



LIFE Natura 2000
Value Crete

NATURA 2000

Network

Ecosystem Services of **Coastal Areas**
of **Crete**

Natura 2000 *Sea of life*

INFORMATION GUIDE



NATURA 2000

Network

Ecosystem Services of Coastal
Areas
of Crete

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This publication was implemented by the University of Crete - Natural History Museum of Crete (NHMC) in the framework of the LIFE Natura 2000 Value Crete project: "The ecological services, social benefits and economic value of the Ecosystem Services in Natura 2000 sites in Crete" (LIFE13 INF/GR/000188). The project is co-financed by the European Commission/DG Environment at a percentage of 50% and was also co-financed by the Ministry of Environment and Energy (MEEN), the Green Fund and the A. G. Leventis Foundation. Associated beneficiaries are the Decentralized Administration Authority of Crete – Directorate of Coordination and Supervision of Forests and the Hellenic Ornithological Society (HOS).

UNIVERSITY OF CRETE – NATURAL HISTORY MUSEUM OF CRETE
Knossos Avenue Premises
GR714 09 Heraklion, Crete

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Authors: Tania Ploumi, Elisavet Georgopoulou, Niki Kyriakopoulou

Scientific editing: University of Crete - Natural History Museum of Crete

Publication coordination: Michalis Probonas

Editing - Correction of texts: Panagiotis Georgiakakis, Popi Baxevani

Graphics editing: Giannis Harkoutsis

Maps editing: Elisavet Georgopoulou

English translation: Elisavet Georgopoulou

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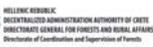
NATURA 2000

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Ecosystem Services of Coastal Areas of Crete

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Care, goods, investment

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Preface

The natural ecosystems of Crete support the economic, social and cultural well-being of the island's inhabitants. More specifically, ecosystem services are considered the benefits for the people, derived from the natural environment and include the raw materials necessary for social well-being, natural processes such as photosynthesis and soil-formation which affect air purity, climate and rainfalls, as well as cultural services such as artistic inspiration and recreation.

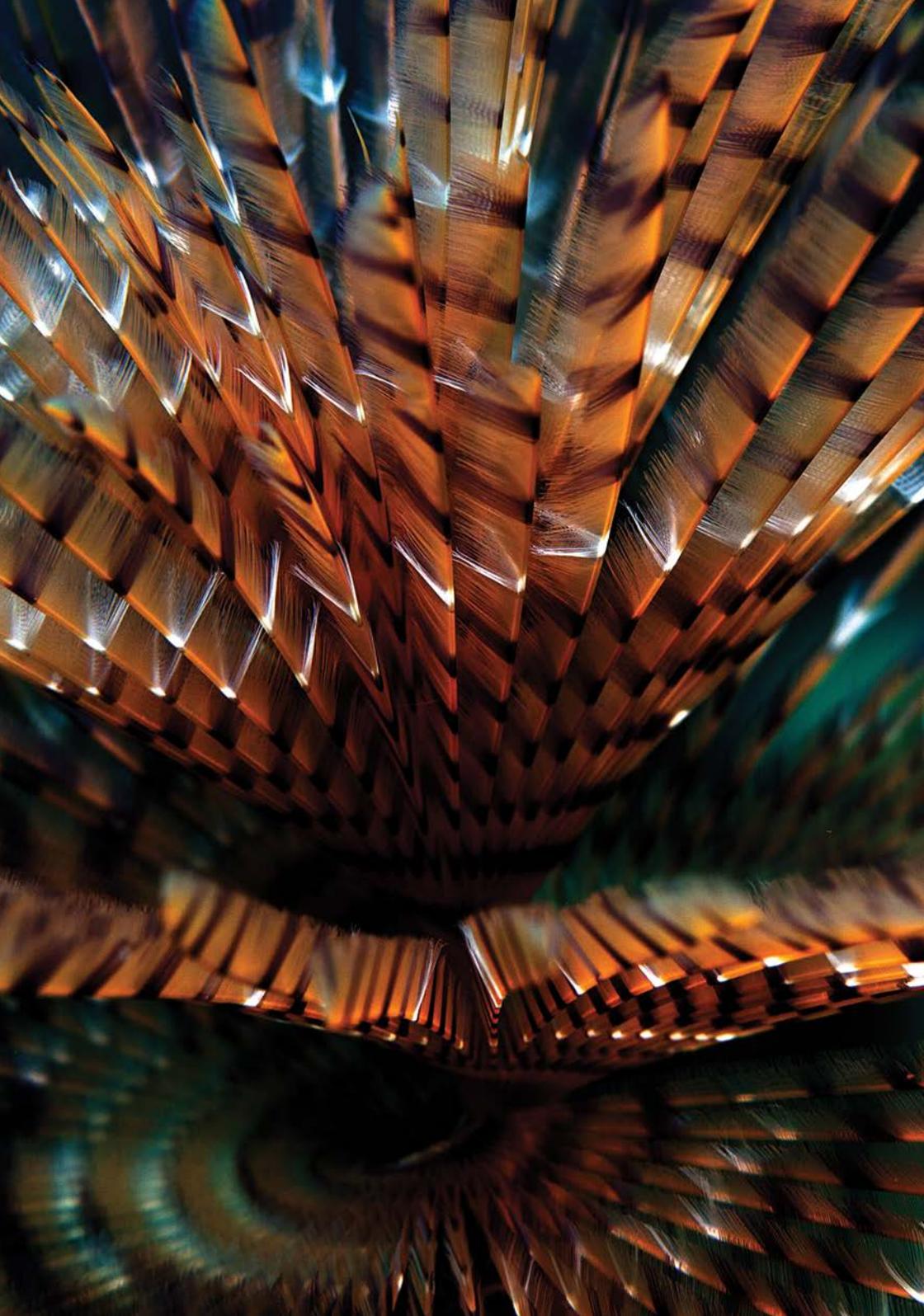
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The objective of the "LIFE Natura 2000 Value Crete" project is the implementation of an environmental information campaign for the population living and operating inside the NATURA 2000 areas and the wider Cretan population regarding the environmental, economic and social value of the areas included in the Network.

The Information Guide makes reference to the ecosystem services in the areas of NATURA 2000 Network in Crete, the nature, society and economy of the areas concerned, as well as jobs and employment opportunities. We believe that with this guide we will manage to overturn the misconception that NATURA 2000 areas are an obstacle to development and demonstrate that the conservation of biodiversity is a guarantee for sustainable development, prosperity and quality of life.

Dr. Michalis Probonas

University of Crete – NHMC
Project Coordinator "LIFE Natura 2000 Value Crete"





Contents

1	INTRODUCTION	8
1.1	Ecosystem services	8
1.2	NATURA 2000 Network	9
1.3	Crete	10
1.4	Protection status and development potential inside the NATURA 2000 Network	12
2	NATURE, SOCIETY AND ECONOMY	14
3	ECOSYSTEM SERVICES AND NATURA 2000 NETWORK	16
3.1	Ecology and Economy	16
3.2	Culture	20
3.3	Need for the protection of the environment	24
3.4	Protection measures - management actions for the environment ..	26
3.5	<i>Posidonia oceanica</i> seagrass meadows	30
3.6	Sea turtle <i>Caretta caretta</i>	32
3.7	Principal human financial activities	34
4	WORKING POSITIONS AND EMPLOYMENT OPPORTUNITIES	36
4.1	The economy of Crete	36
4.2	Employment opportunities	39
4.3	Other employment opportunities	41
5	MAIN FORMS OF ALTERNATIVE TOURISM	42
6	BIBLIOGRAPHY	52
7	GLOSSARY	54
	Photo Source	55



INTRODUCTION



1.1 Ecosystem Services

Natural ecosystems in Crete offer many benefits to the health and well-being of the island's inhabitants. More specifically, ecosystem services are defined as the benefits for the people derived from the natural environment and include the raw materials necessary for social well-being, natural processes such as photosynthesis and soil-formation which affect air purity, climate and rainfalls, as well as cultural services such as artistic inspiration and recreation.

The evaluation of ecosystem services is a means of assessing the provision of these services in economic terms, aiming at the integration of economic values of ecosystem services in policy making and the improvement of environmental decision-making.

In 2000, the UN launched an initiative to assess ecosystem services at a global level.

This initiative and its conclusions were documented in the "Millennium Ecosystem Assessment" (MEA) Report, which was completed in 2005. The above-mentioned Report (MEA), recognized four main categories of ecosystem services, but later the Common International Classification of Ecosystem Services (CICES) established a three – categories classification as shown in Table 1.

In conclusion, natural ecosystems provide benefits that promote economic growth, offer new opportunities for investment and employment, but also improve the living standards and quality of life of local communities. Consequently, the protection and conservation versus the degradation of natural ecosystems increase or decrease respectively the range of benefits that can be gained by the local communities of Crete in the future.



TABLE 1. Ecosystem services according to CICES (2017).

