The examination of the feasibility of implementing a biosphere reserve in the Maltese Islands: Applying a conservation value evaluation framework

Alexander Borg

James Madison University

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Investing in your future
THE EXAMINATION OF THE FEASIBILITY OF IMPLEMENTING A
BIOSPHERE RESERVE IN THE MALTESE ISLANDS
Applying a Conservation Value Evaluation Framework

Alexander Borg

A thesis submitted to the Graduate Faculty of
UNIVERSITY OF MALTA
JAMES MADISON UNIVERSITY

In Partial Fulfilment of the Requirements for the degree of
Master of Science

Sustainable Environmental Resources Management
Integrated Science and Technology

28th November 2011
17th December 2011
DEDICATION

This thesis is dedicated to my grandparents, Antonia and Karmenu. They inspire me and always manage to make me smile.
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<table>
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<tbody>
<tr>
<td>AEI</td>
<td>Areas of Ecological Importance</td>
</tr>
<tr>
<td>AoS</td>
<td>Area of Study</td>
</tr>
<tr>
<td>CVAC</td>
<td>Conservation Value Appraisal Criteria</td>
</tr>
<tr>
<td>DPA</td>
<td>Development Planning Act</td>
</tr>
<tr>
<td>EPA</td>
<td>Environment Protection Act</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
</tr>
<tr>
<td>MEPA</td>
<td>Malta Environment and Planning Authority</td>
</tr>
<tr>
<td>NWLP</td>
<td>North West Local Plan</td>
</tr>
<tr>
<td>SAC</td>
<td>Special Areas of Conservation</td>
</tr>
<tr>
<td>SCI</td>
<td>Sites of Community Importance</td>
</tr>
<tr>
<td>SPA</td>
<td>Special Protection Areas</td>
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<tr>
<td>SSI</td>
<td>Sites of Scientific Importance</td>
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<td>WNBR</td>
<td>World Network of Biosphere Reserves</td>
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ABSTRACT

Biosphere reserves are protected areas which are internationally recognized within the United Nations Educational, Scientific and Cultural Organisation’s Man and the Biosphere Programme for promoting and establishing a balanced relationship between people and nature. Biosphere reserve management is guided by principles of biodiversity conservation; sustainable development; local, national and international partnership and support; local capacity-building; research and monitoring and co-operative management that is multidisciplinary, multi-stakeholder and locally-based. The research evaluated the feasibility of implementing the biosphere reserve concept in the Maltese Islands. This was studied by applying a conservation framework which consisted of holistic conservation value appraisal criteria – incorporating ecological, geomorphological and cultural values, spatial analyses and specialist involvement. The resultant data was digitised into a series of thematic layers by means of a Geographic Information System (GIS). The resultant layers were superimposed to identify locations with significant conservation value. This resultant data was used to propose a delineated biosphere reserve zonation system in the Maltese Islands. A biosphere reserve system would be an appropriate mechanism to pursue in the study area mainly due to the flexibility of the reserve’s zonation system and the encouragement of the active inclusion of local populations in the management of protected areas. The proposed biosphere reserve could be a success if the protected area would be implemented with an appropriate management system incorporating local stakeholders, an identification of a suitable financing mechanism to run the reserve, and the involvement of the local populations in all of the designation and management stages of the protected area.

Keywords:
Biosphere reserves, protected area management, conservation value, evaluation criteria, landscape approach.
CHAPTER 1

INTRODUCTION
CHAPTER 1
INTRODUCTION

1.1 Overview

Biosphere reserves are best described as learning laboratories for sustainability (MAB, 2010). In 1968, The Biosphere Conference initiated the idea of conserving natural resources even whilst accommodating human use. Natural resources, including biological diversity, can be conserved through a global network of protected areas. This may ensure harmonious compatibility of populations and use of natural resources, which is vital for their survival and livelihoods (UNESCO, 1970, cited in UNESCO, 2001: 11). The ‘Man and the Biosphere’ (MAB) Programme was launched in 1970 on the basis of this Conference (UNESCO, 2011a). It was also at this event that the term ‘biosphere reserve’ was first coined, with the concept reflecting a recognition of the importance of meeting the needs of man with less impact on the biosphere. However, a fully fleshed-out biosphere reserve concept was successfully formulated later, between 1985 and 1986, when an ad hoc Scientific Advisory Panel for Biosphere Reserves was set up. This panel was not only able to reassign the whole programme in order to review proposals for new reserves, but it also helped define the concept, giving each biosphere reserve three fundamental functions (UNESCO, 2001) (Figure 1). These are:

- the conservation of landscapes, ecosystems, species and ecological diversity;
- aiding the sustainable economic and human development; and
- fostering support for research, monitoring, education, and the sharing of local, regional, national and global information of conservation and development.

(UNESCO, 2011a)
A regulatory framework for biosphere reserves was enacted during the Seville Conference, organised by UNESCO in 1995 (UNESCO, 2001). This helped the programme achieve a legal status which was, until then, still lacking.

Under the current institutional regime, each biosphere reserve has to fulfil the three fundamental functions described above. These functions are applied by introducing zonation criteria for each reserve (Figure 2). The first zone is the core area that would include areas of high ecological importance, including biodiversity hotspots. The core area would have most legal protection and in most circumstances, core areas are designated in existing protected lands. The second, surrounding, area/s include the...
buffer zone, which normally but not exclusively encircles the core area. These areas can derive direct benefits from the ecosystem, such as quality recreational regions and opportunities to develop tourism, local gastronomies and other cultural activities. However, it is important that such activities in the buffer zone are compatible with conservation objectives of the biosphere reserve. Thirdly, the transition area is a more ‘fluid’ zone, where certain activities can be allowed due to a more flexible management approach, and where education and research would aid in contributing towards enhanced sustainability so as to improve the environmental quality of the region in question. Moreover, it is an area within which sustainable environmental resource management practices are promoted and developed (Batisse, 1997; Natural Resources Defence Council, 2000; UNESCO, 2011a).

![Figure 2: An example of a typical zonation pattern in a biosphere reserve](image)

Source: Lange, 2005
An area can be declared a biosphere reserve, subsequent to a formal application, if it meets a number of zonation criteria according to the 1995 Statutory Framework for the World Network of Biosphere Reserves (UNESCO, 1996). These criteria largely depend on geographical conditions, social and cultural aspects and existing assets within protected areas and other local issues and constraints.

1.2 Biosphere reserves in Malta: does the concept have a potential in the Maltese Islands?

Through this dissertation, I will be examining the potential of implementing and assessing regional capacity to accommodate a biosphere reserve, and exploring the potential of implementing such an approach in Malta. Locally, there are already a number of designated natural areas scattered throughout the Island. Such areas include Areas of High Landscape Value, AEI’s, SSI’s, Natura 2000 designations including SAC’s SCI’s and SPA’s, Bird Sanctuaries, Nature Reserves, Ramsar Sites and a nature and history park. These are mostly managed by the national environment protection agency (MEPA) and local non-governmental organizations such as Birdlife Malta, Nature Trust (Malta), GAIA Foundation, amongst others. (MEPA, n.da).

The introduction of a biosphere reserve would highlight areas of ecological importance in its core zone and thus enable monitoring of such sensitive sites. Moreover, in the buffer and transition zones, areas for sustainable research and development would be identified and properly managed. In addition, the biosphere reserve could aid to collectively organize all these protected areas under one umbrella for sustainable environmental resources management, and a singular management
framework that would lead to a streamlined approach towards sharing assets relating to logistics, human resources and, possibly, funding.

The major challenge for protected areas in Malta is the limited geographical space and the high population density of the Island. Local landscapes are highly influenced by anthropogenic activities which, as a consequence, led to urban encroachment. This is mostly the result of the long history of human occupation and recent demographic and economic trends. The zonation criteria of the core, buffer and transition areas of biosphere reserves are, to a broad extent, quite flexible to geographical conditions and local constraints (Batisse, 1997). This flexibility is of advantage for biosphere reserve planning and subsequent management, where many factors can be taken into account in the zonation process such as the issue of space and a highly anthropocentric landscape as that of the Maltese Islands.

Traditional management practices within protected areas do not cater for the interests of those who live in their environs and depend on these resources for their livelihood (Brown J.D., 2002). Their main aim is to keep the natural environment free from human impacts as much as possible. Thus, they have been established in areas of low population density or in very specific sites such as highly inaccessible locations including mountainous areas or else within arid regions (Brunckhorst, 2010). In other cases, protected areas are concentrated solely in exclusive high biodiversity hotspots (Dudley, 2008).

In regions such as the Mediterranean, establishing protected areas is not always an easy task, mainly due to population pressures and multiple land uses. This is
especially true in regions such as alluvial and agricultural plains, the temperate and Mediterranean grasslands, and in coastal areas, (Batisse, 1997). However, one of the major advantages of biosphere reserves is that they represent protected areas that intend to “demonstrate a well-balanced relationship between conservation of biodiversity and an appropriate local development” (Ozyavuz and Yazgan, 2010: 1105). Biosphere reserves are an actual attempt to establish sustainable landscapes (Kusova et al., 2008, cited in Ozyavuz and Yazgan, 2010: 1105). Hence, a biosphere reserve in Malta can serve as a bridge between the sustainable management of the local landscape whilst protecting and maintaining human activities around the protected region.

A biosphere reserve is can serve as one way of implementing Agenda 21, the Convention on Biological Diversity, several Millennium Development Goals and the UN Decade of Education for Sustainable Development (UNESCO, 2011a). The implementation of a Biosphere reserve may serve to raise awareness among local people and government authorities about environmental and sustainable development issues. An additional strength of Biosphere reserves is the interconnectedness, physical and/or institutional, between the over 500 reserves found in over 100 countries (UNESCO, 2011a). Within this network, the exchange of information, knowledge, experience and personnel is facilitated and encouraged.

The area that would be proposed for a biosphere reserve would be ecologically, socially, culturally, historically and economically important for the proposed protected region. A biosphere reserve that does not have a protected core area is not a true biosphere reserve. Moreover a National Park which does not take into
consideration the sustainable development of the surrounding protected areas and the basic needs of its inhabitants, is not a biosphere reserve either (Worboys et al., 2001). Hence, the biosphere reserve concept could result as a framework for better management of conflicting land uses and for alleviating the resultant environmental pressures on local resources. The conservation site could be sustainably managed and co-ordinated with the help of past knowledge and experience from other international biosphere reserves.

1.3 Research Statement

This thesis addresses the question of whether it is feasible to implement a biosphere reserve in Malta. Bearing in mind the land area limitations and the overall human pressures around the island, additional criteria to ecology and biodiversity have been added in order to identify areas of conservation value. A more holistic approach towards conservation value was taken. Apart from identifying areas of ecological importance, geomorphology and heritage sites where also assessed for conservation value. This question is addressed by investigating and assessing the local regional conditions, including geological, ecological, social, cultural and historic dimensions, and the potential of accommodating activities that conform to biosphere reserve principles of conservation, sustainable management and co-operation amongst involved stakeholders. The main objectives of the research are to:

- spatially assess areas of significant geological, ecological, social, cultural and historic fabric applicable in terms of their potential for biosphere reserve status;
• develop a research process to determine the feasibility of establishing a biosphere reserve, including the application of a biosphere reserve zonation pattern in a previously identified AoS; and
• identifying strengths and challenges of Malta regarding biosphere reserve feasibility.

1.4 Structure of the Study

• Chapter 2: A literature review of existing different concepts of protected area management and the paradigm shift of protected areas, implications of protected areas in a Mediterranean context including the Maltese Islands and a literature review of the biosphere reserve concept including relevant issues to the local context.
• Chapter 3: An overview of existing protected areas in the AoS and an evaluation framework for a potential implementation of the biosphere reserve concept in the Maltese Islands.
• Chapter 4: The analysis of the conservation evaluation framework adapted to identify locations compatible with the biosphere reserve framework.
• Chapter 5: A discussion of the feasibility of establishing a biosphere reserve framework in the Maltese Islands.
• Chapter 6: A statement of whether it is feasible to implement a biosphere reserve in the Maltese Islands in accordance with the evaluation framework adapted. Other conclusions and recommendations are included.
CHAPTER 2

LITERATURE REVIEW
CHAPTER 2
LITERATURE REVIEW

2.1 Conservation challenges and the role of protected areas and sustainable landscapes

Where will our water come from? When will our land use become truly sustainable? How can our environment adapt to climate change? What would it take to rebuild a wildlife rich countryside? Why are so many people disconnected from nature?

(Green Places, 2010: 30)

The answer for these questions does not rely on a single solution. Protected areas can however be one way forward to respond such queries. The establishment of legally protected areas is considered as one of the most important ways of protecting species and their habitats. The World Commission on Environment and Development (WCED) recognized that such areas are not luxuries set up to benefit wealthy tourists and wildlife enthusiasts but are essential elements in the search for sustainability in the world (Lucas, 1992).

Virtually, every country in the world has some form of legal or customary measures involving the designation of protected areas. Protected areas are defined by the IUCN as:

An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources and managed through legal or other effective means.

(IUCN, 1994:7)
Protected sites are found in multiple forms and fulfil several different purposes. Such regions differ in sizes, policies and allowances. Some do not permit any visitors whilst others are open for tourism and recreational activities. Other protected areas support wildlife and conserve the biological status whilst other areas protect complex, long-settled and unique landscapes with historic, cultural and scenic venues (Shepherd, 2008). Countries differ in their interpretation of protected areas. A ‘protected area’ could be a general term that incorporates a wide range of land that may have some biodiversity and landscape value for conservation, or it can also be a more precise term that describes a particular form of management system especially geared towards conservation (Dudley, 2008) and sustainability.

Sustainability and sustainable development have been buzz words used by politicians and the media alike in the last few decades. Rachel Carson’s ‘Silent Spring’ in 1962, not only facilitated the banning of DDT but triggered an environmental movement which started to evolve during the 1970’s and 1980’s, in part because of a realization that supposedly renewable sources of wild stock such as fish, whales and timber trees were being driven to extinction (Cassar 2010; Lockwood and Kothari, 2006). World consumption and development projects, including infrastructure, transportation, energy production and industrialization were (and are) destroying global ecosystems and biological diversity whilst depleting vital resources (Lockwood and Kothari, 2006). These factors slowly led to milestone events for sustainability and environmental protection as the situation was getting visibly critical. These events included amongst others the UN Conference on the Human Environment in 1972 in Stockholm, the Brundtland Report (Our Common Future) published by WCED in 1987, the UNCED Earth Summit in Rio de Janeiro in 1992 which included the
adoption of the Convention on Biological Diversity (CBD), and the 2002 World
Summit in Johannesburg (Cassar, 2010; Mulongoy and Chape, 2004).

2.1.1 The role of landscapes

The long emerging sustainability challenges around the world lead to greater
understanding about the need for conservation worldwide. In parallel, there has been a
broadening of the aims of protected areas to encompass the wider landscape hence
initiating a new concept of including all issues in protected area management such as
culture, heritage and involvement of local populations (Mulongoy and Chape, 2004).

Landscapes are multifunctional and include diverse facets. On one hand they are
functional and analytical units from an ecological point of view and on the other hand,
landscapes include cultural facets which are often subject to different interpretations
(Conrad and Cassar, 2007). However, these conditions are ideal as they provide
policy makers with a broad array of applicable conservation methods. However, the
challenge is to translate such understanding into action: identify, protect, and sustain
these valued landscapes for the future (Barrett, 2010).

Landscapes, especially in Europe, have generally been defined by anthropogenic
criteria, and are usually limited by territorial boundaries, river catchments or other
main economic uses of the area (Shepherd, 2008). According to landscape ecologists,
landscapes are deemed to exhibit some heterogeneity against a fundamentally connected
background which contains some kind of internal order or logic (Shepherd, 2008). Man-
made activities may lead to fragmentation in such landscapes. The challenges involved
in ensuring a delicate balance of wildlife and human co-existence are clearly seen, for
example, in Portugal’s first and only Natural Park. Peneda-Gerês Natural Park is carved by mountain ranges, rivers, canyons, gorges, and streams which are inhabited by forty endangered Iberian wolves who share their terrain with some 11,000 people (Mueller, 2011). The landscape of Peneda-Gerês, has been strained in recent decades by the construction of vacation homes and hydroelectric dams inside the park together with one of the largest wind farms in Europe (Mueller, 2011).

