Traditional forest management in Psiloritis, Crete [c. 1850 - 2011]: integrating archives, oral history and GIS

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Abstract

The research scope of this thesis focused on traditional forest management practices in eastern Psiloritis Mountain in Crete, employing oral history, archival information and GIS. The main focus was over the end of the 19th century till present.

The useful and productive forest of the past, extensively exploited by local populations, is often considered nowadays as unproductive and thus neglected by modern society.

Historical and social incidences influenced the behaviour of local population towards natural resources and their interaction with their natural environment has changed over time. Therefore, different traditional management practices were applied locally in the past and recorded in this thesis.

A unique forest landscape was evolved based on a complex system of interactions among the trees with animals and the human population that were dependent on the forest.

The use of GIS helped unveil a wealth of information further elucidating archival material and explain better different geographical phenomena.

Several management practices of the past contributed for the creation of a rich biodiversity and cultural elements helped shape the forest landscape of Psiloritis. The importance of this traditional management was highlighted with regard to the conservation of the forest today. In this way the thesis shows that forest history can help modern forestry to establish a more effective management of the forests for the benefit both of the environment and the society.

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Abbreviations

E.E.A.: European Environmental Agency

E.G.N.: European Geopark Network

E.H.: Environmental History

E.S.E.H.: European Society for Environmental History

EC: European Commission

EU: European Union

F.H.S.: Forest History Society

F.R.I.: Forest Research Institute

GIS: Geographical Information Systems

H.F.D.: Heraklion Forest Direction

H.M.G.S.: Hellenic Military Geographical Service

I.U.F.R.O.: Union of Forestry Research Organisations

M.E.E.C.C.: Ministry of Environment Energy and Climatic Change

M.R.D.F.: Ministry of Rural Development and Food

N.S.S.G.: National Statistical Service of Greece

NTFPs: Non Timber Forest Products

WWII: Second World War

Chapter 1: Introduction

One of the most important elements in Mediterranean islands is their eco-diversity. Long term human influence has resulted in an agro-silvo-pastoral landscape (Papanastasis 2004) and 'political' landscape, 'reflecting cultural, ecological and economic factors in the political agenda' (Naveh 2008, p.ix). In order to maintain Mediterranean Island landscapes within fragile mountainous areas, a holistic approach is needed. There is a need to understand the traditional management practices that were applied. Traditional management practices generally include: controlled grazing, burning, and wood cutting, (Moreno et al. 1993, Papanastasis 2004) and several researchers have suggested that conservation should focus on maintaining a diverse landscape rather than mono-cultivation (Naveh 2008, Papanastasis 2004, Rackham and Moody 1996).

In forest history it is crucial to recognise traditional practices and correlate them with human interactions with their natural environment from both an historical and ecological perspective. The past can help to understand the present and to predict how the future of woodland will evolve. In forest management, it is essential to know how management will influence the forest of the future as this is not only connected with timber production but also with wildlife, eco-biodiversity, and cultural and landscape values (Chatzistathis and Ispikoudis 1995, Vogiatzakis et al. 2007).

Despite considerable research in Crete information regarding forests and their management is rare. The lack of management knowledge in terms of the history of forests in Crete has helped to lead to an absence of forest management by the contemporary Forest Commission. This has led to the forests being used only as pastureland and they are generally characterised as 'unproductive'.

The research of this thesis was conducted in the eastern Psiloritis (Ψηλορείτης) in Crete (Figure 1.1). The Mountain is also called Idi or Idha, derived from its ancient Greek name, but in contemporary Crete it is called Psiloritis, derived from the Greek word 'psilos' meaning high. The mountain range of Psiloritis includes five high summits, with one of them being the highest in the island of Crete (Timios Stavros, 2 456 m). The name of this summit relates to the church that is built there in the architectural style of shepherds' settlements in the mountains of Crete. The existence of that

church on the highest summit is mentioned by Melena (1892), an Anglo-German woman who moved to Crete in 1865 and wrote about her travel experiences.

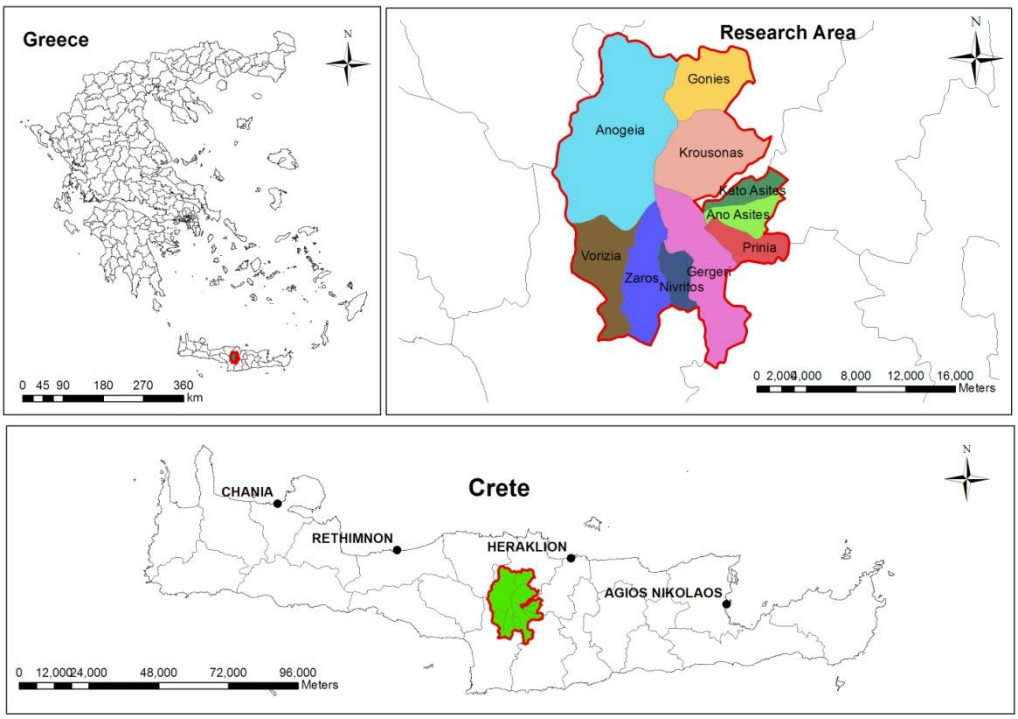


Figure 1.1: The research area in eastern Psiloritis Mountain.

Source: Map drawn by the author using ArcGIS

A diversity of forest ecosystems can be found in the area today, largely as a result of different physical conditions and different human activities over time. However, in the Mediterranean region and particularly on the island of Crete, the lifestyle has dramatically changed over the last ninety years. This period has been characterised by rapid transformation connected with intensive mono-cultivation agricultural practices, increased animal husbandry, mass touristic development and migration from rural to urban areas (Papanastasis 2004, Rackham and Moody 1996, Vogiatzakis and Rackham 2007). Hence contemporary Crete is characterized by a modified landscape, more homogenized and alien to the traditional elements of Cretan landscape features. Landscape diversity has been replaced by mono-cultivation of olives and the introduction of greenhouses together with large scale modern hotels close to the sea. All these changes have been associated with a decrease of landscape value and biodiversity (Vogiatzakis et al. 2007).

The Forest Commission largely focuses on the protection of forests and some small scale works when public funds are available. Contemporary forest infrastructural development is limited to forest road construction and some narrow strips of plantations, mainly with conifers. There is also a great concern to conserve endemic species or ancient trees and several areas are under legal protection and have been designated as 'natural monuments' (see glossary). In the Heraklion prefecture this includes endemic orchids, oak trees and plane trees (Table 1.1).

In addition, the majority of the forests in Crete fall within a NATURA 2000 (see glossary) site. This includes Psiloritis, thus this area is of great importance at the European level, in terms of biodiversity, ecological and cultural elements (Table 1.2). The area of Psiloritis has also been recently included in the European Geopark Network (see glossary) that was established in 2000 (EGN 2011) for its geological values. Moreover, the new Greek forest law, introduced in 2003 suggests that 'for the management of forests and forested areas provision should be made for the conservation of all the levels of biodiversity (genetic, species, ecosystems and landscape)' (Hellenic Republic 2003, p.5182).

Title	Year
The evergreen plane tree in Festos, Crete	1977
The oak tree in Corfes village, Heraklion	1980
The Cretan Cephalanthera in Kamares village, Heraklion	1985

Table 1.1: Natural monuments in Heraklion Prefecture.

Source: Table drawn by the author, based on archival information of H.F.D. (HFDA12)

Over the last thirty years in the UK and other European countries, the concept of ancient woodland has become a key concern in forest management and nature conservation (Howard et al. 2002, Watkins and Kirby 1998), and is connected with the forest history knowledge of an area. However, this trend has not yet been a concern in Greece. The ancient nature of Greek forests remains a mystery and there is a gap in terms of how to manage this quite new concept. Furthermore, new trends in forestry have focused not only on wood and timber production, but 'the

concept of sustainable forest management has been broadened to include economic, environmental, social and cultural dimensions' (Castañeda 2000, p.34).

Code	Name	Area (ha)
GR 4310002	Yiouchtas Gorge of Agia Eirini	716
GR4310003	Island of Dia	1.337
GR4310004	West Asterousia	2.922
GR4310005	Asterousia	16.173
GR4310006	Mount Dikti	3.939
GR 4330002	Mount Kedros	4.500
GR 4330003	Gorge of Kourtaliotis	3.425
GR 4330004	Prasiano Gorge, Patsos, coast of Rethymnon	14.500
GR 4330005	Idi Mountain (Psiloritis)	44.800

Table 1.2: The areas Heraklion and Rethymnon Prefectures that are designated as NATURA 2000 site.

Source: (M.E.C.C. 2011a)

The main goal of this research is to explore traditional management practices in the forests of eastern Psiloritis Mountain at a local spatial scale using GIS and by exploring the role that humans played in shaping them. It is intended that the results will be integrated into modern forestry management and could influence the type of management that should be encouraged in Crete today.

My background as a forester, employed since 2002 in H.F.D., inspired me in relation to this lack of management in Cretan forests, particularly in the context of the new conservation targets set within NATURA 2000 sites. Being a forester gave me the opportunity to be familiar with the area and the local population of eastern Psiloritis.

However, elements that you have learned during your undergraduate studies are often driving your decisions and the view of other people's opinions in relation to forestry topics, regarding the fact that you are considered an expert on the field (Johnston et al. 2000). In addition, Takacs (2003, p.27) states that:

> few things are more difficult than to see outside the bounds of your own perspective – to be able to identify assumptions that you take as universal truths but, which, instead, have been crafted by your own unique identity and experiences in the world.

The findings though, that came out during the research and especially the fact that local people have a connection with the Mountain and the forests of the area made me carefully listen to what they had to say.

The thesis examines the forest history of the area from the end of 19th century up to present and the interactions of local people with their forest resources and their continuity and presence in the area. In order to address the above goals, a multi-method research approach has been carried out in the area of eastern Psiloritis that includes archival research, oral history, field observation, and GIS analysis.

The rediscovery of this 'lost' knowledge could help us to understand better the current forest and it will help to make better decisions in forest policy in Crete in the future. This research will hopefully be used as a case study-example and the methods and approaches applied to other forested areas of Crete and the Mediterranean islands generally.

Chapter 2: Literature review

2.1 Introduction

Forest history is a key approach for studying the environment. Historical ecology, environmental history, climate history, forest history and so forth, are all histories of the earth, of the environment we all live in. Thus, they are referring to research concerning interactions of humans with earth surface (Horden and Purcell 2000). The only difference from physical science is that it is adding an historical perspective in order to understand current situations and try to explain phenomena that probably cannot be explained with only the study of environmental and physical data. Saratsi (2003, p.78) argues that the 'past and present should be studied in parallel so that one can inform and elucidate the other'.

Therefore, research into forest history is a complex problem, as it contains a variety of different methods and approaches, requires interdisciplinary collaboration (Watkins and Kirby 1998) and most importantly the lack of evidence and data in an area can be a very common problem.

The formal website of Forest History Society (F.H.S.) supports that their 'core mission is to promote the study of the history of human interaction with the environment' (F.H.S. 2010, p.1). In other words forest history 'links the past to the future by identifying, collecting, preserving, interpreting, and disseminating information on the history of interactions between people, forests, and their related resources - timber, water, soil, forage, fish and wildlife, recreation, and scenic or spiritual values' (F.H.S. 2009, p.1).

2.2 How forest history starts

Forest history research can be dated back to 14th (Pietro de Crescenzi) and 18th (Friedrich Stisser) century publications in Italy and Germany respectively, and Agnoletti (2000, p.2) mentions that 'forest history was always treated together with hunting history or as an introduction to other subjects'. However, forestry as a holistic discipline contains not only timber production but also wildlife management and it is normal to be studied in parallel with other topics.

In 1664 John Evelyn published in England the book 'Silva' and he highlighted the negative results of overexploitation of forests (Chinard 1945), and the 'needs for future generations for continued use of these

resources' (Wiersum 1995, p.322). Thus, forestry had emerged from historical incidences that resulted in timber shortage and the need to sustain natural resources for future generations. As early as the 18th century A.D. in German forestry, the term sustainability 'Nachhaltigkeitsprinzip' had already been used (Wiersum 1995).

Furthermore, several modern disciplines such as historical ecology and environmental history have their roots in the study of woodland history or actually started from a forest focused research. Watkins and Kirby (1998) mentioned that historical ecology has only recently been considered a distinct discipline and is connected with the history of woodland.

In Greek scholarship, several publications contain forest history elements (Table 2.1) and even information from ancient philosophers regarding forests could be seen as preliminary forest history approaches. For example, Homer wrote about forest fires and the impacts of numbers of goats grazing in forests, and Aristotle mentioned good productive forests in west Crete and Macedonia (Zagas 2007).

Undoubtedly, what actually brought a new methodology to the study of forests was the publication of 1976 of the book: 'Trees and Woodland in the British Landscape' by Oliver Rackham (1976). It introduced a new approach to study forest history, by integrating ecological and historical information in order to understand landscape and forest changes. However, despite the recognition of this new approach that includes human interaction with the forest, scientists still focus their research on 'climate and soil as the main factors affecting vegetation changes' (Agnoletti 2000, p.5).

Although in Great Britain and Northern Europe historical ecology 'has been consolidated during the 1970s as part of studies for environmental conservation' (Moreno and Montanari 2008, p.31), in other places, for example in Italy, it has been integrated into geographical and historical studies since the 1980s.

Furthermore, it should be mentioned that in an international level, 'the foundation of a research group of the International Union of Forestry Research Organisations (I.U.F.R.O.) dedicated to forest history' in 1963 (Agnoletti 2000, p.4) was an important step for more global collaboration on this issue. In addition, the foundation of societies such as the F.H.S. in 1946 in the US with a focus in the Americas, and the European Society for Environmental History (E.S.E.H.) in 1999, have promoted the significance of forest history in current academic research.

In addition, scholarly journals dedicated to environmental history include forest history publications that help new knowledge to be distributed and increase the interest in forest history research. The two main Environmental History journals are: the US based Environmental History Journal edited by Nancy Langston (EH 2011) and the UK based Environment and History Journal that was edited by Georgina Endfield and now by Stephen Mosley (WHP 2011). More recently (2008) another Journal of History and Natural and Social Sciences, based in Italy, the Global Environment, edited by Mauro Agnoletti and Gabriella Corona has been published (GE 2007, ESEH 2009).

Author	Title	Year
Kontos, P	Greek Forest history	1929
Kontos, P.	Forest policy in Greece: contemporary forest issues with elements of agricultural policy	1929
Kiriakos G.	Forest policy formerly and now	1939
Grispos, P.	Forest history of contemporary Greece	1973
Papastavrou, A. and Makris, K.I.	Forest policy	1985
Gerasimidis, A.	History of Forest vegetation	2001

Table 2.1: Publications in Greek literature regarding forest history and forest policy.

Source: Table drawn by the author.

2.3 Research in forest history

A clear methodological approach to forest history has not yet been established. Different approaches in the methodology (Watkins 1998, Agnoletti 2000) are a result of variations between different parts of the world and the diverse researchers' backgrounds. In the IUFRO 3 publication, *Methods and approaches in forest history,* several methodologies are mentioned and analysed. Agnoletti (2000, p.1) considers the different 'perspectives from anthropology, botany, ecology, economic history, genetics, geography, forestry and history' and emphasises that there are 'different methods but also a diverse cultural approach to the matter of human/forest relationships'. Even the concept of 'forest' itself is a very complex and ambiguous topic, thus adding more fuzziness to forest history research.

In addition, forest history deals with human interactions with the environment, thus 'encompassing humans and nature as a total

phenomenon' (Agnoletti 2000, p.6). As a consequence, the use of different methodologies is essential in order to have a more objective and accurate outcome in your research.

Forest and woodland vegetation are characterised by their dynamic, large scale and long term processes (Watkins and Kirby 1998) which can be difficult to study with conventional methods. Even the fast growing poplar hybrid plantations have a harvesting time of 15 – 20 years (Panetsos 1989), while a coniferous forest needs almost 80 years of growth for timber production (Ntafis 1990). In addition to this slow growth, human and animal interactions make the study of forest ecosystems even more complex (Watkins 1998).

Moreover there are important connections between forest history and other environmental historical studies, such as: landscape history, historical ecology and rural geography. Methodologies applied in these fields can be also very useful in forest history research.

Several methodologies have been used in forest history studies, depending on the purpose of the study. For example, pollen analysis is able to give information for 'the longest time frame' (Watkins and Kirby 1998, p.x), while written sources can cover the historical era, and both of these two methods are 'supplemented by photographs, oral records and direct observation' (Watkins and Kirby 1998, p.xi). On the other hand another method, Dendrochronology, has mainly been used in reconstructing past climates, and has proved to be useful in studies regarding conservation of ancient forests (Ranius et al. 2009, Watkins et al. 2004).

For example pollen data along with archaeological data and micro-charcoal analysis were used to investigate woodland history and leaf fodder production in the Ligurian Apennines in Italy (Cevasco and Molinari 2009). In Greece, Gerasimidis (2009) investigated palynological evidence to explain human influence in the evolutionary process of the main vegetation zones of the country.

Guidi and Piusi (1993) in their study in the Prealps of Friuli in Italy, used a variety of sources, such as oral history, geological data, field observation, and current forest distribution and concluded that 'vegetation dynamics and the characteristics of the new forest landscape are partially determined by past rural activity' (Guidi and Piussi 1993, p.67). On the other hand Saratsi (2003) used oral history to evaluate the landscape values and to discover past management practices that affected them in an

area of northern Greece. In the same research, archives were used to examine influences of the law and the ethics of local people on the landscape.

Di Martino (1993) drew on censuses, statistics, cadastral sources and the national forest inventory to analyze the forest history of Molise in Italy and to explain deforestation and natural regeneration of the forests. He concluded that using these sources involved several problems regarding their reliability and the compatibility of the records during the different periods. In order to eliminate these disadvantages as far as possible, he:

> analysed and compared data of different periods for every single commune in terms of percentage of the total land area; by grouping municipal data district by district and by using the oldest boundaries of the region as the reference area (p.70).

Another approach used by Moreno et al. (1993) in an mountainous area of North Italy in Liguria, combines dated photographs from the State Forestry Administration 'in conjunction with historical documents and ethnographical, archaeological and botanical evidence' (Moreno et al. 1993, p.94). All these sources were used to identify historical and traditional land-management practices. However, problems regarding the different use of terms in geographical, legal and agricultural terminology for land-use types during different eras require careful evaluation.

On the one hand, Speck (1998, p.81), used an interdisciplinary approach within historical geography, soil science, and paleoecology to study the 'interactions between humans and woodland in prehistoric and medieval Drenthe' in Netherlands. On the other hand, Marañón and Ojeda (1998) used physical data and analysis and integrated these approaches with specific historical events in order to explain the forest characteristics of an area of Southern Spain, near the Strait of Gibraltar.

Bohan (1998) used historical literature, biological surveys in the forest, and topographical features for woodland history, combining field data, cartography and history, in order to describe the forest history of Manx woodland in the Isle of Man. Barker (1998) used local history, pollen analysis and present vegetation status to reconstruct the history of the Coniston woodlands in Cumbria in the UK.

For the UK, relevant archives can be grouped at several sectors, public or private and cover different time periods. These can include tithe maps, legal documents court rolls or place names (Rackham 2006, Watkins

1998). There are different elements hidden in these sources and a researcher should be aware of their reliability.

Often vegetation studies are focused on current:

> relationships between existing structures and living communities (animals, plants) and environmental factors that determined them. A similar goal is pursued by the historical-environmental approach, with the difference that in this case in the foreground there are economic and social factors that govern human communities and relationships between these and environment resources, rather than the environmental «natural» ones. It is clear that one and the other acted as a crucial cause and it is therefore also clear that neglecting that for the benefit of other interpretations can lead away from reality (Moreno and Montanari 2008, p.33).

Furthermore, Di Pasquale et al. (2004, p.13) supports the suggestion that 'studies of vegetation dynamics in Mediterranean countries, as driven by anthropogenic factors, are usually vegetation histories, with the complex interactions of man and vegetation rarely studied', and argued that the 'use of biomass is the most important factor in the relationship between man and forest in the Mediterranean over the last eight millennia, from the Neolithic Age until the first half of the twentieth century' (Di Pasquale et al. 2004, p.13) (Figure 2.1).

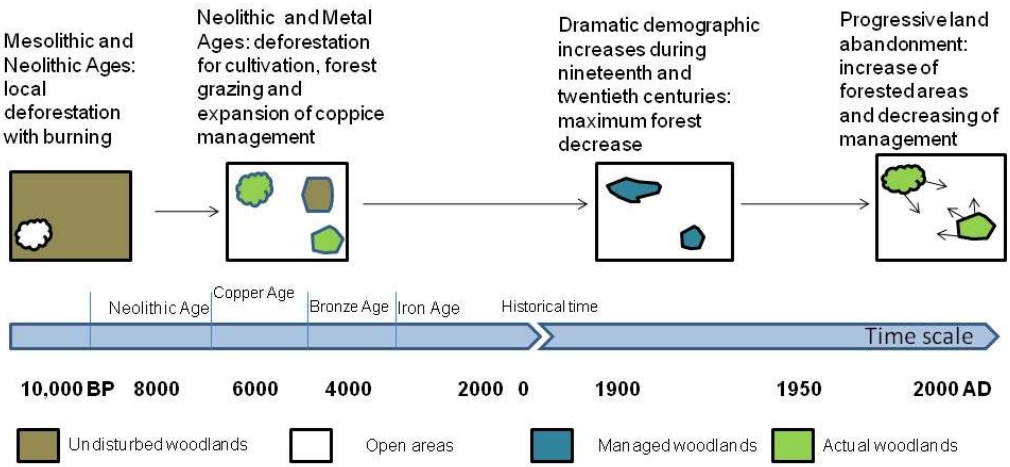


Figure 2.1: 'A generalised history and landscape dynamics in the Mediterranean Basin' (Di Pasquale et al. 2004, p.14).

Source: diagram re-drawn by the author, taken from Di Pasquale et al. (2004, p. 14)

The study of the complexity of anthropogenic influences on vegetation and forests, suggests that the use only of single sources is diminishing and the use of multiple sources provides 'a more reliable picture of the process described' (Agnoletti 2000, p.16). In forest history research it is important

to be able to fill potential gaps or evaluate contradictory results and most importantly to have alternative methods when no data are actually available. The use of multiple techniques and sources is probably the only solution when dealing with these limitations of forest history research.

2.4 Written sources

In order to reconstruct the past environment of an area, any information that is available in written sources should be examined. As Russell (Russell 1997, p.19) states:

> travellers write diaries and letters describing the new lands they visit. Farmers and others keep track of their daily activities in diaries. Governments collect statistics about the land they govern. All of these and more constitute evidence for reconstructing the past environment and the human actions and attitudes that affected it.

The information that can be collected from these documents can be either primary or secondary. On the one hand, information of direct observations of a traveller or data collected for administrative works can be considered to be primary. On the other hand, information based on other sources such as descriptions of a place from a writer, based on others knowledge, should be considered secondary sources. Although, scientific articles can be considered primary, review articles are mainly secondary sources because they 'summarize and synthesize the work of others' (Russell 1997, p.22).

Generally, primary sources are more valuable as they contain original information, which a researcher can rely on for her specific research project (Russell 1997). Secondary sources may also be valuable, though consideration should be applied according to the scope of the authors in the use of the original sources and their results.

In forest and environmental history research, 'historical sources are increasingly being used as a media for reconstructing histories in many parts of the world' (Endfield and O'Hara 1999, p.384). These sources are a key tool for historians and they are often aware of their reliability. However, when researchers with different backgrounds study them and they are not informed or cannot detect potential bias or limitations on their context, erroneous interpretations can be drawn (Stewart 2009). Written sources do not always tell the true facts but can be a source of information which includes bias and these biases need to be considered. As Ernst (2000, p.30) notes:

> sources are written documents that come from the past. Sources tend to lie. And even if they do not lie sources can tell only part of the story. Our ancestors wrote them from a certain perspective with a certain purpose. They perceived reality in the light of their specific view and purposes.

Thus, often only a part of the scientific truth is included in sources and history can be only partially reconstructed from such evidence (Radkau 1996).

In history, two methods are used to evaluate sources. The first has to do with the sources themselves. Hence, the origins of the sources and information regarding the people that collected them, their motives, to whom the data were allocated, are critically important. The second is to contrast different kind of documents. For example, in research of preindustrial Germany 'by contrasting laws and descriptions with financial documents, maps and statistics we gain new insights into the development of forests and into the question of wood scarcity' (Ernst 2000, p.30).

This element of bias in official documents is apparent also in modern society. Official documents may not include the whole truth; for example, in Greece, information regarding afforestation and probably a failed plantation in an area, probably would be connected with weather conditions and not attributed to the wrong site selection or a failure to plant in the correct season. Officially the documents will state: failure due to extreme environmental dryness, although that was not the real reason for the plantation's lack of success (HFDA9, HFDD43).

Other problems are related to forest history, such as definitions of 'forest', 'forested lands', 'pasture' or 'woodland'. Such terms can be inherently vague (Longley et al. 2005) and a clear definition does not exist even today because forests are dynamic ecosystems with no clear boundaries (Couclelis 2003). The concept of forest may vary from place to place. This element of ambiguity has probably existed in the past and the research should take this into account, especially when we are studying documents and comparing present data with past information such as maps or forest law.

In forest history, a combination of sources and data along with written sources tends to be used to formulate the story. However, several studies have been based on written sources, especially when they wanted to study only the historical, political or economic context of an area without connecting it with the present picture. Some examples included the study of forest culture of 18th century and 19th century in Tuscany (Nanni, 2000),

the first views of the Amazon from the perspective of different observers (Sedrez, 2000) and the economic – historical study of the exploitation of Russian forests between 1890 and 1914 (Björklund, 2000). It is suggested that this approach is more important concerning the historical value of a study, but lacks the ability to connect the present with the past, and hence lacks the potential to be applied to contemporary forestry.

2.5 Pollen analysis

Pollen analysis is 'one of the most classical techniques in palaeoecology' (Agnoletti 2000, p.15). It can help us form a picture of the distribution of forests, their synthesis, what species dominated an area and can help to detect 'long-term vegetation changes in all Europe' (Agnoletti 2000, p.15), and more recently pollen has been used to explain the field of human nature interactions (Atherden 2000, Canavas 2009).

There are several limitations with pollen records, connected with the ability of a species for pollen production and distribution; different species can produce various amounts of pollen and with various shapes and ability of movement, this species cannot be represented in the same way in pollen records. Although the study of the distribution of a particular species, such as for example *zelkova* in Italy, can be very helpful. Studying pollen and fossil records from central Italy, Follieri et al. (1986) explained the distribution of *zelkova* and correlated its expansion or decline with climatic changes that happened in the different eras. However, at that time (1986) *zelkova* was regarded as being extinct from Italy and the only remained population in Europe for this genus was in Crete. The species though was rediscovered in 1991 in southeast Sicily (Fineschi et al. 2002, Nakagawa et al. 1998).

Furthermore, recently fine scale analysis of palynological data has helped to provide a higher resolution picture, instead of 'a broad-scale picture of regional forest changes over centuries' (Watkins and Kirby 1998, p.x, xi). Gerasimidis and Athanasiadis (1995) studied the woodland history of the Northern mountainous parts of Greece by examining pollen profiles taken from five different mountain ranges. They concluded that Northern Greek woodland history, as derived from pollen profiles, corresponds to the profiles derived from Central European sites.

However, the difficulties for pollen studies in Greece and especially for mountainous areas are numerous. Bog formation which is ideal for pollen preservation is problematic in the Greek mountains due to the frequency of

limestone bedrock and the dryness of the environment. Moreover, in Crete Rackham and Moody (1996, p.7) have mentioned that only 'four pollen cores are known, and several other sites have been sampled unsuccessfully'. All of them are in low altitudes and none of them in mountains. In addition, they argue that the study of pollen analysis in Crete is problematic and can only partially help to reconstruct the vegetation history on the island.

Despite the difficulties in coring and having successful results, a project was implemented in 1971 in the area of Aghia Galini, by Dr. Boekschoten and Prof. Dr. W. Van Zeist, and pollen were analysed by Bottema (Bottema 1980). The case study area was situated in the south coast of central Crete, in the sea level, around the mouth of the Platys River and close to the borders of Heraklion and Rethymnon prefectures. The distance from here to Psiloritis Mountain is not far. The results of this pollen record showed a primary stage with predomination of pine and later an oak extension, especially the deciduous variety. The dating of these data is traced back to more than 10,000 years BP and provides a picture of the vegetation before humans started shaping their natural environment. There are several fluctuations in arboreal vegetation, and not necessarily connected with human influence. However, this information verified that deciduous oaks were not introduced by humans, as has been suggested by other researchers previous to these documents but were a part of the native vegetation in Crete. In the core labelled Z that represents more recent years (after 5,000 BP), pollen data show a pattern that is very close to modern vegetation species distribution, suggesting that the early Minoan civilisation had a strong influence on the distribution of vegetation.

Another sample was constructed from Asi Gonia, an area in Western Crete, in an elevation of 780m. This peat bog was sampled in the early 1990s. It covers a time span of 1,500 years that represents the early Byzantine period up till present (Atherden and Hall 1994, Atherden 2000). There are several vegetation changes with a decrease in arboreal vegetation from the earlier stages till the present (Figure 2.2).

A more recent sampling took place in Chania Prefecture again in Omalos polje on the Lefka Ori Mountain, in an elevation of 1060 m above sea level. The core was dated into two samples, which were 13,600 years BP and 4,200 BP respectively and two distinctive zones were verified. The first zone (2,600-13,600) has minimal concentrations of pollen. The other zone

(2,600 till present), has arboreal pollen records and again represents oaks, both evergreen and deciduous (Ghosn et al. 2010).

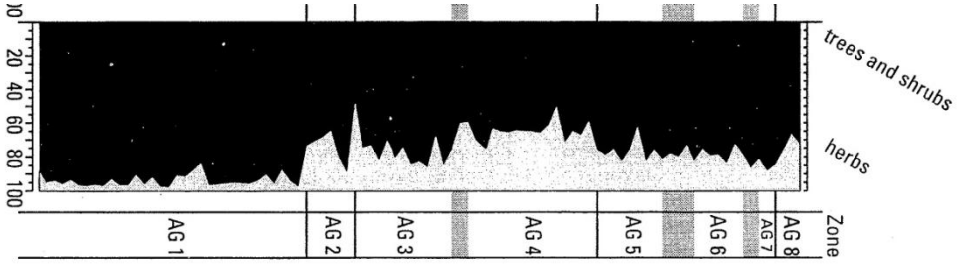


Figure 2.2: Pollen diagram for Asi Gonia, showing information for the last 1,500 years. A decrease of trees and shrubs is recorded since the second Byzantine period (1010±70 BP) (AG2) since present.

Source: (Atherden 2000, p.69)

2.6 Different views of forest

What is a forest or how we can define forest is a very complex and fuzzy issue. Not only has it varied between different countries but also between different eras in the same state. An ecological definition of a forest could be different from a legal definition, however recently the Greek constitution (2008) adapted the definition as it was defined by Greek forest ecologists and it is:

> by forest or forest ecosystem is meant the organic whole of wild plants with woody trunk on the necessary area of ground which, together with the flora and fauna co-existing there, constitute, by means of their mutual interdependence and interaction, a particular biocoenosis (forest biocoenosis) and a particular natural environment (forest-derived). A forest expanse exists when the wild woody vegetation, either high or shrubbery, is sparse (Hellenic Parliament 2008, p.43).

However, despite the definition of forest in the Greek state constitution, there are differences between the laws based on different forest canopy percentages and the forest concept is still a vague issue in Greece. This has resulted in a conflict between government and nongovernmental organisations and it is still up to the 'superior court' to decide the correct definition for forest.

Despite the differences of the concept 'forest' or 'woodland' in legal or ecological definitions in different periods, there is also another approach of forests, depending on the background of a researcher. For example Watkins and Kirby (1998, p.xiv) suggest that 'the management of woodlands and trees is much more than just the conventional forestry training' and continue that 'it may involve pasturage, the treatment of individual trees, keeping open space here, favouring old trees there'. A

forester though, would argue that this is actually 'conventional' forestry (Ntafis 1990). In addition, Rackham (2006, p.445) argues that 'most forms of modern forestry rely on planting trees to create artificial vegetation; this is what distinguishes forestry from woodmanship', and continues 'the intention is to create a crop, independent to the natural vegetation'. This perception of forestry could be applied to 'central Europe's 'wake' theory *kielwassertheorie* based on the supposed primacy of timber' (Fabbio et al. 2003, p.73); however, this is not the case for Mediterranean countries. Even the first forest school in France, not a pure Mediterranean country, which was established in Nancy in 1824, was dedicated to Water and Forestry (Fabbio et al. 2003) not forestry per se.

Furthermore, in the School of Forestry and Natural Environment, in Aristotle University of Thessaloniki, a forester is taught that in forest management, timber production is never the goal and you do not deal with 'crops' but with natural ecosystems. Timber is always a secondary element in forest conservation that can be the vehicle to meet your different management targets (Ntafis 1990). Certainly, there is a lack of knowledge in integrating traditional management practices, especially at the micro scale level; however, several traditional management practices have been adopted in Modern Greek forestry, such as coppicing, which are still being applied in forests today (Ntafis 1990).

The definition of 'modern' is also ambiguous. Some forest research mentions the need to avoid mono-cultivation in forests, even plantations, and supports sustainable management, a crucial element in forestry from its initial development (Chatzistathis and Ispikoudis, 1995). Actually foresters were the first to mention the problem of overexploitation and supported the idea that forests should be managed as multipurpose elements for future human generations (Papastavros and Makris 1986, Wiersum, 1995).

On one hand, a historian or a social scientist could see the forest as the element for human development, as capital for progress and probably would regard wood cutting as a disaster for the forest (Rackham 2006) or even never focus on the forest itself. On the other hand, a biologist might be interested only in the concept of biodiversity and, for example, emphasise the fact that conifer forests are not species-rich places and thus argues that a forest habitat is not so positive in environmental management and would not benefit from conservation measures, disregarding other important values of a forest (Maestre and Cortina

2004). Such a negative approach to forestry is connected with a tactic of extensive plantations in the past, destroying natural vegetation and wildlife of a place. This made forests an easy to manage element just for timber production or hunting (Rackham 2006, Worster 1994). All these negative assumptions of forestry can lead to an underestimation of the real value of the forest concept and forest science of the past.

Another difficulty when describing forests, connected again with the different views in recent research is the degree of 'naturalness'. Terms such as 'natural', 'semi-natural', 'ancient', 'old growth' or 'virgin', are often ambiguous and several researchers have tried to define these terms, with more or less common definitions (Butler et al. 2001, Rose 1992). Forest history is connected with these terms, and often the history of a forest can define the degree of old growth. There is a big debate especially among human geographers over what is natural and if nature actually exists (Castree 2000, Williams 1983, Peterken 1996). In addition, there are different interpretations of Nature. For example the word for *natural* in Greek is also the word for *physical*, containing other meanings, probably adding even more ambiguity to the term.

2.7 Ancient forest

Goldberg et al. (2007, p.110), argue that 'the concept of ancient woodland can be traced back to at least the 19th century'; however, it has only recently been a scientific concern (Peterken 1977, Rackham 1976). During the last thirty years the importance of ancient trees and woodlands in biodiversity, ecology, nature conservation, landscape ecology and forestry has been finally recognized (Howard et al. 2002, Rackham 2001).

Ancient trees are now considered to represent aspects of continuity in history with a direct ancestry dating back to the original primitive wildwood of Europe (Vera 2000). Moreover, their value for identifying old growth forests is essential. They are the most critical indicator for the existence of old growth deciduous forests, maintaining an important habitat rich in biodiversity especially in fungi, entomology and lichen (Butler et al. 2001).

Furthermore, the existence of ancient trees in an area is responsible for the increase in its interest. For example, the wood-pasture ecosystems in Great Britain have only recently achieved a significant interest due to the survival of veteran trees in these habitats (Goldberg et al. 2007, Kirby et al. 1995, Read 2000).

Moreover, it is important to mention some factors responsible for the development of an ancient tree, often connected with human activities. Ancient trees are frequently a result of human management practices, such as pollarding, shredding and coppicing (Rackham 2001, Petit and Watkins 2003). Hence, the working trees we see today are a result of human needs in the past, containing important knowledge relative to tree management and cultivation. Although their importance in biodiversity and culture is invaluable, they encounter problems as a result of the discontinuity of past management practices (Butler et al. 2001, Rackham 2001).

Researchers of Cretan vegetation and landscape have been emphasising the importance of ancient trees in the landscape, archaeology and wildlife of the island. These trees represent various species (Vogiatzakis and Rackham 2007, Vogiatzakis et al. 2006, Rackham and Moody 1996); however, a clear definition for them has yet to be established. Another issue that should be also examined is whether we have to deal with ancient forests or with isolated ancient trees found sporadically in forested areas. Even the concept of ancient forest does acknowledge the existence of ancient trees, but continue existence of forest in a place for centuries (Peterken 1996). Can we conclude that this is the case for Crete or actually should we produce another concept for ancient forest? This should be examined as evidence has not yet been collected to address this problem.

Several management practices have been proposed for ancient forests especially in the UK, though management in the Mediterranean islands and especially Crete regarding this important concept has not yet been established. The existence of ancient kermes oak (*Q. coccifera*) and ampelitsia (*Zelkova abelicea*) trees in the form of 'giant pollards' has been already recognised (Vogiatzakis and Rackham 2007). However, there are no suggestions of how these trees should be managed.

The concept of the 'ancientness' of Cretan forests has not been integrated into current research as most research has been concentrated more on other elements of the landscape. Further study is needed regarding forests and how contemporary forestry approaches should manage them. All these elements should be of concern for foresters, regarding values such as biodiversity, landscape ecology and stability for the conservation of forests in Crete.

Other definitions such as semi-natural, avoiding the term natural that is related to virgin (Peterken 1996), used in an antithesis to afforestations,

are ambiguous and it is very difficult to say what is semi-natural or not, as woodlands are actually dynamic ecosystems with a variety of formations even in the same area (Ntafis 1990). Although, there are no actually *natural* forests, the term can be used to describe woodland that is a result of a natural process. In contrast, a *virgin* forest is a woodland 'which has never been significantly influenced by people' (Peterken 1996, p.16). In Greece the majority of the forests are a result of a natural process, containing native species and definitely influenced by human actions. Hence, the term used in Greek to describe them and distinguish them from plantations is *physical*.

Moreover, in Greece the majority of the land that is not cultivated with some exceptions, is regarded as communal and is under forest legacy. The Forest Service is responsible for the conservation and management of these areas that generally are considered as public lands. There is a big gap in current research concerning these areas that are often of high conservation importance, because researchers do not include this fact in their studies. As a result their outcomes cannot be integrated by foresters and often this knowledge cannot be applied to contemporary forest management. For example, the suggestions for avoiding mono-cultivation and to continue firewood collection from phryganic areas (Papanastasis 2004), or continuing 'grazing and occupational burning as essential to maintain the Cretan landscape' (Rackham and Moody 1996, p.210) lack spatial and temporal elements of management. A forester does not know that these suggestions actually are important in woodland management as this is not clear in their research or these results might never come in fact across their knowledge. In addition, there is not a proposed practical guide to where, when and how to apply these measurements.

In recent decades logging, along with other forestry management, has been abandoned in Crete (Rackham and Moody 1996). Consequently there is a gap in management of the forests and actually no management is practiced anymore. Furthermore, the absence of a historical ecological approach in the management of forests in Crete, has led to a gap of natural conservation especially given the majority of forested areas are within a NATURA 2000 network.

2.8 Traditional management

The forests of Crete have no clear boundaries and edges, and can vary from dense to open forests and wood-pastures, or savannah to maquis

(Zohary and Orshan 1965, Rackham and Moody 1996). The various micro-climatic conditions and probably the different human management practices even in neighbouring villages have led to this considerable differentiation. It is important to define these practices, integrate and evaluate them in current scientific knowledge and apply them to contemporary forestry. The lack of management in Mediterranean forests often leads to degradation, loss of biodiversity and increases forest fires (Papanastasis 2004). These forests have actually co-evolved with humans for thousands of years and the need to continue traditional management practices is important for their conservation. There is an emerging need to define these practices before local people forget about this completely, as modern practices take place in the area and actually traditional forestry is no longer practiced. The term 'woodmanship', is used from Rackham to describe and distinguish conventional forestry from 'traditional' forestry (Rackham 2006).

In the UK even since the 1980s only ancient British woodlands of two hectares or more have been analysed and evaluated. This concept helped to transform conventional forestry practices in ancient woods. Similar approaches have been adapted in Europe and the United States. These examples from different parts of the world can be a guide of how to manage ancient forests in Crete. However, 'the policies adapted in the UK with its paucity of woods may not be directly applicable to France or Germany, but there are may be some useful lessons and vice versa' (Watkins and Kirby 1998, p.xiv).

Moreover, in Greece there is a gap regarding this traditional knowledge and this has resulted in problems and a lack of continuity in current forest management. For example in Northern Greece in Pindos, several traditional practices that today have been abandoned were responsible for the conservation of a cultural landscape which is also rich in biodiversity (Saratsi 2003), and Halstead (1998, p.232) argues that:

> along with grazing, burning, logging and cultivation, leaf-foddering must be regarded as one of the major cultural forces which has shaped the recent landscape, and especially vegetation, of the Plikari area and of the Pindos mountain in general.

The importance of recognising the 'long term and large scale dynamics of woodland vegetation and associated animal communities, and their interaction with people', (Watkins and Kirby 1998, p.x) is essential in woodland ecology, and thus too in forestry. However, despite the fact that

in 'conventional' forestry woodland dynamics both in a temporal and spatial scale are of great importance, there is a gap in knowledge of human presence and their interactions with the forest. Often traditional practices in Greece are neglected by foresters or are even unknown to them.

Recently, rural policies in Europe have focused on landscape conservation. Fish et al (2003, p.40) state that there is a need 'to consider the values, knowledges, and practices of land managers, including farmers' in conservation practices and policies. Forest management should also integrate upland population knowledge, past and current, and evaluate it for the benefits both of the forest ecosystems and the society. In Greece often the human dimension within forestry is disregarded in the sense of human involvement in traditional management. However, it is now recognised that 'indigenous groups offer alternative knowledge and perspectives based on their own locally developed practices of resource use' (Berkes et al. 2000, p.1251), thus Greek forestry could be illuminated by such information. Rackham and Moody noticed that (1996, p.210) 'traditional Crete has much to tell the rest of the world about living in harmony with the landscape', and it is important to recognise and evaluate this wisdom of Cretans related to their natural environment management.

2.9 Change or no change

Over recent decades there has been considerable debate and several million Euros have been spent on research of ecosystem monitoring and land cover change. It seems that people resist change and are inherently conventional or afraid of the new stages that they have to face. One of the main programmes funded from EU was the CORINE. This programme started in 1985 and tried to check land cover changes and to monitor ecosystems and natural heritage at the European level (EEA 2000).

Freranec et al (2010, p.19), suggests that at the European level, 'the overall area of identified land cover changes in 24 European countries in the period 1990–2000 was around 88,000 km^2 which equals 2.5% of their total area'.

Quezel (2004) supports that there is generally an increase in forest cover over the last hundred years all over the north Mediterranean, while the south faces deforestation. Crete geographically is in the middle. Despite the general trend of northern Mediterranean countries that includes continental Greece as well, the case for Crete is different.

Rackham and Moody (1996) support the first view of a general increase of forest over the last 150 years in Crete, as a result of cultivation abandonment, reduced browsing and woodcutting.

However, other research based on census information between 1990 and 2000 for Greece suggests that Crete has very high deforestation rates and Heraklion and Rethymnon Prefectures are among the five cases in Greece with the highest values (Minetos and Polyzos 2010). These results could reflect a pressure on coastal forests that has been influenced by touristic development and urbanization. In addition, they suggest that 'deforestation moves to more remote regions as accessibility improves' (Minetos and Polyzos 2010, p.470) in Greece.

Other researchers suggest a more stable status of forest cover since 1945, when the first aerial photography is available. Arianoutsou (2001, p.167) in her research in west Crete, recorded that between 1945 and 1989 'the total area of the natural Mediterranean plant communities, that is phrygana, maquis, garrigues, other broad-leaved woodlands, *Pinus brutia* and *Cupressus sempervirens* forests, has not change significantly'. However, phryganic vegetation and maquis 'have been reduced in favour of the *Pinus brutia* and *Cupressus sempervirens* forests' (Arianoutsou 2001, p.168), and this was connected with depopulation of the upland villages over the last decades.

In central Crete and the area of Psiloritis, more recent research concerning deforestation and land cover change has been implemented. A piece of research that compared satellite imagery from 1977 till 1996, concluded that 40% of the vegetation cover in Psiloritis had been decreased, where 21% had been increased, with the majority of the degradation occurring in the central areas of the Mountain (Hostert et al. 2003). In another study in the same area, that included aerial photography from 1945 and satellite imagery (1996), thus covering a period of more than 50 years, it was concluded that forests are resistant to change. In addition, the authors concluded that there was an 'unexpected spatial heterogeneity concerning vegetation degradation levels' (Hostert et al. 2003, p.4028) and the degradation levels of forested areas are significantly less than other vegetation types of Psiloritis. In addition, in this research the result was a complex picture of degradation areas, areas with increased vegetation cover or neutral areas and there was not a clear connection with increased numbers of livestock in Psiloritis over the last decades. Papanastasis et al. (2003) concluded that in Psiloritis,

overgrazing had a negative impact on plant diversity in grasslands and in phryganic ecosystems only when it was combined with fire. Generally, woody vegetation, even phryganic, provides more resilience to overgrazing.

2.10 GIS in forest and historical research

'GIS, the acronym for **G**eographical **I**nformation **S**ystems, has been around since the 1980s' (Fotheringham and Wilson 2008, p.1). However, a clear definition for GIS does not really exist, and varies according to user needs and the applications where GIS is used. Apart from the conventional functions of data and digital map storage, visualization and spatial analysis (Couclelis 2003, Longley et al. 2005), GIS is 'also a tool for synthesis of geographic information, and therefore, for the production of applied geographical knowledge' (Couclelis 2003, p.166). Geography has been transformed from conventional cartography to digital maps (Vogiatzakis et al. 2006) and GIS has become a tool to create maps for everyday computer users.

Moreover, the ability of GIS to integrate different data sources and create new knowledge makes it an invaluable and necessary tool in different disciplines, such as ecology and history. Ecologists 'discovered a powerful tool for storing ecological data and analysing ecological processes' (Vogiatzakis et al. 2006, p.185). GIS is a key tool for environmentalists, since it can help them to integrate different complex data and can support the decision making process in an efficiently and correct way when and where it is needed (Longley et al. 2005, Salem 2003, Lee et al. 2002).

The use of GIS in historical research has only recently received significant attention (Gregory 2003, Gregory and Healey 2007), and 'emerged as a promising new approach for studying the past', although it 'is still something of a maverick method in the study of history, as yet unheard of in some quarters' (Knowles and Hillier 2008, p.xiii).

It is often connected with historical geography and recently many scientists have started to appreciate its advantages. Baker (2003, p.44) states that it is 'an exciting and challenging development' that can present historical knowledge visually, implement sophisticated analysis and study the relationships of historical data in various scales and not only at the local scale as is normal in conventional history (White 2008).

Despite the ability of GIS to create knowledge (Couclelis 2003), many historical geographers have regarded it as a tool for mapping (Gregory and

Healey 2007). On the one hand, the role of GIS in map creation is very important but it is not the main purpose or characteristic. On the other hand, GIS should be considered more as a database technology, which integrates different data types and adds a key dimension to them: spatial data. This specific feature of GIS enables it to execute queries, not only about what features the database contains but also where they are placed (Longley et al. 2005, Gregory and Healey 2007, Fotheringham and Wilson 2008). The ability to integrate different complex data in various scales enables analysis from local to regional scales, and as a result, 'we can tell more complex stories more clearly and coherent' (White 2008, p.x).

GIS has been used in several applications in the study of ecology, forestry and agriculture as well as ancient trees (Farcy et al. 2005, Longley et al. 2005). There are numerous examples of GIS use in studies related to landscape fragmentation and species distribution (Vogiatzakis et al. 2006). Frequently, ecological research has been focused either on the study of a specific species or at the habitat and ecosystem level (Brito et al. 1999, Russell et al. 1997). Axelsson (2000) in a boreal forest of Northern Sweden used GIS to combine different historical data and he was then able to identify crucial forest habitats for biodiversity. Finally, he presented a GIS model that could integrate historical data into current management plans. Furthermore, GIS integrated with GPS technology has been used in the UK for managing ancient woodland and trees and for prioritizing the areas of future conservation measurements (Goldberg et al. 2007, Smith 2000, Lee et al. 2002). This ability of GIS can help managers to reduce cost and time and focus on the areas that actually have high risk status.

In addition, in agriculture, GIS has proved particularly useful in monitoring olive tree movements in an area of Andalusia in Spain (Ramos et al. 2007) and has helped farmers and agriculturists in Hungary to make more effective farming decisions (Nemenyi et al. 2003). Moreover, GIS analysis was able to explain the differentiation in agricultural productivity in Wales in the mid-nineteenth century that was not only related to the physical characteristics of the fields but it was also influenced by human factors: the owners and the tenants of the fields (Gregory and Healey 2007). Nowadays, the use of GIS in precision agriculture is even more important, despite the fact that GIS tools still remain expensive and somewhat user unfriendly (Runquist et al. 2001).

The use of historical geography and ecology is crucial when we need to study ancient trees, forests or old growth areas. Past facts and moreover

history are essential for current and future conservation of these important locations that contain ancient characteristics. Goldberg et al. (2007, p.110) state that 'the concept of ancient woodland and the inventory have become powerful tools in conservation policy'. However, future conservation measurements have to consider some crucial elements, such as: 'the likelihood that ancient woods are primary; degrees of semi-naturalness; where does woodland end and wood-pasture begin; how small ancient woodland can be' (Goldberg et al. 2007, p.110). GIS can help to answer these questions and apply new knowledge in order to help conservationists support their decisions.

In contrast, there is criticism of historical GIS studies, mainly based on the fact 'that they are better at identifying and describing patterns than they are at explaining them' (Gregory and Healey 2007, p.650). However, even the ability to identify patterns is important as it can result in an explanation of these patterns. Moreover, Vogiatzakis et al. (2006, p.189) argue that 'understanding current species and vegetation patterns in the Mediterranean Basin requires an understanding of past human activities'. However, data that are used in GIS analysis have to be measurable and mapable. This has resulted in a gap in the use of human disturbance data in GIS analysis of vegetation and ecological studies in the Mediterranean (Vogiatzakis et al. 2006).

In forest history research the combination of different methods produces a more accurate result. The use of GIS in forest history research will add a spatial element to the sources in order to understand forest ecosystem evolution better and be able to apply current management practices spatially and temporally.

2.11 A new era in Geography

A new era in geography and GIS is a fact. Since 1998 when the inspirational speech of Al Gore for a Digital Earth took place, we have witnessed the development of Google Earth and Virtual Earth and his dream seems to have been fulfilled (Goodchild, 2008). Today the internet has become widely available, the evolution of GIS from a focused GIS specialists group has been moved to a daily common application of any internet-user. It maybe a less sophisticated use of spatial questions, but it still remains a GIS use.

Google Earth eliminates the need to study expensive satellite images as Rackham did to discover the rare and hidden forests of Crete (Rackham

and Moody 1996). Everyone can now just open an application on their pc and navigate in those secret and hidden places. Of course all these are also satellite images that are freely accessible.

On the one hand, there are still several limitations and a lot of progress is needed in order to have a global tool, used from everyday applications to specific research needs. On the other hand, scientists are now more familiar with this advent and often use Digital Earth in their research. For example Conroy et al. (2008), used GIS to export and share palaeontological data derived from the Great Divide Basin of south-western Wyoming in the US in a Google Earth application. The other users were unfamiliar with sophisticated GIS software and this application helped them to use the data in an easy and efficient way. This is only one example of new opportunities created today in sharing knowledge.

However, several other uses of web-GIS, not always connected with Google Earth, but interacting with community members, have been in range for a long time. Web-GIS has been used even in collecting specific ecological information in a data-base, or in helping citizens to participate in decision making processes, relative to environmental and landscape conservation issues (Kelly and Tuxen 2003, Schuck et al. 2005).

2.12 Current trends in Forestry

Since 1992, the NATURA 2000 network has been established in all EU member countries, and there is a need to develop a new approach to forest management. Almost all the forests and forested areas of Crete are within a NATURA site and the fact that even the new forest law in Greece demands new standards in forest works that are within NATURA areas, resulted in the need to understand and study the forest history of these places. The need to study human actions of the past that are connected with current vegetation status in the Mediterranean Basin has been recognized as particularly important by several researchers (Vogiatzakis et al. 2006, Moreno 2004, Rackham 2006, Kirby and Watkins 1998). One cannot understand the present Mediterranean ecosystems without studying their history, and thus cannot apply conservation measurements in these areas disregarding a continuity of traditional management practices applied over for centuries.

In the UK over recent decades, there has been a scientific concern with the concept of ancient woodland (Goldberg et al. 2007), and the importance of ancient trees and woodlands in biodiversity, ecology, natural

conservation, landscape ecology and forestry has been finally recognized (Howard et al. 2002, Rackham and Moody 1996). The need for forest history is obvious if we want to understand and manage these important sites. This example of management in the UK should be applied in Mediterranean ecosystems, where human actions have altered the landscape and created an 'equilibrium' between human and nature (Papanastasis 2004).

Moreno (2004, p.389) reinforces the importance of historical ecology and local history in the identification of the 'environmental aspects of the European rural heritage' that will be used for their conservation. Often European policy, applied across the whole of Europe, disregards such local elements and traditional management practices thus lose their continuity. This is often the case in forestry, where traditional management and local knowledge are neglected.

However, recent and current trends in forestry, even in central European conventional forestry, show a shift from timber production to more sustainable forest management that includes Non-Timber-Forest-Products (NTFPs) and services of forests (Siry et al. 2005). Farrell et al. (2000, p.5) concluded that, 'while sustainable management, seen as sustained yield of wood supply, has been practised in forestry for centuries modern ideas of sustainability are broader in scope, embracing all the goods and services of the forest'. The 'globally agreed criteria for sustainable forest management are: extent of forest resources, biological diversity, forest health and vitality, productive functions of forests, protective functions of forests, socio-economic benefits and needs, legal, policy and institutional framework' (Castañeda 2000, p.34).

Furthermore, over recent decades, NTFPs have attracted the attention of researchers all over the world. There are several definitions and observations in relation to NTFPs. Some of them include only non-timber products collected from forests, whereas others include a broader definition and mention Non-Timber Forest Benefits or Non-Timber Values, including forest services, such as watershed protection, carbon storage, tourism, and cultural values (Croitoru 2007). However, there were several problems when people tried to enumerate and study their economic impact on societies. Often NTFPs are used for local consumption and are not included in formal accounts and are not eligible for large scale commercialization (Pierce et al. 2003).

Croitoru (2007, p.769), defines six major categories of NTFPs for Mediterranean forests: 'firewood, cork, fodder for grazing, mushrooms, honey and other NTFPs. The last category covers a variety of fruits and plants, which are usually found in smaller amounts than the five main NTFPs'. In Greece and particularly Crete, the role of NTFPs' in forest management and the daily life of local populations is unknown. How official foresters valued these products and how important they were in the life of rural populations in the past and today has not yet been explored.

In the Mediterranean basin and especially in Crete, forest management cannot be applied as it has been in other continental European areas. Forests are not 'productive' in terms of timber, and thus cannot be managed with a main target being timber production (Scarascia-Mugnozza et al. 2000, Fabbio et al. 2003). In Greece over 40% of the forests are managed for timber (Fabbio et al. 2003) where the remaining 60% are regarded as unproductive and are generally neglected. Forests in Crete are of the second category, unproductive, and no forest management is currently applied. In order to redefine forestry in Crete there is a need to understand forest evolution and rediscover traditional management practices. There is a need to integrate past actions with modern trends of forestry that will respond to current social circumstances, in order to manage forests and gain benefits, for both society and environment.

One of the most fascinating elements of forest history is that it can be applied to contemporary forest science, regarding management and conservation of forests and not just simply as a history. In a discipline such as forestry where the decision of a manager will be seen and evaluated by future generations, historical research is a useful tool to help achieve a 'correct' management decision and not repeat mistakes of the past (Rietbergen 2001). It is easier to study the past in order to understand the present and predict the future than to conduct experiments and try to find out what the future could be like.

2.13 Conclusion

Forest history research has not yet become important in Greece or Crete. Recent works have mainly focused on the landscape elements (Rackham and Moody 1996), vegetation studies (Tsiouvaras 1987) or degradation and desertification (Lyrintzis and Papanastasis 1995, Hill et al. 1998, Hostert et al. 2003), but never on the forest and its value for Cretans.

Moreover, the use of GIS in historical and forest research is quite rare and this study will use GIS to integrate historical and ecological information.

In addition, most of the time researchers have focused on elements that are useful in their specific topic of research and their discipline but not on how all this important information can be integrated in practice, or implemented in the field. Management issues theoretically have been proposed but never from the position of someone who is responsible for their implementation. Thus this research is not only important for its epistemological findings but also practicality, in terms of implementation in current forestry in Crete.

Chapter 3: Methodology

3.1 Introduction

A key element in forest history research is the combination of different sources and methodologies. 'Forests are shaped by humans and they also affected human society, but the possibility of detecting evidence of this mutual influence is given by our ability to combine different approaches and methods' (Agnoletti 2000, p.17). The synthesis of these various techniques is important to lead to a clear picture and to understand the procedures that have taken place in the past and have shaped current forests. The available information and sources, in relation to chronology in environmental historical studies as they have been proposed by Moreno and Montanari (2008) are shown in Figure 3.1.

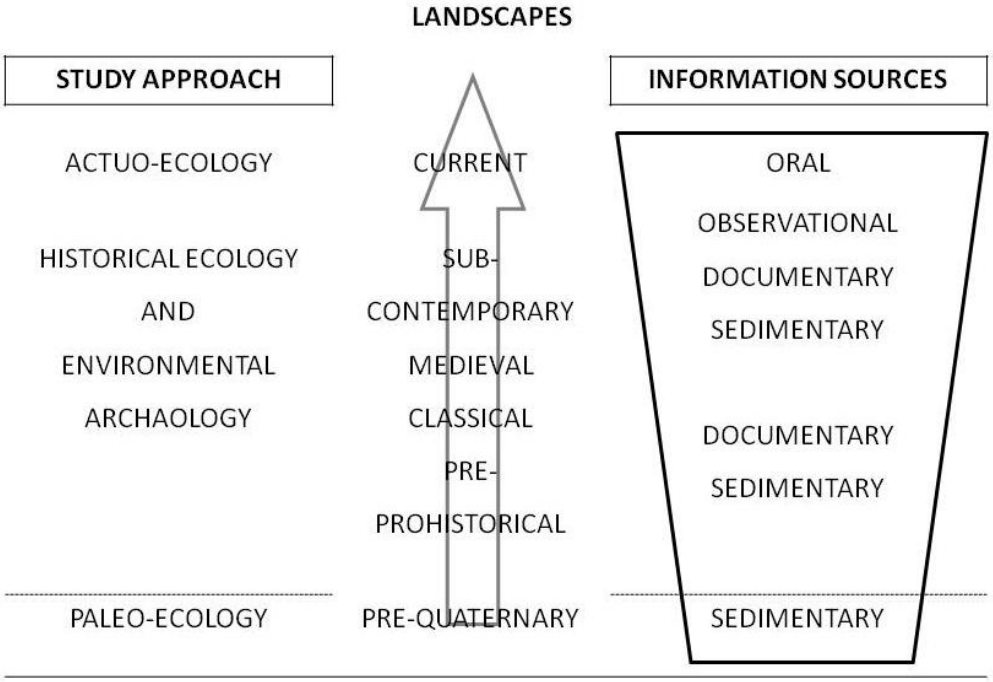


Figure 3.1: 'Scheme of the relationships within cultural landscapes, chronology, study approaches and main available sources' (Moreno and Montanari 2008, p.34)

Source: Figure redrawn by the author, taken from Moreno and Montanari (2008, p.34)

In this research the focus is to define traditional forest management practices, used by local people in the past in order to understand current forests. A deep knowledge of human interactions with their environment in Crete will inform modern forestry with new knowledge, applied in the past by local people but misunderstood or ignored by modern foresters and managers in Greece.

3.2 Issues in forest history research

There are several limitations in forest history research. Problems occur when researchers focus mainly in one of the two essential elements of the human - physical environment, without applying an equal balance between the two. The need to use different sources and methodologies requires knowledge of several techniques. Despite the fact that foresters are aware of the value of forest history they 'often lack knowledge of traditional historical sources and the skills needed to combine them with field evidence' (Agnoletti 2000, p.9). The need for knowledge to be exchanged between the different disciplines is very important in forest history (Watkins and Kirby 1998, Agnoletti 2000).

The use of written sources, that often contain bias, and can tell us only a part of the story, is very common in forest history, and the researcher should be aware of this when analysing and evaluating the reliability of the sources used (Speck 1998, Agnoletti 2000). In addition the use of various techniques and methods, despite several limitations, can be beneficial when some sources are not available in an area.

Rackham (2006) summarizes (Table 3.1) what a researcher should be aware of, in order to tell a more accurate history. It is important to combine different sources, evaluate them regarding the different spatial differentiations and avoid writing 'pseudohistory' and 'pseudoecology'.

'How to write pseudo-history	**How to write pseudo-ecology**
Do no field work	Confuse trees and other plants and animals with 'The Environment'; do not investigate their behaviour
Confine yourself to written documents	Assume that all trees behave alike
Use contemporary documents of a generalised nature	Confuse the history of the countryside with the history of country folk or of what people have said about the countryside
Use forest laws as direct evidence of what was or was not done	Copy what previous authors have said
Rely on other people's translations	Expect the history of the landscape to be simple
Pay attention to contemporary writers who had much to say for themselves	Take official statistics at face value, without reading the small print of how they were arrived at or what exactly they mean
Assume that everything presented as 'legend' or 'oral history' is what it claims to be	Never admit you don't know something'

Table 3.1: 'How you can write a pseudo-history/ecology' (Rackham, 2006, p.185-186).

Source: Rackham 2006, pp.185-186

Methodology in forest history research cannot be applied in the same way in different areas, even in the same state. Forest ecosystems are diverse and can react differently in a temporal and spatial scale to human and environmental influences. Moreover, human adaptation to environment can vary between different societies, even when they are facing similar problems. This differentiation is often connected with the cultural and social status of a society (Orlove, 2005).

3.3 Choosing the methodology

In this study, the chosen methods include both quantitative and qualitative elements. Written sources, oral history, field data collection along with the use of physical data, were integrated in GIS and were analysed. The selection of multiple methods was important to gain a better understanding of the forest history of the area and was useful in 'triangulation'. This can reduce uncertainty derived from the use of different methodologies and leads to a better understanding of the research question and more accurate conclusions (Valentine 2005). For example, interviews can be used as 'stand alone methods'; however, they are often used 'as a mean of triangulation in multi-methods research' (Longhurst 2010, p.106). Investigations of archival or secondary sources which may include bias can be cross-evaluated with oral history data and vice versa. In the present study, oral histories were useful as a means of testing written records and to evaluate field observation of the study area and vice versa. Moreover, the recall of these traditional forest management practices resulted in useful information about forest law and its influence on local communities and contemporary forests.

3.4 Selection of the study area

Psiloritis Mountain located in central Crete, was selected for this research for its natural characteristics and the cultural importance it has played in Crete and Greece. The place that Zeus was raised hidden from his father Crones is still considered the main representative element of Crete. The eastern parts of the Mountain are within Heraklion Prefecture and were studied for their forest values. In addition the area of the municipality of Anogeia, in the neighbouring Prefecture of Rethymnon was also included in this research (Figure 3.2).

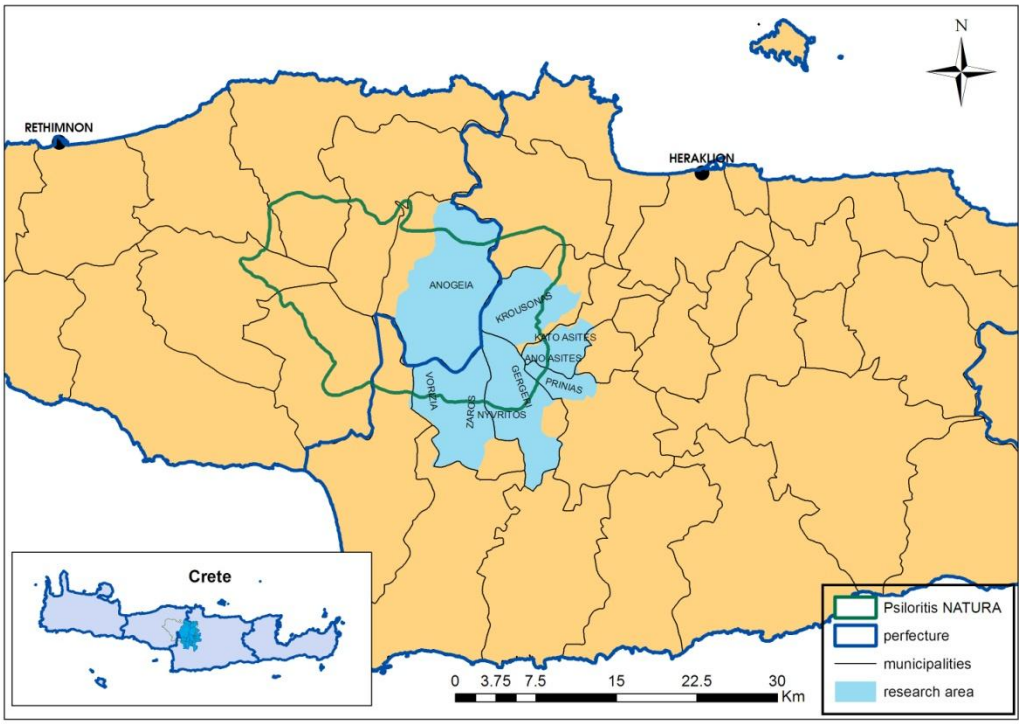


Figure 3.2: Map of Crete, with the research area.

Source: Map drawn by the author using ArcGIS

In Psiloritis one of the largest kermes oak (*Q. coccifera*) forests, the forest of Rouvas, exists and it is characterised by its uniqueness of the formation of forest for this species. The area of Psiloritis has been under human exploitation for at least 10,000 years (Lyrintzis 1996, Lyrintzis and Papanastasis 1995, Papanastasis 2004, Rackham and Moody 1996). Traditional management by local people has produced the current landscape features that will be examined at the local scale of eastern Psiloritis. The results of this study can be extended to other areas of Crete, and Greece or the Mediterranean regions that present similar environmental characteristics. Forestry can be illuminated from this traditional knowledge, where generally forests are considered unproductive and neglected (Scarascia-Mugnozza et al. 2000).

3.5 Initial contacts

My contacts with the area of Psiloritis are inherent as my descent is from one of the Psiloritis villages, Ano Asites. In addition, having studied forestry in Greece I worked in the municipality of Rouvas as a forester for a period of more than three years and later on in Heraklion Forest Direction for another seven years. Thus, I had a very good network of contacts with local people from the research area before this research was

implemented. This did help me to extend the network of contacts during the research and perform the necessary field work, interviews and archival research more efficiently. Several problems could arise from my background as a forester and being an employee in Forest Service, and subjectivity was an issue I had always to deal with.

Takacs (2003, p.29) highlights that 'only by listening to others can I become aware of the conceptual shackles imposed by my own identity and experiences'. This was more obvious during the second year of the research and after having implemented the first pilot interviews in the summer of 2008. Definitely my observation and the critical evaluation of the information have been influenced by my background, as a forester and as a citizen of Crete. However, this was more positive than negative because it inspired me to carry on with this research as my findings could have a practical use in my current work. The ability to evaluate or to discover useful practices that could be applied in current forest management was one of the most fascinating things. In addition, the connection of local people with Psiloritis showed the strong relationship of humans with their land, something that modern life style and urbanization tends to reduce.

3.6 Oral History

Oral history is widely used in geographical research, and remains one of the main methods in human geography. The two main tools to obtain current information in oral history are interviewing and questionnaires.

Interviews are another way of talking to people. However, talking only is not enough: you need to listen, and listen carefully to what people say. You need to elicit information that often is hidden behind words and expressions (Krueger and Casey 2000, Longhurst 2010). Another way to explore people's daily lives is through questionnaires. However, as Valentine argues, 'they are not tailored to individual circumstances' (2005, p.110) and they do not allow participants to express their own opinion, but try to suit their responses in a 'yes or no' format (Longhurst 2010). Questionnaires are more useful in research related to large populations and help to survey a representative sample. It should be considered a quantitative rather than a qualitative method. On the contrary, interviews, which can be unstructured or semi-structured, provide an opportunity for interviewees to depict details of their everyday life, which are often complex and unique, and to reflect them in their own words and

expressions (Valentine 2005). Instead of being a statistical focused tool as questionnaires often are, interviews are 'analysed using a textual approach, relying on words and meanings, rather than statistics' (Valentine 2005, p.111).

In forest history research there is a need for information related to past events and interactions of humans with forest resources. It is important to gain detailed information regarding past management practices, rather than to have a yes or no answer that a questionnaire can provide. Hence, interviews are the appropriate method for recovering hidden elements of life in the past in the villages and of how people use nature for their own benefit (Saratsi 2003).

The use of oral interviews was crucial for obtaining a clear picture of how, when, where and why traditional management practices were held. Some limitations though can exist as Rackham (2003, p.15) could hardly find information on 'woodmanship' from villagers in England and mentions 'how little people observe and how short memories are'. However, in Crete this was not the case as there are different uses of the forests some of which involve the participation of the whole population of a village (Arvanitis 2008). Oral interviews were useful to identify villagers' approaches and needs related to the forested areas. Information derived from the oral history interviews were combined with the formal governmental decisions in both local and state level. The main aim was to acquire the knowledge regarding traditional management practices that existed in the past and may continue in the present. These practices were used to evaluate and prioritise future forest management suggestions, regarding current trends in forest conservation and environmental management.

3.7 Interviews

The development of a research based in oral history is a very complex and difficult task. Several issues needed to be taken into consideration before going out in the field and ahead of the actual process of interviewing. Which method of interview you should select depends on what your research actually needs. There are three main types of interviews 'structured, unstructured and semi-structured, which can be placed along a continuum' (Longhurst 2010, p.105). For the purposes of this research and in order to fulfil the research objectives, the semi-structured and unstructured types were selected. These methods, were efficient and gave

time and space to the interviewees to speak freely and describe their life or memories of the past. I was aware of the important ethical issues, and how not to put the interviewee in an uncomfortable position. In addition, the interviews were in a format that kept the attention and interest of the interviewees till the end. People can be very busy, cautious, or unwilling to be interviewed, but these potential difficulties were limited through the development of some initial key contacts with the target group of interviewees.

Interviews were held initially with 'gatekeepers', such as mayors, council workers and forest service personnel. 'Gatekeepers' are the 'individuals in an organization that have the power to grant or withhold access to people or situations for the purposes of research' (Burgess 1991, p.48). These people provided me with information, where and who to approach next. Furthermore, with other contacts, not necessarily gatekeepers, a *snowballing* technique was applied. 'This term describes using one contact to help you recruit another contact, who in turn can put you in touch with someone else' (Valentine 2005, p.117). This procedure helped to build a more extended network of contacts, useful not only for interviews but also to gain information and access to different sources useful for the whole research. In addition, these first interviewed contacts allowed me to familiarise myself with the interviewing procedure, to evaluate the questions and the structure of the interview.

Some limitations of the snowballing technique, such as the potential subjectivity of the initial Gatekeepers in terms of who they suggested for subsequent interviews, was addressed by the use of multiple Gatekeepers. This strategy helped me to contact a wider range of interviewees.

In geography the spatial element is important, and the villages selected for interviews (Figure 3.3) had different characteristics. In some villages the majority worked in animal husbandry, while in others only a few villagers still had animals, other villages had more of a farming culture and some had a mixed population of farmers and shepherds. It is important to mention that villages with a large area of land used for grazing have a minimum amount of land used for farming and vice versa. There are also areas with a more mixed land use, like *Gergeri* and *Ano Asites* or *Krousonas (*Figure 3.4*).* In addition, interviews were conducted with people of different age groups and genders (Figure 3.5 and Figure 3.6).

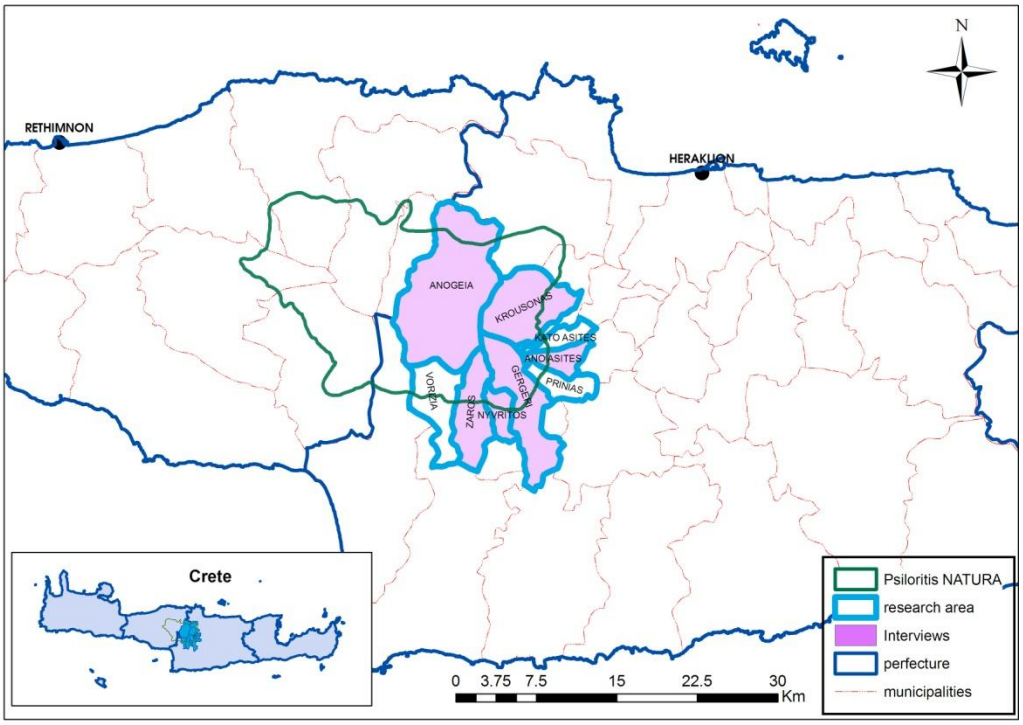


Figure 3.3: Selected villages of the research area for interviewing.

Source: Map drawn by the author using ArcGIS

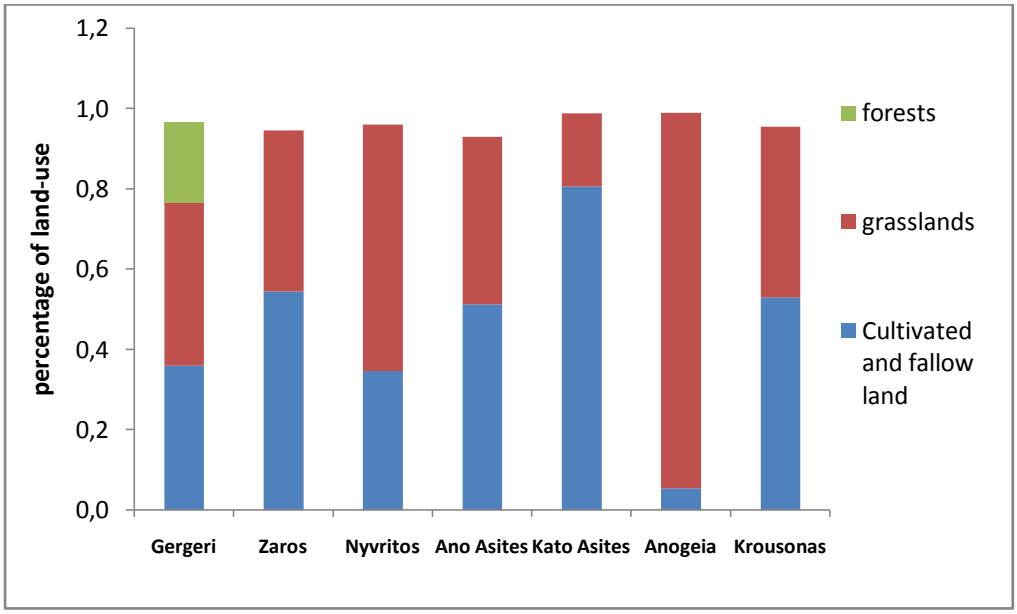


Figure 3.4: Land-use types of the year 1991 for the selected villages for interviews.

Source: Graph drawn by the author based on information from the Statistical Authority of Greece (EL.STAT. 1991)

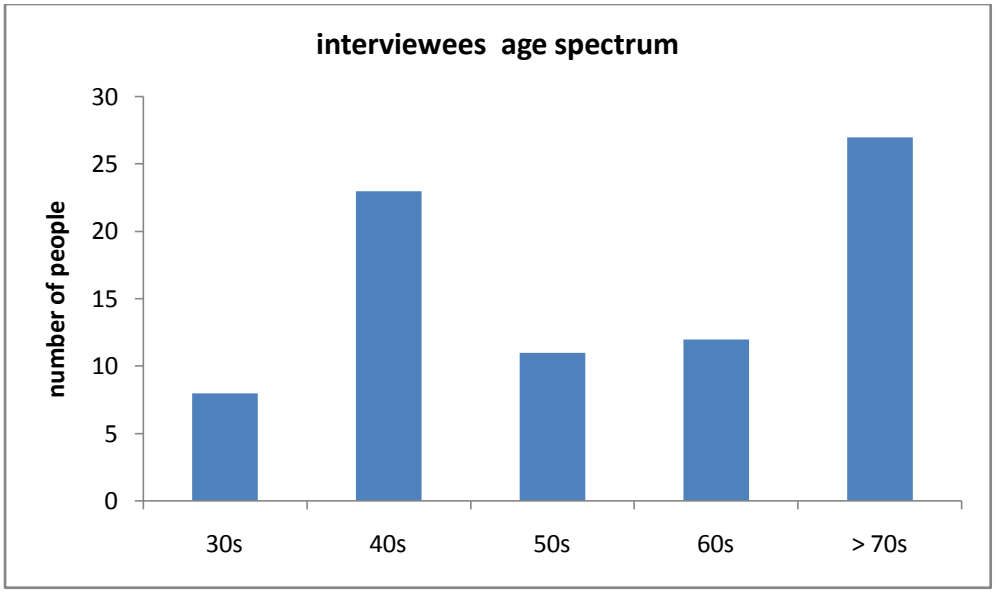


Figure 3.5: The age spectrum of the interviewees. Ages are divided in decades, eg. 50s include the ages 50-59.

Source: Graph drawn by the author based on interview data (Appendix II)

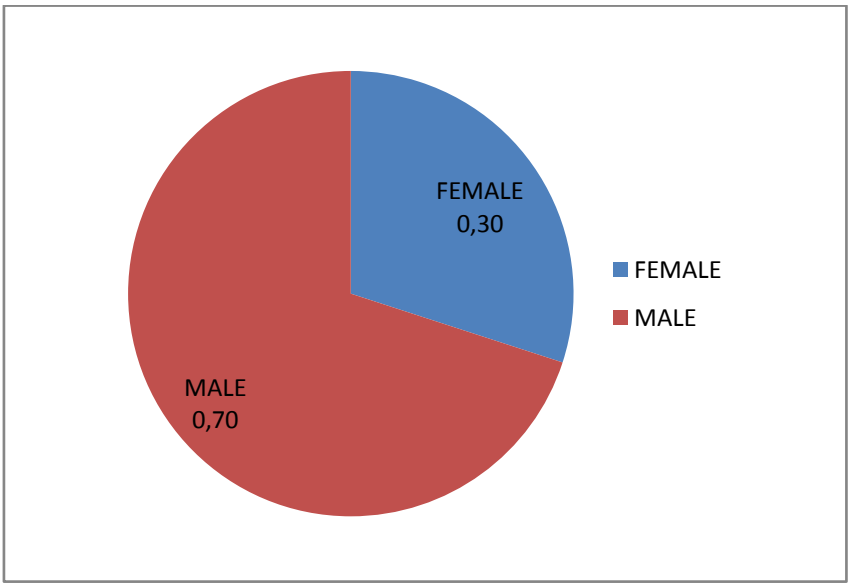


Figure 3.6: Sex percentage in the interviewees.

Source: Graph drawn by the author based on interview data (Appendix II)

3.7.1 Conducting the interviews

Interview types vary from structured to unstructured depending on the topic and the confidence of the interviewer. Each project is unique and there is no strict guide to follow (Dunn 2005, Valentine 2005). However, there are several suggestions that a researcher can adapt, such as: preparing a list of themes and questions; start with an easy to answer question; leave difficult to answer questions until the second half of the interview; leave enough time to warm up before the interview (Longhurst

2010). Often, new themes arise in an interview, and the researcher should have the flexibility to recognise them and alter questions in order to collect new information (Valentine 2005), thus an unstructured format is often useful.

One of the most important problems is the lack of confidence of the researcher and the experience to manage complex interviews. In order to get confidence in interviewing in the present research, the first interviews were held in a semi- structured type format and the author gradually shifted to an unstructured format. Hence, questions initially of a semi-structured type were useful for gatekeepers (Appendix I) and unstructured questions were specifically designed for the villagers. The questions were divided into two sorts, those dealing with forest elements and grazing elements (Appendix I). Depending on the interviewee's interests the questions were focused on forestry or grazing or both.

In addition preliminary research on the archives was implemented before the formation of the questions. This was particularly useful as it provided information of past management practices in the research area that were documented officially. Moreover, familiarization with what was happening in the past along with some historical information, helped to develop a list of themes that were useful in prompting interviewees to recall memories of the past. The first interviews showed that the suggestion of McDowell for interviewers 'not to talk so much' (2010, p.165) was particularly useful and something I tried to follow, though this was not always easy.

The total number of the people interviewed was 90 with an average length of each interview of 40 minutes. The majority of the interviews were recorded, using a digital recorder. This technique is particularly helpful in allowing the researcher to concentrate on the interview without trying to write down the information (Longhurst 2010). Moreover, it allows the researcher to revisit the original interview several times and study it in more depth. Although this procedure has several benefits, it requires much effort in transcribing the interview material (Valentine 2005). Four of the interviewees refused to speak to the recorder, thus their responses had to be written on paper.

3.7.2 Ethical issues

A main concern when doing interviews should be the status of the researcher and how interviewees will perceive the relationship with the interviewer. Sharing similar experiences with the interviewee or having the

same background can help to establish a better relationship. The result can be a 'rich, detailed conversation based on empathy and mutual respect and understanding' (Valentine 2005, p.113). Therefore, my lineage from one of the villages (Ano Asites), being able to speak the local Cretan dialect, having been employed in one of the local municipalities (Rouvas, 1999-2002), and being a forester in Heraklion Forest Direction, was particularly useful. These characteristics helped to establish a good relationship with most of the interviewees. In close societies such as small villages in Crete, knowing a few members of the village is like knowing the entire population. Anyone knows everybody; as a consequence most of the people feel familiar with me even though meeting for first time.

In general, it is important to avoid questions that may refer to ethical issues or make interviewees feel uncomfortable. Although, questions were not referring to an action as illegal, several interviewees mentioned that themselves, probably because they felt the interviewer was part of their society. Here is an example, where the question was about hunting in the mountain and the response from the interviewee emphasised the fact that her father did not have any permission to hunt.

> P: και δεν μου λες κυνηγούσανε παλιά;
> An12: Εγώ σου λέω κοπέλι, ο πατέρας μου ήτανε και κυνηγός, κόντεψε να σκοτωθεί και ήταν αιτία το κυνήγι. Ποτέ με άδεια βέβαια. Αλλά τέλος πάντων, μην το ακούνε και πολλοί, ναι.
>
> P: And can I ask you did they hunt in the past?
> An12: I am saying to you, I was still a child, my father was hunter as well, and he almost got killed because of the hunting. Never with permission of course. Don't tell anybody else about it now.
>
> An12: 45, F, Civil Servant

Although, most of the interviewees felt comfortable talking about illegal actions regarding forest law, for ethical reasons it was decided to conduct the interviews anonymously. Moreover, it helped some of the interviewees to feel more comfortable and to speak more openly about their thoughts, especially Forest officials.

Another concern, connected with interviewees comfort, is the venue for the interview. It is important that an interview is hold in a neutral environment (Valentine 2005). Hence, it was decided the majority of the interviews to be conducted, in Cafés or the house of the interviewee. People felt secure, and also being in the research area, it helped them to recall memories of the past more effectively. The gatekeepers were interviewed in their work environment. This was also very helpful making

them feel comfortable, although sometimes there were interruptions and some questions had to be repeated.

3.7.3 Interpreting

The material from the interviews was transcribed into World files, initially in Greek and then partially translated to English. Thus the whole coding process was done in the Greek text where special features and themes were identified. Coding is useful and helps build the interviewing material into themes that 'can serve as the main topics for the final product' (Cope 2010, p.448). The whole process was divided into three mains steps. First these themes were recognised as separate specific elements, and then I included broader topics. The selected broad themes were copied into separate Word files, including the text before and after the interview, and the code of the interviewee. After those two steps, more detailed subdivision was implemented and analysis was focused on the initial subthemes. For example some initial features were: Charcoal making, logging, firewood, herbs, animal husbandry, forest values, implement construction, acorn collection and so forth. Later these elements were included into broader themes, such as timber and charcoal production, firewood, husbandry, forest elements, NTFPs. After this division, further analysis was implemented for every feature, for example for charcoal details of how to make charcoal kilns, when to cut trees, what type of trees were used, transfer, uses of charcoal and so forth.

The selected quotations presented in this research are followed by the identity of the interviewee (Figure 3.7) and more details that included their age, occupation, place of the interview, have been recorded in the Appendix II.

The quotations presented include also the Greek text, often in Cretan dialect. This can help to obtain a better understanding of the meanings as translations cannot express totally the original text (Saratsi 2003).

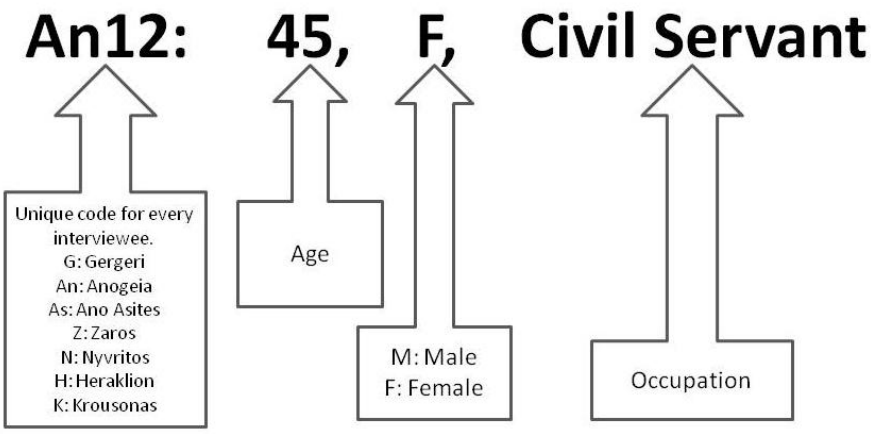


Figure 3.7: Explanation of the unique code for every interviewee provided for all quotations.

Source: Diagram drawn by the author

3.8 Written sources

Written sources available in Crete can be dated back to as early as 1800-1550 B.C., although these are written in an undeciphered language. The earliest readable sources of antiquity written in Linear B contain 'economic records, dealing largely with land and its produce' and 'one third of the Tablets are concerned with sheep and wool' (Rackham and Moody, 1996, p.7). However, and despite the fact that Roman and early Byzantine periods are characterized as an active and important period for Cretan civilisation, according to a significant amount of archaeological evidence, the written sources can be included on a single page (Rackham and Moody, 1996). The periods of the Venetians and Ottomans have left documents that could be used in environmental history. Documents covering that period that were used in this study are published translations from parts of this archival information in Greek (Table 3.2) as well as books from several travellers that visited Crete and wrote about their trips.

Title	Author	Year of interest
Monuments of Cretan History. Volumes: I, II, III, IV, V	Stergios Spanakis	I: 1589, II: 1629, III: 1594, IV: 1602' V: 1630
Translations of Turkish historical documents. A, B, C, D, E volumes	Nikos Stavrinidis	A: 1657-1672, B: 1672-1694 C:1694-1715, D:1715-1752 E:1752-1765

Table 3.2: Catalogue of the Venetian and Turkish archival publications available in Greek.

Source: Table drawn by the author

Turkish archives are the work of Nikos Stavrinidis who was born in the village of Saip in Asia Minor in 1895, and came to Greece in 1922 after the catastrophe of Smyrna. For more than 45 years he was responsible for the Turkish Archive in Heraklion. He was a historian with a speciality in turkology and the first one to study the Turkish archive in Heraklion (Doganis 2011). He published several books mainly focused on the local history of Crete and translations of the Turkish archive.

The other researcher, Stergios Spanakis was from Crete and born in 1900. He was a lawyer and worked in Vikelaia library in Heraklion, and his interests were focused on the Venetian period of Crete and the local history. He published several historical books for Crete, including the translations of Venetian archives for Crete.

Other archival sources are available in Crete and were included in this research covering the period of Cretan independence (1898) till present. A main focus was in the Heraklion Forest Direction and local commune archives that have never been studied before. Table 3.3 shows the archives studied in this research and the time period they cover.

Archive	Information	time
Historical Archive of Crete (HAC)	In the HAC, is kept the whole archive of the autonomous Cretan State (1898-1913), court archives, press archives and a collection of photos and cart postal (Municipality of Chania 2011)	1821 - present
Municipality of Rouvas	Several different types of archival data were collected, and the documents used in this research are mentioned in Appendix III .	1849 - present
Gergeri commune archive		1849 - 1998
Nyvritos commune archive		1849- 1998
Municipality of Zaros		1910 - present
Zaros commune archive		1910 - 1998
Vorizia commune archive		1936 - 1998
Municipality of Gorgolaini		1920 - present
Ano Asites commune archive		1920- 1998
Municipality of Anogeia archive	The old archive was burned when the Germans destroyed the village on 1944	1964 - present
Heraklion Forest Direction archives (H.F.D.)	Several registry books and various documents relative to forestry (Appendix III, IV)	1917 - present

Table 3.3: A list of the archives visited and studied for the purposes of this research. Communes were abolished and merged into municipalities in 1998 (Hellenic Republic 1997).

Source: Table drawn by the author

3.8.1 Information in the archives

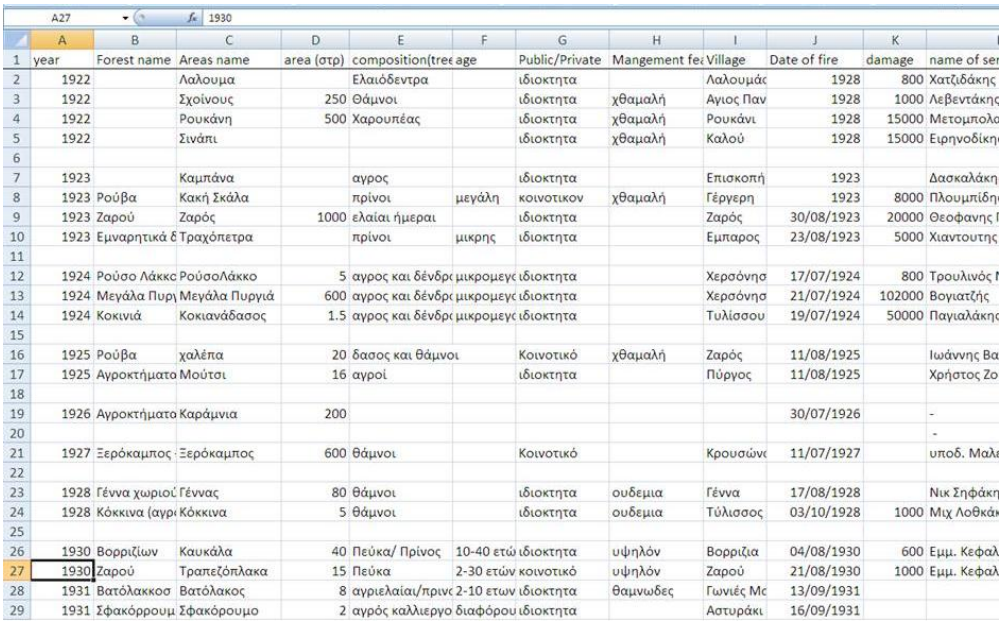
The majority of the quantitative information was derived from HFDA documents. For example the registry *Book of accusations* (Figure 3.8) contains information about illegal actions regarding forest law offences and the actions that the Forest Service has implemented. The book contains information of the name of the prosecutor/their residence, the name of the offender/their residence, the characterisation of the action, date of the prosecution, date of operation, date of trial, and result. These data can be used to derive quantities of the number of the illegal actions and when they were implemented. In addition, the entries regarding the residence of the offender and the characterisation of the action are always present. This information has been used to add a spatial element to the qualitative data and to help understand how that has changed over time and if there are any correlations with traditional management practices in the prefecture level and in Psiloritis Mountain.