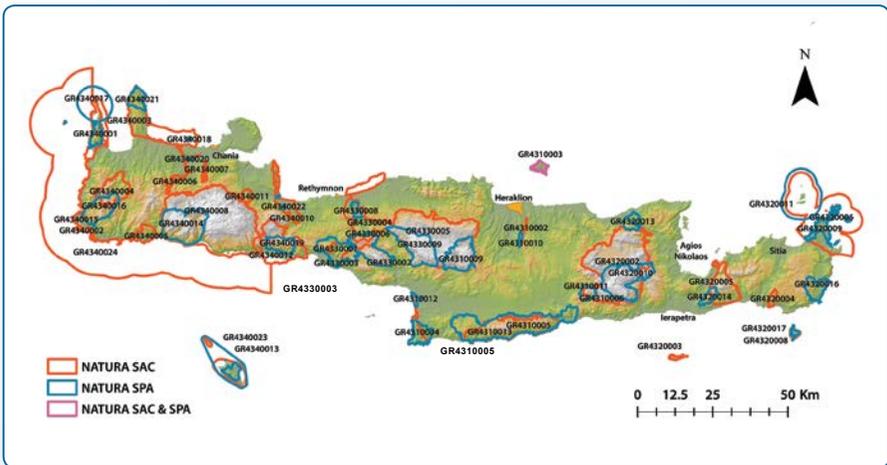
Regulating and Maintenance Services	Necessary for the operation of all other services such as oxygen production and soil formation. Benefits from ecosystem functions such as climate regulation and extreme weather protection.
Provisioning services	Products obtained from ecosystems such as food, water and timber.
Cultural services	Sensory pleasure, artistic inspiration and recreation.

1.2 NATURA 2000 Network

The European Network of Protected Areas NATURA 2000 is the basic legal and institutional framework of the European Union for the protection of biodiversity. It is based on two European Directives:

1. Directive 92/43/EEC “On the conservation of natural habitats and of wild fauna and flora” (or “Habitats Directive”) and
2. Directive 2009/147/EC “On the conservation of wild birds” (or “Birds Directive”, which replaced the original Directive 79/409/EEC).

MAP 1. The NATURA 2000 Network areas in Crete.





The main objective of Directive 92/43/EEC is the protection of biodiversity through the conservation of natural habitats on the European territory. For this reason, it establishes a coherent ecological network of Special Areas of Conservation (SACs) called “NATURA 2000”, which includes the Special Protection Areas for birds (SPAs), as have been defined by the “Birds Directive”.

The NATURA 2000 Network in Greece consists of 443 areas. In Crete, it covers around 30% of the island’s area and includes 54 areas (SACs and SPAs), several of which overlap (e.g. the SPA of “Ethnikos Drymos Samarias - Farangi Trypitis - Psilafi – Koustogerako” and the SAC of “Lefka Ori paraktia zoni”).

The framework for the management of the NATURA 2000 Network areas foresees the establishment of Protected Areas Management Bodies (PAMBs) that can undertake the management of one or more areas.

Despite the large extent of the NATURA 2000 Network on Crete, there are only two PAMBs, the “Management Body of Samaria National Forest and Western Crete” and the “Management Body of Protected Areas of Central and Eastern Crete”.

Finally, the NATURA 2000 Network framework does not prohibit any economic activity; however it sets restrictions that ensure the protection of local ecosystems, which in turn contribute to the sustainable development of Crete (see subchapter 1.4, pp. 12-13).

1.3 Crete

Crete, the largest island in Greece and the second largest in eastern Mediterranean is located at the southern edge of the Aegean Sea, between three continents - Europe, Asia and Africa. From the seashore to the highest peaks of Psiloritis and Lefka Ori, over an area of 8,336 square kilometres, a mosaic of landscapes unfolds.

Rocky and sandy shores, deep valleys and steep gorges, small fertile plains and pastures, barren and rocky slopes are some of the landscapes that one encounters in Crete. These landscapes have been sculpted by rain, air and time, as well as the long human presence on the island.

The kermes oaks, the cypresses, the palm trees and the carob trees, as well as the sea lilies, the orchids, the ironwort and the anemones, are only few of the plants we find on the island. Next to the sea or between stones,



The south entrance of Samaria National Park, Agia Roumeli.



Sea daffodils (*Pancratium maritimum*).



Apiculture in a coastal are of Crete.

there are bushes and wildflowers coexisting with many small animals such as snails, beetles, the spiny mice and lizards. Also, there are large animals such as the Cretan wildgoat (agrimi), the Cretan wildcat and the bearded vulture (kokalas), animals inherently linked with the Cretan tradition and history.

An important part of the island and its history are the agricultural and pastoral activities such as the cultivation of olive groves and vineyards, the production of honey and cheese products.

All these landscapes, humans, animals and plants compose and contribute to the creation of a unique mosaic, inextricably connected with the history of Crete.



Livestock farming is a traditional occupation in Crete.





1.4 Protection status and development potential inside the NATURA 2000 Network

Below are summarized the activities permitted inside the NATURA 2000 Network, as well as some activities prohibited in these areas.

What is allowed inside NATURA 2000 protected areas [L. 1650/1986, L. 4042/2012] (based on environmental licensing terms, distances, uses and deadlines where applicable):

- Agricultural activities.
- Livestock activities.
- Beekeeping.
- Grazing.
- Ecotourism.
- Sports activities.
- Recreational activities.
- Road construction following a Special Ecological Assessment (impact study inside a NATURA 2000 area) and the issuing of Environmental Terms Approval Decision (ETAD) for a certain period of time.
- Hunting of the species mentioned in Ministerial Decree 127568/2533/07-08-2015 (GG B 1670) (e.g. from 20/08/2015 to 29/02/2016 hunting of hares, ferrets, thrush, woodcocks, etc. was permitted).
- Building after an autopsy and permission by the competent authorities.
- Creation of mountain shelters.



Sharpshooting games: sport activities in Frangokastello.



- Tourism and other mild economic activities following Special Ecological Assessment.
- The harvest of ironwort, marjoram, sage and oregano to cover individual needs (up to 500 grams, during the flowering-maturing period, using shears or knife, and without removing all shoots from each plant in order to guarantee their reproduction).
- The collection of herbs for marketing only after the permission of the competent Forest Service.

What is forbidden inside the protected areas NATURA 2000 [L. 1650/1986, L. 4042/2012] (some of the following prohibitions also apply to areas outside the NATURA 2000 Network):

- Any activity inside the areas of absolute protection (as defined in the Management Plans and/or the Special Environmental Assessments).
- Hunting without a legal hunting license.
- Hunting of wildlife (Regulation EC 338/1997, CITES Convention, L. 4042/2012).
- Hunting of non-game species.
- Hunting inside residential areas and within a radius of 250 metres from them.
- Hunting inside cultivated and fenced areas.
- Hunting inside wetlands.
- Hunting within 300 meters from the coast.

- Hunting inside fire-stricken areas.
- Hunting inside archaeological sites.
- Hunting inside areas where PPC infrastructure exists.
- Hunting during snowfall.
- Hunting around dams.
- Hunting when local regulations forbid it.
- Scattering of poisoned baits.
- Uprooting or complete cropping of the shoots of all kinds of aromatic, medicinal, apicultural, floricultural and decorative plant, sapling, shrub, or herb.
- The unlicensed collection with the aim of marketing of ironwort, marjoram, dittany, sage and oregano in all areas included in the NATURA 2000 Network.



Illegal hunting near Krios beach, within the protected area of the NATURA 2000 Network.



2 NATURE, SOCIETY AND ECONOMY



In general, the coastal zone is regarded as the contact point between the land and the sea, and it is shaped through the land-sea interaction in the course of time. The coastal zone is constantly changing and its delimitation is not always easy. The definition of the coastal zone can be achieved in accordance with geographic, natural, ecological, economic, administrative and cultural elements. From a geographic point of view, the coastal zone includes both terrestrial and sea sections.

The coastal areas are particularly interesting, not only because of their ecological characteristics, but also due to reasons related to economy and social welfare. The relationships between society and the coastal ecosystems are multivariate, as it will become obvious later in this guide. Coastal ecosystems support human life and activities. The products and services they provide are of vital importance for the maintenance of human prosperity, as

well as, for the future economic and social growth of the society.

The contribution of the marine environment to the economic and social welfare lies on the diverse activities that are traditionally related to the sea, such as fishing, shipping and sea trade, and other activities that have developed in later years such as the production of various forms of renewable energy and the production of drinking water, the archaeological, oceanographic and cultural research, recreation activities and tourism. Moreover, the abovementioned activities determine to a great extent the quality of life in coastal areas, where the population accounts for the 50% of the total population on Earth.

Below the main or most important ecosystem services of the coastal ecosystems are presented.



TABLE 2. The most important ecosystem services of coastal ecosystems.

