Environment and Ecology in the Mediterranean Region

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Edited by

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PREFACE

Our consumerist attitude towards natural resources has adversely affected the carrying capacity of our planet, as the global ecological deficit has increased without regeneration. The situation in the Mediterranean Region is no different. Ecosystems there have reached a stage where biological diversity is greatly threatened.

Reclamation of damaged ecosystems needs a thorough understanding of the ecological functions that control them. Although restoration and reclamation efforts are underway, the process of acquiring knowledge and learning is slow. Learning the dynamics of a habitat, the plasticity of individuals in an ecosystem, and the microclimatic features are all integral to any restoration programme. In addition, stresses induced due to global climate change must be taken into consideration while planning restoration so that resulting restoration projects are resilient and self sustaining.

This book, Environment and Ecology in the Mediterranean Region, is a result of papers presented at the International Conference on the Mediterranean region held in Edremit, Turkey from 5-7 May 2011. 160 participants from 25 countries attended and presented 170 papers, of which 35 are selected for this publication. Chapters include aspects of environmental ecology, drought, changes in land use/fragmentation, tourism, sea level rise, environmental transformation, climate change, rural development and agriculture, water use, urban ecology, and forest resources/fires. Although much remains to be done, we fervently hope that this book will upgrade the importance of awareness among the public for protecting this fragile environment.

—The Editors

CHAPTER ONE

DENDROARCHAELOGICAL STUDIES OF SHIPWRECKS ALONG THE MEDITERRANEAN COAST OF ISRAEL

NILI LIPHSCHITZ

Introduction

Comprehensive dendroarchaeological investigation of ancient shipwrecks in Israel started several years ago and the results of the detailed analyses turned out to be an integral component of shipwreck studies. Wood samples taken from various hull components are best preserved when kept in sea water until their examination in the laboratory, thus avoiding deformation of the anatomical wood structure and enabling an accurate identification up to the species level of the hull construction timbers (Liphschitz, 2007).

The paper presents the detailed studies of ten shipwrecks from the Mediterranean coast of Israel, which sank at three sites: one at Ma'agan Mikhael, seven at Tantura Lagoon (Dor), and two at Akko bay. One shipwreck is from the Classical period, four shipwrecks represent the Medieval period and five shipwrecks represent the Post Medieval period.

Cross and longitudinal, tangential, as well as radial sections, were made with a sharp razor blade for each sample, stained with Safranin and preserved in Glycerol. The identification of the wood up to the species level was based on the three dimensional structure of the wood as seen microscopically in those sections. Comparison was made with reference sections, prepared from systematically identified living trees and shrubs and with anatomical atlases.

Assumptions concerning the possible construction areas of these ships are based on the native distribution of the various tree species used in the construction of these hulls. Use of repairs on a ship can be located due to the presence of “foreign” timbers, made of trees originating from a

different geographical region than most of the vessels' construction timbers, pointing to damage caused to the vessel either on its route or on its arrival site.

The Classical Period Shipwreck from Ma'agan Mikhael from the 5th Century BC

The Classical (Persian) period ship was discovered 70m off shore of Kibbutz Ma'agan Mikhael, ca. 30km south of Haifa. It was submerged in less than 2m of water and buried under 2m of sand. It was a small cargo vessel, about 13.5m long. The ship was dated to the late 5th century BC (Kahanov 2003). A substantial portion of the wooden hull structure survived in a good state of preservation and was conserved with Poly Ethylene Glycol (PEG) (Linder 1991).

