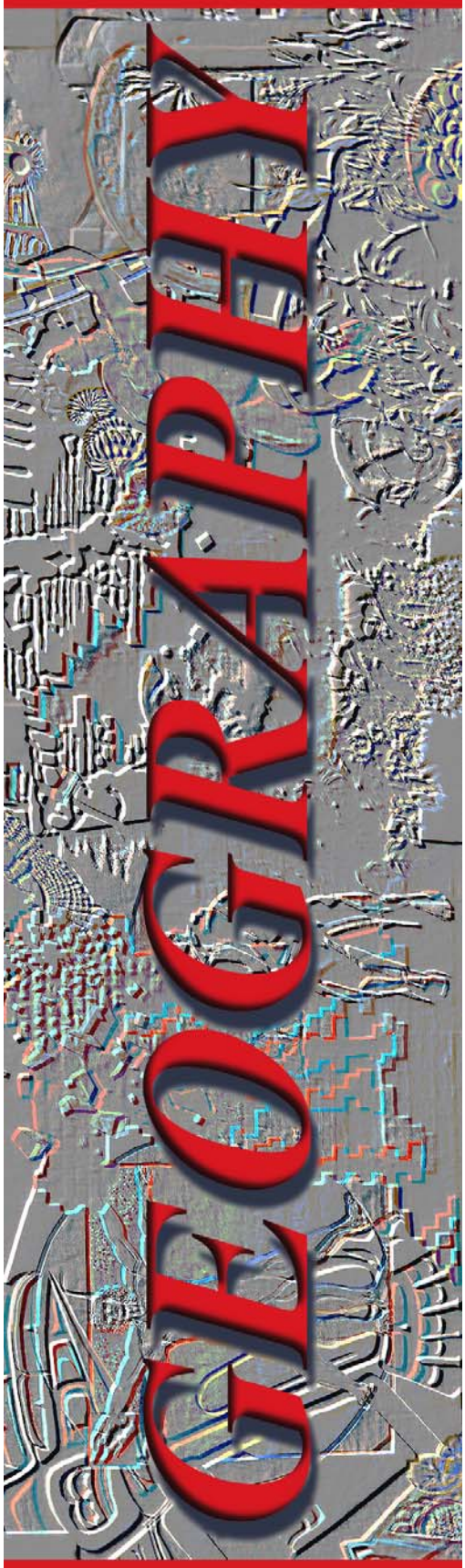

Island Landscape Dynamics:
Examples from the Mediterranean

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Geographical Paper No.183

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August 2007

Series Editor: A. M. Mannion

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Acknowledgement

This discussion paper is a summary of **Mediterranean Island Landscapes: Natural and Cultural Approaches** (2007) edited by Vogiatzakis, I.N., Pungetti, G. and Mannion, A.M., published by Springer: Dordrecht.

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N.B. *This* ***Geographical Paper*** *is produced by the Department of Geography, University of Reading, with the approval of Springer, Dordrecht, the publisher of* ***Mediterranean Island Landscapes: Natural and Cultural Approaches*** *(2007) edited by Vogiatzakis, I.N., Pungetti, G. and Mannion, A.M.*

Introduction

All islands resemble each other; each island is different in its own way. This is the case globally and no less so in the Mediterranean. These 'pieces of land surrounded by water', as defined in the Oxford Dictionary, are bound by their common isolation, or insularity, which is a major limiting factor in relation to resources and which creates the nearest naturally-defined unit to a closed system. This contrasts with the contiguity of the continents and means that islands can be regarded as self-contained microcosms and natural laboratories of quantifiable proportions. Island size is also important because it is a major, but not the sole, determinant of the extent of resources. Since the work of Darwin in the mid-1800s natural scientists have been fascinated by islands, culminating in the seminal work of MacArthur and Wilson entitled *The Theory of Island Biogeography* which was published in 1967. This has spawned a raft of studies (e.g. Whittaker, 1998 and Patton, 1996) examining all aspects of island dynamics including natural and cultural developments well as the issue of carrying capacity and population growth and regulation. Despite this volume of research there has been no text which brings together the natural and cultural aspects of Mediterranean islands, a situation now redressed by the publication of an edited collection of papers entitled *Mediterranean Island Landscapes: Natural and Cultural Approaches* (Vogiatzakis, Pungetti and Mannion, 2007) in December 2007 and of which this paper is an introduction and synopsis.

While insularity is a condition common to all islands it varies in intensity depending on proximity to the mainland. Thus Mediterranean islands contrast with the isolated islands of the Pacific insofar as they located in a basin which is at the crossroads of three continents and with which they share environmental and cultural characteristics. There are more than 5000 Mediterranean islands of varying sizes and with unique characteristics; all are considered to be hotspots of biodiversity at the global scale (Médail and Quézel, 1997; Davis *et al.*, 1994). All have diverse prehistories and histories ranging from initial human settlement in the first half of the Holocene, through recorded history to their roles as members of the European Union (EU).

This paper is concerned with the largest Mediterranean islands, notably Sicily, Sardinia, Cyprus, Corsica, Crete, the Balearics and the Maltese Archipelago (referred to hereafter as the Mediterranean Islands). Their location and general relief is shown in Figure 1. Of these islands, Cyprus and Malta are island nations while the others are so-

called island regions of mainland EU nations. Sicily and Sardinia belong to Italy, Corsica belongs to France, Crete belongs to Greece, and the Balearic Islands belong to Spain. There is considerable variation in size (Figure 1) and population; Malta is the most densely populated while Corsica is the least densely populated. There is also considerable variation in topography, as shown in Figure 1; most islands, except Malta, have mountain topography and all have attractive cliff, beach and sometimes lagoonal coastal areas.

Each has a distinctive biogeography, prehistory and history, cultural and economic development and degree of conservation/landscape protection and planning. Agriculture, and to some degree industry in a broad sense, have helped shape island landscapes though today tourism is a primary economic force in all these islands. In the medium term climatic change and associated sea-level rise as well as changing tourist aspirations and conservation programmes will primarily dictate landscape character.

Figure 1. The Mediterranean Basin

http://www.lib.utexas.edu/maps/europe.html

The first part of this paper focuses on the generalities and commonalities which have affected the natural and cultural development of all the islands. These include the long-term geological evolution of the Mediterranean basin, environmental changes of the postglacial period/Holocene (beginning c. 12,000 -10,000 years ago to present) which provide a backdrop for the islands' settlement history, land transformation and cultural development as well as their biogeographical characteristics. Reference is made to the impact of the rises and declines of the many civilisations/cultures which have influenced the islands through

past millennia and whose heritage remains a vital component of the modern tourist industry as well as a testament to the individuality of island cultures. The political shaping of island landscapes is just as important now as in the past and the impact of modern pressures and on sustainable development and traditional *genres de vie* is considered. Such pressures include tourism which has been highly significant in the socio-economic development of the islands, and the Mediterranean basin in general, since World War II. Its embrace has led to improved standards of living, economic viability and a reduction in emigration but at a cost of traditional activities associated with agriculture, abandonment of agricultural land and a shift of population to the tourist resorts as well as increased pressures on water supplies, waste disposal and cultural sites. Reconciling future tourist demands and sustainability is a major challenge facing all the islands referred to herein. Membership of the EU has also influenced political decision-making which in turn has contributed to landscape change.

Subsequently, in the second part of this paper, the specifics of each island/island group are examined briefly. Reference is made to the factors listed above and those which contribute to the individuality of island landscapes are highlighted. Finally, particular issues likely to be important in the future are discussed in the context of strategies for landscape development for which holistic and trans-disciplinary approaches are advocated.

Generalities: Background to environmental, cultural and socio-economic development

In geological terms the Mediterranean Sea is a recent feature of the Earth's surface; it was formed c. 65 million years ago as the African and European plates converged to force the contraction of the pre-existing Tethys Ocean. Since then there have been episodes of drying and flooding, low and high salinity, low and high sea levels, and cold and warmth, as well as volcanic activity and earthquakes. Of particular significance is the Messinian event which began c. 6×10^6 years ago at the end of the Miocene epoch (Cenozoic era). By this time the connection with the Atlantic Ocean via the Strait of Gibraltar had been closed. There are conflicting views as to how the closure occurred and in relation to the rapidity of its occurrence (see debate in Duggen *et al.*, 2003) but the Mediterranean Sea evaporated almost completely giving rise to extensive saline deposits and desiccation. The Messinian

event ended c. 600,000 years later when the link with the Atlantic Ocean was re-established via the Strait of Gibraltar and the Mediterranean Sea was re-established.

