AN OUTLINE STRATEGY

FOR

IMPLEMENTATION OF A NATIONAL RESTORATION AND AFFORESTATION PROJECT

IN THE MALTESE ISLANDS

LOUIS F. CASSAR Ph.D.

&

ELISABETH CONRAD Ph.D.

OCTOBER 2014

Table of Contents

Executive Summary **4**

1. Introduction **5**

1.1. Report overview 5

1.2. Key terms 6

2. The biogeographical context of the Maltese Islands **7**

2.1. The Mediterranean setting 7

2.2. The Maltese Islands 9

3. The legal & policy context for planting & management of trees **13**

3.1. The Structure Plan for the Maltese Islands 13

3.2. Structure Plan Review topic papers 14

3.3. Local Plans 15

3.4. Guidelines on Trees, Shrubs and Plants for Planting and Landscaping in the Maltese Islands 20

3.5. Trees and Woodlands Protection Regulations & other relevant regulations 21

3.6. National Biodiversity Strategy 23

4. Afforestation and restoration efforts in the Maltese Islands **24**

4.1. Overview of efforts to date 24

4.2. Reflections 29

5. Key considerations for 'greening' strategies **31**

5.1. Fragmentation & connectivity 31

5.2. Ecosystem services 33

5.3. Ecological restoration 34

5.4. Urban green space 36

6. Project philosophy **37**

6.1. A holistic and integrated approach 37

6.2. Specific recommendations 38

7. Project implementation..... 41
7.1. Phase Two: Establishment of Core and Ancillary (Support) Teams 41
7.2. Phase Three: Site selection and evaluation.....42
7.3. Phase Four: Identification of goals/objectives and formulation of site plans ..43
7.4. Phase Five: Project implementation.....44
7.5. Phase Six: Project monitoring.....44
7.6. Project timeline 45
7.7. Final considerations.....46

References..... 47

Executive Summary

The Maltese Islands have experienced widespread urbanization and development over past decades, with resultant negative impacts on both natural habitat areas and on green spaces in general. As a result, there has increasingly been recognition both of the need to safeguard existing habitat areas, and of the possibility of extending the network of green areas through tree planting initiatives. The former is presently addressed through several conservation actions, particularly through designation of protected areas across the Maltese Islands. The scope for tree planting in the country is the subject of this Outline Strategy. While there have been several afforestation initiatives in the Maltese Islands over the years, there has not yet been a consolidated national effort to extend the coverage of wooded areas in a coordinated and systematic manner for both conservation and social ends; nor have there been large-scale attempts at implementing ecological restoration projects – these seek, not only to increase habitat and species coverage, but also to create self-sustaining and self-regenerating ecosystems in the long-term.

This Outline Strategy is thus intended to provide the basis for such a national afforestation and ecological restoration project; in this regard, this report considers the following:

(i) The biogeographical context within which tree planting efforts should be considered, with particular reference to Malta's central Mediterranean location and related ecological characteristics;
(ii) The legal and policy context relevant to planting and afforestation actions;
(iii) Afforestation/restoration efforts implemented to date and their respective successes and weaknesses; and
(iv) Critical ecological and social considerations which such a project should seek to address, including the urgency of mitigating fragmentation and enhancing connectivity, the importance of safeguarding ecosystem services, the scope for ecological restoration initiatives, and the socio-cultural need for urban green space.

Based on the above, the report outlines a strategy incorporating a spectrum of both afforestation and restoration actions within rural and urban areas, based on the principle that such a project should aim to maximize both social and ecological benefits to the greatest degree possible. Accordingly, the strategy proposed seeks to provide increased recreational space, to enhance exposure to nature in urban areas, to extend and buffer existing areas of natural habitat, and to increase the provision of associated ecosystem services wherever possible. The strategy includes an outline plan for implementation over six phases (initial strategy, team establishment, site selection and evaluation, identification of goals/objectives and formulation of detailed site plans, project implementation, and monitoring), with the involvement of a wide range of stakeholders from public, private and non-governmental sectors.

1. Introduction

1.1. Report overview

This report was assigned in August 2014 by the Ministry for Sustainable Development, the Environment, and Climate Change, with the brief of providing an overall strategy for afforestation efforts in Malta, taking into account the following key considerations:

- The extent and effectiveness of previous afforestation initiatives implemented in Malta;
- The long-term actions necessary to safeguard and manage existing sites; and
- The potential for woodland creation and management in new and suitable locations.

Additionally, and in accordance with the brief provided, this Strategy takes into account Malta's national Biodiversity Strategy, seeks to contribute to national actions related to climate change mitigation, and aims to support the improvement of quality of life through the provision of recreational spaces.

This report thus draws on the author's expertise in ecological sciences and landscape ecology in particular, and on his extensive experience in conservation and land-use planning, through public, non-governmental and academic sectors, both in Mata and overseas. The report also takes into account relevant literature related to afforestation in the Maltese Islands and draws on extensive field surveys conducted both prior to and during the compilation of this report.

The report is structured as follows:

Section 2 provides an overview of the biogeographical context of the Maltese Islands, their main ecological characteristics, and the relevance of these to the management of afforestation efforts in the Maltese Islands.

Section 3 outlines the legal and policy context relevant to trees and tree planting in the Maltese Islands.

Section 4 reviews afforestation experiences in the Maltese Islands to date, highlighting factors that have influenced their outcomes, positively or negatively.

Section 5 describes the 'philosophy' that should underlie management of existing sites and new afforestation initiatives, focusing on four key aspects, namely (i) fragmentation and connectivity, (ii) ecosystem services, (iii) ecological restoration, and (iv) urban green space.

Section 6 outlines key strategic considerations for the management and improvement of existing afforestation sites, and for the creation of new afforested/restored spaces.

Section 7 presents an outline framework for implementation in six stages: (i) initial strategy, (ii) team establishment, (iii) site selection and evaluation, (iv) identification of goals and objectives, and formulation of site plans, (v) project implementation, and (vi) monitoring.

1.2. Key terms

A **tree** is generally considered to have three fundamental characteristics: (i) it is a woody perennial plant, (ii) typically having a single self-supporting main stem (or in the case of coppiced trees, several stems), and (iii) with a more or less definite crown (Gschwanter *et al.*, 2009).

A **shrub** may be defined as (i) a woody perennial plant (ii) typically without a definite crown, (iii) generally ranging in height between 0.5–5 m, and (iv) often without a definite stem (Gschwanter *et al.*, 2009).

Afforestation refers to the establishment of trees on non-forested land. The term **reforestation** is also used for the same purpose, but the latter term refers to establishment of trees on land that had recent tree cover, while *afforestation* refers to tree planting on land that has been without forest cover for much longer (IPCC, nd).

Ecological restoration may be defined as attempts to fully or partially restore the components and processes of a damaged site or ecosystem to a previous historical state, to a contemporary standard, or towards a desired future condition (Gayton, 2001).

An **indigenous** species is one which is native to an area, i.e., one whose presence in an area is purely the result of natural processes, without human intervention.

Archaeophtyes are species which were introduced into an area in antiquity; while there is no fixed cut-off date, the term is often used for species introduced into an area prior to 1492, which marks the arrival of Christopher Colombus in the New World and the beginning of the *Columbian Exchange*.

An **endemic** species is a species restricted to a particular country or part thereof, and found nowhere else.

2. The biogeographical context of the Maltese Islands

2.1. The Mediterranean setting

The unique biota of the Mediterranean region is a product of the region's tectonic development and its geographical location at the intersection of two major landmasses; these created a dynamic set of climatic, geological and geomorphological conditions conducive to evolution of distinctive ecological assemblages (Grove and Rackham, 2001). Biodiversity in the Mediterranean Basin is made up of an intricate blend of extant biotic elements, derived from *in situ* evolution, and an influx of species from surrounding and distant regions. Such is its richness of biodiversity that the Mediterranean Basin is considered to be one of 27 biodiversity hotspots on the planet, i.e., areas that are of immense ecological importance but that are also facing a critical degree of threat, and that should thus be priorities for conservation. The Basin is also host to some ten 'mini-hotspots' that include coastal strips in Algeria and Morocco, the Rif-Betique mountain range in Spain, the area of Cyrenaica (Jebel Ahdar), the Tyrrhenian Islands, Cyprus, and others.

While the diversity of mammals and birds in the region is somewhat limited compared to that in other hotspots, the Mediterranean Basin is considered to be particularly important for its plant life. Some 25,000 plant species are found here (Myers *et al.*, 2000), with the significance of this figure becoming evident when it is compared to the 6,000 species of vascular plants that are found in the rest of Europe (outside the Mediterranean area), a land area more than four times greater in size. Furthermore, some 60% of these species are endemic (Thompson *et al.*, 2005), i.e., found nowhere else in the world, with this representing one of the highest levels of plant endemism found anywhere on the planet. Mediterranean islands are considered to be amongst the most important areas for development of species endemism. Virtually every island within the Basin has developed its own suite of indigenous species or subspecies - according to Médail and Verlaque (1997), Mediterranean island floras show percentages of endemism of 10-13% or ever higher.

The flora that today characterizes the Mediterranean region has been significantly altered over time. Formerly a quasi-unbroken continuum of evergreen, deciduous and coniferous forests, the Mediterranean now consists of a mosaic that includes patches of exposed, outcropping rock formations, cliffs and escarpments, mattoral formations, remnant parcels of forests and a suite of semi-natural and anthropic habitats (Quézel 1976a, 1976b; Blondel and Aronson 1999). It is estimated that only some 5% of original vegetation cover remains intact in the region (FAO, 2014). Remnants of the original forests are still represented in the Basin's present-day vegetation, with these including species of the genera *Ceratonia, Laurus* and *Chamaerops*, among others. While forest cover has been extensively reduced, the region is still considered to have a high degree of tree richness and endemism, with some 290 indigenous tree species, of which 201 are endemic (Conservation International, 2011). Patterns of limited species distribution are relatively common within the Basin, as may be

exemplified by trees of the genus *Abies*, *Arbutus* and *Tetraclinis*. For example, the Barbary Thuja, also known as the Sandarac Gum-tree or Alerce (*Tetraclinis articulata*), is a monotypic conifer whose remaining populations are restricted to the thermo-Mediterranean zone of northern Africa, together with a few mountainous localities in southern Spain and four to six localities in Malta. This long-lived conifer, designated the national tree of Malta, is a palaeo-relict whose closest surviving relatives occur in the subtropical forests of south-east Australia and nearby islands (Blondel & Aronson 1999).

Numerous Mediterranean tree elements that one encounters, such as *Olea*, *Myrtus*, *Phillyrea*, *Cistus*, *Quercus* cf. *ilex*, *Pinus* spp., *Abies* and *Cedrus*, began to colonize the Basin during the late Miocene and throughout the Pliocene. However, modern-day Mediterranean landscapes and the current organization of vegetation structures and formation are a direct consequence of climatic upheavals that occurred during the Quaternary (largely but not exclusively during the Pleistocene) and the subsequent modifications to the landscape by human agency during the Holocene; the latter has had a profound bearing on natural ecological equilibrium since the development of Neolithic society, particularly through farming and herding, and likely contributed positively to the emergence of biodiversity, in a manner typical of cultural landscapes. Thus, climatic changes which took place over several millennia and landform, together with anthromorphic elements, played a critical role – both directly and indirectly – in shaping arborial formations together with their associated assemblages, the shrublands and herbaceous scrublands.

Human impact in the region has thus long been an influence on ecology, and the level of impact has certainly not decreased over time. On the contrary, this has escalated to the point that Mediterranean biodiversity is now increasingly at risk from mounting pressures on natural areas, with these often leading to profound changes in land-use patterns and to habitat loss and degradation. The emergence of milder climatic conditions after the last Ice Age facilitated demographic growth in the Region that led to intensified exploitation of land resources and to the loss of the 'sustainable balance' that had been attained as a way of life in previous millennia. Among the land-use changes induced was a massive reduction in forest cover.

Over the last decades, the richness and diversity of the flora and fauna, much dependent on the maintenance of stable and functioning marine and terrestrial ecosystems, has diminished noticeably. As a consequence of anthropic disturbance, biotopes are degraded, food chains disrupted and entire ecosystems irreversibly damaged. Such wholesale degradation of the Mediterranean's ecosystems can have serious and far-reaching effects, notably the loss of essential functions in the balance of ecosystems, reduction in goods and services provided, and species extinction. Present-day trends of waste generation and degradation have led to reduced regenerative capacities of natural systems. As a result, the capacity of Mediterranean ecosystems to replenish resources and absorb waste, will eventually be outpaced by over-exploitation and misuse of resources, constraining future economic growth and development in the region. Ironically, economic activities such as agriculture and tourism, which largely

depend on the vitality of ecosystems and landscape integrity, are likely to suffer if haphazard development region-wide is not contained. Moreover, a further loss of species will diminish the aesthetic value of the region, a factor that may have an unquantifiable effect on future generations (Cassar, 2010). It is worth pointing out the multiple benefits that biodiversity affords, including the maintenance of ecosystems in the long-term, utilitarian benefits related to the economic value of nature's products and humankind's dependence upon them, and spiritual and aesthetic services to humankind.

