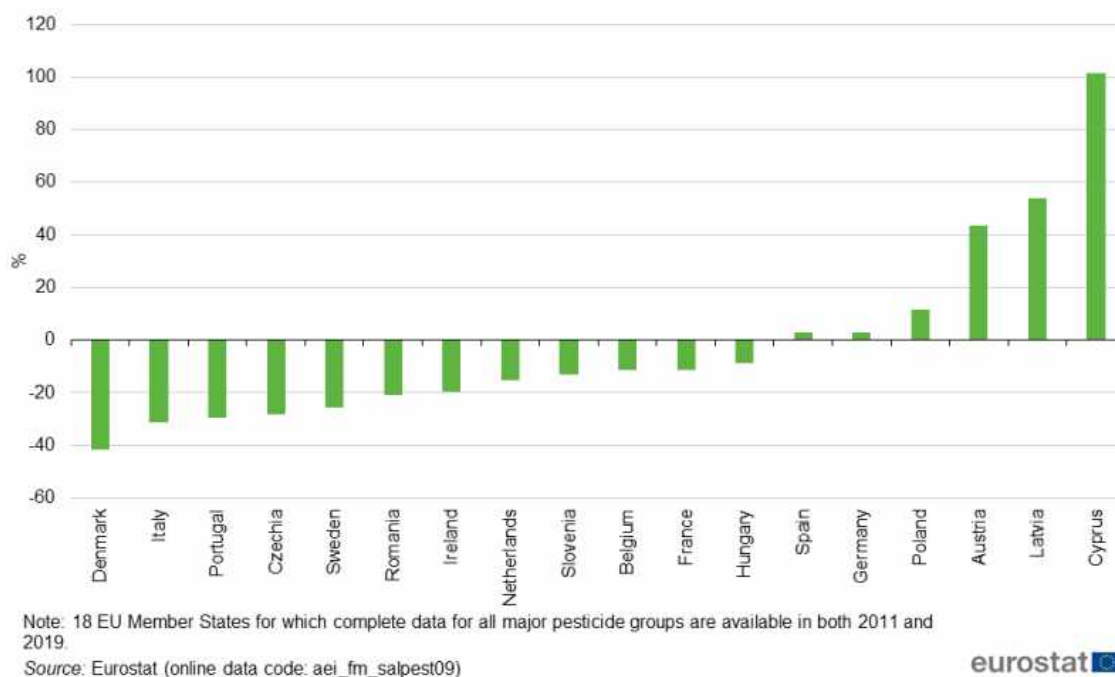


Figure 11 Sales of pesticides, 18 EU Member States, percentage change 2019 compared with 2011 – Source: Eurostat

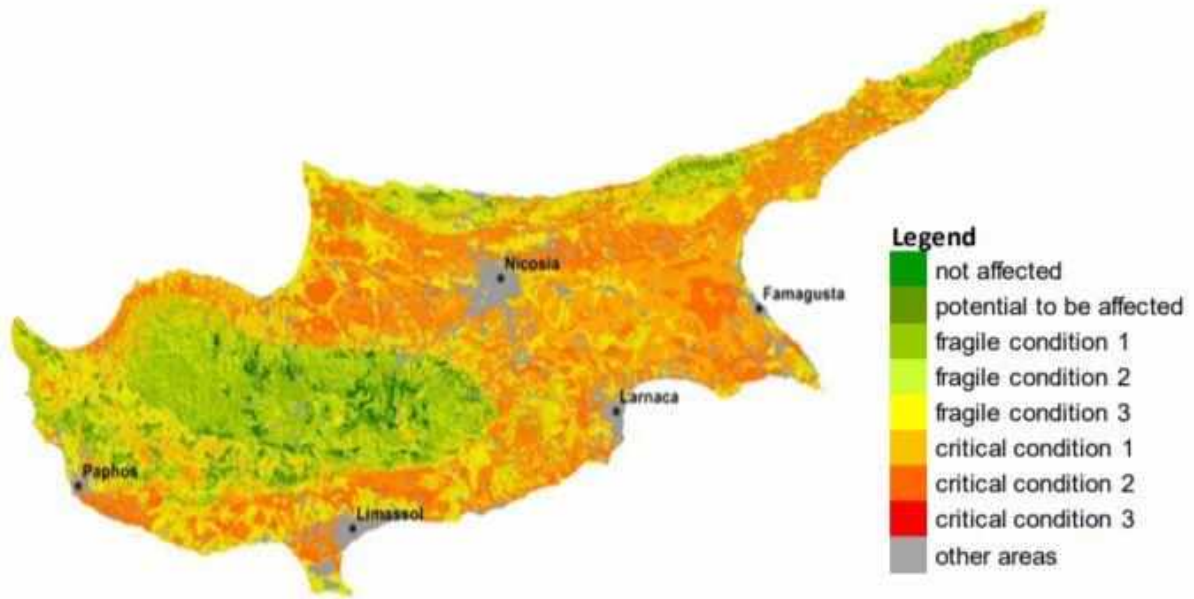


Figure 12 Status of areas of Cyprus in relation to risk of desertification – Source: Ministry of Agriculture, Environment and Rural Development, “Climate Change Risk Assessment, Land Desertification” 2016

Despite the fact that regenerative farming practices are seeing an increase in Cyprus, the overall organic farming area in Cyprus accounts for a mere 4.5 percent of the island’s total agricultural land – a percentage 3 percent lower than the average EU organic farming area (In-Cyprus, 2019).



Figure 13 Salt marsh habitats in the East Mesaoria Plain IBA in 2008 (left) and 2021 (right) - Source: Google Maps

2.3 Resource use

2.3.1 Energy

Cyprus has been setting quite unambitious goals in reducing its overall greenhouse gas emissions (GHG). In the country's long-term strategy for the reduction of GHG emissions, none of the decarbonization proposed scenarios are able to achieve the cumulative savings in GHG emissions as required by the Intergovernmental Panel on Climate Change's (IPCC) 1.5°C trajectory. According to specialists, more radical interventions are needed demanding simultaneous actions from multiple ministries and departments such as the Ministries of Transportation and Commerce.

