

**AN ECOLOGICAL SURVEY  
OF THE GHAIN TUFFIEHA AREA  
PREPARED FOR THE GAIA FOUNDATION  
AS PART OF THE MANAGEMENT PLAN FOR THE AREA**

**BY**

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UNIVERSITY CAMPUS  
MSIDA MSD 06**

**MAY 1997**

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# 1. INTRODUCTION

The Gaia Foundation has commissioned Malta University Services Ltd. to undertake a number of studies of the Ghajn Tuffieha area and to make specific recommendations regarding its management, as part an overall management strategy for the region. The present study is concerned with ecological aspects.

The study area is shown in Fig. 1. For ease of reference, the area has been subdivided into a number of sectors labelled **A** to **J**. Sectors **A** to **D** are the same as in a previous report on the Ghajn Tuffieha area prepared by MUS Ltd for the Planning Authority (Micallef *et al.*, 1995). Sectors **E** to **J** extend the original area surveyed by more than 100% to include the Tal-Lippija plateau to the South of Ghajn Tuffieha, and part of Ir-Ramla tal-Mixquqa to the North. The sectors are shown in Fig. 2.

The terms of reference given to MUS Ltd require the following:

1. An update of the previous survey of sectors A to D, and a survey of the new sectors (E to J).
2. Specific recommendations for:
  - a) rehabilitation and preservation of sectors A-D, to include:
    - i- A listing of the specific plant and tree species that should be encouraged in each section;
    - ii- An indication as to whether the above should include African Tamarisk (*Tamarix africana*) and whether this plant is considered indigenous;
    - iii- Whether the Blue-leaved Acacia (*Acacia cyanophylla*) should be phased out, and if so, how;
    - iv- The time of year when recommended species should be planted;
    - v- Whether planting should involve seeds, saplings, more developed plants, or a combination thereof;
    - vi- Whether selective transplantation of Esparto Grass from dense inland areas to sparse areas subject to heavy erosion is advisable and, if so, who should supervise this operation;
    - vii- Any other recommendations regarding erosion;
    - viii- The identification and location of any species of outstanding importance and the detailing of the habitat most conducive to their preservation;
    - ix- Whether grazing is compatible with the levels of protection conferred upon the site.

- (b) For sector F, a list of plants, shrubs and trees to be encouraged in a landscape project around the tower.
- (c) For the whole area, a listing of the terrestrial fauna occurring in the area, with details of any species of particular importance, to be undertaken mainly from a survey of the literature.
- (d) An assessment of the existing designation of the study area, or parts of it, as **AEI** (Areas of Ecological Importance) and **SSI** (Sites of Scientific Importance) and recommendations regarding these designations and proposals for new ones.

## **2. METHODOLOGY**

Site visits were carried out in April 1997 and the land area within the boundary shown in Fig.1 was surveyed, together with the land peripheral to this boundary. Classification and mapping of the ecological units present was based on indicator species of higher plants, although no attempt was made to compile a complete species list as this was impractical and unnecessary for the purpose of this report. Fieldwork was supplemented by literature surveys and personal communications with persons who have worked on the area under study.

The results of our studies are presented as (1) a habitats map (Fig.3) with accompanying commentary; (2) species lists of fauna and flora; and (3) discussion of the specific questions listed under 2(a) (i) - (ix) and 2(b) and (d), above.

Only species which are ecological indicators of particular habitat types or of particular environmental conditions, or are of particular ecological or conservation importance are included in the commentaries and species lists and, where applicable, the threat status is given with reference to the *Red Data Book for the Maltese Islands* [RDB] (Schembri & Sultana, [eds] 1989).

## **3. THE ECOLOGICAL LANDSCAPE**

The study area extends from the top of the cliff overlooking Ir-Ramla tal-Mixquqa (more popularly known as 'Golden Bay') in the North, to the plateau edge and clay slopes in the vicinity of Ta' Zammitello in the South and to Ghajn Tuffieha and Tal-Lippija in the East. To the west, the sea delimits the boundary of the study area; marine communities are excluded from the survey. Due to its high aesthetic value and the presence of four sandy beaches in the

general area, the study area is highly frequented and thus subject to intense anthropogenic pressures which need to be managed with both ecological and recreational considerations in mind. Hereunder is a description of the key elements within each of the sectors represented in Fig. 2.

Sector A includes the escarpment and associated boulder scree (*rdum*), and the clay slopes on the southern flank of the Ghajn Tuffieha plateau. This sector has a typical coastal *rdum* landscape, with an Upper Coralline Limestone block overlying Blue Clay. Erosion and recession of the latter causes the cliff edges to collapse under their own weight resulting in massive boulders which then move downslope over the mobile clay, particularly when this is wet and plastic. A boulder scree thus results at the foot of the escarpment and extends downslope to the sea where it may form a boulder shore in places. A perched aquifer is present in the permeable Coralline Limestone, supported by the Blue Clay aquiclude. Seepage from this, in the form of scarp-foot springs, results in the slopes below the *rdum* receiving abundant water during the wet season and beyond. This, together with the shelter provided by the escarpment and the boulders, results in a rich vegetation composed of a complex mosaic of steppe, garigue, rupestral and even maquis elements, which is best termed an '*rdum* assemblage'. A path skirting the cliff edge, the Ghajn Tuffieha Tower, a concrete shack built on the cliff edge next to the tower and a derelict hotel (the ex-Riviera Martinique, part of which has now collapsed due to the slope processes described above) are key anthropic elements here, whilst nearer the shore, a disused establishment providing beach services in summer, overlooks the sandy beach below.

Sector B comprises the sandy beach of Ir-Ramla ta' Ghajn Tuffieha and the receding clay slope to the back of this. These slopes result from Blue Clay that has eroded out of its stratum and has flowed downslope through the combined action of gravity and water transport to cover the underlying rock. Admixed with the clay are boulders of coralline limestone derived from the *rdum* edges of the Il-Hotba l-Bajda and Tal-Lippija plateaux. The clay slopes in Sector B have been afforested. Beneath the escarpment which forms the northern boundary of the Tal-Lippija plateau, there is a rocky area consisting of a scarp-foot boulder scree formed as described above (Sector A).

Sector C comprises the isthmus which bridges the Il-Karraba promontory (Sector D) to the mainland. It consists of a narrow clay ridge flanked by clay slopes on both sides. A small sandy beach has formed at the foot of the steeper southern slopes. The clay ridge represents the exposed Blue Clay stratum, the coralline rock which presumably originally covered this clay and linked the Il-Karraba block with the plateaux on the mainland, having now been completely eroded away. The slopes beneath the Tal-Lippija plateau to the south of Sector C receive

freshwater in the form of scarp-foot springs and seepages as already described above (Sector A).

The promontory known as Ras il-Karraba makes up Sector D. It consists of a block of Upper Coralline Limestone (Il-Karraba) fringed by *rdum* on top of Blue Clay. Erosion of this block has led to the formation of extensive boulder screes round Il-Karraba and of a boulder shore surrounding the whole promontory.

Sector E consists of the clay slopes along the Il-Hotba l-Bajda ridge, atop of which is a WWII gunpost and to the south, a sparse boulder scree originating from the edge of the plateau above.

On its seaward side Sector F is a continuation of the scarp-foot boulder scree found in Sector A. The top of the plateau was originally cultivated but practically all the fields are now abandoned and the area is very degraded.

Sector G represents a depression ('valley') between the high ground of Il-Ballut ta' Ras il-Gebel to the Northeast, and that of Tal-Lippija to the Southwest. The soil is clayey and receives abundant water from springs and seepages from the two plateaux above it. The area is extensively cultivated and irrigated (*aba saqwi*). A watercourse draining the surrounding slopes skirts the road to the East of Sector G.

Sector H comprises the slopes beneath the western edge of the Tal-Lippija plateau. These are characterised by boulder screes (*rdum*) at the foot of the escarpment, partly steppic clay slopes and a boulder shore at the waterline. An interesting feature of this sector is the flat limestone platform at sea-level towards the northern boundary of Sector H (Plate 1). The shore consists of Upper Globigerina Limestone and this soft rock has been planed flat by wave action.

