AGROFORESTRY SYSTEMS CHANGE IN THE MEDITERRANEAN: SOME EVIDENCE FROM GREEK AND SPANISH EXAMPLES

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Abstract

Agroforestry is a cultivation technique that combines tree growing with arable cultivation or grazing of the trees understorey. It has a very long history around the world with very different cultivations (both for trees and in the understorey) and management systems. In the Mediterranean, early agroforestry systems were developed since the beginning of farming and some of the systems still encountered today date from the end of the Neolithic or early historic times. In this paper, some typical agroforestry systems of the Mediterranean are presented with a specific focus on their management systems and the landscapes they produce. These systems are considered as "better" in regard with environmental management than similar "modern" systems. Recently, some of these systems face abandonment due to extensive socioeconomic changes that have taken place in the areas they are found. Geographically, the examples are from Spain and Greece and in land use terms they cover olive cultivation – grazing, oak cultivation – grazing and chestnut cultivation – grazing. With the use of research material from Lesvos Island and Cáceres Province, the different management systems are presented in brief along with recent management changes and an initial exploration of their impacts in economic, social and environmental terms.

Key words: agroforestry; Mediterranean; landscape;

1. Introduction: Agroforestry systems in the Mediterranean

Since the beginning of cultivation and animal husbandry, trees have provided food, firewood and timber in societies across the world. Although the "taming" of tree species is a more time consuming process than that of annual crops, most early farmers have grown trees in regular plantations or irregular groves. In the Mediterranean and the Fertile Crescent, tree cultivation has been regarded as a 'noble' act, linked with notions of 'paradise' and aesthetically desirable landscapes. As management systems became more and more complicated and more knowledge was gained on the micro-ecology of different plant and animal species on one the hand and more plants and animals were introduced on different localities on the other, trees, annual crops and grazing animals were mixed in systems that today are called agroforestry (Eichhorn et al., 2006). According to the World Agroforestry Center (ICRAF), agroforestry has been defined a

> "*collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land management unit as agricultural crops and/or animals, either in some form of spatial arrangement or temporal sequence. In agroforestry systems, there are both ecological and economic interactions between the different components*." (Gordon et al. 1997, p. 1)

There are in general two differentiating qualities of these systems: the type of the use of the understorey of the trees and the type of the plantation. Regarding the former, the type of land use can be for: (a) arable land (in silvoarable systems); (b) pastures and/or grazing of the understorey (in silvopastoral systems); and (c) arable crops and grazing (in agrosilvopastoral systems) (Nair 1993).

Agroforestry plantations can be regular or irregular. Regular plantations are plantations in which trees are planted or grafted in ordinary rows and approximately equal spaces. They can be grown for nuts or fruits or their barks or to provide leaves or tree parts for grazing animals, or pollen, or for wood. On regular plantations all three types of land use discussed above can be encountered with tree densities varying according to the tree species and the location of the site (level or sloping field; type of soil; precipitation patterns). Irregular plantations are plantations in which trees are grafted upon wild ones or planted but at irregular spaces in a savannah style landscape with varying tree densities. The uses of trees can be the same as the ones on regular plantations, although here, cultivation for fruits is not so common, as harvests in

irregular plantations tend to be lower on average, for similar soil-climatic conditions, due to the varying tree density. Irregular plantations are usually linked with grazing, but arable cultivation can also be an option.

Agroforestry systems are mixed and multifunctional by definition. Their functions are not purely productive, as the presence of trees also provides environmental services such as soil improvement, reduction of surface runoff and conservation of biodiversity with their many different soil and air microclimates. At the same time, agroforestry systems provide aesthetic services as well.

In the Mediterranean, agroforestry systems date back to the Neolithic with a variety of trees and management systems. Some of the most typical trees used in old agroforestry systems include: Olive trees, oaks, chestnut trees, carobs, apples, almonds and date trees. They can be encountered in regular or irregular plantations, with all the types of land use already discussed. Other tree crops that were introduced at different times in the Mediterranean such as pears, oranges, lemons, peaches, apricots and more recently kiwis among others, can also be found in agroforestry systems (some can not as they involve tree cultivation alone). Geographically, the spread of such systems is very wide, as they are found in both the European, African and Asian parts of the basin, while they are encountered from the coasts of the sea to the tree limit on the mountains.