The utilization of all urban buildings for the establishment of solar roofs, remains a widely unexplored field in Cyprus. Instead, fertile agricultural land is progressively being repossessed and transformed into photovoltaic parks. In terms of transportation, in 2018 Cyprus was able to achieve a percentage of 2.5 percent powered by RES instead of its 10 percent goal (Theopemptou, 2018b), while the energetic upgrade of new buildings owned and administrated by public authorities, a legal obligation as of the beginning of 2021, has not yet been sufficiently employed by the State (Theopemptou, 2018a).

Overall, Cyprus has been lagging investments in green mobility such as the promotion of electric cars, the enhancement of public transportation, the discouragement of private car ownership, the creation of more, safer and higher efficiency bike lanes and the overall utilization of RES for the production of electricity. In Both Greek and Turkish Cypriot communities lack an organized and centralized public transportation system, cycling and walking trails are limited and disorganized and urban areas make navigation by foot or by bicycle difficult.

2.3.2 Water management

According to the Water Framework Directive (WFD), use of water should be prioritized first for the consumption of humans, secondly for utilization by the environment and lastly for purposes of irrigation. Policies on the exploitation of available water resources in effect though in Cyprus, seem to be leaving the environment as one of the last beneficiaries. Part of Cyprus' plan to increase water resiliency on the island has been to construct several large-scale dams: in the southern part of the island only, 18 dams with a total capacity of 290 million cubic meters have been constructed (Water Development Department, 2021). Such structures might be increasing water supply and irrigation security, but many times they have been noted to cause tremendous degradation of downstream aquatic habitats.

Furthermore, Cyprus notes the highest water exploitation index compared to all other EU countries. The recorded indexes of 75 to 83 percent during the years 1998-2013, indicate a nation under “severe water stress” (Environment Department, 2016). Of all groundwater bodies, only 20 percent are reported to be in good quantitative condition, a status that has not managed to improve in the last twelve years (European Commission, 2015). Over-exploitation of groundwater is a significant pressure on the island, mainly due to lack of regulation of privately-owned boreholes. Furthermore, excessive abstractions have been recorded to cause saltwater intrusion in an increasing number of regions in Cyprus with 5 out of 21 groundwater systems appearing to be in a state of bad quality, due to nitrate pollution and submarine groundwater discharge (Environment Department, 2016).

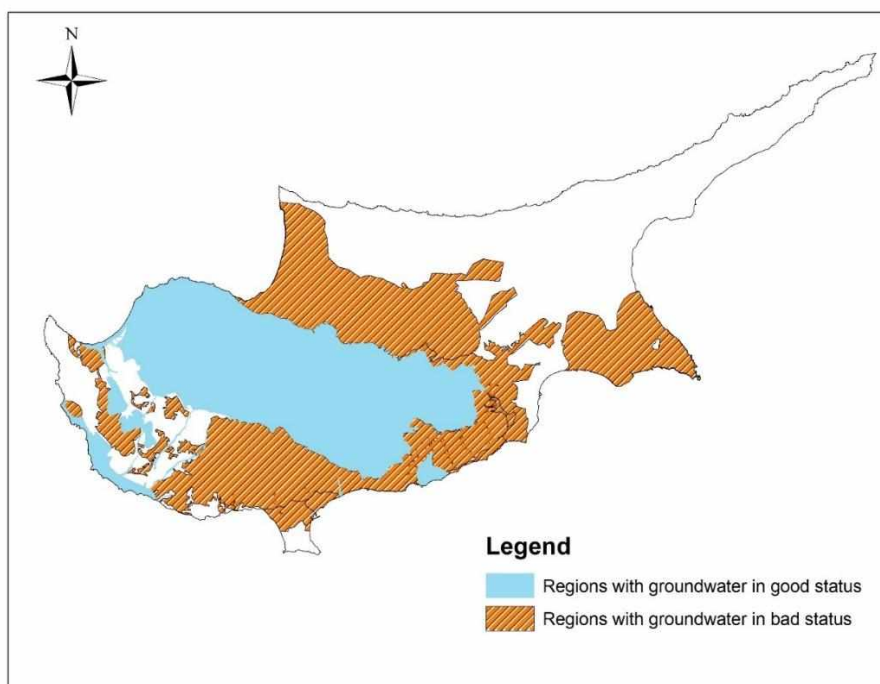


Figure 14 Regions in Southern Cyprus with groundwater systems in good and bad status – Source: Sofia Matsi - Based on data provided by Hydrology and Hydrogeology Service (Ministry of Agriculture, Environment and Rural Development)

While groundwater bodies are being depleted from overuse, insufficient measures are being taken to promote their replenishment: development in urban centres results in massive soil sealing with rainwater failing to infiltrate and recharge groundwater reservoirs. Instead of implementing localized urban rainwater harvesting systems, rainwater is left to flood city centres and directed, untreated, towards urban sewage systems and marine environments. The Turkish Cypriot community now sources much of its domestic and agricultural water from a pipeline serving the Geçitköy dam. This is widely considered to be an unsustainable solution to the problem of drought and more actions are needed to increase sustainability of water use through innovative local solutions.

2.4 Air quality

Air quality is perceived as the number one environmental concern of EU citizens and Cypriots, according to professor Jean Sciare, director of the Energy Environment and Water Research Centre (EEWRC) of Cyprus Institute. Air pollution currently costs the nation around 748 million euros a year, 3.3 percent of the country's GDP. Exposure to pollutants such as PM_{2.5}, NO₂ and O₃ causes 870 premature deaths in Cyprus annually (EEA, 2020), which means Nicosia residents end up dying 1 to 1.5 years earlier due to poor air quality. Such an important health issue would be expected to be under serious monitoring schemes in Cyprus, yet an alarming lack of data exists today regarding tracking and recording PM_{2.5} levels. Seventy percent of air pollution in Cyprus today has an anthropogenic source with major sources being biomass burning (32 percent), traffic (17 percent) and cooking (15 percent). In the Turkish Cypriot community, air quality in the Kyrenia and Famagusta regions are of great local concern, with two oil burning power stations operating outside of EU air quality mitigation requirements.