Thereafter climatic instability set in, eventually developing into alternating cold and warm conditions which are equivalent to the glacial and interglacial (ice ages and interglacials; for an explanation of terms and types of evidence see Mannion, 1997 and 1999)) conditions of middle to high latitudes by c. 2.5 million years ago. Evidence for the environmental changes of the last 5 million years derives from the fossils, notably foraminifera, and oxygen-isotope characteristics of sediment cores from the Mediterranean Sea. Further evidence for the last one million years derives from the fossil content of lake sediments especially pollen which provides a means of reconstructing past vegetation changes, raised beaches, soil profiles, volcanic ash (tephra) deposits, speleothems (cave deposits) fossil faunal remains and archaeological sites. Some of this evidence, notably pollen assemblages from lake-sediments, derives from mainland Mediterranean nations, notably Greece, France, Italy and Israel, but it nevertheless provides valuable information on overall climatic and ecological change in the Mediterranean basin which would have affected all the islands.

Flora, faunas, ecosystems and soils have responded to the repeated cooling and warming of climatic cycles. Forests, grasslands and shrublands, with associated fauna, underwent continual reassembly as temperatures rose and fell during the numerous, possibly more than 30, climatic cycles of the last two million years. Overall, each cycle comprised a relatively long cold period (a stadial) of c.100,000 years, when open, low-growing plant communities dominated terrestrial environments, and a comparatively short warm period (interglacial) of c. 10,000 to 15,000 years when first coniferous and then deciduous forests persisted. As is the case today, conditions and ecosystem characteristics were far from uniform throughout the Mediterranean basin with increasing aridity towards the east during interglacials when semi-desert/steppe communities persisted in contrast to the western Mediterranean region where forests developed. The repeated waxing and waning of polar and upland ice sheets also affected coastline location with changes in sea-level by as much as 120m between a stadial and an interglacial stage. In particular changing sea-levels created and severed land bridges such as those between Sardinia and Corsica, Malta and Sicily, and Malta and North Africa. Such links in the past have had a substantial influence on the composition of island floras and faunas which have also been affected by subsequent isolation.

The beginning of the current interglacial stage, the Holocene, is of particular importance in the natural and cultural environmental history of the Mediterranean islands. First, oscillating temperatures during the sharp transition from stadial to interglacial halted early forest/shrub establishment and caused a short-lived return to open habitat/steppe-like vegetation. By 10,000 BP coniferous forests dominated by species of pine and juniper were present; by 5000 years BP deciduous trees, e.g. species of oak, elm, hornbeam and beech, were becoming dominant. Moreover, a new agent of change had begun to colonise the islands; *Homo sapiens*, with a capacity for harvesting natural resources was already present in the Mediterranean Basin and beginning to clear land for agriculture. Apart from Sicily, all the Mediterranean islands discussed herein had been colonised permanently by humans between 11,500 and 5,000 years BP, by cultures who introduced domesticated animals and crops.

As shown in Table 1, Sicily has the longest history of human occupation which dates back to the latter half of the last stadial. This early occupation is unsurprising in so far as a land bridge existed with Italy and with Africa via Malta; Sicily is now and always has been the least insular of the islands discussed herein. Pioneering and pre-1990 work on the early settlement of Mediterranean Islands is summarised in Cherry (1990). However, recent archaeological evidence provides further insight and indicates that Sardinia, Corsica and Cyprus were next to be colonised, though the evidence of an occupation c.13,500 years BP from Sardinia is disputed. Moreover, it is likely that hunter-gatherers visited the islands sporadically, possibly seasonally, prior to permanent settlement and the introduction of agriculture which was first established in the Near East from whence it spread. Thereafter wildscapes were transformed into landscapes as the imprint of humanity intensified. Fire and people were the major agents of change; fire has always been a significant component of natural ecosystem change and a potent force for humans to manipulate land transformation (see Pyne, 2001 for a discussion). From c.6000 years BP there is evidence for the rise and fall of many different civilizations. Of particular note are the ancient Greek and Roman civilizations which touched all the islands; indeed some islands spawned mighty forces themselves, as is the case of the Minoans (2900-1150BC) of Crete and the Nuraghi people of Sardinia (beginning c.1000 years BC).

The advent of people not only transformed wildscapes into landscapes (did any Mediterranean islands ever have true wildscapes in the Holocene given the convergence of interglacial warming and the onset of human occupation?) but also began the process of

species introduction. Plants, animals, fungi etc were introduced deliberately and accidentally from the surrounding mainlands, a process which continues today. Examples include the rat (*Rattus rattus),* house mouse (*Mus musculus),* and rabbit (*Oryctolagus cuniculus)* while plant species such as *Agave americana, Ailanthus altissima, Carpobrotus edulis, Opuntia ficus-indica, Oxalis pes-caprae* and various *Eucalyptus* species are now part of the Mediterranean landscape. Introduced species may have contributed to the extinction of native species. The advent of humans probably also have caused extinctions; the pygmy elephants of Cyprus and Crete, for example, disappeared soon after the initial human settlement, possibly because of over-hunting.

Table 1. A tentative chronology for the human colonization of Mediterranean Islands
(Vogiatzakis et al in press)

Island	Date (approx BP)	Site	Reference
Sicily	37,000-20,000	Stone tools on Catania Plain and Agrigento province	Leighton, 1999
	17,000-10,000	Abundant evidence from coastal caves	
Sardinia	13,500	Corbeddu Cave*	Hofmeijer, 1997
	9,100	Corbeddu Cave	Sondaar et al 1986
Cyprus	10,600	Akrotiri	Simmons, 1999
		Aetokremnos	
Corsica	11,500-9,500	Various rock shelters	Costa et al, 2003
Crete	8,000	Knossos	Rackham and Moody, 1996
Balearics	5,000-4,000	Various e.g. Cova des Moro, Majorca	Alcover 2004
(disputed)	7,000-8,000		
Malta	7,500	Ghar Dalam Cave	Trump and Cilia 2002

* dates for Sardinia are disputed.

Location in relation to adjacent continents, insularity, climate and human activity were the major determinants of landscape characteristics during the Holocene, as they are today. The records from archaeological sites and sedimentary archives indicate a dynamic period of people-environment interactions which has given rise to the present landscapes. Their biogeographical characteristics are the present stage in the continuum of the ever-changing Holocene epoch. So rich is the biodiversity of the Mediterranean islands that most

are classified as ‘hot spots’ (Blondel and Aronson, 1999); all contain a high proportion of endemic plant species (Greuter, 1995), data on which are given in Table 2. This reflects insularity, the role of islands as refuges and the adaptation of species to island environments, especially aridity/moisture gradients.

Table 2. Islands’ size and plant diversity (Delanoë *et al.* 1996)

Island	Area (km^2)	Species No	Endemics No	% Endemism
Sicily	25708	2700	310	11.5
Sardinia	24090	2054	200	9.7
Cyprus	9250	1620	170	10.5
Corsica	8748	2354	270	11.5
Crete	8700	1706	200	11.7
Balearics	5014	1450	180	12.4
Malta	316	700	32	4.6

The flora of the Mediterranean islands can be classified into three broad categories according to their origin (Greuter 1979): i) a relict element: ancestors of pre-isolation phase, ii) a telechorous element: resulting from natural long-range dispersal and iii) an anthropic element: human induced. In addition, the floristic affinities of the islands fall into two groups i.e. a western group (Tyrrhenian and the Balearics) and an eastern group (Aegean, Crete, Cyprus). In general islands share the vegetation types found in the Mediterranean region, notably forests, open woodlands, maquis, garrigue, phrygana and steppe (see Table 3 for descriptions).