Plate 1. Il-Karraba promontory, clay slopes and the Globigerina Limestone platform.

Sector I is the Lippija plateau which is a large block of Upper Coralline Limestone overlooking Ir-Ramla ta' Ghajn Tuffieha and Il-Bajja tal-Gnejna, girdled by *rdum*, and with a typical karstic surface vegetated by garigue and steppic assemblages (Ix-Xaghra tat-Torri), except at Tal-Lippija, where there is a small area of agricultural land.

Sector J consists of abandoned terraced fields and a stretch of cultivated terraced fields at Il-Lippija.

## 4. DESCRIPTION OF THE BIOTIC ASSEMBLAGES

### [terms of reference item 1]

The study area incorporates substantial stretches of karstland, boulder screes, agricultural land and clay slopes. Within the study area, the latter are either completely bare, or else colonised by indigenous vegetation typical of clayey steppes, or planted with a mixture of alien and indigenous trees. Fig. 3. illustrates the different biotic assemblages present in the study area.

### **BOULDER SCREES**

Boulder screes form a heterogenous habitat, providing ample shelter in the numerous depressions and clefts, to support rich plant communities. Dense thickets of both maquis and garigue trees and shrubs develop in a unique assemblage typical of such a landscape, where soil and water are more effectively retained than on exposed rocky slopes.

### **Il-Karraba (Sector D)**

Il-Karraba supports two distinct boulder scree communities. The mixed community on the northern side of the promontory has a high species richness, with no particular species dominating, except for a patch where *Euphorbia dendroides* (Tree Spurge) is the most conspicuous shrub. The tree species present, including Carob (*Ceratonia siliqua*), Fig (*Ficus carica*), Date Palm (*Phoenix dactylifera*) and Olive (*Olea europea*), and the Great Reed (*Arundo donax*), provide shelter for lower garigue shrubs such *Thymus capitatus* (Wild Thyme), *Periploca laevigata* subsp. *angustifolia* (Wolfbane) [RDB:27 **Rest (Med)**], *Cichorium spinosum* (Spiny Chicory), *Phagnalon graecum* subsp. *ginzbergeri* (Eastern Phagnalon) [RDB:36 **Rest (Med)**], *Inula crithmoides* (Sea Samphire), *Crithmum maritimum*, *Convolvulus oleifolius* (Olive-leaved Bindweed) [RDB:28 **Rest (Med)**], *Prasium majus* (Evergreen Germander), *Teucrium fruticans* and *Erica multiflora* (Mediterranean Heath). These two strata of vegetation provide shelter and support for climbers which typically form an understory in maquis communities. These include *Smilax aspera*, *Rubia peregrina*, *Lonicera implexa*

(Evergreen Honeysuckle) and *Asparagus aphyllus*. A stratum of low-lying species covers the ground.

Species include *Limonium melitensis* (Maltese Sea Lavender) [RDB:26 **Endemic**], *Sedum rubens* and *Theligonum cynocrambe*. *Adiantum capillus-veneris* grows in shaded crevices and nooks in the vertical rock faces where conditions are particularly humid. More ubiquitous plants such as *Dittrichia viscosa*, *Senecio cineraria*, *Capparis orientalis*, *Euphorbia pinea*, *Umbilicus horizontalis* and *Anthirrinum tortuosum* are also found. Also present was the alga *Phyllosiphon arisarii*, parasitic on Small Lords-and-Ladies (*Arisarum vulgare*).

The south-facing side of the boulder scree provides a more protected habitat since it is sheltered from the prevailing northerly and northwesterly winds. This is probably the reason for the different assemblage which has developed here; a 'sub-maquis', dominated by *Euphorbia melitensis* [RDB:21 **Endemic**] and *Periploca laevigata* subsp. *angustifolia* [RDB:27 **Rest (Med)**]. Other species present include *Fagonia cretica* [RDB:21 **Vulnerable, Rest (Med+MI)**] (Plate 2).

Plate 2. The rare Fagonia shrub (*Fagonia cretica*).

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### **It-Torri ta' Ghajn Tuffieha (Sectors A & F)**

A similar scree assemblage is found below It-Torri ta' Ghajn Tuffieha, facing Ir-Ramla ta' Ghajn Tuffieha. Species include large shrubs of Fig, *Darniella melitensis* [RDB:12 **Endemic**] and *Capparis orientalis* accompanied by, *Convolvulus oleifolius* [RDB:28 **Rest (Med)**], *Inula crithmoides* and *Thymus capitatus*. Further to the north, a boulder shore backed by a sheer rock face sparsely vegetated with *Euphorbia melitensis* [RDB:21 **Endemic**] and *Darniella melitensis* [RDB:12 **Endemic**] has developed. This eventually gives way to a more gentle slope colonised by *Inula crithmoides*, *Crithmum maritimum*, *Dittrichia viscosa* and *Senecio cineraria* which grades into a boulder scree community dominated by *Euphorbia melitensis* [RDB:21 **Endemic**].

### **Tal-Lippija (Sector I)**

Along the northern side of the Lippija plateau is a community composed of a mixture of typical boulder scree and maquis elements. Some low Fig and Date Palm trees are found along with climbers such as *Asparagus aphyllus*, *Rubia peregrina*, *Lonicera implexa* and *Smilax aspera* and the shrubs *Crithmum maritimum*, *Prasium majus*, *Teucrium fruticans*, *Inula crithmoides* and *Senecio cineraria*. Scarp-foot springs seeping out of the low rock face support such hydrophilic species as *Holoschoenus vulgaris* and *Festuca arundinacea*.

## **GARIGUE**

### **Il-Karraba**

The top of Il-Karraba is very exposed and the karstland only supports a low *Thymus capitatus* garigue, with shrubs growing prostrate, hugging the ground; geophytes such as *Asphodelus aestivus*, *Urginea maritima* [RDB:38 **Rest (Med)**] are abundant. A hunting and trapping site is present.

### **Ix-Xaghra Tat-Torri / Tal-Lippija**

Although predominantly a low garigue, in most places species richness is high and the prostrate form of the shrubs appears to be a function of exposure rather than of trampling and other anthropogenic pressures. The dominant species are *Thymus capitatus* and the geophytes *Asphodelus aestivus* and *Urginea maritima* [RDB:38 **Rest (Med)**]. Other species present include *Anthyllis hermanniae*, *A. vulneraria*, *A. tetraphylla*, *Sedum caeruleum* [RDB:16 **Rest (Med)**], *S. sediforme*, *Convolvulus oleifolius* [RDB:28 **Rest (Med)**], *C. elegantissimus*, *Prasium majus*, *Teucrium fruticans*, *T. flavum*, *Phagnalon graecum* subsp. *ginzbergeri* [RDB:36 **Rest (Med)**], *Asparagus aphyllus*, *Brachypodium retusum*, *Hyparrhenia hirta*, *Fumana arabica*, *Ornithogallum narbolense*, *Serapias parviflora*, *Allium subhirsutum*, *A. roseum*, some *Anacamptis pyramidalis*, *Ophrys lactea* and thistles such as *Atractylis gummifera*, *Carlina involucreta* [RDB:34 **Rest (Med)**] and *Galactites tomentosa*. The latter species are especially

abundant where the natural garigue habitat has been disturbed, for example, along pathways and close to dumps. There is evidence of a thriving Wild Rabbit population.

The southern half of the Ix-Xaghra Tat-Torri / Tal-Lippija plateau is more exposed and this has resulted in a more steppic character for the communities present (Plate 3). The dominant species along the cliff edge in this region were prostrate *Thymus capitatus* and *Convolvulus oleifolius* [RDB:28 **Rest (Med)**] and *Cichorium spinosum*.

Plate 3. A low garigue develops on the exposed Tal-Lippija plateau.

Further north along the plateau edges, *Fagonia cretica* [RDB:21 **Vulnerable, Rest (Med+MI)**], *Phagnalon graecum* subsp. *ginzbergerii* [RDB:36 **Rest (Med)**], *Crucianella rupestris* [RDB:27 **Rest (Med)**], *Inula crithmoides*, *Convolvulus oleifolius* [RDB:28 **Rest (Med)**], *Plantago bellardi*, *Ophrys lutea* and *Lygeum spartum* are found.