Although, quantitative information regarding the number of actions is available, there is no information regarding the amount of illegal wood cut, or charcoal produced. As a result this information is more qualitative and shows what illegal actions were present in Heraklion Prefecture from 1925 till present. Other registry books though included such information, such as the book of loggings. More details of the information recorded in HFDA are mentioned in Appendix IV.

Generally in the majority of the archives the documented actions were categorised and for the analysis were included in more general categories or some of them were excluded from the quantitative analysis when there was not enough information. All the quantitative information was recorded in Excel files so that it could be used in statistical analysis and in GIS (Figure 3.9).

Figure 3.8: An example of the registry books and how information was recorded. In this figure is presented a copy of the book of accusations (HFDA2) of the year 1925.

Source: HFDA2



	A	B	C	D	E	F	G	H	I	J	K	L
1	year	Forest name	Areas name	area (στρ)	composition(tree	age	Public/Private	Mangement fe	Village	Date of fire	damage	name of ser
2	1922		Λαλουμα		Ελαιόδεντρα		ιδιοκτητα		Λαλουμάς	1928	800	Χατζιδάκης
3	1922		Σχοίνους	250	Θάμνοι		ιδιοκτητα	χθαμαλή	Αγιος Παν	1928	1000	Λεβεντάκης
4	1922		Ρουκάνη	500	Χαρουπέας		ιδιοκτητα	χθαμαλή	Ρουκάνι	1928	15000	Μετομπολα
5	1922		Σινάπι				ιδιοκτητα	χθαμαλή	Καλού	1928	15000	Ειρηνοδίκη
6												
7	1923		Καμπάνα		αγρος		ιδιοκτητα		Επισκοπή	1923		Δασκαλάκη
8	1923	Ρούβα	Κακή Σκάλα		πρίνοι	μεγάλη	κοινοτικον	χθαμαλή	Γέργερη	1923	8000	Πλουμπίδη
9	1923	Ζαρού	Ζαρός	1000	ελαίαι ήμεραι		ιδιοκτητα		Ζαρός	30/08/1923	20000	Θεοφανης
10	1923	Εμναρητικά δ	Τραχόπετρα		πρίνοι	μικρης	ιδιοκτητα		Εμπαρος	23/08/1923	5000	Χιαντουτης
11												
12	1924	Ρούσο Λάκκο	ΡούσοΛάκκο	5	αγρος και δένδρ	μικρομεγ	ιδιοκτητα		Χερσόνησ	17/07/1924	800	Τρουλινός
13	1924	Μεγάλα Πυρ	Μεγάλα Πυργιά	600	αγρος και δένδρ	μικρομεγ	ιδιοκτητα		Χερσόνησ	21/07/1924	102000	Βογιατζής
14	1924	Κοκινιά	Κοκιανάδασος	1.5	αγρος και δένδρ	μικρομεγ	ιδιοκτητα		Τυλίσσου	19/07/1924	50000	Παγιαλάκης
15												
16	1925	Ρούβα	χαλέπα	20	δασος και θάμνοι		Κοινοτικό	χθαμαλή	Ζαρός	11/08/1925		Ιωάννης Βα
17	1925	Αγροκτήματο	Μούτσι	16	αγροί		ιδιοκτητα		Πύργος	11/08/1925		Χρήστος Ζο
18												
19	1926	Αγροκτήματο	Καράμνια	200						30/07/1926		-
20												-
21	1927	Ξερόκαμπος	Ξερόκαμπος	600	θάμνοι		Κοινοτικό		Κρουσώνα	11/07/1927		υποδ. Μαλ
22												
23	1928	Γέννα χωριού	Γέννας	80	θάμνοι		ιδιοκτητα	ουδεμια	Γέννα	17/08/1928		Νικ Σηφάκη
24	1928	Κόκκινα (αγρ	Κόκκινα	5	θάμνοι		ιδιοκτητα	ουδεμια	Τύλισσος	03/10/1928	1000	Μιχ Λοθκά
25												
26	1930	Βορριζίων	Καυκάλα	40	Πεύκα/ Πρίνος	10-40 ετώ	ιδιοκτητα	υψηλόν	Βορριζια	04/08/1930	600	Εμμ. Κεφαλ
27	1930	Ζαρού	Τραπεζόπλακα	15	Πεύκα	2-30 ετών	κοινοτικό	υψηλόν	Ζαρού	21/08/1930	1000	Εμμ. Κεφαλ
28	1931	Βατόλακκος	Βατόλακος	8	αγριελαίαι/πριν	2-10 ετων	ιδιοκτητα	θαμνωδες	Γωνιές Μο	13/09/1931		
29	1931	Σφακόρρουμ	Σφακόρουμο	2	αγρός καλλιεργο	διαφόρου	ιδιοκτητα		Αστυράκι	16/09/1931		

Figure 3.9: An example of the database created in excel for the registry book of fires.

Source: Database created by the author, based on archival records (HFDA10)

Quantitative analysis of the archival data was applied for both the Heraklion Prefecture and the subset of Psiloritis. The data selected for the subset were the ones referring to the villages in Table 3.4.

Initially analysis was implemented for the whole data set, and then data were reduced only for the research area. For the second analysis the data were limited only to the villages in Table 3.4 and are actually villages whose territory is within the NATURA 2000 site of Psiloritis.

Name of the village	**Greek**
Ano Asites	ΑΝΩ ΑΣΙΤΕΣ
Vorizia	ΒΟΡΙΖΙΑ
Gergeri	ΓΕΡΓΕΡΗ
Gonies	ΓΩΝΙΕΣ
Zaros	ΖΑΡΟΣ
Kamares	ΚΑΜΑΡΕΣ
Kato Asites	ΚΑΤΩ ΑΣΙΤΕΣ
Korfes	ΚΟΡΦΕΣ
Krousonas	ΚΡΟΥΣΩΝΑΣ
Nivritos	ΝΥΒΡΙΤΟΣ
Prinias	ΠΡΙΝΙΑΣ
Sarchos	ΣΑΡΧΟΣ

Table 3.4: Villages included in the analysis for Psiloritis Mountain. These villages have a portion of their area in the boundary of the NATURA 2000 site of Psiloritis.

Source: Table drawn by the author

The spatial information in all the archival resources has some limitations. In some cases, the spatial element is extracted by indirect registrations such as the residence of the person that was involved in an illegal or logging action and so forth and is not connected necessarily with the place that the incident happened. However, information in early years can be considered as more reliable than later on, as a result of the difficulties of transportation in the past: absence of roads and motor vehicles.

There are several missing parts in the registry books and information for specific decades is missing. These books were lost or destroyed in the past because of lack of space. Several parts of the archive were destroyed when H.F.D. moved to new buildings in 1999, where there was no space to store the old archives. There is not a clear policy in Greek State to conserve historical documents and often the formal policy is to burn items that are not characterised as important and not in use anymore.

Fortunately, the missing periods are different between the different registry books. Thus, each registry book can enlighten missing information from other registers. This was useful for the qualitative research but not for the quantitative. For example the type of forest personnel, although registry books are missing in 1932, could be derived from the books of accusations or logging permissions and in 1956 from the book of incidences. However, missing quantitative data of the amounts of forest production 1958 - 1969 could not be derived. Information for the type of forest production could be obtained from the Book of Accusations for that period. The measurement units of forest production used in HFDA archives until 1970s were cubic metres for timber, oka (1.27 kgr) for charcoal and zygi (100 oka) for firewood. Later the measurements were tons and kilos that replaced oka and zygi respectively.

The rest of the archives in local communes and HAC were more useful in qualitative analysis. Several contracts (Figure 3.10), council decisions, as well as forest documents, were studied in those archives. For example in Gergeri archive a forest management plan of 1930, conducted by Forest officials, was very useful as the forest archive of that period was destroyed (Figure 3.11).

Several of the archives contain systematic information covering a time span of more than 80 years, an important element in forest history research, where data are often missing or gaps on information are a common issue (Agnoletti 2000).

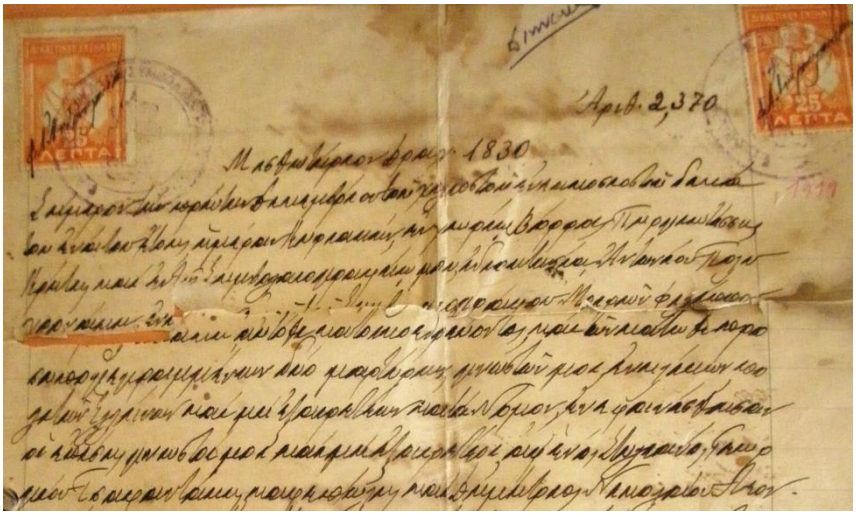


Figure 3.10: An example of a rental contract for the uplands from Zaros commune archive. It is dated 1910.

Source: Zaros Commune Archive (ZZC1)

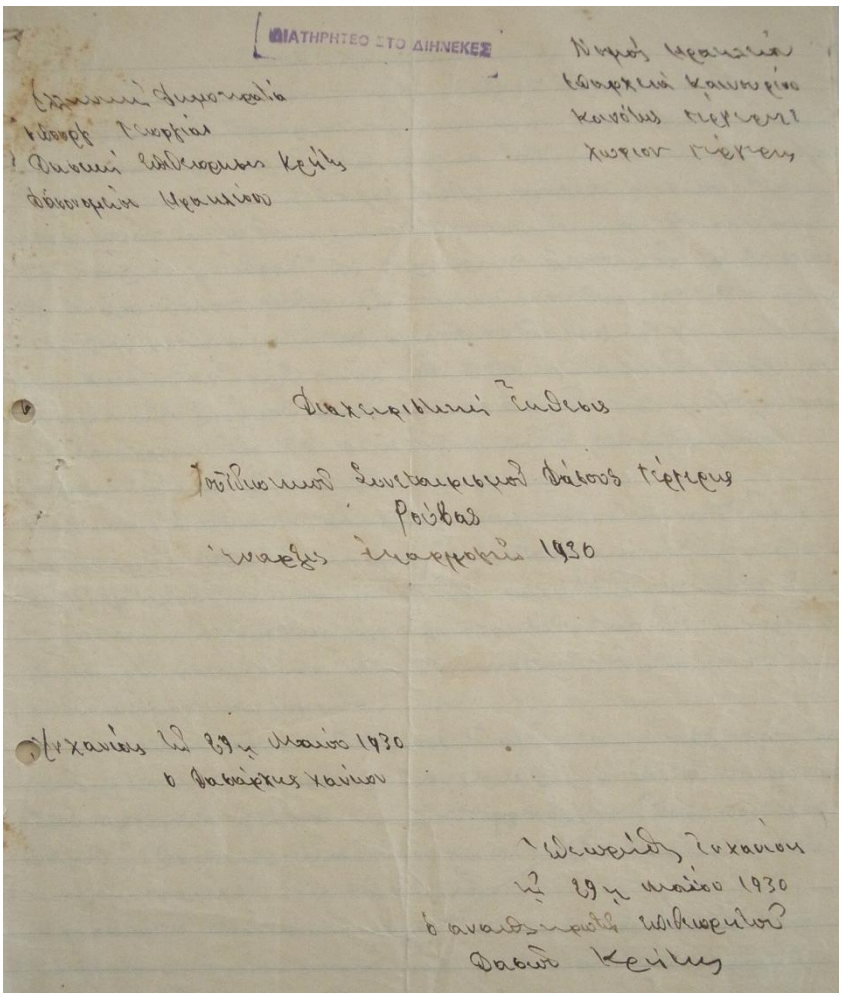


Figure 3.11: Management report for Rouvas forest (1930) in Gergeri.

Source: Gergeri Commune Archive (RGC4)

3.9 National statistics and censuses information

Two main categories of statistical data were used in this study, the population census data and the agricultural census data with the later including not only agricultural information but also livestock censuses and forest censuses. Different periods of these data were studied to have a picture of the population status over time as well as the rural life in Crete and the Heraklion prefecture. Population censuses are held in Greece since 1951 every ten years. The first period studied was in 1928, and then 1940 and all the rest from 1951 till 2001, every ten years.

Agricultural, livestock and forest data were studied for the years of 1914, 1929, 1961, 1971, 1981, 1991, 2002 and 2005 as they have been recorded from the Greek Statistical Authority. These data have been criticised for their reliability, and Saratsi (2003, p.117) argues that:

> census data are representative of real numbers. Depending on the broader political, economical and social circumstances the numbers of the products or animals can be over or under estimated.

Thus, in the analysis of this information, this was taken into consideration. Although they have limitations, statistics were very useful at least to draw a trend of the censuses and not necessarily to rely on their absolute numbers.

3.10 Aerial photographs, Maps and Photographs

Aerial photographs in Greece are available from the HMGS and for Crete exist in a scale of 1:42,000 for the year of 1945, and in a scale of 1:30,000 for the year of 1960 (HMGS 2009). For the purposes of this research, selected aerial photographs were purchased in print format for the years 1945 and 1960 (HMGS 2009). In addition, orthophotomaps, derived from aerial photography of the year 1996, available in digital format was kindly provided from HFD. and covered the whole Heraklion prefecture. More recent satellite imagery is freely available from the application Google Earth, and this was also studied. The main use of aerial photography was to provide information about land-use changes since the 1940s and how this has influenced forest distribution.

Other types of maps available in print format were also used in this research. These included geophysical maps of Crete, geological maps, soil maps, and so forth. The scales were generally in 1:50,000 and also in 1: 5,000 for the topographical diagrams. These maps as well as aerial

photographs were scanned and then geo-referenced in QGIS and ArcGIS applications, in order to be able to be used in the GIS analysis.

In addition, several old photographs from the research area were studied from the HFDA and private collections. These photos were useful as they represent past features of the forest and can be examined with current information.

3.11 Physical and geopolitical data

Available climatic information for Heraklion and Rethymnon prefecture are shown in Figure 3.12 where several gauges operate till today, and Anogeia has one of the first established in Crete in 1918. Climatic data were provided from H.F.D. in excel files. For the purposes of this research, the data were transferred into a database (Figure 3.13), and then imported in the GIS so further analysis could be implemented.

Furthermore, several geopolitical digital data such as district boundaries, village locations, DEM and so forth, were obtained from H.F.D. or other sources that are available for free and were used in GIS analysis (Figure 3.14).

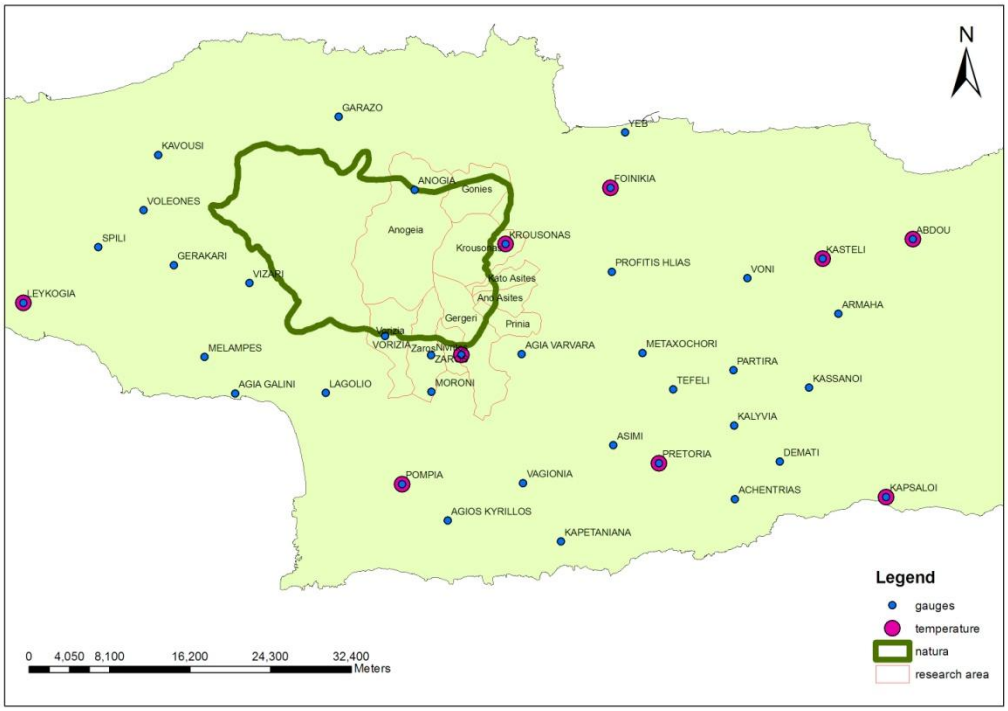


Figure 3.12: The available climatic information from the gauges in Heraklion and Rethymnon prefectures that were used in this study.

Source: Map drawn by the author using ArcGIS

C15 3869189

	A	B	C	D	E	F	G	H	I	J
1	STATION	X	Y	ELEVATION	MAX RAIN	MIN RAIN	AVERAGE RAIN	AVERAGE TEMP	AVERAGE MAX TEMPER	AVERAGE MIN TEMPER
2	ABDOU	630277.808	3899571.842	230	1243.2	440.8	792.8714286	15.54444444	29.3	6
3	AGIA VARVARA	590956.3997	3887998.164	570	1301	551.8	929.436145			
4	AGIOS KYRILLOS	583516.9493	3871289.717	450	837.7	251.1	517.8666667			
5	ARMAHA	622794.8144	3892071.526	450	1373.7	464	806.3			
6	ASIMI	600169.2953	3878852.157	200	1105.5	341.6	598.8269231			
7	ACHENTRIAS	612398.1896	3873449.08	680	1018.8	361.5	686.953125			
8	VAGIONIA	591086.1739	3875059.405	190	1107.5	278.6	517.8516129			
9	VONI	613640.892	3895649.456	330	1357	431	744.4029412			
10	VORIZIA	577213	3889845	520	2076.8	588.1	1115.736842			
11	GERGERI	584882.5299	3887939.189	450	1286.3	465	843.8263158	17.34166667	27.4	6.9
12	DEMATI	616913.6446	3877203.444	210	812.7	196	464.4685714			
13	ZAROS	581845.6099	3887911.228	500	1305	416.5	804.0144983			
14	KALYVIA	612306.8177	3880842.809	200	1014.3	327.7	579.1967742			
15	KAPETANIANA	594892.000	3869189.000	800	1441.2	341.8	677.1612903			
16	KASSANOI	619856.779	3884636.904	320	946.4	271.4	578.901717			
17	KASTELI	621202.5165	3897596.56	350	1182.5	329.8	711.7790323	16.08435606	25.7	6.4
18	KAPSALOI	627608.225	3873649.584	10	663.9	207.7	410.2	19.70576923	30.4	10.1
19	KROUSONAS	589328.2515	3899073.578	500	1423.7	655.7	995.1666667	18.3325	28.5	7.7
20	LAGOLIO	571245.5352	3884124.632	140	916.4	344.8	532.9387097			
21	METAXOCHORI	603104.2681	3888128.318	430	1129.8	470.2	715.9848485			
22	MORONI	581879.0142	3884214.451	400	1014	363	657.7125			
23	PARTIRA	612238.1886	3886388.157	400	1025.6	390.6	629.465625			

Figure 3.13: Formation of a database with the total climatic data for the gauges in Heraklion and Rethymnon prefecture. The gauges were referenced with coordinates so they could be integrated in GIS.

Source: Database drawn by the author in Excel

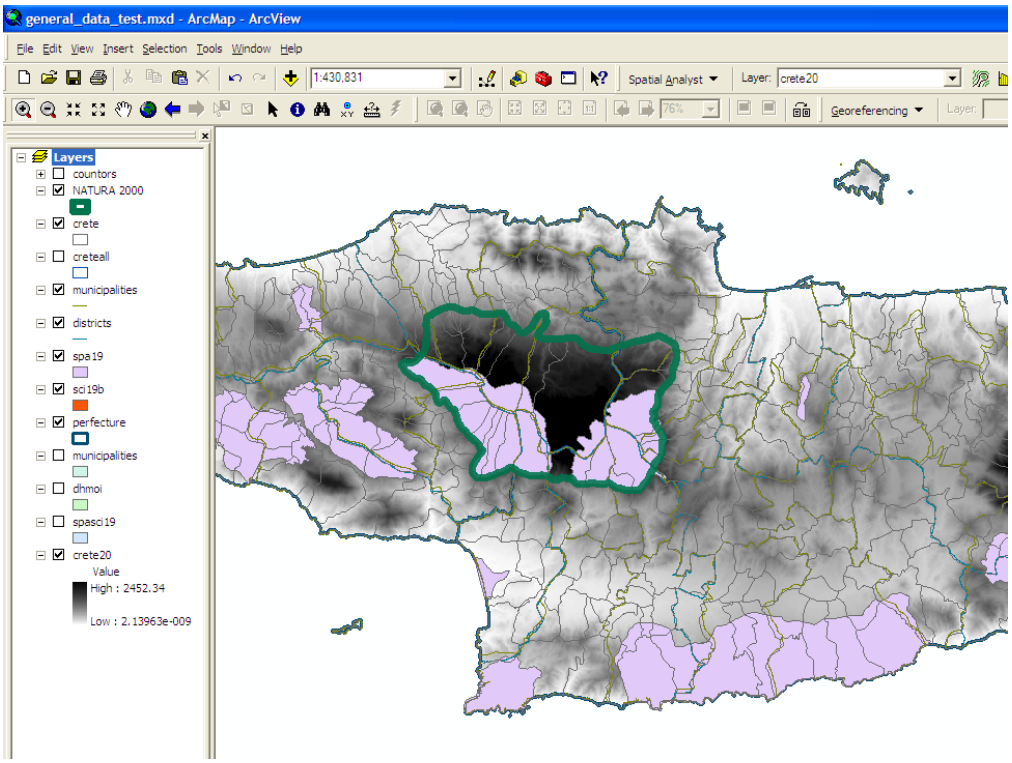


Figure 3.14: The basic digital data imported in GIS that were obtained from H.F.D. and other free sources. Later more levels of information were added derived from the field and archival research. This was useful to implement spatial analysis in GIS.

Source: Map drawn by the author using ArcGIS.

3.12 Field observation

Several field visits were implemented during these years of study, in order to find information and study the forests of eastern Psiloritis. In all these field visits, assistance and guidance was given from forest officials who sometimes assisted in the field data collection. Also participant observation of the use of trees and forest by local people was implemented and visits in the uplands with some of the interviewees were conducted.
In detail these field visits were conducted:

- in August 2008, where mainly was studied the Ano Asites forests in Prinos area,
- in summer 2009, where the forests of Nyvritos, Zaros and Gergeri commune were visited with the help of H.F.D. personnel in order to document forest characteristics and evidences of past management in the trees themselves,
- in winter 2009-2010, the areas of Gergeri forests and Anogeia were visited. Two shepherds from Gergeri also participated in this field visit to show the techniques used in pollarding trees and firewood collection,
- in summer 2010, field visit was implemented in the areas of Gergeri, Ano Asites and Anogeia with my supervisor Charles Watkins, and also with forest personnel. The area of lakkos-tou-Rouva was visited and several field data were collected. In addition the forest of Zaros and Vorizia were visited and also plantations in the research area.

In order to have a spatial element in the data collected, so that they could be integrated in GIS, GPS technology was used. All the features recorded were also added in the GPS and several notes were taken in the research diary. All this information was later imported in a database and then in GIS. In addition several photographs were taken during the field visits of important features of the forest and the research area. Moreover, pictures from the same place as old photographs were taken in order to have a comparative analysis.

3.13 GIS analysis

GIS analysis was implemented with the integration of existing physical and geopolitical data and data obtained from the research, such as field data and quantitative archival information. Spatial analysis helped to

understand, define and correlate relationships and trends derived from environmental data, forest structure and historical information.

The GIS software that was used in the research was ArcGIS (9.2), the most common commercial software (ESRI 2011) that is available in the University of Nottingham and also Quantum GIS (1.6.0 Capiapo), a free source application (QGIS 2011).

Some types of the spatial analysis used in this study were: Ordinary Kriging, overlay, Voronoi, surface (slope, aspect, elevation) and buffer analysis. For example, Kriging analysis was performed in order to obtain values from the original data in areas where data do not exist (Longley et al. 2005, De Smith et al. 2007). Kriging analysis is a part of spatial interpolation, and in this study it was applied to climatic data as well as to quantitative data derived from the archives. More information of spatial analysis types is mentioned in Appendix V.

3.14 Conclusion

In this research the use of multiple sources and evidence helped to draw a better picture of the use of forest resources in the past and cross evaluated the different types of information. This was helpful to minimise the limitations that exist in forest history research. Oral history was specifically useful to understand relationships of local people with their natural resources and how they benefit from them. Also what written documents do not provide were the management practices and how they were applied. Oral history was very enlightening on this aspect. On the other hand archival quantitative information used in GIS helped to understand a broader trend in the uses of forests in Heraklion and not only in the research area. The use of several different archival sources was useful to fill gaps within the archival material. Something that was missing from one archive was found in another and less ambiguity existed.

All these combined methods are rare in forest research especially in Greece and this thought to be the first time that a forester has used oral history to study forest management practices. Hopefully this will should be a new era in forest history and forestry generally that will help to understand better Cretan forests and their values.

Chapter 4: Context elements of eastern Psiloritis

4.1 Physiographic and biotic characteristics of Crete and Psiloritis Mountain

4.1.1 Geomorphology of Psiloritis

The Mountain of Psiloritis is characterized by the existence of two main types of limestone (Figure 4.1). The one symbolised with *Ts?-E* includes grey limestone and dolomites. The second one *J?-Ek* is 'Plattenkalk' formation (platy marbles) of limestone and is found mainly in the area of Anogeia. The geological structure of an area is important for the formation of soil and then the general type of vegetation that will be associated with it. Plants are very tolerant with the bedrock type and can or cannot survive different rock types (Papamichos 1990).

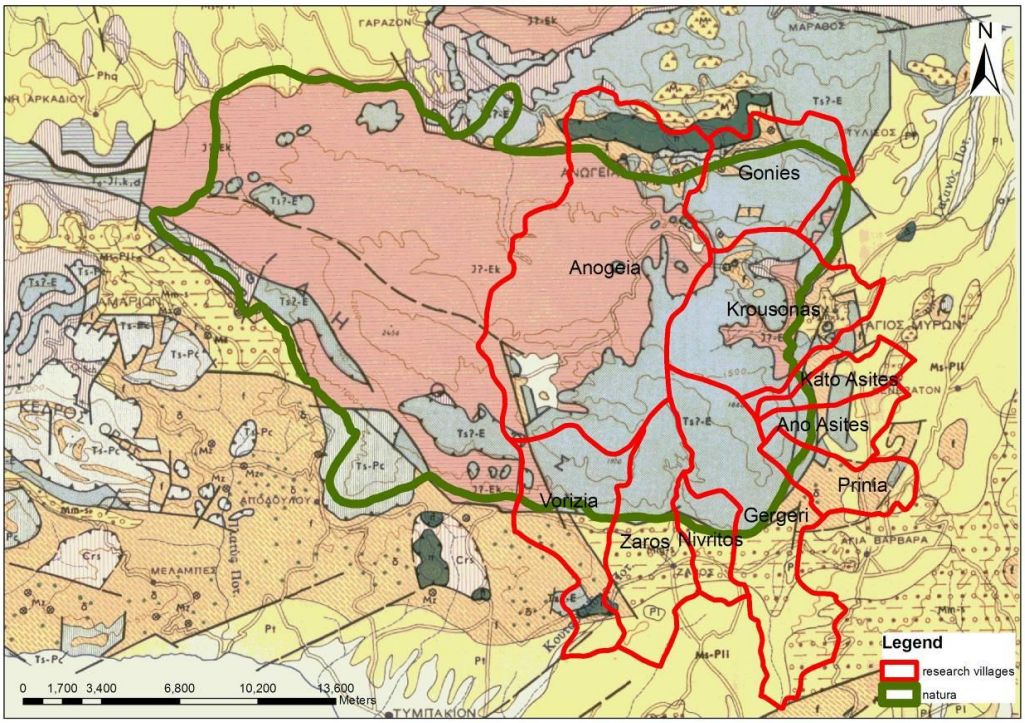


Figure 4.1: Geological map of Psiloritis Mountain. Explanations of the symbols are presented in Appendix VI.

Source: Geological map of Crete (Creutzburg 1977), overlaid in QGIS with NATURA 2000 and village boundaries.

In Psiloritis the soil conditions are generally characterised as poor and found in valleys or the several plateaus of the Mountain (Fassoulas 2004). In several areas the soil level is completely missing and there is often bare rock limestone (Forest Service 1997).

4.1.2 Climate

Climatic conditions of Crete are of the pure Mediterranean type.

> Most of the precipitation occurs between November and March, during the colder period. From June until August rainfall is an exception and it has little or no effect upon the vegetation because of the high temperatures. In between the two main periods, quite prolonged transitions take place. Frost and snow are very rare in the coastal area and lowlands, but on the mountains snow occurs up to April or May (Bottema 1980, p.196)

This description from Bottema (1980) is very accurate and defines the dry period that is crucial for the vegetation. The absence of rainfall for a certain period, during the summer is the limiting parameter in both cultivation and the distribution of natural vegetation. In the research area this dry period is often two to three months long and during the summer rainfall is almost absent.

Moreover, climatic conditions in the research area, and generally in Crete, are unpredictable. Examining the annual mean precipitation values of Figure 4.2, it could be suggested that the research area is a relatively wet region, with more than 850 mm annual rainfall, and generally wet years tend to concentrate higher rainfall values in the central areas of Psiloritis and the eastern parts of the mountain have less rain (Figure 4.3).

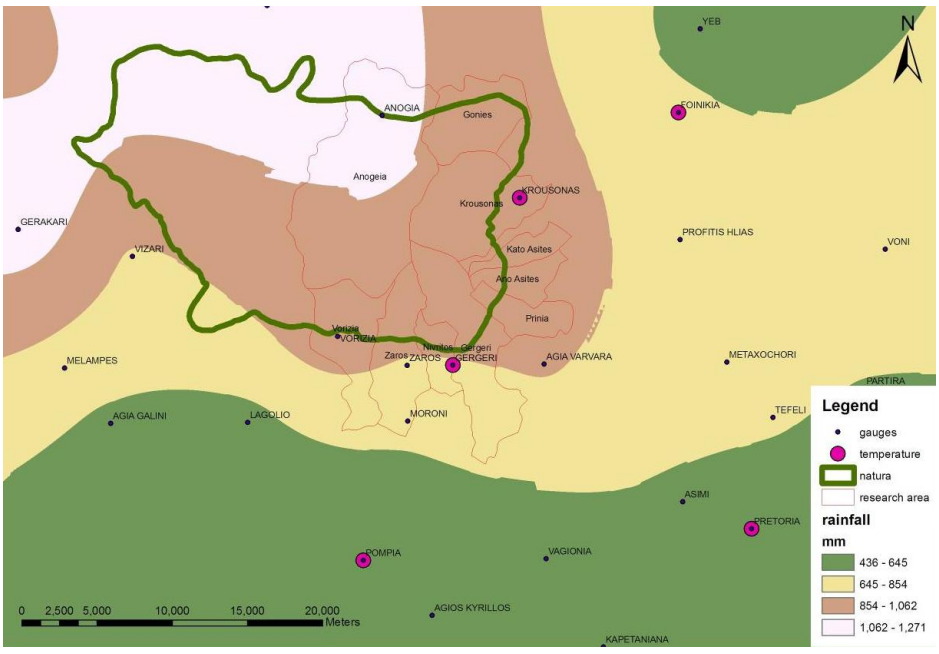


Figure 4.2: Mean annual rainfall, based on information available from meteorological gauges in the area.

Source: Map drawn by the author using ArcGIS

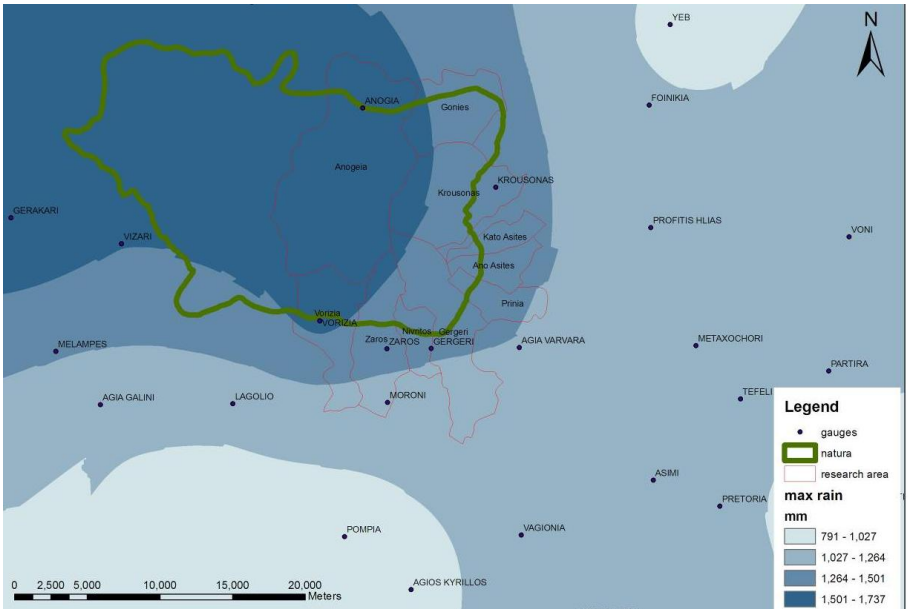


Figure 4.3: Maximum annual rainfall from every gauge.

Source: Map drawn by the author using ArcGIS

On the other hand, drier years tend to have a more homogenous rainfall pattern within the research area (Figure 4.4) and that shows that a dry year has more severe influences.

In order to understand better the climatic conditions of Crete, it is important to study parameters other than the annual average rainfall or temperature. More detailed research shows that there is a fluctuation in climatic conditions not only on a seasonal scale but also on an annual level. There are very dry years, followed by wet years and so forth (Figure 4.5). Examination of the rainfall and temperature on a monthly basis shows that actually there is a clear period of no rain at all. This pattern differs from gauge to gauge and areas in the uplands have a shorter dry period than areas in lower elevations. The start of the drying period is actually the intersection of the rainfall line with the temperature line, where from that point rainfall starts decreasing and temperature reaches a maximum till they intersect again where the wet period starts. Normally that happens in March and November respectively (Figure 4.6). This general pattern is followed by all the gauges close to Psiloritis. Some differences occur in the exact timings and this is connected with the location of the gauge. For example that at Anogeia is located at a higher elevation than the rest of the gauges; rainfall disappears completely in July and appears again in August while in Gergeri this happens in June and September respectively (Figure 4.6). Thus the dry period of Anogeia is relatively shorter than at Gergeri.

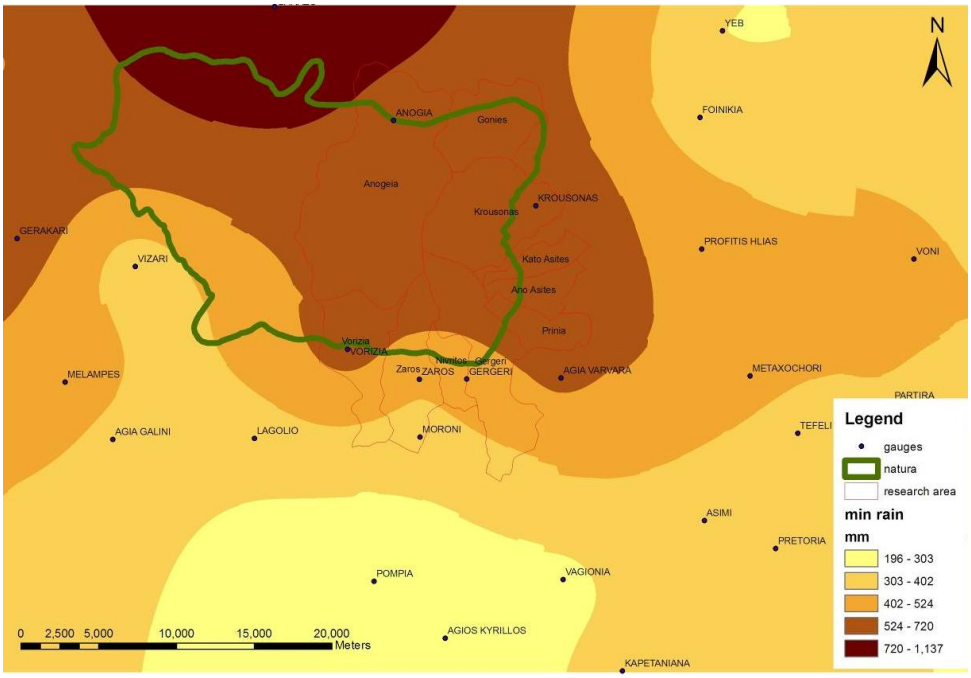


Figure 4.4: Minimum annual rainfall from every gauge.

Source: Map drawn by the author using ArcGIS

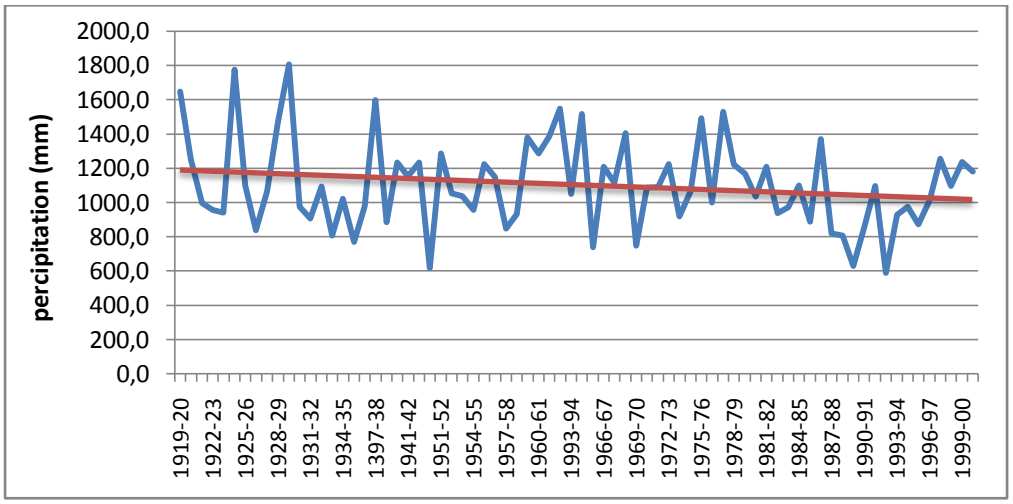


Figure 4.5: Analysis of the annual rainfall of 75 years (1919-2001) from Anogeia village. The trend line shows a small decrease over time.

Source: Diagram drawn by the author, based on the information of the Anogeia Gauge meteorological station.

Extreme climatic variables are important in ecological research and dry periods and the lowest or highest temperatures play a key role in understanding the ecology of species and the types of mechanisms that they have developed to avoid them. In order to have a better picture of the climatic conditions that can appear in the research area, a dry year of the Vorizia gauge was selected and the results are shown in Figure 4.7. The precipitation year of 1989-1990, was the driest year for Vorizia and

Gergeri as well. The total amount of rainfall was 588.1 mm, when the average annual rainfall is 1115.7mm. The actually wet months were only two, February and November with some short rains in October, December and March. This shows that dry periods can exist in winter and summer. Crete has an environment that often appears very harsh for life to survive. Water is crucial for life development and not only to agriculture but also to natural vegetation and can be the limiting parameter in species distribution.

Palynological records, dated back to the Holocene period, suggest that from this period the species found in Crete are more or less the same, especially the tree species. The main trees were pines and oaks as it is still the case today (Bottema 1980). This suggests more or less the same climatic conditions in Crete or the development of mechanisms from these species that could survive climate fluctuations over the last 10,000 years.

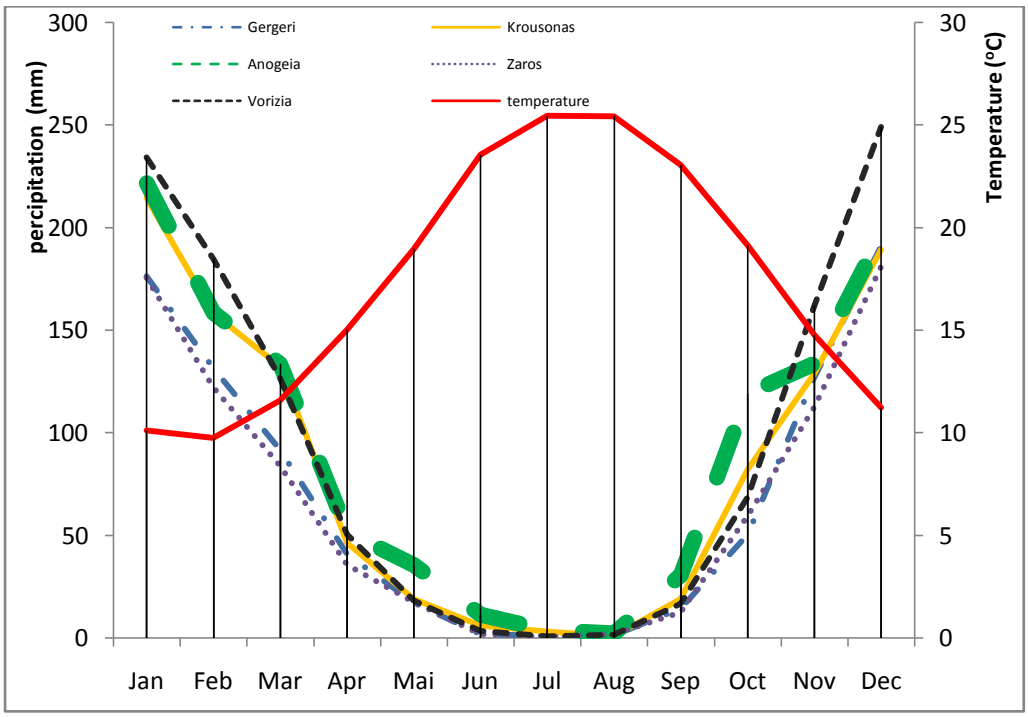


Figure 4.6: Diagram of precipitation versus temperature. This type of analysis demonstrates the dry period that starts with decrease of rainfall and increase on temperature values. Temperature data are obtained from Gergeri gauge.

Source: Diagram drawn by the author, based on the information of the Gergeri, Anogeia, Krousonas, Zaros and Vorizia meteorological stations.

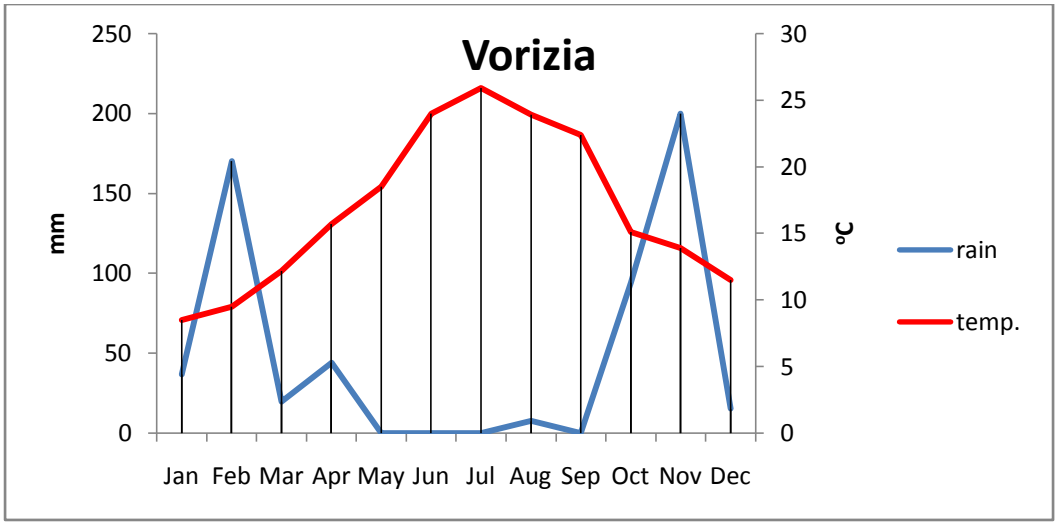


Figure 4.7: Diagram of precipitation versus temperature of the driest year for Vorizia (1989-1990). Temperature values have been derived from Gergeri gauge.

Source: Diagram drawn by the author, based on the information of the Vorizia Gauge meteorological station

4.1.3 Ecotypes

Vegetation types have evolved according to physical environmental conditions, together with cultural influences. Geology can limit or define which species can flourish in specific soil types, and the current distribution of forests and the variability of species extension in the mountain are a combination of environmental conditions and human factors. Generally:

> in the Mediterranean basin, with its dry, bright summers, the vegetation survives the severe conditions by developing xerophytic characteristics (a tolerance of water shortage, narrow or very small leaves, etc.); this is true especially of the ligneous species whose hard, tough leaves remain in place for several years (sclerophyll vegetation). In Europe and Anatolia, the Mediterranean basin is largely encircled by mountains, and its vegetation is divided attitudinally into the following zones: (a) the thermomediterranean zone featuring carob and wild olive (*Oleo-Ceratonietallia*) (T); (b) the mesomediterranean zone featuring sclerophyllus oakwoods (*Quercetalia illicis*) (M); (c) the supramediterenean zone featuring deciduous oakwoods (*Quercetalia pubescentis*) (S); (d) the oromediterranean or montane zone with conifers (H); (e) the altimediterranean and supra-forest zone (Z) (Council of Europe 1987b, p.55).

For Crete the vegetation zonation is shown in Figure 4.8. The area of Psiloritis is mainly within the two zones of M9 (oak forests of Crete with *Quercus ilex*) and H5 (Pine cypress forests of Crete). The zone of T3, is the lower zone from sea level till 500-700m and is characterised by the *Q. brachyphylla* extension. This map information is very general and cannot be used in micro analysis as the level of the information has been derived

from a map of 1,300,000 scale. However it does present a general idea of the vegetation zones. The oak forests of the zone M9, are not *Quercus ilex* but *Q. coccifera.*

More detailed information is included in Corine data of 2000 and several vegetation types are found in the research area; however, this information does not define necessarily a vegetation type but mainly land use types. According to the formal definition Corine provides information on Land cover (Bossard et al. 2000). The main categories that are found in Eastern Psiloritis are: Broad-leaved forest, Coniferous forests, natural grasslands, sclerophyllus vegetation, sparsely vegetated areas and transitional woodland-shrub (Figure 4.9).

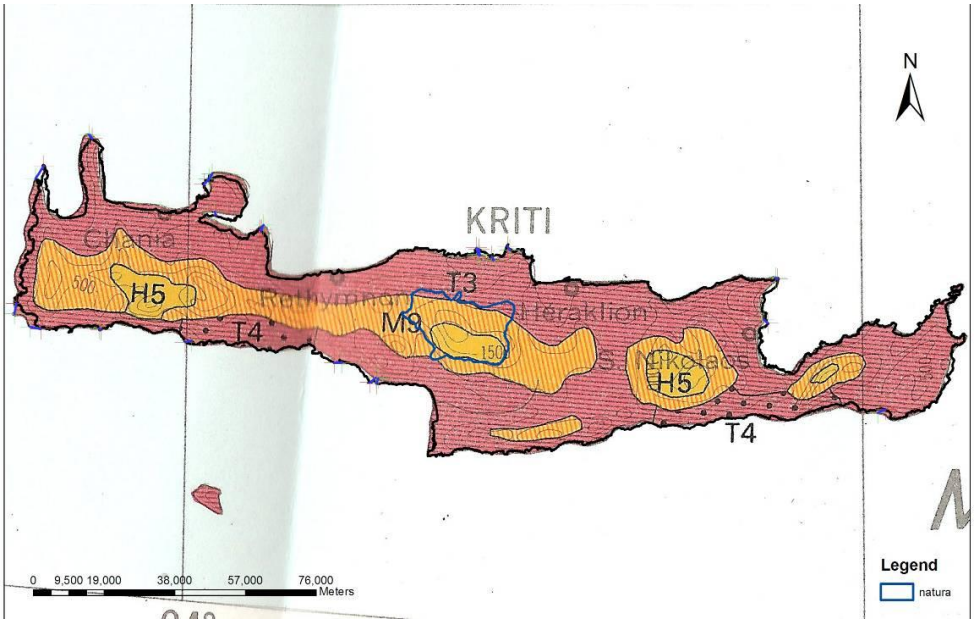


Figure 4.8: Vegetation zones in Crete. Overlaid with the NATURA 2000 boundary. Symbols T3, T4, H5, M9, are explained in Appendix VI.

Source: Map drawn by the author using ArcGIS. The base zonation map (Council of Europe 1987a) was scanned and geo-referenced using ArcGIS

In the area of Psiloritis, it can be suggested that current vegetation distribution has been influenced by elevation. This is a result of the data collected during the field visits as well as information derived from secondary data. Higher areas are occupied generally with kermes oak (*Q. Coccifera*) and maple (*Acer creticum*) or cypress (*C. Sempervirens*) while the lower elevations have brutia pine (*P. brutia)*. Generally pines are more resistant to drought where broadleaved species have more water demands. All these species are resistant to limestone rocks. The species that occupies this climatic type are resistant to dry conditions and have developed mechanisms that help them to survive over long dry periods.

According to the INTERPRETATION MANUAL OF EUROPEAN UNION HABITATS (E.C. 2007), and the data collected and observed during this research, the ecotypes found in the research area are presented in Table 4.1.

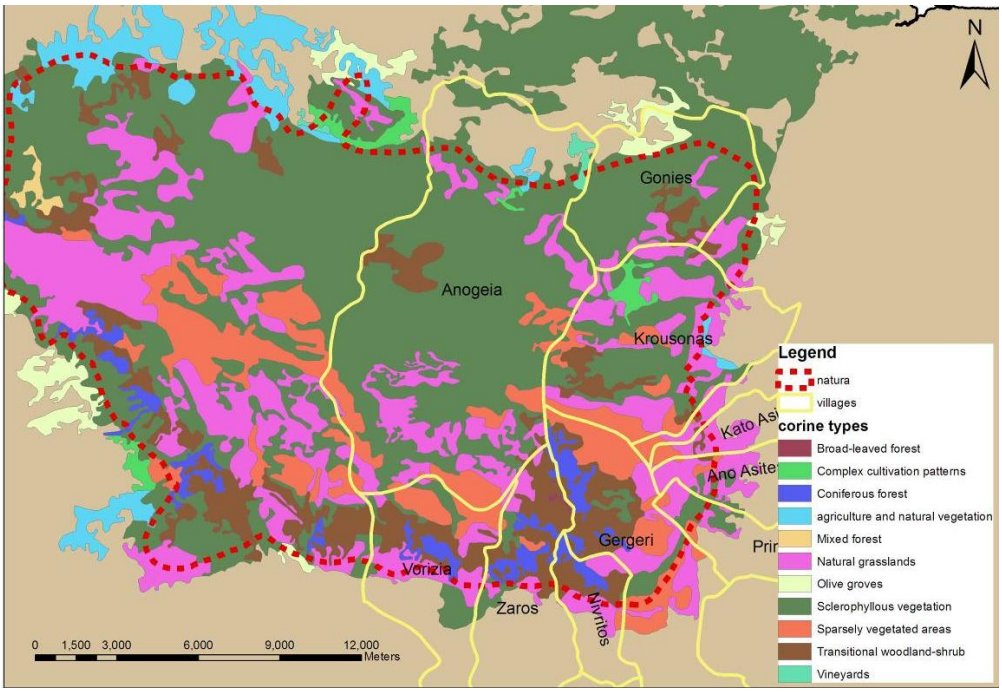


Figure 4.9: Corine land use data in the area of Psiloritis.

Source: Map drawn by the author, using Corine digital data in ArcGIS.

Code	Description of the ecotype	Comments
3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	
4090	Endemic oro-Mediterranean heaths with gorse	
5210	Arborescent matorral with Juniperus spp.	
5420	Sarcopoterium spinosum phryganas	
5430	Endemic phryganas of the Euphorbio-Verbascion	
8210	Calcareous rocky slopes with chasmophytic vegetation	
8310	Caves not open to the public	
9290	Cypresses forests (Acero-Cupression)	
9310	Aegean Quercus brachyphylla forests	
9320	Olea and Ceratonia forests	
9340	*Quercus ilex* and *Quercus rotundifolia* forests	In the research area *Q. ilex* is found in small stands and the forest is consisted mainly of *Q. coccifera*.
9540	Mediterranean pine forests with endemic Mesogean Pines (42.85 - Aegean pine forests)	

Table 4.1: Ecotypes, according to the Interpretation Manual of European Union Habitats, which are found in eastern Psiloritis, based on field data collection and observation.

Source: field data collection, (E.C. 2007)

All these types of ecotopes are very detailed and can describe several ecosystems of Europe. However, there is no definition that can describe the kermes oak forests (*Q. Coccifera*) of Crete. Hence, for Crete a different type should be added that will include the forests of Psiloritis. This should be a *Q. coccifera* forest that is often found mixed with maple (*A. Creticum*) forests of Crete.

4.2 Census information

Population censuses reflect the structure of Cretan society and can help us understand how and when urbanisation took place in the research area. In Figure 4.10 an overall population census for Heraklion prefecture shows that the general pattern of the prefecture is positive and actually population has increased with a stable rate. There was a period in the 1960s with a trend of decrease, connected with the wave of migration to western European countries and mainly Germany.

> G1: Εκείνη την εποχή, μέχρι το 64, μέχρι την μετανάστευση όλα άλλαξαν. Μετά το 60 όλοι φύγανε, πήγανε στην Γερμανία. Στα χωριά δεν έβρησκες νέο άθρωπο.
>
> G1: At that time till 1964, till the migration everything changed. After the 1960s, everyone left, they went to Germany. In the villages you couldn't find any young person.
>
> G1: 80, M, Civil Servant

Population in the 1970s recovered and the picture changed for the Heraklion prefecture (Figure 4.10). Although there is a general trend of increase in the prefecture level, in the research area this is not completely true. In Figure 4.10 it is clear that the migration wave of the 1960s, influenced the villages as it had influenced the whole prefecture of Heraklion. The population though followed the general trend of the prefecture and recovered in the 1980s. Later on till the present, there is a trend of depopulation, connected with increasing urbanisation that took place since the beginning of the 1990s. This is the time that Greece joined EU (1981), and new policies in rural development took place.

In the majority of the villages presented in Figure 4.10 there is a strong population decrease in the 1990s and in the census of 2001 population reached the levels of 1971. There is only one exception with increase in Anogeia village. However, these numbers could be less, as in Crete there is a tradition of people to be registered in their home place, as censuses take place on Sundays when people have the opportunity to visit them.

Communes promote this registration as they can benefit from presenting higher population registrations by receiving more governmental subsidies.

In the research area depopulation that happened after 1991 has changed the rural life of the villagers. Modernisation in agriculture and the abandonment of traditional management practices are strongly connected with depopulation and the reduction in available labour in rural areas that has often led to loss in wild life and biodiversity (Moreno and Montanari 2008, Riley 2003). Changes have also occurred in livestock censuses and Table 4.2 shows the change in animal type. It is important to notice the huge decrease in horses and mules after 1991 which is connected with strong modernisation and mechanisation in farming.

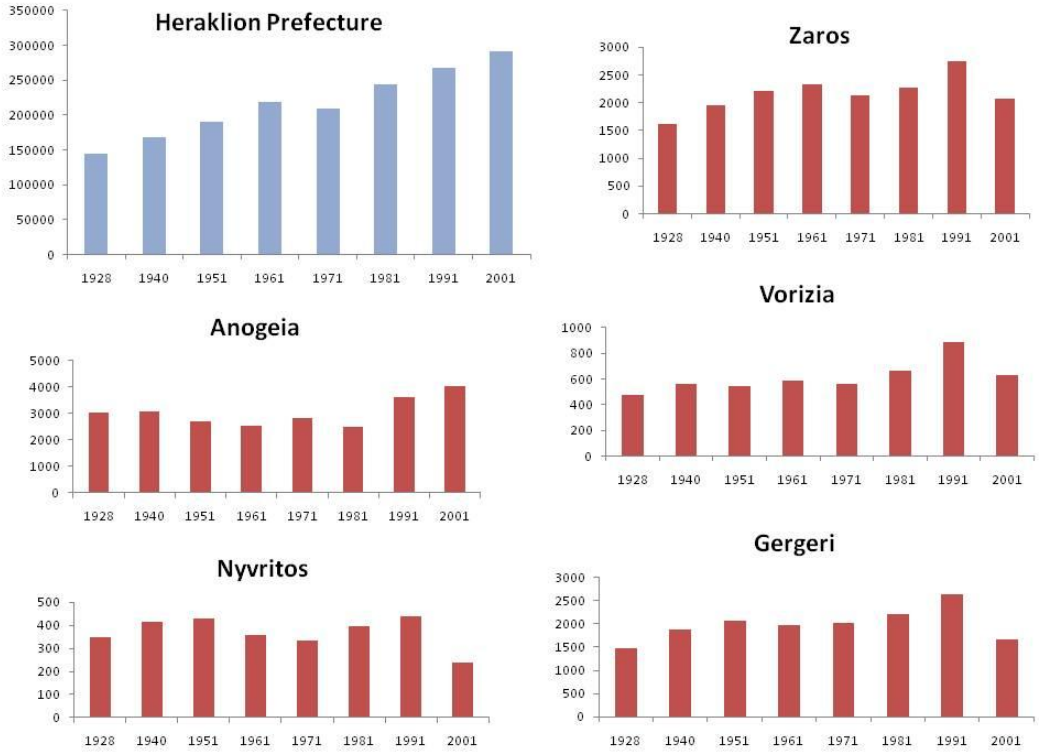


Figure 4.10: Population information from 1928 till 2001.

Source: Diagrams drawn by the author using census data of the years 1928 (N.S.S.G. 1935), 1940 (G.S.C.G. 1950), 1951(N.S.S.G. 1951), 1961(N.S.S.G. 1964b), 1971 (N.S.S.G. 1972), 1981 (N.S.S.G. 1994a), 1991 (N.S.S.G. 1994b), 2001 (N.S.S.G. 2009b).

Although depopulation had several negative effects in traditional farming, it seems that goats and sheep have increased significantly. At the same period there is an increase in bee-hives that shows changes in primary production. All these alterations resulted in a shift in agricultural production that is reflected in Table 4.3 for the Psiloritis region.

Year	Horses/Mules/ donkeys	Cattle	Buffalos	Sheep	Goat	Pigs	Fowl	Beehives
1914	46,305	42,788	650	357,514	166,306	38,625	283,270	69,959
1929	56,148	45,411	350	239,682	166,773	28,992	245,829	42,881
1961	78,329	35,058	43	393,793	251,751	27,519	649,204	73,922
1971	67,553	20,550	0	571,863	306,158	49,495	1,158,561	86,647
1981	43,218	15,270	0	713,602	329,123	95,388	1,659,901	105,204
1991	21,470	2,669	0	1,113,435	457,941	62,959	1,349,801	110,720
2005	3,942	2,029	0	1,316,426	637,185	68,030	1,030,486	154,795

Table 4.2: Number of livestock raised in Crete for different species from 1914 till 2005.

Source: 1914 (Direction of Statistics 1916), 1929 (G.S.C.G. 1934), 1961 (N.S.S.G. 1964a), 1971 (N.S.S.G. 1978), 1981 (N.S.S.G. 1984), 1991 (N.S.S.G. 1995), 2005 (N.S.S.G. 2009a)

Uses of Agricultu-ral land		1961	1971	1981	1991	Percentage change 1961-1991
Arable land cultivations	Number of farms	5,432	4,999	4,268	2,303	-57,60%
	Area	56,634	41,156	31,892	17,267	-69,51%
Vines and raisin vines	Number of farms	6,297	6,199	5,932	5,368	-14,75%
	Area	51,241	43,382	49,126	36,469	-28,83%
Tree cultivations	Number of farms	6,490	6,276	6,252	5,555	-14,41%
	Area	64,559	68,515	97,904	104,390	61,70%
Other areas (gardens, fallow land etc.)	Number of farms	3,673	3,134	2,548	3,363	-8,44%
	Area	41,259	35,237	32,316	100,433	143,42%
Total	Number of farms	7,059	6,843	6,268	5,844	-17,21%
	Area	213,693	182,784	211,238	258,559	21%

Table 4.3: Cultivated land in Psiloritis area and the changes that took place from 1960 till 1991.

Source: Information derived from the Special Management plan for Psiloritis, implemented through a LIFE project in 2001. (Grivas et al. 2002, p.63)

There is a strong increase in tree cultivation, mainly olive groves and decrease in the other crops. From a complex farming system in Psiloritis area, cultivation has been transformed to a more homogenised system, reflecting fewer farmers and the abandonment of less fertile land used in the past for grain production (Figure 4.11). Two interviewees from Ano Asites village remember the existence of grain cultivation in the past:

As1: Σπαρτά είχαμε πάρα πολλά, τώρα δεν έχει καθόλου. Στον Κόκκινο δέτη θερίζαμε.

As1: Grains we had a lot, now there is none. On Kokkinos detis we were harvesting them.

As1: 63, F, Farmer

As8: Μέχρι τη ρίζα του βουνού σπέρνανε, εκεί είχαν κλίση τα χωράφια.

As8: Till the foot of the mountain we were seeding (grain), where the land was steeply sloped.

As8: 60, F, Housekeeper

Despite the depopulation that took place in rural areas (Figure 4.10), there is a significant increase of people involved in animal husbandry since 2002 (Figure 4.12). This is connected with subsidies and EU policy in animal husbandry. For example the population of Anogeia village where the majority of the villagers are involved in shepherding has increased. This has not happened in the rest of the research villages, where only a portion of the population is shepherds:

An3: Είπαμε ότι το χωριό έχει δυναμισμό, έχει νεολαία τα πρόβατα κρατούνε νέους αθρώπους εδώ πέρα πολλούς. Ο βοσκός είναι που έχει πιο πολλούς ψήφους και τη δύναμη.

An3: I said that the village (Anogeia) has a lot of dynamism, a lot of youth; sheep keep a lot of young people here. The shepherd has more votes, thus and more power (in the village).

An3: 84, M, Tavernier

The Mayor of Zaros has noticed a decrease in farmers and an increase in shepherds.

Z9: Από το 2000 θα έλεγα. Ίσως να φταίει η επιδότηση, ίσως να φταίει η υποβάθμιση των αγροτικών προϊόντων. Οι νέοι, στην περιοχή διαπιστώνουν ότι σταματάνε πλέον να καλλιεργούν σιγά σιγά, αμπέλια και ελιές και προτιμούν να πάνε να κάνουν τον κτηνοτρόφο ή τον μελισσοκόμο. Βλέπω δηλαδή ανθρώπους νέους, νέους αγρότες που ασχολούνται, το πιο μεγάλο κομμάτι το πάνε στην κτηνοτροφία. Γιατί θεωρούν ότι είναι πιο προσοδοφόρα συγκρινόμενη με τα αγροτικά προϊόντα.

Z9: Since 2000 I think. It could because of the subsidies; maybe it is the demotion of agricultural products. The young people in the area (Zaros) are gradually stopping cultivation of vineyards and olives, and prefer to become shepherds, or apiculturists. I saw people, young people that are farmers and the majority of their works has to do with stock breeding. They think it is more profitable, compared with arable production.

Z9: 54, M, Politician

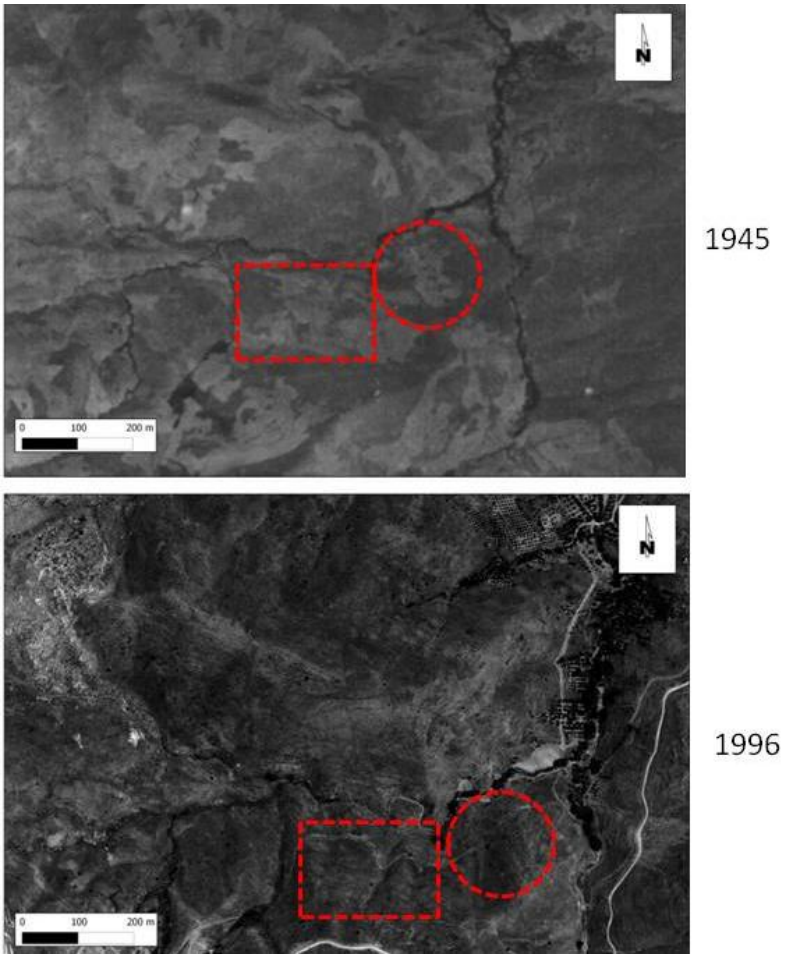


Figure 4.11: Abandonment of grain cultivation in the area of Ano Asites. The less fertile areas used for grain cultivation has been totally abandoned and the land is not cultivated any more.

Source: Map made by the author using QGIS

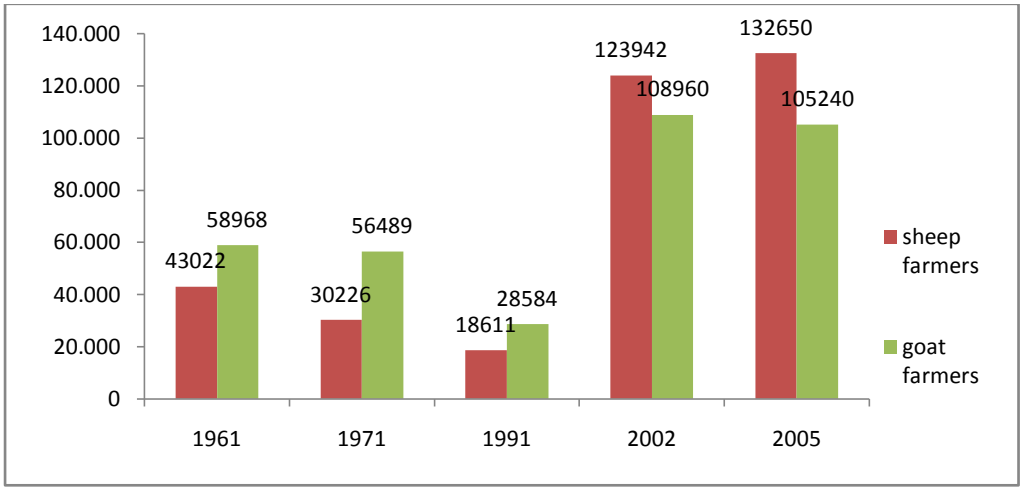


Figure 4.12: The number of farmers of sheep and goats in Crete from 1961 till 2005.

Source: Diagram drawn by the author, based on the formal statistical censuses. 1961 (N.S.S.G. 1964a), 1971 (N.S.S.G. 1978), 1991, 2002 (H.S.A. 2011)

Statistical accounts show a trend, but they do not necessarily reflect the whole truth. After the EU policy of subsidies was applied to livestock farming, several families registered their members as individual shepherds in order to avoid taxation and gain more subsidies, as smaller flocks can benefit better under this policy. Nevertheless, there is a clear trend of increase in livestock farmers as a result of their ability to have an important income and that has helped to retain the upland population.

Greek statistics show a trend of resistance to urbanisation from rural areas in Psiloritis region, at least till 1991. Later though with the modernisation of the society, this picture suddenly changed and the rural population collapsed. Villages that had a high proportion of shepherds resisted this trend and in Anogeia village the population has increased. Instead of agricultural production, shepherding seems to be more sustainable and profitable for local farmers.

4.3 Forest ownership

During the long Venetian occupation, Crete was feudalized and the uncultivated land, pastures and forest, were under direct control of the state or a part of a feud. Feudal land was not private land but was generally given to Venetian aristocrats for long periods with rights to manage it (Gasparis 1997). After Cretan conquest by the Ottomans, land status changed and the land was given to the ones who served the new empire:

> According to the traditional land-owning system of the Ottoman Empire, all agricultural land was technically a miri, belonging to the Sultan, or the state. Its use could be granted to a sipachi, or cavalryman, in return for his military services. Depending on the size of his timar, or fief, he would be expected to supply a certain number of soldiers from those working his land. If his son merited it, he could inherit his father's position (Brumfield 2000, p.38).

Uncultivated land, forests and the bare uplands, were generally under state control. A part of them was leased for grazing and generally forests were used for grazing (Papastavros and Makris 1986). The Greek state, the successor of Ottoman rule in continental Greece, bases its arguments on the old Ottoman Justice system to legally support its rights to forests and forested areas. However, legal ownership in Crete is even more complicated as the successor of the Ottomans was the Cretan State, which became part of Greece in 1913.

This legacy in Crete is very complicated and several communes consider their uplands as commune land (RNC1, RNC2, RGC5, AM16). Today communes have been replaced by larger municipalities but they generally continue this policy and regard uplands as municipal (HFDD47). This was not only recognised by the local authorities, municipalities or communes, but also by the Forest Service. Qualitative information derived from the registry book of forest fires, suggests that often forests were considered as commune or private land. In this archive, in the column for public or private it was registered till 1976 as private, communal or monastic.

In addition, since 1956 according to the registry book of incidences, forest ownership status was not resolved and a forest official stated that:

> the issue of forest ownership in Crete has not been resolved and is still under investigation. Till today the State have never claimed rights on the forests and their management is implemented by private owners. Only the island of Dia, 12.5 ha, belongs to the State. Of the existing forests, from a coarse characterisation, 3,980 ha belong to the communes, 990 ha are multi-owned, and 100 ha are private. In addition, from the partially forested lands and forested grazed lands, 14,472 ha are characterised as communal, 14,910 ha as multi-owned and 7,365 ha as private. Mapping of the forests does not exist and has never taken place (HFDA9).

This policy though, rapidly changed in 1957. In the same archive it was now registered that:

> with the action 51098/434/22-3-57, issued by the Minister of Agriculture, the forests of the whole island of Crete have been characterised as 'occupied' by the State and since the issue of this action, they are managed as so (HFDA9).

A retired forester recalled this action:

> Η6: Υπάρχει μια απόφαση του υπουργού Γεωργίας το 1957 νομίζω ήτανε Μάντεσης Μάνεσης που έλεγε ότι, έβαζε το θέμα της διακατοχής, τα ονόμαζε διακατεχόμενα, τα δάση της Κρήτης, δηλαδή κυριότητα στο δημόσιο και η νομή στους δήμους και στις κοινότητες. Από το 57 λοιπόν άρχισε αυτή η διακατοχή που έλεγε ότι η κυριότητα ανήκει στο δημόσιο.
>
> H6: There is a decision of the Minister of Agriculture in 1957, I think he was Mantesis or Manesis and there it was stated the issue of possession; the forests of Crete were called 'occupied'. It means public ownership and their use to municipalities and communities. Since 1957 this 'occupied' term started and it means that ownership is public.
>
> H6: 62, M, Forester

Despite this action issued from the Ministry of Agriculture, forest officials in Heraklion did not change the registry status of the land in the registry book of fires until 1977. This year the term 'occupied' is used, meaning

public land that someone else has the right to manage, or a status of ownership not solved (Council of State 2002). In the 1980s the term 'occupied' is the only one used and in 1990, this policy changed completely and till today all the areas are registered as public land. This is connected with a central governmental decision and legislation of the Upper Courts, based on the formation of a new constitution in Greece in 1975 (Hellenic Parliament 2008).

McGrew in his work 'Land and Revolution in modern Greece' states that there is an:

> ambiguity surrounding property ownership in contemporary Greece, especially in rural areas of the Peloponnesus and central Greece. In most districts one finds that there is no cadastral register that many landholders have no title deed to their farms, and that boundaries are not clearly fixed. Lines of demarcation between private holdings and community or state property are frequently vague. The state services charged with the unenviable task of protecting the public domain are equipped with inadequate maps and records (McGrew 1985, p.xii).

This is also the case for Crete and the absence of title deed is very common even today. Oral tradition is still used in rural Crete and often there is no formal contract issued in ownership rights over family property. Even in private land, ownership rights are based on oral tradition and no official cadastral system exists till now. This tradition highly respected by the villagers, where everyone knows to whom land belongs, may have been developed and still operates because with this someone can avoid taxation on inherited property. This occurs only in rural areas where society is very tight and not in urban areas. In addition to this oral tradition, common land of the village, without very exact boundaries is regarded as communal and not public.

There is though, a difference from the rest of Greece, where in court the State does not need to prove ownership at the forests, but private owners do. In Crete the Hellenic State as well as the individuals has to prove ownership rights in court (AM23, Hellenic Republic 1979). This element makes the legal ownership of the forests in Crete even more ambiguous and complex.

On this basis several former communes and current municipalities claim ownership of forested land. Moreover, the Forest Code of 1969 that is still in use mentions that grazing rights in the forest and forested areas are given to the communes (Greek Kingdom 1969). This reflects an older

tradition that was included in the formal establishment of the Forest Code in 1969. In the archival research in the local communes, several contracts dated since 1910 (ZZC1, RNC5, ZVC1) were responsible for renting the uplands to individual shepherds. In those contracts the legal status of the land is not based on evidences, but the contracts mention that the grasslands belong to the communes. However, this does not necessarily suggest possession rights over the land itself. As the local communes have had the grazing rights for several decades now, and the income from them, they have the impression that the land is theirs:

> An10: Κοίτα να δεις εμείς το αόρι το θεωρούμε δημοτικό, δεν έχουμε βέβαια τίτλους αλλά ο δήμος το θεωρεί ιδιοκτησία του.
>
> An10: Look, we consider the Mountain as municipal, we do not have any titles, but the municipality considers it its own property.
>
> An10: 36, M, Politician

Today the Forest Commission supports its land rights to the forests and generally to the uncultivated land. Several conflicts have arisen between individuals as well as local authorities and with the Forest Service (HFDD47, 48, 49, 51). A forester from Anogeia village, states the complexity of the problem:

> An11: Ο δήμος (Ανωγείων) θεωρεί ότι είναι δημοτικά, και το δημόσιο θεωρεί ότι αυτά είναι δημόσια. Δηλαδή το ιδιοκτησιακό αυτών των εκτάσεων είναι ακριβώς έτσι. Αν χρειαστεί κάποιο χαρτί αρχίζει το μπέρδεμα μετά. ... Ο κόσμος, πάντως τις χρησιμοποιεί σαν δικές του, αναγκάζετε και πληρώνει στο δήμο δημοτικούς φόρους για να έχει κάποιες παροχές από το δήμο διανοίξεις δρόμων και τέτοια, αλλά θεωρεί ότι είναι δικά του. Ο δήμος βέβαια θεωρεί χωρίς να έχει χαρτιά, ότι είναι δημοτικές εκτάσεις και το δημόσιο, τα θεωρεί δημόσια. Κατά τεκμήριο δικά του.
>
> An11: The municipality (Anogeia) considers that they are municipal; the State considers them as public. I mean that the ownership status of these areas is exactly that. If someone needs a formal paper, then problems start. ... People though use these areas as they are theirs, they have to pay municipal taxes, so they will have some provisions from the municipality, road construction and so forth, but they consider them as theirs. The municipality of course, without having any documents, thinks that these areas are municipal and the State considers them public. It is assumed to be public with no evidence needed.
>
> An11: 40, F, Forester

In 1997, the Rouvas municipality applied an action against the Hellenic Republic for recognition of ownership in their forested areas (HFDD46). This action in 1998 was judged and the court decision was negative for Rouvas municipality. The main arguments in the court decision were based on the legacy of the Ottomans, and the court stated that:

> according to the Ottoman justice of the 7th Ramadan 1274 year of Hegira (it means 1856 AD), except of the private land all the

> rest, either public (erazi ermiyie) either religious (vakouf) either communal (metrouce) either dead (mevat) belongs to the Turkish State (section 2). Specifically, public land according to the Ottoman law are the fields, the winter and summer pastures (areas that produce, in winter or summer, grass for the grazing animals, grasslands (tsairia), the forests, as well as all the areas that have trees that no one had planted them (houdai nabit), whether they are fruitful or not (HFDD49).

Even if there is some private forested land, the Modern Greek Constitution and law imposed several restrictions about how to manage it or how inheritance rights are implemented. According to Goupos and Papastavrou (2000, p.157):

> the protective provisions concerning forests and forest lands are related to the real nature of the property or local relationships. The main restrictions in forest ownership are: prohibition of changing the forest character, prohibition of division control and supervision of management, the privilege of the State for first refusal, compulsory formation of associations of forest owners for protection, transactions in forests destroyed by fires, boundary marking, declaration of lands as reforested after burning by forest fires, and opening of forest roads.

Despite this evidence and the fact that municipalities will face difficulties to defend ownership in a court, as happened with Rouvas municipality, several conflicts still exist between neighbouring municipalities for grasslands and forests. A recent example is in Anogeia village, where there was a big dispute with the village of Zoniana about grasslands. Anogeia territory includes the largest part of the Psiloritis Mountain, and the majority of its citizens are shepherds. In the recent past, shepherds from Zoniana started entering Anogeia's pastures and grazing their flicks there. Anogeia started defending their pastures from what was thought to be invasion from Zoniana shepherds. At that point and in order to define their territory from the increasing pressure from Zoniana commune they fenced the uplands so that Zoniana shepherds could not enter them (AM19, 20, 22). All these elements suggest that ownership rights are very important to local populations. They consider commune land as theirs, their responsibility to defend it, especially the uncultivated 'wild land' (αγριάδα) as it is often called in Crete. Whatever the constitution suggests, or forest law implies, this element has a long tradition in Crete which cannot be ignored.

4.4 A general historiography of Forest Commission in Greece.

The Greek State was first officially recognised as an independent State in 1830 after the war of independence from the Ottomans in 1821. According to McGrew (1985, p.xi):

> the Greek revolution was in its largest sense not only a national liberation from an alien conqueror who had occupied Greek lands for four centuries. It also marked a turning of Greek society from an Asian to a European orientation.

The new established state was influenced by the other western European countries and a king initially imported from Bavaria and later from Denmark, was the head of the new Kingdom. Even today the legal system of Greece is very similar to the German legal system, influenced by the first ruler of the state who was Bavarian. Bavarians supported the State ownership of common lands thus their policy influenced forest policy as well. McGrew (1985, p.124) argues that:

> The Bavarians, experienced in forest management, were especially concerned with protecting against abuse. State policy toward this public resource therefore aimed at its conservation in addition to the twin objectives of confirming state ownership of all forests which had not been explicitly assigned by the Ottomans to private use, and of realizing revenues from public and privately owned forests.

The first forest laws were issued almost with the beginning of the new state and in 1836 it was a government policy to create a united forest authority in the state to promote the public economy and rights. With this law a structural Forest Commission was established the following year that could manage the forests of Greece (Greek Kingdom 1836). At that point there was not a clear connection of a forester with the necessary qualifications, obtained from university level studies. Two main higher categories of forest personnel were defined with this Action, the Forest Director (Dasarchis) and a second level called 'dasonomos' that was mainly responsible for the forest law and conservation obligations and also to help the Forest Director. There were also mentions of lower level forest personnel of guards, what is called today forest rangers (Greek Kingdom 1836). Both of these terms are in use today in Greece. The qualifications mentioned in the Action of 1836, suggested that 'a Forest Director can be someone that had the knowledge of all the branches of forestry science, and had a practical experience of forestry for a long period' (Greek Kingdom 1836, p.97). In the case of 'dasonomos', a clear scientific

qualification was not needed, but work experience in the lower levels of forest personnel and knowledge of writing and reading (Greek Kingdom 1836).

In 1897, a new Government decision was made to increase the number of Forest Directors to 30, and to provide six state scholarships for forestry studies in Europe (Greek Kingdom 1897). This is probably one of the first steps to integrate European forest knowledge into Greece. It is interesting to add here that in England a formal Forest Commission was established in 1919, and English forestry was strongly influenced by Germans scholars as well (James 1990), where forestry management and science had a long tradition dating from the 18th century A.D. (Wiersum 1995). These elements highlight an early connection and influence from continental European forest knowledge.

In 1906 a Greek forester wrote one of the first forest books, with the title: 'Forests and civilisation particularly for Greece'. His name was Petros Kontos and he had initially studied civil engineering in Athens and later he finalised his education in the University of Vienna in forestry. In 1906 he was the head of the Forest Authority in Attica. In his work, he is very concerned about the differences that existed between Greece and western European countries and that his work was an original one, based on primary sources and not a translation of other works outside Greece (Kontos 1906). In 1939 the Minister of Agriculture appointed Petros Kontos to reorganise the Forest Commission. At that point Petros Knotos was a professor in the School of Forestry in Thessaloniki (Kyriakos 1939). Moreover, in 1916 twenty five high school Greek graduates were sent to forest schools of Austria, for three year studies and they later took the positions of Forest Directors (Papastavros and Makris 1986) in Forest Commission. The School of Forestry had a long tradition of research cooperation with central European forest schools, especially the German speaking ones. Even today several professors of the Forestry School obtained their PhD studies in Germany (AUTH 2011).

Several other legislations took place in following years regarding forest and forest policy in Greece and some of them are still in use, with some new legislation for forests imported even today. According to Papastavros and Makris (1986) Greek Forestry can be divided into four characteristic periods with the first one called transitional period, covering the era of 1833 – 1893. Before the formal establishment of a Forest Commission in 1833, the Ministry of Finances was obligated with 'the benefits from the

public forests, their defence against potential illegal actions and their freedom from malign 'slaveries'' (M.R.D.F. 2011a, p.1), connected with a strong economical value derived from the forests.

The second period is characterised as preparative, and covered the period 1893 - 1931. At this stage, forestry knowledge is developed domestically and a more extended forestry action took place (Oikonomopoulos 1966). At this period we have the establishment of a Forest Administration and a Forestry School, initially in Athens (1917) and then in Thessaloniki in 1927 where it is still based. This is one of the first University Schools established in Greece and shows the importance of forests for Greece. In France the foundation of the Imperial School of Forestry was established at Nancy in 1824 (Grove 1996) and in England forestry was taught in the late 19th century (James 1990). Germany had an earlier tradition of forestry science, dating back to the 18th century with sustainable management being in its initial stages (Wiersum 1995).

In 1924, the Forest Service was organised into 14 Regional Forest Inspectorates, with 55 Forest Authorities and 65 Forest Districts (Papastavros and Makris 1986) and Crete that joined Greece in 1913 was one of the 14 Regional Inspectorates. In the Cretan State (1898-1913) an Agricultural Authority was proposed to be established, where a special division within it would be in charge of the forests. There was no attempt to develop an autonomous Forest Commission as forests were regarded as sparse and not profitable (Cretan State 1899a). In this period, the Cretan State was more influenced by French than German speaking scholars and often in the Cretan official documents such opinions are quoted. For example the collapse of the Mediterranean civilisation was strongly connected with the deforestation that took place and uncontrolled forest use in the past. In the archive actually it is mentioned that:

> according to the opinion of the director of Institut agronomique, in Paris, Mr Risler and other scholars and travellers, one of the main reasons of the collapse of agriculture in the countries of South east Europe, Minor Asia, and the islands of the Mediterranean sea, is the clear cutting of their Mountains (Cretan State 1899a, p.9).

This prompted local authorities of Crete to issue legislation for forest protection till 1913, where the local legal system was replaced by the Central Greek statutes. The Great Powers (Italy, United Kingdom, France and Russia) were obliged to help the new State and provide security (Miller 1898). Several government consultants were foreigners and had an

important influence on the State, as the French director did in the forest policy of that time (Cretan State 1899a).

The third period of Greek forestry is called the edifying period (1931-1965) where, theoretical and practical knowledge was enough to help forestry works and research. At this period, different sectors within forestry were developed, such as: Forest management, Afforestation, Forest roads, Forest pastures, Mountain hydrology, Management of conservation areas, Game and inland fisheries, Forest census and forest soil classification and Forest research (Papastavros and Makris 1985). This information is in parallel with a global trend in forest science of that period where:

> in the middle of the 20th century the interpretation was broadened to include the principle of multiple use. Under this broader view, forest management should focus not only on timber as a commercial product, but also should aim at the provision of an optimum mix of human-valued products and services (Wiersum 1995, p.322).

Finally the fourth period, 1965 till the 1980s, according to Papastavros and Makris (1986), is characterised by the development of a holistic management approach and the emergence of multiple purpose forestry. This period is more organised and focus is given to sustainable management where timber is not necessarily the main target. However, such holistic forestry management approaches are found in the earlier 1906 publication for forestry of Kontos (1906) and also in a report in 1930 of foresters in Crete (RGC4). In these documents forest management is characterised by a holistic approach, especially in relation to soil erosion protection and the ability to use forest for grazing animals, or for hunting, not necessarily only for timber production. Similar types of forest values over time are found in forest archives in the 1950s (HFDA9), where forest conservation is a main element and multiple purpose forestry was already in focus.

Holistic approaches of forest management can be traced back to the early development of forestry in Greece and not only in 1965 as argued by Papastavros and Makris (1986). It seems that multiple forest management and sustainability is an inherent element of Greek forestry and coevolved with the discipline by the beginning of forestry science in Greece in 1917 where the first Forestry School was established. This element of sustainability and forestry of multiple purposes is still one of the main taught elements in Greek Forestry Schools today (Ntafis 1990, Chatzistathis and Ispikoudis 1995, AUTH 2011).

Currently forestry has to face new trends and integrate again the holistic approach that will be enlightened with the knowledge of forest history and take into account the anthropogenic parameters, disregarded all these years. It seems that a new period for forestry has already started not only in Greece but worldwide.

Different formats of Forest Administration have taken place up to the present day. The general scheme can be traced back to 1924 and is still in use today. The current general format of Forest Administration regarding regional Forest Authorities is shown in Figure 4.13. The higher the level the Forest Commission, the less is the involvement with local authorities and population. The Direction of Coordination and Inspectorate of Forests according to the official Greek Gazette:

> is responsible for the coordination, supervision and inspection of all the Forest Commissions of Crete and their personnel. It has to be in a continuation of cooperation with the relative Ministry for the best solution of the problems and their matters and it should follow its instructions (Hellenic Republic 2010, p.4748).

This general scheme of Figure 4.13 is applied differently within the regions of Greece, so in Crete the Forest divisions are as shown in Figure 4.14. In the case of Crete there is an absence of Forest Authority, and the responsibilities of this division are held by the upper level of division, the Forest Direction. Hence:

> Forest Direction for every prefecture of the Decentralised Administration of Crete will be responsible in particular for forest development and protection of forests and forested areas, execution of forestry projects, forest mapping and property matters of the prefecture. Must be in constant liaison with the relevant Ministry to better address the problems and assumptions of responsibility and follow its instructions (Hellenic Republic 2010, p.4749).

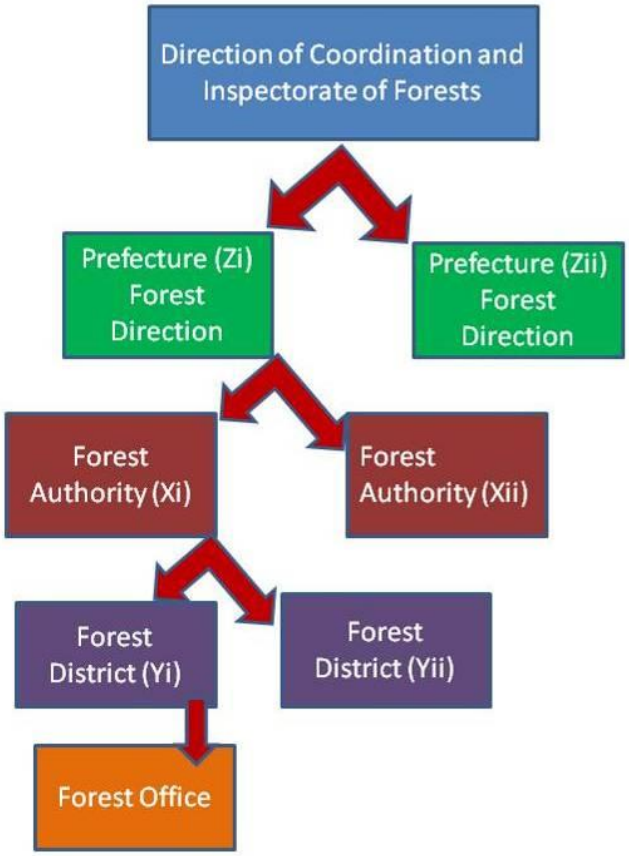


Figure 4.13: Contemporary Forestry structure in a regional scale.

Source: Figure drawn by the author, based on information from the Forest Authority formal website (M.E.C.C. 2011b)

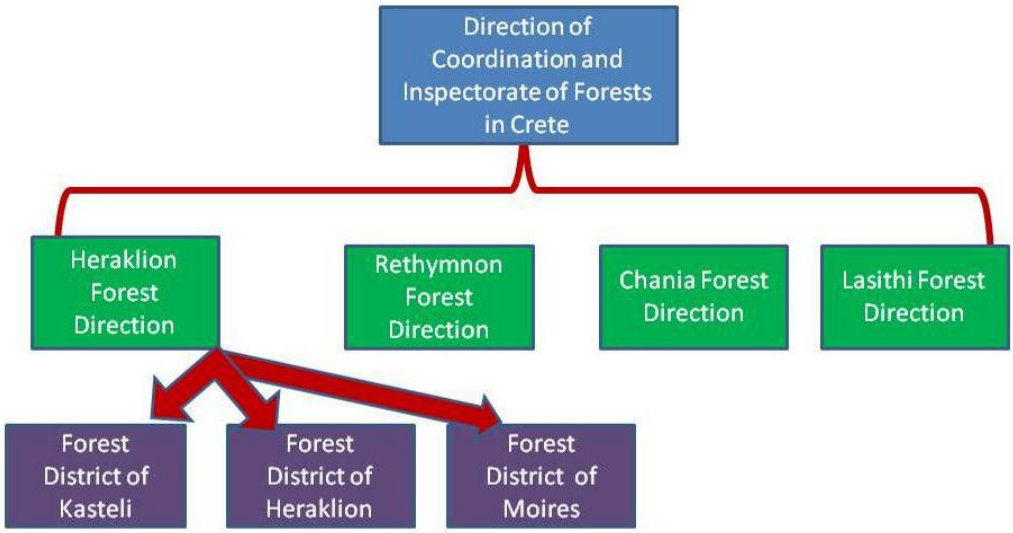


Figure 4.14. Forest Administration in the island of Crete as it was recorded in 2011.

Source: Figure drawn by the author, based on personal knowledge and information of the Governmental Gazette for the establishment of the Decentralised Administration of Crete (Hellenic Republic 2010)

Local archives in Heraklion have been examined in order to understand how central political changes have influenced local Forest Authorities in the Heraklion prefecture and generally the presence of forest personnel in the research area through time. Luckily, several registry books since 1918 have survived and inform us about the personnel and the Forest structure involved in the Heraklion Prefecture.

Archival information shows that in Heraklion a Forest Authority was established in 1917 and several local Forest Offices gradually were developed. In the early stages, there was a strong connection with local Police Authorities. The head of Heraklion Forest District was a Major policeman, and he was supposed to be in charge of Forest responsibilities in the absence of any Forestry personnel. Later Heraklion was demoted to a Forest District, and the Forest Authority was established in Chania, which was the capital of Crete (1850-1970). This demotion or promotion from Authority to District and vice versa happened several times up to 1976 when finally Heraklion was promoted to the upper level, called at that period Forest Authority District, a term replaced the following year to the one used till today, Forest Direction (HFDA4, 5, 9).

The existence of Forest personnel in the villages of Psiloritis was secured since the establishment of the Forest Commission in Heraklion. In Zaros village the existence of a Forest Office is first mentioned in 1921. The person working there was characterised as 'illiterate' and he had limited responsibilities and called a forest ranger. The same year another office was established in the area, in the village of Vorizia. In the following years, between 1924 and 1926 a reduction in Forest personnel took place and there were no staff in the area of Psiloritis. In October 1926 a rehabilitation of Forest Rangers occurred, however, in the village of Gergeri this time. This status remained unchanged at least till 1932. There is a gap in archival information between 1932 and 1956 regarding Forest personnel, as several of the archives were destroyed in 2000 when the Forest Direction moved to new buildings. Another registry book, called the 'Book of Forest Incidences' survives and dates back to 1956, and it is still in use. This book was characterised as 'the mirror of the Commission' by a forester in Heraklion and he highlighted its importance in terms of historical information for the Forest Commission:

> H1: Δεν ξέρω Αν βρεις κάτι στο βιβλίο των δασικών χρονικών. Το βιβλίο των δασικών χρονικών υποτίθεται ότι είναι ο καθρέπτης της υπηρεσίας. Αν ενημερωνότανε σωστά όλα αυτά τα χρόνια, είναι ο, είναι ο καθρέπτης της υπηρεσίας.

> H1: I am not sure if you can find something in the book of forest incidences. The book of forest incidences is supposed to be the mirror of the commission. If it was updated properly all these years, it is actually the mirror of the commission.
>
> H1: 59, M, Forester

In this book information on forest personnel is registered along with the most important incidents which happened during each year. For the first time in 1950 there is a mention of the term 'Commune Forest Ranger'. These forest rangers were locally based and they were responsible for a particular commune. It is important though that almost all the villages of the research area had such personnel, something not common in other forested areas in Heraklion prefecture.