In spite of providing these important services, Mediterranean natural habitat areas (wooded areas included) have been severely impacted by many human activities, but particularly by urban development and by the demands of an increasingly consumptive population. Population growth is mostly concentrated in coastal and urban regions, a demographic pattern which in itself produces significant pressures on environmental sustainability. Tourism is also a major source of impact, with the Mediterranean catering for some 32% of the world's tourists, despite having only 6.5% of world land mass. Additional sources of pressure include the intensification of agriculture and overexploitation of natural resources. The impacts of these activities are further aggravated by the water scarcity that characterizes countries in the region and by soil degradation problems. Climate change is also expected to exacerbate pressures on biodiversity, with projections for the region predicting even warmer and drier conditions that may lead to shifts in bioclimatic regions and increased water stress for both vegetation and human society. More indirect and complex impacts may also be expected; for example, it has been suggested that a change in the timing of plant flowering could reduce the availability of pollinators, with potential consequences for agricultural production. Similarly, carbon storage by vegetation could decrease under conditions of climatic stress.

Given the above, it becomes crucial to (i) ensure effective protection of the remaining natural habitat areas in the region, and (ii) extend the integrity of ecosystems to enhance their resilience to change and to ensure that these will be able to continue to provide humanity with the fundamental services to essential to our well being. In a region with such a long history of human impact (both positive and negative), reaching these objectives will mean not only instituting protective measures but also remedial measures – the afforestation and restoration activities being discussed in this strategy constitute an example of the latter.

2.2. The Maltese Islands

The Maltese Islands harbour a rich biodiversity, with some 2000 species of plants and over 3000 species of animals recorded to date, and with representative ecological populations and communities from the three continents that border the region - Europe, Africa and Asia – even if a high percentage of species present are of Euro-Mediterranean origin. There are several terrestrial ecosystem types, with woodlands, particularly, the order **Quercetalia ilicis**, representing the highest successional sere that can develop in

the central Mediterranean climatic regime.

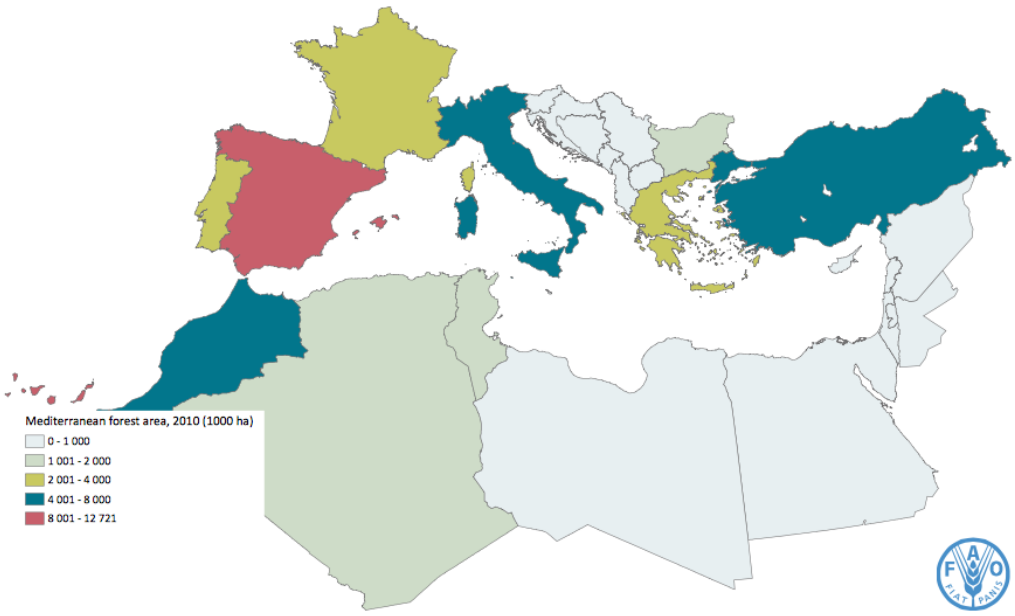
It is thought that, prior to being settled by humans, the Maltese Islands would have supported relatively extensive tracts of Mediterranean sclerophyll forest, dominated by species such as the Holm Oak (*Quercus ilex*) and Aleppo Pine (*Pinus halepensis*). Fossil evidence of this theory has been cited by several authors (e.g. Evans, 1971; Zammit Maempel, 1977, 1982; Pedley, 1980; Hunt, 1997). Once the Islands were settled, however, extensive deforestation took place to make space for farmland and habitation, and to provide timber as fuel. Meantime, grazing by domestic animals made it extremely difficult for young tree growth to survive, with these factors resulting in a near complete loss of Maltese forests.

Within the Mediterranean region, Malta has one of the lowest levels of forest coverage (Figure 2.1), presumably a combined result of the country's small size, extraordinarily high population density, and long history of human habitation, leading to a large human footprint and extensive anthropicization of the land. The only remaining forest remnants occur in localized pockets (with four particular copses of significant age). The only significant extent of mature woodland in the Maltese Islands now occurs within Buskett, where as noted below, the naturally-occurring woodland was enlarged through afforestation efforts during the rule of the Knights of St. John.

It was during the rule of Grand Master La Valette (1557-1568) that the Bosketto area began to be used for the rearing of local falcons in connection with an in-part fulfillment to a condition, laid by the Viceroy of Sicily, to present him with a falcon on an annual basis. Grand Master Verdalle (1582-1595) erected a massive fortified palace on the valley's upper, northern flank, and continued to afforest the valley slopes, while the reign of Grand Master Lascaris (1636-1657), who is largely responsible for the current layout, saw the development of orchards and vineyards as well as the planting of conifers.

As a consequence of a relatively significant abundant water supply at the headwaters of the catchment around the Hal-Tartarni area (a village that existed at the time close to Dingli and which, notwithstanding its small size, was elevated to the dignity of a parish around 1436), Lascaris also ordered the installation of a number of water fountains and an irrigation system that channeled water across tracts of the established gardens. He was also responsible for the creation of two large ponds (il-Bahar ta' Fuq, and il-Bahar t' Isfel), in which the Knights engaged in boat races for the purpose of leisure – that is how much water, it seems, flowed through Wied il-Luq at Buskett at the time!

Figure 1: Coverage of forests in the Mediterranean region (FAO, 2014)



Quercus ilex forests would normally support an undergrowth of smaller tree species and shrubs of various dimensions, many of which are also characteristic of maquis assemblages[1], while coniferous woodlands would tend to lack a significant understorey. Maquis assemblages, which, in the Maltese Islands, typically occur in somewhat sheltered environments such as valley slopes and boulder screes (*rdum*), do not constitute woodlands in the strict sense of the term, but consist of smaller trees and tall shrubs; these assemblages, which may occur naturally but also a result of secondary succession following deforestation and subsequent re-growth of woodlands, are also of relevance to this report.

Species typical of the archaeophytic maquis include trees/large shrubs such as the Carob (*Ceratonia siliqua*) and Olive (*Olea europaea*), while components of naturally-occurring maquis (and, in cases of clearance and subsequent re-establishment, semi-natural assemblages) include the Lentisk (*Pistacia lentiscus*), Bay Laurel (*Laurus nobilis*), Myrtle (*Myrtus communis*), Hawthorn *(Crataegus monogyna*), Terebinth (*Pistacia terebinthus*) and Mediterranean Buckthorn (*Rhamnus alaternus*). The undergrowth within these areas typically includes species such as the clambering Spiny Asparagus (*Asparagus aphyllus*), Yellow Germander (*Teucrium flavum*), the scaling Smilax (*Smilax aspera*) and Bear's Breeches (*Acanthus mollis*). Maquis elements are widespread throughout the Maltese Islands, albeit restricted in size. In particular, maquis assemblages occur within those regions that provide a craggy karstic topography, as is prevalent in the hillier parts of Gozo (where the maquis is mostly made up of archaeophytic species) and the north-western segment of the main island. The

[1] Most often the species composition of the sclerophyll forest and the Mediterranean maquis, within the Thermo-Mediterranean zone, is comparable; they differ mostly in terms of size (height attained) and density, with the maquis being essentially lower and with denser overall coverage, largely, as a result of edaphic factors and, to some degree, the level of exposure.

Sandarac Gum Tree, Malta's national tree (*Tetraclinis articulata*), forms a hardy coniferous maquis, which can survive in relatively shallow soils within significantly exposed karstland; however, few populations of this species persist in the wild in Malta, with the most notable metapopulation (numbering around a hundred individuals), occurring within the Ta' Pennellu region, in the limits of Mizieb/Mellieha.

3. The legal & policy context for planting & management of trees

3.1. The Structure Plan for the Maltese Islands

Tree planting in Malta has to date been guided by specific policies and laws issued under relevant frameworks for environmental protection and spatial planning. In the case of the latter, policies regarding tree protection and afforestation were included in the 1990 Structure Plan for the Maltese Islands prepared by Buchanan & Partners and Generale Progetti SpA (even if afforestation initiatives had already taken place in prior decades, as discussed in Section 4 below). Of particular importance are rural conservation policies RCO 6 and RCO 30-33, which are reproduced in Box 3.1 below for ease of reference, with additional remarks by the author in blue text.

Box 1: Structure Plan policies relating to afforestation

Policy RCO 6: Following the adoption of the Local Plans for Rural Conservation Areas, the Planning Authority will institute a programme of enhancement and management in conjunction with the Ministry of Agriculture and the Secretariat of the Environment comprising:

1. Afforestation and landscaping schemes…

Relevant detailed guidance is provided in the seven Local Plans concerning a variety of relevant aspects, including the siting of afforestation areas, the safeguarding/upgrading of open spaces, the implementation of soft landscaping schemes, and the provision of informal recreational spaces for residents; (relevant policy maps are reproduced in Annex 1). However, Local Plans do not in general provide detailed guidance for long-term maintenance and management of afforested sites. Key points highlighted in the afore-mentioned local plans are discussed in Section 3.2 below.

Policy RCO 30: There is a general presumption against the siting of afforestation projects where stable indigenous (native species) natural vegetational communities are already established, but encouragement of the siting of afforestation projects on abandoned agricultural land and on derelict ground will be given.

This presumption concerning appropriate siting of afforestation projects appears to have been consistently applied, with no such projects implemented on areas of established natural vegetational communities; however, there have not yet been widespread efforts to afforest abandoned agricultural land, even if this possibility is also discussed in a number of Local Plan policies.

Policy RCO 31: Afforestation project sites in non-urban areas will make use only of indigenous and archaeophytic (brought by man in prehistoric times, and now naturally occurring) species. The use of exotic (not native to the country) species will be limited to urban areas.

This policy has been implemented primarily through the adoption of the *Guidelines on Trees, Shrubs and Plants for Planting and Landscaping in the Maltese Islands* in 2002, and their subsequent application to development projects; these guidelines are discussed in Section 3.3 below.

Policy RCO 32: The planting of appropriate species of trees will be encouraged where they enhance the landscape, particularly along roadsides, where they provide a screen to visually unattractive areas, and alongside footpaths where they provide shade. Species which attract birds will be encouraged in suitable locations.

Trees have been planted for soft landscaping/visual screening purposes in a variety of both public and private sector development projects; however, there is certainly much scope for more widespread tree planting for these purposes, particularly for screening of unsightly development and for the provision of shade, as noted in this policy. Trees which attract birds have been planted primarily in rural areas, driven by efforts to attract avifauna for hunting and trapping; while native species have been used on some occasions, much of this planting has made use of exotic species (notably fast-growing *Eucalyptus* sp.), in direct conflict with the provisions of the above-mentioned Policy RCO 31. Artificial stands of such exotic trees within the rural context (as commonly found in the Gozitan countryside, mostly within embayments that occur beneath ridgelines and escarpments, for example) also have detrimental impact on landscape integrity.

Policy RCO 33: Specified individual trees or groups of trees of aesthetic, historical, cultural, arboricultural, and/or scientific interest will be protected by means of the Tree Preservation Orders which prohibit the uprooting, destruction, or damage to trees growing in the wild and in public parks, gardens, and other spaces, or on private land, and regulate any other activity which may cause harm or death of such trees.

In addition to Tree Preservation Orders outlined in this policy, the protection of specific trees or groups of trees has also been established through the provisions of the Trees and Woodlands Protection Regulations (2011), the List of Historical Trees having an Antiquarian Importance Order, and the Conifer Trees (Preservation) Regulations – these are discussed in Section 3.3 below.

