SURVEY OF THE EVOLUTION OF HUMAN IMPACT ON THE NATURAL ENVIRONMENT AND LANDSCAPE OF A PROTECTED AREA. THE CASE OF SOUTHERN MANI (GR2540008), GREECE

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Abstract

Since antiquity humans have been affecting nature to varying degrees. Many areas due to their specificities, e.g. rare species of flora and fauna, have become lately a source of great interest to the society due to their ecological value. For the conservation of the biodiversity of these important areas, they have been set under a special protection regime accompanied with formal measures.

Mani is located at the southernmost tip of mainland Greece in the Peloponnese region. South Mani is an area of great ecological value and is included in the Natura 2000 network (code GR2540008). The area covers more than 132.000 acres including mountains, forests, pasture and agricultural land. In the area there are more than 280 villages and small settlements; their vast majority is not inhabited nowadays.

The purpose of this study is to present data concerning the perceptions of the area by the people and relate them to the continuous impact of human activity in an area of such a great morphological and ecological interest. The tools used were mainly quantitative (questionnaires) and some qualitative (in depth interviews). The results have shown that most changes were due to road network development, building development and the reduction of the population of several bird species. Finally, one could say that the region has not changed for decades with regard to its' main characteristics.

Key words: *human impact, landscape, protected area, GR2540008*

1. INTRODUCTION

Since humans invented tools and started trying to understand the environment they lived in, as best as they could, they created the conditions for changing the surroundings. The quest for the optimum or best use of space so that humans can take from the land the necessary resources to satisfy their needs has never stopped since. The transition from hunting to cultivation and cattle breeding is an important landmark in human history and the environment as human activity started to have an impact on geomorphology and to change the microclimate. (Melinda & Zender 2008).

Humans started cultivating the land, constructing houses, opening roads and establishing organized settlements. Since the end of the 19th century with the rapid increase in technology, the growth of human needs has accelerated, having as a result the increase in pressures and changes on the earth surface. As a result, environmental problems have become more and more tangible in many places of the planet.

The energy needs of the planet are always on the rise, especially in the developing countries, while in the developed countries the current consumption pattern persists. Species of animals and plants have become extinct or are under threat of extinction while the greenhouse effect makes its presence felt. (Thuiller & Lavorel 2004) However, modern humans do not seem determined to change their way of living while nature had no rights even a few years ago.

Almost all sciences have started to deal with problems concerning the environment, to research it, so as to create better ecological conditions and where appropriate to restore degraded ecosystems. Recently, in the broader scientific field of ecology there has been a new trend, a branch which deals with the anthropogenic impact on the environment (along with natural processes) and with how any

human intervention can have an impact, up to what point, if these impacts are reversible but also how human societies will still exist in the future and in what form. This trend is called ecological resilience and essentially, it tries to study the potential that each area has to resist or recover from pressures or disasters.

Broadly speaking, one could claim that the term resilience can be interpreted in many ways (Adger, 2000). Many authors related the term ecological resilience to the resistance of ecosystems to a specific extreme change while others attach to it the meaning of flexibility or the time it takes an ecosystem to return to its normal state. These scientists accept only one condition of local stability and their theory is usually influenced by Applied Mathematics and Engineering. (Gunderson & Allen 2010). The ability of an ecosystem to recover is related to different variables: economic, environmental, social, etc.

The purpose of this study is to analyze data, trends and facts which could give us the most accurate approach to the rate of change of an ecosystem as well as the ability for recovery in an area, which is part of the Natura network the area of northern Mani.

2. STUDY AREA

The research site hosts high biodiversity and belongs to the European ecological Natura network 2000 with the code GR2540008 (Fig. 1). The research site consists of more than 280 villages and small settlements, most of which are deserted or occasionally resided by very few inhabitants. The extent of the study site as a whole is larger than 132,000 square meters including woodland, populated areas, pasture grounds and mountains. (Hellenic Statistical Authority, 2002) One of its parts, which lies in the north, includes some of the villages that constitute the municipality of Sminous, is protected by the "habitat" and "birds" directives. The semi-natural vegetation in Mani is characterized by low bushes, mainly species of brushwood (*Cisto-Micromerieta*). The site has been characterized as degraded and the trend of the state of the area is that of slow degradation.

