LIFE Natura 2000 Value Crete

NATURA 2000 Network

Ecosystem Services of Mountain Areas of Crete

Natura 2000 Peaks' assets

INFORMATION GUIDE

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Ecosystem Services of Mountain Areas of Crete

Natura 2000 Peaks' assets Care, goods, investment

INFORMATION GUIDE




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 Natura2000ValueCrete" 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

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.
Cultural services	Sensory pleasure, artistic inspiration and recreation.
Provisioning services	Products obtained from ecosystems such as food, water and timber.

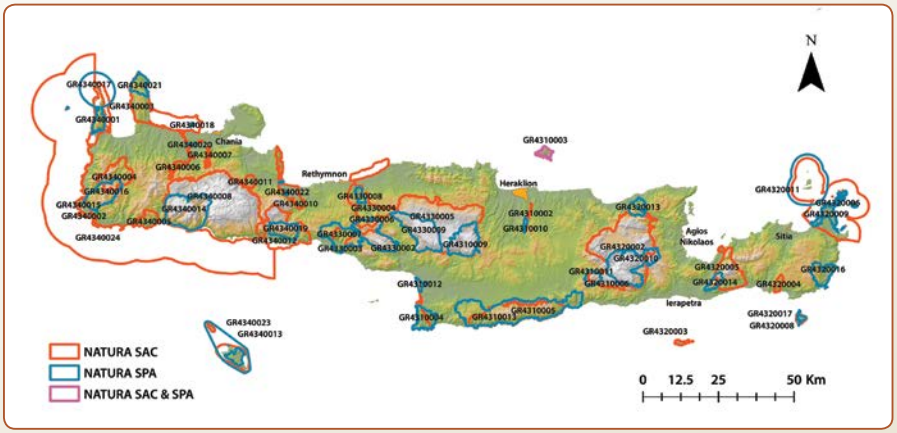
1.2 NATURA 2000 Network

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).

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",

MAP 1. The NATURA 2000 Network areas in Crete.



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) [Map 1], 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".

The steep slopes of the Lefka Ori in Agia Roumeli.

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. 14-15).

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, there are bushes and wildflowers coexisting with many small animals such as snails, beetles and lizards. Also, there are

Zakros: The mountains and the plain covered with olive groves.

Chrysaetos or vitsila (golden eagle - *Aquila chrysaetos*).

large animals such as the Cretan wildgoat (agrimi), the Cretan wildcat as well as big birds of prey, such as the bearded vulture (kokalas), the griffon vulture (skara or kanavos) and the golden eagle (vitsila), animals inherently linked with the mountain landscape and the Cretan tradition.

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 dairy 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.

Traditional cheese making in a shepherd's mountain hut.

1.3.1 Geomorphology of Crete

The magnificence of Cretan nature, from the mountain to the lowland and coastal areas of the island, is evident in the successive alternations of the landscape which hold many surprises for the visitor. 21.6% of the total area of Crete is at altitudes above 700 meters.

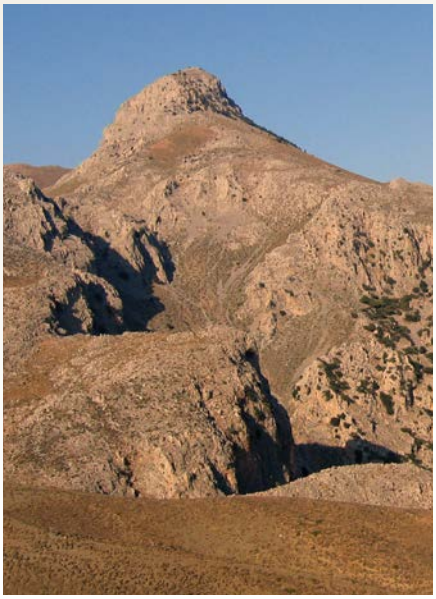
The island presents great geological interest because of the great variety of rocks and the unique geological formations. The majority of the rocks of Crete are limestone of various types. A narrow strip of slate sometimes appears between limestones.

Crete is marked by a mountain "chain" extending from one end of the island to the other. From the west to the east, large mountains dominate: the Lefka Ori in the

Western foothills of the Thripti Mountain.

The Melindaou peak, Lefka Ori Mountains.

"Platy marbles" in Psiloritis mt.



The top of Kofinas, Asterousia Mountains.

west (2,453 m), with 56 peaks exceeding 2,000 m and creating a 100 sq. Km mountain desert, the so-called "Madares", Psiloritis or Idi in the centre of the island (2,456 m), and Dikti or Lasithi Mountains in the east. Moreover, in the south of the Heraklion Regional Unit there are the Asterousia Mountains and the Mountains of Sitia in the eastern part of the island.

The tectonic processes and the corrosive action of water on the limestone rocks of the island have created numerous karstic forms such as plateaus, gorges, sinks, caves, springs and underground canals.

Many mountain regions of Crete host fertile plateaus, some of which retain water during certain periods of the year and form seasonal ponds of significant ecological value, protected by the Greek and European legislation. The most famous are the plateaus of Omalos in Lefka Ori, Nida in Psiloritis and Lasithi in Dikti. These areas are either farmlands or abandoned cultivations converted into pasture land.

More than two hundred canyons run through Crete, mostly from the North to the South, with the Samaria Gorge being the bigger and best known. Many endemic plants live in the canyons. Rare birds of prey and mammals have found shelter on the steep rocks, even though the extent of their territory is much bigger. At least 5,000 caves and underground formations have been recorded in Cretan mountains, of which nearly half have been explored.

Underground river at Kynigiana of Mylopotamos, Psiloritis.

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.

Hunting is allowed in specific areas and time periods and it concerns certain species.

Cycling on Psiloritis.

- 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 EC338/1997, 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 electric power 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.

2 NATURE, SOCIETY AND ECONOMY

Mountain ecosystems in Crete are characterized by three distinct elements: altitude, steep slopes and large environmental contrasts in a relatively short distance.

In Crete, mountain ecosystems are called those located at altitudes higher than 700 meters, corresponding to the end limit of olive cultivation.

Area of Agios Ioannis Sfakia.

The extreme climate conditions and topography and the rough but beautiful scenery have not intimidated man who nevertheless managed to prosper in the inhospitable surroundings of the mountain areas of the island. Over the centuries, inhabitants of the mountains exploited the land, got involved with animal farming and created traditions and cultural heritage that are preserved to this day. The knowledge of all the manifestations of the indissoluble relationship between man and mountain ecosystems can be instrumental for their protection.

This guide presents all the goods generously offered by the Cretan mountains to the people, in order to enable the reader to also make use of them, always in view of their preservation for the future generations.

The beginning of the Ha gorge, in Thripti.

The snow feeds the groundwater aquifers of Crete.

At the global level, mountain areas play an important role and offer a large number of benefits to people. Around 20% (~1.5 billion) of the world's population live in the mountains or close to them, while 50% depend, directly or indirectly, on the natural resources of mountain ecosystems.

Mountain areas supply more than 50% of the world's population with drinking water, irrigation water, industrial raw materials, food and energy resources, while at the same time they are important carbon "sinks". The precipitations are more in the mountains and water is stored as ice and snow, therefore the sources of the largest rivers and groundwater reserves are found in mountain areas worldwide.

In addition, the mountains are sanctuaries of biodiversity, significant part of which is used as food, prey, timber and pharmaceutical products. Furthermore, mountain ecosystems function as pastures, but also allow small-scale agriculture.

Healthy mountain ecosystems regulate local climate, air quality, water cycle, while the vegetation and soil contribute to the protection from various natural hazards and the effects of extreme weather events such as avalanches, landslides, etc. Furthermore, since mountain ecosystems are particularly sensitive to climate change, they are considered important indicators of this phenomenon.

The mountains also retain a significantly high proportion of the global cultural and ethno-linguistic diversity, representing the heritage of human history and adaptation to the demanding mountain environments through the centuries and even millennia. Their aesthetic value, together with the aforementioned characteristics, make mountains leisure centres on the one hand, as they contribute to the well-being of the growing urban populations, and tourism centres on the other hand with the various economic benefits to both mountain residents and the national economy.

Mountain ecosystems offer a multitude of activities for nature lovers and those looking for adventure. Mountaineering, climbing, trekking, canyoning, mountain biking, cave exploration, horse riding, bird watching, etc. are just some of the activities offered in the mountain areas.