Not all systems are of the same in terms of frequency of occurrence in different settings and locations or their (productive, ecological and aesthetic) value. Regarding the distribution of the different systems, some species and systems spread throughout the region and others are found in particular locations. Examples of widespread systems include the cultivation of olive trees with grazing of the understorey by goats and sheep (the cultivation of arable or garden crops is more rarely encountered) that is so common that it has been characterised as one of the elements that assign the specific identity of the Mediterranean (Horden and Purcell 2000). Another very common example is the cultivation of oaks in a variety of systems, but typically with grazing of sheep, goats or pigs. These two systems arose as adaptations to the particularities of the Mediterranean climate and the morphology of its landscape (Allen, 2001, Grove and Rackham, 2001).

Recent developments have put many of older and "traditional" agroforestry systems at risk. The first and probably the most important such development is the rural depopulation caused by changes of the socioeconomic system in the area. Agriculture has been "modernised" and mechanised on one hand, while on the other the whole economy has moved towards industry at first and services nowadays. At the same time, social expectations shifted towards life styles away from the low incomes, higher risk and harsh work of farming. Therefore, the population of rural areas that sustained such systems has been reduced significantly, not only quantitatively but also qualitatively, as the younger inhabitants are those that left and continue to leave. A tendency of abandoning or simplifying former complex management systems is thus recorded around the Mediterranean, and agroforestry systems have suffered from these developments as well as other management systems.

In this paper, some typical agroforestry systems are presented in an environmental management light with a specific focus on the management systems and the landscapes they produce. These systems are considered as "better" in regard with environmental management than similar "modern" systems. Geographically, the examples are from Spain and Greece and in land use terms they cover olive cultivation – grazing, oak cultivation – grazing and (to some extent) arable crops, and chestnut cultivation – grazing. With the use of research material from Lesvos Island and Cáceres Province, the different management systems are presented in brief along with recent management changes and an initial exploration of their impacts in economic, social and environmental terms.

2. Methods and Data

In this paper, some typical agroforestry systems are presented from two very different areas of the Mediterranean, West and East: Lesvos Island in Greece and Cáceres Province in Spain.

Lesvos is one of the biggest islands in the Aegean (1632.8 km^2), with a population of 89,935 (in 2001). The main settlement is the capital Mytilini (36,196 inhabitants in 2001, or 40% of the total). The number of farms has been reduced recently (20%, from 22,799 to 18,132 in 1971-2001,), but agriculture is still quite important, especially in rural areas. After the 18^{th} century, agricultural and industrial development of olive oil mills, soap factories and leather processing factories brought forward economic prosperity followed by a rapid population increase (by 152% from 1800 to 1890). At the end of the century, the basic exports of the island were olive oil, soap, figs and acorns (Karidis and Kiel, 2000); while the imports were mainly cereals. The 20^{th} century brought economic crisis and the beginning of the rural exodus towards mainland Greece or abroad that accelerated after the 1940's (leading to a population decline of -35% between 1940 and 1981).

Rural exodus resulted in significant decline of most land uses other than olive groves since the 1930s (Kizos and Koulouri 2006), along with a gradual halt in practices that combined different land uses, forestry,

agriculture and animal husbandry (fallow, seasonal movements, mixed farming). On the other hand, sheep numbers tripled: from 70,000 in 1911 to 267,000 in 2001 (Kizos and Koulouri 2006).

Today, its agricultural landscapes can be classified at 3 zones: grazing lands (for sheep), terraced olive groves and intermediate landscapes. The visual characteristics of the zones differ: In the grazing lands zone, many animal husbandry constructions and dry stonewalls are encountered, separating the relatively large patches. Vegetation includes scattered oak trees or oak groves and dominance of garigue, with presence of some terraces, remnants of practices that stopped after the 1960s (i.e. plowing and harvesting cereal and pulses). In the olive groves zone, terraces are the dominant element and patches are small. In the intermediate zone, there are elements of the other two zones along with increased presence of arable land in plains. Here, we will present examples of: (a) a former agrosilvopastoral system (now silvopastoral) of oak cultivation with grazing in the grazing land and intermediate zones; (b) a silvopastoral system of olive trees cultivation in the olive plantations zone; and (c) a silvopastoral system of chestnut trees cultivation in the olive plantations zone.