<p>Regulating and maintenance services</p>	<ul style="list-style-type: none"> • Habitat maintenance for animals and plants. • Oxygen production. • Genetic diversity. • Nutrient recycling. • Hydrological cycle – water cycle. • Diffusion of processed waste. • Water and air quality control. • Concentration of carbon dioxide (carbon sinks). • Protection from extreme weather phenomena (e.g. tsunami). • Climate regulation. • Biological control.
<p>Provisioning services</p>	<ul style="list-style-type: none"> • Food provision (fish, mollusks etc.). • Energy production. • Production of pharmaceutical raw material. • Building materials (e.g. limestone). • Aquaculture production. • Drinking water. • Algae production. • Production of sponges. • Production of material used for decorations, jewelry etc. • Sea salt production.
<p>Cultural services</p>	<ul style="list-style-type: none"> • Tourism. • Diving. • Wildlife observation. • Water sports. • Leisure. • Artistic inspiration. • Education and research.



3 ECOSYSTEM SERVICES AND NATURA 2000 NETWORK



Natura 2000 Sea of life

3.1 Ecology and Economy

The coastal and marine environment of Crete plays an important role in the lives of the locals and visitors of the island, as it provides services and goods of vital importance. The climate regulation, the food production through fisheries and aquaculture, as well as the chances for education, recreation and economic growth based on tourism, are mere examples of the importance of coastal ecosystems for people.

Since the Minoan period, the dynamism, the status and the longevity and prosperity of the Minoans were largely supported by their strong relationship with the marine environment, e.g. by exploring and establishing seaways connecting them with cities and different cultures on adjacent islands and the mainland, or by harvesting the goods provided by the coastal ecosystems. The marine environment, is a common subject of frescoes and other art works of the Minoan period, highlighting the important role of the coastal ecosystem in the lives of the Minoans.





The economic and social prosperity in Crete was – and continues to be – inherently connected to a great extent to activities related to the marine and coastal environment.

According to the General Population Census of 2011, Crete has 623,065 permanent inhabitants. It is worth noting that, the five most populated cities of Crete (i.e. Iraklio, Chania, Rethymnon, Agios Nikolaos and Ierapetra), which are located by the sea, account for circa 50% of the total population of the island (312,985 inhabitants), proving this way the

importance of the coastal ecosystems for the local population of Crete.

On a European level, the estimated value of the financial assets situated up to 500 meters from the sea amounts to 500 – 1,000 billion euros, while the public expenses of the European Union for the protection of the coastlines from the risk of erosion and flooding is estimated to be around 5.4 billion euros annually for the period 1990-2020.



A Cretan wild goat on the islet Agioi Theodoroi.

Fishing in the Bay of Messara.





Cretans love spearfishing.



The reduction of catches is affecting coastal fishing in Crete.



The crystal clear waters of Crete attract visitors from all around the world.

In Greece, the highest percentage of commercial activities – with tourism being on the first line – takes place in areas near the sea. The nutrient-poor and low-density plankton seas, such as the Mediterranean Sea, constitute an attraction for the tourists, as their waters are crystal clear, boosting thus the touristic and economic growth of the coastal areas.

Moreover, important commercial activities in the Greek Seas are fisheries and aquaculture. In our days, the intensive form of aquaculture is practiced alongside the traditional exploitation of natural nurseries, placing Greece, between the most productive countries on

aquacultures in Europe. The products of the aquaculture sector constitute a main export product of Greece.

Besides the species that are important for fishing, the Greek Seas host the majority of marine mammals living or being reported in the Mediterranean Sea. The common bottlenose dolphins (such as those depicted on the frescoes of Knossos in Crete), the long-finned pilot whales, the Mediterranean monk seals, the sperm whales and Risso's dolphins, are among the plethora of species found in the Greek Seas.



Finally, vegetation of the coastal areas of Crete is determined by the exposure, the soil type and the distance from the sea. On the island of Crete we mainly find shrublands (maquis and phrygana). Very close to the shores, the main form of vegetation is resistant to increased soil salinity and sea winds (salt-tolerant plants). Among others, the main salt-tolerant plant representatives of Crete are the tamarisk, the sea daffodil (a symbol of the Minoan civilization), *Helichrysum*, the sea-poppy, the caper bush, *Pistacia*, the cade juniper and rock samphire.



Tamarisk (*Tamarix smyrnensis*) on the south coasts of Crete.



Crithmum (*Crithmum maritimum*).



3.2 Culture

Greece is a country with extremely rich diversity, regarding its geomorphology, the climate, and culture. As far as the sea is concerned, the Greeks were always – and continue to be – people of the sea; up today the Greek economy and culture is strongly based on the influence of the coastal and marine environments.

The myth of Cosmogony is a characteristic example of the relationships between culture and the natural environment; in our case the sea. According to the myth of Cosmogony, which was widely known among the Proto-Greek (early Hellenic) populations living on the coasts of the Mediterranean, the beginning of everything was the Ocean (Oceanus).

From verses of Homer's Iliad, the Ocean is the ancestor of Gods, the element in the beginning of creation, on which everything.

“...Ὠκεανόν τε θεῶν γένεσιν καὶ μητέρα Τηθύν...”.

“...and Oceanus, from whom the gods are sprung, and mother Tethys...”. Homer, Iliad, ξ' 201 (Translation: H. G. Evelyn-White).

“...Ὠκεανοῦ, ὃς περ γένεσις πάντεσσι τέτυκται...”.

“...Oceanus from whom they all are sprung...”. Homer, Iliad, ξ' 246 (Translation: Loeb Classical Library).



Ruins of the sunken city of ancient Vienna, on the beach Limni Kriou, west of Palaiochora.





The sea has always been a favourite topic of the Cretan culture.

Important is also, the artistic inspiration of the inhabitants of Crete that stems from the natural environment. The arts, as a defining structural element of culture and their study, provide us with important elements of the relationship of people with nature.

In Minoan Crete, themes from the nature such as flowers, fishes, birds and dolphins were very often motives of artistic expression, while from the Minoan period up to a few years before our time nature was often chosen as a theme to decorate traditional outfits. In literature and poetry, nature is mentioned several times in order to present a more vivid and graphic description of beauty, love, adversity, or other intense emotions.



The ancient port in Falassarna, 9 meters above today's sea level.

The archaeological site of Rousolakos at Palaikastro, Sitia.





The ancient roman theater on Koufonisi islet.



Ancient Lissos, southwest Crete.



*“Sometimes as a symbol and sometimes as a scene of action, sometimes as a transfer of an emotional state and sometimes as a carrier of supreme values, nature has innumerable reflections in Greek literature”.**

In Crete, the nature and ecosystem services have been a source of inspiration, artistic expression and creativity for writers such as Vintzezos Kornaros, Nikos Kazantzakis and many folklore artists.

Describing emotions...

“The seashore was shining, the sea was sleeping, on the trees and waters a sweet rhythm was sounded”.

(“Erotokritos” στ. 771, V. Kornaros).

“On the seashore the waves breaking, the greatest storm is when a heart is hurting.

Because the heartbeat has no place to break out. It doesn’t have a rock to hit or a beach to rest...”.

(From the collection “Kritikes Mantinades” of M. Lioudaki).

Describing the multiple benefits the natural environment provides to the people...

“Happiness is a simple and terse thing - a glass of wine, a chestnut, a brazier, the hum of the sea. Nothing else”.

(“Life and Times of Alexis Zorbas”, N. Kazantzakis).



Ancient Itanos, northeast Crete.



Matala, south Heraklion.



Minoan Palace in Zakros (Kato Zakros). An important commercial stop of eastern Crete in ancient times.

*Excerpt from WWF Hellas Views: “Nature and Man”, January 2012.



3.3 Need for the protection of the environment

According to some ancient Greek myths, the Sea (Thalassa) was born from the Earth. However, nowadays many of the dangers threatening the sea come from the earth (meaning the terrestrial environment). Threats that constantly become more frequent and intense include among others, pollution from human activities, like chemicals used for agriculture and urban waste, and climate change.



Land use conflict: agriculture (greenhouses) and tourism are pressuring the south coasts of Crete.



A Minoan site and a modern industrial area: parallel worlds.



Tons of plastic waste end up every year in our seas.

The oceans' acidification, the changes in salinity, the sea currents, and the ecosystems' composition with the expansion of invasive species outside their current distribution due to change in the sea temperature, are just a few of the threats that will affect the Greek Seas. These changes are predicted to have an effect on various sectors like economy and health.

Moreover, the uncontrolled development on the coastal zone, mainly along the north coastline of Crete, the interventions on the coastal front (e.g. in order to create sandy beaches), the overfishing and the intensification of aquaculture, are altering the morphology of the sea floor and the coast zone of Crete.

Worth noting is the reduction of fisheries stock, mainly because of the commercial and

trade pressure. The pressure for more fish results in increased fishing costs, as the fishing boats have to travel longer distances and stay for a longer time in the open sea, in order to meet the increasing commercial demand.