This recent rise in modernity needs to be carefully managed, as advocated by Mallia and Delia. Mallia and Delia (2010) identify five main reasons why we should protect landscapes. These are, quality of life, national identity, value of tourism, recreation and due to successes or failures of spatial planning. The local landscape has long been protected in Maltese legislation, including in the Constitution of Malta. However this legislation comprises mostly general statements which are not enforceable (Mallia and Delia, 2010). This idea of protected areas being elevated at a bioregional scale, where people and areas of conservation value can coexist both through the judicious use of natural resources and human habitation, is the new strategy approach for protected areas in the twenty-first century (Miller, 1999).

2.1.2 Sustainability in protected area management

Human survival is very much dependent on maintaining a development regime that is sustainable in its use of renewable resources. Considering this, public interest is growing for protected areas where people live and work in a manner which leaves the environment unharmed and conserved (Lucas, 1992). The Strategy for Sustainable
Living issued by IUCN/UNEP/WWF in 1991, clearly sees a major role for protected landscapes. According to the report a protected area system provide safeguards for:

- natural and modified ecosystems that are essential to maintain life-support services, conserve wild species and areas of particularly high species diversity, protect intrinsic and inspirational values, and support scientific research;
- culturally important landscapes (including places that demonstrate harmonious relationships between people and nature), historic monuments and other heritage sites in built-up areas;
- sustainable use of wild resources in modified ecosystems;
- traditional, sustainable uses of ecosystems in sacred places or traditional sites of harvesting by indigenous peoples; and
- recreational and educational uses of natural, modified and cultivated ecosystems


The promotion of sustainability through protected areas is not an easy feat. However, there are a number of tools and policy measures which help protected area managers and policy makers in their decision making procedures. According to Cassar (2010), one of the challenges today lies in creating mechanisms that are sustainable at the policy and operational levels. The uses of proactive scientific tools that permit forecasting and better contingency plans are essential for conservation development (Cassar, 2010). Technologies such as Geographic Information Systems (GIS) and remote sensing are ideal tools for decision making, environmental management and mitigation planning. By their capacities, GIS can have multiple roles including spatial data basis information, data manipulation, visualization and management and several spatial analysis techniques (Ioniţă and Roman, 2007). Using such tools in conjunction
with adequate policymaking could potentially help in achieving a more sustainable environmental management in protected areas.

Different approaches can be taken in setting protected areas within the context of sustainable development. On one hand protected areas can be set up to from strictly protected core reserves, on the other hand other zones can be implemented where human needs are accommodated to a greater degree (Dudley et al., 1999). A range of ‘soft’ management options are available and these include sustainable forest management, leisure fishing, organic agriculture and ecotourism (Dudley et al., 1999). Lockwood (2006) advocates a ‘bottom-up’ approach in planning. Sometimes in certain contexts, top-down approaches in protected areas may not be effective in reaching conservation objectives, as these alienate local resource users and are perceived as a drain on the scarce resources of many countries (Brown, K 2002). Conversely, bottom-up approaches include extensive stakeholder participation in the planning process. When protecting landscapes, management practices must consider people as an integral part of both the problems and solutions of the region (Conrad, 2010). This is especially true in landscapes which are homogeneously influenced by people, such as is the case in Malta. A bottom-up approach considers:

- integration of social, cultural, economic and natural concerns;
- development of social and cultural values, as well as maintenance of natural values;
- sharing or devolution of decision-making power;
- interdependence of conservation and development; and
- managing ecosystem in an anthropogenic context.

2.1.3 Issues in protected areas

Notwithstanding their indisputable value, protected areas are not a universal answer for sustainability issues around the globe. Brunckhorst (2010) argues that protected areas will always be insufficient to sustain biodiversity and ecosystem processes. Protected areas’ site coverage, connectivity and size will remain inadequate (Shaffer et al., 2002 cited in Brunckhorst, 2010). Most endangered ecosystems and rare species lie outside conservation sites, mostly on private land and the acquisition of such areas for conservation is unaffordable. Many of the protected areas in existence today have been poorly planned and designed. Their size and location have been constrained by political considerations, resulting in reserves that are isolated from other suitable habitat, too small, missing key components, or simply in the wrong place (Mulungoy and Chape, 2004).

Another issue with designation of protected reserves is that conservation strategies can rest on the assumption that nature can be protected in an asylum walled off from anthropogenic disturbance. However, no reserve is immune to changes in atmospheric composition, temperature and rainfall and ultimately they are mismatched in a world that is increasingly dynamic (Camacho et al., 2010). The complex changes in the Earth’s biogeochemical systems, most notably due to climate change, are strongly modifying humans’ interactions with the environment (Price, 2001). Protected area managers need to prepare for shifts in the location of biomes, loss of species, new development pressures, and increased frequency and severity of flooding, storms, fire and drought, as well as desertification, habitat encroachment and reduction in snow and ice (Lockwood et al., 2006). Climate change will require nature conservation
criteria that extend from a fixed protected area concept to conservation efforts operating at the landscape scale with larger contiguous tracts of land that aid species movement (Green Places, 2010) through landscape corridors and better human involvement in protected area management.

2.2. Changes in protected area paradigm and in protected area management planning

At the end of the 20th century, protected area management suffered severe criticism, undermining the status and effectiveness of protected areas (Dudley et al., 1999). The initial era of protected zones was met with great excitement amongst conservation scientists. Yosemite State Park and Yellowstone National Park were the first results of approaching nature preservation by excluding most forms of human interference. The creation of Yosemite national park in 1864, together with other cultural practices, helped the initiation of environmentalism in America (Grusin, 1998). Yosemite and Yellowstone in 1872 inspired the beginning of protecting the Earth’s remnant natural heritage not only for future generations but also for the sake of life diversity on the planet. “National parks and protected areas have become more than means to preserve scenery, places of spiritual renewal, venues for outdoor recreation and tourism development, or scientific research sites. They have become a major tool in global efforts on behalf of preserving endangered species, habitats, and ecosystems, and valued natural and cultural landscapes” (Stevens, 1997: 13-14). From then on, the number of natural parks escalated, reaching a good 1823 sites of protected area around the globe by 1870 (Lockwood and Kothari, 2006).
Phillips (1999) argues that traditional nature reserves and national parks, especially in developing countries have resulted in failures. The emphasis for most of the twentieth century, not only in the United States, but throughout much of the Americas, Australia, Asia and Africa, was on creating areas and regions in which people could not hunt, gather, herd, farm, fell trees, or even collect medicinal herbs. This resulted in catastrophic results for indigenous peoples (Stevens, 1997). People were forced to resettle outside the newly established park, finding that the natural resources which sustained their ancestors and themselves were now out of bounds. In the first half of the twentieth century, natural parks were common instruments of colonial rule in many areas of Africa and Asia. For example, the designation of Kenya’s Southern Game Reserve in 1902, led to the eviction of the Maasai from their traditional pastoral lands in present-day Kenya and Tanzania. Other examples include the Ik people of Uganda, forced out from the Kidepo Valley by the creation of the Kidepo National Park. Eventually, the Ik disintegrated as these hunters and gatherers starved in resettlement areas on the border of their previous homeland (Stevens, 1997).

These and many other experiences have resulted in new policies and in new attitudes and policies at national and international levels. This paradigmatic shift gathered momentum in the second half of the twentieth century. Raymond Dasmann, an ecologist and a former IUCN leader, was one of the first who started to introduce a new way of thinking regarding protected area principles (Dasmann, 1976 cited in Stevens, 1997: 38). An ethical question was being raised when indigenous and tribal people were being evacuated from their homeland for the creation of national parks. Indigenous people were usually the longest residents of the land. Most tribes possess great knowledge about the biota and they took care of the land which they called
home (Colchester, 2003; Stevens, 1997). Since the 1960’s, protected areas have been established in many parts of the world that demonstrate new ideologies about the role of people and nature conservation. Some are officially designated as conservation areas, wildlife management areas, and biosphere reserves. Others, most notably in Australia, Canada and Alaska, are national parks which were revaluated by introducing new management policies, thus altering the Yellowstone Model (Stevens, 1997). In addition, at national scales there have been numerous examples of protected areas established by indigenous people within their territories. One well known example is that of Kaa-Iya del Gran Chaco National Park in Bolivia where local people assumed financial responsibility and management authority for the park in order to sustainably support resource use on their own territory (Naughton-Treves et al., 2005).

2.2.1 Paradigm Shift in protected area management

Parallel with a dramatic growth in the number and extent of protected areas over the last 40 years has been a significant shift in which protected areas are visualized (Lockwood et al., 2006). This paradigm shift in protected areas introduced a new diverse model which included management for cultural and social reasons, with local people involved in taking and implementing decisions (Mulongoy and Chape, 2004). Policies which once saw people as a threat now regard people as potential partners in sustainable development strategies (Blaikie and Jeanrenaud, 1997 cited in Brown J.D, 2002).
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category Ia:</strong> Strict Nature Reserve</td>
<td>protected area mainly managed for science. It includes an area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.</td>
<td>The Svalbard Islands, north of Norway. The Islands are large and significantly free from human intervention, and have scientific research as the main use of the reserved areas.</td>
</tr>
<tr>
<td><strong>Category Ib:</strong> Wilderness Areas</td>
<td>protected area managed mainly for wilderness protection. It includes a large area of unmodified or slightly modified land and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.</td>
<td>Wilderness concept mainly originated in the US and is demonstrated by the chain of wilderness areas located in the Rocky Mountains.</td>
</tr>
<tr>
<td><strong>Category II:</strong> National Park</td>
<td>protected area mainly managed for ecosystem protection and recreation. It includes a natural area of land and/or sea designated to either protect the ecological integrity of one or more ecosystems for present and future generations, or to exclude exploitation or occupation inimical to the purposes of designation of the area and to provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.</td>
<td>Nahuel Huapi National Park in Argentina – declared for the protection of large ecosystems and the provision of recreation.</td>
</tr>
<tr>
<td><strong>Category III:</strong> Natural Monument</td>
<td>protected area managed mainly for conservation of specific natural features. It includes an area containing one or more specific natural or natural/cultural feature of outstanding or unique value because of its inherent quality rarity, representative or aesthetic qualities or cultural significance.</td>
<td>Dinosaur National Monument in the US protects a paleontological site, and interpretation for public education is provided as well as protection of the fossil record of the site.</td>
</tr>
<tr>
<td><strong>Category IV:</strong> Habitat/Species Management</td>
<td>protected area managed mainly for conservation through management intervention. It includes an area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.</td>
<td>Luneburger Heide Nature Reserve in Germany, which was established to protect heath lands which are currently maintained through grazing.</td>
</tr>
<tr>
<td><strong>Category V:</strong> Protected Landscape/Seascape</td>
<td>protected area managed mainly for landscape/seascape conservation and recreation. It includes an area of land, with coast or sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this a traditional interaction is vital to the protection, maintenance and evolution of such an area.</td>
<td>North York Moors national park in the UK. Includes areas with high scenic quality, diverse habitats, and traditional land-use patterns.</td>
</tr>
<tr>
<td><strong>Category VI:</strong> Managed Resource Protected Area</td>
<td>protected area managed mainly for the sustainable use natural resources. It includes an area containing mainly unmodified natural systems, managed to ensure a long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.</td>
<td>Mana Pools National Park in Zimbabwe, which are managed to maintain the natural habitat and allow sustainable hunting.</td>
</tr>
</tbody>
</table>


Table 1: IUCN protected area categories
The new paradigm allows for protected areas to provide benefits for local people, where appropriate human activities can be accommodated without compromising conservation objectives. In order to allow for a gradation of approaches, to suit different contexts, IUCN identified six different protected area categories, based on varied management objectives (Dudley, 2008) (Table 1). At the forefront of this new paradigm are Categories V and VI (Locke and Dearden, 2005), which allow for a more inclusive form of protected area, through protected landscapes (Category V) and managed resource protected areas (Category VI). Management models for both categories rely on the involvement of local communities. These categories are in fact closely linked with the biosphere reserve concept to be discussed in the following section.

2.3 The biosphere reserve concept

Biosphere reserves originated some thirty years ago. Along the years biosphere reserves changed to address issues related to sustainability, biodiversity and climate change amongst others (Bridgewater, 2001). Sandwith and Lockwood (2006) state that broadening of governance possibilities in traditional protected area management has led to an emerging paradigm on working towards better local community and a broader scale of stakeholder involvement. This new paradigm of involving the local communities in protected area management is the main concept behind biosphere reserves.

The UNESCO’s Man and the Biosphere (MAB) programme combines human action with the preservation of the environment by proposing an interdisciplinary research
agenda and capacity building effort (Dittrich and Mack, 2005; Isacch, 2008). “Biosphere reserves aim to preserve genetic resources, species, ecosystems and landscapes; foster sustainable economic and human development; and act as a demonstration of what can be done in relation to local, national and global issues of conservation and sustainable development”(Sandwith and Lockwood, 2006: 584). They serve in some way as ‘living laboratories’ for testing out and demonstrating integrated management of the ‘ecosystem approach’ developed by the Convention of Biological Diversity (Özyavuz and Yazgan, 2010). The ecosystem approach is a strategy for management of land, water and living resources that promotes conservation and sustainable use in an equitable way (Smith and Maltby, 2003). This approach also takes into consideration the sustainable interaction of people and biodiversity; it extends biodiversity management beyond protected areas and engages the widest range of sectoral interests (Shepherd, 2008; Smith and Maltby, 2003).

2.3.1 The three roles of biosphere reserves

Today, with more than 480 sites in over 100 countries, the world network of biosphere reserves constitutes one of the main vehicles for the MAB programme in disseminating knowledge sharing, research and monitoring, education and training, and participatory decision making (Isacch, 2008). In addition, a number of biosphere reserves simultaneously encompass areas protected under other systems and other internationally recognized sites (including World Heritage sites amongst others) (Lockwood, 2006). This latter consideration is important for the case of Malta as the Island already harbours several forms of protected areas, also including World Heritage sites, which could be managed concurrently with a biosphere reserve.
Each biosphere reserve has three main fundamental roles to fulfil. These roles are as follows:

- a conservation role through which a biosphere reserve provides protection of genetic resources, species, and ecosystems, on a worldwide basis;
- a logistic role through which it provides interconnected facilities for research and monitoring in the framework of an internationally coordinated scientific programme; and
- a development role, involving the search for rational and sustainable use of ecosystem resources and hence for close cooperation with the human populations concerned.

(Worboys et al., 2001)

These roles are fulfilled by a zonation pattern adopted by each biosphere reserve designation.

2.3.2 The three zones of biosphere reserves

Biosphere reserves should contain three elements: one or more core areas, which are securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research and other low impact uses (such as education) (UNESCO, 1996). Since the core area requires legal protection, it can be creatively incorporated by respecting local constraints and also using available protection laws (Pollock, 2009). This flexibility is one of the strongest points of the biosphere reserve concept, through which it facilitates the integration of protected areas into the wider landscape (MAB, 2008). Special attention is to be given
to a clearly identified buffer zone, which usually surrounds or adjoins the core areas, and is used for co-operative activities compatible with sound ecological practices including environmental education, recreation, ecotourism and applied and basic research (UNESCO, 1996). Finally a flexible transition area, or area of co-operation, which may contain a variety of agricultural activities, settlements and other uses and in local communities, management agencies, scientists, non-governmental organizations, cultural groups, economic interests and other stakeholders work together to manage and sustainably manage the area’s resources (UNESCO, 1996). Transition areas can be arbitrarily designed; nonetheless their zonation has to be specified for their inclusion in the World Network of Biosphere Reserves (MAB, 2008).

### 2.4 Key challenges addressed by biosphere reserves

The Madrid Action Plan (MAP) for biosphere reserves (2008-2013) identified three potential challenges: climate change; provision of ecosystem services and; urbanization as a principal driver towards ecosystem-wide pressures (MAB, 2008).

#### 2.4.1 Climate change

The global average temperature has warmed some 0.8 degrees since 1880. The year 2010 was one of the three warmest on records. 2000 – 2010 was the warmest decade so far and scientists assume a further heat increase of at least 1.8 degrees during the twenty first century (UNESCO, 2011b). The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4), estimated that the global-mean sea
level rise of 0.29 – 0.59 m for an approximately 4 degrees warmer world (Pachauri and Reisinger, 2007). According to Gosling et al (2011), more recent seal level rise estimates identify that AR4 estimates may be underestimated and a more likely higher tendency of sea level rise is most probably to occur. Uncertainties about the rate and magnitude of climate change and potential impacts prevail but there is no question that it is gradually and powerfully changing the ecological and socio-economic landscape of certain regions in the world (Rawat et al., 2010).