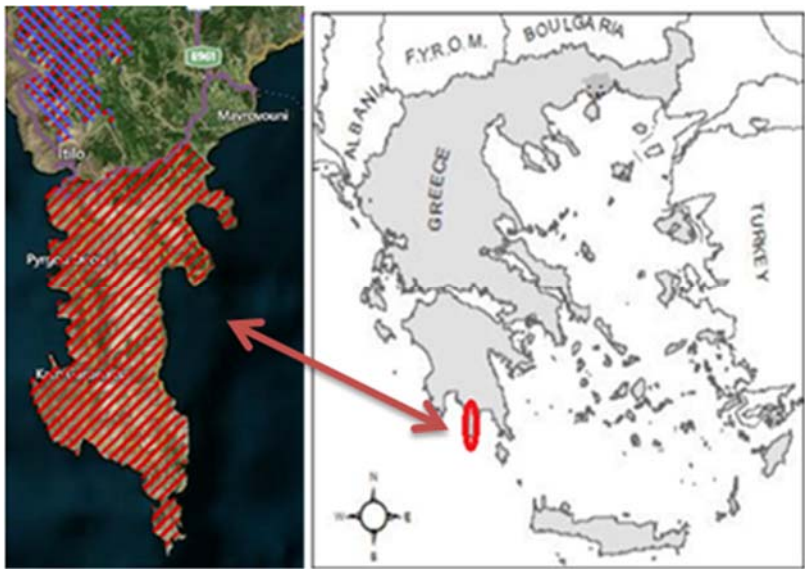

Figure 1. Map of study area
Source: http://natura2000.eea.europa.eu

2.1. The use of land

In the study site the prevalent land cover types include sclerophyllous vegetation, grazing land as well as crops consisting of olive trees, vineyards (less than 2%), some fruit-bearing trees and many

vegetable gardens. At the same time a significant number of cultivable plots of land include isles of natural vegetation.

Mani, particularly its dry and barren southern and sloping part is not suitable for farming. The more favorable northern part has been turned into an area of great productive importance. The poor soil and the steep ground forced cultivators to make a system of terraces. Most of these structures are additionally protected by a system of lateral walls, called "dry walls", which provide support and protection. Without the terrace system the potential of cultivating the land would be very limited.

The stonework also helped to remove the stones and the pebbles from the ground, they were later used to fill in the gaps in the structure. Inside the terraces, the ground was flattened and special care was taken so that they would not have a negative slope that would result in water flowing between the terraces. Even today the terraces damaged in wintertime are mended in springtime. When the slope of the ground becomes too steep, the strips of land become narrow, while they become wider when the slope is smaller. There are certain points where the side walls reach the height of 3 to 4 meters. In the case of Oitilon in order to get 10-15 hectares of cultivable land, structures of more than 80 kilometers in length and of diverse height was used (Pierrakeas 2001).

2.2. Flora and land cover

In terms of flora and vegetation, Mani is divided into three zones. The first is the coastal eastern and western zone in the most southern section. The morphology displays a "savage" view with deforested mountains and very steep coasts. In recent years and as a result of hard toil, the inhabitants have managed to cultivate clumps of olive trees which, however, have a very slow rate of development, to such a degree that they have a sickly and bushy appearance. The flora includes species of bushes and brushwood, as well as elements of ammophilous and halophilous vegetation. Finally, in the area some locust bean trees and prickly pear cactuses are grown. In contrast, the second area which extends from Skoutari to Gythio can be regarded as quite fertile. This area has oak (tree) woods and generally lush vegetation. Cotton, grain and water melons are cultivated, particularly in the area of Mavrovounio. Moreover, vineyards, citrus trees and olive trees grow in abundance. The northernmost, area which lies beyond Oitilon is also very fertile, especially in the plains. Mt Taygetus has dense woods with abundant fir and pine trees. In this area, especially in the subalpine zone, there are brushwood-type plants and rich vegetation. (Kalonaros, 1981).

2.3. Fauna

The most important fauna elements are the birds –migratory birds of prey and Passeriformes. Seven (7) out of twenty one (21) European species, which reproduce exclusively in the Mediterranean zone, breed in the area. An important mammal species is the golden jackal, whose populations have dramatically decreased recently due to poisoning with illegal baits so that they do not cause damage to farming (Callisto 2009).