The Spanish province of Cáceres is located along the border to Portugal and extends over 19,945 km^2 of mainly flat or gently rolling lowlands around the city of Cáceres (mean elevation around 460 m). In the Northern, Eastern, and Western province limits there are steep mountains with altitudes reaching to 2401 m. Extensive grassland and livestock production predominate, the emphasis being on lamb and beef production. Population density is low (20.6 persons km^{-2}). 72% of the useful agricultural land in the region is held in large estates comprising more than 100 ha although these represent only 8% of the agricultural operations.

Rural Cáceres has been stamped by a “crisis of traditional agriculture” that started in the 1960s and provoked fundamental changes in land-use. A massive emigration of the rural population to the then booming industrial agglomerations in Spain and abroad started in the 1950s and peaked between 1960 and 1970. Many villages suffered losses of more than 50% of their population, with labor shortage arising on many estates subsequently. Traditional labor-intensive management practices such as periodic livestock migrations (transhumance) to summer mountain pastures in Northern Spain and shepherding were abandoned, and metal fences were introduced instead. A pandemic of African Swine Fever and the decline of wool prices through American and Australian competition and the rise of synthetic fibers and cotton additionally led to a crisis in two important agricultural commodities – ham and wool – and resulted in a dramatic drop of sheep and hogs stocks. Among the remaining livestock, indigenous breeds were replaced by introduced high-performance breeds. Finally most farm estates lost their self-sufficiency and became dependent on farm machinery, supplementary feed, fertilizer, and agro-chemical inputs from outside.

The prevailing landscape types in Cáceres province are dehesas, pseudosteppes, and mountain landscapes. The most common feature is the dehesa, a savanna-like landscape characterized by pasturelands with scattered holm and cork oak stands and an understorey of grassland, cereal crops or Mediterranean scrub. Pseudosteppes are a man-made, large-scale and tree-less mosaic of crop cultivations, stubble fields, fallow land, and pastures. The mountain areas of Cáceres province have been shaped by a century old tradition of migratory livestock grazing. In this paper, the most extensive agroforestry system of the province dehesas composed of mixed and monospecific Holm oak (*Quercus ilex*) and Cork oak (*Quercus suber*) stands – will be studied in detail.

These examples are presented in an environmental management light with a specific focus on the management systems and the landscapes they have produced along with recent management changes and an initial exploration of their impacts in economic, social and environmental terms. Since these systems face abandonment due to extensive socioeconomic changes that have taken place in the areas they are found, the changes are briefly discussed along with some reflections for their future. The material that is used comes from research in these areas already published elsewhere (Kizos and Koulouri 2006, Kizos and Koulouri, in press, Plieninger 2006, Plieninger et al. 2004) and from our own personal experience in the areas in question. This material includes interviews with farmers and managers for information on practices and land use changes; data from aerial photographs or satellite imaging and observations in the field.

For all the systems the same structure has been followed: a short introduction with the historical context of the system in the area; the main features of the system management in a productive (what is produced) and an environmental (positive and negative impacts) light; recent developments in management patterns in the area and current state of the system; and discussion of the future of the system with mention of specific practices of productive and environmental benefits.

3. Findings

3.1. Oak, olive and chestnut cultivation and grazing on Lesvos

The first of the three agroforestry systems encountered on Lesvos is oak cultivation with grazing. It is an ancient system concerning the particular land uses (oak trees and grazing), but the specific practices have an unknown history on Lesvos. Oaks are mentioned from Ottoman sources on the island in the particular areas (Karidis and Kiel 2000) and sheep are also reported (Kizos and Koulouri 2006), but there is no direct mention of such a mixed system, although it probably could be found. It certainly was encountered in the 19th and early 20th centuries in the grazing land and intermediate landscape zones.