2.5 Waste management

One of the most crucial environmental issues for Cyprus is the lack of efficient and sustainable waste management mechanisms. Currently, the island is lacking the "Separation at Source" initiative, leaving tons of organic waste from households and farms to be sent to landfill as opposed to being used resourcefully (e.g. for compost). According to 2014 data, Cyprus generates exceptionally high volumes of municipal solid waste: 617 kg per capita with only 18 percent of it being recycled. This means that the country is failing to achieve its 2020 50 percent recycling target (EEA, 2016). Civic amenity sites, known as the "Green Points" (Πράσινα Σημεία) were created by the State for the facilitation of household waste management. But whether these units serve their waste management goals has been questioned (Theopemptou, 2020). In the recycling sector, about 50 percent of plastics that end up in recycling units consist of non-recyclable plastics. The need for stricter policy and awareness programs applicable both on the consumer and industry levels, is evident.

One of the major causes of forest fires in Cyprus, are farming activities (Forestry Department, 2021d). One of the most notorious ways Cyprus farmers choose to eliminate organic farming residues produced on their farms is through setting them on fire. Such a practice though often leads to catastrophic events, such as the fire in Solea in 2016 that burnt 18 Km² of native forest and the latest one in Arakapas, which ended up with 4 human lives being lost and 55 Km² of local forest being charred. Lack of awareness programs among the

farmers, as well as shortage of state and private initiatives that aim for the collection and management of farming residues, only proliferate this phenomenon.

Hazardous waste generated by abandoned mines on the island, often end up polluting nearby water bodies putting residents of adjacent areas in danger. For example, in the case of the abandoned Xeros Mine in the Morphou area, elevated quantities of heavy metals such as cadmium, arsenic and lead have emerged in nearby water bodies causing increased cancer levels to the neighboring community of Lefka.

2.6 State and Political situation in Cyprus

Even though environmental policies hold a priority amongst the entire EU community, Cyprus frequently lags. Despite, for example, the competent authorities' obligation to harmonize with the Green Public Conventions (Law for the regulation of conducting Public Conventions [N.73(I)/2016]), agreements between state entities and green food producers do not currently take place. As a result, local organic farmers are not currently supplying public hospitals, schools, and military bases with their produce as the convention entails. Failure to prioritize environmental conservation on the national level is ultimately evidenced by the fact that in 2019 only 0.3 percent of the country's GDP was spent on the protection of the environment, one of Europe's lowest governmental expenditures (Figure 11).

In a recent assessment conducted by a judge of the European Union Court, it emerged that inadequate mechanisms exist in the constitution and legislative framework of Cyprus (Lycourgos, Vlachogiannis and Yiordamli, 2021). Such gaps result in local NGOs having limited access to environmental justice tools, therefore enhancing the need for the state to do more about the promotion of environmental justice.

Cyprus' specific political situation has had an adverse effect on the island's environmental integrity. Lack of cooperation among authorities between the north and the south inevitably leads to an uncoordinated strategy for the efficient management and conservation of the island's natural environment. Moreover, despite the fact that there is an exceptional research and conservation contribution due to the activity of Northern-Cyprus scientists and NGOs (Charalambidou and Gücel, 2008; Snape *et al.*, 2013; Hellicar *et al.*, 2014; Keller *et al.*, 2020) discrepancies exist till today between funding allocated to NGOs active in the north and the south of the island. Northern-Cyprus NGOs, have limited funds to work with as they are not eligible recipients of LIFE/Darwin initiative EU grant and are often limited to restricted funds allocated to them via EU's support package for the Turkish-Cypriot community which arrives as civil society grants - competing with flaming issues such as refugee aid and human trafficking.

	Environmental protection	Waste management	Waste water management	Pollution abatement	Protection of biodiversity and landscape	R&D Environmental protection	Environmental protection n.e.c.
EU-27	0.8	0.3	0.1	0.1	0.1	0.0	0.1
euro area	0.8	0.4	0.1	0.1	0.1	0.0	0.1
Belgium	1.3	0.4	0.1	0.6	0.1	0.0	0.1
Bulgaria	0.7	0.6	0.0	:	0.0	:	0.1
Czechia	0.8	0.3	0.2	0.0	0.2	0.0	0.0
Denmark	0.4	0.0	0.0	0.0	0.2	0.0	0.1
Germany	0.6	0.2	0.1	0.2	0.1	0.0	0.0
Estonia	0.7	0.2	0.1	0.1	0.1	0.1	0.1
Ireland	0.4	0.0	0.2	0.0	0.1	0.0	0.0
Greece	1.4	0.7	0.0	0.6	0.0	0.0	0.0
Spain*	0.9	0.5	0.1	0.0	0.1	0.0	0.1
France*	1.0	0.5	0.2	0.1	0.1	0.0	0.1
Croatia	0.7	0.1	0.1	0.0	0.1	0.0	0.3
Italy	0.9	0.6	0.0	0.0	0.1	0.1	0.0
Cyprus	0.3	0.2	0.0	0.0	0.0	0.0	0.0
Latvia	0.6	0.4	0.0	0.1	0.0	0.0	0.1
Lithuania	0.4	0.2	0.0	-0.1	0.0	0.0	0.1
Luxembourg	0.9	0.2	0.4	0.1	0.1	0.0	0.0
Hungary	0.5	0.2	0.2	0.0	0.1	0.0	0.0
Malta	1.4	0.6	0.4	0.0	0.3	0.0	0.0
Netherlands	1.4	0.5	0.4	0.3	0.1	0.0	0.0
Austria	0.4	0.0	0.1	0.2	0.0	0.0	0.0
Poland	0.5	0.1	0.2	0.1	0.0	0.0	0.1
Portugal**	0.6	0.2	0.1	0.1	0.1	0.1	0.1
Romania	0.7	0.3	0.2	0.2	0.0	0.0	0.0
Slovenia	0.6	0.0	0.2	0.1	0.0	0.0	0.1
Slovakia*	0.8	0.3	0.1	0.1	0.1	0.0	0.2
Finland	0.2	0.0	0.0	0.1	0.0	0.0	0.0
Sweden	0.5	0.1	0.2	0.0	0.0	0.0	0.1
Iceland	0.6	0.4	0.0	0.0	0.2	0.0	0.0
Norway	0.9	0.2	0.4	0.1	0.1	0.0	0.1
Switzerland	0.6	0.1	0.2	0.1	0.0	0.0	0.0

(:) data not available

* provisional

** estimated

Source: Eurostat (online data code: gov_10a_exp)

eurostat 

Figure 15 Total general government expenditure on environmental protection for 2019 (& of GDP) – Source: Eurostat

3. Mapping the Champions

Below is a shortlist of environmental organizations, associations and groups currently active in Cyprus and doing excellent work in the fields of biodiversity conservation, sustainable land use, renewable energy, waste management and climate change.

