

## **Annex: Stakeholder analysis and sustainability goals in Crete**

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## **Stakeholder analysis and sustainability goals for Crete study site**

### **1. Introduction**

In the coming years the formulation of agro-environmental tools to support sustainable development of rural areas and to support our society's demands for protection of the environment becomes increasingly important. The European Union Program of policy and action in relation to the environment clearly identifies the need for applying such land management practices that support the sustainable use of natural resources. The sustainable use of natural resources requires an adequate management of the key activities associated to them with a great interest and measures adapted for soil and water conservation.

Sustainable farming is defined as an agricultural system evolving towards greater human utility, increased efficiency of resource use, minimum depletion of non-renewable resources, and environmental interaction favourable to humans and to most other species. Sustainable farming is associated with measures applied in agriculture in order to confront, overcome, and prevent land degradation and desertification. The main threats to agricultural and natural ecosystems are related to the following processes: soil erosion, soil salinization and alkalization, loss of organic matter, chemical contamination of soils and waters, loss in biodiversity, soil compaction and sealing. All these processes are associated with land desertification. Soil erosion and particularly accelerated erosion which is caused by anthropogenic activity leads to deterioration or loss of one or more soil functions and vegetation performance. Factors which usually lead to accelerated erosion are stripping of natural vegetation especially clearance of forests, change in cultivation techniques, over-grazing, wildfires, land leveling, cultivation of steep slopes. The soil organic matter content reflects a dynamic equilibrium between inputs from vegetation and the decomposition of organic matter by soil biota. Decline in organic matter content is an important component of land degradation greatly affecting soil erosion and CO<sub>2</sub> emission to the atmosphere. Intensification of agriculture and wildfires leads to drastically decline of organic matter content. Soil salinization is a process that leads to excessive amounts of water soluble salts in the soil resulting from upward movement of ground water to the soil surface due to evapotranspiration and from irrigation with poor quality of water. Soil contamination and water pollution may occur over wide areas introduced by diffusion from the atmosphere, or more locally by industrial activity or by the application of fertilizers and pesticides. Soil biodiversity is exceptionally diverse and it is closely related to soil

functionality and climatic conditions. Soil compaction is related to reduction of air-filled porosity causing a deterioration or loss of one of soil functions. It is caused by external forces arising from surface loading exerted by agricultural machineries or from the grazing animals. Soil sealing is related to urban expansion and connecting infrastructures that leads to complete or partial sealing of soil surface, resulting in loss of any agricultural function by eliminating water infiltration and gaseous exchanges with the atmosphere. The above mentioned threats are motivated by various drivers and pressures resulting in degradation of the various agricultural ecosystems. Sustainability has the main objective to alleviate the above processes and ensure minimum depletion of natural resources. The various agricultural ecosystems are subjected to various degradation risks depending on the type and the intensity of the threat. The objective of this topic was to identify sustainability goals and objectives for protection and restoration of natural resources in Crete study site through facilitated discussion and multi-criteria evaluation in focus groups including local stakeholders.

## **2. Methodological approach**

The analysis of the sustainability goals for protecting natural resources from land degradation and desertification was conducted following two main approaches: (a) farm survey, and (b) stakeholder workshop. The purpose of the farm survey was to collect data on indicators (WB2) and to discuss with individual farmers possible sustainability goals for environmental protection. The farm survey included informal discussions with the farmers related to: (a) the physical condition of the farm and the problems faced in crop production and loss in land productivity, (b) the impacts of land degradation and desertification on the physical environment and on the social and economical characteristics of the area, and (c) the possible actions and goals for protection and restoration of natural resources. The farm survey was conducted in two dominant land use types: (a) agricultural crops (olives and vines) and (b) and pastures. Forests are also important land uses in the island but these areas are strictly controlled by public agencies.

The stakeholder workshop 1 was conducted in the municipality of Agia Barbara included farmers, land managers and policy makers drawn from the local community, including public organizations such as the Forestry and Natural Environment Department of Heraklion, the Agricultural Department of Heraklion and NGOs. The various speakers analyzed the causes and impacts of land degradation and desertification using the results of research projects conducted in the area. Each presentation was followed by a discussion of 30-50 minutes. At the end, the participants were asked to provide their opinion and stance with respect the major forces and processes of land degradation and possible actions for sustainable use of natural resources. After the discussion, people were asked to vote on which of the options they consider as the most important assigning different scores. The various identified sustainability goals were categorized according to their importance based on multi-criteria evaluation taking into consideration the most importance processes of desertification, the social and economic characteristics of the area, and the existing trends in the island on sustainable use of natural resources.