Biosphere reserves are learning sites for sustainability hence they are an effective instrument for mitigating climate change and serve as models for adaptation measures for both natural and human systems, assisting the development of residence strategies and practices (MAB, 2008; UNESCO, 2011b). This applies particularly in the domains of sustainable land use, green economies, safeguarding ecosystem services, energy efficiency and the use of renewable energies (UNESCO, 2011b). In addition, the WNBR bring added value through the integrated approach which is generally absent elsewhere, by seeking and testing solutions as well as monitoring any climate change dynamics (MAB, 2008). Hence, biosphere reserves may serve as areas where collaborative research on climate change mitigation and adjustment techniques in protected areas, could be researched and studied.

However, climate change impacts can pose difficult challenges to protected areas and biosphere reserves. Fixed reserve boundaries of protected areas, mobile species range limits and land use change are the most prominent issues regarding climate change in protected areas (Hannah, 2008). Climate change predictions may result in geographic rearrangement of species due to climate alterations. Protected areas are however
geographically fixed and are therefore poorly suited in accommodating the movement of species due to changing climate patterns (Hannah et al., 2007). Species distribution models suggest that in some cases protected areas may no longer maintain populations of key species, possibly the very ones that the reserves were created to protect (Ackerly et al., 2010). Halpin (1997) suggests that in order to combat climate change impacts, there is the need of buffer zones around protected areas, larger reserves, landscape connectivity and management of existing threats and disturbance regimes (cited in Hannah, 2008: 202).

2.4.2 Ecosystem services

The Millennium Ecosystem Assessment (MA) (2005), a large study undertaken in 2001-2005, identifies ecosystem services as those benefits people obtain from ecosystems. These services are classified into four distinct categories and include:

- the provisioning of services such as food and water;
- regulating services such as regulation of floods, drought, land degradation, and disease;
- supporting services such as soil formation and nutrient cycling; and
- cultural services such as recreational, spiritual, religious and other nonmaterial benefits.

(MA, 2003)

Indeed, the assessment states that in the last fifty years humans have altered ecosystems and degraded them more extensively than in any comparable period of time in human history (MA, 2005). Depletion of ecosystem services translates into fewer benefits for humans. This automatically results in lower net human well-being
than would be possible under better ecological management (Raudsepp-Hearne et al., 2010). Many of the world’s ecosystems are very close in reaching ecological thresholds which if breached may possibly cause irreversible changes to the supply of ecosystem services with serious consequences for human well-being (Hancock, 2010). Approximately 60 per cent of ecosystem services assessed by the MA were found to be in decline, whereas the use of such services is in continuous increase (MA, 2005; Raudsepp-Hearne et al., 2010). Hence protected areas are facing the arduous task of protecting and conserving ecosystem services without limiting human growth.

Pyke (2007) argues those countries that do not designate protected areas may jeopardize the local provision of ecosystem services, whereas other countries with extensive protected areas can receive profits from ecotourism, recreation, and ecosystem services. The essence of biosphere reserves is to sustainably manage resources in the area they are set in. Therefore they can be used as sites to design and develop place specific mixes of supporting, provisioning and regulating ecosystem services that enable the environmental, economic and social well-being of residents and stakeholders in the biosphere reserve (MAB, 2008). For example the various zones of biosphere reserves can serve as places that attract new investments into until then neglected services, such as water purification and biodiversity conservation whilst also the provision of services, including; agriculture, fisheries and/or ecotourism (MAB, 2008). Moreover, understanding the importance of ecosystem services can aid in creating management partnerships in the protected area or reserve, either due to direct self-interest or because stakeholders become convinced of the area’s wider, intrinsic values (Berghöfer and Dudley, 2011).
Ecosystem services contribute to agriculture through processes such as pollination and soil nutrient cycles. Agriculture is one of the most present activities in rural areas in Malta. It contributes by heavily shaping the local landscape through terraced fields, rubble walls and small huts or ‘girna’. In fact, it is the largest land user, accounting for 47.8 per cent of the total Islands area (RDD, 2009). On the other hand, agriculture only accounts for 2.2 per cent of the total Gross Value Added (GVA) (RDD, 2009). Economic value from agriculture could be increased by the potential development of agro-tourism. Additionally, farm operators can diversify their income stream thus serving as a potential cushion against farm income fluctuations due to variability in weather, prices and government subsidies (Berghöfer and Dudley, 2011). In Malta, agro-tourism services could benefit from unique landscape in rural settings, such as rural accommodation, open-air recreation and sports, cultural excursions and the marketing of food items and crafts from local cottage industries (Boffa, 2010). One should however ensure that adequate management and controls must be conducted, to avoid excess tourist flow in rural areas and subsequent urban encroachment (Boffa, 2010), and to minimize any impacts on the landscape.

2.4.3 Urbanization

The Madrid Action Plan (2008) identifies urbanization as a principal driver towards ecosystem wide pressures. In addition, the Millennium Ecosystem Assessment (2005) states that some of the most important direct drivers of change in ecosystems are habitat changes due to land use alteration, overexploitation, invasive alien species, pollution, climate change and urban encroachment. Urban encroachment fragments and impairs habitat, simplifies and homogenizes species composition, alters
hydrological features, and modifies energy flows and nutrient cycling (Ma et al., 2009).

Urban landscapes are one of the sources leading to global change on ecosystems, both in terms of pollution (air, noise, visual) but also because they provide extreme, visible and measurable examples of human domination of ecosystem processes (UNESCO, 2011b). The implementation of a biosphere reserve can be used as a remedy and/or mitigating factor in controlling and limiting urbanization impacts on fragile ecosystems. Biosphere reserve principles can be applied with the intention of using the concept as a tool for planning and managing sustainable urban development (MAB, 2008).

2.4.4 Ecotourism

The Maltese Islands, with a total population of slightly more than 413,000 (NSO, 2010), are visited by more than 1.2 million tourists a year (NSO, 2010). Tourism is an important sector, contributing 30 per cent (NSO, 2009) of the local gross domestic product. Hence, tourism and ecotourism would be an essential consideration for the introduction of a biosphere reserve in Malta.

First of all, it is important to distinguish between ecotourism and nature-based tourism. Ecotourism refers to a recent evolution in the tourism industry where environmental conservation is essential in combination with the well being of visitors to the area (Worboys et al., 2001). Eco-tourists seek high levels of environmental quality and this sector is concentrated in national parks, wildlife reserves and other types of protected
areas (Eagles, 1999). Conversely, nature tourism implies the desire of people to experience nature in their leisure time, mostly involving moderate and safe forms of exercise such as hiking, biking, sailing and camping (Eagles, 1999; Worboys et al., 2001).

Conservation managers should be directly involved in managing tourism in a protected area. If there is no leadership in the sector, tourism is likely to fill the void by default (Worboys et al., 2001). One negative aspect of tourism is that it creates stereotyped landscapes (Ellul, 2010). It is important that regions should have their individualities embraced and preserved. This ultimately would help to have a competitive advantage over other touristic areas due to a unique sense of place and distinctive landscapes. Another issue of tourism is the general lack of public awareness of the value of natural resources, especially fauna and flora, and man’s limited knowledge of the complex system of interacting processes of the environment (Kala and Maikhuri, 2011).

Some natural areas, including remote regions with rich biodiversity, have been excluded from tourism due to conservation purposes. However, other protected areas situated near habitable zones such as tourist centres, can easily attract visitors. For sustainable tourism in a protected area, tourism opportunities need to be developed in a way that tourists are attracted to otherwise unvisited natural areas, especially those under threat from competing economic activities, complement nature conservation and support the income generation and development needs of the local population (Hearne and Santos, 2005). In many cases the existence of protected areas further
increase visitor satisfaction and, by protecting landscapes and ecosystems, provides goods and services that attract tourists (Dixon and Sherman, 1990).

Ellul (2010) advocates ‘Area Analysis’ when planning for tourism. This entails the identification of key biophysical factors including geology, ecology, climate, soils, wildlife and cultural factors such as demographics, settlements, economic activities, and infrastructure and land use patterns. GIS is usually used in representing the different land uses. There are a number of criteria that must be adhered to when planning and managing sustainable tourism in a protected landscape. These include the following:

- resource protection – visitor management practices such as limits, permits, zoning, dispersal of visitors, concentration of visitors, rules on the length of stay, segregating different recreation activities, seasonal limits, limits on the size of party, tour operator concessions;
- tourism must be below the carrying capacity if the destination;
- marketing and product development go hand in hand;
- local communities are important stakeholders in the process;
- visitor management techniques, such as interpretation, help to create a positive experience of the destination visited;
- conflicting uses need to be addressed and priorities set and defined;
- environmental education and interpretation;
- codes of practice need to be adopted;
- facilitating environmental protection schemes for tourism operators;
- using renewable energy sources;
- recycling facilities need to be set up; and
Tourism planning does not occur in a vacuum, and must be integrated with other sectors and vice versa.

(De Lacy and Whitmore, 2006; Ellul, 2010)

Tourism must essentially benefit the destination - the protected area. Non-sustainable developments must be transformed in more sustainable forms. This is done by setting sustainability standards especially in sensitive areas (IUCN, 1994). However, tourism may have unwanted impacts on the protected landscape. All human actions in natural areas cause some impact in one way or another (Eagles, 1999). Despite the performance of few outstanding companies, the tourism industry has been slow to achieve substantive environmental improvements (Worboys and De Lacy, 2003 cited in De Lacy and Whitmore, 2006). The growing market of nature based tourism is exerting new pressures in areas which previously were nearly untouched (Nolte, 2010). Moreover unplanned tourism in and around natural resource rich areas has always led to the degradation of natural resources (Silori, 2004). Therefore, it is essential that adequate planning measures and sustainable models of ecotourism must be adhered to when accepting visitors in a protected area. Success in achieving an appropriate balance between recreation provision/tourism and resource protection mandates, require professional management of landscape resources and visitor use (Marion and Farrell, 2002). This would aid in benefiting the conservation of the site whilst introducing revenue for the local inhabitants and the running of the protected zone.

Some biosphere reserve examples show that tourism and nature conservation can mutually co-exist. The Nandi-Devi Biosphere Reserve in India Himalaya is a good
example. The region has been attracting pilgrims, aestheticians, naturalists, trekkers, mountaineers and explorers of historical areas (Kala and Maikhuri, 2011). In 1982, the region was declared as a national park and the immediate ban on entry resulted in a heavy decline of tourists (Kala and Maikhuri, 2011). In 1988, the park was declared a biosphere reserve, and it was realized that the ban on entry lead to negative effects on the local economy of the protected area (Kala and Maikhuri, 2011). In view of this factor a more eco-friendly concept of tourism was put forward, which made tourists aware of the fragility of the biosphere reserve. Adequate training to tour promoters and tour operators was given, together with proper site transportation and culturally and environmental sound tourist activities were implemented (Kala and Maikhuri, 2011). Moreover the money generated was used for financially supporting biodiversity conservation of the biosphere reserve (Kala and Maikhuri, 2011).

Nonetheless, it has been shown that where tourism occurs in mass form in sensitive ecosystems, sever impacts have resulted. These impacts mostly derive from infrastructure and buildings (Rawat et al., 2010), however one must never underestimate impacts originating from touristic activities. Rawat et al (2010) state that in most cases buffer zone areas are unable to withstand the recreational pressure that eco-tourism generates and the subsequent impacts of further development and infrastructure. This shows that conservation managers have to regulate touristic activities and have to issue regulations and policies regarding the construction of touristic amenities in the biosphere reserve. This would ultimately aid in preserving the sustainability status of the protected area. Also, even though tourism and recreation and highly valued protected area benefits, only eight countries are taking significant advantage of tourism-related potentialities in the Mediterranean region.
(IUCN, 2006). IUCN (2006) also identified that more often than seldom, income generated by protected areas is transferred to government general accounts without being re-invested to the protected area system.

2.4.5 Monetary issues

Establishing high quality protected areas involves a wide variety of expertise in different disciplines. These, coupled with other infrastructure and operational costs, especially conservation methods, need a hefty financial back up. Therefore, it is important to discuss financial challenges which might be incurred when establishing and maintaining a protected area, especially in the case of Malta, where resources are limited.

Dixon and Sherman (1990) associate three main types of costs to protected areas. These are ‘direct’, ‘indirect’ and ‘opportunity’ costs. Direct costs represent direct budget outlays. These include the initial costs of establishing protected areas. Some regions may have to be acquired from private ownership or else may require major developments such as road and other facilities for land management. Administrative, staff and maintenance costs are also direct costs. Monitoring and enforcement are important elements for landscape conservation and must be developed and maintained, together with education programmes and relevant associated research. Indirect costs may result from unplanned circumstances. Protecting vast areas of landscape and complex ecosystems and biodiversity may result in unintended consequences which would end in economic repercussions which have to be dealt by the protected area managers. Lastly, opportunity costs are those economic activities which had to be
halted by the introduction of a protected area. Some activities such as timber felling or grazing, may be important financially for the local population but may not meet be compatible with protected area designation (Worboys et al., 2001).

However protected areas should not be regarded as a financial burden. A range of people can derive economic benefits from a protected area such as:

- businesses that offer services within the protected area, such as commercial tours, skiing facilities, food and accommodation;
- businesses and local communities that gain individual benefits from the presence of the protected area, through visitors purchasing fuel, food, accommodation and other services outside the protected area;
- owners of properties in the vicinity of the park that are worth more due to nearby presence of the park; and
- owners or users of resources outside the park that are maintained in quantity or quality due to the presence of the protected area.

(Worboys et al., 2001)

Lockwood and Quintela (2006) write that in regions with a low Human Development Index (HDI), there is an average of less than 30 per cent of funds necessary for basic conservation management. This lack of funding is mostly present in tropical countries where most of the planet’s biodiversity is located, in developing countries due to other priorities mostly related to financial and urban development, and in the Mediterranean region due to many other financial burdens (IUCN, 2006; Lockwood and Quintela, 2006; Philips, 1999). In most cases, protected areas are not a national priority in Mediterranean countries and their finance highly depends on international aid (IUCN,
Additionally, biosphere reserves do not have an international financial system and each protected area has to be internally financed (Batisse, 1997). Hence, the financing of the protected area is one of the most pressing issues with the potential introduction of a biosphere reserve in the Maltese Islands.

Nonetheless, adequate funds are necessary in running a protected area. Financial sustainability is the key towards effective protected area management. This can be achievable by:

- developing cost-effective systems for management and administration funds;
- incorporate financial considerations within planning and management processes;
- provide incentives and opportunities for managers to generate and retain funds;
- strengthen institutional capacity to use financial and business planning tools; and
- establish more supportive economic policy and market conditions.

(Emerton et al., 2006; as cited in Lockwood and Quintela, 2006)

Another way, in which protected areas can be highly valued financially, is to adopt the ‘client’ approach as advocated by Philips (1999). The ‘client’ approach is when people residing in or nearby protected areas together with visitors and users of the site are regarded as customers. In times of financial austerity and insufficient funding, introducing an entrepreneurial approach to protected area management may help such areas to sell their goods and services in a way that will strengthen the protected area to support the conservation of biodiversity and sustainable use of resources.
Finally, it is important that protected areas, like any other major business enterprise, must have a diverse pool of funding in order to have a strong financial base and reduce the risk of funding oscillations (Lockwood and Quintela, 2006). In regards to biosphere reserves, there is no funding mechanism, resulting that in some instances, the potential usefulness of the concept has not always been realized (Lucas, 1992). Hence, it is important that any potential protected area designation must have a stable funding base. This must include funding from governmental agencies, the private sector, donations and contributions from local communities, NGOs, trusts and business enterprises in order to allow employment and other benefits for key stakeholders (Lockwood and Quintela, 2006).

2.5 The conservation framework in the Mediterranean and the Maltese Islands

2.5.1 The Mediterranean

Historian Fernand Braudel (1949) described the Mediterranean as being an age-old crossroads. This sea was the central hub for world commerce and navigation for centuries. This Mediterranean’s lengthy and eventful history led to numerous cultural and environmental impacts. These impacts rendered the region unique but with an elevated level of anthropogenic disturbance.