AKTI (<http://www.akti.org.cy/>): AKTI Project and Research Centre was established in Nicosia, Cyprus in 2000 by a group of experts in environmental issues. Over the last 20 years, AKTI has created an extensive network of collaborators and volunteers in more than 50 countries across Europe and the world working on sustainability, promoting applied research and advocacy and is keen on involving the public in scientific research through innovative citizens science methods. AKTI's activities span four main areas: applied environmental research, environmental education and vocational training, integrated coastal zone management and marine environments and public outreach and advocacy. The group has received funding from the EU, such as the Horizon 2020 research project SEALIVE on developing bioplastics for agriculture and fisheries, and has been the recipient of many international grants from the US department of State, BeMed and Ocean Conservancy. The organization has received several International awards and recognitions: in

August 2021, AKTI's action TIGANOKINISI – domestically used cooking oils as a “fuel for sustainability”, received the international Global Education Award (GENE) for Exemplifying Quality in Global Education. In May 2020 Ocean Conservancy awarded AKTI's action #potavristou, which targeted the promotion of crowdsourcing and citizens science for collecting marine litter data, as one of the most innovative actions internationally for plastic free oceans. In 2019 AKTI has been included in the U.S. State Department's '1000 Ocean Actions' initiative.

Avli (<https://avli.org/>): Avli is a recently established environmental organization looking to educate people who live in Cyprus about the stakes and effects of climate change on the island. To achieve this, the organization is working on creating a platform that incites thoughtful discussion on the future of Cyprus as well as coordinating actions regarding climate change, renewable energy resources and promoting peaceful island-wide solutions, in association to other NGOs and interested parties.

BirdLife Cyprus (<https://birdlifecyprus.org/>): With 13 young scientists and specialists as full-time staff and over 500 members, BirdLife Cyprus is one of the leading nature conservation organizations in Cyprus. BirdLife Cyprus is a non-profit conservation organization and is one of over 100 partners worldwide of BirdLife International. The organization's goal is to protect the wild birds of Cyprus and their habitats as well as the wider biodiversity of the Cyprus landscape, through monitoring, lobbying, conservation and education actions and by building on or enhancing people's appreciation of nature. Their activities include leading projects for the restoration of important bird sites and habitats such as the “LIFE Oroklini Project” and the “Darwin Akrotiri Marsh Project,” as well as the “LIFEwithVultures” project, which focuses on saving the Griffon Vulture and halting illegal poisoning of wildlife. The organization is active in lobbying decision-makers to affect policy and in field monitoring of waterbirds, farmland birds and of key species such as the Roller and Audouin's Gull. A big part of BirdLife's work focuses on combatting bird crime, especially illegal bird trapping, and on promoting sustainable nature-friendly farming practices. Additionally, BirdLife Cyprus has been involved in running school education programs and has reached almost 10,000 children so far.

Cyprus Marine Environmental Protection Association (CYMEPA)

(<http://www.cymepa.org.cy/index.php/en/page/home>): CYMEPA is an autonomous charity, not-for-profit organization funded entirely by its members. The charity is a pioneer for an array of environmental projects and operates extensive public awareness campaigns. CYMEPA gives priority to environmental education of school children via a series of successful programs: its *Eco-School* program encourages and acknowledges the significance of inviting students, teachers and parents as well as the local community to engage in sustainable, environmentally-responsible behavior, the *Young Reporters for the Environment* program engages secondary school students in discussions along with the local authorities, laboratories and customers

on specific local environmental issues, while the *Learning about Forests - LEAF* initiative, involves primary schools in a curriculum specialized on Cyprus' forests. The organization runs several environmental programs such as the *Blue Flag*, an eco-label for beaches, marinas and sustainable boating tourism operations, the *Green Key*, the hospitality industry standard for environmental responsibility and sustainable operation excellence and the *Green Offices* eco-label for offices and buildings addressing issues such as a company's energy and resource consumption, waste management, use of environmental friendly products and the development of public green spaces. CYMEPA runs several Beach Cleaning Campaigns where thousands of interns and volunteers clean beaches and collect information on the rubbish collected and the pollution sources.

Cyprus Wildlife Research Institute (CWRI) (<http://www.cwri.net/>): The Cyprus Wildlife Research Institute was initially established as part of the NGO *Taskent Nature Park*. It is a privately funded non-profit organization, relying on donations from the public, businesses, and key sectors. The institute consists of the *Cyprus Marinelife Center*, the *Wildlife Rescue and Rehabilitation Center* and the *Wildlife Hospital and Research Laboratory*. CWRI's fundamental purpose is to protect all Cypriot wildlife and habitat through education, rescue, research, and rehabilitation activities. Since its foundation, the CWRI has conducted several workshops, published numerous research articles, implemented conservation projects, built the capacity of governmental organizations and supported the development of relevant legislation. CWRI's research is not restricted to some species but covers all flora and fauna of Cyprus, with recent projects including radio tracking of Bonelli's Eagles, investigating the medical properties of the venom of the endemic scorpion, and the restoration of native habitats on Kyrenia Mountains.

Enalia Physis (<https://enaliaphysis.org.cy/>): Enalia Physis Environmental Research Centre is a Cyprus-based non-profit organization that operates mostly through grant-giving foundations, EU funding and private donors. Its goal is to ensure the protection and sustainable use of marine and terrestrial resources through scientific research, advocacy, education and consultation in order to promote conservation through progress in environmental, political, cultural and social change. Enalia Physis is an active organization on the themes of Alien Invasive Species (AIS), local marine species and habitats and marine protected areas. Among its currently running projects are: "*Cyprus Bycatch Project Phase II*", "*Know Thy Enemy: Behavioral study approach to manage and reduce invasive lionfish populations in the Eastern Mediterranean*", "*Monk seal conservation in the Eastern Mediterranean*", "*Posbemed2: governance and management of posidonia beach-dune systems across the Mediterranean*" and "*MarLitCy: Marine Litter for Synergies, Capacity-building and Peacebuilding*".

