AN ECOLOGICAL SURVEY OF THE RDUM IL-MAJJIESA AREA PREPARED FOR THE GAIA FOUNDATION

By

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1 Introduction

The aim of this study is to make a qualitative analysis of the vegetation of Rdum il-Majjiesa, and propose recommendations for the management and protection of the site. Being prepared for The GAIA Foundation, this survey will be used as part of a Management Plan for the area.

1.1 Description of site and Methodology

Rdum il-Majjiesa is located West of Manikata within the limits of Mellieha's jurisdiction. The site is about 1.5 – 2km long and ranges between sea level and 55m asl.

Rdum il-Majjiesa consists of a coastal scree typical of this part of the island, having an Upper Corraline Limestone overlying Blue clay. The mobility of the latter causes the Corralline Limestone to subside and collapse, producing a network of massive boulders.

The site visits were carried out in early May. A qualitative analysis of the vegetation was made together with mapping of the different habitats. A list of plant species was also prepared.

The results are presented through:

- A map of habitats, and discussion on the various plant communities found.
- Recommendations for the management of the site.
- Recommendations for the protection of the area.
- List of species encountered.

2 Study area

The study area extends along the area known as Rdum il-Majjiesa, all along the base of the cliffs starting from just behind the Golden Sands Hotel in the South (at il-Minzel tal-Majjiesa). The plateau on the peninsula known as Ix-Xaghra tal-Majjiesa is not included in the survey.

Due to their restricted accessibility, these cliffs are relatively undisturbed. There are only two means of access, a small cement road on the South side at il-Minzel tal-Majjiesa, and a staircase on the North side. Access through the South is further limited by the local farmers who do not allow people and vehicles to enter. The North is more easily accessible since entry here is not restrained. In fact some areas in the North side are more degraded than the South. The least accessible part is the Western tip of the peninsula which is furthest away from both entrances. This is the least degraded and supports some of the most preserved vegetational communities in the Maltese Islands.

The study area was divided into 4 sectors according to their habitats.

2.1 Clay slopes

Clay slopes are a common feature of Rdum il-Majjiesa, constituting about 35% of the surface area of the study site. Apart from this, the clay is the driving force behind the formation of this landscape. The clay here is found as a layer underlying the Upper Coralline Limestone. Being very mobile, the clay tends to get eroded from underneath causing the coralline cliffs to collapse under their own weight. This creates a series of huge boulders which gradually keep moving down the slope to form a scree.

The clay slopes here are almost entirely dominated by steppic communities, dominated by the Esparto grass, *Lygeum spartum.* Other common species are *Atractylis gummifera, Coronilla scorpioides, Mesembryanthemum nodiflorum, Fagonia cretica* (very rare in the rest of Malta) and *Carlina involucrata.*

Parts of the clay slopes are relatively bare of vegetation tending to have a greater erosion potential. This is especially the case with the clay slopes next to the sea. From photo 1, it can be seen that the erosion is greater when the slope is not protected by any boulders thus making it more vulnerable to the pounding action of the sea. Slopes protected by large boulders have a thick vegetation cover, sometimes supporting trees and shrubs (mostly *Tamarix africana*).

The largest stretch of clay slope is found in the South east corner of the study site. Here the vegetation again consists of steppe, being dominated by *Lygeum spartum, Carlina involucrata, Cynara cardunculus* and *Avena sterilis.* The vegetation here has the

Photo 1

highest percentage cover in the area reaching over 95%. The clay slopes on the North side of the peninsula are more degraded for the reason explained earlier (human interference). This habitat is smaller here consisting of a narrow belt along the coast. Nevertheless there seems to be more trees here. *Tamarix africana* forms small pockets of more than ten trees each. The trees on the South side are more scattered.

2.2 Scree

This is the most abundant habitat in the area. In extent it covers 45% of the *rdum.* It is narrowest on the South side where it forms a narrow stretch just under the cliff. On the West of the peninsula it extends all the way down into the sea forming one of the best and most undisturbed scree habitats in the Maltese Islands. It is so inaccessible in some places that it could possibly harbour some rare species that have survived here due to lack of human interference.