### **CLAY SLOPES**

#### **Ghajn Tuffieha**

The whole of the Ghajn Tuffieha area is very rich in Blue Clay exposures and the predominant vegetation of the clay slopes is a characteristic steppe which may be termed a 'clay steppe'. Typically this is dominated by grasses, mainly *Lygeum spartum* (Plate 4). Also common are *Cynara cardunculus*, *Hedysarum coronarium*, *Inula crithmoides* and *Carlina involucrata* [RDB:34 **Rest (Med)**]. Where the gradient is very steep, colonisation even by vegetation is hindered, probably due to the highly mobile nature of the substratum and the clay is consequently bare.

Plate 4. Esparto grass (*Lygeum spartum*) plays an important role in binding the clayey substratum.

### **Il-Karraba**

All of Sector C is steppic, although Esparto Grass is rather sparse in this area. The north-facing slope is colonised by Cardoon (Malt. Qaqocc tax-Xewk; *Cynara cardunculus*), Esparto Grass, Golden Samphire (Malt. Xorbett; *Inula crithmoides*), Clustered Carline-Thistle (Malt. Sajtun; *Carlina involucrata* [RDB:34 **Rest (Med)**]) and Cape Sorrel (Malt. Haxixa Ingliza; *Oxalis pes-caprae*). The south-facing slope is practically bare due to the steep gradient although in some areas the slopes are covered by blankets of *Fagonia cretica* [RDB:21 **Vulnerable, Rest (Med+MI)**] and the tenacious alien Cape Sorrel (Photo 4).



To the West and the Northeast of these steep slopes, the steppes become dominated by herbaceous species and bulbous plants such as Asphodel and Seaside Squill, although Esparto Grass is still present.

## **II-Hotba l-Bajda**

The clay slopes at the back of Ir-Ramla ta' Ghajn Tuffieha have been planted with Tamarisk and in localised patches, Acacia. The undergrowth is composed of a dense population of *Lygeum spartum*. Although the Tamarisks were originally planted, a stable association has formed between this shrub and *Lygeum spartum*. In fact the Tamarisks, which are true natives (*Tamarix africana* [RDB:23 **Rare, Rest (Med+MI)**]), are now self-regenerating and fully naturalised. This community is playing a crucial role in reducing erosion of the Blue Clay, as the roots stabilise the substratum and the dense canopy minimises the effects of water and wind erosion. This slope is also the only known locality for the threatened *Barlia robertiana* [RDB:47 **Endangered, Rest (MI)**] (Plate 5), which grows dangerously close to footpaths which are frequently used by motorcyclists.

Plate 5. The slopes of Ghajn Tuffieha are the only known Maltese locality for the endangered Giant Orchid (*Barlia robertiana*).

Il-Hotba L-Bajda has been afforested, mainly with Acacias, but also with Tamarisks and some Eucalyptus, to give the so called 'Israel Grove'. This was planted by the Department of Agriculture in the period between 1969 and 1971 on the advise of experts from Israel, hence the name (Borg, 1990). The undergrowth, although dominated by Cape Sorrel (*Oxalis pes-caprae*), also includes *Inula crithmoides*, *Asparagus aphyllus*, *Avena sterilis* and *Galactites tomentosa* with occasional *Gladiolus italicus* and *Narcissus tazetta*. Typical clay species such as *Lygeum spartum*, *Tragopogon hybridus*, *Hedysarum coronarium* and *Scorzonera laciniata* occur in areas where the tree cover is reduced or absent. *Avena sterilis* has also invaded most of these patches. To the South of Il-Hotba L-Bajda and to the Northeast of Tal-Lippija/Ix-Xaghra tat-Torri plateau, the elsewhere dominant Acacia is replaced by Olive exhibiting considerable secondary growth. Below the escarpment, the ground is too steep for agriculture and the large seed-bank of Acacia at Israeli Grove has led to its establishment and dominance in this region as well, with a thick undergrowth of *Asparagus aphyllus*, *Cynara cardunculus*, *Carlina involucrata*, *Hedysarum coronarium*, *Avena sterilis*, *Dactylis hispanica* and *Oxalis pes-caprae*. Aleppo Pine, Olive and Cypress also occur.

### **Ta' Zammitellu**

The slope leading towards the sea North of Ta' Zammitellu is mainly clayey, interspersed occasionally with coralline boulders, hence giving the whole area rather specific habitat characteristics. Dense stands of *Arundo donax* arise where there is considerable runoff from the various scarp-foot springs. Degraded areas are overrun with *Avena sterilis*. The rest of the area is a mosaic of grass steppe dominated by *Lygeum spartum* and a boulder scree assemblage. Where sheltered by the escarpment face, the vegetation is dominated by Carob, Fig, Olive and Pomegranate, many of which were originally planted, and by maritime shrubs such as *Inula crithmoides* and *Darniella melitensis*. Small patches of cultivated land are also found. Closer to Il-Karraba, the clay substratum is more mobile and as a consequence the vegetation cover decreases. The rare *Fagonia cretica* [RDB:21 **Vulnerable, Rest (Med+MI)**] is present along the whole talus up to the northernmost point of the Tal-Lippija/Ix-Xaghra tat-Torri plateau.

### **SANDY BEACHES**

#### **Ir-Ramla ta' Ghajn Tuffieha**

No appreciable vegetation develops on the sand of Ir-Ramla ta' Ghajn Tuffieha. Banquettes of the sea-grass *Posidonia oceanica* [RDB:50] accumulate along the shoreline during the autumn and winter months. Particularly well developed banquette communities (c. 1m high) occur along the southern arm of the beach, skirting the Il-Karraba isthmus and support a rich fauna of amphipods, isopods and insects. Of particular interest is the littoral isopod *Buchnerillo littoralis*,

known from only three sites in the Maltese Islands, and the isopod *Armadilloniscus candidus* known only from Il-Karraba and Mistra.

## **AGRICULTURAL LAND**

### **Ghajn Tuffieha**

Sector G consists entirely of highly fertile arable land, forming a wide basin between the surrounding high ground of Il-Hotba l-Bajda to the West and Il-Ballut ta' Ras il-Gebel to the East. Although isolated patches of fallow land are present, most of the area is actively cultivated. A drainage channel formed by runoff from the slopes to the East borders the eastern perimeter of this sector and supports a dense community of *Arundo donax*, rushes (unidentified) and *Festuca arundinacea*, as well as some Fig and Carob trees.

## **DEGRADED AREAS**

### **It-Torri ta' Ghajn Tuffieha (Sectors A & F)**

The much degraded cliff edge and adjacent area in this region is colonised by species such as *Daucus rupestris*, *Convolvulus oleifolius* [RDB:28 **Rest (Med)**], *Chrysanthemum coronarium*, *Galactites tomentosa* and *Hirschfeldia incana*. Further North, the fields which once skirted the cliff edge have been long abandoned and their soil has practically all eroded away, exposing the bedrock in places. A rough track has also been constructed skirting the plateau edges. The track verges are colonised by such opportunistic species as *Carlina involucrata*, *Galactites tomentosa* and *Senecio cineraria*. Dumping of refuse and construction rubble around the car park area and on the land adjacent to the track to the South is widespread.

### **Tal-Lippija**

The boulder scree below the Tal-Lippija plateau to the North, gradually grades into a mixed garigue and close to the escarpment the vegetation consists of *Thymus vulgaris*, *Cichorium spinosum*, *Inula crithmoides*, *Anthyllis hermanniae*, *Senecio cineraria* and *Brachypodium retusum*. This community is much degraded, probably due to off-roading by motorcycles as indicated by the numerous wide tracks with motorcycle tyre-prints in the area. Access to these tracks appears to be from the Il-Hotba l-Bajda area.

### **Il-Hotba l-Bajda**

Just inside Sector B to the East is a saddle in the clay slopes which has for some time been utilised as an unofficial camping site. The area is thus subject to a high degree of trampling, refuse tipping and the threat of fire from makeshift campfires (Plate 6). The track leading from the car park in Sector F provides access to this region.

Plate 6. Campfires on the dry summer slopes increase the risk of fires which destroy considerable patches of vegetation each year.