3.2. Structure Plan Review topic papers

A series of topic papers were issued during a process of reviewing the Structure Plan for the Maltese Islands discussed above; relevant topic papers include those addressing Leisure & Recreation, Landscape, and Rural Strategy.

Leisure & Recreation Topic Paper
The Leisure & Recreation Topic Paper discusses six categories of recreational activities, of which the most relevant to this strategy is informal outdoor recreation. Both rural and urban recreational facilities discussed in this report are of relevance. The Topic Paper makes reference to several initiatives implemented to develop amenities such as public gardens and playgrounds, but refers to a Public Attitudes Survey carried out in 1999 to show that public demand for such spaces is still not adequately met. Eighty-three percent of respondents to the survey in question felt that there should be more recreational facilities, such as parks and public gardens, in their respective localities, while 91% of respondents agreed that "there should be more trees in my locality".

Landscape Assessment Study of the Maltese Islands
The Landscape Assessment Study refers to the lack of trees in the Maltese Islands as one of the most evident marks of human impact in the country, noting however, that there have been numerous attempts to reintroduce trees, including trees planted for their produce, trees planted to provide shade and shelter, and trees planted for decorative or ceremonial purposes, particularly in private gardens and on roadsides. The report discusses several afforestation initiatives conducted in the Maltese Islands since the 1950s – these are discussed in more detail in section 4 of this report – and highlights afforestation of appropriate species on specifically identified degraded habitats as a relevant

policy objective. The report also highlights the landscape implications of Malta's dearth of trees, noting that while masses of trees tend to block access to long distance views, their relative absence tends to, conversely, promote such views.

Rural Strategy Topic Paper
This topic paper (issued in 2003) notes that there were no large-scale afforestation projects during the Structure Plan period, even if such projects are required, particularly in degraded areas or areas very close to urban settlements. The Rural Strategy paper notes that such afforestation efforts are important for several reasons, including relieving pressure on more ecologically sensitive areas, mitigating the impact of urbanization, and improving quality of life. The same topic paper further highlights the fact that, even if developments in rural areas are required to mitigate visual impacts through appropriate landscaping, the amount of wooded land remains very limited and afforestation projects should therefore be *"encouraged and managed for the enjoyment of the public*".

3.3. Local Plans

The seven Local Plans, which provide a detailed framework for future development of different geographical regions of the Maltese Islands, include several provisions directly or indirectly relating to tree planting and afforestation, as outlined below.

Gozo and Comino Local Plan (August 2006)

The Gozo and Comino Local Plan (GCLP) notes that, while Gozo is often considered to be greener than Malta, there is nonetheless a severe lack of mature trees on the island. The GCLP makes a number of proposals for new afforestation areas (see Map A1, Annex 1), but notes the importance of planning for water provision (for irrigation) for these through the construction of appropriately-screened reservoirs or the digging of boreholes. The Local Plan emphasizes the importance of afforestation projects being guided by ecological principles, noting that these should not be monocultures, nor should they be considered as public gardens. In areas where recreational uses are envisaged, the Local Plan advocates for the provision of rubbish bins and fire fighting points; the plan further notes that afforested areas should not be made accessible to vehicular traffic, although very limited access to emergency vehicles may be planned for on a case-by-case basis.

Author remarks: Of the proposed afforestation areas highlighted in Map A1, relatively few have benefited from tree planting initiatives to the degree outlined in the Local Plan; this is clearly evident both from visits to the sites as also from recent aerial photography. A notable exception on Gozo is the Blue Clay slopes area beneath Fort Chambray, which has seen tree planting activities through recent joint initiatives of the Ministry for Gozo and the HSBC Malta Foundation, as also tracts of land on Comino, including in the vicinity of Wied Ernu; the technique of ripping, involving the excavation of relatively shallow linear

furrows within karstic terrain, was used in the latter case some decades ago. In other cases, the proposed afforestation areas remain generally devoid of wooded tree cover.

Central Malta Local Plan (August 2006)

The Central Malta Local Plan (CMLP) discusses afforestation primarily within the context of protection of Strategic Open Gaps (Map A3, Annex 1), with objectives for these including

"*maintaining and enhancing attractive landscapes and the improvement of derelict land through habitat recreation, rural afforestation and soft landscaping schemes where appropriate, nature conservation and improved presentation of important habitats (where appropriate)…and providing opportunities for public informal recreation in appropriate locations*."

The Local Plan notes that central Malta is heavily urbanized and that strategic open gaps thus take on a particularly important role to offer 'respite' from townscapes, with the importance of this role only likely to increase with a forecasted increase in urban density. It further points out the necessity of cooperation between local councils and all other relevant agencies to manage and enhance these Strategic Open Gaps. In addition to these points, CMLP Policy LJ 07 makes specific provision for afforestation at a site in Triq il-Mosta, Lija, where several old olive trees are already present; the area serves as a buffer between residential and industrial/commercial areas.

Author remarks: With reference to the above-mentioned Policy LJ 07, additional tree planting does not appear to have been carried out in the area indicated to date. Given the historical and cultural value of these trees, which can easily be considered to have monumental status, it is critically important that these are safeguarded at a minimum. While the existing agricultural use of surrounding tracts of land can be considered to be compatible with the protection of these trees, the growth of grasses during fallow periods may pose a potential fire hazard. The possibility of additional tree planting here may need to be reevaluated, taking into account the potential for expansion and other relevant considerations, such as land ownership. In more general terms, the point noted in the Local Plan with regard to the important role of open spaces within these townscapes remains pertinent, particularly given an increase in the built footprint of this region since publication of the Local Plan and the destruction of a number of private gardens within towns and villages due to development.

North Harbours Local Plan (August 2006)

The North Harbours Local Plan (NHLP) discusses afforestation primarily in the context of issues relating to leisure and recreation. Among other things, the NHLP highlights the need to protect public and private open space and

availability of public access, the need to provide afforestation initiatives in urban fringe areas, and the need for management and responsible agencies for implementation. Similarly to the CMLP, the NHLP notes the critical importance of open space but the severe absence of it, particularly in the inner coastal belt of this Local Plan area, i.e., in Sliema, St. Julian's, Paceville, San Gwann, Msida and Gzira. Indeed, the NHLP calculates the availability of open space (in the NHLP considered to include gardens, public gardens and sports grounds) within the Local Plan area to be limited to 0.33 hectares per 1000 individuals. The plan includes relevant policies focusing on upgrading of public open spaces (NHSE05) and soft landscaping (NHSE06) (see also Map A4, Annex 1). It notes specifically that "*the urban environment will be substantially improved by the introduction of more trees particularly in densely built-up areas".* On a related point, the NHLP highlights quality issues with some residential environments, with one of the factors of concern being the lack of open/play spaces.

Author remarks: The pace of development in the North Harbours area has been very rapid, particularly in locations such as Sliema, with a consequent increase in urban density and resulting congestion. The provision of urban green space thus takes on particular significance as a mitigatory measure to improve the quality of life of urban residents; as noted in the NHLP, remaining open spaces should be strictly safeguarded, not only for aesthetic reasons, but also with regard to spatial planning and civil protection considerations. For example, should Malta be significantly impacted by seismic events, with consequent damage to infrastructure, lack of open space will hinder rescue operations and is likely to be a factor that may potentially lead to higher casualties. In addition to the strict protection of remaining open areas, however, it is also important to use all available avenues for increasing tree coverage even within areas that are *already* intensely developed, for example along existing promenades and in traffic islands (the use of appropriate geo-textiles in order to prevent damage to road surfaces and underground infrastructure by rooting systems may be necessary). A further subject of particular interest to these dense urban environments is the greening of roofs and buildings, as discussed elsewhere in this report.

North West Local Plan (August 2006)

The North West Local Plan (NWLP) area includes a number of wooded areas, including original forest remnants at Il-Ballut (Wardija), Il-Ballut ta' l-Imgiebah, Ta' Baldu/Wied Hazrun and Il-Bosk, and afforested areas in Mizieb, l-Ahrax tal-Mellieha, Dwejra, Mtarfa, Mgarr, Qammiegh and Ghajn Tuffieha, among others. Notwithstanding, the NWLP strategy strongly advocates further tree planting, noting that various negative landscape impacts (e.g. related to dumping and quarrying) are exacerbated by the relative absence of trees in the landscape, and suggesting that the planting of trees around the edges of built-up areas would have positive visual effects. The strategy proposed in the NWLP with regard to trees thus includes the identification, protection and maintenance of afforested areas. Additionally, the Local Plan makes provision for afforestation projects on abandoned or derelict land as well as within reclaimed quarry areas. Specific initiatives include the designation of Woodland Conservation Areas (Policy

NWCO 10), comprising forest remnants and semi-natural wooded areas, within which no development is to be permitted and the planting of indigenous trees encouraged, if appropriate (see Map A5, Annex 1). Passive recreation activities (such as walking, bird watching, and picnicking) are considered to be compatible with these conservation areas. On a different note, the same NWLP recognizes that misguided afforestation efforts have also had negative impacts on garrigue ecosystems within the Local Plan Area.

Author remarks: The Woodland Conservation Areas proposed in the above-mentioned Policy NWCO 10 do not appear to have been implemented to date; given the existence of other protection designations (e.g. Tree Reserves) established through relevant regulations and discussed elsewhere in this report, there does not appear to be a critical need for formalization of this designation. Nevertheless, the safeguarding of the areas in question is imperative, particularly given that the forest tracts in this Local Plan area represent the only intact remnants of the Mediterranean forest cover, which would once have extended to other areas. This Local Plan area also affords perhaps the most extensive possibilities for afforestation and restoration actions, given both its size and the persistence of rural and semi-natural land areas. The strategy for this region should thus focus both on protection of existing trees and spaces, as also on extension, both on adjacent land and in intermediate locations, the latter with a view to creating stepping stones for connectivity – the subject of connectivity is discussed further in Section 4 below.

South Malta Local Plan (August 2006)

Similar to other Local Plans, the South Malta Local Plan (SMLP) notes the prevalence of high density urbanization within the region, with only some 5% of the urban zone in the Local Plan area taken up by open space; this level of urbanization is considered to have a detrimental impact on the quality of life of residents and on the quality of the urban environment; accordingly, the SMLP notes that the provision of greenery is important to improve the amenity of the area. The strategy advocated is thus that of, not only retaining all existing public urban open space, but also providing additional areas for community use, as and where appropriate. The SMLP specifically advocates the development or upgrading of public urban open spaces within designated areas, while noting that only limited interventions should be permitted within public green areas (such as provision of seating or landscaping), and no development at all should be permitted within private garden green areas. Through Policy SMSE 09, the SMLP also makes provision for a programme of enhancement and landscaping within urban settlements, including through the planting of appropriate species of trees and shrubs. Specific areas where tree planting could be carried out include (i) in squares, traffic junctions, and public urban open spaces, (ii) along main transport corridors and pedestrian routes, (iii) in town centres and housing estates, (iv) for screening visually unattractive areas (including in industrial settings), and (v) along settlement boundaries. Specific plans for afforestation are discussed with reference to the area surrounding the Addolorata Cemetery and at a site in Hal Far.

Author remarks: The proposed afforestation interventions in Addolorata and Hal Far do not appear to have been implemented to any significant degree to date; the creation of a park as proposed in the SMLP would undoubtedly have significant social and amenity value. Some actions relating to the proposed programme of enhancement and landscaping within urban settlements can be considered to have been carried out, with, for example, embellishment of traffic islands and roundabouts in recent years. However, this would appear to be a far cry from the extensive planting measures advocated in the SMLP and there remains substantial scope for widespread planting within the five categories of locations highlighted above.

Marsaxlokk Bay Local Plan (May 1995)

Policy ME03 of the Marsaxlokk Bay Local Plan (MBLP) focuses specifically on afforestation, stating the following: "*For agricultural, recreational and landscape improvement purposes, a programme of afforestation in the form of structural planting will be undertaken".* The policy notes the importance of using indigenous and archaeophytic species and of avoiding established vegetation communities and maquis/garrigue areas. The MBLP focuses in particular on planting in three types of locations: (i) along footpath routes, (ii) in major industrial zones, and (iii) in agricultural areas. In the first case, the Local Plan proposes a recreational footpath network, along which picnic places will be provided, with planting efforts concentrated at these locations. Tree planting in industrial zones is considered to be important for both visual screening and worker amenity purposes, while tree planting in agricultural areas is seen to be relevant to improving growing conditions for field crops, as well as improving the quality of the rural landscape. Local Plan policy ML04 makes specific provision for extension and enhancement of pre-existing tree planting areas on the St. Lucian Peninsula, while policy MV05 plans for tree planting to take place upon reclamation of the site at Il-Mara and its redevelopment as a camping area. Tree planting is also discussed as a measure for the creation of shading along the promenade in Triq San Patrizju, Birzebbuga (Policy MB24).