In that book in 1956 it was mentioned that 'as a result of their low payments, the above Commune Forest Rangers, did not contribute, as they could, to the guarding of the forests' (HFDA9). It can be assumed from the information available that this type of Forest personnel was of a lower level in terms of payments and responsibilities. Commune Forest Rangers were present in the research area till 1968, the year that all of them were dismissed. This could be the result of a problematic integration with Forest Authority and negative reports to the central ministry for their quality of work (HFDA9). In addition, at that period Greece was under a military government, and decisions were made by the army leaders. Several Interviewees remember them and their power. An interviewee in his 70s, from Nyvritos, recalls an event, just after the end of the WWII where two people from his village were charged for illegal logging:

> Ν4: Υπήρχε δασοφύλακας, να σε καταγγείλει και δεν γατέχω ίντα…ο Πατατάκης ήταν ο πρώτος. Ο Πατατάκης τώρα όταν επήγε ο κουνιάδος μου ο Γιωργάκης με το νίκο του Κώστα, και κόψανε στις καλύβες πευκαλούδες και κάμανε, και σάσανε μεσοδόκια, που σκέπασε και ο κουνιάδος μου βέβαια το μισό του σπίτι, και ο Κωστονίκος εκιέ, τόχε με τσι πευκαλούδες, τα πελεκίσανε και τα κάνανε αυτά και.. τσοι κατάγγειλε δηλαδή ύστερα ο Πατατάκης και επήγανε στο Ηράκλειο και θυμούμαι τώρα, ήμουνε μεγάλος, εδικάσανε τζοι και εκάμανε τότες σας τον Κωστομανώλη, τον είχανε πιάσει ως προδότη, δοσίλογο, και τον είχανε στη φυλακή, και τσοι πήγανε και αυτούς εκιά τότες σας.
>
> N4: There was a forest ranger, he could charge you, Patatakis was the first forest ranger (in Nyvritos). Patatakis, when my brother-in-law went and cut pine from kalyves area, and they made beams for roofing, and my brother-in-law finished half of his house, Kostonikos also made it with pine, they processed the wood for beam making, and then Patatakis charged them, and they had to go to Heraklion for the court. And I remember, I was old enough that they were charged and they went to the jail where they met Kostomali, who was arrested for betraying, and he was kept in the jail, and they were sent there as well.
>
> N4: 70s, M, Hayward

In the late 1970s the picture changed and Forest Offices were no longer important and gradually they were abandoned. That is a result of a lack personnel and the development of road networks. However this has resulted in a loss of immediate contact of forest personnel with local people that created an impression of absence of authority from the forests. Today foresters and even forest rangers spend more time in the central office in Heraklion city than in their natural field of work in the forests.

In section 17 of the statue of 1836 for the organisation of forest districts, it was mentioned that:

> the Committee of the Finance should take into consideration that all instructions should be very clear and simple and that forest personnel should not be involved as far as it is possible, in bureaucratic works (Greek Kingdom 1836, p.97)

This suggestion should perhaps also be introduced in current forest law, so that today foresters would have more opportunities to re-establish the lost connection with local societies and implement more effectively their work.

4.5 Crete and forest production till 19th century A.D.

4.5.1 Timber from Cretan woods

The forests of Crete and their timber production played a more or less important role for the different rulers of the island (Table 4.4). Under the rule of Byzantines, 4th-7th century AD, forests were less used for timber production and presumably only wood for ordinary purposes was used extensively by local people, as the empire had access to other areas of the Balkan Peninsula (Lemerle 1979) for timber.

Period (A.D.)	Ruler
324-820	Byzantines
820-961	Arabs
961-1212	Byzantines
1212-1669	Venetians
1669-1898	Ottomans
1898-1913	Cretan State
1913-present	**Greece**
1941-1944	German occupation
1946-1949	Greek Civil war

Table 4.4: Historical information of the different rulers of Crete since 324 A.D.

Source: table drawn by the author.

This seems to change, when the island was under Arab rule, 7th- 8th century AD. It was an independent small kingdom and the forests were used extensively for timber to satisfy their needs for shipping, especially oaks (Canavas 2009). These assumptions are based on pollen diagrams of that period; however, it is not clear that oak forests were exploited only for shipbuilding and not for other products such as charcoal. According to Canavas, 'short-time changes did have long-time effects on Cretan forests' (Canavas 2009, p.104), and the short period of 140 years of intensive use of forests by the Arabs had a long term influence on the landscape. Deciduous oak woods did not recover after the re-conquest of Crete by the Byzantines (960-1) till the end of the Venetian rule in 1669 (Rackham and Moody 1996). Venice had access to forest resources, mainly in the Dalmatian peninsula, thus it was not necessary for her to use Cretan timber. There is evidence though for shipbuilding in Crete with the use of local and imported timber. The long term rule of Crete from Venice, more than 450 years, probably resulted in an overuse of forests, and then abandonment when these resources were reduced and then again, when forest resources recovered, another cycle of overexploitation. In a Venetian document of 1602 it is mentioned that:

> other crooked timber, can be found in Crete, one of the best and rare qualities, and in quantities enough even if it is going to be shipped 50 galleys, as someone can conclude from the timber used for the construction of the previous new three galleys. For these galleys it was used timber derived partially from Corfu, before it was discovered that this type of timber exists in Crete, that it is more than enough today for these galleys to be finished (Spanakis 1958, p.156).

According to the discoveries of Venetian officials in 1602, there was enough timber in Crete that could support shipbuilding efficiently. This information can support the theory of a cycle of an overexploitation - forest recovery, and in 1602 we had a recovery of forest, enough to support timber of good quality for shipbuilding.

In 1630 it is mentioned that timber from the forests of Sfakia area (south west Crete), was used for shipbuilding and roof construction during the Venetian period:

> there are also in the area of Sfakia a lot of mountains with vast forests of cypress, kermes oaks and other trees from whom they bring to the city planks and timber for galleys and ship construction, for housing building and other purposes (Spanakis 1969, p.22).

Although new forest resources were discovered and ships were constructed, Venetian rule ended in 1669 and the Ottomans came in power for the following 200 years. For the Ottoman Empire, Crete was not an area of great importance and actually its last conquest (Brumfield 2000). The Ottomans had access to several forested areas with more extensive and productive forests for timber. Turkish archives from Crete have less information about timber production and some of them show that Cretan timber was used for local needs. In a document of 1670, a conflict between a merchant and a buyer shows that timber was acquired from local woods. In this document it is mentioned that:

> the archbishop of the non-believers in Crete, Neofytos, sold to Hasan Bece his part of the amount of timber that we, with our people had cut. The buyer (Hasan Bece) though with no permission took and the amount of timber, that was in my behalf (Stavrinidis 1986a, p.351).

Here it is clear that timber was taken from Cretan woods for local uses. In another document the following century (1761) the authorities used wood for military purposes procured from local woods in the area of Chania, officially ordered:

> After the epistle sent from the commander of Chania, that the wooden parts of firearms of the castle of Chania, and their wheels have been damaged from ageing,..., they (specific personnel in charge) should find the 1000 boards needed from the nearest to the Chania Castle Cretan forests (Stavrinidis 1985, p.166).

There is also some information regarding imports of wood from other areas such as Constantinople (Stavrinidis 1986b).

4.5.2 Non timber products from Cretan woods.

In the Greek translation of the Venetian archives there are several references to firewood and charcoal as well; however, other non-timber product information is not found. The available information in Venetian archives only reveals a limited picture of how firewood was used at that time. Zuanne Mocenigo a Venetian 'Provveditore Generale' (1589) in his report to Venice reflects his worries of the pressure that Knights often put on peasants even for firewood collection. In his report to Venice he wrote:

> there are some knights that they do not let them (peasants) cut not even the acanthus (acanthine plants) that grow in the fields for setting off a fire or to heat kilns, without special permission being given to them (Spanakis 1940, p.2).

This passage provides evidence that for firewood collection a type of permission had to be sought even for brush-wood used for cooking purposes in that period. In the same report is mentioned the need of the capital Candia (Heraklion) for firewood. Local governors were assigned with the task of supplying wood for the capital of Candia at least for certain periods during Venetian rule and in this report it was suggested that this should be applied again, 'the castellans should be assigned, like in the past, for the cutting and transportation of the wood in the city of Candia' (Spanakis 1940, p.45).

It seems that the replenishment of firewood supplies was problematic and the area close to Candia was not able to satisfy its needs. In 1630, Fransesco Basilicata, in his report to Venice, suggests that along with the firewood imported from the islands there should be also the development of a store area for charcoal, useful for war time, as it is a durable product:

> despite the deposit of wood, I would see with regard a large amount of charcoal supply, that is necessary for any need, and when that will happen, it should not be used for any purpose, only in the case of war time, because this procurement it is durable and no one can doubt that it can ever be destroyed (Spanakis 1969, p.228).

Francesco Basilicata stated also the problems of firewood supply in Candia that was mainly obtained from the islands:

> as far as concerning firewood supply, the situation could be worse if there were not the boats that are going to the islands of Archipelago, and transfer them from there, because in the onshore areas of the kingdom, wood cannot be found any more that could satisfy provisionally the needs of the city of Candia (Spanakis 1969, p.227).

The islands of Cyclades do not have much forest and could not provide sufficient quantities of wood, but they have had more efficient links with continental Greece than Crete. It can be assumed that the wood was imported there from continental Greece and then transferred to Crete. However, it is questionable why Venetians did not use wood from Crete itself but had to import it from distant areas, using boats. An explanation could be that the cost to carry it from the mountains of Crete, as wood was no longer available in the lowland areas, was greater than to transport it by boats.

The Turkish archives provide more information on firewood taxation. These taxes were often in the terms of firewood commodities or could be replaced with money in several cases. Firewood was used for the needs of

the officials (Pasha) and there is evidence that the villagers close to the Pasha's base were assigned with the task of providing firewood, while distant districts offered money. That could be a result of transportation problems and increased costs. In 1685 it was reported that 'the governors of Crete, levied from the nearby residents in commodities, from the distant ones the value of wheat, ... firewood' (Stavrinidis 1986b, p.281).

Frequently these taxes created conflicts and the selected translations from Turkish to Greek from Stavranidis are often documents of unfair taxation from Pashas to ratepayers, sent to courts or superior governors. In 1693 it was reported that 'taking from them (Pashas), using force, for winter taxes and gifts, ... firewood ...' (Stavrinidis 1986b, p.436), and in a document of 1694 that:

> although, we offered to his majesty Mahomet Pasha all the customary gifts (peskeshi) that we every year give in the appointed Pashas, which are: one tseki (measurement value) firewood for every ratepayer raya (Greek-Christian) (Stavrinidis 1987, p.34).

Turkish archives have only two records of charcoal. One mentions the amount of tax paid from the Christians of Heraklion to the Pasha of Chandax (Heraklion city) that was 50 grosia[1] per year for 6.000 oka[2] of charcoal. The other contains information regarding a cargo in a ship, travelling from Heraklion to Alexandria, where charcoal is mentioned along with other materials. There is no other information, regarding tax collection of charcoal production. The picture of this period regarding charcoal is very vague but probably charcoal was not as important as firewood.

Generally NTFPs are not included in official documents while other agricultural products, more essential for the survival of the population, such as wheat, raisins and olive oil are often mentioned. Moreover, De Bonneval and Dumas in their 'reconnaissance de l' Ile de Crete' included no data for forest products in Crete in 1783. According to them, 'Crete produces wheat, barley, oat, wine, honey, wax, soya, fruits of all kinds, flax and cotton' (De Bonneval and Dumas 1783, p.222). In terms of other NTFPs there is only one case recorded in the Ottoman archives, for the export of carob pods to Alexandria (Egypt), along with several other products in the year of 1757 (Stavrinidis 1985).

[1] Grosi/grosia, gurus in Turkish, is a silver coin used in Ottoman Empire.

[2] 1 oka/okadhes = 1,282 kgr.

Historical information, suggests that at least during the Venetian occupation, firewood and charcoal were imported from areas outside Crete, and charcoal production was limited in Cretan forests. This continued during Ottoman rule where information on charcoal is very rare. As empires, both of them had other lands, more suitable for charcoal production, along with timber. The urban areas of Crete, lying on the coastline, were potentially more accessible from the sea than inland roads, and it is more likely that areas outside Crete provided the necessary fuel for the cities.

The last period of Ottoman occupation (17th century) is characterised by several conflicts and the war for the union with Greece, that led to a short lived semi-independent Cretan State (1898-1913) under the protection of the Great Powers. According to Rackham and Moody (1996, p.137) the late Ottoman period, is a 'more wooded phase, which could be related to the rebellions that plagued the island from 1770 to 1898', and is connected with an abandonment of cultivation and less exploitation of natural resources.

4.5.3 Animal Husbandry

Grazing is highly connected with forestry in Greece today. The majority of grasslands or grazed lands are forested areas or even forests. Greek forests and Cretan forests were always under browsing pressure (Rackham and Moody 1996, Papanastasis et al. 2000, Papanastasis 2004). For this reason one cannot exclude shepherding from forestry in Greece, and both are interrelated elements.

Information, regarding animal husbandry, is included in the Turkish archives and shows its importance during that period. In those documents, there are several cases relating to herd sizes. Data suggest that whole flocks were owned by rich Turks or Orthodox monasteries and they were managed by Christian shepherds. A document for the year 1658 states that the shepherd of the monastery of 'Ayio Pnevma' (Holy Spirit) was killed accidentally:

> Under the taxation, Michail, shepherd of the monastery, he climbed in the mulberry tree in order to collect mulberry leaves to feed silkworms, he fell down there and died (Stavrinidis 1986a, p.36).

In another document of the year 1672 a local governor (Pasha) owner of a large herd appointed Christian shepherds from Anogeia village to manage his flock:

> I had delivered for grazing the defendants' 992 sheep belonging to his majesty my manager. Disease did appear on these sheep and they were sold to *Apti Bese* all the diseased 342 sheep, the ones that were able to be sold, and they were 190 sheep for 51 aspra per each, the rest 152 died. I request you to ask about this event the villagers from Anogeia and I want their responce to be recorded (Stavrinidis 1986b, p.3).

Furthermore, some other documents of a later period (1694-1715) show that Turks owned herds of a relatively large size and appointed Christian shepherds from upland villages to manage them:

> The shepherd of Gergeri village had in his ownership the above mentioned sheep and goats that belonged to the zaipis Mustafa Aga. Sheep 130, rams 50, goats 150, male goats 70. Total 400' (Stavrinidis 1987, p.334).
> Kasap Achmet Chaous resident of Heraklion, prosecutes Vasileion, that comes from Anogeia village, because from the 330 sheep that he was given to graze through the chief shepherd Kosta Yianni, he returned 210 sheep; he (Kasap Achmet Chaous) asks for the return of the rest (Stavrinidis 1987, p.245).

All this information supports the existence of relatively large herds, owned by large estates during the Ottoman occupation. In addition, other Turkish records provide taxation data for animals that suggests individual ownership by local villagers and shepherds as well. Taxes included commodities as well as money or taxes for the use of pastures. In contrast to the previous taxation information, a document under the title 'new code' suggests that taxation on animals and pastures was not allowed, along with several other taxes. This document although not dated, Stavrinidis (1986a) suggests was written in 1671:

> With an empire firman it is forbidden, abolished and cancelled, in the island of Crete, all the arbitrary political taxes ... tax for goats/sheep, ... tax for pastures and winter pastures,... Not even in the future should these taxes be enforced in this island (Stavrinidis 1986a, p.310).

This document verifies that before its issue, there were several taxes on animals and pastures in Crete. In addition, later documents in the years of 1694, 1698 and 1712, implied that taxation of animals continued for those periods. Actually animal taxation was given to individuals for collection as a renting element, something common in the late Ottoman Empire (Stavrinidis 1987). In addition, in another Turkish document of the 1698, it is mentioned that small animal stocks are excluded from taxation:

> With this general imperial command the new taxation in sheep/goats will be as: They are excluded from any tax, the

> owners of 150 sheep/goats, for the more than this number animals, it will be paid one aspro per head, 20 aspra for production tax and 5 aspra for grazing tax for 300 animals (Stavrinidis 1987, p.211).

Other information included censuses on animal numbers and in 1699, the total number of sheep and goats for taxation reasons of eastern parts of Crete and Sfakia region in south west Crete was recorded. The document states a total number for these areas of 109,895 goats and sheep (Stavrinidis 1987).

Definitely till the end of the Ottoman occupation in Crete, there were several estates, normally owned by rich Turks, living in the urban areas or big villages that had large herds. This feudal system changes later under the union with Greece and the departing of the Cretan-turks in 1922. Along with these large estates that employed often Christian shepherds, villagers had their own herds, probably in smaller sizes and they were under taxation as well. Husbandry was a very important element during this period and grazing was one of the main uses of the uncultivated land.

4.6 Forest production in the 20th century

After the formal establishment of Forest Commission in Crete in the beginning of 20th century, ordinary information of forestry elements were recorded. This often refers to forest production and an analysis was implemented and presented in this section.

The main source of information relative to forest production is the registry book of logging. In this book not only timber production is registered, but also other forest products, today often called NTFPs. The general quantitative results derived from the archive are shown in Figure 4.15, Figure 4.16, Figure 4.17 and Figure 4.18.

Another archive that includes elements of forest production is the registry book of accusations. Here in contrast to the registry book of logging, there is not any quantitative information available regarding amounts of forest production. However, its information is useful to cross-reference the type of forest products derived from the forests and check any other type of products that were obtained without formal permission. The illegal actions that took place in Heraklion prefecture are shown in Figure 4.19 and for the research area in Figure 4.20. Analysis of the data (Figure 4.19, Figure 4.20) showed that from 1925 and till 1945 illegal charcoal making was dominant, and then ten years later this problem disappeared completely.

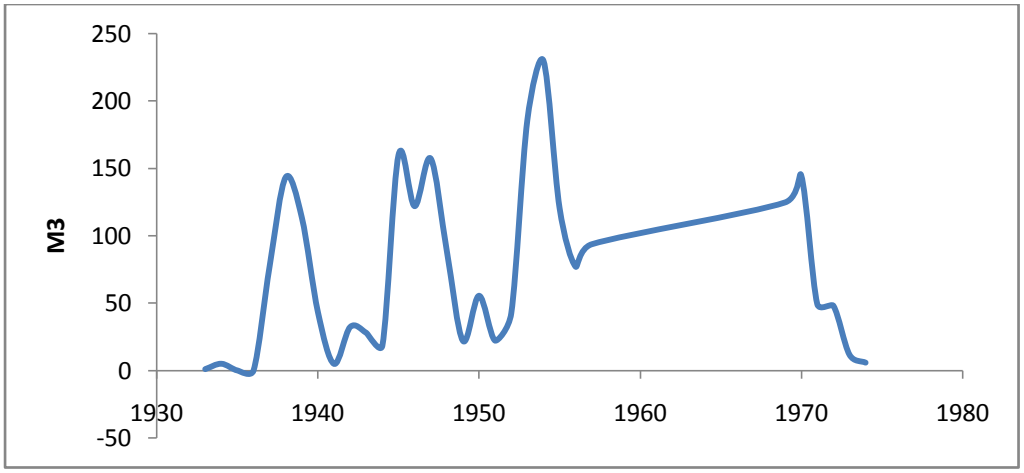


Figure 4.15: Timber production in Heraklion.

Source: Diagram drawn by the author, from quantitative information from HFDA6, 7, 8

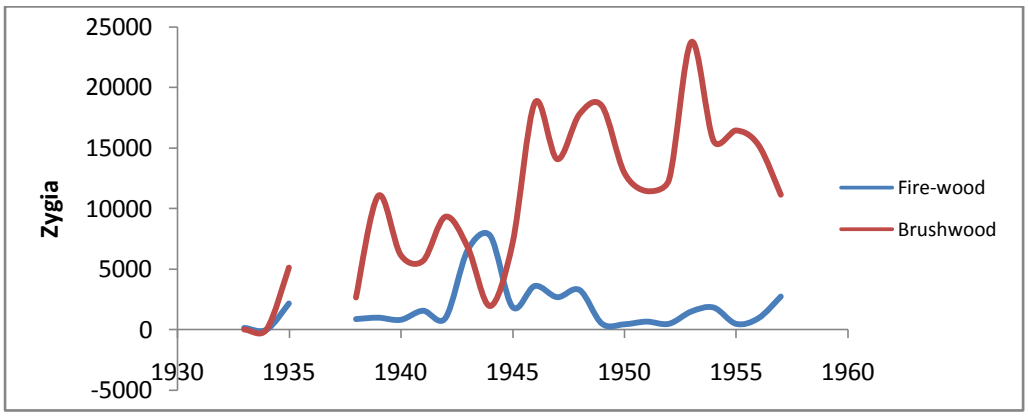


Figure 4.16: Firewood and brushwood (used for lime) production in Heraklion.

Source: Diagram drawn by the author, from quantitative information from HFDA6 , 7

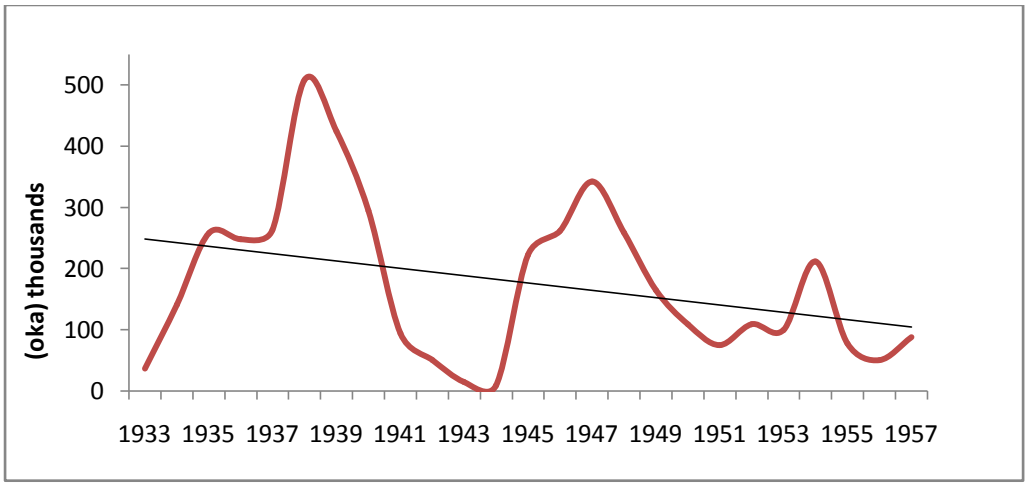


Figure 4.17: Charcoal production in Heraklion.

Source: Diagram drawn by the author, from quantitative information from HFDA6, 7

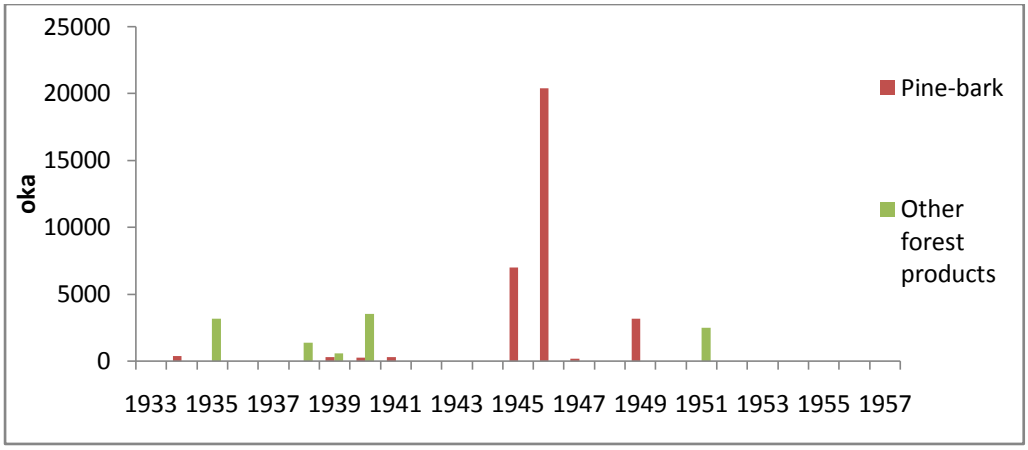


Figure 4.18: Other forest products in Heraklion.

Source: Diagram drawn by the author, using quantitative information from HFDA6 , 7

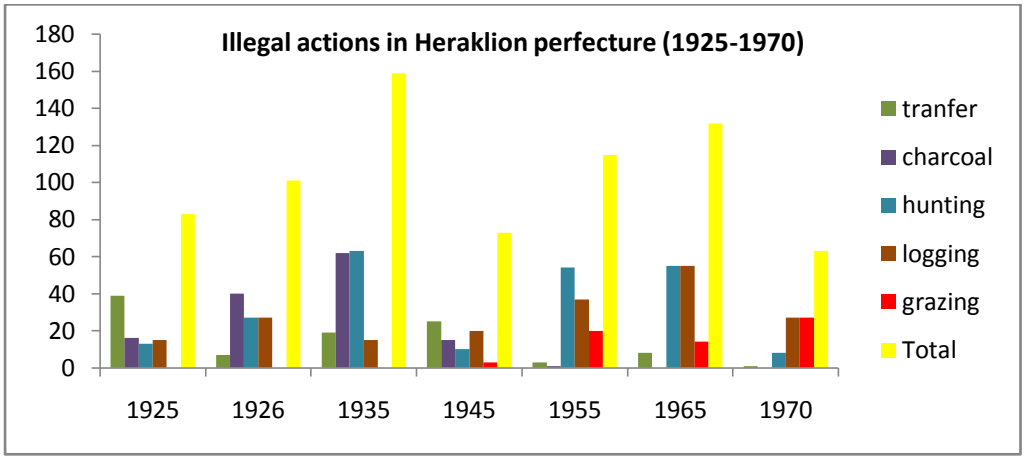


Figure 4.19: Illegal actions in Heraklion Prefecture till 1970.

Source: Source: Diagram drawn by the author, using quantitative information from HFDA2

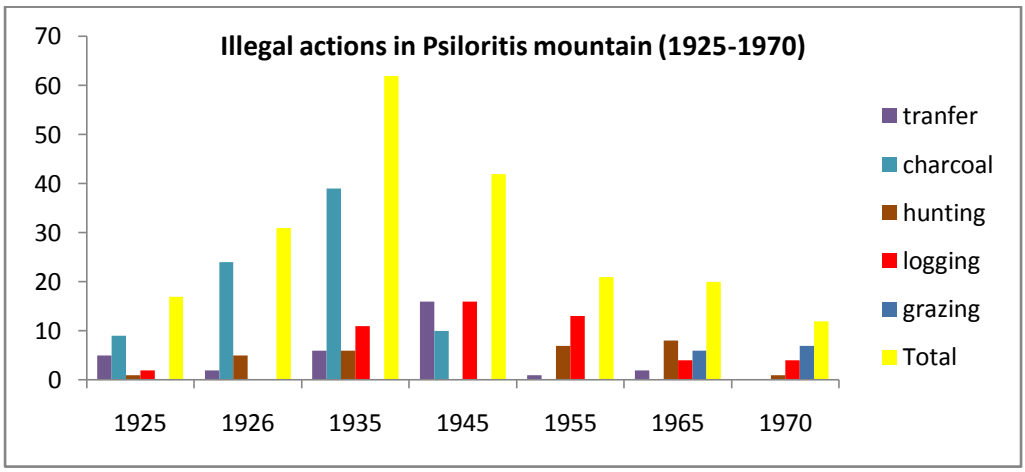


Figure 4.20: Illegal forest actions in eastern Psiloritis till 1970.

Source: Diagram drawn by the author, using quantitative information from HFDA2

The increase in legal charcoal making after the 1930s can be explained by the fact that there is an increase in illegal charcoal cases in 1935 and that pressures peasants to get formal permissions. This can be connected with a more efficient structure and organisation of Forest Commission and the development of local Forest offices in the 1920s (HFDA4, 5). In addition, illegal charcoal is high in 1935 in Psiloritis, and that is connected with a decision by forest officials to forbid charcoal making in the 1930s from the forests of Gergeri village (RGC4) and also by the existence of a local Forest Office there that could implement the decision.

It seems that one of the most important forest products up to the 1950s was charcoal along with firewood and brushwood for lime making as shown from the book of loggings (Figure 4.16, Figure 4.17). This trend changes in the 1960s, where forest production is now reduced only to timber that continues till 1970, when this also ceased (Figure 4.15). The illegal cases graph (Figure 4.19) shows that if there is a need for a product there is always an illegal production of it in parallel with the formal registrations.

The three illegal actions, charcoal making, forest products transfer and logging, are highly related. Obviously when an illegal transfer of forest products occurred or illegal charcoal had been made, illegal wood-cutting was hidden behind these actions. In the archive, several accusations include transfer along with one of the two, charcoal or logging.

This trend of forest production reducing continued and in recent times and along with the forest archives (Table 4.5), information from the statistical authority supports that as well (Table 4.6). It is clear that the last entry for a formally obtained forest product was 1974. Since that year and till today there is not any timber felling in Heraklion prefecture. Rackham and Moody (1996, p.116) in their only one paragraph for woodcutting supported that 'there can be no doubt that until about 1950 wild trees, shrubs and even under-shrubs were much used'. However, Forest archives also suggest that after 1950 woodcutting continued for more than 20 years.

It is important to mention that although it is not connected with forest production, and it was never formally recorded in the archives, grazing was registered among the illegal actions. As soon as charcoal making disappeared, illegal grazing started to arise. Illegal grazing, till the 1940s was not considered as important as in 1970. That year the majority of the accusations involved grazing for both Heraklion prefecture and eastern Psiloritis (Figure 4.19, Figure 4.20).

Year	Timber (m^3)	Charcoal (tons)	Fire-wood (tons)	Brushwood (lime)	Pine-bark	Other forest products
1969	10		1			
1970	2		0			
1971	12.2		4			
1972	0		0			
1973	2		0			
1974	5.803	2	0			

Table 4.5: Forest products from the registry book of loggings from 1969 till 1974.

Source: Table drawn by the author, using quantitative information from HFDA 8

Year	Region	Timber (m^3)	Firewood from forests (tons)	Firewood from cultivations (tons)	shrubs from pastures (tons)*	Charcoal (tons)	Resin (kgr)	Bay leaves (kgr)*	Origan (kgr)*	Mountain (Greek) tea (kgr)*
1971	**Crete**	**2171**	**27676**	**147256**	**27073**	**1142**	**2050**	**93575**	**165215**	**83457**
	Heraklion	490	7110	84927	8784	74	50	245	7136	32112
1981	**Crete**	**1548**	**12562**	**142218**	**13235**	**7013**		**35**	**138**	**110**
	Heraklion	180	3890	52712	2166	400		1	20	67
1991	**Crete**			**90982**		**1550**				
	Heraklion			20879		400				
2001	**Crete**			**81540**						
	Heraklion			31884						

Table 4.6: Statistical accounts of forest production from 1971 till 2001 in Crete and Heraklion Prefecture. These categories were not recorded since 1991.*

Source: 1971 (N.S.S.G. 1978), 1981 (N.S.S.G. 1984), 1991 (N.S.S.G. 1995), 2001 (N.S.S.G. 2006)

Illegal grazing could be connected with an increase in grazing animals (Hill et al. 1998) and an increase in awareness of the negative effects of grazing in forests. In addition the issue of actions from the Forest Service that prohibited grazing in certain places, especially areas that have been burned could also be related with this trend. This is also supported by the analysis of forest fires in the Heraklion prefecture (Figure 4.21) that show an increase after the 1960s and is connected with the forbidding of grazing in the burned areas for a certain period of years.

A statistical analysis of the data contained in the archive of forest fires is presented in Figure 4.21 and Figure 4.22. These charts include the total fires recorded per year and it is concluded that there is a big change in the 1960s. The general pattern derived for the total data set, is followed from the subgroup for Psiloritis Mountain. This indicates that the research area does not differ a lot in the fire element from what was happening in the whole prefecture of Heraklion.

The available data show that the number of fires after 1960 has more than doubled (Figure 4.21). Furthermore, several peaks occur every 10 years, with variations and sub-peaks within every decade. The trend-line of the statistical analysis is increasing in time, however if we subdivide the data set and apply it only since the 1960s, then the trend of increase is not so strong (Figure 4.23). We can conclude that in the last 50 years we have a quite stable pattern of forest fires in Heraklion, although different from the previous decades before 1960.

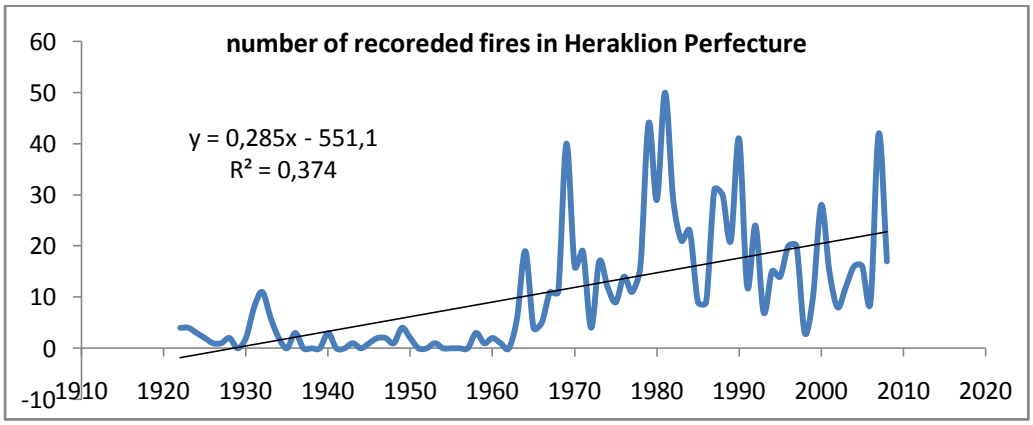


Figure 4.21: Forest fires in Heraklion prefecture from 1920 till present.

Source: Diagram drawn by the author, using quantitative information from HFDA10

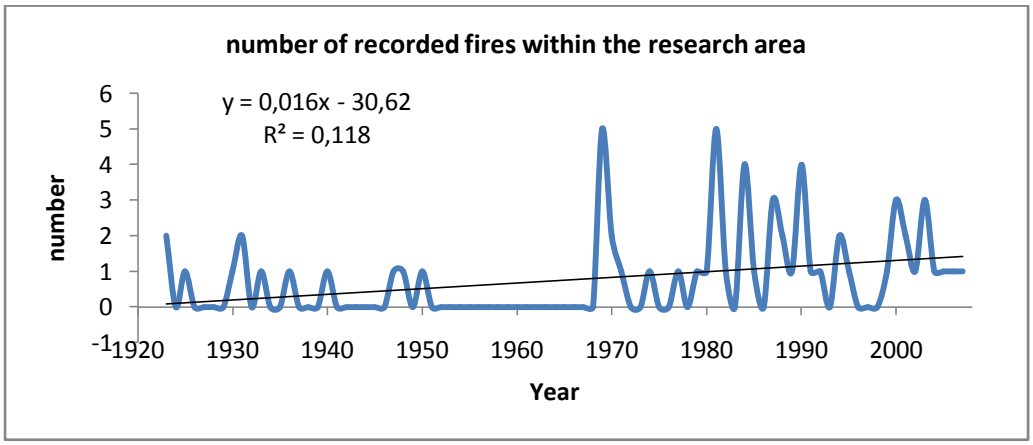


Figure 4.22: Forest fires in eastern Psiloritis.

Source: Diagram drawn by the author, using quantitative information from HFDA10

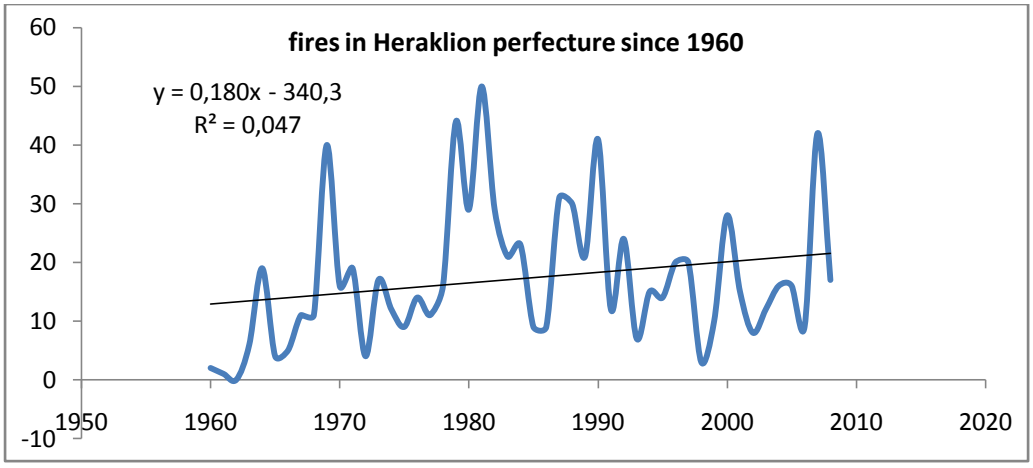


Figure 4.23: Forest fires in Heraklion prefecture since 1960.

Source: Diagram drawn by the author, using quantitative information from HFDA10

It can be suggested that there is a strong correlation of an increase in forest fires and the abandonment of forest production, especially firewood and brushwood collection. Just after the total cessation of firewood and brushwood collection, at the end of the 1950s, there is a sudden increase in forest fires (Figure 4.24).

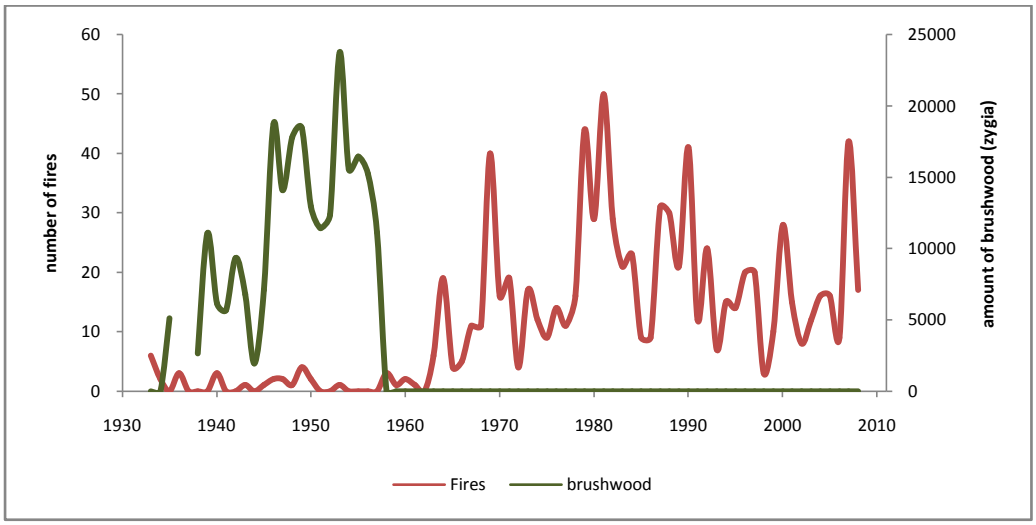


Figure 4.24: Correlation of fire number with brushwood collection.

Source: Diagram drawn by the author, using quantitative information from HFDA6,7,8,10

This correlation can have several dimensions of explanation depending on what view one takes, that of the ecologist or the forester. Several scientists argue that the increase in forests, especially conifers, is connected with forest fires (Rackham and Moody 1996) and others state that this is a result of the human absence from the forest responsible to create a more heterogeneous landscape (Papanastasis 2004).

The cessation of forest production in Heraklion prefecture definitely resulted in less wood cutting from the forests. However, the tension of this procedure and how that influenced forest cover needs to be examined with more reliable data, such as aerial photography. Moreover, correlations regarding forest fires and the increase in forest should be critically evaluated. In the Psiloritis mountain, many researchers have mentioned the increase in animal numbers (Papanastasis 2004, Lorent et al. 2009, Hill et al. 1998, Hostert et al. 2003) and suggest that it can be 'more than 200% between 1980 and 1990' (Hill et al. 1998, p.166), and frequently shepherds in order to create better grass for their herd burn grasslands, thus increase in grazing pressure could result in increase of forest fires.

4.7 Conclusion

Cretan native vegetation and thus forests had a different role over the centuries. Byzantines and Ottomans exploited them less than Venetians or Arabs. Recent written sources, after the formation of a Forest Commission in Greece, following the steps of the western European countries, suggests a use of Cretan forests at least till the 1970s. The main forest product was charcoal and firewood, while timber played a secondary role. Two main observations derived from the archives are on the one hand, the abandonment of forest production, and on the other hand the increase in forest fires in the last 40 years.

Generally, current forest vegetation is resistant to human influence and browsing, and well adapted to harsh climatic conditions. This is an inherent element that helped plants to survive and evolve after the human alteration of the landscape during the Holocene period. Thus, vegetation species are the same as the ones recorded in palynological investigations with several differences in their distribution during the long human history in the island.

Chapter 5: Timber and charcoal from eastern Psiloritis

5.1 Introduction

Forest in Crete is not what traditionally is called productive forest in continental Europe or even in continental Greece. Often foresters working in Crete question their role in the island and wonder if they should be working in an area that does not actually have any productive forests focused on timber as in other parts of continental Greece such as Thrace and Macedonia (Figure 5.1).

> Η3: Εδώ όπως ξέρεις δεν υπάρχει πολύ δουλειά, εν έχουμε διαχείριση, δεν μπορούμε να κάνουμε αναδασώσεις, ούτε δρόμους.
>
> H3: As you know, here (Crete) we don't have a lot of forestry work. There is no management (focused on timber), we can't do plantations, no forest roads….
>
> H3:43, M, Forester

Figure 5.1: A productive forest of spruce (Picea excelsa) in the region of Macedonia, in the Drama Prefecture, in Rodopi area, close to the borders with Bulgaria.

Source: Photos taken by the author, October 2005

However, forests are increasingly recognised as sources for several uses and not only for timber production (Castañeda 2000, Farrell et al. 2000). The term 'productive' is vague and different circumstances can alter natural resources from neglected materials into useful and valuable elements for humans (Koutsopoulos 1990). Nevertheless, if Cretan forests

were or are classed by foresters as productive, they had a crucial role in the recent past for local people. Oral history and archival information provide a picture of what was produced and obtained from the forests of Psiloritis and the Heraklion Prefecture generally, for the last century till the present. Although today foresters regard woodlands of Heraklion, as neglected, sparse and non-productive, archives from the Forest Commission, suggests that there was timber production and another important product, connected with logging, charcoal, formally documented in the forest archives at least till the 1960s. In this chapter these two elements will be considered in the light of oral history, field observation and written sources along with GIS analysis.

5.2 Timber and charcoal in recent written sources

During the Cretan State period, several new laws and regulations were introduced and some of them concerned forestry. There was a view of Cretan forests as overexploited in the past, and this resulted in the issue of several legal forms restricting charcoal production and woodcutting in the forests. Government authorities argued that woods were so rare, that only tree branches should be allowed to cut and never the whole tree for charcoal or timber (Foumis 1899, HAC1).

In addition there is no mention of charcoal taxes, even though there was a tax for almost everything, even for herb collection. At that time, the Cretan State was in its initial stages and actually never had the time to be established as a modern state. The development of an agricultural department, responsible for the forests only reached its initial stages. Thus, any permission for forest use was issued by local authorities, the local mayors. Local authorities tried to change this central decision for charcoal and timber and asked for special permission to exploit their forests (HAC1). The suggestions from officials and consultants were published in the Cretan State Gazette, and they were negative to such practices in the forests. The reply to one of these requests states: 'Moreover, charcoal development, can be permitted, if no trees are destroyed, to be cleared and only the branches of no value to be harvested' (Foumis 1899, p.98). In another document of the same period, that is actually a draft proposal for a law, entitled 'For the protection of forests and all forest vegetation' the first article in the first sentence mentions the prohibition of charcoal or timber production without any permission (HAC1). In the analysis of this legal proposal, it is mentioned

that permission can be provided for charcoal production under specific conditions:

> unless it is used timber derived from dead branches, no trunk from a tree or a young tree will be used, except the side branches that will gathered after the clearing of the domestic or wild trees that are in every forest; the kilns should stand at least 100 metres away from any forest vegetation (HAC1 p. 58).

This picture seems to change when the Hellenic Authority was established in the island in 1913. Now the legislation for forests was connected with the rest of legal system applied in Greece. Cretan forests were not distinguished from the rest of Greek forests as rare and in need of special protection, hence the formal procedure for logging permissions and charcoal making as it was applied in the rest of Greece was followed. In the island, a formation of Forest Commission in every prefecture and the first formal records of forest production took place. An interviewee from Zaros village remembers that there were special permissions for charcoal, issued by the Forest Commission:

> Z1: Παλιά βέβαια παλιά, κόβανε πρίνους και κάνανε κάρβουνα. Παίρνανε άδεια, από το δασαρχείο, βγαίνανε, κόβανε τα κάνανε εκεί κάρβουνα και τα πουλούσανε. Τώρα δεν γίνεται αυτό.
>
> Z1: In the past of course, they cut the kermes oaks and they made charcoal. They had permission from the Forest Service, they went (in the forest) cut, made the charcoal there and they sold it. Now that is not happening.
>
> Z1: 83, M, Farmer

Forest Archives support logging activity in the Heraklion prefecture for timber, although the quantities obtained were not significant. They reached their maximum in 1954 of a total amount of 230 m^3 (Figure 4.15) of timber and definitively did not satisfy the needs of the Prefecture for wood. However, we should not assume that Cretan forests could not satisfy the timber needs of Crete generally. Timber production is not only connected with the availability of forest resources, but also with financial and social factors and available sources elsewhere, that can provide timber at more competitive commercial prices (Sohngen and Sedjo 2000, Tromborg et al. 2000). It seems that charcoal production was more important than timber in Cretan forests and often the Archive is dominated with charcoal making permissions (HFDA6, 7).

Several fluctuations of timber and charcoal production in Heraklion Prefecture can be traced in recent historical events, such as WWII and the emigration wave in the 1950s and in the 1960s (Figure 4.15 and Figure

4.17). This wave had some variations in the different villages that could influence local production differently.

For both, timber and charcoal, there is definitely a peak in the 1930s and a drop during WWII and the German occupation. Another peak occurred after the war ended in the 1940s, but for charcoal never reached the amounts produced before the war. Data are missing for the period of 1958 to 1969, because the archive has been destroyed. However, it can be assumed that charcoal production was stopped sometime at the end of the 1950s, as illegal charcoal is no longer mentioned in the archive (HFDA1, 2), and in the years of 1969 and later, there is not any charcoal production recorded.

In addition to this quantitative information of charcoal and timber, analysis of the data from the Book of Accusations (Figure 4.19) shows that between 1925 and 1945, illegal charcoal making was the dominant action regarding forest law, and then ten years later disappeared completely. More detailed research into this period (1950s) for the Heraklion prefecture showed that illegal charcoal making gradually reduced and in 1955, there was only one documented case (Figure 5.2). For the next decades illegal charcoal making was no longer included in the archive. On the other hand, illegal logging continued to exist and is one of the major activities in the 1960s and 1970s (Figure 4.19).

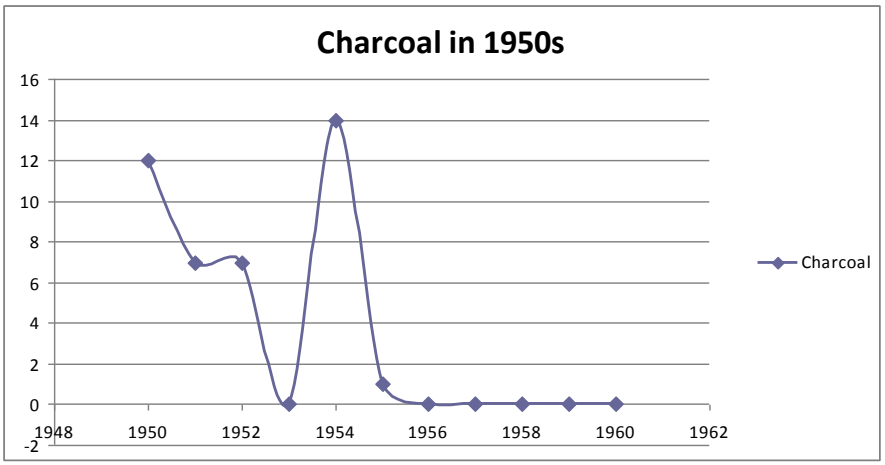


Figure 5.2: Number of incidences of illegal charcoal making in the 1950s.

Source: Diagram drawn by the author using Archival information (HFDA2)

In Argolis, a prefecture in Peloponnese, the amount of charcoal production in the 1930s, is much less than in Heraklion. In his research, Forbes, (2000), argues that according to the Forest Service archives in Argolis, annual charcoal production rises from 9,500 okades in 1933 to

18,000 okades in 1937. Moreover, there is a halt in charcoal making because of the WWII and then it resumes 'on a commercial scale until the beginning of the 1950s' (Forbes 2000, p.103). The delay of commercial charcoal production for almost a decade after the end of WWII is explained by the existence of the Greek Civil War (1945-1949). However, that was not the case for Crete, where the civil war ended just after the WWII. 'The communists failed to infiltrate Crete, which is largely spared the bloodshed and bitterness that engulfs Greece' (Kyriakopoulos 2008, p.36). In Heraklion, charcoal production resumes just after the WWII, in the late 1940s. That can be explained by the end of the war, the commercial need of charcoal in urban areas and probably in Athens. Other continental areas of Greece were affected by the civil war and could not efficiently supply Athens with charcoal. That can explain the sudden increase of charcoal in Heraklion and then a decrease in the 1950s, just after the end of the civil war.

Moreover, the story can be that after the civil war markets from other places of Greece could access Crete and charcoal was imported to Crete, thus the need for local charcoal production was also reduced. The amount of charcoal production was influenced by the social disturbance that was happening in Greece and was able to support Crete with charcoal and vice versa, when Cretan's neglected forests could support continental Greece with charcoal.

A further analysis with the quantitative information derived from the archives was implemented, with the use of GIS, for the years of 1937, 1946 and 1955. In 1937 (Figure 5.3) the western parts of the Heraklion prefecture, were more productive in timber than the eastern. However, timber is not necessarily connected with the uplands and the forests. It seems that lowlands played an equal role for timber as the uplands. That is in accordance with qualitative information that showed an extensive use of the plane tree (*Platanus orientalis*) for timber.

In 1946, the research area appears with the same values as the majority of the prefecture (Figure 5.4). Information on the species cut is not mentioned and probably again plane was the most common tree used for timber. In 1955 data for the research area were not recorded and the majority of the species cut were as in 1936 plane trees (*P. orientalis*).

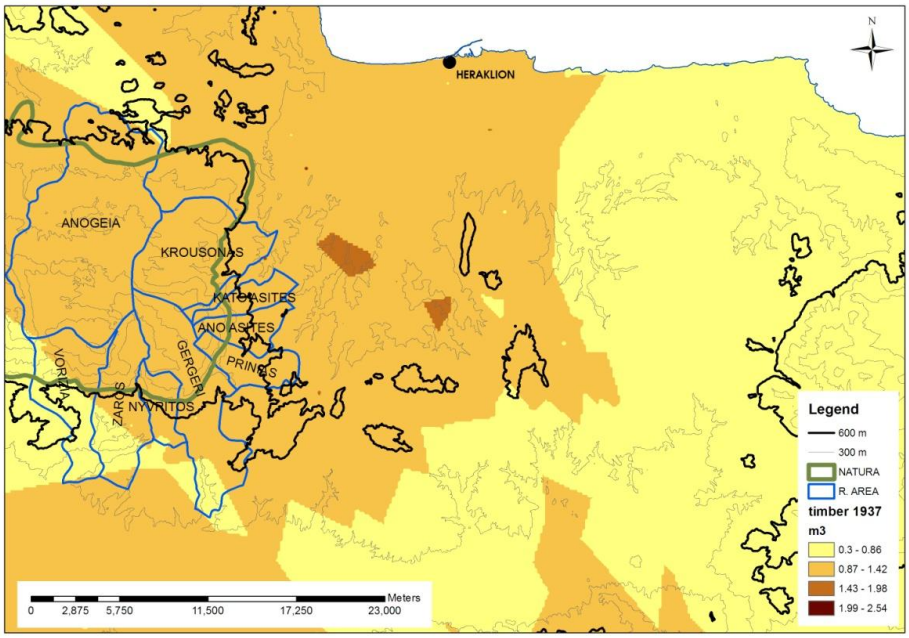


Figure 5.3: Timber production in 1937 for Heraklion prefecture.

Source: Maps drawn by the author using ArcGIS, based on HFDA6

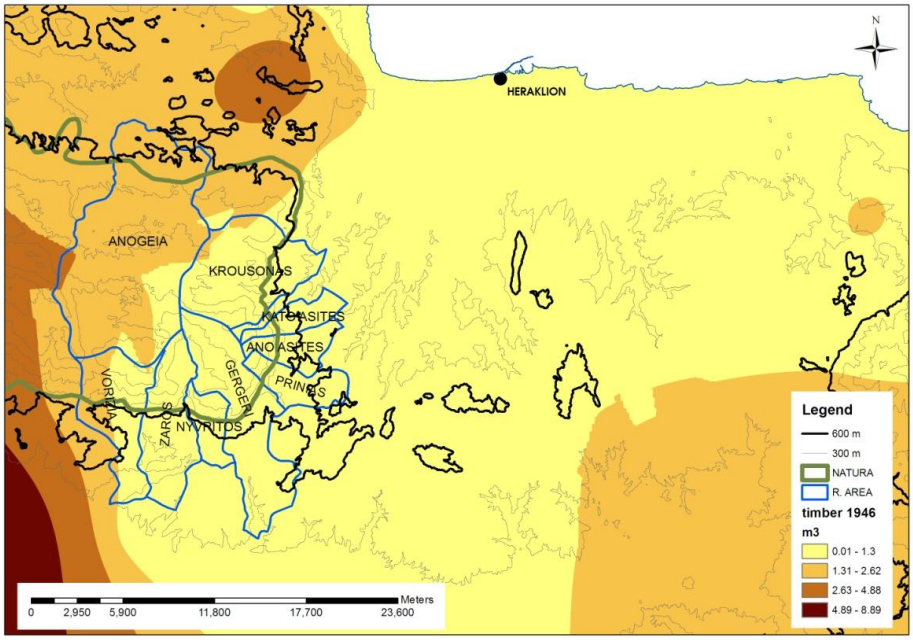


Figure 5.4: Timber production in 1946 for Heraklion prefecture.

Source: Maps drawn by the author using ArcGIS, based on HFDA6

The picture of charcoal spatial distribution is different from timber. In 1937 (Figure 5.5) and 1946 (Figure 5.6) the research area played an important role for charcoal production. There are also areas south of the prefecture, in lower elevations, equally important especially for 1936. Hence, natural vegetation of these areas was also exploited for charcoal

making at those periods. Charcoal in the research area was made from kermes oak (*Q. coccifera*), however kermes oak forests are absent from lower elevations. Those areas have a different type of woody vegetation and forests. The species found there are mainly deciduous oaks (*Q. brachyphylla*), wild olive (*Olea europaea var. sylvestris*) and carob (*Ceratonia siliqua*) and these species were also possibly used for charcoal production.

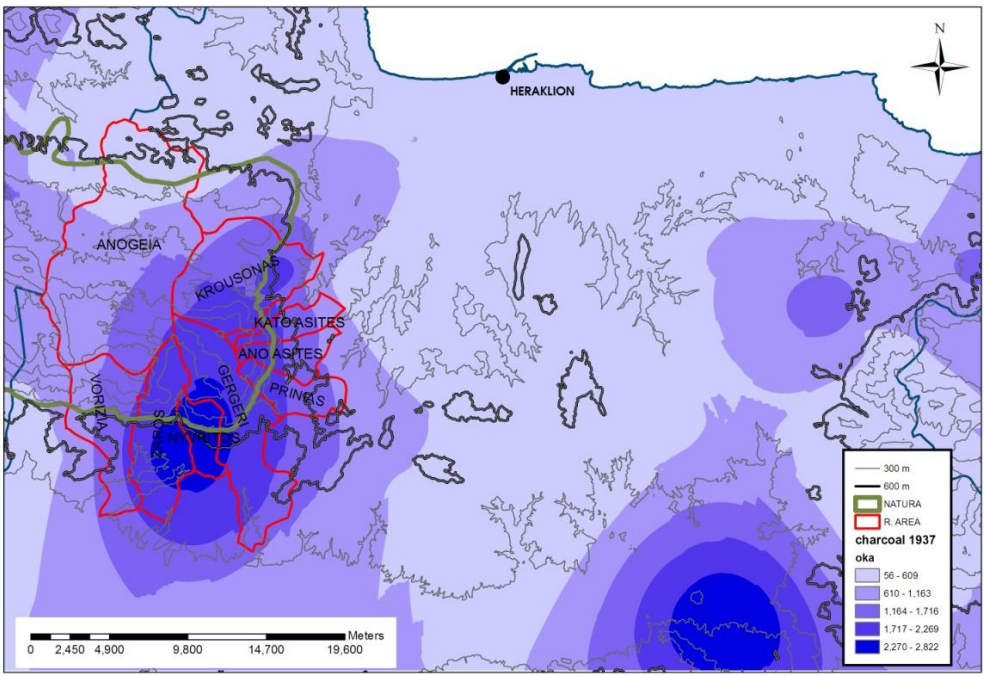


Figure 5.5: Charcoal production in 1937 for Heraklion prefecture.

Source: Maps drawn by the author using ArcGIS, based on HFDA6

Archival information, through GIS analysis, shows that timber was not as important as charcoal in forest production for eastern Psiloritis. Generally the lowlands provided enough timber mainly obtained from plane (*P. orientalis*) and oak (*Q. brachyphylla*). There are also loggings for kermes oak, however these are less important compared with the plane. On the other hand, kermes oak wood was very useful for charcoal making and forests in the uplands were the main producers in Heraklion prefecture. Charcoal production ceased in the 1950s and today and since the 1970s, no timber has been extracted from Cretan forests, at least as far as formal records show.

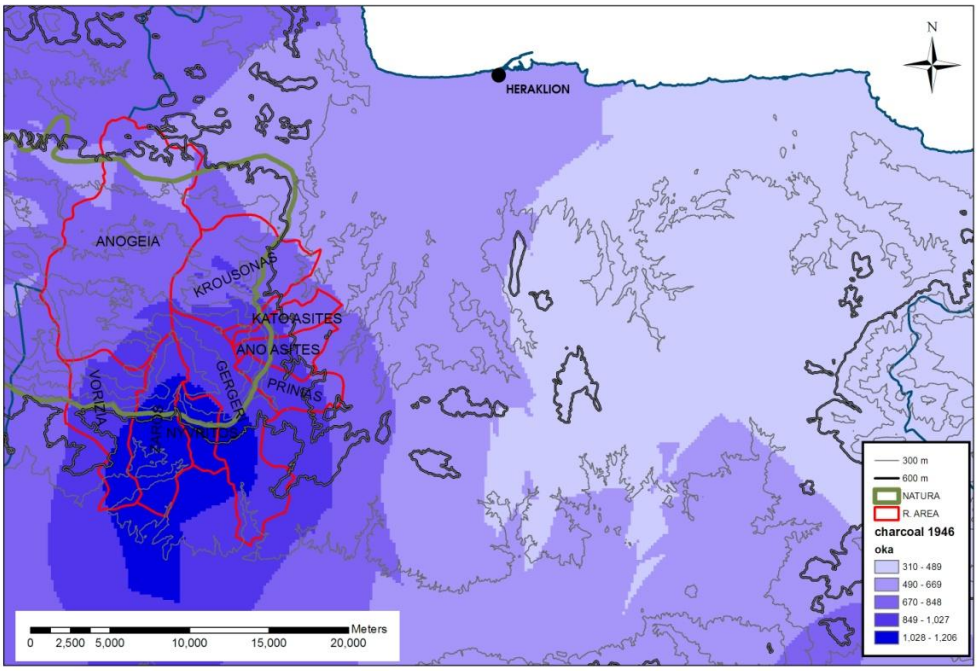


Figure 5.6: Charcoal production in 1946 for Heraklion prefecture.

Source: Maps drawn by the author using ArcGIS, based on HFDA6

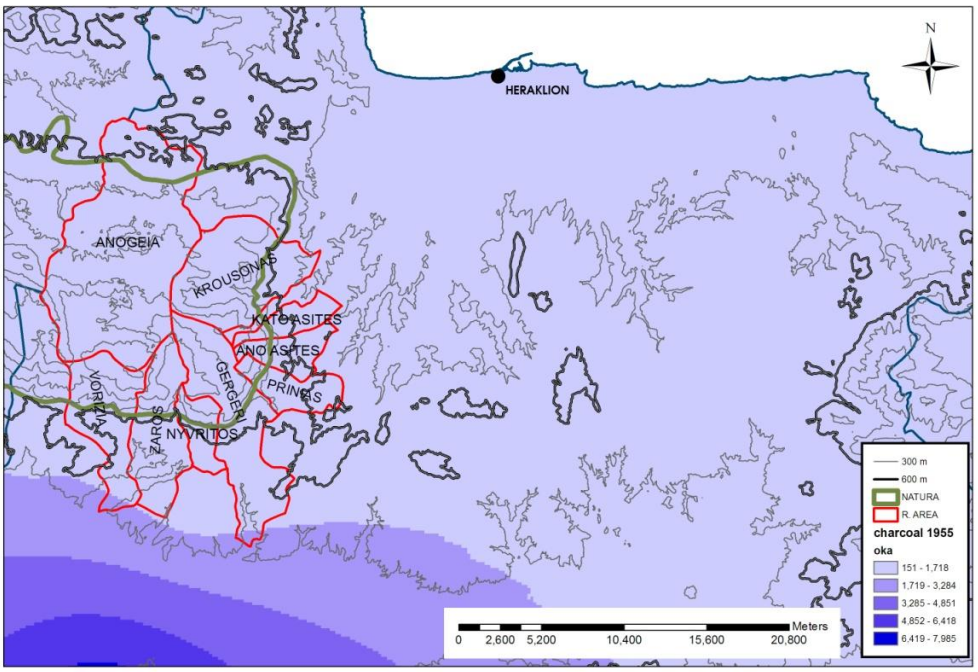


Figure 5.7: Charcoal production in 1955 for Heraklion prefecture.

Source: Maps drawn by the author using ArcGIS, based on HFDA7

5.3 The use of wood in Psiloritis

The archives provide evidence of logging activities; however, information on the use of timber itself is missing. Interviews though, give a better understanding of the different uses of wood from villagers. Oral history suggests that forest was exploited by local people for their needs for the time span covered by the interviews, which is a few decades before WWII till the present.

Crete lacks mineral deposits (Fassoulas 2004), and in the past several agricultural implements were constructed from wood. Local people were aware of the different types of wood available in the area, and used different tree species for different applications. Often, maple (*A. creticum*) was used when light wood was needed for several household implements and kermes oak (*Q. coccifera*) when hard and strong wood was needed, for example for agricultural implements.

Moreover their observations on nature provided them with knowledge about tree species attributes and value of wood, even when they did not use it. Cypress especially, was appreciated as a durable material compared to other trees and was often used in furniture construction such as cupboards, probably connected with the existence of resin in it and potential protection from insects or other infection on food storage. Oral history supports the value of cypress wood and its resistance to ageing:

> G2:Το κυπαρίσσι, όπως λέει ο φιλιότσος έχει άλλη ανθεκτικότητα, αυτό μπορεί να το κόψεις να κρατήσει ο κορμός του εκεί να ζει πολλά χρόνια εκατό διακόσια. Το κυπαρίσσι έχει άλλη αντοχή στο χρόνο, το άγριο προπαντός.
>
> G2: Cypress, as my godson says, has other resistance, you can cut it and its trunk can survive for lots of years, hundred, two hundred. Cypress has a distinctive resistance to time, the wild one especially.
>
> G2: 78, M, Shepherd

> Z2: Όι, τότες, εβάζαμε όμως, εχρησιμοιποιούσαμε το καλύτερο ξύλο για τα ντουλάπια, το κυπαρίσσι.
>
> Z2: No, at that time, we used the best wood for cupboards, cypress.
>
> Z2: 71, M, Hotelier

Furthermore, the time of wood cutting, according to their observations was very important. If you failed to cut the wood at the right time, then it would not last, but would decompose within a few months. In the past and still today, villagers cut wood or harvested potatoes according to the phases of the moon. Woodcutting should be applied only between a full moon phases, till the beginning of the new moon (Figure 5.8). They had

also recognised that specific times were more important than others, for example the August and September moon phases or January were the best time to cut wood:

> G6: Ἐκοψες στη γέμιση, όλα τα ξύλα σε 15 μέρες είναι ολομαμούνιαστα. Κόβεις στη λίγοση και τα ‘χεις δίπλα από τα άλλα, εκιανά που είναι στη λίγοση δεν, όλες οι λιγόσεις είναι το ίδιο, αλλά του Γενάρη και του Αυγούστου, είναι οι χυμοί, απού πρέπει να ναι οι πιο πολλοί ας το πούμε, γερή λίγοση στα ξύλα. Αλλά όλες οι λιγόσεις καλές είναι. Αλλά του Γενάρη λέει και του Αυγούστου, είναι η καλύτερη.
>
> G6: You cut on moon waxing; all the timber in fifteen days will be full of insects. You cut in moon waning, and you have them next to the others, the ones that have been cut on moon waning no (problem), all wanings (moon) are the same, but the one in January and August, the juice is (in timber), they must be more, very strong waning for the woods. But all wanings are good. However, January and August it is said to be the best.
>
> G6: 78, M, Shepherd

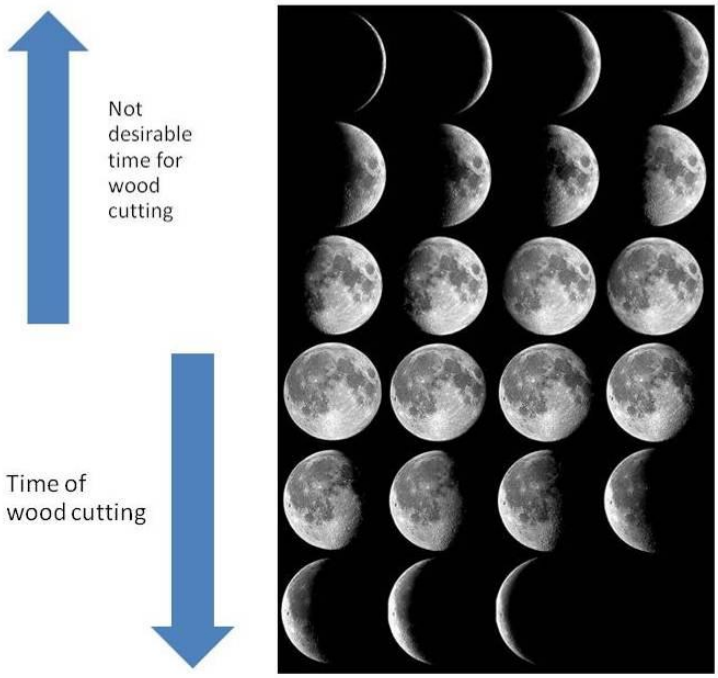


Figure 5.8: A diagram of moon faces and wood cutting time.

Source: diagram drawn by the author, based on interview material

Interviews suggest various uses of timber for ordinary local uses or even for commercial purposes. Generally, conifers, pine (*P. brutia*) and cypress (*C. sempervirens*), were used in house building and especially as beams. This was actually a process done by individuals for their own needs. They went to the forest, selected the desirable trees and cut them. Transportation was done with mules or donkeys and often pre-processing was applied in the forest, such as stripping the bark. Actually this process

is still carried out in productive forests of Greece (Drosos 2006). Then, the trunk was transported to their house and further processing was made, in order to satisfy their needs. For house building, long straight trees were needed, and the most desirable one was cypress:

> Z6: Εκόβαμε κυπαρισσές, πευκαλούδες μεγάλες, μακρυές και κάναμε μεσοδόκια, να σκεπάσουμε το σπίτι. Έβλεπες να πούμε μια πευκαλούδα μακρυά, τοσινε στο χόντρος, την εκόβαμε και την εκαθαρίζαμε και τσοι κατεβάζαμε κάτω, απ'την άκρα του ξύλου, κάνανε ένα ζωναράδι έτσι και το δένανε κολοσερτό ύστερα από κια και το κατεβαζανε κάπου που να μπορεί να φορτωθεί σε ζώο.
> P: Δηλαδή με τα χέρια το τραβούσατε;
> Z6: Ναι με τα χέρια τα τραβούσανε και κατεβαίνανε μακριά, όπου ήπρεπε να πάει για να φορτωθεί στα ζώα.
> P: Από τα πεύκα πιο πολύ αυτό;
> Z6: Ναι απ'τα πεύκα που ναι και τώρα είναι πεύκα. Τώρα την εποχή εκείνη που εμείς εσάζαμε στο μεσήσκλι τα σπίτια, επήγαινα με ένα αδελφό μου μα είναι μακαρήτης τώρα χρόνια, και έκοβγε αυτός και γω ξεφλούδιζα ήβγανα τη φλούδα, και τα πετούσαμε με τον κώλο, με το χόντρο ετσέ κάτω και κατεβαίνανε, τσουρλούσανε, κατεβαίνανε σε ένα σημείο και από κει τα ξανά μεταφέρναμε. Και τα πηγαίναμε τώρα ύστερα στο σπίτι απού ήθελε να πάμε στο σπίτι, καθίζαμε και τα πελεκούσαμε και το κάναμε πλάκα, και σκεπάζαμε τότε τσοι βίλες.
> P: Πώς τα ξεφλουδίζατε;
> Z6: Με σκεπάρνι.

> Z6: We cut cypress, big pines, long and we made beams, to cover (roof) the house. You could see a tall pine, like this bulk (diameter of about 40cm), we cut it and we clean it and we transfer them down, from the edge of the wood, we made a belt like this and we tied it and we dragged it from the back from there, till we reach a place that animals could carry it.
> P: So you drag it with your hands?
> Z6: Yes with the hands we drag it for a long distance, till it will reach the place to be carried with the animals.
> P: Pines were used for that more?
> Z6: Yes from pines, that are and now, are still pines. At the time that we were building in Mesiskli (village name) the houses, I was going with my brother, he is departed since years ago, and he was cutting and I was barking the trunk, and we fell them down with the back, the bulk end and they were getting down, rolling, and they were getting in a place, and then we transport them again. And then we transfer them to the house when we will get in the house, and we sat down and we chopped them, we chopped it till it was straighten and then we cover (roofing) the villas.
> P: And how you was barking them?
> Z6: with the adze.
>
> Z6: 82, M, Shepherd

In the past, according to interviewees, cypress was quite rare in the area and in order to find it you needed considerable effort:

> Z6: Τα κυπαρίσσια εκείνα τα άγρια, την εποχή εκείνη, έψαχνες να βρεις τρούλα, να βρεις μακρύ, να το κάνεις δοκάρια που είπα προηγουμένως για να σκεπάσεις σπίτι. Τώρα όλα είναι.

> Z6: Cypress the wild ones, at that time, you had to search to find a sprout of it, to find a long one, to make beams, as I said before to cover a house. Now all are (abundant).
>
> Z6: 82, M, Shepherd

Thus, rarity was a result of extensive use of it not only for timber but also as an occasional material in the charcoal making. This is different today, where the population of cypress is starting to recover (Figure 5.9). However, it is not as extensive as in western parts of Crete (Zohary and Orshan 1965).

Figure 5.9: Cypress (C. sempervirens) in the area of Zaros, north of the village.

Source: Photo taken by the author, August 2010

Furthermore, areas with less conifer forests such as the area around Asites villages, used the fast growing poplar tree (*Populus sp.*) that is found on riversides, instead of pines or cypress from the forest. Often cypress was also planted in the cultivated land, in the borders of the fields, and was cut to be used for house construction (Figure 5.10).

A 95 year old woman from Ano Asites village mentions the use of poplar trees as beams in roof construction and suggests that people planted them:

> As7: Φύτευαν πεύκη, για να κάνουν τάβλους, και μεσοδόκια. Κόψανε έναν πεύκο, ειδικοί από την Αγία Βαρβάρα για να κάνουνε τα μεσοδόκια.
>
> As7: They planted poplar, in order to make beams and boards. They cut one poplar, special people from Agia Varvara (village), to make beams.
>
> As7: 95, F, Worker

Figure 5.10: Cypress (C. sempervirens) in Ano Asites village.

Source: photo taken by the author, July 2008

In this interview the name used for poplar tree (peyki/os) is similar to pine (peyko) in continental Greece. However, in Crete, in the past the term used for pine was 'peykalouda' not 'peyki or peykos'.

Additionally pine provided sticks for the fields and several branches were cut in a pollarding method (Figure 5.11). An interviewee from Zaros village went in the past in the pine forest close to his village and cut such sticks for his vines:

> P: Αλλά από τα πεύκα, έπαιρναν ξύλα καθόλου;
> Ζ1: Όχι δεν τα πειράζανε. Απλώς τώρα τι μπορούσαμε να κάνουμε, αλλά δεν το έκοβανε το δέντρο. Γιατί πήγα και εγώ, όταν πρώτο-φύτεψα το πάνω κλήρο… επήγα και έκοψα κλάδους ας πούμε στρογγυλούς τόσο στο χόντρος (8-10cm) και μακριούς κάνα 2 μέτρα και έφραξα το αμπέλι, αλλά δεν το έκοβα, το δένδρο από τον πάτο. Έκοβα τα κλαδιά από τα πεύκα, για τέτοια πράγματα, γιατί οι πρίνοι δεν έχουν τέτοια πράγματα, για στύλους, σε τέτοια, κόβανε ας πούμε, αν και απαγορευόταν κόβαμε. Στα ζούλα, κόβαμε. Αλλά για να κόψεις δένδρο από τον πάτο όχι.
>
> P: from pines did you get any wood?
> Z1: No, we did not disturb them. We just may take something, but we did not cut the tree. I went once, when I planted for first time my field, I went and I cut branches, roundish like this thick (8-10cm), and long, about two metres, and I fenced my vines but I did not cut the tree from the base. I cut branches

> from pines, for such things, because kermes oak did not have such things. So for sticks, such things they cut although it was forbidden. In secret we did. But not a whole tree to cut, from its base, no.
>
> Z1: 83, M, Farmer

Figure 5.11: Brutia pine (P. brutia) with cut branches in the pine forest of Zaros that were used in agricultural works.

Source: photo taken by the author, August 2009

Moreover, even in areas where today conifers are more common, the demand for straight beams for roof construction resulted in the use of poplar trees even in the villages of Gergeri and Nyvritos. Several interviewees, from Nyvritos village mentioned the use of poplar trees:

> P: Ξύλα στο σπίτι, μεσοδόκια, από τα πεύκα τα κάνανε ή κυπαρίσσα;
> N4: Κόβγανε και κυπαρίσσα, κόβγανε και πεύκους απού λέμε στους ποταμούς.
>
> P: Timber for the house, beams, did you cut from pines or from cypress?
> N4: We cut cypress as well, and 'peykous' (poplar), as we call them, from the riverside.
>
> N4: 70s, M, Hayward

Foresters in the 1930 management plan for Rouvas forest recorded such use of poplar from Gergeri population, and they mentioned that the species used was *Populus nigra:*

> Because of the absence of suitable species, construction timber production for local needs from the forest is limited and that

had led of long time now to the plantations of Black Poplar in their fields (in Gergeri) (RGC4).

5.4 Wood implements

Timber was not only used as beams and boards in the research area. Actually, this uses were quite limited and were only to satisfy villagers' needs. The real production, that characterised the area, and created a local market, was the use of timber for making farming and household implements.

A very important implement of the past was the wooden plough (Figure 5.12). The villages of Zaros, Gergeri and Nyvritos were plough providers for the fertile plains, and especially the Messara plain (Figure 5.13). Having in mind that in the past grain cultivation was very extensive in Crete, ploughing the land was very common and undertaken by almost all the farmers of the area. In statistical accounts, the wooden plough in 1929 is very common and metal ploughs are very rare (Table 5.1).

Figure 5.12: Wooden plough made from kermes oak wood in Anogeia village.

Source: photo taken by the author, February 2010 from a private collection in Anogeia

In his work on the agricultural economy of Crete in 1961, Kriaris mentioned that the number of wooden ploughs in Crete was 15,500 and metal ploughs 29.500 (Kriaris 1961). At that point and after the war, gradually the wooden plough started to be used less and was replaced by the metal plough (Figure 5.14):

Ρ: Τι άλλο έκαναν, Έκοβαν ξύλα, Έκαναν γεωργικά εργαλεία;

G2: Ναι, τα εργαλεία τα έκαναν πριν την κατοχή και μέσα στην κατοχή ακόμα. Ο κάμπος όλος, ήταν ξύλινα τα αλέτρια, μετά την Κατοχή έκαναν το σιντερένιο αλέτρι οι χαλκιάδες. Πολλοί πάρα πολλοί έκαναν ξύλινα αλέτρια.

P: What else did they make, did they cut wood and make farming instruments?
G2: Yes, the implements were made before the German occupation, and during it. The whole plain, ploughs were wooden, after the German occupation metal plough was made, from the blacksmiths. A lot of people made wooden ploughs.
G2: 78, M, Shepherd

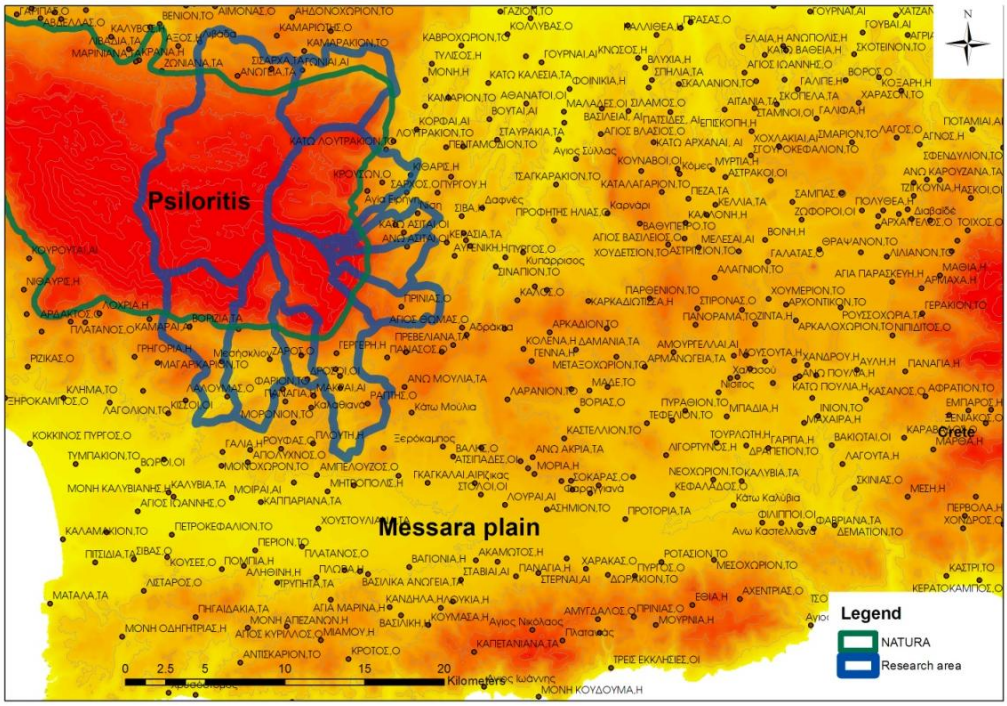


Figure 5.13: The fertile area of Messara that was provided with wooden ploughs, made in the villages of the research area. Low elevation areas are with yellow colour and red areas represent higher altitudes.

Source: Map drawn by the author, using ArcGIS

Prefecture	plough		Benzene plough	harrow		Harrow for thresh floors (volosiros)
	wooden	metal		wooden	metal	
Total	30,159	5,832	33	5,793	982	2,608
Heraklion	**8,906**	**3,279**	**6**	**2,720**	**85**	**1,557**
Lasithi	8,322	381	2	1,160	391	1,031
Rethymnon	5,459	2,73	1	279	226	20
Chania	7,472	1,899	24	1,634	280	0

Table 5.1: Information on agricultural machinery of the year 1929 for Crete.

Source: (G.S.C.G. 1934, p.270)

Figure 5.14: Metal plough that replaced the wooden one. This was found in the garden of the high school of Gergeri.

Source: photo taken by the author, January 2010

Cereal production, created a need for other implements for further processing of the seeds after the harvest. For example a harrow for threshing floors (*volosiros)*, (Figure 5.15) was used to crack the seed from the haulm. Another implement called '*lichnistiri'* (pitchfork) (Figure 5.16) was used to separate the seed from the straw of hay:

> G2: Αυτοί ήταν πολλοί επαέ στο χωριό. Ο Γιάννης ήτανε καλός αλετράς ήτανε ο Κακουλοφανούριος ήτανε ο Λουλούδης, που λες από τσοι πρώτους, αυτός ήκοβγε και ήκανε πολλά εργαλεία ήκανε, από τον ασφένταμο ήκανε και τα λυχνιστήρια, τα θρυνάρια, απού λέγαμε και τσοι παλάμες, το βολόσυρο που σβάρνιζε. Ήταν και αυτός ή από πεύκο ή από ασφένταμο. ήκανε και αυτός βολοσύρους που λέμε … και τ' αλέτρι. Το αλέτρι ήταν πάντα από πρίνο. Γιατί είχε αντοχή.
>
> G2: There were lots of them here in the village. Yiannis, was a good plough maker, it was Kakoulofanourios, it was Louloudis, from the best ones, he was cutting (wood) and made a lots of implements, he made from maple Lichnistiri, thrinaki, the spades we called that time, volosiro for harrowing (harrow), it was also made from maple or pine, … and the plough. Plough was always made from kermes oak. It was resistant.
>
> G2: 78, M, Shepherd

In addition, another instrument, necessary to keep oxen together when ploughing the earth, was called *zyghos* (yoke) (Figure 5.17). It was made from maple in order to be light and help the animals in their hard work:

Ν4: Για το ζυγό ήτανε το καλύτερο ξύλο ο ασφένταμος. Έχει στο βουνό δεν θα το έχεις παρατηρήσει. Εκιοσάς ο ασφένταμος έκανε καλό ζυγό.
Ρ: Ήταν πιο μαλακό το ξύλο του για αυτό;
Ν4: Και πιο αλαφρύ, το σηκώνανε τα βούγια τα κακόμοιρα.

N4: For the yoke the best wood was maple. It is in the mountain, you may not have noticed it. That one, the maple could make good yoke.
P: Was the wood softer for that?
N4: And lighter, the poor oxen have to carry it.

N4: 70s, M, Hayward

Its literal meaning in Greek is balance; however, it is also used as a means of reaction against rulers and suggests that Greeks cannot afford any (yoke) *zyghos* in their back, as oxen can.

Another important implement, used for bread baking, was *thrinaki* (Figure 5.18) a kind of wooden spade, useful to move the bread in or out of the kiln. A 70 year old woman from Nyvritos remembers her uncle selling *thrinaki* in the plains:

Ν3: Τα θρυνάκια, ένας μπάρμπας μου επήγαινε κάτω στους κάμπους απού εκεί δεν είχανε βουνό ξύλα να τα φτιάχνουνε και επήγαινε δα ύστερα στους καμπους και τα πουλιε. Κήθελε να πάρει καρπό γιατί δεν είχανε οι αθρώποι λεφτά να του δώσουνε μόνο καρπό που εβάνανε στους κάμπους καρπούς γιατί εμάς επαέ τα ορεινά χωριά δεν εβγάνανε καρπούς και πήγαινε στους κάμπους τώρα τα χρειαζόμενα αυτά και ύπαιρνε καρπούς και ίζε πέντε παιδιά που τα 'χαινε.

N3: Thrinakia, an uncle of mine, went in the plain where they haven't mountain, wood to make them and so he was going to the plains, to sell them. And he was given seeds (cereals) because people didn't have any money to give, only seeds that were grown in the plains, because here, in the mountain villages we didn't grow any seeds (cereals) and they were going to the plains all these useful implements and they were getting seeds (in exchange to wooden tools) to feed their children.

N3: 70. F, Housekeeper

Figure 5.15: Volosyros (harrow) made from maple or pine wood.

Source: Photo taken by the author February 2010 (private collection in Anogeia village)

Figure 5.16: Lichnistiri (Pitchfork) made from maple (A. creticum) wood.

Source: Photo taken by the author January 2010, (local collection in Gergeri village)

Figure 5.17: Oxen used for ploughing the earth with a wooden plough and a yoke to keep them together, ca. 1900.

Source: Mikros Nautilos, (Anonymous 1995)

Figure 5.18: Thrinaki (spade)

Source: Photo taken by the author January 2010, (local collection in Gergeri village)

Several other wooden implements were also made from the available wood from the nearby forests. Even shoes and pipes were made. In Table 5.2 several uses of wood for local and more distant markets, according to oral history are presented.

Type of implements	Tree species	Use
Volosiros (harrow)	Pine (*P. brutia*)/ maple (*A. creticum*)	cereal production
Thrinaki/thrinari/palami (spade)	Maple (*A. creticum*)	bread cooking
Lichnistiri (pitchfork)	maple(*A. creticum*)	cereal production
Aletri (plough)	Kermes oak (*Q. coccifera*)	farming
Pipes	Rose (*Rosa sp.)*	daily use
Tsokara (shoes, patten)	Maple (*A. creticum*), plane (*P. orientalis*), fig	daily use
Zygos (yoke)	Maple (*A. creticum*)	farming
Mill instruments	Maple (*A. creticum*)	cereal production

Table 5.2: Uses of wood in the past from the villagers of eastern Psiloritis.
Source: Table drawn by the author, information derived from oral history

Today wood from the forest is still used by local people but in a more artistic way. Villagers having satisfied their everyday needs, and enjoying modern facilities, return to the forest to collect wood and create art, or even handmade wooden implements that are still in use. Such implements include shepherds sticks or wooden spoons (Figure 5.19). At the same time, dead wood found in the mountain inspires them to express their emotional world and it is transformed into sculptures (Figure 5.20). In 2008 an exhibition was held in Heraklion in the Basilica of St Mark, under the title 'The myth of the earth from the hands of humans' and several local artists from Psiloritis presented their work (Kokolakis 2008). The majority of the sculptures were made of wood.

Figure 5.19: Photo on the left: shepherd's sticks that are still made in Gergeri village mainly from kermes oak. Photo on the right: use of special instruments to create a spoon from maple.

Source: Photos taken by the author February 2010

Figure 5.20: The photo on the left shows a wooden sculpture made from dead kermes oak wood in Gergeri. The photo on the right shows a portrait of Lady Diana made after her death by a local artist in Zaros village.

Source: Photos taken by the author January and February 2010

5.5 Charcoal: a dark, artistic result from wood.

It took modern people almost eight decades (1852-1932) to understand completely the chemical process that changed wood to charcoal, a work that had been happening for millennia all over the world (Antal and Gronli 2003). Charcoal is the 'solid residue that remains when wood (or other organic material) is 'carbonised' or 'pyrolised' under controlled conditions in a closed space' (Olson 1991, p.411). In other words, charcoal is carbon with as little as possible of other substances. 'Pyrolysis abruptly transforms wood into a tarry vapor containing a complex soup of organic compounds mixed with non-condensable gases (including CO_2, CO, H_2, CH_4, and heavier hydrocarbons)' (Antal and Gronli 2003, p.1620). How illiterate people knew this process and used it for hundreds of years, from generation to generation, is a fascinating phenomenon.

In his research, regarding firewood and charcoal in classical Athens, Olson (1991, pp.412-413) suggests that:

> there are two basic primitive technologies for making charcoal, the pit and the mound, both of which can be used on a small or large scale. In each case earth is used to restrict the amount of air available to the wood being burned.

Charcoal pits are common in areas with deep soil conditions, whereas mounds are more suitable in rocky and mountainous areas (Olson 1991).

5.6 Charcoal in Psiloritis Mountain

5.6.1 Uses of charcoal

It is important to mention that charcoal was not primarily produced for local use in the mountainous communes, but for selling to other areas, villages that had no access to woods, or the urban area of Heraklion city. This was strongly highlighted in the interview material:

> P: Και κάρβουνα κάνανε, θυμάσαι;
> G17: Αμέ, κάνανε και κάρβουνα, τα πουλούσανε στην Αγία Βαρβάρα. Με τα κάρβουνα και τα καμίνια που κάνανε, αποκια ζούσανε. Δεν εφυτεύανε επαέ στο χωριό λέει γιατί δεν εφυτρώνανε. Οι παλιοί, σοβαρά και κάνανε τα κάρβουνα και τα πουλούσανε στην Αγία Βαρβάρα και στη Μεσσαρά και πέρνανε πατάτες και όσπρια και τέτοια.
>
> P: Do you remember charcoal making?
> G17: Of course, they did charcoal, and they sold it in Agia Varvara (nearby village). With the charcoal and the kilns they made, from there they could survive. They did not plant anything in the village (Gergeri) because they thought they could not grow. The old people thought so, and they made charcoal and they sold it in Agia Varvara and in Messara and they could get potatoes, legumes and other stuff (in return).
>
> G17: 45, M, Farmer

Charcoal was necessary for blacksmiths, taverns for cooking, tailors (Figure 5.21), and for heating. Olson (1991, p.412) suggests that charcoal is good for ironworking as it has a 'heat value of 6,500 to 7,200 kilocalories per kilogram, roughly comparable to that of bituminous coal, and thus yields much more heat per kilogram than even dry wood'. This type of use is also mentioned in other case studies in the Argolis Prefecture, in the Peloponnese, and information for its use for heating households is available even in Greek ancient literature (Forbes and Koster 1976, Forbes 2000). The uses of charcoal are also mentioned in this interview:

> G2: Το Ηράκλειο τώρα, όλες οι ταβέρνες οι άλλοι οι ραφτάδες που εσιδερώνανε, για σίδερο, όλα, προπαντώς οι ψησταριές. Και για θέρμανση τα βάνανε, τα βάνανε σε ένα μαγκάλι, αλλά αυτά ήτανε βέβαια και επικίνδυνα πολλές φορές γιατί στο μαγκάλι το κάρβουνο δημιουργούσανε δηλητηριάσεις. Εποθάνανε και πολλοί από το μαγκάλι.
>
> G2: In Heraklion, all the taverns, the tailors for ironing, all, especially the chop-houses. And for heating it was used, they put them in a brazier 'mangali', but that could be dangerous, because in the brazier, charcoal could cause poisonings. Many died because of the use of charcoal braziers.
>
> G2: 78, M, Shepherd

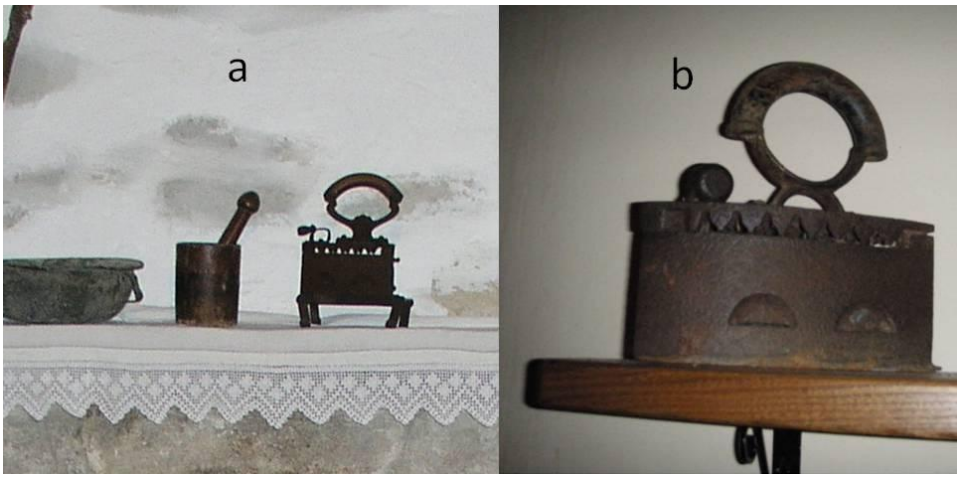


Figure 5.21: Irons using charcoal to keep high temperatures, used in households or even from tailors in the past for cloths ironing. The first picture is from Ano Asites museum, and the second from Italy, Liguria from a private collection in Scurtabò. There are several similarities between them.

Source: photos taken by the author, (a) summer 2005, (b) April 2010

5.6.2 The woodcutting

The period that charcoal was produced in Psiloritis Mountain was just after the winter, probably the beginning of March till the end of October or November, depending on the weather conditions, as a 78 year old shepherd from Gergeri village recalls:

> G2: το χειμώνα βέβαια δεν ήτονε εύκολο να κάμεις κάρβουνα πάνω, γιατί είναι το χιόνι και το κρύο. Και άμα εξεκαλοκαίρευγε μετά όλη την περίοδο ήτανε τότε..
>
> G2: In the winter of course it was not easy to make charcoal, because of the snow and the cold. And when it was getting warmer, then all the rest of the time they were doing it.
>
> G2: 78, M, Shepherd

The type of wood used in charcoal making, differed from area to area. The species used for charcoal in Crete are mainly oak, deciduous (*Q. brachyphylla, Q. macrolepis*) or evergreen (*Q. ilex, Q. coccifera*), carob (*Ceratonia siliqua*) and olive (*Olea europaea*). However, in the mountains kermes oak (*Q. coccifera*) is more common than carob or olive that grows in lowlands. In eastern Psiloritis the species that was mainly used for charcoal production was the kermes oak, a very important wood according to a 83 year old interviewee from Zaros:

> P: Αυτό γινόταν κυρίως από ξύλα πρίνου;
> Z1: Πρίνου μόνο. Κάνανε και κάτι άλλα, αλλά αυτά δεν υπήρχαν στο βουνό. Από χαρουπιές, η χαρουπιά κάνει και η χαρουπιά. Και η ελιά κάνει. Αλλά το πολύ καλό, είναι ο πρίνος. Καλό είναι και της χαρουπιάς, αλλά χαρουπιές δεν έχει στο βουνό, κάνανε και με αυτό.
>
> P: Was this (Charcoal) done mainly with kermes oak (*Q. coccifera*) wood?
> Z1: Kermes oak (*Q. coccifera*) only. They used some other species, but they don't exist in the mountain. It can be done from carob trees, carob can be used and olive can also be used. But the best is kermes oak (*Q. coccifera*). And carob (*C. siliqua*) is good also, but you cannot find carob in the mountain, they used that also.
>
> Z1: 83, M, Farmer

They used the whole tree, and the timber, according to its size was placed in different parts of the kiln. The trees needed for charcoal differed in size and age. Almost every tree bigger than a specific diameter could be used for charcoal. Moreover, ancient trees with huge trunk diameters provided wood for charcoal from their branches. The use of tree branches for charcoal making was permitted during the short Cretan State era and it was also integrated in the forest law of that period (Foumis 1899). Today mid-sized trees are rare in the Rouvas forest, and the majority of the trees are of ancient status, with quite large trunks (Figure 5.22) or relatively young. This can be explained by a continuation of exploitation and demand for medium sized trunks for charcoal making from the 1930s till the 1950s that removed a specific age group of trees from the forest. Two interviewees suggest the use of whole trees in charcoal making:

> P: Έκοβαν, τα δέντρα ολόκληρα;
> Z1: Ολόκληρα, το κόβανε από τον πάτο ναι, από τον πάτο γινόταν αυτή η δουλειά.