Table 1-1: Tree species used in the hull construction of Ma'agan Mikhael shipwreck

Tree species	Components	No. of samples
Pinus brutia	planks, frames, keel, stringers mast - partner beam, mast step, stanchion, stern knee, bow knee	97
Quercus coccifera	tenons, anchor	17
Quercus pubescens Q. petraea	false keel	2
Fraxinus excelsior	peg	1
Fagus orientalis	tenon	1
Cornus sanguinea	part of anchor	1
Total samples examined		119

Altogether 119 samples were examined (Table 1-1). They were taken from various parts of the hull ship: keel, false keel, frames, planks, stem, sternpost, false sternpost, bow and stern knees, tenons, pegs, mast step, mast-partner beam, stringers, stanchion and anchor parts. The hull was made of seven wood species: Pinus brutia (Calabrian pine), Cornus sanguinea (Common dogwood), Fagus (orientalis) (Oriental beech), Fraxinus excelsior (Common ash), Quercus coccifera (Holly oak) and Quercus pubescens (Downy oak) / Quercus petraea (Sessile oak) (Liphschitz 2004a, 2004b, 2009; Liphschitz and Pulak 2007/8).

The majority of the hull timbers were of Pinus brutia (81.5%). All timbers of the ship were made from trees which grow native mainly in west - northwestern Turkey, thus pointing to the site where the ship was constructed.

The Tantura Lagoon (Dor): The Medieval Period Ships from Dor: The 2001/1 Shipwreck from the 5th-6th Centuries AD

Dor 2001/1 was probably a Byzantine coaster carrying building stones, dated to the end of the 5th or beginning of the 6th century AD. It was found about 70m offshore at a depth of 1m and buried under 1.8m of sand. The total length of the finds was 11.5m and its maximum width was 4.5 m (Mor and Kahanov, 2006).

Altogether 202 samples were taken and identified, representing the keel parts, false keel, planking, ceiling, frames, chine strake, central stringers, planks, wale, mast step sister and end post (Table 1-2). In this ship timber originated of Pinus brutia, Cupressus sempervirens (Cypress), Fagus orientalis, Ulmus campestris (Elm), Quercus coccifera, Quercus cerries (Turkey oak), Ziziphus spina christi (Christ thorn; Jujube) and Tamarix (X5) (Tamarisk) (Liphschitz and Pulak 2007/8).

Table 1-2: Tree species used in the hull construction of Dor 2001/1 shipwreck

Tree species	Components	No. of samples
Pinus brutia	planks, ceiling, frames	42
Cupressus sempervirens	keel, planking, central stringers, chine strake, wales, mast step sister	54
Quercus cerris	frames	7
Quercus coccifera	frames, false keel	9
Fagus orientalis	frames	39
Ulmus campestris	frames, end post	18
Ziziphus spina christi (repairs)	frames	17
Tamarix (X5) (repairs)	frames	16
Total samples examined		202

All other tree species are native to west – northwestern Turkey, except for Ziziphus spina christi and Tamarix (X5) which are native to Israel, and were used for repairs on the ship made on its arrival at Dor.

Dor-2006 Shipwreck from the 5th-6th Centuries AD

The Dor-2006 ship is dated to the 5th-6th centuries AD. The shipwreck was located 800m south of Dor/Tantura lagoon, 100m offshore, at a depth of 3-4 meters. It was spread over an area of 11x5 meters (Navri 2009). Altogether 101 wood samples were identified from Dor-2006 taken from frames, planks, limber boards, ceiling and tenon. The hull timbers were made of *Pinus brutia*, *Pinus nigra* (Austrian pine; Corsican pine), *Cupressus sempervirens*, *Quecus cerris*, *Quercus petraea*, *Quercus coccifera* and *Ulmus campestris* (Table 1-3). All hull construction timbers were made of trees which grow natively in west - northwestern Turkey.