For Crete, the main categories of services provided by mountain ecosystems are summarized in Table 2.

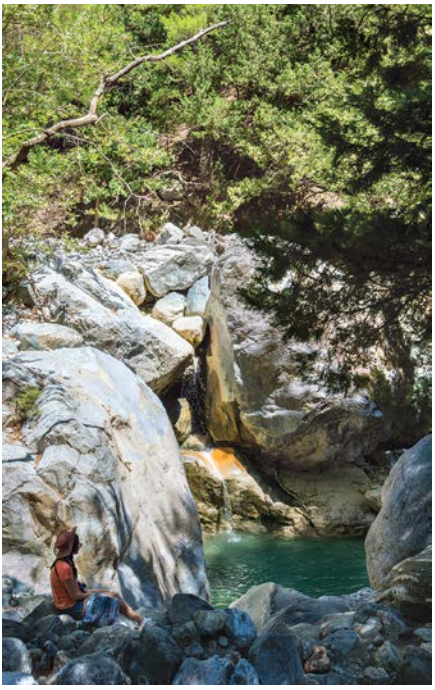
TABLE 2. The most important services of mountain ecosystems in Crete.

Regulating and maintenance services	• Provision of habitats for animals and plants (e.g. canyons as nesting areas for birds of prey). • Soil formation. • Oxygen production. • Recycling of soil nutrients. • High biodiversity density. • Climate, air quality and water flow adjustment. • Protection of lowland areas from natural disasters and their impacts (e.g. floods, droughts and heavy storms). • Water storage and supply. • Soil productivity. • Pollination.
Cultural services	• The aesthetic value of the mountains. • Spiritual - religious value of the mountains. • Artistic inspiration. • Cultural and ethno-linguistic diversity. • Mountain activities and excursions to nature.

Provisioning services	• Drinking water. • Water for domestic use and for irrigation - industry - power generation. • Milk production - dairy products. • Meat production. • Production of animal by-products (hair, wool, skins, etc.). • Cultivation of edible, medicinal and ornamental plants. • Honey production. • Wood and firewood. • Forest products other than timber.

The highest percentage of honey in Crete is produced in mountain areas.

Lasithi plateau.



Enjoying the aesthetic value of mountain nature.

3 ECOSYSTEM SERVICES AND NATURA 2000 NETWORK

3.1 Brief History - Mythology

"There is a kind of flame in Crete - let us call it 'soul' - something more powerful than either life or death. There is pride, obstinacy, valor, and together with these something else inexpressible and imponderable, something which makes you rejoice that you are a human being, and at the same time tremble"

Nikos Kazantzakis

The oldest traces of human presence are estimated to be from the Palaeolithic period (200,000-120,000 years ago). However, the first organized communities of farmers seem to have been created by Neolithic people, some 8,000 years ago. The cultivation of land and stockbreeding have shaped the Cretan land in the mists of time.

Crete was the birthplace of the Minoan civilization, the first one to have arisen on European territory and which flourished from 3000 BC until 1200 BC, mainly in central and eastern Crete.

The intense topography of the Cretan landscape, dominated by rocky mountains, impressive canyons, caves and plateaus, influenced human societies and also Minoan civilization and religious perception.

The caves were home to the first Neolithic people, and then became sites for the burial of the dead and worshiping the gods (indicatively, there have been archaeological finds in the following caves: Kamaraiko in southern Psiloritis, Chosto Nero in Giouchtas, Trapeza in the Lasithi Plateau, etc.). According to my-

Dikteon Cave, Psychro, Lasithi Plateau.

thology, the Dikteon and Ideon Caves are inherently associated with the birth and upbringing of Zeus, the later father of the gods. Zeus, in the form of a bull, abducted Princess Europe of Phoenicia and brought her to Crete. Minos, the king of the Minoan civilization was the fruit of the mating of Zeus and Europe under the evergreen plane tree of Gortyna, (reference to the Minoan worshipping of trees). This is also how Europe (the continent) acquired its name.

The belief of the people that deities appeared from the sky, contributed in placing of worship places on the top of mountains and hills. Many pilgrims from the countryside and the cities arrived there to bring their offerings (tributes have been found in many peak sanctuaries in mountain summits such as in Giouchtas, Kofinas, Vrisinas, Petsofas, Traostalos, etc.). In addition these peak sanctuaries are connected with local myths, legends and traditions. The canyons also have a significant cultural value and have played an important role during certain periods of local history. Ancient temples, oracles and sacred sites are located there, further highlighting the long-standing human presence.

During the Subminoan and Protogeometric periods (known as "Dark Ages", 1100 BC - 800 BC), inhabitants of the coastal areas, feeling threatened from the appearance of the Achaeans and Dorians on the island, withdrew up in the mountains. There they built cities in the most difficult and naturally fortified places, mainly in the eastern mountains of Crete. Living in these inaccessible areas was so tough that in a few centuries these settlements declined and disappeared.

Caves and peaks still hold their sacred character. Christian hermitages and monasteries are located on all the mountains of the island, as well as at the entrances of many caves.

Kamares Cave, Psiloritis.

Potato cultivation on the Lasithi Plateau.

Over the centuries and through the transformations in the social and political structure of the island (e.g. periods of the Venetian and Ottoman rule), the traditional activities of the inhabitants of mountain regions changed. In general, however, the way of life and the tools of farmers and stockbreeders did not change significantly, preserving some of their archaic characteristics.

The Cretan mountain landscape demonstrates some primitive features from another era. Moreover, the presence of sheep and goats, the traces they leave in their passage, the grazing marks on the vegetation, etc. are elements interlinked with the mountain landscape and the cultural heritage of the Cretan mountains.

Haystacks on the plateau of Omalos, Lefka Ori.

3.2 Activities inside the NATURA 2000 Network in Crete

The mountain regions have been in the past and still are part of the social and economic life of Crete. Most of the inland villages are built at the foothills of the mountains and the two main productive activities that take place there are traditional agriculture and stockbreeding. In addition, mountain areas contribute to the supply of water to the plains, climate regulation, and the supply of food, timber and herbs.

The majority of the mountain areas of Crete are included in the NATURA 2000 Network. Also, sparse vegetation (vegetation of shrubs and chasmophytes grown on limestone rocks), scrublands and forests, which are the typical ecosystems of the Cretan mountains, are largely included in the NATURA 2000 Network (Table 3). Their value lies in the fact that they host many endemic species and contribute to the cycle of water and soil in the island.

Twenty-five (25) of the 54 NATURA 2000 sites in Crete are located, partly or entirely, at altitudes above 700 meters. These areas are shown in Table 4 and Map 2.

Mountain village in Keramia, Chania, foothills of the Lefka Ori.

TABLE 3. Extent of the NATURA 2000 Network in Crete and types of ecosystems that characterize the mountain regions of Crete.

Local Communities with at least 1% of their area inside the NATURA 2000 Network	194 of 578
Mountain areas in Crete	21,6% of the total area of Crete
Percentage of mountain areas inside the NATURA 2000 Network in Crete	50.1% of the total area of the NATURA 2000 Network in Crete
Percentage of sparse vegetation inside the NATURA 2000 Network	78,4% of the total sparse vegetation of Crete
Percentage of scrublands inside the NATURA 2000 Network	40.1% of total scrublands of Crete
Percentage of forests inside the NATURA 2000 Network	20.6% of total forests of Crete

TABLE 4. NATURA 2000 Network areas per Regional Unit (RU) of Crete, including parts of mountain areas with altitudes above 700 meters (data: Ministry of Environment and Energy/MEEN).

Regional Unit (R.U.)	Area code	NATURA 2000 per R.U.	Site type
Heraklion	GR4310005	Asterousia (Kofinas)	SAC
	GR4310006	Dikti: Omalos Viannou (Symi - Omalos)	SAC
	GR4310009	Krousonas - Vromonero Idis	SPA
	GR4310010	Oros Giouchtas	SPA
	GR4310011	Koryfi Koupa (Dytiki Kriti)	SPA
	GR4310013	Asterousia Ori (Kofinas)	SPA
Lasithi	GR4320002	Dikti: Oropedio Lasithiou, Katharo, Selena, Krasi, Selakano, Chalasmeni Koryfi	SAC
	GR4320005	Oros Thryptis kai gyro periochi	SAC
	GR4320010	Lazaros Koryfi - Madara Dikti	SPA
	GR4320013	Farangi Selinari - Vrachasi	SPA
	GR4320014	Notiodytiki Thrypti (Koufoto)	SPA
	GR4320016	Ori Zakrou	SPA

Giouchtas Mountain, Regional Unit of Heraklion.