### **3. Identified sustainability goals**

The analysis of the information obtained from the farm survey and the stakeholder workshop showed that farmers have realized that the existing land management practices applied has in many cases created problems on plant production, farmer's income and on the environment. Also stakeholders have pointed out that restoration of degraded hilly areas used as pastures or for agricultural crops are costly and impossible under the existing social and economic conditions, but farmers promptly accept to change land management practices for preventing further degradation and protection of the environment. Of course some of the changes on land management practices can be achieved under the existing policies or after providing financial support by the local government or European Commission. Some of the most important sustainability goals pointed out by the local stakeholders can be summarized as following:

- Policy enforcement of existing regulations on protection of natural resources
- Reduction of grazing animal density
- Technology transfer to farmers
- Preservation of olive plantations
- Water conservation and increasing water availability
- Afforestation of degraded agricultural or grazing land
- Control of illegal expansion of agricultural land on natural areas
- Measures for protection of forest fires
- Promotion of organic farming
- Delineation and protection of productive agricultural land
- Reduction of soil and water pollution

Based on the above identified goals of sustainability for the study site of Crete and considering the most important processes of degradation and existing actions or trends for sustainable use of natural resources more widely accepted by the local society, the following sustainable goals for land protection from desertification have been identified and proposed:

- Policy enforcement of existing regulations on protection of natural resources
- Awareness and technology dissemination
- Sustainable management of grazing land
- Preservation of olive plantations
- Water conservation and increasing water availability
- Promotion of organic farming
- Delineation and protection of productive agricultural soils

#### **Policy enforcement of existing regulations on protection of natural resources**

Policy enforcement refers to the implementation of existing regulations on environmental protection. For example the Greek regulation 1032/1979 defines policies for the protection of forested areas and considers measures for the improvement and development of these areas. Farmers have realized that there many regulations for protection of the environment but they are not implemented. EU policies have affected considerably the formulation of policies in the study area of Crete and in the whole country. For example the Water Resources policy aims the sustainable planning and management of water resources to ensure their adequate protection while meeting present and future

development needs. However, the water resources policy faces implementation problems. It has no dedicated financial instruments. Many and competing decision makers and water users from various spatial levels are involved in water resources complicating sustainable actions.

The Biodiversity policy (Habitat Directive and NATURA 2000 network) refers to the protection of biodiversity and sensitive ecosystems including decertified areas. However, their implementation is fraught with problems. Violations are frequent as most users of land pursue other than environmental goals. Policy makers and implementers are reluctant to enforce the directive, which, in addition, is not tied to any financial instrument.

The Forest policies have the potential to protect forest resources as well as to restore degraded lands by controlling forest fires, deforestation, etc. However, they are frequently violated as they conflict with the economic goals of the users of land.

The spatial planning policies and systems are of instrumental importance at national and regional level. Theoretically, they aim at guiding the optimal spatial distribution of economic activities and uses of land towards sustainable management of resources. Development control (e.g., zoning, green belts, etc.) coupled with economic instruments may help protect resources from present and future degradation by moderating population pressures. However, these policies are often either absent or inadequate; their formulation is influenced by vested interests, and bureaucratic problems, administrative compartmentalization.

The Greek National Action Plan for combating desertification includes guidelines for proper land management in the sensitive and affected areas. Its implementation is hampering by the absence of strong spatial policies and the involvement of many and conflicting interests in the land development process.

### **Awareness and technology dissemination**

It has become obvious that desertification is a serious local regional and international environmental problem, with severe global consequences that requires consistent combating strategies. The success of such strategies depends on how well our society is informed about the multiple consequences in our life. People of Crete have pointed out the importance of warning the society on this major global environmental problem and disseminating existing knowledge on combating desertification. In this aspect there is an urgent need for national and local administrations and citizens to take knowledge-supported decisions and action concerning the causes and consequences of desertification, and to implement effective mitigation solutions for combating desertification. This means that local farmers should be accordingly informed about the negative impacts of desertification and educated in appropriate land management practices for alleviating the desertification impacts.

The growing use of information and communication technologies (ICT) has opened an enormous window of opportunities for the transfer and exchange of knowledge. The internet has become a privileged instrument of information transmission; of ideas and concepts, sharing results, with the advantage of being interactive and allowing work in real time. A new reality is being faced, one that makes possible effective spreading of the practical and applied components of science, which is essential for the progress of human society as a whole. Furthermore, the existing organized information on easily used tools can help scientists to disseminating knowledge to the farmers.

### **Sustainable management of grazing land**

Crete has a long history of overgrazing but in some areas of the island such as Asterousia and Psiloritis mountains overgrazing resulted in land desertification. Since 1980, sheep and goats have increased by about 3 times, mainly due to European subsidies. Overgrazing resulted in a land with sparse shrubs, which is the last degradation stage of the mountain these sparse shrubs have increased by 85% between 1961 and 1989 at the expense of denser scrublands and forests (Papanastasis, 2004). Overgrazing removes the vegetative cover and expose the soil to erosion. If overgrazing occurs for a long period under semi-arid climatic conditions such as those prevailing in Crete, then land desertification is expected.