An important factor in the reduction of the fisheries stock is the invasive species, which very often disrupt the ecosystems' balance, resulting in the shrinking of populations of local edible species. Nowadays, this phenomenon, i.e. the increase of invasive species and reduction of fisheries stock, is becoming quite prevalent in eastern Crete. The fishermen of eastern Crete are now demanding management measures in order to limit the distribution of the invasive species in the area (e.g. the spinefoot and the silver-cheeked toadfish etc.).



Finally, unsustainable (e.g. use of dredges) and illegal (e.g. use of explosives and toxic substances) practices have contributed to the reduction of the fisheries stock in Greece. The presence of important and invaluable marine habitats such as the *Posidonia oceanica* seagrass meadows (which will be extensively mentioned in the following chapter), as well as coral reefs and coral formations, has been extensively limited mainly due to the above-mentioned practices that were implemented in the previous decades in the Greek Seas. Moreover, the improper management practices of fish aquacultures can cause irreversible damages in sensitive ecosystems, vital for biodiversity, such as the *Posidonia oceanica* seagrass meadows.

The rapid increase of the number of holiday residences in coastal areas during the last decades, constitutes one of the most important causes of the transformation of the natural environment along the coast-

line of Crete. Many of these coastal holiday residences have been built and developed on either public land or on property under dispute, and very often they are found on the coastline limit or even on the beach. This phenomenon of illegal building, without having the infrastructure and the urban planning controls, is a common practice along the coastline of Crete.

In the past, societies were often unable to understand the importance of ecosystems, as they were considered to be common goods and thus were often underestimated. The loss of ecosystem services provided by the natural ecosystems will demand costly alternative solutions, while conserving the natural capita will lead to long term savings. Better information and greater raising of awareness for the decision makers, as well as the public, is required regarding the economic value of goods and services provided by the ecosystems.



Unregulated building on the coastal zone.



3.4 Protection measures – management actions for the environment

3.4.1 Coastal areas - Legislation

“For most of history, man has had to fight nature to survive; in this century* he is beginning to realize that, in order to survive, he must protect it”. (Jacques – Yves Cousteau).

The European Union as well as Greece, have adopted a series of Directives, Regulations and Laws, targeting the protection and management of coastal and marine ecosystems.

Regarding fisheries in the Mediterranean Sea, the European Regulation 1967/2006 recognizes the importance of *Posidonia oceanica* seagrass meadows and coral reef formations, by prohibiting the use of fishing gear including trawl nets, dredges, purse seines, boat seines, shore seines or similar nets (Article 4, paragraph 1) above the seagrass beds, as well as in all areas that have been designated for their protection.



Fishing gear and other waste is accumulating on the Cretan sea floor.

The above mentioned Regulation has been implemented in Greece by prohibiting the use of towed dredges and trawl nets in depths less than 50 meters. As the mapping of the *Posidonia oceanica* seagrass meadows has not been completed yet in Greece, the implementation of the regulation was based on the knowledge that the maximum depth that *Posidonia oceanica* can be found is 50 meters. The same Regulation prohibits fishing with trawl nets, dredges, shore seines or similar nets above coralligenous habitats and märl beds (Article 4, paragraph 2).



Throwing construction waste is one of the most destructive practices for coastal wetlands.

*Referring to the 20th century.



Destroyed part of a *P. oceanica* meadow, resulting from an abandoned anchor.

Within the framework for the protection of *Posidonia oceanica* meadows, the placement of aquaculture units above or close to these ecosystems is prohibited according to the Special Framework for Spatial Planning and Sustainable Development for the Aquacultures (OGG 2505/2011).

Important is also the implementation of the Directive 91/271/EEC regarding the urban water-waste discharges with the application of biological treatment, as well as the implementation of the decisions of the Barcelona Convention which was ratified in Greece with the law 1634/86 (OGG 104/A/1986). According to the Barcelona Convention and the Protocol “for the specially protected areas of the Mediterranean Sea”, the Contracted Parties pledge themselves to adopt appropriate measures for the protection of the important marine environment that have a goal to pro-

tect the natural resources, the natural landscape and the areas of cultural inheritance. In Crete, the Samaria National Park and the aesthetic forest in Vai, have been included in the aforementioned Convention.

The Marine Strategy Framework Directive 2008/56/EC, targets the preservation of marine ecosystems and the protection of marine goods and services, while the Directive for Maritime Spatial Planning (2014/89/EU) aims at promoting the sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources.

Finally, on a national level, the Ministerial Decision 40332/2014 regarding the “Adoption of a National Biodiversity Strategy for the years 2014-2019 and a 5-year Action Plan” was issued on 2014 (OGG 2383/B/8-9-2014).



Diverse types of materials end up at the beaches, brought down by the water after intense rainfall.



3.4.2 The NATURA 2000 Network and coastal areas

The framework for the sustainable management of the Greek coasts is defined by the obligations and the constraints that come with the NATURA 2000 Network. The Member States should establish their own appropriate management framework, as every marine area has its own diversified situation, specific problems and needs.

For a fraction of the NATURA 2000 Network area in Greece, legislation has been issued targeting the conservation of habitats and species. For the remaining NATURA 2000 Network areas the applied measures are described by the Law 3937/2011, the thematic spatial plans and the forestry management provisions.



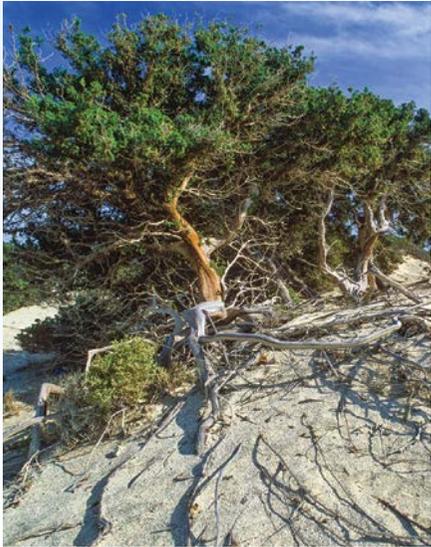
Eleonora's falcon (*Falco eleonorae*): 12.5% of the world's population breeds on the satellite islets of Crete.

Measures to avoid disturbance are applied during the environmental licensing procedure of new projects and other activities.

It is obvious that an approach like this, i.e. environmental licensing, requires a Special Spatial Planning Study for each particular protected area, which should be updated every 10 to 15 years, under the light of new social, economic and environmental developments in the respective area. For the areas that are not covered under the current legal framework, a "National Coastline database" is required in order to ensure the basic spatial planning of the development activities, aiming to the resolution of problems regarding land use conflicts.



The north steep shores of Dragonada islet (Dionisades), host an important colony Eleonora's falcons.



Sand dunes in the "juniper forest" of the Chrysi Island.



Sand dunes on Koufonisi Island.



Potamos beach, Gavdos Island.



3.5 *Posidonia oceanica* seagrass meadows

The underwater *Posidonia oceanica* seagrass meadows are considered to be one of the richest and most valuable biotopes in the Mediterranean Sea. Poseidon's plant (Neptune grass), *Posidonia oceanica*, is a black-green plant, usually confused with the seaweeds. It is an endemic plant of the Mediterranean Sea that grows in the sandy seafloor of shallow marine areas, as well as in sand and biogenic debris (particles of organic origin) stripes existing between hard substrates. We can find *Posidonia oceanica* in waters up to 50 meters deep (depending on water clarity). The species is

very resistant to temperature fluctuations, but at the same time it is very sensitive to salinity and nutrient changes that may cause eutrophication phenomena. The species forms extensive meadows where many of the so called "commercial" marine species such as sponges, crabs, shrimps, crayfish, octopuses, cuttlefish, perch, the scorpionfish etc. find refuge and breed there.

The *Posidonia oceanica* seagrass meadows are characterized by high primary production, they can control the surface sediments flow, protect sandy beaches from erosion and are considered in general, an ecosystem with very high diversity, providing thus important ecosystem services to the local population.

TABLE 3. Most important ecosystem services provided by the *P. oceanica* seagrass meadows.

<p>Regulation and maintenance</p>	<ul style="list-style-type: none"> • Coastline erosion protection. • Sequestration of nutrients and contaminants. • Decrease of the sound and power of waves. • Habitat for many species, including protected ones. • Stabilization of sea bed. • Increase of sea biodiversity. • Water oxygenation. • Nutrient cycling. • Concentration of carbon dioxide (carbon sinks).
<p>Provisioning</p>	<ul style="list-style-type: none"> • Use of dead seagrass as fertilizer and food for farmed animals.
<p>Cultural</p>	<ul style="list-style-type: none"> • Snorkeling and submarine vision boat. • Research subject. • Source of artistic inspiration. • Alternative tourism.



