The natural environment of the Maltese Islands: human impact and conservation

by Patrick J. Schembri

The Geographical Setting

The Maltese Islands are a group of small, low islands aligned in a NW-SE direction and located in the central Mediterranean at latitude: 35° 48'28" - 36°05'00" North and longitude: 14°11'04" - 14°34'37" East. They are situated on a shallow shelf, the Malta-Ragusa Rise, part of the submarine ridge which extends from the Ragusa Peninsula of Sicily southwards to the African coasts of Tripoli and Libya. The islands lie approximately 96 km from Sicily and 290 km from North Africa. The Maltese Archipelago consists of three inhabited islands: Malta, Gozo and Comino and a number of small uninhabited islets. The table below gives the land area of the various islands:

Malta:	245.7 km²
Gozo:	67.1 km²
Comino:	2.8 km²
St. Paul's Islands:	10.1 ha
Cominotto:	9.9 ha
Filfla:	2.0 ha
Fungus Rock:	0.7 ha

Geologically, the islands are composed almost entirely of marine sedimentary rocks, mainly limestones of Oligo-Miocene age, capped by minor Quaternary deposits of terrestrial origin. The five main rock types are (in order of decreasing age):

Lower Coralline Limestone
Globigerina Limestone
Blue Clay
Greensand
Upper Coralline Limestone.

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Maltese soils are characterized by their close similarity to the parent rock material, their relatively young age, the ineffectiveness of the climate in producing soil horizon development, and the great importance of human activities in modifying them.

Erosion of the different rock types gives a characteristic topography. Lower Coralline Limestone forms sheer cliffs which bound the islands to the west; inland this rock type forms barren grey limestone-pavement plateaux on which karstland develops. The Globigerina Limestone, which is the most extensive exposed formation, forms a broad rolling landscape. Blue Clay slumps out from exposed faces to form c.45° taluses over the underlying rock. Upper Coralline Limestone forms massive cliffs and limestone pavements with karstic topography similar to the Lower Coralline Limestone.

Both main islands are tilted seawards to the northeast. There are no mountains, the highest point on Malta is only 253m above sea level; the highest point on Gozo is 191m. There are also no lakes, rivers or streams but only minor springs.

Characteristic topographic features of particular ecological importance are the *rdum* and *widien* (singular *wied*). *Rdum* are near vertical faces of rock formed either by erosion or by tectonic movements. Their bases are invariably surrounded by screes of boulders eroded from the *rdum* edges.

Because of the shelter they provide and their relative inaccessibility, the *rdum* sides and boulder screes provide important refuges for many species of Maltese flora and fauna, including many endemics. *Widien* are drainage channels formed either by stream erosion during a previous (Pleistocene) much wetter climatic regime, or by tectonism, or by a combination of the two processes. Most *widien* are now dry valleys, that is, they only carry water along their watercourse during the wet season; a few *widien* drain perennial springs and have some water flowing through them throughout the year, attaining the character of miniature river valleys. By virtue of the shelter provided by their sides and their water supply, *widien* are one of the richest habitats on the islands.

The climate of the Maltese Islands is typically Mediterranean. The average annual precipitation is 529.6mm (mean for period 1854-1986). Rainfall is highly variable from year to year; some years are excessively wet while others are extremely dry (extreme minimum for period 1854-1986, 191.3mm; extreme maximum for period, 1031.2mm). The seasonal distribution of rainfall defines a wet period (October to March with c.70% of the total annual precipitation) and a dry period (April to September). Air temperatures are moderate (mean annual temperature for period 1951-1986, 18.5°C; mean monthly range, 12.3-26.2°C) and never fall too low for adequate plant growth. Evapotranspiration is high and accounts for between 70-80% of the total annual precipitation. Only some 16% of the rainfall infiltrates into the

substratum and can be used by vegetation.

Maltese Habitats and Biota

It is thought that originally the Maltese Islands were covered by climax Mediterranean sclerophyll forest, dominated by Holm Oak *(Quercus ilex)* and Aleppo Pine *(Pinus halepensis)*, with maquis scrubland and garigue communities in places where edaphic factors and exposure prevented climax forest from developing. Much of the natural vegetation was cleared by the early Neolithic settlers to provide land for agriculture and habitation. Currently there are only remnants (occupying only a few tens of square metres) of the original climax woodland. Other wooded areas on the islands have been planted by man.

Maquis communities occur in small patches in sheltered situations, as for example on the sides of the deeper *widien*, at the bases of *rdum* and amongst the boulder screes surrounding them. Maquis also develops in very small patches of a few square metres around Carob *(Ceratonia siliqua)* and Olive *(Olea europea)* trees planted round the periphery of fields. Hilltops, cliff verges, the edges of *widien*, coastal karstland and other exposed ground support garigue communities of small perennial bushes, geophytes and annuals. Where this has been degraded, steppic communities dominated by grasses (Gramineae) develop. Garigue and steppe are the most widespread natural vegetational communities on the Maltese Islands and show many different subtypes, amongst which is a maritime garigue/steppe dominated by halophytes and xerophytes. Erosion of the Blue Clay produces clay slopes which support a distinctive vegetation dominated by grasses of which the most important is Esparto Grass *(Lygeum spartum)*. Other minor habitats include freshwater marshlands, saline marshlands, sand-dunes, rainwater pools, cliff-sides and caves.