Most of these categories occur, often as a mosaic of communities on the larger islands by unique communities/assemblages. Examples include the carob forests in Cyprus, the cork oak forests in Sardinia, valonia oak (*Quercus macrolepis)* forests in Crete, chestnut forests in Corsica and upland hazel groves in Sicily and Sardinia (Barbero *et al*., 1995). There is also considerable variation on islands with altitudinal gradients e.g. Crete, Sardinia, Corsica and Sicily, reflecting the importance of temperature as a determinant for plant species location.

Table 3. The main vegetation types in the Mediterranean islands

Term	Definition
Forest	Tree covered land but can also include other habitats in a matrix of trees
Maquis	A dense mostly evergreen shrub community 1-3 m high characteristic of the Mediterranean region
Garrigue	A community of low scattered often spiny and aromatic shrubs of the Mediterranean region
Phrygana	Low shrub developed over dry stony soil in the Mediterranean region. In general it is an equivalent term to garrigue which is used in the West Mediterranean.
Steppe	Mainly grasses with bulbous and other herbaceous plants

In general, the fauna of the Mediterranean Islands is similar to that of nearby mainlands. Large herbivores, including the mouflon, ibex and deer, are present on the larger islands although most of them were probably introduced. Smaller mammals include marten, weasel, wild pig, fox and wild cat. It is in the reptile and amphibian faunas that affinities with Europe may be found, especially in the western islands where impoverishment is not as great as in the eastern islands. In contrast, avian faunas are especially varied, mainly because most of the islands are located along principal migratory routes, especially during the winter. Moreover, the presence of wetlands and salt lakes in some islands provides specialised habitats which encourage species diversity, e.g. the lagoons of Sardinia host species such as the pink flamingos but also crane, spoonbill, avocet and others. Many islands exhibit a remarkable presence of birds of prey including vultures, eagles, buzzards and falcons. Again, patterns of birds of prey richness reflect a distinction between eastern and western islands and corroborate the theory of island biogeography in the context of the importance of island area and proximity to the mainland (Donázar *et al*., 2005).

Topography, climate, flora and fauna as well as land-cover and land-use history are the determinants of today's landscape ecology. In general, only relatively small remnant patches, or islands, of natural/semi-natural communities remain, having been isolated by intensifying human activity. Hedges, tracks, irrigation channels, terraces etc. provide valuable connections or corridors between these islands and have an important role to play in conservation strategies. To date most strategies have concentrated on the preservation of habitats to safeguard species from extinction. The present extinction rate of Mediterranean

higher plants is 0.1 percent (i.e. 37 species presumed to be extinct), while 4251 taxa are considered to be under threat (Greuter 1994). Given likely future pressures from global warming, invasive species and increasing tourism rates of extinction are likely to accelerate with endemic species being particularly vulnerable especially at high altitude.

The anthropogenic factors which have contributed to the evolution of Mediterranean landscapes fall into two categories: cultural and political. All landscapes can be described as cultural because they are perceived and described as landscapes by humans and are thus cultural constructs, and because all humans function within an environment or landscape. Furthermore landscapes may be considered to embody ancestral energies, spiritual forces, memories, dreams and identities and so they change over time to reflect changing activities and aspirations. The manifestation of cultural landscapes is highly visible in the Mediterranean Basin, and especially in the more spatially-confined islands which are nevertheless linked via a maritime network bring into contact powerful empires and three continents. Thus the sea was and is an important vehicle for cultural change which, in turn, influences island landscapes.

Early human impacts occurred before 6000 years BP and consisted mainly of stone use and hunting and gathering; hunting may have led to extinctions (see above). Once agriculture was established vegetation clearance occurred with terrace construction on steeply sloping land. Terrace construction/maintenance has remained important since then because of the importance of terracing to combat soil erosion, soil nutrient depletion and water loss. Although the state of terrace repair has deteriorated since c.1960, when rural depopulation began and tourism overtook agriculture as the mainstay of island economies, terracing remains very much in evidence. Other aspects of agriculture have also shaped landscapes, e.g. the use of forests/woodlands for animal grazing, land-subdivisions using stone walls, track/road networks, the construction of windmills and rural dwellings, as well as nucleated settlements with their landmark churches, monasteries etc. The rise and fall of civilisations influenced both rural environments and architecture as did religion; many islands have sites of pilgrimage, e.g. springs, groves and mountain tops, for various reasons. Periods of colonisation often gave rise to increased agricultural intensity to supply the colonising homelands and at the same time the colonisers left distinctive landmarks such as castles, forts, harbour constructions etc. All Mediterranean Islands bear witness in a variety of ways to six thousand or more years of human presence. Many sites/landmarks are protected as ancient or historical monuments and many are designated as UNESCO World

Heritage sites. It is perhaps no coincidence that Sicily is rich in such sites given its proximity to Europe via Italy, and Africa.

Since 1960 tourism, and the infrastructure necessary to support it, has dominated Mediterranean Islands, beginning with the Balearics and Malta. Today, tourism is a major generator of wealth for all the islands referred to in this paper. Indeed the cultural heritage of Mediterranean landscapes, together with the natural attractions of good beaches and a warm, dry summer climate, is a major tourist attraction. This situation reflects the interplay between cultural attributes, which might be described as the result of the politics of the past, and political decisions which partly determine the culture of the present.

It is axiomatic that all landscapes, because they have been defined and/or moulded by human action are to some extent political. This is particularly apparent for Mediterranean Islands lying as they do at the crossroads of many past civilisations and cultures which have sometimes merged and at other times clashed. The post-1800 status of the Mediterranean islands in terms of independence, annexes to mainland nations etc. has varied over time. This is summarised in Table 4 along with significant dates. For islands other than the nation states of Malta and Cyprus an important issue is the degree of autonomy they enjoy within the mother country and whether or not this takes into account the 'peculiarities' of insularity or simply treats the island component as just another region. Table 5 gives a synopsis of the current position and reflects heterogeneity re autonomy, administrative power, legislative capability etc. It is apparent, for example, that Italy and Spain allow greater self-governance than France or Greece. There is also the issue of island status under EU policy, especially the designation of islands under categories Objective 1 and 2. These are the priority categories for so-called structural funds, e.g. INTERREG for promoting transnational co-operation on spatial planning, LEADER, which finances projects for rural development, and others (European Commission 2006). Moreover, the Treaty of Amsterdam (European Union 1997) introduced several provisions re islands to the EU treaty especially in relation to disadvantaged regions but given that this does not take account of the specific conditions of insularity (EURISLES 2002), some politicians argue that islands should be accorded a unique status.

Table 4. Important dates in the islands recent political history

	Period as Independent State	Year of Independence or Joined Mainland	Accession year to the European Union
Sicily		1860	1958*
Sardinia	1848-1860	1861	1958*
Cyprus		1960	2004**
Corsica	1755-1769	1769	1958*
Crete	1898-1913	1913	1981
Balearics	1276-1344 (Mallorca) 1287 -1344 (Minorca)	1802	1986
Malta		1964	2004

* The French and Italian islands effectively entered the then called European Economic Community.
** Applies only to the southern part of the island under the UN recognised Republic of Cyprus

Table 5. Level of Autonomy in the Mediterranean Islands of the European Union (source: Hache 2000)

Islands	Autonomy granted by the National Constitution	Legislation power	Administration Power	Common Law
Sicily	√	√	√	
Sardinia	√	√	√	
Corsica			√	
Crete				√
Balearics	√	√	√	
North Aegean islands				√
South Aegean Islands				√
Ionian Islands				√

Of particular importance is how political and resulting legal frameworks impinge on landscapes and equally important is how much environmental issues are coming on to the political agenda. For example, the Common Agricultural Policy (CAP), both contentious and anathema to many EU states has been influential as a determinant of island (and EU) landscapes. In addition, for Mediterranean nations in general, landscape as a political focus emerged in the 1970s; it has continued to be important at local and national levels. This, in turn, has spawned diverse conservation objectives, programmes and on-the-ground protected areas (e.g. Vogiatzakis *et al.,* 2006).