Author remarks: The Marsaxlokk Bay Local Plan paid substantial regard to the subject of afforestation, as can be noted above; however, implementation has not quite kept pace with initial plans, with several of the above-mentioned plans remaining on paper, or not fully implemented. A number of tamarisk trees are present along the Birzebbuga promenade; however, these do not quite meet the objective of providing shade due to their limited size and growth pattern.

Grand Harbour Local Plan (April 2002)

The Grand Harbour Local Plan (GHLP) recognizes several benefits of tree planting, including mitigating pollution and greenhouse gas emissions, improved aesthetic appeal, increased recreational and play opportunities, the provision of shade, and the sustenance of wild flora and fauna. Policy GE03 makes provision for the protection of formal and informal open spaces from development; the

Plan notes that while regeneration and redevelopment are important to revitalize the region, there is a need to balance the latter with protection of open land. The complementary policy GE04 describes the implementation of a programme of afforestation for amenity, recreational and landscape improvement purposes, particularly (i) on the edge of existing settlements, (ii) adjoining main transport corridors, (iii) near extensive sports/recreational areas, (iv) along the perimeter of major development sites, and (v) along long-distance footpaths and heritage trails. Policy GC07 targets the improvement of existing afforested land within the Local Plan area to provide managed picnic and recreational woodland areas; these tracts of land include expanses of mature trees, such as for example the pinetum at Pieta' planted on the Floriana bastion glacis and adjoining avenues and ramparts. The Local Plan notes that the neglect of these areas is an issue in terms of anti-social practices, with related suggestions including the provision of hard landscaping, lighting or fencing, if and where appropriate.

Author remarks: There has not, to date, been any systematic programme of afforestation in the Grand Harbour area along the lines outlined in the above-mentioned local plan policies. Similarly, some of the issues highlighted in this report, e.g. anti-social practices in neglected afforested areas such as the Pieta/Floriana pinetum, remain relevant, and there are few picnic and recreational facilities, with substantial scope remaining for their enhancement.

3.4. Guidelines on Trees, Shrubs and Plants for Planting and Landscaping in the Maltese Islands

The Guidelines on Trees, Shrubs and Plants for Planting and Landscaping in the Maltese Islands, issued in 2002, are intended to provide guidance for environmentally-sound planting and soft landscaping schemes. They outline key considerations for ensuring successful planting projects, highlighting points such as the need for planting density to be appropriate for allowing non-stunted tree growth, the need to make allowances for the increased size of trees at maturity, the importance of planning for irrigation and of having a maintenance programme in place, etc. The guidelines also aim to ensure compatibility with the environment, and in this regard, distinguish between species of trees that are considered suitable for planting in urban areas and other species of trees that are considered to also be appropriate for use in the rural environment.

With reference to the rural environment, the guidelines note that trees or plant species used should be characteristic of the habitat in question, that unnatural combinations of species should not be used, and that large-scale monocultures and rectilinear plantations should likewise be avoided, both for visual and ecological reasons. Instead, the guidelines advocate the use of tiered planting that includes understory vegetation. Appendix 3 to the Guidelines lists species that may be used within such rural areas, including outside development zones and in urban fringes, while Appendix 5 lists species that should not be planted within the rural environment. It is of interest to note that a number of species listed in this Appendix were actually used within early afforestation schemes in

the rural environment (e.g. *Acacia* sp.) and/or planted in the countryside in more recent years (e.g. *Eucalyptus* sp.). Appendix 6 further provides a list of trees and plants that are considered suitable for non-crop planting on agricultural land.

Guidelines for planting in urban areas include the avoidance of exceedingly invasive species; however, the use of non-invasive exotic species is preferred to the use of imported stock of native species. The guidelines also advise caution when using species that form aggressive root systems (which may damage buildings and infrastructure), species that may have adverse health and safety impacts (e.g. species which are toxic if ingested or which may trigger allergic reactions), and species that could pose a hazard to road safety. The document also recommends taking into account the historical relevance of urban structures, noting the undesirability of, for example, planting initiatives within the ramparts or glacis of historic military fortifications not originally intended for this purpose. Finally, the guidelines recommend the use of species that are reasonably hardy and resistant both to environmental conditions and to possible vandalism and/or fire. Appendix 4 to the Guidelines provides a list of Mediterranean-type plant species that are acceptable only in gardens and urban plantings, while Appendix 7 lists species which should be used with caution within the urban setting.

Author remarks: The Guidelines provide useful insights for minimizing negative ecological impacts of tree planting activities. However, given that more than ten years have elapsed since their adoption, there may be room for these to be revised and updated. For example, additional conifers such as *Cupressus sempervirens* can be added to Appendix 3 (List of species that may be used in sites outside development zones and in urban fringes); the cypress is used in a widespread manner throughout the central Mediterranean, does not compete or cause ecological harm, does not pose any risk of structural damage to infrastructure, and has a small root ball. There is therefore no reason why this should not be considered for landscaping use in rural areas.

3.5. Trees and Woodlands Protection Regulations & other relevant regulations

The Trees and Woodlands Protection Regulations (Legal Notice 200 of 2011) provide a legal framework for the protection of trees and woodlands, for regulating activities that may have an impact on trees and woodlands, and for managing tree species that damage biodiversity or the natural environment in general. The regulations also outline the requirements for issuance of permits, where these are necessary to allow for interventions to be carried out. Schedule I of the Regulations identifies strictly protected tree species, including (i) trees included on the List of Trees of Antiquarian Importance Order, (ii) trees protected by Tree Protection Orders, and (iii) an additional 27 species of trees listed in this Schedule. Schedule II lists species of trees that are protected within protected areas and Outside Development Zones, while also affording protection to all trees older than 50 years of age within protected, Outside Development Zones, and in Urban Conservation Areas – (some exceptions to the latter do,

however, apply). Similarly to the above-mentioned Guidelines for Trees, Shrubs, and Plants, Schedule III lists invasive, alien or environmentally-incompatible species, including species which are not permitted for use Outside Development Zones but which can be used in urban landscaping.

Author remarks: This Legal Notice replaces a prior version of these regulations (Legal Notice 12 of 2001). This more recent version includes additional provisions for the selection of important sites and for the designation of Tree Protection Areas, and concerning tree species which are causing damage to biodiversity. The revisions have also addressed a number of issues which had limited the practical applicability of the 2001 regulations; for example, exemptions to the requirement of needing a permit for interventions have now been allowed in the case of horticultural pruning. Similarly, more cautious wording has now been used with regard to the kindling of fire and open flames near protected trees – the wording used in the previous version of these regulations had rendered this provision practically unenforceable, given the widespread use of candles in cemeteries which often include protected trees. These revised regulations are therefore considered to provide a much more pragmatic basis for enforcing tree protection measures.

There have, however, been changes with regard to levels of protection, with considerably less tree species now listed in Schedule I (Strictly protected trees), and with the Schedule II category of 'Protected Trees' now replaced with a Schedule II which lists 'Trees Protected in Selected Areas' – several species previously listed in Schedule I have instead been listed here. Protection for older trees has also been downgraded to some extent – whereas previously protection was afforded to all trees of more than 50 years of age which were not listed in Schedule V and which were not causing damage to protected trees, this protection has now been qualified as applying only to trees within protected areas, Outside Development Zones, and in Urban Conservation Areas. While it is recognized that the blanket protection afforded to older trees was often not applied in practice (with, for example, cases of such trees being uprooted in development sites), this does facilitate the removal of trees from development zone areas and may pose a threat to the survival of mature gardens within such areas. The list of alien, invasive, or environmentally-incompatible species has also been expanded in this newer version of the regulations.

Other relevant regulations, the provisions of which should be borne in mind, include:

- The Wild Thyme Protection Regulations, 1932 [Government Notice 85 of 1932] which affords protection to Mediterranean Thyme (*Thymbra capitata*);
- The Conifer Trees (Preservation) regulations, 1949 [Government Notice 328 of 1949], which requires permission from the Director of Agriculture for removal of existing conifer trees; and
- Government Notice 269 of 1933 concerning a List of Historical Trees having Antiquarian Importance.

3.6. National Biodiversity Strategy

Malta's National Biodiversity Strategy and Action Plan (NBSAP) (2012-2020) is based on the vision that *"All Maltese citizens will value the importance of Malta's biodiversity and work hand-in-hand with nature in their daily lives"*. The aims of the afforestation/restoration strategy being presented here are fully compatible with and complementary to this vision. Of the NBSAP's 18 themes, several are directly or indirectly relevant to this initiative, which can contribute tangibly to the achievement of several of these goals; these include but are not limited to the ones listed in Box 3.2 below.

Box 2: National Biodiversity Strategy and Action Plan goals of particular relevance to afforestation & restoration

Theme 2 (Species and habitats)

SH1: The integrity, structure and functioning of important ecosystems is maintained and, where required, restored, thereby securing the continued flow of ecosystem goods and services.
SH3: Opportunities for species reintroduction or reinforcement are explored and adopted, where feasible and where deemed of added value.
SH6: Guidelines on habitat management and restoration are adopted and provide information on best practices for managing the different terrestrial and aquatic habitat types in Malta.
SH7: Urban biodiversity in villages and towns is safeguarded through the uptake of community initiatives, such as green rooftops, green open spaces, and other incentives, such as competitions for the best gardens and open spaces in urban areas, which promote the use of indigenous species (as opposed to invasive non-native plants). Such initiatives contribute to an increase in green urban areas.
SH8: The "2002 Guidelines on Trees, Shrubs and Plants for Planting and Landscaping in the Maltese Islands" are updated to include guidance on context sensitive landscaping and planting, and to establish new standards on the basis of experience gained over the past years since their publication.

Theme 5 (Sustainable Use of Biological Resources)

BR1: A sustainable and diversified local source of native plant stock is available to cater for the increasing demand for native species of trees and shrubs for use in forestation, landscaping and planting for site stabilization and restoration.

Theme 7 (Climate Change)

CC1: The interlinkages of climate change and biodiversity are taken into account when designing adaptation and mitigation activities, so as to ensure that such activities are both compatible with policies for the protection of biodiversity in Malta and the goals of creating a climate-resilient and low-carbon economy.
CC2: The adaptive capacity of species and the sequestering ability of key habitats that act as sinks or carbon reservoirs are maintained or restored in so far as feasible, by way of forward planning, climate proofed management plans where possible, and via the proactive management of resources to reduce both no-climatic stresses and climate-related stresses.
CC4: Forestation for climate change mitigation is carried out on land of low biodiversity value or ecosystems largely composed of non-native species (following appropriate removal of invasive species using established guidelines) and preferably degraded ones, and taking into account the Pan-European Guidelines for Afforestation and Reforestation. Ecologically-sensitive forestation schemes, strategically located within the landscape, also enhance habitat connectivity.

Theme 11 (Participatory Conservation)

PC2: The positive and active role of Maltese farmers as stewards of agrobiodiversity and in the maintenance of the countryside and rural environment is strongly encouraged.

4. Afforestation and restoration efforts in the Maltese Islands

4.1. Overview of efforts to date

There have been sporadic afforestation efforts implemented over recent years, particularly from the 1950s onwards. It is worth pointing out, however, that afforestation has been carried out long before this, including during the rule of the Knights of St. John – perhaps the most significant legacy of the latter in this regard is the enlargement of the woodland at Buskett, initially planted to provide hunting grounds for the nobility, but now established to the point that it can be considered to constitute a self-regenerating ecosystem. Planting continued under British rule, particularly during its latter years, and continued following the acquisition of Independence and into the 1970s and early 1980s. Sites afforested during this period included Bajda Ridge and Mellieha Ridge (Mellieha), Qammieh, Mtarfa, the Dwejra Lines, Madliena, the Cottonera Bastions, Tas-Silg (Marsaxlokk), the Ta' Qali National Park, St. Andrew's, Ghajn Tuffieha, Manoel Island, and Ghallis (Borg, 1995).

Some of these projects have left a notable mark on the landscape. The *Landscape Assessment Study of the Maltese Islands* (discussed in Section 3.2 above), notes, for example, that Malta's main cemetery can almost be considered an afforestation project which now plays an important role visual mitigatory role within a heavily industrialized landscape (Figure 2). Similarly, afforestation projects in Mellieha, initiated following the donation of around 10,000 trees to Malta by the Israeli Government in the late 1950s, have completely transformed the landscape qualities of the topographical ridges in this part of the island of Malta, with a continuous green cover which can be seen even from some distance (Figure 3). These afforestation efforts spanned a wide variety of settings, including areas adjacent to valleys, in the proximity of industrial complexes, within and around fortifications, and along road verges.