Farmers in Crete have realized that land is overgrazed with adverse consequences on the environment. Reduction of grazing intensity or application of alternative land management scenarios are welcome by the local people under the condition that their income will not decrease. Successful mitigation of desertification in grazing lands and landscapes can be achieved if integrated grazing management is applied. Such a management involves the use of alternative grazing lands feed resources, existing or developed for this particular purpose, so that the high grazing pressure on grazing land is alleviated. Some other social-political measures for protection grazing land are: (a) enhancement the use of local breeds by providing financial support through subsidies or better prices of products, (b) promotion of the production of quality animal products so that to encourage farmers to reduce the high number of animals and concentrate fewer but more productive ones, (c) allocating the present subsidies under the condition that the number of animals will be reduced to a sustainable number, (d) diversifying farmer income by promoting other activities such as honey production, collection of aromatic plants and developing agro-tourism.

### **Preservation of olive plantations**

Olive's plantations are supremely adapted to Mediterranean climatic conditions. They can tolerate low temperatures down to -15°C in midwinter. Foliage is damaged by frost only during active growth. Olive plantations can be considered as a natural forest. Biodiversity under certain land management practices and in particular traditional and marginal ones provide dry food and protection to numerous species of microorganisms, small and large animals, birds, other understory plant species and thus contribute decisively to maintaining high biodiversity levels in one area. In Crete, about 65% of agricultural land is covered by olive plantations which are separated by other plantations by the other plantations by the beautiful silvery-green color of leaves. Several tourist resorts are surrounded by olive plantations and many tourist complexes have their grounds decorated with old or new olive trees.

Olives present a particularly high adaptation and resistance to long term droughts. The olive groves can be considered as a natural forest highly adapted in dry Mediterranean conditions, with lower vulnerability to fires as compared to pine forests protecting hilly areas from desertification. Soil erosion rates can be substantially decreased in olive groves with understory vegetation of annual plants. The annual vegetation and plant residues have a high soil surface cover, preventing surface sealing and minimizing the velocity of the overland runoff water. Furthermore, olive trees are evergreen plants interrupting raindrop impact on soil surface, therefore, soil erosion is highly reduced. Olive plantations growing in hilly areas under proper farming practices greatly contribute to higher

amount of rain water infiltration into the soil enriching subterranean aquifers and springs.

Of course intense cultivation of olive groves by plowing the soil and applying high amount of fertilizers greatly contributes to land degradation and ground and surface water pollution. Intensive cultivation of olive plantations account for 30% of the overall area of Crete. Preservation of olive groves and promotion of sustainable farming will greatly contribute to protection of silty areas sensitive to desertification.

### **Water conservation and increasing water availability**

The sustainable use of water resources requires an adequate management of the key activities associated to them with a great interest and measures adapted for water conservation by local authorities and land users. Although precise estimations of the available water resources in Crete have not been made, most related entities agree that the water consumption and use constitute only a small percentage (less than 5 %) of the annual precipitation. The annual water accumulation from rainfall and snow fall for Crete has been estimated by the Greek Institute of Geological Research (IGME) to 7.2 billion of m<sup>3</sup>. From this amount 3.6 billion of m<sup>3</sup> are lost, 1.6 billion m<sup>3</sup> are moved by surface water toward the sea and the remaining 1.6 billion m<sup>3</sup> are moved underground with its' final destination the sea. Although the Messara valley receives on average about 600 mm of rainfall per year it is estimated that about 65 % is lost by evapotranspiration, 10 % as runoff to sea and only 25 % percolates into the ground for recharging aquifers. In the area of Chania the yearly water capacity is estimated at 150 million m<sup>3</sup> of water (both ground and underground sources). The existing water works projects in Chania are estimated to capture and utilize only 35% of the water resources. The rest is unable to be stored in water reservoirs and it is flowing to the sea. The uneven distribution of rainfall during the winter months and the high demand for water during the summer months creates water availability problems in Crete.

Transfer of water from western to eastern Crete faces severe technical, social and cost limitations. At present, there is little surface runoff storage and the groundwater is being depleted rapidly. Groundwater is the key resource controlling the economic development of Messara valley while spring water is mainly used in Chania region. Following the detailed agricultural development study conducted by the United Nations Food and Agriculture Organization in 1972 (FAO, 1972) for the exploitation of the Messara valleys water resources, an extensive network of pumping stations has been installed since 1984 using the water for irrigation of olive groves. The consequences were the increase in plant productivity and the dramatic drop of 20 m or more of the groundwater level in some places. In addition, It is estimated that about 30% of the water distributed to agriculture for irrigation is lost through the network in the Chania region. Furthermore, in Heraklion prefecture, water network is old and leaky, with up to 50% of water being lost according to local residents. Therefore, water conservation can be achieved by decreasing losses of water along the conveyance structures by constructing lined instead of unlined conveyance canals or channels, sealing channels using sealing materials, etc. Furthermore, water can be conserve by applying techniques such as: using crops of lower water requirements, scheduling irrigation according to water requirements, decreasing of water applied to olive groves up to 30% without significant change in oil production, promoting higher rain water infiltration into the soil by applying the appropriate cultivation technique.