The designation, protection and management of valued areas, as well as the effectiveness of enforcement, vary considerably between islands as does unlawful but often widespread poaching and hunting. How are such areas identified? How can they be protected? How will such areas react to climatic change in the light of current (IPCC, 2007) deliberations? Should conservation objectives continue to embrace the tried and tested objectives of conserving species or concentrate on the preservation of habitats? The answers, albeit disputable, are different for each Mediterranean Island.

Specifics: Island contexts

Since the opening of the Holocene the environmental, cultural and political factors discussed above have given rise to both the similarities and differences between Mediterranean Islands. This is illustrated below through brief reference to each island.

Sicily

At 25708 km^2 Sicily is the largest of the Mediterranean Islands. It has a coastline of 1039 km with cliffs, ravines and small pebble beaches in the north and northeast, low dune systems to the south and west, with small bays to the southeast. There are also the archipelagos of the Aeolian, Egadi and Pelagie islands. Sicily's relief is shown in Figure 2 which illustrates its predominantly hilly disposition. Hills occupy c. 62% of its surface while flatlands occupy 14% and mountains 24% including Mount Etna, Europe's highest active volcano which was formed c.700,000 years ago. The overall Mediterranean-type climate is tempered by these variations in relief and soils which are a function of geology and Sicily's location at the meeting point between the mountain chains of mainland Italy

(the Apennines) and North Africa, i.e. where the Eurasian and African plates have clashed over the last 40 million years, as well as the erosion / deposition of sediments and the elevation of ancient coral reefs. Relief, rock and soil variations plus the geographical position of Sicily between Italy and Africa and the oscillating cold/warm stages of the last 2 million years have given rise to a rich biodiversity.

Figure 2: Sicily: Relief

(from CIA map, 1973: Italy, 1:2,700,000)

Sicily's flora comprises 2700 species (Delanoë *et al.* 1996) of which 11.5% is endemic; there are species common to Europe, Asia and Africa and relict species of Tertiary age. According to De Montmollin and Strahm (2005) eight vascular plants are currently at the brink of extinction. The dominant vegetation type is maquis with forests on mountain ridges and grass-dominated communities in some coastal areas. An important faunal element of Sicily's ecosystems is migratory birds which move between Africa and Europe. Some 324 bird species have been recorded, many of which are rare or threatened. Wolves and two species of deer have been made extinct; fox, hedgehog, marten and rabbit are native species and reasonably abundant while the dormouse and hare have been introduced. Amphibians include the painted frog, an African species not found elsewhere in

Italy. Former landbridge connections with Africa are reflected in fossils of dwarf elephants and hippopotami.

The island has an equally rich cultural history (Benjamin, 2006). There is evidence for human presence 35,000 years ago and since then Sicily's landscape has been shaped by human activity, especially with the advent of agriculture in Neolithic times. Historically, the earliest farmsteads were constructed c.400 years BCE and since then rural buildings, known as *bagli*, have characterised the landscape. The rise of the Roman empire turned Sicily into the 'granary of Rome' and created road networks, aqueducts and land division known as centuriation. Subsequent cultures added to agricultural diversity by introducing new crops, irrigation, and inheritance rules. Deforestation, soil erosion and salinisation also occurred along with battles, fortifications and upheavals. Today, the landscape remains agricultural with just over 1.5 million hectares being farmed mainly by family-run 365,000 enterprises. Durum wheat production dominates the central region, with horticulture, fruit and nut cropping and flower production in areas with reliable water supplies. Rural diversity is matched by urban diversity which reflects the many cultural influences of Sicily's history e.g. Syracuse and Agrigento with their squares of Greek origin; other towns are of Roman or Medieval origin. All provide attractions for tourism. Industrialization along with intensifying and diversifying tourism and its infrastructure have been the major agents of landscape change in the last 60 years. Oil deposits led to petrochemical works and industry has caused water pollution but tourism's impact dominates the coast. Roads, resorts, sport and boating facilities have altered more than 80% of Sicily's coastline (WWF, 1996) and intensified pressures on protected areas. Roads have also facilitated illegal activities such as poaching, unauthorised construction and water extraction as well as led to an increased incidence of forest fires. Recently, wind farms have been proposed which will alter landscapes further though tree-planting has been encouraged under EU directives.

In terms of conservation, Sicily was one of the first Italian regions to enact laws related to the creation of parks and nature reserves. There are four Natural Regional Parks, 76 regional Nature Reserves, two Ramsar wetlands and more than 220 Natura 2000 sites. Not all are well managed or policed. UNESCO has also designated a number of World Heritage sites in Sicily. For example, the Aeolian Islands have been recognised for their specific type of volcanism while many of Sicily's towns are recognised as cultural

monuments which reflect ancient Greek, Roman and Byzantine influence. International, EU and Italian agencies are also involved with successful anti-poaching programmes.

Sardinia

With an area of 23,833 km^2 Sardinia is the second largest island in the Mediterranean Basin. It is almost equidistant from Africa and Europe and is only 10 km from Corsica. Figure 3 shows that it is mountainous with plateaux and plains, which influence the dominant Mediterranean climate.

The relief reflects the solid geology and seismic history of the island. There is a basement of Palaeozoic granitic and metamorphic rocks and Mesozoic dolomite and limestone which were deposited under marine conditions; the alpine orogenesis of the Tertiary period created the present relief. There is a system of semi-rifts arranged on a north-south axis which have been affected by several cycles of volcanic activity when basaltic lavas filled the shallow valleys and which have been eroded to create plateaux known as *giare.* Sardinia's geological heritage includes deposits of barite, fluorite, silver, lead and gold. Xerothents are the predominant soils. Geomorphologically, the island can be divided into three sections: the eastern sector has the most variation in relief and includes the Limbara and Gennargentu mountains; the central area is characterized by broad basaltic lava flows, and the Palaeozoic rocks of the west. Evidence of the Quaternary oscillations of climate is present as raised beaches and alluvial deposits of interglacial age which attest to the rises and falls of sea-level in tune with the waxing and waning of polar ice sheets.

For much of its geological history Sardinia was joined to Corsica with severance episodes in the Quaternary period during phases of high sea-level i.e. during the warm/interglacial stages. Thus biogeographically the two islands have much in common especially in relation to endemic species. According to Boccieri (1995) Sardinia's flora comprises 2,054 species of which 200 are endemic. Therophytes dominate the flora and comprise 39.9%, followed by hemicryptophyes at 28.1% and geophytes at 12.1%. There are also c.900 introduced species. Some three percent of the flora are globally threatened taxa and eight percent are locally threatened (Delanoë *et al.* 1996). Vegetation communities are typical Mediterranean associations such as forests of various oaks and pines, including extensive cork oak forests, maquis comprising wild olive, lentisk (pistachio), juniper, myrtle, and garrigue. Shrubs dominate above the treeline at c.800m.

Figure 3. Sardinia: Relief

(from CIA map, 1973: Italy, 1:2,700,000)

The native fauna comprises fox, wildcat, marten and wild boar. Various species of deer have been introduced. Populations of wild horses and mouflons are present in the uplands though their origins are uncertain. There is a rich avifauna which is particularly evident in coastal lagoons and there several endemic animal species including the Sardinian newt, the dormouse and the Sardinian salamander.

There is much debate as to when humans first colonised Sardinia (see Table 1); the earliest evidence points to 13,000 years ago as sea levels rose. Neolithic communities introduced agriculture c. 8000 years ago and since then this activity has been the main cause of environmental change; fields have replaced forests which have also been modified through grazing and food production has been influenced by internal factors such as population growth and external factors such as trade and colonialism. The Carthaginians

and later the Romans colonised and expanded trade; this involved deforestation for agriculture, especially for cereal production and viticulture, and wood exports. Mines and quarries were initiated. Colonisation by the Byzantines, Vandals and Arabs followed in the wake of the Roman Empire but there was an economic decline for several centuries which led to land abandonment and the re-establishment of shrubs and trees in many areas, especially the coasts. Four *Giaduci*, religious and military leaders, were established in the Middle Ages and their power to assign land to individuals began a tradition of sheep farming which remains the most important type of agriculture in the uplands today with cereal production on the plains. Sardinia's landscapes owe much to the House of Savoy which took over the island in the 1700s. Drainage of wetlands commenced, partly to control malaria, and there was a shift of emphasis from pastoral to arable agriculture which gave rise to new field patterns; enclosure of communal was permitted though this could be achieved only by large landowners. Thus class differences were accentuated and resentments between shepherd and arable farmer grew ever greater. Moreover, woodland resources were heavily exploited due to markets in Italy for railway sleepers and pit props.

