



United Nations
Environment
Programme



UNEP(OCA)/MED WG.46/6
20 March 1992

Original: ENGLISH

MEDITERRANEAN ACTION PLAN

Fourth Meeting of the Task Team on
Climatic Changes on the Island of Rhodes

Athens, 30-31 March 1992

**IMPLICATIONS OF EXPECTED CLIMATIC CHANGES
ON THE ISLAND OF RHODES**

ECOSYSTEMS OF THE ISLAND OF RHODES

by

N. MARGARIS

FIRST DRAFT
NOT TO BE CITED

2.4. ECOSYSTEMS OF THE ISLAND OF RHODES

1. Natural terrestrial ecosystems¹

Three basic mediterranean terrestrial ecosystem types have been observed in the island of Rhodes: forests, shrublands and wetlands.

1.2. Forests

Almost all forests in Rhodes consist from conifers, pines or cypresses and their cover is relatively high, reaching a value of over 40%, compared to the mean value of Greece (19%). This fact deserves a special attention because the signals of degradation became evident during the last years. For example, an area of about 40 km has been burnt in 1988.

From the pine species *Pinus brutia* is the dominant native one while *Pinus halepensis* had been introduced during the Italian occupation of the island and later. The Cypress (*Cypressus sempervirens*) has two discern forms: the wild-native and the cultivated one. The later has a "vertical" form. According to the above it is rather easy to distinguish the planted from the wild pines and cypresses.

1.3. Shrublands

The shrublands in Rhodes cover about 35% of the island extend. At the wet end of the gradient a dense evergreen shrub community dominates, while towards the dry end, the evergreen scrub is replaced by an open scrub community.

Thus, two major mediterranean ecosystem types can be distinguished: maquis and phrygana. As far as maquis ecosystems are concerned, there is an agreement in terminology, while phryganic ecosystems are too often referred to by the term garrigue.

Plants dominating maquis ecosystems are adapted to summer drought stress by means of evergreen sclerophylly while those in phryganic ones by the mechanism of seasonal dimorphism (Margaris 1980) by which they considerably reduce the mass of transpiring body (e.g. leaves) during summer.

1.3.1. The maquis in Rhodes

The dominant evergreen shrub that dominates the maquis ecosystems of N.E. Rhodes is the *Arbutus adrachne* which many times becomes a conspicuous tree which forms lush, impenetrable thickets mixed with *Erica arborea* and *Quercus coccifera*. This high shrubland continues in the more humid areas which are lowlands in the northern part of the island. As elevation becomes higher, they occurrence is a reality in other places as well.

In the drier south the maquis become less luxurious and the *Quercus coccifera*, *Olea europea* (wild form) and *Pistacia lentiscus* take the place of the *Arbutus adrachne*.

Other typical species found in maquis of Rhodes apart from *Arbutus adrachne*, *Quercus coccifera* and *Pistacia lentiscus* are the evergreens *Ceratonia siliqua* (possibly an ancient introduction), *Myrtus communis*, *Laurus nobilis* etc.

¹ We are considering that aquatic coastal and ecosystems will absorb early the perturbation that climatic change will cause. Especially for Rhodes where wetlands are practically absent.

1.3.2. Phrygana of Rhodes

Phrygana comprises undershrubs such as thyme (*Thymus capitatus*), dwarf heather (*Erica manipuliflora*), *Sarcopoterium spinosum*, *Cistus* species, spinybroom (*Calicotome spinosa*), the spiny *Genista acanthoclada*, and (in the south on Mount Attaviros) *Euphorbia acanthothamnus*. Most of this is similar to Cretan phrygana, but a speciality of Rhodes is *Lithodora hispidula* with its needle-sharp hairs and bright blue flowers.

Since the rather "wet" -according to the Aegean standards-climate of Rhodes island can support maquis, the phryganic communities found can be characterized as man-made due to anthropogenic mismanagement with fires and overgrazing. The almost deserted place in the Attaviros Mount can be characterized as a typical case.

2. State of the natural environment and the more crucial problems

The combination of high temperatures and water deficiency during the summer leads to a high frequency of recurring fires. The association of this climatic type with fire is well known and SHANTZ (1947) refers to them as "fire-type" stating: <...that this type was ever free from fires seems unlikely >.