Freshwater Life Project (<https://freshwaterlifeproject.org/>): The Freshwater Life Project was created by a small team of independent researchers in the hope of making real changes to support, protect and preserve aquatic habitats all around the world with the vision of human and environmental development occurring sustainably and simultaneously. To do achieve their mission, they identify species and habitats at risk, they connect with local organizations and individuals, they then assess what action is required and focus on educating the public on how important freshwater ecosystems are and why, and finally they make tangible changes at all levels. In Cyprus they are currently running two projects:

- (1) “*The search for the last salaria in Cyprus*” - In collaboration to local people and businesses Freshwater Life Project is working on restoring at least one natural flowing river in the Lemesos district of Cyprus with the goal of re-introducing the only indigenous, exclusively freshwater dwelling fish species of Cyprus, *Salaria fluviatilis* – a species presumed extinct after 111 years of absence since it’s discovery.
- (2) “*Help save the Cyprus Killifish*” – Both independently and alongside authorities and existing organizations and in line with existing projects, the group is working to ensure the long-term protection of the habitats which host the locally threatened Mediterranean Killifish *Aphanius fasciatus* in Cyprus, a species with only three remaining populations on the entire island, all of them located in unprotected habitats suffering primarily from anthropogenic causes.

KUŞKOR (<http://www.kuskor.org/>): KUŞKOR – The Society for the Protection of Birds and Nature has been active since 1988 with the goal of protecting birds and their habitats in Northern Cyprus through education, research, monitoring and lobbying. KUŞKOR members survey wetland and migration sites and count birds, reporting them to the *KUŞKOR google group birdwatching forum* where observations and counts are collated into a database. Data are made available eg. to authorities and impact assessment consultants to support site protection. Members also report on the state of habitats, to support lobbying efforts. The organization runs one of two national ringing schemes collating and submitting national data to the European Union for Bird Ringing. KUŞKOR directed several large grants including the EU-funded All-island Important Bird Areas Project, in collaboration with Birdlife Cyprus and contributed to the *European Breeding Bird Atlas*. The group is heavily engaged in fighting for the recognition of *Mia Milia sewage works* as an important wetland, while through the EU-funded *Kukla Wetlands* project they landscaped a wetland and installed two bird hides; the two sites host thousands of wintering wetland birds including critically endangered and threatened species. KUŞKOR maintains a dedicated anti-trapping effort and collaborate with CABS on trapping securing convictions and removal of trapping gear such as nets, callers and lime sticks. The group holds a stand at British Birdwatchers every year where they engage birders and promote birding in Cyprus trying to secure funds from interested donors.

Laona Foundation (<https://laona.org/>): Laona Foundation is a private non-profit organization with a long history of environmental activity in Cyprus, since its establishment it has been collaborating with local and international NGOs as well as state authorities. The foundation has been involved in rural community projects that relate to the sustainable regeneration of the Cyprus countryside both on the natural and cultural level and has worked right from the start on the establishment of agrotourism and now the promotion and development of cultural tourism. In collaboration with international and national universities, Laona pioneered landscape mapping of Cyprus as a tool for better territorial and land use planning. Laona's interest in regenerative land use and climate change, has involved them in concepts relating to prevention of further desertification in Cyprus, promotion of more sustainable and resilient systems for agriculture and soil protection, including dry-stone walling, and advocacy for sustainable agro-environmental policies. In addition, the foundation has played a crucial role in promoting access to justice on environmental matters for Cyprus NGOs and has been running an annual bicomunal workshop for young eco-journalists. The foundation has a long list of publications relating to river valleys ecological surveys, manuals on traditional building, guidelines on agrotourism, models for sustainable rural development in the Mediterranean and the sustainable rehabilitation of mines and quarries.

Marine and Environmental Research (MER) Lab (<https://www.merresearch.com/>): MER is an established enterprise composed of highly qualified and experienced scientists that offer specialized research and consulting marine and environmental services. Since 2008, they have successfully implemented numerous projects and research programs around Cyprus' coastal and offshore areas, in the fields of marine biology and ecology, aquaculture and fisheries. The organization offers a variety of services such as running marine research programs, conducting environmental impact assessments, and providing marine environmental monitoring, analyzing samples, conducting laboratory work, and providing management suggestions for the conservation of oceans. MER is also running several citizen science projects with the engagement of local communities. Examples of MER's research programs include the scientific coordination of "*Preventing Lionfish Invasion in the Mediterranean (RELIONED)*," the coordination of "*Mapping Marine Key Habitats and Assessing their vulnerability to fishing activities (MedKeyHabitats II Project)*," *coordination of mapping and evaluation of important marine habitats under the European Habitats Directive (92/43/EEC), in the coastal waters of Cyprus (Tender # 19/2018, DFMR)*", "*Elasmobranchs Low-Impact Fishing Experience (ELIFE)*," and *Increasing Industrial Resource Efficiency in European Mariculture (IDREEM) (FP7 Programme)*. The scientists at MER have extensive published work in the fields of AIS, sustainable fishing practices and the establishment and management of marine protected areas.

SPOT - North Cyprus Society for the Protection of Turtles (<https://cyprusturtles.org/>): Initially established as an organization dedicated to the conservation of sea turtles in Northern Cyprus, SPOT worked for thirty years

in developing a legacy of high impact research in all aspects of sea turtle ecology and conservation. Thousands of tourists visit SPOT's field bases where they are engaged in sea turtle conservation activities, and their volunteer program employs over 100 international and local volunteers each summer. Today SPOT has expanded its activities to a broader field of marine life including work on bycatch of threatened species including monk seals, cetaceans and elasmobranchs, with associated research and conservation outputs. Among current projects the organization is running are: *"Sea turtle conservation in the Mediterranean Region"*, *"Cyprus Elasmobranch Research and Conservation Network - CERECON"*, *"Monk seal protection in the Eastern Mediterranean,"* *"INDICIT project"* and the *"Cyprus Bycatch Project"*. SPOT works in close collaboration with the Centre for Ecology and Conservation at the University of Exeter and partners and stakeholders across the island to deliver its results.