Lasithi Plateau, Regional Unit of Lasithi.

Regional Unit (R.U.)	Area code	NATURA 2000 per R.U.	Site type
Rethymnon	GR4330002	Oros Kedros	SAC
	GR4330003	Kourtaliotiko Farangi - Moni Preveli Evryteri periochi	SAC
	GR4330004	Prassano Farangi - Patsos - Sfakoryako Rema - Paralia Rethymnou kai ekvoli Geropotamou, Akrotiri Lianos Kavos - Perivolia	SAC
	GR4330005	Oros Idi (Vorizia, Geranoi, Kali Madara)	SAC
	GR4330006	Soros - Agkathi - Kedros	SPA
	GR4330007	Kourtaliotiko Farangi, Farangi Preveli	SPA
	GR4330009	Oros Psiloreitis (notiodytiko tmima)	SPA

The Petradolakia area of Psiloritis, Regional Unit of Rethymnon.

Regional Unit (R.U.)	Area code	NATURA 2000 per R.U.	Site type
Chania	GR4340004	Elos - Topolia - Sasalos - Agios Dikaios	SAC
	GR4340008	Lefka Ori kai paraktia zoni	SAC
	GR4340012	Asfendou - Kallikratis and kai paraktia zoni	SAC
	GR4340014	Ethnikos Drymos Samarias - Farangi Trypitis - Psilafi - Koustogerako	SPA
	GR4340016	Meterizia - Agios Dikaios - Tsounara - Vitsilia Lefkon Oreo	SPA
	GR4340019	Farangi Kallikratis - Argouliano Farangi - Oropedio Manika	SPA

Psari peak on Lefka Ori, regional Unit of Chania.

MAP 2. The NATURA 2000 Network areas in Crete: sites with a section located above 700 meters are hatched.

3.3 Mountain biodiversity

The long isolation of Crete from the mainland, its turbulent geological history, the steep and fragmented topography, the significant differences in the climate from the East to the West, from the North to the South and from the lowlands to the mountain regions, have created a complex mosaic of habitats, each of which is characterized by particular natural conditions (e.g. soil type) and microclimate. Also, the mountain areas of Crete are characterized by high biodiversity and a large number of endemic plants and animals, as well as significant populations of birds of prey.

Preservation of biodiversity is a very important service of the ecosystems, as its loss reduces the efficiency of biocenoses to assimilate the resources necessary for life, to maintain their primary productivity and to recycle essential nutrients.

In sum, the benefits of biodiversity in the mountain ecosystems of Crete are the following:

- Increase in primary productivity.
- Provision of a wider variety of products (food, raw materials, timber, firewood, herbs, pharmaceuticals).
- Recycling of nutrients.
- Pollination.
- Adjustment of the hydrological cycle and supply of water to the lowland areas.
- Water quality improvement.
- Protection against erosion, soil leaching, landslides, floods, e.g. through the retention of the soil by the roots of the plants.
- Climate regulation.

- Aesthetic value of the landscape.
- Spiritual tranquillity.
- Leisure and tourism.
- Educational value.
- Artistic inspiration, e.g. in painting.
- Many income opportunities for the inhabitants of the mountain regions (through activities such as agriculture, stockbreeding, alternative forms of tourism, etc.).
- Preservation of the health of soil and water (by controlling nitrogen levels and various pollutants, e.g. through their absorption by plants).
- Improvement of the quality of life (e.g. nutrition, raw materials for the fabrication and dyeing of clothes).
- Natural protection from crop pests and diseases and the reduction of the use of fertilizers and pesticides.
- Stability of mountain ecosystems.

Thyme, the king of the scrublands of the island.

The plant biodiversity of Crete is remarkable. It includes around 1,700 species, of which 9% are endemic, i.e. they are found only on the island and not elsewhere. The main types of vegetation in the mountain areas are mountain scrublands (grazing-resistant species), chasmophytes and forests. Mountains, as mentioned above, are refuges for the endemic flora, as a large proportion of Cretan endemic plants grow there. Especially the Lefka Ori Mountains seem to have the largest number of endemic plants from any other region of Crete.

Mountain areas are the habitat for many aromatic plants, the use of which as medicinal plants, herbs and food, dates back to antiquity. Some are also used in apiculture, for example thyme, and there are those that are cultivated nowadays, significantly contributing to the local economy.

Known aromatic plants are the sage, oregano, savory, etc., found in garrigue ecosystems. Some endemic aromatic plants grow on the slopes of limestone cliffs and canyons as chasmophytes. The best known in Crete is erontas or dittany (*Origanum dictamnus*), which is cultivated on a small scale in Crete. There have been numerous references since the antiquity for its medicinal properties. Theophrastus, the father of Botany, reports in his work "Stories Regarding Plants" in the 4th century BC: "*Dittany is a plant that grows only in Crete...*" and expresses the perception of the time that "*it is capable to eject the iron arrowheads from wounded bodies*". It is a protected species and is found in 12 of the 25 mountain areas of the NATURA 2000 Network in Crete.

The forests of the Cretan mountains are sparse and are not characterized by distinct zoning. They are not exploited productively, since they have very low timber stock, so

Illustration of wounded Cretan wildgoat eating dittany.

no timber is extracted commercially. Forest vegetation (trees and shrubs) that have been legally harvested, as well as products of pruning, cleaning etc. become available as firewood for private use after a relevant authorisation.

Other examples of forest services are the supply of edible herbs for human consumption and animal feed for livestock, the aesthetic and cultural value, honey production, protection from floods and erosion etc.

The most important trees we find in the forests of Crete are the following:

- Kermes oak (*Quercus coccifera*), with the largest forest located north of Rouvas in the mountain area of Psiloritis.
- Mediterranean cypress (*Cupressus sempervirens*), found mainly in Lefka Ori. In the Fre - Tzitzife area, at the foothills of Lefka Ori, cypress form a mixed forest with laurel trees. It has been known since antiquity, as some of them are over 2,000 years old.
- Cretan maple (*Acer sempervirens*), which form shrubs and rarely occur as trees.
- Calabrian pine (*Pinus brutia*), which forms pine forests in the southern Lefka Ori, in the south of Asterousia, in southern Dikti, in Thrypti etc.

The fauna of the mountain areas includes species that have adapted to the extreme conditions that characterize them, many of which are protected by national and international conventions.

Several groups of invertebrates live in the mountains of Crete, e.g. snails, insects, spiders, scorpions, etc. Frogs, lizards, snakes, birds and mammals are also an integral part of mountain biodiversity.

Cypress forest in Lefka Ori.

The most emblematic species of the mountain avifauna of Crete are the birds of prey. They are nesting on the vertical limestone rocks and in the gorges that run through the island. Griffon vultures (*Gyps fulvus*) are found in almost every part of Crete. They feed on dead livestock (mainly goats and sheep) and act as "cleaners" of the ecosystem. Griffon vulture is a protected species and is found in 18 of the 25 mountain areas of the NATURA 2000 Network in Crete.

Another scavenging bird of prey is the bearded vulture or kokalas (*Gypaetus barbatus*), a very rare species that spreads in the mountain areas of Crete (at an altitude of at least 600 meters and up to the mountain peaks). Crete is the last sanctuary of the bearded vulture in Greece. It feeds mainly on bones of livestock animals (mainly sheep and goats). It is a priority species and is found in 17 of the 25 mountain areas of the NATURA 2000 Network in Crete.

Mammals that can be found in the mountain areas of the island are the hedgehog, the hare, the ferret, the badger, as well as the weasel.

Agrimi (Cretan goat or wildgoat, *Capra aegagrus cretica*).

A special animal of the high mountains, resistant to the harsh climatic conditions, is the Cretan wildcat (*Felis silvestris cretensis*). One individual had been trapped in the past in Psiloritis, and so far there have been many reports from locals but few verified records of the species, in Lefka Ori, Dikti and southern Psiloritis.

The Cretan wild goat (*Capra aegagrus cretica*) is the best known animal of Crete. It is a symbol of the wild mountains of the island because of its impressive ability to move on vertical cliffs. It lives in Samaria and the neighbouring gorges. It is an endemic and

Gypaetos or kokalas (Bearded vulture, *Gypaetus barbatus*).

protected subspecies and is found in 2 of the 25 mountain areas of the NATURA 2000 Network in Crete.