P: Did they cut the whole tree?
Z1: Yes the whole tree was cut from the ground, from the ground was that work done.

Z1: 83, M, Farmer

P: Μεγάλα δένδρα κόβανε δηλαδή για τα κάρβουνα; G2: Και μεγάλα και μικρά.

P: So they cut big trees for charcoal? G2: Both, big and small.

G2: 78, M, Shepherd

For kiln making an essential element was to have a good location: the area should be flat, with enough soil and more importantly trees close to it. The wood was cut in smaller pieces, around one metre and smaller:

P: Έκοβαν πολλούς δηλαδή;
Ν2: Πολλούς πρίνους ήθελε να κόψεις. Διότι τα 'κοβγιες κοντά τα ξύλα, ένα μέτρο, μισό μέτρο, ανάλογα τώρα τα έκοβες τα ξύλα.

P: Did they cut a lot of trees?
N2: A lot of kermes oaks *(Q. coccifera)* you should cut. Because you cut the timber short, one metre, half metre, depends how you should cut them.

N2: 75, M, Farmer

Figure 5.22: Ancient tree of holm oak (Q. ilex) in Rouvas forest, in the region of Gergeri.

Source: photo taken from the author, August 2010

The main instrument used in wood cutting definitely till the end of 1950s, was the axe (manara or manari in Cretan dialect). It is still called in Crete with that name and is sold in the market under the name 'manara' (Figure 5.23) and not the formal Modern Greek 'tsekouri'. The absence of

chain saws created several difficulties in wood cutting and much effort was needed. This, according to several interviewees, helped the forest to be conserved and retain till today several ancient kermes oaks:

> G2: τότε η μανάρα είχε, ήτονε το καλύτερο εργαλείο. Αλλά ήτανε οι αθρώποι τότε σκληροί, γιατί με την μανάρα κόβγανε αυτοί πελώρια δεντρά και τα κονίζανε με τσοι λίμες.
>
> G2: At that time, the axe was the best instrument. But the people also were tough, because with the axe they cut huge trees and they sharpened them with the files.
>
> G2: 78, M, Shepherd

> N2: Άμα είχανε μεγάλη παρέα, προπαντώς 2 τρία, 4 άτομα να χουνε συνδρομή, γιατί ετότες δεν υπήρχανε τα αλυσιδορπίονα, αν υπήρχε το αλυσιδορπίονο, τότες εδά δεν θα θελε υπάρχουνε και πρίνοι. Μόνο με τσοι μαναρες τώρα. Ότι ήθελε να κόψεις.
>
> N2: If there was a big group, especially 2, 3. 4 persons in order to have assistance, because at that time, there was no chain saws, (if saw existed at that time) then now there will be no kermes oak *(Q. coccifera)* left. Only with an axe, whatever you could cut.
>
> N2: 75, M, Farmer

Figure 5.23: An axe as it is advertised in the website of a company for selling purposes in Crete today. They advertised it as 'manara' as it is called in the Cretan dialect.

Source: (Kosmadakis 2011)

Despite the fact that charcoal was made in the forest for a long time without interruption, there was antagonism between the different users of the area. Shepherds saw themselves as the 'protectors' of the forest during that period. They repeatedly tried to stop overexploitation of the forest by charcoal burners; however, they were often charcoal burners themselves. There is no doubt that shepherds should not be considered as forest protectors or primitive nature conservationists. The forest and especially the kermes oak *(Q. coccifera)* trees, provided fodder and feed for their

flocks. Fewer trees, means less acorns and less leaf fodder. A 78 year old shepherd supports that shepherds suggested to charcoal makers what trees to cut in order to protect the forest:

> G2: Οι βοσκοί βέβαια, πολλές φορές, τσοι ζηγώνανε, βέβαια, ξέρεις τι τος έλεγανε πολλές φορές; Μην κόψεις από τον πάτο τον πρίνο, κόψε έναν κλάδο εκεί που είναι μια φαφουλιά πρίνοι, που το λέγαμε εμείς φαφουλιά, και είναι πέντε με έξε κορμοί από τον πάτο, κόψε τρεις τέσσερις και να αφήσεις δύο τρεις, του κανείς καλό ακόμα, και άμα, του έκοβες κλάδο, ενεηκεύγανε μετά. Κόπηκανε πολύ και από ψηλά και κάμανε ύστερα.
>
> G2: The shepherds of course a lot of times chased them away and told them a lot of times: Don't cut the kermes oak *(Q. coccifera)* from the ground, cut a branch, there that it is a group of kermes oaks *(Q. coccifera)*, growing all together, we called them 'foufoulia', and they are 5 to 6 trunks, growing together from the ground, cut three to four, and left 2 to 3, you can benefit the forest. And if you were cutting a branch it grew again young growth. There were a lot of them cut from the top and they had grown later.
>
> G2: 78, M, Shepherd

This information could be regarded as a primitive knowledge of pollarding in traditional management. A knowledge that during the Enlightment 'was systematised in an effort to develop a body of scientific disciplines whose main purpose was to ensure the steady wood supply' (Agnoletti 2006, p.384). Another explanation is that actually the forest law of the Cretan State, prohibited wood cutting unless there were enough trees to replace the trees that were cut (HAC1). The shepherds from Gergeri could be aware of this law and tried to prohibit extensive wood cutting.

Woodcutting for charcoal making was made initially in the areas close to the villages, probably before or during WWII, according to oral history:

> G2: Επαέ τα νοτικά τσοι φάγανε την κατοχή. Είχε καλούς πρίνους.
>
> G2: Here in the south they have been 'eaten' (cut) during the German occupation. There were good kermes oaks.
>
> G2: 78, M, Shepherd

> P: Εσείς που πηγαίνατε εδώ από πάνω;
> N2: Να, εδώ στην κορυφή, σε όλο το πλάι.
>
> P: Where did you go for charcoal, here in the uplands?
> N2: Here in the top and in the whole slope.
>
> N2: 75, M, Farmer

As forest resources were reduced close to the villages, charcoal burners moved to more distant areas. In the areas close to the villages, today you can find only sporadic ancient trees of kermes oak (Figure 5.24 and Figure 5.25). The areas that were mainly under the pressure of charcoal were the

most preferable in terms of soil conditions for the forest to grow (Figure 5.26). Deep soil conditions were more attractive for charcoal. There it was more probable to find a good location for the kiln and enough timber. However, the pressure in the forest reached probably a maximum at a certain time that charcoal-burners extended deeper in the forest, as the resources of wood were reduced in areas closer to the villages.

> G2: Το κακό που κάνανε το πολύ κακό το κάμανε εδώ μπροστά μπροστά, στο δάσος μέχρι Τον Αι Γιάννη, εκιά εγίνηκε το πολύ κόψιμο, αλλά ευτυχώς εκεί είναι πιο πλούσιο, το έδαφος, και ντύθηκε πάλι εντύθηκε. Αλλά επηγαίνανε βέβαια, μέχρι να φανταστείς μέχρι τα πηγάδια τα δικά μας πιο μέσα, είδα εγώ καρβουνιά.
>
> G2: The most damage that was done it was done here in the front, in the forest till Ai Yianni, there the most wood-cutting occurred, but there fortunately the soil is richer and it was 'dressed' (greening) again. But they went, if you can imagine, even deeper than our wells, I have seen charcoal kilns.
>
> G2: 78, M, Shepherd

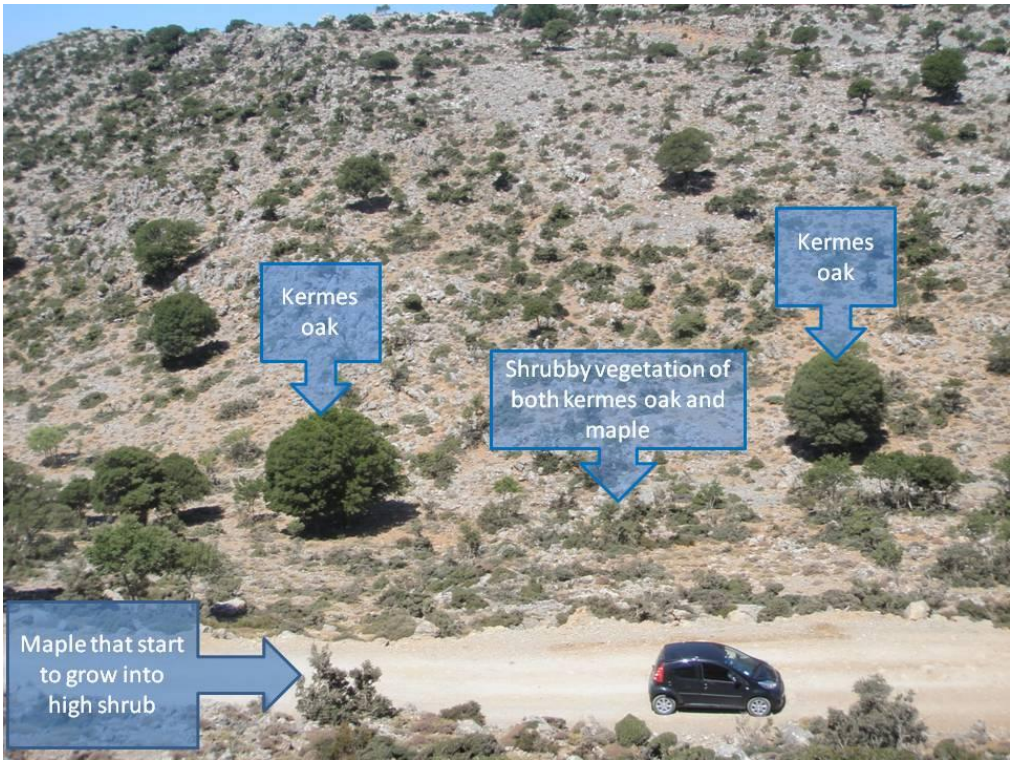


Figure 5.24: Area north of Gergeri village, after 'kaki skala', with sporadic ancient trees of kermes oak (Q. coccifera). Maple (A. creticum) starting to escape browsing level and gradually will be developed into tree. Areas more accessible to the villages had a higher degree of exploitation.

Source: photo taken by the author, July 2010

Figure 5.25: Agios Eythimios area, north of Nyvritos village. Some sporadic kermes oak trees (Q. coccifera), close to the village in more accessible areas are found. In the highest slopes forest becomes denser.

Source: photo taken by the author, August 2010

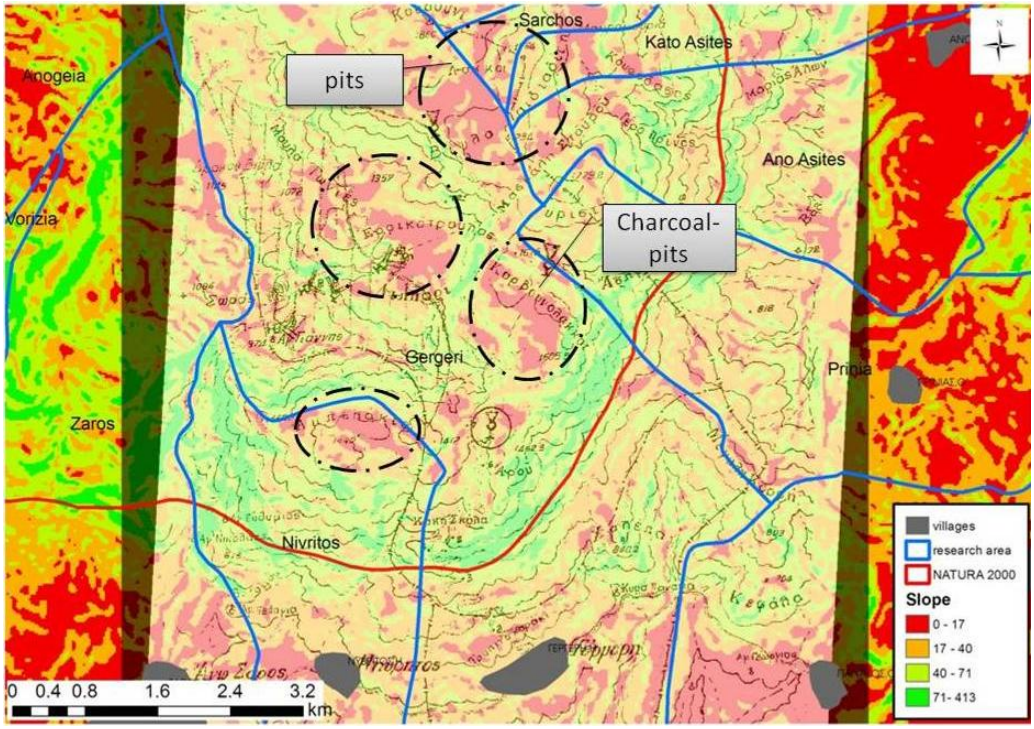


Figure 5.26: Potential kiln sites for charcoal making. The areas with red are more preferable for kiln formation as they are more flat. The slope values were overlaid with a forest map of 1966 (HFDD6), which indicates sites of charcoal-pits and pits. These sites are of red colour. The red areas had the highest pressure in terms of charcoal making and are marked with dash circle.

Source: map drawn by the author, using ArcGIS

5.6.3 How to make charcoal

The charcoal production in the research area was made using the mound technology (Olson 1991). Charcoal production was implemented in Psiloritis Mountain, using two different methods, one with a round and

another with a rectangle kiln. These two methods were used in neighbouring villages and probably other techniques existed in other areas of the mountain. Another method has been used in the lowlands but includes water in the procedure, something rare and difficult to transfer to the mountains in the past.

> G2: Το Κάρβουνο, εμάς επαέ το κάνανε τιλί. Γιατί σε άλλες, σε άλλους τόπους, εδά κάτω που κάνουν με ελιές κάρβουνο, στον κάμπο που κάνουν τους αναδασμούς και κόβανε, τα έστεναν τα ξύλα ορθά και μετά το σβήνανε με νερό και είχανε αυτοί πιο καλή επιτυχία γιατί εγβάνανε αμάροτους τους κορμούς. Η τεχνική ήταν διαφορετική.
>
> G2: The charcoal here it was done 'tili', in other areas, in the valley where they made with olive trees charcoal, in the plain that they did the agrarianism, they put the wood standing and then they extinguished it with water and they had more success because they took out the trunks intact. The technique was different.
>
> G2: 78, M, Shepherd

It was work that required expert people, with knowledge of the whole procedure: wood cutting, kiln making and burning. Initially, depending on the available wood in the area, and the topographic conditions, the location and size of the kiln were selected. The process is common to both types of kiln, and includes the wood built inside the kiln, the isolation of it from the atmospheric air, by two separate insulating layers: natural materials and earth. Natural insulating materials included oak leaves, cypress *(C. sempervirens)* branches with leaves, oak bark with lichens or just lichens. The kiln had an entrance, and most of the time two ventilation ports (blow holes) called 'batzas' or 'fougaros' on the back. There could be more ventilation ports, depending on the size of the kiln. The insulation layers were called 'gampas'. At the bottom of the kiln the thicker timber was put and as the height increased, thinner wood was placed there.

The fire was helped by flammable, dried shrubs or branches put at the bottom of the kiln, and close to the entrance. After the start of the fire, and when smoke started going out from the 'batzas' the entrance was closed. The procedure lasted for several days, depending on the weather conditions and the size of the kiln, and the charcoal had been 'baked' or burned when the smoke coming out of the 'batzas' was white. When that happened, then the 'batzas' holes were also closed, and they had to wait for two or more days for the kiln to cool down before collecting the charcoal.

> G2: ... δίπλα βάζαμε πέτρες οι πρώτοι κορμοί που επατούσανε οι πιο χοντροί, κάτω οι πιο χοντροί και βάζανε πέτρες και πατούσαν απάνω, να μην πατούν στο έδαφος, ένα κενό είχε και μετά του δίνανε φωτιά και αποκεις ήθελα κεντήσει.

> Και είχε από πάνω βέβαια γύρω γύρω εκάνανε το γαμπά που λέμε, τι κάνανε τώρα στο γαμπά, εβάνανε ή πυκνό κυπαρίσσι κόβανε, ή αζίλακα, αλλά το πυκνό κυπαρίσσι και έβαζαν στις τρύπες για να μην μπαίνει το χώμα και μετά εκλιούσανε όλους τους πόρους και βάνανε χώμα. Από δω του δύνανε φωτιά, από δω τώρα εκεί, στο πίσω μέρος υποχρεωτικά υπήρχε ένας τον λέγανε μπατζά, και κάνανε από δω μια θυρίδα για να φεύγει ο καπνός από εκεί, αλλά έπρεπε να κάνει άλλη μια από δω και άλλη μία από κει. Αν ήταν πιο μεγάλο κάνανε περισσότερες. Για να παίρνει αναπνοή. Και ανάβανε πια μπρος και απεις ήθελε να ανάψει, να ξεκεντήσει το καμίνι, να ντακάρι να πετά καπνό εκλιούσανε μπροστά τον πόρο απού είχε και ανάβανε, τον εφράζανε και αυτόν με χώμα και άρχιζε και κάπνιζε, και, έβραζε, με την βράση εψηνούντανε το κάμίνι, όχι με λάβα … και την ώρα που ήθελε να ντακάρει να σπρίζει ο καπνός το κλιούσανε τσοι μπατζάδες απου λέγανε, τσοι θυρίδες που είχανε αφήσει.
>
> G2: ... in the side we put stones, the first trunks standing on the stones, the most thick, the most thick in the bottom and there were stones to stand on them (the trunks), so they will not stand in the ground, it was an empty space and then we put fire and after that it will be burned. And outside this all around it they made the 'gampas' as we called it, what they did in 'gampas' they put either dense cypress *(C. sempervirens)* that was cut or helm oak *(Q. ilex)*, but the dense cypress *(C. sempervirens)* kai they put it in the holes so that no earth could enter and then they closed all the holes, and put earth on it ... So from here they put the fire, from here then, in the back there was we called it 'mpatza' and we made a port for the smoke to get out from there. But they had to make one from the one side and one from the other. If it was bigger, they made more. In order to breath. And they put the fire first and when it will have been burned enough the kiln, they closed it with earth and then it started smoking, and it was 'boiled', it was the boil that burned the kiln not the fire. … And the time that the smoke started became white, they closed the 'mpatzas' ventilation ports that they had created.
>
> G2: 78, M, Shepherd

Another description from the village of Nyvritos, suggests an orthogonal kiln:

> Ν2: … σκεπασμένο όπως σου πα με χώμα, έσκαφτες και το σαζες. Δεν το χτιζες στο ύπαιθρο. Έπρεπε να ανοίξεις σαν την βάγκα, μια μεγάλη … ένα τετράγωνο όπως είναι τα πατητήρια να το γεμίσεις ξύλα, να το βάλεις να καεί. Αυτό εψήνουντανε μες στη γης ...Ένα μέτρο και πιο πολύ από ένα μέτρο. Μεγάλες καμινωσές φτιάχνανε ...Τα 'χτιζες μέσα. Γιατί έπρεπε να τα χτίσεις καλά. Να τα σάσεις όμορφα, και στο τέλος όπως είπαμε να τοσε βάλεις τα κοντά κοντά ξύλα να τα καλύψεις και από πάνω τα βρυγιά, αυτά που βγάνουν οι πρίνοι.
>
> N2: ... it was covered with earth as I said, you dig and you made it. You didn't build it outside. You should make an excavation like a gap, a big one, a square, as the winepresses are and you will fill it with wood and then put it to be burned. Then it will be burned inside the earth. One metre (deep), and more we made big kilns. You should build them inside (timber). You should build them very well. Made them nice, and at the end as we said to put short wood, cover them and then at the top the 'vrigia' (lichens) from the kermes oak *(Q. coccifera).*
>
> N2: 75, M, Farmer

5.6.4 Harvesting the charcoal

The result of a good production of charcoal was characterised as 'amalago' meaning the pieces of wood not damaged. The harvest of the charcoal was also a work that needed a kind of expertise. After the burning of the wood, and when the kiln was cool enough, with special instruments, called

'Katsounia', something similar to what is called today 'katsouna' and is the shepherds' crooks in Crete (Figure 5.27) they moved and broke the charcoal in the charcoal yard, next to the kiln and cooled it by putting earth on it for a day, or water.

After the extra cooling, they put them in a heap and were ready for transportation. The transportation to the villages was mainly done by donkeys and charcoal was put inside sacks. Two interviewees describe the procedure:

> G6: Μετά αρχίζει το ξεκαμίνιασμα, σιγά σιγά με κατσούνι, με ένα κατσούνι σέρναμε τα κλαδιά που είχε απέξω, τα βγάναμε και βγάναμε τα κάρβουνα κι ήπρεπε να χεις νερό. Γιατί τα κάρβουνα ανάβανε ακόμα. Κι ήπρεπε να χεις νερό να τα λαντουράς να τα βάλεις στην άκρα.
>
> G6 : After (the burn of the kiln), gradually, with the use of 'katsouni' (hook) we pull the branches out, then we took charcoal out and you needed to have water, because charcoal was still burning and you watered it and put it on the side.
>
> G6: 78, M, Shepherd

> N2: θα το ανοίξεις Το τραβάς με μια κατσούνα μακρυά μακρυά, ξύλινη πάλι, να το τραβάς, να βγάνεις τα κάρβουνα, είχαμε ετσά αυλές καομένες απ'το καμίνι, να τα στρώνεις να τα σβήνεις. Τα εσβηνες πάλι με το χώμα. Όχι με νερό. ... Αυτό βέβαια ήτανε και τελείωνε το καμίνι.
>
> N2: You will open it (kiln) to pull it with a tall 'kastsouna' wooden also, to pull it, take the charcoal out we had yards made outside the kiln, to lay them to extinguish them. You extinguish them with earth. Not with water. That was all and the burning was over.
>
> N2: 75, M, Farmer

Figure 5.27: Katsouna made by local people and used extensively by shepherds for catching the animals.

Source: Photo taken by the author January 2010, (local collection in Gergeri village)

5.6.5 Problems in the procedure, failures

There were certainly several difficulties that could end with a total failure in the production. The main problem that often occurred was the creation of holes during the burning that disturb the isolation from the outside air. This problem could be solved with several actions that were able to retain the insulation. By putting in the holes small wood and then on the top of it a branch of cypress, lichens or just other branches, you could retain the isolation:

> G2: … τώρα ετρύπα βέβαια, και του βάνανε, ένα κομμάτι, ξύλο μέσα και μετά του έβαζαν ένα κομμάτι κυπαρίσι ή κλάδί και έβαζαν πάλι χώμα. Γιατί άμα ήθελε να τρυπήσει, να πάει οξυγόνο μέσα ήθελε να καεί και ήβγανε στάχτη.
>
> G2: … If there was a hole they put a piece of wood inside and then they put a piece of cypress *(C. sempervirens)* or other branches and then again earth. Because if a hole was made and oxygen could get inside, then the wood was burned and the result was ash.
>
> G2: 78, M, Shepherd

It was very important to maintain close attention over the kiln during the burning process in order to prevent holes being created and to retain the isolation; otherwise the charcoal would become ash. However, other problems also occurred during the harvesting time and the transportation. Several charcoal pieces remained warm and in contact with oxygen they could be burned, resulting in the loss of the production:

> Z6: Πολλές φορές τα τσουβαλιάζανε, εφορτώνανε τώρα απτο βουνό τα γαιδούρια και τα κατεβάζανε κάτω. Συνήθως εβάζανε τα παιδιά και τα κουβαλούσανε, αλλά έπρεπε να κρατάς νερό στο δρόμο, γιατί καμιά φορά ήτονε κάρβουνο μέσα στο τσουβάλι και με τον αέρα έπαιρνε φωτιά. Κι ήπρεπε να βαστάς το παγούρι το νερό να τα λαντουρίσεις από κια που εκάπνιζε το τσουβάλι να το σβήσεις.
>
> Z6: Several times, they put them in the sacks, they loaded them from the mountain to the donkeys and they brought them here in the downs. Usually this was done by children. They carried them, but they needed to have water with them on their way, cause, sometimes some charcoal inside the sacks with the contact with air could get burned. So you needed to have a water-bottle with you and water the sack that was smoking.
>
> Z6: 82, M, Shepherd

5.6.6 Social elements

Charcoal production increased, according to oral history, just after WWII. In contrast archival information suggests a higher charcoal production before WWII (Figure 4.17), and oral history fails to recognise this. Interviewees argue that the difficulties of the period after the war, the poverty and the absence of enough cultivated land, drove villagers to use forest resources and particularly charcoal making:

> G2: Και την κατοχή και μετά την κατοχή, η μεγαλύτερη υλοτόμηση που γίνηκε στο δάσος έγινε το 44 που εφύγανε οι γερμανοί και το 45 που είχε ο κόσμος κρίση. Λύση έτσι το βουνό, πηγαίνανε βγαίνανε τότε το μισό χωριό και κόψανε και κάμανε κάρβουνα για την επιβίωση.
>
> G2: During the German occupation and just after it the biggest logging occurred in the forest, after 1944 the Germans left and in 1945 that people had a crisis: the mountain was a solution for them, they were going, at that time half of the village, and they cut and made charcoal for their survival.
>
> G2: 78, M, Shepherd

The forest was able to provide an income with no other extra cost, close to their villages. Only the personal labour of the villagers was needed, no further expenses of transportation. This is still the case today in underdevelopment and developing countries, where other sources of energy and particularly petroleum products are expensive and difficult to access; 'charcoal can be produced locally using inexpensive or free raw materials and extremely primitive technology' (Olson 1991, p.412).

Although, primary sources were almost free, the work itself for charcoal making was demanding and difficult to manage. People put a lot of effort into it. In a mountainous, rocky area, such as the majority of mountains in Crete, the materials collected for charcoal making, often required extra effort compared with other areas. For example the transportation of earth from surroundings areas was needed to cool down the charcoal, and all this was done by hand. A 78 year old shepherd from Gergeri, states that:

> G2: Το χώμα βέβαια ήτανε σε πολλά σημεία σπάνιο και το κουβαλούσανε από πέρα πέρα με τα τσουβάλια, εξωθήκανε οι κακομοίρηδες και αυτοί, αλλά, ξέβγαλανε και δεντρά πολλά βέβαια.
>
> G2: The earth, of course, was in many areas very rare, and they carried it from distant places with sacks; they had many difficulties, poor them, but they also ravaged many trees of course.
>
> G2: 78, M, Shepherd

During the German occupation there was a forbidden zone and people were not allowed to enter Psiloritis Mountain and something similar happened in other mountains of Crete. This explains the decrease in charcoal production during the German occupation (Figure 4.17). Other reasons might be insecurity and loss of other markets outside Crete (Forbes 1996) during the German occupation (Tolmi 2008) as a result of the collapse of the economy in urban areas where people could not afford to buy charcoal (Kalitsounakis et al. 1983). The occurrence of a forbidden zone led to intensive charcoal production in the areas close to the villages.

> G2: Την Κατοχή βέβαια ήταν απαγορευτικό από δω απτό αφουρλί και πάνω και δεν εκάμανε. Είχανε νεκρά ζώνη κάνει, το 42 και έπειτα.

G2: During the German occupation, it was forbidden, from here in the 'afrouli' and up and they didn't make (charcoal).

G2: 78, M, Shepherd

G1: Even the Germans did a lot of destruction, they coppiced it very hard. They wanted the charcoal and the wood. They had a forbidden zone made, after '42.

G1: 80, M, Civil Servant

The social problems and poverty just after the WWII, created pressure on the natural resources of the area. Charcoal making was an important income for the family, especially the poorest ones. A 75 year old farmer from Nyvritos village had to stop elementary school, in order to transport charcoal:

Ν2: Αλλά στην έκτη τάξη που πήγαινα επήγε όλη μου η ιστορία στα αόρια και δεν επροβιβάστηκα, δεν επήρα απολυτήριο δημοτικού. Γιατί κουβάλουμε κάρβουνα. Υπήρχε τότες δυστυχία.

N2: However, in the sixth grade, that I was attending at that time, all my life was occupied in the mountain and I didn't graduate I haven't got an elementary degree. Because I was transferring charcoal. There was a lot of misery at that time.

N2: 75, M, Farmer

People that made charcoal were mainly from villages of Nyvritos, Zaros, Vorizia and Gergeri, especially those of lower social status, the poor:

Ρ: Ήτανε από το Χωριό αυτοί που το έκαναν;
Ζ1: Και από το χωριό και από την Γέργερη και από όλα τα χωριά αυτά

P: Were they (charcoal burners) from the village (Zaros)?
Z1:And from the village and from all these villages (in the mountain)

Z1: 83, M, Farmer

In Argolis, Forbes (1996, p.86) supports the suggestion that charcoal was made 'by the rural poor, who have little land or little opportunity to exploit the waste for grazing' and suggests that 'charcoal-burning has been a very low status occupation'. Similar social factors occured in Crete, and charcoal was a job for the poor. However, at a local scale almost every member of those villages faced the same poverty problems at that period.

In Gergeri, Vorizia and Nyvritos, most of the families were involved with charcoal making in the forest, and often there was cooperation. This cooperation often included family members that joined a group:

Ν2: Μετά που έφυγαν οι γερμανοί το 45 όλοι εβγήκαμε στ'αόρι, εγώ τότες σας ήμουνε 10-12 χρονώ πήγαινα και στο σχολιό πήγαινα και στ'αόρι και κουβάλουμε κάρβουνα. Ήψειναι ο παππούς μου, ο πατέρας μου, οι γειτόνοι τώρα, όλοι οι χωριανοί πηγαίνανε, που θελα βγάλουνε 10 δρχ.;

> N2: After the Germans left in '45, all of us went up to the mountain, I was 10 to 12 years old, and I was going in the school and in the mountain and I was carrying charcoal. They burned, my grandfather, my father, our neighbours, all my fellow villagers went, where else could they gain 10 drachmas?
>
> N2: 75, M, Farmer

The group number, the bigger the better, had an effect on kiln size and the amount of charcoal produced. Moreover, the product had more possibilities to be successful within a big group, as there were more people to guard it effectively during the burning process for several days (Olson, 1991). Not everyone had the knowledge to make charcoal, however, expert people taught the rest of the group through participatory learning.

> Z1: Κόβανε τα ξύλα ας πούμε ανάλογα, αλλά αυτοί ήτονε ειδικοί απού την εκάνανε απού το καμινιάζανε.
>
> Z1: They cut the wood let's say accordingly; they were experts that did that, that made the kiln.
>
> Z1: 83, M, Farmer

> N2: Ήταν και παρέες 2 με 3 νομάτοι κάνανε ένα καμίνι, ήταν άλλος αμοναχός ανάλογα ... Ο γεις με τον άλλο έβλεπε και μάθαινε.
>
> N2: They were groups, two to three people, made a kiln, others were alone, depends. … One with each other observe and learn how to do it.
>
> N2: 75, M, Farmer

It is important to notice that initially young children were used in non skilled work, such as the collection of wood or transfer of charcoal with donkeys. After watching the others for a certain period they could participate in the actual process of charcoal making. This procedure enabled knowledge gradually to be transferred from generation to generation within a participating and observation progress, away from what we call today teaching. This process includes the knowledge and experience of hundreds of years and could be actually 'perfected' by the mistakes and improvements of past users.

Today charcoal is produced only in one of the villages (Krousonas) in the research area and this is not one of the main producers of the past (Figure 5.28). Moreover, in Crete this traditional practice still continues in other parts of the island. In the area of Perama, in Rethymnon prefecture, at least two villages still produce charcoal (Tzanakis et al. 2001). However, the wood needed is imported from areas often distant from the villages and almost all the charcoal is made from olive trees (Tolmi 2008).

Figure 5.28: Charcoal kiln in Krousonas village. Now made from blocks and is more like a building. This is one of the places that charcoal is still made using olive wood.

Source: Photo taken by the author January 2010.

5.7 Conclusion

The short lived Cretan State, considered the forests of Crete rare, and the remains of an overexploited natural environment of the past. Thus their protection was very important and crucial for Crete. Extended timber and charcoal production had no place in such a devastated natural environment.

The story of charcoal production in Crete changes when the island finally united with the rest of Greece. Probably the forests of Crete were not considered as important as in the past, and there were not any special rules for Crete anymore, despite the fact that the island now had a specialised Forest Service. What was applied to the rest of Greece was applied at that time and for Crete, even if the forest ecosystems differed from continental Greece.

Timber from the forests of Psiloritis in recent history was used mainly for ordinary building purposes. However, a local market was created for wooden implements and the forest was essential for the survival of several villagers involved with their construction.

When things were difficult, the forest helped local people to survive, providing a free, costless material, charcoal. Oral history suggests that charcoal production engaged many local people from the mountainous villages. There were two main variations of kiln shape, and cooperation

between people was needed. There was some antagonism over natural resources between shepherds and charcoal burners. Social elements and conflicts in Greece had a big influence on charcoal making in Heraklion. Charcoal production was influenced by the demands of local urban areas and access to other producers outside Crete.

Interviewees suggested that the greater exploitation of the forest and charcoal production took place just after the WWII, but this is not supported by the archival research. Archival information suggests that there was a peak in charcoal production in the 1930s, and those levels were not reached again. Woodcutting of the past especially for charcoal making has influenced current forest composition and structure. The degree that Cretan forest will be used in the near future for timber production is very uncertain today and local forest resources are not used to any significant extent. Forests remain in the mountains, waiting, storing energy, creating a future pool of natural sources. When humans need it again, it will be there for them.

Chapter 6: Firewood

6.1 Introduction

Firewood is probably the first 'fuel', humans used. In ancient Greek mythology, Prometheus a Titan, stole fire from the Olympian gods and gave it to mortals. His action was motivated by the harsh conditions the human race had to deal with against nature's powers. This can be regarded as the first step of human civilisation, and Prometheus was punished for his action from Zeus (Frazer 1921).

Dougherty (2006, p.18) in her work for Prometheus, suggests that:

> fire and the technology that it makes possible are at once the source of civilized life, giving mankind freedom from the constraints of nature – warmth in cold winters, light in darkness, cooked not raw food – and the historic roots of devastation and destruction.

Fire enables humans to change their landscapes, to exploit their world and to create civilisations. The use of firewood is probably as old as the human race is, and it is an inherent need to obtain energy and to alter the environment for its benefit.

Today most of the developing world uses firewood for its daily survival. People that have no access to electricity or modern facilities rely on firewood (Eckholm et al. 1984, Ticktin 2004). This was a necessity of pre-industrialized western countries and was a common issue for rural Crete until the mid 20th century and for some sectors of society today.

6.2 Firewood types and uses

The uncultivated land and especially the highlands of Psiloritis provided the necessary firewood for the needs of the peasants at least until the beginning of the 1970s. Their needs for firewood can be divided into two main categories: a) house heating and b) cooking. Firewood was also used as a source of energy for lime production, however this will be analysed in a later section within this chapter. The two key wood uses required different types of wood. Wood for heating purposes includes thicker branches that can be burned continuously so that fire would not need to be often refuelled. On the other hand, firewood for cooking was lighter, and not essential to maintain fire for long periods of time.

Firewood was collected from forests during the summer and stored in households to cover their heating needs for the forthcoming winter. A 78 year old interviewee mentions that only dead wood was collected:

> Z7: Τα ξύλα, κόβανε πραγματικά τα σπασμένα και ξερά, σπασμένα δέντρα, από το χιόνι, από τις ανεμοθύελλες. Τα χρησιμοποιούσαν για πρώτη ύλη, καύσιμο, τότε δεν υπήρχαν ηλεκτρικά. Όλες οι εργασίες γίνονταν με τη φωτιά. Ότι ήθελες να ζεστάνεις χρησιμοποιούσες το ξύλο.
>
> Z7: The wood, it was really the broken and dried wood, the broken trees, from the snow, from the windstorms. They were used for raw material, fuel, then there was not any electric. All work was done with fire. Whatever you wanted to heat you should use wood.
>
> Z7: 78, F, housekeeper

Archival documents from municipalities also support this procedure and suggest firewood collection was free for the members of the communes. A contract in 1910, for renting the forest to some shepherds, has a section for firewood collection (ZZC1). In this document there is information related to payments to the leasees when there is exploitation of the forest, and especially when woodcutting occurs. However, it is mentioned that 'the members of the commune have the right to collect firewood' (ZZC1). Thus it can be assumed that this referred mainly to dead wood collection rather than green wood.

On the other hand, the archival information from the Forest Commission (HFDA2, 3, 6, 7, 8) and several elderly interviewees suggested logging for firewood. These data are available since 1920 and are shown in Figure 4.16. There was a procedure for permissions for firewood cutting, where dead wood was freely collected:

> N3: Απαγορευότανε τα δροσερά.
> N2:Για την πούληση ήθελε να πας ξερά ξύλα άμα 'θελα σε πιάσει δροσερά ήθελε να σε καταγγείλει.
>
> N3: It was forbidden to cut green wood.
> N2: For firewood selling you have to go with dead wood only. If you were caught with green wood you will have been charged.
>
> N2: 75, M, Farmer/N3: 70. F, Housekeeper

It should be mentioned though that the Forest Archives have some gaps in the information relating to firewood. Tree species used for firewood are not always documented. When the species is registered is often mentioned as *Drys* the Greek name for oak. There are no data regarding kermes oak (*Q. coccifera*) and probably the recorded cases for oak, are of *Q. brachyphylla*, a deciduous species growing mainly in the lower elevations. This suggestion is supported by the fact that *Drys* refers mainly to *Q.*

brachyphylla species and in the archive in other cases recorded, for example timber, they refer to kermes oak *(Q. coccifera*) with the term *Prinos* and not *Drys.* Furthermore, when charcoal or timber are produced from the forests, several by-products from loggings are used for firewood and such information is included in the archives (HFDA6, 7).

There was a preference for dead wood because it could be freely collected and for several other practical reasons. Dead wood which is actually dried wood, has lost its quantities of moisture allowing more pure carbon to be burned. The amount of moisture in the wood is important for transport, processing and burning. Laughton (2006, p.26) mentioned seven reasons why dried wood should be used instead of 'green' wood: green wood 'is heavy to move; it does not easily ignite; it gives off little heat; it chokes up the chimney with tar; it increases the acid content of flue gases; it increases ash; it smokes a great deal'. All these characteristics of firewood were more or less known to peasants, thus they preferred to collect it dry. Especially, in a mountainous environment such as Psiloritis Mountain, where transportation was difficult and the heat of the summer made environmental conditions harsher. Hence, lighter wood was easier to collect and could be transported in larger quantities and with less effort. A 63 year old woman from Ano Asites suggests that thick dead wood was collected from the uplands mainly for heating:

> As1: Όποιοι δεν είχαν ελιές αλλά επειδή τις καθαρίζανε κάθε τρία χρόνια, επηγαίνανε στο αόρι, στο βουνό και μαζώνανε ξύλα. Πηγαίνανε με τα γαϊδουράκια και μαζεύανε ωραία ξερά ξύλα.
> E: Δεν μάζευαν δροσερά;
> As1: Δεν μάζευαν τα δροσερά γιατί ήταν βαρά. Όλοι πηγαίνανε και κάνανε ξύλα. Επίσης τα κλήματα και τις ελιές, αλλά για τα χοντρά ξύλα (για θέρμανση) πηγαίνανε στο βουνό και τα πέρνανε.
>
> As1: The ones that didn't have olive trees, but also because they shredded them every three years, they went to the mountain, to collect wood. They went with donkeys, and they gathered good, dried wood.
> P: Didn't they cut green wood?
> As1: They didn't collect green wood because it was heavy. All went and collected wood. Also branches from vines and olives, but for the thicker wood (for heating) they went to the mountain to get them.
>
> As1: 63, F, farmer

The effort needed for this work has been described in several interviews; however, this specific interviewee from Nyvritos draws a clear picture of the whole procedure:

> N2: Και πηγαίναμε να βγάλουμε κουτσούρες ξερές. Να πάμε μέσα τσοι δέτες τσοι κακοβολιές για να βρούμε τα ξερά ξύλα που ήτανε πρίνοι πεσμένοι από τσοι χιονιές. Ήτανε δύσκολα μπορούσε να πα κάμουμε στην κορυφή εκια τω μεσοδοκιώ να πάμε και να κατεβείς από κάτω στον αραγό μέσα να πας τα ξύλα

> 200 μέτρα για να τα βγάλεις να τα γομαριάσεις αλλά να τος εκάμεις 2 με 3 απόπειρες να τα μετακινήσεις. Δεν μπορείς να τα σηκώνεις πολιόρα ήτανε κακόβολος, στο χαλίκι μέσα στο να βγεις να σηκώσεις 2 3 ξύλα, πόσα να σηκώσεις. Δύσκολα τα πράματα, ανηφόρες ήπρεπε να πας το καλοκαίρι πρωί πρωί να μην σε φάει η κάψα.
>
> N2: And we were going to take out tree-trunks, which were dried. We were going in the cliff, in rough areas to find dried wood that was kermes oaks, felled in the snow-storms. It was difficult, we were going there in the summit of 'Mesodokio', then go down in 'aragos' (place name of a slope) to move the woods 200 metres, take them and make them into a load, and tried to move them a couple of times. You could not lift them up for a long time, it was a rough place, in the gravel, to go there, try to lift them up, two to three woods, how much of it you could lift up. Difficult work, uphill, you needed to go in the summer, very early in the morning so that heat would not affect you.
>
> N2: 75, M, farmer

Forests in Crete and particularly in Psiloritis Mountain, often consist of ancient trees. Frequently they have broken and collapsed branches during winter (Figure 6.1), as a consequence of snow storms or strong winds. In the summer that wood is dried, lighter and ideal for transportation and use for firewood. The majority of ancient trees in Psiloritis Mountain are of kermes oak species (*Q. coccifera*) therefore, the available dead wood was mostly collected from it.

There was also collection of maple (*A. creticum*) wood. However, even today, oak wood is preferable for firewood, and according to Laughton (2006, p.90), oak wood is 'one of the best firewoods. When seasoned well, it gives off a good, lasting heat; it burns reasonably slowly' and is graded with a class of 4 (high) on a scale of 1 to 4. Maple *(Acer sp.)* on the other hand is marked as 3, regarding it as good firewood (Laughton 2006).

In addition local people believed that kermes oak (*Q. coccifera)* wood was better than other species for heating and baking in the ovens:

> G6: Τσοι παλαιούς φούρνους, άμα ήτανε τα ξύλα καλά ήκανες και πιο καλό ψωμί, δηλαδή, εψηνόντανε πιο καλά. Εγώ θα πάω λέει στα κατσοπρίνια γιατί, θα ζυμώσω. Τάξε είναι γερό το, η φωτιά του. Δεν υπάρχει καλύτερο ξύλο από τον πρίνο για τη φωτιά.
>
> G6: In the old ovens, if the wood was good you could bake good bread, it baked better. I would go, they said, to collect shrubby kermes oaks, because I am going to knead. It means they are very strong, their fire. You cannot find better wood than kermes oak for the fire.
>
> G6: 78, M, shepherd

Figure 6.1: Dead wood from an ancient oak tree, in the forest of Rouvas, as a result of a strong snow storm probably in 2003.

Source: photo taken by the author, August 2010

Other trees, valuable for heating and cooking used in the research area were several broadleaved species such as wild pear *(Pyrus sp.)* and wild olive *(Olea europaea var. sylvestris)* as this villager from Zaros recalls:

> Z6: Την εποχή εκείνη, γιατί τώρα είναι αλλιώς τα πράγματα, εγειρεύαμε ξύλα για να μαγειρέψουμε, εψάχναμε τον κόσμο. Και όσοι ήτανε κοντά στο βουνό πηγαίνανε στο βουνό και βρίσκανε ξύλα, εμείς απού είμαστεν λίγο πλιο κάτω τα δάση, τα ντόπια δάση εδώ πέρα να κόψουμε αγρουλίδες να κόψουμε αχλαδιές διάφορα άγριες αχλαδιές να τα στοιβιάζομε να τα 'χωμε το χειμώνα.
>
> Z6: At that time, because things are now different, we were looking for firewood so we could cook; we were searching all over the place. And those who were close to the mountain, they went in the mountain to find firewood. But we, being a bit lower down exploited the local forests here, we would cut wild olive, pear wild pear, and other species, to load them, to keep them for the winter.
>
> Z6: 82, M, shepherd

Although dead wood was desirable it was not available everywhere. Areas with scarce vegetation and absence of ancient trees could not efficiently supply dead wood for heating or cooking. In these areas, shrubs were used for wood collection and that included logging procedures. For example in the area of Anogeia (Figure 4.9) where less forest was close to the village, people collected wood from maple (*A. creticum*) that as a result remained in a shrubby format for several decades. Today that wood cutting

has almost ceased, and maple (*A. creticum*) has been developed into trees and the landscape of the area is more forested (Figure 6.2, Figure 6.3). This procedure of wood cutting was also applied and in the forests, where forest regeneration was constructed to a shrubby format for long periods, as a shepherd from Gergeri has noticed:

> G3: Εγώ έφταξα τα αφρουλακάκια ετοσανέ, αυτά δεν τα αφήνανε γιατί βγαίνανε με τσοι γαιδάρους και την ώρα που θελε να σταθεί τόσο ναι, τάκα και το κόβανε. Και το κάνανε καυσόξυλα. Γιατί είχαμε την παρασιά τότες σας, ζούσανε αποκλειστικά από το ξύλο.
>
> G3: I remember these maple shrubs so small, and they did not let them grow because they were coming with the donkeys and by the time it would have grow just a bit, they cut it immediately. And they made firewood. Because we had the fireplace at that time, people relied exclusively on wood.
>
> G3: 45, M, shepherd

Figure 6.2. Acer creticum, in Zomynthos area close to Anogeia, developed into tree.

Source: photo taken by the author, September 2006

Figure 6.3. Acer creticum, gradually escaping the shrub level and developing to tree. Area of Nida plateau in Anogeia.

Source: photo taken by the author, September 2006

In addition, brushwood was extensively used as kindling for both cooking and heating. A widely used species for this purpose was the phryganic shrub of *Genista acanthoclada* (Figure 6.4) a very common species in Crete, which is very flammable even when it is not dried as it contains several dead parts within the live plant (Sfikas 1995). This shrub became rare in the research area, and it was difficult to find it in the past:

> G15: Χινοπόδι τώρα που, άμα πας τώρα πάνω εκεί από την Κερά την εκκλησία, μπορεί να βρεις ένα χινοπόδι που να μην το βάνει το αυτοκίνητο, τότε αν ήθελε να βρεις τόσο χινοπόδι. Γιατί τότε τα χινοπόδια τα 'χαμε στο τζάκι, για ξάναμα. Ήτανε στον πάτο το χινοπόδι και ao πάνω όλα τα άλλα ξύλα ήτανε τα θυμάρια και ξέρω 'γω. Τότες μου 'λεγε η μάνα μου άμε παιδί μου να βρεις 2, 3 αχινοπόδια και πήγαινα ao πάνω ψηλά, στα φεγγάρια … ναι το 'ψανχα ακριβώς, και ξυπόλητος βέβαια ε.
>
> G15: *Genista acanthoclada* now, that if you go now up to the Kera church, you can find a *Genista*, it will not fit in the car, at that time, you couldn't find so huge a *Genista* shrub. At that time we needed *Genista* for the fireplace, as kindling. It was at the bottom the *Genista*, then higher up all the other wood, thyme and other types of wood. At that time my mother would ask me, go my child to find two or three *Genista*, and I was going up, in the Feggaria (place name) … I needed to search for it and bare-footed of course.
>
> (G15: 50s, Electrician)

G. acanthoclada is not a palatable species thus more competitive to other plants which are more actively grazed. Today its expansion is a result of overgrazing and its collection has ceased.

Figure 6.4. Genista acanthoclada expanded in former agricultural land in Ano Asites village.

Source: photo taken by the author, November 2005

Depending on the size of the villages, their location and the different era, lowlands could or could not support firewood supply efficiently. In addition, the use of light wood for lime making suggests an overexploitation of the lower parts of the mountains, thus firewood supply was often problematic. Hence, along with thicker wood, people had to collect light firewood from the nearby uplands:

> Z1: Για το φούρνο ναι, πήγαινε τακτικά, γιατί οπωσδήποτε το χωριό ήταν μεγάλο, δεν φτάνανε κάτω, ήτονε καλλιεργήσιμες περιφέρειες, δεν βρίσκανε ξύλα. Και αναγκαζόταν να πάει στο βουνό, να βρει ξύλα, να κατεβάσει ξύλα από κει, και χοντρά, και για το φούρνο.
>
> Z1: For the oven they went regularly (for firewood collection in the mountain). Because the village was big, and there was not enough wood in the lowlands, it was cultivated land, they could not find wood. And they had to go to the mountain to find wood, to carry wood from there, and for heating and for baking in the oven.
>
> Z1: 83, M, Farmer

The use of fire for cooking was essential throughout the year. The cooking can be divided into two sub-categories, cooking in the fireplace and in the oven, at least till the 1960s, when fireplaces were gradually replaced with gas stoves. Wood needed for ovens, mainly consisted of brushwood or later the by-products of cultivation, mainly from vineyards.

A significant expansion in raisin production (sultanas) took place between the 1950s and 1980s in Heraklion prefecture, providing enough light firewood every year (Andreadakis 2010). This resulted in a reduction of the light firewood collected from the mountain; however, collection of firewood for heating continued.

What the locals called 'light firewood', was mainly used to light ovens. The use of oven cooking is a common procedure here but also in other parts of Greece. Often an oven was shared by several households and an example from the Cyclades islands, suggests that it was actually an efficient way to manage firewood which it was difficult to find. In these islands, firewood was mainly brushwood from phryganic vegetation (Zacharopoulos 2006). This is a similarity with the area of Psiloritis Mountain, where at least till the 1960s, brushwood was extensively used, along with light wood from the forest. This seems to change for the research area, after the 1960s with the expansion of vineyards, whereas in the Cyclades, the absence of intensive agriculture meant that brushwood is still used (Zacharopoulos 2006).

Firewood was not only required in the households, but also required in large quantities for husbandry. Till the end of the 1970s, beginning in the 1980s, on Psiloritis Mountain, milk was processed on the spot. The absence of roads and vehicles made the transportation of milk impossible. In the mountain every *Mitato* (shepherds' hut), was actually a cheesery cooperative. Milk was converted to cheese locally and for that large quantities of firewood were needed. The wood needed was brushwood for setting the fire, as well as 'thick wood' to retain the necessary heat for the whole process. Shepherds collected firewood for their needs in the mountain, as well as for their household in the villages. The person responsible for firewood collection for the *Mitato*, was called *Mantratzis*, and one of his obligations was to collect the necessary firewood for daily cheese making. A 75 year old shepherd mentions that the cessation of firewood collection even for cheese making helped the forest to recover:

> G2: και είχανε και ένα μαντρατζή που ήταν υπεύθυνος να κουβαλεί τα ξύλα. Να που λες πως εγλυτώσανε και τα ξύλα, γιατί η κάθε μάντρα ήθελε κάθε μέρα το

καζάνι μία με 2 δεματιές ξύλα. Και από γύρου γύρου από το μιτάτο το κόβανε και ξεραίνουντανε και τα κάβαμε.

G2: and they had a mantratzi (a person working with the shepherds) that he was responsible to gather firewood. That's a reason that wood escaped, because every day for cheese making every Mitato needed one to two bunches of firewood. And in the area around the pinfold, they cut them (vegetation) and then they left to dry and then we burnt them.

G2: 78, M, Shepherd

6.3 Labour and commercial values of firewood

The majority of peasants from the villages were tasked with the job of collecting firewood. Although, social status influenced this work and often the poorer parts of the population collected firewood, for the majority of the villages almost all the population to a greater or lesser degree participated. Often people from the mountainous villages, areas with less developed agriculture, were connected with that job and provided the necessary firewood for other markets especially in the lowlands. Below are two examples of the participation of local people in firewood collection:

Z8: Όλοι, όλες οι οικογένειες πηγαίνανε. Ξύλα τότε ήτανε λίγα, δεν είναι όπως τώρα. Αποτελούσανε πηγή ζωής.

Z8: All, all the families were going. Firewood was rare, it was not like today, and it was an element of life.

Z8: 80, M, Farmer

Z2: Από τα Βορίζια πχ που ήτανε πιο φτωχοί και ήτανε κάποιοι άλλοι που ήτανε συνταξιούχοι κλπ τα αγοράζανε. Εγώ θυμάμαι να φέρνουνε τα ξύλα και να τα πουλούνε. Κόβανε τα ξύλα, τα φόρτωναν στα ζώα και μετά τα φέρνανε και τα πουλούσανε.

Z2: For example from Vorizia village, the people were poorer and they were and some others, that were pensioners, etc, and they bought the wood. I remember them bringing firewood here and selling it. They cut wood; they loaded on the donkeys, and then brought it here and sold it.

Z2: 71, M, Hotelier

An interesting comparison came from contemporary information on firewood gathering which is still applied in several areas of the modern world, especially in developing countries. Eckholm et al (1984, p.9), mentioned in their work on fuel-wood that 'while the richer half of humankind ponders the vagaries of oil prices and the dilemmas of nuclear power, the poorest half still relies on our most ancient fuel, wood, for cooking and home heating'. This description could refer to Crete at least until the 1960s. Today modernization and economic development have changed this situation. However, firewood did have an essential economic

value for decades in the recent past for the mountainous villages of Psiloritis and probably for the whole of rural Crete.

Firewood gathering, according to its commercial value, could be divided into two main categories, wood for collectors' own needs and wood for trading. The value of wood, and its importance on a daily basis in the past, especially in the plains where forest was absent, added an important income for the upland populations. Peasants collected firewood, and then transferred it to other villages to sell it or exchange it with other products. Often firewood was sold or exchanged for just a few kilos of vegetables or wheat or even bread, as this interviewee from Nyvritos suggests:

> Ν2: να βρεις ξύλα ξερά να τα φέρεις εδώ και μετά από δω να τα φορτώσεις να πα τα πουλήσεις. Από δω φορτόναμε ξύλα και τα πηγαίναμε στην Πλουτή για να πάρωμε άχαιρα που δεν είχαμε εμείς. Να πας ένα γομάρι ξύλα να πάρεις 1 γομάρι άχαιρα … να τα πάμε στην Αγία Βαρβάρα να πάρομε 10 κιλά πατάτες … άλλος πήγαινε να πάρει λεφτά, ότι εμπόριε ο καθανείς ήκανε το κουμάντο του.
>
> N2: You needed to find dried woods, bring them here and then from here to load them and go to sell them. From here we load firewood and went to Plouti to get hay that we didn't have. For a load of firewood you were getting a load of hay … we were going to Agia Varvara, and we were taking 10 kilos of potatoes … someone could go to get money, whatever someone needed, everyone was managing to get what he needed.
>
> N2: 75, M, Farmer

This kind of trading can help to understand several difficulties of that period, faced by mountainous populations and the problematic agricultural production of the 19th and mid 20th centuries. Today the land is intensively cultivated and provides enough income for the villagers. It seems that was not the case in the mid 20th century where the local population often relied on the forest to obtain the necessities of life. The value of firewood should be considered as an important element that helped peasants to gain income actually by investing only their own labour. It was free, and could be something collected almost by anyone without any specific skills.

In addition, there was collection of wood during weddings. In this case, the friends and family of the forthcoming married couple were obliged to collect firewood necessary for the wedding fiesta and also for their needs for the winter. It was part of a social help, which the commune gave to the new household being established in the village, as these two interviewees mention:

> G15: Και επίσης εκάμανε και του γάμου τα ξύλα άμα δεν σου το έχουνε πει. Όταν γινόταν οι γάμοι, οι φίλοι του γαμπρού, μια Κυριακή ας πούμε, ένα μήνα πιο μπροστά, μπορεί και δυο για να είναι τα ξύλα ξερά, εσμήγανε 10-15 άτομα, με 20-30 γαϊδούρια, και πηγαίνανε στο βουνό, και κόβανε ξύλα και τα

φορτώνανε και τα πηγαίνανε σπίτι του γαμπρού. Τα είχανε για το γάμο τους. Για να ψήνουνε τα κρέατα.

G15: It was also firewood for the weddings. When it was the time for a wedding, the friends of the bridegroom, a Sunday let's say, a month before, maybe two, so that the wood will be dried, they meet, 10-15 people, with 20-30 donkeys, and they went in the mountain, and they cut wood and they loaded it and they carried it to the house of the bridegroom. They were used for their wedding, to cook the meat.

G15: 50s, M, Electrician

An2: Εκάναμε και τα ξύλα του γάμου, ήθελε να πάνε οι φίλοι του γαμπρού, να μαζέψουμε ξύλα για να περάσει το χειμώνα.

An2: We collected also firewood for the weddings. The friends of the bridegroom, would meet and collect the firewood needed for the winter.

An2: 30, M, Civil Servant

Generally transportation of firewood and also charcoal was by mule or donkey (Figure 6.5 and Figure 6.6). Both of these animals were mainly used by poor peasants and were accustomed to the harsh rocky soil of the uplands. Horses are more sensitive to such conditions and they have never been mentioned by the interviewees for transportation in the uplands. An interviewee from Zaros remembers her brothers carrying firewood by mule and donkey from the uplands:

Z5: Εμείς όταν ήμασταν απάντρευτοι, επαγαίνανε τα 'δέρφια μου και έκαναν ξύλα, και περνούσαμε όλο το χειμώνα, από το βουνό. τα κουβαλούσανε με τα μουλάρια με τσοι γαιδάρους με τέτοια πηγαίνανε αυτοί στο βουνό.

Z5: When we were not yet married, my brothers went and made firewood, and there was enough for the whole winter, from the mountain. They carried it by mule or donkey, with those things they went in the mountain.

Z5: 78, F, Housekeeper

Moreover, the value of the animals was much appreciated and people had the knowledge of what type of cargo they were able to carry and they did respect their needs. However, the inexperience of one of the interviewees caused some problems in the transportation of firewood. In his case donkeys suffered from an overload of cargo that in the end his father criticised him for his actions. People were aware of the amount of cargo donkeys were able to carry and had knowledge of where to stop and when to feed them. This amount was about 80 okades (101.6 kilos) according to this interview:

G15: Αλλά θυμάμαι αυτό που μου είχε μείνει, όταν πρωτοπήγα στο αόρι, με ένα συμπεθεράκι μου Μάρκο τον ελέγανε, ο οποίος αυτός επήγαινε κάθε μέρα στο αόρι. Αυτός το χαρτζιλίκι του δηλαδή το χε από τ' αόρι. Βέβαια και αυτός αρχάριος ήτανε ας πούμε προς το θέμα των κιλών. Και πάμε ... ριχνουμε ένα πρίνο κάτω. Και φορτώσαμε 'ντονε σε τρεις γαϊδάρους. Αυτός μπορεί να ήτανε ετότες σας 200 οκάδες ο κάθες του μπράτσος. Ξέρεις ο κάθε γάιδαρος πάνω από

80 οκάδες τότες σας δεν σηκώνει. Και φύγαμε 12 η ώρα και στα πρώτα σπίτια εφτάξαμε στις 5 το απόγευμα. Στο πρώτο σπίτι πέσανε οι γαϊδάροι … τέλος πάντων, θυμάμαι ότι έπεσε εκεί και έρχεται ο πατέρας μου με τον αδερφό μου και τα σηκώναμε και τα πήγαμε στο σπίτι, ο γάιδαρος βέβαια δεν τον εξεχώριζες λες και τον είχανε βάλει μέσα στη θάλασσα, και θυμάμαι τον έδεσε ο πατέρας μου σε ένα δεντρό απέξω από το σπίτι και του βαλε τσουβάλια, και τον εσκέπαζε ας πούμε, και 'τονε τάιζε, δηλαδή τότε το ζώο, όπως έχουμε το αμάξι, το ίδιο είχανε τότες σας το γάιδαρο. Ο γάιδαρος ήτανε το μέσο ας πούμε, της οικογένειας. Και μου λέει ο πατέρας μου ω κακομοίρη, όλο το αόρι ήθελε να το μονοφέρεις μια φορά.

G15: But I remember an incidence, still remember it, when I went for first time in the mountain, with one of my relatives, Markos was his name, and he was often going in the mountain, however, inexperienced with kilos. And we went, … we cut a kermes oak. And we loaded it on three donkeys. This tree could be each big branch 200 okas (254 kilos). You must know that a donkey cannot carry more than 80 okas (101 kilos). We left at 12.00 and we reach the first houses of the village at 17.00. In the first house, the donkeys fell down. ... anyway, I remember that it fell down there, and my father came with my brother, and we carry them to our house. The donkey of course, you could not distinguish him from the sea, it was like he had been inside the sea, and I remember my father, tied him in a tree outside our house, and he brought sackcloth, covered him, fed him. At that time the animals, as we have today the car, it was the same with the donkeys at that time. Donkey was the utensil of the family. And my father told me: oh you … the whole mountain you wanted to bring down in one go!

(G15: 50s, Electrician)

Figure 6.5: A photo showing a donkey in Heraklion city a few days after the killing of several Christians by the Turks in 1898 (Patris 2010). The same type of animals could be used in the research area for firewood transportation.

Source: Photo published in Patris local newspaper of Heraklion on 29/11/2010 (Patris 2010)

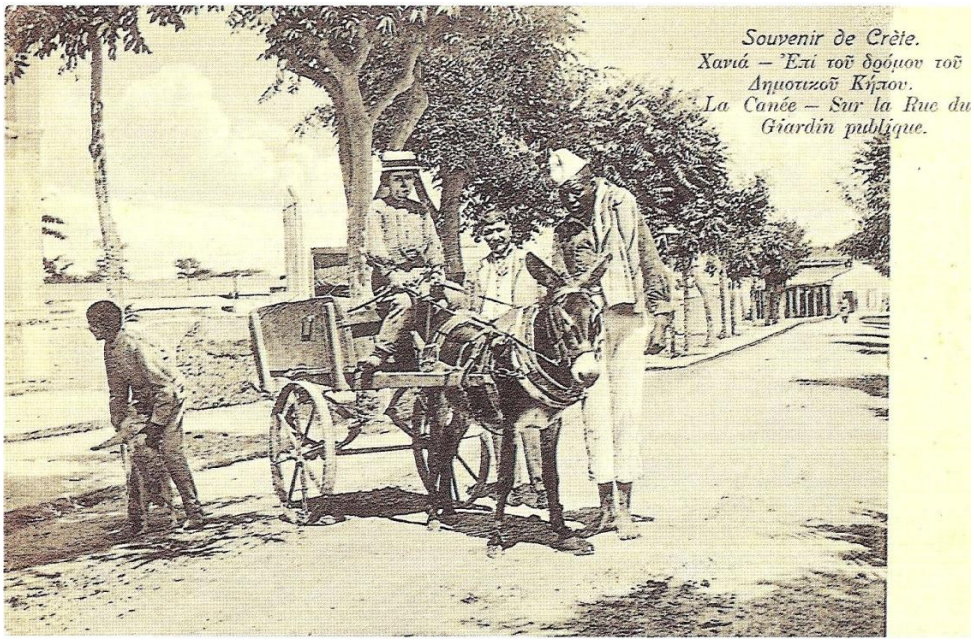


Figure 6.6: In this picture a mule or a donkey (probably mule as its size is relatively big) is used for carriage in the city of Chania. Similar types of mules were used in Psiloritis for transportation of humans and products.

Source: (Anonymous 1995), photograph taken in the 1900s

Firewood collection did not require special knowledge or skills; hence children or young boys often participated in both collection and transportation. A traditional Cretan song mentions the use of children in firewood collection, assuming that this was a common regular practice. In this song a man is thinking of a solution of where to send the children of his married lover, so they could share more time together. The most common daily work was probably at that time gathering firewood and water.

Ω μια παντρεμένη αγαπώ
έχει και δυο παιδάκια γιάλα-γιάλα,
Το 'να θα στέλνω για νερό
τ' άλλο για ξυλαράκια…

…Oh, I love a married lady,
and she has two children as well,
one of them I 'll send for water,
the other one for firewood…. Traditional Cretan song, (Xylouris 2009)

In addition, most of the interviewees described firewood collection, done by them, when they were children. In one interview, the amount of wood collected is mentioned, along with the type of wood collected from the mountain. In this case, at the end of the 1970s, wood collected from the mountain was mostly firewood for heating and the interviewee remembers that:

> G5: Τα ξύλα ένα παράδειγμα να σου δώσω μια προσωπική εμπειρία, θυμούμαι στην πρώτη τάξη δημοτικού που τελείωσα, είχα και πομήνει κιόλας, και με πήρε ο πατέρας μου με το γαϊδουράκι και βγήκαμε στο αόρι και μου φόρτωνε το γάιδαρο ξύλα, και όλο το καλοκαίρι έκανα αυτή τη δουλειά. Δηλαδή τη μια μέρα, βγήκαμε στο βουνό, την επαύριο μου φορτώνει το γάιδαρο και κατεβαίνω την τρίτη μέρα ξανά ανέβηκα. Δηλαδή κάθε τρεις μέρες εκατέβαζα ένα γομάρι ξύλα. Κατέβαζα 35 όλο το καλοκαίρι. Εκατέβασα 35 γομάρια ξύλα. Τα οποία αυτά τα γομάρια δηλαδή ήτανε ότι φορτώνουντανε σε ένα γάιδαρο. Ήτανε μιας χειμωνιάς τα ξύλα, για να περάσει το σπίτι τη ζεστασά ντου, το τζάκι του. Δεν εκάλυπτε τσοι ανάγκες του φούρνου, γιατί στσοι φούρνους μπαίνανε φούντες τα λιανά ξύλα.
>
> G5: For firewood for example, I will give an example drawn from a personal experience, I remember, I had just finished the first class of elementary school, and I had not graduated as well, and my father, took me with the donkey and we went in the mountain, and he was loading firewood on the donkey, and the whole summer I was doing that job. So one day I was in the mountain, the next day, he was loading firewood the donkey and I went back and the third day I was up again. It means that every three days I was carrying one load of firewood. I did carry 35 loads the whole summer. These loads were what could be loaded on to a donkey. It was the wood needed for the wintertime. For the house to be kept warm, for the fireplace. It would not cover the needs for the oven. Because in the ovens, we burned light wood.
>
> G5: 43, M, Bee-keeper/Shepherd

A 75 year old interviewee from Nyvritos suggests that the firewood needed for the winter was over one cargo for a week:

> N2: Εκεί ήταν τώρα η ζωή μας. Και να θες και δύο μέρες να πας να κάνεις ξύλα 2 φορές την εβδομάδα να βάνεις στην παρασιά να καις στην παρασιά, να πυρώνεσαι, εδά το χειμώνα. Εδά το χειμώνα, ένα γομάρι ξύλα δεν μας έφτανε την βδομάδα στην παρασιά.
>
> N2: There was all our life spent (in the mountain). And you needed two days to make firewood, twice a week, to have them for the fireplace, to burn them in the fireplace, to have heating for the winter. Now in the winter, one load of firewood per week was not enough in the fireplace.
>
> N2: 75, M, Farmer

This can be summarized as about 35 cargoes per season. Winter in Crete generally starts after October, although differences do occur within the island between uplands and coastal areas and between west and east. The interviewee from Nyvritos mentioned the use of at least one cargo per week. If we assume that winter starts in October and ends in March, this is about 6 months. This implicates, at least 24 cargos for the winter period. A bit less than mentioned in the other interview from Gergeri. Definitely there were variations of the amount of firewood needed between the villages as the climate within the research area varies. South slopes tend to be warmer and elevation has a significant influence especially in terms of temperature. This could be an indicator of different pressure in the forests for firewood. Generally it has been suggested that fuel-wood

needed for the population (50 million inhabitants) of the Mediterranean region was about 27 million tonnes/year (Di Pasquale et al. 2004).

The time for firewood collection was mainly during the summer period, especially in the uplands, where the conditions were favourable and dead wood was already dried, thus more flexible to carry down:

> Z7: Στα ξύλα πήγαιναν το καλοκαίρι,
>
> Z7: For firewood they went in the summer.
>
> Z7: 82, M, Farmer

German occupation, despite being less than four years had a significant influence on the forest of the area, according to the peasants. Germans had the technology that could transform an area within a few hours. This power is the power modern humans have, and explains sudden change in the landscape features of Crete (Rackham and Moody 1996, Papanastasis 2004). The German army needed firewood for heating as well. Local forests close to the villages were easily exploited for firewood. Moreover, several interviewees mentioned that common oak (*Q. brachyphylla*) was cut from the cultivated lands during German occupation. Two interviewees from Ano Asites village mention Germans destroying ancient oak trees:

> As2: Οι Γερμανοί εκόψανε πολλούς ντρυγιάδες. Εθέλανε να κόψουνε και το δικό μας αλλά τελικά δεν τον έκοψαν και επέζησε.
>
> As2: The Germans cut a lot of oaks *(Q. brachyphylla).* They want to cut our oak, but then they didn't, so it survived.'
>
> As2: 56, F, Farmer/Ceramist

> As3: Τσοι ανατινάξανε με δυναμίτη τσοι ντρυγιάδες. Τονε βάνανε γύρω από το δεντρό.
>
> As3: [Germans] They cut the oaks with dynamite. They put it around the tree.
>
> As3, 58, M, Farmer

In addition, archival research suggests that there was an increase in firewood production during German occupation (Figure 4.16). It can be assumed that during that period, probably other sources of energy were limited, not available even to Germans, thus firewood was in big demand. Archival and oral information suggests also a decrease of charcoal making, another source of energy for heating, so there was probably a higher pressure for firewood during the German occupation. German authorities, required villagers to participate in compulsory work, called locally 'aggaria'. This type of work included firewood collection and transportation. The same term was used by the Venetians, regarding complementary work

done by villianis (peasants) for the Venetian authorities (Gasparis 1997). This term survives in Modern Greek and relates to hard work, that someone is forced to do. Villagers from Nyvritos remember Germans cutting the trees for firewood:

> Ν5: Οι Γερμανοί φάγανε πολύ.
> Ν6: Εκεί από κάτω, για τους Γερμανούς απου λέει, με είχανε βάλει αγγαρεία με τσοι γαιδάρους και κουβαλούσαμε ξύλα … ήτανε από τον Αγιασμό από πάνω ένα δάσος και τα θερίζανε με τα πριγιόνια οι Γερμανοί … Αγγαρείες ναι, επηγαίνανε και τα φορτώνανε … από κια ηρχούντανε τ' αμάξι και τα φορτώνανε οι Γερμανοί και πηγαίνανε στα χωριά που ήτανε οι Γερμανοί είχανε σόμπα και τα ανάβανε.
>
> N5:The Germans destroyed a lot (forest).
> N6: There down, for the Germans that he mentioned, I had been in aggaria (forced work) with the donkeys, and we carried the wood. It was from 'Aggiasmos' (place-name) up a forest, and they reaped them with the chain saws the Germans. … Yes 'aggaria' they went to load them and from there a vehicle would come to carry them in the villages where Germans stayed and they had their wood-stoves to light.
>
> N5: 70s, M, Farmer / N6: 80s, M, Shepherd

6.4 Firewood collection stopped

Intensive firewood collection from the forest ceased around the end of the 1970s. The reason was mainly the availability of other wood resources in the lowlands, which was more accessible than firewood in the forest. In the 1980s, an EU funding programme for replanting olive trees with a new variety called coroneiki introduced from Peloponnese created a significant availability of wood. This wood was actually the wood from ancient olive trees that were planted close to the villages, and then gradually were growing thicker and had extended into former cereal cultivations since the 1950s.

> Ν1: Ξύλα δεν μαζεύουν εδώ και χρόνια, μετά το 1960 σταμάτησαν. Τώρα υπάρχουν πολλά ξύλα από τις χοντρολιές
>
> N1: Firewood they stopped to collect after 1960. Now you can find much wood from olive trees.
>
> N1: 50, M, Herb collector

This wood was transported from the nearby fields into peasants houses with vehicles and it was cut into smaller pieces with machines. This work was easy compared to firewood collection within the forest. Wood was now abundant everywhere in the island of Crete and prices were affordable for almost all the population due to overproduction. In the same period, households gradually started to replace wood heating with petrol or other energy sources. These modern innovations were easier and efficiently

operated, providing better heating during the winter. Hence, these two incidences, olive wood production and new energy innovations for heating, were responsible for firewood collection ceasing from the forests since end of the 1970s. The modernisation that has invaded rural Crete today is mentioned in these two interviews:

> G5: ε τώρα δεν χρειάζονται τα ξύλα. Εδώ πλεόν το χωριό έχει αστικοποιηθεί. Δηλαδή όποιος δεν έχει πετρέλαιο θα έχει πυρινόξυλο, οι σόμπες δηλαδή οι ξυλόσομπες, ή τα τζάκια είναι ελάχιστα. Στη Γέργερη, στα χωριά πλέον. Ποια πολλά τζάκια έχει στην πόλη, από ότι στα χωριά. Γι 'αυτό δεν γίνεται. Δηλαδή δεν υπάρχει το κίνητρο για να γίνει. Όχι ότι έχουμε αλλάξει και έχουμε γίνει χριστιανοί, πλέον δεν το χρησιμοποιούμε το ξύλο.
>
> G5: Now, they don't need firewood, Here the village has been urbanized. I mean, if you don't have petrol, you will have olive waste paste, I mean the wood-stoves, to the fireplaces are few. In Gergeri, in the villages now, more fireplaces you will find in the city, than in the villages. For that it stopped. I mean, is no motivation for it anymore. Not that we have changed, and we became Christians, they don't need firewood anymore.
>
> G5: 43, M, Bee-keeper/Shepherd

> Z3:Εδά εδά με τσ' ελιές δεν πάει δα κιανείς στο βουνό. Εδά οι πιο πολλοί έχουνε καλοριφέρ.
>
> Z3: Now because of the olives (firewood), no one goes to the mountain. Now the majority has calorifier (radiator).
>
> Z3: 65, F, Hotelier

There are some cases, where firewood from the forest is still collected locally. Shepherds or visitors of the forest still use dead wood for fires for cheese production or for cooking. This is not always the case, and is often criticised that young people visiting the mountain take firewood with them instead of trying to find it on the site, assuming that the young generation do not want to put much effort into finding firewood any more. Also as an interviewee mentioned, in the areas close to the roads is not so easy to find dead wood, however in more remote and less accessible areas of the forests, dead wood is abundant. Thus, dead wood collection probably is still happening in places accessible by vehicles, but is not a widely applied operation anymore.

> G19: Αν πας τώρα στο βουνό, θα βρεις πολλά ξύλα. Όχι σε τόπους που σιμώνει αμάξι βέβαια, εκιά τα μαζώνουνε. Αλλά σε άλλους τόπους είναι γεμάτο.
>
> G19: If you go now in the mountain you will find a lot of wood. Not in the areas that are accessible by car, but in other areas it is plenty.
>
> G19: 45, M, Civil Servant

6.5 Firewood and how it influenced the forest

Firewood collection of green wood can influence forest distribution and composition, as there is a different preference for various tree species. In the research area, maple has been maintained in shrubby format for long periods and today it has been gradually developed into tree level.

The Germans did have a small scale influence on the areas where they had applied extensive logging, and even today the forest has not recovered. The disappearance of ancient trees in that area resulted in a landscape more close to phrygana than forest (Figure 6.7).

Figure 6.7: A view of Nyvritos forest. Probably in this location Germans applied loggings in the 1940s, and only a few scarce trees remain in the lower parts of the area till today. The majority of the trees are kermes oak (Q. coccifera).

Source: photo taken by the author, July 2010

Several scarce ancient trees survived but were not able to support regeneration at least up to the present day.

This could be connected with grazing and logging along with forest fires occurring in the same area in recent past. The existence of grazing is the main reason, according to several interviewees, while others suggest that grazing was not as important as woodcutting in the reduction of forest. Those that support the second opinion are mostly shepherds:

> Ν4: Άμα κοπεί τώρα ο πρίνος, ήτανε τα κοπάδια οι κατσίκες και δεν φήνανε. Και να ανοίγει δεν τονε εφήνανε να, δεν άνοιγε δεν ήβγαινε.

N4: If you cut kermes oak, then it was the flocks, the goats, and they prevented the trees from re-growing. And even if it was sprouting, they did not let it, it could not sprout, and it could not grow.

N4: 70s, M, Hayward

An1: Ένα ενθαρρυντικό που έχει το βουνό, είναι τώρα που η υλοτομία εσταμάτησε σχεδόν 100 %.
Τώρα δεν συμβαίνει αυτό, και έχει αναδασώσει το αόρι. Εάν ήθελε να την γλιτώσουν ακόμα κάποια χρόνια θα είναι μετά δάσος.

An1: A positive thing, that the mountain has today, is that logging had stopped, almost 100%. Now that is not happening, and the mountain has been forested. If they will survive for a few more years, it will be then forest.

An1: 50, M, Shepherd

In addition, several interviewees suggest that forest rangers were an important element in forest conservation within the area. They regarded forest law as a power for retaining natural forest and protecting it from peasants' damage. People today, regard that as something positive, which possibly was not the case at the time they wanted to implement wood cutting. In the report of the 1930s, the local commune of Gergeri insists that forest law should not be applied in their forests (RGC4). Several other documents from the Cretan State show that local authorities resisted the implementation of forest law (Foumis 1899). Interviewees from Nyvritos remember that forest rangers were very strict with kermes oak (*Q. coccifera*) firewood collection:

N3: Επαε ένας γείτονας μας, δεν το θυμούμαι μα το χω ακούσει από αυτόν, είχαινε ξύλα ξερά πρινιένα ξύλα, στην ταράτσα, και πως του τα βρήκανε πρινιένια ξύλα τον επήγανε στο δικαστήριο. Άσχετα πως ήτανε ξερά. Τόσονα τα απαγορεύανε τα ξύλα τα πρινιένια.
N2: Είχαμε και δασοφυλακές. Παλιά όλες οι κοινότητες είχαν δασοφύλακες.
N3: Αν δεν είχανε δεν θα Είχαν αφήσει αυτοί πρίνο στο αόρι. N2: Αλλιώς το δάσος δεν ήθελε να υπάρχει τώρα. Ήθελε να είναι κατεστραμμένο. Γιατί είχε δυστυχία ο κόσμος και … δεν είχε άλλο πόρο να πα βγάλει 10 δραχμές.

N3: Here one of our neighbours, I don't remember that, but he told me it, they had kermes oak wood on their roof, and because they found them, and they were kermes oak wood, he went to the court. It didn't matter that they were dried, so much they forbid wood from kermes oak.
N2: There were also forest rangers, in the past all the communes had.
N3: If they were not here, no kermes oak will have been left in the mountain.
N2: Otherwise the forest wouldn't have been here now. It would have been destroyed. Because people were very poor and it was the only way to get some money.

N2: 75, M, Farmer, / N3: 70. F, Housekeeper

Another important element could be the intensive removal of dead wood from the forest that could influence the biodiversity of the forest and the ecosystem itself. In what degree that could be a negative or positive element probably can not be answered today. The fact that dead wood was removed almost completely from the forest every year meant that the

spread of tree diseases was controlled. However, modern studies have shown that dead wood is a source of richness within an ecosystem and there are more positives than negatives associated with it (Norden et al. 2004, Jonsson et al. 2005, Fridman and Walheim 2000).

6.6 Fuel-wood for lime making

Lime has a long-term use throughout human history. Archaeological evidence from different places of the world points to the use of lime 10,000 years ago (Guelberth 2003). The availability of limestone throughout the globe makes it an accessible construction material itself, while it can be transformed into other products, such as lime. Egyptians used it in the construction of the pyramids, and 'by about 1000 B.C., there is evidence of the wide-spread use of quick- and hydrated lime for building by many civilisations, including the Greeks, Egyptians, Romans, Incas, Chinese, and Mogul Indiana' (Oates 1998, p.3).

In addition, the availability of limestone in Crete generally and in the area of Psiloritis specifically (Figure 4.1) facilitated the production of lime almost everywhere as the primary source was easy available and accessible.

An important element in producing lime is the availability of fuel. Fuel costs, even today, represent 40% - 50% of the total cost in lime production. Limestone is heated in kilns, at high temperatures, around 900 ^{o}C (Oates 1998). There needs to be enough energy to convert 'calcium carbonate and magnesium carbonate into calcium oxide and magnesium oxide commonly known as quicklime' (Guelberth 2003, p.162).

$CaCO_3 \cdot MgCO_3$ + heat $\rightleftharpoons$ $CaO \cdot MgO + 2CO2\uparrow$ (adapted from Oates 1998).

The extensive use of lime has made it an important material for centuries and even today its demand is high worldwide. The implications of its production for the environment are associated with the extraction of limestone itself (Saratsi 2003) and by the need to satisfy its high energy demands. Till the end of 1950s in Greece, only fuel-wood was used for its production. Today, fuel-wood has been replaced at least in Crete by a by-product of olive oil production, the olive press cake after it is dried which contains the wooded parts of the olive fruits and is widely available (Manios 2004).

Oral history suggests that up to the 1950s, in the research area, the limiting factor in lime making was actually the lack of energy. Thus the

availability of vegetation to provide firewood for the limekiln was essential. Kilns were made in the areas, close to the villages, in foothills, surrounded by phrygana and shrub-lands. This was probably the same limiting factor throughout the historical era in Crete. An 82 year old interviewee mentions the locations for limekilns and the necessity of enough fuel-wood:

> P: Και ασβέστη κάνανε;
> Z6: Ναι ασβέστη κάναμε ασβεστοκάμινα. Επαέ χαμηλά. Στο βουνό δεν εμπόριες να κάμεις ασβέστη. Μόνο στσοι πρόποδες του βουνού στο τέρμα, εκεί εγινόντανε και εκεί καμίνια, που είχε κλαδί πολύ και βγάνανε εκείνη την εποχή. Εγώ ήκαμα, εμπήκα σε 2, σε 3 ασβεστοκάμινα, είχα μπει συνέταιρος.
>
> P: And did you make lime?
> Z6: Yes, lime, we did lime-kilns. Here in the lower land. In the mountain you couldn't make lime. Only in the foothills, at the end, there they were made, and kilns, where there was a lot of vegetation and they could cut it at that time. I did, I went to two, three lime-kilns, I had been a co-partner.
>
> Z6: 82, M, Shepherd

Rarely were lime-kilns made in the mountains. The vegetation close to the kiln provided the necessary supply of wood, for setting the fire and keeping a stable temperature. The procedure was the clear-cutting of vegetation, creation of fuel-wood bundle, initially of fresh plants that were left in the land till they dried. Contemporary studies showed that green wood contains a large quantity of water (Oates 1998). It is suggested, that vegetation should be dried for almost a year, but this is not necessary in the Cretan environment, where summers are dry and hot. The wood was collected after March, and left to dry, probably for several months till it was used in lime production. 'Wood has been described as the 'ideal' fuel for lime-burning as it burns with a long, lazy flame which is relatively cool. This helps to ensure that the quicklime is reactive' (Oates 1998, p.130). An interviewee illustrates the whole procedure of the use of fuel-wood for lime making:

> N2: Κάνανε και ασβεστοκάμινα, από την λαμπρή και μετά, την εποχή που είναι το κλαδί φουντωμένο, έχει πολύ άνθιση, έχει ανοίξει πολύ, ετότες κάνανε ασβεστοκάμινα. Του βουνού τα κάνανε δεματιές, όπως είπα στην αρχή, το κλαδί όταν ήταν φουντωμένο καλά τότε σας φτιάχνανε τα καμίνια. Και κάνανε τσοι δεματιές στρογγυλές. Έκανες μια δεματιά και ήβγαινες απάνω, την πάθιες σιγά σιγά, όσο εμπόριες μια δεματιά, στρογγυλή και μετά θελα τση βάλεις απάνω 3-4 πέτρες να την εφήσεις εκεί. Και άμα ήθελε να ξεραθούνε, τα κουβαλούσανε, και τα πήγαινες στο καμίνι. Δουλεύανε όλοι με μεροκάματο τώρα ανάλογα τα ρούπια τώρα που λέγαμε η εμισό ρούπι ή αμάλαγο επήγαινες.
>
> N2: They made limekilns after Easter. The time when vegetation is on the increase, it has many blossoms, it sprouts a lot. Then was the time we made the limekilns. From the mountain they made bunches. As I said before, when vegetation (branches) was blooming enough we made the kilns. And we made roundish bunches. You made a bunch and then you were going up on it to push it with your feet, as much as you could, roundish and then you should put three

> or four stones in the top and you left it there. And after they were dried you carried them in the kiln. Everyone was working in wage, based on the roupi, as we called it, so you could go half roupi or whole roupi.
>
> N2: 75, M, Farmer

After the collection of the necessary amounts of fuel-wood, people maintained fire for the kiln. The collection of fuel-wood itself was based on local needs and the availability of people to work. The work was divided into day work values, called roupi-a. Depending on the amount of lime needed for their works or the market, participants had to offer the appropriate effort.

Lime making is connected with a temporal cycle of vegetation recovery. An area was exploited for lime production, then for several years it was left unexploited. After the recovery of vegetation, it was again exploited. This harvest cycle rotated every five to six years and this type of management is more suitable for shrub-lands than forests. In forests, even in coppiced ones, the harvest cycle is more than 15 years, normally 20 (Ntafis 1990). This type of five year cycle of lime production was also documented by Saratsi (2003) in Epirus. However, in her case, documents suggest that the repetition of lime making in the same area could not support the kiln, and more wood should be obtained from other sites. In this case, is most likely that they refer to woodland and not shrub-land, and the five year period was not enough for the forest to recover and provide enough fuel.

> P: Εδώ κοντά τα κάνανε ή στο βουνό;
> N6: Όχι στο βουνό, στσοι πρόποδες έπαε στον αγιασμένο από πόδε πόδε έιναι ένα και αμα ήθελα περάσουνε 5 με 6 χρόνια του βγάνανε το κλαδί όλο να πάει ίσα πάνω, φασκομηλιές ασπαλάθους και κάνανε τσοι δεματιές σαμε να ανευτό πάλι το κλαδί. Στο σκίδι πάλι άλλονένα στα σπήλια, δυο και, και κια στα δυο μπήκα. Πέρα πέρα τώρα σύνορο με τη Γέργερη πάει, άλλο καμίνι. Οντε ήθελε να ανοίξει το κλαδί να αναπτυχθεί μόνο μόνο, άντε πάλι καμινωσά.
>
> P: Here close you did it (lime) or in the mountain?
> N6: No in the mountain, in the foothills here in Agiasmenos (place-name) there close is one, and when five to six years have passed we took away all the vegetation from the hill, Greek sage, *Callicotome villosa*, and we made bunches, till the vegetation will recover again. In Skidi (place-name) another one, in Spilia two, and in both of them I participated. On the other side now, close to the borders with Gergeri, another one. When the vegetation had bloomed (sprout) again another kiln was set up to operate.
>
> N6: 80s, M, Shepherd

The degree of forested land exploitation, close to the villages, not only for lime production but also for cooking, can be recognised by some events, mentioned in the interviews. In the village of Ano Asites, the close mountain is called Prinos, a name derived from a huge Kermes oak (*Q. coccifera*) tree that could be seen from the village. That tree was destroyed

by lightning and today does not exist. Although, lime was normally made close to the villages, villagers went to the mountain, used the wood from the destroyed tree and produced lime. This can be an explanation of lack of fuel in the low-mountain areas, due to overexploitation:

> As1: Ήτανε ένα μεγάλο δεντρό στην περιοχή, γιαυτό τηνε λένε και Πρίνο, αλλά ένας κεραυνός το 'καψε. Από το ξύλο του εκάμανε 130,000 οκάδες ασβέστη.
>
> As1: It was a very big tree in the area for that they call the mountain Prinos (kermes oak), but a lighting hit it and burned it. From its wood they produced 130 000 oka/des (1 oka = 1.27 kilos) of lime.
>
> As1: 63, F, Farmer

This type of management of the land should be considered as another type of forest clear-cuttings, applied in phryganic areas. In the past, in forestry often clear-cutting management procedures were used. Clear-cuttings are an efficient and practical tool, applied easily and with less cost and effort (Efthimiou 2011). However, modern Greek forestry policy rejects this methodology, mainly for ecological and erosion problems and suggests a selective wood cutting method, so that forest soil will be all the time covered with vegetation (Ntafis 1990). There are however, exceptions where clear-cutting is still applied, such as broadleaved woods, managed as coppice woods, especially in Northern Greece.

Lime is a very useful material and can be stored for several years. In fact the storage actually resulted in the creation of another product, called lime putty or lime paste. It is the reaction of lime with a certain amount of water. This material is better if it is aged for several years. This procedure, the reaction of lime with the water is called slaking, and long periods of slacking, help to completely hydrate lime and produce a smoother material for house construction.

$CaO \cdot MgCO + 2H_2O \rightleftharpoons Ca(OH)_2 \cdot Mg(OH)_2$ + heat (adapted from Oates 1998).

> P: Τον άσβεστη Τι τον κάνατε;
> N2: Τότες όποιος δεν τον επούλιε, τον ήθελε για δικού του, ήνοιγαι μεγάλους λάκκους σαν τσοι στέρνες και τον έβανε μέσα, του βανε νερό τον έσβηνε και τον είχε εκιά 2 με 3 χρόνια, δεν εχάλα. Μόνο να τον εκαλοσβήσεις, να τον έχεις συν'εχεια με νερό να μην ξεραθεί. Συνέχεια ήθελε νερό. Άμα Έχει συνέχεια νερό δεν χαλάει σε μια στέρνα μέσα.
>
> P: What you did with the lime?
> N2: If somebody didn't sell it, they used it for their needs, he should dig a pit like the water basin, and he will put it in. And he feel it with water and he was 'extinguish' it and he could have it there two or three years it wouldn't stale. But you need to extinguish it very well to keep it with water all time so it won't

> dry out. It needed water all time. If it has water continuous it will not go stale inside the pit.
>
> N2: 75, M, Farmer

The degree of negative environmental impact resulting from lime making and fuel-wood collection remains questionable. The areas close to the villages were overexploited, in a cycle of 5-10 years, at least in the recent past. However, if that exploitation is repeated in a continuation of thousands of years, it could be responsible for the degradation and probably the replacement of lowland forests, with a scrubby - phryganic vegetation type, more efficient to use and more productive in terms of firewood supply. Several researchers support this theory of land degradation in Mediterranean. These theories cannot be proved unless more scientific methods can investigate pollen evidence, something difficult in the case of Crete. Even pollen diagrams can be imprecise. However, it is more important to gain information, regarding these past management practices in the lowland forested areas, and to see how people and society have benefited from them.

Since the end of the 1950s fuel-wood for lime production ceased and these areas remain unexploited. Their use is limited to grazing, often overgrazing, and as a result the more favourable vegetation species to survive, are the more flammable ones. Plants with many prickly, dry parts are flourishing as a reaction to grazing and these areas are the most vulnerable to wild fires.

The increase of forest fires in Heraklion after 1960 (Figure 4.24) is related to this abandonment of management in the lower parts of the mountain. Past management practices, helped to reduce the amount of woody plants on the surface, and provided more space favourable to grazing plants. This repeated action almost every five years, helped also to create zones of no woody vegetation, which discourage fires.

6.7 Spatial analysis of firewood and fuel-wood for lime production

GIS analysis was implemented for the years of 1937, 1946 and 1955 for both firewood and fuel-wood for lime production. The information from 1955 for firewood and 1937 for lime are not presented as there was not any spatial differentiation as a result of the small quantities recorded for this period.

In 1937 firewood appears to be more important in the eastern parts of the Heraklion Prefecture (Figure 6.8) and this is reversed in 1946 (Figure

6.9) where the western parts concentrate higher values and the research area seems to be the centre of this peak.

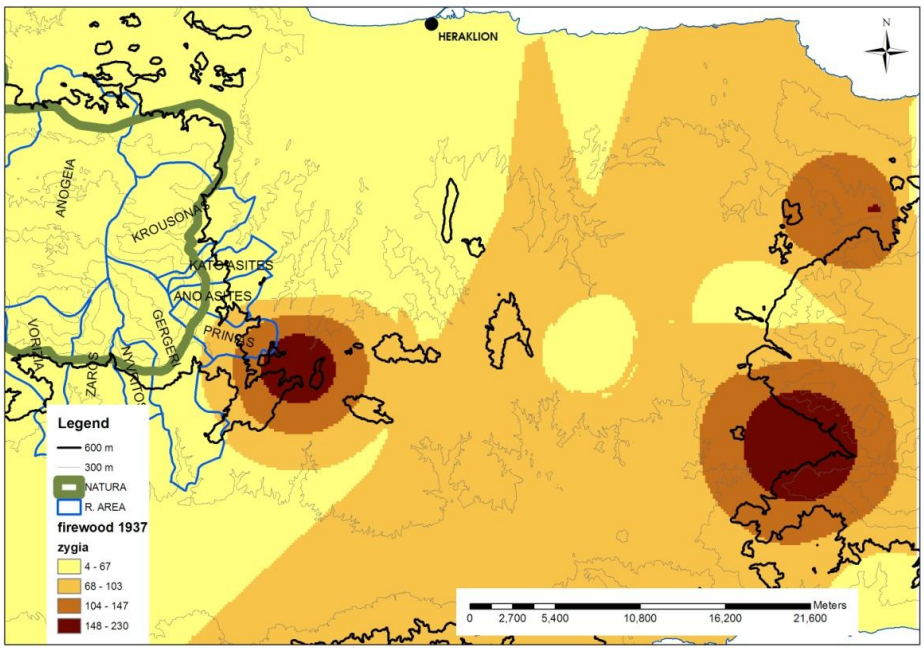


Figure 6.8: Firewood production in the Heraklion prefecture in 1937.