Climate is one of the few binding factors of the Mediterranean region. The climatic pattern is characterized by hot and long summers with very low precipitation levels. The summer water deficit required local flora and fauna to adapt by having
xerophytic characteristics. Geographical characteristics including climate, relief and historic influence (most notably the Mediterranean being an important trade route in the past resulting in high traffic and numerous introductions of alien species colonising the region) led the Mediterranean to have a diverse eco-region and an original biogeography. The physical location between three continental masses; Europe, Asia Minor and northern Africa, the Mediterranean served as a convergence point for numerous species of different origins (Cassar, 2010).

The Mediterranean biome is a global conservation priority owing to high plant species diversity and density that rivals that of tropical rainforests (Klausmeyer and Shaw, 2009). The Mediterranean’s terrestrial biodiversity is of great value and importance. The great number of islands in the Mediterranean basin (more than 5000) has favoured the evolution of new species adapted to the diverse ecological niches created by unique combinations of topography, climate, geology and history (IUCN, 2011). A wealth of about 25,000 plant species are found in the Mediterranean, with a high level of endemicity; approximately 13,000 species are found only in the Mediterranean region, hence its status of a biodiversity hotspot (Radford et al., 2011). In addition, these account to 10 per cent of known species in the biosphere on less than 1.6 per cent of total land area (Benoit and Comeau, 2005). Animal biodiversity is also equally abundant. 35 of the 62 known amphibian species and 111 of the 179 reptile species are endemic to the Mediterranean (Benoit and Comeau, 2005). However, Mediterranean ecosystems are fragile. Lack of rainfall and drought during the summer period, and heavy showers during winters (accentuating soil erosion) coupled with a very long history of anthropogenic impacts; render the region prone to disturbance (Batisse, 1990). The Blue Plan report, which tries to identify sustainability issues in
the Mediterranean together with possible future scenarios, identifies six sustainability issues in the Mediterranean: water scarcity, energy demand, transport, urban areas, rural areas and impacts on coastal areas (Benoit and Comeau, 2005). Hence, the need of proper management and conservation in the region is essential.

Figure 3: World Map identifying UNESCO biosphere reserve designations. Red box indicates biosphere reserves in the Mediterranean region.

There are more than 4,400 protected areas in the Mediterranean, of which 67 per cent has been assigned an IUCN category (IUCN, 2007). However, although the Mediterranean biome is widely recognized as a global conservation priority, only 4.3 per cent of the region is within formally protected reserves specifically designated for biodiversity conservation, thus having the second lowest level of land protection of all the 13 terrestrial biomes (Cox and Underwood, 2011; Klausmeyer and Shaw, 2011). Conversely, biosphere reserves in the Mediterranean are numerous. In fact, there are more than 90 biosphere reserves, 40 of which are located in the Iberian Peninsula (MAB, 2010) (Figure 3).
2.5.2 The Maltese Islands

<table>
<thead>
<tr>
<th>Capital: Valletta</th>
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<tbody>
<tr>
<td>Government: Republic</td>
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<tr>
<td>Population: approx 412,970</td>
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<tr>
<td>Population density: 1307 persons per km²</td>
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<tr>
<td>GDP (at market prices): €5749.7 million</td>
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<tr>
<td>GDP composition by sector: Agriculture- 01.9%</td>
</tr>
<tr>
<td>Industry- 17.2%</td>
</tr>
<tr>
<td>Services- 80.9%</td>
</tr>
<tr>
<td>Tourist arrivals: 1.2 million per annum</td>
</tr>
</tbody>
</table>

Geography: The Maltese archipelago consists of three inhabited islands; Malta, Gozo and Comino, and a number of uninhabited isles: Kemmunett, Filfla, Selmunett and Fungus Rock, together with some large rocks/stacks.

Geographic coordinates: 35°48'28" to 36°0'0"N; 14°11'04" to 14°34'37"E

Area: 316 km²

Shoreline (Malta): 139.6 km

Climate: Mediterranean with mild, rainy winters and hot, dry summers

Rainfall: 553.1 mm per annum

Wind speed: 16.3 km/hr average per annum (highly variable monthly)

Prevailing wind: Northwesterly (average 20.7% a year)

Terrain: Mostly low, rocky, flat plains; mainly coastal cliffs

Highest elevation: 253 meters above sea level

Natural resources: Limestone, salt

Habitats: steppic communities, rupestral communities, garigue, maquis, sclerophyllous woodland

Biodiversity: Species – approx 1000 flowering plants and 1000 lower plants, some 60 molluscs, 500 arachnids, more than 100 crustaceans, more than 3000 insects, 1 amphibian, 9 reptiles, around 180 birds and 20 mammals

Endemic species: 21 higher plants, 2 lower plants, 7 molluscs, 57 anthropods, 1 reptile and 1 mammal

(adapted from: Conrad 2004; MEPA, 2008; METOFFICE, 2011; NS0, 2010)

Table 2: General data of the Maltese Islands

Evidence of human presence in the Maltese Islands goes back to the Neolithic when the first settlers arrived from nearby Sicily (Cassar, 2010). From then on, human presence shaped and impacted the Islands thoroughly. The Island’s population density
of 1307 persons per km² (NSO, 2010), makes it one of the most densely populated
countries in the world (Table 2).

Landscape modifications took place systematically throughout the ages, reaching their
climax during the last century (Cassar, 2010). Main threats included clearance of
natural habitats for agriculture and building development, quarrying, dumping of
domestic and building waste, pressures from tourism and invasive alien species
(Cassar, 2010; Montmollin and Strahm, 2005). These pressures have resulted in high
levels of stress to the local flora and fauna. In fact, the International Union for the
Conservation of Nature has traced the 50 most endangered plant species in the
Mediterranean: three of which are located in the Maltese Islands, most notably the
*Cheirolophus crassifolius*, (Maltese rock-centaury) which is the Islands’ national
plant (Deidun, 2011; Montmollin and Strahm, 2005). In addition, 64 per cent of local
habitats and 44 per cent of species have an inadequate or bad conservation status
(MEPA, 2008). Moreover, the rural environment is highly dominated by agriculture.
Agriculture has an important stewardship role in ensuring countryside quality.
However, land abandonment, loss of rubble walls, dumping, agricultural land
reclamation, blocking of countryside access and inappropriate design of rural
buildings are quickly altering the landscape fabric (MEPA, 2008).

The latest Environment Report (2008) issued by MEPA identified six sustainability
issues for the Maltese Islands. These are population density pressures, the building
industry, energy, transport, agriculture in terms of pollution and tourism (MEPA,
2008). The latter, the tourism industry, is very important economically but is one of
the major activities having an impact on the Maltese environment. Malta was first
marketed as a ‘sun and sea’ destination by the local authorities from the late 1950’s, to attract mass tourism and all of its economic benefits. From the mid-eighties, there was a shift towards new niche markets such as cultural tourism (Markwick, 2001). Impacts deriving from tourism include; additional consumption of resources, pressure on ecological sensitive areas, an increase in waste generation, and an increase in land used for touristic purposes (MEPA, 2008).

Hence, there is a need for a more sustainable tourism industry. Tourism needs to focus on ensuring a quality product that prevents undue pressure on the local resources, such as by attracting more tourists in the shoulder seasons, penetrating niche markets that are generally more sensitive and supportive towards conservation, pay attention to international more sustainable trends in tourism and the need to protect and conserve the local culture and the built and natural environment by limiting land use associated with tourism and involve community stakeholders especially those being negatively affected by the industry (Markwick, 2001; MEPA, 2008).

In view of the significant human impact and evidence of human presence over the last seven millennia, the Maltese landscape can be described as cultural rather than natural (Cassar et al., 2008). On one hand the clearance brought about a loss of existing biotopes and biotic communities, while on the other hand, it created an increased niche space for new species to establish themselves (Cassar et al., 2008). The terrestrial vegetational assemblages of the Maltese Islands may be grouped in three categories: (i) major communities that are part of the successional sequence towards the climatic climax (ii) minor communities which are either specialised to occupy particular habitats, or occupy habitats that are infrequent/rare in the Maltese Islands,
or are relics from a previous ecological regime, now surviving in a few refugia; and
(iii) vegetation assemblages of disturbed habitats, which are those occupying land
subject to periodic disturbance, usually related to anthropic activities (Schembri,
1997).

2.6 Case Studies

**Lanzarote Biosphere Reserve**

The Lanzarote Biosphere Reserve is made up of the northernmost island of the Canary
Archipelago. It covers 84600 ha including the northern minor islands, and has a
population of over 110,000 (2002). The Canary Islands are volcanic and young on a
planetary scale. Lanzarote is one of oldest islands, but the last eruptions which
occurred in the 18th and 19th centuries are still visible in the island landscape today
because of the low plant cover.

Due to the relatively low altitude and gentle relief, the island does not catch the
humidity of the trade winds, and rainfall is only some 115 mm/year. As a result, plants
are adapted to arid conditions, and water for human consumption comes from the
desalinisation of sea water. In spite of this, Lanzarote has a relatively high number of
species of which approximately twenty plants are locally endemic.

The harsh volcanic environment has been adapted by human ingenuity to make highly
specialised agricultural landscapes and the very special nature of Lanzarote has incited
its inhabitants to take conservation measures. For example, one of the core areas,
Timanfaya National Park, was established at the request of the local Government (the
Cabildo), and a Marine reserve of 70,000 hectares has been created, forming one of
the buffer zones. The idea of mass tourism was rejected and, under the influence of the
celebrated local artist César Manrique, priority has been given to blend tourist
infrastructure with the beautiful but inhospitable environment. The Cabildo de
which curbs excessive urban and tourist developments, and in 1994 the Natural
Protected Spaces Law was modified, to enable to protect over 40% of the terrestrial
area. Lanzarote has thus traced a path over the last thirty years trying to guide its
touristic development towards more sustainable practices. The Biosphere Reserve
designation corresponds to the social choice of the local communities: the Biosphere
Reserve Council, an open-participatory body, has become of high social and political
relevance, with more than thirty social and institutional representatives and economic
stakeholders.

Source: (UNESCO, 2007)

Table 3: Lanzarote Biosphere Reserve
Menorca Biosphere Reserve

The main characteristic of the Menorca Biosphere Reserve is the diversity characteristic of nearly all Mediterranean island ecosystems. The most notable habitats are the gullies, caves, wetlands made up of ponds, lagoons and marshes, dune systems, coasts and islets. Some 220 species of birds, and 1000 species of plants (60 of which are endemic) have been recorded. One of the most important landscape features of the Biosphere Reserve is the number of gullies that cross it in the direction of the south coast, which offer spectacular landscapes and have an abundant and varied flora and fauna. Also important are the nesting sites of birds of prey and aquatic birds nesting close to small permanent or seasonal water sources. Menorca has many natural land caves and underwater caves, situated in the north and south of the island. The coastal wetlands include Albufera de Es Grau (a Natural Park and the core area of the Biosphere Reserve), as well as Addaia, Son Saura and Son Bou. The rocky coast, mainly the limestone cliff provides habitats for marine birds such as the Cory’s shearwaters, cormorants, seagulls and various birds of prey. Oak woods are abundant only in the central part of the island and in a few gullies. The woods of wild olive trees, known on the island as ullastrars, appear in areas of thin soils, and is the dominant tree species on the island. As in many parts in Europe, the ‘whole island’ biosphere reserve of Menorca has become a patchy mosaic of landscapes as a result of centuries of human-induced fragmentation. Menorca has a population of 80,000 inhabitants, mainly engaged in tourism, commerce, agriculture, and jewellery and footwear industry. The biosphere reserve constitutes a rich historical and cultural legacy, expressed in numerous settlements and prehistoric monuments. The zonation was changed in 2004 and the original core area expanded to increase a marine zone.

Source: (UNESCO, 2006)

Table 4: Menorca Biosphere Reserve
CHAPTER 3

DESIGNING A BIOSPHERE RESERVE

FRAMEWORK FOR MALTA
CHAPTER 3
DESIGNING A BIOSPHERE RESERVE FRAMEWORK FOR MALTA

3.1 Overview of protected areas in Malta

MEPA is the national agency responsible for the local administration and management of protected areas under the EPA and the DPA (Conrad, 2004; MEPA, n.d.a). Protected areas in Malta are designated through national legislation under the auspices of the EPA and DPA, and through multilateral agreements including the Bern Convention, EC birds directive, EC habitats directive, Ramsar Convention, and protocols concerning SPA’s and Biological diversity in the Mediterranean (MEPA, n.d.a; Axiak et al., 2002).

Habitats and biocoenoses afforded protection by the DPA 1992 are scheduled under a set of Structure Plan policies; first issued in 1990 and revised in 2005, which amongst others incorporate Rural Conservation Areas which in turn include AEIs and SSIs (Conrad, 2004; Axiak et al., 2002). Sites scheduled as AEIs include:

- watercourses;
- saline marshlands and coastal wetlands;
- sand dunes and beaches;
- valleys;
- garigue;
- maquis;
- forest remnants and woodlands;
- coastal cliffs; and
• talus slopes.

(MDI, 1990)

Sites scheduled as SSI’s include:

• the only known locality in the Maltese Islands where certain endemic and/or non endemic species are found;

• a locality where certain endemic and/or non endemic species with a restricted distribution in the Maltese Islands occur (‘restricted distribution’ is taken to mean occurrence in five localities or less);

• the type locality of an endemic species;

• an important bird nesting site or of some other major ornithological interest;

• a locality of a special paleontological interest;

• a lithostratigraphical type section;

• a locality of particular geomorphological interest; and

• some other specific feature of scientific importance not listed above.

(MDI, 1990)

This scheduling gives listed areas blanket protection from certain activities but these do not fall under any management regime (Axiak et al., 2002). However some sites have been given to NGOs for management on behalf of the Environment Protection Department. Examples include the GAIA Foundation responsible for the management of Ghajn Tuffieha area and Ramla l-Ħamra Bay in Gozo, Birdlife Malta which is responsible for the Ghadira Nature Reserve and Simar Bird Sanctuary and Nature Trust, responsible for the management of Ballut ta’ Marsaxlokk, Marsaxlokk Nature Park, White Tower Bay sand dunes, Dwejra Heritage Park in Gozo, Xrobb l-Għagin

3.1.1 North West Local Plan

The NWLP was approved by MEPA in 2006. The Plan proposes policies and standards according to the Structure Plan. The Plan boundary runs roughly from Ghallis Point in the north, to Wied Fulija in the south, and includes all the rural, coastal and settlement areas west of Malta, Siggiewi and Qrendi, and includes the National Recreation Centre at Ta’ Qali (MEPA, 2006) (Appendix B). The area in question contains most of the distinctive rural landscape of Malta, but it also contains historic towns and villages. The area is highly important for tourism and recreational activities and these activities may lead to environmental impacts. Hence, amongst other functions, the NWLP aims to safeguard environmental resources by identifying and designating environmentally sensitive areas and resources, prohibiting damaging development, encouraging positive intervention, preparing environmental management schemes, and rehabilitating degraded zones (MEPA, 2006).

3.1.2 Natura 2000 designations

In May 1992, the EU adopted legislation designed to protect the most seriously threatened habitats and species across Europe by adopting the Habitats Directive’s SCIs and SACs. This directive compliments the Birds Directive (SPAs) which was adopted way back in 1979 (European Environmental Agency, n.d; Gurskienė and
Ivavičiūtė, 2009). The Natura 2000 Network comprises of more than 25000 sites, covering around 20 per cent of the EU land area (European Commission, 2009). The main aim of the Natura 2000 Network is the setting up of areas for nature conservation in EU countries to ensure Europe’s most valuable species and habitats. These designations are not restricted to nature reserves, but are based on a much broader principle of conservation where people and nature interact sustainably (European Commission, 2009).

Each Member State of the European Union has the obligation under the Habitats Directive to contribute to the creation of the Natura 2000 Network (MEPA, n.db). Moreover the Wild Birds Directive requires each Member State to protect naturally occurring wild birds and their subsequent habitats (MEPA, n.db). By the end of 2009, Malta had 35 designated Natura 2000 sites (Natura 2000, 2009) (Appendix B). In addition, Malta has 28 SCIs and 13 SPAs covering to 13.3 per cent and 5.1 per cent of the total land area respectively (European Commission, 2009). According to the Natura Barometer, which indicate the present state of progress as regards the completion of the Natura 2000 Network, Malta is ‘largely complete’ as regards to both SCIs and SPAs, in terms of land space designated as Natura 2000 protected area (European Commision, 2009; MEPA, n.db).