Cretan wildcat.

In addition, the wild goat has been an inexhaustible source of artistic inspiration, for rizitika songs and mantinades the rhyming couplets of Crete. A characteristic rizitiko song from the highlands of Lefka Ori is the following:

My wild goats, my little wild goats,
my tame deers,
tell me, where are your lands,
where are your winter dwellings,

The cliffs are our lands,
the mountain balconies are our winter dwellings,
the small mountain caves, are our parent homes.

3.4 Principal human activities

The interaction of human communities with nature has led to the development of knowledge and practices that constitute the cultural heritage and contributed in shaping the landscape of the Cretan Mountains. Centuries old traditions and activities such as stockbreeding, agriculture, construction of buildings (e.g. archaeological sites, monuments, etc.) have contributed to the shape of the island's current landscape. Overgrazing and the traditional use of fire to clean pasturelands has greatly influenced the vegetation of mountain ecosystems. A characteristic feature of the landscape are the plateaus, where small and medium-scale cultivations can be found. The Cretan landscape seems to change over time, as well as with altitude changes.

Annual crops have been limited mainly to the medium altitude areas of the island, while in recent years there has been a shift towards traditional crops. In exceptional cases, olive groves can be found at altitudes of up to 900 meters. In addition, farmers invest in viticulture for the production of wine and raki spirit as well as in the cultivation of fruit trees. Due to the abundance of wild herbs, edible herb collection and apiculture are quite widespread. The Lasithi Plateau supplies the whole island, mainly with potatoes and vegetables.

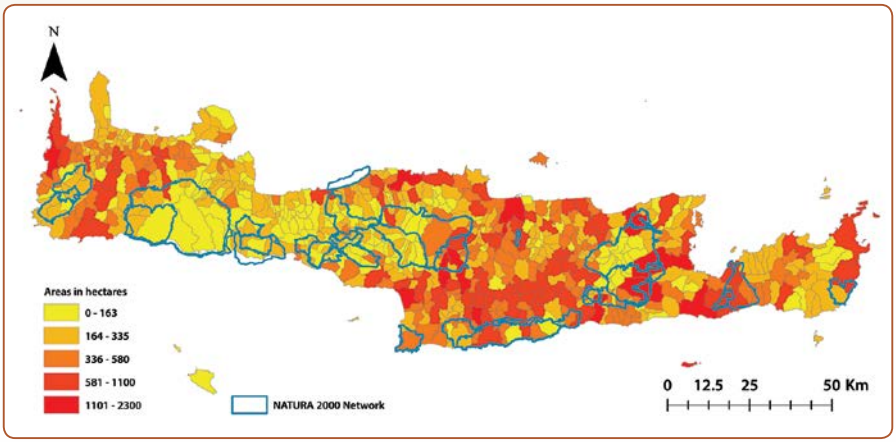
In Crete, stockbreeding still is one of the traditional occupations. During winter it is not rare to migrate flocks from the mountains to the lowland/coastal areas and keep them sheltered with supplementary food. During spring, the flocks return to the mountain pasturelands.

The production of dairy products in Crete, which amounts to 25% of the national production, and their packaging is now done in modern and properly equipped craft units, mainly in the areas of Lefka Ori, Psiloritis and Dikti.

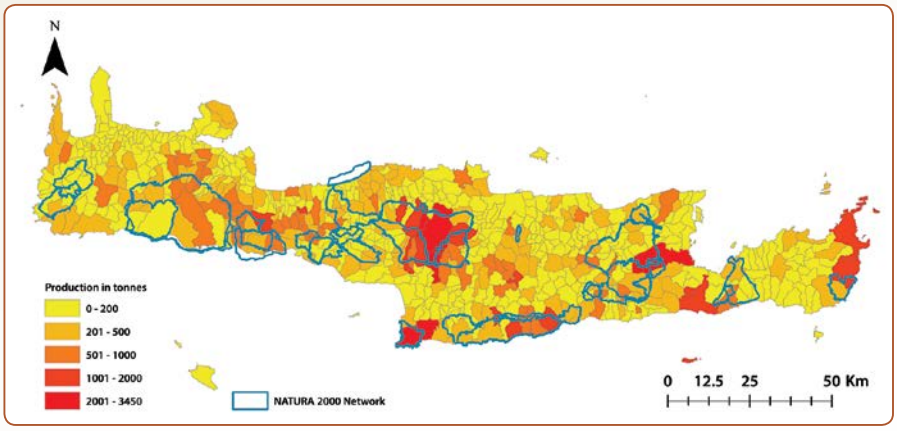
Below are presented maps regarding the main goods produced in the mountain ecosystems of the NATURA 2000 Network. These values have been calculated at the Local Communities (L.C.) level.

Grazing at the Omalos plateau in Chania.

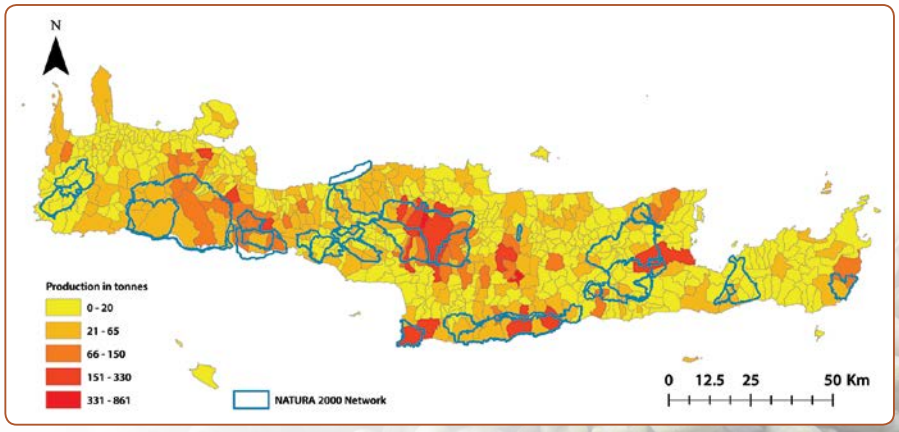
MAP 3. Areas of tree crops in Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2010).



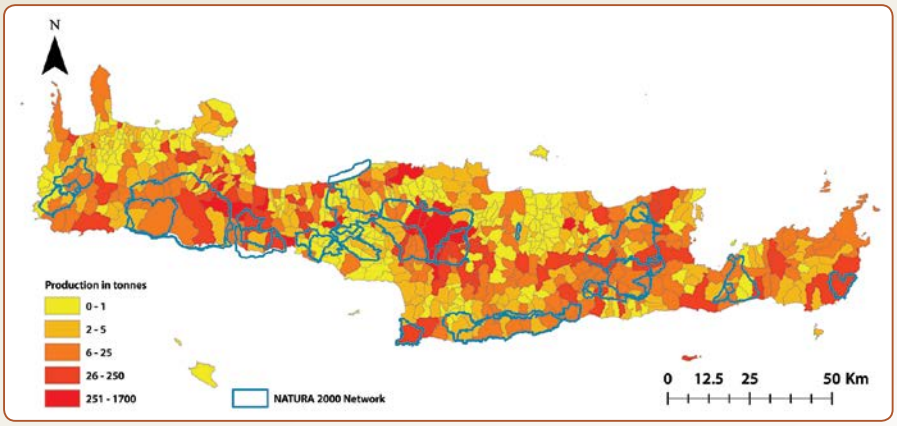
MAP 4. Production of sheep and goat milk in Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2010).



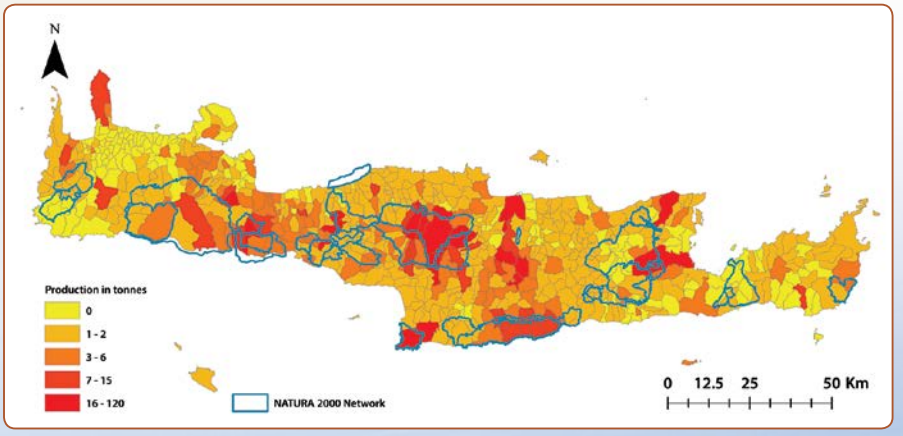
MAP 5. Production of lamb and sheep meat in Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2010).