It was not until the post World War I period that government policies attempted to revive Sardinia's agriculture; such policies included malaria control, land drainage, and the construction of irrigation systems. Although wetland ecosystems were lost wooded pastures prevailed and continue to be protected (Vogiatzakis *et al.* 2005) to provide economic returns through cork exploitation and animal husbandry. These agrosilvopastoral practices give rise to heterogeneous landscapes and constitute a sustainable land-use though subsequent economic activities have encroached as Sardinia's economic activities have diversified since World War II. Agriculture diversified to include viticulture, horticulture and tree crops such as fruit and olives along with sheep farming and cereal cultivation. This plus inheritance traditions which caused land fragmentation altered Sardinian landscapes and wildlife was adversely affected by agricultural chemical use and sometimes poor management. Industrially, mining has continued to be important though today gold mining is the only activity; the discovery of oil underpins petrochemical works and urbanisation has consumed some of the rural area.

As in other Mediterranean islands, tourism has become a major sector of Sardinia's economy. Coasts and coastal activities dominate tourism on an island richer in natural rather than cultural assets. It brings another set of problems: resort development, infrastructure, pollution and waste disposal etc. Despite this, Sardinia retains a strong

nationalistic identity, a major reason why the Italian Constituent Assembly, after the Second World War, declared Sardinia an Autonomous Region with a Special Statute (*Regione Autonoma a Statuto Speciale*).

Efforts to conserve Sardinia's landscapes and wildlife (RAS, 2003a) are relatively recent, e.g. the concept of Natural Parks originated in the 1970s with formal regulation beginning in the 1980s. In addition Sardinia's government has designed, and is now beginning to implement, a landscape territorial plan to effect conservation and protection of the island's natural and cultural heritage. This has not been free of controversy.

Cyprus

Cyprus has an area of 9,251 km^2. Located in the northeastern part of the Mediterranean Sea, its nearest neighbours are Turkey, Syria and Egypt. Politically, Cyprus is a divided island; having gained independence from the UK in 1960 it was invaded by Turkey in 1974. This created a division between Greek and Turkish communities, as shown in Figure 4, and contributed to a long-lasting animosity between Greece and Turkey

The relief tempers the overall Mediterranean climate. For example the hot dry summers vary in length from 7 months to 7.5 months from sea level to 350m above sea level, 6 to 7 months between 400m and 850m a.s.l., and four to five months above 850m. Average precipitation also varies from 300mm to 1100mm, increasing with altitude, and varying from year to year. Relief is related to geology, especially the emergence c.90 million years ago of sediments laid down in the Tethys Ocean due to the collision of the African and Eurasian plates. Further upthrusts resulted in the emergence of the Troodos and Pentadactylos mountain ranges comprising sediments with igneous intrusions. As Figure 4 shows, numerous rivers drain these mountains through coastal plains to the sea where cliffs with caves and beaches.

With respect to biotic elements, Cyprus is sufficiently large, varied in relief and relatively isolated to support high habitat and species diversity, but close enough to three continents to be influenced by continental biotas. Moreover, human presence (see Table 1 and Simmons, 1999) for c.11,000 years, beginning with hunter-gatherers and later Neolithic farmers, means that disturbance has been considerable and that many plants and animals have been introduced. Such activities plus the exploitation of woody species for fuel, house-

building and ships have altered or even eliminated typical and widespread Mediterranean vegetation communities of trees and shrubs and accelerated erosion regimes.

Figure 4. Cyprus: Relief

http://www.freeworldmaps.net/europe/cyprus

Periods of particularly intense forest loss coincide with various phases of cultural development, notably annexation by mainland powers. The first forest inventories undertaken by the British Administration in the late 1800s indicate that forest depletion was considerable, even in areas unsuitable for agriculture. Afforestation programmes have countered this to some extent but forest still covers only 20% of the island. Pines, cedar, including the endemic Cyprus cedar, and cypress predominate. Cyprus also has significant coastal vegetation communities and lagoons. The island has a native flora of 1,612 species (Cyprus Flora, 2005). Some 500 plants are classified as rare; there are 108 endemic plant species i.e. 6.7%; the Troodos Mountains are rich in endemics. The terrestrial vertebrate fauna includes 30 species of mammals, 22 reptiles and 3 amphibians (Iezekiel 2001). The degree of endemism is not as high as Cyprus's location might indicate but of particular interest are the now extinct pygmy hippo, pygmy elephant (*Palaeoloxodon cypriotes*) and extinct crocodile, possibly due to early Holocene hunting by humans. There are seven endemic reptiles and a resident avifauna of 36 species, of which two are endemic.

Cyprus was first settled c.10,600 years ago (Table 1); the archaeological site at Akrotiri is remarkable on two counts: it predates other sites on the island and is pre-Neolithic; there is an association between cultural remains and those of now-extinct animals such as the pygmy elephant. There is a considerable body of evidence for later settlement and agricultural activity, as well as ancient Greek, Roman and Byzantine influence. Burning, grazing, cutting, coppicing as well as terracing and cultivation, degraded the Mediterranean native forest into maquis, garigue, batha and grass communities and converted the land into agricultural and pastoral landscapes (Naveh, 1975). The extent of woodland has, however, increased in the last 50 years due to afforestation programmes and a decline in the cultivation of tree crops and fruit. At the same time the built-up area has expanded considerably mainly due to the expansion of tourism and a growing local population. Tree crops, especially olive and carob, remain a mainstay of the economy and give rise to the traditional agro-sylvo-pastoral landscapes which reflect multi-use as tree cropping is combined with animal husbandry. They are also important wildlife habitats

Three important dates for recent socio-economic and environmental change can be identified: 1878 when the UK began their administration of Cyprus, 1960 when Cyprus became independent, and 1974 when Turkey invaded and subsequently occupied the northern third of the island. The control of forest use, forest conservation and afforestation characterised the British era. Independence corresponded with the general upsurge in tourism and there was a shift from a largely agrarian economy to one based on tourism and services; forest protection continued and engineering works were established to conserve and store water. Unrest and finally invasion in 1974 caused extensive fires which destroyed c.17 percent of the island's forests, and brought in a two different development policies. The division of the island also led to a population shift south as people abandoned their homes and farms. This increased pressure on the south to find housing and employment and thus boosted tourism. This, in turn, has caused loss of coastal habitats

Nature protection in Cyprus has been subject to legislation and measures since the early 60s (Environment Service, 2005) and a series of Strategic Development Plans since 1994 as well as membership of the EU have, brought further regulations re planning, land use, the identification of habitats for conservation and fire control. Today there are designated Natural Reserves and National Forest Parks, a national Marine Reserve and three Ramsar wetland sites. Adoption of the EU Natura 2000 framework has led to the identification of 39 Sites of Community Importance (SCIs) and Special Protection Areas

(SPAs) which will require integrated management focused on the preservation of habitat integrity.

Corsica

Corsica is the 4th largest Mediterranean island and occupies 8682 km^2. While once being part of an initial geological structure which included southern France and Sardinia for millennia, it became isolated at the end of the Miocene era. Corsica is distinct insofar as it is the most northern, the wettest and the most mountainous Mediterranean island with many peaks over 2000 m (see Figure 5). Most of the island is composed of granite, with a rough cliff and peak topography on its west coast. In the north east, schists predominate giving a smoother topography (1767 m maximum at San Pedrone). These two major units are subdivided by a corridor creating not only geological/morphological units but also cultural units. Even today, the north east of Corsica is differentiated from the south east; the two administrative sub-structures (called 'départements') are, respectively Haute-Corse (Capital City: Bastia) and Corse-du-Sud (Capital City: Ajaccio). The former is more agricultural and community based, while the latter is less modified by human activity.