3. METHODOLOGY

The method used to conduct the research was that of structured interviews (questionnaires). During the research more than 300 questionnaires were distributed to permanent inhabitants and landowners in the study site and ten in depth interviews were conducted.

The statistical package IBM SPSS Statistics was used for the statistical analysis and Microsoft Excel was employed for the diagrams.

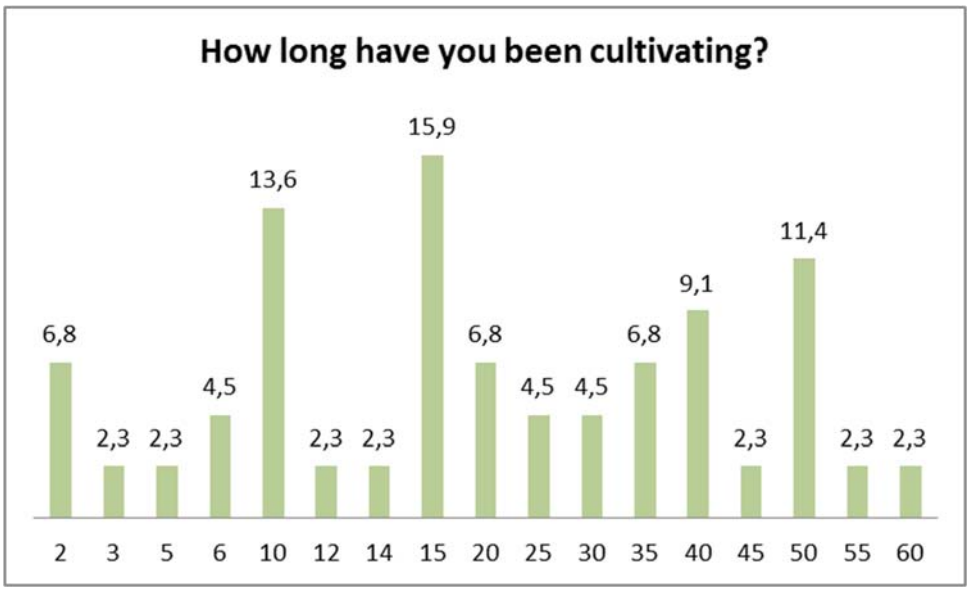

Figure 2. Years of occupation in agriculture (%).

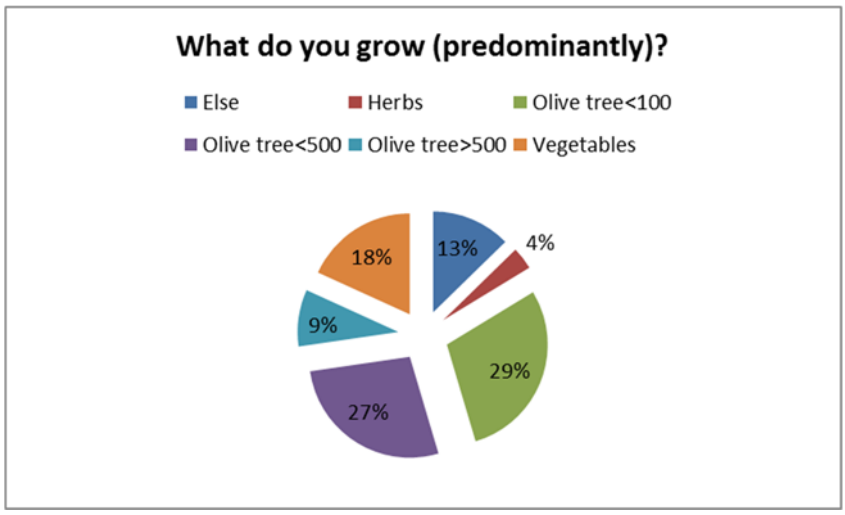

Figure 3. Dominant crops grown (%). Olive tree: less than 100 trees, olive tree <500: more than 100 trees but fewer than 500, olive tree >500: more than 500 trees.

4. RESULTS

The following conclusions were drawn from the elaboration process of the questionnaires in relation to agriculture, the farmers' habits (farmers and cattle breeders) and their viewpoints on the changes in the local landscape.