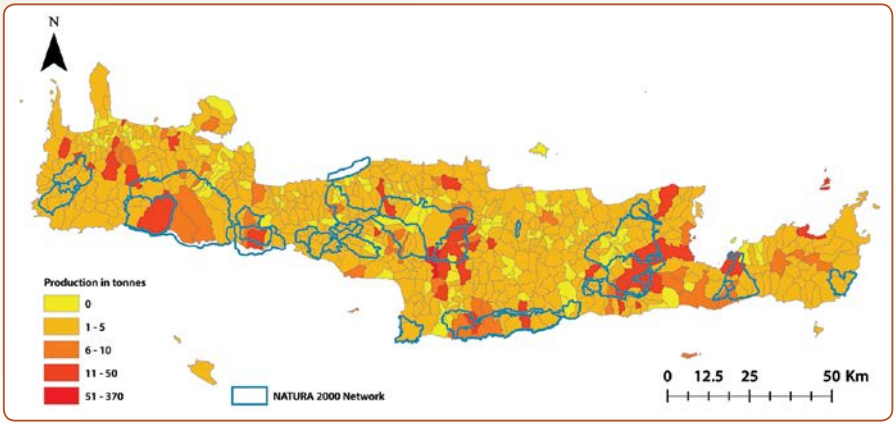
MAP 6. Production of dairy products in Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2010).



MAP 7. Production of sheep wool in Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2010).



MAP 8. Production of honey in Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2010).



Sheep shearing.

Beehives in Selakano, Lasithi.

Nida plateau, Psiloritis.

4 WORKING POSITIONS AND EMPLOYMENT OPPORTUNITIES

Rural areas in the mountains of Crete suffer from population decline and income reduction in the agricultural and livestock sectors. In addition, agricultural properties and irrigated plots are small and scattered, resulting in poor infrastructures. However, the primary sector is the basis of the Cretan economy and also part of the island's identity. It is the growth lever for many sectors that are based on the economy, cultural heritage and biodiversity.

The employment possibilities of mountain residents are many and are mainly oriented by the traditional practices which have retained many elements of the past. In addition, the primary sector and alternative forms of tourism (tertiary sector) are the pillars that can redefine the economy and the development of the country.

In order to achieve these goals, the following conditions must be met: (a) the conditional exercise of activities under the existing legislation on NATURA 2000 protected areas, (b) the effective conservation of biodiversity (high endemism in mountain areas) as an irreplaceable and valuable asset; (c) the promotion of the rich cultural heritage, folkloric art, traditional food and wine, through the establishment of related exhibitions, museums, festivals, mountain activities, paths and trails, and (d) the use of NATURA 2000 areas for the production and supply of quality products with comprehensive environmental protection.

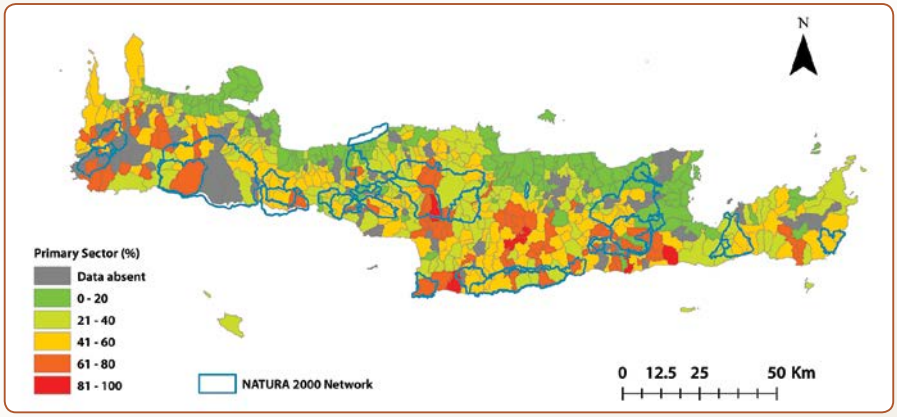
Below, follow three maps related to the percentage of employees in the Local Communities of Cretan mountains (at altitudes over 700 m) in the three production sectors, i.e. the primary, secondary and tertiary.

The primary sector includes the harvesting of goods directly from nature, in the form they exist in it (raw materials), for direct or indirect consumption. This includes agriculture, stockbreeding, minerals extraction, etc.

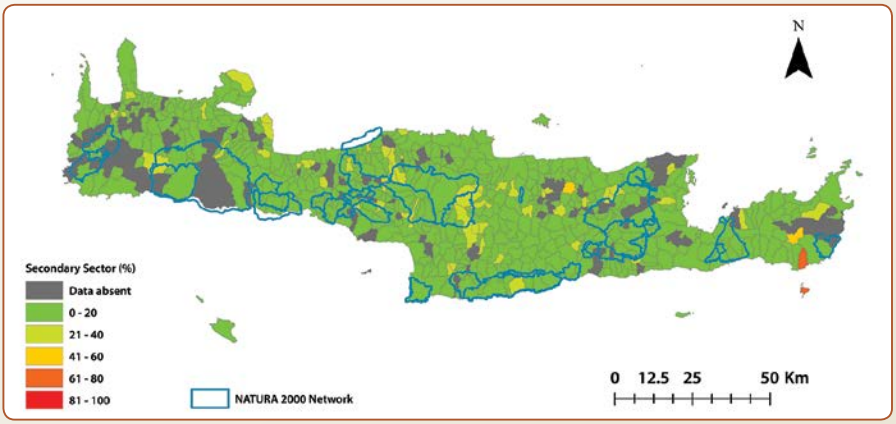
The secondary sector is about human activities that modify the primary products in an artificial way. This includes the processing of goods (e.g. fruit and nuts for the production of sweets, milk, timber, leather), the production of electricity, water, etc.

The tertiary sector involves the provision of services to people, i.e. education, health, tourism, banking services, communication, etc.

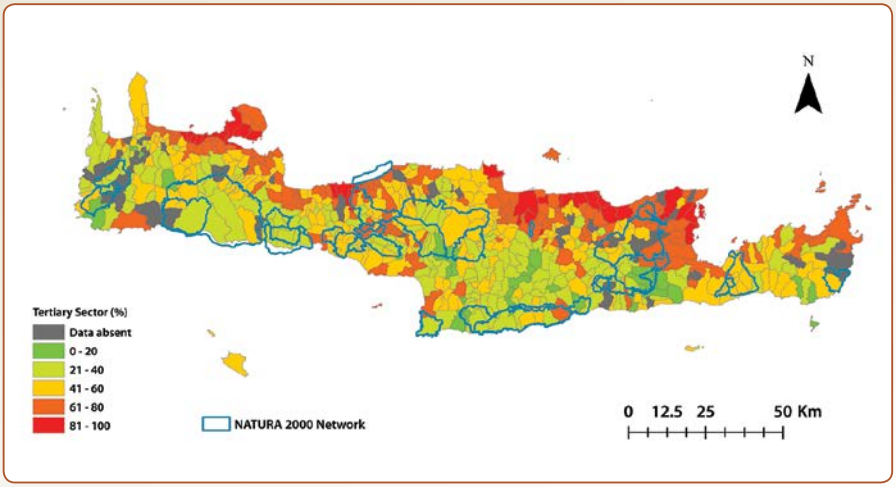
MAP 9. Percentage of employees in the primary sector in the Local Communities of Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2011).



MAP 10. Percentage of employees in the secondary sector in the Local Communities of Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2011).



MAP 11. Percentage of employees in the tertiary sector in the Local Communities of Crete: the areas of the NATURA 2000 Network with a section located above 700 meters are outlined (ELSTAT data, 2011).