The system in question was an agrosilvopastoral one in the past, with oak trees cultivated on sloping areas that were plowed for cereals (mostly barley) or legumes in two or three years of fallow and grazed by sheep during fallow periods. Cultivation terraces were constructed to reduce the gradient of the slope (Figure 1). The system provided acorns for domestic consumption of goats, home kept pigs, the tanning industry and export. It also provided food and grazing space for sheep and goats that were used for cheeses and milk. Some of the informants we have found claim that cultivation of the understorey was rare already in the 1970s and stopped completely in the 1980s. Concerning the environmental management of the land, the specific system presents some positive features. One of these is the construction of terraces that increase water infiltration, reduce the speed of runoff water, improve soil properties and control erosion (Koulouri and Giourga 2007) apart from providing level surfaces for arable cultivation. Apart from this fact, another positive feature of the system is that the oak trees create microclimates that increase humidity in the field and are also valuable habitats for insects, birds and small mammals. Finally, the mixed system of arable cultivation with a two year rotation with fallow increases the floristic biodiversity in the field and fertilizes it with the manure of the sheep that graze it during the fallow year.

Today, the system has transformed from agrosilvopastoral to silvopastoral, with grazing of the understorey by sheep and a few goats. Apart from this change, terraces are not maintained, trees are not pruned and the grazing density has increased, or the system is abandoned in some cases and it is slowly transforming into shrub lands. These developments decrease the environmental quality of the land. The future of the system is uncertain. There are no signs of returning to the former management practices as none of the former products (acorns, cereals and non irrigated legumes) have nowadays commercial value. The former complex agrosilvopastoral system is now a grazing land.

The second system is a silvopastoral system of olive trees cultivation. Historically, the presence of olive cultivation on Lesvos has a long history, but its significance in the island's economy and land use has risen rapidly after the 18th century (Kizos and Koulouri 2006). In the 18th and 19th centuries it became almost a monoculture in the East part of the island and drove industrial and economic development. As already mentioned, olives were less affected from rural depopulation of the 20th century, compared to other land uses. The reasons for this are that olive trees may be cultivated with limited management practices (such as clearing and pruning in non irrigated areas), while harvesting can be negotiated 'at leisure' (weekends and afternoons). At the same time, olive oil always kept a considerable market value that can cover household needs and finally, plantations represent important investments. As abandoned fields have a lower value, many farmers keep the trees and the fields in good condition to raise their value. In 2001 agricultural censuses recorded 14,375 olive farms (95% of total farms) that covered 45% (38,951.8 ha) of the total Utilized Agricultural Area (UAA) and roughly 30% of the total area of the island. Surprisingly, the total number of trees is unknown. Estimations based on subsidies data raise them to 10.5 – 11 million, with an average density of 250 to 280 trees /ha. Most olive plantations on Lesvos lie on small, mountainous and sloping fields which are all terraced, either in pocket style (a single terrace in part of a circle around one tree, Grove and Rackham, 2001) or in a parallel – braided style. The understorey is very rarely cultivated with arable crops, but in the past it was very often grazed, either by sheep of the locality, or by sheep from other places of the island that moved for summer pastures from the west to the east. Management practices are kept low in most cases and as a result the landscape may be considered as semi-natural, offering a rich variety of habitats for different species of flora and fauna (Allen 2001). Recent research has demonstrated that in the last decades some olive plantations are abandoned (Kizos and Koulouri 2006).

Kizos and Koulouri (in press) classify olive plantations on Lesvos into four different types (based on Beaufoy (2000) and Xiloyanis et al. (2004), with another two types that are not encountered on Lesvos being intensified traditional plantations and intensive modern plantations): (a) low-input traditional plantations; (b) neglected fields that are 'between' cultivation and abandonment and besides collecting the olives and some pruning, little other management is practiced; (c) abandoned fields that are former olive fields without cultivation and olive harvest for a number of years; and (d) former olive fields where one or more houses are

built (homes, second homes or tourism units) but some trees are still encountered. Low-input traditional plantations are the silvopastoral system in the agroforestry context. In Beaufoy's frame (p. 41) these plantations have potentially the highest natural value of all cultivated fields, due to features such as terraces, old trees, stone walls and high floral diversity; and the most positive effects (such as water management in upland areas) as well as the least negative effects on the environment. At the same time they are also the least viable in economic terms and hence most vulnerable to abandonment.

Recently, this system has changed significantly in two ways: (a) grazing has been reduced and in these areas the system has now transformed into a tree growing activity; and (b) some fields are abandoned and slowly transformed to Mediterranean forests (Figure 2).