Table 1-3: Tree species used in the hull construction of Dor-2006 shipwreck

Tree species	Components	No. of samples
Pinus brutia	frames, planks, limber boards, ceiling, mast? keelson?	20
Pinus nigra	planks, ceiling	5
Cupressus sempervirens	planks, ceiling	16
Quercus cerris	frames, tenon	21
Quercus petraea	frames	10
Quercus coccifera	tenon	1
Ulmus campestris	frames, ceiling	28
Total samples examined		101

Tantura F Shipwreck from the 8th Century AD

The Tantura ship is dated to the beginning of the 8th century AD (early local Islamic Umayyad period). The shipwreck was discovered in 1996 during a survey at Dor (Tantura Lagoon) about 70m offshore in 1m of water, buried under an additional 1.5m sand. The archaeological remains covered an area of 12x3.5m (Wachsman and Kahanov, 1997; Barkai and Kahanov, 2007). Altogether 137 wood samples were identified from the

Tantura F shipwreck. The samples were taken from keel, frames, planks, stringers, mast step and central longitudinal timbers, matting and a twig (Table 1-4) (Liphschitz and Pulak 2007/8).

The hull was constructed (except for a piece from the keel) of two tree species: Pinus brutia (55%) and Tamarix smyrnensis (tamarisk of diffuse porous wood, and 5 sepals, petals and stamens) (44.5%). Both tree species grow natively together in two regions in Turkey: Izmir in west Turkey, and Antalya in south Turkey (Davis 1965-82). One piece from the keel was made of Pinus nigra.

Table 1-4: Tree species used in the hull construction of Tantura F shipwreck

Tree species	Components	No. of samples
Pinus brutia	frames, stringers, keel section, planks, mast step assemblage	75
Pinus nigra	keel section	1
Tamarix smyrnensis	frames, central longitudinal timbers	61
Total samples examined		137

Tantura E Shipwreck from the 7th-9th Centuries AD

The Tantura E shipwreck was located about 25m offshore in a water depth of 2.5m. Radiocarbon analysis dated the wreck between the end of the 7th and the beginning of the 9th centuries AD (the early local Islamic period). Its measured length was ca. 7.2m and its width was ca. 3.1m and its estimated length varied between 12m to 15m (Royal and Kahanov 2000; Planer, 2007; Kahanov et al., 2008).

Altogether 103 samples were collected and identified, including keel, keelson, end post, frames, strakes, stringers, ceiling planking and stanchion. The hull timbers were made of *Pinus brutia*, *Cupressus sempervirens, Tamarix (X4), Tamarix (X5), Quercus coccifera, Quercus cerris, Ulmus campestris* and *Fraxinus excelsior* (Table 1-5). All hull construction timbers, except *Tamarix (X5),* were made of trees which grow natively mainly in west - northwestern Turkey. *Tamarix (X5)* is native to Israel and was used for repairs on the ship upon its arrival at Dor.

The Post Medieval (Late Ottoman) Period Ships from Dor: Dor C Shipwreck from the 17th-19th Centuries AD

Dor C is a Late Ottoman (17^{th}-19^{th} century AD) wreck of 16m long, found lying off Dor. Excavations started for the first time in the year 2000. The hull was completely buried in sand. The wreck is 16m from stem to sternpost (Bowen, 2001). In 2008 another excavation session was carried out (Kahanov et al., 2008) and 87 wood samples were taken for wood identification from ceiling planking, planks, frames, wales, stem, keel, stemson, mast, mast step, apron, stanchion and treenails. The excellent state of preservation of the wood is also evident in its hardness.

Table 1-5: Tree species used in the hull construction of Tantura E

Tree species	Components	No. of samples
Pinus brutia	planks, stringers, frames	39
Cupressus sempervirens	keel, ceiling planking, stringers, false keel, keelson, planks, stanchion, end post	24
Tamarix (X5)	frames, keel section	29
Tamarix (X4)	frames, keel section	29
Tamarix (X5)	frame	3
Quercus coccifera	frames	2
Quercus cerris	frame	1
Ulmus campestris	frame	1
Fraxinus excelsior	frames	4
Total samples examined		103

All parts - ceiling planks, frames, wales, stem, mast and mast step and stanchion - were made of *Pinus brutia* which constituted 85% of the hull timbers examined. The keel and treenails were made of *Quercus cerris* and other treenails were of *Quercus coccifera*. The stemson was of *Pinus nigra*, the apron was of *Ulmus campestris* and another wooden nail from the keel was made of *Corylus colurna* (Table 1-6). The native distribution area of the assemblage of wood species used in the construction of the hull grows natively together in west – northwestern Turkey, suggesting that the ship was probably built in this region.