4.1 Employment opportunities in the mountain areas of the NATURA 2000 Network in Crete

Some of the employment opportunities are summarized below:

- Establishment of tour agencies for the organization and promotion of alternative forms of tourism.
- Establishment of information centres for tourists and visitors.
- Organization of environmental awareness actions.
- Establishment of small restaurants and leisure companies such as agrotourism units, traditional guesthouses, cafes, taverns, etc.
- Establishment of mountain parks where environmental education and activities such as mountaineering, horse riding, wildlife observation, research, visitors accommodation, etc., will take place. This will create conditions for the development of local populations and the integration of tourism activities in the communities daily life with respect to the environment.
- Organization of excursions in traditional agriculture and stockbreeding sites, e.g. fruit farms, educational farms, apiculture sites, etc., as well as other activities such as the collection of herbs, etc.
- Organization of seminars in traditional workshops such as the production of dairy products in shepherds' huts, wine in wineries, etc., as well as tasting sessions of the related products.

- Creation of cultural (e.g. food tasting) and educational spaces (e.g. libraries, folklore, historical and natural history museums, exhibitions) as well as the organization of environmental activities related to the folkloric and local mountain heritage.
- Organization of local events (festivals and traditional fests) for the promotion of local products, agricultural production and the cultural heritage of each area, and also in order to become familiar with the Cretan cuisine.
- Marking of local attractions and monuments, such as the ruins of ancient cities, Minoan palaces and other monuments of great archaeological importance, Venetian fortresses, castles and Byzantine temples, monasteries and hermitages, monuments of folk architecture and other important buildings and sites that mark the history of Crete and the influence of its conquerors.
- Improvement and restoration of communal areas for the promotion of mountain traditional settlements (e.g. paving, restoration of parks and squares, pedestrianisation, improvement of mountain roads).
- Restoration, upgrading and preservation of the cultural character of mountain ecosystems (e.g. fountains, springs, bridge restoration, restoration of old watermills and windmills, olive mills, winepresses and shepherds' huts).
- Creation of handicraft workshops, e.g. textiles, Cretan ceramics, woodcarving, traditional instrument making, wickerwork, use of plant dyes, etc.
- Establishment of cottage workshops and food production with quality ingredients from the NATURA 2000 mountain areas, e.g., spoon sweets, jams, production and packaging of beverages and cosmetics made with local plants and herbs of the Cretan mountains, salt or vinegar preserved products, honey products and dried fruits.
- Establishment of women's cooperatives in the mountain areas of the NATURA 2000 Network.
- Infrastructure improvement of existing businesses using renewable energy sources for their energy needs.
- Restoration, improvement and conservation of the mountain landscape, e.g. by the improvement or construction of footpaths in order to create cycling, trekking and hiking routes (such as the European path E4) through landscapes of exceptional natural beauty - rough mountain peaks - impressive flora and fauna, and also interventions to protect the soil from erosion, creation of sightseeing spots, or bird watching spots especially for birds of prey.
- Establishment and operation of suitable infrastructure (paths, mountain shelters) for winter activities on the snowy Cretan mountains, such as ski mountaineering, snowboard and snowkiting.
- Establishment and operation of suitable infrastructure for alternative activities, such as technical canyoning, climbing, paragliding and bungee jumping.

5 MAIN FORMS OF ALTERNATIVE TOURISM

The various forms of alternative tourism are usually small scale and a sort of traveling which is friendly for the environment and the visitor, allowing positive social interactions and shared experiences among members of different societies. Considering the above, Cretan mountains can undoubtedly benefit from alternative tourism activities.

The most important forms of alternative tourism in the mountain regions are ecotourism, agrotourism, mountaineering tourism, winter tourism, nature tourism, walking tourism, cultural tourism and religious tourism.

Rouvas forest.

Applying the windmill cloths at the Lasithi Plateau.

Some of the benefits of alternative tourism for the local community are the following:

- Tourism model of reduced negative impact on the society, culture and environment of the area.
- Protection of the environment.
- Sustainability and longevity of existing natural resources.
- Promotion of local products.
- Interconnection of tourism with other sectors of the local economy, e.g. agriculture, stockbreeding, handicraft.
- Preservation and promotion of the cultural heritage of the area.
- New jobs for the locals of mountain areas and reduction of their migration to urban centres.

Canyoning at the Abas Gorge, Asterousia Mountains.

Natural History Museum of Ano Zakros.

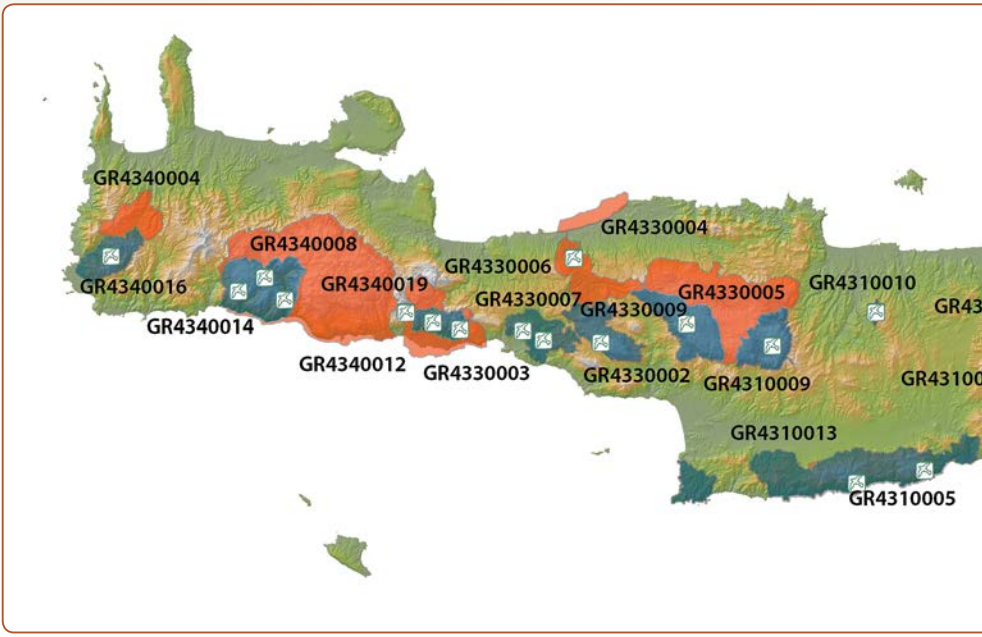
Paragliding in Dikti.

5.1 Bird watching

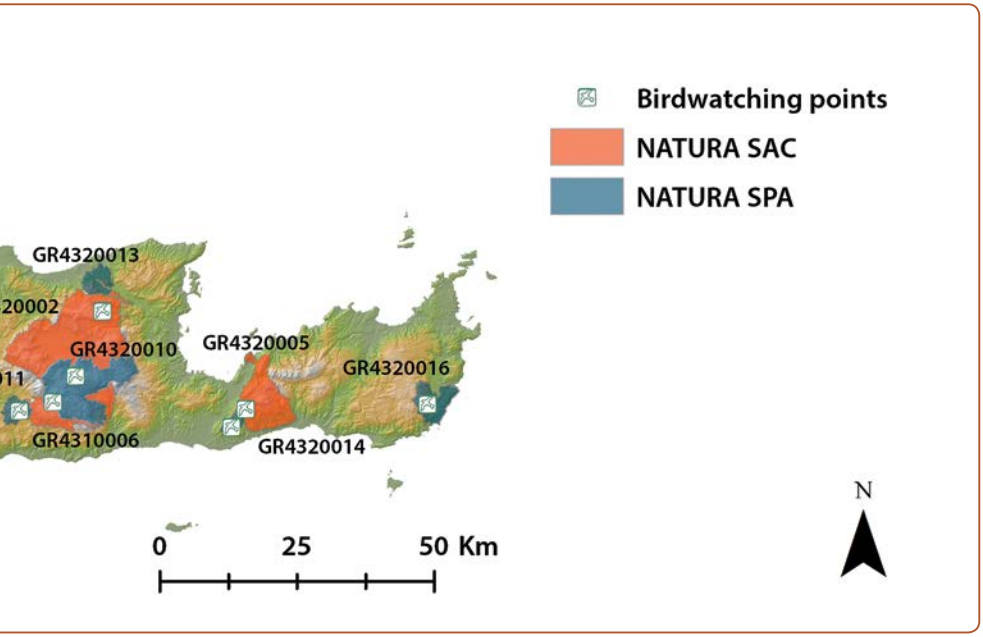
The avifauna of Crete is particularly important and includes many migratory species, but also species that live permanently and reproduce on the island. Dominating among these are the large birds of prey in the mountain ecosystems of Crete (eagles, vultures, etc.), which maintain important and healthy populations. Additionally, 26 of the 54 NATURA 2000 areas of Crete have been designated as Special Protection Areas for Birds (SPAs) and 14 of them are on the mountains, at altitudes above 700 meters (Table 4), highlighting the importance of the mountains for the conservation of rare bird species.