3.1.3 Il-Majjistral Nature and History Park

The area around the coast from ir-Ramla tal-Mixquqa to il-Prajjet was designated as il-Majjistral Nature and History Park by the government of Malta in September 2007 (Il-Majjistral Nature and History Park, n.d.) (Appendix B). It includes the coastal
cliffs known as Rdum Majjiesa and Rdum id-Delli as well as the site of Xaghra l-
Hamra. The whole extent forms part of the SAC of International Importance known as ‘Rdumijiet ta’ Malta (Coastal Cliffs)’ and forms part of the Natura 2000 network of protected areas in the EU (Il-Majjistral Nature and History Park and MEPA, 2010). The Management of the Park is entrusted to three NGOs; Din l-Art Ħelwa, which has restored and is managing several coastal towers and other heritage sites, The GAIA Foundation which works in the field of integrated coastal zone management and Nature Trust (Il-Majjistral Nature and History Park, n.d.).

Geomorphologically, the Park consists of two karstic plateaux and a watercourse forming part of the Wied tal-Kalkara valley system. This watercourse is mainly characterised by cultivated agricultural lands. The area is predominantly characterised by vast stretches of karstland, supporting garrigue vegetation, abandoned and disturbed ground. The Park however is predominantly a coastal zone. The coastal cliffs and boulder screes of il-Minzel tal-Majjiesa and Rdum Majjiesa represent a composite biotope upon permanent and semi-permanent freshwater springs and watercourses, other pockets of agricultural land, and steppe and garrigue, and other aerohaline vegetation communities (Il-Majjistral Nature and History Park and MEPA, 2010). Moreover, the area at Ramla l-Mixquqa is a dynamic geomorphologic system including a mixture of fluvial, marine and aeolian processes which combined they form a sandy beach which is highly populated by locals and tourists alike during the summer months.

Several impacts are evident within the Park including disturbed ground due to dumping found at il-Prajjiet and the area at ix-Xaghra il-Ħamra. The dumped material
has been colonised by opportunistic species that are typical of such habitats (Il-Majjistral Nature and History Park and MEPA, 2010). Off-roading is also having an effect by degrading areas within the Park due to the widening of footpaths and loss of vegetation and soil (Il-Majjistral Nature and History Park and MEPA, 2010).

Il-Majjistral Park contains various features of cultural interest. These features include cart ruts, dry stoned rubble walls, farmhouses, small beehives, tombs dating to the Classical period, natural caves, rural corbelled stone huts (giren), British military architecture dating to the early 20th century and Hospitaller Knights of St John military architecture dating to the early 18th century (Il-Majjistral Nature and History Park and MEPA, 2010).

In April 2010, Il-Majjistral and Nature and History Park Management Board in collaboration with MEPA issued a Draft Management Framework for the Park. This Framework Plan proposed five measures:

- to maintain and restore the conditions necessary to protect significant species, groups of species, biotic communities, habitats or physical features of the environment where these require specific human manipulation for optimum management;
- to facilitate scientific research and environmental monitoring as primary activities associated with sustainable resource management;
- to develop limited areas for public education and appreciation characteristics of the habitats concerned and of the work of wildlife management;
- to eliminate and thereafter prevent exploitation of occupation inimical to the purposes of designation; and
to ensure that other relevant issues arising from management of this SAC are clearly addressed in a sustainable manner.

(Il-Majjistral Nature and History Park and MEPA, 2010)

3.2 Methodology

The aim of this dissertation is to study and research the feasibility of introducing a biosphere reserve in Malta. Evaluating the capacity of the Maltese Islands to support a biosphere reserve consisted of an evaluation framework, based on the essential components of the biosphere reserve model. This section describes all the steps taken to identify such components relevant to the biosphere reserve concept.

3.2.1 Criteria needed for a biosphere reserve

The Seville Strategy is a Statutory Framework setting out the conditions of the WNBR. One of the highlights of this document is the setting up of criteria for an area to qualify for a biosphere reserve designation. Article 4 of the document indicates that for an area to qualify as a biosphere reserve:

1. It should encompass a mosaic of ecological systems representative of major biogeographic regions, including a graduation of human interventions.
2. It should be of significance for biological diversity conservation.
3. It should provide an opportunity to explore and demonstrate approaches to sustainable development on a regional scale.
4. It should have an appropriate size to serve the three functions/roles of a biosphere reserves (Chapter 2 section 2.3.1).
5. It should include these functions, through appropriate zonation, recognizing a core area, a buffer zone and an outer transition area (Chapter 2 section 2.3.2).

6. Organization arrangements should be provided for the involvement and participation of a suitable range of inter alia public authorities, local communities and private interests in the design and carrying out the functions of a biosphere reserve.

7. In addition, provisions should be made for
   a) mechanisms to manage human use and activities in the buffer zone or zones;
   b) a management policy or plan for the area as a biosphere reserve;
   c) a designated authority or mechanism to implement this policy or plan;
   and
   d) programmes for research, monitoring, education and training.

   (UNESCO, 1996).

3.2.2 Area of Study

The first phase of the research was to identify an AoS. Time was a limiting factor hence it was decided that only mainland Malta was going to be taken into consideration for the biosphere reserve concept. Aerial photos of the Island and Google Earth were used to delineate a geographical area where rural landscape was dominant over the urban landscape. The urban area is conglomerated in the Grand Harbour area in the north eastern part of the Island. This zone was not included in the AoS as rural land uses are more compatible with the biosphere reserve concept of sustainable interaction between human land users and the surrounding environment.
The AoS was thus concentrated in the northern part of the Island, including the Northwest and Northeast (excluding urban areas such as Buġibba) and all through Southwest and Southeast zones of Malta (Figure 4).

![Figure 4: Area of Study adopted for this research study](image)

### 3.2.3 Evaluation framework

Evaluation is a systematic and objective review of the appropriateness, efficiency and/or effectiveness of a programme or concept (NSW, 2011). This framework would help determine whether criteria 1 and 2 (see section 3.2.1) are prevalent in Malta for the designation of a biosphere reserve. These two criteria are predominantly focused on the significance of the ecological and biodiversity value for an area to qualify as a biosphere reserve. In order for successful conservation planning, it is imperative to be able to provide some measure of ecological value in order to allow for the setting of
priorities and for the distinction of relevant ecological and biodiversity significance in diverse areas (Cassar, 2010).

However, the evaluation framework used for this research study, encompasses an additional multi-disciplinary and holistic approach. The approach advocated is based on landscapes, that is, an approach that endeavours to identify the dynamics that govern landform and the different geological and geomorphological processes, as well as those of ecology, in relation to landscape. Geomorphology is directly linked with ecology as different formations, such as valleys and cliffs, host different communities. Moreover, the landscape has been anthropogenically influenced over time. Cultural and historical land uses were also taken into consideration as evaluation criteria, thus adopting a multi-disciplinary and holistic approach towards conservation value.

3.2.4 Digitising of thematic layers

Geographic Information System (GIS) (ESRI ArcGIS v9.3.1 and v10), was used to map relevant data in the AoS. This data was digitized on a base map consisting of an outline and contour lines of the Maltese Islands. The data was not geo-referenced. Thus, the maps from the MEPA website, the contour lines, and images from Google Earth and other aerial photos were used to map the thematic layers on the base map accordingly.

Existing conservation-related designations within the AoS where digitized and mapped. These included AEIs, SSIs, Areas of High Landscape Value and Areas of Archaeological Importance according the Structure Plan of MEPA. This data was
accessed from the Malta Scheduled Property Register from the MEPA website (http://www.mepa.org.mt/schedschedulingsearch). These sites are designated by MEPA as a series of Rural Conservation Areas (MDI, 1990). As regards to AEIs and SSIs, these were digitized according to four different levels of protection ratings established by the Structure Plan (1990) as follows:

- Level 1 zones include important habitat types present only in small areas and/or sites with unique species or features;
- Level 2 zones include important habitat types present in relatively large areas and/or sites with rare species or features;
- Level 3 zones include areas where control is necessary to preserve habitats/species/features in adjacent sites (buffer zones);
- Level 4 zones include habitats and/or features of general interest.

(MDI, 1990)

Other protected areas are found within the chosen AoS and such sites where mapped accordingly. These included Il-Majjistral Nature and History Park and the Nature 2000 sites. Il-Majjistral Nature and History Park was mapped as indicated in the Draft Management Framework (2010) compiled by the il-Majjistral Nature and History Park Management Board. The Natura 2000 sites where mapped by utilizing the Natura 2000 Network viewer accessed from http://natura2000.eea.europa.eu/#. Moreover, data was acquired from the Natura 2000 database accessed from http://www.eea.europa.eu/data-and-maps/data/natura-1. The Natura 2000 database offers data on the impacts on the concerned sites designations. The impacts for the SCI sites were also mapped on a separate layer to identify external activities occurring in existing protected areas in the AoS of this research. According to the
Commission of the European Communities (1996) impacts relate to all anthropogenic activities and natural processes that may have an influence, either positive or negative, on the conservation and management of the site.

In addition, a survey was sent to four specialists who were asked to pinpoint on a map of the AoS, five sites which according to their expertise are deemed to be significantly important for protection and conservation. The aim of this survey (Appendix A) was to provide an additional element of validation and site characterization from specialists experienced and trained in different fields. The survey was sent to Mr Avertano Role (a geographer by training), Mr Edwin Lanfranco (a botanist by training), Dr Malcolm Borg (a planner by profession and training) and Dr Sandro Lanfranco (an ecologist by training). In the survey, they were also asked to give a numerical preference to the chosen sites - 1 as the most important and 5 for the least significant. Consequently, the sites chosen by the experts were mapped according to the numerical preference given.

3.2.5 Spatial analysis techniques

Spatial analysis techniques were used to geographically identify areas with different levels of conservation status from the digitised layers. Two spatial analysis techniques were used; the ‘Select by Attributes’ feature and ‘Select by Location’ feature. The ‘Select by Attribute’ feature enables the decision maker to select features/attributes in different thematic layers which have the same properties and/or are related. For example, by this exercise, MEPA designations under the Ecology and Geomorphology layer, which are of Level 1 of protection importance, could be
highlighted and thus geographically located on the digitized map. Hence, this made it possible to identify both ecological and geomorphological areas with a high level of protection importance according to MEPA. This exercise was repeated for both the sites chosen by the experts and the Natura 2000 designations.

The ‘Select by Location’ feature enable the decision maker to use the selected attributes from the previous exercise and spatially identify those layers which either intersect, are within a distance of, completely contain, are completely within, have their centre in, share a line or segment with, touch the boundary of, are identical to, are crossed by the outline of, contain or are contained by the previous selected attributes or layers. For example, geographical points containing heritage and cultural important sites which are within areas of Level 1 of ecological and geomorphological protection status, were identified. Hence, these exercises made it possible to spatially recognize areas which holistically merit protection status in ecological, geomorphological and in heritage terms.

3.2.6 Conservation Value Appraisal Criteria

After analyzing conservation value in terms of the various existing protected areas, an additional conservation value approach was implemented to verify the data used and to provide an additional conservation dimension to this research study. The conservation value in terms of geomorphology, ecology and cultural and historical significance of the AoS was evaluated with reference to a suite of Conservation Value Appraisal Criteria. The criteria used for this study were adapted from Cassar’s (2010) criteria of the island of Gozo, which were largely based on the Ratcliffe Conservation
Review Criteria (1977) and the IUCN Criteria (1986). For this study, the criteria were modified to include geomorphological factors and sites of significance for heritage. This was done to incorporate a more holistic approach towards conservation and restoration needs in the AoS to identify the feasibility of implementing a Biosphere Reserve.

The following are the different criteria used and how these were measured and/or identified for the adopted CVAC:

- **Rarity**: linked with the presence of endangered species as listed in the Red Data Book (1989) and as identified through consultations with Mr Edwin Lanfranco.

- **Naturalness**: Areas of relative disturbance, including those areas which have been least subjected to disturbance. These were mapped through a series of ground-thruting exercises and by using aerial photography to identify areas with no/least land uses.

- **Richness & Diversity**: Habitat richness and diversity. This was mapped by referring Schembri et al. (1987) *Localities with conservation value in the Maltese Islands* and the Natura 2000 network database.

- **Connectivity**: Geomorphological features and landuse patterns with the potential to act as wildlife corridors including agricultural land with the presence dry rubble walls, valley systems with tributary channels, derelict land, coastal cliffs and escarpments;

- **Protection Status**: legal status in terms of nature conservation and environmental management;
- **Habitat Loss and Fragmentation:** Severe degradation of habitats and landscape fragmentation due to human agency, including insensitive urban expansion and ancillary development, illicit concrete sluicing, quarrying, inappropriate afforestation, damming of valley systems and watercourses and large scale reclamation for cultivation, road constructions, non-traditional methods of agriculture, hotels and other catering establishments in remote rural areas, concentration of bird trapping sites in ecologically sensitive areas among others. These were identified by using aerial photography, ground-truthing exercises and Natura 2000 network database.

- **Presence of Heritage:** The presence of cultural/historical infrastructure and/or archaeological sites.

The CVAC criteria were applied by utilizing Google Maps, the Natura 2000 Network site viewer and Aerial photographs for field mapping. These were backed by a series of ground-truthing exercises to add verification to the data mapped on the GIS.

### 3.3 Review of the conservation evaluation framework

Despite that the conservation evaluation framework adapted incorporated three different exercises - a *conservation value appraisal criteria*, spatial analysis of the existing protected areas and specialist involvement, it is evident that some weaknesses still remain. For instance, all the thematic layers digitized into the GIS system were not geo-referenced. The layers are thus not accurately digitized in terms of location and extent. Moreover, the lack of geo-referenced data in the GIS system limited the
use of a number of spatial functions, which could be used to assess additional criteria, on each digitized layer.

The proposed biosphere reserve designation lacked the input from other possibly involved stakeholders. Biosphere reserves must involve local communities from the first stages to the management of the protected area. This constraint can be overcome by formulating a questionnaire and/or meetings with a selection of involved and interested stakeholders to incorporate their ideas in the final decision making of a possible designation of the reserve.

A further limitation of the proposed biosphere reserve is that the AoS chosen did not cover the islands of Kemmuna and Gozo. The reason for excluding both islands was mainly due to time constraints associated with the completion of this study.
CHAPTER 4

CONSERVATION EVALUATION
Figure 5: Map illustrating locations mentioned in the thesis
CHAPTER 4
CONSERVATION EVALUATION

4.1 Analysis of the CVAC

In this chapter an analysis was undertaken to identify areas of conservation value and to assign an appropriate zoning recognizing core areas, buffer zones and transition areas in accordance with the principles of biosphere reserve delineation. This was undertaken using spatial analysis techniques of the mapped layers as described in Chapter 3. The entire suite was evaluated on the basis of the conservation value appraisal criteria that were specifically adapted for this research from Cassar’s review criteria bearing the same nomenclature (Cassar, 2010) from which an ecological evaluation of the Island of Gozo, at landscape scale, was developed as a result of the modification of existing Ratcliffe Conservation Review Criteria of 1977 (cited in Cassar, 2010: 85) and the IUCN Criteria of 1986 (Mackinnon et al., 1986, cited in Cassar, 2010: 85). These criteria for evaluation were adapted to encompass a holistic approach towards conservation where in addition to ecological criteria, other factors such as geomorphology and culture components of landscape were are also taken into consideration.