DW-2 Shipwreck from the 17th-19th Centuries AD

The DW2 shipwreck was found in the southern lagoon of Dor beach, at a depth of less than 2m. Its estimated length was 15.5m and it was dated to the 17th-19th century AD (Late Ottoman period) (Yovel, 2005).

Altogether 63 wood samples were identified. The samples were taken from keel, frames, planking, floor timbers and treenails. Most wooden parts (96%) were made of *Pinus brutia*. Three nails were made of *Quercus coccifera* and one nail was made of *Quercus cerris* (Table 1-7). The assemblage used in the construction of the hull grows natively together in west-northwestern Turkey, suggesting the ship was probably built in this region (Liphschitz 2004a; Liphschitz and Pulak 2007/8).

Table 1-6: Tree species used in the hull construction of Dor C shipwreck

Tree species	Components	No. of samples
Pinus brutia	ceiling planking, wales, frames, mast step, mast, stanchion	79
Pinus nigra	stemson	1
Quercus coccifera	treenails	2
Quercus cerris	treenail, keel	3
Corylus colurna	treenail	1
Ulmus campestris	apron	1
Total samples examined		87

Table 1-7: Tree species used in the hull construction of DW2 shipwreck

Tree species	Components	No. of samples
Pinus brutia	frames, keel, planking, floor timbers	59
Quercus coccifera	treenails	3
Quercus cerris	treenail	1
Total samples examined		63

Dor 2002/2 Shipwreck from the 17th-19th Centuries AD

Dor 2002/2 shipwreck was discovered on the shore line, ca. 30cm below sea level. It was dated by 14C AMS to the 17th-19th century AD

(late Ottoman period) (Cvikel 2005). The excellent state of preservation of the wood and the existence of a metal cable in the shipwreck suggest it is a late Ottoman vessel.

Altogether 27 samples were taken and identified. They included timbers from planks, frames and treenails. Most of the timber (81%) was made of *Pinus brutia*. Other species identified were: *Quercus coccifera, Quercus cerris* and *Pinus nigra* (Table 1-8) (Liphschitz 2004a; Liphschitz and Pulak 2007/8). The timbers of the ship grow natively together in west – northwestern Turkey, where it most probably was built (Liphschitz and Pulak, 2007/8).

Table 1-8: Tree species used in the hull construction of Dor 2002/2 shipwreck

Tree species	Components	No. of samples
Pinus brutia	planks, frames, treenail	22
Pinus nigra	treenail	1
Quercus cerris	plank	2
Quercus coccifera	plank, treenail	2
Total samples examined		27

Table 1-9: Tree species used in the hull construction of Akko 1 shipwreck

Tree species	Components	No. of samples
Pinus brutia	frames, planks, ceiling, planking	43
Quercus petraea / Q. pubescens	frames, false stem, planks	180
Quercus cerris	keel, frames, stem, wale, apron, ceiling planking	56
Quercus coccifera	frames	10
Fagus orientalis	false keel	1
Ulmus campestris	plank	1
Acer pseudoplatanus	plank	1
Tamarix (X5)	frame	1
Total samples examined		293

Table 1-10: Tree species used in the hull construction of Akko 2 shipwreck

Tree species	Components	No. of samples
Pinus brutia	planks, keel	49
Total samples examined		49

Akko Bay-Akko 1 Shipwreck from the 17th-19th Centuries AD

The Akko 1 shipwreck is located 30m north of the Tower of Flies at depth of 4m. The shipwreck is 23m long and 4.38m wide. It was dated to the 17th-19th centuries AD (Kahanov et al. 2008; Cvikel and Kahanov 2009).