Terra Cypria (<https://terracypria.org/>): Terra Cypria, the Cyprus Conservation Foundation, is an NGO officially established in 1992 as a charitable non-profit organization. Its overall aim is to promote environmental awareness and sustainability through pressure and environmental education, as well as through programs that promote conservation, environmental protection and research. Part of Terra Cypria's activities is the protection of natural areas with projects such as the *"Cyprus Wetlands project,"* *"MedisWet project,"* and *"PANDOTEIRA – LIFE IP Physis, Managing the Natura 2000 network in Cyprus and shaping a sustainable future"*. The Foundation is also working to stop the loss of biodiversity and raise public awareness about the value of biodiversity with projects such as *"Monitoring of Reptiles and Amphibians in Akamas,"* *"ReTrack Project"* and *"BioForLife"*. The promotion of sustainable agriculture principles and the assessment of whether existing agricultural aids meet the objectives of climate change and sustainable development, are amongst the Foundation's thematic areas of activity, with projects such as the *"AGROLIFE project"* and the *"MEDSCAPES project"*. Terra Cypria places great emphasis on environmental training, education, and inspiring the youth, through the operation of its Cyprus Environmental Studies Center (CESC) at Kritou Terra in Paphos, as well as organization of school visits, and coordination of experiential and nature workshops.

4. Potential Cyprus Environment Foundation (CEF) Projects

Finding a way to direct sources of funding towards the environmental champions of the island, would provide the organizations with the fuel to thrive and to do what they do best: monitor, campaign, lobby, and act on the conservation of Cyprus' natural environment. Below are some examples of potential projects CEF could help fund, enabling local environmental NGOs, groups, and associations to expand and share their best practices inspiring thus more great work to happen in the fields of biodiversity conservation, regenerative land use and sustainable resources management (water, energy, waste).

(1) Sustainable waste management

- Only a small proportion of organic waste in Cyprus is currently separated at the source: a great need exists to enhance **organic waste separation and collection schemes**, as well as the creation of a greater number of more efficient municipal and private composting facilities (EEA, 2016). Community owned shredders and local composting facilities for farming organic residues could be a way in which organic waste is reduced in Cyprus, simultaneously diminishing the risk of fire.

(2) Sustainable resources management

- One of the measures the Ministry of Agriculture is proposing through its National Strategy for the Mitigation of Climate Change, is the promotion of sustainable use of rural and urban rainwater rather than guiding it to the sewage (MOA, 2017). In the eye of climate change, more robust farming and urban systems could be generated if small and localized features for **rainwater harvesting** are created. Rain tanks and simple grey water systems can collect, process and direct water towards the irrigation of urban green areas. Small dams and ponds serving the needs of individual farmers or a community of farmers, can help alleviate water stress on groundwater bodies and reduce dependence from costly municipal processing water units. Techniques such as cover crops, mulching and the increase of organic matter in crops are some examples of methods that should be promoted through advocacy and policy change in the Cyprus farming society.
- The initiation of pilot projects in schools where **renewable sources of energy** are promoted, such as the construction of small wind turbine stations that power schools, could potentially engage the students and teachers as well as the local community, instigating the creation of more such projects across Cyprus.
- Campaigns are also needed to bring sufficient awareness to the current method Cyprus is using to conform with the EU's obligations for GHG emissions. When citizens are more aware of the lack of policies in place, the demand for more green mobility strategies will increase, putting pressure on the state authorities to change.
- A concrete strategy for the reduction of air pollution is needed on the island. More **green transportation** should be encouraged with more pedestrianised areas within the city centers, increased bike lanes, more bus rides and adjustments made to existing public transportation infrastructure, so as to accommodate the public's hybrid transportation (eg. The combination of car and bicycle transportation while commuting).

(3) Regenerative farming practices

The Mediterranean region, is one of the areas where agriculture is anticipated to be most negatively impacted by climate change in the following years, with irrigation requirements increasing between 4 and 18

percent (Aguilera *et al.*, 2013) and the European Mediterranean region transforming into an arid climate landscape (Alessandri *et al.*, 2014). Adaptation and mitigation of climate change in the Mediterranean in the field of food production is achievable through the adoption of sustainable agriculture practices.

The EU is strongly committed to the promotion of more sustainable agricultural practices: The *European Green Deal* for example focuses on eco-schemes that reward farmers for providing a diversity of ecosystem services, beyond provisioning ecosystem services, such as positively affecting regulating and supporting ecosystem services like carbon sequestration, biodiversity enhancement, nutrient cycling, soil erosion control and water infiltration and availability (Almagro *et al.*, 2016; Lee *et al.*, 2019). *Farm to Fork Strategy*, the *Biodiversity Strategy for 2030* and the new *Common Agricultural Policy (CAP)* are some initiatives that promote healthier, fairer and more environmentally friendly food systems.

- a. Many regenerative farming approaches exist today that can be readily adopted in Cyprus such as agroecology, agroforestry, permaculture, biodynamic agriculture, organic farming, regenerative farming, conservation agriculture and high nature value farming (Oberč, B. & Arroyo Schnell, 2020). Reduced or no tillage, the implementation of cover crops and mulching as well as the diversification of agroecosystems, are sustainable agriculture practices that should be promoted and, in some cases, enforced by schemes of the CAPO and the Ministry of Agriculture, Environment and Rural Development. More advocacy and promotion of such practices should also be promoted by local groups.
- b. To achieve such transformation of the local food system proper awareness and training of farmers is needed. Hands-on workshops and seminars should be organized with the goals of educating farmers on the methodology as well as all the potential benefits of regenerative agricultural practices. Incentives can be given to farmers that adopt **regenerative agricultural practices** and demonstration sites where such techniques and methods are employed should be created on the island and utilized as training centers and experimentation sites, where methods are tested and adjusted to local conditions.
- c. More natural and regenerative agricultural practices, such as the use of heterogenous material in farming, should be encouraged as techniques that allow climate change mitigation. The support of local groups that are involved with the identification, multiplication and dissemination of locally adapted **heirloom seeds** should be encouraged. The support of such groups or the encouragement of the creation of local organic heirloom seed companies will inevitably lead to Cyprus' harmonization with the EU 2018/848 regulation on the production and marketing of plant reproductive material of biological heterogenous material of genera or species.

- d. The implementation of more efficient **Farm to Fork** initiatives for the empowerment of rural areas is needed. Technological tools on sales and distribution can be made accessible to rural producers, encouraging local production, and directly connecting them to their customers all across Cyprus. Local hubs that gather rural products can be created and logistic infrastructure appropriate for the rural context can be provided.