Figure 5. Corsica: Relief.

http://www.lib.utexas.edu/maps/france.html

A unique Quaternary deposition plain covers the east side of the island along the coast and on the west side there are the low plains of rivers such as the Figarella, Liamone and Gravona. The varied topography gives rise to several different microclimates and vegetation communities depending on altitude, from typical Mediterranean forests and shrublands on the coast to alpine communities above 1500 m. Summers are usually hot and

dry and last from May till October. Winters can be cold and there is generally snow on the highest peaks until June, but by then the ambient temperature on the coast is in the mid-20s°C and the July – September average is 27°C. The average annual temperature is 12°C. Annual precipitation varies from 600mm on the coast to 2000mm on the highest peaks and occurs mainly in spring and autumn, with recurrent heavy storm events; up to 400mm can fall within 24hours, leading to destructive flash-flood events. Heavy winds can also blow from the north and west (mistral); they are particularly violent and dry in summer leading to a high fire risk. The northern cape (Cap Corse) and Bonifacio strait in the south experience the fastest winds (up to 150-220km.h-1).

The natural vegetation of the island is Mediterranean, comprising forests, woodlands and shrubs, and covers more than half of the island. The coastal lowlands are part of the Tyrrhenian-Adriatic sclerophyllous and mixed forests ecoregion, where forests and woodlands of evergreen sclerophyll oaks predominate; the major species are Holm Oak and Cork Oak. The cooler and wetter mountains are home to the Corsican montane broadleaf and mixed forests ecoregion; this is characterised by diverse forests of oak, pine, and evergreen deciduous trees, with vegetation more typical of northern Europe on the highest peaks. Much of the coastal, lowland and part of the mountain forests have been cleared for human activities such as mining, agriculture and tourism.

Corsica's population is approximately 272 000 people with about half living in the two coastal cities of Ajaccio and Bastia. Today the island is an administrative 'region' of France, with a peculiar political status compared to the other metropolitan regions, and an assembly. With 365 villages, many inhabited by less than 100 people, Corsica is the least densely populated 'region' of France, with 30 inhabitants per km^2 as compared with 108 per km^2 in France as a whole and about half the island has a population density of 10 inhabitants per km^2. The earliest signs of habitation, dated to c. 6570 BC, were of humans living in caves with subsequent development of agro-pastoral practices. Situated at the crossroads of the major maritime trade routes of the Mediterranean 'Old World', invasions from successive civilizations until the 6^{th} and 5^{th} centuries BC, were accompanied by alliances which were just as quickly compromised by the constant arrival of newcomers. The Romans and Moors have left a legacy in archaeological remains. The island was controlled by Genoa until a rebellion in 1755 when Corsica gained independence. 1768 saw the secession of Corsica to France to pay off a debt. A short period of English administration between 1794 and 1796 ensued and then administration passed to the French

at the Congress of Vienna in 1815. French rule brought education and relative order, but economic life remained agrarian. The intervention of French troops, then later the victorious campaigns of Napoleon strengthened the bonds with France, which, with its colonial Empire, quickly became a land of emigration and offset a major population increase during the 19th century. Due to its troubled history, a unique climate and topography, and its isolation from continental France, Corsica had to find a compromise between facing the drastic economic changes of the 20th century and, conserving its natural resources which constitute the main wealth of the island.

In relation to Corsica's flora, Gamisans and Jeanmonod (1993) recorded 2978 taxa of which 12.2 percent are considered endemic. These are prevalent in the montane flora of which almost 36 percent are endemic. Many endemic species of mammals have disappeared and Corsica's fauna is impoverishedin relation to that of France. Montane landscapes rather than Mediterranean-type landscapes predominate on Corsica and their characteristics reflect traditional landuses as well as a conjunction of mediterranean and alpine influences. The isolation of mountain villages and emigration in the early part of the twentieth century led to land abandonment but in the last few decades the modernisation of agriculture has occurred and tourism has intensified, trends which have brought landscape change to both uplands and coasts. Environmental conservation and protection has been introduced through thr designation of special areas, notably Nature Reserves, Conservatoire de l'Espace Littoral, Arrêté de Biotope, Natural Zones of Ecological, Faunistic and Floristic interest. Sites for innclusion under the Natura 2000 are under consideration.

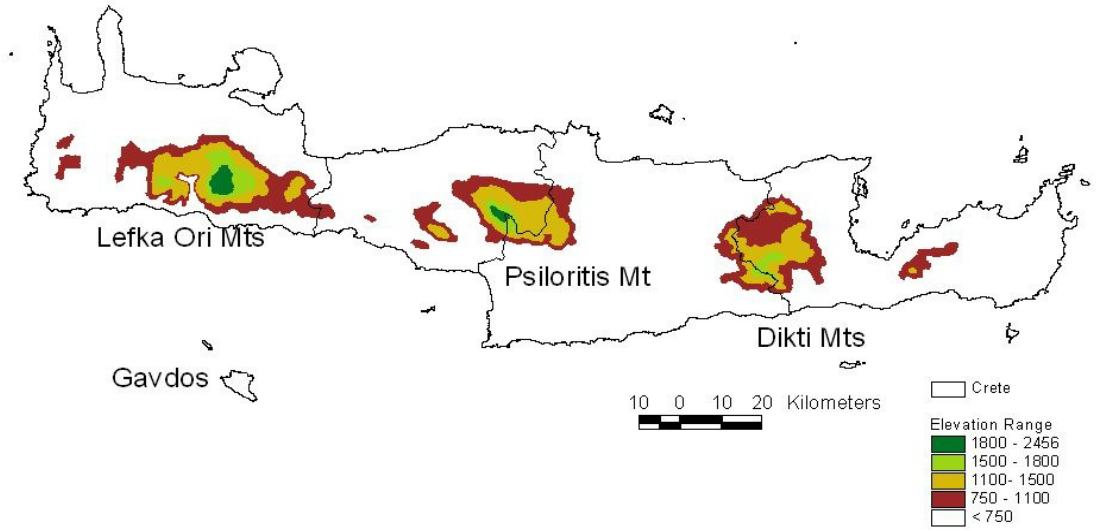
Crete

At 8400 km^2 Crete is the fifth largest island in the Mediterranean. Crete once had a great independent civilisation, the Minoan in the Bronze Age (2900-1150 BC). For centuries it had a mixed economy, mainly agricultural, while over the last three centuries olive-oil production has gradually increased and now dominates the island's economy. As Figure 6 shows, Crete is a mountainous island; its mountains create huge regional variations in what is essentially a Mediterranean climate, with rain-excesses and rain-shadows. In general, aridity increases from west to east and from north to south.

The island was formed by the Alpine mountain-building process that began 70 million years ago. It forms the greater part of the Hellenic Island Arc which connects

Greece to Asia Minor and is dominated by Mesozoic and Tertiary limestones, which vary widely in texture and composition. Crete is rich in Karstic features such as dolines, gorges and mountain-plains widened by limestone solution; and a three-dimensional underground labyrinth of caves into which the hollows drain.

Figure 6. Crete: Relief



The many inland cliffs generate vast quantities of scree while Richter slopes are a feature of altitudes over 2000 m in the Lefka Ori. These are slopes at 32° which consist of solid limestone covered with a thin layer of scree and which result from long periods of frost and limestone weathering and solution in the absence of vegetation.