The Seville Strategy’s Statuary Framework identified seven criteria for an area to qualify as biosphere reserve. The first two criteria indicate that the selected region should encompass a mosaic of ecological systems and should incorporate significant biological diversity for conservation (UNESCO, 1996). Hence, it was considered vital to identify areas within the selected AoS that are ‘home’ to such features. Choosing where to focus conservation efforts depends on what objective is being pursued. One
The criterion is conserving threatened ecosystems with high degrees of endemism (Batisse, 1997). In fact, the undertaken CVAC study included the criteria rarity, connectivity, naturalness and richness diversity to identify ecologically significant zones for conservation. The criterion rarity (Figure 6) indicates the presence of rare, scarce or endangered species within a given landscape or parcel of land. This criterion is mostly represented in the areas of Wied Babu, Wied iż-Żurrieq and Wied Hoxt, Imtaḥleb and Bahrija area and the Marfa peninsula especially in the isthmus/Ghadira zone as well as in several other locations (Refer to figure 5 for locations mentioned). These areas are home to several important species including the national plant, *Palaeocyanus crassifolius* found in Wied Babu and *Plantago bellardi* populations which seem to be confined to the Marfa peninsula only (Lanfranco, 1989; Schembri et al., 1987). In particular there is a concentration of features that fall within the rarity criterion around coastal areas most notably in the north western and south western sheer cliffs and escarpments, in rupestral community environments and in sheer sided valleys. These locations are highly inaccessible and thus, they are localities where anthropogenic influences have been minimal throughout the centuries. Moreover, it is important to highlight the remnant sclerophyllous Mediterranean woodland in Wardija. The area is resident to some ancient examples of *Quercus ilex* trees which are five hundred to nine hundred years old and possibly constitute some of the oldest trees in the Maltese Islands (Lanfranco, 1989).

The connectivity criterion refers to those locations which have the potential to function as wildlife corridors such as ‘steeping stones’ (Figure 7). Habitat connectivity facilitates the movement of fauna and flora across the terrain and thus ensures the continuance and viability of populations and communities (Cassar, 2010). These include geomorphological features such as sheer coastal cliffs, escarpments,
valley systems and associated tributary channels. Also, other land cover elements include derelict land and agricultural land. The latter are important as the local agricultural landscape is characterized by dry stone rubble walls and/or dense *Opuntia ficus-indica* used to de-lineate farmland and/or to protect soils from wind and rainwater erosion. Even though the dense *Opuntia* stands are considered an alien species in ecological terms, its presence is valuable as a wildlife corridor for a number of species that utilize the shade and shelter it provides as well as the fruits of this cactus for nourishment, particularly during the hot, dry summer months (Cassar, 2010).

![Figure 6: Rarity](image)

This criterion is very evident in the AoS. Most notably it is important to accentuate the importance of the coastal cliffs located throughout the north southern and north western part of the Island. The location of id-Dahla to Ras ir-Raheb area, incorporating also the cliffs in Dingli, il-Kullana to il-Çifen, is an important corridor for avian populations along the entire stretch of the coastal cliff face. The area also supports breeding colonies of *Calonectris diomedea* and *Puffinus yelkouan* (Birdlife
The north eastern cliffs of the Marfa peninsula are also important corridors and support one of the largest colonies of *Puffinus yelkouan* in the Mediterranean (Birdlife Malta, 2011). In addition, the escarpments situated above the sheer cliffs and the adjacent abandoned and agricultural land act as stepping stones for other terrestrial species. Agricultural land with the potential to act as stepping stones is present in Fomm ir-Riħ, Mgarr and Żebbiegh area. This land is situated adjacent to the Great Fault. From the Great Fault northwards, there is a sequence of block faulting creating a series of horsts (ridges) and grabens (valleys) forming a potential sequence of additional ‘stepping stones’ and different habitats for fauna and flora.

The criterion *naturalness* (hemerobiotic state) was somewhat difficult to assess (Figure 8). In the Mediterranean context, the anthropogenic influence is pervasive throughout the landscape. Hence, areas of relative disturbance were assessed and digitized on the map. Areas of relative disturbance are thus mostly located in zones of limited access where human impact was minimal compared to other locations, hence next to coastal sheer cliffs and inland ridges.
The *richness and diversity* criterion was assessed by referring to the work of Schembri *et al.*, (1987), ‘Localities with conservation value in the Maltese Islands’, the Natura 2000 database accessed from [http://www.eea.europa.eu/data-and-maps/data/natura-1](http://www.eea.europa.eu/data-and-maps/data/natura-1), and from specialist involvement. This criterion is primarily linked with species richness within a community and biotope and also habitat diversity within a landscape. Figure 9 indicates that Marfa Ridge and isthmus are important for species richness and diversity. Apart from being a significant locality for local geological stratigraphy, this northern part of the Island is home to a diverse range of species. Ramla tat-Torri bay contains one of the few remaining remnant sand dune habitats in the Island. Sand dune species present in the area include floral species such as *Euphorbia paralias* and *Echinophora maritima* and faunal species including *Prionyx kirbi*, *Ectemnius sescinctus* and rare species such as *Prionyx viduatus*, *Bembix oculata* among others. In addition, the aforementioned coastal cliffs of Rdum il-Madonna contain one of the largest colonies of Yelkouan Shearwater in the
Mediterranean with an estimated five hundred pairs amongst others (Birdlife Malta, 2011; Schembri et al., 1987).

Another prominent area for species richness and diversity is Buskett. Buskett is semi-natural woodland which existed as small forest remnant that was subsequently enhanced and extended during the reign of the Knights of Saint John. Currently, it shows signs of self-regeneration and has the character of the natural climax community, the Mediterranean sclerophyllous woodland (Schembri, 1993). The adjacent freshwater valley, Wied il-Luq which passes through the semi-natural woodland is likewise important for species richness and diversity and is also the only known station for several freshwater species in the Islands (Schembri et al., 1987).

Figure 9: Richness and Diversity
Figure 10: Habitat Loss and Fragmentation

The omnipresent human footprint across the Islands renders the habitat loss and fragmentation criterion an important element to evaluate, particularly within and around areas of conservation value. Apart from ground-truthing exercises and the use of aerial photos and Google Maps, data from the Natura 2000 database was also utilised to list all the impacts present in the AoS. This criterion indicates habitat loss in the form of insensitive urban expansion and ancillary development, illicit dumping of inert waste, quarrying, inappropriate afforestation, damming of valley systems and watercourses. In addition, evidence of landscape fragmentation as a result of infrastructural development such as road construction in rural areas, infrastructure in coastal areas including hotels, bars and other embellishments, non-traditional methods of agriculture, concentration of bird-trapping sites in ecologically sensitive areas and the screeding (the process of laying concrete to provide a hard-landscape surface) of valleys and watercourses were also analyzed and mapped under this criterion. Other impacts having a negative effect on the landscape were also mapped such as antagonism arising from the introduction of new species, accentuated erosion patterns
and the use of motorised vehicles in rural areas amongst others. Figure 10 indicates that human influence leading to habitat loss and fragmentation is universally spread out throughout the AoS, even in sites which have limited accessibility.

Figure 11: Heritage

The CVAC system used for this study was adapted to include a more holistic approach towards the identification of locations with significant conservation value. The criterion *heritage* encompasses sites of historical, cultural and archaeological significance within the study area (Figure 11). Specific historic sites provide evidence of human interactions in the landscape (Lennon, 2006). These sites are also linked to a rich and interesting past mirroring the landscape alterations the Mediterranean region experienced throughout the centuries primarily to accommodate agricultural practices coupled with other intensive environmental resource uses (Cassar, 2010).

The AoS includes numerous sites which are valuable for their heritage value. The region includes sites of UNESCO World Heritage importance, such as the Megalithic temples of Mnajdra and Ħaġar Qim, and late Neolithic temple at Ta’ Ħaġrat, and late
Neolithic temple and settlement at Skorba. Other landscape features of archaeological importance include cart ruts located on the western side of the Island, most notably in Clapham Junction and the dense concentration found in Qlejgha. Whilst there is widespread agreement that the paired ruts are intimately linked to the passage of some form of ‘vehicle’ and transportation, there are many unresolved issues concerning their origins, where assumptions have ranged as widely as the Neolithic (5200-3800 BC) and Arabic periods (c. 870 AD) (Mottershead et al., 2008). Another interesting feature in Figure 4.6 is the line of fortifications present alongside the Great Fault. The Victoria lines are a line of fortifications built by the British military during the 19th century. Other sites mapped in the category include 17th century coastal towers, catacombs, punico-roman remains, World War II shelters, paleochristian hypogea, chapels, Bronze Age settlements, ancient quarries, tombs, cave dwellings, ‘giren’, and traditional farmhouses amongst others.

The protection status criterion reflects the legal status, in terms of nature conservation and environmental management of a particular area. Figure 12 indicates protected
areas under local and EU environmental laws and regulations. The AoS includes a wide range of protected areas, covering extensive land cover of ecological and scientific importance. The region encompasses designations such as Natura 2000 sites (SCI’s and SAC’s), il-Majjistral Nature and History Park, and AEI’s, SSI’s and Areas of High Landscape Value designated by the local environmental authority.

GIS spatial analysis techniques were utilized to spatially identify areas of different protection ranking. This identification is important as a potential biosphere reserve can be implemented in conjunction with existing laws and regulations. Moreover the fifth criterion indicated by the Statutory Framework of the Seville Strategy states that for an area to qualify for biosphere reserve status, it needs to include an appropriate zonation pattern, recognizing a core area, a buffer zone and a transitional zone (UNESCO, 1996). Hence, the existing levels of protection can serve as one of the indicators to assign the zonation pattern according to the biosphere reserve criteria.

Figure 13 is indicating locations listed as SSI’s and AEI’s. The highlighted features are indicating sites with a protection status of level 1. Level 1 zones include important habitat types present only in small areas and/or sites with unique species or features (MDI, 1990). The selected locations include saline marshlands, coastal sand dunes, freshwater wetlands, valley systems, garrigue areas and isles amongst others. These habitats are of significant ecological value. Such sites are limitedly distributed around the Island due to the small size and extensive human footprint found in Malta.

Level 2 zones include important habitat sites found in relatively large areas. Figure 14 indicates all the coastal sheer cliffs of the Maltese Islands. The coastal cliffs are an important feature in the local landscape. Moreover, they are ecologically significant
as they harbour a number of endemic and rare species and serve as potential corridors and stepping stones for various flora and fauna.

Figure 13: Selection of SSI’s and AEI’s of a protection level 1

Figure 14: Selection of SSI’s and AEI’s of a protection level 2

Figure 15 indicates existing buffer zones assigned by the local environmental agency. The map shows buffer zone of coastal cliffs, sandy beaches, garrigue biotopes, saline marshlands and woodland amongst others. Finally, Figure 16 highlights ecological
and geomorphological areas of general interest. These include small areas which have a significant anthropogenic influence such as the touristic sandy beach of Ghadira and the rocky coastline of il-Bajja tal-Mixquqa.

Figure 15: Selection of SSI’s and AEI’s of a protection level 3

Figure 16: Selection of SSI’s and AEI’s of a protection level 4
<table>
<thead>
<tr>
<th>Protected Site</th>
<th>Description</th>
<th>Conservation Status</th>
<th>Global Assessment</th>
<th>Habitat Priority</th>
</tr>
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<tr>
<td>Maqlebaba</td>
<td><strong>Tetraclinis articulata forests</strong></td>
<td>nd</td>
<td>nd</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Arborescent matorral with Laurus nobilis</td>
<td>B</td>
<td>B</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Calcareous rocky slopes with chasmophytic vegetation</td>
<td>nd</td>
<td>nd</td>
<td>0</td>
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<tr>
<td>I-Imgiebah/tal-Mignuna</td>
<td><strong>Calcareous rocky slopes with chasmophytic vegetation</strong></td>
<td>B</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Olea and Ceratonia forests</td>
<td>B</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Quercus ilex and Quercus rotundifolia forests</td>
<td>B</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)</td>
<td>C</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Mediterranean salt steppes (Limonietalia)</td>
<td>B</td>
<td>B</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Vegetated sea cliffs of the Mediterranean coasts with endemic Limonium spp.</td>
<td>B</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Thermo-Mediterranean and pre-desert scrub</td>
<td>B</td>
<td>B</td>
<td>0</td>
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<tr>
<td>Selmunett Islands</td>
<td>Vegetated sea cliffs of the Mediterranean coasts with endemic Limonium spp.</td>
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<td>Salini</td>
<td>Coastal lagoons</td>
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<td></td>
<td>Large shallow inlets and bays</td>
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<td>Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)</td>
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<td>B</td>
<td>0</td>
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<tr>
<td></td>
<td>Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>Salicornia and other annuals colonizing mud and sand</td>
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<tr>
<td>Għadira s-Safra</td>
<td>Mediterranean temporary ponds</td>
<td>C</td>
<td>C</td>
<td>1</td>
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<tr>
<td></td>
<td>Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)</td>
<td>C</td>
<td>C</td>
<td>0</td>
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<tr>
<td>ix-Xagħra tal-Kortin</td>
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<td>West Mediterranean clifftop phryganas (Astragalo-Plantaginetum subulatae)</td>
<td>B</td>
<td>B</td>
<td>0</td>
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<tr>
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<td>Calcareous rocky slopes with chasmophytic vegetation</td>
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<tr>
<td>Location</td>
<td>Vegetation Type</td>
<td>Code</td>
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<td></td>
<td>Calcareous rocky slopes with chasmophytic vegetation</td>
<td>A</td>
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<tr>
<td></td>
<td>Annual vegetation of drift lines</td>
<td>C</td>
<td>C</td>
<td>0</td>
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<td></td>
<td>Embryonic shifting dunes</td>
<td>C</td>
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<tr>
<td></td>
<td>Dunes with Euphorbia terracina</td>
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<td>Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.</td>
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<tr>
<td>Għadira area</td>
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<td>C</td>
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<td>C</td>
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<td></td>
<td>Dunes with Euphorbia terracina</td>
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<td>Thermo-Mediterranean and pre-desert scrub</td>
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<td><em>Quercus ilex</em> and <em>Quercus rotundifolia</em> forests</td>
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<tr>
<td></td>
<td>Thermo-Mediterranean and pre-desert scrub</td>
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<td>B</td>
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<td></td>
<td>Caves not open to the public</td>
<td>B</td>
<td>B</td>
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<td></td>
<td>Mediterranean temporary ponds</td>
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<td>ir-Ramla tac-Ċirkewwa sa l-Ponta ta' Benghisa</td>
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<td>Mediterranean salt steppes (<em>Limonietalia</em>)</td>
<td>C</td>
<td>C</td>
<td>1</td>
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<tr>
<td></td>
<td>Thermo-Mediterranean and pre-desert scrub</td>
<td>A</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>West Mediterranean cliff top phryganas (<em>Astragalo-Plantaginetum subulatae</em>)</td>
<td>B</td>
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<td></td>
<td>Calcareous rocky slopes with chasmophytic vegetation</td>
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<td>A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Southern riparian galleries and thickets (<em>Nerio-Tamaricetea</em> and <em>Securinegion tinctoriae</em>)</td>
<td>C</td>
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<td></td>
<td>Endemic phryganas of the <em>Euphorbio-Verbascion</em></td>
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<td>B</td>
<td>B</td>
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<td></td>
<td>Mediterranean and thermo-Atlantic halophilous scrubs (<em>Sarcocornetea fruticosi</em>)</td>
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<td>C</td>
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<td>Reefs</td>
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<td>Arborescent matorral with <em>Laurus nobilis</em></td>
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### Table 5: SCI data in the Area of Study

<table>
<thead>
<tr>
<th>Location</th>
<th>Conservation Status</th>
<th>Global Assessment</th>
<th>Habitat Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salix alba and Populus alba galleries</td>
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<td></td>
<td>0</td>
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<tr>
<td>Annual vegetation of drift lines</td>
<td>C</td>
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<tr>
<td>Embryonic shifting dunes</td>
<td>C</td>
<td></td>
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<tr>
<td>Simar</td>
<td>C</td>
<td>1</td>
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</tr>
<tr>
<td>Mediterranean temporary ponds</td>
<td>C</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Coastal lagoons</td>
<td>C</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>I-Għar ta’ l-Iburdan</td>
<td>C</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

**Key:**

- A: excellent conservation status
- B: good conservation status
- C: average or reduced conservation status
- nd: no data

**Global Assessment in terms of the value of the site for conservation of the natural habitat type concerned - assessment of criteria including:**

- Presence of human activities that would affect the conservation status of the habitat type,
- The ownership of the land,
- The existing legal status of the site,
- The ecological relations between the different types and species.