Table 1-11: The Native habitats in Turkey of tree species used in the hull of 10 Israeli shipwrecks (from: Davis 1965-1982)

Tree species	Native distribution in Turkey
Pinus brutia	Outer Anatolia, Turkey in Europe &Islands
Fagus orientalis	N. Turkey & scattered in N. & W. Anatolia
Quercus coccifera	N. & W. Turkey, S. Anatolia & Islands
Quercus cerris	Throughout Turkey, except N.E. & E. N.W. Turkey
Quercus petraea	Throughout Turkey, except N.E. & E. N.W. Turkey
Quercus pubescens	Turkey, E. & W. Anatolia
Cornus sanguinea	NW. Anatolia, C. & S. Anatolia
Fraxinus excelsior	N. Anatolia
Ulmus campestris	N.W. Turkey & adjacent, N.E. Anatolia
Cupressus sempervirens	Antalya, Taurus and Islands
Tamarix smyrnensis	Izmir, Antalya

Altogether 293 samples were taken for wood identification from the keel, false keel, frames, stem, false stem, planks, ceiling planking and apron. The hull timbers were mainly made of *Quercus petraea/Quercus pubescens* (61%), *Quercus cerris* (19%) and *Pinus brutia* (15%). The false keel was made of *Fagus orientalis*. Three other components were of *Ulmus campestris*, *Acer pseudoplatanus* and *Tamarix (X5)* (Table 1-9).

Akko 2 Shipwreck from the 17th-19th Centuries AD

The Akko 2 shipwreck was dated to the 17th-19th centuries AD (Kahanov et al., 2008). Altogether 49 wood samples were taken and identified. All hull timbers examined, including planks and a keel, were made of *Pinus brutia* (Table 1-10).

Table 1-12: The native distribution in the world of tree species used in the hull of 10 Israeli shipwrecks (from: Davis 1965-1982).

Tree species	Native distribution in world
Pinus brutia	Turkey, S. Italy, Crimea, W. Syria, N. Iran, W. Caucassus
Fagus orientalis	Turkey, Bulgaria, Romania, Greece, Crimea, Caucassus
Quercus coccifera	Turkey, France (Gallia-Nabonensi), Peleponese, Spain
Quercus cerris	Turkey, Central Europe, Austria, South-Central Europe
Quercus petraea	Turkey, Balkans, Caucassus, N. Iran
Quercus pubescens	Turkey, W. Europe, Central Europe, Crimea
Cornus sanguinea	Turkey, Central Europe, South-East Europe, Russia, Crimea, Lebanon, S. Asia
Fraxinus excelsior	Turkey, Caucassus, N. Iran
Ulmus campestris	Turkey, Greece, Trace
Cupressus sempervirens	Turkey, Cyprus, Crete
Tamarix smyrnensis	Turkey

Conclusions

The determination of wood species used in constructing the hulls of these ships enables the identification of possible regions where each vessel may have been built. The hulls of nine ships, dated to the Classical period (Ma'agan Mikhael), Medieval period (Dor 2001/1, Dor-2006, Tantura E) and Post Medieval period (Dor C, Dor 2002/2, DW2, Akko 1, Akko 2), were mainly constructed of *Pinus brutia, Quercus coccifera, Quercus cerris and Quercus petraea/Q.pubescens*. The habitat where all four tree species, as well as other species used in their hull construction, grow natively is in west – northwestern Turkey (Tables 1-11, 1-12), thus pointing to this region as the area where these ships were most likely built. One ship of the Medieval period (Tantura F) was built of *Pinus brutia* and

Tamarix smyrnensis which grow natively together in Izmir in west Turkey and in Antalya in south Turkey. Use of timbers made of trees, which grow natively on the Israeli coast in two ships (Dor 2001/1 and Tantura E) points to use of repairs due to damages caused to the vessels on their arrival to the Israeli coast.