4.1. Farming/Agriculture and farming/agricultural methods

Olive trees and lupines were the main cultivable products (Interviews 7, 9, 5) followed by the grain crops (mentioned only in two interviews with two superannuated people), while in the most northern part grain as well as citrus trees were cultivated in large estates of land. Since 1963 the cultivation of grain has gradually declined and was progressively abandoned altogether. Nowadays, the olive tree monoculture prevails in the area and while most farmers grow it from ten to twenty years, there are

many new cultivators, along with some others who have been cultivating the olive tree for more than half a century.

As shown in Figure 3, the olive tree is the most common crop in the area. Most farmers own between 40-100 and 100-200 olive trees, while only 9.1% of them own more than 500 olive trees (Fig.3). With the term gardening products we refer to vegetable gardens, small gardens, vegetables, greenhouse, etc. In the questionnaires 18.2% of those questioned answered that they grew gardening products while 3.6% answered that they mostly grew herbs and vegetables. Finally, the word 'other' refers to answers such as olive trees in combination with gardening products, orange trees, etc. which constitute 12.7% of the answered questions.

Pesticides are used for crops protection, fungicide, insecticides and acaricides, by around 10% of the respondents, as well as fertilizers, mostly potassium. Highly toxic pesticides, such as organophosphorus compounds, are used in the cultivation of olive trees. However, the qualitative interviews casted doubt on these results, since our informants claimed that frequent use of fertilizers is made (1, 2, 4).

Organic farming developed in the research site from 1996 to 2006. Now there are very few organic farmers according to the president of the union of organic farmers in Lakonia. With respect to production levels, an increase in the produce compared to the past is claimed by only 22.2% of those questioned. 60% of those questioned mentioned a reduction while 17.8% claimed that the produce was stable.

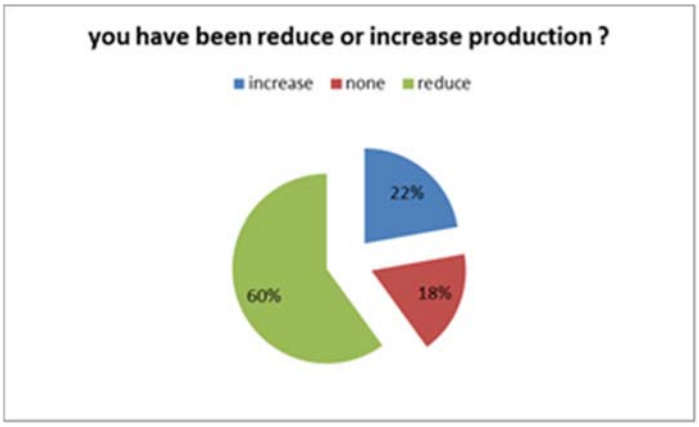

Figure 4. Tendencies in production volume according to the respondents (%).

4.2. Fauna

Most participants in the research, 67.1%, replied positively to the question as to whether there had been changes in the wild fauna of the area. It should be noted that most answers concerned extinction of species in general, some of them were about the increase in fox population and several of them were about avifauna extinction. 32.9% of those questioned answered that they had not noticed any change.

Most inhabitants have noticed the clear reduction in the number of some species, a fact which is confirmed by literature sources concerning avifauna. Pesticides are often used to exterminate not only wild animals such as foxes and martens but also domestic animals such as cats and dogs.

4.3. Perception of changes in the landscape of the study site

63.5% of those questioned claim that there have been changes in the area that have to do mainly with infrastructure, but also with farming and landscape structure, 28.9% believe that the area has not changed and finally 7.5% supports that there have been slight changes.

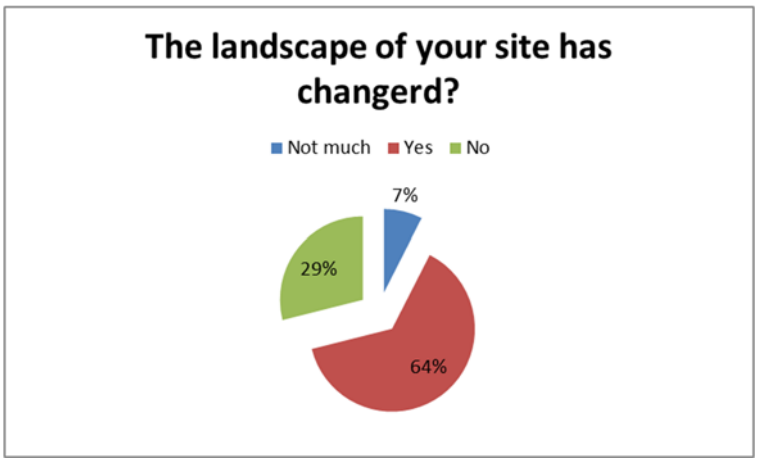

Figure 5. Perception of the degree of change in the landscape (%).