- A: excellent value
- B: good value
- C: significant value
- nd: no data

<table>
<thead>
<tr>
<th>C: excellent conservation status</th>
<th>A: excellent value</th>
<th>B: good value</th>
<th>C: significant value</th>
<th>nd: no data</th>
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</thead>
<tbody>
<tr>
<td>Habitat Priority</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>1: habitat of priority</td>
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<td></td>
</tr>
<tr>
<td>0: habitat of lesser priority</td>
<td></td>
<td></td>
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</tbody>
</table>

(adapted from European Commission, 2009)
The commission of the European Communities identifies each Natura 2000 and SCI and SPA zones with a number of set criteria. The relevant data from these criteria was utilized to analyse the conservation value of the existing SCI designation within the chosen AoS.

Table 5 indicates that very few locations have an A for conservation status and global assessment. One site which has assigned an A for both criteria is il-Ballut tal-Wardija, a remnant Mediterranean woodland containing possibly the oldest trees in the Maltese Islands. Other sites with an assigned A criteria include coastal cliffs, which are relatively inaccessible for human manipulation, and rocky slopes with chasmophytic vegetation which have adapted to deal with extremely inhospitable environments as this vegetation grows mostly in rock crevices and thus this type of land was difficult to alter for productive agricultural use. The great majority of the other listed habitats were assigned either a B or a C for each criterion. This may result from a variety of factors, including the overall human influence in the Islands, the relative small extent of each habitat and inadequate or the lack of environmental management actions to sustainably conserve and protect these sites.

4.2 Specialist Involvement

As an additional validation method, four specialists were asked to select five areas, which according to their respective expertise are relevant for conservation within a Biosphere Reserve framework. Expertise of the chosen specialists included geomorphology, botany, ecology and heritage.
The coastal areas in the western part of the Island, the Marfa peninsula and Great Fault/Victoria lines and environs are the locations which were pointed out by the specialists, as zones of utmost importance for conservation in relation to the Biosphere Reserve criteria. The geomorphological significance of the Great Fault and the historical importance of the Victoria lines have already been mentioned. However the area is also an important agricultural location especially in the Bingemma and Dwejra area which is additionally an important location for local cultivar agriculture.

The Marfa peninsula was highlighted for both its ecological and botanical importance and also for its geomorphological significance. The Marfa peninsula and isthmus contains a number of sandy beaches such as ir-Ramla tat-Torri which host a number of unique species which have been eradicated elsewhere in the Island. Ras il-Qammieh and Rdum il-Qammieh are geologically significant in relation to the outcrops of the entire stratigraphic sequence, that is, all the Maltese rock types, and fossil beds present. The area is important for its coastal quaternary deposits, such as fossil dunes and raised beaches. Coastal quaternary deposits are rare in the Maltese Islands and the sequence at Ċirkewwa is quite typical (Hunt, 1997). In the isthmus area, the Ghadira Nature Reserve is a managed, largely modified saline marshland which hosts a number of important species, supporting the only European population of *Orabanche densiflora*, a very diverse entomofauna and an important resting and a foraging site for waders (Birdlife Malta, 2011; Schembri et al., 1987).

The coastal areas in the western part of the Island are topographic features of particular ecological importance. These vertical rock faces are shaped by either erosion or tectonic activity with boulder screes and other debris eroded from the rock.
face surrounding their base. As a result of the shelter provided by the physical properties of these formations, they afford a suitable habitat for many species of flora and fauna, most of which are endemic (Cassar et al., 2008). Other formations are also found in the western coastal area of Malta. These include sheltered sandy beaches forming between two headlands such as il-Bajja tal-Mixquqa and Ghajn Tuffieha. The latter inlet bay includes the Qarraba promontory, consisting of a remnant plateau of Upper Coralline Limestone with surrounding clay taluses and boulder screes (Cassar et al., 2008).

<table>
<thead>
<tr>
<th>Expertise</th>
<th>Conservation Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning/heritage</td>
<td>1. The Great Fault/Victoria Lines</td>
</tr>
<tr>
<td></td>
<td>2. Hagar Qim/Mnajdra/Filfla</td>
</tr>
<tr>
<td></td>
<td>3. Buskett, Verdala Palace, Ghar il-Kbir, Clapham Junction</td>
</tr>
<tr>
<td></td>
<td>4. L-Ahrax tal-Mellieha</td>
</tr>
<tr>
<td></td>
<td>5. Coastal cliffs of Western and Eastern part of the Island.</td>
</tr>
</tbody>
</table>

Table 6: Dr Malcolm Borg’s selection of localities for conservation value

<table>
<thead>
<tr>
<th>Expertise</th>
<th>Conservation Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botany</td>
<td>1. Imtaħleb area</td>
</tr>
<tr>
<td></td>
<td>2. Marfa Peninsula and Isthmus</td>
</tr>
<tr>
<td></td>
<td>3. Wied Babu/Wied iz-Zurrieq/Wied Hoxt and environs</td>
</tr>
<tr>
<td></td>
<td>4. Binġemma/Dwejra area</td>
</tr>
<tr>
<td></td>
<td>5. Ta’ Pennellu area</td>
</tr>
</tbody>
</table>

Table 7: Mr Edwin Lanfranco’s selection of localities for conservation value

<table>
<thead>
<tr>
<th>Expertise</th>
<th>Conservation Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geomorphology</td>
<td>1. Wied Babu area</td>
</tr>
<tr>
<td></td>
<td>2. Binġemma/Dwejra area</td>
</tr>
<tr>
<td></td>
<td>3. Ras id-Dawwara and ċirkewwa</td>
</tr>
<tr>
<td></td>
<td>4. Qarraba area</td>
</tr>
<tr>
<td></td>
<td>5. Filfla</td>
</tr>
</tbody>
</table>

Table 8: Mr Avertano Role’s selection of localities for conservation value
<table>
<thead>
<tr>
<th>Expertise</th>
<th>Conservation Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecology</td>
<td>1. Qarraba/Rdum Majjesa</td>
</tr>
<tr>
<td></td>
<td>2. Coastal Cliffs of Western part of the Island</td>
</tr>
<tr>
<td></td>
<td>3. Ħirkewwa</td>
</tr>
<tr>
<td></td>
<td>4. Great Fault/Victoria Lines</td>
</tr>
<tr>
<td></td>
<td>5. Qalet Marku</td>
</tr>
</tbody>
</table>

Table 9: Dr Sandro Lanfranco’s selection of localities for conservation value

4.3. Identifying areas of conservation value.

Figure 17: Diagram illustrating the overlaying of the digitized layers to identify areas of conservation value within the areas of study.
The discussed selection of digitized layers, including all of the criteria from the CVAC, spatial analysis and specialist involvement were digitally superimposed one above the other (Figure 17 and Figure 18). The resultant map was used to identify the zonation pattern needed to adopt a biosphere reserve in the Maltese Islands and hence study the feasibility of this type of protected area management. The resultant map was then studied to identify those locations with most superimposed layers (avoiding those areas of high levels of habitat loss and fragmentation), as core areas, whilst locations with lesser layers where then recognized as either buffer zones or transitional zones. In addition, aerial photographs and ground-truthing exercises were utilised to assign the appropriate zonation in accordance to with present landscape and land use patterns.
CHAPTER 5

ESTABLISHING THE BIOSPHERE RESERVE FRAMEWORK IN THE MALTESE ISLANDS
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5.1 Introduction

The conservation evaluation in chapter 4 enabled the identification of key locations which are valuable for conservation within the selected AoS. Areas encompassing a mosaic of ecological systems, biodiversity, geomorphological, and cultural significance were identified. These sites were analyzed by means of an evaluation of a conservation value appraisal criteria, using spatial analysis through a GIS system and by specialist involvement. These study criteria enabled the examination of the feasibility of implementing a biosphere reserve in the Maltese Islands.

Following the resultant studies and research, a map was developed indicating an appropriate zonation pattern, recognizing core areas, buffer zones and transitional locations according to the biosphere reserve framework (Figure 19). The assessment of conservation value highlighted the fact that certain sites were evidently of much greater conservation value in terms of ecology, geomorphology and heritage. Fifteen sites were identified as core areas, twelve sites as buffer zones and eight sites as transitional areas. The following is a detailed description and analysis of each site and their compatibility with the UNESCO biosphere reserve criteria.
Figure 19: Map illustrating the proposed biosphere reserve zonation in the area of study following the adopted research study.
5.2 Core areas

According to the Seville Strategy, the core area(s) should be “protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research and other low-impact uses (such as education)” (UNESCO, 1996: 4). Core areas should have a clearly defined boundary within biosphere reserves and are locations with the highest degree of legal protection. In most cases, core areas are designated in already existing protected zones (Méndez-Larios et al, 2006; Pollock, 2009). In fact, the majority of the proposed core areas are already protected area designations.

Figure 20: Wied Babu valley in Żurrieq
The main focus in core areas is nature conservation and protection of long-term ecological integrity. However, other ‘low impact’ activities (such as education) which do not harm the protected environment are permissible in these designations. The exact definition of ‘low impact’ uses varies with the conservation objectives of different biosphere reserve. These objectives should then be agreed upon by the involved stakeholders during the potential designation process (Pasquini, 2008).

The largest site designated as a potential core area, was the coastal zone on the western coast of the main Island, from il-Minkba to Ghajn Tuffieha inlet bay. The region is already protected as AEI of level 2 and level 3 and SCI under the habitats directive. These protected areas, however, include whole stretch of the coastal cliffs through to the area know as il-Ponta ta’ Benghis. The study concluded that the
stretch from il-Ponta ta’ Benghisa up to Hal Far includes areas of fragmentation and habitat loss mainly due to the presence of quarries and industrial buildings next to the coastal cliffs. The vicinity of such impacts to the coast inhibits the establishment of appropriate buffer zones, as required by the biosphere reserve criteria and thus the coastal cliffs of that region were not designated as core areas.

The area from il-Minkba to Ghajn Tuffieha includes a mosaic of habitats and ecological systems of utmost importance. This zone is mainly characterized by coastal cliffs. These cliffs are vertically plunging cliffs and are generally cutting in the Lower Coralline Limestone and usually lack shore platforms at their bases. These cliffs are vertical, rectilinear, forming an undercut notch at sea level and are probably tectonic in origin (Magri, 2006). The area also encompasses boulder screes, escarpments, calcareous rocky slopes with chasmopythic vegetation, riparian habitats and galleries found in Wied Babu (Figure 20), Wied Hoxt (Figure 22) and Wied iż-Żurrieq, Wied il-Gerżuma and Wied il-Bahrija, sandy inlet beaches in Ġnejna and Ghajn Tuffieha where the unique Qarraba promontory including the extensive Blue Clay talus slopes, is located (Cassar et al., 2008; Magri, 2006) (Figure 24).
The coastal inlet in Wied iż-Żurrieq is a partially drowned valley, typically known as calanque, of subaerial erosion (Magri, 2006). This proposed core area also includes a typical limestone cave subsidence structure, il-Maqluba located in Qrendi (Figure 23). Apart from the geological interest of this doline, it also supports a unique population of the Sandarac Gum Tree, *Tetraclinis articulata*, which is an endangered species on a European scale, amongst other species of interest (Schembri *et al.*, 1987). This proposed core zone also contains areas of significant richness diversity including the valley system in Wied Babu, Wied Hoxt and Wied iż-Żurrieq, Fawwara, and the Imtahleb and Bahrija area. The whole region is also a potential corridor for numerous bird species, particularly the coastal sheer cliffs. On the overlying escarpments, especially in the Dingli area, the geomorphological composition of the land may act as possible corridor for a number of terrestrial floral and faunal species. The region
above the escarpments is characterized by a series of abandoned fields, suitable as potential connecting corridors for plants and animals (Figure 27). The landscape of this proposed core area, is enriched by a number of locations which are significantly important for their heritage and cultural value. The area includes a concentration of curt ruts in Qlejgha, 17th century coastal towers in Żurrieq and the surroundings of Siġġiewi, and Megalithic temples of Mnajdra and Haġar Qim. Consequently, the landscape of the region is significantly important in ecological, geomorphological and cultural terms.

Two other proposed core areas are located in the north western coast of Malta. One of these locations is Il-Majjistral Nature and History Park (refer to chapter 3 section 3.1.3), which is already being managed by three local NGO’s and forms part of the
Natura 2000 network being an SAC zone. The other selected core zone is the coastal stretch of land from Rdum Majjiesa to Ċirkewwa. The area, is important for its geological characteristics, especially at Rdum il-Qammieh where the local geological stratigraphy can be visualized in outcrops on the coastal cliffs. Moreover the region is important for accumulations of fossilized remains, including coastal quaternary deposits. Hence, the site has the potential for subsequent research and study, this being an important aspect for the success of any biosphere reserve implementation. In addition, the saline marshland at Ta’ Qassisu is protected under local environmental protection as a level 1 AEI (Figure 25). Moreover, the lack of accessibility in these areas has resulted in a much minimized anthropic impact in the region, compared to the rest of the Island. This aided to maintain in the naturalness qualities of the region which is host to a number of diverse species. Moreover, the coastal sheer cliffs have the potential to act as connectivity corridors for avifauna and terrestrial species of flora and fauna.

The importance of the Marfa peninsula and isthmus has been highlighted in the previous chapter. In fact two other core areas are being proposed in the region. These are ir-Ramla tat-Torri to l-Imgharrqa coastal area and the Ghadira Nature Reserve. As its name implies, in the headland adjacent to the bay of ir-Ramla tat-Torri, there is a 17th century coastal tower, it-Torri l-Abjad (Figure 26). The sandy bay is very important as it contains one of the few remnant sand dune communities in the Maltese Islands. These embryonic dunes are the only locality in Malta for the Sea Spurge, *Euphorbia paralias* and *Echinophora maritima*, and other valuable populations of sand dune plants and associated fauna such as the sphecid wasps *Prionyx kirbi* and *Ectemnius sescinctus*, found only in this locality (Schembri et al., 1987). The adjacent
coastal cliffs, mainly Rdum tal-Madonna, also include low rocky shore platforms, cut in Lower Coralline Limestone forming a series of pools and lapiés (Magri, 2006). These cliffs act as habitats to the only Malta population of *Bepleurum semicompositum*, a large population of *Plantago bellardi* found only in the Marfa peninsula, possibly the only site in Malta for the *Mutilla barbara barbara*, a mutillid wasp of biogeographical interest (Schembri et al., 1987). These coastal cliffs are also habitats and corridors of ornithological interest. Apart from hosting the largest colonies in the Mediterranean of *Puffinus yelkouan* it also provides habitat to the National Bird of Malta, the Blue Rock-thrush, *Monticola solitarius*, locally known as il-Merill (Birdlife Malta, 2011; Schembri et al., 1987).

Figure 24: Il-Qarraba promontory and adjacent blue clay talus slopes
The managed and highly modified saline marshland at the Għadira Nature Reserve is also an important location for migrating birds, including waders, herons and egrets and a good wintering area for the *Podiceps nigricollis*, the *Tachybaptus ruticollis*, the *Rallus aquaticus*, the *Fulica atra*, the *Gallinula chloropus*, and the *Alcedo atthis* (Schembri *et al.*, 1987). This proposed area also serves as breeding habitat for the endangered species, the *Miliaria calandra* (Schembri *et al.*, 1987). Moreover, this natural reserve is host to more than ten rare and endangered floral species (Lanfranco, 1989).

Figure 25: Ta’ Qassisu boulder scree

L-Imġiebah and tal-Miġnuna, together with Tal-Blata/Rdum Rxawn coastal cliffs, next to Mistra Bay also resulted as two important areas for conservation value. Both coastal cliffs are protected as level 2 and level 3 under local environmental protection.
and are also part of the Natura 2000 SCI zone. Also, both sheer coastal cliff sites have the potential to act as corridors for avifaunal vegetation. In the region of l-Imġiebah and tal-Miġnuna, there are areas of abandoned fields which may also act as eventual corridors for terrestrial animal and floral species. At Ghajn Hadid there is another 17th century coastal tower overlooking the Imġiebah and tal-Miġnuna area. This region includes some rare and endangered species and the region is one of the only two localities in the Maltese Islands where cepses of *Quercus ilex* are found (Lanfranco, 1989; Schembri *et al.*, 1987). On the other hand, the l-Blata area is a habitat for the endemic snail *Lampedusa scalaris*. This location is also quite popular for certain outdoor activities, most notably camping and nautical sports. Hence, these activities could be better managed if they are adversely affecting the potentially protected core area (Pollock, 2009).