Very often people avoid to swim in places where *Posidonia oceanica* is present, however the exact opposite should be happening. The species is recognized as a good biological indicator of marine water quality and coastal system health. The high sensitivity of the species to anthropogenic interventions and the alterations they create to the marine environment, coupled with their ecological role in the ecosystem, are the main reasons for the protection of the species in the European Union.



Washed out dead *P. oceanica* on a Cretan beach. Although unattractive to look at, they effectively protect coastline from erosion.

The *Posidonia oceanica* ecosystem is among the priority habitats in the Habitats Directive (92/43/EEC). In the actions taken for the conservation of marine flora in the Mediterranean Sea, special attention is given to the *Posidonia oceanica* seagrass meadows for their unique role in the marine environment, as well as the ecosystem services they offer (UNEP-RAC/SPA, 2012). Although *Posidonia oceanica* is protected, the seagrass meadows continue to shrink. In the Mediterranean Sea, the decrease of the seagrass meadows' extent by 10% the last 100 years has resulted in financial losses.

In Crete, so far the only recorded *Posidonia oceanica* seagrass meadows are those inside the NATURA 2000 Network areas of the island. It is mandatory to map in detail the distribution of the seagrass meadows, as well as to further research and collect scientific data that will shed light on the current status of *Posidonia oceanica* in Crete.

P. oceanica seagrass meadow.





3.6 Sea turtle *Caretta caretta*

The sea turtle *Caretta caretta* is among the symbols-species of the Mediterranean Sea. Greece is hosting the largest number of sea turtle nests compared to the other Mediterranean countries. The most known nest locations are found in Zakynthos, in Kyparisia bay, in Lakonia and in Crete – in particular in Rethymnon, Chania and the Bay of Messara.

Crete is an important stop for the species, as every year hundreds of sea turtles visit the island's sandy beaches in order to lay their eggs. The areas with the largest number of nests are the bay of Chania, the beach of Rethymnon and Kommos beach in Messara (south Heraklion)

Caretta caretta spends the greatest part of its life in the sea and only the female turtles come out ashore during the nesting season, which takes place from May to September. It is noteworthy that the turtles return to lay their eggs at the same beaches where they were born. The ideal place for the turtles to lay their eggs should be quiet sandy beaches, with no lights at night and no people, speedboats and noise during the day. Mass tourism in these areas does not facilitate the species reproduction.



Sea turtle (*Caretta caretta*).





Pathway for the newborn *C. caretta* at Kommos beach (bay of Messara).

The newborn turtles will have to face their natural enemies such as the seabirds, which prey on them, upon emergence from the nest and the carnivorous fish when they enter the sea for the first time. When the turtles become adults, only larger animals like sharks can threaten them.

Caretta caretta has been listed as Vulnerable in the Red Data Book of Threatened Species

published by the International Union for the Conservation of Nature (IUCN). The dangers the species faces are mainly the fishing gear where the turtles get tangled and the solid waste, mainly the plastic bags, which the turtles confuse with jellyfish, shallow them and asphyxiate. Moreover, an observed reduction in the number of nests has been attributed to sandy shores erosion, in time.

A study from the University of Aegean in 2010, using part of the beach of Rethymnon which belongs to the NATURA 2000 Network as a study area, showed that only 2.6% of the visitors take part in eco-touristic activities, while only 1 in 4 was aware of the NATURA 2000 Network in the Prefecture of Rethymnon. Finally, the visitors in the study area, expressed their willingness to pay 1.13 euros extra per night they spend there in order to protect the nesting sites of the sea turtle in Rethymnon. Goal of the abovementioned study was to evaluate the opinions of the visitors in the study area in relation to the alternative environmental management policies of coastal and/or marine ecosystems.

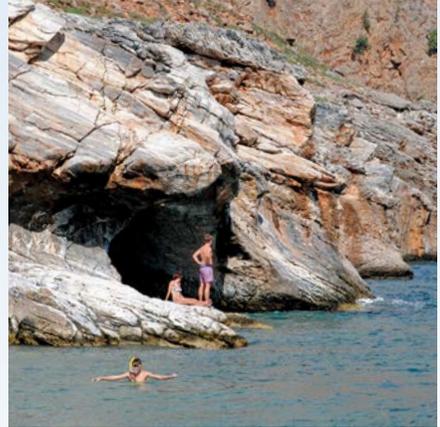
The population of sea turtles reproducing in Crete is under the threat of extinction, as studies have shown that there is a downward trend, mainly because of the failure to follow the basic principles for the protection of the species during the nesting period. Thus the effective application of measures for their protection is necessary.



3.7 Main human financial activities

3.7.1 Leisure and Tourism

Coastal areas are the most popular vacation destination of Europeans, as 63% of the holiday makers choose them as their destination for vacations. Visitors of these areas do not seek only relaxation, but they search also for new ways of leisure. For example, it is estimated that six to eight millions of people choose fishing as a sport or a hobby, resulting in annual profits between eight and ten billion euros in Europe.



Swimming in the area of Marmaras in Sfakia.



Windsurfing at Kouremenos bay, Palaikastro.

Tourism in Crete is a dynamically growing sector that plays an important role in the island's economy. Demand for tourism, provides motives for important investments in hotel units, while at the same time, the tourism sector faces structural problems which are mainly focused on the seasonality of tourism and the limited extension of tourism to the inland parts of Crete (e.g. tourism in mountain settlements).



Loutro, Sfakia.



Amateur fishing at Dionisades.

3.7.2 Fisheries – Aquaculture

Although Crete is the largest island of Greece, it is not the dominant provider of goods that come from the marine ecosystems, as there are limited fishing activities on the island. Proportionally to the population, the majority of fishing vessels are found in the Prefecture Units of Chania, Heraklion, Lasithi and Rethymnon.

Considering that the traditional methods of fishing cannot cover the demand of the Greek consumers, the constantly developing field of aquacultures is filling this gap in the domestic demand. Although Greece is leading in the field of aquacultures and is among the top producing countries in the European Union, Crete shares only a very small part in this.



A large number of marine species, like dreamfish (*Sarpa salpa*) is feeding in the extensive *Posidonia oceanica* seagrass meadows.



4 WORKING POSITIONS AND EMPLOYMENT OPPORTUNITIES



4.1 The economy of Crete

The goods that are presently distributed in the markets worldwide, are products that come from the three different sectors of economy: the primary, the secondary and the tertiary sector.

The primary sector includes activities related to the harvesting of goods directly from nature, in the form they exist in it (raw materials), for indirect or direct consumption. It includes agriculture, fisheries, livestock farming, mineral extraction, etc.

The secondary sector includes human activities that transform the products of the primary sector using various techniques. It includes the processing of goods (e.g. fruit, vegetables, milk, wood, and leather), production of electricity, water, etc.

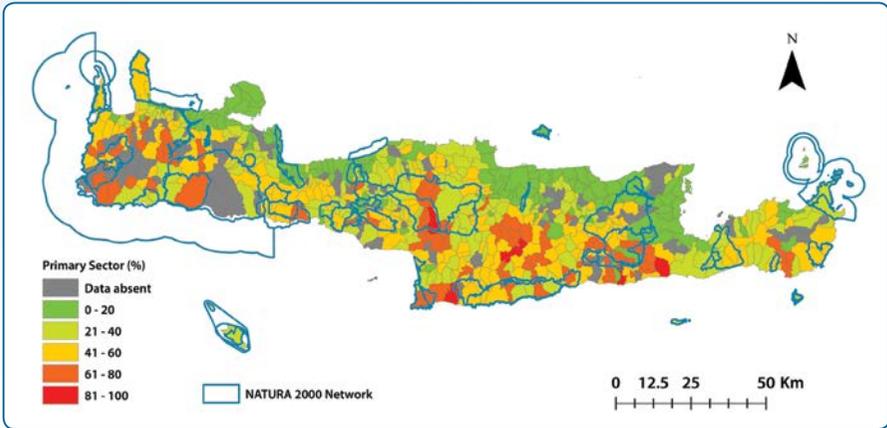
The tertiary sector involves the provision of services to people in order to cover their needs. It includes education, health services,

tourism, banking services, communications, wholesale and retail trade etc.