In an effort to track the timing of the changes we asked the participants in the research how many years ago did the greatest changes occur. 19.5% said that the greatest changes occurred about 20 years ago (Fig.6), a fact which coincides chronologically with the staggering increase in construction permits (Fig.7).

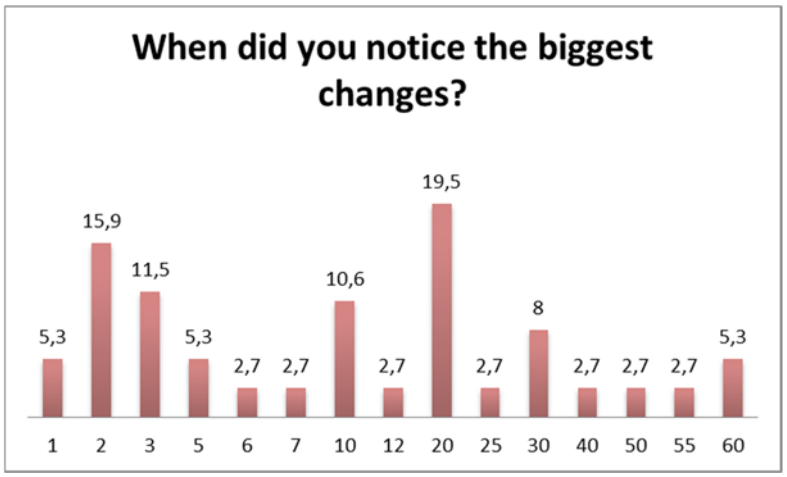

Figure 6. Perception of the time of maximum change in years prior to 2013(%).

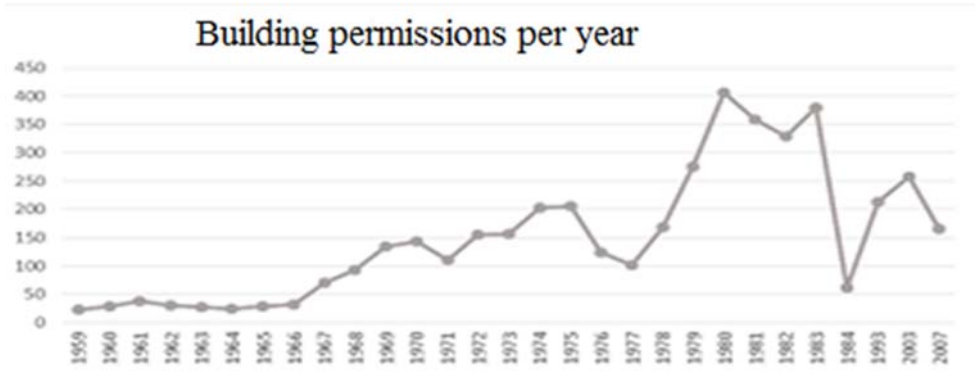

Figure 7. Building permissions per year (Source: City Planning administration in Gythion).

Interesting answers were given to the question 'What would you like to change in your area? 4.2% of those who were asked the question answered that they would like to have the road network improved. 4.9% suggested that more job openings should be created. The really considerable percentage of 20.1% said that they wished the mentality of a great number of local inhabitants would change, 6.3% would like the population to increase, 14.6% would not wish for any changes, 12.5% wanted more tourism development, 16.7% wished for more and better infrastructures.

Finally, we wish to point out that with the word other we have codified the rest of the answers which amounted to 20.8%, (answers such a generally, many, improvement of nature, pollution issues, cleanliness, development, etc.)