The third system is a silvopastoral system of chestnut trees cultivation in the olive plantations zone. There are no records known to us that reveal how old the particular system is on the island. Evidence from other areas of the Mediterranean relates it ads back as the Roman era (Grove and Rackham 2001). On Lesvos, it may be related to the settlement of Agiassos that is found in the 16th century approximately. Since the middle of the 20th century, chestnuts provided a very useful additional food source and income for chestnut farmers, along with grazing space for sheep, goats and pack animals. After the general rural exodus on the island and the fall of the importance of chestnut in the village and island economy, some of the chestnut groves were abandoned, while at the same time in the particular locality of the island, sheep herds were reduced.

The main features of the management of this system in the recent past included a very extensive cultivation of chestnut trees that resembles a natural forest in more than one aspect: the trees were not fertilised (except animal dung), watered or sprayed for diseases and only occasional pruning was practiced to thin branches, keep the trees at a reasonable height and provide wood fuel and timber. Signs of coppice stools are still evident in most of the chestnut fields, a practice encountered in other chestnut growing areas as well (Grove and Rackham 2001). Moreover, sheep and goats were allowed to browse through the fields, graze the understorey and fertilise the trees, while cultivation terraces were built in some fields. Today, many fields are abandoned and occasionally only the chestnuts are picked, but none other practices are encountered. The reduction of the number of animals has brought decline in browsing densities and even the cutting of wood is reduced and abandoned coppices are left as remnants of older practices.

Recently, chestnuts have regained part of their commercial value and the chestnut groves are a very popular winter destination for short winter walks combined with the picking of chestnuts and local tourism activities combined with this are flourishing. At the same time, growing petrol prices have revived the interest in fuel wood and chestnut trees provide excellent wood. This has lead to the revitalising of some of the chestnut management practices (Figure 3) and some of the fields will be kept productive in the future, but it seems unlikely that the former agroforestry system will be revived in its entity.

3.2. Oak cultivation and grazing in Cáceres province

In Cáceres, around 25% of the land are covered by large scale dehesa agroforestry systems. Dehesas comprise a combination of extensive livestock raising, crop cultivation, and forest management. Singular on the Southwest of the Iberian Peninsula, dehesas stand out among the many traditional agroforestry systems in Europe due to their large extent of around 2,700,000 ha (Díaz et al. 1997). Although their landscape structure appears relative uniform at first sight, dehesas can vary considerably in terms of species composition, function, and physiognomy. The majority of dehesas are composed of Holm oak (*Quercus ilex*) and Cork oak (*Quercus suber*). Oak stands are regularly scattered. Holm oak stands do not originate from plantation, but have been constructed through selection and protection of superior, well-shaped trees ocurring among natural stands. Cork oak stands, which are restricted to siliceous soils and moister conditions, result from intentional planting of acorns chosen from trees with desirable properties in some regions.

The origin and development of dehesas is not very well known. They have evolved and been refined over hundreds of years, but the final systematic use pattern seems basically an invention made in the 18th century (Grove and Rackham 2001). A fundamental characteristic is the great complementary relationship between pastoral, agricultural, and forestry components, resulting in a high resource use efficiency and important interactions with different natural ecosystems. The traditional dehesa is multifunctional and primarily based on self-sufficiency. Management activities result in a large assortment of commodities (amongst others meat, wool, cork, charcoal, milk, ham, honey, acorns, mushrooms, and medicinal plants) and non-commodities (e.g. biodiversity, soil conservation or regulation of the hydrological cycle).