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CHAPTER TWO

LAND USE CHANGE IN THE LOWER ALENTEJO (SOUTH OF PORTUGAL) AND THE NEW ENVIRONMENTAL CHALLENGES: THE OLIVE CULTURE

MARIA JOSE ROXO
AND JOSE EDUARDO VENTURA

Introduction

The European Union agricultural policy has had a strong impact in the rural landscape, in particular in Alentejo. In this region the soil occupation has reflected the type of support to the agricultural sector from the EU and the construction of the Alqueva enterprise which, with its vast dam and irrigation system, has enabled the reconversion of land use from dry to irrigated cultures, or even the changing of traditionally dry cultures, such as olive, into irrigated cultures in recent years.

The Alentejo is Continental Portugal's Agrarian Region which possesses the largest extent of olive groves, amounting to 40.8% of the Country's total (Fig. 2-1).

The average size of farms are also found to be larger in this region, with an average of 6.9 hectares in a national context of an average 2.4 hectares.

According to the statistical yearbooks (Anuário de Campanha 2005/2006, Principais Ajudas Directas), Alentejo has been the Agrarian Region with the largest declared area (53%) in regard to requests for help regarding the olive groves, particularly concerning the largest farms (between 100 and over 500 hectares) which, together, represent over 80% of that area.

Cultivating the olive grove takes advantage of the edaphoclimatic features of the region and presents conditions for a strong restructuring

through the dimension of farms in addition to the availability of water from the Alqueva enterprise.

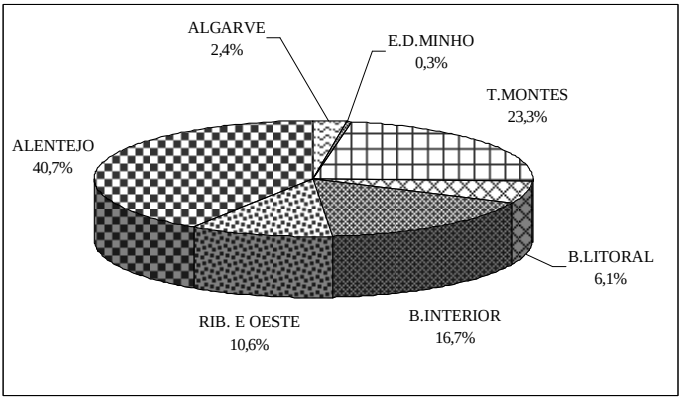

Fig. 2-1: Distribution of olive groves throughout Agrarian Regions of Continental Portugal (www.gppaa.min-agricultura.pt/drural/doc/FileiraAzeiteSantarem.pps)

This is also equally potentiated by the advance and modernization of the sector in Spain to the point where the plantation of new olive groves is no longer allowed due to the unavailability of quotas, as contemplated in the EU's Common Agricultural Policy.

Thus, Spanish farmers have begun investing in the purchase of land in Alentejo, mixing the availability of land at a lower price than in their country with the advantage that it is still possible to expand this culture in Portugal. Portuguese entrepreneurs and farmers have, in the meantime, awoken to the possibilities made available by the sector and, together with Spanish entrepreneurs, are undertaking an "Agricultural Revolution" in Alentejo, by condensing the old and planting new olive groves which occupy about twenty thousand hectares in an intensive or super-intensive system, supported with irrigation.

This change in olive plantation is already referred to in a journalistic context as the "New olive culture", resulting from the combination of knowledge of olive grove potential with new agronomic techniques, adopting production systems developed for vineyard plantations.

In the intensive and super-intensive systems, productivity increases significantly. Although the production per olive tree is similar in the diverse systems, the number of units is between 200 and 300 olive trees per hectare in the former system, and can reach up to 2000 olive trees in the latter, also halving the number of years necessary to reach the

production peak. In new olive groves, mechanization allows a substantial reduction in production costs regarding harvesting when taking into account that this task is one of the more onerous in traditional olive groves.