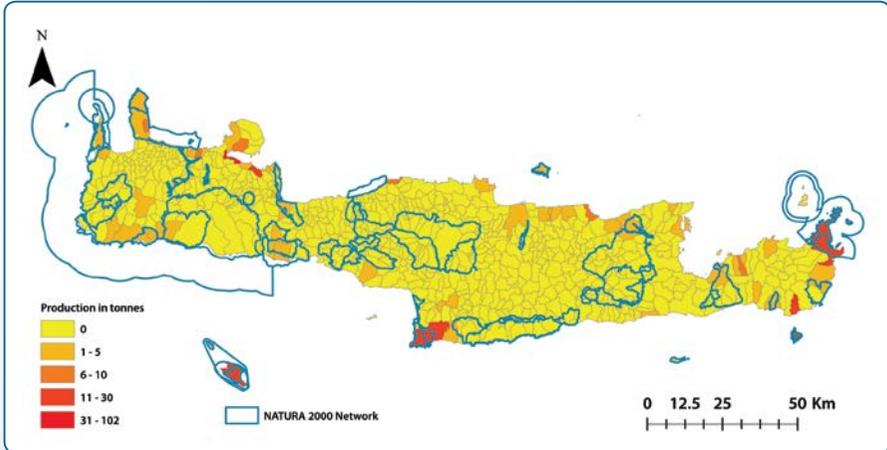
Until the late 60's, the economy of Crete was largely based on agriculture. This has gradually changed and an increase of services provisioning (related to tourism) is now observed. Nowadays, while agriculture and farming is still practiced due to the topography and the climate of the island, there is a noticeable decrease in the constructing sector mainly because of the financial crisis in the last years. In parallel, there is an important increase in service provisioning (see tourism). All these three sectors of the Cretan economy (primary, secondary and tertiary) are directly linked and depend on each other. Below (see Map 2-5) the data regarding the three sectors of economy of Crete for the years 2010 and 2011, according to the Hellenic Statistical Authority (ELSTAT) are presented.



MAP 2. Percentage of employees working in the primary sector in the Communities of Crete in relation to the NATURA 2000 Network (ELSTAT data, 2011).



MAP 3. Fisheries (ELSTAT data, 2011).



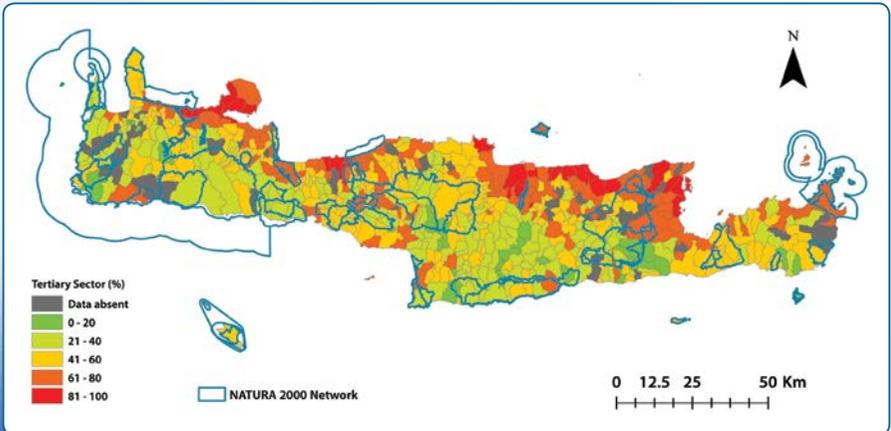
Fish catches are the eighth most important export product of Crete (Region of Crete data, 2012).



MAP 4. Percentage of employees working in the secondary sector in the Communities of Crete in relation to the NATURA 2000 Network (ELSTAT data, 2011).



MAP 5. Percentage of employees working in the tertiary sector in the Communities of Crete in relation to the NATURA 2000 Network (ELSTAT data, 2011).



Elafonisi.



4.2 Employment opportunities

Given the fact that Crete has important natural and cultural resources that attract the global interest, as well as inland hosting infrastructures, there is considerable growth potential. The employment opportunities in Crete could easily be grouped in three basic categories: tourism, culture and production.

4.2.1 Tourism

Although tourism already plays a major role in the economy of Crete, accounting for the 31% of the Gross Production Value (GPV), there are possibilities to further strengthen the sector of tourism, under the condition that the tourism product will be expanded and diversified and the provided services will improve, with priority to the conservation of the environment.

Crete, a well-established touristic destination, has the first place among the Regions of Greece with respect to the number of overnight stays. An important matter regarding tourism in Crete, according to data from the Region of Crete, is that the mean expenditure per visit is constantly decreasing. As a counter-measure, emphasis could be given to alternative forms of tourism, in which Crete has a competitive advantage over other competitive areas.

Crete has significant advantages regarding the development of alternative forms of tourism, as it constitutes an attractive destination due to its history, the top gastronomic options of the Cretan diet, and its unique natural environment. On the island, 88 destinations are recorded, with numerous beaches, either organized or non-organized, two of which (Elafonisi and Balos) are placed among the 25 top beaches in Europe. The

10 small islets that have been characterized by the Ministry of Environment and Energy as “sensitive ecosystems” (the most known are Gavdos, Elafonisi and Spinalonga) add a unique character to Crete.

Shortly, working positions could become available in sectors like:

- Alternative tourism (e.g. boat tours, and diving tourism, culinary tourism, sightseeing, cruising, religious tourism). Priority could be given to the Cretan gastronomy.
- Service provisioning (e.g. treatment with products such as sea plants, sea weeds and sea salt). Also, the eco-tours are a rising section in the service provisioning sector.



Dia Island.

- The development of innovative businesses and accommodation facilities that will focus on alternative, nature and gastronomic tourism and will have as a target the visitors’ contact with the natural, economic, social and cultural environment of the Cretan countryside.



4.2.2 Culture

In the sector of culture, employment opportunities can arise through the reinforcement of the following activities/actions:

- Promotion of research and innovation for the production of state-of-the-art products, and the development of technological applications for the reduction of the environmental footprint.
- Development of innovative applications for linking the Minoan, Byzantine and Venetian Cultures, and their relationship with the sea and coastal ecosystems.
- Development of underwater sightseeing with educational or recreational characteristics in sites of archaeological, historical, or environmental interest.
- Wildlife observation for recreational or educational purposes.
- Development of alternative activities such as: organization of music seminars and of making mantinades (the rhyming couplets of Crete) inspired from the nature, exercise and alternative forms of therapy in the nature.



Birdwatching on Imeri Gramvoussa islet, Chania.

4.2.3 Production

In order to boost the production of coastal and marine ecosystems, the improvement of the infrastructure servicing fishing boats and facilitating fish trade is suggested. This kind of facilitations are considered the following: creation/improvement of ice, water and fuel supply facilities for boats, cold storage facilities, storage facilities of fishing gear and tools of fishing boats, boat lifting machines and small repairing and maintenance workshops. Working positions related to production can arise from the reinforcement of the production of fisheries products of high nutrition value and the creation of local certified products.



Preparing a concert in the Venetian fortress of Frangokastello, Chania.



4.3 Other employment opportunities

4.3.1 Diving tourism

Given the fact that 25 million divers exist worldwide, Crete due to its climate, its unique marine environment and history, could claim an important share of the diving market. It is noted that competition from countries and areas such as the Red Sea, the Maldives, Mexico, Malta, Italia etc. is particularly strong. Two out of ten spots for diving in Greece as proposed by the Professional Association of Diving Instructors (PADI) are located in Crete. A precondition for the development of diving tourism is the cooperation of the business world with the research institutions that have the know-how, like e.g. the Hellenic Center for Marine Research (H.C.M.R) that has conducted studies for the identification of suitable areas for diving.

The further development of diving tourism in Crete has important prospects given that:

- It has ideal climate and geomorphology.
- It is characterized by great biodiversity, with lots of endemic species.
- It has a rich cultural tradition and heritage.
- It already has important tourist infrastructure.
- Greece has the same currency (euro) with other states and applies all international safety rules.





5 MAIN FORMS OF ALTERNATIVE TOURISM



The sector of coastal tourism is becoming more demanding, as nowadays tourists do not only seek the sun, the sea and the beach, but also a great diversity of leisure activities and experiences, as for example, sports, gastronomy, culture and the natural environment. On the other side, the tourism development puts pressure on the local society of traditional touristic destinations, as there is a risk of altering their cultural heritage and identity, as well as the natural environment of the area.

In Crete, the sun, the beaches, the unique landscapes with ecosystems rich in diversity and the Cretan diet, advocate the development of various profitable services such as diving, boat tours, wildlife observation trips and restaurants based on the gastronomic identity of the island. In diving for example, the first steps have already been made on the island, as several business initiatives have been taken (approximately 20 diving centers) in many areas, mostly of the northern coast of Crete.



Hiking on the E4 route, from Elafonisi to Palaiochora (Chania).



Finally, and having as a main target the creation of safe and attractive touristic coastal destinations, with healthy ecosystems and clear waters, it is necessary to conduct a study for the integrated management of the coastal zone which will pre-require the following:

1. Conservation of ecosystem health and water purity.
2. Sustainable management practices for coastal areas.
3. Provision of security measures for the visitors of the coastal areas.
4. Infrastructure development for the protection of coastal erosion.
5. Maintenance of the attractiveness of coastal areas via restoration measures.
6. Policy implementation for the protection of wildlife and its habitats.