Afforestation has taken place to a lesser extent in Gozo. Notable afforestation areas include those located at Gnien Migarro on the clay slopes surrounding Chambray, Ta' Blankas on the limits of Xewkija, Ta' Lambert, and some planting at Ghammar, overlooking the church of Ta' Pinu. Both native and alien species were used for these early afforestation projects; examples of the latter included the planting of various *Acacia* sp. (now considered unsuitable for planting in rural locations) at Mizieb and at l-Ahrax tal-Mellieha, and the planting of *Araucaria* in several locations, with these trees, because of their large size and distinctive symmetry, indeed serving as landmarks.

Figure 2: Aerial view of the Addolorata cemetery, highlighting the visual 'relief' it offers within a heavily urbanized landscape.

The *Landscape Assessment Study* notes that over the past two decades, afforestation was not directed at planting over large areas; instead, the focus appeared to have shifted towards the greening of many urban and rural areas; indeed, over the past decade, much investment appears to have been directed at embellishment, for example in roundabouts, central strips and other pockets of public land.

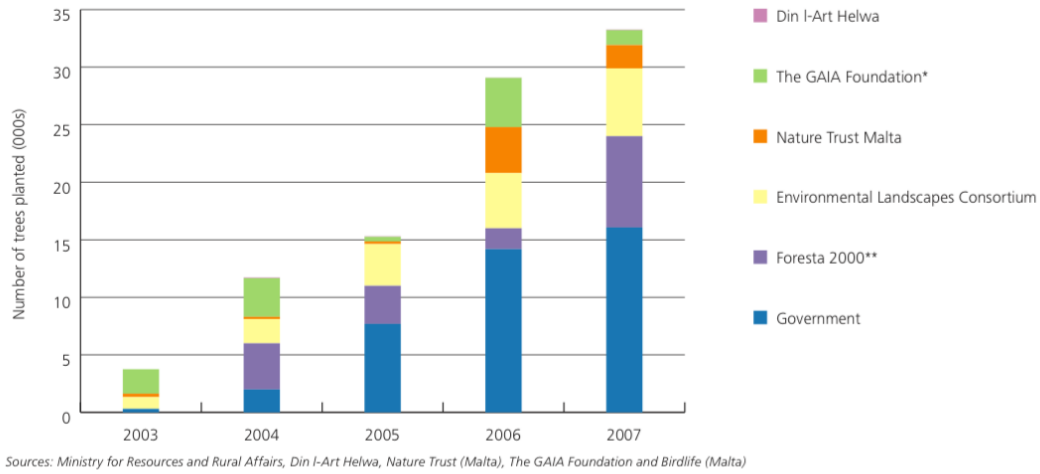
As noted in the *Landscape Assessment Study,* the main sources of trees for these more recent projects were the government nurseries, while the micro-propagation centre in Lija worked to establish stock of endangered trees and plants, possibly for eventual re-introduction. Several copses of trees have also been planted in rural areas, notably *Eucalyptus* sp. planted by hunters and trappers with the intention of attracting birds; however, the above-mentioned *Landscape Assessment Study* highlights increasing positive efforts by the hunting and trapping community to promote planting of indigenous or archaeophytic species.

Figure 3: Forested tracts in (a) l-Ahrax tal-Mellieha (top) and (b) Mizieb (bottom),

More recent afforestation initiatives have been led both by successive governments and related government departments (e.g. the PARC unit at the Ministry for Resources and Rural Affairs) and through projects initiated/supported by various non-governmental organizations; the latter include BirdLife Malta (and its predecessor, the Malta Ornithological Society), Nature Trust (Malta) (incorporating within it the groups formerly known as Arbor, Verde, and the Society for the Study and Conservation of Nature), the International Tree Foundation (Malta) (originally Men of the Trees), the Gaia Foundation, and Din l-Art Helwa. In more recent years, tree planting has also

been carried out with the involvement of the private sector, through the Environmental Landscapes Consortium. Major afforestation initiatives have included the 34U campaign and the Foresta 2000 project, which are discussed briefly below. The overall number of trees planted in afforestation projects has increased over the years (Figure 4), although it should be noted that these figures do not take into account maintenance and actual tree survival.

Figure 4: Number of trees planted in afforestation projects, as outlined in *State of the Environment Indicators*, 2007



Sources: Ministry for Resources and Rural Affairs, Din l-Art Helwa, Nature Trust (Malta), The GAIA Foundation and Birdlife (Malta)

** 2007 figures exclude 300 trees that were planted for the Foresta 2000 project.*
*** Foresta 2000 is a joint Birdlife Malta, Din l-Art Helwa and the PARC Department (MRRA) venture.*

The Tree4U (or 34U) campaign, launched in January 2005, involves a system of tree 'sponsorships' by individuals, NGOs, and the corporate sector. Trees planted are indigenous species, with planting sites across the Maltese Islands. The campaign includes a number of 'sub-schemes' encouraging the planting of trees to commemorate special occasions and/or individuals, including 34Love, 34Gifts, 34Graduate, 34Babies, 34Life, and 34CleanAir. According to the website of the Directorate for Parks, Afforestation and Countryside Restoration (PARC), which is responsible for this initiative, over 100,000 trees have been planted in the identified planting sites. The PARC unit is also responsible for managing afforestation areas within the Ta' Qali and Salini Parks.

Meanwhile, the Foresta 2000 initiative, the idea for which dates back to 1995, is being run by BirdLife Malta, in collaboration with Din l-Art Helwa and PARC, and involves the environmental improvement of a site of approximately 104 ha located on the west slope of Marfa Ridge (Figure 5), with the project aiming to establish a Mediterranean forest on site. The project has drawn on the participation of several individuals, schools and corporations, and on the work of volunteers. It has also benefited from contributions of external partners – the project website mentions, for example, that the Italian Corpo Forestale dello Stato have provided 8000 trees and shrubs over three years. As per details provided on the same website, the project has succeeded in planting some 20,000 trees and shrubs "*with little space for further planting left*". The project has, however, unfortunately been subject to vandalism, with an early attack in 2004 involving the cutting down of some 100 trees, a second major attack in

2007 destroying around 3000 trees, and with further damage to 104 trees and saplings during a 2010 attack. There have also been incidences of violence towards the person and property of the park ranger responsible for management of the Foresta 2000 site.

Figure 5: Foresta 2000 afforestation site.

Additional afforestation efforts have also taken place through the involvement of partners other than those listed above. The HSBC Malta Foundation, for example, has supported an afforestation project forming part of the Ministry for Gozo's Eco-Gozo Action Plan; this project was launched in 2010 at Taht Chambray in Gozo, with the planted grove now covering 45,000m^2. The same Foundation has also supported afforestation efforts by the NGO Nature Trust Malta, which is responsible for tree planting within various sites it manages, including Xrobb l-Ghagin and Wied Ghollieqa nature parks. The Gaia Foundation has contributed towards tree planting (with a figure of 18,000 planted trees, shrubs and grasses cited on the organization's website), mostly at sites managed by the same NGO at Ghajn Tuffieha and Ramla, but also at other locations. The stock for planting has been derived mostly from the same organization's tree nursery (Project Elysium). The organization Din l-Art Helwa has also participated actively in various afforestation initiatives, both within the Majjistral Park site which it is involved in managing and elsewhere. It has also been a vocal opponent of development which poses a threat to trees, for example of infrastructural works being conducted on the Coast Road in the Kennedy Grove area and which involve the uprooting of several mature trees.

Although as can be noted above, there have been extensive afforestation efforts in the Maltese Islands, to date no major ecological restoration projects have been attempted. However, a project falling under the aegis of the Operational Programme Italia-Malta project (OP Italia-Malta 2007-2013) implemented a number of pilot restoration actions at four sites in Gozo. The project, entitled

SIMBIOTIC (Sicily-Malta biogeographical transboundary insular connectivity) was led by the Institute of Earth Systems of the University of Malta, with partners including the Ministry of Gozo and Sicilian institutions.

4.2. Reflections

The various afforestation experiences described above, as well as developments in legal and policy fields, afford valuable insights that should guide any future afforestation and restoration initiatives planned on the basis of the strategy being presented here. Key points to note from planned and implemented initiatives to date include the following:

- While there has been substantial interest in tree planting for some time, implementation of these plans has lagged far behind what was presented on paper, with several initiatives not completed or not even initiated. This points to the critical importance of strategies at the policy level being supported by detailed operational plans that address all aspects necessary to ensure implementation and ongoing maintenance; these aspects are discussed further in Section 6 below and include (i) securing land, (ii) securing funding, (iii) obtaining resources for initial planting efforts, (iv) ensuring ongoing maintenance and assigning responsibilities accordingly, and (v) securing planting sites. In simple terms, it will be pointless to develop further strategies and plans unless these are accompanied by a very firm and tangible commitment towards implementation and subsequent upkeep, with this including details concerning necessary capital expenditure and plans to finance this.

- There is no doubt that there has been an increase in tree cover in the Maltese Islands through these various afforestation efforts; however, it is also true that returns have not equaled investment in many cases, with reasons including vandalism and theft of trees. These criminal actions can be assumed to include at least two subsets: (i) those pertaining to general anti-social behaviour, and (ii) those pertaining specifically to anti-afforestation efforts, either because of opposition to the environmental agenda, and/or because of animosity towards the organizations involved (and towards certain NGOs in particular). The former problem is likely to persist in any case, even if only a very minor subset of the Maltese population is likely to engage in such actions. The likelihood of such acts occurring would ideally be minimized through a suite of measures, including minimizing opportunities for anti-social behaviour in tree planting sites (for example through fencing/lighting in urban areas/use of CCTV), strict enforcement, and harsh penalties for any perpetrators; more proactive measures which are likely to produce results in the long-term include those that seek to foster an enhanced sense of civic responsibility and citizenship, often coupled with educational efforts. The second category of criminal actions is one that may be more directly addressed by ensuring that future tree planting initiatives are not seen as the 'domain' of specific environmental organizations only, but rather as

projects that are of value to *all*, even if individuals may hold different ideological positions on other environmental aspects. Given experiences to date, it may make sense for tree planting *not* to be 'bundled' with other environmental agendas, as it may otherwise become an unwitting 'victim' of those who disagree, for example, with the anti-hunting agenda. It is therefore suggested that future projects are as inclusive as possible in their range of partners.

- In addition to the above, it must also be noted that not all trees planted eventually survive, even in the absence of vandalism/theft. Available statistics tend to focus on the number of trees planted, with little indication of the proportion of survival. Any future afforestation initiatives should include a plan for a monitoring programme to allow for periodic evaluation, i.e., an objective assessment of successes and failures in order to inform and guide future actions.

- Afforestation efforts have, in large part, focused on the propagation of indigenous species, which is advisable from an ecological point of view. However, it should be noted that non-indigenous species can also be considered for more widespread use in appropriate environments (such as urban areas, including public gardens), allowing for more diversity from an aesthetic point of view, but with these also providing useful ecosystem services notwithstanding the fact that they may not be native.

- Given the severe dearth of tree cover on the island, all trees should be considered as beneficial, providing that they are not causing damage, ecological, infrastructural or to human health. It has been of concern to note the removal of mature trees from areas where these were established (e.g. the ditch surrounding the Mdina bastions) in recent projects, particularly when considering this scarcity of trees and the length of time that these would have needed to grow. Removal of trees, even in cases where this is in clear breach of the legal provisions discussed in Section 3 above, leads to a situation where regulations lose credibility or appear to be applied inconsistently, in turn leading to loss of faith in environmental protection systems. It is therefore very important that, afforestation efforts notwithstanding, relevant provisions to safeguard existing trees are applied consistently, in all situations, and as per the provisions of the law.

5. Key considerations for 'greening' strategies

This section takes into account the points outlined above, as well as additional considerations that should inform the formulation of an afforestation strategy for the Maltese Islands.

5.1. Fragmentation & connectivity

Notwithstanding their high urban footprint, the Maltese Islands harbour a variety of sites of ecological value; these include the 34 terrestrial Natura 2000 sites in the Maltese Islands, other areas protected under a variety of national designations (including nature reserves, tree reserves, and scheduled areas), as also areas that are presently not protected but that nonetheless serve important ecological functions (greenways or corridors for ecological connectivity, or ecosystem services – see section 5.2 below). The latter category includes both actively cultivated agricultural land, and land that has been abandoned and is undergoing processes of secondary succession. Collectively, these sites constitute a network of both natural and cultural heritage that supports a range of habitats and biotic assemblages. This network includes a gradation, from sites that are still in a semi-pristine semi-natural state due to a low level of anthropogenic disturbance, to other sites that have been extensively modified by human influence but that still serve a viable ecological role. This latter category also includes a variety of sites that have been degraded but that have the potential to be rehabilitated and/or restored.