It should be noted that Portugal still displays a chronic shortage in olive oil production, which satisfies about half of the demand, compensated, in large part, by imports from Spain. The current situation means that a good part of the new production can be commercialized in the country, making it noteworthy that in a few years production may be able to satisfy demand.

Study Area

The study area (Fig. 2-2) in this paper is located in the south of Portugal. The area under continental Mediterranean climate conditions is affected by heavy rainfall events, as well as lengthy drought periods (years of 1980/81 and 2005/2006 with less than 250mm of annual rainfall). The annual rainfall average is around 500mm in the South of the Region and 700mm in the north. Most of the landscape, draining to the Guadiana River, is dominated by flat surfaces in eruptive rocks in the north, and by a rolling topography in metamorphic rocks, with an important relief rate to the local base level (100-200m) in the south. Soils are developed and are of good quality in the eruptive rocks, but are mainly shallow lithosols in the schist. Natural vegetation is much degraded, reduced to matorral (thickets) in the steepest areas besides the main valleys. Disperse trees (*Quercus suber* and *rotundifolia*) appear as part of a mix productive system named *Montado*. In the whole Alentejo Region, it is the Lower Alentejo that contains more olive grove areas, with 42% of the total (Fig. 2-3). Here, the restructuring of old and plantation of new olive groves is more dynamic, with significant impact on the landscape and on the region's natural resources.

In the Lower Alentejo, the olive grove area is quite uneven amongst the various municipalities, with the larger surfaces in the municipalities of Serpa, Moura and Beja. In 2007, intention to cultivate new plantations was high in those municipalities, led by the municipality of Ferreira do Alentejo. Although this municipality is not in the area with the larger tradition for olive plantation, this situation justifies itself through the existence of good agrarian soils and through irrigation infrastructures that are integrated in the Alqueva irrigation system, which makes this municipality into one of the more desirable for the implantation of new olive groves (Fig.2-4).

Cartographic font: CAOP, 2009

Fig. 2-2: Study area: Alentejo

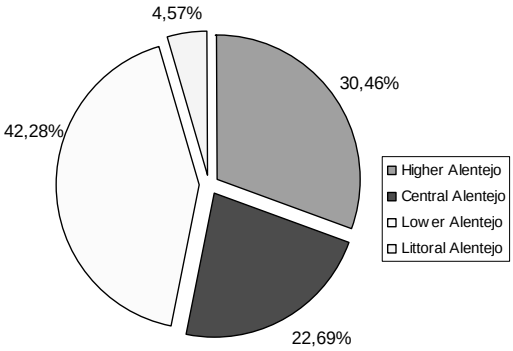

Fig. 2-3: Extension of olive grove area in the Alentejo (www.draal.min-agricultura.pt/produçao/.../olival_total_2007.pdf)

Methodology

a) The evolution of the olive grove problem was equated from available news on the internet and, in order to know society's perception, through analysing information published online and in regional and national newspapers. The opinions of experts and decision makers were

also sought about production methods and their inherent consequences, not only in environmental terms, but in social and economic terms.