Bird watching at the Asterousia Mountains.

MAP 12. Proposed bird watching locations in the mountainous NATURA 2000 sites of Crete.



Bird watching location in the mountains of Gergeri.



5.2 Other forms of alternative tourism

Overall in Crete, there are many registered places of cultural and historical significance, inside and outside the NATURA 2000 Network areas, which are related to mountain ecosystems. Additionally, any places not inside the NATURA 2000 Network areas are located less than 10 km away from any of them. These places are related to archaeological sites, residences of historical figures, watermills, bridges, monumental trees, etc. Tourism in mountain ecosystems can be combined with a visit to these sites during walking tours.

Also, the island has mountain shelters on all its large mountains, which are managed by the Mountaineering Associations of the island. Visitors can stay in the shelters after arrangement with the associations. Indicatively, some shelters are the following:

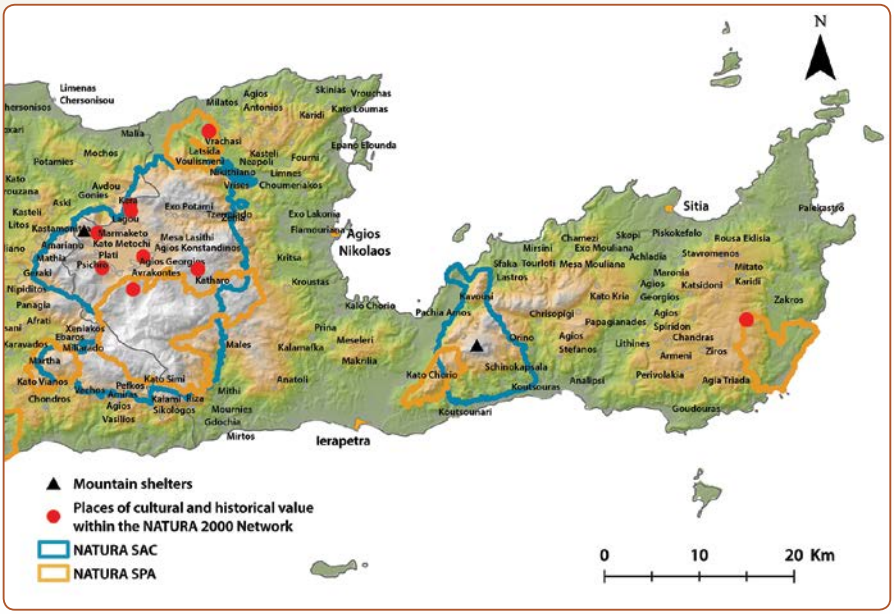
LASITHI
- ▲ Limnakaro shelter

HERAKLION
- ▲ Prinos shelter
- ▲ Samari shelter

RETHYMNON
- ▲ Lakkos Migierou shelter
- ▲ Toubotos Prinos shelter

CHANIA
- ▲ Kallergi shelter
- ▲ Tauris shelter
- ▲ Houliopoulos shelter
- ▲ Volikas shelter
- ▲ Observatory of the Cretan Wild goat in Greleska

MAP 13. Indicative sites of cultural and historical value and mountain shelters in the mountain areas of the NATURA 2000 Network in the Regional Unit of Lasithi.



Indicative sites in the Regional Unit of Lasithi are the following: the Dikteon Cave, the Cave of Trapeza (or Kronio), the Holy Monastery of Vidiani and the Windmills (near the village of Pinakiano) in the Lasithi Plateau, the ancient ruins in Kefala, the Minoan settlement and the cemetery at Mount Karfi, the fortifications and the domed tombs at Anavlochos, dating back to the "Dark Ages", the historic village of Skalia in Sitia.

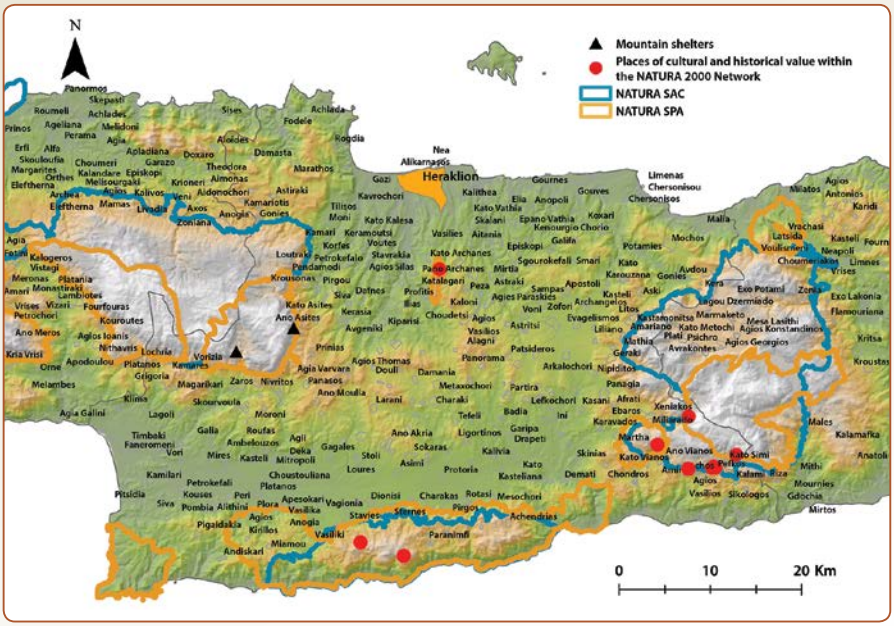
Skalia, Zakros Mountains.

Lasithi plateau.

Mount Dikti, Katharon plateau.

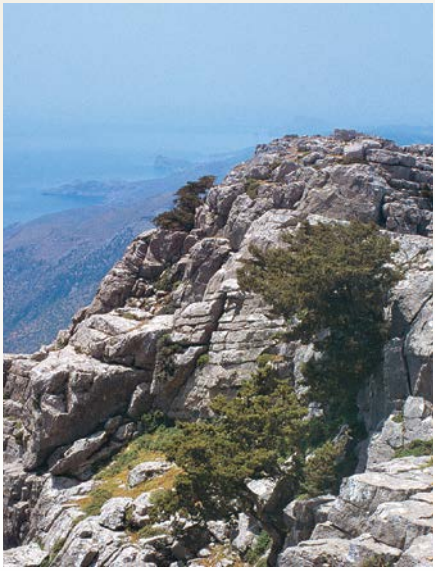
Mount Dikti: View from the Afentis top towards the north.

MAP 14. Indicative sites of cultural and historical value and mountain shelters in the mountain areas of the NATURA 2000 Network in the Regional Unit of Heraklion.



Indicative sites in the Regional Unit of Heraklion are the following: the Hermes and Venus Sanctuary in Kato Symi of Viannos, the Towers of Viannos, the Historical and Folklore Museum of Ano Viannos, the Fountain in the settlement of Amiras in Viannos, the Fountains "Pitropou", "Hani" and "Miliarades" in the settlement of Pefkos of Viannos, the Peak Sanctuary of Giouchtas, the Peak Sanctuary of Kofinas in Asterousia and the Minoan fortress in the settlement of Kapetaniana.

View of the peak of Giouchtas from the south to the north.