A present point of concern with regard to the above-mentioned network of sites of ecological value in the Maltese Islands is fragmentation. Although the overall coverage of such sites is significant, particularly when considering the country's limited size, individual sites tend to be small and isolated; locally, habitats may be fragmented both by permanent and semi-permanent barriers. The former category includes, for example, urban development and related infrastructure (e.g. networks of roads), while an example from the latter category would be the 'barrier' created by strong floodlighting and related light pollution. Such fragmentation has an impact not only on habitat integrity but also on the various floral and faunal species that the habitat supports. For example, micro-mammals such as the Algerian Hedgehog (*Atelerix algirus*) and the Least Weasel (*Mustela nivalis*) are frequently victims of road-kill as these species attempt to cross main thoroughfares and secondary roads in the Maltese countryside. The small size of individual habitat patches is also a major limitation, as, other factors being equal, the ecological value and robustness of sites tends to increase with size (albeit up to a point); small sites tend to harbour smaller floral and faunal populations, have a limited range of habitats, are more susceptible to environmental phenomena (e.g. droughts, flood), and are consequently more vulnerable to negative impacts and less well able to respond to change. This renders their long-term resilience somewhat limited. The limitations of small size can be, however, countered, to some degree, by reducing the level of isolation of sites through landscape connectivity.

The concept of landscape connectivity refers to the extent to which the landscape (and the land-use patterns contained therein) allows or impedes movement of organisms across a given tract of land, including between different habitat patches. The improvement of connectivity between isolated habitats brings with it numerous ecological benefits, including the facilitation of interaction at the genetic level between different populations of the same species (metapopulation). The concept has both a structural and a functional dimension. The former is based on the physical make-up of the landscape, looking at whether there are actual on-the-ground physical connections between different habitat areas; structural connectivity thus emphasizes the need to have land features that facilitate movement, such as 'stepping stones' (carob trees, for example, serve such a purpose for passerines and other bird species across an otherwise open, cultivated landscapes) and linear corridors for movement.

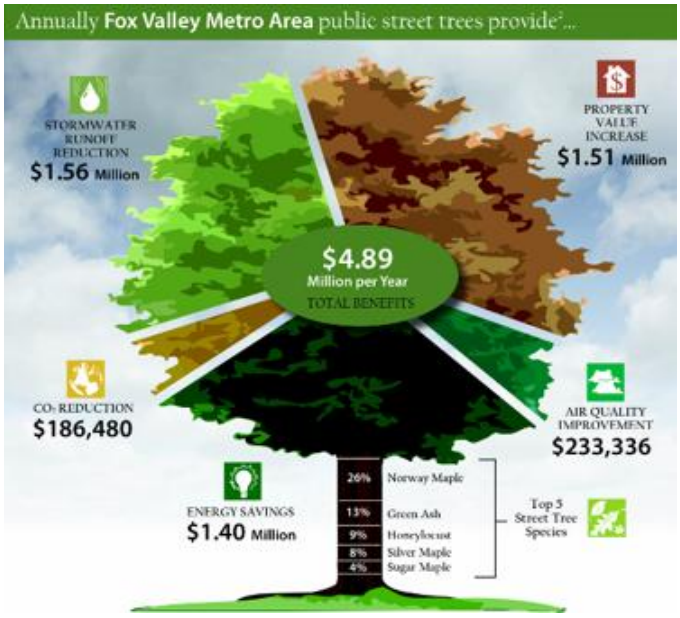
Within the Maltese landscape, such features are found at a variety of scales, and include rubble walls, tree stands, valley systems, roadside vegetation, stands of prickly pear (*Opuntia ficus-indica*), and various other such elements along which species can move. Natural avenues for movement also exist, such as the sheer sea-cliffs which border the island of Malta's southern coast, inland sheer escarpments, well-vegetated karstic pavements, and rills on exposed clay taluses, amongst others. The extent to which any of these can function as a corridor for movement depends on its specific characteristics but also on the degree to which any practices or activities engaged in are conducive or not to sustaining species – for example, heavy pesticide use in the vicinity of rubble walls would likely be an issue of concern. On a larger, 'biogeographical' scale, the entire Maltese archipelago can be considered to be a stepping stone for species (migratory insects, avifauna, bats) movements within the central Mediterranean area.

The functional dimension of connectivity science focuses on the way in which species respond to the features present in the physical landscape. Structural and functional connectivity are related, but not identical. For example, habitats that are not structurally connected (e.g., two wetland areas that are spatially disjointed, such as Ghadira and Simar) may still be functionally connected if they can be used by species that are capable of crossing the gap (such as avifauna). Planning for connectivity therefore needs to take into account both land-use and landscape features but also the specific habitat and resource requirements of the species being targeted. Additionally, it is important to consider land-uses within the landscape matrix that lies beyond these habitat patches, corridors or stepping stones. The level of disturbance occurring around a valley system, for example, would need to be considered to ensure that this could function as an avenue for species movement. In the case of the Maltese Islands, the country's small land area and consequent limited space availability would suggest that it would make sense for a connectivity strategy to aim to facilitate movement, if and where appropriate, for as many species of conservation interest as possible.

5.2. Ecosystem services

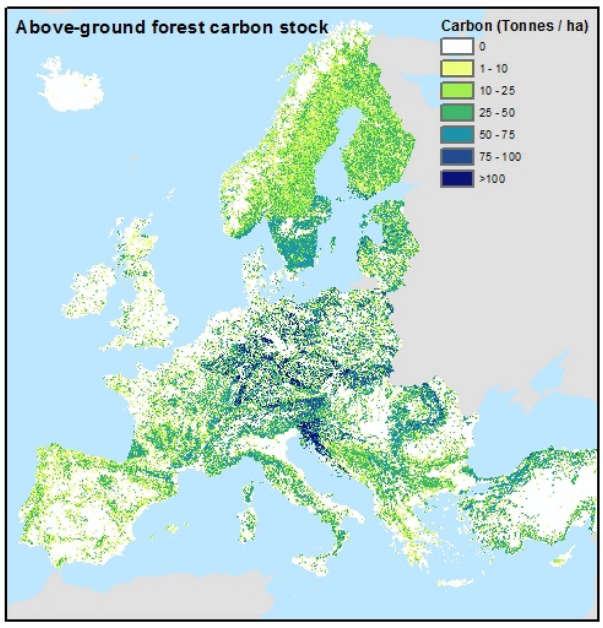
In addition to the above, the project in question should take into account the concept of ecosystem services, i.e., those services that are of benefit to mankind that are provided by nature for free. Ecosystem services have been classified in various ways, with a leading classification developed through the Millennium Ecosystem Assessment considering four main categories: (i) provisioning services (e.g. food, water), (ii) regulating services (e.g. pollination, climate regulation), (iii) cultural services (e.g. recreation, tourism), and (iv) supporting services (e.g. soil formation, maintenance of genetic diversity). These ecosystem services are widely acknowledged to underpin many fundamental economic activities (e.g., agriculture, fishing) and human development. Trees provide a variety of services (Figure 6), including air pollutant reduction, heat mitigation, aesthetic benefits, human engagement with nature, and carbon sequestration; the latter is of particular relevance to the project in question, particularly given current concern over mitigation of (and adaptation to) climate change. Figure 7 indicates above-ground forest carbon stock in the EU; this can be assumed to be very low in Malta given extremely limited tree cover.

Figure 6: An example of economic benefits of ecosystem services provided by trees in the urban environment (source: http://goo.gl/M29sJs)[2]



[2] The figures presented here were developed using a software application developed by the USDA forest service entitled i-Tree; this is intended to help communities of all sizes to strengthen their urban forest management. It includes a subset of tools including i-Tree Eco (which quantifies urban forest structure, environmental effects and values to communities), i-Tree Streets (which focuses on benefits provided by a municipality's streets, i-Tree Hydro (which simulates the effects of changes in tree and impervious cover within a watershed), i-Tree Vue (which uses satellite-based imagery to assess land cover and related ecosystem services), and i-Tree Design (for assessment of individual or multiple trees at the parcel level, among others.

Figure 7: Above-ground forest carbon stock in the EU (source: http://forest.jrc.ec.europa.eu/activities/forest-ecosystem-services/)



While the study of these ecosystem services in the Maltese Islands is still in its infancy, their significance should nonetheless not be underestimated, in both rural and urban environments. Initial studies have already shown that such ecosystem services are important within Natura 2000 sites, even if these have often not been explicitly factored into management decisions (Bajada, 2014). It is particularly important that these services be taken into account in future conservation planning, as studies worldwide have indicated not only the immense economic benefits that they afford, but also the fact that several such services are being severely degraded or are under threat. This project could serve as a means to, not only improve the state of integrity of habitats and species, but also improve the provision of ecosystem services locally, through actions that directly or indirectly benefit ecosystem functioning and ensure the continued maintenance of the many services provided locally.

5.3. Ecological restoration

Ecological restoration is based on the notion of mitigating damage done to natural habitat areas and has become established as a core element of conservation science. *Restoration Ecology* also seeks to reverse degradation, (where this is prevalent) through scientifically sound conservation measures/actions, with a view to improve the conservation status of a species or assemblage. The concept is of particular relevance within the Maltese Islands and the wider Mediterranean region, the ecosystems of both of which have, as a result of their long history of human occupation, experienced pervasive and widespread human-induced impacts. There is a considerable range of ecological restoration strategies, varying from relatively minor interventions to embellish and/or improve the functioning of a habitat, to major attempts to reconstruct

past habitats. Projects of the latter sort are often challenging due to the difficulties involved in determining what the landscape or habitat may have looked like in the past. Notwithstanding, there is substantial scope for restoration efforts to 'engineer' degraded ecological assemblages in a way that the end result resembles natural communities of vegetation and fauna of high scientific and/or conservation value, even if this may be different to what would have existed in the past (largely as a result to a dissimilar climatic regime). A specific goal of several restoration projects is to, not only reestablish vegetation species in an area, but to create an assemblage that will, in due course, become part of a self-sustaining, functioning ecosystem. This marks a key difference from afforestation *per se*, the focus of which is the planting of trees, without the need to establish a functioning ecosystem. Restoration thus differs from afforestation in various ways; restoration of a woodland area, for example, would focus on planting a variety of species that would in nature be found within the same assemblages to re-establish the stratified nature of a natural woodland, with canopy vegetation and an undergrowth. In technical terms, restoration takes into account *phytosociology*, which is a sub-discipline of plant ecology that looks at the co-occurrence of plant species within communities in specific environments.

Ecological restoration is a particularly relevant topic for Malta, for various reasons. First, pressures on natural areas in the country have continued to increase, with consequent pressures on species and habitats. It is worth pointing out that the rate of urban development over seven thousand years of more or less permanent human habitation on the Maltese Islands has increased more than threefold in the last three decades or so. Second, legal instruments and policies have been refined over time to allow new possibilities for land use re-appraisal. This point is especially valid given the phenomenon of agricultural land abandonment. This is, on the one hand, a concern from the perspective of a decline in the agricultural sector. On the other hand, however, it may represent an opportunity for exploring new uses for such abandoned tracts of land; given the already unusually high level of urban development in the country and the dearth of green spaces, ecological restoration projects (together with afforestation) would appear to be well worth considering as potential options for such abandoned land. Third, the establishment of local government organs and the strengthening of the non-governmental sector in Malta has afforded new opportunities for having the capacity to implement small-scale initiatives to restore degraded sites.

The specific design of a restoration project can vary, depending on its aims. A restoration initiative can be driven by aims that may be described as more horticultural in emphasis, for example, the creation of visually attractive vegetation assemblages, or the creation of recreational grounds. Alternatively, restoration efforts may focus more on conservation targets, such as safeguarding rare species or communities. There is scope for both of these, and for a range of options in between across the Maltese Islands, depending on the specific sites being considered. For example, in urban areas, the horticultural ethic may have priority, as may the goals of providing urban green space and/or recreational areas. In this context, the use of both indigenous and non-indigenous species

may be appropriate. In more natural settings, however, or where a restoration area lies adjacent to a habitat of conservation interest, conservation concerns would be expected to prevail, and intrusive human intervention discouraged. A restoration option that is often considered in such a context is that of encouraging natural colonization of an area, albeit a somewhat slow process.