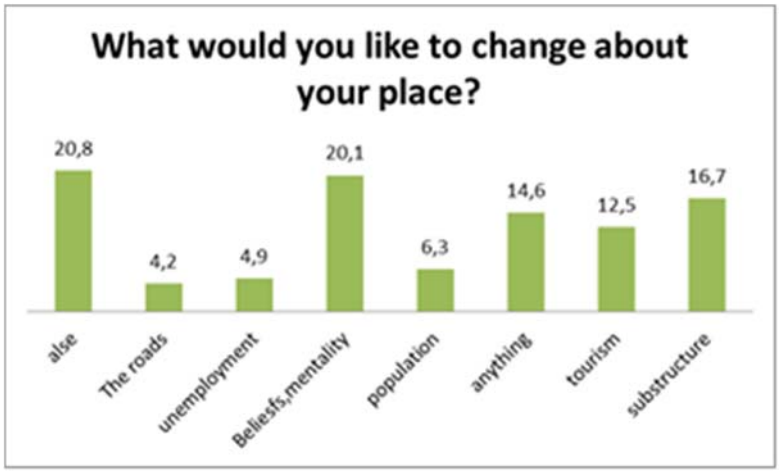

Figure 8. Preferences for change (%).

It should be mentioned that the locals in this particular area of Greece have a very strong and special bond with it. This may be due to the fact that the area is extremely arid in its greatest part and the exploitation of land is extremely arduous, or maybe because it was one of the wildest and most secluded areas in terms of nature but even in terms of culture.

As a result, even the slightest changes in the landscape could cause discontent. Such an example is the prompt reaction of the local inhabitants when a permit for a wind-energy park was prevented from being issued. This can be understood even by the answers to the question if they wished for something to be changed in each participant's village. While almost all of them had complaints for various reasons, the overwhelming majority did not wish for any changes for fear that the area might lose its character. 54% of the inhabitants consider that their quality of life has worsened in the previous years, while older people said that their life has improved in relation to that in the past. When asked if they are willing to change their way of living, 85.4% of them declared eager to do so.

5. PROBLEMS

5.1. Grazing

Grazing along with overgrazing problems is one of the most serious problems the locals are faced with. Nowadays, cattle breeding has been systematically accused of the deterioration of many territories (Miller 1996). The intensity and the frequency of grazing and the species of animals that are involved have an impact on the forest and ecosystem of pasture land/meadows. (Papanastasis & Ntoitsakis 1992).

In southern Mani there is a strong anxiety of the inhabitants for the free grazing of cattle. In the interviews given by four inhabitants from the southwestern part of Mani (Mina, Polemita, interviews

6, 7) and from eastern Moudanistika (interview 5) at an altitude of ~700 m a. s .l. and finally from the eastern part (interview 8) in the village called Lagia this problem is strongly emphasized and referred to as one of the most serious that the area has to deal with. Specifically, since the cattle which roam freely in teens following the overgrazing of herbaceous vegetation, they have turned to young olive trees or to the lowest part of olive trees to graze on. It can be observed that the landscape in many areas, in particular close to villages, has been transformed in relation to the existence of particular species of flora.

In the past there were hundreds of prickly pear cactuses while now the very few that still exist are "injured" with their foliage starting from a point that cannot be reached by cattle. Young olive trees do not exist, only those that are found in well fenced land. Overgrazing in some areas does not seem to have influenced some species of plants. In interviews 8 and 5 this fact is mentioned by inhabitants who say that they protect these spots day and night. Finally, it has been pointed out in a study conducted by the Ornithological Society that overgrazing seriously threatens areas which are protected by Natura network. (Ornithologiki 2009). Moreover, it has been stressed by Komninos and Kastritis that among the dangers and threats posed to the avifauna of the area is overgrazing in the mountainous and semi-mountainous areas of southern Mani. (Dimalexis & Kastritis 2009).

14.2% of the permanent inhabitants regard the absence of biological wastewater treatment as the most serious problem that the area is faced with, 13.5% of them think it is the road network (here we have also included the means of transport), 19.4% consider financial problems and unemployment to be the worst problem (Fig. 9) while 9.7% believe that the most serious problem is the population reduction (the population of the area has diminished a little more than 30% since the 1950s). 5.8% of those asked regard overgrazing as the most serious problem, a considerable percentage if we consider the fact that there are no animals in the most densely populated areas. Finally, 9.7% of them believe the most serious problem to be the absence of sanitary landfills (XYTA) or the fact that some of them are illegal. 27.7% of those asked answered something else such as absence of the state, the port, water supply, the mentality of people, infrastructures, fires, accessibility, etc.