Extensive raising of sheep, pigs, cattle, and goats was and is the dominant activity that determines all other land-uses. Hardy, indigenous breeds were traditionally used, and fodder scarcity in summer was overcome by livestock movements over some 500 km to summer pastures in the mountainous North of

Spain. Cattle were historically held as working animals, while beef was only a by-product. Pig husbandry has always been tightly related to dehesa management as hogs provide the best use of acorn mast by producing highly priced acorn ham (*jamón de bellota*). Goats were the classic milk producers in the dehesa. Forest management is another integral component of the dehesas. Holm oak and Cork oak stands were regularly cleared, thinned to densities of 10-50 trees ha^{-1} and pruned to enhance herb growth, ensure a maximum yield of acorns for pig forage, and maximize cork harvest. In the traditional system rotational plowing was a common management strategy for the cultivation of wheat, barley, oats, rye, and common vetch (*Vicia sativa*) and for the control of shrub encroachment. Cultivation in dehesas traditionally had long rotation cycles of four to seven years. Since the 1980s, the extent of arable farming in dehesas has strongly decreased. By this, the multifunctional agroforestry system lost one of its basic components and was converted from an agrisilvopastoral into a silvopastoral system.

Dehesas have become renowned Europe-wide for supporting outstanding levels of species and habitat diversity – a property that qualified them to become listed in the EU habitat directive as natural habitat type of community-wide interest. Despite their large extent, dehesas have a high level of structural diversity both on a within-habitat scale and a between-habitat scale. On the within-habitat scale, habitat heterogeneity is caused by the presence of isolated trees and their canopy effects on the herbaceous layer. On the between-habitats scale, the elevated biodiversity results from a variety of grazed, shrubby and cultivated types of dehesas and from differences in stand composition, density and structure (Díaz et al. 2001). The mosaic of habitats maintains a rich diversity of plants and animals. For example, 30 % of the vascular plant species of the Iberian Peninsula are found in the dehesas (Pineda and Montalvo 1995).

Today dehesas are facing a number of environmental and socioeconomic challenges that put risks on the future of this diverse and valuable land-use and ecosystem. Outstanding among these challenges is the failure of oaks to regenerate in sufficient numbers (Plieninger 2007). Existing oak stands in dehesas are mostly aged, while oak seedlings or saplings are almost nonexistent. The consequences of the skewed age structure of oak stands may be hidden for many decades, but in the long run the changes may impact landscape structure considerably. The reasons behind regeneration failure are complex, but the current view is that tree regeneration is simply not part of the management system and has neither been applied in traditional nor in modern dehesa use. Financed by EU afforestation schemes holm oaks, Cork oaks, and other native woody species have been planted on thousands of hectares in southwestern Spain since the 1990s. However, the answer whether these artificial plantations can spawn a dehesa-like forest structure remains unanswered yet.

EU policies have been the principle driving force of both agricultural intensification and land abandonment since the 1980. However, the inception of these processes was in the 1950, when the traditional labor-based land-use system became unprofitable. It remains open whether recent shifts in EU policies toward decoupling of agricultural support from production will be able to alleviate productivist tendencies in dehesa agriculture. So far, agrienvironmental schemes have proven beneficial for the support of high-nature farmland. However, the preservation of the natural capital of the dehesas and the many ecosystem services they provide are far from being fully compensated by society.

It is a great challenge to find ways to conserve or revitalize localized, traditional forms of dehesa management and to integrate them into modern strategies of land-use. On the ground conservation has been stimulated by a number of initiatives. For example, the marketing of food with a specified geographical indication of origin (such as wine, cheese, or honey), a field where Spain is leading the European market, has been a long-lived success. Likewise, organic farming has spread out widely among dehesa farms. Both marketing tools, however, lack a direct specific link to biodiversity conservation in dehesas so far. The use of cork is a conservation activity per se, as it directly improves the economic situation of Cork oak dehesas. Unfortunately, the conservation argument has been insufficiently communicated to wine consumers, and in consequence there is a great ignorance of the conservation impact of cork use. This communication is even more important as cork caps are increasingly replaced by synthetic wine stoppers.

There have also been dehesa conservation efforts from the regional governments: Andalusia has launched a “pact for the dehesa”, a conservation campaign that intends to raise awareness for dehesa conservation. The establishment of UNESCO Biosphere Reserves (e.g. Monfragüe, Las Dehesas de Sierra Morena) underlines the importance of the dehesas for biological conservation. Moreover, biosphere reserves provide an organizational framework to develop strategies for balancing land-use and conservation by adding value to sustainable dehesa uses. In Los Alcornocales Natural Park, a pioneering effort has started to reach consensus with several administrations, landowners, farmers, and hunters for a large-scale regeneration of dehesas. More than 6,000 ha are in the process of regeneration thorough plantation, artificial seed and support of natural regeneration now, and other areas are likely to follow. All these efforts are promising and important, but are just a very first step in the quest to conserve the unique natural and cultural diversity of the dehesas.