5.4. Urban green space

Malta has one of the highest rates of urban development in the European Union, with a built-up area that exceeds 30%. By comparison, the rate of urban development in most other EU states averages 8-13%. At the same time, Malta does not have the benefit of the large urban parks that are found in several European cities, and recreational areas in Maltese towns and villages tend to be characterized to a very large degree by hard landscaping. As a result, the Maltese population has a somewhat low level of engagement with nature, a point that is of some concern given that exposure to nature has long been emphasized as being integral to human well-being in fields such as environmental psychology. Nature has been shown to have beneficial stress-reducing and therapeutic effects, to aid in recovery from illness, and to benefit individuals suffering from a variety of medical conditions, ranging from depression and Alzheimer's in adults to Attention Deficit/Hyperactivity Disorder (ADHD) in children. Conversely, lack of contact with nature has been shown to have detrimental effects, with these particularly marked in urban environments (indeed, with a recognized psychological phenomenon of 'urban stress'). The lack of contact that children currently have with nature is of particular concern, given that many are leading an increasingly urbanized sedentary lifestyle, with consequences in terms of their health (e.g. obesity issues), social skills, and general well-being.

Green areas in and around towns and villages would thus have important health, educational and recreational benefits. Furthermore, trees in urban areas have been shown to also provide ecosystem services such as reducing air pollution, reducing noise pollution, and reducing the *urban heat island effect* (a phenomenon by which temperatures in urban areas tend to be slightly elevated in comparison to surrounding rural areas). Greater exposure to nature through urban green spaces would arguably also be of benefit in terms of establishing a stronger sense of connectedness to nature; this is important in developing motivation for and interest in biodiversity conservation in the Maltese Islands. There are various types of urban green spaces that can be considered for this purpose, including parks and gardens, semi-natural green spaces, amenity green spaces, and allotments and cultivation areas (for growing edible crops). Permaculture practices are particularly relevant to the latter, with these often seeking to combine natural and edible landscaping while developing diverse, stable and resilient ecosystems – the related concept of urban agriculture is still relatively new to the Maltese Islands but has been applied in several large cities worldwide. It has substantial possibility to be applied within this small island context, providing for both increased green space and increased contact with nature, even in highly urbanized environments.

6. Project philosophy

Section 4.2 above outlined key aspects that any new afforestation or *Restoration Ecology* initiatives need to keep in mind, while Section 5 identifies four 'priority' themes which should guide such a project. This section elaborates in further detail on some of the main aims of such an 'afforestation' initiative, and on important considerations for its implementation.

6.1. A holistic and integrated approach

It is crucial that a broad view to biodiversity conservation is adopted in future initiatives, ensuring that whatever measures are considered, a holistic and integrated approach is employed. This includes both avoiding restrictive application of ecological principles where this is unnecessary, as well as having a view to wider social and economic perspectives. In the case of the former, for example, while acknowledging that the Prickly Pear (*Opuntia ficus-indica*) is an alien species and has the potential of being somewhat invasive, to the detriment of indigenous floral species, its cultural value within a man-made agricultural landscape has also to be recognized, primarily in areas where dry stone rubble walls cannot be maintained without difficulty, e.g. dynamic clay hillsides that are cultivated, as is common in many parts of Gozo. Moreover, *Opuntia* stands are especially important within open agricultural plains since they function as local corridors for wildlife, as also as a means of nourishment for a variety of species (summer migrant and resident passerines, and micro-mammals feed on the fleshy fruits produced by this central American cactus) during the dry season.

Notwithstanding the above, potentially invasive species like *Opuntia*, *Acacia* and *Eucalyptus* need to be controlled and every effort should be made so as not to allow such species to spread in areas of pristine habitat, where important plant communities thrive or where there is the potential for ecological restoration. Such management is critical to ensure that alien species, particularly potentially invasive ones, do not displace indigenous species on a wide scale.

As noted above, it is also important that this 'broad' view seeks to combine, as far as possible, biodiversity conservation prerogatives with social and economic ones. Afforestation efforts should not be discussed (or presented) simply in terms of their benefits to other species, but also in terms of the tangible health, environmental, and economic benefits that they provide to humankind. Such a wider perspective would open up many more opportunities for 'greening' Malta, including in a highly urbanized environment. Furthermore, it would allow for better identification of opportunities – for example, the abandonment of agricultural land, while often seen as a negative aspect of landscape degradation, also presents opportunities in terms of land availability for tree planting, afforestation and ecological restoration projects. Similarly, presently unutilized spaces within the urban environment may also potentially be converted for productive purposes.

Based on the above, core aims of this afforestation/restoration initiative will include:

1. Extending the coverage of wooded areas across the Maltese Islands;
2. Buffering existing natural and semi-natural habitat areas to increase their resilience and decrease their vulnerability;
3. Preserving and enhancing the local gene-pool through the increase and maintenance of indigenous trees of local stock;
4. Creating a system of inter-linked habitats (greenways, wildlife corridors and/or biotope networks), both those naturally occurring and those created by man;
5. Increasing the availability of wooded areas for countryside recreation and leisure;
6. Increasing the coverage of green areas within urban environments, inclusive of the concept of lining selected avenues with trees;
7. Enhancing the provision of ecosystem services, including those relating to climate change mitigation;
8. Enhancing the economic benefits afforded by wooded areas;
9. Increasing the sense of connectedness to nature amongst the Maltese population.

6.2. Specific recommendations

Below follow specific recommendations for the advancement of the above aims:

- Identifying and assessing a spectrum of habitat types, ranging from high priority core areas where human modification should be kept to a minimum, to heavily degraded and/or modified sites. This allows, not only for planting efforts to cater for a range of environment types in different locations, but also to provide a range of services. For example, planting in close proximity to core habitat areas (such as protected areas) can serve to buffer impact on the latter and absorb some level of pressure (for example, accommodating visitors who would otherwise impact on the core habitat area), as well as creating areas that may function as pools of important populations of flora and fauna and for the maintenance of ecological processes. Planting in degraded environments, conversely, can serve to provide crucial ecosystem services (e.g. psychological benefits of connectedness to nature) in areas where some of these may be severely lacking.

- Existing wooded remnants should be enhanced wherever possible, either through direct enlargement if land ownership and environmental conditions permit, or by seeking additional alternative areas close by. These remnants are unique and fragile by the very nature of their limited extent, and extending these would therefore enhance their survival prospects (= favourable conservation status).

- Managing sites, both those sustaining natural habitats and those where afforestation has taken place/is envisaged, as one single system, administered from the perspective of maximizing connectivity through a hierarchy of linkages sufficient to enable interchange between landscape components of species and parts therefore (genes, seeds, etc.). The benefits of linkages are numerous since these assist faunal movement and dispersal (a) during migration and for everyday life-cycle requirements, (b) between fragments across inhospitable environments, and (c) that create opportunities for re-colonization following local extinction.

- Seeking the collaboration of all relevant stakeholders to ensure their active participation in the project; any future afforestation initiatives must seek to create a sense of ownership of the project amongst the general public, with this category including those already interested in conservation, those interested in outdoor activities that may not always be seen to be compatible with conservation (e.g. hunting), as well as those who hold no strong positions relating to conservation. It will also be important to introduce concepts of 'greening' into areas beyond the countryside, notably in urban environments. The role of local councils and citizens' groups may be particularly important for this purpose. For this reason, and as noted above, such afforestation and restoration efforts should not be packaged with (or seen to be packaged with) other agendas, environmental or otherwise.

- Striking a balance between use of indigenous and non-indigenous species; while use of the latter is not to be encouraged in open countryside or in other areas where they may potentially compete with indigenous flora, their use should not be discouraged in areas where (i) they do not pose such a threat, (ii) they may still provide valuable ecosystem services, and, (iii) they may be utilized for embellishment purposes to aesthetically enhance a location. Conversely, however, there is scope for the gradual removal of stands of non-indigenous trees in the countryside (e.g. *Eucalyptus* sp.) and their replacement with indigenous alternatives; this must, however, be done in a sensitive manner over an extended time period. Moreover, it is crucial that indigenous trees are planted in ecological context.

- Ensuring employment of appropriate and responsible water conservation strategies, given Malta's semi-arid climate and severe water shortages, through carefully designed irrigation systems, use of second-class water and the use of 'water-wise' species such as indigenous species (which are acclimatized to local conditions). The water requirements of non-indigenous species should be examined and carefully considered before committing to their use for embellishment purposes in urban areas.

- Encourage the implementation of restoration activities (rather than only afforestation) where appropriate; the advantage of restoration lies in the creation of a self-sustaining functioning ecosystem, to a far greater degree than what can be provided by artificial 'plantations'. While it is recognized

that experience with restoration initiatives is still lacking, there is certainly much scope for this to be explored locally.

- Developing human resource management capacity for such a network of semi-natural/afforested/restored sites through appropriate training for personnel at different hierarchical levels and training-of-trainers initiatives. Partnerships with, for example, institutions like the University of Malta and CIHEAM (*Centre International de Hautes Etudes Agronomiques Méditerranéennes*) could be explored for implementation of such training.

- Ensuring that all relevant protective measures and legal provisions are fully and unequivocally applied wherever so required as per the dictates of the law, supported by a strong enforcement system; inconsistent protection is extremely damaging in the long-term, not only because of direct damage to trees when protective measures fail, but also because of the loss of faith in environmental protection regulations amongst the wider public – this in turn undermines any attempts to involve people in conservation and 'greening' measures.

- Combining afforestation/restoration efforts with the formulation of a strategy to address the issue of abandoned agricultural land, with a view to using (some) suitable areas for planting activities, while potentially encouraging re-cultivation of others; the two options are not mutually exclusive, with the use of tree crops on abandoned land also a possibility.

7. Project implementation

The proposed project will involve six phases of work. The compilation of this initial report, detailing the project rationale, its overarching vision and philosophy, and its general aims and scope, represents Phase One. The remaining five project phases are outlined below. Overall, it is also critical that the project plan includes provisions for: (i) identifying and securing land, (ii) securing the necessary funding for initial capital expenditure, (iii) obtaining the necessary stock of planting material, (iv) ensuring on-going maintenance after planting, and assigning specific responsibilities accordingly, and (v) ensuring the security of planting sites.

7.1. Phase Two: Establishment of Core and Ancillary (Support) Teams

The initial part of phase 2 will involve the setting up of a small but effective project management team, responsible for detailed project planning and for overseeing project implementation. The suggested composition of the Core project management team is as follows:

- Chairperson
- A senior representative of the Ministry for Environment, Sustainability and Climate Change
- A project manager
- Individual/s with horticultural expertise
- Individual/s with ecological expertise
- A representative of or individual to liaise with the Department of Lands

The project will further require the involvement of:

- Field analysts, with appropriate training and requisite field and laboratory skills; these will be responsible, amongst other duties, for carrying out preliminary analysis of selected sites to determine key physico-chemical characteristics; this will enable the determination of which species are likely to be successfully established there, allowing for avoidance of unsuccessful planting efforts.

- A number of dedicated gardeners, who will be responsible for actual site preparation, planting, and subsequent maintenance (including irrigation and pruning). These activities should be led and guided by gardeners with appropriate technical experience and skills, but there is also substantial scope for the involvement of volunteers, either through a dedicated volunteering scheme specific to the project or through the mobilization of volunteers already involved in other organizations. A combination of both options should also be considered, as should the specific involvement of environmental non-governmental organizations, hunters' organizations, youth associations (e.g. Scout Movement) and university students and schoolchildren. Additionally, the involvement of the private sector should be actively sought, both through public-private partnerships, as also

through contributions to tree planting initiatives as part of companies' Corporate Social Responsibility schemes. Finally, means for interested members of the public to be involved should also be made available.

- An enforcement team, responsible for ensuring that planting sites are not vandalized, as also for promoting awareness and education amongst the public. Such an enforcement team could either be set up specifically for this project, or else could draw on personnel already deployed for similar purposes in other units.

The project may furthermore wish to explore incentivizing the participation of farmers during both planning and implementation stages. Agricultural land is Malta's largest land-user, and farmers already play an important stewardship role within such land areas, a role that could potentially be better integrated with conservation efforts. Despite some concerns relating to chemical use on agricultural land, the latter already provides important natural habitat to various species, and its role as a linkage between semi-natural habitat areas could be further enhanced through conservation planning for connectivity, as outlined in section 2 above. The project could explore mutually beneficial schemes for tree planting on agricultural land, combining the production of agricultural produce (e.g. from fruit trees) with the enhancement of ecosystem services, the provision of increased habitat, and the improvement of ecological linkages. There are also specific geographical areas (such as parts of the coast) where agricultural production is difficult due to harsh physical conditions (e.g. strong winds, influence of sea spray), and it may be worth investigating whether these could potentially be converted to semi-natural maquis-type woodlands, with the full involvement (and if necessary, compensation) of farmers involved.