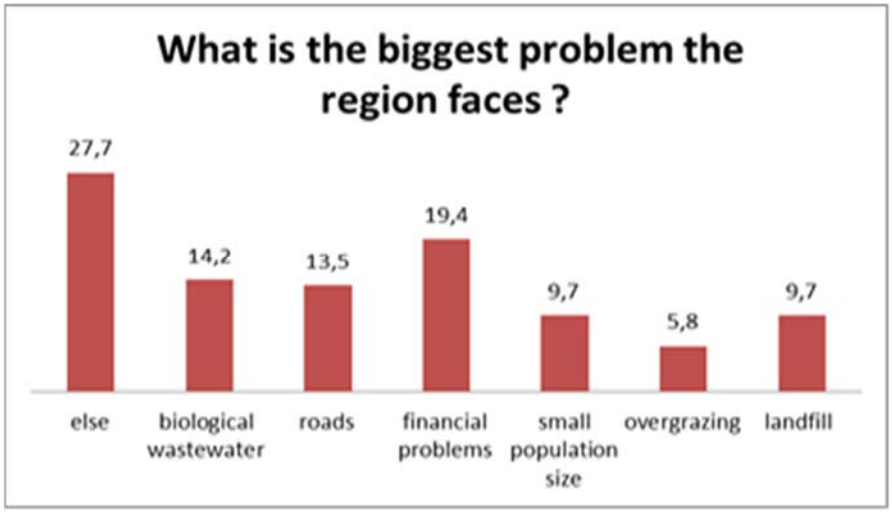

Figure 9. What is the biggest problem the region faces in percent (%)

5.2. Fires—Waste

The phenomenon of fires in the area of Mani could be characterized as non-natural or as a consequence of human activities, as it has existed for thousands of years since people started cultivating and deforesting forest areas in order to make room for their crops (Myler 1996). In cases that the effects of fire overwhelm the ability of the ecosystem to recover it also leads to a rapidly

changing anthropography, a process taking place at a considerably increasing rate. (WWF,2008). In the area fires usually burn both in cultivated land and woodland, (Tsagari et al. 2011).

In the qualitative interviews many of those asked mentioned fires that started close to farming and cattle-raising installations (like the great fire in 2006), an opinion that is also stated in Tsagari's research in which she claims that "the most disastrous fires in the prefecture of Lakonia are those whose ignition points were in farming and cattle raising installations." (Tsagari et al. 2011). Once ignited, fire extinction is very difficult in the study area, since the rates of atmospheric humidity are very frequently rather low (<50%) for a great period of time and the average temperature is quite high. However, the locals in their overwhelming majority do not regard fires as the most serious threat or problem for their area (a conclusion that results from the interviews). It should also be noted that after a fire people collect wood from scarred by fire or burnt trees which could, if not collected, deposit in the soil rich organic and inorganic ingredients that through the ash can be easily assimilated by plants (WWF 2008) and use it as coal after processing. Generally speaking, the majority of locals were not willing to talk about fires.

Finally, there are quite a few illegal waste dumps in the area, where the phenomenon of self-ignition is common. The creation of conditions of anaerobic digestion is favored, leading to a high risk of a fire breaking out in these areas. (Panagiotakopoulos 2007).

6. CONCLUSIONS

One of the most serious problems in the area and consequently in our research is the low number of permanent inhabitants and secondly the unwillingness of the few locals to answer the questionnaire. While more than 800 questionnaires were distributed, only 300 were answered. As for the qualitative interviews, things were different because most locals participated in them willingly and provided us with useful information.

In conclusion it could be said that the study site has not changed significantly during the last decades with the exception of the road network and some towns which have become bigger. The crops grown are almost the same, despite the fact that not all farmland is cultivated and some fields have been abandoned in the course of time. What has certainly changed is the occupation of people with the land, something that may give the area the time and potential to return through a natural process to previous semi natural state. Finally, it should be mentioned that what worried most locals was the financial-economic crisis that plagues the country, a situation to which the very high percentage of negative answers to the question if the quality of life is better compared to that of life in the past can be attributed.

The area is sparsely populated and as a result human interventions are fewer and milder. The locals do not wish for the transformation of their homeland and are willing to change their way of living so that it will become friendlier to the environment. Any restoration of an ecosystem should be the result of collective consensus because the decisions taken in this way can possibly be put into practice more easily than those that are implemented unilaterally. The need for planning becomes more imperative when we deal with a composite landscape of continuous ecosystems (Clewell et al. 2004).