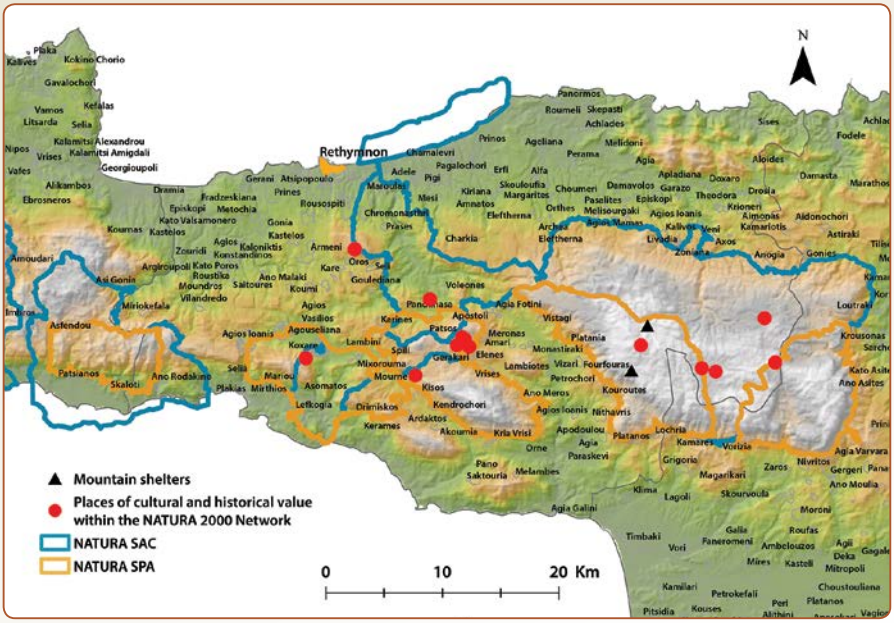


View to the southwest from the top of Kofinas.

Omalos Plateau, Viannos.

View from the shelter "Prinos" (Ano Asites) to the east. In the background, the Giouchtas and Lasithi mountains covered with snow.

MAP 15. Indicative sites of cultural and historical value and mountain shelters in the mountain areas of the NATURA 2000 Network in the Regional Unit of Rethymnon.



Indicative sites in the Regional Unit of Rethymnon are the following: the ancient town of Syvritos, the archaeological site and Krategos (monumental tree) in Zominthos, the shepherd's huts of Nida, the Ideon Cave, the Minoan settlement of Elenes, the cave "hole of Margele" close to the village of Elenes, the prehistoric settlement at Agios Onoufrios and the cave Kalogerospilios in the village of Mesonisia, the Peak Sanctuary of Vrysina, the Peak Sanctuary of Korakia in the Kouroupa Mountain range and the Monastery of Agio Pnevma of Kissos.

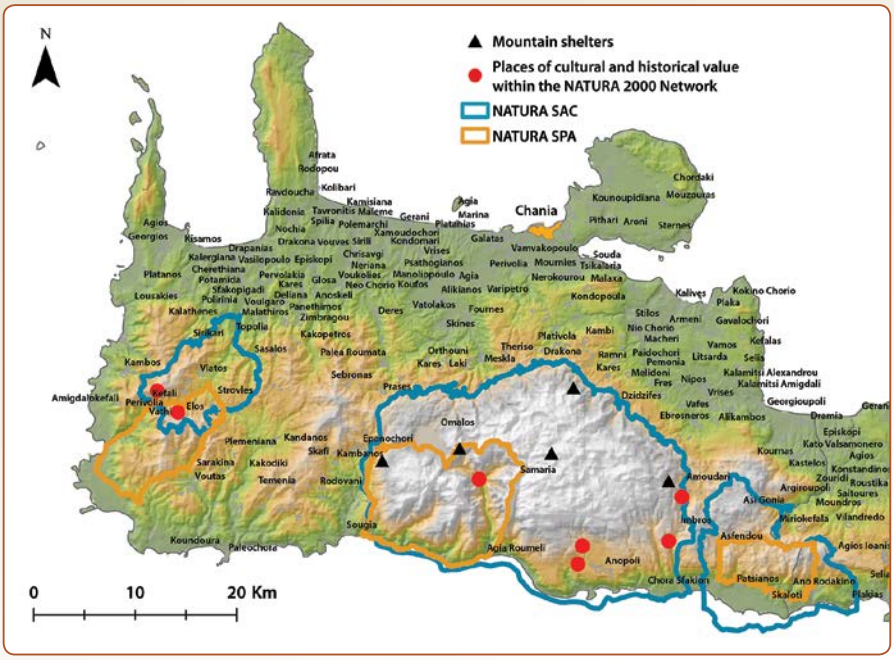
Shepherd's hut in Nida, Psiloritis.

Psiloritis: descending from the shelter of Toubotos Prinos towards Kouroutes.

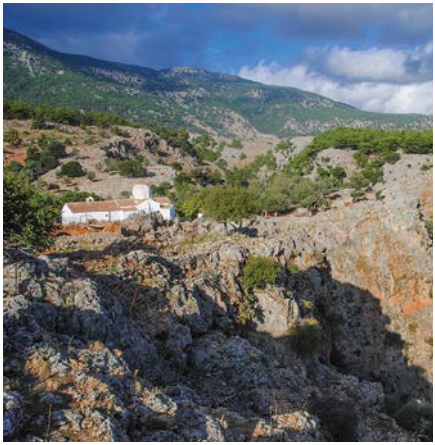
Kissos gorge.

Zominthos area, monumental common hawthorn (*Crataegus monogyna*).

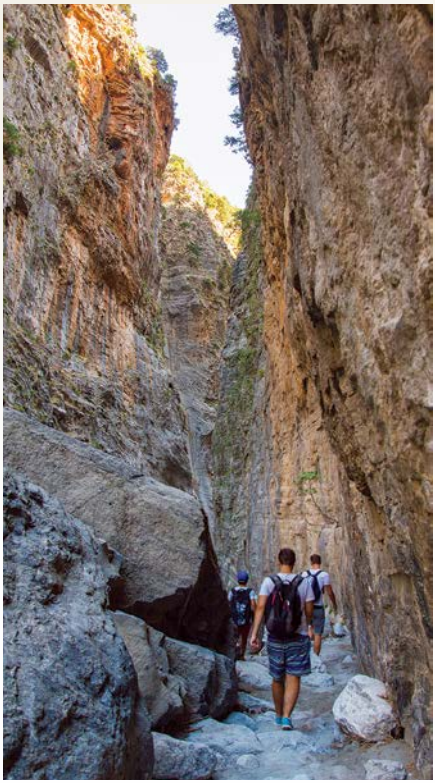
MAP 16. Indicative sites of cultural and historical value and mountain shelters in the mountain areas of the NATURA 2000 Network in the Regional Unit of Chania.



Indicative sites in the Regional Unit of Chania are the following: the church of Agios Ioannis in Elos, the Great Olive Tree of Aerinos near the settlement Felesiana, the kouledes (small fortresses) in the Askyfou plateau (on the limits of the NATURA 2000 Network), the Manousakis house in Imbros, the ancient Anopolis, the Byzantine church of Michael Archangel in Aradena of Sfakia and the old village of Samaria in the gorge of the same name.



The Byzantine church of Michael Archangel in Aradena.



Samaria Gorge.

National Park of Samaria.

Sassalos area, Agios Dikaios.

Pachnes, looking south. Mountaineering in the Madares of Lefka Ori.

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The Koudouni peak and the mountain of Psiloritis as seen from the Gyristi peak.

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.

Ecotopes: Land areas or wetlands distinguished by their biological and non-biological geographical characteristics, which are entirely natural or semi-natural.

Endemism: The situation in which a species or other taxonomic group is restricted to a particular geographical area, as a result of some factors, e.g. isolation or reaction to climatic or terrestrial conditions. Such a species (plant or animal) is called an endemic species of this area.

Habitat: Position with a suitable environment (e.g., appropriate vegetation or food sufficiency) for an organism.

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.

Natural resources or natural goods: All natural substances available on earth and used by humans for their survival and development. They can be non-renewable (e.g. minerals, plant/animal species) or renewable (e.g. sun, air).

Precipitations: The measurable quantities of water that reach the surface of the earth as a consequence of the liquefaction of atmospheric water vapour. The following forms of precipitation occur in Greece: rain, snow, hail and sleet.

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Engraving page 29a: DAPPER, Olfert. Naukeurige Beschryving der Eilanden in Archipel der Middelantsche Zee, en ontrent deelve, gelegen: Waer onder de voornaemste Cyprus, Rhodes, Kandien, Samos, Scio, Negroponte, Lemnos, Paros, Delos, Patmos, en andere, in groten getale ..., Amsterdam, Wolfgangh, Waesbergen, Boom, Someren, Goethals, 1688.

p. 4: Ascend to the peak Spathi of Lefka Ori.

p. 6: Shepherd hut in the area of Rouvas.

p. 54-55: The northeast side of the Lefka Ori Mts. as seen from Apokoronas.

p. 56: The Gious Kambos plateau in Kedros.

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Natura 2000 Peaks' assets

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