Additionally, human activities have created a variety of habitats such as fields, gardens, road verges and land cleared of the natural vegetation cover for a variety of purposes. Of these, those not under active management become invaded by a flora of weed species.

In spite of their limited land area and habitat diversity, and the intensive human pressure on the natural environment, the Maltese Islands support a rich and diverse biota, certain elements of which are of particular scientific and cultural importance. For example, there are some 1000 species of flowering plants and an equal number of lower plants, some 60 species of freshwater and terrestrial molluscs, more than 4000 species of insects, one amphibian, nine terrestrial reptiles, some 13 resident, 57 regularly visiting and 112 migrant birds, and some 21 species of mammals. A relatively large number of species of plants and animals are found in the Maltese Islands only and nowhere else in the world. These include some 21 flowering plants, 17 molluscs, 17 butterflies and moths, more than 25 beetles, some 20 other

invertebrates and one reptile.

Human Impact

The islands have been inhabited since about 5000 BC. The present population is 345,418 (1985 census) distributed as follows: Malta, 319,736; Gozo, 25,670; and Comino, 12. The overall population density is 1095 per km^2 (Malta, 1301 per km^2; Gozo, 302 per km^2; Comino, 4.3 per km^2). The growth rate is 0.9% per year (1985 statistics).

Built-up areas (residential and industrial) occupy c.16.0% of the island of Malta and c.10.1% of the island of Gozo (1985 statistics). There are 1463 km of roads and 112,827 vehicles giving a density of 358 vehicles/km^2 (1986 statistics). The only airport, at Luqa, covers an approximate area of 3.45 km^2. Registered agricultural land covers c.38% of the islands' area (1985 statistics). Local laws of inheritance subdivide land equally among offspring, resulting in fragmentation of agricultural land; 67.7% of holdings (12,173) are under 1 ha in area (1983 statistics).

The resident population is augumented by substantial tourist arrivals which have tended to increase over the years as evident from the table below:

Year	*Tourist arrivals*	*Year*	*Tourist arrivals*
1970	170,853	1980	728,732
1971	178,704	1981	705,506
1972	149,913	1982	510,956
1973	211,196	1983	490,812
1974	272,516	1984	479,747
1975	334,519	1985	517,864
1976	339,537	1986	574,189
1977	361,874	1987	745,943
1978	477,741	1988	783,846
1979	618,310	1989	828,311

The first settlers on the islands cleared the land for agriculture and used wood for fuel and for construction. Concurrently, these settlers introduced sheep and goats which prevented the trees from regenerating through their grazing activities. This process of deforestation has continued and has resulted in the almost total destruction of the native forests and most indigenous trees; all present day wooded areas have been planted by man in relatively recent times.

Much of the land area of the island is given over either to agriculture or to buildings and roads (see above). Some agricultural land has in recent years been given over to other uses, mainly for buildings (registered agricultural

land fell from c.56% of the islands' area in 1957 to c.45% in 1968 to c.38% in 1985).

Globigerina Limestone is quarried for use as a building stone while Coralline Limestone is quarried for use as spalls. Many of the old quarries have been worked out and abandoned without any reclamation. New quarries are being established, in some cases in ecologically sensitive areas, such as on coastal cliffs.

The coasts, particularly sandy beaches which constitute only 2.4% of the Island's coastline, are under high human pressure due to their recreational value. Most of the local population makes heavy use of the coasts during the hot summer months while tourism adds to this pressure, both directly due to use of the coasts by tourists, and indirectly due to the building of tourist facilities on the coasts.

Much agricultural land is on sloping ground which is terraced with retaining walls made of limestone rubble. Many of these rubble walls have fallen into disrepair with a concurrent increase in soil erosion. Most of the agricultural land is not irrigated, which leaves the soil bare of vegetation during the dry period of the year, leading to accelerated erosion. Additionally, during the transition from the dry to the wet season, short but very heavy rainstorms are common; these lead to increased runoff and erosion. Loss of soil through runoff is accentuated due to the large number of roads which provide an unimpeded channel to the sea for storm water.