Source: Map drawn by the author using ArcGIS, based on quantitative data (HFDA6, 7)

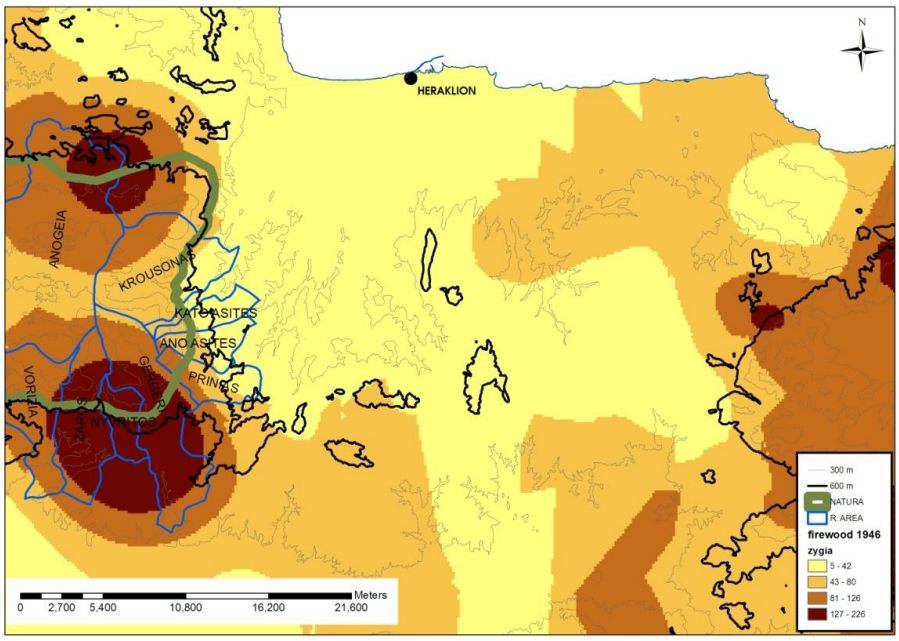


Figure 6.9: Firewood production in the Heraklion prefecture in 1946.

Source: Map drawn by the author using ArcGIS, based on quantitative data (HFDA 6, 7)

If the analysis is implemented with the sum of the data for 1937, 1946 and 1955, then two peak centres appear on the east and west parts of the prefecture and close to the mountains (Figure 6.10). Thus, firewood

collection is connected with the uplands. In addition, lower areas, between 400m and 700m, appear with high values, and this implies that common oak (*Q. brachyphylla*) as it was suggested in the archives (HFDA6, 7) was also exploited for firewood as this species grows in this zone. Moreover, areas close to the mountains, such as the eastern and western parts of the prefecture had more need for firewood as winter is more severe there than the coastal areas.

The analysis for lime showed also a peak in the western parts in 1946 (Figure 6.11) and then in 1955 on the eastern parts of the prefecture (Figure 6.12). The total value for all the years suggests a more complex pattern, suggesting exploitation almost everywhere. There are though, peaks in the eastern and western parts of the prefecture.

This shift almost every ten years of the higher values from east to west supports a cyclic exploitation of the different areas that were left to recover and were then exploited again. For lime production this was also supported in oral history, but not for firewood collection. GIS analysis of archival information suggests that this cycle was also applied in firewood collection.

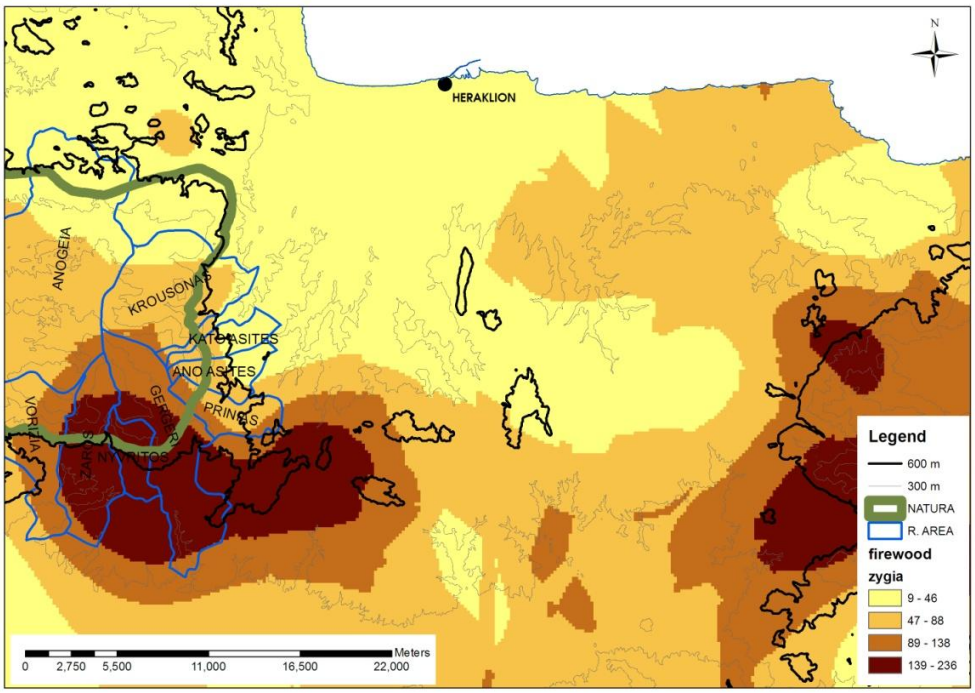


Figure 6.10: Total firewood production in the Heraklion prefecture for the years of 1937, 1946 and 1955.

Source: Map drawn by the author using ArcGIS, based on quantitative data (HFDA6, 7)

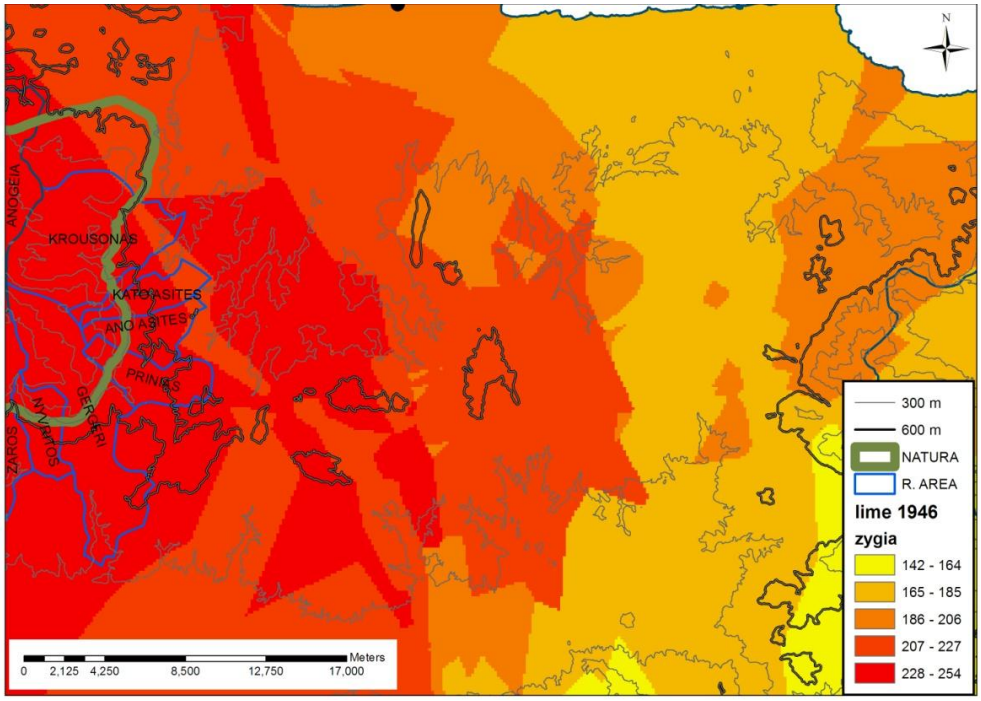


Figure 6.11: Fuel-wood used for lime production in the Heraklion prefecture in 1946.

Source: Map drawn by the author using ArcGIS, based on quantitative data (HFDA6, 7)

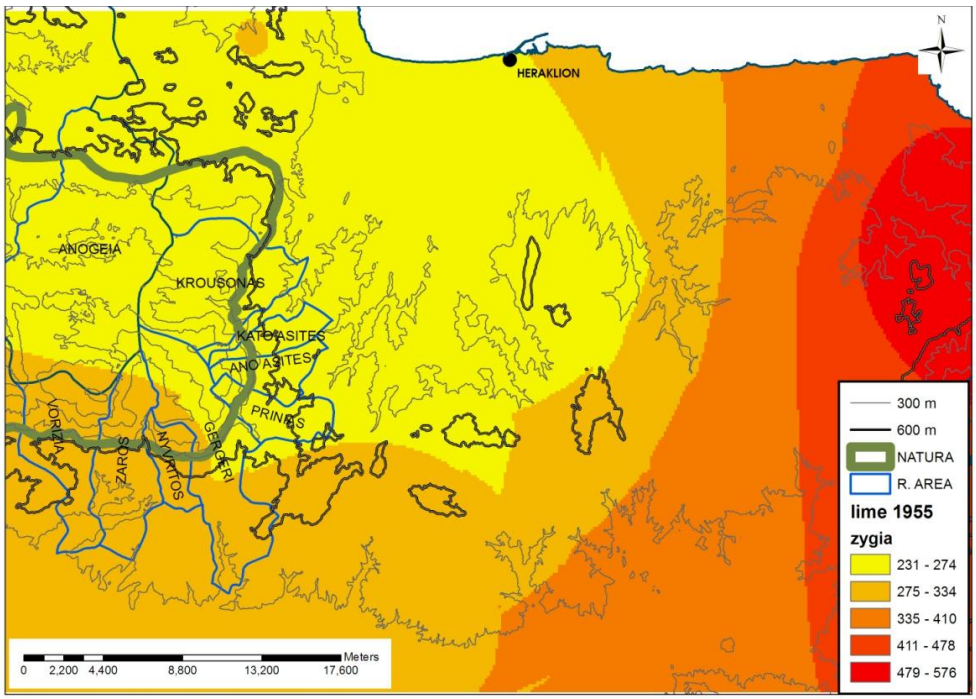


Figure 6.12: Fuel-wood used for lime production in the Heraklion prefecture in 1955.

Source: Map drawn by the author using ArcGIS, based on quantitative data (HFDA6, 7)

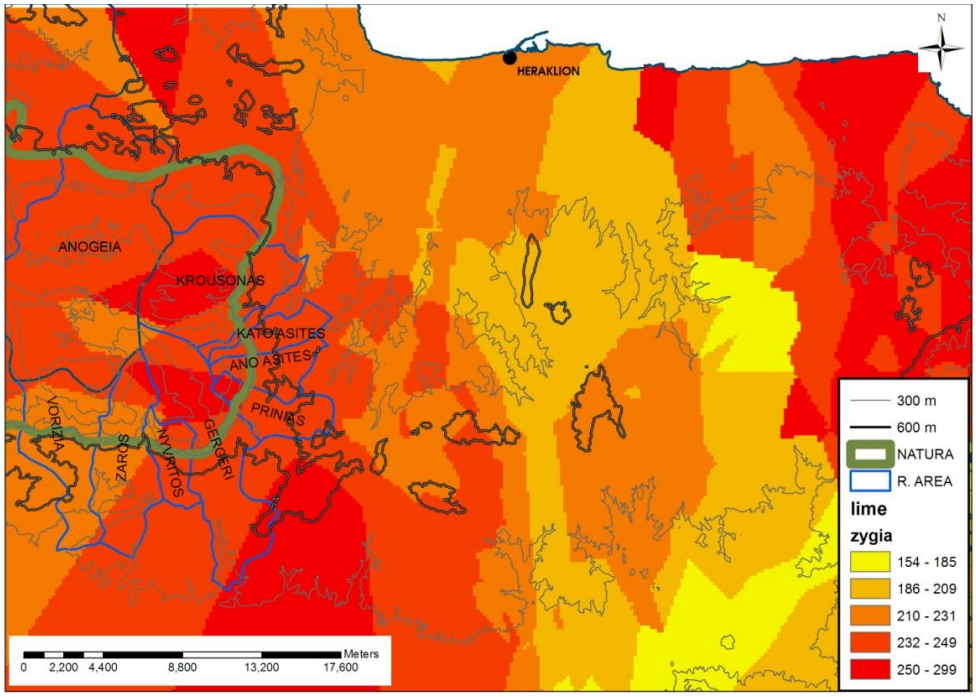


Figure 6.13: Total fuel-wood used for lime production in the Heraklion prefecture for the years of 1937, 1946 and 1955.

Source: Map drawn by the author using ArcGIS, based on quantitative data (HFDA6, 7)

6.8 Conclusion

Forests in eastern Psiloritis were heavily exploited for firewood up to the 1960s and in a lesser degree in the 1970s. The majority of the peasants were involved in firewood collection to satisfy their needs and also to gain some extra income. Often children participated, especially in its transportation using loaded animals, donkeys and mules.

Forest exploitation for firewood had influenced forest expansion and composition, and today several species have recovered, especially maple.

Another use of fuel-wood was connected with the uncultivated land in the lower parts of the mountain. This fuel-wood was used in lime production and totally ceased in the 1950s. A cycle of completely removing shrubby and phryganic vegetation every five or ten years has been suggested from oral history and GIS analysis till the 1950s. Similar management was also applied in coppiced woods for the northern Mediterranean where 'until the first half of the past century the cycle of cuts was short or very short (8-10 years)' (Di Pasquale et al. 2004, p.15). The cessation of clear-cutting in those areas is connected with an increase of forest fires after 1960.

Chapter 7: Other NTFPs

7.1 Introduction

The main non-timber forest products (NTFPs), produced locally in the area of Psiloritis, are summarised in this interview extract and included firewood (analysed in a previous chapter), acorn and herb collection.

> N3: Θέλω να σου πω, Πώς από το βουνό Ζούσαν μια φορά οι άνθρωποι. Άλλοι από βελάνια, άλλοι από φασκομηλιά άλλοι από ξύλα και ξύλα πουλούσανε.
>
> N3: I just want to say that once upon a time, people made their living from the mountain. Others from acorn, others from Greek sage, others from firewood, and firewood they did sell.
>
> N3: 70, F, Housekeeper

Several researchers worldwide suggest that NTFPs are not always included in formal forest production (Ghosal 2010, Shanley et al. 2005, Pierce et al. 2003) and that it is also true for Greece and Crete as well. Croitoru, defines six major categories of NTFPs for Mediterranean forests: 'firewood, cork, fodder for grazing, mushrooms, honey and other NTFPs. The last category covers a variety of fruits and plants, which are usually found in smaller amounts than the five main NTFPs' (2007, p.769). Definitely there were permissions for collecting firewood found in the forest according to archival information (HFDA6,7). Information regarding other NTFPs in HFDA is rare, and when found they are registered as 'other forest products', and often extra clarifications of the specific product were added. These few cases included pine bark, 'dhadhi' and herb collection. Fruits collected from forested areas normally were not registered officially. Oral history provides a wider view of other NTFPs collected from the uplands that included mainly fruits and herbs with the acorn being one of the most important.

7.2 Fruits from the forest, food for the animals

Almost every tree produces seeds and often fruits that contain them, useful for their reproduction and expansion. Several of these fruits and seeds have different values and can be used as sources of food for grazing animals and humans. In the area of eastern Psiloritis, broadleaved forests consist mainly of kermes oak (*Quercus coccifera*) and maple (*Acer creticum*). Other broadleaved species found in the forests are holm oak (*Q. ilex)*, wild pear (Pyrus sp.), common hawthorn (*Crataegus monogyna*), *Phillyrea latifolia* and Cretan zelkova *(Zelkova abelicea)*. All of these

species generally are found in small clumps or even individual trees. Evergreen oaks are mainly concentrated in the uplands (kermes oak and holm oak) and actually no deciduous oaks are found there.

Deciduous oaks (*Q. brachyphylla, Q. macrolepis*) are found in lower elevations, generally in more fertile areas close to the villages. In addition, in middle elevations (400-700), carob (*Ceratonia siliqua*), wild pear (*Pyrus sp*.), wild olive (*Olea europaea var. sylvestris*) as well as azarole (*Crataegus azarolus*) are also found in the area of Psiloritis. Table 7.1 lists the tree species found in the area of Psiloritis and their seed or fruit types. The species mentioned in the interviews and used by the villagers as a source of feed are also recorded.

Species name	Local name	fruit type	Use as feed source	Grafting	Distribution (m)
Maple *(Acer creticum)*	Asfentamos (Ασφένταμος)	Samaras	no	no	>600m
Kermes oak (Q. coccifera)	Prinos, katsoprini (Πρίνος/κατσοπρίνι)	Acorn	yes	no	>500m
Holm oak (*Q. ilex)*	Azilakas (Αζίλακας)	Acorn	yes	no	>600m
Common oak (Q. brachyphylla)	Drigias (Δρυγιάς)	Acorn	yes	Yes	400-600m
Valonia oak (Q. macrolepis)	Velanidia (Βελανιδιά)	Acorn	yes	no	400-500m
Wild pear (*Pyrus sp.)*	Aclada (Αχλάδα)	Pomes	yes	Yes	>500m
Carob (*Ceratonia siliqua*)	Charoupia (Χαρουπιά)	Pod	yes	Yes	300-600m
Common hawthorn (*Crataegus monogyna)*	Trikoukia (Τρικουκιά)	Haws	unknown	no	>800m
Azarole (*Crataegus azarolus)*	Koudoumalia (Κουδουμαλιά)	Haws	unknown	no	500-700m
Phillyrea latifolia	Lioprini (Λιοπρίνι)	Drupe	no	no	>600m
Cretan zelkova *(Zelkova abelicea)*	Anegnoro (Ανέγνωρο)	Drupe	no	no	>800m

Table 7.1: A list of the tree species found in Psiloritis, their fruit type and use and their grafting use. In this table, the information is for Psiloritis Mountain only, for example kermes oak can be found and in lower elevations elsewhere in Crete.

Source: Information for grafting and use as feed source has been derived from oral history and archival research

7.3 Acorn: a useful fruit from the oak tree

7.3.1 Acorn uses

In 1851 Captain James Spratt, visited Crete and in the area of Axos (Figure 7.1), a village in Rethymnon prefecture, met a group of villagers harvesting acorns probably from holm oak or kermes oak trees. In his work, 'Travels and Researches in Crete' he described the whole procedure of threshing oak trees and collecting the acorns and provided information about their use:

> the valley near the gorge is lined with some scattered groves of ilex oaks, which are a small-leaved kind, and only useful for their acorns to feed the village pig. Several of the trees were of large growth, and at the time of our passing they were being threshed by men, women, and children with long poles and sticks, to gather the ripe acorns from them, the inhabitants being all Christians in this neighbourhood (Spratt 1865, p.76).

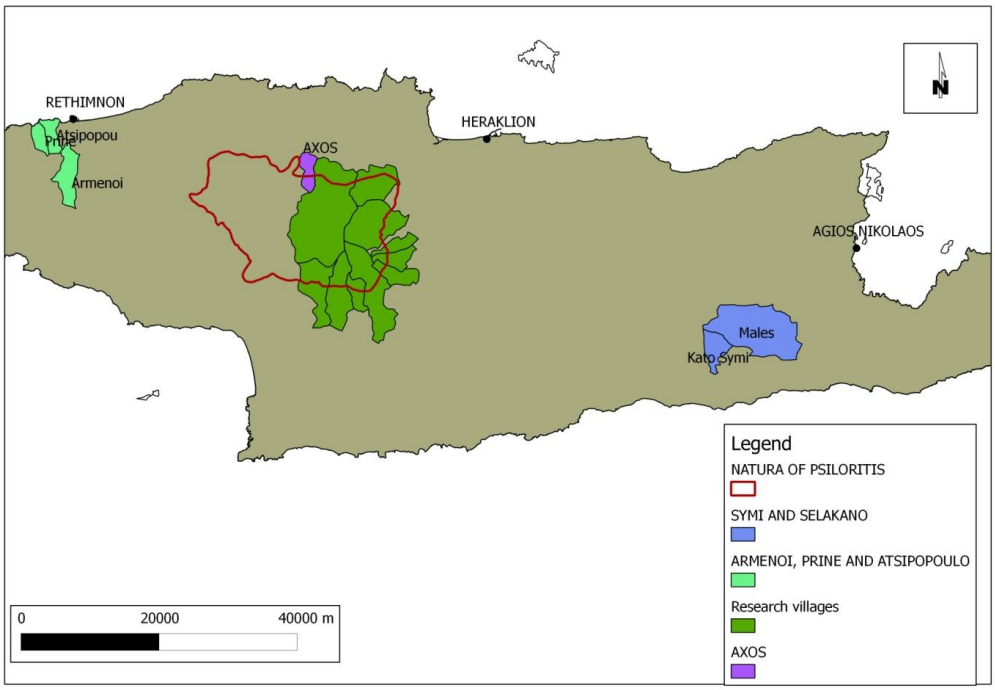


Figure 7.1: Map of Crete, where the area of Axos, Prine, Atsipopoulo and Symi, are shown in comparison with the research area.

Source: Map made by the author using QGIS. Information regarding the expansion of Valonia oak, were derived from written sources. Information regarding the use of forests in Selakano and Symi are derived from oral history

However, acorns were not only used for animal feed as this passage supports. In the past, before the introduction of chemicals, acorn cups called valonia, and mainly derived from valonia oak (*Q. macrolepis*), were extensively used in tanneries. Vegetable tannins were needed to convert animal skin into leather and acorn cups from valonia oak were rich in

natural tannins, while the acorns themselves contained none (Dussauce 1867, Yocum 1910). Dussauce on 1867 (1867, p.75) mentioned that 'more than 10,000 to 12,000 tons of this tanning agent are annually used in England' and the valonia was imported from Greece and Turkey for this purpose.

Several taxation documents from the Cretan State period (1898-1913) refer to acorns and acorn cup production (Cretan State 1899b). In another document of the same period, valonia oak (*Q. macrolepis)* is regarded as a very useful tree, and an area in Rethymnon prefecture is fully dependent upon its products. According to the Agricultural Department of Cretan State report of 1903, 'Oak (*Q. macrolepis*) is the main financially productive tree in the villages of Atsipopoulo, Gallos, Prine and Armenoi in the Rethymnon Prefecture' (Agricultural Department 1903, p.8). However, Rackham and Moody argue that 'the use of valonia in Crete itself seems to begin in the 1570s but was never very important, nor were oaks deliberately cultivated for valonia in Crete' (1996, p.65). In this area of the Rethymnon Prefecture though (Figure 7.1), acorn and acorn cup production did play an important role at least during certain periods over the last century.

In addition, Cretan State officials suggested that grafting should be used for the common oak (*Q. brachyphylla*) so it would be developed into the useful and tannin rich valonia oak. Common oak (Figure 7.2) was regarded useful only for animal feeding so not as valuable as valonia oak (Agricultural Department 1903). In the area of Armenoi, Rackham and Moody suggest that the common oak in that area is *Q. macrolepis* and *Q. brachyphylla* is 'mysteriously absent' (1996, p.65). That could be a result of grafting *Q. brachyphylla* in the past that gradually was replaced by *Q. macrolepis*. Different uses of tree seeds and fruits could influence their distribution and several varieties or species could be expanded in advance of those less desirable for humans. Common oak grafting was probably reduced after the ending of the use of valonia acorns in tanneries, when chemicals gradually replaced them. However, this past management practice can be connected with the current distribution of valonia oak in certain areas of Crete.

Interview material reveals no mention of acorn cups used in tanning and that could be explained by the absence of valonia oak from the research area. Only one individual tree was found growing in a house yard in Ano Asites village (Figure 7.3), where its acorn cups were used for cloth dyeing

in the past by the owner of the tree. A 60 year old woman remembers her grandfather dyeing clothes with the help of acorn cups. This could be another use of valonia in Crete that today has been forgotten:

> As8: Τον παππού μου τον λέγανε μπογιατζή έκοβε αυτά που έβγαζε, δεν ήτανε πάλι βελάνια, είναι διαφορετικά και είχε κάμει ένα χαβάνι με πέτρα μάρμαρο, δεν ξέρω, με χερούλι, και μάζευε αυτά που έβγανε βελάνια δεν ξέρω γω τι και τα κοπάνιζε, και τα βάνε στα τσικάλια και έβαφε ρούχα, πως γινότανε τώρα τα ρούχα δεν ξέρω. Και τον λέγανε μπογιατζή γιατί ήβαφε. … Η βελανιδιά ήταν δική του, Νομίζω πως έχω ακούσει ότι δεν την φύτεψαν αυτοί, μόνο πέρνα ένας κόρακας και το κρατούσε λέει στο ράμφος και το ριξε. Και από εκεί εφύτρωσε και του άρεσε του παππού μου και δοκίμασε και έκανε την βαφή.
>
> As8: My grandfather was called mpogiatzis (dyer man), he was cutting something from the tree, it wasn't the acorns, they were different, and he had a stone bowl with a big handle and he collected that acorns, I don't know how they call them, and he pressed them and then he put them in big pots and he dyed clothes, how that was happened I don't know. People called him mpogiatzi because he was dyeing clothes. … The Valonia oak belonged to him. I think I have heard that they didn't plant it, but a raven hold the acorn in its beak and it fell down. From this acorn the tree grew and my grandfather liked it and he tried and he did the dyeing.
>
> As8: 60, F, Housekeeper

Figure 7.2: Common oak with acorns. Q. brachyphylla was regarded as useful by Cretan State officials only for feeding animals with its acorns.

Source: photo taken from H.F.D. digital archive, September 2004

Figure 7.3: Valonia oak (Q. macrolepis) in Ano Asites village. The only tree found in the research area.

Source: photo taken by the author, July 2008

The key use of acorns though, was for animal feed. Acorns, derived from the uplands, were harvested or left to ripen and fell naturally. In the first case they were collected for feeding domestic animals while in the second case they were grazed by goats and sheep in the forest. An interviewee from Gergeri argues that everyone in the village collected acorns:

> P: Δεν μου λες, μαζεύατε και βελανίδια από το βουνό;
> G2: Α βελάνια και τα πουλούσανε και τα δίνανε και για τα γουρούνια ή για τα πρόβατα που είχανε επαέ, τα μαρτάρικα όλα, όλοι εμαζόνανε βελάνια
>
> P: So did you pick up acorns from the mountain?
> G2: Yes acorns and we sold them and we were feeding pigs or sheep that were here (in the village), the domestic animals all. All of us collected acorns.
>
> G2: 78, M, Shepherd

Although animal feeding was very important, it seems that there were other uses of acorns. This depended on the different periods and situations

that people had to face in the past. Under some circumstances, these fruits, which were more suitable for animals, were used to feed humans as well. Acorns were collected, baked and then milled to produce flour and mixed with other cereals they were used for baking bread. These cases are associated with food shortage mainly due to war as this interviewee from Zaros suggests:

> Z3: Στην κατοχή λέει ήκουσα και 'γω μια Βοριζανή ότι πήγανε και μαζώνανε, επαέ δεν τα μαζώξανε γιατί είχανε καρπούς, αλλά αυτοί που δεν είχανε μαζώνανε τα βελάνια και τα φουρνίζανε και τα αλέθανε για ψωμί. Και ήτανε λέει δηλητήριο, πικρό.
>
> Z3: During the German occupation I heard from a woman from Vorizia village that they collected acorns, here they did not collect them (Zaros village) because they had cereal seeds, but those who did not have that collected acorns and baked them and then they milled them for bread making. And they said it tasted like a poison, bitter.
>
> Z3: 65, F, Hotelier

In addition, acorns were eaten as a fruit itself, like chestnuts. Chestnut trees in Crete grow only in small areas in the western part of Crete, where acid soils are present, due to their sensitivity to lime soils that are abundant in almost all the island. An interviewee from Ano Asites remembers the use of acorns in his area:

> As3: Η βελανιδιά ήταν ένας παράγοντας για να αναθρέψεις το χοίρο, τα κάναμε βέβαια και οφτά και τα τρώγαμε, όπως τα κάστανα.
>
> As3: Oak (acorns) was useful for raising pigs, we did bake them and eat them like the chestnuts.
>
> As3, 58, M, Farmer

The use of acorn-bread has been mentioned in other Mediterranean regions. In south-western Spain sweet acorns from the holm oak (*Q. ilex)* were used for bread production (Parsons 1962). An interviewee from Zaros village mentions the existence of sweet acorns in the area of Psiloritis from holm oak (*Q. ilex)* as well (Figure 7.4), and according to his words this type of sweet acorn could have been used for bread:

> Z2: Έχει και κάτι άλλες βελανιδιές, αζιλάκους νομίζω τους λένε, και είναι όπως το κάστανο, γλυκιά. Αν το βάλεις στο κάρβουνο και ψηθεί λίγο λίγο είναι όπως το κάστανο. Δεν είναι μια ποικιλία το βελάνι είναι πολλές ποικιλίες. Έχει και γλυκά.
>
> Z2: There are some other oaks, azilakas (*Q. ilex*) I think is called, and it (acorn) is like sweet chestnut. If you put it in the fire, and is cooked a bit, then it is like chestnut. Acorns are not only of one variety there are several varieties, some of them are sweet.
>
> Z2: 71, M, Hotelier

Figure 7.4: Holm oak (Q. ilex) in Rouvas forest.

Source: photo taken by the author, August 2010

Moreover, the local name for holm oak (*Q. ilex)* in Crete is 'azilakas', very similar to the Portuguese word 'azinheira' (Parsons 1962) or even more similar to the Catalan word 'alzina' and can reflect a Latin origin or a Venetian influence. Holm oak (*Q. ilex)* is not very common in the area of Psiloritis and occupies sparse parcels, even consisting of just individual ancient trees within the forest of kermes oak (*Q. coccifera)*. Thus, the use of its acorns for bread probably was not extensive and instead of holm oak's sweet acorns, kermes oak (*Q. coccifera)* bitter acorns were used.

Acorns when they were collected were mainly used for feeding pigs, an animal kept in peasants' households for a year and bred for providing meat for Christmas. Acorns were not an exclusive forest product. In cultivated land, several ancient oak trees survived and produced acorns collected by the peasants (Figure 7.2 and Figure 7.5). Generally these lowland oaks, were of a deciduous species, and were mainly used for pig feeding, whereas acorns from the forest were eaten by grazing animals and collected for pig feeding:

> As2: Τον είχαμε (βελανιδιά) για να μαζώνουμε τα βελάνια. Κάθε σπίτι είχε χοίρο. Τα σφάζαμε τα Χριστούγεννα, δεν τα ταΐζαμε με κάτι άλλο μόνο με πίτουρα και βελανίδια.

As2: We had it (oak) for acorn collection. Every house had one pig. We slaughtered it at Christmas; we did not feed it anything else, only bran and acorns.

As4: 56, F, Farmer

An1: Εμείς δάσος δεν είχαμε πέρα από το δάσος, στα βρουλίδια. Το προσέχανε, διότι κάνανε τα βελάνια, το χρησιμοποιούσανε για τροφή τα πρόβατα.

An1: We did not have forest here. Only the forest in Vroulidia. They protected it, because it was producing acorns, they were used for feed for the sheep.

An1: 50, M, Shepherd

Figure 7.5: Common oak (Q. brachyphylla) ancient tree in Ano Asites village, growing in cultivated land.

Source: photo taken by the author, July 2008

7.3.2 Commercialization of acorns

Acorns were a product mainly derived from the forest for feeding animals. The degree to which this became commercial was influenced by the production, the local needs and the different era.

During the Cretan State (1898-1913), governmental documents mentioned taxation for acorns, acorn cups and carob pods (Cretan State 1901) and thus indicate that there was a commercial value to all these products. Although there is evidence of taxation for acorns and carob pods in the official Cretan State Gazette, the Forest Service archives have only five cases recorded for acorns and carob collection for a period from the 1930s till the 1990s. Moreover, all these cases are recorded in 1945

(acorns) and 1946 (carob). This suggests they were a less important product for the Forest Service or a problematic central control of their market. Although official documents of that period lack information about the commercial value of forest fruits, oral history suggests the commercialization of them, especially for acorns, in the same way as firewood was recorded in the H.F.D. archives.

An interviewee recalled an event of taxation several years later between 1940 and 1950. Local authorities taxed market positions; something not necessarily applied only to acorns but generally connected with taxation of the occupation of a place in the local markets:

> Ν2: γιατί όι μόνο πως εμαζώναμε για τα μαρτάρικα εμαζώναμε και πηγαίναμε και στσοι Μοίρες και τα πουλούσαμε. Θυμούμαι και τα δίδαμε 2 δραχμές. Να πας τώρα δυο τρεις φορές στ' αόρι για να κάμεις ένα γομάρι να το πας το Σαββάτο στσοι Μοίρες και αν ναι το πουλήσεις. Ήθελε να το πλερώσεις το πεζοδρόμιο που εκράτιες τη φορολογία σου και συ επούλησες δεν επούλησες ο φορατζής ήθελα σου πάρει τα λεφτά, το φόρο. Μπορούσε να μην πουλήσουμε τα βελάνια να τ' αφήσουμε εκιά στη στίβα το λέγανε να τα πας να τ' αφήσεις εκιά όσο όσο να φύγεις.
>
> N2: Because we did not only collect them (acorns) for domestic animals, we went also in Moires and we sold them. I remember we sold them for two drachmas. You had to go in the mountain two, three times to make a cargo, and go on Saturday in Moires and if you could sell them. You had to pay for your position in the market, your taxation, no matter if you had or had not sold them, the tax officer would come to get the money, the tax. We might not be able to sell the acorns, and we left them in the heap, at a lower price and then we left.
>
> N2: 75, M, Farmer

Despite the absence of formal records for acorns, they did play an important role for the peasants' economy in mountainous villages. In their management plan of 1930 for the forest of Rouvas, foresters did observe the value of acorns for the peasants and they reported:

> In this forest (Rouvas) kermes oak acorns' are collected intensively, although we are not able to know the exact amounts, that are being used for the household animals and for selling them in the neighbouring villages. It seems that it is an important yield if someone considers the interest of all peasants in them (RGC4).

Breeding of pigs in the past was essential for the survival of humans and the provision of proteins for the winter time. Pork could be stored in lard, and conserved for long periods and acorns were an important element as a source of feed for pigs. When they were not available in their area, peasants had to buy acorns from other villages or exchange them with other products in order to feed their pigs:

> An3: παλιά ήτανε, η κάθε οικογένεια έπρεπε να χει να σφάξει τα Χριστούγεννα το χοίρο. Αν είχε δηλαδή 500 οικογένειες το χωριό, οι 300 οι 400 είχανε. Από ένα γουρούνι η οικογένεια. Έτσι ως καλό για τις γιορτές,
> P: και μαζεύανε βελανίδια από το βουνό για να τα ταΐσουν;
> An3: βελανίδια από το βουνό. Τη χρονιά που δεν είχε βελανίδια, παγαίνανε απτά χωριά κάτω, είχε ντρυγιάδες πολλούς, και παίρνανε θυμάμαι εγώ από δω λαχανικά, αυτοί δεν είχανε νερό καθόλου, ξεραήλα πολύ, και έπαιρνε κιοντανέ πράσα, και πήγαινε και φόρτωνε βελάνια και ξαναγύριζε.
>
> An3: In the past, every family had to have and slaughter pig for Christmas. If there were in the village 500 families, 300 to 400 of them had from one pig each family. It was regarded as good for the holidays.
> P: Did they collect acorns from the mountain to feed them?
> An3: Acorns from the mountain. The year that no acorns were available they were going to the villages, lower, there were a lot of oaks there (*Q. brachyphylla*) and they were having with them, as I remember, vegetables from here. There they did not have water, it was very dry, and they got with them leeks, and they will go there and loaded acorns and came back.
>
> An3: 84, M, Tavernier

> As5: Τα βελάνια τα μαζεύανε και τα πουλούσαν αναμεταξύ τους αν δεν είχε χοίρο, σε κάποιον που είχε.
>
> As5: Acorns were collected and then they sold them to each other, ıf someone did not have a pig, to someone that had.
>
> As5: 75, F, Housekeeper

In the lowland villages a shortage in acorn availability was a result of inaccessibility to oak forests and the private ownership of deciduous oaks that grew there. Moreover, individual oak trees could probably not maintain stable production due to temporal variability in their fruit production (Athanasiadis 1985). Hence, several households could not always produce or collect acorns for their needs. On the other hand, upland populations were able to access oak forests in areas that were regarded as common land and provided the nearby markets with acorns:

> Z1: Τα βελάνια οι πιο πολλοί τα είχαν για δικού ντους. Αυτοί που είχαν ευκαιρίες, και δεν είχε δουλειές, πήγαινε και μάζευε, και τα πουλούσε. Ήκανε δηλαδή και την επιχείριση κεινι ναι. Έ όσοι είχανε την ευκαιρία και βγαίνανε απάνω για δικού τους, μαζεύανε και για δικού τους. Πολλοί άλλοι βγαίνανε, μαζεύανε και τα πουλούσανε.
>
> Z1: The majority collected acorns for their own needs. People that had the opportunity, they did not have any other work, they were going and for their needs and they collected them. Several others were going to the uplands, they collected and sold them.
>
> Z1: 83, M, Farmer

> N4: Εμαζώναμε όλη την εβδομάδα που λες βελάνια το Σαββάτο ήθελε να φορτώσουμε δυο φορτία βελάνια να πάμε τσοι Μοίρες να μας εδώσουνε κουκιά, ανεθρέφανε τότε χοίρους να πούμε, να σου δώσουνε ένα 2 οκάδες κουκιά να πάρουνε ένα τσουβάλι ρύζι, λαθούρι, ε όσπρια τέτοια.
>
> N4: We were collecting acorns the whole week. On Saturday we were loading two cargos of acorns, and we were going to Moires, and we were getting broad beans, they bred pigs at that time, so you were given two okadhes broad beans, to get one sack of rice, legumes such stuff.

N4: 70s, M, Hayward

Moreover, the consideration of acorns as a source of feed that made pork tasty also added a higher value to it. Peasants said that in the past it was believed that pigs had to eat at least two cargoes of acorns so their meat would be flavoured.

> G5: ο χοίρος ήπρεπε λέει να φάει δυο καλά γομάρια βελάνια τα Χριστούγεννα
>
> G5: Pigs had to eat two good cargoes of acorns in Christmas.
> G5: 43, M, Bee-keeper/Shepherd

Definitely this procedure had a seasonal duration, as acorns are produced from August to December and it was not work that continued throughout the year. It can be described as an ephemeral job, undertaken by poor peasants who exploited their natural resources to gain their survival and add an extra income, as a shepherd from Gergeri suggests:

> G6: Ναι απιτις θαλε να ναι τα βελάνια, η εποχή τω βελανιώ, εμασεύνανε και βελάνια, πηγαίνανε και τα πουλούσανε στσοι Μοίρες στα παζάρια, και εβγάνανε και από κιά αλλά ήτανε λίγη ας πούμε εκεινά η περίοδος.
>
> G6: And when it was the time for acorns, they collected acorns as well. They were going to Moires and sold them, in the markets, and they got some income from there as well. However, that period was short.
> G6: 78, M, Shepherd

7.3.3 Antagonism over acorns

Commercialization of acorns in the early 20th century created antagonism between shepherds and other peasants and between neighbouring communes. The collection of acorns only for domestic pigs within the same village did not create important problems with shepherds. In addition, formal actions were taken to ensure such conflicts were minimised, at least between members of the same commune. Thus, in a contract of 1910 (ZZC1) associated with the Zaros commune, acorn collection from the forest, is permitted for free for all members of the commune; however, if there is commerce with other villages, then taxation is provided to the leasees of the forest. Despite this formal regulation, there were such conflicts even between members of the same commune as a result of high pressure over acorn yields due to commercialization and the high demand on acorns:

> N2: Πληρώνουν κατι τις, αλλά τα παλιά που είχαν τώρα … κατά κεφαλήν τώρα ότι είχε καθης εδήλωνε αλλά μας απαγορεύανε να πάμε να μαζόνουμε βελάνια εμείς μετά.
> P: Οι Κτηνοτρόφοι, δηλαδή σου έλεγαν είναι δικό μου.

> N2: Εγώ πληρώνω το βουνό Που βλέπω τα πρόβατα τσε αίγες, να μη μαζώνεις τα βελάνια τα τρώνε τα οζά μου. Ε είχαμε πολλές τραβάγιες.
>
> N2: They do pay today something (shepherds for the grasslands) but in the past they paid per head (animals) of the numbers they had registered, but afterwards they forbade us to go and collect acorns.
> P: Shepherds regarded as theirs'.
> N2: I pay for the mountain, where I am grazing sheep and goats, you should not collect acorns, my animals eat them. We had several problems with them (shepherds).
>
> N2: 75, M, Farmer

The term used to describe collectors of acorns was 'velanades', the English equivalent could be 'acorners'. Shepherds regarded 'acorners' as a source of 'evil' for the trees. According to a 78 year old shepherd from Gergeri, 'acorners' often threshed the trees early in the morning, when low temperatures occurred in the area and when acorns had not yet ripened. Hence, according to him, trees were damaged. On the other hand shepherds, 'protectors of the trees', tried to prevent that catastrophe:

> G6: Πριν να πέσουνε τα βελάνια πήγαιναν και χτυπούσανε τσοι πρίνους και `κιά τσοι ζυγώναμε εμείς οι βοσκοί. Ε να δεις εδά αυτό ήκανε πολλή ζημιά του πρίνου όταν θαλα να είναι προπάντων παγωμένο, να πάει τώρα πρωί πρωί, αυτός εσηκώνουντανε τη νύχτα και επήενε στα βελάνια, να χτυπά `κιά και δεν τον είνιαζε δα ότι και να και δεν πόμενε φύλλο απάνω. Εκιά έκανε ζημιά. Απιτις ηθελε να μεστώσουνε όμως, τον ίσσες τον πρίνο και χαμοστρώμιζε.
>
> G6: Before the fall of the acorns they were going and threshed the kermes oak and there we, shepherds, chased them. Have in mind that this thing was very damaging for the kermes oak trees. When it was still freezing, he would go very early in the morning, he would wake up in the night to go for acorns, he was threshing there, and he did not care if no leaf was left in the tree. There he was making damage. However, when they were ripe, you just had to push kermes oak and they were falling on the ground.
>
> G6: 78, M, Shepherd

Although the previous interview could include bias in the information, it is a likely scenario, as 'acorners' wanted to harvest acorns for as long as possible. They could not wait for the natural maturation of the fruits and the loss of the yield due to grazing from the flocks in the mountain. In addition, they did visit the mountain early in the morning, when temperatures were still low, so they had the time to harvest the acorns and to carry them to the village the same day. Hence, they had to thresh the trees intensively as immature acorns did not fall easily and the cold could provoke damage to tree leaves. A 75 year old 'acorner' states the time for visiting the forest for acorn collection and this was early in the morning:

> N2: Αο παέ εσηκωνομεστανε εμείς 3 ηώρα, να πάμε στο μέσα Ρούβα στα βελάνια.

N2: Ah, here we waken at 3.00 am, and we were going to Rouvas for acorns.
N2: 75, M, Farmer

Shepherds tried to take advantage of their continuing presence in the forest and tried to collect acorns for their benefit, before 'acorners' came and gathered them, a procedure, not necessary for them, as acorns when mature, fell down naturally allowing animals to eat them. However, because of the antagonism with 'acorners' they threshed the trees, so animals could eat the acorns before 'acorners' gathered them:

G2: Και άμα ήθελε να ΄ρχιξουνε και τα βελάνια το Σεπτέμβριο μέσα Να κάνει ψιμοκαίρι να ροδίζουνε Λίγο λίγο, Βγαίναμε στσοι πρίνους Απάνω και τους ραβδίζαμε και τρώγανε οι αίγες από κάτω. Το κάναμε και αυτό. Για να μην προλάβουν και οι βελανάδες σαν μας τα πάρουνε.

G2: And when it was the beginning of acorns, in September, when it was early warm weather, they (acorns) were just a bit reddish, we were climbing up in kermes oak trees and we threshed them and goats were eating below them. We did that so 'acorners' will not have the time to get them from us.
G2: 78, M, Shepherd

Moreover, members of other communes had conflicts when they tried to collect acorns from neighbouring areas, but within the same forest. These conflicts were mainly with shepherds that regarded them as competitors for the same natural source and felt they had the right to prohibit them as members of another commune that invaded their territory. Acorn collection included several dangers and 'acorners' from Nyvritos, felt they should be on the alert all the time to avoid attacks from their enemies. In this example, the enemy are villagers from the Zaros commune:

N2: Από το φαράγγι πηγαίναμε από τη σκάλα που λένε, ήτρεχε ο ποταμός και ήτανε βοσκοί Ζαριανοί σε ορισμένα σημεία και άμα ηθελε να βρούνε ευκαιρία να σου παίξει μια μαχαιριά στη βούρια να στα σκίσουνε. Επειδή τοσε μαζώναμε τα βελάνια. Σου λέω ετότες επληρώνανε οι βοσκοί τα αόρια καλά γιατί δα δεν πάνε μουτε στα οζά. Και εκάνανε και στραπάτσο. Οι Ζαριανοί…

N2: From the gorge we were going, from the steps as we call it, and there was water in the river, and in some places they were shepherds from Zaros village, and when they had the opportunity they had a knife with them and they gash your sack. Because we were collecting their acorns, I told you at that time shepherds paid for the mountains. And they damaged us, the Zaros' villagers.
N2: 75, M, Farmer

Currently antagonism for acorns has disappeared and the grazing flocks can freely enjoy feeding on acorns with no disturbance from 'acorners' and shepherds do not need to thresh the trees any more. It is questionable though if acorn production is enough, with the increase in the number of animals in the area of Psiloritis:

> P: Τα βελάνια τα κατέβαζαν για τα γουρούνια;
> Z9 Κυρίως για ζωοτροφή. Όχι, αυτό συνεχίστηκε μέχρι και, ακόμα και σήμερα υπάρχουνε κάτοικοι που εκτρέφουν το γουρούνι στο σπίτι, με τον παραδοσιακό τρόπο για να το σφάξουν τα Χριστούγεννα και θα ανεβούνε, μια η δυο βέβαια φορές το πολύ, να μαζέψουν ένα τσουβάλι βελάνια. Αν βρούνε βέβαια κάτι και έχει απομείνει απάνω γιατί Ο αριθμός των ζώων είναι μεγάλος και δεν αφήνουνε.
>
> P: Were acorns collected for pigs?
> Z9: Mainly for feed. That continued till.. even today there are some villagers that breed their own pigs in their home, in the traditional way, so they will butcher it for Christmas. So they will go up one two, no more than three times to collect a sack of acorns. If they find anything left up, because the number of the animals is large and they do not leave any.
>
> Z9: 54, M, Politician

7.3.4 Collection time - production of the trees

Oaks in Greece ripen their acorns after the end of August till December, with several variations within different species and areas (Sutton 1990, Humphries 2006, Schwartz 1968, Athanasiadis 1985).

In the forest, interviewees noticed a differentiation and variability in maturation times within kermes oak trees. There are areas within the same forest, where trees due to genetic variations and micro-climatic differentiations, have different temporal acorn maturation. Moreover, in forest trees, years of full fruit production follow years of less or no fruit production, in a general cycle of four years (Chatzistathis and Ntafis 1989). This happens with olive trees as well, and the term used for a full year of fructification in Crete is 'vedema'. A word derived from the Venetian word 'vendemma' meaning harvest. The same term was used for oaks' yield, as an 82 year old famer from Zaros village correlates oaks with olive trees:

> Z7: Ύστερα και αυτά όπως οι ελιές λέει έχει βεντέμα οφέτος, έτσι ρωτούσανε λέει «έχει μωρέ βελάνια το αόρι οφέτος; Δεν έχει πολλά πράματα. Είπαμε ότι τα βελάνια, ξεκινούνε πες στο έμπα του χειμώνα, και το, γιατί έχει πρώιμα όπως και οι ελιές, στο ίδιο σημείο να ναι ο ένας και ο άλλος να κάνει μετά. Και το υπήνεμο, είναι πιο πρώιμο.
>
> Z7: On the other hand, they also, like olive trees if it was a vedema this year, people asked: Are there acorns this year in the mountain? Not much. We said, acorns started when winter was about to start, and there are premature ones as with the olives, in the same spot, one tree and the other to produce later. The one that is protected from wind is premature.
>
> Z7: 82, M, Farmer

Several times in forests, there is a trend of higher or less fruit production in the whole forest. However, variations between individual trees even within this trend still exist (Chatzistathis and Ntafis 1989). This is different to cultivated trees, especially olive trees, where often a 'vedema' exists in the whole orchards of an area, probably connected with trees that hold a similar genotype (Panetsos 1989). In the kermes oak

forests in the research area, an interviewee mentioned that when there was a productive year for the 'chontrolia' variety of olive trees (see glossary), at the same time, the kermes oak had a good production as well. This comparison shows that oak trees were linked to olive groves, which peasants were more familiar with:

> Z9: Η εμπειρία λέει από τους παλιούς ότι όταν η χοντρολιά γεννά, γεννά και ο πρίνος. Πακέτο πάνε αυτά.
>
> Z9: Experience derived from the old suggests that when the chontrolia variety (olive) produces, kermes oak produces as well. They are connected.
>
> Z9: 54, M, Politician

In addition to different acorn ripening times, there is also huge variability in phenotype characteristics, varying from leaves to acorns. The majority of trees have prickly leaves. However, several variations from prickly to non prickly leaves often exist. A similar diversity exists in acorns, with different sizes and shapes not only for kermes oak trees but also within trees of common oak (*Q. brachyphylla*):

> Z8: ποικιλίες έχει, ποικιλίες είναι και κείνα, πιο ψιλά, πιο μακριά, πιο χοντρά, πιο στρογγυλά. Το ίδιο είναι και ο δρυς που είναι εδώ πιο μέσα, στις μέσες.
>
> Z8: There are several varieties (kermes oak) as well, thinner, longer, thicker, roundish. It is the same with oak, in the Meses area.
>
> Z8: 80, M, Farmer

However, local people's observations on the trees included some techniques to increase acorn production. These techniques were not actually applied deliberately but were a result of harvesting acorns, mainly by threshing kermes oak trees. It is suggested from the interview evidence that threshing the trees resulted in positive increases in acorn production the following year and interviewees believed that if the branches of the trees were damaged then they were more productive:

> N4: Άμα ήθελε να σπά ο πρίνος ήκανε και του χρόνου πάλι. Να σπάσουν τα κλαδιά και δεν γατέχω ίντα, πάλι ήκανε. Νάναι λιάτικος ο πρίνος.
>
> N4: If kermes oak branches were breaking, it was producing next year. If its branches were breaking then next year it was producing again. It was the liatikos kermes oak (variety with less prickly leaves).
>
> N4: 70s, M, Hayward

> Z4:Παλιά ναι τώρα όχι πλέον. Εραβδίζανε τσοι πρίνους. Και έχει την ιδιότητα ο πρίνος άμα τον εραβδίσεις κάνει περισσότερη όπως και η ψιλολιά που θέλει χτύπημα και κάνει περισσότερη βλάστηση και περισσότερα βελάνια.

> Z4: In the past, not anymore, they threshed the kermes oak trees. And kermes oak if you threshed it, it produces more, like the koroneiki variety (olive) that needs to be threshed, and it was making more leaves and acorns.
>
> Z4: 36, M, Farmer

Acorns in the forest were generally available from late September until December. Peasants needed them for their animals and especially for pigs. The acorn was a seasonal product that needed to be consumed in a short period but served to feed pigs another temporal breed:

> G11: Είχαμε τσοι χολινούς χοίρους δηλαδή. Για τα Χριστούγεννα. Και ήτανε το 80% και κάθε Οκτώβρη αρχινούσανε, και ήταν Οκτώβρη, Νοέμβρη, Δεκέμβρη τα βελάνια για τσοι χοίρους.
>
> G11: We had the 'cholinos' pig for Christmas. And it was 80 percent (of the peasants), and every October they started, it was October, November, December the acorns for the pig.
>
> G11: 70s, M, Shepherd

Just before Christmas pigs were slaughtered and the meat was conserved to be used over the rest of winter time. In an article in a local newspaper in 1948, the breed of pig and the benefits of it were discussed:

> One live young pig, from the ones that are offered in the market, can provide for Christmas enough meat for the family, for a long period. If someone processed according to the customs of Mountain populations, such as ham, in lard, etc…… Pigs, can easily be fed very well by net plant ingredients, acorns, legumes, pulses, potatoes, barley, bran, greens, with no problem. It can also be fed with faunal elements, such as remainders from cooking, slaughtering, cheese making, flour mills, etc (Agricultural Crete 1948, p.3).

Pigs were considered very useful, an animal that can eat almost everything. It is actually the rubbish eater. Everything that was not used by households was given to pigs. In the same article in 1948, they mentioned a popular adage saying that 'the interest is afraid of the pig' (Agricultural Crete 1948, p.3) which means that pig breeding is very profitable.

The acorn, a nutritional and energy-rich feed, was able to give more taste to pork and fatten domestic pigs during the final period of their production. This procedure was applied in South-western Spain in the 1960s, where hogs were fattened in holm oak forests after September (Parsons 1962). However, in Spain, hogs were grazed in the forests, whereas in the Psiloritis area, people gathered acorns and carried them home for their domestic pigs.

New social changes introduced after the 1970s, prohibited villagers from having their own pigs. This resulted also in a change in the demand for acorns. People now had feed available in the markets, and if someone still had a pig, they did not rely on acorns to feed it. However, several peasants still collect acorns for their pigs:

> Z3: Εμείς επηγαίναμε παλιά στα βελάνια και μαζώναμε για τη δική μας χρήση, είχαμε γουρουνάκι και για νάναι το κρέας του πεντανόστιμο, επηγαίναμε και βρίχναμε βελάνια. Όχι πως δεν είχαμε να το ταΐζουμε, αλλά για να κάμει καλό κρέας. Αλλά δα ποιος πάει; Τώρα σταματήσανε, αλλά ο γιος μου όμως εκιά που έχει τις περιουσίες, έχει και βελανιδιές, και το ταΐζει το γουρούνι για να βγάλει ονόστιμο κρέας. Εδά είναι στα πόδια του. Τώρα δεν πάει κανείς στο βουνό.
>
> Z3: We were going for acorns in the past, for our needs, we had a pig and for its meat to be very tasty we were collecting acorns. Not that we did not have feed for it, but in order to produce a good meat. But now none is going. Now they have stopped. However, my son, in his fields, there are oaks and he feeds the pig with acorns so it will produce a tasty meat. Now it is close to him. Now no one is going in the mountain.
>
> Z3: 65, F, Hotelier

7.3.5 Harvesting the acorns

Acorns were gathered by threshing kermes oak trees and then the acorns were collected by hand. This procedure was practised by men and women, as it was observed by Spratt in 1851 (Spratt 1865) and described by a 78 year old villager from Gergeri:

> G6: Κατάλαβες, τα μαζώνανε από κάτω, είχανε γυναίκες, στα βελάνια επηγαίνανε γυναίκες ναι βέβαια, γυναίκες επηγαίνανε το πλείστο. Με τον άντρα τζη, την αδελφή του.
>
> G6: They collected them from the ground. They had women, for acorns mainly women were obliged. With their husband, his sister etc.
>
> G6: 78, M, Shepherd

This is a different element from firewood collection, which was mainly a male task.

In deciduous oaks, found in lower elevations, close to the villages, acorns were left to ripen and fall from the tree naturally. Then they were collected from the ground by hand as well, by both women and men. This difference is explained by the absence of antagonism in the lowlands, where oak trees were private, and the owners could gather acorns when they wanted:

> As2: Τον ντρυγιά τον είχε ιδιοκτησία, του πατέρα μου ο πατέρας. Το δέντρο αυτό το έχουμε τώρα δύο άτομα ιδιοκτησία, ήταν τρεις αλλά την αγόρασε την πάρτη του ο αδερφός μου. Έκανε πολλά βελάνια, τσουβάλια. Όποτε έπεφταν πηγαίναμε και τα μαζεύαμε με τα χέρια.
> As2: The common oak (*Q. brachyphylla*) tree belonged to my father's father. This tree now belongs to two people, we were three owners, but one of the

parts was bought from my brother. It produced huge amounts of acorns, a lot of sacks. Whenever they fall down, we went and collected them.

As2: 50, F, Farmer/Ceramist

For threshing, long sticks were used, mainly obtained from the forest. Their shape was about 3 to 4 metres long, straight, and they were probably obtained from kermes oak or *Phillyrea latifolia* trees (Figure 7.6). These types of sticks were used also for olive tree threshing.

P: Και πως τσι ραβδίζανε;
Z1: Με τέμπλες, έβγαινε απάνω, είχε και χάμε, αλλά έβγαινε απάνω στον πρίνο με την τέμπλα και τα κοπάνιζε.
P: Οι τέμπλες ήτανε αυτές που είχαν και για τις ελιές;
Z1: Οι τέμπλες ήτανε ένα ξύλο μακρύ. 2 με 3 μέτρα, 4 μέτρα οι οποίες χρησιμοποιούσαν και για το βελάνι και για τις ελιές, και για τις χοντρολιές, τότε παλιά στο τέλος και για τα χαρούπια ναι απαραιτήτως για τα χαρούπια, δεν πέφτανε όλα τα χαρούπια κάτω. Έπρεπε να χει τσοι τέμπλες, να υπάρχουνε οι τέμπλες. Τα μαζεύουν μετά με τα χέρια.

P: And how they threshed them?
Z1: With sticks, they climbed up, they were also in the ground (acorns), but he would climb the kermes oak, with the stick and threshed them.
P: Sticks were the same as for olive trees?
Z1: Sticks were a long branch, two, three, four metres long, that was used for both kermes oak and olive trees in the past at the end. And for carob, especially for carobs not all carob pods fall down. They need to have sticks. Then they collected them by hand.

Z1: 83, M, Farmer

P: Και ραβδίζατε τα βελάνια δηλαδή, με τι τα ραβδίζατε;
N4: Εκόβγαμε από ένα πρίνο ή λιόπρουνο μια, ένα ίσιο ξύλο και κόπανο.

P: So you threshed the acorns, with what did you thresh them?
N4: We cut a straight branch from kermes oak or *P. latifolia* and we hit it.

N4: 70s, M, Hayward

After having threshed the tree, acorns were collected from the ground, put into sacks and carried by mules and donkeys or by hand to the villages. This is different to firewood collection, where only cargo animals were used for its transportation. If firewood collection is considered as a work for poor and deprived parts of the society, then acorn collection was regarded a job for the poorest peasants who did not even have a donkey or mule to use. When acorns were carried by humans, the procedure was called 'sikota' describing something that is being lifted up or 'rachi' meaning back and indicates that they were carried on people's backs. Big sacks, similar to traditional woollen sacks called 'vourgia' in Crete (Figure 7.7), were provided with a rope and then carried on people's backs:

G6: Πηγαίνανε και με τη ράχη. Από δω απ'τη Νύβριτο επηγαίνανε από την πάντα του φαραγγιού που ήτανε κοντά και είχανε ένα σακί μεσάτο, και το κάνανε βούρια με σκοινιά και το σηκώνανε και το φέρνανε, τα πουλούσανε.

P: τα κουβαλούσανε οι ίδιοι;
G6: Ναι ήτανε πολλοί που δεν είχανε ζώα και πηγαίνανε και γινούντανε οι ίδιοι ζώα.

G6: They also go with 'back' (carried them in their back). From Nyvritos, the way to the gorge, that it was closer, and they had a sack half full, they made it like a back pack with a rope, and they lift it and they brought it, they sold them,
P: So they carried them themselves?
G6: Yes they were several people that they did not have any cargo animals and they would go and they transferred themselves into cargo animals.

G6: 78, M, Shepherd

N4: Στα βελάνια πηγαίναμε γιατί τα χαμε σηκωτά στου Ρούβα το φαράγγι ήσα κάτω…. Έχω κουβαλήσει από κια είχα ένα φάρδο και ήβανε.

N4: For acorns we could go because we carried them by ourselves. In Rouvas gorge, down there, I have carried from there, I had a sack and you could put in...

N4: 70s, M, Hayward

Figure 7.6: P. latifolia in Rouvas forest. A tree species, used to provide threshing sticks for acorn collection in the uplands.

Source: photo taken by the author, August 2009

This work was done mainly by men who had to carry cargos for long distances in a mountainous environment which made transportation even more difficult. One of the interviewees not accustomed to such hard work,

regretted his decision to go for acorns without his donkey and he never tried to do it again:

> N5: Μια φορά πήγα. Μα δεν εξαναπήγα και μου το πε ο συγχωρεμένος ο πατέρας μου τότες σας κάτσε μου λέει και άστα τα βελάνια, γιατί εσύ δεν είσαι μαθημένος να πηγαίνεις. ... Και του λέω όι θα πάω. ... μας είχε φέρει τότες Η Ουρανία το κτήμα και τα φορτώσαμε, Αλλιώς αν δεν είχαμε το κτήμα εκεί δεν θα τα πήγαινα. Μα δεν εξαναπήγα κιόλας με τα πόδια στα βελάνια. Αυτό ήκαμα εγώ μιαν εβδομάδα να σαλέψω. Ε ναι εγώ δεν ήμουνε συνηθισμένος να πηγαίνω με την πλάτη απού λέγαμε τώρα στα βελάνια. Πηγαίναμε εμείς επαέ στο νοτικό με το μουλάρι να βρούμε τώρα για τα ζώα και ένα γομάρι ξύλα να φορτώσουμε να ᾽ρθουμε.
>
> N5: I went once. But I did not go again. My deceased father told me: stay here and do not go for acorns you are not used to such work. ….. And I answered him no I will go. ... It was Ourania that brought us the donkey to load them; otherwise I could not bring them home. However, I never went again by foot for acorns. It took me one week to walk again. I was not used going with the 'back' as it was called for acorns. We were going here in the south with the mule, to find some for our animals and firewood and then loaded it and then came back.
>
> N5: 70s, M, Farmer

Figure 7.7: Traditional woollen sacks (vourgies) used for different purposes to carry products in the past. A similar type of bigger sizes was also used for carrying acorns from the uplands.

Source: photo taken by the author from Ano Asites folklore museum, summer 2005.

In the cultivated areas, where acorns were often collected from ancient oak trees of *Q. brachyphylla*, and left to fall naturally, weather conditions influenced harvesting time. For example, strong winds promoted acorn fall

and peasants had to go and collect them. In Ano Asites village there is an example of an ancient oak tree, owned by several families. All members of these families visited the tree together and then shared the collected acorns:

> As6: Ο ντυγιάς ήτνος τεσσαρω αθρώπω. Τέσσερις πάρτες. Μαζεύαμε τα βελάνια. Μετά από κάθε δυνατό άνεμο, συνήθως πέφτανε πολλά κάτω. Παρήγαγε πολλές ποσότητες, μπορεί και 4-5 τόνους. Τα μαζεύαμε όλοι μαζί, και μετά τα μοιραζόμαστε. Τα είχαμε για να ταΐσουμε τα ζώα και κυρίως τσοι χοίρους.
>
> As6: The oak belonged to 4 people. It was 4 parts. We collected the acorns. After a strong wind, normally a lot of them fell down. It produced huge quantities, maybe 4-5 tons. We collected them all together and then we shared them. We fed the animals with them especially the pigs.
>
> As6: 66, M, Farmer

In the same village, peasants that did not own an oak tree were visiting uncultivated land, not necessarily the forest in the nearby mountain, and threshing the kermes oak trees that grew there (Figure 7.8):

> As1: Τα χρόνια εκείνα, όποιος δεν είχε βελάνια, πήγαινε στο, έχει κάτι άγρια κατσοπρίνια, πήγαινε στη χαλέπα, Άγιο Αντώνιο, στα καμίνια, και μάζευαν τα βελάνια από τα κατσοπρίνια.
>
> As1: On those years, when someone did not had any acorns, was visiting, there are wild kermes-oaks there, in the area of Halepa, Agios Antonios, in the Kaminia, and they collected acorns from the kermes oaks.
>
> As1: 63, F, Farmer

Figure 7.8: Kermes oak (Q. coccifera) north of Ano Asites village that was used in the past for acorn production by peasants that did not own Q. brachyphylla trees. These trees are grown in uncultivated land or on the borders of the cultivations.

Source: photo taken by the author, August 2008

7.3.6 Storage of acorns: Nature does all the work

Although acorns were an important source of animal feed, any procedure regarding their storage was not developed at least in recent times within the research area. It seems that their production was not significant enough to create a need for storage and their consumption was instant by pigs or grazing animals:

> Εγ: Τα αποθηκεύατε αυτά πουθενά ή τα τρώγανε κατευθείαν;
> Ζ6: Α όχι δεν σηκώνει αυτό αποθήκευμα. Σαν τα κάστανα τα χλωρά επουλιούντανε.
>
> P: Did you store them or were they consumed immediately?
> Z6: No you could not store them, like the fresh chestnut they were sold.
>
> Z6: 82, M, Shepherd

> G6: Αυτό το βελάνι απις θελα μεστώσει δε… μόνο να το χεις όξω να βρέχεται, να μην το φήσεις σε τόπο να γιατί χλιούσανε άμα ήτανε σωρό και ήταν ογρό σαπίζουντανε καμιά φορά. Και τα βάνανε το πλείστο όξω αλλά αυτά τα τρώγανε τα ζώα και εφεύγανε. Κατανάλωση είχε.
>
> G6: Acorns once ripe, you could not, only if you had it outside in the rain, you should not leave it in a place, because it would decompose, if it was left and it was wet, it would decompose. They left them outside, but they were eaten by the animals, and they were consumed in a short time.
>
> G6: 78, M, Shepherd

Moreover, acorns could survive naturally in the forest till the following spring. Acorns that fell to the ground, were covered with leaves, and retained there, till the following May where animals could still eat them. Shepherds had noticed that acorns were still fresh when animals visited the forest in the summer period, and could find them and eat them:

> P: Τα βελανίδια που μάζευαν τα στέρευαν πουθενά;
> G2:: Δρίκα να δεις η καλύτερη Αποθήκευση Ήτανε Να το βγάλεις στην Ταράτσα επάνω, Να βρέχεται και να λιάζεται Πιο καλά παρά να είναι σακιασμένο. Να δεις τώρα, εκιονά που πομένει μας στ᾽αόρι, προπαντώς τα χρόνια που φέυγανε τα ζα το χειμώνα, το βρίχνει Την άνοιξη Και είναι σαν το παξιμάδι. Και ανοίγει και βρέχεται όταν βρέχεται την όρα που αυτό στεγνώνει, Δεν σαπίζει και είναι σαν το παξιμάδι και το βρήσκει το ζο, Και Μπορεί να το φάει Τον Μάη και το δευτεροούλι Έβρισκαν πολλές φορές αμα ήτανε πολύ χιονιά. Άμα έχει βελανιάσει κάτω, το Σκαλίζει και Το τρώει. Είναι η καλύτερη τροφή, σαν το παξιμάδι…
>
> P: Did they store acorns anywhere?
> G2: Well, the best storage was to leave them on the roof, to get rain, to get sun, better than leave it in a sack. However, if you noticed the one that was left in the mountain, especially the time that flocks were leaving the mountain in the winter, it could be found in the spring and it was like a biscuit. And it was opened, and it was rained on and it was dried again. It did not decompose, and it remained like a biscuit and animals could find it and eat it, in May or even in July they could find it, especially if there was a severe snow. If it is full of acorns in the ground, the animals can dig it and they can eat it. It is the best feed, like a biscuit.
>
> G2: 78, M, Shepherd

Furthermore, there are some techniques to store acorns. Often in forest nurseries there is a need to conserve acorns, as a result of variation between different years in fruit production of oak trees. In order to have stable plant production, acorns need to be conserved and used the following year for seeding. The procedure includes several layers of leaves and sand material continued with acorn layers and so forth till a heap is created. The heap is left outside and acorns retain their ability to grow the next year (Chatzistathis and Ntafis 1989). This scientifically suggested procedure to conserve acorns is actually very similar to what shepherds had noticed and what nature is doing physically in the forest.

7.4 Other fruits from the uncultivated land

Although the majority of wild fruits collected from the forest were acorns, there were also some other fruits derived from wild trees such as carob (*C. siliqua*) and wild pear (*Pyrus sp.*).

In a previous section of this chapter, it was mentioned that official agricultural policy encouraged grafting of common oak (*Q. brachyphylla*) onto the 'more productive' valonia oak. A similar grafting practice was applied to carob (*C. siliqua*) and wild pear (*Pyrus sp.*) trees during the Cretan State rule. In a report from the Agricultural Department, the need to graft carob trees with more productive varieties, originated from the Heraklion prefecture, and in the rest of the island's regions it is highlighted (Agricultural Department 1903). Moreover at that period, there were several censuses implemented in order to record the number of wild trees in the island that could be grafted, and for the village of Anogeia 2,291 wild pear trees were recorded for that period (HAC6). At that point, it was a strong policy to alter the wilderness into productive elements that could help the population of the island to escape depravation (Cretan State 1899b).

Although oak grafting was abandoned in the early 20th century, grafting continued for carob and wild pear. This grafting policy continued and after the union of Crete with Greece (1913), and in the recent past (1960s-1970s), rural policemen were charged with this task. Generally, carob trees were grafted with more productive varieties and wild pear was grafted with domestic varieties of pear. An interviewee from Ano Asites village, that had grafted a wild pear growing in his field, remembers rural policemen grafting trees in his village:

P: Την απιδιά ποιος στην μπόλιασε;

As9: Εγώ την μπόλιασα, μου είχανε μπολιάσει κάποια άλλα δέντρα εδώ, είδα πως το έκαναν και την μπόλιασα μόνος μου. Παλιά οι αγροφύλακες μπολιάζανε συνέχεια. Και εδώ στο χωριό μας είχανε μπολιάσει πολλά δέντρα.

P: Who grafted the pear tree?
As9: I did, someone grafted some other trees here, I saw how he did it and I grafted by myself. In the past rural policemen grafted all the time. Here in the village they had grafted a lot of trees.

As9: 55, M, Electrician

This grafting practice is still used by individual farmers and applied to olive trees today (Figure 7.9) or wild pear and carobs. The current EU policy of afforestation programmes, implemented by the Forest Commission in Greece, started in the 1990s and still continues (EU 1992, M.R.D.F. 2001). Under this policy, cultivated fields are subsidised to be planted with specific forest species and one of them is carob. Several of the investors, after the succession of the plantation, grafted the trees with more productive varieties of carob.

The carob tree (Figure 7.10) grows in lower elevations and can be found in both forested and cultivated areas, and can be regarded as a wild as well as a cultivated tree (Ball 1968). Wild pear on the other hand, is found in the uplands as well as in the lowlands, but in higher elevations than carob.

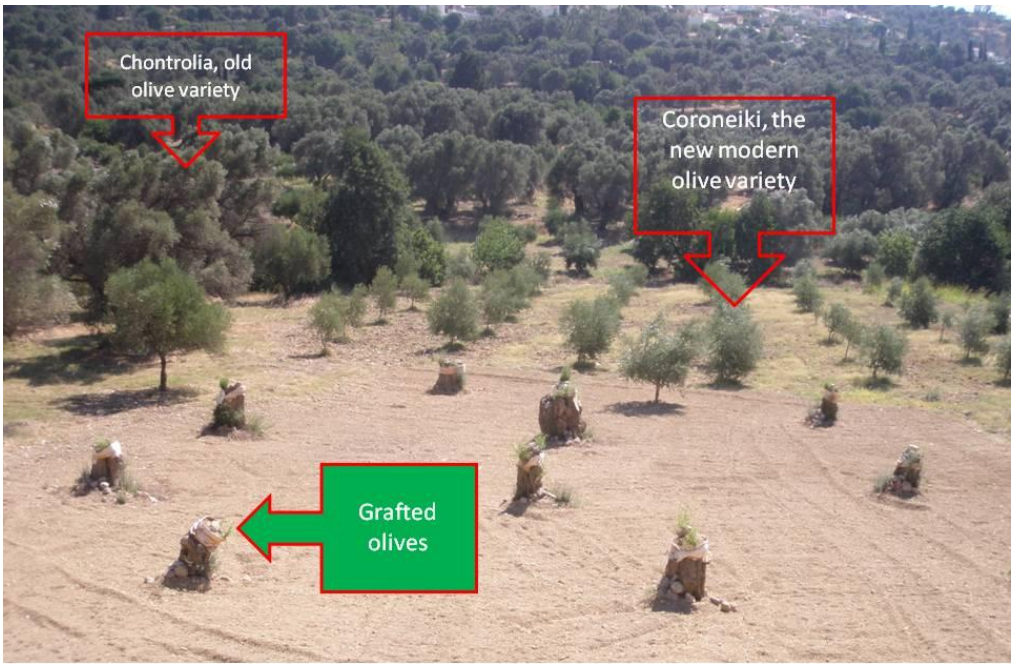


Figure 7.9: Grafted olive trees of chontrolia variety with the modern variety coroneiki, introduced in the area in recent decades. In the background of the photo, the chontrolia variety, tall trees, can be seen, and next to the grafted trees is a new plantation with coroneiki variety. This area is close to Nyvritos village.

Source: photo taken by the author, August 2010

Figure 7.10: Carob (C. siliqua) tree in Zaros village in the area of Votomos.

Source: photo taken by the author, January 2010

Both of these tree fruits were used for feeding domestic animals, and to a lesser degree for the grazing flocks on the mountain. Carob fruit was also dried or baked and eaten as 'chocolate', because of its dark brown colour, and the sweetness it had, especially during harsh times when there was a shortage of food:

> Z9: Ένας Μικρός επίσης αριθμός χαρουπιών που υπάρχουν στην περιοχή. Και αυτοί χρησιμοποιούτανε, μάζευαν τα χαρούπια, τροφή έτσι (ζώα) και των αθρώπω καμιά φορά, Ελάχιστα βέβαια αλλά μιλάμε για πολύ παλιά, το τρώγανε και αυτό το πράγμα.
>
> Z9: A small number of carob pods that there are in the area. It was also used, they collected carob pods, feed for the animals, and for humans sometimes. It was used minimally of course for humans, in the past, they ate that thing (carob pods).
>
> Z9: 54, M, Politician

> Z3: Και τα χαρούπια τα φουρνίζανε, και τα βάνανε ψηλά ψηλά και τα δίνανε στα κοπέλια σα σοκολάτες. Και ήτανε εδώ ένας Ανωγειανός και είπε στη μάνα του να φάει ένα μετά το φαί και του πε, το βράδυ. Από την πίνα κάνανε οικονομία για να επιβιώσουν. Σου λέει 2 χαρούπια να πιει και νερό να πάει να κοιμηθεί το βράδυ, τι να του δώσει να φάει;

Z3: Carob pods were also baked and they hung them and they gave them to children like chocolates. It was here someone from Anogeia village, and he asked his mother to give him one after his lunch and she replied he could have one at night. Because of the starvation they were economical so that they could survive. His mother was planning to give him two carob pods in the night, he would drink water and then he could go to sleep. What else she could give him to eat?

Z3: 65, F, Hotelier

Generally wild pear (Figure 7.11) was used to feed domestic pigs. An 84 year old villager from Anogeia, remembers the collection of wild pears for feeding domestic pigs:

Αn3: Μεταξύ των δέντρων αυτών είχε και κάτι αχλαδιές. Άγριες. Που κάνει ένα αχλάδι τόσο ήτανε. Σε τόσο μέγεθος, τα οποία πηγαίνανε και τα μαζεύανε για τις γουρούνες. Και μαζεύανε αρκετές ποσότητες.

An3: Between these trees (forest trees) they were and some pears. Wild ones. It produces a pear, about this size, and people collected them for the pig. And they collected large quantities.

An3: 84, M, Tavernier

Figure 7.11: Wild pear (Pyrus sp.) in an area north of Ano Asites; its fruits were used in the past for animal feeding.

Source: photo taken by the author, August 2008

The same was also happening in other villages of the Psiloritis area, such as Ano Asites:

> As1: Είχαμε και αχλάδες, και τα μαζώναμε και τα δίναμε στα γουρούνια.
>
> As1: We had also wild pears and we collected them (fruits) and we fed pig.
> As1: 63, F, Farmer

> As5: Τα θρέφαμε τότε με τα πίτουρα, τα αχλάδια, δεν υπήρχανε τότε οι τροφές. Ψεβία.
>
> As5: We fed them (pig) with bran and wild pears. You could not find at that time any commercial feed.
> As5: 75, F, Housekeeper

7.5 Herb collection

Herb collection has a long tradition in Greece and in Crete (Clark 1997). People from the villages, still collect aromatic plants for their own needs. Even if in Crete coffee culture is more extensive than tea today, herbs are still used as a medicine to cure cold and relieve stomach or body pains (Clark 2002). People believe they have important nutrients that can help them to have a healthier life. There is currently an increased interest of the antioxidant effects of Cretan herbs and a new research project has focused on their pharmaceutical production (Konstantoulaki 2011).

An interviewee from Anogeia village highlights the extended and continued use of herbs in her village:

> P: μάζευαν βότανα
> An7: Πάντα τα χρησιμοποιούσανε τα αρωματικά φυτά, ναι πάντα, όχι όμως για αγορά, για δική τους χρήση. Ότι χρειαζόταν ο καθένας στο σπίτι του το βρησκε από το αόρι.
>
> P: Did they collect herbs?
> An7: Always they used aromatic plants, always, not for commercial purposes, for their own needs. What villagers needed for their house, they could find it from the Mountain.
> An7: 42, F, Economist

The use of aromatic plants only by locals could be the case in Anogeia village. In the southern slopes of Psiloritis, though, and especially the village of Nyvritos there was also a commercialisation of herbs. The majority of aromatic plants are still collected for different uses (Rackham and Moody 1996), but two of them, had important commercial value in eastern Psiloritis areas, the Greek sage (*Salvia triloba*) and the Cretan Dittany (*Origanum dictamnus*). Greek Sage, 'faskomilia' in Greek, is a common Greek herb, where Cretan Dittany, 'erontas' in Cretan dialect, is an endemic species and they have different palatability and habitats.

7.5.1 Greek Sage

Greek Sage was one of the main products, collected from uncultivated land, in the lower zone of the mountains (500m to 700m). It is not a palatable shrub and survives grazing, thus often flourishes after fires. This happened in an area north east of Nyvritos village that was damaged after a forest fire in 1994 that destroyed a part of the nearby pine forest (Figure 7.12). A 50 year old sage collector, recalls that after the fire, sage was abundant everywhere, but it later decreased again:

> Ν1: Πριν την φωτιά είχε μειωθεί η φασκομηλιά, μετά την φωτιά σαν να την είχες σπείρει. 2 με 3 χρόνια όμως μετά μειώθηκε.
>
> N1: Before the fire, there was a decrease of Greek sage, after the fire, it was like it has been seeded. Two to three years later though it was decreased.
>
> N1: 50, M, Herb collector

Figure 7.12: Collection of Greek sage, from the area that was burned in 1995, and the plant is still abundant.

Source: photos taken by Tsakalakis Stelios, summer 2006

Its extensive spread made its harvest easy and several villages were involved with its collection. Specifically the village of Nyvritos was one of the main local providers of Greek sage and today one company still operates. Collection time is between June to August, and the whole procedure has changed over time. Initially people collected only the leaves of the plant, but with the introduction of technology, and the ability of

automated machine based separation of the woody parts from the leaves, the whole shrub is now collected:

> Ν1: Η συγκομιδή της φασκομηλιάς: Ιούνιο, Ιούλιο και Αύγουστο. Με ένα δρεπανάκι κοφτό, κόβεις τα επάνω, μαζεύεις το φυτό και κόβεις τα κλαδιά.
> Παλιά στην φασκομηλιά τραβούσαν μόνο τα φύλλα, την τραβούσαν με τα δάχτυλα που τα έδεναν με πανιά για να μην πληγωθούν. Μετά με τα τσαπράζια τα έκοβαν μετά που βγήκε το μηχάνημα που διαχωρίζει τα φύλλα από το ξύλο.
>
> N1: The harvest of Greek sage is on June, July and August. With a small sickle you cut the upper parts, you grip the plant, and cut the branches. In the past from Greek sage they pulled only the leaves, they pulled it with their fingers that were covered with cloth so they wouldn't be hurt. Later with small sickles they were cut when the machine that separates leaves from woody parts was developed.
>
> N1: 50, M, Herb collector

The method used in the past is now completely abandoned and a few people still remember it. In this procedure, hand fingers were used to pull the leaves from the stem and collect them. There were variations to protect fingers either through cloth pieces tied on them or by developing a more advanced innovation of leather finger rings as a 70 year old woman from Nyvritos recalled:

> Ν3: Πηγαίναμε στο τσαγκάρη και μας έκανε με δέρμα που σάχνουνε τα παπούτσα, μας έκανε σαν τα δαχτυλίδια και τα βάζαμε στα μπροστινά δαχτύλια που τραβούσαμε τη φασκομηλιά και την εσέρναμε.
>
> N3: We were going to the shoemaker, and he was making with leather that shoes are made from, he was making rings, and we put them on our front fingers the ones' we were pulling the Greek sage, and we were pulling it.
>
> N3: 70, F, Housekeeper

The collection of Greek Sage was done individually from common lands, and the product was concentrated in the village of Nyvritos where there were local traders who processed it and sold it outside the village:

> P: Την ξεραίνατε όμως πριν την πουλήσετε;
> N3: 'Οι κατευθείαν δροσερή τη δίναμε. Οι εμπόροι, όλοι εδώ στο χωριό που έκαναν επιχειρήσεις την έπαιρναν.
>
> P: Did you dry it before you sell it?
> N3: No, we gave it immediately, still green (after the collection). The tradesmen, here in the village that had enterprises took it.
>
> N3: 70, F, Housekeeper

The processing of the herb includes a drying session and today separation of the leaves from woody parts of the plant. Currently, a local producer packs Greek sage and other herbs and sells them to the market through his firm (Figure 7.13):

N1: Τα φυτά τα ξεραίνω, τα μαδάω και τα συσκευάζω υπό σκιάν. Αλλά δεν έχει ζήτηση πια. Παλιά αγόραζαν 6 -7 έμποροι, τώρα κανείς. Παλιά όλες οι ταράτσες του χωριού ήταν γεμάτες.

N1: I dry the plants then I pluck them and pack them in the shade. But it is not in demand anymore. In the past there were 6-7 traders now there is no one. In the past all the roofs of the houses were full.

N1: 50, M, Herb collector

Figure 7.13: A traditional herb collector with his modern firm on the herbs that he sells. He also has a website for his advertising, www.nivritosherbs.gr.

Source: www.nivritosherbs.gr

7.5.2 Erontas: worth losing your life

The second herb, that played an important commercial role locally, was Cretan Dittany (*Origanum dictamnus*) (Figure 7.14). It had a high value in the past and its prices reached the amount of 1000 drachmas (3£) per kilo in the 1950s and 1960s as it is suggested from oral history.

The high palatability of the plant (Rackham and Moody 1996, Kypriotakis 1998) has resulted in a limitation of its spread, in areas which are inaccessible for grazing animals, such as cliffs. Several endemic species of Crete are found on cliffs, where goats cannot reach them and they are generally called chasmophytic plants (Kypriotakis 1998). These cliffy areas present difficulties for human access as well. The harvesting of Cretan Dittany was hard work, mainly done by men. For its collection, villagers

had to climb on the cliffs or even to be tied with rope and hang to the cliff and collect the precious herb. This procedure included a lot of danger and people risked their lives to collect it. Interviewees from Nyvritos recall several of their relatives or friends who died while collecting it:

> N6: Και ο έρωντας. Εμάς ήτανε και ο έρωντας. Σκοτωθήκανε και 2 3 από παέ.
> P: Είχε πολύ χρήμα ο έρωντας;
> N6: Είχε Ένα χιλιάρικο, χρυσά λεφτά. Αλλά να θελε να βρείς μια οκά.
>
> N6: And cretan Dittany. Here we had cretan Dittany. Two or three people from here were killed in its collection.
> P: Was it worth a lot of money?
> N6: It had one thousand (drachmas), a lot of money. But was difficult to find one oka (kilo).
>
> N6: 80s, M, Shepherd

> N3: Τση πεθεράς μου ο πρώτος άντρας εσκοτώθηκε στον έρωντα. Εκεί στοι δέτες τώρα αο πίσω προς το φαράγγι ήτανε ο έρωντας ο πολύς μέσα τσοι δέτες. Αλλά τσοι δέναν λέει με τα σκοινιά και τσοι κατεβάζανε μέσα στοι δέτες για να κόψουνε τον έρωντα.
>
> N3: My mother-in-law's first husband was killed in Cretan Dittany collection. There in the cliffs behind the gorge, it was where most of the Cretan Dittany was found, inside the cliffs. But there were tied with ropes, and then they could reach the cliffs and cut the Cretan Dittany.
>
> N3: 70, F, Housekeeper

*Figure 7.14: Cretan Dittany (*Origanum dictamnus*) with flowers in the area of Gafari gorge, in the borders of the Zaros and Gergeri communes.*

Source: photo taken by the author, August 2010.

These two main products were very important for the local market in the past, used in pharmacology and as tea as one local producer states:

> N1: Κυρίως χρησιμοποιούνταν για ρόφημα, κυρίως το δίναμε σε εξαγωγείς για φαρμακευτικά προϊόντα και για ρόφημα.
>
> N1: Mainly it was used for tea making; it was generally sold for exportation for pharmaceutical production and for drinking (tea).
>
> N1: 50, M, Herb collector

Greek sage is still collected in the research area; however collectors face financial problems with the importation of products from other markets outside Greece. In addition, Cretan Dittany has been extensively cultivated in the eastern parts of Heraklion prefecture, mainly in the village of Emparos, and the need for its collection from the wild for commercial purposes has ended (Pagkalos 2009).

7.6 Other products from the forest: Dhadhi

Several other products were and are still obtained from the uplands; however, they play a minor role in the daily life of the villagers. Some of them include the collection of fresh salads and greens, snails, and so forth; products found not exclusively in the Mountain.

Another product that was actually recorded in the archive involves the collection of 'dhadhi' and is connected with pines. There are only a few cases refering to this product as well as to pine bark collection. 'Dhadhi' was mentioned only by interviewees in Nyvritos village:

> N2: Ὑστερα θυμάμαι εγώ παλιά, όταν ήμουνε βέβαια πολύ μικρός, εδώ ένα γειτονά μου τον Αδάμ, Αδάμ τον ελέγανε ήτονε απ'τη Γέργερη και εμάζευε αυτήν την κουκουναριά, ξερό ξύλο την καρδιά ήτανε … είχε σαν το λάδι και τα 'κοβιε ήτανε σαν τα σπίρτα μικρά μικρά κομμάτια και τα πούλιε. Κεντούσανε λέει, δαδί το λέγανε και εκαίντα σαν το σπίρτο. Άναβε φωτιά και ανάβανε τη φωτιά. Αλλά ήτανε σαν το κερί το ξύλο, η καρδιά του. Το πεύκο από μέσα ήταν η καρδιά του ολοστρόγγυλη και ήτανε σαπιμένο το υπόλοιπο και ήθελε να το ξετινάξει και αυτή η καρδιά ήτανε οσά ντο κερί ήτανε μέσα σαν το λάδι είχε. Και αυτό τα 'κοβγιε μικρά, μικρά, και αυτός τα πούλιε εκεινά την εποχή, την κατοχή μέσα. Το πούλιε αυτό το δαδί.
>
> N2: I remember, in the past, I was then very young, here one of my neighbours, Adam, that was his name, he was from Gergeri, and he was collecting, pine, dried wood from the core of the pine. It had something like oil, and he was cutting them and it was like matches, very small pieces, and he was selling them. It was very flammable, it was called dhadhi, and it was as flammable as matches are. He was using it to set fire. But it was like the candle the wood, its heart. The pine, from inside, it was its heart (core), very roundish, and the rest was decayed, and he was moving it away, and the core was like a candle, it had inside like oil. And then he was cutting this into small pieces and then he sold it, at that time, during the German occupation. He was selling the dhadhi.
>
> N2: 75, M, Farmer

The archive also records one case on 6 July 1946 for Nyvritos. The name registered in the archive is Adam Tzortzakis, and is the person that the interviewees had also mentioned. This single case of 'dhadhi' collection, found in the studied archives, suggests that this was not something extensively used by locals.

Dhadhi was a product that was found in pine trees and actually it was inside the tree trunk, in the core of the tree. A similar product, obtained from conifers of Northern Greece was recorded by Saratsi in her research in Zagory, in the Epirus region. According to Saratsi (2003, p.213) 'dhadhi was the heavily resinous core of conifer trees, which is highly flammable and was used as firelighter'. Dhadhi was extensively used by the mountain population of Zagorian villages, something different to the Psiloritis area in Crete. Different environmental conditions and the existence of flammable phryganic vegetation in Crete provided other sources of kindling that were more accessible. This case of Adam collecting Dhadhi refers mainly to a product sold outside the village, probably to urban areas, where people had fewer opportunities to exploit natural resources.

7.7 Bee-keeping

Apiculture has a long tradition in Crete since the Minoan era (Figure 7.15). Harissis and Harissis (2009, p.1) argued, in their research in Apiculture of prehistoric Aegean, that from prehistoric depictions, there is evidence of 'the remarkable preservation of apiculture techniques and paraphernalia from prehistoric up to modern times'.

Figure 7.15:'Gold pendant from Mallia (photo Heraklion Museum)'.It represents bees producing honey.

Source: Apiculture in the Prehistoric Aegean (Harissis 2009, p.i)

A main source of feed for the bees is not actually the pine trees themselves, but an insect, the pine scale (*Marchalina hellenica*) that parasites the pines. Pines, as gymnosperms, are aerial pollen germinators and do not provide flower nectar for insects to be fed (Athanasiadis 1986, Bell and Ridge 2002). According to Hatjina and Bouga, pine scale (*Marchalina hellenica*):

> feeds on sap that sucks from the tree and it produces a transparent, and at times pinkish and reddish sweet droplets of honeydew. Honeydew is the excess pine sap that the insects provide and it is the raw material collected vigorously by honey bees to be converted to pine honey (Hatjina and Bouga 2009, p.164).

In Greece, pine scale occurs mainly on the Brutia pine (*Pinus brutia*) and Alepo pine (*P. halepensis*) and to a lesser degree on other pine species (*P. sylvestris, P. pinea, P. nigra*) (Gounari 2004, Kailidis 1991).

Pine forests in Crete are of Brutia pine (*P. brutia*) species. Extensive pine forests are found mainly in the eastern parts of the island, and in the eastern parts of the Heraklion Prefecture as well. In this site of Dikti Mountain and the area of Symi, (Figure 7.1), the insect population is flourishing and has been there for a long time. Apiculturists from all over the island are transferring their bee-hives to this area and as a result there are a lot of problems in terms of antagonism for space between them:

> Η5: Στο Σελάκανο και στην Σύμη, γίνεται χαμός, είναι χιλιάδες μέλισσες, από όλη την Κρήτη. Δεν βρίσκεις κανένα ελεύθερο μέρος, οι ντόπιοι νοικιάζουν τα γύρω χωράφια στους μελισσοκόμους.
>
> H5: In the area of Selakano and Symi, it is a mess, thousands of bees from all over Crete. You cannot find any free place the locals rent the areas around the forest to the bee-keepers.
>
> H5: 42, M, Forester

> Η1: Αυτοί κυρίως πάνε Σε Όλο το νομό Ηρακλείου, Αλλά ο κύριος όγκος πάει Σύμη. Χαμηλά όμως όχι ψηλά. Ψηλά δεν πάνε οι μέλισσες. Όλο Αυτό το σύμπλεγμα Σύμη, Καλάμι, Συκολόγο, Εκεί όπου υπάρχουν Κάτι δάση, Αυτή την περίοδο ειδικά είναι γεμάτο μέλισσες.
>
> H1: They generally go in the whole Heraklion Prefecture, but the main amount goes in Symi. In the lower areas not in the uplands. In the uplands the bees do not go. In all these areas of Symi, Kalami, Sykologo, that there are forests (pines). This period of the year (August) is full of bees.
>
> H1: 59, M, Forester

In the Psiloritis Mountain, apiculture traditionally was limited to the lowland, phryganic and cultivated areas, and was based on angiosperms:

> P: Παλιά δεν υπήρχε αυτό στα πευκοδάση;
> Z4: Όι, παλιά δεν είχε, παλιά βγάζανε από Χαρουπιές (μέλι), μα δεν τις βγάνανε και στο βουνό παλιά καθόλου τσοι μέλισσες. Έπαε στα σόχωρα, επαέ χαμηλά τσοι χανε και τρώγανε από πορτοκαλιές, χαρουπιές περισσότερο, θύμο.
>
> P: In the past was that in the pine forests (bees)?
> Z4: No, not in the past, in the past they harvest carobs for honey, and they never brought the bees in the mountain. Here in the cultivations, in the lowlands, and they were fed from orange trees, carobs, more on thyme.
> Z4: 36, M, Farmer

The pine forests had not been infected by pine scale, and the insect until the last few decades was absent from the research area. Over the past ten years and maybe more, local bee-keepers from the villages of Psiloritis introduced the insect to the forests of their communes, even to individual trees planted in the road sides or in the school gardens. The insect, after several failures, was successfully introduced and today has colonised almost all the pine forest of the area:

> Z1: Είναι ένα σκουλήκι, εδώ στο Λασίθι, Που έχει πάρα πολλά πεύκα, είχα τσοι μέλισσες αλλά μου τσοι κλέψανε και τσοι πήγα εκεί, και είχε Σκουλήκι που Κυκλοφορεί επάνω και τρυπάει το φλοιό Και τρέχει το, βγάζει εκείνο το μέλι ας το πούμε, Για τις Μέλισσες είναι αυτό. Επήρανε Λοιπόν από κει σκουλήκι οι μελισσοκόμοι, τα Βορίζα έχουνε πολλούς μελισσοκόμους από κει πήρανε από κει σκουλήκι και το μεταφέρανε εδώ, Και απ' ό,τι έμαθα έχει πιάσει. Εκείνη η περιφέρεια, Βγάζει πεύκο – μέλο Πάρα πολύ.
>
> Z1: It is a worm, here in Lasithi, that there are lot of pines, I had the bees there but they stole them. I brought them there and it was the worm, that walk on the trunk and hole the bark and then it run out that lets say honey, for the bees that is useful. So they took from there the worm, the bee-keepers, Vorizia have a lot of bee-keepers, they took it from there, they brought it here and I was informed that it has been established. That area (Lasithi) is a good pine-honey producer.
> Z1: 83, M, Farmer

> N4: Είχα βάλει δύο με τρεις πευκαλούδες εκιά θέλανε εμβόλιο, θέλανε το μαμούνι. Πήραμε από κια και παε στσοι καλύβες επήγα 2 χρονιές. Φέραμε από εκεί το μαμούνι αυτό και πήγαμε και το μολάραμε εκιά και ίδιδε και επαέ το πεύκο. Παλιά δεν είχε.
>
> N4: I had planted two to three pines there, and they need the graft, the insect. So we took it from there, and in Kalyves (area with pine forest) I went one year and the next. We brought the insect and we released it there and it was then the pine was productive and here as well. In the past it did not have the insect.
> N4: 70s, M, Hayward

The sudden increase in bee hives over the last decades is connected with the commercialization and demands for the product from markets in urban areas. The villages of Zaros and Vorizia are among the bigger producers of honey in Heraklion. In addition, the other villages include honey producers, but to a lesser degree:

> Η1: Ζαρό, Βορίζα, στην Γέργερη δεν βλέπω πολλές μέλισσες δεν ξέρω γιατί. Δεν ξέρω αν τις έχουν χαμηλά. Ζαρό όμως και Βορίζα πάρα πολλές.
>
> H1: Zaros, Vorizia, in Gergeri I have not seen many bees, I don't know why. I don't know if they have them in the lowlands. In Zaros and Vorizia there are a lot.
>
> H1: 59, M, Forester

During a field visit in 2009, colonies of the insect were detected in several trees, but they were not extensive. The following year the picture had changed and the insect was dominant almost everywhere in the forest (Figure 7.16). This could just be an increase of the local population as a result of favourable climatic and environmental conditions of this specific year. On the other hand could present a boom in the population of pine scale that found an empty area, free of its predators, and resulted in high reproduction rates.