**Ix-Xaghra Tat-Torri/Tal-Lippija**

A few Blue-leaved Acacia have been planted near the agricultural area of Tal-Lippija and enclosed within low rubble walls. The vegetation surrounding these has developed a distinct steppic character, as have nearby patches adjacent to bird hunting and trapping hides. Tracks traversing the entire plateau have also been constructed to provide access to these hides. The area surrounding It-Torri ta' Lippija is completely denuded of vegetation due to heavy trampling, presumably by vehicles.

## 5. RECOMMENDATIONS

### 5.1 The Management Plan

Management of the Ghajn Tuffieha area will involve a number of actions whose effects will not be visible in the short term, for example, planting of trees and slope stabilisation. As such, it is important to understand how each of these activities fits into a long term plan for the area. The Gaia Foundation must therefore have a clear vision of what they want the Ghajn Tuffieha area to look like in 20 years time. For example, should the present day vegetation be maintained in the *status quo*, or should the present steppes be encouraged to develop into garigues and the present garigues into maquis; or, should the abandoned agricultural land be allowed to develop a vegetation cover naturally or should it be planted, and if so with what: the natural vegetation of the area or with indigenous plants which are not necessarily found in the Ghajn Tuffieha area at present? Until the long term strategy is worked out and approved by the authorities, it is difficult to properly plan re-vegetation work and other habitat interventions such as weed control, track management, and slope and cliff stabilisation etc.

The Gaia Foundation have not provided any information on to their management objectives for the Ghajn Tuffieha area, but have indicated that they are open to suggestions. In this section we offer such suggestions outline some of the main issues that need to be addressed in a management plan for the Ghajn Tuffieha area.

In our opinion the main management objectives should be:

- conservation of indigenous plants and animals, and their habitats;
- regeneration of native vegetational communities in appropriate areas;
- protection of the cultural heritage (for example the towers, traditional agriculture, etc.);
- visitor education (for example, through a permanent exhibition, sign-posted nature trails etc.);
- promoting low-impact recreational use (for example, walking and horse riding, picnics in appropriate areas, and bathing).

## 5.2 General Recommendations

- Some of the following recommendations have already been suggested in the previous report on the Ghajn Tuffieha area (Micallef *et al.*, 1995). These are repeated here both for the sake of completeness and for ease of reference, however, we have also taken the opportunity to expand on certain recommendations and issues.
- So far, the Ghajn Tuffieha area is protected in terms of the Development Planning Act 1992. It is highly recommended that the area, or at least the Level I and Level II AEI/SSI, be declared as a 'Nature Reserve' in terms of the Environment Protection Act 1991. This will enable the issuing of regulations for the management of this reserve with the force of law. It will also integrate the activities of the Planning Authority and the Environment Protection Department vis-à-vis the conservation and protection of this ecologically sensitive area.
- Both towers within the Ghajn Tuffieha area (It-Torri ta' Ghajn Tuffieha and It-Torri tal-Lippija) are historic landmarks and important parts of our cultural heritage. Both are abandoned and in need of extensive restoration. These monuments should be scheduled, restored and possibly put to use. Possible uses are as a visitors' centre to house a permanent exhibition providing information about the area, or as a base for the reserve wardens.
- The former Riviera Martinique is now both dangerous and an eyesore. It should be demolished completely and all the rubble carried away from the site. The slopes beneath the derelict building should also be cleared of rubble which has cascaded onto them over the years. Consideration is to be given to what is going to happen to the cleared site. If no other structure is going to be built in this space, then it should be re-vegetated using appropriate species.
- Another eyesore, is the concrete building perched on the cliff edge next to It-Torri ta' Ghajn Tuffieha. This building mars the skyline and jars with the landscape and the

majestic tower. Ownership should be investigated with a view to eventual appropriation (if the land is in private ownership) and removal.

- Hunting and trapping activities within the Ghajn Tuffieha conservation area are an issue. Hunting appears to take place all over the area, but especially on the slopes immediately beneath the escarpment and on the plateau surfaces. Shooting/trapping hides are present on top of the plateaux of Il-Karraba, Il-Hotba l-Bajda and Tal-Lippija/Ix-Xaghra tat-Torri. Hunting and trapping are not compatible with Level I AEI/SSI status, however, they may be allowed in Level II areas if these are considered as “traditional activities” (See Explanatory Memorandum to the Structure Plan pp. 102). If it is decided to allow hunting and trapping to continue in designated areas, the hides should at least be built of traditional materials such that they blend with the landscape and hunters and trappers should be individually identified and issued with a special permit to practice their activities in the area. What they are allowed or not allowed to do (planting trees, covering rock with soil, etc.) should be clearly specified and they should also be bound to remove any wastes resulting from their activities (for example spent cartridges).
  
- Another issue is the vegetation or rather the re-vegetation, of those areas which are degraded or from which the natural vegetation has been extirpated by anthropic activities. The available options are:
  - leave as is;
  - control the worst weeds or aliens and erosion but do nothing else;
  - re-vegetate with trees & shrubs (native but necessarily occurring in the Ghajn Tuffieha area);
  - re-vegetate to something like "original vegetation" that occurred in the area prior to human intervention.
  
- In our opinion all four options have a place in the management plan since different sectors of the Ghajn Tuffieha area require different treatment, as follows:
  - Areas where the vegetation is still in its natural state should not be interfered with.

- Areas where the vegetation is still predominantly 'natural' but which have become invaded by weeds and aliens require selective weeding and removal of alien elements. The main invasive aliens present are Acacias and management policies regarding these are discussed in Section 5.3. Prickly Pear and American Agave found in Sector A, which have escaped from cultivation and are now integrating themselves into the natural vegetational communities, should also be removed.
  - In areas degraded due to human activities (trampling, fire, over-grazing, dumping) but which have the potential for regeneration, the disturbing influence should be removed and then natural regeneration of the remnant vegetation should be encouraged. Such areas might require initial management, for example, weeding and supplementing the natural seed-bank with seeds collected from adjacent areas.
  - Where natural regeneration is not possible, for example, on slopes where little or no remnant vegetation remains, suitable shrubs (Tamarisk) and grasses (Esparto Grass) may be planted.
  - 'Developed' areas, such as the margins of the asphalted access roads, the car park, etc. may be suitable for planting or landscaping with native species which do not necessarily occur in the Ghajn Tuffieha area at present.
- In any re-vegetation work, the following principles should be followed:
    - All plants should be propagated from locally collected seed or from cuttings from local stock.
    - The ground should not be ripped up prior to planting, as this creates disturbed ground which is ideal for invasion by weeds.
    - No planting should take place in the middle of good stands of native vegetation
    - Trees should not be planted where they are unlikely to survive or thrive due to exposure.

- The clay slopes at Ghajn Tuffieha are actively eroding (see Section 5.3.). Certain activities such as off-roading, trampling, picnicking and camping on the slopes are aggravating channel formation and destroying the vegetation which binds the superficial layers of the clay. As a consequence, erosion of the upper layers of the clay is being accelerated (Plate 7). It is therefore recommended that all these activities be prohibited on the clay slopes. Some of these activities may be allowed in areas designated for the purpose (for example walking, picnicking and camping), where they can be controlled. Other activities however, are incompatible with the status of the area as a conservation area (e.g. off-roading).

Plate 7. Off-roading on the clay slopes accelerates erosion of clay.

- At present there are a large number of tracks criss-crossing all over the area. Some of these are wide enough to take vehicles and are actually used for vehicular access to otherwise remote sites. One track to allow vehicular access to the beach for emergency use may be allowed provided that access to it is strictly controlled, otherwise all the wide tracks and associated clearings should be eliminated. Likewise, most of the footpaths which traverse the area are unnecessary and should be eliminated. What should remain is

a carefully thought out route or routes through the area which would allow visitors access to all the interesting features present. A track around the edge of the plateaux would provide an excellent opportunity for walkers to enjoy the view, however, tracks on very steep slopes should be avoided due to the inevitable problems with erosion. Routes should be clearly marked (for example by using wooden stakes), sign-posted, provided with boards at key points explaining to the visitor what there is to see, and they need to be maintained and protected as from vandalism.