The combination of small and big mountainous masses and the sea (a bigger port is already under construction in the area of Gythio) could make the area ideal for many forms of tourism all year round. The olive tree cultivation is a monoculture, a fact that favors the establishment of big processing and bottling and packaging units of its products. The area can be helped with the rational management of waste and the permanent closure of illegal landfills, with the establishment of environmental education centers and also by raising the awareness and informing the locals and the visitors in the area of the ecosystems and their significance, e.g. something in the form that Archelon does seasonally as it informs the public of the protection of the sea turtle (Margaritoulis 2011).

REFERENCES

Adger, N. 2000, "Social and ecological resilience: are they related?", *Progress in Human Geography,* vol. 24, no. 3, pp. 347-364.

Callisto, 2009, "Jackal fandom of the Greek countryside", viewed 22 Feb.2016, <http://www.callisto.gr/tsakali.php> (in Greek).

Clewell, A., Aronson, J. & Winterhalder, K. 2004, Society for Ecological Restoration International Science & Policy Working Group, 2nd Version, Tucson, Arizona, pp. 1-13, viewed 16 Feb.2016, < http://www.ser.org/docs/default-document-library/english.pdf >.

Dimalexis, T. & Kastritis, Th. 2009, *Action Plan for the Special Protection Zone «GR4220028 Andros Island : Central and southern part , surrounding islands and coastal marine area*, Athens: Min. Environment, viewed 13 February 2016 <http://www.ypeka.gr/ LinkClick.aspx?fileticket=TJu2F7IKalk%3D&tabid=572 > (In Greek).

Hellenic Statistical Authority, 2006, Distribution area of Greece by main use categories - coverage by Region, viewed 14 February 2016 <http://www.statistics.gr/el/statistics/-/publication/SPG51/-> (In Greek).

Gunderson, L. Allen, C. & Holling C. 2010, *Foundations of Ecological Resilience*, DC: Island Press, Washington.

Kalonaros, P. 1981, *Mani, the Castle of Traditio*, Patsilinakos, Athens (In Greek).

Margaritoulis, D. 2011, "The Sea Turtle Protection Society of Greece", *Marine Turtle Newsletter*, vol. 131, Archelon, Athens.

Myler, T. 1996, *Living in the Environment: Principles, Connections and Solutions*, ION (9th Edition), Athens.

Ornithologiki 2015, "*Important Bird Areas of Greece"*, viewed 13 Feb.2015, < http://ornithologiki.gr/page_cn.php?aID=1061&tID=2592 > (In Greek).

Ornithologiki. 2009, *"GR121 south Mani, Mountain Sagias and Cape Tenaro"*. Accessed 16 Feb.2016], [Online] viewed 11February 2016, <http://ornithologiki.gr/page_iba.php?aID=121 > (In Greek).

Panagiotakopoulos, D. 2007, *Sustainable Municipal Solid Waste Management*, Libra. Thessaloniki, (In Greek).

Papanastasis, B. & Ntoisakis, B. 1992, *Wildflower meadow ecology, **Λιβαδική Οικολογία*** Giahoudis-Giapoulis Thessaloniki, (In Greek).

Pierrakeas, B. 2001, *The formerly People of Mani*, Unconquered Mani, Areopoli (In Greek).

Thuiller, W. Lavorel, S. Araujo, M. Sykes, M. & Prentice, C. 2004, "Climate change threats to plant diversity in Europe", *Proceedings of the National Academy of Sciences,* vol 102. pp. 8245-8250, viewed 17 February. 2016, <http://www.pnas.org/content/102/23/8245.full >.

Tsaggari,K. Karetsos, G. & Proutsos,N. 2011, Wildfires of Peloponnese 1983-1985, Alphabeta, Athens. (In Greek).

WWF. 2008, "*A sustainable future for the forests of Europe - Proposal for substantial improvement of forest protection system against fires*", WWF Hellas, Athens (In Greek).

Zeder, M. 2008. Domestication and early agriculture in the Mediterranean Basin: Origins, diffusion and impact. *PNAS,* viewed 17 February 2016, <http://anthropology.si.edu/archaeobio/images/zeder_2008_pnas.pdf >.