Figure 7.16: Pine tree (P. brutia) infected by scale pine in 2010 in the pine forest of Zaros.

Source: photo taken by the author, August 2010

The view of the insect from several foresters is positive, and forest literature in Greece considers it as beneficial as it produces feed for the bees and promotes multi-functional forestry (Kailidis 1991). Other researchers though regard it as negative and as an introduced pathogen that actually kills pines (Petrakis et al. 2010, Rackham 2008). In Crete, in the Chania Prefecture, foresters from Forest Direction of Chania saw problems with the uncontrolled introduction of the insect that was associated with pine deaths, in their area, according to their observations.

In a document dated in 2001, sent to the Forest Research Institute in Thessaloniki, they mentioned:

> our problem was focused in the existence of honey-productive insect *Marchalina hellenica*, mainly in pines of decreased vitality or even dead trees as well as in healthy trees. We should also add that the inoculation of the pines with this honey-productive insect occurred without our Commission to be aware. Our opinion was negative to this introduction in the pine forests of our prefecture. This negative opinion was announced repeatedly in the requests of bee-keepers, because we were aware of the influence in the pine forests and afforestations but first of all the influence it could have in the ecosystem of the National Park of White Mountain (HFDD52).

Later on, in another document they had urged the negative effects of the pine scale and the disappearance of the pine forest in an area of the Chania Prefecture. In their observations they found out that:

> in areas, three months ago, there were no deaths and attack of Marcalina, now there both are flourishing. Not only the insect had attacked the pines, but also it had been spread and in cypress that consisted a mixed forest with Brutia pine. Areas with dense forest had become open spaces and the forest is disappearing with fast rates. The tree deaths are found in areas, that four years before were infected with the honey-productive insect *Marchalina hellenica*, following programmes of the Agricultural Ministry, without any participation or opinion asked from our Commission (HFDD52).

In this last document, it seems that foresters from the Chania Prefecture are exaggerating this issue, and similar negative paradigms from Heraklion Prefecture cannot be found. Although, in the years 2002–2004 several deaths of pines were recorded in Heraklion, these cases were connected with the natural phenomena of extreme drought seasons and not with the pine scale presence.

In addition, the Forest Research Institute (FRI), in two of its replies in 2000 and 2002 sent to Forest Direction of Chania, regarding pine scale, highlighted there were no negative effects of pine scale on the pines. In these documents it is mentioned that:

> as far as it regards the honey-productive insect *Marchalina hellenica* is considered useful and measures against it are not recommended. In your case, you should decide after considering the aesthetic value of the forest and the near distance of the National Park of White Mountain (HFDD50).
> and the existence of the honey-productive insect *Marchalina hellenica,* has no negative effects to the trees and there is not any suggested treatment (HFDD53).

In both of these documents of FRI is reflected the traditional forestry idea of the insect as a positive element for the forests.

Finally in 2008, there was an issue of a Ministry Directive, forbidding the spread of the insect in areas characterised as NATURA 2000 sites, archaeological sites, parks, national parks, and forests close to urban areas (HFDD53).

Regardless of the negatives or positives of pine scale in the Brutia pine forests of Crete, and the long term effects it could have in the forests where it has been recently introduced, *Marchalina hellenica* is an example of how an unproductive pine forest was transformed into a useful element to benefit the local population, and not necessarily the forest itself.

Today the key players in the area have changed and a new dynamism has been introduced. Local people took the initiative, and disregarding officials and regulations, introduced pine scale into their forests. They regarded their forests as an element of their life, the common land that they have the right to use and they altered them so they could gain more benefits from them.

The degree to which this new exploitation will be positive or negative to the forest ecosystem is not yet clear. On the one hand, people are now present in a fire sensitive ecosystem all over the summer period, thus preventing forest fire and reducing fire risk. On the other hand with their works several of them have constructed forest roads, and increased flat clear areas within the forest (Figure 7.17).

There are several others that follow more traditional, environmentally friendly bee-hive keeping within the forest (Figure 7.18). The golden rule could be equilibrium between bee-keeping and forest protection, and the Forest Authority should play a key role in this, something that has yet to happen. Forestry can gain benefits from this new use of forests, and introduce to the area more actors, and promote forestry of multiple purposes.

Figure 7.17: Bee-hives kept within the forest in a cleared area from under-shrubs.

Source: photo taken by the author, August 2010

Figure 7.18: Bee-hives kept in areas within the forest. The exploitation is not as present as in Figure 7.17.

Source: photo taken by the author, August 2010

7.8 Conclusion

Other NTFPs, were used by peasants in the past and are still collected locally. On several occasions and different eras, they played an important role in the local economy as well. Among the most important other NTFPs, in terms of commercialisation, in the recent past, were acorns and herbs.

Acorns were strongly connected with pig breeding and it seems that there was a co-evolution of that type of stock breeding with acorn production for centuries. Acorns were also important for other uses such as tanning or cloth dyeing; however, all these were spontaneously operated whereas pig breeding was continuous.

On the other hand herb collection was a traditional practice that served peasants' needs, but it did also play an important role in the local economy at least in a local scale in eastern Psiloritis. Greek Sage and Cretan Dittany collection were essential till the mid 1960s for Nyvritos village which created a local economy based on these two products. Both of these NTFPs were not recorded officially by forest officials and forestry was not at least formally informed about these forest values. Other NTFPs seems to be neglected and absent from forest management policy since the last century and this continues to the present.

Although most of these other NTFPs have ceased to play an essential role in the rural economy of Crete today, new innovations introduced in the forests have increased their value in the local economy. Pine forests currently, with the introduction of pine scale, are exploited by apiculturists and are now very important for honey production.

Definitely all these NTFPs are still in use by peasants to satisfy their own needs, a tradition that still survives locally. Whether this will be expanded again at a wider economic scale or will play an essential role in the peasant economy, is questionable, and this is something that will be influenced by new social and financial needs and trends that Greece will face in the near future.

Chapter 8: Browsing in the forest

8.1 Introduction

Archaeological evidence and historical documents suggest an official use of animal husbandry in the past as old as the first civilisations in Crete (Figure 8.1). In the Minoan Era, there were official accounts of sheep in Linear B tablets of Knossos, connected with a central administration on husbandry of that time (Killen 1964, Rackham and Moody 1996). Rackham and Moody suggest a continuity of 5,000 years of intentional grazing (Rackham and Moody 1996).

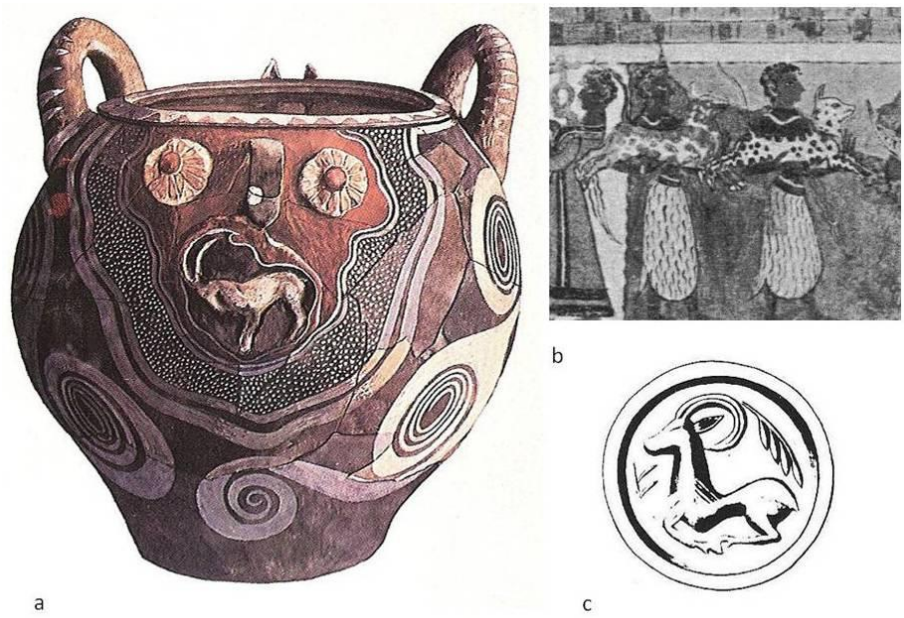


Figure 8.1: Several representations of goat from Minoan era. (a) 'Hole-mounted jar with appliqué of goat from Old Palace Phaistos' p. 103 , (b) 'Ayia Triada sarcofagous: Side A with presentation scene in front of tomb', p. 241 (plate 50). A part of the scene, where two men carry kids. (c) 'Early Minoan III to Middle Minoan I ivory seals' p. 29, an example of a goat next to a shrub (Immerwahr 1990).

These early interactions of humans with animals continued till today, in different patterns and trends, regarding the different political, social and environmental conditions. Despite the different degree of exploitation that often influenced the expansion or decrease of forest itself, pastoralism was present in the forests since the beginning of civilisation in Crete. Thus, early grazing practices had influenced vegetation structure and type. However, the resilience of native Cretan plants to grazing should be noted even in earlier times. Before humans colonized Crete, wild grazing animals such as deer, elephants and even hippo in an unorganized way, were

grazing Cretan forests (Poulakakis et al. 2002, Iliopoulos et al. 2010). Hence, Cretan vegetation includes an inherent resilience to grazing. However, the big difference occurred when humans introduced goats and sheep to the island, in the early Neolithic period (Rackham and Moody 1996). Plant species, and especially trees and shrubs, have developed different mechanisms that help them avoiding grazing and gradually escape the grazing level and develope into trees (Figure 8.2). Often such species normally in shrub format elsewhere in Greece, in Crete are developed into trees and form forests.

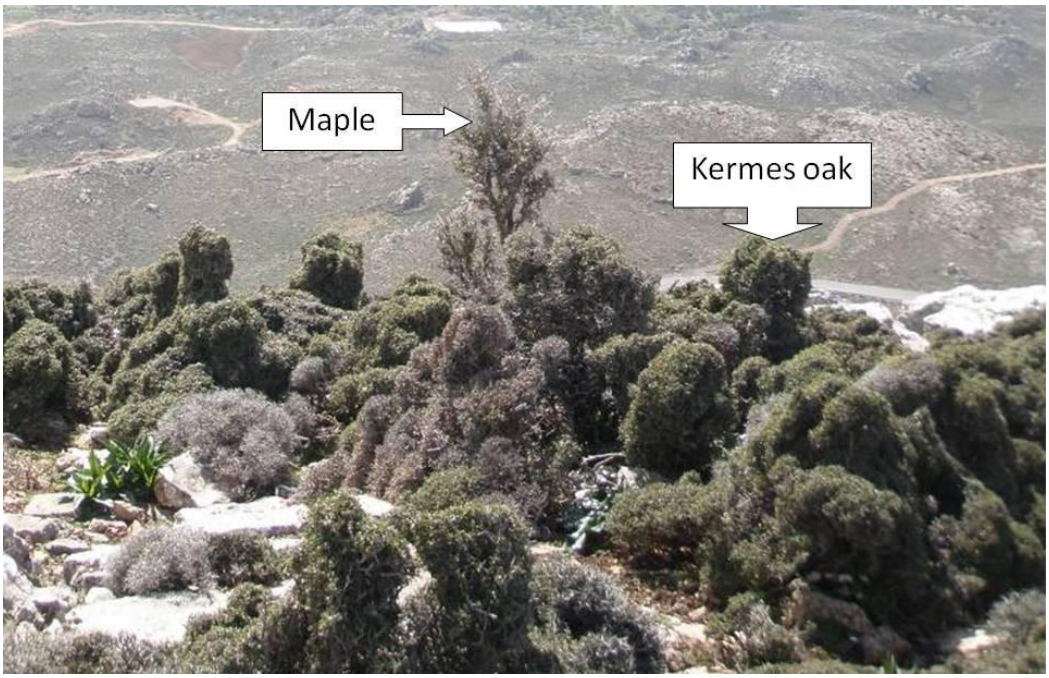


Figure 8.2: Shrubby forest vegetation that gradually escapes browsing level and develops into tree. The species in this photo are kermes oak (Q. coccifera), and maple (A. creticum), heavily grazed. The site is located close to the area 'kakia skala' north of Gergeri.

Source: photo taken by the author, January 2010

8.2 Transhumance and flock movements

Transhumance can be defined as 'a traditional livestock practice which permits the complementary exploitation of resources between the highlands and lowlands' (Ruiz and Ruiz 1986, p.73). At least in a short-range format it was widely applied in Mediterranean areas for centuries (Garnsey 1988), however, in recent decades it has been in decline and replaced by other stock raising practices such as intensive and semi-intensive systems (Stefanakis et al. 2007). These systems are characterised by the absence of seasonal movements and the introduction of additional concentrate feed that is not provided by the pastures.

One of the key causes of this change has been the implementation of policies under the Common Agricultural Policy (CAP) which through the provision of subsidies for sheep and goats encouraged a significant increase in numbers. This was in the context of increased market demand for sheep and goats in Greece (Stefanakis et al. 2007, Lorent at al. 2009).

It has been suggested that transhumance is a dynamic system, and has been developed, to better exploit natural resources in a spatial and seasonal context, in order to support an increased demand of specialized products from husbandry (Nixon and Price 2001). Transhumance has its origins in Crete in the Early Iron Age, where written sources and archaeological evidence support its existence (Wallace 2003). According to Chaniotis (1999, p.191), transhumance in modern Crete included the seasonal movement of 'individual shepherds - not whole households - living mostly in the mountainous villages of the island … (usually 400-700 m above sea level) … to winter quarters situated in the coastal plains (cheimadia) or to summer pastures on the upland plains'. The uplands in Crete were used as summer pasture-lands in the long applied procedure of transhumance.

In northern Greece, in Epirus, Saratsi (2003) defined two types of transhumance, small-scale and large-scale, regarding different distances between the uplands and the lowland pastures of the winter. In Crete, transhumance should be regarded as small-scale, as distances between uplands and lowlands are short. However, in Chania Prefecture, and in the mountains of Madares, Rackham and Moody (1996) recorded a transhumance that included whole household movement and two different settlements (villages) one in the lowlands and one in the uplands. This was not the case in eastern Psiloritis.

The characteristics of transhumance are its flexibility and its adaptation to local conditions and the needs of individual shepherds. Even in the area of Psiloritis there were some subtle differences in transhumance, mainly regarding the time that the stock was transferred to the uplands or intermediate movements of the flocks in the same period. The general pattern of transhumance though was more or less the same in the area of Psiloritis. This included a general movement of the animals after Easter to the uplands (summer pastures) and then after October their transportation to the lowlands (winter pastures), in forested or phryganic uncultivated areas, close to the coastline (Figure 8.3 and Figure 8.4). A peasant from Zaros recalls the seasonal movement of the flocks:

Z1: Τέλος Νοεμβρίου, τέλος Δεκεμβρίου που φοβόταν τη χιονιά, Κατέβαιναν την Κάτω, Ρίζα είχανε νοικιασμένα χειμαδιά, κατεβαίνανε εκιέ και κάνανε σάμε το Πάσχα, δηλαδή μέσα στον Απρίλι, που αρχινούσε να γίνεται η θερμοκρασία πιο ζεστή, τα πέρνανε και τα ανεβάζανε απάνω.

Z1: End of November, end of December when they were afraid of the snow, they descended Kato Riza, they had rented pastures, and they went there and stayed till Easter. Which means in mid April, that temperature began to be warmer, they took them (animals) and brought them in the uplands.

Z1: 83, M, Farmer

Within this general pattern, differences regarding mainly the time visiting the uplands or leaving them did occur. That differed between the villages in eastern Psiloritis, and also seasonal variations existed. Often severe climatic conditions prevented shepherds from visiting the uplands at a certain time. Furthermore, the decision to visit the uplands was influenced by local market demands and generally the date of the Orthodox Easter that is different every year. In Greece traditionally during Easter there is high consumption of lamb or kids and shepherds were staying in the villages to sell their products. That benefited them as less animals were transferred to the summer pastures and they had more time for cheese production and more grass for the remaining animals.

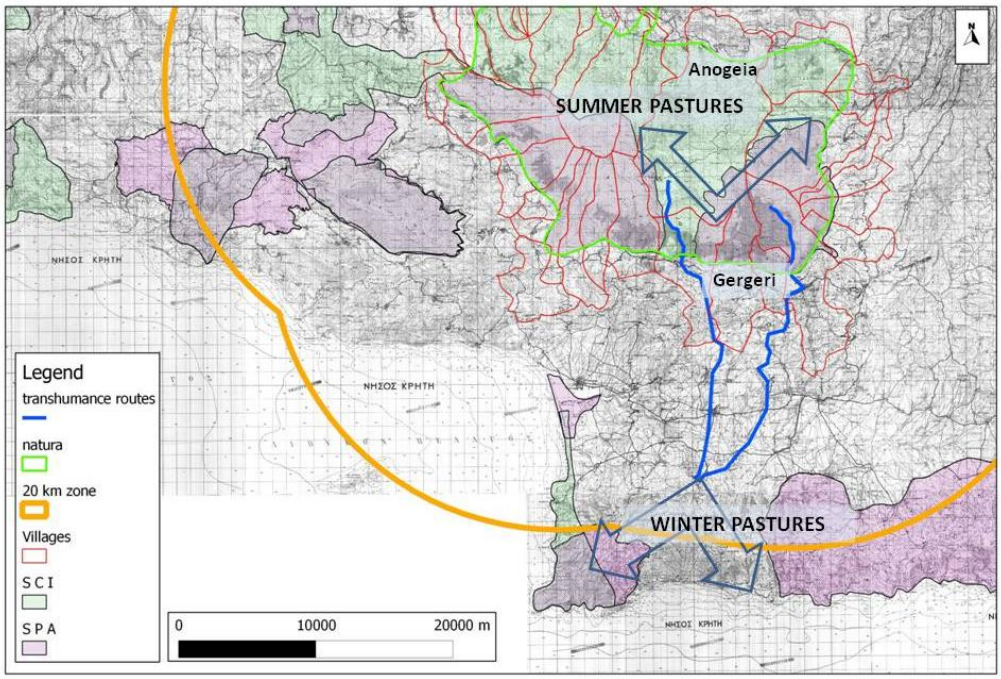


Figure 8.3: Map of Psiloritis area, showing transhumance routes for Anogeia and Gergeri village. SCI and SPA are areas under special environmental protection measures. A zone of a 20 km distance from NATURA 2000 site is shown.

Source: Map drawn by the author using QGIS, information for transhumance routes were created using oral history and topographic maps of the area of a 1:50,000 scale

Figure 8.4: A part of the route used by the animals on their movement from the uplands to the coastal pastures and vice versa, in the area Kakia Skala in Gergeri village.

Source: photo taken by the author, January 2010

An interviewee from Zaros stated the date that shepherds visited the uplands:

> Z9: Συνήθως έτσι ορόσημο θα έλεγα ότι είχαν το Πάσχα. Εποχές του Πάσχα ήταν, συν, πλην δέκα μέρες μπρος πίσω. Ήταν οι εποχές που σφάζαν τότε τα μικρά, και ανεβαίνανε πάνω, ξεκινούσε τότε η αρμεγά.
>
> Z9: Usually an important date was Easter. Time of Easter was, plus, ten days ahead or behind. They were the times that they slaughter the kids (goats) and then visit the uplands, it was when milking started.
>
> Z9: 54, M, Politician

Transhumance in Psiloritis was useful in several ways. First of all, it gave the advantage of an efficient way to exploit local resources in a temporal scale for grazing. Secondly it allowed the pasture-lands to remain unexploited for certain months every year, thus to recover from the grazing pressure. In the following interview it is recognized that the second element is very important for the environment and the conservation of the mountain. Moreover, nature is regarded as such a powerful element, that humans ultimately had to follow its rules:

> G2: Εδώ είναι ορισμένες εποχές τώρα, να ξεκουράζεται και ο τόπος, είναι Το καλύτερο. Και ένα φρακτό που βλέπεις άμα το ταΐσεις και φύγεις πριν φύγει ο

> χειμώνας και κάνεις ένα μήνα να μπεις να δεις τι διαφορά έχει. Να το. Εκιονά τ' αόρι, πρέπει να ξεκουράζεται και αυτό. Κάνει αυτό πολλές φορές από δικού του γιατί έχει και η φύση έχει δικά της όπλα και αμύνεται. Και όταν κάνει μια μεγάλη χιονιά τσοι θωρείς όλους και εξαφανίζονται και ότι θα υπάρχουνε τα τελειώνει. Και αμύνεται και αυτή η φύση με τον τρόπο τζη. Έχει δηλαδή και αυτή τα δικά της όπλα και αμύνεται. Η φύση είναι υπέρ άνω όλω, … Και η κάθε παρέμβαση που κάνεις την πληρώνεις.
>
> G2: It is best for an area to be rested for a while, for some time. Even a fenced area, if you graze it and then leave it before winter comes, and for a month you don't graze it, you will see a big difference. That it is. The mountain, need to get rest as well. It does (react) though many times by itself, because Nature has its own weapons and defence. And when it makes a big snowfall you can see everything disappear and whatever exists (sheep or goat left in the uplands) comes to an end. And nature defends itself as well with its own ways. That means that it has its own weapons, and it can defend as well. Nature is above everyone, ... and every action you may do you will pay for it.
>
> G2: 78, M, Shepherd

Two general variations within the research area can be defined: one mainly applied in the eastern parts and the other in central Psiloritis, mainly in the village of Anogeia. The period spent in the uplands is more in the first area, and less in the second. This is a result of less severe climatic conditions in the eastern parts (Figure 4.6) that result in earlier arrival and later leaving.

Moreover, the eastern parts are more forested, thus a greater variety of feed is available through the year, especially late summer and the beginning of autumn, when grass is less and trees can provide the necessary feed, either with acorn production or with fodder cutting. Despite the existence or not of enough feed, the main reason for leaving the uplands was the occurrence of severe winter conditions and the appearance of snow that made grazing impossible, especially in higher elevations above 1,200m (Figure 8.5).

The herd animals, sheep and goat, depending on their productivity, had different time entrances into the uplands. Initially animals were transferred to the middle zones and the productive ones to the best pastures. In Gergeri for example there was a productive pasture that was rented by the shepherds and used for common grazing. Most of this area was private, owned by several villagers and a small part of it was communal. Shepherds merged their flocks and commonly grazed them in that area called 'Amourgella' for a period of one to two months:

> G2: Ναι την αμουργέλλα την είχανε κοινόβια, είχαμε μια συνεννόηση, κάθε τόπου οι βοσκοί είχανε έτσι μιαν ας πούμε μεταξύ τους και πράγματι είχανε μια καλή συνεργασία. Επαέ ένα χώρο που ήταν ιδιόκτητος το μεγάλο μέρος, εμετρούσαμε τσοι έγκαλες μια περίοδο, πόσες έγκαλες είχες εσύ πόσες εγώ και ότι αναλογούσε, που πληρωνόταν το στρέμμα τότε και το πληρώναμε όλοι μαζί.

Πολλά χρόνια κράτησε αυτό το πράγμα. Εμείς εκάναμε επαέ ένα μήνα 2 μήνες, πληρώναμε όλοι μαζί, και φεύγαμε και δεν ξαναγυρίζαμε.

G2: Yes 'Amourgella' was common grazed. We had an agreement, shepherds from every area, had an agreement between them. This area was private in the largest part, we counted the productive animals, and according to what everyone had, we all together paid the owners of the pasture. That was in use for many years. We stayed there for a period of two months, we paid all together and then we did not return to it again.

G2: 78, M, Shepherd

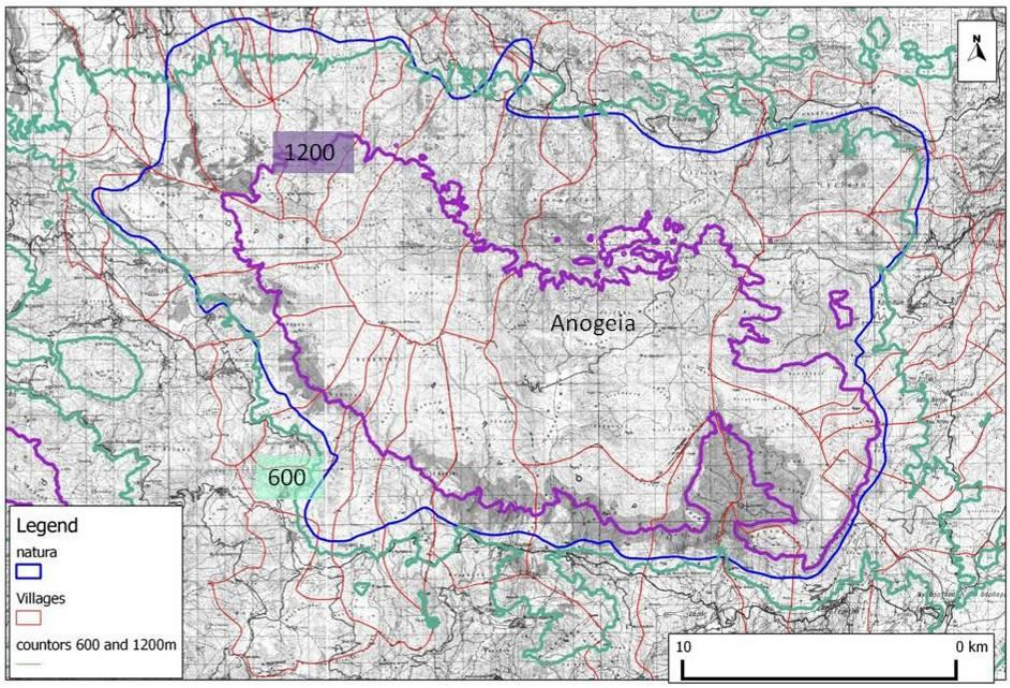


Figure 8.5: Map of NATURA area, where the elevation of 1,200m and 600m are displayed. The area of Anogeia commune has a large portion of pasture in higher elevations than 1,200m.

Source: Map drawn by the author using QGIS

Later the productive animals were transferred to the forest and then, after a certain period, the remaining unproductive flock was moved there. Moreover, several shorter movements were also applied. After the grain harvest, sheep were transferred to the cultivated land to graze the remaining stubble and transferred back to the forest in September (Figure 8.6 and Figure 8.7), as a shepherd from Gergeri remembers:

G5: Βγαίνανε λοιπόν τα πρόβατα και οι αίγες, 10-15 του Μάη στο αόρι, τα δε υπόλοιπα στείρα, ιτσικά και σία βγαίνανε το δευτεροούλι, τέλος του δευτεροούλι στο βουνό. Απεις ήμπαινε ο δευτεροούλις πάλι, και ποθερίζανε οι αθρώποι, και λονεύανε, φεύγανε το 100% τα πρόβατα, και κατεβαίνανε τσοι καλαμιές.

G5: So sheep and goat were visiting at 10-15 of May in the mountain, the others sterile, goats and the rest went up after July, end of July in the mountain. After the beginning of July and it was the end of the cereal harvest, 100% of sheep left and were put in the stubble.

G5: 43, M, Bee-keeper/Shepherd

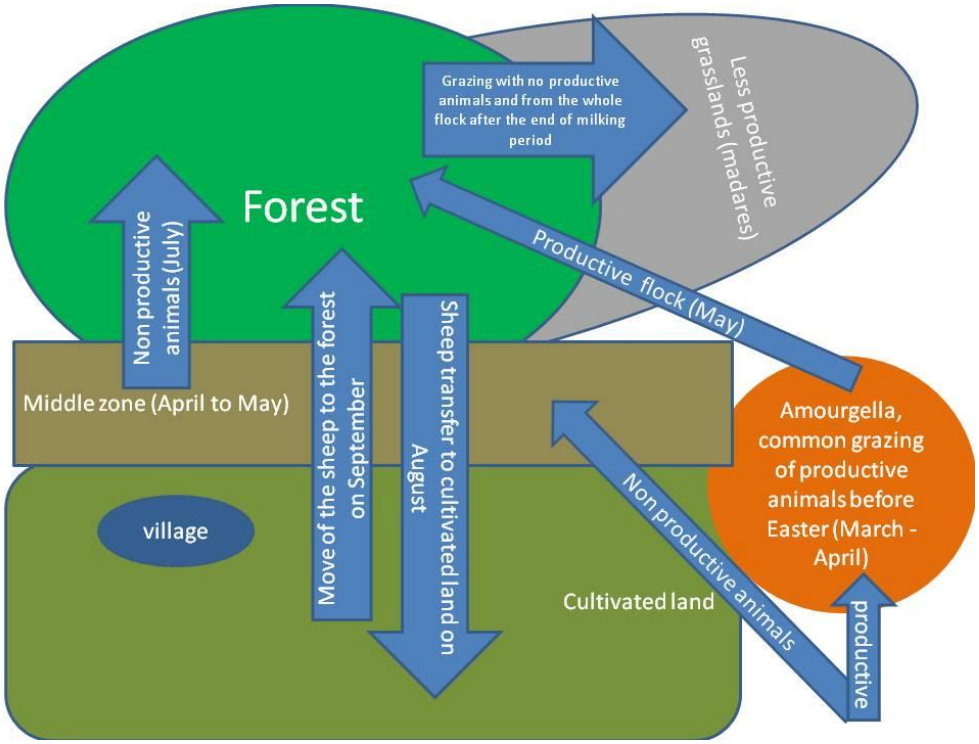


Figure 8.6: The example of Gergeri village pastures, of short term movements of the flock in the summer period, when they were grazing in the uplands.

Source: Diagram drawn by the author, based on information derived from the interviews

This is a good example that shows that the goat is more adaptable to the mountainous environment and especially forest. It also shows that the animals staying in the mountain were not remaining continuously in one place for the whole period of the summer, thus less pressure was applied on the uplands.

However, that was not happening in the central mountain area, in the region of Anogeia. Although animals initially were moved in the middle zones and later in the upper parts of the pastures, there were no moves into cultivated lands in the lowlands. In this area cultivated areas with crops existed within the uplands. Animals were grazing them after their harvest. In addition, the area of Anogeia is more favourable for sheep grazing as it contains less forest, more flat areas, and a large plateau called 'Nida', where enough grass was available (Figure 8.8).

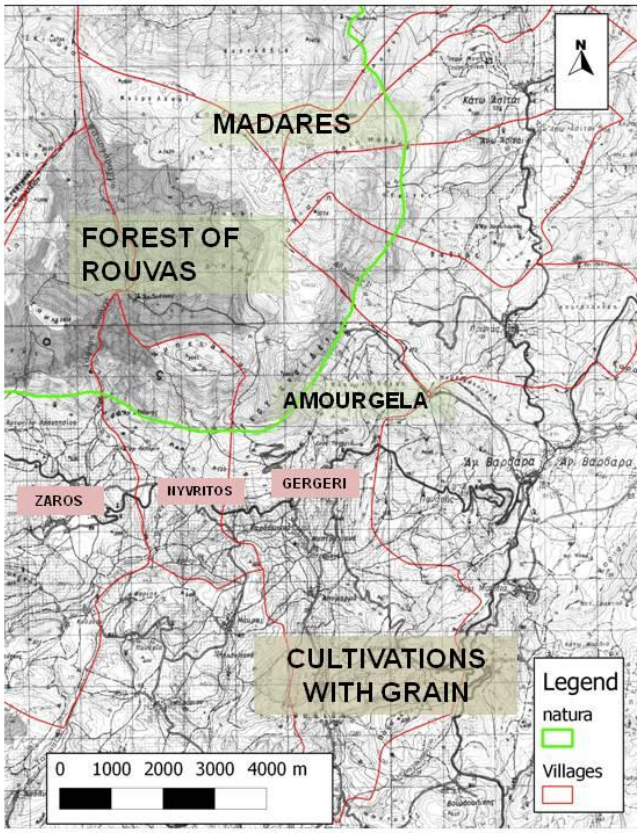


Figure 8.7: A map of Gergeri commune, with the locations used by shepherds during the summer period.

Source: Map drawn by the author using QGIS, information for the locations obtained from oral history

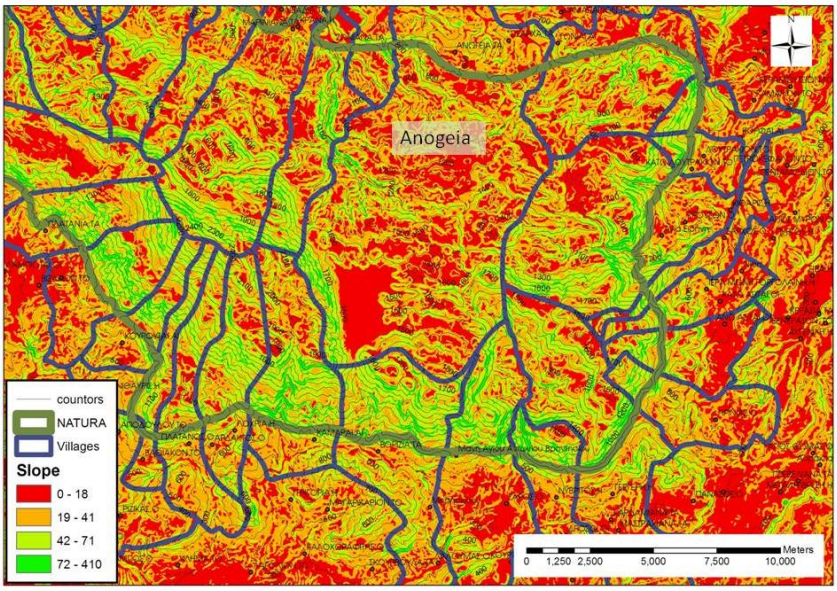


Figure 8.8: Map of Anogeia village, showing the flat areas existing in the uplands, compare it with the neighbouring villages. Red areas are completely flat. Several of them were cultivated in the past, and provided important feed for sheep. Moreover, the flatter environment, benefited sheep over goat.

Source: Map drawn by the author, using ArcGIS

8.3 Animal number and type

The number of grazing animals in Crete is assumed today to be huge and associated with environmental problems, erosion, degradation and desertification (Enne et al. 2004, Carmel and Kadmon 1999, Papanastasis et al. 2002), although several others debate this assumption (Lorent et al. 2009, Menjli and Papanastasis 1995, Rackham 1996, Forbes 2000) .

Information on animal numbers is first mentioned for Crete in the Linear B archives, during the Early Iron Age, 12th to 11th centuries B.C. (Killen 1964). This information, according to Wallace (2003), shows a central administration control of pastoral production and the number of sheep in the area of Knossos at about 100,000. The number suggested for the whole island is derived from archival data and other archaeological evidences at about 500,000, for the same period.

In Turkish documents as it has been presented in Chapter 4, in 1699, the total number of sheep and goats in eastern Crete and Sfakia was 109,895 (Stavrinidis 1987). This account may reflect the real number of that period but also it may not include animals that were not under taxation. It can be assumed that the total number of goats and sheep could be doubled for the whole island of Crete. A minimum proposed number could be approximately 220,000 animals for that period.

Livestock censuses support a continuation of the increase in sheep and goat numbers till today (Table 8.1) mainly as a result of CAP. Subsidies promoted the increase in animal numbers and several farmers were focused on this element, to have more animals in order to get more subsidies. Lorent et al. (2009, p. 17) argue that:

> the policies applied by the Greek Ministry of Agriculture, an organization that is in charge of both agricultural expansion and the national action plan against desertification ... may be a cause of socioeconomic and biophysical degradation in the livestock sector. The objective of providing income support and preventing of land degradation are sometimes contradictory. ... The marginal importance of sheep and goat husbandry in the European dimension means that their specificities are not fully taken into account in the definition of these policies.

As result, European policy that holds the implementation of subsidies keeps the key factor on how it can influence sheep and goat husbandry in Greece.

Year	Sheep	Goat	Total	Total increase (%)	Increase of sheep (%)	Increase of goats (%)
1914	357,514	166,306	523,820			
1929	239,682	166,773	406,455	-22	-33	0,2
1961	393,793	251,751	645,544	59	64	51
1971	571,863	306,158	878,021	36	45	22
1981	713,602	329,123	1,042,725	19	24	7
1991	**1,113,435**	**457,941**	**1,571,376**	**51**	**56**	**39**
2005	1,316,426	637,185	1,953,611	24	18	39

Table 8.1: Percentage of sheep and goat increase between the different year records. The increases refer to the previous record in the table.

Source: Statistics implemented by the author, animal numbers derived from the Hellenic Statistic Authority, from the different statistical accounts of the year mentioned. 1914 (Direction of Statistics 1916), 1929 (G.S.C.G. 1934), 1961 (N.S.S.G. 1964a), 1971 (N.S.S.G. 1978), 1981 (N.S.S.G. 1984), 1991 (N.S.S.G. 1995), 2005 (N.S.S.G. 2009a)

However, contemporary statistical accounts concerning husbandry are criticised for their credibility. Collection of these data is very vague and uncertain in the sense that no official record system exists. Shepherds need to register their animals in order to secure funding or to sell their meat. The problematic checking of these records, from official officers, results in an ambiguity over their reliability:

> Z9: Και η κτηνοτροφία, τα τελευταία χρόνια παρουσιάζει σημαντική αύξηση. Και κτηνοτρόφων και Αιγοπροβάτων. Παρακολουθώντας από τις κτηνοτροφικές δηλώσεις στο δήμο, σε λίγο διάστημα θα αγγίξουν τις 200 δηλώσεις με γύρω στις 45.000 δηλωθέντα αιγοπρόβατα. Κατά πόσο είναι αυτό, πραγματικό, αυτό δεν το γνωρίζει κανένας. Υπεύθυνη Δήλωση, κάνουν δηλώνουν ότι θέλουν. Αντίγραφα στις αστυνομίες και από κει και πέρα δεν είναι δικιά μας αρμοδιότητα.
>
> Z9: Animal husbandry in recent years has increased substantially, an increase in both shepherds and sheep/goats. Following the livestock statements recorded in the municipality, in a short time they will reach 200 which means a number of reported sheep/goat around 45,000. Whether it is real no one knows that. Solemn Declaration they made, they can declare whatever they want. We sent copies to the police and from there it is not our (municipality) own responsibility.
>
> Z9: 54, M, Politician

Moreover, the common rumours in Greek rural society and especially in Crete support an overestimation of the numbers of animals, which shepherds register in order to take advantage of more subsidies. A shepherd from Anogeia suggests that the real number is 100,000 not the 300,000 registered:

> Αn4: μωρέ όσαν είσανε, είχανε όμως επί το πλείστον είσανε και παλιά 20.000, 15.000, 30.000 εδά είναι πάνω από 100 σχεδόν και στα χαρτιά είναι 300.

> An4: You know, they were, they were in the past 20,000, 15,000, 30,000, now they are almost more than 100,000 and in the papers they are 300,000.
>
> An4: 69, M, Shepherd

This type of animal registration has been criticised a lot and under a new regulation, shepherds are required to have electronic tagging on their animals that were born after 31st of December 2009 (Patris 2011b). Although current statistical information contains uncertainty, this does not necessarily reflect the statistical accounts of the years before the 1980s:

> G3: Πριν από τις επιδοτήσεις υπήρχε το κατοστάρι, για το πρόβατο μόνο, η αίγα δεν έπαιρνε. Κάθε χρόνο. ηρχούντανε ο γραμματικός του χωριού ή ο αγροφύλακας και σου τη μέτρα μία μια.
>
> G3: Before the subsidies, it was the 100 (drachmas). Only for sheep, the goat got nothing. Every year the secretary of the village would come or the Hayward and he would count them one by one.
>
> G3: 45, M, Shepherd

But these records may contain fewer animals registered as in some cases shepherds had to pay tax according to their animal numbers (Rackham and Moody 1996). Thus, an underestimation could occur, particularly in the number of goats as sheep were subsidised. Goats can be viewed as a negative element, an evil creature that destroys the environment (Siddle 2009), while the sheep is always preferred by policy makers at least since the 19th century. In the formal Cretan State Gazette the Secretary of the Chania Prefecture states that Mayors should be responsible and remove from the cultivated lands that had fruitful trees or grafted trees all the grazing animals, but specially goats that are characterised as 'the implacable enemies of every sprouting tree' (Cretan State 1899c, p.3). Even today, goats are subsidised with less money than sheep.

Statistical records with less or more credibility do offer a picture of what has changed over the last decades. Table 4.2 suggests a dramatic increase in animal numbers for goat and sheep and the disappearance of other animals, since one of the first official records of 1914. Contemporary information and oral history supports a sudden increase in ovicaprid numbers since the 1980s as a result of subsidies. However, this seems to be false according to statistical data. In this case, oral history suggested that till the 1970s – 1980s things were stable, and there was no mention of an increase in the 1960s.

Oral history reflects mainly the sudden increase of animals after 1980. This can be connected with no realization of the previous increase from 1961 to 1971. The reason for this should be related with the fact that till

the 1970s, no concentrate feed was used in husbandry as it has been supported in the interviews. The grazing system was self-dependent and was not influenced by external sources. This changed completely in the 1980s when shepherds started introducing concentrate feed that made them able to sustain larger flocks (Papanastasis 2004, Lorent et al. 2009).

Statistical data and oral history supports that till the 1970s, although the number of animals increased significant compared to the accounts of 1961, pastures could still provide the necessary feed for the livestock. Until the beginning of the 1970s, no external feed could reach the pastures as a result of isolation and absence of vehicles. On the other hand, in the mid 1970s, concentrates gradually started to be introduced in husbandry and the construction of forest roads had increased dramatically (Hostert et al. 2003). Thus, since beginning of the 1980s, concentrate feeding was and still is a common practice in animal husbandry as a result of the CAP that promoted the increase of animal numbers (Stefanakis et al. 2007). Larger flocks that do not rely solely grazing on pastures became the norm (Lorent et al. 2009 and Hadjigeorgiou et al. 1998).

The total increase in sheep and goats between 1961 and 2005 is more than 202% (Table 8.1). Table 8.1 shows the increase between the different dates. In terms of goat/sheep numbers, pastures seem to have a high pressure and today grazing should be considered as negative for the environment. The degree that this reflects degradation or less forest cover in the uplands is still questionable. Statistics not only reflect the carrying capacity of Cretan pastures but also show the importance of the shepherds' work in the rural economy. In terms of social elements, husbandry was very vital, and as we can see from statistics, shepherds were large in number till 1971. In 1991 their number has been reduced to half, but it recovered later and in 2002 and 2005 there is a huge increase (Figure 4.12), resulting in smaller herd sizes again (Figure 8.9).

The increase in the numbers of sheep and goats does not necessarily mean that the farmers have increased their income. Indeed Lorent et al (2009, p. 19) argue that 'farmers who increased their flocks to maximise CAP subsidies became more sensitive and less adaptive to adverse price changes in agricultural commodities'. Thus farmers could be affected adversely by fluctuations in the prices of inputs such as concentrates and fuel.

Figure 8.9: Statistical analysis showing the number of animals per shepherd in Crete. The trend shows again a move to smaller herds as it was before the 1990s.

Source: diagram drawn by the author based on statistical accounts of: 1961 (N.S.S.G. 1964a), 1971 (N.S.S.G. 1978), 1981 (N.S.S.G. 1984), 1991 (N.S.S.G. 1995), 2002 (H.S.A. 2011), 2005 (N.S.S.G. 2009a)

8.4 Managing the flocks

In the previous section, animal number and type have been analysed, but an important element is not only their numbers but also the size of the herds that individual shepherds owned. This can be important in social and cultural terms and in pasture management. Management of large flocks had different needs in comparison with small scale farms.

Oral history suggests a small herd size owned by individual shepherds and big stocks were an exception, at least in the area of eastern Psiloritis. There is no evidence of common animal ownership, at least regarding sheep and goats. It is probable that the environmental and topographical conditions of Crete with a distinct and long dry period reduced the carrying capacity of pastures. Thus, small size flocks could be better accommodated.

Often, shepherds' families provided the initial stock to their male children that would be involved in pastoralism. There are several examples where the son inherited a small number of animals to start his own business and family. A forty-one year old woman from Gergeri village mentioned that her father started his own business with no more than twenty animals:

G16: Ο: Ο πατέρας μου πείρε 19 θαρρώ, 19, 13 οζά, όχι πάνω από 20, μιράσι από τον πατέρα του και ξεκίνησε την οικογένεια του.

> G16: My father I think took 19, 13 animals, no more than 20, a share (inherited) from his father and he began his family.
>
> G16: 41, F, Agronomist

Traditionally the male children will continue the job of a shepherd and the previous interviewee's brother is today a shepherd.

Small flocks are more flexible to move and to exploit efficiently pastures that are often isolated due to the mountainous topography of Crete. Although distances are not big, high mountains and gorges create an environment that makes everyday transportation difficult. Lorent et al. (2009) argue that stock holders in dry-lands have to adopt flexible strategies to cope with harsh environmental conditions and herd mobility is essential in such areas. The same procedure was followed in eastern Psiloritis till recently.

Therefore, for several different reasons, small herds were common in the early 20th century and were able to exploit efficiently the natural resources of the diverse Cretan environment. On the other hand, small flocks cannot provide an efficient stable production of dairy products and especially cheese that markets demanded. As a result, individual shepherds had to create a manageable farm that could provide the necessary quantities of milk for cheese production, the main product of the uplands. Hence, in order to have a more effective exploitation of natural resources and the works needed for animal husbandry, shepherds were organized under a common operation called 'mitato'. According to oral information, this was extensively applied till the 1970s:

> G2: Το σύστημα που είχαμε παλαιότερα ήτανε το πιο δημοκρατικό σύστημα που υπήρχε σε κλάδους. Εκάμαμε ή ομάδες ή αδρεφοσύνη ή και ακόμα από δυο τρεις οικογένειες σε ομάδα και εκάμαμε να σμίξωμε να κάμωμε μαζί μιτάτο να φάμε το γάλα μαζί. Την περίοδο του γαλάτου.
>
> G2: The system we had in the past was the most democratic system that existed in any other profession. We made groups or brotherly or even two or three families joined a group and we met together to make the Mitato to 'eat' (process) together the milk. The milking period.
>
> G2: 78, M, Shepherd

Mitato normally refers to a permanent settlement or stone house, made in the mountains and used for the shepherds' needs during their stay in the uplands; it was actually a shepherd's hut. This type of construction with small differentiations existed over the whole island of Crete (Plimakis 2008, Blitzer 1990, Rackham and Moody 1996). In addition, shepherds' huts in the uplands are found in other areas in Mediterranean region and other parts of Greece (Sanders 1954). Mitato were owned by an individual

shepherd, it was the place to sleep, and mainly it was used for cheese making (Figure 8.10). In the surrounding area, often some other constructions, in the same form as Mitato, were used for cheese storage and maturation (Figure 8.11).

Having that settlement (Mitato) as the centre of their works, individual shepherds merged their flocks and cooperated mainly for cheese making. Often these shepherds were members of the same family, but that was not always the rule. Particularly important was the type of animals that resulted after the unification. The ratio of sheep and goat had to be 70 and 30 percent respectively according to oral information:

> G5: Δηλαδή η αναλογία ήτανε 70-30 (πρόβατα-αίγες) σε όλα τα κοπάδια. Όχι επειδής ήτανε νόμος, έτσι ητανε η ισσοροπία. Για να κάμεις και ένα καλό τυρί, ήθελες ένα 30% ιτσικό. Παραπάνω δεν ήτανε καλό. Γιαυτό δηλαδή είχανε μια ισορροπία, 30-70.
>
> G5: So the ratio was 70-30 (sheep, goats) in all herds. Not because it was a law, was thus the equilibrium. To make a good cheese, you needed 30% goats milk. More than this was not good. That is why they had a balance, 30-70.
>
> G5: 43, M, Bee-keeper/Shepherd

There were shepherds with mixed flocks, goats and sheep or herds with only one type of animals. Regardless of the type of herds, mixed or single, the cooperation of Mitato had to be of mixed type, always in the ratio of seventy – thirty percent of sheep/goat. That was established for the purposes of cheese type made in the area and statistical data do support a proportion of seventy and thirty percent between sheep and goat from 1914 till the 1970s (Figure 8.12).

Although, there is a strong trend for this proportion to decrease in favour of sheep, probably in cheese making it is still a rule and kept by cheese makers. However, there is evidence that this tradition is changing and in several cases goat's milk has decreased, as a shepherd of Anogeia states:

> An1: Το μιτάτο που είχαινε αίγες ήτανε το προνομιούχο. (E: το πιο καλό) ε ναι βέβαια, γιατί αυτή η αίγα δίνει περισσότερο γάλα, και το γιτσικό γάλα, προσμίγοντας το με το πρόβειο, φτιάχνει, ειδικά γραβιέρα, όταν περιέχει ένα 10% γιτσικό γάλα, στο πρόβειο, του δίνει κάποια, κάποιο άρωμα. Και ο αθότηρος που έιχενε γιτσικό γάλα μέσα, ανάχυμα όπως το λέμε εμείς ήτανε το κάτι άλλο.
>
> An1: The Mitato that had goats was privileged. (P: the best?) yes, of course, because goat gives more milk and goat's milk if it is mixed with sheep milk, it makes, especially for graviera cheese when sheep milk contains 10% of goats milk, it gives it some, a scent (aroma). And the 'athotiros' (hard cheese, similar to ricotta before its dried) that had goats milk in it, the 'anachyma' as we call it, it was something else (very tasty).
>
> An1: 50, M, Shepherd

Figure 8.10: A typical stone construction, 'Mitato', the main shepherd's hut in the Psiloritis Mountain.

Source: photo taken by the author, May 2004

Figure 8.11: Stone construction for cheese maturation. The small entrance (no more than a metre high) is characteristic and keeps temperature stable for cheese storage.

Source: photo taken by the author, October 2004

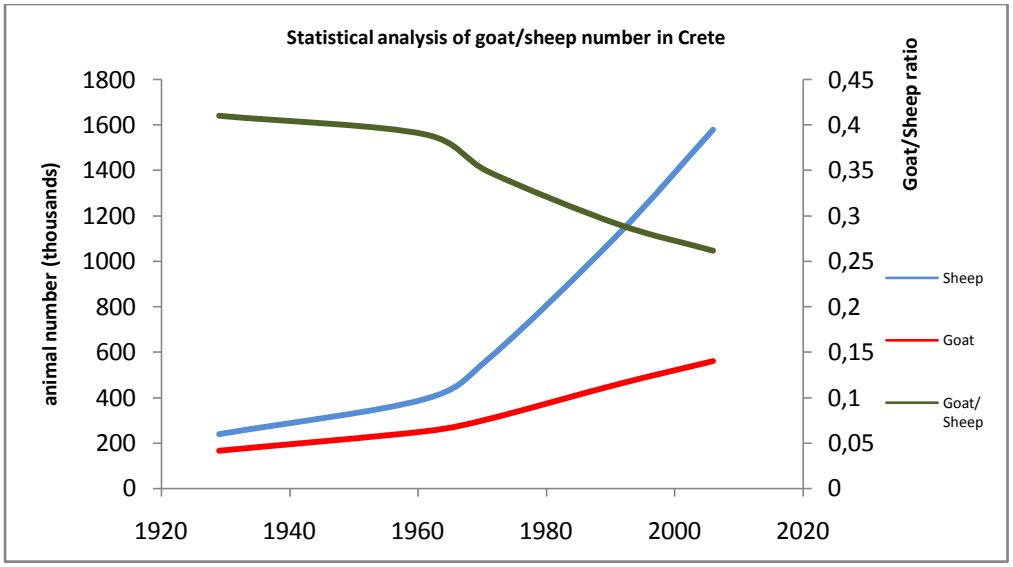


Figure 8.12: Statistical analysis of the ration goat/(sheep+goat) that shows the increase of sheep.

Source: Diagram drawn by the author, based on the numbers of Table 4.2

Mitato in terms of partnership contains a certain independence amongst its members, and every year that partnership could be different. The members were equal and were referred to as 'afentiko' (Boss):

> G17: Εγώ που επήγα βοσκάκι μια φορά, μαντρατζής, βοσκός και μαντρατζής, ήτανε πέντε αφεντικά, είχανε δυο γκαλονόμους ξένους, εγώ που ήμουν μαντρατζής, οχτώ άτομα.
>
> G17: I went once as a young shepherd, 'mantratzis', shepherd and 'mantratzis', they were 5 bosses, they had two 'galonomous', employees, and myself as 'mantratzis', 8 people in total.
>
> G17: 45, M, Farmer

Mitato coop was created only for milking purposes and cheese making (Figure 8.13). The rules were clear and very specific for the area of Psiloritis. The mitato was a highly specialized husbandry, and the works needed were specific for every member. The animal owners often did several of the necessary works and then several other people were employed if the number of bosses were not enough to cover the work needed. Generally the works were divided in certain categories that are summarized in Table 8.2.

For the cooperative it was normal for three to five or even more shepherds to merge their flocks and create a Mitato. The total number of people was approximately six to eight, and most of the times, 'galonomos', 'stironomos' and 'mantratzis' did not own any animals but were workers in the cooperative.

Figure 8.13: Traditional cheese making in Mitato in konomaki area, north of Gergeri. Several shepherds still make cheese on the spot.

Source: photo taken by the author, May 2004

The Mitato cooperation in the area of Psiloritis, was based on a system of 'milking days'. Everything was counted in milking days. Each productive animal was counted in the whole process and normally a system of forty or thirty productive animals was applied. For example the owner of forty/thirty animals had the right of one 'milking day'. Then person that owned the cheese making implements was having one milking day, 'galonomos' had two, stironomos and mantratzis for one milking day each.

Name	Works
Tyrokomos (τυροκόμος)	The person responsible for cheese making. Often a member of the family had expertise in this.
Galonomos (γκαλονόμος)	A shepherd obligated with the grazing of the productive animals.
Stironomos (στιρονόμος)	A shepherd obligated with the grazing of non-productive animals or animals in winter pastures.
Mantratzis (μαντρατζής)	The person for the rest of the works (firewood collection, cleaning the implements of cheese making, transport of products and firewood in the village)

Table 8.2: The main specialisations in a Mitato.

Source: Table drawn by the author, based on oral information

The system was highly hierarchically structured. According to the interviews, during the milking period, the first to take the cheese production, the first milking day, was the person with the more animals. Then the rest of the bosses followed and then the galonomos, then stironomos and last the mantratzis. In cases where the cooperation was based on family members, it was the oldest member that had the first day production. In accordance, the following days were given to the oldest son and so forth.

> G2: Άμα είχες 40 ή 30 πρόβατα έγκαλες ή αίγες έκανες μία μέρα γάλα τη σαιζόν. Τι έκανε τώρα, αυτός που έιχε τα πια πολλά πρόβατα ήπερνε πρώτος το γάλα, το καζάνι, τα τουπιά όλα τα σκεύη αυτά εβγάνανε μία μέρα γάλα. Άμα θέλανε οι γκαλονόμοι επέρνανε 2 μέρες γάλα και είχανε και ένα μαντρατζί Που ήπερνε μια μέρα.
>
> G3: If someone had 40 or 30 productive sheep and goat, he was having one milking day. The person owned the larger flock, was taken first the milk. The milking implements have the right for one milking day. Galonomos gained 2 milking days, and they had also the mantratzi for one milking day.
>
> G2: 78, M, Shepherd

> G3: Στην αδερφοσύνη επήγαινε παράδειγμα, ο πατέρας, οπια μεγάλος γιος δεύτερος, και ουτο καθεξης.
>
> G3: When it was a family based Mitato, it was first the father, then the eldest son, then the second son etc.
>
> G3: 45, M, Shepherd

Moreover in order to have a more reliable and equitable system, days with less production, as a result of bad weather conditions or other unpredictable factors were under common share. This means that these days' production was placed in 'Mesi' meaning in the middle, and was shared by all the members of the cooperative. The following milking day, when production was normal, it was given to the person that was in order to take his harvest.

That system was applied in Psiloritis Mountain, and different less hierarchically structured systems were developed in other parts of Crete. For example in western Crete in Sfakia, another system of partnership was applied. The difference was mainly in the type of product sharing. Here the production was not divided in days but in products. The whole production was divided at the end between the owners and their workers, according to their sharing value. However, more or less the works and specializations needed were the same (Plimakis 2008).

Generally, workers in husbandry were people from nearby villages and, depending on the work type, high specialization was often required. For

example, the work of 'galonomos' and 'tyrokomos' was much appreciated and required special skills:

> An1: Ήτανε οι αθρώποι που ασχολιότανε με την τυροκόμιση, δεν μπορούσανε να κάνουνε όλοι τους τυροκόμους ή δεν ήταν όλοι ειδικοί για τυροκομική, ένας από κάθε οικογένεια, από κάθε πατούγια, ήτανε και ο ειδικός ο οποίος τυροκομούσε. Και οι μαντρατζίδες, οι οποίοι ήτανε ας πούμε οι ταχυδρόμοι να το πούμε έτσι λογιός, ήτανε πολύ δύσκολη δουλειά, διότι την κάνανε συνήθως παιδιά. Δηλαδή ο μαντρατζής ήτονε ναι μεν, δεν είχε τόσο μεγάλη υπευθυνότητα όπως ήτανε οι άλλοι ο γαλονόμος, ο στειρονόμος, ο τυροκόμος, να κάνουνε να δείξουνε, αλλά ήτανε ο απαραίτητος να λειτουργήσει ένα μιτάτο.
>
> An1: There were certain people obligated with cheese making, not everyone could be a cheese maker or they were not all specialists for cheesing, one from each family, each 'patougia', was the expert for cheese making. And 'mantratzides' who were let's say the postmen, it was a very hard job, and it was done mostly by children. Although mantratzis was not a very responsible work as they were others such as 'galonomos' 'steironomos', the cheese maker, the (mantratzis) was thought necessary to operate a Mitato.
>
> An1: 50, M, Shepherd

The work of 'mantratzis' that did not require any particular skill, as mentioned in the previous interview, involved mainly young children. The poorest families sent their children in such work to have some extra income for their household. Here is an example of a very poor family that sent one of their children in the mountain and another one as a servant in a house in Heraklion city:

> N3: Τον κακομίτσι τον Σ... Ήταν 12 χρόνων, και το έβαλε ο πατέρας του μαντρατζή και ήπαιρνε από τσοι βοσκούς τώρα που τόχανε ήπαιρνε γάλα τυρί και ίζε τα άλλα παιδιά του. Και το φανούργιο είχαι βάλει φαμεγιάκι και παρνε τα μηνιάτικια και πέρναν στο σπίτι τα απαραίτητα. Για να ζήσουνε.
>
> N3: Poor S... He was 12 years old, and his father put him mantratzi, and so he could get from the shepherds that he was working to, milk and cheese to feed his other children. And F…… (S… brother), was sent as a servant and his father was taking his salary and then they could buy the necessities for their house. So they could survive.
>
> N3: 70. F, Housekeeper

Other products such as wool production were also important, but in the 20th century cheese was the most valuable. The main reason for the establishment of Mitato was mainly for cheese making, needed for commercial purposes.

This type of cooperation was most relevant for small sized farms and large herds were individually run. In the late 1970s, a shepherd from Anogeia village went for the first time to the uplands to work in husbandry and noticed that the majority of the 'mitato' were a cooperation of small herds and the rest were individual large sized ownerships:

> An1: Δυο και τριες ή 4 άτομα εμαζευόταν όσοι είχανε λίγα, μικρό κλήρο, πρόβατα, 50, 100, μαζευότανε 3-4 άτομα και κάνανε ένα μιτάτο. Όσοι είχανε από δικά το 300-400 δεν χρειαζότανε ήτανε μόνοι. Αλλά συνήθως ήτανε μικροϊδιοκτήτες που μαζευότανε και κάνανε ένα μιτάτο. Δηλαδή το 70% τω μιτάτω ήτανε συνεταιρισμοί.
>
> An1: Two, three or four persons could meet, the ones that had small herds, sheep, 50, 100, they met 3 -4 persons and they made a Mitato. The ones that had by themselves 300-400 did not need that, they were alone. However, normally they were small sized farms, and they met and create a Mitato. So 70% of Mitato, were cooperation.
>
> An1: 50, M, Shepherd

8.5 Where should I graze Mr/Ms. Mayor?

In Psiloritis Mountain and generally in Greece, uncultivated areas, mainly consisting of forests and forested lands, are considered as state land (Hellenic Republic 1979), as has been analysed in Chapter 4. Regardless of the formal legal status of the land another type of rights of pastures existed. Oral history informs us that shepherds divided the uplands into what is called 'dochi' (δοχή) or 'apostrofi' (αποστροφή):

> G2: Του βοσκοτόπου τώρα εμείς είχαμε ένα προνόμιο επαέ το χωριό μας που είχε πολύ κοινοτική αγριάδα. Αλλά ο καθένας είχε μία δοχή τη λέγαμε, αποστροφή τη λέγαμε στη γλώσσα τη δική μας, και βοσκούσανε άλλοι εδώ στο πιο κοντά στα Σελλιά, άλλοι στο διπλόρι, άλλοι πιο μέσα μέσα, και εμείς πιο μέσα.
>
> G2: For the grazed land we had an advantage here, because we had a huge communal wild (uncultivated land) area. However, each of us had what it is called 'dochi' or we called it 'apostrofi' in our language, and someone could graze here more close (to the village) in 'Selia' others in 'diplori', others inner and we even more inner.
>
> G2: 78, M, Shepherd

This was a division based on family members which is still in use. Although the land was regarded as common in terms of grazing rights, there was a strong connection of specific defined areas with several families from the villages. This status has no juridical recognition and it should be considered more as a local social element developed in Crete for different cultural reasons. This tradition has a high ethical status and respect among the users of the mountain. The time that it was developed and under which circumstances is unknown. It probably resulted from a need to avoid conflicts between shepherds. No one would go to graze another family's land, 'dochi'. It was a reason for conflict, and often bloody conflict. This element is still respected by locals and according to a forty-two year old interviewee from Anogeia village, although her family does not visit the uplands anymore, when they want they can return to it:

> Αn7: Ο κάθε βοσκός είχε τη δοχή του, δηλαδή το κομμάτι που αυτός εκμεταλλεύεται, οπότε το κομμάτι αυτό ήτανε για αυτόν, και ο διπλανός το σεβότανε και αυτός σεβότανε του διπλανού, ορισμένα τα όρια, όχι αποδοχή σαν ιδιοκτησία, αλλά (Ε: σαν περιοχή που βόσκω;) και τα ζώα αναγνωρίζανε σε πια περιοχή πάνε κάθε χρόνο από μόνα τους. (Ρ:Αυτό συνεχίζετε μέχρι και σήμερα;) Με σεβασμό θα έλεγα. Ναι. Υπάρχουνε βέβαια πολλές οικογένειες, οι οποίες έχουν σταματήσει να υπάρχουνε βοσκοί, στην περιοχή ας πούμε που ήτανε ο πατέρας μου, που ήταν εκεί πέρα βρέντζηδες πολλοί, κοντά στη Νίδα, εκεί κοντά στο χιονοδρομικό, δεν είναι κανείς βοσκός από μας τώρα. Υπάρχει το μιτάτο, (Ε: οπότε πάει κάποιος άλλος εκεί τώρα) δεν πάει κάποιος άλλος, δεν πάει με την έννοια ποια, άμα περάσουνε 5-10 χρόνια πομήνει ανεκμετάλλευτο, και είναι δημοτικός χώρος, σιγά σιγά πάει. Αλλά η δοχή τω Βρέντζηδω, αν κάποιος Βρέντζος τώρα γίνει βοσκός, θα πάει εκεί. Δικαιωματικά κατά κάποιο τρόπο διεκδικεί το κομμάτι αυτό για να βάλει τα πρόβατα. Τα τηρούνε με ευλάβεια αυτά. Δηλαδή μου έχει κάνει φοβερή εντύπωση. Το χω κουβεντιάσει, το τηρούνε με ευλάβεια.
>
> An7: Each shepherd had his area (dochi), that means a piece of land that he exploits, so this land was for him, and his neighbours respected that and he respected his neighbours, boundaries were defined, not accepting it as a property, but (P: as an area to graze?) and the animals knew in which area to go every year on their own (P: This continues up to today?) With respect I would say. Yes. Of course there are many families that they stopped being shepherds any more, in the area that was my father, who was over there the Vrentzides many of them, close to Nida, in the nearby ski resort, there is no shepherd now. Their Mitato is there.
> P: so someone else is going there now?
> An7: No one else is going now, but in the sense which, if 5-10 years will pass and the area remained unexploited, and it is a municipal land, they will start going. But the area (dochi) is of Vrentzido, if someone Vrentzos now become a shepherd, he will go there. It will be his right to have his sheep in that area. They strongly keep this tradition. This has a lot impressed me. I have discussed this element with them and they keep it with veneration.
>
> An7: 42, F, Economist

Crete is famous for several positive and several negative cultural elements. One of the negatives is 'Venteta'. 'Venteta' is a conflict between the members of two hostile families without an end, resulting often in murders of male members. Several 'venteta' were connected with pasture use between shepherds and resulted in the abandonment of whole villages in the past. Fortunately this negative 'tradition' seldom occurs today. However, there are still some incidences often involving conflicts over pastures. In local newspapers news often cover such conflicts: 'the accused had land disputes with the victim as there were demands for pasture and a few years ago the deceased had beaten him' (Pervolarakis 2008, p.1).

The absence of legal rights in 'dochi' does not mean that it did not have a strong influence on local decisions. Recent archives from local communes, document a type of auction for renting the pastures to shepherds and their participation in them. However, we should consider such elements as formal procedures that officials had to follow, but which do not reflect the reality. These auctions were a formal procedure implemented by the officials, where other people put 'fake' offers so that at

the end each shepherd would take their 'dochi' after having offer the best renting price (GAC1, 3).

Current Greek agricultural policy is strongly connected with the CAP and animal subsidies are a result of this policy. In Crete two main subsidies are connected with sheep and goats. These two policies were introduced in 1999 and 2001 and are still in force. The first one is related to what is defined as Less Favoured Area (LFA) and is connected with the available amounts of grazed land for each farmer (EC 1999). The second is defined as the 'ewe and goat premium' and according to the Council Regulation (EC 2001. P.341/7) 'the ewe premium and the goat premium shall be granted in the form of an annual payment per eligible animal per calendar year and per producer within the limits of individual ceilings.' This type of subsidy is not connected with the amount of grasslands or the grazing pressure in an area. Thus, although for the farmers, 'the ewe premium grows proportionally with flock size, the LFA subsidy is tied to the sum of rangeland and fodder areas (in ha). If this limit is exceeded, a penalty of 20% is applied to the livestock component of the subsidy' (Lorent et al. 2009, p. 6).

As a result of this policy and the large proportion of common lands in the uplands, local authorities have to verify that shepherds have enough space for their animals, so they do not damage the environment. This is implemented by municipalities so that their shepherds will not lose any subsidies, according to European directives. It seems that current local authorities have more power than in the past:

> P: Ο δήμος δηλαδή Το θεωρεί δημοτικό;
> Z9: Δημοτικό ναι, τα ενοικιάζουμε στους κτηνοτρόφους. … Δεν μπορούμε να τους καλύψουμε βέβαια γιατί η έκταση δεν φτάνει σε καμία περίπτωση. Εκεί τους δίνουμε ένα τμήμα γης, ίσα ίσα να καλυφθούν για να παίρνουν τις επιδοτήσεις. Αυτή είναι η αλήθεια, γιατί όλος ο αριθμός των αιγοπροβάτων που δηλώνουν, δεν ανεβαίνει στο δάσος.
>
> P: So municipality considers this land (uplands) as municipal?
> Z9: Municipal yes. We rent it to the shepherds. …. We cannot cover them though, as the land is not enough. We just verify a parcel of the land that it is just enough to cover them for the subsidies. That is the truth, because not the whole number of ovicaprid that they record is visiting the forest.
>
> Z9: 54, M, Politician

Therefore, today a shepherd has to ask his/her Mayor, where should I graze Mr/Ms Mayor, so I can get some more money for my family. The answer will be formally recorded on a paper but will have no connection with reality.

8.6 Grazing in cultivated land

The rural economy in Crete was at least till the 1970s based on households' self sufficiency (Shay and Beattie 1993, Kosseris and Clutton 1968). Every family regardless of their main occupation, shepherds, farmers or other, had their own stock. Animals were raised for their meat or dairy products that were in daily need. Generally, pigs were raised to be consumed at Christmas and lamb at Easter. On the other hand, oxen were mainly used for manufacturing works, ploughing the earth and for threshing. Horses, mules and donkeys were mainly used to transport goods. Fowl and their products were used more often as a protein source for household needs. In this mixed type of farming, goats and sheep were the main stock raised and it was very common for each household to have more than 3 animals. The majority of households had goats, the cow of the poor as it is often called in Greece. This type of animal was referred as 'martarika' or 'spitarika oza' meaning house livestock. This was also common during the Venetian period and during the Ottoman occupation.

During the Venetian period, Gasparis mentioned that:

> 'a special category was the herders for cattle (*bovarii* or *custodes bovium*). They were obligated with the grazing of the animals of the whole village or only of the fief, but with a salary after a personal agreement' (1997, p.114).

The same story was also mentioned in one of the interviews regarding cattle grazing at least till the 1960s. In the village of Zaros all the cattle were moved in the area of Messara to graze the stubble of the fertile plain (Figure 8.14):

> P: Μα δε μου λες τότε αυτά που σπέρνανε, την καλαμιά την καίανε ή όι;
> Z1: Όχι εγινότανε το άλλο Η Καλαμιά χρειαζότανε για τροφή για τα ωζά. Μάλλον κάτω όχι στο Ζαρό, δεν εγινότανε αυτό που θα πω. Τελειώνοντας ο κόσμος, Να θερίσει και να αλωνέψει με τα βόδια που αλωνεύανε, τα βόδια μετά δεν χρειαζότανε δυο μήνες, τρεις μήνες, ήτονε αθρώποι που αρχινούσανε και τα μαζεύανε στα καπαριανά για να τα βλέπουνε. Πήγαινες το ζευγάρι σου το φηνες στον άθρωπο αυτό, το παραλάμβανε αυτός και είχε ο καθένας τους από 100 – 150 ή 80 βόδια ανάλογα τη προτίμηση είχε και τα μολέρνανε, γιατί αμπέλια είχε μόνο στην κάτω μεριά, τα άλλα ήτανε μόνο καλαμιές, τα ποτίζανε και το βράδυ το δένανε. Οι καλαμιές βέβαια χρειαζότανε, για τροφή.
>
> P: Can I ask you, in the ploughed land, the stubble was burned or not?
> Z1: No, they did something else. The stubble was needed for animal feed. Probably, down (in the plains), not in Zaros, what I will say was happening. After the harvesting of cereals and the threshing, with oxen they threshed, then oxen were not needed for a period of two, three months. So there were people, which started collecting the oxen and gathered them in Kapariana, so they could look after them. You would bring your oxen pair and you leave it to that people, and he would take them, and everyone had 100, 150 or 80 oxen, depends on what he preferred and then they left them free, because at that time vineyards were only in the south area, the rest (land) was only stubble,

> they watered them, and during the night they tied them. The stubble was needed for animal feed.
>
> Z1: 83, M, Farmer

The type of goats raised in the houses was also called 'Zana', another variety more productive and more suitable for domestic spaces. Moreover, if someone did not have the good variety of Zana, they had to collect the best goats of their flock the ones that were less wild and more productive, and kept them in the house for milking and cheese making as a shepherd from Gergeri suggests:

> G5: Τα οικόσιτα. Δεν υπήρχε σπίτι να μην έχει 2,3,4 ήταν νόμος όλοι. (E: αυτοί δεν πηγαίνανε στο βουνό όμως καθόλου). Όχι αυτά, και ο κτηνοτρόφος είχε. Στο σπίτι, εμείς που το σπίτι μας ήταν κτηνοτροφικό, ο πατέρας μου, είχαμε 3 αίγες. Και είχε για να πίνουμε ένα ποτήρι γάλα, για να κάνει το τυροζούλι, ήτανε νόμος. Γιατί δεν υπήρχε και η δυνατότητα να αγοράσεις γάλα. Όπως υπάρχει τώρα. Είτε είχανε αυ᾽τες τις αίγες τις ζάνες, είτε απτο κουράδι, κρατούσανε μια δυο αίγες τις πιο καλές, τσοι πιο γαλατερές τις πιο ήρεμες, και τσοι χανε στο σπίτι για να εξυπηρετείτε… οι ανάγκες του σπιτιού. Πως ήθελε να θρέψει τα κοπέλια, ίντα ήθελε να τος εγοράζει το ΝΟΥΝΟΥ ΦΑΜΙΛΙ
>
> G5: The animals kept in the home. There was not a house that would not have 2,3,4, it was a 'law' (a common practice for every household in the village) , for everyone. (P: They did not go to the mountain at all?).No, not them, and the shepherd had as well. At home, we, that our home was a shepherds home, my father had 3 goats. And he had them so we could drink a glass of milk to make white cheese, it was like a law. We did not have the opportunity to buy milk. As it is today. Either they had this goats Zanes, or from their flock they would keep one or two goats the most good, most productive the most calmed and they kept them at home to serve their needs in the house. How they could feed their children, what you could buy, NOYNOY FAMILLY (a modern brand of milk)?
>
> G5: 43, M, Bee-keeper/Shepherd

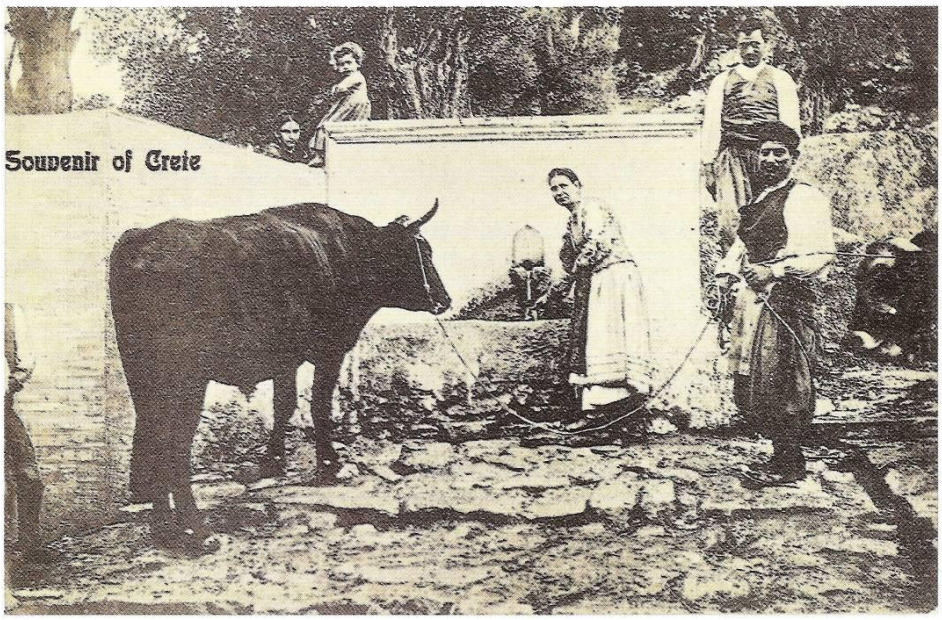


Figure 8.14: Oxen watered in Crete ca 1900, area unknown.

Source: Mikros Nautilos, (Anonymous 1995)

Furthermore, not only oxen were used in a common grazing system for certain periods of the year, but also goats and sheep. Every village had a shepherd tasked with the grazing of the animals, especially when farmers were occupied with harvesting of cereals and grapes:

> As6: Θα σου πω μια ιστορία. Παλιά, όταν οι αθρώποι εδουλέυανε στα χωράφια ένας από το χωριό, ήπερνε όλα τα οζά και τα πρόσεχε. Αυτός τα έπαιρνε κάθε μέρα και τα βόσκευε στα χωράφια των χωριανώ. Κει έβλεπες κάθε απόγευμα που τα μόλερνε να γλακούνε να πάνε στο σπίτι τους. Ήταν μια πολύ όμορφη εικόνα αυτό να το βλέπεις. Να τρέχουνε όλα στο σπίτι τους και να φωνάζουνε στα μικρά τους. Η κάθε οικογένεια είχε 3 με 5 οζά, κυρίως αίγες και πρόβατα.
>
> As6: I will tell you a story. In the past, when people were occupied with daily works (harvest time), one person from the village was responsible to take care of the animals (from the whole village). That person should take every day all the animals and feed them in the fields of the owners. However, every afternoon he released them and each of them was running alone to its owner. It was very nice to see that. All of them running and bleating looking for their house and their offspring. Every family had about 3 - 5 animals, mainly goats and sheep.
>
> As6: 66, M, Farmer

Although cultivated land was grazed often by household animals, shepherds took advantage of the extended grain cultivation of the past as well. As has been mentioned in the section on transhumance, after the harvesting, they also grazed such areas. The use of cultivated land for grazing was very important in husbandry. It provided fodder when grass was in a decline in the uplands as well as manure for the crops.

8.7 Leaf fodder collection: 'kladizo'

8.7.1 Preferred trees

An additional source of feed, along with the acorns, was provided from the trees in the forest. In the past and less today broadleaved trees were used for leaf fodder collection. Not all tree species were used for it, but there was a differentiation on preferred trees. The main species for leaf fodder collection were maple (*Acer creticum*) and kermes oak (*Quercus coccifera*), the most common trees in the broadleaved forests of Psiloritis. On the other hand, other woody species, such as *Phillyrea latifolia* or holm-oak (*Quercus ilex*) were not used due to their negative taste characteristics and animals did not like them according to shepherds' observations:

> G9: παρόλο που, πραγματικά λες, ο αζίλακας, και οι λιοπρίνοιοι, το λιοπρίνοι αποπέρα δεν έχει αζιλάκους; Ε δεν τσοι τρώνε μωρέ οι άιγες όπως τρώνε τον κατσοπρινο ο πρίνος έχει και αγκάθες και τονε τρώνε όμως ε; γλυκή, ας έχει αγκάθες, το λιοπρίνι δεν έχει αγκάθες και δεν το τρώνε, ο αζίλακας, και τον αποφεύγανε. σου λέω ήτανε στιφή μωρέ και ο αζίλακας στιφής είναι. Για κιονά γενίκανε και οι αζιλάκοι, έχει στο ζαριανό αζίλακα απού ναι δεν παλεύεται θερία δεντρά.

G9: Athough, actually you could assume, that holm-oak, and lioprinos (*P. latifolia*) are palatable, goats do not eat it as they eat the shrubby kermes oak. Kermes oak although it has spines goats like to eat it. It is sweet, although it has thorns. *P. latifolia* and holm oak have no thorns but they do not eat them, they are avoided. I am saying that both are bitter. That's the reason that holm-oak survived, it is in the mountain, the side of Zaros village, very big trees (holm-oaks).

G9: 60s, M, Shepherd

However, if holm-oak (*Q. ilex*) was not a palatable species, then it should be a quite common species in the forest, as grazing would not have a significant effect on it. This is not the case though and holm-oak is mainly found on cliffs, avoiding grazing, or in very distinctive areas within the forest. According to Rackham and Moody (1996), holm-oak in Crete cannot survive grazing pressure. The observations of shepherds in the area of Psiloritis could support that young holm-oak trees are more palatable than mature plants, thus holm-oak was not used for fodder collection and shrubby holm-oak is difficult to find in the area that is heavily grazed. In addition, holm oak could have been more exploited for other uses, charcoal or firewood for example, in the past. On the other hand, kermes oak as more valuable for leaf fodder collection could have been unexploited for timber and charcoal thus more abundant today.

Trees often contain large phenotype variability. For example Kermes oak has a range in leaf phenotype, varying from very spiny to smooth leaves. Trees with less prickly leaves (Figure 8.15) were more desirable for fodder, even than maple according to an 82 year old interviewee from Zaros village. Generally, kermes oak (*Q. coccifera*) had denser foliage than maple (*A. creticum*) (Figure 8.16), and could provide more feed:

Ρ: Κόβανε καθόλου κλαδιά για να ταίσουνε τα ζώα;
Ζ6: Αμα θελε να ναι ποθές φούντες αγρουλίδες, και στα αόρι που ‘ταναι πρίνοι, τα κλαδίζανε, κόβγανε τσοι πρίνους και τα κλαδίζουνε.
Ρ: Αλλά πώς, πηγαίνανε σε ένα πρίνο και κόβανε όλα τα κλαδιά; Ή κόβανε …
Ζ6: Την καλή καλή φούντα. Ναι. Βέβαια έπρεπε να τον εδιαλέξεις και τον πρίνο να κόψεις γιατί είναι πρίνοι που έχει αγκάθια και δε ….Είναι πρίνοι που είναι σαν την ελιά να πούμε το φύλλωμα του έκιουσας τσοι ερημάσανε. Βέβαια κόβγανε, τσοι κόβγανε όλη τη φούντα.
Ρ: Και ασφεντάμους, κόβανε κλαδιά από τους ασφένταμους;
Ζ6: Ε, οι ασφένταμοι δεν έχουνε πολύ φαί.

P: Did they cut branches for animal feeding?
Z6: If you could find anywhere, bushy wild olive tree or in the mountain what you can find is Prinos, they cut them, they cut prinos for fodder.
P: Did they cut the all the branches of a tree?
Z6: The good bush. You need to choose the prinos, because there are prinos with prickly leaves. There are kermes oak, that their leaves are like olive's, those ones, was cut a lot. They cut from them the whole bush (leaves).
P: And from maple, did they cut branches from maple?
Z6: Maple does not contain a lot of feed (foliage is not so dense)

Z6: 82, M, Shepherd

Figure 8.15: Kermes oak (Q. coccifera) in Rouvas forest with less spiny leaves. This type of foliage was more desirable for grazing.

Source: photo taken by the author, July 2004

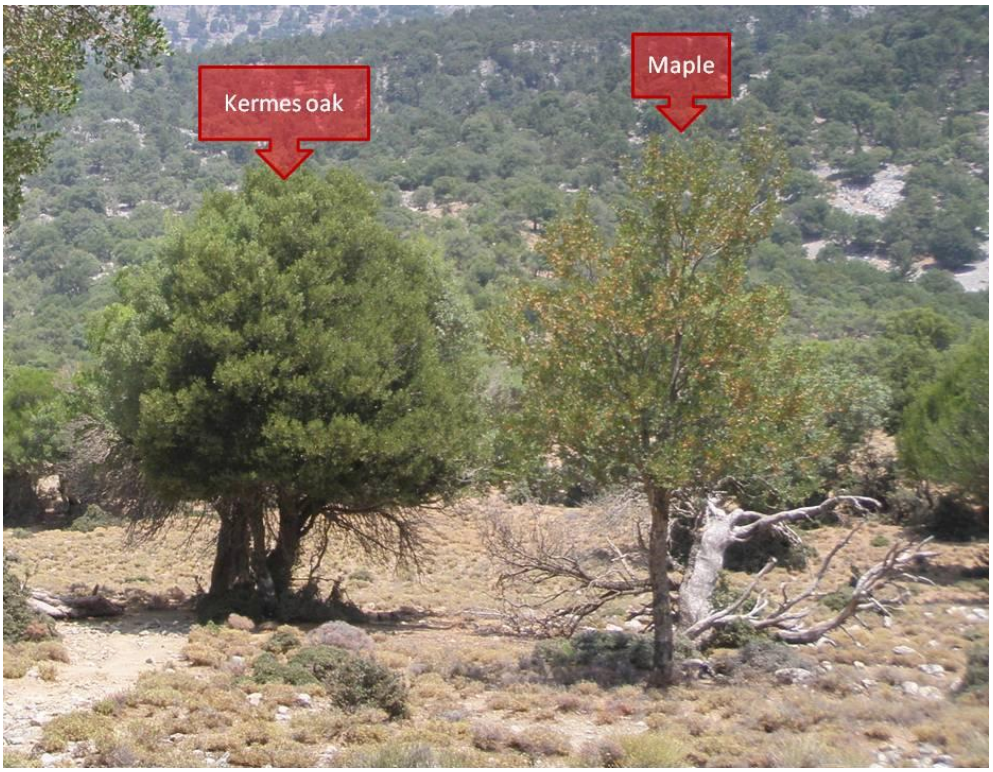


Figure 8.16: Kermes oak (Q. coccifera) and maple (Acer creticum) in Rouvas forest. Generally Kermes oak has denser foliage than maple.

Source: photo taken by the author, August 2010

The majority of the interviewees though, supported the suggestion that the preferred fodder species was maple (*A. creticum*), whose leaves had no prickly characteristics and animals preferred it. Maple was pollarded or shredded the whole period that shepherds spent in the uplands, but preferably in July, when its fruits were mature. This relation of fruit maturation and leaf fodder collection is not necessarily connected with maple fruits themselves. Maple fruits do not contain a huge amount of feed, as acorns or pears do. Maple (*A. creticum*) is a deciduous species and could not be used for fodder when its leaves were still in the sprouting phase. Moreover the fruit maturation period could be connected with maximum foliage production and nutritional value. Hence, maple branches were more desirable to be cut at that period (Figure 8.17):

> P: Κόβατε καθόλου κλαδιά και να τα ταΐσετε τα ζώα;
> G2: Ορισμένες εποχές. Ξέρεις ποια εποχή; η συνηθισμένη, η καλύτερη εποχή ήτανε την ώρα που μεστώσει ο αροδαμός. Το δεύτεροούλι εκόβγαμε τον ασφένταμο και έκανε και καλό, εντύνουντανε μετά. Γιατί ο ασφένταμος ξέρεις, κάνει μια πεταλούδα, άλλοτε είναι προς το μωβ και άλλοτε είναι κοκκινερή. Δύο λογιό είναι η πεταλούδα αυτή. Ανάλογα τώρα, γιατί είναι το ίδιο πράμα αλλά και ο κάθε πρίνος κάνει και διαφορετικό το βελάνι. Το ίδιο και ο ασφένταμος, άμα έχει και καρπό και φύλλο, εκόβαμε και παχαίναμε τα ρίφια τότε, γιατί από το βυζί δεν εμπορούσαμε να τα πουλήσουμε, και τα κασαπικά τώρα τα κόβγαμε και τα ταΐζαμε άμα ήθελε να μεστώσει ο αροδαμός.
> P: Όταν ήταν αυτό κόκκινο;
> G2: Ναι να μεστώσει κόβγαμε από πάνω τα κλαδιά. Όχι όλα, αυτά που πηγαίνανε προς τα πάνω και φείναμε και λίγες ποδιές, του κάναμε σαν το κλάδεμα. Κλαδίζαμε τα ρίφια. Πολλές φορές άμα είχε και κανένας λίγες αίγες, μιαν εκατοστί ζα τος ήκοβγε και που και πρίνο το χειμοκαίρι τώρα.
>
> P: Did you cut any branches to feed the animals?
> G2: Specific times. You know the usual time, the best time was the time that its fruits were mature in July, and then was the time to cut maple and it was good, it could re-grow later. Maple as you know, makes a butterfly (fruit), sometimes is purple and sometimes is reddish. There are two varieties of that butterfly (fruits). Depending, because although it is the same species, but as it is happening with kermes oak, every tree produces different acorn. The same thing is happening with maple. When the tree had both leaves and fruits, we cut it in order to fatten the young goats. Because just with the milk we could not sell them. And the ones that were planned to be killed, we fed them as well (goats), when the fruits of the tree were matured.
> P: When it was red?
> G2: Yes when it was mature. We cut the branches, from the top. Not all, only those who went to the top and we left a few 'aprons', we made something like pruning. 'Kladizame' (branch-ing) the young goats. Many times when someone had a few goats, 100 animals, he could cut now and then kermes oak in the end of the summer, autumn, and that was good for the trees.
>
> G2: 78, M, Shepherd

On the other hand, kermes oak, was shredded after August. Although this species is evergreen and could be used for fodder all over the year, there was a preference after August. This is presumably connected with the existence of enough grass till July. The pressure in the grasslands was

more as animals spent more time on it. The lack of rainfall in the summer and a potential re-sprouting of grasses made woody vegetation that still contained green parts more desirable. Trees with leaf fodder and shrubs naturally grazed provided the necessary feed for the animals during the dry period of the summer (Papanastasis et al. 2008). Kermes oak was more desirable after August when shepherds could benefit from the acorns of these trees:

> P: κυρίως ασφεντάμια κλαδίζανε;
> G5: Ναι όχι ο πρίνος τόσο να πολύ. Ήτανε πιο γλυκό, πιο καλά τρωγότανε ο ασφένταμος παρά τον πρίνο. Και ο πρίνος ήτανε καλός όταν είχε βελάνι, τον Οκτώβρη πχ γιατί το βελάνι για να πέφτει κάτω να το βρει το ζο, πρέπει να μπει ο Οκτώβρης, ο Νοέμβρης, να βρέξει, ενώ απεις να μπει ο Σεπτέμβρης, ο Οκτώβρης, κόβανε τα κλαδιά απού είχανε και βελάνι, τότες ήτανε ο πρίνος πιο αρεστός για κλάδισμα. ….. Το σφεντάμι ήταν όλη την εποχή.
>
> P: Did you collect leaf fodder from maple?
> G5: Yes not kermes oak so often. It was sweetest, maple was eaten better than kermes oak. Kermes oak was good when it had acorns, in October for example because, acorns naturally dropped down and then the animal to find it, it has to be October or November, when it rains. So beginning of September, October they cut the branches that had acorns on them and they were more wanted for leaf fodder collection. Maple was wanted all the time.
>
> G5: 43, M, Bee-keeper/Shepherd

Figure 8.17: Acer creticum in July, when its fruits are mature and foliage had reached the maximum growth.

Source: photo taken by the author, July 2004

As a result of the different ecological characteristics between species there was not only a differentiation between the species, but also a temporal preference between them for leaf fodder collection. Shepherds tried to satisfy the needs for extra feed for their flock and to take advantage of the best time for leaf collection that could provide them with less effort and yet maximum production.

8.7.2 Why leaf fodder?

The importance of fresh feed for the animals, especially during the long dry summer period in Mediterranean regions, has been stressed by several researchers (Croitoru 2007, Papanastasis and Papachristou 2000, Papanastasis et al. 1999). Although woody shrubby plants do provide such feed, leaf fodder from trees can be an extra nutritional source in a crucial period. In addition, in the region of Psiloritis leaf fodder collection was used as a managerial tool for the flock. For example often animals were provided with leaf fodder when new animals were introduced into the herd. It was actually used as a tool to keep them close to the shepherd's hut and control them efficiently till they became used to the new environment. Often this included keeping them in an enclosed area, made from stone walls (Figure 8.18); today some shepherds still do this but with a metal fence (Figure 8.19).

Furthermore, the nutritional value of leaf fodder was appreciated by shepherds and often it was used for fattening young animals. Generally, it seems that leaf fodder was not a common feeding source that could help the goat and sheep growers to support their flocks with sustainable feed all round the year but a highly valued extra resource used under specific circumstances:

> P: Και πάνω δεν ταΐζανε δηλαδή τα ζώα, μόνο που κόβανε κλαδιά;
> G5: Ζωοτροφές όχι. Εγώ θυμούμαι μια χρονιά, και γόρασε ένας μπάρμπας μου μια 50ρα αίγες και για να τσοι σταματήσουμε να τσοι χουμε σε έλεγχο τος εκόβαμε το πλείστον ασφεντάμους. Για να τσοι στέσουμε. Αλλά βγαίναμε με ένα σαρακάκι. Κλαδίζανε, πάντως δεν ήταν λύση για να επιβιώσει το κοπάδι σου. Εκλαδίζανε που, να χεις ένα κούμο οζά, να χεις πιάσει κάποιο οζό, αλλά όχι ότι ήταν ένα πράγμα στάνταρ.
>
> P: So in the uplands they did not feed the animals, they only cut branches?
> G5: Feeding not. I remember one year, my uncle a bought about 50 goats and in order to stop them, have them under control, we mainly cut maple. To keep them there. We cut them with a small saw. However, that was not a solution for your herd to survive. We cut leaf fodder to feed an animal that you kept inside a fence, it was not a standard procedure.
>
> G5: 43, M, Bee-keeper/Shepherd

Figure 8.18: Stone wall next to a shepherd's hut, where animals were kept for milking and other needs. In the area called Diplori, in Rouvas forest.

Source: photo taken by the author, August 2010

Figure 8.19: A fenced area where goats are kept and fed with leaf fodder from kermes oak, next to a spring, in Zaros commune, in Rouvas forest.

Source: photo taken by the author, August 2010

8.7.3 'Kladizo'

The Cretan word used for leaf fodder collection and feeding the animals in the area of Psiloritis is 'kladizo' (κλαδίζω), as was mentioned earlier, meaning 'branch-ing'. This term describes the whole process of shredding or pollarding and then feeding the animals. Thus, leaf fodder collection and feeding the animals were a unified procedure.