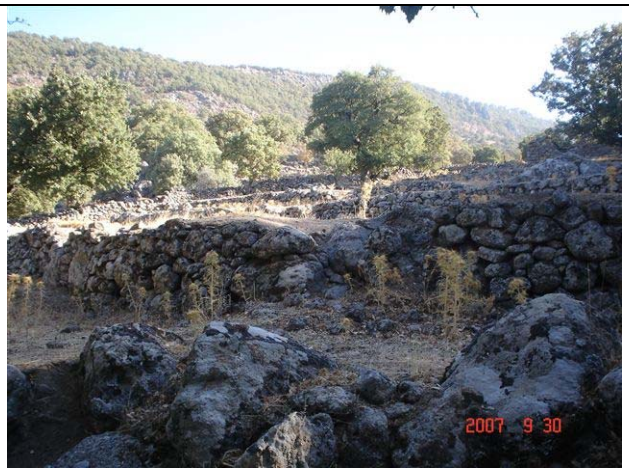

Figure 1. Former agrosilvopastoral system of oaks (quercus macrolepsis) with cereals – legumes cultivation and grazing, now transformed into a silvopastoral system or a grazing land (Photo near Filia settlement on Lesvos Island by T. Kizos)

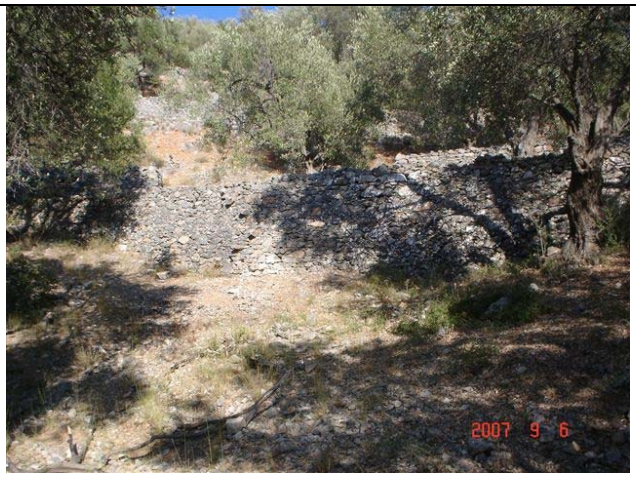

Figure 2. Former silvopastoral system of olive trees (olea europea) with grazing, now transformed into a olive plantation with grazing almost stopped (Photo near Mytilini settlement on Lesvos Island by T. Kizos)

Figure 3. Former silvopastoral system of chestnuts (castanea sativa) with grazing, now transformed into growing chestnuts with grazing almost stopped (Photo near Agiassos settlement on Lesvos Island by T. Kizos)

Figure 4. Hog husbandry in a community-owned Holm oak dehesa, Monroy, Spain. Animal sanitation regulations have made family-operated hog raising a rarity (Photo: T. Plieninger)

4. Conclusion

Agroforestry systems are very important today in the Mediterranean for productive, symbolic and environmental reasons. Production for most of them is today different than that of the past, but even today they produce valuable local products. Especially today when the importance of the “local” and of “quality” in food production increases, these systems can offer such local and quality products with their original extensive management. Symbolically, these systems and the landscapes they produce are part of local identity and linked with the areas they are found and therefore constitute valuable local resources. Finally, in environmental terms, these mixed and complex systems are very well adapted to local conditions and are indeed “better” in regard with environmental management than similar “modern” and simpler systems.

Before concluding, one final note should be made concerning the management principles of all the systems that have been mentioned. All these systems change constantly and this crystallization of their principles that is presented here is artificial to a degree. There were no “golden rules” for the management of such systems and the available evidence (and common sense) suggests that farmers changed their practices according to many diverse factors, most of which where out of their control completely (such as extra local markets for products, political regimes, social changes, etc.). In this sense, differences between Spanish and

Greek examples presented here are not very important and in any case less important than differences between these systems over time and this paper has presented some highly changing but nonetheless multiply valuable systems.

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