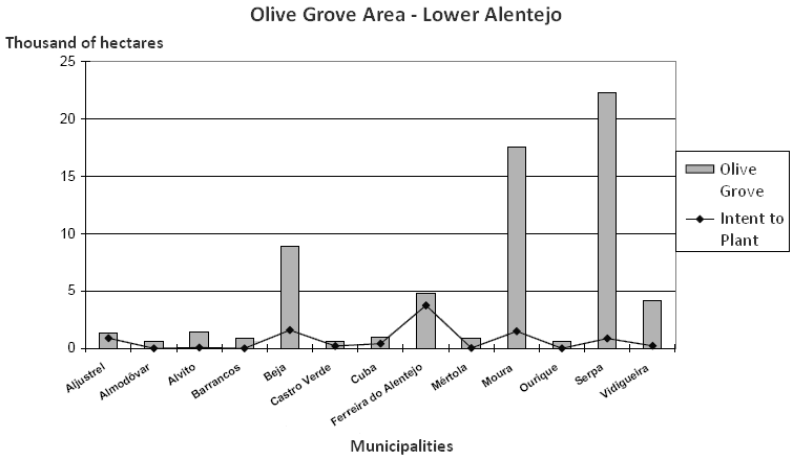

Fig. 2-4: Information regarding Lower Alentejo's olive grove in the context of NUT III (2007) (www.draal.min-agricultura.pt/produçao/.../olival_total_2007.pdf)

The adopted methodology was one of collecting news on the internet through the search engine www.google.pt, using search words "Olival intensivo" and "Olival Super intensivo" between quotation marks, conditioning the search to only phrases where the words were written together. The research refers to the years from 2004 through 2009.

In order to treat the obtained information, a database was built using the program Access, with the following fields: Title, Data, Information, Geographical Information, Dimension, Farm Name, Nationality, Type of Olive Grove, Species of Olive Tree, Irrigation technique, Treatment Technique, Quantitative Data, Investments, Arguments for, Arguments against, Reference to associations, Legislation, and notes.

The aim of this systematization was to help interpret each of the collected pieces of news. It is important to mention that repetitions were excluded, since it is frequent that on the same day the same news is divulged by different media.

b) The evolution of the olive grove planted surface in the Lower Alentejo since 1990 has been investigated. Images from Corine Land Cover were used, analysed using the program Arc Gis 9.3 with the aim of estimating the areas of olive grove gained and lost between 1990 – 2000 and 2000 – 2006.

c) A database of olive oil mills was built and their location noted.

d) An inquiry was done into the oil mills to determine some of their characteristics such as: dimension, first year of activity, residual waters, and pomace destiny, origin of the processed olive, and estimated annual production.

Results

The news published in the media: The inventory of news about the olive grove (2004/2009) allowed an analysis of their inter-annual evolution (Fig. 2-5); its variation, on average, through the year (Fig. 2-6), as well as the number of times that each municipality of the region is mentioned in the considered period (Fig. 2-7). Thus it can be verified that the years with the publication of the largest amount of news correspond to the last three years of the period, 2007 to 2009, with the maximum standing out in 2008. It can also been seen that there is an increase in news starting in the beginning of Autumn and continuing throughout the Winter, accompanying the Olive season, since that is the period when soil is prepared and new olive groves are planted. Among the references to the region's municipalities, the municipalities of Ferreira do Alentejo, Serpa, Beja and Moura stand out, meaning that those municipalities are the ones with larger olive groves, as well as being subject to a larger dynamic of implementing new plantations.

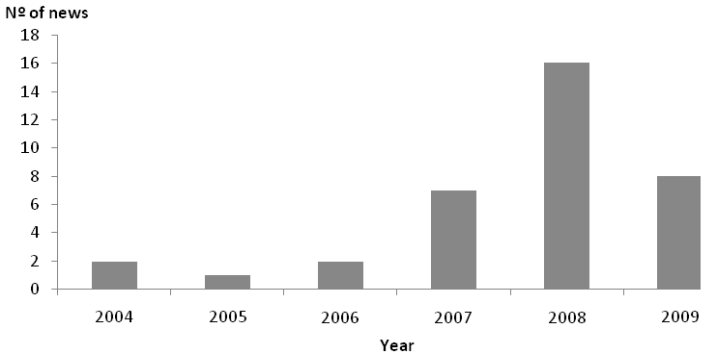

Fig. 2-5: Number of news items per year

In terms of content we can verify a large number of references to Spanish farmers and entrepreneurs, which largely surpass those referring Portuguese (Fig. 2-8), and the predominance of news referring to the