The mayor of Zaros municipality recalled the 'kladizo' method and underlined the fact that it was a careful form of management. Leaf fodder collection was quite common with shepherds that were familiar with what and how to cut. He argued that the trees were not damaged and shepherds only cut the 'unnecessary' branches, something that according to him actually helped the trees:

> Z9: κόβανε Κλαδιά οι κτηνοτρόφοι αλλά κλαδεύανε τους πρίνους και τρώγανε τα ζώα τη φούντα που λέγαμε. Τα βλαστάρια, έτσι τα λέγαμε. Αλλά κανονικό κλάδεμα. Δηλαδή ο καθένας ήξερε ότι είναι σε μια συγκεκριμένη περιοχή. Δεν πήγαινε να κόψη τον πρίνο να τον καταστρέψει Έκοβε Ορισμένα Κλαδιά, τον κλάδευε και αυτός ξανάνοιγε μετά. Τον αναζωογόνησε, Και ήταν πάρα Πολύ σημαντικό. Από Τη στιγμή που κλάδιζανε τα ζώα τότε, τα κλαδίζανε έστι ακριβώς λέγανε, θα πάω να κλαδίσω τα πρόβατα. Όταν λέγανε τα κλαδίζανε, Ανέβαινε πάνω με ένα σαρακάκι που είχε ο κτηνοτρόφος και έκοβε τρία, τέσσερα κλαδία, όχι παραπάνω από το κάθε δένδρο τα άφηνε κάτω και μαζεύονταν τα ζώα. Μόλις ήθελε να πέσει το πρώτο κλαδί, έβλεπες τα ζώα και έτρεχαν κατευθείαν κάτω.
>
> Z9: Shepherds cut branches, but they were lopping kermes oak, and animals were eating the bush as we call it. The sprouts as we call it. However, it was a normal lopping. Everybody knew he was operating in a particular area. They wouldn't go to cut kermes oak, to destroy it. He will cut, specific branches, he was pruning it and then it would sprout again later. It was revivifying the tree and that was very important. When they were feeding the animals with fodder 'kladizo' as they called it, they would say I am going to 'kladiso' the sheep. When they say 'kladizo', they would climb in a tree with a saw that the shepherd had with him, and he would cut three, four, branches, no more from each tree, and he let it down and the animals were gathered. When first branch fell down, you could see the animals running immediately down (by the tree).
>
> Z9: 54, M, Politician

Shepherds were provided with axes or saws and climbed into a tree to cut the necessary branches. Apparently, prickly leaves such as those on kermes oaks meant that they were more problematic to cut than other species (Figure 8.20). Shepherds often damaged their clothes when they were cutting such spiny foliage and a 45 year old shepherd from Gergeri village, joked that you needed a new shirt every time you climbed a tree:

> P: Πώς τα κόβατε; είχατε μανάρι, σάρακα;
> G2: Μανάρι ή σαρακάκι, ένα από τα δύο. Τότε, δεν υπήρχαν τα αλυσοπρίονα.
> P: Πως ανεβαίνατε επάνω;
> G2: Τότε ο κόσμος ήτανε σαν τα λάστιχα δεν είχε τέτοιο πρόβλημα, καθόλου.
> G3: Κάθε φορά ήθελες ένα πουκάμισο.
>
> P: How did you cut the branches? Did you have an axe or a saw?

G2: An axe or a small saw. One or the other. At that time we did not have chain saws.
P: How did you get into the tree?
G2: At that time people were very flexible (stamina and good physical condition), they did not have such a problem (to climb).
G3: Every time after that (leaf fodder collection) you needed a new shirt.

G2: 78, M, Shepherd / G3: 45, M, Shepherd

The whole procedure of 'kladizo' creates a bucolic imaginary of the past, described by several interviewees. Animals preferred this type of feed and when they heard the noise of wood cutting, they rushed to the area, waiting for the tasty fodder to fall. The animals connected the sounds and human actions with fresh fodder:

Z7: Οι βοσκοί κόβανε με τα μπαλταδάκια ή με τους σαράκους τότε που δεν χρησιμοποιούσανε τροφές, εκόβανε κλαδιά και κλαδίζανε που λέγανε, εκλαδίζανε. Και μαζευόντανε οι αίγες, είχανε μάθει από τον ήχο, απ'το χτύπημα ή απ'το πέσιμο, και πηγαίνανε, εγώ που το δα δηλαδή στο κυνήγι πολλές φορές, από 100 και παραπάνω μέτρα, να ακουστεί να κόβει κάποιος, και τρέχανε όπως η πυξίδα.

Z7: Shepherds cut branches with small axes or with saws, at that time that they did not use any feed, and they cut branches, 'kladizo' as they called it. And goats will come there, they had learned the sound from the hit or from the fall, and they went, I saw it when I was hunting several times, from a distance of 100 metres and more, if it was a sound of cutting heard, they were running like having a compass.

Z7: 82, M, Farmer

Figure 8.20: Kermes oak (Q. coccifera) foliage, with a detail of spiny leaves. The dense foliage of the tree, related with spiny leaves, caused problems when leaf fodder was collected.

Source: photo taken by the author, July 2008

This also happened when people were threshing oaks for acorns and animals waited under the trees for acorns to fall. Today, this bucolic view as with many other elements has been heavily modernised. The sound of the axe that could break the tranquillity of the uplands has been replaced by the sound of the shepherd's car horn. Animals today respond to the modern sound of the horn, gathering close to the road and waiting to be fed, with a compound feed probably imported from distant places outside Crete or even Greece (Figure 8.21):

> G6: Αυτός τώρα δεν κατεβαίνει από το αμάξι καθόλου. Και αυτές βέβαια, τον είδανε, εγνωρίζανε το αμάξι, και δρίκας, είχανε εκιά τα πλάγια πιασμένα, και μούγκριζανε, και να να να να να εφώναζε αυτός και κράτιουνε ένα τσουβάλι όφκερο, σε 10 λεφτά είχανε μαζοχτεί κια 100 αίγες
>
> G6: Now they do not leave the car (modern shepherds) at all. And when they (goats) saw him, they recognize his car, and you could hear them, they were around the area, and they were screaming, and he was calling them, and he holds an empty sack. In ten minutes 100 goats gathered there.
>
> G6: 78, M, Shepherd

Figure 8.21: Sacks that contained compound feed. Animals are familiar with them and when they saw the shepherd holding them they come close to him. The tree is kermes oak (Q coccifera).

Source: photo taken by the author, July 2010

In other parts of northern Greece in the Pindos Mountains, kermes oak bushes were also used for stall-feeding and deciduous trees were used for leafy hay making (Halstead 1998, Halstead et al. 1998). This has not been recorded in Psiloritis, probably because of the less severe winters that did not require leafy hay making. Moreover in Crete less deciduous trees are found compared with Pindos. Halstead (1998) recognised the importance of leaf-foddering in shaping the recent landscape of the area of Plitaki in Pindos.

8.7.4 Trees browsed by goats

Although, several interviews supported the existence of leaf fodder collection there were a few examples where this was not a common practice. Definitely areas with less forest were not used extensively for leaf fodder collection as the existence of enough trees is essential for this activity. For example in Anogeia village the absence of substantial ancient trees and the lack of extensive forests, did not create opportunities for leaf fodder collection:

> Ε: και ξέρεις αν οι βοσκοί κόβανε καθόλου κλαδιά;
> Δεν κόβανε, το πουρνάρι τώρα το ραβδίζανε. Για το βελάνι. Ελάχιστο τότε, δηλαδή για να κόψει να φάει, να χορτάσει το κοπάδι όχι, δεν υπήρχε μόνο το βελάνι.
>
> P: Do you know if the shepherds cut branches?
> An3: they did not. Kermes oaks were threshed. For the acorns. It was not much at that time. However, to cut and feed the animals (leaf fodder), to be enough for the herd, no, only the acorns.
>
> An3: 84, M, Tavern keeper

Moreover, the gradual abandonment of this practice, as a result of modernization and shift to a more sheep-based husbandry, made some interviewees forget about this practice or not to have seen it even in areas such as Gergeri where it was often applied. For example an interviewee in his mid 50s from Gergeri did not recall shredding or pollarding trees when he was a shepherd in his 20s. Even his wife, a shepherd's daughter herself, who had spent several periods in the mountain, did not recall this. On the other hand, she was familiar with another procedure, of the goats browsing the trees themselves:

> Ρ: Και δεν μου λες οι κτηνοτρόφοι έκοβαν καθόλου κλαδιά για να ταΐσουν τα ζώα;
> G15: Μπα δεν πιστεύω. Όι. Ντα είχανε σαρακάκια τότες σας;.
> G16: Δεν το θυμούμαι ποτέ.
> Ρ: Γιατί κάποιοι μου είπαν ότι κλαδίζανε τον πρίνο.
> G15: Μπορεί και να τον εκλαδίζανε.

G16: Μήπως είχανε πιο πολλοί πολλές αίγες εξεπήτιδες για να κλαδίζούνε μοναχές τους; Πιο πολλές αίγες θυμούμαι 'γω και 'χαμε. Να κόβουνε κλαδιά δεν θυμούμαι ποτέ τον πατέρα μου.

P: Can I ask you if the shepherds cut branches to feed the animals?
G15: No I don't think so, they didn't even have saws at that time.
G16: I cannot recall something like that.
P: Some people told me that they did.
G15: They may cut branches.
G16: I think that goats were more because they were able to collect leaf fodder themselves. I remember that we had more goats (than sheep). To cut branches I don't remember my father doing it.

G15: 50s, M, Electrician/ G16: 41, F, Agronomist

The ability of the goat to climb on the tree and eat the leaves reduced the number of trees to which pollarding could be applied. The use of the trees by the goats themselves, also meant that there was no need for leaf fodder collection (Figure 8.22, Figure 8.23, Figure 8.24).

On the other hand, the climbing of goat in the trees was not always seen as positive and shepherds did not necessarily promote it according to a 78 year old shepherd from Gergeri, as it often resulted in a loss of capital for them. This is in contradiction with Zacharis' (1977) observations in eastern Crete, where he noticed that shepherds put stones and chopped the trunks of kermes oak, to help the goats climb in the trees. However, such practices were not recorded in this research in eastern Psiloritis and a shepherd from Gergeri rejected the idea:

P: Εσείς σαν βοσκοί βάζατε πέτρες για να μπορούν να ανεβαίνουν να τρώνε πάνω στα δεντρά;
G6: να βάλουμε δυο πέτρες να βγούμε να τονε ραβδίσουμε, κιαποκιας την πέτρα την εβγάναμε. Όι δεν εκάναμε εμείς τέτοια. Ντα εμείς δεν εθέλαμε να βγαίνουνε οι αίγες γιατί είχαμε απώλειες. Κανείς βοσκός δεν πιστεύω πως έκαμε πρόβα να βγαίνει να βόσκετε η αίγα γιατί ήτανε να την κρεμάσω μοναχός μου.

P: Did shepherds put stones, so that goats could climb on the tress?
G6: We put some stones so that we could reach the tree and thresh it, and then we will remove the stone. We did not do such a thing. We did not want the goats to climb, because we had a loss. No shepherd in my opinion would ever try to do something like that, to allow the goat to climb graze the trees, it was like I wanted to be hanged.

G6: 78, M, Shepherd

Moreover, the amount of time and effort that shepherds should spend discouraged them from shredding or pollarding the trees. Gradually, the effort of pollarding and the introduction of commercial feed reduced this management practice.

Figure 8.22: A goat browsing kermes oak in Viannos area in east Heraklion.

Source: H.F.D. digital archive, photos taken by the author November 2003

Figure 8.23: Young kermes oak (Q. coccifera) browsed by goats. The trunk of the tree is used by the goats for climbing.

Source: photo taken by the author, August 2009

Figure 8.24: An ancient Kermes oak (Q. coccifera), that goats still climb, is naturally pollarded. This type of tree was not useful for leaf fodder collection.

Source: photo taken by the author, July 2010

As mentioned previously, there are several risks associated with climbing goats. In several cases they were trapped in the branches of kermes oaks by their horns and could not escape. They finally were left dead hanging from the trees. This was common and was recorded in a traditional couplet by local people, referring to the villages of the eastern slopes of Psiloritis Mountain.

> Γεργερη Νύβριτος Ζαρός, Βορίζα και Καμάρες, εκιά το τρώνε το κριγιάς που δεν το τρώνε οι σκάρες.
> 'Gergeri Nyvritos Zaros, Voriza and Kamares, it is there that they eat the meat that even vultures do not eat'.

Most of Cretans believe that this refers to the poverty of these villages and as a consequence people were eating even the worst quality of meat. However, after several conversations with locals, they explained that the couplet actually refers to their custom to eat the meat of the goats that were left dead hanging in the trees. This meat could be found several days after the death of the goats, thus in the couplet they are compared with vultures.

Currently shepherds, occasionally still pollard trees and use leaf fodder for their flocks. It is not as common as it was in the past, but traces of this

management practice can still be found in the area as we can see in Figure 8.19 and Figure 8.25.

Figure 8.25: Maple (Acer creticum) where a few branches have been cut recently for leaf fodder collection.

Source: photo taken by the author, January 2010

8.7.5 Pollarding system

The system of pollarding the trees was recorded in the foresters' report of 1930. There they noticed that villagers pollarded forest trees, especially kermes oak, in a similar manner to olive trees:

> In the past, even these remaining trunks of kermes oak were lopped, influenced from the customs of lopping old olive trees. All of the oaks have now re-sprouted. However, when Forest Commission involvement became stronger, this was forbidden, and it is still forbidden as it is illegal and dangerous for the health of these sparse trunks (RGC4).

This system of ancient olive tree pollarding was very common in the villages of Psiloritis and normally was applied to the trees every 5 to 6 years (Arvanitis 2008). The same procedure was followed for kermes oaks, however, with a longer rotation, as in the forest people had access to more trees and could allow longer periods of re-growth. Olive trees were pollarded to increase the yield of olives, kermes oak to increase the foliage and acorn production:

As1: Τις κλαδεύανε τις ελιές ο πατέρας μου αλλά και άλλοι αθρώποι. Μετά το κλάδεμα, έβαζαν γκουανό. Κυρίως τα ξεράδια αλλά και τα μεγάλα κλαδιά που έβγαιναν πολύ ψηλά. Τις κλάδευαν κάθε τρία χρόνια, όσο πιο πολύ τις κλάδευες, τόσο πιο καλές ήτανε. Περνούσαν όμως και πέντε και δέκα χρόνια, και δεν τις κλάδευαν γιατί ήταν δύσκολο. Να κλαδεύουν. Δεν τις κλάδευε και όποιος ήτανε,. Ο πατέρας μου είχε πάει και είχε μάθει. Τις πιο πολλές φόρες έβαζαν μάστορα να τις κλαδέψει. Τις αραιώνανε και τους πολύ ψηλούς κλάδους τους έκοβαν και σε τρία χρόνια γίνονταν πιο καλές.

As1: We lopped the olives, my father and others. After they were lopped we fertilized them. They cut mainly the dead branches and other branches that were very tall. They lopped them every 3 years, if you lopped them regularly, they were better. It could though be every 5 or 10 years because it was a difficult procedure. They should be lopped only by specialized people. My father learned how to do that. Most of the times a specialist should do that. They spaced them and they cut the very tall branches and in three years they were better.

As1: 63, F, Farmer

It seems that in the 1930s leaf fodder collection from kermes oak trees was legally forbidden. The degree to which this was widely enforced is not clear. Presumably, villagers could be prohibited from doing it on a large scale, but they might continue cutting a smaller number of tree branches that would not leave a significant visual effect on the tree. Oral history suggests that trees were not pollarded in a 'heavy way', meaning cutting all the foliage of a tree, as it is shown in Figure 8.26. In this case we should consider a 'light pollarding' left the tree with several branches. It is a mixture of pollarding, lopping and shredding at the same time. This system was also used for ancient olive tree pollarding, as has been described in the previous interviews (Figure 8.27).

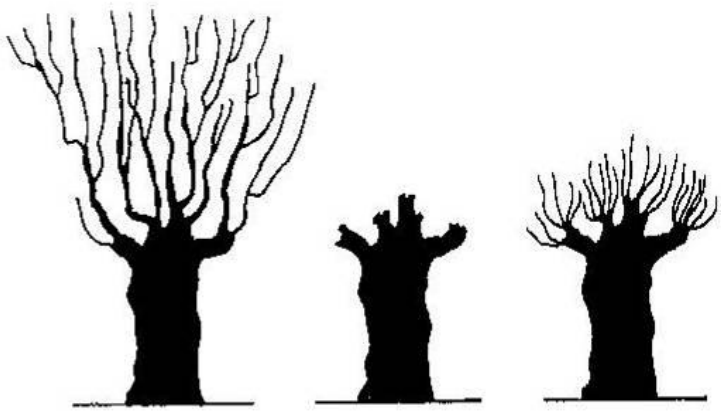


Figure 8.26: 'Pollarding. Each tree is shown before cutting, after cutting, and one year after cutting'. (Grove and Rackham 2001, p.48).

Figure 8.27: Ancient olive tree in Asites village, recently pollarded.

Source: photo taken by the author, July 2008

On the other hand, pollarding maple was not considered to be a negative element by forest officials. In the same report (1930), they wrote that:

> Related to grazing is leaf fodder collection, and especially from maple. However, as a result of the general conditions, it seems it is the only economical use of this species, thus, it (leaf fodder collection) cannot be classed as harmful or dangerous (RGC4).

The importance of maple for leaf fodder collection was noticed by forest officials in the 1930s. Moreover, their flexibility in management solutions, and their notion of production from the forest, led them to propose the continuation of this practice on maple. Kermes oak on the other hand, was regarded as more important for charcoal and acorn production, thus leaf fodder collection was not an important income for that species. In addition, the fact that they did not find any natural regeneration of kermes oak, but they recorded such for maple, supported their decision to applying different management practices to these two species regarding leaf fodder collection (RGC4).

Later in the 1960s, the Forest Code was developed and there was a special section for leaf fodder collection. Although, one might expect that at that time foresters would regard cutting branches as a negative element for the trees and the forest, this was not actually true. The Forest Code of 1969, included such characteristics and this predates the more recent

recognition of the importance of pollarding and shredding in recent decades by several researchers as an element of landscape value, biodiversity and beneficial management of ancient trees, that could be crucial for their survival (Rackham 2003, Butler et al. 2001). It is also important to mention that in this code, social and traditional factors are taken into consideration as leaf fodder collection is described under the Greek word of 'kladonomi', meaning 'collecting branches' which is very close to the Cretan term for leaf fodder collection, 'kladizo'.

Article 112: 'Kladonomi' (leaf fodder collection)

> 1. Leaf fodder collection is prohibited in public or non public deciduous oak forests, beech, chestnut and pine forests for feeding the livestock, and the Head Forester is able to issue a restriction which will mention the prohibition, regarding time and place.
> 2. In exceptional circumstances it is possible to allow leaf fodder collection, free of taxation, in the forests … , and in areas, where that was implemented in the past, only when the trees are very old, deciduous, and leaf fodder collection is already practised … and after they have been marked by the relative forest officials (Greek Kingdom 1969, p.57).

So the Forest Code of 1969 did include elements of ancient tree conservation, however, it was the responsibility of the Forest personnel to recognise and apply this in forest management. Moreover, in 1930 foresters in Crete did realize the importance of leaf fodder collection from maple and supported a continuation of this management.

8.7.6 Damaging the trees.

The majority of the shepherds consider that this management of the trees is positive for the tree itself. They think this type of management should be continued and that the trees today do not look as healthy as they were in the past. Moreover, oral history provides evidence that pollarding resulted in more acorn production from kermes oak, as with ancient olive trees:

> G9: Τι λες μώρε Γιώργη δεν εκόβγαμε; και πρίνους και κλαδί στα ζα μονό ένια σου κιαποκιά κρατούν ακόμα αλλιώς θανήτανε όλοι ξεραμένοι.
>
> G9: Well George, we cut kermes oak and branches, and that's the reason that they are still alive, otherwise all of them would have been dead.
>
> G9: 60s, M, Shepherd

> Η2: Πάντα, αυτό (κλάδισμα) γινότανε πάντα. Κλαδίζανε, άρα στην ουσία κλαδέβανε τα δέντρα, ήτανε μόνο καλό, δεν βάζανε το δέντρο κατω, κλαδέβανε τα κλαδιά και δίναντος, άρα στην ουσία γινότανε ένα κλάδεμα και μια ανανέωση του δέντρου.
>
> H2: Always, this (leaf fodder collection) was happening always. They 'kladizo' so actually they were lopping the trees, and it was positive, they did not cut the

> whole tree, they trimmed the branches, so actually they did a lopping, a renewing of the tree.
>
> H2: 45, M, Veterinarian

There is a connection between these ideas and the problems of reduced productivity in ancient olive trees and their gradual replacement with a modern variety. A 66 year old farmer from Ano Asites village mentioned that when ancient olives were not pollarded, they died. However, people realized that and the ones that were pollarded are very green and healthy today (Figure 8.27):

> As6: Τσοι χοντρολιές δεν τσοι κλαδέυανε. Τσοι αφήνανε και ψηλώνανε και για κιονα στο τέλος εξεραθήκανε. Κάποιοι τσοι κλαδέψανε και τώρα ξανανοίξανε. Αυτό έπρεπε να έχει γίνει από παλιά.
>
> As6: The chontrolia (ancient) trees were not pollarded. They let them grow in height and for this finally, they have died. Some have pollarded them (ancient olive trees) and now they have grown again. This should have been done in the past.
>
> As6: 66, M, Farmer

Pollarding by shepherds was a type of forest management. This made shepherds consider themselves as the conservationists of the forest. This is in contrast with what a forester would assume, as grazing and browsing are most of the times considered enemies of the forest. Grazing along with other factors is connected to and blamed for degradation, forest ecosystem collapse, desertification and all the negatives that did not allow the 'primitive' forest in Greece to develop. However, local people from the Psiloritis area, mainly shepherds, regarded themselves as the protectors of the forest that the rest of the population wanted to destroy. Not only by protecting individual trees but also by applying management to them, they actually helped the forest, according to their observations on nature:

> G6: Είναι πολλά δεντρά (εννοεί στο δάσος του Ρούβα) και φταίει η κτηνοτροφία. Τα κλαδεύαμε εμείς, και εμείς εκλαδεύαμε δεντρά, και αναπτύσουντανε, ύστερα ενοίγανε και ήτανε το πιο πολύ επικαρπία ας πούμε, ήκανε άμα το κοβες και ήτανε καλό και για το ζώο απου εβόσκευε και αυτό που έγένα καρπό και έκανε πιο πολλά βελάνια. Γιατί ήτονε, όχι βαριά δηλαδή σαφή είχε το βουνό βελάνια, εδά όμως που δεν το κόβουνε δεν καθαρίζετε δεν… αλλά να μην το κόβεις από τον πάτο. Κατάλαβες; Ε το συντηρούσαμε ας πούμε εκεί…
>
> G6: There are lots of trees, and it is because of animal husbandry. We lopped them, and they were helped to grow. And the yield was better. If you cut it (the tree), it was productive, it was better for the grazing animals, and for the tree that was able to produce more fruits. Because in the past in the mountain there were always acorns, but now that they stopped cutting, they do not clean it, it has not. But you should not cut the whole tree from the base. You know what I mean, we conserve it there.
>
> G6: 78, M, Shepherd

8.7.7 Leaf fodder, an alternative forest management

Leaf fodder collection and the feeding of grazing animals were interconnected in the area of Psiloritis. There is no evidence of leaf fodder collection in the uplands for commercial reasons or storing, but fodder was consumed immediately after the collection and thus used locally. This management, 'kladizo' had been used by local people, mainly shepherds, over centuries, and its origins are lost in the past. Leaf fodder was appreciated for its nutritional values and it could provide fresh green feed during the crucial dry period of the summer. Hence, it was often used by individual shepherds for specialised uses, such as controlling the flock and fattening young goats.

Although, this type of fodder was not considered as essential for the survival of the livestock, it had a significant influence on the forest itself. The existence and survival of ancient trees in the forest was closely connected to shepherds' management practices of individual trees. Several researchers have suggested that ancient trees are actually ancient because of traditional management practices, and that when these were abandoned the trees gradually died (Petit and Watkins 2003, Rackham 2003, Butler et al. 2001). Although today, the majority of the trees seem healthy and their growth is significant, we cannot assume that in the future they will not collapse and die. The gradual abandonment of pollarding could decrease their ability to re-grow and could result in their natural death. Pollarding preserves the ability of the tree to re-sprout and 'remember' its genetic code of youth.

Managing and pollarding the trees can be divided into three main categories: pollarding, tree browsing and semi-pollarding. The first category has been recognized by Rackham and regards the removal of the entire tree stem but not at ground level. This according to interviewees was not common in the area of Psiloritis; however, characteristics of several ancient trees support that this was in fact actually used sometime in the past. The second case has also been recorded by Rackham and it is common in Crete today (Figure 8.24). The third case is actually a mixture of shredding and pollarding, where after pollarding someone cannot visually recognise the effect of branch cutting (Figure 8.25). This was the common practice in Psiloritis according to oral history information and the foresters' report of 1930, which mentioned pollarding and that all the trees had totally re-sprouted. This ability to manage the forest and not leave visual effects on it is one of the fundamental forest management principles

(Ntafis 1990) and this semi-pollarding method as it was implemented in eastern Psiloritis Mountain could be adopted by modern forestry.

8.8 Interactions of Forest Service with Shepherds

The relationship of forest officials with grazing animals is twofold. The one is that nomadic grazing is closely related to forest studies in Greece. The other is that pastures are regarded as forested land under the constitutional management and protection of forest law. In the management plan of 1930 foresters took into consideration the value of the forest for animals (RGC4). Thus, forest personnel were mainly regarded in positive terms by shepherds. The Forest Commission especially after the 1970s, created water tanks, roads and so forth, under the term 'improvement of pastures'. Financing was supported by central government policies and implemented through the Forest Service (HFDA9). Shepherds realized that they could have roads next to their 'mitato', water for their flocks, all provided through the Forest Service. With the help of local authorities, they applied pressure for more 'pasture improvement', and even local communes implemented such work under the supervision of the Forest Service, when they had necessary funds.

In one of their forest plans, in 1985, foresters suggested that a forest road should be constructed in Psiloritis and specifically in the pastureland of Nyvritos village. One reason was that:

> the access works will help to transfer construction materials for the water works, the transportation of animals, dairy products, feeds and shepherds. The water works will ensure the necessary quantity of water for the animals and their equal distribution in the pasture, so that the concentration in a few spots of a huge number of animals will be avoided and also their movements over large distances in order to find water. With the access and water works husbandry production will be increased and the standard of living of the shepherds will be improved (HFDD29).

From this document it is clear that road construction, which later became a problem and several ecologists regarded it as catastrophic for the natural environment, was a strong political target. Forest roads were strongly connected with grassland improvement. It was important for shepherds to have better accessibility to their pastures. This forest policy resulted in an extended road network, of several kilometres in Psiloritis Mountain that changed its previous isolated status (Xirouchakis and Nikolakakis 2002). The mountain is not anymore an inaccessible area, a mysterious refuge where formal state laws could often be avoided.

Moreover, forest roads helped the import of more and more feed that helped to sustain large flocks. The Mountain is not anymore a reserve that could provide free feed for grazing animals. Overgrazing is in fact a result not only of the subsidies that provide the necessary capital for feed that allows large flocks, but also of recent forest policy. Forest policy provided the necessary funds for road construction that resulted in greater accessibility of more and more isolated mountainous areas.

Forest Service archives suggest less conflict in the past with shepherds than with other villagers. That gradually changed, and today the majority of forest offences are connected with shepherds (HFDA2, 3). Overgrazing was not a problem in the past, as it seems to be today. Moreover, several current forest policies are connected with forbidding grazing connected with forest fires. If a forest fire occurs in forested areas then a direction is issued from the Forest Service forbidding grazing for several years. Hence, more land is under prohibition of grazing (Figure 8.28) and often shepherds disregard this and graze within the burned areas and this produces conflicts (HFDA3, 11). In addition, the creation of new forests and the increase of forest land, especially close to urban areas is a current policy target. As a consequence, plantations have been established in former pastures, and often shepherds graze their animals in them and that creates more conflict.

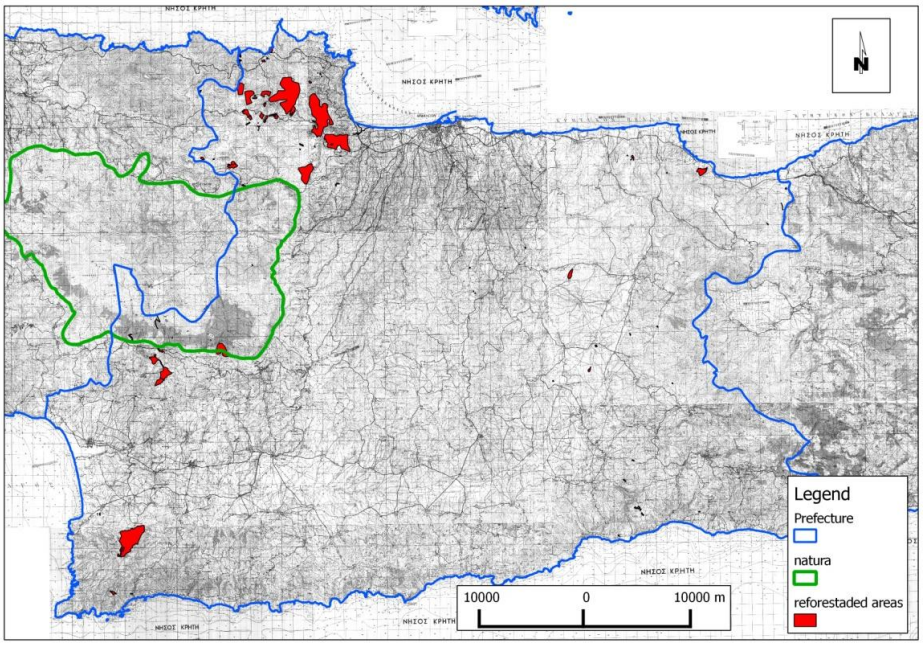


Figure 8.28: Areas that are under forest law protection and called reforestated in Heraklion Prefecture. Grazing can be forbidden for several years.

Source: Map drawn by the author using QGIS, information for the reforestated areas were obtained from forest maps from HFDA11

8.9 Contemporary grazing practices

Current EU policy and the Common Agricultural Policy (CAP) have influenced grazing practices in Greece. Lorent et al. (2009, p.1) note that 'The Common Agricultural Policy (CAP) subsidies of the European Union (EU) have been pointed to as a potential driver of livestock growth and consequent increased grazing pressure' and that this 'has led to land degradation in Greece.' Greek agricultural policy is strongly influenced by the CAP and very recently there has been a new focus on environmental conservation (M.R.D.F. 2011). Officially the M.R.D.F. (2011, p.1) states that:

> the rural development policy for Greece is implemented through the Rural Development Programme 2007-2013 (RDP) focusing on the following Axes: AXIS1: Improvement of the Competitiveness of the Agricultural and Forestry Sector, AXIS2: Improvement of the Environment and the Countryside, AXIS3: Quality of Life in Rural Areas and Diversification of the Rural Economy, AXIS4: Implementation of LEADER Approach.

However, these policy targets are at a very general level and there is hardly any direct mention of livestock, which is included as a small part of the general plant crop sector (M.R.D.F. 2011). Moreover, this document misses the fact that since 2010 the forestry sector has been moved to a different Ministry, the Ministry of Environment (M.E.C.C.). This institutional separation of forestry from agriculture may well make it more difficult for future cooperation between them regarding, for example, policies towards livestock numbers and grazing.

Livestock policy is still under the umbrella of the CAP and Greek Agricultural policy fails to establish a clear local policy specifically for this sector. As a result livestock policy is still implemented through the two main subsidies that were mentioned in section 8.5 of this chapter. For example the ewe premium in 2006 was 16.8€ per head of productive animals and this could be increased by an extra 7.95€ per head in the mountainous areas, making a total of 24.75€ for each mountain sheep. This policy does not appear to recognise the implications of the resultant pressure to increase stock numbers on the quality of grazing pastures and the adverse environmental side-effects (Canali 2005 and District of Crete 2006). Moreover the LFA subsidy connected with grazing pressure and livestock density has promoted the cultivation of fodder, mainly consisting of barley, so that farmers can prove that they have enough productive space for their animals and gain the maximum of the LFA subsidy (Lorent

et al. 2009). But again, the environmental consequences of increased barley production have not been brought into the equation. So although forestry may not be connected with the CAP directly, CAP policies, especially those on livestock, have a big influence on forest conservation.

Contemporary shepherding, strongly influenced today by the CAP subsidies, is still based on the traditional grazing system. For example several shepherds still move their flocks from the uplands to the winter pastures, they still make cheese in their 'mitato', they still collect fodder from trees, and they have the same type of animals, goats and sheep. Although the current system is based on the traditional grazing method, several differences occur. The socio-political circumstances have dramatically changed over the last hundred years and shepherding is highly influenced by these changes.

The biggest change in the current environment is the accessibility of uplands, especially in islands, such as Crete, where uplands are a few kilometres from lowlands. In the past the absence of transport vehicles and a road network made transhumance a necessity for economically sustainable flock management. There was a need to exploit natural resources whenever and wherever they were available.

Today there is no need to collect fodder from the mountain as olive leaves are available from olive cultivation. Shepherds collect the cut olive tree branches or the leaves from olive harvesting and carry them to the mountains to feed the animals. Even goats and sheep have changed their behaviour and reactions. In the past they were used to the sound of the axe and moved to the tree that was cut. Now they are used to the sound of the shepherds' cars and their klaxon and come close to the road.

> K1: Εδά κουβαλούνε τα φύλλα των ελιώ, με το αμάξι ντος και τα πάνε στο αόρι.
>
> K1: Today they carry (shepherds) the leaves from olives with their cars and brought them in the uplands.
>
> K1: 77, M, Shepherd

Today the main product of the flock remains milk used for cheese making but the big difference is that almost all the milk is transferred and sold to cheese factories. Cheese making in 'mitato' is abandoned at least for commercial purposes.

However, the recession that Greece is facing today has already influenced the shepherds. Today, more than during the last decade, shepherds tend to return to more traditional practices, such as cheese

making and leaf fodder collection. This may help them to gain more profit from products, such as cheese, and reduce the amount of concentrates for feeding their flocks. As a result of this, early in 2011, shepherds of Heraklion created a cooperative called 'Cretan Mitata' and they will sell their own products to the consumers without any mediators and agents (Lasithiotaki 2010, Patris 2011a). Traditional products are highly appreciated in Crete today and several networks of local producers have started operating. In Psiloritis one of them is called 'Tastes of Psiloritis' (Psiloritis Natural Park 2011). All these current trends and the value that traditional products are gaining could help animal husbandry to survive and flourish.

Furthermore, new regulations will influence shepherding in the near future. The absence of an effective cross referencing system that did not exist in Greece for several decades seems to have come to an end. New technology and applications will bring back a cadastral system like that of the Ottomans who effectively controlled the lands they had occupied, mainly for taxation reasons. This will verify and will apply a new environmental policy targeted from the EU, and adopted by the Hellenic Republic. Almost all the uplands areas and winter pastures as well, are NATURA 2000 sites (Figure 8.29). This in the near future will result in regulations imposing a maximum allowed number of animals (M.E.C.C. 2011a, M.R.D.F. 2010).

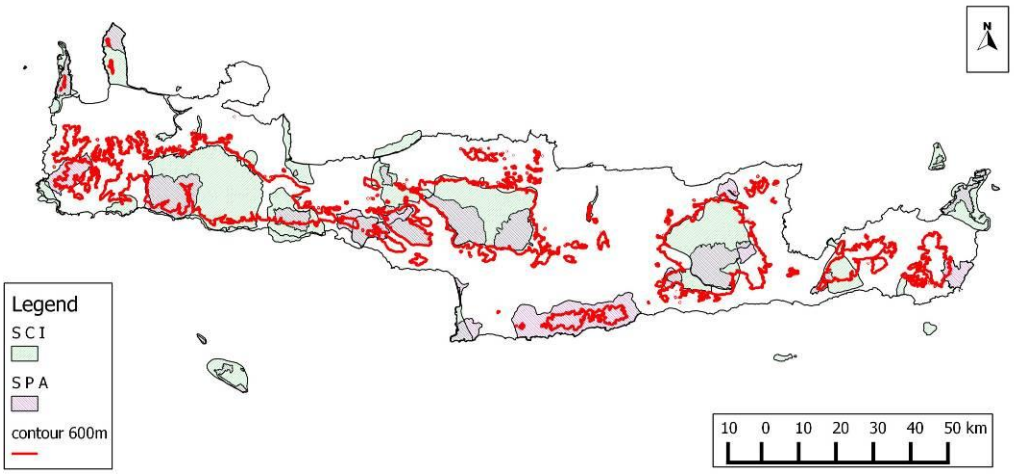


Figure 8.29: Crete, with NATURA 2000 sites. Sites of Community Importance (SCI), Special Protected Areas (SPA) (M.E.C.C. 2011a). The contour of 600m is also shown.

Source: Map drawn by the author using QGIS

8.10 Conclusion

This chapter has argued that grazing has a long presence in Crete and vegetation has an inherent resistance to it, not necessarily connected with the shepherding tradition on the island. Husbandry has a history of more than 5,000 years and is connected with the first civilisation and human settlement that introduced ovicaprid farming.

Transhumance was the traditional livestock practice, along with household livestock breeding. Today household livestock has declined and transhumance is still applied in a modern way, however it is not used extensively. In addition new semi-intensive practices have been introduced, mainly in the middle elevation zones, whereas in the uplands transhumance still survives. Recent decades have been characterised by the complete disappearance of cattle and other animals, such as mules and donkeys from the uplands.

The huge increase in sheep and goat numbers over the last three decades was strongly influenced by the CAP. This resulted in a dependence on concentrates that is often connected with higher costs to maintain large flocks. Flocks were generally managed for milking over the last hundred years and the final product was cheese making. Shepherds were organised in a coop, called 'mitato', for these purposes. Meat production was a sub-product of milking. Today shepherds are still focusing on milk production, although not on cheese making on the spot. The most recent trend is a new type of cooperation based on marketing local products.

Grazing itself has influenced and is still influencing the forest. Leaf fodder collection, a traditional form of management which has gradually disappeared, had a strong influence on forest trees. This management should be evaluated and integrated into modern forestry for the conservation of ancient trees.

Shepherding as a result of the CAP and global market influences is facing a transitional stage today. Adapted management practices from the past may become more important as result of the rapidly changing socio-economical factors that influence Greece today. Recession and the new CAP regulations that will be introduced in 2013 may result in a need to use these past management practices and to exploit natural resources more efficiently. This is important for forestry as grazing is highly connected with forest management in Crete and forestry should take advantage of this and interact in a positive way with shepherds, the main users of the uplands.

Introducing a new type of management could help to conserve the forest, and reduce conflicts with shepherds which occasionally exist today.

Chapter 9: Contemporary Forestry in eastern Psiloritis

9.1 Introduction

The forest complexity and the slow growth that characterises Cretan forests, often creates problems in forest management. In order to understand forest ecology and current forest structure, detailed local research is needed. This has not yet been recognised by foresters and this creates several problems and failures in modern forest works.

Forest works generally in Heraklion are focused on forest road construction, improvements of pastures, plantations as well as pathway development and forest recreation. The fact that forest management for timber is not applicable in Crete as it is in continental Greece, has resulted in the neglect of Cretan forests and their value and their characterisation as unproductive. Thus an absence of management creates an ambiguity over what type of forest works can be implemented in Cretan forests and often these small scale interventions fail to reach their targets.

9.2 Micro scale analysis with the use of aerial photography

In this section, four case studies (Figure 9.1) within the research area were studied through objective analysis, mainly based on aerial photography and satellite imagery, integrated with GIS analysis. These four sites were selected because they represent different management forms implemented in the past and are also sites of various forest types. Particularly, Lakkos-tou-Rouva, appears today with a different forest type from the surrounding area, the view of Lachtaridias, is a location where photographs are available for a series of years, thus comparison can be applied. The third area, Prinos, is an abandoned grain cultivation site in the uplands, next to the forest and the fourth is a pine forest where all the remaining areas are occupied by broadleaved species.

Analysis of these four case studies will help to understand what elements influenced vegetation evolution and the reasons that specific forest types occur in the area today.

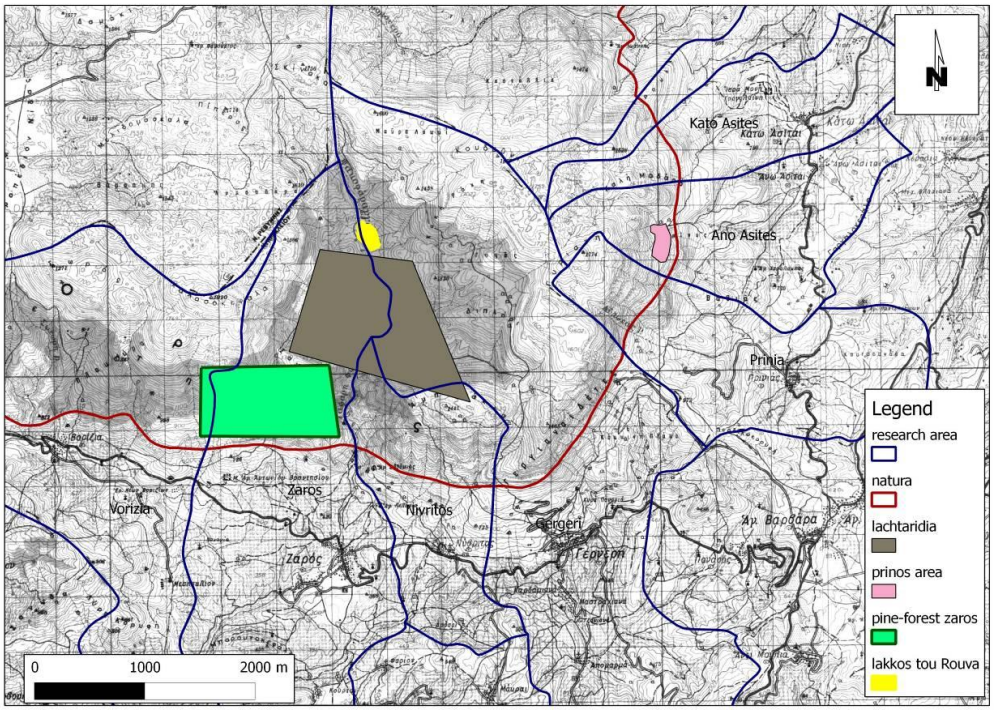


Figure 9.1: Location of the four case studies.

Source: Map drawn by the author using QGIS

9.2.1 Case study 1: The lakkos-tou-Rouva area

Lakkos-tou-Rouva is located in the northeast boundaries of Gergeri commune and Zaros commune (Figure 9.1). In the site of Gergeri, mysteriously, a relatively flat area is missing dense forest whereas the neighbouring areas include denser forested vegetation. Initially, when the area was visited by several foresters, including myself, in 2000 for the needs of an EU funding project, Life '99 (E.C. 2011a), it was speculated that a different soil type could be the result of such a phenomenon. This relatively small area, surrounded by forest, more or less dense, has an appearance of a very dry soil type, and there you can find *Cistus* species widely spread. Several individual young trees are found, from the same species as the nearby forest (*A. creticum, Q coccifera, C. sempervirens, P. latifolia*), and also some *Pyrus sp.* grafted in the past; however, today only some of them retain the grafts and survive (Figure 9.2).

Cistus species under the canopy of the forest is rare and that can be easily explained by the ecology of the species and is not necessarily connected with the soil type. *Cistus* likes sun, something difficult to find under dense forest cover. However, it was difficult to explain the fact that forest was absent from this site. It was assumed that a different soil type from the rest of the area, probably acid soil, was present as this type is

favourable to *cistus* species found there, and that was the reason of this differentiation.

Figure 9.2: Dead pear tree (Pyrus sp.), in the area of 'Lakkos-tou-Rouva', the species that survived from the clear-cutting in 1930.

Source: photo taken by the author, August 2010

The examination of environmental data did not show any differentiation from the surrounding forested areas; the soil type was common to a large area and it is limestone. In addition, slope and elevation is partly more favourable for Lakkos-tou-Rouva, and there are no climatic variations to the nearby forest (Figure 9.3).

In the management report dated on 1930 for the forest of Rouvas, the site of Lakkos-tou-Rouva, is mentioned and it was the main reason for the foresters of that time to visit Rouvas forest in the Gergeri commune. According to the archival information, the commune council asked for foresters' help, in order to manage their woodland efficiently. Under this formal inquiry was hidden another request. In this report it is mentioned:

> Today, the cooperative asking for the compilation of a management report, aimed not in the normal economical income, but on two things: a) at the community satisfaction of this need b) and mainly at the logging of as much as possible amounts (if they have the approval through logging tables) so that through this income, they could be able to pay the expenses of the new educational building that its construction just started (RGC4).

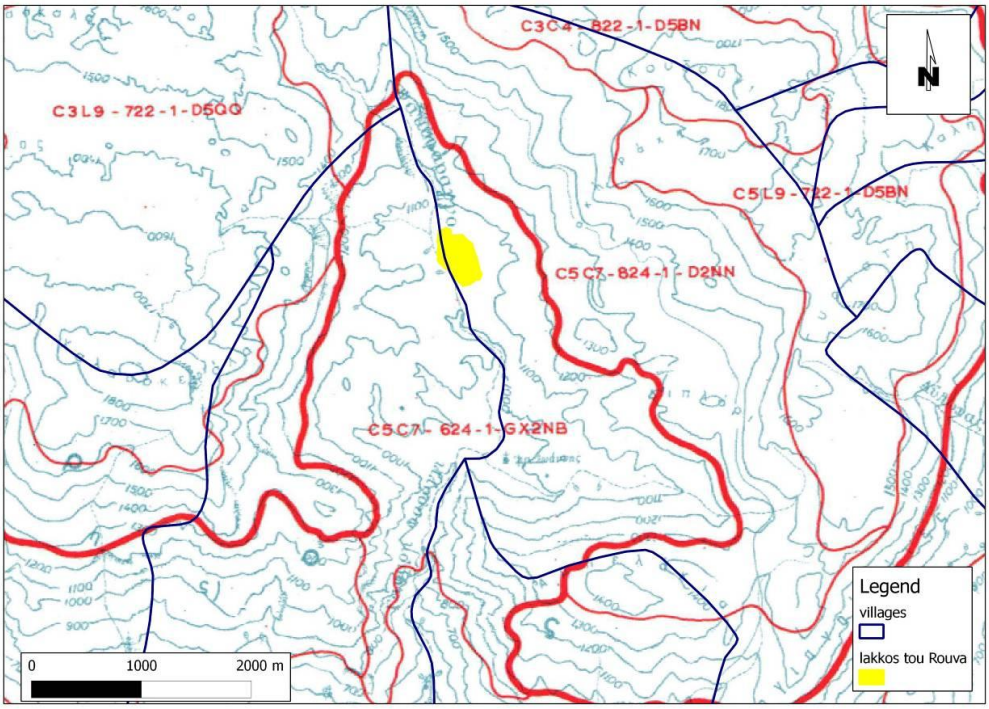


Figure 9.3: Geological map, overlayed in GIS with the site of Lakkos-tou-Rouva. The geological data regard a similar type of soil. C5C7 code indicates hard limestone in middle and lower slopes.

Source: Map drawn by the author using QGIS. Information regarding soil data was derived from Soil Map of Greece (Forest Service 1997).

It seems that since the establishment of the Forest Authority in Heraklion and the existence of forest personnel in the research area since 1921, local authorities lost control of their forest production and permission had to be issued from Forest Office. For this, local authorities asked foresters, the experts, to visit their area and permit more exploitation, as sudden needs had to be satisfied and in this case it was the building of a new school. In the next section of the report it is mentioned that:

> in this forest, charcoal yield may only be allowed in the flat and earthen area of 'lakkos Rouva' where today and in the past, as the ruins of houses and threshing floors show there was an agricultural exploitation, and already they had started grafting wild pears. Thence may completely remove all the kermes oak trees, as total capital, without damaging anyone, but for increasing the productivity of this area, indicative is also the name stream-of-good-grass (RGC4).

It seems that foresters had agreed to this request of overexploitation and they tried to support their decision. Their main argument was that the area in the past was cultivated, thus exploitation with extensive clear-cuttings in a flat area, where erosion could be minimal, can be applied. Their decision could have been influenced also by local politicians who

could have received requests from the Commune Council for more forest production to satisfy their need for capital. An interviewee from Gergeri suggests that the president of the Commune of that time had connections with the political party that was in power and could influence forest officials for his benefit:

> G2: Γιατί ήταν του Ζαχάρη του Γιώργη πρόεδρος και κάνανε μιαν αιτία, ήτανε το δασαρχείο και ήτανε του κόμματος και του βάλανε και έβγαλαν άδεια και πήγανε πολλοί οι Γεργιανοί και κόψανε εκιονά. Το Ζαριανό Δεν κόπηκε, κόπηκε μόνο το χωριανό μας.
>
> G2: Because it was Zacharis of Giorgi president, and it was the Forest Authority, and he was a supporter of the ruling party and he got permission and then several people from Gergeri went there and they cut it. The area that belongs to Zaros village was not cut, only our village area.
>
> G2: 78, M, Shepherd

Foresters in their report mentioned the amounts of charcoal that could be produced:

> from the yield of this flat area that will include the nearby slopes, can be extracted (200,000) two hundred thousand okades of charcoal so with that the immediate objectives will be satisfied and for which this report was complied (RGC4).

This amount is relatively large, if it is compared it with the total charcoal production for the whole prefecture of Heraklion as it was recorded in the forest archives (Figure 4.17). In 1934 production was 141,690 okades, and the maximum charcoal production recorded in the archive was 507,872 okades in 1938 (HFDA6). This verifies the great interest of the local authorities in the exploitation of the area and the capital they could get. In addition foresters made clear that this could influence future forest production and they mention that:

> it is appropriate and necessary herein to be mentioned in the most categorical way that with the specification and the charcoal making on this flat part, will be stopped for a long time, totally and for good, the capital of all kinds of logging trade in this forest. This should be into consideration by the cooperative and the charcoal makers of the village (RGC4).

This is strongly connected with sustainable yield production of the forest as a total, something strongly connected with forest science even from its initial formation (Wiersum 1995). Overexploitation of a specific part of the forest means the cessation of forest production from the whole forest so that the total yield remains stable.

The event that changed the landscape in Lakkos-tou-Rouva area was also mentioned in oral history. Several interviewees recalled it and some of

them remember the whole procedure as it was passed to them from their ancestors. A 43 year old interviewee remembers that in early 1900 the site of Lakkos-tou-Rouva was clear-cut in order to cultivate the area:

> G5: Από ότι λένε το λάκκο του Ρούβα, αυτό λέει εγίνηκε αρχές του '900 είχανε βγει λέει και είχανε υλοτομήσει και είχανε κόψει όλα τα δεντρά, για να το καλλιεργήσουνε. Ένα τμήμα λέει βάλανε και φωτιά.
>
> G5: From what I have heard, Lakos of Rouva, that did happen in early 1900, they went there and logged, cut all the trees, so they could cultivate it. In a part of it they set off fire as well.
>
> G5: 43, M, Bee-keeper/Shepherd

Another older interviewee from the same village recalls more details of this event, and some of them are very similar to what it was reported in the 1930 document:

> G2: Ο Κυριακίδης πρέπει να ήτανε πρόεδρος όταν εκόψανε τον λάκκο του Ρούβα. Και κάμανε, πήρε μια απόφαση το κοινοτικό Συμβούλιο. Να κάνουνε λέει το λάκκο του Ρούβα, να αφήσουνε μόνο τσοι αχλάδες, να κάνουνε τύπου καλλιέργειες, να κόψουνε τσοι πρίνους. Και σημάδεψανε βέβαια, εβάλανε, σήμαδούρες, γύρω γύρω το λάκκο όλο, την πάντα τη δική μας. Ήταν όλο μεγάλοι πρίνοι, και πήραν άδεια από το δασαρχείο και τους έκοψαν όλους, εφήνανε μόνο τσοι αχλάδες και δεν ξέρω τι άλλο δέντρο αφήνανε. Και το έκοψαν εκιονα το πράμα, πρέπει να το έκοψαν και πριν του Μεταξά.
>
> G2: It was Kyriakidis at that time president of the commune when they cut the 'Lakkos-tou-Rouva'. The commune council had a decision. They wanted to cultivate the 'Lakkos-tou-Rouva' to leave only the wild pear trees, and to cut all the kermes oak trees. They marked, they put marks all around the area, on our side. There it was full of big kermes oak trees, and they had permission from the Forest authority, and they cut them all, they left only the wild pear, and I do not know if they left any other tree species. They cut all this area, they must cut it before Metaxas regime (1936-1941).
>
> G2: 78, M, Shepherd

All this information provides evidence that the forest existed in a part of the area of Lakkos-tou-Rouva that today has a different appearance, and could not be explained only with environmental information. The date that this clear-cutting occurred is unclear; however, it can be concluded that it was implemented after 1930 when the report was issued and before 1936 as it was supported by oral history.

A further analysis of Lakkos-tou-Rouva was implemented studying and analysing information of aerial photography of 1945, 1960, 1996 and 2003. This information shows how the forest in a micro scale analysis recovered or did not after a heavy and sudden human exploitation that occurred in a short period.

In 1945 (Figure 9.4) the image shows that the area lacks any trees and only a few individual ones are spotted, probably pear trees that remained

as a result of the past policy to change the forest into a productive pasture and cultivated land. The external boundary of the area follows the stream that is actually the boundary between Gergeri and Zaros communes. All the flat area to the east of the stream is left clear and the surrounding slopes are unexploited. This is the result of an action implemented almost 15 years before, and the forest has not recovered yet. Oral history supports abandonment during the German occupation of the forest, with less grazing pressure and woodcutting in the inner mountain areas, like Lakkos-tou-Rouva. This seems to have had no actual effect on the clear-cut area that retains the treeless characteristics. The same characteristics of the vegetation appear in the aerial photograph of 1960.

Recent aerial photographs of 1996 (Figure 9.5) and 2003 (Figure 9.6) show that the landscape was partially more forested than the one of 1945. Although, today locally forest is denser and clusters of trees have been developed, the general pattern is of an area with less vegetation.

In all the aerial photographs there is a stable zone with cluster of trees with more or less similar density. This zone is in parallel to the boundaries between the two Communes of Gergeri and Zaros, in the site of Zaros. The clear-cutting of the 1930s was applied only in the area of Gergeri, thus this zone survived in the commune of Zaros and remains forest today (Figure 9.6).

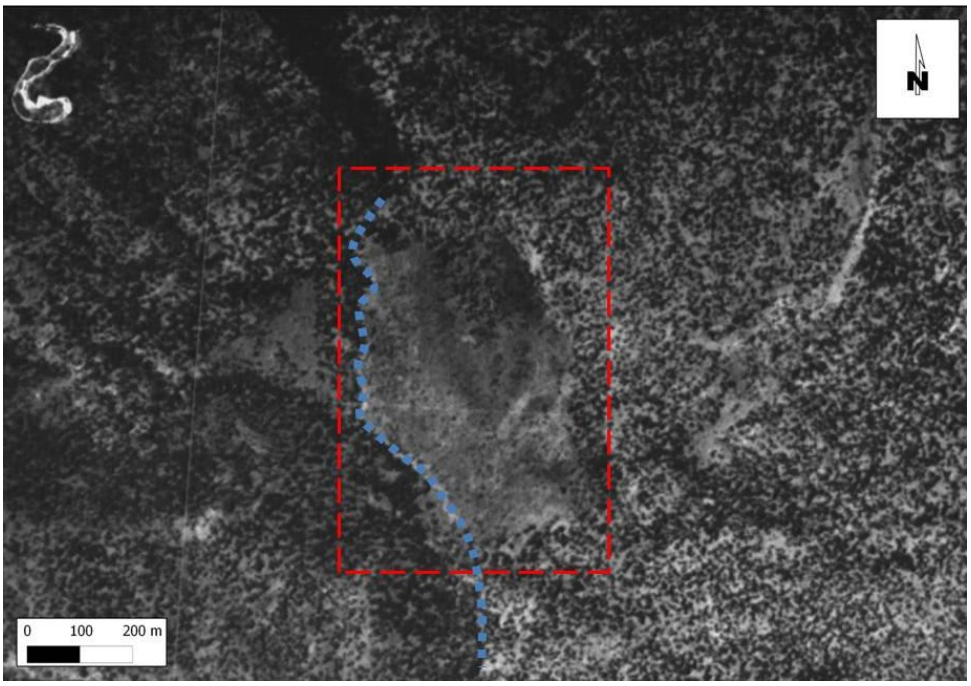


Figure 9.4: Aerial photography of 1945, where the site of 'Lakkos-tou-Rouva' is shown with red line, missing woody vegetation cover. The blue line is the border between the Gergeri and Zaros communes.

Source: Map drawn by the author using QGIS

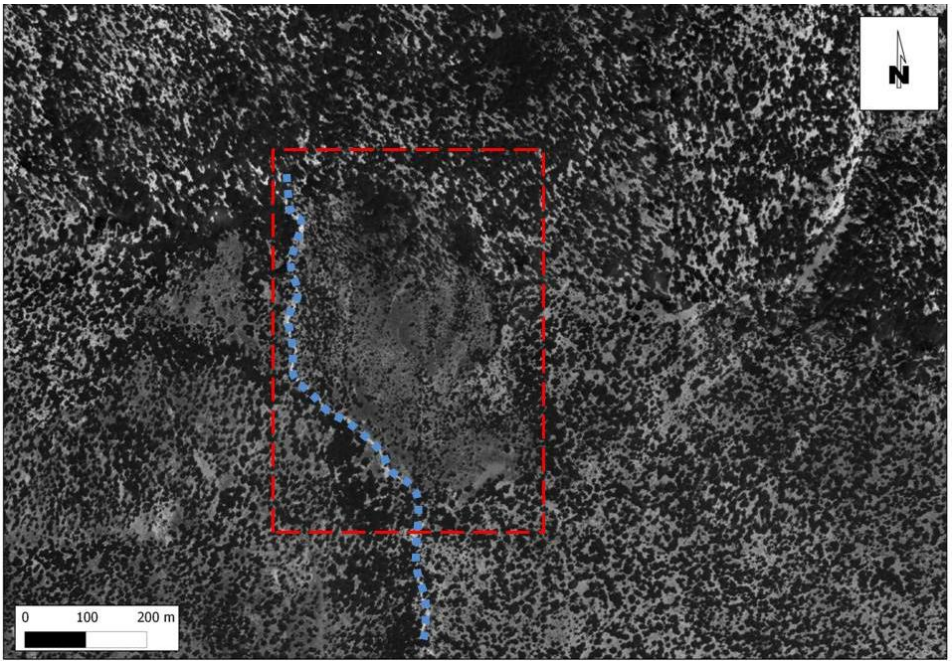


Figure 9.5: Aerial photography of 1996 where the site of Lakkos-tou-Rouva is shown with red line with more woody vegetation cover compared with 1945. The blue line is the border between the Gergeri and Zaros communes.

Source: Map drawn by the author using QGIS

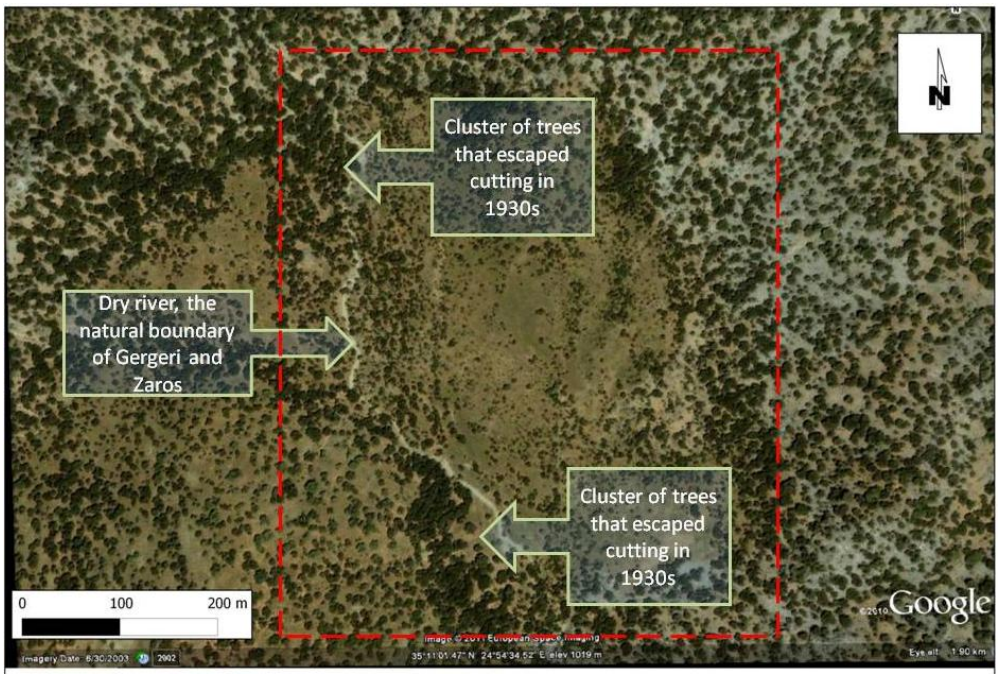


Figure 9.6: Aerial photography of 2003 where the site of Lakkos-tou-Rouva is shown, with more woody vegetation cover compared with 1945. Here the dry river is the natural border between the two Communes, Gergeri and Zaros.

Source: Map drawn by the author using QGIS

Field data collected from the area, show trees with smaller girths (Table 9.1), compared with the nearby forest and also some dead young trees (Figure 9.7). The sudden disappearance of the forest in the early 1930s resulted in a change in the microclimatic conditions that made natural regeneration very slow. Young trees are now less protected from weather conditions and especially the summer heat. Although the first impression of the area indicates that there may have been some reforestation, it seems that there are several problems associated with it.

GPS point	Girth (cm)	Species
41	73	*A. creticum*
41	66	*Q. coccifera*
41	87	*Q. coccifera*
43	82	*Q. coccifera*
44	78	*A. creticum*
46	186	*Q. coccifera*
47	268	*Q. coccifera*
47	144	*Q. coccifera*

Table 9.1: Data collection from Rouvas forest, with measurements of tree girths in breast height as they were collected on August 2010.

Source: Table drawn by the author from field data collection

Figure 9.7: Dead maple trees in Lakkos-tou-Rouva area. This is also a part of the area that was sampled and the results are shown in Table 9.1.

Source: photo taken by the author, August 2010

The analyses of different periods of aerial photography, suggests that there is a long period of forest recovery, even in areas where environmental conditions are favourable. From this micro scale analysis, it can be suggested that clear-cutting has relatively permanent results in the forests of Psiloritis, at least at the human scale of observation. After almost 80 years, the forest in Lakkos-tou-Rouvas has not completely recovered and remains an open space.

This could be due to a combination of factors, environmental, ecological and human. At least until the 1950s charcoal was produced from the forest and firewood was collected until the 1970s and an increase in grazing pressure occurred over the last decades. All these actions may have resulted in the halting of forest expansion and the area is still in a shrubby format, although individual trees seem to gradually be recovering.

9.2.2 Case study 2: The view of Lachtaridias

In this case study, information derived from photographs was studied to check current trends in a micro-scale analysis. The area looks over the Gorge of Gafari, north of the village of Zaros (Figure 9.1). Figure 9.8, taken probably in 1992, by a Forest Service employee, shows the forest and the view to the gorge. Another photo taken in 2004 from the same position was found in the H.F.D.'s digital archive (Figure 9.9). During the last field visit in 2010, another photo from the same position was taken in order to have a comparable analysis (Figure 9.10). In these photographs, several characteristics were spotted and presented on the figures. These locations are open spaces of the forest and show that they retain their character over time. The photos, that include a time span of more than 15 years show a stable landscape with limited or no change. Specifically, the area that is shown with letter (A) was found in the photograph of 1945 (Figure 9.11) and is exactly the same as it appears in the photographs and in recent digital maps as well (Figure 9.12). This is probably the result of a dynamic erosion phenomenon that prevents forest expansion.

In addition, the photographs suggest that for a period of 15 years, individual trees are shown to be of limited growth. This implies a slow growth of species in Crete that make things even more complicated. Although forests are dynamic ecosystems, this dynamism is often difficult to record within human life spans (Watkins and Kirby 1998). For example, in the research area, forest and landscape seems to be more or less stable, however, this is recorded within a period of several decades, from the information that is available. Such trends lead us to false conclusions

concerning the ecological evolution of the area and management suggestions. The dynamism of these ecosystems is hidden in slow growth. Aerial photography often gives the impression of a more stable environment, as it fails to capture the evolution of the underneath vegetation cover. Field observation suggests a trend of forest increase and a transition from shrubs to trees (Figure 9.13).

Figure 9.8: A view of Gafari Gorge, north of Zaros village, taken ca 1992.

Source: photo taken by Pantelis Tzortzakis, ca. 1992

Figure 9.9: The same area as in Figure 9.8, taken in 2004.

Source: photo taken by the author, 2004

Figure 9.10: The same area as in Figure 9.8 and Figure 9.9 taken in 2010 during a field visit in the research area.

Source: photos taken by the author, August 2010

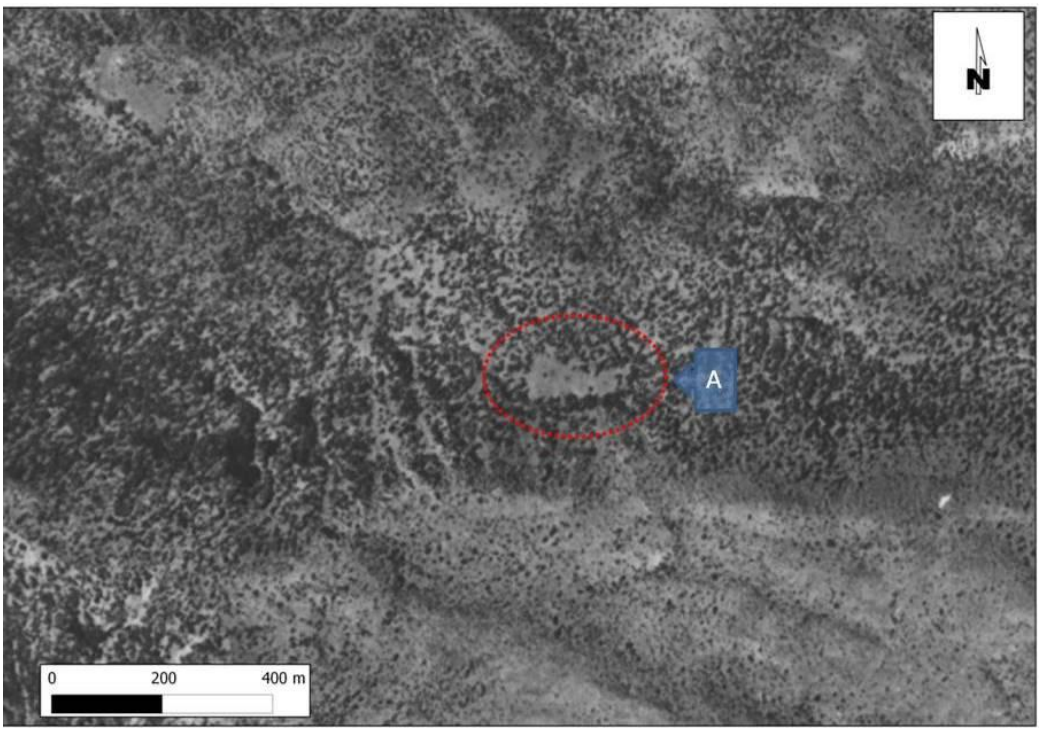


Figure 9.11: Aerial photography of 1945, where a bare vegetation area is recorded and is the same as it appears in Figure 9.8, Figure 9.9, Figure 9.10.

Source: Map drawn by the author using QGIS

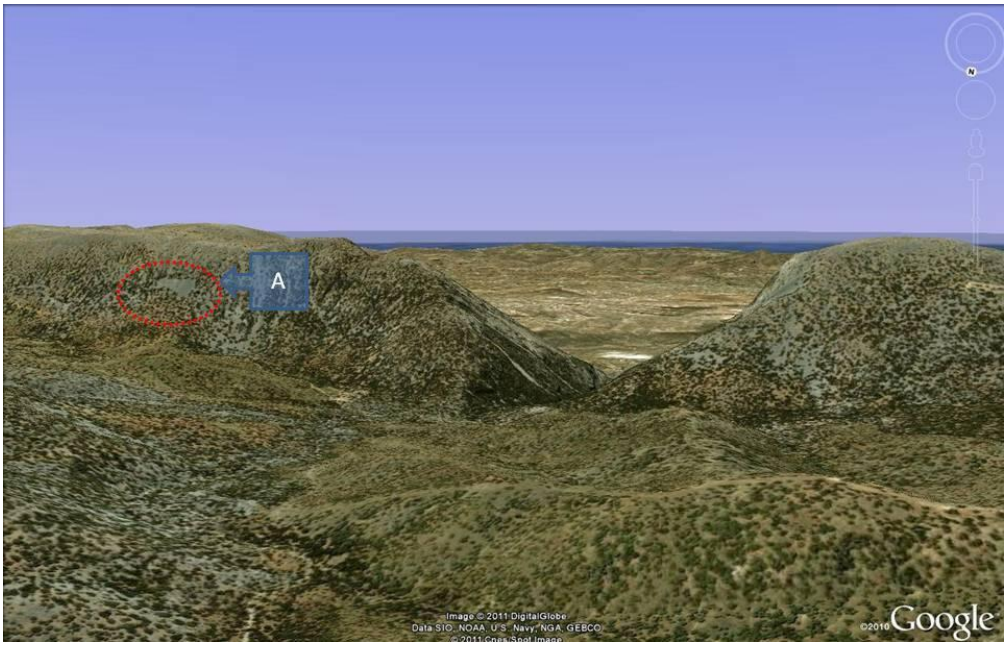


Figure 9.12: The view of Lachtaridias site as it is shown in 3D. The aerial imagery used is of the year 2003. The site A is shown and is similar to that shown on the 1945 aerial photograph.

Source: 3D view derived from Google Earth

Figure 9.13: A photograph in Rouvas forest, showing kermes oak (Q. coccifera) developed into tree and nearby shrubs of kermes oak that gradually could evolve into trees.

Source: photos taken by the author, August 2010

9.2.3 Case study 3: Prinos area in Ano Asites

Prinos area is located west of Ano Asites village in the higher elevations (Figure 9.1) and according to oral history was cultivated in the past (Figure 9.14) with grain at least until the mid 1960s. Today, as has happened in less fertile lowland areas, it has been abandoned and is used mainly for grazing, as is the surrounding forest. The absence of flat areas in the past and the pressure for arable land drove local people to cultivate areas in the uplands even if they occupied only a small acreage.

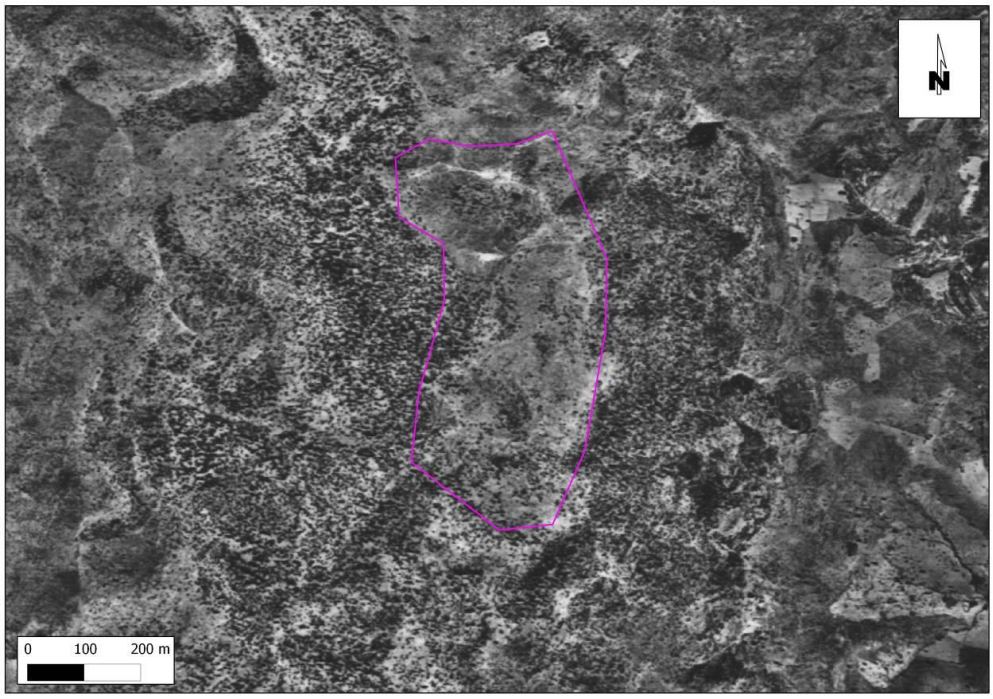


Figure 9.14: Prinos area as it is shown in aerial photography of 1945.

Source: Map drawn by the author using QGIS

The Prinos area was extensively used by locals for firewood collection, to satisfy their own needs, as well as for commercial purposes. Other uses of the forest such as acorn collection were not applied extensively as the locals had access to oak trees elsewhere in the lowlands of Ano Asites village (Arvanitis 2008). Thus, heavy exploitation mainly for firewood occurred in the forest in the past which prohibited its expansion and growth.

After the 1960s according to oral history from Ano Asites, firewood collection and cultivation stopped in the Prinos area. Vegetation gradually developed into tree format, and today the area is more forested with an increase in vegetation cover (Figure 9.15). Furthermore, the cultivated land, has been gradually invaded by forest species; however, their expansion is slow, as the area is still heavily grazed (Figure 9.16). If this

trend continues in the future the area could resemble a dense broadleaved forest.

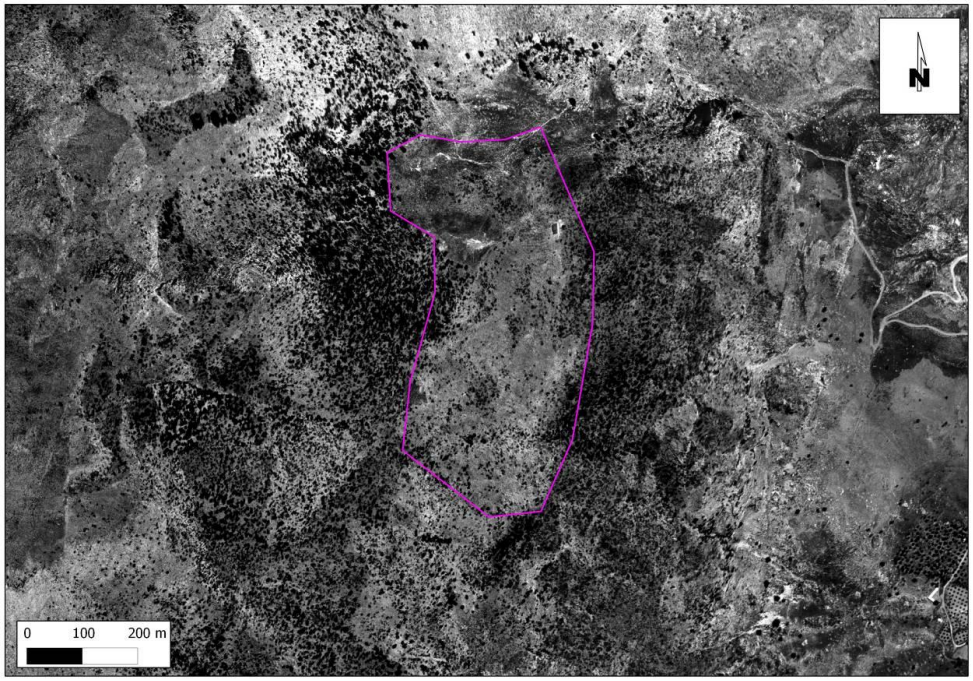


Figure 9.15: Prinos area as it is shown in the aerial photograph of 1996.

Source: Map drawn by the author using QGIS

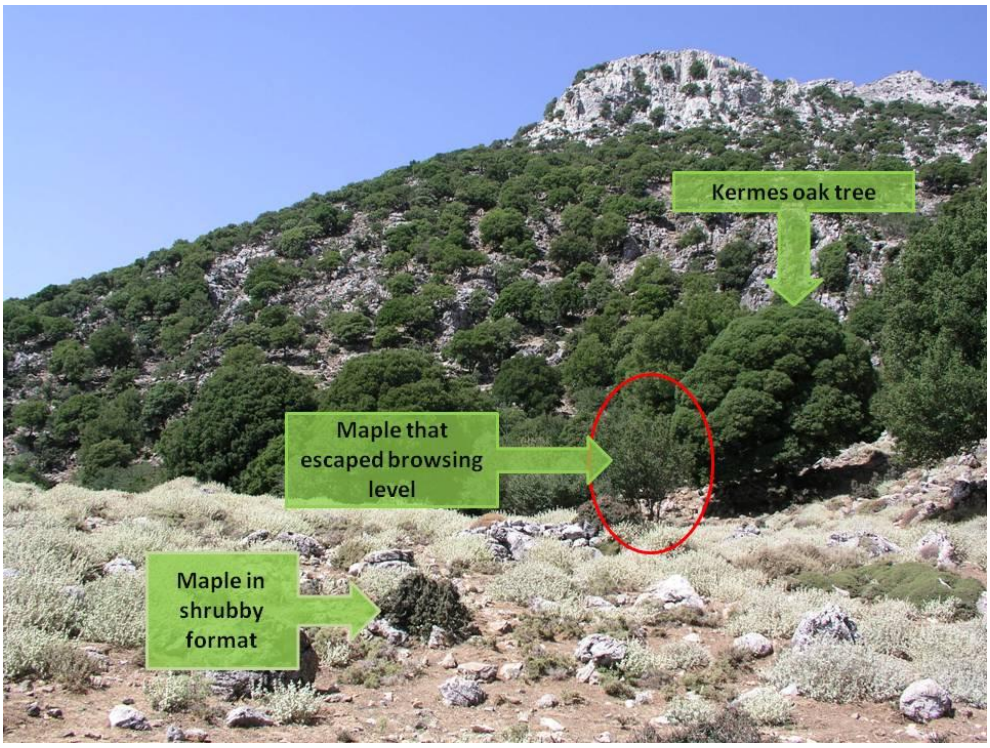


Figure 9.16: The cultivated area in Prinos, next to the forest that is gradually being invaded by maple (A. creticum). The nearby forest is a mixed forest of kermes oak (Q. coccifera) and maple (A. creticum).

Source: photos taken by the author, July 2008

9.2.4 Case study 4: Pine forests of Zaros.

The pine forest of the Zaros commune (Figure 9.17), on the south-east slopes of Psiloritis, eastwards of Zaros village, occupies almost the same area as in 1945 (Figure 9.18 and Figure 9.19). There are elements of an increase in the density of vegetation cover; however, this is not as extensive as might be expected.

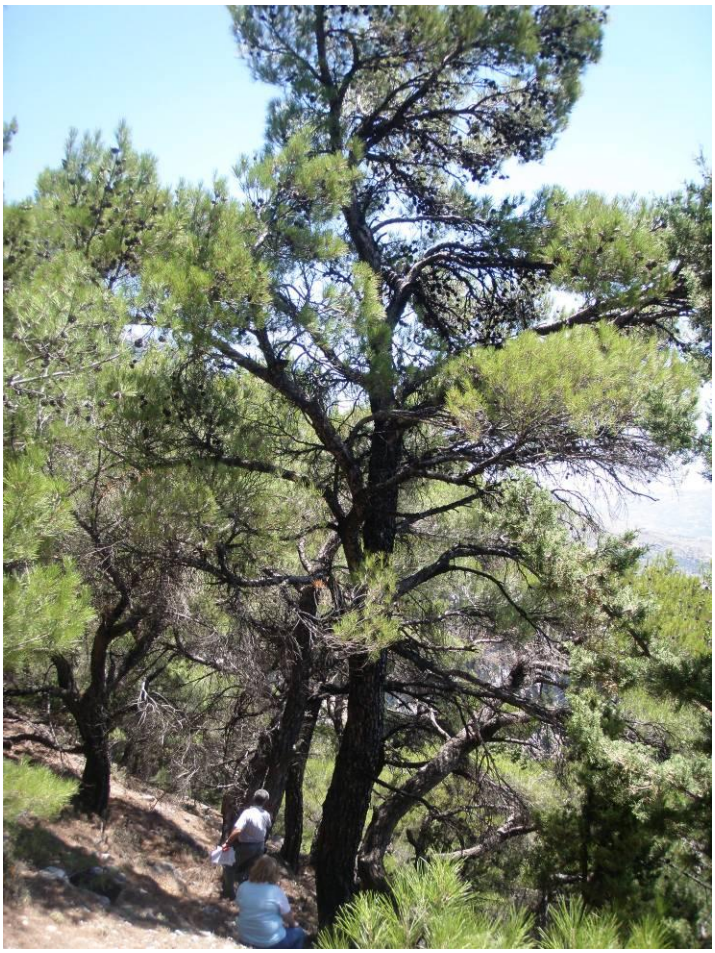


Figure 9.17: Pine forest of Zaros as it is today.

Source: photos taken by the author, August 2009.

According to Rackham and Moody (1996), pine forests have been extended in Crete and have invaded former cultivated lands, but this is not the case for eastern Psiloritis. This specific area did not have forest fires which can rapidly change the landscape and forest distribution over the last 70 years. This area of pine forest (Figure 9.20) is recorded as more forested compared with the past in a period from 1945 till 1996 (Hostert et al. 2003).

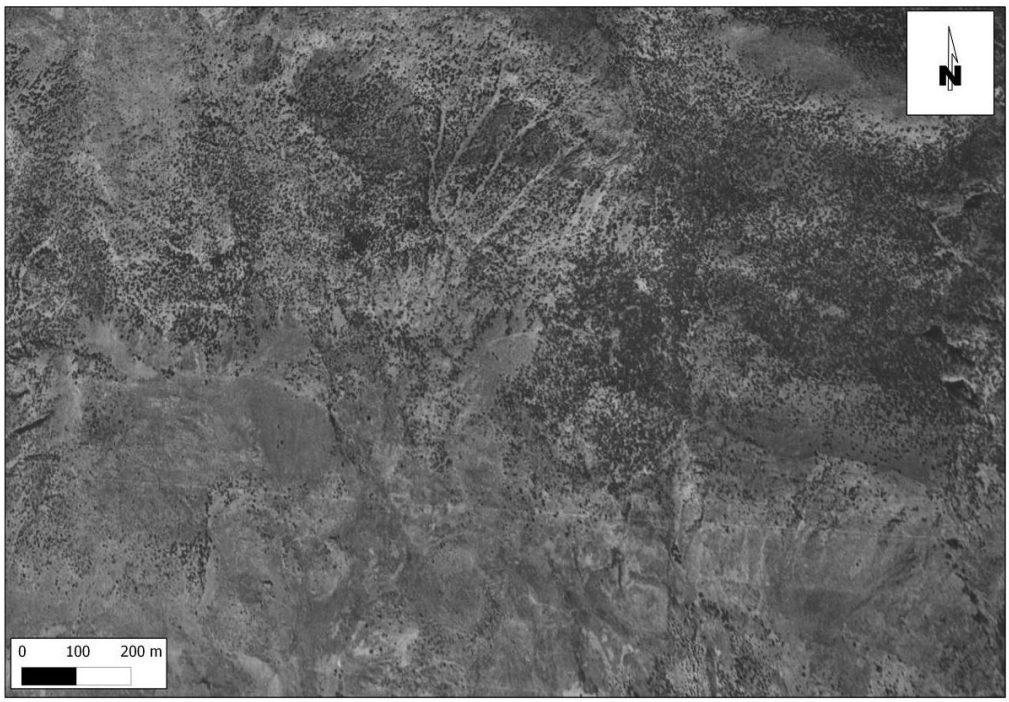


Figure 9.18: Aerial photography of 1945 of Zaros pine forest.

Source: Map drawn by the author using QGIS

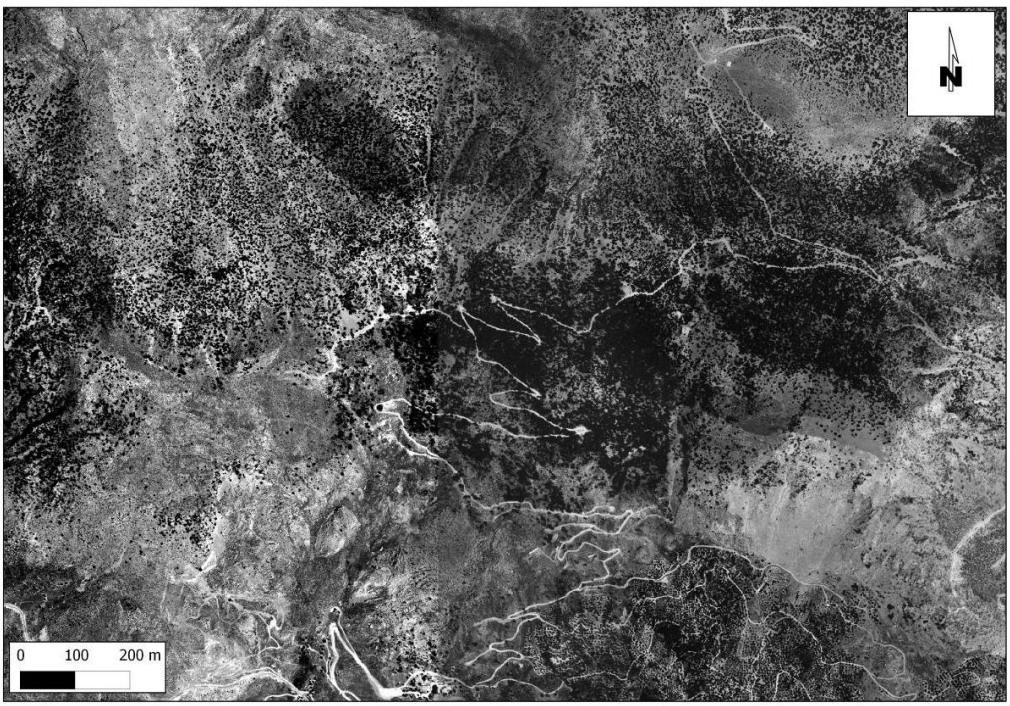


Figure 9.19: Aerial photography of 1996 of Zaros pine forest.

Source: Map drawn by the author using QGIS

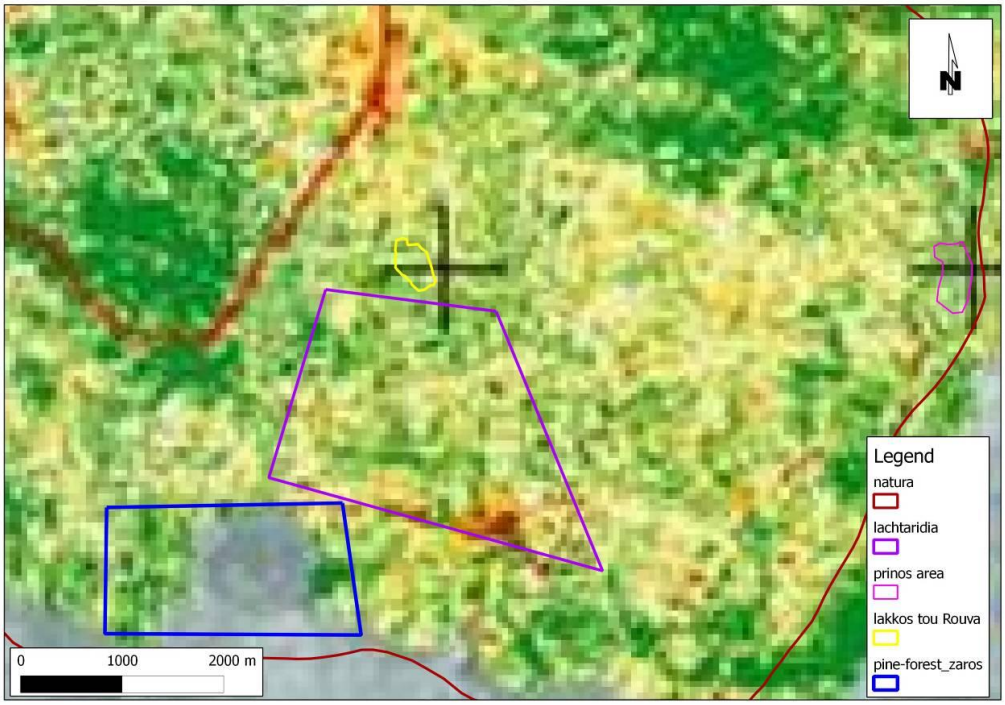


Figure 9.20: Forest cover change for the case studies.

Source: Map drawn by the author using QGIS. The vegetation cover change map has been derived from Hostert et al. (2003, p.190). Green colours represent strong increase of vegetation cover, where reddish colours represent a decrease.

All these case studies highlight that forest ecology is complex and that it is often influenced by human actions. It seems that what is defined as natural regeneration by conventional forestry in other places of Greece, needs to be reconsidered in the Cretan context. In the area of Psiloritis there is a different form of natural regeneration. Forest species and the forest generally, as a result of grazing pressure and past human actions, show different stage transitions from seedlings into tree development. Here, the stages should not be defined clearly as forest stages from i) seedlings to ii) young trees and finally iii) mature trees, but a stage of shrubby format that could retain these characteristics for long periods, which gradually developed into young trees that could evolve into ancient trees. The fact is that when vegetation exceeds browsing level then the development of the forest is more dynamic and trees can develop quite fast.

Moreover, areas that had forest in the past and for some reason have lost it, retain this characteristic and forest recovers gradually, but at a slow rate that is not always perceptible. This element is of great importance in decision making, especially forest management and could lead to a misunderstanding of the whole ecological procedure and misleading

management plans. This has happened after forest fires in pine forests or after a sudden clear cutting of oak species. In the second case in 'Lakkos-tou-Rouva', the forest has not retained its previous characteristics of a dense forest. However, this area according to observations over a period between 1945 till 1996, shows an increase in vegetation cover (Hostert et al. 2003) (Figure 9.20) and could gradually return to a similar forest level as the surrounding area. All these elements are a result of the species characteristics found in Psiloritis and in Crete generally that have a high resilience to browsing and fire. Their root system can survive fire or high exploitation pressure and still re-sprout. Then they can remain alive in a shrubby woody format even for centuries and develop into trees and forest when the circumstances permit.

9.3 Plantations in eastern Psiloritis Mountain

Extensive plantations did not occur in Crete. Especially in the Heraklion Prefecture, plantations are concentrated in areas that were generally ceded from local communes or monasteries. Until the 1960s, reforestation was rarely supported by the Forest Authority and only the private sector or communes applied locally small scale plantations. The Forest Authority provided the necessary plants that were produced in a local forest nursery that was established in a permanent area in 1966 and still operates there. In the Book of Incidences in the year 1966, it is mentioned that:

> In the absence of forest public land, there is no reforestation implemented with public funds, and as result, all the reforestations are based only on private initiatives. However, because of several difficulties and back-drops that often occur, they (private initiatives) did not show the proper interest in the field of reforestations and it can be said that they showed total apathy (HFDA9).

These types of comments often occur regarding the absence of reforestation or afforestation. It can be assumed that the forest policy of that time promoted reforestation, but in Crete for different political reasons such policy could not be implemented. The reasons are mainly connected to the land ownership system that until that time was problematic and the land was not clearly public. Moreover, the existence of extensive animal husbandry and the absence of a good road network caused problems for any plantations in the uplands. In addition, the fact that productive forests, as they are defined by timber forestry did not exist in Crete meant that there was never an actual need to implement an extensive plantation policy. The existence of a long dry period made plantations very costly.

Moreover, fertile land was often cultivated, thus plantations had to be developed in less fertile areas, where soil conditions are poor and several difficulties could arise.

In the area of Psiloritis until the 1970s, extensive plantations did not happen. In the village of Anogeia, several small areas were planted by the Forest Commission based in Rethymnon Prefecture, and an interviewee, recalling that event, criticised local political authorities for not taking this example and extending reforestations over the whole mountain around the village:

> An3: Όσο για τους δημάρχους, εγώ είμαι εδώ πέρα από το 62. Το 62 ήρθε το δασαρχείο, εδώ πέρα, ε τότε ήταν το χωριό καημένο από τους γερμανούς, δεν είχε ακόμα συνέλθει ας το πούμε. Και μου, είχα εγώ τις αποθήκες εδώ πέρα, και ενοικίασα στο δασαρχείο το χώρο, και έμενε και ένας ή δυο υπάλληλοι, και είχανε και τα εργαλεία, οπότε φυτέψανε τότε τα δέντρα αυτά, που υπάρχουνε, βέβαια τα δέντρα έπρεπε να είναι όλο το, αυτό το γυμνό μέρος έπρεπε να είναι φυτεμένο. .... έπρεπε να έχουμε πολλές χιλιάδες δέντρα ακόμα φυτεμένα. ... Εμπάς περιπτώσει δεν μπορούμε να πούμε και όλα αρνητικά, είμαστε σε ένα σημείο που μπορούμε πολύ καλύτερα. Από απόψεως πρασίνου, από απόψεως και ευχόμαστε να το κατανοήσουν οι νέοι άρχοντες, και οι δήμαρχοι .... Αν είμουνε δήμαρχος αυτού του τόπου θα είχα 5000 δέντρα ακόμα γύρω γύρω απ'το χωριό.
>
> An3: Moreover, as far as it concern the Mayors, I have been here since 1962. In 1962 the Forest Commission came here, at that time the village was burned by the Germans, and had not yet recovered. And I had here a spare room I rented it to the Forest Commission, and one or two employees of the Forest Commission were staying here, and they had their implements, and it was that time that they planted these trees that are here now. Of course, trees should be all over these bare slopes, the entire place should have been planted. …. We should have thousands of trees planted. …. Anyway, we should not consider everything negatively; we are at a point that we can be much better. In terms of greening, I hope the new local authorities, the Mayors understand this. ... If I was the mayor of this area, I would plant 5,000 trees all around the village.
>
> An3: 84, M, Tavernier

This positive perception of trees and forest generally is an example of how local people regard the plantations as something positive. More trees and more green in the bare rocks around their villages, thus a better landscape. In northern Greece Saratsi (2003, p.219) suggests that plantations were regarded by local people as something positive:

> because they expect that they can be worked as a potential source of income for the area, or because they perceive such kind of afforestation as an organised attempt for the protection of their environment and their woods in particular.

On the other hand, natural regeneration and invasion of forest trees into abandoned cultivated land were regarded 'as the inevitable evil' (Saratsi 2003, p.294). In Crete, plantations and forests are not regarded as a potential income, for example for timber, at least over the last 60 years.

They are more connected with positive elements of landscaping and protection of the environment.

This example of plantations in the uplands, but close to the village of Anogeia, cannot be considered as an upland reforestation policy but more a landscaping procedure of the areas surrounding the village. It is not clear though if it was a Forest Service initiative or if they were promoted and implemented by local authorities. The interviewee suggests that the Forest Commission implemented it; however it could be the case that it provided the plants and some supervision as a result of ownership problems in the 1960s, where forested areas were regarded as 'occupied' with the grazing rights belonging to local communes. Thus, the Forest Commission could not invest funding on reforestations in an area where land ownership was problematic.

This policy changed after the New Greek Constitution in 1975 that was introduced after the abolition of the dictatorship (1967-1974) and the establishment of a new democratic elected government. The new Forest Policy implies that all forested land is regarded as public (Hellenic Republic 1979).