- No major rehabilitation measures are necessary in the Ghajn Tuffieha area as the area is relatively undisturbed and free of litter and dumped material, except for some areas (for example the track leading down to the beach, the slopes at Il-Hotba l-Bajda and parts of sectors A and F). It is recommended that all dumped material and litter be removed and an alternative site be found for the disposal of residue from beach-cleaning activities.
- It is not clear whether the kiosk on the beach at Ir-Ramla ta' Ghajn Tuffieha is still operational or not.. If it is not, serious consideration should be given to its removal together with the concrete platform on which it stands, and the area rehabilitated.
- The thick banquettes of Neptune Grass (*Posidonia*), which accumulate along the shore during the autumn and winter months are of ecological importance, however, no detailed study of this habitat has yet been carried out locally. These banquettes are usually cleared away at the beginning of summer, as part of a beach-cleaning process to make beaches more attractive to bathers. The sandy strip extending along the southern arm of the Ras il-Karraba isthmus and that part of Ir-Ramla ta' Ghajn Tuffieha that forms its northern shore, are relatively unfrequented. It is recommended that at least here, banquettes be allowed to develop.

### **5.3 Specific recommendations regarding the rehabilitation and preservation of sectors A-D**

#### **Plant species which should be encouraged [Terms of reference 2(a) (i)]**

For an overview refer to the brief report already prepared for the Gaia Foundation by Christensen & Lanfranco (1995) which contains most required information in a nutshell. This report is reproduced here as Appendix I.

<b><u>Species</u></b>	<b><u>Type</u></b>	<b><u>Remarks</u></b>
<i>Tamarix africana</i>	Tree	Suitable for planting on clay slopes, salt and wind resistant.
<i>Tetraclinis articulata</i>	Tree	Rare, Malta's "National Tree". Can be planted in the upper part of the hill as at Sector B & E.
<i>Pinus halepensis</i>	Tree	Can be used, to a limited extent, in the upper slopes and to provide shade down the stairway and some of the paths.
<i>Olea europaea</i>	Tree	The Olive can be planted in the upper and middle reaches of the slopes.
<i>Quercus ilex</i>	Tree	This large oak can be introduced in some of the more sheltered areas in the upper slopes.
<i>Darniella melitensis</i>	Shrub	Endemic species. May be used on slopes and in screes. Also to skirt footpaths.
<i>Euphorbia dendroides</i>	Shrub	Should be planted on upper slopes.
<i>Chamaerops humilis</i>	Shrub	This dwarf palm is now extinct from the wild, but it can easily be introduced on the slopes. It resists drought, salt spray and wind.
<i>Vitex agnus-castus</i>	Shrub	This large shrub or small tree should be planted along the stream.
<i>Atriplex halimus</i>	Shrub	Can be planted on all slopes.
<i>Periploca angustifolia</i>	Shrub	This can be planted in the upper reaches of the slopes.

### **The African Tamarisk *Tamarix africana* [Terms of reference 2(a) (ii)]**

The African Tamarisk (*Tamarix africana*) is a small tree (or large shrub) belonging to the family Tamaricaceae and growing to a height of 2-3m. The African Tamarisk is native to the western and central Mediterranean, including the Maltese Islands, where it grows in coastal areas on sandy and saline soils. It is a very resilient tree, able to survive full exposure to sea spray. Although used as an ornamental tree and widely planted in the Maltese Islands, this species is a true native and dense native stands of this species exist in several places. It is important not to confuse *Tamarix africana*, which is indigenous, with other similar species of Tamarisk which are aliens, for example *Tamarix gallica* and *Tamarix parviflora*. Any Tamarisk planted should be *Tamarix africana* preferably of proven indigenous stock.

### **Acacias [Terms of reference 2(a) (iii)]**

The site includes some large plantations with *Acacia saligna* (= *A. cyanophylla*) and *Acacia cyclops*. These species are invasive aliens that not only do not form part of Mediterranean ecosystems, but are harmful to such ecosystems since they gradually displace native species. *Acacia* spp. and Eucalypts, particularly *Eucalyptus camaldulensis* and *E. gomphocephala*, have been widely used in afforestation programmes in Malta during the sixties, seventies and early eighties, since they thrive very well in our climate, are quick growing, decorative and cheap. However, being native to Australia, they do not fit in the Mediterranean vegetation context. Moreover, both Acacias and Eucalypts are known to produce exudates which inhibit growth of other plants and thus reduce biodiversity (Plate 8). Eucalypts also consume large quantities of water and have been used in several parts of the world to drain swamps. As such, Acacias and any Eucalypts, should be phased out. However this should be done gradually, with the trees being thinned out progressively and gradually replaced by more desirable species. The best method for thinning out Acacias is by cutting down the trees gradually to diminish their numbers. Other trees can then be planted in the opened spaces. The final aim should be to remove all Acacia trees from the area. It is also advisable to start removing Acacia leaf litter which inhibits the development of an undergrowth.

Plate 8. An Acacia copse with a sparse undergrowth as a result of allelopathic effects.

**Time of planting [Terms of reference 2(a) (iv)]**

The best time for planting most species is generally early autumn and early spring. Autumn is preferable since it is at the start of the rainy season and thus cuts down on the need for summer watering. If the autumn is particularly dry however, watering of newly planted saplings and other vegetation may still be necessary.

**What should be planted [Terms of reference 2(a) (v)]**

Given the highly exposed nature of much of the area under consideration and the nature of the substratum, it is perhaps advisable to plant 1 to 4 year old saplings. For best results, plants should be at least 50cm high. Several of the species listed above can be started from cuttings which can be grown in a nursery and later transplanted. Others need to be started from seed (*Tetraclinis*, *Pinus*, *Quercus*), also in a nursery.

**Esparto Grass (*Lygeum spartum*) [Terms of reference 2(a) (vi)]**

Transplantation of Esparto Grass (*Lygeum spartum*) is important. This is one of the most valuable plants of the clay areas and plays a major role in binding the clay. It will be valuable to reduce erosion where gullies have formed. The Esparto grass may be collected from dense stands and transferred to bare areas. If transferred directly it will require watering until established.

## **Control of erosion [Terms of reference 2(a) (vii)]**

Erosion is the dominant physical process in the study area and the present landscape is largely a result of past and ongoing erosion. Three types of rock are exposed in the study area: Globigerina Limestone which is overlain by Blue Clay which is in turn capped by Upper Coralline Limestone. Blue Clay, by far the most friable of the three, erodes out of its stratum to cover the underlying Globigerina, at the same time undermining the Coralline Limestone. This leads to collapse of the cliff edges to give boulder screes (*rdum*) at the foot of the escarpments. The eroded clay travels downhill under the action of gravity, especially when it is wetted and becomes plastic, leading to mudslides. These carry with them the overlying limestone boulders. The result is an *rdum* landscape such as dominates the coastline of the study area. The formation of such a landscape is well understood in general terms and the processes involved have been described by Guilcher & Paskoff (1975), Paskoff & Sanlaville (1978), Ellenberg (1983) and Paskoff (1985). However, no detailed studies have been made, especially of the erosion of the Blue Clay, which is the key step in the sequence of events leading to *rdum* landscapes. Without such detailed study it is difficult to suggest corrective measures. For example, it is not known whether the lack of vegetation on the clay slopes is the cause of mudsliding or a result of it. In the former case, planting soil-binding vegetation will retard erosion; in the latter however, such planting will do little to alleviate the problem in the long term.

What is certain however, is that the landscape is highly active and dynamic. Micallef (1996) carried out a series of simple experiments which demonstrated that the superficial layers of clay at Ghajn Tuffieha move downslope even over very short periods of time and that the rate of displacement is highest where the slopes are bare of vegetation. An ongoing study by Grattan & Gilbertson (in preparation) has demonstrated the magnitude of the problem. Aerial photographs of the Lippija tower indicate that in the early 1960s the cliff edge was approximately 16 metres towards the sea from the foot of this tower; in 1997 this has been reduced to 3 metres - less in places - and most of the missing cliff appears to have detached itself in a single section and slid down towards the sea., where it can now be observed a few metres above the beach in Gnejna Bay (J. Grattan & D. Gilbertson, personal communication). Study of aerial photographs and observations made during field visits in 1996 and 1997 by Grattan & Gilbertson suggest that there is rapid and catastrophic movement of the Blue Clay in both Gnejna Bay and Ghajn Tuffieha Bay. A small excavation on the beach at Gnejna Bay showed that the beach itself has formed OVER

several older mudslides., while at Ghajn Tuffieha Bay mud slides are encroaching on the beach (J. Grattan & D. Gilbertson, personal communication).