(4) Engage the public in environmental conservation efforts

- Invasive alien species are the 2nd largest threat in ecosystems with more than 600 IAS established in the Mediterranean. To proceed to a more efficient management of NIS, precise and up-to-date information on the species' distribution and abundance should be retrieved and shared among interested parties. Such efforts are enabled through societal participatory initiatives such as **citizen science**. While being a cost-effective tool, citizen science appears to be crucial for the monitoring and management of IAS as proven by initiatives such as "*Is it Alien to you? Share it!!!*", where NIS were monitored both in Greece and Cyprus through the participation of people who spend time in / at sea (Giovos *et al.*, 2019). The establishment of citizen-based platforms enables for the validation of sightings, photos and other data (Department of Fisheries, 2017). While allowing for the robust collection of data, such tools help enhance peoples' knowledge and connection to the natural environment and create awareness and motivation around the need for natural ecosystems' protection, preservation and conservation (Kleitou, Rees, *et al.*, 2021).
- More NGO initiatives should be directed towards acting: more funds should be allocated for the creation of demonstration sites run and facilitated by NGOs involving the participation of local communities and facilitating learning-by-doing. Community based projects have proven to be an efficient way to engage the local community and bring grassroots changes from the community to the national level. Examples of such work can be seen in Birdlife Cyprus' [Oroklini Project](#) and [Akrotiri Marsh Restoration](#). Setting up more and larger community-based projects is required to increase the efficiency and impact of such initiatives. (MIA)

(5) Enhance and improve MPAs

- The establishment of more MPAs and set-up of efficient and applicable management plans for their regulation, are actions needed for the protection of potentially important marine areas in Cyprus and could be promoted via local NGO's initiatives. The incorporation for example of a new region, Kakoskali, among the enlisted marine protected areas was achieved through the intervention of a local NGO.

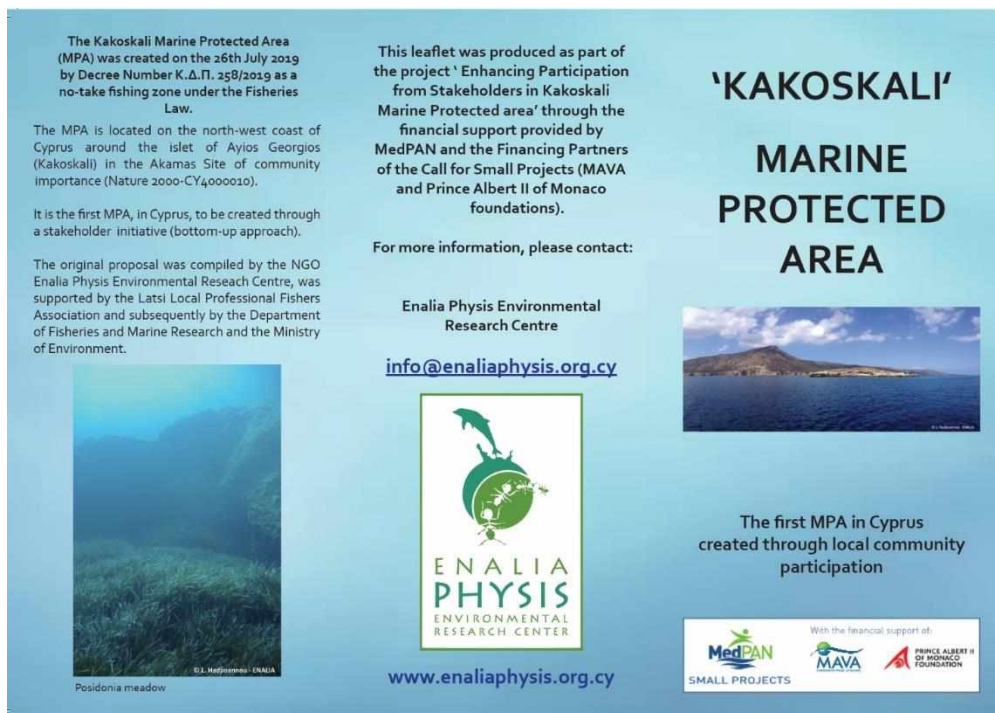


Figure 16 Kakoskali MPA: The first MPA in Cyprus created through local community participation – Source: Enalia Physis

- One of the main obstacles of properly managing MPAs, is securing sufficient funds for the continuation of their monitoring and data collection. Such information proves to be vital when advocating for the need of protecting and/or restoring important habitats as well as for understanding the main causes that pose a threat on them.

(6) Promote more sustainable fishing and marine practices

Even though fishing practices applied in Cyprus are assessed to have a relatively low impact on marine resources, their interaction with climate change and IAS stress, could have a negative effect on available fishing stocks. Monitoring schemes and adaptive regulation of fishing pressures is therefore required (DFMR, 2019a).

- *Posidonia oceanica* meadows are some of the most diverse and productive ecosystems in the Mediterranean sea and their ecological status affects the composition of marine species communities (DFMR, 2019a). Despite high mortalities of the meadows in neighbouring regions due to temperature rises, Cyprus remains an area where the species seems to be thriving, calling for a greater need for its study. There seem to be many promising effects from the restoration and transplantation of such species where multiple ecosystem services can be served, such as carbon sinking, climate regulation, erosion control and the provision of habitats for local biodiversity.
- More sustainable fishing practices could be adopted in Cyprus allowing for the creation of more jobs while assuring for the protection of marine habitats, helping Cyprus meet the United Nations Sustainable Development Goal 14 for the conservation and sustainable use of the oceans, seas and marine resources. For example, novel and more sustainable methods of aquaculture can be

promoted, such as the **Integrated Multi-trophic Aquaculture (IMTA)**, where systems deliver greater productivity and diversity with reduced environmental impact. More projects such as *Increasing Industrial Resource Efficiency in European Mariculture (IDREEM)* could be run that do not only promote the increase of employment but at the same time they assure the protection of the marine environment (Mer, 2016). Additionally, alternative fishery tools associated with less bycatch could be introduced to the local fishing community (LifeElife, 2021) and all necessary economic evaluations of the promoted fishing methods could be completed. Such comprehensive analysis could drive political influence and inevitably lead to policy change and more efficient protection of marine and coastal areas.