This 'no-plantation' formal policy seemed to change over the 1980s and 1990s in Heraklion Prefecture. Several plantations were implemented in areas close to the villages, always on a small scale but never in the uplands. Definitely the involvement of local authorities in this procedure is essential, however, plantations are often implemented by the Forest Commission. A forest official regards reforestation as one of the main forestry works over the last decades:

> Ρ: Ήσουν στα έργα για πάρα πολλά χρόνια, σε σχέση με το παρελθόν και το σήμερα τι έχει αλλάξει;
> Η1: Το κύριο αντικείμενο ήταν και οι αναδασώσεις, έγιναν αρκετές άσχετα αν δεν επιβίωσε καμία. Οι δασικοί δρόμοι, πάρα πολύ. Έργα αναψυχής πάρκα. Αυτά, οι τρεις κατηγορίες ήταν κυρίως αυτές.
>
> P: You were working in the sector of forest works for a long period, compare it with the past, how that is different today?
> H1: The main subject was reforestations; we had implemented several, nevertheless that none of them survived. Forest roads, lots of them, recreation projects, parks. That is all, these three categories mainly these three.
>
> H1: 59, M, Forester

Three different examples of plantations that were established since 1990, in the villages of Vorizia, Zaros and Gergeri will be presented here. These cases had different objectives and were implemented by different organizations. Their success varied for different reasons and this was not

necessarily a function of the environment, as all of these examples are located in a similar climatic environment.

9.3.1 The example of Vorizia

The former commune of Vorizia in 1987 sent a request document to the Forest Commission in Heraklion, asking for the creation of a forest just outside their village. In their document it is mentioned that:

> most of the area is rather flat and without much expense a huge woodland can be created, that will result in benefit for our citizens and for the whole of our area. The Commune Council with a recent voting, declared this space as 'reforested' and decided to include it within the new agricultural zone for its protection from the animals (HFDD31).

Local authorities of Vorizia regarded grazed lands as something useless and unproductive. A forest could improve the environment and create more green space, a positive element for them and they mentioned that 'the tree plantation will result in the benefit of both the villagers and the entire region' (HFDD33).

Heraklion Forest Directive's reply was negative because of several other requests and economic constraints at that time (HFDD32). Nevertheless the following year, Vorizia Commune, submitted a new document hoping to take advantage of an early request. Their request again was not successful.

After that, almost ten years later, the plantation was actually established. In 1994 with the involvement of the beekeepers' association of Heraklion, Vorizia Commune sent a new request with a reminder about the availability of enough space in their village for plantations (HFDD36). The following year though, the Commune declared again its decision to assign an area of 20 ha for reforestation. In their document it is mentioned that:

> The Commune Council decided to assign a communal area of 20 ha in the area 'Kafkalo', for reforestation with whatever tree species you want, but they should certainly be useful in apiculture that lately had increased in our commune and it will result in the benefit of apiculturists (HFDD39).

In this document, they were more specific about the type of trees to be planted. In addition it was highlighted that:

> the commune during the planting of the trees will help the works of Forest Commission with the necessary personal work that will be needed. Moreover, (the commune) will assist with

> the watering of the trees, for the time-span needed for them to be watered (HFDD39).

This shows the interest of local authorities in plantations and the strong perception of them as something positive for both their lives and their environment.

The same year the Forest Commission implemented the necessary reforestation studies in the area. The total area planted, according to the official study was 5.8 ha and the species selected were pine 50%, cypress 10%, prickly oak 20%, carob tree 10% and eucalyptus 10% (HFDD40). It is obvious that the selection of pine, carob tree and eucalyptus, all together about 70%, was influenced by apiculturists as these species are regarded as useful plants for bees (Plakoutsis 2006).

In the archival documents, both the Vorizia Commune and the Forest Commission used the term reforestation. However, the actual English term that should describe this procedure should be afforestation.

The analysis of the aerial photographs of 1945 (Figure 9.21) and 1960 (Figure 9.22), shows that the area was uncultivated and the vegetation type was shrubby and phryganic, and it was probably used for grazing. In 1945, the vegetation is sparser and the area looks more exploited, compared with 1960. In contrast, in 1960, the nearby areas appear to be intensive cereal cultivations, but the area itself appears denser and with a more shrubby vegetation than in 1945. It seems that less intensive use of the area took place in the 1950s, probably connected with less brushwood collection occuring in that decade.

Ortho-photographs, derived either from Google Earth or from the Forest Commission, were taken just after the plantation and a clear picture of the type of vegetation and land use just before the reforestation cannot be made (Figure 9.23). Information though, regarding the vegetation type of the area just before the reforestation, is included in the reforestation study of 1995. According to this study, the area was covered with 'shrubby and phryganic vegetation of the species *Calicotome villosa, Sarcopoterium spinosum, Thymus capitatus, Salvia sp., Salvia officinalis, Ramnus sp*. and several grasses' (HFDD40).

All this information shows that the reforested area was treeless and had no forest vegetation from 1945 to 1996. The aerial photography shows relatively bare land in 1945 and shrubbier land in 1960 suggesting a form as it was described in the study of 1995. Thus, the term used to describe this plantation should be considered more as afforestation than

reforestation, as it refers to the establishment of forest in an area previously not occupied by trees for at least the last 60 years.

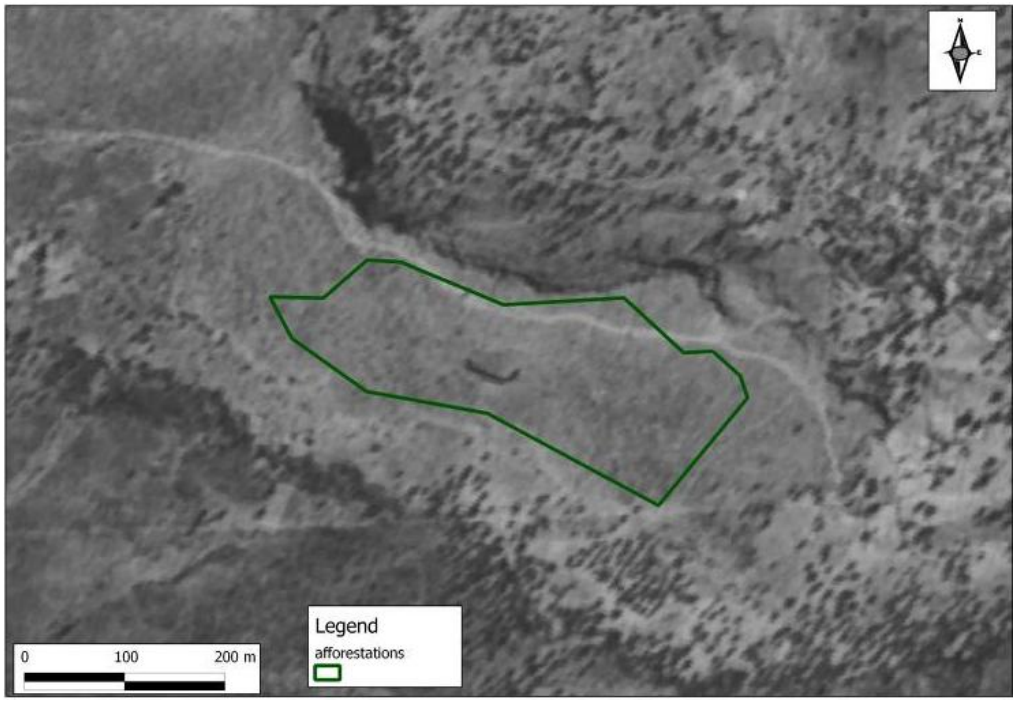


Figure 9.21: Aerial photograph of 1945, geo-referenced and overlaid with the current boundary of reforestation in Vorizia village.

Source: Map drawn by the author using QGIS

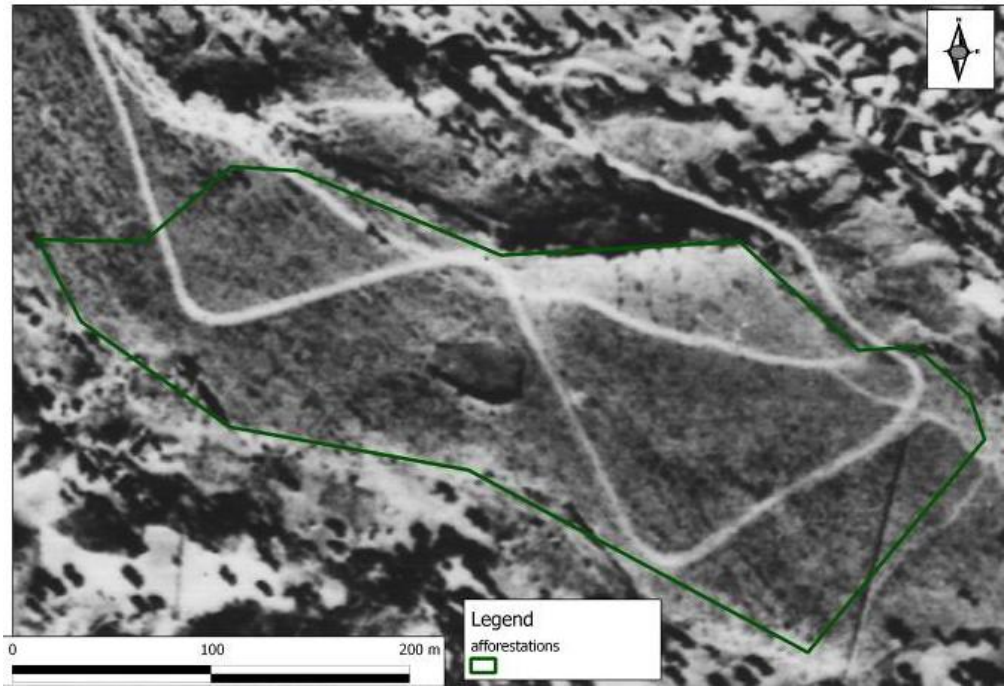


Figure 9.22: Aerial photography of 1960, geo-referenced and overlaid with the current boundary of reforestation in Vorizia village.

Source: Map drawn by the author using QGIS

Figure 9.23: Aerial photography of Google Earth (2002) geo-referenced and digitized to create the current boundary of reforestation in Vorizia village.

Source: Map drawn by the author using QGIS

This plantation was successful and the trees still survive in the area (Figure 9.24). The apiculturists use the plantation for their benefit and it can be concluded that the targets of the commune were achieved (Figure 9.25).

On the other hand, the main targets of the reforestation study have not yet been totally satisfied. These according to the study were:

1. 'Landscaping of the area
2. The development of forest recreation opportunities, employment and the improvement of hygiene (health) of local people
3. The help of aviculture in the area' (HFDA40)

The first one, landscaping of the area is a very subjective element and cannot be evaluated easily, however, the successful establishment of woodland in a formerly grazed land, from a forestry perspective can be evaluated as positive. The second target does not seem to be successful, when an extensive natural pine forest exists close to that area, and even there forest recreation is not well established (Figure 9.26). However, such a target needs a lot of time to gain success as a result of the slow-growth of forest trees. This also is connected with the improvement of the environment and the life of local people, and it is a very subjective issue to

be evaluated. The last target was the same as the commune target and it has definitely been achieved as previously mentioned.

Figure 9.24: Pines in the reforestation of Vorizia village, implemented in 1996.

Source: photo taken by the author, August 2010

Figure 9.25: Beehives within the reforested area in Vorizia.

Source: photo taken by the author, August 2010

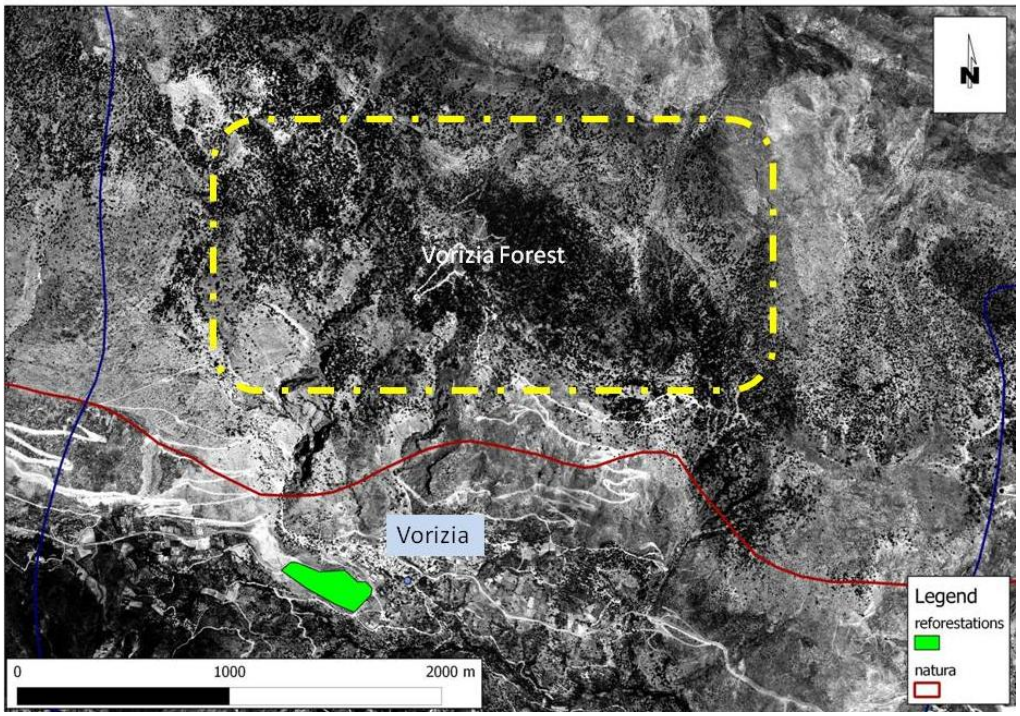


Figure 9.26: The location of the plantation in Vorizia village and the forest close to the commune.

Source: Map drawn by the author using QGIS

9.3.2 The example of Zaros.

The second example is in the village of Zaros, where a plantation was implemented in 1997. This area was destroyed by a forest fire in 1994 and previously had forest and forested vegetation (Figure 9.27 and Figure 9.28).

In their study implemented in December 1996, foresters mentioned that:

> the forested woody vegetation, that occupied the area before the fire was dense and mainly consisted of pine and in a less percentage cypress. Today in the area there are some individual trees of pine, cypress and a small percentage of prickly oak that had not been burned (HFDD45).

In that study in the section 'Target of reforestation', it is mentioned that: 'reforestation of the area is necessary in order to achieve a partial restoration of the damage done by the fire in 1994, particularly because the natural regeneration is less or totally absent' (HFDD45).

Figure 9.27: A part of the Zaros forest that was burned in 1994, where a more dense pine forest appears on the slopes.

Source: H.F.D. photographic archive, taken before 1994

Figure 9.28: Part of the same area as in Figure 9.27. The dense pine forest has disappeared.

Source: photo taken by the author, August 2010

In this case we have an example of a forest fire that destroyed a pine forest, and two years later a conclusion from forest officials that there was not enough natural regeneration, thus natural progress should be replaced and 'helped to recover'. This example reflects a misunderstanding of the forest ecology and the impression that nature works fast. The decision of the foresters to propose reforestation in that area was not only influenced by forest scientific knowledge. In this case as in many other examples, this decision was connected with legal issues, funding availability and social factors. Forest science supports the idea that reforestation is never a priority after a forest fire. Pine forests generally have the ability to regenerate naturally after a fire, when they are older than 15 years and have the ability to produce fertile seeds (Ntafis 1990). Reforestation is suggested only when natural regeneration has totally failed and that should be evaluated after a certain time period, that is never less than 5 to 6 years (Chatzistathis and Ntafis 1989). This of course is a general rule applied in Greece where environmental conditions differ greatly within the country. For example, in the case of Crete, this time span probably should be extended for more than 6 years, as a result of the slow growth of species and the variability of rainfall between different years.

In addition the strong feeling that in an area that you had forest you should have forest, connected with the legal context influenced the management decisions of foresters. According to Greek Forest Law, forests should remain forests forever. It is also mentioned that in the case of forest destruction, and when 'natural regeneration is not possible, then reforestation should be implemented within three years from the date that the area was recognised as 'reforested' and this is the responsibility of the Forest Authorities' (Hellenic Republic 1979, p.2856). An area is designated as 'reforested' according to Forest law, when its natural vegetation for various reasons is being destroyed (Hellenic Republic 1979). Moreover, often the wrong idea that if you do implement reforestation you will not get any negative results but only positive, and help nature itself, influenced their decisions (HFDA9).

In contrast to all this scientific knowledge, forest officials did implement reforestation in the area and not only once. The first attempt completely failed and then a second attempt a few years later was again unsuccessful. The selected area was the most suitable one to implement planting, and other steep areas were left outside the plantation plan (Figure 9.29). A

Forest official argues that the failures of reforestation were connected with overgrazing:

> Η1: Σε ένα κομμάτι εμείς κάναμε αναδασώσεις οι οποίες δεν επιβίωσαν λόγω υπερβόσκησης, ένα μικρό κομμάτι εμπάς περίπτωση. Αυτό που προσφερόταν. Νομίζω τρεις ή τέσσερις φορές τις κάναμε, δεν επιβίωσε τίποτα από την υπερβόσκηση. Από τους βοσκούς, παρότι η έκταση είχε περιφραχτεί, είχε ποτιστεί είχε είχε.
> Ρ: Πιστεύεις ότι έβαζαν τα ζώα μέσα και γι' αυτό το λόγο απέτυχε η αναδάσωση;
> Η1: Άνοιγαν την περίφραξη και έβαζαν τα ζώα μέσα.
>
> H1: In one part of the area we did reforestation. It did not survive because of the overgrazing. It was a small area, the more suitable one. I think three or four times we did them, nothing had survived (trees) because of the overgrazing. Because of the shepherds. Although the area was fenced, was watered, etc.
> P: Do you think that the area was grazed and is that why reforestation failed?
> H1: They were opening the fence and they were bringing inside the animals.
>
> H1: 59, M, Forester

The absence of the vegetation had negative results several years later. Significant erosion after heavy rainfall occurred in 2005-2006 and the river bed was completely changed as a result of the huge amount of top soil loaded into it (Figure 9.30). There was only partial soil cover left on the slopes, where some trees had escaped the fire. Today the landscape is different.

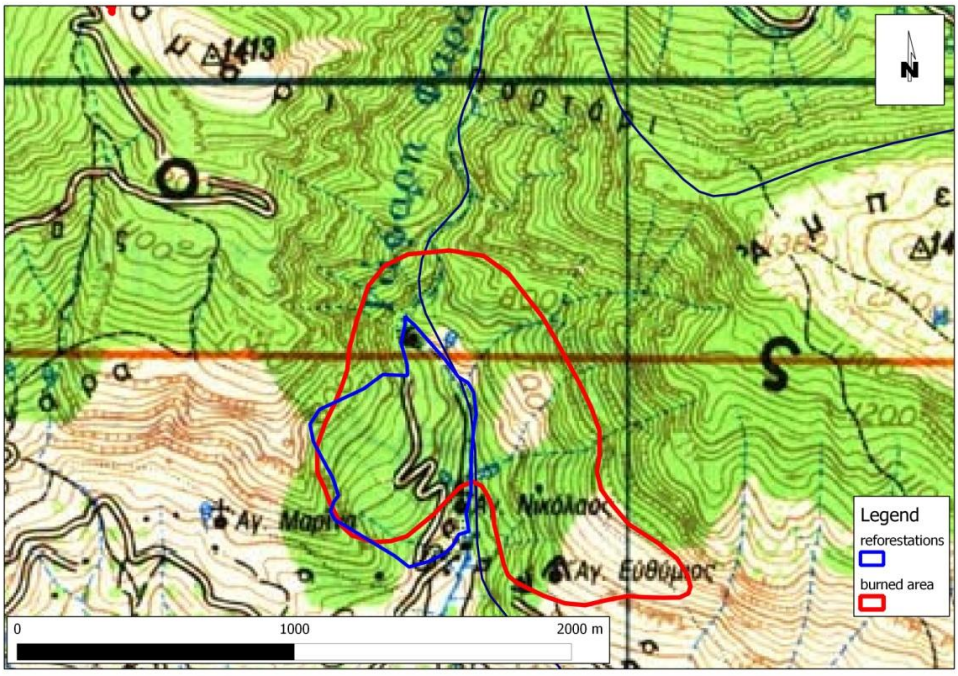


Figure 9.29: Burned area of 1994 and the reforestation area in Trapezoplaka, in Zaros village. Steep areas were left out of the plantation plan.

Source: Map drawn by the author using QGIS

Figure 9.30: Erosion in Zaros forest in 2005-2006. The area was burned in 1994. The soil was protected in areas that the trees had survived

Source: H.F.D. photographic archive, November 2006

In Zaros village, regardless that the scientific knowledge did not support a reforestation in the area, reforestation was established several times despite the previous failures. However, it should be debated if the reforestation had negative influences on the natural regeneration itself. The surrounding areas outside the plantation have not yet recovered a complete and dense forest. A careful study of the area from aerial photography of 1945 (Figure 9.31) suggests a similar landscape form as it is today, without the dense forest.

Research in the HFDA10, shows that there have been several forest fires in the Zaros region since 1923. Table 9.2 presents information on forest fires in Zaros village as they have been recorded in the archive (HFDA10). From this information there is a fire recorded in 1930 in an area called 'Trapezoplaka'. This is the same place name as the area burned in 1994 and reforestation took place. The fact that both areas have the same place name and both were a pine forest in Zaros village is evidence that they are the same area. Moreover aerial photography of 1945 has similar landscape features as recent aerial photography (Figure 9.32), obtained after the fire, supporting the idea that the area already had a forest fire before 1945.

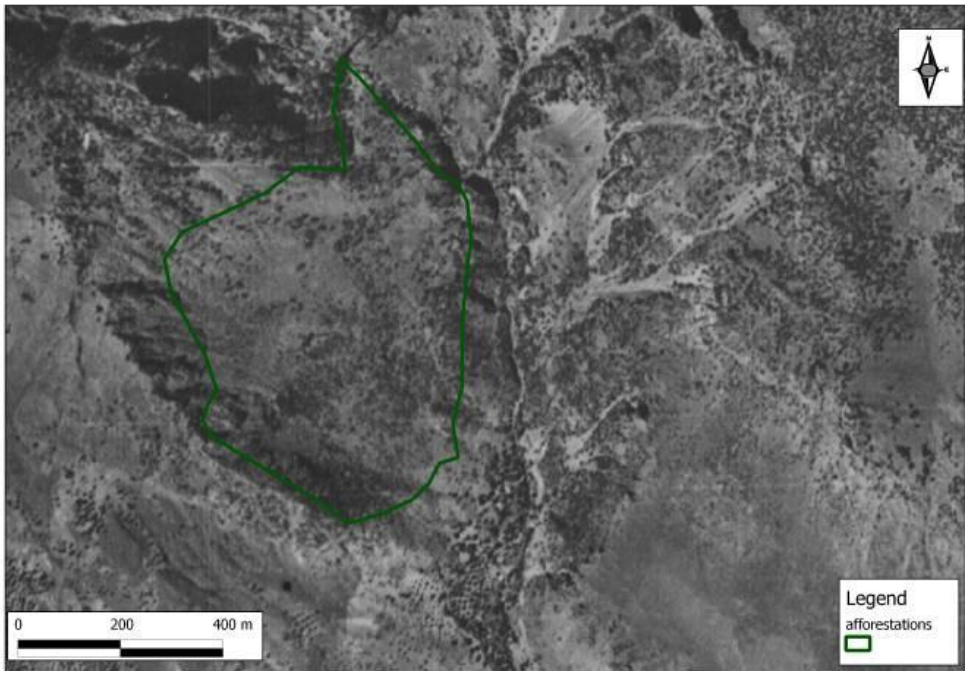


Figure 9.31: Aerial photography of 1945, geo-referenced and overlayed with the current boundary of reforestation in Zaros village.

Source: Map drawn by the author using QGIS

year	Forest name	place name	area (ha/10)	composition(tree species)	Age of trees
1923	Zaros	Zaros	1000	Olive trees	
1925	Rouva	halepa	20	Forest and shrubs	
1930	**Zaros**	**Trapezoplaka**	**15**	**Pines**	**2-30**
1933	Forest of Zaros	Kato spyria	200	Prickly oak pines	20-80
1947	Alonaki Kalamafka		5	Prickly oak pines	0-80
1948	Rouva, commune of Zaros	Kalamayka	9	Prickly oak pines	25-75
1950	Kolovia Mesa Vroulisaki		25	phrygana	
1969	vrontisaki	Vrontisaki	5	Myrtles	
1969	Alonaki	Alonaki	50	Pine	
1984	Kourtokefala		300	grasses	
1990	Voulismata		4	Pine	
1990	**Trapezoplaka**		**2**	**Pine**	
1994	**Rouvas**[1]		**3020**	**1000 forest, 2000 grasses**	
1999	Parti		200	forested	
1999	Parti		300	grasses	
2000	Hosto nero		5	forested	
2000	Vrontisi		1	grasses	
2001	Koutelo		1	grasses	

Table 9.2: Zaros forest fires as they have been recorded in the book of forest fires (HFDA10). [1]The area Rouvas, refers to a larger forest that includes the area with the place name 'trapezoplaka'.

Source: Table drawn by the author, based on HFDA10

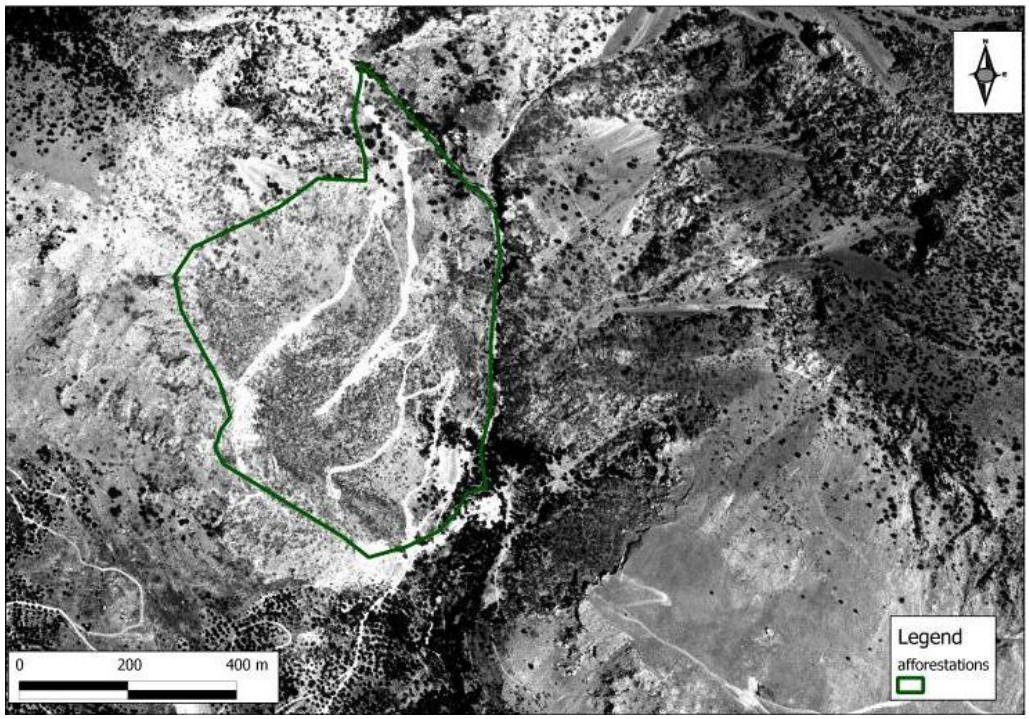


Figure 9.32: Aerial photography of 1996, geo-referenced and overlayed with the current boundary of reforestation in Zaros village.

Source: Map made in QGIS by the author

All this information, archival and aerial photographs, suggests that there was a stage of 'stable' pine forest from the 1950s till the 1990s (Figure 9.27). Moreover, the time for forest to recover could be more than six years because after the fire of 1930, in 1945 the forest had not totally recovered. The current forest may be a different forest in extension and density to the previous status of pine forest in the area. This can be connected with an increase in grazing pressure that can result in more slow growth and regeneration of the forest.

In addition even a forest official argues that forest fire was not important and did not had a negative influence on the forest itself:

> P: Στο δάσος του Ζαρού Το 1994 είχε γίνει μια πυρκαγιά, είχε κάψει ένα κομμάτι πευκοδάσους.
> H1: Δεν ήταν όμως κάτι αξιόλογο. Μην με ρωτήσεις για αναγέννηση, δεν υπάρχει τίποτα. Μάλλον υπάρχει κατά θέσεις. Δεν ήταν όμως μια πυρκαγιά που να έχει κάψει πάρα πολύ δάσος, είχε κάψει περισσότερο βοσκοτόπους από την μεριά της Γέργερης. Νοτιοανατολικά, πάνω από την Γέργερη. Και μετά μπήκε μέσα στο δάσος ένα ελάχιστο, κομμάτι.
>
> P: In the forest of Zaros in 1994, there was a fire, it had burned a pine forest.
> H1: Yes but was not a very important one. Do not ask me for regeneration, it is nothing there, although it is partially some. It was not though a fire that had burned a lot of forest, it had burned more grazed lands from the side of Gergeri, southeast, in the upper places of Gergeri. And then it went into the forest, but it burned a small area.
>
> H1: 59, M, Forester

Regardless all this information, reforestation was implemented. The knowledge of history in forest management could support the idea that reforestation should not have been implemented and the loss of a lot of funding and time could have been saved. The existence of a forest fire in the same area, in the past, and the fact that forest recovered later, could have helped foresters to take the correct decision and hence avoid a failure.

Although reforestation did not influence natural regeneration, forest works did have a negative influence on the landscape. Forest roads could promote erosion in the area and instead of trees, the only remains of forest works are the roads and the cement tanks that were made, both infrastructures that have a permanent influence on the landscape (Figure 9.33 and Figure 9.34).

The main reasons for the failure of the plantation could be connected with the time of planting, problems in organising efficient management of the whole plantation, and mainly the pressure and antagonism over grazing. The timing of plantations is very important in Crete, as juvenile trees have to survive a harsh dry summer period that can last more than 4 months. Often funding availability and deadlines of projects are not connected with planting times and plantations do not adhere to appropriate planting periods.

Figure 9.33: The area reforested in Zaros village in 2002.

Source: photo taken by the author, August 2002

Figure 9.34: The area reforested in Zaros village in 2010.

Source: photo taken by the author, August 2010

9.3.3 The example of Gergeri

In the municipality of Rouvas a local policy of landscaping the areas around the villages was developed and in the main village, Gergeri, the Mayor, promoted a policy of removing the apparently negative elements of the landscape. In the upper parts of the village, he funded the removal of a shepherd's stable, that was regarded as a negative landscape element and replaced it with a soccer field. Next to the new soccer field was an area which was used as an uncontrolled rubbish dump site and was selected for landscaping by creating a forest (Figure 9.35). At the same time, several citizens of the village, mainly beekeepers, promoted pine plantations to increase honey production. This is an example where villagers took the initiative to create a forest in their area that could provide them with a better landscape and of course to help apicultural development. The Forest Commission provided the necessary plants and then several volunteers planted them in 2001.

This plantation took place when the author was working as a forester in Rouvas municipality and his suggestions for the species selection were under negotiation with some of the volunteers. The increase in apiculture and a sudden love for pines from beekeepers created a debate over what

species should be planted. They wanted only pines to be planted there and no other species. Finally, a mixture of species was selected, including pines.

Although in this area there was a small scale plantation, there were some conflicts with a shepherd who was grazing his livestock there and a fire did occur there a few years later, though it did not destroy the plantation. Today the trees do survive, and the shepherd seems to have accepted the new status, and uses it for his benefit as well (Figure 9.36).

Figure 9.35: The plantation in Gergeri.

Source: photo taken by the author, January 2010

Figure 9.36: The entrance of sheep in the fenced area of the plantation in Gergeri.

Source: photo taken by the author, January 2010

9.4 The management problem

The importance of forestry in Heraklion is generally neglected as a result of extensive agriculture development in the prefecture and the absence of timber production from forests. Today financially, forestry does not play an important role in the local economy, as is happening in other parts of Greece, especially in Macedonia and Thrace.

Today in Crete, the Forest Authority is more often regarded as a bureaucratic commission than a sector connected to development. This is a result of the involvement of the Forest Commission with house building permissions. In Greece, the Forest Commission needs to verify, for land outside urban areas, if it is or it is not under forest law regulation. This is often one of the main aspects of current forest work, which is time consuming in areas with high pressure for building development as it is Crete and other islands (HFDA9). The lack of timber production and the involvement in house building permissions resulted in a notion of neglecting forestry, something felt among forest personnel. There is an impression that Crete is not a proper field for a forester, where 'productive' forests do not exist.

> Η3: Εδώ ασχολιόμαστε συνεχώς με πράξεις χαρακτηρισμού, το 90% της δουλειάς μας είναι αυτό. Δεν έχουμε παραγωγικά δάση στην Κρήτη.
>
> H3: Here the main work is related to building permissions, the 90% of our work is there. Productive forests does not exist in Crete.
>
> H3: 43, M, Forester

The management problem in Crete is an area of debate. Often people disregard what a forester is and how the forest resources of the island should be used. Management of forests is not a stable situation but is influenced by social status and other available resources. Forests were used historically for the development of different civilizations and until recently, forested areas and forests were used to cover local people's needs and provide an extra income when it was needed. In order to define how management should be implemented in the research area today, several different factors should be questioned. This problem has arisen because what conventional forestry regards as management is often concentrated on logging management plans. Forestry has a long tradition in this and it is probably the first time that the term sustainable management was introduced and actually implemented (Wiersum 1995).

A forester from H.F.D. suggests that forest management is totally absent for Crete and suggests that forest management can be only timber production:

> Η4: Για όσα χρόνια ξέρω εγώ δεν υπάρχει διαχείριση σε κανένα δάσος.
> Ρ: Δηλαδή ουσιαστικά διαχείριση δεν έχεις υπόψη σου ούτε πως γίνεται ούτε αν γινότανε;
> Η4: Δεν έχουμε τέτοιο αντικείμενο, και γενικά στην Κρήτη δεν νομίζω και σε άλλους νομούς να υπάρχει κάτι ανάλογο.
> Ρ: Όταν ας πούμε λέμε για διαχείριση εσύ πως το έχεις στο μυαλό σου, τι φαντάζεσαι;
> Η4: Πρώτα από όλα φαντάζομαι ότι έχει να κάνει με υλοτομίες, δηλαδή υπολογίζεις το ξυλαπόθεμα σε ένα δάσος, το ετήσιο ξυλαπόθεμα και ανάλογα ορίζεις αυτό που πρέπει να απομακρυνθεί. Τώρα αν περιλαμβάνει και άλλες ενέργειες δηλαδή, δεν ξέρω τι άλλο μπορεί να είναι.
>
> H4: For the years that I am here and I know there is no management in the forests.
> P: So actually you do not know how management was implemented or if it was done?
> H4: We don't have that type of forest works, and generally I do not believe that other prefectures of Crete have something similar.
> P: When we speak about management how you think it should be applied?
> H4: First of all I guess that has to do with logging, which calculates the timber yield in a forest, the annual yield and then you define what can be harvested. If there are other elements there I do not know what else it could be.
>
> H4: 45, F, Forester

However, another notion of management, appeared as early as in the 1960s in Greece, and was connected with pasture management (Papastavros and Makris 1986), based on the principles of sustainability. Forestry today in Greece includes also hunting, wildlife protection and pasture management. This though seems to be neglected by some forest officials today.

Another Forester from H.F.D. seems to be more aware of this type of multipurpose forestry and suggests that management in Cretan forests should be tailored according to the needs of the different areas, and it should import regulations in what is today totally uncontrolled:

> Ρ: Σε ότι αφορά τα Δάση του νομού Τι πιστεύεις ότι θα έπρεπε να γίνει και τι δεν έχει γίνει;
> Η1: Μια σωστή Διαχειριστική μελέτη. Η Οποία να προβλέπει Τις πραγματικές ανάγκες. Δάσους, Κτηνοτρόφων, Και Προπάντων, Ο Μεγαλύτερος εχθρός που παίζει είναι η υπερβόσκηση. Και δει η κατσίκα. ... Άλλος θα είναι ο στόχος στον Ψηλορείτη, Και άλλος θα είναι ο στόχος στην Βιάννο. Διαφορετικά πράγματα ε.
>
> P: Regarding the forests of the prefecture, what do you think should has been done and what has not been done?
> H1: A correct management plan. A management plan that will take into account the real needs of the forests, the shepherds and mainly, the biggest enemy, overgrazing. Especially the goat. ... The targets will be different in Psiloritis, in Viannos, different things.
>
> H1: 59, M, Forester

However, when foresters face reality and have to deal with resources where logging is not the main management strategy, problems and confusion exists. A formal guide for an alternative management practice does not exist. Foresters are confused although they have been taught about alternative management, when logging is not implemented. Moreover, the current status of animal husbandry does not allow for the development of a proper management plan for pastures that will be implemented in Crete. As a result in Crete over the past 60 years, forestry management is limited or completely absent from the island. There have been a few forest works, related to husbandry, forest recreation and forest road construction, but an organised management plan has never been applied (HFDD10, 18, 21, 27, 28, 35, 41)

> Η1: Πώς θα γίνει η υλοποίηση, το πρόβλημα είναι πως θα γίνει η υλοποίηση στην περιοχή μελέτης, η οποία σίγουρα θα προβλέπει, ... ό,τι πχ θα βόσκουνε 1000 πρόβατα, κομμάτια οζά, εκεί που βόσκουν τώρα 10.000, τα 9.000 πώς θα φύγουν. Αυτά είναι, τα 9000 πώς θα φύγουν. Η πολιτεία δεν θέλει να το ρυθμίσει, για διάφορους λόγους, όχι για τα χρήματα ... Είναι και κοινωνικοί παράγοντες μετά.
>
> H1: How this will be implemented (management plan), that is the problem. The management plan will suggest ... that for the area studied for example, can graze 1000 sheep, now they are 10,000, the rest 9,000 animals where they will be removed. The State does not want to regulate it for different reasons, not only for money ... there are also social elements connected with this.
>
> H1: 59, M, Forester

Moreover, there have been some other management plans for the protected area of Psiloritis developed outside the Forest Service and funded by the EU, under several Life Projects (E.C. 2011b). Often these management plans are neglected by foresters as unrelated or a gathering of information that could be useful for a scientist but not necessarily applicable in current forestry in Crete.

Forest Commission has several successful examples of forest works that have helped the local population and added important values to neglected areas. Although forest roads have been greatly criticised for landscape destruction by ecologists, a retired forester suggests that such works were very useful to the upland populations:

> Η6: Υπήρξε αποτέλεσμα και το αποτέλεσμα φαινόταν στο πρόσωπο των κτηνοτρόφων ας το πούμε. Οι οποίοι θέλανε 1 μέρα με τα ζώα να φτάξουνε στο μιτάτο και άλλη μια μέρα να κατέβουνε κάτω, και αφού ανοίξαμε το δρόμο, σε μια ώρα φτάνανε στο μιτατο, το τελευταίο μιτάτο ... και άλλη μια ώρα να κατεβούνε ας πούμε με τα αυτοκίνητα τους. Για αυτούς ήτανε μεγάλη υπόθεση διότι, κερδίζανε χρόνο, μειώνανε το κόστος της παραγωγής,

> H6: There was a benefit and the result (of road construction) was in the faces of the shepherds. They needed one day with the animals to get to Mitato, and another day to go back to the village, and when we constructed the road, in one hour they were in the last Mitato... and they needed another hour to get down. For them this was very important, they gain on time, and reduced their productive cost.
>
> H6: 62, M, Forester

Another example of successful forest work is the creation of a recreational forest area in the 1980s in Zaros village. This was done with the cooperation of the Water Commission that wanted to create an irrigation system with a reservoir in the area. The Forest Commission suggested the creation of a lake that was later connected with a pathway in the nearby gorge of Gafari. Today this area is one of the main visiting tourist spots for Psiloritis region (Figure 9.37).

One of the main suggestions of a forester of how to implement forest works was:

> H6: βέβαια Παντελή θα πρέπει να ξέρεις, ότι για να γίνει ένα έργο και να γίνει σωστό και καλό, πρέπει να χρειάζεται ενδιαφέρον, να χρειάζεται μεράκι και στη συνέχεια να υπάρχουνε και τα λεφτά. Διότι αν υπάρχουν τα λεφτά και δεν υπάρχει το ενδιαφέρον, δεν γίνετε τίποτα.
>
> H6: You must know Pantelis, that in order of a work to be implemented and to be done in a good way, there is a need for interest. You need to have passion and then money. If there is only money available, and there is no interest in the work, nothing will be done.
>
> H6: 62, M, Forester

All these examples and suggestions facing current reality and the neglected role that Forest Commission plays can be summarised in what a 40 year old forester states:

> An11: Τώρα να σου πω πιστεύω ότι δεν παίζει καθόλου ρόλο το δασαρχείο. Αυτή είναι η προσωπική μου εκτίμηση και είμαι από μεσα και μπορώ να πω ότι έχω... Πιστεύω ότι μπορεί να παίζει, αλλά να πω μάλλον το εξής, ουσιαστικά είναι ένας διεκπεραιωτικός φορέας το δασαρχείο, διεκπεραιώνει και προσπαθεί να διεκπεραιώσει τα γραφειοκρατικά του πολίτη. Τίποτε άλλο δεν είναι αυτή τη στιγμή η δραστηριότητα του. Δεν έχει ένα σχεδιασμό, δεν έχει ένα όραμα, του τόπου του νομού ας πούμε που ασχολείται.
>
> An11: I should say that I believe the Forest Commission has actually no role (in rural development). That is my personal opinion and I have an inside view of the things (employee in H.F.D.). I believe that it can play an important role, but I should say this: actually today is a bureaucratic office, it tries to work with the bureaucratic problems of the people. Nothing else it is at the moment. It does not have a target, a schedule a vision for the area for the prefecture.
>
> An11: 40, F, Forester

Figure 9.37: The area of Votomos in Zaros, where F.H.D. created an organised recreation site.

Source: photo taken by the author, July 2009

Currently there is a strong absence of Forest authority regarding control over grazing and this can result in a lack of efficient management and overexploitation. The problem is even more complex as animal husbandry officially is under the service of the Agricultural Department. However, the formal manager of uncultivated land, thus the majority of grasslands, is the Forest Commission. These contradictory elements have resulted in a permanent neglect and confusion among foresters, and have led them to conclude that forest management in Crete cannot be applied.

9.5 Conclusion

Recent forest works were successful and unsuccessful, an example being the plantations implemented in eastern Psiloritis. The lack of understanding of how forest ecology works and the fact that small scale interventions had long term results in the forest makes things even more complicated. Plantations have to be evaluated carefully and only when the circumstances are applicable should they be implemented.

Irrespective of the quality of the plantations' material and the appropriate procedure that a forester could suggest and supervise, reforestation or afforestation should be evaluated in a broader context

before a decision is made of where and when it is to be implemented. Local initiatives for afforestation should be promoted as they include small scale developments often for landscaping damaged sites, where forest is the most appropriate landuse. These cases are costless and have much more chance to succeed as they often have the agreement and support of local people. What was criticised as negative in the forest archives in the 1950s for Crete was that only the private sector provides a limited reforestation programme. Today this should be promoted and the Forest Commission can play a key role in that.

Reforestation attempts in areas where forest was destroyed by fire should be avoided and natural processes should remain unaffected. The knowledge of the history of the forest sites is important as it can help us to understand the dynamics of the habitats and promote the appropriate decisions for forest conservation. Knowing the past can help us to understand the present and develop a management plan that will affect the future and be suited to our needs and targets.

The Forest Commission needs to redefine its role and adopt current trends in forestry. In Crete, where shepherding dates back to early civilisations, there is a strong need for cooperation with the shepherds. They are the actual users of the uplands today and the ones that should be the beneficiaries of forestry. There is a strong need to set short term achievable management targets that can be applied in the current conditions, taking into consideration that forester actions will be permanent for long periods in the forest. Foresters need to evaluate their targets and adopt a new vision for the benefit of both, the forests and the society.

Chapter 10: Conclusion and discussion

10.1 Summary of the research findings

The neglected forests of Crete were not always neglected and unproductive. Different epochs created needs that exploited them more or less. Whatever the central governmental policy from the various rulers of Crete was, over the historical era, local people relied on their forest resources for their survival.

This thesis has shown that forest resources provided security in times of need and when circumstances were harsh. Forests and the isolated mountain provided a refuge and extra income. In addition forest resources were intensively exploited to provide the necessary needs for survival.

Oral history and archival research have provided insights into forest uses over the last hundred years from the perspective of local people and central policy makers. The uplands, where the main forests survive and are hidden according to Rackham and Moody (1996) provided the necessary fuel and timber for locals' needs as well as feed for their livestock. Depending on the time and the harsh social circumstances, these sources were also commercialised and marketed to those that did not have access to forest.

The main management practices implemented by locals were leaf fodder cutting, firewood collection, grazing and logging for timber and charcoal. These actions influenced forest synthesis and expansion. Other products obtained from the forest not necessarily connected with management practices, but which could influence them, were acorns and herbs both of which were very important for the local economy in the past.

The majority of these practices ceased in the 1960s. Some of them were regarded by the locals as negative for the forest; for example, charcoal production which was seen as responsible for destroying much of their woodland, but a necessity for their economic survival at the time. Others such as leaf fodder cutting were assumed to be positive for the trees and were a factor that renewed them.

All these different uses of the past drew on a complex system of rights and utilization within the same space, but from different users. Although conflicts did occur, all of these various and often contradictory uses coexisted for hundreds of years. Today the scene has dramatically changed and new trends in spatial use have appeared. The only remaining

traditional practices associated with the trees are leaf fodder and firewood collection, although they are only sporadically applied. Currently the main use of the forest is for grazing and it can be argued that this is a persistent practice that has been continuous for millennia.

The complex system of the past has disappeared and shepherds regard themselves as the only occupier of the uplands. The multiuse of the forest has been abandoned and it is now exploited only by browsing animals whose numbers have significantly increased. Traditional animal husbandry faces changes as well, in both the type of animals, an increase in sheep and a decrease in goats, and the grazing system applied. In the past the uplands were able to sustain independent animal husbandry, without any need for extra feed imported from outside the area. Nowadays this has changed and shepherds rely on concentrated feed at a huge economic cost.

Ancient trees remain one of the most enduring characteristics of the landscape, and were useful as key points to geo-reference aerial photographs of 1945 with current satellite imagery. In addition, the micro scale analysis implemented in this research highlighted the importance of historical geography in ecological studies and especially in forestry. Historical geography plays a key role in understanding and evaluating vegetation status and can be applied locally in specific sites in a micro scale analysis to explain different geographical phenomena. This was obvious in chapter 9 where the cases presented showed that historical geography enlightens current geographical phenomena that could not be explained easily by studying only the physical environment.

As a result of this micro scale analysis, forest status was better understood in eastern Psiloritis. Forest is shown to resist degradation from overgrazing and vegetation cover has decreased mainly in the grasslands of the upland plateaus where there is higher pressure. Overgrazing is not necessarily connected with forest reduction in Crete as Cretan trees are resilient to browsing and can survive high pressure and recover when conditions are more favourable.

The key players of the forest were the majority of the upland population and after the 1920s the forest officials as well. This was true till the 1960s, when most of the traditional practices ceased. Forest officials were not needed anymore to issue permissions for woodcutting, and gradually the local forest offices were abandoned. Today the main users of the uplands are shepherds and forest officials who promote works for the improvement

of grasslands, mainly road constructions, over recent decades. This has also stopped since the end of 1990s. Today the absence of the Forest Commission is more obvious than ever and is connected with the recession in Greece and a lack of capital investment in forestry works. In addition new regulations and prohibitions are about to be introduced as the area of Psiloritis has been classed as a NATURA 2000 site as have the majority of forests in Crete. At the moment however, the current situation is characterised by the increase in grazing animals fed with concentrated foods, the accessibility of the uplands by vehicles, and the absence of any clear forest management.

10.2 Methodological issues

The use of a multi-source research approach was particularly helpful in the study of forests and helped to add information in areas that were missing. Data were often found in unexpected sources, hence there is a recognised need to be flexible in forest history research and not focus on only one method. Preliminary research in the archives provided background information about the history of eastern Psiloritis and allowed the better formation of questions for the interviews.

Undoubtedly, the fact that I was already familiar with the study area helped the research process. This was the reason that I could gain free access to local commune archives as well as to HFDA, which were studied for first time in the project. Some difficulties occurred in the H.A.C., where the strict implementation of the rules permitted only limited access to the sources. Archival research can be very time consuming when following the formal regulations and fortunately this was not the case for the unorganised local archives, otherwise the amount of data collected for this research would have been much less.

An important element was the use of a micro scale analysis on specific forest sites that were particularly useful to understand forest status and that can help forestry in the future to have better management decisions. This is connected with the importance of historical geography not only in geography itself but also in other disciplines such as applied forestry.

The combination of both qualitative and quantitative methodologies was beneficial. However, it was important to keep a balance between them. Moreover, the amount of data found in the archives could not be studied for every available year in detail, thus only selected years were integrated in the GIS quantitative analysis. Therefore, only a partial idea of the real

picture could be shown in this thesis. The absence of quantitative information in digital format was a disadvantage and it was time consuming to transfer these data from paper to database format.

Furthermore, several other archives exist in Crete and could not be studied because of several barriers such as lack of knowledge of Turkish and Italian language and also the lack of available time. These written sources may include additional information on human-nature interactions useful in environmental history which could be studied in the future. The selection of a specific area to be studied offered the opportunity for detailed local research but these results may differ in other parts of Crete as it is a very diverse place and local communities could have adapted other traditional practices.

Digital data collection for GIS was a really important element. Open source data available for free in Greece (OKXE 2011), enables you to perform research with no cost and less time. However these free data often lack any metadata that can provide information from and by whom they were produced, when or their accuracy. This added a level of uncertainty and ambiguity concerning their credibility. This is a problem that has often been addressed and there have been several steps to standardise spatial data (Kralidis 2008) but they are still in progress.

On the other hand, GIS was particularly useful in the analysis of quantitative archival information as it was possible to detect trends that were not obvious only from the qualitative analysis. The creation from scratch of databases from data documented on paper was challenging and time consuming work. In addition in this research only limited capabilities were used and GIS can offer a range of more analytical tools in forest management and conservation.

10.3 Lessons from history for forestry

Current knowledge of traditional management practices, although it has often been neglected by modern society, may contain wisdom and the experience of millennia that today in the scientific world faces the risk of being abandoned and forgotten.

This thesis has shown that what we regard today as neglected and unproductive forest was not so in the recent past. Even the Forest Authority permitted forest production, mainly charcoal, till the 1950s, but today modern foresters ignore this history. Current forest management for timber has totally ceased and often people regard the current situation to

be one of long standing. An interviewee from Zaros mentioned that the life style of the past could not even be imagined by current people:

> Z7:Η απόσταση, αν πάμε 60 χρόνια πίσω, ήτανε μεγάλη απ' τη σημερινή και αν πάμε πιο πίσω 20 χρόνια, πάλι ακόμα πιο μεγάλη. Διαφορές που όποιος δεν το 'ζησε, δεν μπορεί να το φανταστεί.
>
> Z7: The distance, if we go 60 years ago, was vast comparing it to today's life. In addition, if we go even further back in time, twenty years before, it was even bigger. Differences that if someone hasn't lived them, they cannot even imagine them.
>
> Z7: 82, M, Farmer

This shows how easily people forget their past even if it is relatively recent. The current situation is presumed to be what has always been the case and modern urbanised society disregards the use of nature and earth by people and they have lost the connection to their own natural environment.

Historical geography though was able to reveal the secrets of the forest and showed for example that the pine forest of Zaros in Trapezoplaka was not pine in 1945. After the forest fire that destroyed it in 1994, unsuccessful plantations were organised and implemented several times by Forest Commission. If foresters were aware of this they could avoid afforestations in this specific site and invest the available capital in more successful works. Current forest personnel in H.F.D. ignore completely the existence of leaf fodder collection and its value for the conservation of ancient trees (Petit and Watkins 2003, Rackham 2008, Peterken 1996). Forest law does permit under specific conditions leaf fodder collection. However, if someone suggested the implementation of such a practice, they would face negative reactions from foresters, as leaf fodder cutting is regarded as harmful for the trees and the forest. It seems that the forest law in this case is much more flexible than the foresters and provides the necessary tools to implement alternative management when needed. The most important lesson that history has shown is that the forest was an important element for the locals where multi-uses coexisted for long periods and although conflicts existed, a balance did occur and allowed all of them together to exploit their resources.

10.4 NATURA 2000 - Modern forestry

The problematic timber production from Cretan forests created a gap in management knowledge for the 'unproductive' forests of Crete and Greece generally. Forest history can learn from these practices and some could be integrated in current forest works and plans so that both forest and local

people could benefit. Crete needs different management and forestry should be flexible and open-minded to accommodate new practices. Traditionally forestry is a conservative discipline and should be as it has to deal with actions that will be faced by future generations but forestry needs to define new approaches that could promote central policy and also benefit local communities. Definitely today in Greece a formal forest policy does not exist or even if there are some targets written on paper and published in statutes, most of the time they are lost in the bureaucratic chaos of the public sector. It is through individual initiative that this picture can change. A forester from H.F.D. suggests that first we as individuals need to have a vision which breaks through the daily routine:

> Αn11: Αυτή είναι δηλαδή η γνώμη μου και η άποψη μου. Πιστεύω ότι οι νέοι άνθρωποι που είμαστε τώρα στην υπηρεσία, όσοι νέοι είμαστε και όσοι θα ‘ρθουνε από δω και πέρα, πρέπει να έχουνε όραμα, δηλαδή πιστεύω ότι όταν έχει καθένας το προσωπικό του όραμα θα βρει ένα δρόμο να το ακολουθήσει. Αλλά βλέπω πως οι πιο νέοι από μας είναι ακόμη χειρότεροι. Οι πιο νέοι από εμάς έχουν την νοοτροπία των πολύ παλιών. Πιστεύω αυτό δηλαδή βλέπω ας πούμε και με τα παιδιά που έχουν έρθει τελευταία ότι μόνο αυτό που τους λες κάνουνε δεν πάνε παραπέρα, και ούτε έχουνε μία πρόταση. Μία κουβέντα και έχουνε γνώσεις, ο άλλος έχει μάστερ στα GIS, πολύ περισσότερες από μας και δεν κάνει ένα βήμα παραπάνω. Και βλέπω νέα παιδιά πιο μικρά από μας και διορίζονται και τους ενδιαφέρει το οράριο το να κερδίσουνε χρόνο να φύγουνε δεν έχουν όραμα. Δεν την βλέπω εγώ αυτή τη δουλειά σαν όραμα, απλώς είναι η μισή μου ζωή ας πούμε
>
> An11: I mean this is my opinion. I believe that young people that we are now in Forest Commission, … and the new that will come, from now on, need to have a vision. I believe that when everyone has their personal vision they will find a way to follow it. However, I see that the younger of us are even worse. The younger (foresters) of us have the mentality of the very old (foresters). I have noticed that the new people that came to work, they just do what you told them to do. They don't move on, they don't have any proposals. Although they are educated. They have master degrees in GIS, much more than us and they do not do a further step. In addition, I see young people, younger than us, that are employed in H.F.D., and the only thing that are interests them is the working time how to work less and leave earlier, they do not have a vision. I don't mean that this job is my vision, but it is still half my life here.
>
> An11: 40, F, Forester

This is the current challenge, how to change the unproductive status into useful elements that can promote multiple purpose forestry and alternative management. Traditional practices were a result of a need of the local people in the past, but today there is no actual need for these uses to continue. Thus, some of these practises have ceased. Here lies the importance of forestry and foresters who can promote a policy that can help to maintain crucial characteristics and create a need of action. The Forest Commission under specific management targets can encourage these elements crucial to conserve ancient trees and forest generally and

they can again be useful to people that have forgotten them. The Forest Commission has the experience to implement such works and actually in Greece is the only sector that implements management and has the relevant experience.

It is the Forest Commission that should re-establish the lost human-diversity action in the forest and import new users into the mountain. This will bring the lost complexity of the past to the monopoly of shepherds in the area today. Currently the majority of shepherds are regarded as enemies of the forest and the main cause of environmental damage. It is important that shepherds are reminded that they were the protectors of the forest and that they should continue being so as they are and will be the main users of it in the future. New trends and uses within the forest have already taken place. Environmental educational programmes have been established in the mountains, alternative tourism has increased and people want to know more about rural Crete and are not only visiting the massive touristic attractions on the coast (ACEE 2011, EGN 2011).

This has already started happening and foresters in Crete are more open-minded in terms of alternative management than others from Northern Greece. This is a result of the timber production that still operates in Macedonia, Epirus and Thrace, whereas the absence of such management in Crete creates the need to redefine forest values. Thus, H.F.D. often promotes the construction of pathways and recreation sites in the forests. Current trends in the society for the use of traditional products, and the reconnection of urban citizens with nature can help H.F.D. to take advantage and promote a policy towards a productive Cretan forest (Psiloritis Natural park 2011, M.E.C.C. 2011a).

Eastern Psiloritis has been facing different type of changes in its long history. This research has shown that several management practices of the past were responsible for the current landscape status of the area. The findings of this research can be applied in a wider context regarding the management of Psiloritis as a NATURA 2000 site and not only in relation to forest elements. The findings showed that in the past and today, landscape is strongly connected with the human actions. The management of the Psiloritis NATURA 2000 site should be in accordance with the conservation targets and social parameters that modern society faces today. Thus forestry cannot be separated from a holistic management approach that will be applied in the future in the NATURA 2000 site and will include cultural and farming elements. Moreover, local population could be

benefited from this designation of their land as a NATURA 2000 site and promote a sustainable development in their villages. All these elements are interrelated and it is not possible to separate for example forestry from the rest of the uses of the environment in Psiloritis Mountain.

10.5 Further research recommendations

The present research has investigated the relationships of local people with their forest resources based on oral history, archives and GIS analysis. Focus has been placed on the forest elements and not other topics such as traditional products from animal husbandry. The specialisation of these products is very high and different between local producers; however, several of them are being forgotten as a result of unification and mass production. This needs to be investigated and explored in the future, before this knowledge is completely lost.

From an environmental historical perspective, more attention should be given to other archival sources for example from Venetian and Ottoman periods that could produce a clearer picture of those eras.

Experimentation is needed to evaluate past management practices and to apply them efficiently in current ecosystems. This will enable a better evaluation of these actions and the potential benefits that the forests and society can gain.

In forest research, information regarding the use of GIS especially open source, could promote the conservation of forests and could be helpful for investigating its role specifically designed for the Forest Commission. Current available land-use data are not applicable to the Forest Commission today and there is a need to create digital information integrated in an informative system that could be used at least at the level of the region of Crete.

It is also crucial to find solutions to how people can participate in future decision making and cooperate in forest conservation through modern technology and web-GIS applications, the new democratic society that the digital world brings.

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Appendix I

Interview Survey card for Mayors, foresters and gatekeepers (based on Saratsi 2003)

Name	Occupation/Responsibilities
Age	Place
Date	

Life history

The personal history of each individual.

The discipline and the responsibilities.

Potential questions:

- Do you know where there was forest and how this area was called?
- The ownership status of the forests? Communal?
- Who visited the uplands and how they were using their forest? Was any kind of permission required?
- Do you remember any products derived from the forest?
- When this type of management implemented, how was it done, why it was done, who participated?
- When was the last time that this type of management took place? Why it was stopped?
- Do you believe that the forest in the past was bigger and healthier? Was it extended in other areas?
- Do you remember a large scale fire in the past? When and where?
- Today who is the user of the forest and how it is exploited?
- Relationships with ecological organisations.
- The municipality has interest in the forest? What is the value for the municipality of the forest, in terms of management, conservation? Who should implement management in the forests of your areas?
- How will you describe a good forester?

Interview Survey card for villagers

Name	Occupation
Age	Place
Date	

Life history

The personal history of each individual.

Forest elements

- Forest of the area: place, toponyms, species.
- Relations of villagers with the forest/its use/ who visiting the forest.
- Products from forest: timber/agricultural implements/fruits/resin/ branches/leaves/. Transportation of the products, how they collected the products, who collected them, special workers? Storage of the products?
- Pine forests: their use, honey, resin, wood. Their expansion today?
- Forest fires: When, Where. Did they set off fires? Where and why?
- Diseases in the forest and the trees.
- Charcoal making: When, type of wood used, how, commerce.
- Lime making: When, type of wood used, how, commerce.
- During the WWII what happened? Did Germans used local forests and people for their needs?
- Hunting: When, Where? type of game.
- Cultivations today and in the past.
- Historical information of the forest and the uplands, existence of myths.
- Users of the uplands today and in the past.
- Bee keeping: Today and in the past.
- Protected area: What do you know about this? What is your personal opinion?

Grazing elements:

- Grazing system in the past vs today.
- Animals: goats, sheep, cattle. When this changed? The number of the animals in the past and today.
- Did you collect any food for the animals? Did you cut branches with leaves to feed them? From what tree species? When, How, Where? Is that still applied?
- Summer Pastures: When, for how long, from whom, how was the life in the uplands. Trans-humans routes. What is happening today?
- Pastures were considered communal or private? Today what is their status?
- Where is the best pasture today and why you think this?
- Do you think that pine forests are a good place to graze?

- Plants or animals existed in the uplands in the past and today you cannot find them or they have been reduced.
- Concentrated feeds: When they started using them and why?
- Current problems in animal husbandry?

List of traditional management practices based on (Moreno et al. 1993)
Sheep grazing/ Goat grazing/ Hay cutting/ Fodder cutting /Uprooting /Pollarding for fuel/ Felling for timber /Deadwood collection/ Coppicing for fuel /Water drainage/ Tree plantations/ Pastoral fire /Terracing /Charcoal making /Garden cultivations/ Forest fire.

Appendix II

A list of the participants of the interviews during this research:

a/a	code	Place	Date	Occupation	Age	Gender
1	An1	Anogeia	01/02/2010	Shepherd	50	M
2	An2	Anogeia	01/02/2010	Civil Servant (AKOMM*)	30	M
3	An3	Anogeia	17/01/2010	Tavern owner	84	M
4	An4	Anogeia	17/01/2010	Shepherd	69	M
5	An5	Anogeia	17/01/2010	Priest	64	M
6	An6	Anogeia	17/01/2010	Shepherd	52	M
7	An7	Anogeia	14/08/2009	Economist (AKOMM*)	42	F
8	An8	Anogeia	14/08/2009	Agriculturalist (PNP*)	45	M
9	An9	Anogeia	17/01/2010	Teacher (EGP*)	44	F
10	An10	Anogeia	01/02/2010	Mayor	36	M
11	An11	Anogeia	10/01/2010	Forester (EGP*)	40	F
12	An12	Anogeia	25/01/2010	Civil Servant	45	F
13	An13	Anogeia	01/02/2010	Teacher (CEE*)	45	F
14	An14	Anogeia	01/02/2010	Tavern owner	48	F
15	An15	Anogeia	09/02/2010	Researcher (NHMC*)	40	M
16	As1	Ano Asites	12/07/2008	Retired, Farmer	63	F
17	As2	Ano Asites	12/07/2008	Farmer, pottery shop	60	F
18	As3	Ano Asites	10/07/2008	Farmer, painter	58	M
19	As4	Ano Asites	05/07/2008	Farmer, housekeeper	56	F
20	As5	Ano Asites	25/07/2008	Retired Farmer, housekeeper	75	F
21	As6	Ano Asites	23/07/2008	Farmer, builder	66	M
22	As7	Ano Asites	20/07/2008	Retired,	95	F
23	As8	Ano Asites	16/07/2008	Farmer, housekeeper	60	F
24	As9	Ano Asites	12/07/2008	Electrician	55	M
25	As10	Ano Asites	07/08/2010	Civil Servant	30	M
26	As11	Ano Asites	29/07/2008	Farmer, housekeeper	63	F
27	As12	Ano Asites	04/07/2008	Retired Farmer, housekeeper	89	F
28	As13	Ano Asites	04/07/2008	Farmer, beekeeper	61	M
29	As14	Ano Asites	21/07/2008	Farmer	36	M
30	As15	Ano Asites	23/07/2008	Farmer	50	M
31	As16	Ano Asites	20/07/2008	Farmer	55	F
32	G1	Gergeri	19/01/2010	Civil Servant	80	M
33	G2	Gergeri	21/01/2010	Shepherd	78	M
34	G3	Gergeri	21/01/2010	Shepherd	45	M
35	G4	Gergeri	12/01/2010	Bee keeper-Shepherd	43	M
36	G5	Gergeri	27/01/2010	Shepherd	78	M
37	G6	Gergeri	30/01/2010	Shepherd	78	M

38	G6	Gergeri	15/01/2010	Civil Servant	50	M
39	G7	Gergeri	27/01/2010	Shepherd	75	M
40	G8	Gergeri	27/01/2010	Shepherd	76	M
41	G9	Gergeri	20/01/2010	Vice-mayor	40	M
42	G10	Gergeri	27/01/2010	Shepherd	65	M
43	G11	Gergeri	28/01/2010	Farmer	58	M
44	G12	Gergeri	30/01/2010	Shepherd	80	M
45	G13	Gergeri	30/01/2010	Farmer	82	M
46	G14	Gergeri	27/01/2010	Electrician	60	M
47	G15	Gergeri	15/01/2010	Agriculturalist (AC*)	41	F
48	G16	Gergeri	15/01/2010	Farmer	45	M
49	G17	Heraklion	20/01/2010	Teacher (EGP*)	43	M
50	G18	Gergeri	27/01/2010	Pensioner	60	M
51	G19	Gergeri	21/10/2009	Teacher (CEE*)	41	M
52	G20	Gergeri	07/01/2010	Civil Servant	70	M
53	G21	Gergeri	07/01/2010	Civil Servant	45	M
54	G22	Gergeri	07/01/2010	Civil Servant	45	M
55	G23	Gergeri	15/01/2010	Mayor	45	M
56	G24	Heraklion	20/01/2010	Teacher (CEE*)	45	M
57	G25	Heraklion	20/01/2010	Teacher	39	F
58	G26	Gergeri	15/01/2010	Civil Servant	30	F
59	G27	Gergeri	15/01/2010	Civil Servant	30	F
60	G28	Gergeri	07/01/2010	Butcher	40	F
61	H1	Heraklion	26/08/2009	Forester	59	M
62	H2	Heraklion	18/01/2010	Veterinarian (GCG*)	45	M
63	H3	Heraklion	25/01/2010	Forester	43	M
64	H4	Heraklion	25/08/2009	Forester	45	F
65	H5	Heraklion	24/08/2009	Forester	42	M
66	H6	Heraklion	26/01/2010	Forester	62	M
67	H7	Gergeri	30/01/2010	Forester	30	M
68	H8	Ano Asites	20/07/2008	Retired, forester	62	M
69	H9	Heraklion	23/07/2008	Agriculturist (AC*)	45	M
70	H10	Heraklion	09/01/2010	Agriculturalist (AC*)	33	M
71	K1	Krousonas	28/01/2010	Shepherd	77	M
72	K2	Krousonas	28/01/2010	Shepherd	45	M
73	N1	Nyvritos	18/08/2009	Cafe owner	50	M
74	N2	Nyvritos	14/01/2010	Farmer	75	M
75	N3	Nyvritos	14/01/2010	Housekeeper	70	F
76	N4	Nyvritos	14/01/2010	Police-farmer (Hayward)	70	M
77	N5	Nyvritos	14/01/2010	Farmer	70	M
78	N6	Nyvritos	14/01/2010	Shepherd	75	M
79	N7	Nyvritos	13/01/2010	Civil Servant	50	M
80	Z1	Zaros	19/10/2009	Farmer	83	M
81	Z2	Zaros	20/01/2010	Hotel manager	71	M

82	Z3	Zaros	20/01/2010	Farmer	65	F
83	Z4	Zaros	20/01/2010	Farmer	36	M
84	Z5	Zaros	19/10/2009	Housekeeper	78	F
85	Z6	Zaros	21/01/2010	Shepherd	82	M
86	Z7	Zaros	20/01/2010	Farmer	82	M
87	Z8	Zaros	20/01/2010	Farmer	80	M
88	Z9	Zaros	17/08/2009	Mayor/Politician	54	M
89	Z10	Zaros	08/08/2010	Shepherd	40	M
90	Z11	Zaros	08/08/2010	Shepherd	70	M

*__EGP:__ Ecological Group of Psiloritis, **NHMC:** Natural History Museum of Crete, **PNP:** Natural park of Psiloritis, **CEE:** Centre of Environmental Education, **AC:** Agricultural Commission, **GCG:** Geotechnical Chamber of Greece, **AKOMM:** AKOMM-Psiloritis Development Agency of Local Government.

Appendix III

		Heraklion Forest Direction Documents
Code	**Date**	**Title-Information**
HFDD1	25/10/1946	Request for permission of Nyvritos commune to cut branches from their kermes oak forest.
HFDD2	28/12/1946	Approval of 200 wooden sticks derived from the forest of Nyvritos for the fence of the reforestation
HFDD3	12/3/1947	Fence of the reforestation the military camp.
HFDD4	21/3/1947	Court decision for distrait of goats and issue of a fine.
HFDD4	28/5/1948	Guidance for the filling of Book of Incidences
HFDD5	19/8/1949	Program of reforestations in the area of Kavalara in Liliano village
HFDD6	6/3/1966	Special study of the works for the improvement of the hydrological conditions of the mountain pasture of Gergeri commune
HFDD7	25/6/1970	Granted area for reforestation (Krousonas commune)
HFDD8	2/7/1970	Commune of Krousonas decision for assigning area of 25 ha for reforestation
HFDD9	3/7/1970	Allocation of areas for reforestations
HFDD10	13/7/1970	Allocation of areas for reforestations
HFDD11	18/7/1970	Allocation of areas for reforestations
HFDD12	26/7/1970	Allocation of areas for reforestations
HFDD13	30/7/1970	Allocation of areas for reforestations
HFDD14	17/2/1971	Submission of lists with animal husbandry information
HFDD15	26/8/1972	Selection of personnel for the work on forest fires and forest fire protection
HFDD16	11/12/1972	Decision for the time of permissions for wooded houses construction for recreation
HFDD17	2/12/1972	Dismissal of the forbid of grazing the forested areas
HFDD18	28/7/1975	Improvement of Zaros pasture
HFDD19	30/7/1975	Improvement of forests and pastures (Zaros)
HFDD20	9/9/1975	Approval of the study of improvement and management of pastures of Zaros commune
HFDD21	7/10/1975	Study of management plan of pastures
HFDD22	16/12/1975	Compilation of management plan of pastures of Zaros Commune
HFDD23	7/1/1976	Management plan of commune pastures
HFDD24	14/1/1976	For the improvement of communal pastures
HFDD25	16/10/1976	Report for the management plan of Zaros pastures
HFDD26	16/10/1976	Management and improvement plan of Zaros commune pastures
HFDD27	1983	Preliminary study of the organise of forest recreation and fire protection of Rouvas, Zaros gorge
HFDD28	3/4/1985	Final study of forest road in Gergeri- Ai Giannis
HFDD29	1985	Study of the improvement of the hydrological conditions and accessibility of the mountain pasture of Nyvritos commune
HFDD30	7/1987	Preliminary study of the creation and operation of forest recreation in Rouvas, Zaros-Nyvritos gorge
HFDD31	13/3/1987	Concession of area for reforestation (Vorizia)
HFDD32	20/4/1987	Reforestation of communal pasture
HFDD33	11/2/1988	Reforestation of communal area
HFDD34	11/4/1990	Approval of regulation of operation of the forest recreation are in Votomos Zaros
HFDD35	9/6/1992	Survey of Reforestation studies of Heraklion prefecture
HFDD36	12/12/1994	Reforestation of Vorizia communal areas, construction of environmental works and apiculture ect.
HFDD37	24/1/1995	Forbidden of logging in communal forest of Vorizia
HFDD38	23/2/1995	Request for reforestation in Vorizia commune
HFDD39	28/5/1995	Assignment of communal area for reforestation, help with personal work from the commune
HFDD40	24/11/1995	Study of aesthetical reforestations in the region of Vorizia commune
HFDD41	4/7/1995	Protection of Rouvas forest
HFDD42	31/7/1995	Utilization of Mountain range in Rouvas municipality

HFDD43	17/10/1995	Construction of studies (Municipality of Rouvas)
HFDD44	26/1/1996	Delegation of studies construction (Rouvas)
HFDD45	23/12/1996	Study of reforestation works and construction of water tank in the burned areas of the forest of the region of Zaros commune
HFDD46	22/7/1997	Repulse of Municipality of Rouvas lawsuit
HFDD47	22/10/1997	Lawsuit again the Greek State from Kost/nos Kokosali and Ioannis Kokosalis
HFDD48	5/11/1997	Lawsuit of Municipality of Rouvas against the Greek State
HFDD49	4/5/1998	Repulse of Municipality of Rouvas lawsuit
HFDD50	25/6/2000	Results of pine samples regarding nematodes
HFDD51	6/12/2000	Definitive result of the lawsuit of Rouvas municipality
HFDD52	25/5/2001	Problems of pine diseases in Sfakia, Prasse
HFDD53	10/10/2008	Dosage of pesticides for the treatment of *Marcallina hellenica*
		Nyvritos Commune Documents
RNC1	1849	Transaction contact for the forest
RNC2	28/2/1900	Selling contract of land to Nyvritos Commune
RNC3	6/5/1903	Transaction deed of Nyvritos and Gergeri 'wild land'
RNC4	10/10/1906	Statement of ownership recognition
RNC5	14/11/1920	Renting contract of the pasturelands
RNC6	13/4/1929	Selling contract of pastureland
RNC7	1/8/1931	Court decision for the use of pastureland in Nyvritos
RNC8	16/12/1931	Advises of Heraklion Prefecture to Nyvritos Commune for the renting regulations of the pastureland
RNC9	19/12/1931	Renting contract of the pasturelands
RNC10	28/8/1935	Shepherds' declaration
RNC11	5/11/1935	Advises of Heraklion Prefecture to Nyvritos Commune for the renting regulations of the pastureland
RNC12	7/11/1935	Shepherds application to Heraklion prefecture for renting the pastures of Nyvritos Commune
RNC13	10/8/1938	Shepherds' declaration
RNC14	17/7/1940	Registry of occupation of pastureland
RNC15	5/6/1943	Renting contract of the pasturelands
RNC16	17/6/1943	Shepherds application to local court for renting the pastures of Nyvritos Commune
RNC17	4/7/1952	Court decision regarding the renting of the pastures
RNC18	25/10/1957	Request for information of illegal pear harvesting (rural police)
RNC19	22/11/1957	Report of the Communal Committee of Nyvritos for illegal harvesting of pears
RNC20	16/12/1957	Reply to the Nyvritos Commune request (rural police)
RNC21	18/12/1957	Reply to the complains request (rural police)
RNC22	31/12/1957	Auction for the pasture of Nyvritos
RNC23	21/6/1958	Report of Gergeri Commune to Heraklion Prefecture regarding the dispute of Gergeri and Nyvritos for the pasturelands
RNC24	24/6/1958	Report regarding pasturelands ownership of Nyvritos
RNC25	July 1958	Description of the communal 'wild land' (Mountain)
RNC26	9/7/1958	Heraklion Prefecture report regarding the pasture voreino
RNC27	19/8/1959	Lawsuit against Nyvritos for the pasturelands
RNC28	2/10/1959	Report from Gergeri Commune to Nyvritos Commune for pastureland disputes
RNC29	28/5/1960	Rejection of Nyvritos application for land ownership
RNC30	21/8/1960	Reply regarding information of pasturelands from the Gergeri Commune (Heraklion Prefecture)
RNC31	2/9/1960	Request for information for the ownership of pasturelands (Heraklion Prefecture)
RNC32	2/9/1960	Application to the Advisory Committee of the ministry of Economics for the ownership status of pastureland
RNC33	22/9/1960	Reply regarding information of pasturelands in the dispute with Gergeri Commune (Heraklion Prefecture)
RNC34	12/10/1960	Report to Nyvritos Commune for pasturelands
RNC35	18/11/1960	Report to Nyvritos Commune for pasturelands
RNC36	23/4/1961	Request to the ministry of Economics for the ownership status of pastureland
RNC37	3/5/1961	Committee decision for the cadastral records, the case of Nyvritos 'wild land'
RNC38	25/7/1961	Registration of land to Nyvritos commune
RNC39	23/10/1962	Nyvritos commune lawsuit for pastureland

RNC40	9/10/1963	Court decision for pastureland
RNC41	October 1971	Registry documents for commune cadastral information
RNC42	18/5/1972	Nyvritos commune decision for issuing lawsuit for pastureland
RNC43	31/5/1972	Approval of Nyvritos commune decision
RNC44	22/6/1972	Topographical diagram of Nyvritos pasturelands
RNC45	17/10/1972	Court decision for pasture use
RNC46	17/2/1976	Court decision for land ownership
RNC47	14/9/1976	Report of illegal cutting of forested vegetation
RNC48	24/6/1977	Placement of landmarks in the pasturelands
RNC49	8/4/1986	Table of commune ownership lands
		Gergeri Commune Documents
RGC1	1849	Selling document of the forest to 76 villagers of Gergeri
RGC2	22/10/1924	Charter of Cooperative of the management of joint-owned forest
RGC3	14/5/1929	Tax rent 20,200 drachmas of charcoal and timber production (for implement construction) of the forest of Rouvas
RGC4	29/5/1930	Management report of the private cooperative forest of Gergeri, Rouvas
RGC5	May 1934	Commune Committee decision for the representation in the court in the dispute with the cooperative for the forest of Rouvas
RGC6	21/12/1936	Commune Committee decision of ownership of Rouvas forest in the dispute with the cooperative
RGC7	14/12/1937	Request of Forest Office for documents to prove ownership of Rouvas forest
RGC8	7/12/1938	Position paper of ownership of the area Voreino of Rouvas forest (Heraklion Prefecture)
RGC9	20/9/1940	Donation document of pasture land (Chalepa) to the church of Agios Georgios
RGC10	7/1/1953	Request of information regarding grazing rights in the communes (Heraklion prefecture)
RGC11	30/1/1953	Direction of pasture rent
RGC12	6/2/1953	Information regarding illegal grazing in the communes
RGC13	30/6/1966	Reconnaissance study of access forest road to the Mountainous pasture of Gergeri Commune
RGC14	26/2/1969	Decision of Registration Cadastral Committee for the Rouvas forest
RGC15	October 1971	Registry documents for commune cadastral information
RGC16	31/3/1986	Registration and updating of Cadastral information in Communes and Municipalities
RGC17	24/11/1987	Gergeri Commune Committee decision for grazing rights
RGC18	22/11/1988	Gergeri Commune Committee decision for grazing rights
RGC19	24/1/1991	Gergeri Commune Committee decision for grazing rights
RGC20	18/2/1994	Preparatory study of utilization-management and conservation of Mountainous areas of Gergeri commune (Forest Service)
RGC21	10/5/1994	Type of use of pasturelands and specification of grazing rights
		Zaros Commune Documents
ZZC1	6/9/1910	Renting contract of the Rouvas forest to local shepherds
ZZC2	21/5/1929	Agreement of the boundaries between Zaros and Nyvritos Communes
ZZC3	17/12/1939	Agreement of the boundaries between Zaros and Moroni Communes
ZZC4	18/10/1958	Agreement of the boundaries between Zaros and Vorizia Communes
ZZC5	28/6/1960	Agreement of the boundaries between Zaros and Gergeri Communes
ZZC6	8/3/1961	Agreement of the boundaries between Zaros and Anogeia Communes
ZZC7	1/11/1961	Court decision of Zaros and Anogeia communes boundaries
ZZC8	29/9/1967	Decision of Registration Cadastral Committee for the Rouvas-Notika forest
ZZC9	18/10/1972	Catalogue of grazing rights for the economical year 1973
ZZC10	6/12/1972	Improvement of pastures
ZZC11	30/12/1972	Technical report for forest road construction
ZZC12	24/5/1974	Submission of historical information of the German occupation period

ZZC13	30/10/1975	Technical report for fencing the pastures
ZZC14	25/2/1976	Grazing permission on the flocks of Vrontisi Monastery
ZZC15	15/9/1976	Regulations of grazing in Zaros pastures
ZZC16	23/4/1977	Censuses of pastures in Heraklion Prefecture
ZZC17	4/6/1977	Zaros Commune Committee decision of how to use communal pastures
ZZC18	12/9/1977	Court decision for water managing
ZZC19	24/8/1978	Request of machine borrowing to construct pasture roads
ZZC20	28/11/1979	Zaros Commune Committee decision on the request for the construction of a stable
ZZC21	11/2/1980	Zaros Commune Committee decision on the request for the construction of a stable
ZZC22	24/1/1983	Zaros Commune Committee decision on the request for grazing permission on the cultivated zone
ZZC23	2/2/1983	Utilization of pastures and forests
ZZC24	25/3/1983	Request of a shepherd for grazing permission
ZZC25	24/6/1983	Improvement of pastures
ZZC26	18/8/1983	Composition of the creation of forest recreation and fire protection in the Gorge of Rouvas Zaros
ZZC27	30/1/1984	Settling of the cultivated zone in Zaros
ZZC28	29/8/1984	Recognition of natural environment (filling questionnaire)
ZZC29	24/10/1985	Zaros Commune Committee decision of illegal grazing
ZZC30	27/5/1986	Request for pasture works funding
ZZC31	5/7/1988	Zaros Commune Committee decision of how to use communal pastures
ZZC32	8/8/1988	Confirmation of grazing rights
ZZC33	5/5/1989	Invitation of the Zaros Commune president to the shepherds to registry their animals and the areas they are grazing
ZZC34	8/5/1989	Zaros Commune Committee decision on the request for grazing permission of a shepherd on the cultivated zone
ZZC35	20/6/1989	Zaros Commune Committee decision of how to use communal pastures
ZZC36	24/5/1990	Zaros Commune Committee decision on the request for grazing permission of a shepherd in the cultivated zone
ZZC37	12/12/1990	Decision of the Agricultural office about fertilizing pastures
ZZC38	4/3/1991	Zaros Commune Committee decision on the request for grazing permission of a shepherd
ZZC39	30/6/1991	Zaros Commune Committee decision of how to use communal pastures
ZZC40	23/1/1992	Attempt for intervention in the environmental destruction of Psiloritis
ZZC41	20/7/1993	Zaros Commune Committee decision of how to use communal pastures
ZZC42	25/7/1995	Zaros Commune Committee decision of how to use communal pastures
ZZC43	30/7/1996	Zaros Commune Committee decision of how to use communal pastures
		Vorizia Commune Documents
ZVC1	1/12/1919	Renting contract of the uplands to shepherds
ZVC2	28/5/1936	Court decision of Vorizia and Kamares communes boundaries
ZVC3	18/12/1939	Court decision of Vorizia and Skourvoula communes boundaries
ZVC4	18/10/1958	Court decision of Vorizia and Zaros communes boundaries
ZVC5	27/1/1961	Court decision of Vorizia and Magarikari communes boundaries
ZVC6	21/11/1961	Selling of water spring
ZVC7	21/5/1965	Agreement for water works
ZVC8	6/8/1982	Public, Municipal, Communal land
		Anogeia Municipality
AM1	29/5/1964	Court decision of Anogeia and Zoniana boundaries
AM2	11/6/1964	Agreement of the boundaries between Anogeia municipality and Zoniana Commune
AM3	25/6/1986	Problems of the pasture burning
AM4	25/6/1986	Instruction for the protection of houses from fires in the forest, scrublands, grasses
AM5	30/10/1986	Reforestations of the mountains
AM6	16/11/1989	Allegation for wood cutting and pig grazing in the forest of

		Vroulidia
AM7	2/3/1992	Suggestions of the Greek Enterprise of Nature Protection for the protection of overgrazing of Psiloritis
AM8	7/7/1992	Calling to help conserve Psiloritis
AM9	1/12/1992	Reforestation of Psiloritis
AM10	15/3/1993	Results of the Committee meeting for the save of Psiloritis
AM11	29/3/1993	Notification for the overgrazing of Psiloritis and request for developing a management plan
AM12	20/5/1993	Notification to individual shepherds of fencing communal pastures
AM13	18/6/1993	Allegation of goats from Vorizia grazing in the pastures of Anogeia
AM14	5/7/1993	Negative answer to establish permanent forest personnel in Anogeia
AM15	21/7/1993	Renting of grazing in public forests and forested areas
AM16	24/9/1996	Anogeia municipality Committee decision asking for research of the ownership problem of the uplands
AM17	11/6/1998	Request to characterised areas in the uplands as no forested
AM18	12/6/1998	Escalation in the relationships of Anogeia Zoniana
AM19	13/6/1998	Media bulletin for the Anogeia – Zoniana conflict
AM20	29/6/1998	Anogeia municipality Committee decision for fencing communal pastures
AM21	3/7/1998	Reply form Forest Commission to request asking for the status of areas in the uplands
AM22	28/7/1998	Agreement of the pasture uses between Anogeia and Zoniana
AM23	11/9/1998	Lawyers suggestions for the ownership problems in the uplands
AM24	15/6/1999	Census paper for ski resort
AM25	11/10/1999	Scheduling of forest works
AM26	27/10/1999	Concession of upland and coastal areas for reforestation
AM27	24/5/2001	Proposals of forest works
AM28	21/6/2001	Suggestions of Hunting Association for the protected areas
AM29	18/7/2002	Revocation of the Refuge of Wild Life in Psiloritis
AM30	8/5/2005	Request to re-establish the Refuge of Wild Life in Psiloritis
AM31	12/5/2005	Refuges of Wild Life in Trigiodo and Psiloritis
AM32	12/5/2009	Special studies for the validation of ancient trees as Natural Monuments
AM33	12/6/2009	Request to study the disease in the species *Berberis cretica*
		Ano Asites Commune Documents
GAC1	2/3/1955	Ano Asites Commune Committee decision for renting communal pastures
GAC2	25/8/1961	Form of agricultural statistics
GAC3	15/1/1972	Renting agreement for pastures
		Historical Archive of Crete (H.A.C.)
HAC1	1898-1899	Report for the need to create Agricultural department in the Direction of Economics
HAC6	1903	Censuses of the wild trees of the island

Appendix IV

Title of Registry book	Information registered	Notes	Reference years	Type of use in the research	code
Book of decisions in absence [Βιβλίο ερήμην αποφάσεων]	Number and date of decision		1925-1970	qualitative	HFDA1
	Name of defendant				
	Residence of the defendant				
	Time of the trial				
	Sentence issued				
	Reason for conviction				
	Trial date				
	receive date				
	Result				
Book of accusations [Βιβλίον Μηνύσεων]	Name of prosecutor/ Their residence		1925-1971	quantitative /qualitative	HFDA2
	Name of the offender / Their residence				
	Characterisation of the action				
	Date of persecution				
	Date of operation				
	Date of trial				
	Result				

Book of registry for forest infringements [Βιβλίο καταχωρήσεως δασικών ανομημάτων]	Village		1980-present	quantitative /qualitative	HFDA3
	Forest name				
	Public - Private				
	Type of infringement				
	Date it happened				
	Name of the perpetrator				
	Name of prosecutor				
	Date of prosecution				
	Date of trial				
Book of power and payroll of personnel [Βιβλίο Δυνάμεως και μισθοδοσίας Προσωπικού]	Name		1917-1930	qualitative	HFDA4
	Action of employment				
	Started date				
	Action of reassignment				
	District of his descent				
	Department of work				
	Dates of work				
	Salary				
Book of power and payroll of personnel [Βιβλίο Δυνάμεως και μισθοδοσίας Προσωπικού]	Action of employment		1930-1932	qualitative	HFDA5
	Started date				
	Action of reassignment				
	District of his descent				
	Department of work				
	Time of work in the Forest Service				
	Education				
	Salary				

Book of registration of permission loggings [Βιβλία Καταχώρησης εκδιδομένων αδειών Υλοτομίας]	Date		1933-1949	quantitative /qualitative	HFDA6
	Logger name/residence				
	Characterisation (Private-Public etc)				
	Commune				
	Forest Product				
	Quantities	for each product there is a separate column to register the quantities			
Book of registration of permission loggings [Βιβλία Καταχώρησης εκδιδομένων αδειών Υλοτομίας]	Date		1949-1958	quantitative /qualitative	HFDA7
	Logger name/residence				
	Characterisation (Private-Public etc)				
	Commune				
	Forest Product				
	Quantities	for each product there is a separate column to register the quantities			
	Name of the register				
Book of registration of permission loggings [Βιβλία Καταχώρησης εκδιδομένων αδειών Υλοτομίας]	Action of permission	information are now registered in district level and not in commune level	1969-1977	quantitative /qualitative	HFDA8
	Forest product				
	Quantities				

Book of incidences [Βιβλίο γεγονότων]	This book is a type of diary for the commission and various information are recorded each year. This also includes the personnel, the type of forests and new regualations that are imported.		1956-present	qualitative	HFDA9
Book of statistics of fires [Βιβλίο στατιστικής πυρκαγιών]	Forest name		1923- present	quantitative /qualitative	HFDA10
	Place-name				
	area				
	Forest species				
	age				
	Public-Private				
	Management type				
	Village				
	Date				
	Damage				
	Name of the register				
	Date of presecution				
	Name of the arsonist				
	Forbidden action issued				
Archive of reforestaded areas	Several documents related for the reforestated areas of Heraklion, and their maps		1950 - present	quantitative /qualitative	HFDA11
Archive of natural monuments	Information for the areas recognised as natural monuments		1980 - present	qualitative	HFDA12

Appendix V

GIS analyses:

Kriging analysis: is widely used in GIS and 'the basic idea is to discover something about the general properties of the surface, as revealed by the measured values, and then to apply these properties in estimating the missing parts of the surface' (Longley et al. 2005, p.336).

Point to polygon: This is one of the most common spatial operations. It answers the question which points are within or outside of a specific polygon. If polygons overlap, points can be in one, more or no polygons. Moreover the attribute data of the polygons can be added to the points that are within them. ArcGIS can perform this with several tools (e.g. spatial join) (Longley et al. 2005, De Smith et al. 2007)

Polygon Overlay: Similar to point in polygon operation, though it involve polygons. It is more complicated, and the reason for vector model arisen in GIS. It answers various spatial questions, for example which olive orchards are in tertiary deposits (Longley et al. 2005, Goodchild 2002).

Buffer analysis It can be applied in points, areas, and lines and builds a new object, according to the distance we will choose. Is very useful when we need to find what elements are within a distance of an object, instead of trying to find the distance of elements from the desired object. For example we can find which trees are within a distance of 300 m of the villages (Longley et al. 2005).

Voronoi or Thiessen Polygons: It is mainly based on 'Tobler's first Law of Geography: Everything related to everything else, but near things are more related than distant things' (Longley et al. 2005, p. 65). In addition Voronoi analysis can be analysed as: 'given a set of points in the plane, there exists an associated set of regions surrounding these points, such that all locations within any given region are closer to one of the points than to any other point' (De Smith et al. 2011)

Appendix VI

Information of the geological symbols derived from the geological map of Crete (Creutzburg 1977)

'**Ts?-E**: Gavroro – Tripolitza series: (Excluding flysh) Jurassic to Eocene (very questionable occurrences of Upper Triassic). Thick bedded to massive, usually grey limestones and dolomites of tidal to shallow water origin. Locally brecciaed or fine crystalline.

Ts-Pc: Pindos series including its external parts (Ethia series) and early Cretaceous "flysch" deposits, but not Tertiary flysch. Upper Cretaceous to Paleocene –Lower Eocene: Pelagic limestone with chert and lime turbidites.

Cenomanian –Turonian: Graywacke and shale ("flysch").

Upper triasic - Lower Cretaceous: Bedded chert, "radiolarites" and pelagic limestone, likewise lime turbidites.

J?-Ek: "Plattenkalk" formation (s.s.): Jurasic (?) to Eocene. Mostly dark, locally light-coloured, thin-bedded to platy, finely to coarsely crystalline limestones with bands and nodules of chert. Locally, thin intercalations of reddish or greenish phyllites. At some places, for instance in the Sitia penissula, the limestones pass at the top into low-grade metamorphic, greenish calcareous phyllites with Globigerinidae' (Creutzburg 1977)

Information of the vegetation zones in Crete.

'H5: Pine-cypress forests of Crete

M9: Oak forests of Crete with Quercus ilex

T3: Eastern humid thermo-Mediterranean zone

T4: Pine forests with Pinus brutia and cypress' (Council of Europe 1997, p. sheet 4)

Glossary

Chontrolia: the traditional variety of olive trees cultivated in the area of Psiloritis often in ancient format.

EGN: Established in 2000, the European Geoparks Network (EGN) aims to protect geodiversity, to promote geological heritage to the general public as well as to support sustainable economic development of geopark territories primarily through the development of geological tourism.

Grosi/grosia: gurus in Turkish, is a silver coin used in Ottoman Empire. 1 oka/okadhes: Measurement value used in Greece in the past. 1 oka equals to 1,282 kgr. **Zygi/zygia**: 1 zygi equals 100 oka.

Natural Monument is a category of natural protected areas in Greece. They are areas, private or public, with important natural and ecological features. They can be solitary trees, parts of a forest, or areas with rare plants that are important for their biological, cultural, aesthetical or historical values (Chatzistathis and Ispikoudis 1995).

NATURA 2000: 'In May 1992 European Union governments adopted legislation designed to protect the most seriously threatened habitats and species across Europe. This legislation is called the Habitats Directive and complements the Birds Directive adopted in 1979. At the heart of both these Directives is the creation of a network of sites called Natura 2000. The Birds Directive requires the establishment of Special Protection Areas (SPAs) for birds. The Habitats Directive similarly requires Special Areas of Conservation (SACs) to be designated for other species, and for habitats. Together, SPAs and SACs make up the Natura 2000 series. All EU Member States contribute to the network of sites in a Europe-wide partnership from the Canaries to Crete and from Sicily to Finnish Lapland' (Eurosite, 2007).

Mitato: normally refers to a permanent settlement, stone house, made in the mountains and used for the shepherds' needs during their stay in the uplands; it was actually a shepherds' hut. This type of construction with small differentiations existed whole over the island of Crete.

Phrygana: is the vegetation type that occupies areas in Greece and Crete and its species are often aromatic shrubs and shrubs with characteristic dimorphism in their leaves that changes in winter and summer. They contain several spiny leaves and they occupy over grazed areas. They are often called Garrigue in other parts of the Mediterranean.

Prinos/Katsoprini: In local dialect is the term used to describe kermes oak (*Q. coccifera*). When it is in a shrubby format is called katsoprini.