Figure 26: It-Torri l-Abjad and il-Bajja tat-Torri
The more accessible coastal areas around the Maltese Islands have been extensively anthropogenically modified and some valuable habitats have also been totally diminished throughout the centuries. Hence, it is of the utmost importance to protect the existing rare habitats found in the Islands as they support important local species which are only found in fragmented and/or small pockets. Examples include is-Simar and Salini (Figure 28), which are two of the very few remaining saline marshlands in the Maltese Islands, the latter being the most extensive. Both sites are being proposed as potential core areas of a biosphere reserve. Both regions include areas consisting of the garrigue habitat which are protected as level 2 and level 3 under local environmental laws. These areas are also listed as an SCI, part of the Natura 2000 network.

Figure 27: Abandoned fields in Dingli above escarpment; serving as potential corridors for flora and fauna. The image also shows the characteristic dry-stone rubble walls and ‘dura’- a small hut built by hunters.
The area locally known as l-Għadira s-Safra, found between Maghtab and Ghallis, is one of very rare freshwater wetlands/pools found around the Islands. The freshwater wetland is protected as level 1 and level 3 under local environmental laws and also as an SCI, part of the Natura 2000 network. The area supports very rare faunal species including the Tadpole Shrimp (*Triops* sp.) and other floral species, some of them endemic to the locality (Schembri *et al.*, 1987).

![Is-Salini saline Marshland](image)

Figure 28: Is-Salini saline Marshland

The proposed core areas of il-Buskett, Wied il-Luq and Girgenti area and the Wardija remnant Mediterranean forest are the only two designations which are not found in coastal regions. The Buskett, Wied il-Luq and Girgenti area is the largest proposed core area. The semi-natural woodland of il-Buskett is one of the most important extant woodland ecosystems in the Maltese Islands. Many woodland species are in fact only
known from the area. The woodland itself, acts also an important ornithological corridor for avifauna, including birds of prey such as the *Pernis apivorus* which use the woodland for roosting in the autumn migration season (Schembri et al., 1987). The woodland is also important in terms of heritage as the area was used as a hunting zone by the Hospitaller Knights of St John. In fact, in Buskett there is a 16th century palace, used as a hunting lodge and known as Verdala Palace. The adjacent Wied il-Luq, does not only act as a potential corridor for many riparian species, but is home to many rare and endangered flora and fauna, some of which are only located in this valley. The adjacent Girgenti is an important locality as substantial amounts of freshwater collect in the region. In fact in the area there is a profusion of the Reed Mace, *Typha latifolia* and other important water plants. L-Għar ta’ l-Inkwizitut is also located in Girgenti. The cave supports some very important and interesting cave fauna including bats and an endemic population of *Armadillidium aelleni* and *Chtonius girgentiensis* (Schembri et al., 1987). At Girgenti there is another palace built in the 17th century, known as the Inquisitor’s Palace; presently, it is utilized by the Office of the Prime Minister for specific meetings.

The significance of Wardija has been mentioned in the previous chapter. In fact, this remnant woodland is being proposed as a core area (Figure 26). Apart from hosting many important woodland species including endemic Mesogean pines (European Commission, 2009) the site is the habitat of, possibly, the oldest Holm Oaks, *Quercus ilex* that occur in the Maltese Islands. Wardija is already designated as level 2 as SSI and AEI under local environmental designations and an SCI under the habitats directive and it is part of the Natura 2000 network.
The last two proposed core areas are small islets off the coast of the main Island. Filfla is protected as a level 2 AEI and level 1 SSI in terms of ecology, geomorphology and ornithology, in addition to being an SCI and SAC under the Natura 2000 protection network. Additionally, Filfla is also protected under the Filfla Nature Reserve Act, established in 1988 (MEPA, ndb). Even though this small Island was used by the British Military for shooting practice, Filfla is important for many reasons. The Island host a number of faunal endemic species including the lizard (*Podaris filfolensis*) land snails, (*Trochoidea pyramidata despotti* and *Lampedusa gattoi*) and the endemic tenebrionid beetle (*Subterranea melitana*) (Schembri *et al* 1987). Filfla also hosts a number of bird species, such as the largest known Mediterranean colonies of *Hydrobates pelagicus*, the largest local colony of *Laarus argentatus michahellis* and a small colony of *Calonectris diomedea* where it uses the rubble screes beneath the cliffs (Schembri *et al*, 1987).

Selmunett Islands, limits of Mellieha, are also being proposed as a core area designation. These Islands are protected as SCI under the Natura 2000 protection, and as level 1 AEI, level 1 SSI (ecology) and level 2 SSI (geomorphology). The Islands support a thriving population of the wild rabbit and host an endemic race of lizards which are known only from this site (*Podarcis filfolensis kieselbachii*) (Schembri *et al*, 1987). On the Island there is also a St Paul’s statue and niche which are significant for their cultural value.

5.3 Buffer Zones
The zonation pattern of biosphere reserves is intended to promote biodiversity conservation and sustainable development, although only the core area is legally constituted to conserve biological diversity. The Seville Strategy states that the Buffer zone is used for “cooperative activities compatible with sound ecological practices, including environmental education, recreation, ecotourism and applied and basic research” (UNESCO, 1996: 4). The buffer zone and consequently the transition areas, are designed to reconcile trade-offs between conservation and development and address the pressures placed by local communities on the biodiversity resources of the reserve (Ma et al., 2009). There are numerous conceptual and spatial opportunities for establishing buffer zones in the studied AoS. The resultant proposed buffer zones where designated around or adjoining core areas and are largely dependant on the existing land uses. The many existing intensive land uses, most notably agriculture and tourism related activities, have the potential to be run sustainably. In terms of conservation ecology, the proposed buffer zones link core areas in a corridor-type pattern to possibly allow the movement of flora and fauna.

The proposed buffer zones are home to a variety of different land uses, the most prominent include agriculture and tourism. The sandy beach and environs of ir-Ramla tal-Mixquqa is an important attraction for both locals and tourists alike. Unlike the adjacent Ghajn Tuffieha, the bay is more accessible and there are a number of catering and entertainment establishments on the bay, also including a hotel. Another important touristic region is Ghadira Bay in Mellieha. Other proposed buffer zones are mostly composed of either agricultural or abandoned land. These areas are important for their potential connectivity purposes for both local fauna and flora.
For those Islands, namely Filfla and Selunett Islands, designated as core areas, it is being proposed that the marine area around them would serve as natural buffer zones. Hence, potential stakeholders using these marine areas, such as fishermen and scuba divers, should also be included in the potential process of the biosphere reserve designation. In the case of Filfla, marine scientific surveys are currently being carried out around the Island in order to identify if the marine zone qualifies as a potential SCI site under the Natura 2000 designations.

The main aim of the buffer zones in a biosphere reserve is to provide suitable protection for the ecological characteristics of the core areas. It is important that edge effects and ecological fragmentation are limited within buffer zones. This is done by adopting sustainable measures in designated protected regions. The idea of “cooperative activities with sound ecological practices” implies an emphasis on environmental sustainability (Pasquini, 2008:10). For example, it is important that agricultural activities would be monitored in order to avoid unsustainable activities such as overuse of artificial pesticides and fertilisers in agricultural land. In the tourism industry, a shift towards ecotourism must be introduced in order to minimize the impacts on the regions affected. Education and research would be an important characteristic in the designated zone. Educational courses to teach diminishing skills such as dry-stone rubble wall or girna building should be encouraged for the preservation and enhancement of the local landscape. Participatory involvement of local hunters and bird trappers should be encouraged to possibly involve all the potential stakeholders in the management of the protected area. Hence buffer zones should serve as areas for cooperation with the local land users to reach one main goal for sustainability.
5.4 Transition Zones

The Seville Strategy states that “a flexible transition area, or area of cooperation, may contain a variety of agricultural activities, settlements and other uses, in which local communities, management agencies, scientists, non-governmental organizations, cultural groups, economic interests and other stakeholders work together to manage and sustainably develop the area’s resources” (UNESCO, 1996: 4). The resultant transitional zones mainly include rural settlements and consequent agricultural zones found in the AoS. Locations include the cultural/historic villages of Rabat and Mdina, Dingli, Mellieha and small settlements and cluster of buildings next to ir-Ramla tal-Bir and Ramlet il-Qortin in the Marfa peninsula. The transition zones may be the most difficult of the three areas to implement, because according to the UNESCO Statutory Framework, it does not necessarily need to be delineated and does not require legal protection (UNESCO, 1996). The communities living in the region that wish to participate in the biosphere reserve may be are encouraged to make cooperative agreements to contribute to the overall goal of sustainability (Pasquini, 2008). Various instruments such as support programmes, water use regulations, rural development codes, hunting and fishing quotas, incentives for ‘green’ industries and services, etc., can all aid in reaching the said goal (Pasquini, 2008). Other activities which adversely impact the landscape and are found in relative vicinity of identified areas of high conservation value, such as quarries in the AoS were also included in the transition zone. The reason of including such sites in the protected area is to try diminishing the impacts and in certain cases halting those activities which are adversely affecting areas of high conservation value. Also, it is important to include all stakeholders
which are present in the region as the success of a potential biosphere reserve is very much dependant on the cooperation of those inhibiting and visiting the protected area.
6.1 Conclusions

The aim of this study was to reach one final conclusion. Is it feasible to implement the biosphere reserve concept within the Maltese Islands? This study tried to answer this question from a conservation value point of view. The research process chosen was to identify areas of significant conservation value in the Maltese Islands, in terms of ecological, geomorphological, and cultural value. The identified sites were then assigned zonation criteria to reflect the biosphere reserve framework as shown in Figure 19.

The Maltese Islands already have numerous locations designated as protected areas. In fact, many of the assigned location already are an SSI, AEI, Areas of Landscape Value and/or an SCI, part of Natura 2000 network. In addition, in the proposed biosphere reserve, there are two managed protected areas - il-Majjistral Nature and History Park and the Ghadira Nature Reserve. It is important that this entire network of protected land is managed, especially when considering population pressures and the small land area of the Maltese Islands. The proposed biosphere reserve would encompass all of these protected areas. This is not only advantageous from a management point of view but the proposed connecting buffer zones would not only act as possible ecological corridors between core areas, but they would also offer further protection to these sites. In addition, the inclusion of transition zones in the biosphere reserve would help to bridge the local populations with their surrounding environment. Good management of the biosphere reserve could serve to educate the
local populations about the importance of the protected area and the essential need to work together and reach the final aim of sustainability.

The anthropic influence can be detected everywhere in the Islands. Hence it is important that future approaches of protected area management must be compatible with both human needs and conservation. A requirement for such a goal is taking an interdisciplinary approach towards landscape conservation. Landscape conservation does not only take into account the ecological preservation, but it is also encompasses the unique geomorphology, Malta’s cultural heritage, traditional land uses and the numerous land pressures. Consequently, the biosphere reserve concept is definitely one model which could well fit to the Island’s needs. One of the major strengths of biosphere reserves is the flexibility of its zonation system. These zones can creatively be incorporated by respecting the local constraints and also using the local protection legislation. This flexibility is important in order to accommodate the existing diverse land uses.

However, the possible introduction of this reserve is not an easy task. The major issue is to find the financial resources to run the protected area. Managing a relatively large extent of land requires a funding system. The biosphere reserve network lacks an inbuilt funding mechanism, hence the financing of the protected area should be generated from local funds. The implementation of a biosphere reserve could introduce new sustainable activities to the proposed protected area. The introduction of ecotourism would help local land owners and farmers to diversify their income and could aid in funding for the managing and monitoring of the reserve. More tourists could visit the Island during the shoulder season without exerting extra pressures to
the local resources. One of the functions of biosphere reserves is research and monitoring. The proposed protected area would not only benefit from the sharing of research information through the World Network of Biosphere Reserves, but researchers and students would appreciate more the local landscape, in terms of what was lost and the importance to protect what we still have.

This study demonstrated that it is possible, from a landscape analysis perspective, to identify areas on the island of Malta that meet the criteria and zonation requirements for a biosphere reserve. The integration of several spatial analytic techniques (including GIS, ground-truthing, and expert ranking) provided a useful methodology for the requisite landscape analysis. Assessing the ultimate feasibility of implementing a biosphere reserve, however, must involve an analysis of the cultural, social, political, and economic factors that affect the designation of conservation areas and the regulation of human land use practices.

6.2 Recommendations

The conservation of landscapes, ecosystems, species, and genetic variation, is not the sole and only function of a biosphere reserve. Biosphere reserves incorporate a development function, which concentrates on fostering social, cultural and ecologically sustainable economic and human development to benefit local people and logistic support function, which facilitates research, monitoring, demonstration projects, education, and training related to local, regional and global issues of conservation and sustainability (Batisse, 1997). In particular, the UNESCO biosphere reserve model is not so much the space that is contained within its geographical

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boundaries, but about the institutions of collaborative management which the model demands are put in place to ensure that the model’s objectives can be ultimately reached (Sandwith and Lockwood, 2006). All the people involved and the different social groups should be included in the planning for the biosphere reserve right from the beginning (Mayerl, 2005). The study undertaken within this dissertation, that of scientifically identifying areas for conservation value to recognize the feasibility of a biosphere reserve, should then be coupled and married with a stakeholder involvement process, in order to find a common goal for the sustainability of the designated land and its environs.

Local stakeholders may comprise a whole spectrum of people from various walks of life. These may include land owners, resource users, farmers, hunters, bird trappers, locals using the area for recreational purposes ranging from sports, sightseeing, bird watching, hiking, owners of illegal boat houses and/or other illegal establishments amongst others. Establishing a biosphere reserve that implements these three functions and adheres to the zonation pattern needs also proper management initiatives and also entails creating legal and institutional mechanisms to establish cooperative agreement between the various stakeholders involved (Batisse, 1997). Hence, the involvement of local institutions such as MEPA, Local Councils, NGO’s and other groups and organisations in the management of the proposed reserve would be vital for its final success. The primary function of a biosphere reserve remains the conservation of biodiversity, but to achieve this, the designation should be seen as an innovative tool for the resolution of land and other conflicts in all the proposed zones, such as resource use, including water use conflicts, which implies negotiation and consent by all legitimate stakeholders, including the local populations (UNESCO,
Sound management of the biosphere reserve would depend on sharing a common vision and arriving at some kind of contractual agreement with all stakeholders that states what can or cannot be done in the different zones (Batisse, 1997).

Another important and fundamental issue when looking at the feasibility of introducing a biosphere reserve, is to have appropriate funding to achieve the aims and functions of the proposed designation. The potential usefulness of the biosphere reserve concept has not always been realized in practice for a variety of reasons, only one of which is that there is no internal funding mechanism associated with the concept (Lucas, 1992). This resulted in instances where there have been poor linkages between research and the protected area management agency whereas in other instances, intended research programmes have not been implemented (Lucas, 1992). UNESCO (2001) indicate and propose that the source of funding for biosphere reserves should be from NGO’s, Foundations, Bilateral Resources, Regional Economic Organisations and other International sources. This can be coupled with other sustainable activities which can be implemented in the proposed biosphere reserve. The encouragement of ecotourism and other low impact Hence, the feasibility of introducing a biosphere reserve in the Maltese Islands is also bound with other ‘external’ factors, which are still essential for the ultimate success of any protected area designation.
CHAPTER 7

REFERENCES


APPENDIX A
Dear __________,

I am currently examining the potential of implementing a Biosphere Reserve in Malta as part of my MSc dissertation research.

A biosphere reserve safeguards areas of ecological, geological, geomorphologic and of historic/cultural significance in its Core Zone enabling monitoring of such sensitive sites. Moreover, in the Buffer and Transitional zones, areas for research and development that is sensitive with respect to the sustainable use of resources, would be identified and properly managed. In addition, the Biosphere Reserve could aid to collectively organize all these protected areas under one umbrella for sustainable environmental resources management.

Currently I am mapping existing protected areas as designated by MEPA, within my selected study area (shown in the attached map). However I am also seeking complementary specialist expertise on areas of conservation importance within this region.

In this regard, I would be most grateful if you could pinpoint any areas that you deem of value or significance to conservation on the blank map attached. The map outlines my AoS (Area of Study). It would be most appreciated if you could assign numbers according to level of your perceived importance (1 (most important) – 5 (least important)). I would also be grateful if you could very briefly explain the importance of the indicated sites on the form provided.

Kindly do not hesitate to contact me if you require more information.

Thank you very much for your help.

Kind Regards,

Alexander Borg
Location of Il-Majjistral Nature & History Park - Mellieha