Until very recently the islands' water supply depended almost entirely on rainwater percolating through the porous limestone rock and accumulating in aquifers from where it is pumped. The largest aquifer (which until recently supplied c. 95% of the total water used) is the Main Sea-level Aquifer which consists of a Ghyben-Herzburg lens of freshwater floating on denser saline water in limestone rock at sealevel. The other aquifers of importance are the Perched Aquifers consisting of rainwater trapped in the permeable Upper Coralline Limestone due to the underlying layer of Blue clay which acts as an aquiclude. Water from the Main Sea-level Aquifer is used principally for domestic supply while that from the Perched Aquifers is used mainly for industry and agriculture. Pre-1983 this natural supply was supplemented by seawater multi-flash distillation and, from 1983, by desalination of seawater by reverse osmosis. A small sewage water recovery plant supplies water for irrigation.

There is no problem of contamination of water sources by industrial pollutants, however there are problems with high levels of chlorides, nitrates and total hardness. Chloride contamination results from overpumping from the Main Sea-level Aquifer, resulting in diffusion of the underlying saline water into the Ghyben-Herzburg lens. Nitrate levels are

rising in some areas, most probably due to contamination by agricultural fertilizer runoff. High total hardness is due to the limestone strata through which the water percolates.

Water seepage from the Perched Aquifers wherever the Upper Coralline Limestone/Blue Clay interface is exposed, gave rise to so called High Level Springs which drained into *widien* watercourses. Many of these springs flowed all year round, albeit with much reduced flow in the dry period. Many of these springs have now been tapped to feed into the national supply network with subsequent loss of the habitat they provided. A programme of small dam construction across the *widien* watercourses, aimed at reducing flow along these and at retaining water in the *widien* for longer periods to allow increased infiltration and to supply water for irrigation, has provided additional freshwater habitats in the pools that form behind the dams.

One effect of the intense human pressure on the natural environment has been that over the years a number of indigenous species of wildlife have become extinct while others are endangered or threatened in various ways, as detailed in the table below:

Group	*X*	*E*	*V*	*R*	*I*
Tracheophyta	80	55	21	100	5
Bryophyta	0	0	0	33	3
Crustacea	0	2	2	8	2
Mollusca	2	11	7	5	2
Odonata	0	0	1	1	0
Dictyoptera	0	0	0	2	0
Orthoptera	1	0	2	5	0
Dermaptera	0	0	1	0	0
Hemiptera	0	0	0	1	4
Trichoptera	0	0	0	2	0
Hymenoptera	0	1	6	5	0
Lepidoptera	7	1	11	9	4
Coleoptera	11	0	37	64	48
Amphibia	0	0	1	0	0
Reptilia	0	0	11	0	0
Aves	0	10	9	2	0
Mammalia	0	0	7	6	3

The number of extinct and threatened species of Maltese biota. Only those groups for which reliable data exists are included and only freshwater and terrestrial forms are considered. The status classification used is the same as that employed by the International Union for the Conservation of Nature and Natural Resources (IUCN) in its Red Data Books: X = extinct, E = endangered, V = vulnerable, R = rare, and I = indeterminate.

Recent Developments

Many local species are endangered because of habitat destruction as has been discussed above. The underlying cause of this problem is haphazard development, where projects are approved on an *ad hoc* basis without reference to a national land-use and land-zoning plan. The authorities have for many years been lobbied to carry out a landuse survey of the Maltese Islands and to introduce modern land-zoning legislation which defines which areas may be developed for housing, industry, tourism etc., and which should not be developed for various reasons, including environmental considerations. A variety of proposals and draft legislation relating to landuse planning and zoning have been prepared since the mid-1940s when the Government of the day was advised to introduce a comprehensive Town Planning Ordinance and to set up a Town Planning Commission for the Maltese Islands, and a white paper was issued. However, no national plan was ever produced nor a centralized planning authority instituted.

In June 1988, the Maltese Parliament passed The Building Permits (Temporary Provisions) Act 1988 which *inter alia* binds the Minister responsible for the development of the infrastructure to draft a Structure Plan for the Maltese Islands within two years (i.e. by June 1990). The Structure Plan is defined to be:

> *"a written statement...formulating the national Planning Policy and general proposals in respect of the development and other use of land including measures for the improvement of the physical environment and the management of traffic, and interpret the relationship of national policies in terms of physical and environmental planning in so far as these policies concern the integration of the economic, social and environmental policies"*
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> [Act X of 1988 Section 4(3) (a & b)]

The Structure Plan project is financed by the European Economic Community and is entrusted to a consortium of international planning consultants selected after a call for tenders.

As part of the Structure Plan, a Preservation and Conservation Plan based on recommendations made by UNESCO and the Council of Europe is to be formulated. The Preservation and Conservation Plan is to include an inventory of the natural and cultural heritage of the Maltese Islands and to designate areas for protection according to a number of criteria, one of which is:

> *"areas considered to form part of Malta's natural heritage which are identified for protection as having outstanding value from the point of*

view of aesthetics, science, conservation or natural beauty"

[Structure Plan Brief]

A commission to be responsible for the Preservation and Conservation Plan has been set up. This commission is intended to act as a focal point in coordinating the compilation of information as regards the plan. It will also analyse the information collected and determine the extent of protection to be afforded each site.

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