In the course of their evolution ecosystems subject to frequent fires for thousands of years may have developed, properties which make them extremely flammable. In fact these ecosystems may need to be burnt deliberately every so often to prevent fuels accumulating in them to a great extent, since fire outbreak would lead to very high temperatures resulting in turn in real catastrophes. BISWELL (1974) suggests that: < Fire in chaparral is both natural and inevitable. It has always occurred and probably always will, because the vegetation becomes extremely dry near the end of a long, hot, nearly rainless summer. At that time, also, humidity may be extremely low and winds high >.

The wood as burning material was of great importance for the island's people, mainly for heating and cooking. Socioeconomic changes occurred during the last decades with the introduction of central heating systems with petrol, electricity and gas in bottles affected negatively on wood collection from forests.

On the other hand a major problem related to pine forests emerged due to the new chemical products which can be considered as "substitutes" of the natural products taken from the pine trees with the collection of resin and the exploitation.

Although the resin collection was a productive activity some years ago, the discovery of new products similar to that derived from the resin of pine trees, made the resin an unprofitable activity. The resin collectors, being in the past real forest protectors, disappeared and the shepherds invasion becomes the new reality in forest exploitation.

Consequently, the fire prevention policy in Rhodes has proved to be a fire delay policy. Fuel accumulates in the form of dead dry material (e.g. pine-needles) and when fire attacks, sooner or later high temperatures will be developed, the flammable material will give way to a rapid expansion and the result will be a real disaster. In Rhodes the "all fires are bad" syndrome is in full power. There is almost complete lack of desire for acquiring knowledge and assimilating the experience of successful new approaches. Conservatism puts them aside.

Every summer after the fire attack and because no information is available to the politicians and decision makers, everybody believes that the fire was a complete catastrophe. For this reason they decide reforestation as the only solution. Added to that, they use in the so-called reforestation non-indigenous species. Speaking from the ecological point of view we must have in mind that the indigenous tree species generally evolve together with the environment where they

grow. The transportation from their natural habitat and the use in "new" places can totally disturb the indigenous flora and fauna.

3. The natural environment of Rhodes and its flora

Only few plants are endemic in the island and *Dianthus rhodiums* (shrubby pink) and *Consolida arenaria* (sand-dune lark spur) are two of them. Some others such as *Lithodora hirsuta* have their centres in the island and they are extended both to the east and west.

The flora of Rhodes seems to be poorer in comparison with Crete and even Karpathos island (taking into account the difference of the area). This can be explained in some degree from the absence of highly diversified terrains which are the niche of many Cretan endemics. Recent research revealed however that some characteristic species well known about the flora of Crete are also present in the island of Rhodes.

The cypress (*Cypressus sempervirens*) for example which was known as a tree that was native only in Crete, in the gorge of Samaria, is also present in curiously patchy distributions in the island of Rhodes (Rackham 1991) and, according to our observations, in the island of Symi. Also the Cretan Palm Tree, the Phoenix *theophrasti*, is present at Rhodes as well.

Finally Rhodes is the last station for some "eastern" originating plants. For example *Liquidambar orientalis*, called in Rhodes *zydia*, is an eastern tree common to wet places and it dominates the *Petaloudes* (butterfly) valley but it is totally absent from Crete. Another non-European thistle (*Carlina tragacanthifolia*) is also common to Rhodes. Also *Triforium clypeatum* is a common clover in Rhodes, and reaches in Karpathos as well but no further distribution of this species in Europe has been observed.

4. Cultivated land: The "Agro" systems

4.1. Cultivated land

Plant and animal components of semi-arid Mediterranean ecosystems show adaptive strategies by which, under normal conditions, they overcome periods of stress because of water scarcity and, in parallel, make efficient use of water when available.

During the more than 2.000-year period of exploitation, traditional social systems have developed and a "stabilization" of the desertification process has reached. The most useful step was the terracing of slopes and the agricultural and grazing management systems.

Advanced agricultural practices developed during the last decades in the lowlands of mainland Greece provide products of such an improved quality and in such quantity and variety that "terrace agriculture" was unable to match it. Abandonment of terraces resulted in turn in the disruption of traditional grazing management systems. Fires combined with overgrazing became a reality and desertification rates increased dramatically, reaching the level of a catastrophe on almost all islands of the Aegean and the island of Rhodes is not an exception.

4.2. Bottom land cultivations

Today the cultivations in Rhodes are effected on about 20.000 ha from which 10% are irrigated and more than 80% are in bottom land. Two are the basic cultivations: vegetables (mainly tomatoes and water melons) and grapes.

In other times these vulnerable products, consumed only in a fresh state, could deteriorate if they had to stay long before consumption in the hot dry months, while the long distance from continental Greece did not guarantee their timely use.