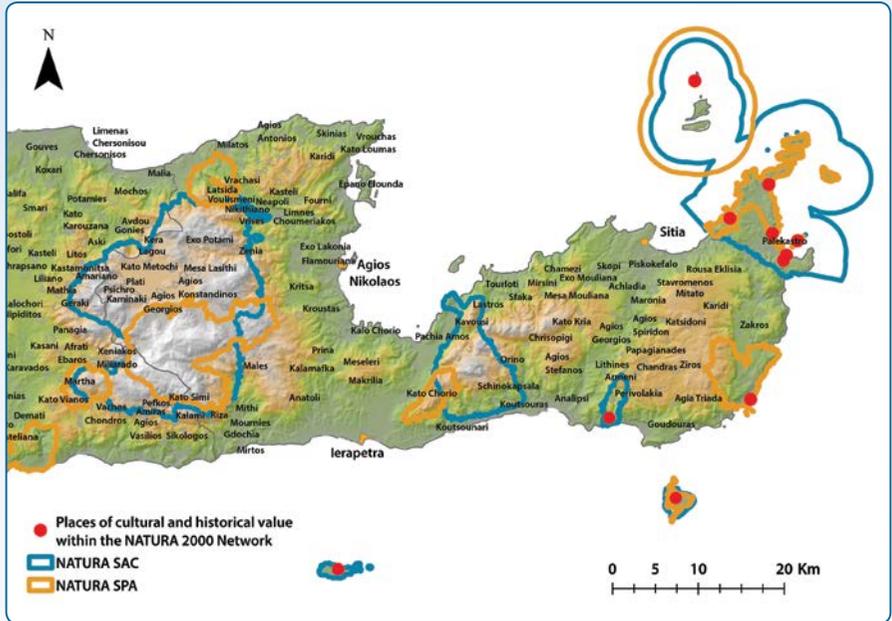
The north steep shores of Dragonada islet and Paximada islet in the background. Dionysades, Sitia.



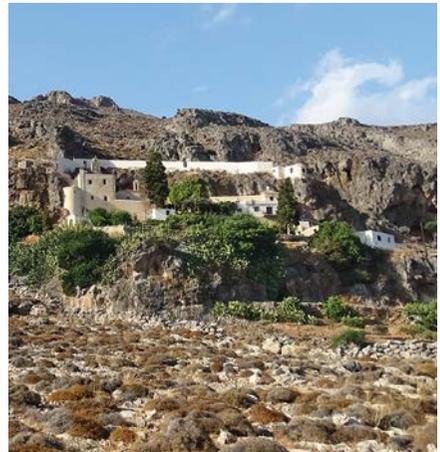
Elafonisi, Chania.



MAP 6. Indicative sites of cultural and historical value, inside the areas of the NATURA 2000 Network in the Regional Unit of Lasithi.



Indicative sites in the Regional Unit of Lasithi are the following; the Toplou Monastery and Toplou Gorge, the ancient city of Itanos, Vai palm forest, the Temple of Dictaeon Zeus in Rousolakos, the Petsofas Peak Sanctuary, the Minoan buildings on Paximada and Dragonada islands, the ancient finds on Grantas island, Hellenistic town of Ampelos in Xerokambos, the Kapsa Monastery, the islands of Koufonisi and Chrysi.



Kapsa Monastery, Lasithi.

5 Main Forms of
Alternative Tourism



Ancient facilities for the processing of the Tyrian purple, Koufonisi, Lasithi.



Katsounaki beach in the area of Xerokambos, Lasithi.



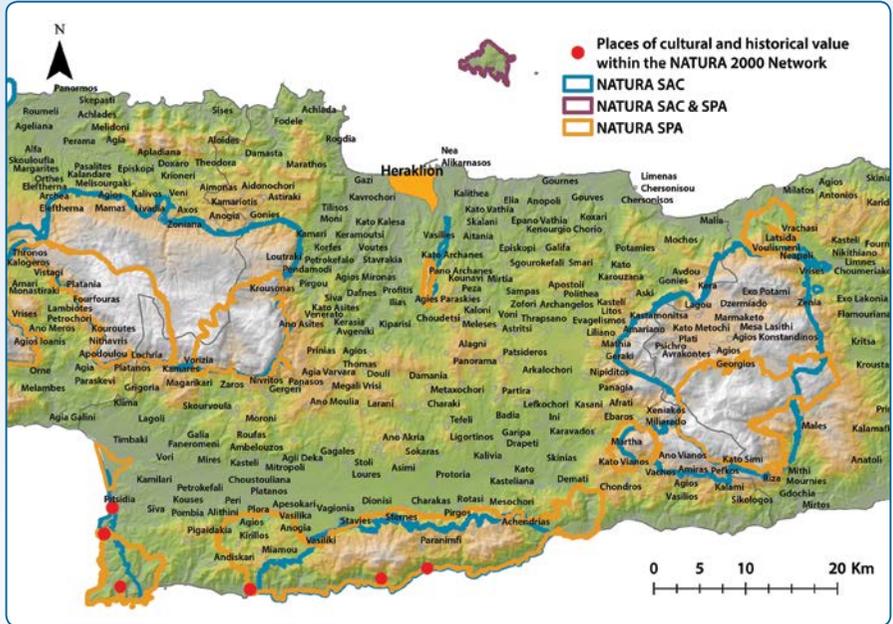
Bay of Agios Antonios, Dragonada, Lasithi.



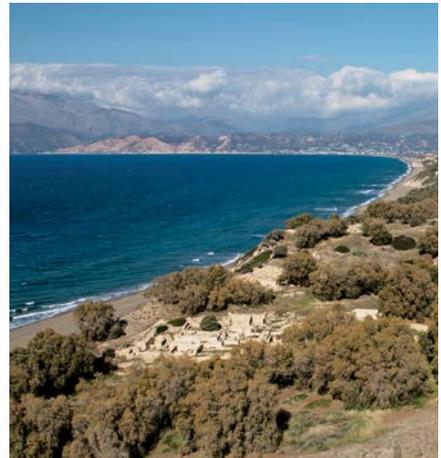
Vai palm forest, Lasithi.



Map 7. Indicative sites of cultural and historical value, inside the areas of the NATURA 2000 Network in the Regional Unity of Heraklion.



Indicative sites in the Regional Unit of Heraklion are the following: the Monastery of St. Pavlos near the Tris Eklisies, the ancient Levina in Lendas, the ancient settlement with the carved cavevns in Matala (haven of Phaistos and Gortyna), the Minoan town Kommos (port of Phaistos), the Kou-doumas Monastery, Agiofarango and Martsalo (important port in the Minoan period).



Archaeological site of Kommos, Bay of Messara, Heraklion.

5 Main Forms of
Alternative Tourism



The coast east of Lendas, Asterousia Mountains, south Heraklion.



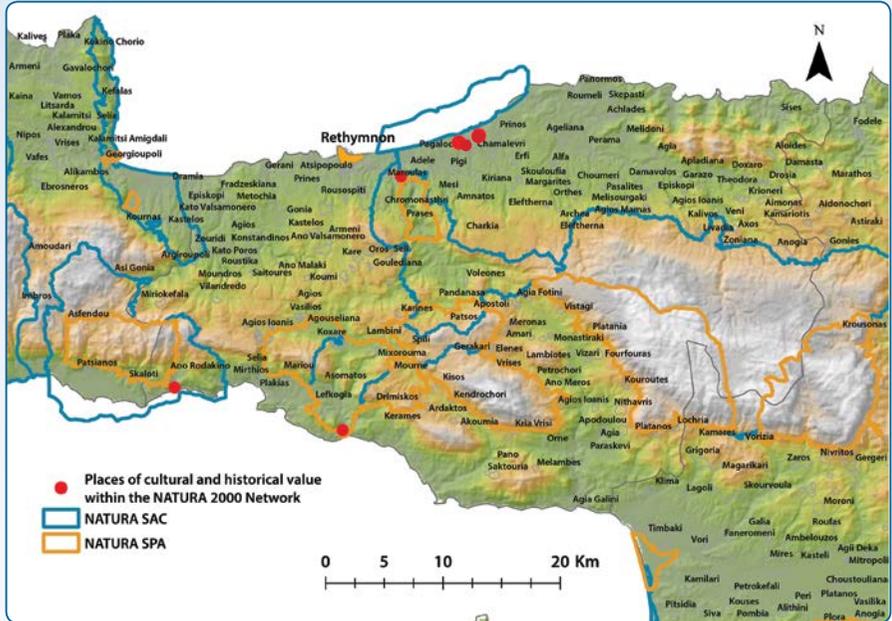
The carved caverns in Matala, Heraklion.



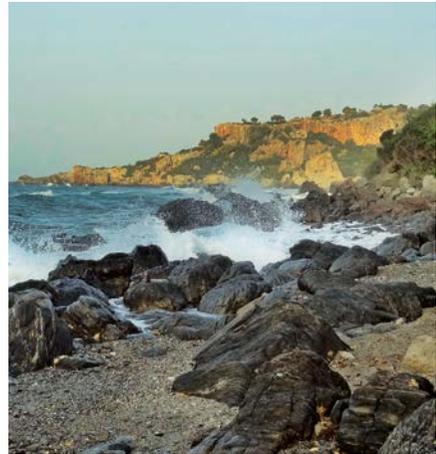
The beach of Agiofarago is a famous climbing destination, Heraklion.