Crete is recognised as a Global Centre of Plant Diversity due to its high degree of endemism. The total native flora amounts to about 1600 species of which some 200 are endemic (Turland *et al*. 1993; Montmollin and Iatrou, 1995). Endemics are most common in the alpine zone and on cliffs, where they form much of the total vegetation, and are also characteristic of the open phrygana landscape Crete shares in the general categories of Mediterranean vegetation i.e. forest, savanna, maquis etc. (see Table 3) plus specialized vegetation types on cliffs, wetlands, the coast, high mountains, cultivated land, and buildings. Maquis, phrygana and steppe often occur as a mosaic rather than as large areas of any one type. Given a considerable altitudinal variation, Crete has a remarkably weak

vegetation zonation comprising only two recognizable zones: that above the tree limit (alpine zone) and that below the tree limit. In terms of its fauna, Crete once had some peculiarities, notably an elephant the size of a calf, a pig-sized, terrestrial, mountain-climbing hippopotamus and deer. Today the island has begun to acquire a new set of peculiar mammals, such as the Cretan 'ibex' (*Capra aegagrus cretica*) and possibly its own wildcat. Other mammals include hare, badger, marten and hedgehog. The avifauna includes species common to the Mediterranean in general but also includes winter visitors which use the island as a migration route. Crete is notable for 12 species of birds of prey including the lämmergeyer, griffon vulture, Bonelli's eagle and barn owl (Blondel and Aronson 1999).

Much of Crete is characterised by cultural rather than natural landscapes. In about 60 percent of Crete settlement takes the form of villages, i.e. settlements of hundreds of people spaced 3-5 km apart. In the rest of the island, especially in the west, settlement is dispersed in the form of hamlets, i.e. settlements of dozens of people, 1-2 km apart. Moreover, Crete has at least 3000 medieval churches, which probably represents the biggest concentration in the world. Crete is a terraced island. Terraces are almost everywhere, except where unstable geology would risk slumping; they reach into the mountains far above the present limits of cultivation, and to offshore islets. Fields are bounded by dry-stone walls (rarely hedges). Enclosures are of many different types, from those that divide the fertile floors of mountain-plains to the huge enclosure-walls that bound some mountain pastures. The Lassithi mountain-plain is still divided into 193 rectangles laid out by late-medieval Venetian surveyors. There is also a very well-developed network of paved mule-tracks, extending even into the high mountains, which were probably constructed in the Venetian period (1210 – 1650) and maintained during the Turkish period (1650 – 1898). In addition, Crete is considered outstanding in Europe for its many species of ancient trees, including the endemic *Zelkova abelicea,* which are important components of historic landscapes and archaeological features as well as unique habitats for animals and plants.

Many cultures have left their mark on the island by providing or influencing landscape components, creating new habitats and introducing exotic palnts and animals. Since its inception at least 7000 years ago agriculture has been a primary cause of environmental and landscape change. Its influence remains important today, especially through olive growing, greenhouse-based market gardening and through land abandonment due to declining pastoralism in the uplands, but it has been overtaken by tourism. Crete was developed as a place of mass tourism in the 1970s and 1980s. With the exception of the

Balearics, Crete is now the most touristic of the large Mediterranean islands. Development is almost exclusively coastal and has come to dominate much of the north coast, with scattered developments on other coasts. The degree of nature protection in Crete has been limited in comparison with other Mediterranean Islands**.** The Samariá Gorge and surrounding mountains (48 km^2) have been designated as a National Park since 1962, mainly to protect the Cretan Ibex. Three islets off the north coast were designated as nature reserves in the 1920s, and small numbers of 'ibex', then considered to be in danger of extinction, were transferred to them and have become part of the islands' ecosystem dynamics through the effects of browsing. More recent efforts on nature protection have focused on Natura 2000 for which twenty eight areas have been proposed as protected Sites of Community Interest (SCIs). For other parts of Crete, especially in relation to tourism development, of Crete is concerned, the best scenario is the gradual introduction and proper enforcement of planning procedures, and appropriate environmental impact assessment of schemes for roadworks, dams, power stations etc.

The Balearic Islands

The Balearic Islands comprise 151 islands and islets with an area of 5061.3 km^2 and a coastline length of 1238.9 km. The four inhabited islands, Mallorca, Minorca, Ibiza and Formentera, represent more than 99% of the total land area of the Balearics and are very different in size, population density and other basic characteristics. Their location and topography is shown in Figure 7.

Although the average distance of the archipelago from the continent is about 150 km this has produced biological, historical and cultural isolation. The islands can be divided into two groups: Mallorca plus Ibiza and Minorca plus Formentera. The former are mountainous while the latter are relatively flat, the macroclimate is thus different and Mallorca and Ibiza are chracterised by a greater range of microclimates than Minorca and Formentera. Agriculture is also different in the two groups and the timing of tourism development has varied.

Humans reached these islands about 5000 years ago in the Neolithic Age. The Balearics were successively conquered by Greeks, Phoenicians, Romans, and different Arabic peoples. As part of Spain, the Balearics currently enjoy "Autonomous Community" status with a high level of self-government. As well as sharing the common traits of all the

Mediterranean islands, such as climate, scarcity of available water, frequency of wild fires, the Balearic Islands present two specific characteristics: high landscape diversity, for the entire archipelago and for Mallorca, and intensive mass tourism development, known as "balearización".

Figure 7. The Balearic Islands: Relief

(from CIA map, 1974: Spain, 1:2,650,000)

In geological times (Upper Miocene), the Balearic Islands were linked to the continent, and formed the north-eastern part of the mountain ridge of the southern Iberian Peninsula. Calcareous rocks predominate in these structures, except for the northern half of Minorca and some small localized areas in the North of Mallorca, which comprise non-calcareous Paleozoic and Inner Triassic substrates (quartz arenites).

Approximately 1,600 plant species have been described for the Balearic islands with a total of 65 endemics. Only a few tree species are present and these form woodlands. They are the holm oak, *Quercus ilex*, the only natural pine tree, *Pinus halepensis*, and *Juniperus phoenicea*. The Balearic fauna is quite rich with an outstanding number of endemics. Birds of prey or raptors like the red kite (*Milvus milvus)* are also very frequent species. Perhaps the most representative of the threatened Balearic avian fauna is the cinereous or the

European black vulture (*Aegypius monachus*) which inhabits the Serra de Tramuntana. Mention should also be made for the peregrine falcon (*Falco peregrinus)*, Eleonore´s falcon (*Falco eleonorae)*, and the Eurasian Kestrel (*Falco tinnuculus)*. Due to the great biodiversity of the Balearics and its extreme structural and functional fragility, any type of environmental impact is greatly magnified.

The Balearic landscapes have been strongly influenced by the impacts of the many peoples who have inhabited the islands. Some 14 cultural landscapes can be recognized and all but three are related to traditional agriculture and farming; they range from dry farming types to irrigated farming. The present Balearic landscape is a mix of natural and ancient cultural relict landscapes, and many modern urban-tourist landscapes, mainly in the coastal areas. Until the beginning of tourism development (in the late 1950s), the Balearic people maintained their traditional *genres de vie*, mainly agriculturally based, and thus conserved their traditional rural landscapes. Three phases of tourism development can be identified. The main impacts of the long and intensive first period of tourism growth on the Balearic landscape affected the coastal landscapes, especially those of the sandy coast: beaches, sand dunes, littoral systems, and brackish areas that became partially or totally occupied by hotels and other tourism infrastructure. The second period of tourist growth began at the end of the first world-wide oil crisis, while the second period of stabilization was produced by a crisis in the British tourism industry.

Finally, the third period of growth was initiated by the crash in Balkan and North African mass tourism destinations, owing to civil war and terrorism, respectively. Tourism has changed the evaluation of insularity from negative to a positive trait. Although there are many legal instruments for environmental protection in the Balearic Islands, in practice there is an overlapping of laws and jurisdictions on the subject to be protected. In terms of landscape conservation, these overlaps render this protection as a whole highly ineffective. At present, about 40 percent of the territory of the Balearic Islands is under some type of legal environmental protection as "Area Natural de Especial Interés" (ANEI) (Natural Area of Special Interest) or "Area Rural de Interés Paisatgístico" (ARIP) (Rural Area of Scenic Interest) but most of these areas have a low level of environmental protection. The island of Minorca is a Biosphere Reserve while the European Natura 2000 Network involves the designation of 127 Special Areas for Conservation (SACs) and 50 Special Protection Areas (SPAs). There is no existing specific legal status for landscape protection in the modern

sense of "cultural landscapes", as promoted by IUCN (Lucas, 1982; Green and Vos, 2001), despite the fact that most of them are threatened, and with some almost having disappeared.