The overall picture which emerges is that there is a continuous downslope movement of the superficial layers of clay, but that under certain conditions, large volumes of clay become fluid and move very rapidly downhill, transporting with them overlying boulders, which may measure over 5m in diameter.

In view of the above, the following recommendations are made:

- The work of Grattan & Gilbertson should be continued and extended. A comprehensive survey of the coastline and assessment of the erosive processes occurring should be carried out and the rate of erosion and cliff collapse must be accurately assessed. In particular mudslides, which are the key to the whole process MUST be studied. What triggers them, how long they remain unstable and what processes stabilise them must be identified. The relationship between climate, soil, vegetation and erosion must also be considered.
- In the meantime, until more information becomes available, planting dense stands of Tamarisk, as suggested in Christensen & Lanfranco (1995) and of Esparto Grass, will be valuable in reducing erosion of the superficial layers of the clay.
- It is recommended that access of vehicles to the slopes be prohibited. Although these probably do not directly cause catastrophic mudsliding, they certainly accelerate erosion of the superficial layers both directly and indirectly through removal of the vegetation cover.
- For the same reason, unnecessary trampling on the clay slopes should be avoided. Only a few of the already existing narrow footpaths should be retained. Unnecessary footpaths, the wider tracks and the large clearings should be removed by covering them with clay and planting Tamarisks.
- During the summer months, many people camp more or less permanently on the clay slopes. This should also be discouraged for the same reasons as off-roading and trampling.

### **Species of conservation importance [Terms of reference 2(a) (viii)]**

The known species of conservation importance which occur in the study area have already been discussed in the commentary on the biotic assemblages present and their geographical distribution (Section 4). A list of the plant species which occur is given in Appendix II.

In summary, the most important plant species present in the study area are:

For their ecological importance: *Tamarix africana*, *Lygeum spartum* (on clays); *Thymus capitatus*, *Euphorbia melitensis*, *Convolvulus oleifolius* (in garigues); *Euphorbia dendroides*, *Periploca angustifolia* (on screes)

For their scientific/conservation importance: *Fagonia cretica*, *Limonium melitensis*, *Daucus rupestris*, *Euphorbia melitensis*, *Periploca angustifolia*, *Convolvulus oleifolius*, *Plantago bellardi*, *Ophrys lutea*, *Barlia robertiana*.

### **Grazing [Terms of reference 2(a) (ix)]**

No evidence of grazing by sheep or goats was noted during the site visits nor did the vegetation show any obvious signs of intensive grazing. From our experience, grazing of sheep and goats in the area has become very reduced in recent years. In our opinion, the present level of grazing may be maintained however, it should not be allowed to increase. Areas where saplings are planted should be protected from grazing until the trees are sufficiently mature to contain limited grazing and browsing.

On the other hand there was evidence of a substantial wild rabbit population on the Ix-Xaghra Tat-Torri/Tal-Lippija area (Sector I). Grazing by rabbits may be one factor keeping the vegetation in this sector at its present developmental stage although it is unlikely that this is the only or even the most important factor. No study on the effects of rabbit grazing on vegetation in the Maltese Islands have been made to date and without such studies and a knowledge of the size of the rabbit population in the area, the magnitude of the problem, if indeed a problem exists, cannot be assessed. The only information available is anecdotal:

eradication of the rabbit population from St. Paul's Islands has allowed the vegetation there to develop from a degraded steppe to a low garigue. At this point in time, rabbit grazing appears to be sustainable. However, some form of culling may have to be resorted to if the rabbit population becomes too large.

#### **5.4 Specific recommendations regarding planting in sector F [Terms of reference 2(b)]**

This was originally a karstland with garigue vegetation which was taken over for cultivation and later abandoned. Here, one may plant garigue species and encourage others to grow in order to re-establish the original landscape. Initially, the area may be planted with shrubbier species such as *Euphorbia melitensis*, *Thymus capitatus*, *Anthyllis hermanniae*, *Teucrium fruticans*, *Euphorbia dendroides* etc. After this initial planting, maturation of the assemblage may be enhanced by seeding with mixtures of seeds collected from nearby garigues in summer - this would help introduce the full suite of herbaceous species which accompany the previously mentioned shrubs in local natural garigues. In the early stages, opportunistic species ('weeds') should be kept in check by careful hand-weeding. Since the area is highly exposed, use of trees is unlikely to be successful.

#### **5.5 Specific recommendations regarding the designation of AEI and SSI in the study area [Terms of reference 2(d)]**

The whole of the study area has been designated an Area of Ecological Importance (AEI) and as an Area of High Landscape Value (AHLV) by virtue of Government Notice 400 of 1996. Sectors A, B, C and D had already been previously designated as an AEI by virtue of Government Notice 117 of 1995. These designations were made in terms of Section 46 of the Development Planning Act, 1992 and in the case of the AEI designations, as set out by Malta Structure Plan Policy RCO12 and sections 15.34, 15.35, 15.38, 15.39 and 15.40 of the Explanatory Memorandum which forms part of the same plan.

As some confusion may arise as to the difference between the various types of Rural Conservation Areas contemplated by the Malta Structure Plan, it is important to understand the policy context for setting these up.

Policy RCO1 of the Malta Structure Plan sets up seven types of Rural Conservation Areas, including two 'ecological/scientific' ones: Areas of Ecological Importance (AEI) and Sites of Scientific Importance (SSI). In short, the difference between these is that whereas the former (AEI) are designed to protect habitats in their entirety (including all biota, regardless of conservation status), the latter (SSI) are designed to protect individual features, which may be a species, a group of species or non-living features of scientific importance.

The types of habitat that are to be protected by designation as AEI are specified in Malta Structure Plan Policy RCO10 which states that the presence of any one of the following habitat types qualify an area as an AEI:

1. Permanent springs
2. Saline marshlands
3. Sand dunes
4. Forest remnants
5. Semi-natural woodland
6. Natural freshwater pools and transitional coastal wetlands
7. Deep natural caves
8. Coastal cliffs
9. Representative examples of typical Maltese habitats such as garigue, maquis, valley sides, watercourses and gently sloping rocky coasts.

The habitats numbered 1-7 in this policy are those which are rare in the Maltese Islands and therefore all examples are to be preserved as a valuable part of our natural heritage. Coastal cliffs (No.8 in the list above) is perhaps our most scientifically important habitat because of the large number of unique species and others of biogeographical interest that it supports; this habitat is not only worthy of conservation as part of our natural heritage, but also as that of all mankind. Number 9 in the above list requires designation of typical examples of more widespread and less threatened habitats, but ones which unless conserved, will with time disappear from the islands at least in their present form, which would be an irreparable loss to our natural heritage.

SSI are those which fit one or more of the following criteria:

1. The only known locality in the Maltese Islands where certain endemic and/or non endemic species are found.
2. A locality where certain endemic and/or non endemic species with a restricted distribution in the Maltese Islands occur ('restricted distribution' is taken to mean occurrence in five localities or less).
3. The type locality of an endemic species.
4. An important bird nesting site or of some other major ornithological interest.
5. A locality of special palaeontological interest.
6. A lithostratigraphical type section.
7. A locality of particular geomorphological interest.
8. Some other specific feature of scientific importance not listed above.

It is obvious, that an area which qualifies for designation as an SSI may also form part of an AEI and indeed, given the restricted spatial extent of non-agricultural countryside in the Maltese Islands, it is normal to find sites which qualify for protection as AEI to include a whole constellation of SSI within their confines.

It is for this reason that, in assigning protection levels to AEI and SSI, Malta Structure Plan Policy RCO12 treats both types of conservation areas together according to the following criteria:

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

In effect, whether a site is protected as an AEI or as an SSI will make no difference since the same levels and the same protection policies apply to both. The only difference in terms of protection is in the case of an AEI which includes a large number of SSI within its boundaries. In this case, such a complex may receive a higher level of protection than would have been received by the AEI alone or any of the SSI alone.