Throughout the scree there are traces of past agricultural use, especially along the North – North Western stretch. These are evidenced by a maze of rubble walls and many fruit trees, which are the relicts of past gone agricultural practices in the area. A considerable proportion of the trees found in the Northern scree are in fact fruit trees, consisting mainly of stone fruits and apples. In many cases the grafted variety has died and was replaced by the hardy rootstock, as is evidenced by the abundance of quince trees (*Cydonia oblonga*); The latter were used in the past as a rootstock for apples.

2.2.1 Scree on Southern slope

The scree here is at its narrowest being restricted to the base of the cliff. The vegetation consists of high garigue to low maquis dominated by *Periploca angustifolia, Euphorbia melitensis, Capparis orientalis* and *Thymbra capitata*. Other common species are *Teucrium fruticans, Teucrium flavum* and *Lonicera implexa.* The vegetation reaches its greatest height in between the boulders with some individuals of *Ceratonia siliqua*. On the boulders itself garigue is more prominent being dominated by *Thymbra capitata*. Other species found here are *Geranium purpureum, Hypericum aegyptiacum, Sedum sediforme* and *Fagonia cretica.*

Along the footpaths various species typical of disturbed habitats can be found, such as *Psoralea bituminosa, Sherardia arvensis, Catapodium rigidum* and T*rachynia distachya.* In the more humid areas between the rocks and boulders *Parietaria judaica* and *Arisarum vulgare* can be found.

Another evidence of disturbance in this area is the presence of *Asphodelus aestivus* and *Urginea pancration*. These plants are typical of overgrazed environments, since they are the last species to disappear, being extremely poisonous, and their presence usually

Photo 2

shows that grazing was present at some time in the area. In fact compared to the Northern and Western screes these species are more abundant here. Another evidence of grazing here is the presence of rabbit droppings all along the peninsula.

At the highest point where the scree meets the base of the cliff the vegetation changes supporting a garigue of typical coastal plants. These plants grow directly at the base of the cliff, which is the highest point where vegetation is found. The vegetation here is dominated by *Limonium melitense, Inula crithmoides* and *Crithmum maritimum*. This community is probably present due to it being more exposed to sea spray, since there were no large boulders here to screen it.

2.2.2 Scree on the Western edge of the peninsula

This part of the study area is the least disturbed and inaccessible part of the whole peninsula. The vegetation here reaches its thickest and highest (Photo 2). Moreover there are few non-native or archaeophytic species here except for *Ficus carica.* The scree is accessible only close to the sea, and the part further inland has no footpaths whatsoever. There are also very few rubble walls here being evidence to the lesser degree of anthropomorphic influence.

The vegetation consists of high garigue to maquis, with the dominant species being *Periploca laevigata* ssp. *angustifolia, Anthyllis hermaniae, Coronilla valentina* and *Euphorbia melitensis.* Other common species are *Teucrium fruticans, Teucrium flavum, Erica multiflora, Ficus carica,* and *Capparis orientalis.*

The garigue species here were similar to the previous scree, although it was thicker and higher with the additional presence of *Erica multiflora.* In the more humid areas *Smilax aspera* was found growing along the boulders.

The only disturbance found here was along the footpath, evidenced by the usual species of disturbed habitats, the same ones mentioned for the previous scree.

2.2.3 Scree on Northern slope

As mentioned earlier, the scree here was used at a greater extent for agricultural purposes in the past. The area is criss-crossed with rubble walls and there are many fruit trees present (Photo 3). A lot of species typical of fallow fields are also present here, such as *Medicago polymorpha, Trifolium scabrum, Trifolium campestre, Trifolium lappaceum* (previously thought to be extinct), *Foeniculum vulgare, Ferula communis, Daucus carota* and *Geranium molle.* The vegetation is thick here as well, probably due to the presence of rubble walls which in turn holds more soil from being swept away during the rainy season.