However, the seasonal population increase due to tourism led to an increased of local demand of fruits and vegetables during summer. This high demand resulted finally in production increase. According to the recent statistics tomatoes annual production in Rhodes reached more than 35.000 tons.

While in the water melons, there is a continuous increase in production at more than 8.000 tons per year, unfortunately, the efficiency of production is about 60% compared to the mean production efficiency in the rest of Greece.

The grape cultivations are not affected seriously by the so called "intensive" agriculture mainly because high quality wine is derived from the dry variety. Nevertheless Rhodes produces more than 10.000 tons of wine per year.

4.3. Need for action

Theoretically, agricultural decline and abandonment of terrace cultivations increases available land for grazing. On the other hand, disruption of traditional grazing systems of management, with the abnormal use of fires and overgrazing, becomes an enormous problem in our days which has not only an environmental impact. The increased erosion, for example, reacts directly on other crucial factors such as water resources.

Over exploitation of the island ecosystem with grazing animals has already resulted in a serious degradation of the plant cover and the biomass leading directly to a serious decline of animal husbandry's economic yield.

5. Water resources in Rhodes

During the last decades many changes occurred in the water consumption in the island of Rhodes.

The first one is the tremendous increase of tourists arrivals. From 230.000 arrivals in 1970 we overpassed the 1.000.000 in 1990. The second one deals with the increase demand per person. From 70 litters per day/per person twenty years ago, we reached values that overpass the 150 litters day/per person. The third change occurred with the increased demand for water for irrigation in Rhodes as well as in the other islands of Dodecanese. For example, each summer more than 49.000 tons of fresh water are imported from the nearby island of Symi.

All above, which make the present state dramatic during the dry summer months, produce a very serious problem. Up to now the measures taken are economically very expensive and environmentally spasmodic and indicate lack of knowledge of the existing trends and the relevant literature. For example there is no information whatsoever about the cost of overpumping which has resulted to a salinization of many wells, which is an irreversible phenomenon.

On the other side and taking into account both possible future climatic changes and human behaviour (increase in consumption per person), new measures are urgently needed. For example, in all pumping systems that are close to sea the device that measures the salt content must be added.

Further to the above and knowing that about 50% of the water is used just toilet flushes, the development of special types of toilet flushes can be suggested which use salt water. Also taking into account the high cost of the water used for irrigation we also suggest that every project that deals with irrigation must be economically rationalized. It is almost ridiculous to use water for growing potatoes in Rhodes when a kgr. of potatoes has a cost of more than 0.5 tons of water! Thus the cost of water is much higher than the potatoes produced. Therefore all these primary sector development "projects" must be reexamined.

6. Climate change implications

According to the scenario developed by the East Anglia group for Eastern Mediterranean and Rhodes in particular, the temperature increase, possibly with the rainfalls decrease, will change the climate of Rhodes to a more arid mediterranean.

Today, the forest biomass accumulation is producing very fragile situation and forest fire attack is an outstanding problem in the island of Rhodes. The temperature's increase and the aridity will accentuate the forest fires problem. On the other hand the new techniques such as prescribed burning are urgently needed even without the climatic change do not take place.

Another point of concern must be directed to the protection of the burnt sites, from both, the invasion of shepherds and the unscientific reactions based on the false impression that a reforestation is needed in order to protect the environment. Recent scientific data proved that the regeneration can take place if we leave the burnt sites to recover themselves.

Going further to shrublands a transformation will take place from the maquis to pyrganic ecosystem. But, again, a careful study of the island will show many problems arising from the human mismanagement and improper actions. Having this in mind a compensation can be achieved in case we proceed to a control of overgrazing.

Taking all the above in mind we considered that the development of a new environmental strategy, in the light of the climatic changes, can have positive effect on the environment of Rhodes. This action will produce higher plant cover in the degraded areas minimizing at the same time the erosion. This in return will increase the natural resources such as soil and water.

REFERENCES

MARGARIS, N.S. Portug. Acta Biol. 14 (45), 1980.

SHANTZ, H.L. The use of fire as a tool in management of the brush ranges of California, California State Board of Forestry, Sacramento 1947.

BISWELL, H.H. In: Fire and Ecosystems (T.T. Kozlowski and C.E. Ahlgren, Eds), Academic Press, N.Y. 1974.

RACKHAM, O. In: Groves, D. Report to EEC about "Crete and the Aegean islands: Effects of changing climate and the environment" Cambridge, March 1991.