In a previous report on sectors A, B, C and D, prepared for the Planning Authority as part of the scheduling process for these areas (Micallef *et al.*, 1995), conservation policies applying to these areas were analysed and protection ratings suggested. With two exceptions, the suggested protection ratings were accepted by the Planning Authority (see Government Notice 117 of 1995). The area under present consideration incorporates sectors A, B, C and D and includes an extensive tract of additional land, especially to the south. For this reason, the original policy analysis presented in the previous report is repeated here and extended to cover the new areas.

### **Conservation policies**

Note: since geology and geomorphology are the subject of a separate report prepared by a different team of consultants, only ecological features will be considered here.

- The whole of Ras il-Karraba, with its boulder scree, garigue and clay steppe communities qualifies as an Area of Ecological Importance (AEI) in terms of Malta Structure Plan Policy RCO10:9.
- Ras il-Karraba and the adjoining Gnejna area, including the cliff edges of the Tal-Lippija plateau and the clay slopes at Ta' Zammitellu, are the only known localities for the rare shrub *Fagonia* (Malt. *Fagonja*; *Fagonia cretica* [RDB:21 **Vulnerable, Rest (Med+MI)**]), qualifying these areas as Sites of Scientific Importance (SSI) in terms of Malta Structure Plan Policy RCO11:1.
- The clay slopes in the Ghajn Tuffieha area qualify as an SSI in terms of Malta Structure Plan Policy RCO11:1, as they are the only known locality in the Maltese Islands for the Giant Orchid (*Barlia robertiana* [RDB:47 **Endangered, Rest (MI)**]) and the reduviid bug *Oncocephalus squalidus*, and as per Malta Structure Plan Policy RCO11:2 as one of the only

two localities for the snail *Hohenwartiana hohenwarti*, the mutillid wasp *Smicromyrme viduata* and the reduviid bug *Pasira basiptera*.

- The slopes at Ta' Zammitellu are good examples of clay slope habitats and therefore qualify for protection as an AEI in terms of MSP Policy RCO10:9.
- The Tal-Lippija area qualifies for protection as an SSI due to the presence of *Plantago bellardi*, a species found in only one other locality in the Maltese Islands, in terms of Malta Structure Plan Policy RCO11:2. The garigues on the Tal-Lippija/Ix-Xaghra tat-Torri plateau are good examples of this habitat type and as such the plateau qualifies for protection as an AEI in terms of Malta Structure Plan Policy RCO10:9.
- The afforested areas on the slopes surrounding Ghajn Tuffieha Bay are eligible for protection by means of Tree Preservation Orders (TPO) in terms of Malta Structure Plan Policy RCO33. Such TPO should only protect indigenous species and not Acacias and Eucalypts.

In view of the above considerations, the following protection ratings are suggested (Fig. 4):

<b>Sector A</b>	to retain its present ratings (Levels 2, 3, 4).
<b>Sector B</b>	to retain its present Level 2 rating and the coastal strip of sector B to retain its present Level 3 rating.
<b>Sector C</b>	to retain its present Level 1 rating.
<b>Sector D</b>	to retain its present Level 1 rating.
<b>Sector E</b>	to be given a Level 2 rating, eliminating the Level 3 rating for the strip between sectors B and E.
<b>Sector F</b>	the slopes below the plateau to be rated Level 2; the plateau surface

	to be rated Level 3, except for the Riviera Martinique area and the car park which are to be given Level 4 rating.
<b>Sector G</b>	is to be given Level 3 rating.
<b>Sector H</b>	is to be given Level 1 rating.
<b>Sector I</b>	is to be given Level 2 rating, except in the region of the rural buildings just West of Ix-Xaghra ta' Ghar is-Sienja, which is to be given Level 3 rating as a continuation of the buffer zone comprising sectors G and J (see below).
<b>Sector J</b>	is to be given Level 3 rating

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**THIS LIST HAS BEEN COMPILED FROM PUBLISHED SOURCES AND FROM PERSONAL FIELD OBSERVATIONS MADE BY THE AUTHORS OVER THE YEARS. IT IS NOT MEANT TO BE AN EXHAUSTIVE LIST AS VERY COMMON AND UBIQUITOUS SPECIES ARE NOT LISTED. SPECIES OF PARTICULAR CONSERVATION IMPORTANCE AND/OR SCIENTIFIC INTEREST ARE HIGHLIGHTED.**

## **INSECTA**

1. Protura (proturans)

**NOT STUDIED BUT SEVERAL SPECIES OCCUR IN THE AREA CONCERNED.**

2. Collembola (Springtails)

**Not studied but several species occur in the area.**

3. Diplura (diplurans)

**Not studied but species occur in the area.**

4. Microcoryphia (bristletails)

Machilidae

***Charimachilis relictta melitensis***

5. Zygentoma (silverfish)

Lepismatidae

***Lepisma saccharina***

***Ctenolepisma ciliata***

6. Ephemeroptera (mayflies)

**not studied but may occur.**

7. Odonata (dragonflies, damselflies)

Ceonagrionidae

***Ischnura genei***

**Red Data Book: V, Rest (MED)**

Aeshnidae

***Anax imperator***

**Anax parthenope**  
**Aeshna sp.**  
Libellulidae  
**Orthetrum canellatum**  
**O. ramburi**  
**Crocothemis erythrea**  
**Sympetrum fonscolombi**  
**S. striolatum**

8. Orthoptera (grasshoppers, locusts, katydids, crickets)

Myrmecophilidae  
**Myrmecophilus ochraceus**

Gryllidae  
**Gryllus bimaculatus**  
**Gryllomorpha dalmatina**  
**Acheta domesticus**  
Tettigoniidae  
**Tettigonia viridissima**  
**Phaneroptera nana**  
**Platypleis spp. (intermedia and others)**  
**Tessellana tessellata**  
Acrididae  
**Chorthippus brunneus**  
**Calliptamus barbaricus**  
**Aiolopus strepens**  
**Oedipoda miniata**  
**Sphingonotus coeruleus**  
**Anacridium aegyptium**  
**Acrida ungarica mediterranea**  
**Acrotylus patruelis**

9. Dermaptera (earwigs)

Labiduridae  
**Euboriella a. annulipes**  
Labiidae  
**Labia minor Linnaeus**  
Forficulidae  
**Forficula decipiens**

10. Isoptera (termites)

**None of the two locally occurring species have as yet been recorded from the area.**

11. Blattodea (cockroaches)

Blattidae  
**Loboptera decipiens**

12. Mantodea (mantids)

Mantidae

***Mantis religiosa***

***Rivetina baetica* ? Red Data Book: R, Rest (MED)**

***Ameles spallanzana***

13. Embioptera (webspinners)

**Not studied but species occur in the area.**

14. Thysanoptera (trips)

**Not studied but some species occur in the area.**

15. Hemiptera (true bugs)

Miridae

***Deraeocoris punctum***

***Calocoris nemoralis***

***C. n. norvegicus***

***Capsodes lineolatus***

Reduviidae

***Ploearia demestica***

***Oncocephalus squalidus* \*\* (single record from Ghajn Tuffieha) \*\***

***Pasira basiptera* \*\* (Known only from Ghajn Tuffieha & Ghajn Znuber) \*\***

***Reduvius personatus***

Nabidae

***Nabis capsiformis***

Lygaeidae

***Spilostethus pandurus***

***Lygaeosoma sardea***

***Nysius graminicola***

***Rhyparochromus saturnius***

Stenocephalidae

***Dicranocephalus agilis moralesi***

Coeridae

***Haploprocta s. sulcicornis***

Alydidae

***Camptopus lateralis***

Rhopalidae

***Maccevethus lineola***

Pentatomidae

***Graposoma lineatum italicum***

***Aelia acuminata***

***Eysarcomis inconspicuus***

***Carpocoris mediterraneus atlanticus***

***Codiophila varia***

***Eurydema ornatum***

***Nezara viridula***

Cydnidae

***Cydnus aterrimus***

16. Homoptera (cicadas, leafhoppers, aphids, psyllids, whiteflies, scale insects)  
**Not studied but several species are known to occur in the area.**