- An **Ecosystem-Based Fishery Management approach (EBFM)** moves away from the concept that non-indigenous species (NIS) have only negative effects on ecosystems and instead, embraces the potential benefits provided by them such as the provision of lost ecological functions and the enhancement of biological complexity. Such approaches include the enhancement of MPAs, the control of invasive NIS within them and the protection of threatened predators, as well as the promotion of NIS products and services in the market, including fishery related tourism (“pescatourism”) (Kleitou, Crocetta, *et al.*, 2021).

(7) Sustainable tourism – Ecotourism

- Agrotouristic plans have been gaining Cyprus’ local authorities’ attention in the last few years. Such schemes though do not consist of panacea for the reviving of the island’s rural areas. The primary and secondary sector should be supported before tertiary activities are encouraged. Projects that encourage young people to return to farming and rural centers can be designed and more sustainable forms of tourism can be promoted such as **Cultural Tourism** where consumption-based patterns are replaced with higher quality and more culture-enriching experiences.

(8) Environmental justice and advocacy

- The enhancement of NGOs advocacy skills and giving more attention to environmental rights awareness campaigns, should be among local NGOs’ priorities. Advocacy should focus on the prevention of environmental destruction and more appropriately accessed and managed EU funds on the part of the government, such as Green Deal initiatives. An abundance of opportunities remain unexploited in the field of environmental restoration and NGOs can help unlock available funding and make more efficient use of it.
- NGOs access to environmental justice is a crucial factor that will enable non-profit organizations to protect Cyprus’ natural habitats more efficiently. For example assisting NGOs with court cases legal

costs and providing them with required legal support, would ensure efficient access to environmental justice for NGOs (Lycourgos, Vlachogiannis and Yiordamli, 2021).

(9) Biodiversity conservation and enhancement

- Conservation and regeneration of freshwater bodies of Cyprus could be accomplished through the implementation of restoration and monitoring programs. Captive breeding and reintroduction of native and endemic species as well as incentives to farmers for the implementation of more regenerative farming practices will not only improve the health of Cyprus' freshwater bodies but also help them reach their WFD goals.
- More monitoring and evaluation of IAS originating from the Suez Canal could take place through the surveillance of Cyprus key marine habitats. The control of IAS could occur through their natural predators: some of the recorded lionfish and rabbit fish predators in the Mediterranean are the dusky grouper (*Epinephelus marginatus*), white grouper (*Epinephelus aeneus*), common octopus and loggerhead turtles (Ulman *et al.*, 2021). Ensuring the conservation of IAS's natural predators is one way of achieving efficient control over populations of invasive NIS.
- Monitoring of marine biodiversity and habitats can improve in Cyprus with the creation of **marine atlases** through which a comprehensive database of Cyprus marine habitats is created enabling for the more efficient identification, monitoring and advocacy of MPAs. The creation of such a broad scale marine biodiversity assessment will strengthen any efforts on marine conservation and provide evidence-based marine biodiversity action plans.
- Local NGO afforestation schemes can be aided through the creation of a Cyprus map containing information on all plots readily available for afforestation and reforestation campaigns. Furthermore, supplementation of the government's limited capacity for forest tree production, can be achieved through the encouragement of independent private nurseries initiatives: such organizations will be in charge of seeding, growing, and caring for a variety of native and endemic forest species that will later be used to regenerate Cyprus' forests.
- Data accumulation on terrestrial, marine, and freshwater habitats of Cyprus is crucial for concluding the effects of specific stressors as well as needed management interventions. Some examples of biodiversity monitoring, awareness and acting initiatives follow:
 - **A Cyprus biodiversity map & mobile app:** Cyprus urgently needs to move towards the realization of a **PAN-Cyprus conservation initiative** where collaboration between organizations active in the North and the South is constant. When conservation efforts are employed on one side, but no action is taken on the other, efforts are inevitably undermined. A project is needed that will collect and visualize biodiversity data of Cyprus via compiling harmonized data from different resources such as academicians, published scientific papers, local authorities, citizen scientists (ie. birdwatchers, nature photographers) and hunters. All uploaded data will be

reviewed and approved by a team of bicomunal experts with different backgrounds such as zoology, botany, mycology, etc. Data gathered will be useful for awareness-raising, technical planning for land use, and in the evaluation process of decision-makers and planners for any proposed activity in a particular area leading inevitably to the most efficient administration of an area. There will be different levels of users who can upload, download, or visualize data to ensure the conservation of sensitive and threatened species.

- Conservation efforts in Cyprus seem to be effective in the protection of threatened species: in the last two decades only, conservation initiatives run in Northern Cyprus, managed to increase nest counts for the loggerhead turtle by 46 percent (*Caretta caretta*) and for the green turtle by 162 percent (*Chelonia mydas*) (Mongabay, 2021). Yet, determination of populations and priority habitats of certain species is still needed: although many studies have been conducted on many species, a knowledge gap still exists on certain species. As Red Foxes (*Vulpes Vulpes*) are the apex predators of terrestrial ecosystems, data on their population size, home ranges, subpopulations, and breeding success is crucial for habitat management. The case is the same for the Bonelli's Eagle (*Aquila fasciata*). Population sizes and habitat of Red List bird species such as the European Turtle Dove (*Streptopelia turtur*) and the Common Pochard (*Aythya farina*) should also be determined and monitored. On the marine and coastal side, the foremost species to be monitored are the Loggerhead Turtle (*Caretta caretta*), Green Turtle (*Chelonia mydas*), Monk Seal (*M. monachus*), Neptune Grass (*Posidonia oceanica*) and the Noble Pen Shell (*Pinna nobilis*).
- **Establishment and Management of Micro-Reserve Areas:** Although legislation for official recognition and management of micro-reserve areas in the south is in place and practice, this is not the case for Northern Cyprus. For endangered rare species such as *Delphinium caseyi*, *Salvia veneris*, *Solenopsis antiphonitis* there is currently no specific in situ protection plan and the persistence of these species is virtually by chance. This provides ideal grounds for collaboration between organizations from both sides of the island to adopt best practices and implement the establishment and management of micro-reserve areas in the North.

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