7.2. Phase Three: Site selection and evaluation

The site selection exercise will be carried out by the core project management team, led by individuals with requisite ecological expertise. The site selection exercise will need to take into account the following factors, amongst others:

- The existing suite of species on site and in surrounding areas;
- Proximate land-uses and the compatibility of these with restoration/afforestation activities;
- Present degree of disturbance and the degree and nature of any pressures/threats which could potentially affect the success of the project;
- The quality of the site in terms of its capacity to support biotic assemblages (taking into account factors such as soil depth, soil organic matter, etc.)
- The extent of the area available for planting;
- The degree of exposure and aspect;
- The proximity of the site to other semi-natural areas, including to protected conservation areas;

- The scope of the site to serve as a corridor and/or stepping stone for species movements;
- The proximity of the site to residential areas;
- The scope of the site to serve as open green space for public use;
- Ease of access (for users and watering/maintenance; and
- Land ownership.

As noted in the project strategy, the above are, in some cases, mutually exclusive but equally important – for example, a site that is of high ecological interest may not be well suited to recreational uses but could potentially be restored to enhance the robustness of the semi-natural area in question. Conversely, while it may not be feasible to attempt to restore a highly degraded site for this to support a self-regenerating ecosystem, there may be substantial scope for restoring this as an open green space for public use. The site selection exercise will therefore need to aim to provide a spectrum of uses (with varying capabilities to accommodate human activity), and appropriate geographical spread across the Maltese Islands. Particular attention should be given to the provision of open green spaces in areas of the Maltese Islands where these are presently lacking, notably in or around dense urban conurbations.

The land ownership consideration takes into account the fact that land ownership will need to be determined prior to any planting efforts; in the case of land owned by the Government of Malta, appropriate mechanisms for making the land available for planting will be explored with the Department of Lands, which, as noted, will be represented on the project management team. Where land is privately owned, the consent of the land owner will need to be sought and appropriate incentivization/compensation schemes to encourage land-owners to commit areas of their land to tree planting may need to be devised.

7.3. Phase Four: Identification of goals/objectives and formulation of site plans

For all planting sites, it is crucial that a clear 'end goal' (often described as *desired future condition*) is identified prior to the initiation of works; this may include, for example, the creation of a picnic space or the re-establishment of an ecological assemblage that would have existed within an area in the past, among many others. Specific objectives can then be identified to achieve that goal. Thus, for example, if the overall goal is to enhance the ecological integrity of an ecosystem, specific objectives may include (i) removal of specified exotic species to below a certain percentage of ground cover over a specified time-frame, and (ii) the planting of indigenous species (of specified types, with specified numbers, and over an indicated time-frame). Such a planning process will need to be carried out for each identified site, and should also take into account historical reference conditions and natural variability, where and if appropriate – the latter considerations are particularly important to restoration initiatives but may be less critical in the case of afforestation. Historical literature, maps and photography may be particularly important where attempts are made to recreate former conditions on site.

Other important considerations at this stage will include identifying clear site boundaries and securing the involvement of relevant stakeholders – these may include land owners, environmental and/or social non-governmental organizations, different governmental entities, local businesses, scientists, and potential funding agencies, among others. Planting design and species' configuration shall also take place during this phase.

7.4. Phase Five: Project implementation

Phase 5 of the project will involve actual implementation works, i.e. land preparation and actual planting in selected sites. This phase of the project will need to be guided by an appropriately detailed operational plan, to be developed upon conclusion of the site selection and evaluation exercise (Phase 3). The exact time frame for this phase will likewise depend on the number of sites selected for planting, the manpower available, and the time of year. With reference to the latter, the ideal time period for tree planting roughly spans September – early February, following the first rains following the summer drought, and before the onset of warmer weather in the spring. Planting could feasibly be carried out at other times of the year, but newly planted trees will require additional irrigation, and this would therefore not be ideal.

7.5. Phase Six: Project monitoring

The final phase of the project will involve ongoing monitoring following successful completion of planting works. The proposed monitoring plan has three components, as outlined below:

- **Scientific monitoring:** this will involve a scientific programme of monitoring the development of restored areas over time, including the development of canopy and understory vegetation, and the extent to which restored areas are able to form self-regenerating ecosystems. The monitoring of ecosystem change will take place using appropriate indicators. Such results would be of great value to the Maltese Islands, given that there have been no such restoration efforts to date; an understanding of the pace of such restoration, of the mechanisms by which it occurs, and of the relative success of planting different ecological assemblages in relation to different physico-chemical site conditions would therefore provide useful guidance for implementation of additional such initiatives in future. It should be noted that whilst restoration projects have been conducted in other parts of the world (most notably in the US and in northern Europe), restoration conditions are highly context-specific, and results from other areas cannot therefore be easily extrapolated to the local context.

  Given that such a programme of scientific monitoring would be of great academic interest, it is proposed that this be established in partnership

with the University of Malta and/or with the involvement of young graduates having appropriate technical expertise, the latter possibly through an internship scheme. There is also substantial scope for developing a database of related academic research through student dissertations, not only on aspects specific to restoration but also on wider concepts of relevance, such as ecosystem services.

- **Surveillance monitoring:** this should ensure that sites are not being subject to vandalism and are being appropriately maintained; such surveillance monitoring should also serve to identify any emerging issues requiring attention (such as infrastructure needing to be replaced or repaired) and to bring these to the attention of the project management team.

- **Public perception monitoring:** this third component of monitoring takes into account the social utility role of this project, and focuses in particular on the success of areas created with the intention of serving as open space for recreation and/or other public uses. This monitoring should take into account feedback from the public concerning the extent of use of created green spaces, opinions regarding positive and negative aspects of these, suggestions for improvements, and interest in the creation of additional such spaces. Such public perception monitoring could take place both through a one-off initiative (such as a large scale survey), as also through providing a mechanism for ongoing public feedback. As noted in the project strategy above, the success of any such project will be contingent on fostering a sense of ownership amongst the wider Maltese population, and the views of the public should therefore not only be acknowledged, but also taken into account throughout the implementation of the project.

7.6. Project timeline

An indicative timeline for the proposed project is outlined below; this is only approximate at this stage, as the exact time frame will depend to a large degree on resources committed to the project, and on the conclusions of the site selection/evaluation exercise.

Expected duration:

Phase 2: Two months
Phase 3: Four months
Phase 4: Six months
Phase 5: On-going
Phase 6: On-going

7.7. Final considerations

Specific elements have come to be seen as being vital to the success of any afforestation/restoration project. Some of these elements are outlined below:

- Having a good understanding of site physical and biological processes;
- Adopting a wider landscape 'big picture' perspective to understand how different sites link together and the influence of other activities and land uses in the landscape matrix;
- Having clear goals and objectives meeting SMART criteria (i.e., *specific, achievable, measurable, understandable, flexible*);
- Involving stakeholders early on in the process;
- Ensuring effective communication throughout;
- Monitoring and evaluation of efforts and implementation of adaptive management;
- Aiming for actions that are cost effective, likely to succeed, and reasonable in their maintenance requirements.

(Adapted from Brown, 2000; Ritchlin, 2001; Gayton, 2001)

References

Bajada, F. (2014) Creating an inventory of ecosystem services for selected Natura 2000 sites in Malta. Unpublished BSc (Hons) Earth Systems dissertation. Institute of Earth Systems, University of Malta.

Blondel, J. and Aronson, J. (1999) *Biology and Wildlife of the Mediterranean Region.* Oxford, UL: Oxford University Press.

Borg, J. (1995) *The Story of the Maltese Forest*. Malta: J. Borg.

Brown, M.A. (2000). Meandering through cities: adapting restoration frameworks for urban streams. Unpublished Master of Resource Management Thesis. School of Resource and Environmental Management, Simon Fraser University, Report #270.

Cassar, L.F. (2010) *A Landscape Approach to Conservation: Integrating Ecological Sciences and Participatory Methods.* Msida: Institute of Earth Systems, University of Malta.

Conservation International (2011) Biological diversity in the Mediterranean Basin. *The Encyclopedia of Earth*. Available: http://www.eoearth.org/view/article/150647/ (Accessed 1 September 2014).

Evans, J.D. (1971) *The Prehistoric Antiquities of the Maltese Islands*. London, UK: Athlone Press.

FAO (2014) *State of Mediterranean Forests 2013*. FAO and *Plan Bleu*.

Gayton, D. V. (2001) Ground work: Basic concepts of ecological restoration in British Columbia. Southern Interior Forest Extension and Research Partnership, Kamloops, British Columbia. SIFERP, Series 3.

Grove, A.T. and Rackham, O. (2001) *The Nature of Mediterranean Europe: An ecological history.* New Haven, USA: Yale University Press.

Gschwanter, T., Schadauer, K., Vidal, C., Tomppo, E., di Cosmo, L., Robert, N., Duursma, D.E. and Lawrence, M. (2009). Common tree definitions for national forest inventories in Europe. *Silva Fennica* **43**, 303-321.

Hunt, C.O. (1997). Quaternary deposits in the Maltese Islands: a microcosm of environmental change in Mediterranean lands. *GeoJournal* **41** (2), 101-109.

IPCC (n.d). Intergovernmental Panel on Climate Change: Reports – land use, land-use change and forestry. Available: http://www.ipcc.ch/ipccreports/sres/land_use/index.php?idp=47 (Accessed 1 September 2014).

Médail, F. and Verlaque, V. (1997) Ecological characteristics and rarity of endemic plants form S.E. France and Corsica. Implications for biodiversity conservation. *Biological Conservation* **80**, 269-281.

Myers, N., Mittermeier, R.A., Mittermeier, C.G., Da Fonseca, G.A.B. and Kent, J. (2000). *Biodiversity hotspots for conservation priorities*. *Nature* **403**, 853-858.

Pedley, M. (1980) The occurrence and sedimentology of a Pleistocene travertine in the Fiddien Valley, Malta. *Proceedings of the Geologists' Association* **91** (3), 762-767.

Quézel, P. (1976a) Le dynamisme de la végétation en région méditerranéenne. *Collana Verde* **39**, 375-91.

Quézel, P. (1976b) Les forêts du pourtour méditerranéen. *Note Technique MAB* **2**, 9-34.

Ritchlin, J. (2001) Healing the Land…Healing Ourselves. A Guide to Ecological Restoration Resources for BC. British Columbia: BC Environmental Network Educational Foundation.

Thompson, J.D., Lavergne, S., Affre, L., Gaudeul, M. and Debussche, M. (2005) Ecological differentiation of Mediterranean endemic plants. *Taxon* **54**, 967-976.

Zammit-Maempel, G. (1977). *An Outline of Maltese Geology*. Valletta, Malta: Progress Press.

Zammit-Maempel, G. (1982). A Maltese Pleistocene sequence capped by volcanic tufa. *Atti della Societa' Toscana di Scienze Naturali Residente in Pisa Serie A* **88**, 243-260.

Louis F. Cassar Ph.D. is a landscape ecologist and environmental planner by training, and has been involved in conservation since the mid-seventies, initially through local and international NGOs and later professionally. For almost a decade, he served as scientific advisor on coastal management to the International Centre for Science and High Technology of the United Nations Industrial Development Organization (ICS-UNIDO). His experience in coastal management and conservation extends to various countries of the Mediterranean region, as well as to West Africa and South America, with further field-work experience in South/South East Asia, the Amazon rainforests of the Guiana Shield, and Southern Africa. He has also been involved in several environmental appraisal assignments, both in Malta and overseas. Between 2001 and 2007, he served as Independent Member on the Board of the MEPA, and, until 2014, as a Member of the SEA Audit Team.

Professor Cassar is Director of the Institute of Earth Systems of the University of Malta, and also holds adjunct status within the Faculty of Integrated Science and Technology at James Madison University, in Virginia, USA, where he was based as Fulbright Scholar on a curriculum development assignment. His research interests include several aspects of environmental management and conservation (including landscape ecology, integrated coastal management, participatory methods for stakeholder involvement, and the valuation of ecological resources at landscape scale), as well as specific areas of entomology.

Elisabeth Conrad, Ph.D., is a lecturer with the Division of Environmental Management and Planning of the Institute of Earth Systems, University of Malta and an adjunct faculty member of the Faculty of Integrated Science and Technology at James Madison University, Virginia. She is an environmental management specialist by training, with her main research and teaching areas including social-ecological systems, protected area management, and landscape conservation. Dr. Conrad has contributed to the coordination and authorship of several Environmental Impact Assessment and related specialist reports and protected area management plans, as well as to various capacity building and curriculum development projects. She has also been actively involved in various international research and outreach initiatives, particularly in areas of landscape conservation and management, conservation and ecosystem management, and sustainability.

Annex 1

Gozo and Comino Local Plan
Map A1: Rehabilitation of damaged landscapes and afforestation areas (Gozo)
Map A2: Rehabilitation of damaged landscapes and afforestation areas (Comino)

Central Malta Local Plan
Map A3: Overall strategy map

North Harbours Local Plan
Map A4: Overall strategy map

North West Local Plan
Map A5: Woodland conservation areas