Tourism has provided the Balearic Islands with an economic base and altered the meaning of insularity to the people of the islands from one of negativity and disadvantage to a positive factor, not least being a major improvement in communications and reduction in isolation. In general, the positive aspects of tourism outweigh the negative impacts and adequate planning, building quality control etc. can curtail environmental degradation.

Malta

The Maltese archipelago is situated in the central Mediterranean Sea, 96 km south of Sicily and 290 km north of the coast of Libya (see Figure 1); the islands comprise a total land area of 316 km^2 and have a total coastline of 189.6 km. Three of the islands are inhabited; in order of size these are Malta, Gozo and Camino. Relief is generally low, as shown in Figure 8, in contrast to most other Mediterranean Islands. Although this means that the range of microclimates and habitats is limited, the Maltese islands are interesting biogeographically due to insularity, the existence of former landbridges, proximity to Africa and intense human settlement.

The Maltese Islands have a long and diverse history of human occupation, dating back at least 7500 years to the Neolithic. Over time, the Islands have been governed by a succession of rulers prior to achieving independence in 1964. In such a small land area, human occupation has inevitably exerted a significant impact upon the Islands' natural elements, often resulting in their modification and in the creation of landscapes which are very much cultural. The constraints of a small island state also render the achievement of a balance between economic and demographic growth and conservation of natural resources both difficult and urgent. This conflict is particularly relevant given the Islands' economic dependence on tourism.

The Maltese climate is typically Mediterranean and strongly bi-seasonal, with characteristically hot and dry summers and mild wet winters. The archipelago is located on a shallow shelf, known as the Malta Plateau; this forms part of a submarine ridge which extends from the south Sicily promontory to the coast of North Africa. The Maltese island group is composed almost entirely of marine sedimentary rocks of Tertiary age. These are mainly Oligo-Miocene limestones, including calcareous sandstones and marl. Globigerina

Limestone and the Upper and Lower Coralline Limestones constitute the Islands' only mineral resources, apart from sea-salt. These rock types are extensively quarried, the former for use as building stone, and the latter mainly for aggregate.

Figure 8. Malta/Relief

http://www.freeworldmaps.net/europe/malta

Erosion of these rock types has greatly contributed to the creation of Maltese landscapes. For example, the topography of northern Malta and of northern and eastern Gozo is characterized by a series of hills capped by karstic plateaux consisting of Upper Coralline Limestone. Topographic features of particular ecological importance are the rdum and wied systems. Rdum consist of almost vertical rock faces, so shaped either by erosion or by tectonic activity, with screes of boulders and other debris eroded from the rock face surrounding their base. Due to the shelter these formations provide, these rdum boulder screes provide a suitable habitat for many species of flora and fauna, including many endemic forms. It is probably true to say that the only reason why the Maltese Islands exist in their present state as an independent island-nation is due, in part, to their geology, as a consequence of which, the initial human colonizers found an adequate water supply. Water seeps out of perched aquifers at the junction of the Upper Coralline Limestone/Greensand

and the Blue Clay to form springs, known as High Level Springs (but more properly as 'scarp-foot springs').
The flora and fauna of the Maltese Islands consists of some 2000 species of terrestrial plants and over 3000 species of terrestrial animals have been recorded to date and many more certainly occur (Schembri, 2003). Moreover, a number of species of plants and animals are endemic to the Maltese archipelago, while a larger number are sub-endemic, i.e. they have a distribution limited to the Maltese Islands and a limited number of islands in the region (e.g. the Pelagian group, Sicily and the circum-Sicilian islands).

The vegetation of Maltese Islands may be grouped in three categories:

i. Communities which are part of the successional sequence (steppe, garrigue, maquis) towards the climatic climax (sclerophyll forest);

ii. Communities which are either specialised to occupy particular habitats, or occupy habitats that are rare on the islands, or are relicts from a previous ecological regime, now surviving in a few refugia; and,

iii. Vegetational assemblages of disturbed habitats, which are those occupying land subject to periodic disturbance, usually related to anthropic activities.

The islands have been more or less continuously inhabited since around 7500 BP (Blouet 1967) when the first settlers arrived from Sicily. At present, the islands' total population is 402, 668 and the overall population density is 1, 274 persons per km^2. Overall, some 38percent of the land area is presently under cultivation, approximately 25 percent is built up, and the remainder is countryside. Human impact is thus highly significant as a cause of environmental/ecological change and thus of landscape dynamics. The latter part of this last century witnessed a significant increase in both industrialization and urban growth. Improvements in public transportation systems also contributed to accelerated growth, making accessible the more remote areas (Cassar, 1997). Post-war economic diversification brought about commercial opportunities which added to the pressures on a shrinking countryside. In addition, in the late 1950s, tourism was identified as a potential source of revenue. The islands' coastline has been severely affected as a result. Other activities which

have had a considerable influence on Maltese landscapes are bird shooting and trapping. One manifestation of the impact of bird shooting is the numerous woodlots of non-native species planted in the countryside, mostly on formerly cultivated land, to attract birds. Recent years have seen the enactment of several environmental regulations, for example a new Environment Protection Act was enacted in 2001 to replace the Act of 1991 and its amendments. This provides for the conservation, protection and management of habitats in order to safeguard biological diversity in general, rather than particular biota. It is in line with EU nature protection e.g. Natura 2000 which became relevant to Malta in 2004 when it joined the EU but for which no sites have yet been selected.

Future prospects: Strategies for landscape development

The preservation of Mediterranean landscapes is of vital importance for the future development of the islands. Human activity in the past, i.e. agriculture and tourism, has shaped these landscapes but tourism especially has the capacity to destroy the very resource on which it is based. In addition, changing agricultural policies, especially those of the EU, are likely to modify rural landscapes further. Implementation on islands may have far deeper repercussions than on mainlands and affects may vary depending on the political status of individual islands. Forward planning and effective planning is essential. Overall, the strategies for the future development of all the islands discussed herein are similar in general terms but different re specifics. All must embrace resources, conservation and development and the delicate balance that exists between them,
i.e. a holistic approach.

Resources include wildlife, environment, climate and water, agriculture and other rural resources such as field divisions/systems, settlements/urban fabric etc. So-called negative resources, such as waste disposal and pollution, must also be considered. Conservation involves more than the designation of specific habitats for protection, it also requires a legal context, enforcement and education. Development involves striking a balance between a resource and its use in order to foster sustainability now and in the future. Landscape ecology is one means of achieving such a balance because of its capacity to accommodate the complexity of natural and cultural ecosystem characteristics, i.e. ecodiversity. It is also multifunctional and holistic, embraces cultural diversity and promotes landscape connectivity while remaining robust, responsive but sufficiently

flexible to accommodate the specific characteristics of individual islands. The landscape is the fabric that integrates settlement, agriculture and ecology and offers a spatial unit for sustainable land management through the integration of sectoral activities and with which stakeholders can resonate. This framework considers human activity as part of the dynamic processes taking place in the landscape and simultaneously promotes interdisciplinarity. The design of a landscape ecology framework for development will require wide consultation, including as many interested parties (stakeholders) as possible e.g. scientists, planners, politicians, business concerns (especially those related tourism), landowners, farmers etc. It will also require determination and compromise to maintain landscape heterogeneity, a traditional characteristic of Mediterranean Islands, and to reduce carbon emissions through tourism and vegetation loss while maintaining a sound economic base. The challenge is enormous.

Conclusion

Over time, the dynamic landscapes of Mediterranean islands will continue to evolve as they have in the past due to pressures generated by socio-economic and political factors in a framework shaped by insularity, geology and climate. In the Mediterranean Basin the superimposition of cultural and socio-economic complexity on a range of natural landscapes, magnifies the challenge of landscape management which is especially difficult in island settings. Maintaining the multifaceted character and popularity of these Mediterranean Islands as tourist destinations will be a difficult task, especially against ever-changing backdrops such as climatic change and its unknown consequences. All islands are particularly susceptible to natural and cultural drivers of change and the Medterranean Islands provide reinforcing evidence of such dynamics which have operated for most of the last 10,000 years. There is no doubt that landscape change will continue but whichever path or paths it takes the single most important influence will remain insularity.

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