Cicadidae

***Cicada orni***

17. Psocoptera (psocids/booklice)

**Not studied but many species occur in the area.**

18. Phthiraptera (lice)

**Order not studied**

19. Coleoptera (beetles)

Staphylinidae

***Staphylinus olens***

Carabidae

***Nebria andalusia***

***Parophonus hispanus* Red Data Book: R, Rest (MI)**

***Calathus cinctus***

Oedemeridae

***Stenostoma melitense* Red Data Book: Endemic, R**

***Oedemera caudata***

Lathridiidae

***Coluocera formicaria***

Histeridae

***Macrolister major***

Elateridae

***Harminus spiniger***

***Cardiophorus* sp.**

Coccinellidae

***Chilocorus bipustulatus***

***Coccinella septempunctata***

***Scymnus* spp.**

***Henosepilachna elaterii***

Meloidae

***Meloe tuccius***

Anthicidae

***Hirticomus hsipidus***

***Cordicomus instabilis***

Scarabaeidae

***Pentodon bidens punctulatus***

***Phyllognathus excavatus***

***Oxythyrea funesta***

***Tropinota squalida***

***Aethiessa floralis***

Carambycidae

***Parmena pubescens* (local race ?? - not restricted to area)**

***Agapanthia asphodeli***

Tenebrionidae

***Belopus elongatulus ecalcaratus***

***Blaps gigas***

***Cossyphus moniliferus***

***Stenosis melitana*** Red Data Book: Endemic

***Tentyria laevigata leachi*** Red Data Book: Endemic

Curculionidae

***Hypera postica* (= *variabilis*)**

***Hypera fuscocinerea* (= *murina*)**

***Smicronyx cynaeus***

***Sitophilus oryzae***

***Brachycerus albidentatus***

***Lixus angustatus***

***Larinus scolymi***

***Baris spoliata***

20. Strepsiptera

**Order not studied.**

21. Neuroptera (lacewings, antlions)

Myrmeleontidae

***Creoleon lugdunensis***

***Macronemurus appendiculatus***

22. Hymneoptera (sawflies, wasps, ant, bees)

Ichneumonidae

***Exeristes roborator***

Mutillidae

***Smicromyrma viduata* \*\* known only from this locality and Santa Marija Bay \*\***

Vespidae

***Paravespula germanica***

***Polistes g. gallicus***

***P. omissus***

Eumenidae

***Pseudopipona tripunctata***

***Euodynerus v. variegatus***

***Rhynchium o. coulatum***

***Eumenes* spp.**

Formicidae

***Tapinoma simrothi***

***Aphaenogaster sicula* \*\* species restricted to clay slopes \*\***

***Messor capitatus***

***M. bouvieri***

***Pheidole pallidula***

***Solenopsis* sp.**

***Monomorium subopacum***

***Leptothorax splendidiceps***

***Tetramorium caespitum***

***Plagiolepis pygmaea***

***Acantholepis frauenfeldi***

***Camponotus barbaricus***

Sphecidae

***Ammophila heydeni***

***Sceliphron* sp.**

***Cerceris* spp.**

***Astata* sp.**

***Tachysphes* spp.**

Halictidae

***Halictus fulvipes***

***Lasioglossum malachurum***

Andrenidae

***Andrena agilissima italica***

Megachilidae

***Anthidium* spp.**

***Chalicodoma sicula balearica***

***Osmia kohli***

Anthophoridae

***Eucera* spp.**

***Anthophora acervorum***

***Tetralonia berlandi***

***Thyreus* sp.**

Xylocopidae

***Xylocopa violacea***

Apidae

***Apis mellifera***

23. Trichoptera (caddisflies)

**None of the two species recorded for the Maltese Islands have as yet been recorded for the study area.**

24. Lepidoptera (moths, butterflies)

Pterolonchidae

***Pterolonche vallettae*** Red Data Book: Endemic, RR

Hesperidae

***Gegenes pumilio*** Red Data Book: V, Rest(MED)

Papilionidae

***Papilio machaon melitensis*** Red Data Book: Endemic

Pieridae

***Pieris brassicae***

***Pieris rapae***

***Pontia daplidice***

***Colias crocea***

***Gonepteryx cleopatra***

Lycaenidae

***Lycaena phlaeas***

***Syntarucus pirithous***

***Lampides boeticus***

***Celastrina argiolus***

***Aricia agestis***

***Polyommatus icarus zelleri***

Danidae

***Danaus chrysippus*** Red Data Book: RR

Nymphalidea

***Vanessa atalanta***

***Cynthia cardui***

Satyridae

***Maniola jurtina hyperhispulla*** Red Data Book: Endemic

***Coenonympha pamphilus***

***Pararge aegeria***

***Lasiommata megera australis***

25. Siphonaptera (fleas)

**Order not studied but species occur in the area.**

26. Diptera (flies)

Therevidae

***Thereva* spp.**

Acroceridae

***Ogcodes schembrii*** Red Data Book: Endemic

Bombyliidae

***Anthrax trifasciata***

***Geron* sp.**

***Petrorossia hesperus***

***Villa quinquefasciata***

Syrphidae

***Eristalinus taeniops***

***E. aeneus***

***Eristalis tenax***

***Eumerus* spp.**

***Metasyrphus corollae***

***Myanthropa florea***

***Platynochaetus rufus***

Tachinidae

***Gonia bimaculata***

***Tachina magnicornis***

***Fischeria bicolor***

***Cylindromyia intermedia***

Sarcophagidae

***Sarcophaga* spp. (several species)**

Muscidae

***Musca vitripennis***

**DIPLOPODA (MILLIPEDES)**

***Ophiulus targionii*** abundant on rdum habitats

***Brachyiulus stuxbergi***

***Ommatoiulus oxypygus***

CHILOPODA (Centipedes)

**Not studied but many species occur in the area.**

ARACHNIDA

PSEUDOSCORPIONES (False Scorpions)

***Chthonius gibbus***

***Chthonius maltensis*** Red Data Book: Endemic (il-Karraba is the type locality)

***Roncus lubricus***

***Minniza algerica***

***Garypus beauvoisi***

***Chernes siciliensis*** Known only from Ghajn Tuffieha

***Hysterochelifer tuberculatus***

SCOPIONES (Scorpions)

***Euscorpium carpathicus candiota*** A species of biogeographical interest

OPILIONES (Harvestmen)

**Not studied but at least two species occur in the area.**

ARANEAE (Spiders)

Sparassidae

***Micrommata ligurinum***

Thomisidae

***Synaema globosum***

***Xysticus cf. bufo***

ACARI (Mites and Ticks)

**Not studied but many species occur in the area.**

CRUSTACEA

BRACHIOPODA (Fairy Shrimps, Clam Shrimps, Water Fleas)

**Not studied but species occur in temporary rainwater rockpools in the area.**

OSTRACODA (Seed Shrimps)

**Not studied but species occur in temporary rainwater rockpools in the area.**

COPEPODA (Oar Shrimps)

**Not studied but species occur in temporary rainwater rockpools in the area.**

ISOPODA (Woodlice)

***Ligia italica***

***Buchnerillo littoralis***

Restricted distribution in the Maltese Islands (one of only three localities for this species)

***Armadillonisicus candidus***

Restricted distribution in the Maltese Islands (one of only two localities for this species)

***Halophiloscia couchi***

***H. hirsuta***

***Chaetophiloscia elongata***

***Porcellio laevis***

***Armadillidium schmalfussi*** Red Data Book: Endemic  
A. ***badium badium***

MOLLUSCA

GASTROPODA (Snails and Slugs)

***Pomatias sulcatus***

***Granopupa granum***

***Hohenwartiana hohenwarti*** Red Data Book: RR, Rest(MI)

***Muticaria macrostoma f. oscitans*** Red Data Book: Endemic

***Papillifer papillaris***

***Sphincterochila candidissima***

***Xerotricha conspurcata***

***Trochoidea spratti f.schembrii/calcarata*** Red Data Book: Endemic

***Caracollina lenticula***

***Cantareus aspersus***

ANNELIDA

OLIGOCHAETA (Earthworms)

**Not studied but several species occur in the area.**