As it was mentioned above, the highest amount of precipitation is lost as surface runoff or deep percolation. Construction of new surface reservoirs, in Crete will greatly contribute to the increasingly demands for water in the agriculture and tourism sector. It has already initiated the construction of a reservoir in Alikianos, Chania region, (the Aposelemis dam) for storing spring water during the winter period and using in the dry period. In addition, the municipality of Agia Barbara, in Heraklion prefecture, is preparing for building a small water reservoir in the watershed of Larani. In the Messara valley has initiated the construction Faneromeni dam near Vori. The work has initiated in 1999 and finished in 2003, but the network for transferring the water is not yet constructed. Another major irrigation project is planned for the Messara valley for redirection of the Platys River, which flows into the sea in Agia Galini area.

### **Promotion of organic farming**

Organic farming is a natural way of producing agricultural products avoiding or largely excluding of widespread use of manmade pesticides, synthetic fertilizers, plant growth regulators, along with livestock feed additives. Land management practices in organic farming includes natural crop rotation, application of crop residues and animal manures, and mechanical control of growing weeds, insects, and other pests that can be harmful to plants. Such techniques can be considered as friendly to the natural environment reducing the rate of land degradation and supporting a higher farmer income. Farmers of Crete have adopted the philosophy of organic farming, as agricultural products are in many cases in Crete are sustainable, without the use of manmade fertilizers and other alternative methods. The first idea was to encourage a parallel sustainable development of tourism and agriculture which is facilitated by many agricultural products consumed by tourists. Organic agriculture is a good "tool" for this because it produces high quality agricultural products in close proximity to hotels and other tourist locations. When properly applied, organic practices can also help protect natural resources and environmental quality.

In Crete the bio-intensive agriculture was the first large scale project on parallel development that was implemented in Greece in 1995. This resulted from the combined efforts of MASH (the consultant for organic production) and Grecotel (the largest hotel chain in Greece) which was the final consumer of the organic products and provided funding for the project. Emphasis was given to vegetables as the primary product and the use of bio-intensive-organic agriculture fulfilled the goal of combining healthy and high quality agricultural products with parallel protection of the environment. The co-existence of farmers and hotels has successfully proceeded over the past decade. Between 1995-2000, the program tested the performance of about 150 varieties of vegetables under bio-intensive methods according to EC Regulation 2092/91 (organic agriculture regulation). Low cost composting methods were introduced to farmers for producing natural fertilizers that promote healthy soils

The natural environment of Crete favors the development "earth friendly" growing crops, particularly for basic agricultural products, such as olive oil, wine, meat and cheese which are well adapted to the climatic conditions of Crete. In the last few years a group of farmers applying organic farming were united in a project to make publicly available selected organic products that would meet the exact requirements of modern consumers. This task started from olive oil producers. Demands for such products were very impressive. Every year new farmers join the organized groups of organic farmers, while scientific research in the field of organic farming is flourishing.

Today the Western Messara valley is considered as the most important organic olive production centre in Crete. The "Organic Farmers of Messara" cooperative includes around 200 olive growers. Most of these growers have small-scale operations, 1.5-10 ha size. Members of the co-operative have formed a producer group (Organic Olive Growers of Messara) consisting of young and older farmers. The cooperative has its own employees controlling the quality of the products, processing, and marketing the olive oil and olives produced by its members. Olive products are consumed in local and international markets.

### **Delineation and protection of productive agricultural soils**

In the last decades urban and industrial areas are expanded in productive agricultural soils. The internal population migration towards the coastal zone is linked with economic activities such as tourism, harbour facilities, naval and storage facilities and services such as fishing, and infrastructure development resulting in a tremendous expansion of artificial land cover over rather short time periods. The coastal zone includes many wetlands which play a crucial role in maintaining and enhancing environmental quality and providing valuable economic benefits through their many functions such as water purification, carbon sequestration, maintenance and equilibrium of the water cycle, hosting millions of migratory birds, and providing excellent environments for leisure. Unfortunately often urbanisation has expanded on illegal basis. Whether the decision makers could or could not stop such a process is often an open question accompanied with much controversy. The concentration of activities in such narrow strips of land is accompanied with loss of fertile agriculture soils and valuable coastal habitats as well as pollution and increased environmental damage. Such productive land has to be mapped and protected from any other use except agriculture.

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