Map 8. Indicative sites of cultural and historical value, inside the areas of the NATURA 2000 Network in the Regional Unit of Rethymnon.



Indicative sites in the Rethymnon Regional Unit are the following: the Monastery of Prevelis, the Kourtaliotis river gorge with its unique ecological and aesthetic value, the coastal area of Rodakino, the Venetian bridge of Plataniias and the archaeological finds in the wider area of Stavromenos (ruins of a prehistoric settlement, Minoan settlement, Mycenaean cemetery and Helleno-Roman town).



Korakas beach, Rodakino, Rethymnon.



Beach east of Kourtaliotis river estuary.



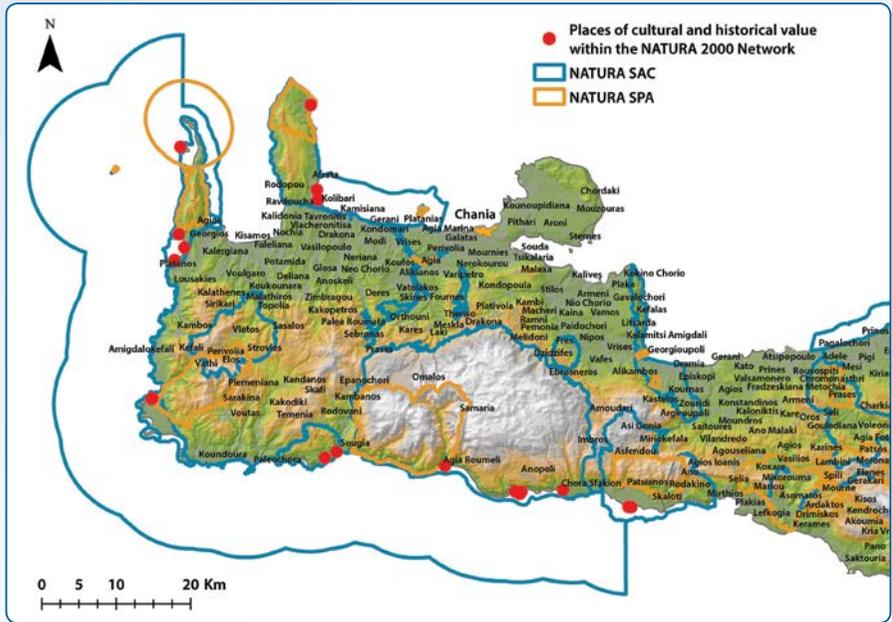
Geropotamos beach, Rethymnon.



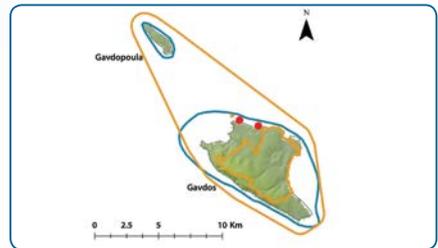
Panoramic view of the palm forest and the beach created by the estuary of Kourtaliotis River, Rethymnon.



MAP 9. Indicative sites of cultural and historical value, inside the areas of the NATURA 2000 Network in the Regional Unit of Chania.



Indicative sites in the Regional Unit of Chania are the following: the ancient city of Phoenix and the Turkish Fortress in Loutro, the ancient city of Tarra, the Minoan settlement and the Monastery of Chrysoskalitissa, the Monastery of Odigitria in Kolympari, the ancient city of Lissos, Frangokastello, the ancient city of Falassarna, the fortress of Imeri Gramvousa, the archaeological site of Diktinna (near Menies beach) in cape Spathia and the beach of Agios Ioannis (Roman finds) in Gavdos.



Finally, many places of a particular cultural and historical value are located very close to NATURA 2000 Network areas across the whole of Crete. Some of these are the ancient city of Zakros and the historical cave of Milatos.



Frangokastello Sfakia, Chania.



Ancient Diktinna, cape Spatha, Chania.



The fortress in Loutro, Chania.



The magical view from the Venetian castle of Imeri Gramvousa towards the Balos lagoon and cape Tigani (Chania).

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European Environment Agency: http://www.eea.europa.eu/el/themes/coast_sea/intro

LIFE NATURA THEMIS project: <http://www.lifethemis.eu/el/content/>



Area of Kokkini Ammos, south shores of Asterousia Mountains.

7 GLOSSARY

Biodiversity or biological diversity: The diversity of all living organisms at all levels of life organization, from genes to ecosystems [Law 2204/1994 (GG A 59) (Ratification of the Convention on Biological Diversity, Article 2 Terminology)].

Ecology: The study of the abundance and Distribution of organisms, and the interactions between organisms and their biotic and abiotic environment.

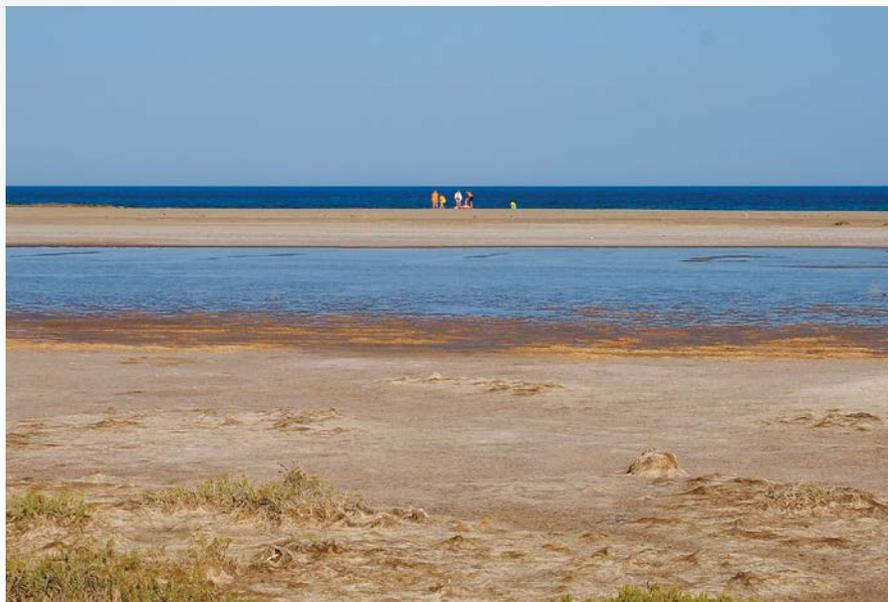
Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit [Law 2204/1994 (GG A 59) (Ratification of the Convention on Biological Diversity, Article 2 Terminology)].

Ecosystem services: Services provided by the natural environment that benefit humans.

Habitat: Position with a suitable environment (e.g., appropriate vegetation or food sufficiency) for an organism (Gillespie, R.G. & Clague, D.A [Eds], 2009. Encyclopedia of Islands).

Natural capital: All the elements nature provides to man for his completion and survival. It includes the basic building blocks of a society such as soil, raw materials, water and air (Source: http://ec.europa.eu/environment/basics/natural-capital/index_en.htm).

Natural resources or natural goods: All natural substances available on earth and used by humans for their survival and development. They may be non-renewable (e.g. minerals, plant/animal species) or renewable (e.g. sun, air) (Source: <http://www.eea.europa.eu/el/themes/natural>).



Alatsolimni, Xerokambos in Sitia.



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Avramakis Manolis - NHMC: p. 10b, 12, 19a, 19b, 22b, 40b, 47c, 51a, 56

Aggelakis Nikos: p. 48

Baxevani Popi - NHMC: p. 13, 17a, 18a, 18b, 18c, 20a, 24a, 24b, 24c, 25, 27b, 28b, 33, 35a, 42b, 43a, 44, 45c, 49b, 51b

Diakonis Giannis - NHMC: p. 23b, 47b

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Poursanidis Dimitris: p. 6, 16a, 26a, 27a, 30-31, 35b, 41

Spyridakis Giorgos - NHMC: p. 47a

Trichas Apostolos - NHMC: p. 8, 22a, 28a, 29a, 29b, 29c, 36, 43b, 45a, 45d, 49c

Trigou Roula - HOS: p. 40a

Trikali Mina - NHMC: p. 11b, 16-17, 53

Vardinoyianni Katerina - NHMC: p. 11c

Page 4: Xerokambos in Sitia, Monachos Kavallos islet.

Page 6: Mediterranean fanworm (*Sabella spallanzanii*), one of the most impressive animals of the Mediterranean.

Page 55: Scopoli's shearwater (*Calonectris diomedea*), the great seafarer of the Mediterranean.

Page 56: Area of Profitis Ilias, south shores of Lefka Ori.





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