Photo 3

Apart from fruit trees there are other native and archaeophytic trees present such as *Olea europaea* and *Ceratonia siliqua*. Further inland, towards the cliffs, the vegetation is thicker and higher consisting of high maquis dominated by *Olea europaea, Teucrium fruticans, Lonicera implexa, Capparis orientalis, Periploca laevigata* ssp. *angustifolia* and *Euphorbia melitensis.* Among the dominant creepers are *Smilax aspera, Tamus communis* (rare in Malta but very common here) and *Vitis vinifera.* In the more humid areas growing between the boulders were the rare pellitory-of-the-wall, *Parietaria lusitanica,* and the ferns *Adiantum capillus-veneris* and *Anogramma leptophylla.*

The garigue here was again dominated by *Thymbra capitata* and the other species associated with it in the other screes, however apart from *Sedum sediforme* there was also the rare *Sedum caespitosum.* The orchid population was also particularly rich, having large populations of *Anacamptis pyramidalis*. The endemic maltese pyramidal orchid, *Anacamptis urvilleana,* was also recorded.

Apart from the rubble walls there was also a *girna* found in this area. The *girna* was still in a good state of preservation, and could be used in the future as a tourist attraction.

2.3 Human induced habitats

These are mainly referring to the areas which are still being used by the local farmers. This includes the cement road going down through il-Minzel tal-Majjiesa, the fields used by the farmer in the South part of the peninsula, and the boat houses and sheds. The vegetation here is typical of disturbed habitats containing species such as *Oxalis pes-caprae, Psoralea bituminosa, Sonchus tenerrhimus, Dittrichia viscosa, Avena barbata* and *Galactites tomentosa.* There are also some introduced alien species, including *Acacia cyanophylla* and *Agave americana.*

In general the local farmers do not affect the area negatively. They use traditional methods of agriculture which do not harm the surrounding environment. In fact the scree is still in a good state here not only because of their practices, but also because they restrict entry of people into the *rdum*. One particular family has been here for generations, so much so that they are known as Tal-Majjiesa.

Apart from growing crops, they also grow various archaeophytic fruit trees, such as *Ficus carica, Prunus dulcis, Punica granatum* and *Vitis vinifera.* Other trees species which are found in this area are *Phoenix canariensis* and *Pinus halepensis.* The latter was planted here by one of the owners of the boathouses.

Apart from alien species and species of degraded habitats, there are also some rare species found growing here. On the dirt road going down into the *rdum* there were some

specimens of the very rare pygmy groundsel, *Senecio pygmaeus,* and the rare *Fagonia cretica.*

On the North side of the peninsula human influence is in the form of trampling and hunting. There is hardly any agricultural activity and only one boat house is present (as compared to the four on the South side). The footpaths are also more numerous in the North than in the two other areas.

2.4 Watercourses

The cliffs here are characterised by having a perched aquifer in the permeable coralline limestone, supported by the clay aquiclude. This aquifer seeps out in the form of springs at the foot of the cliffs. The springs form small semi-permanent watercourses along the clay sediment supporting a variety of watercourse vegetation. Some of the typical species found are *Arundo donax, Holoschoenus vulgaris* and *Polypogon monspeliensis.* There were no apparent watercourses on the Western tip, although there were many on the North slope. There are about three springs in the Southern side, which are mainly dominated by reed beds of *Arundo donax* at the highest end of the slope, while *Holoschoenus vulgaris* becomes more dominant gradually towards the sea.

The North slope had more springs with pools forming in various areas. These pools maintain populations of frogs and other fresh-water fauna. Apart from the same plant species as mentioned above, *Juncus acutus* and *Vitex agnus-chastus* were also found here.

3 Recommendations

Unlike the other site managed by The GAIA Foundation (Ghajn Tuffieha), Rdum il-Majjiesa is quite undisturbed, and apart from a few particular areas does not need any drastic intervention. Some particular areas are so ecologically intact, that no intervention whatsoever needs to be done.

In order to tackle this subject, we divided the *rdum* into three areas and discussed them individually. The watercourses were discussed in another section separately.

3.1 Southern side of the peninsula

3.1.1 Scree

- The scree in this area does not need any particular intervention. There are no alien species, and the little disturbance is restricted to the footpaths. The main intervention here is to restrict the access to one or two footpaths, thus reducing the amount of trampling. Footpaths in steep areas just under the cliff should be discouraged since these tend to be prone to a higher risk of erosion.

3.1.2 Human induced habitats

- Since the agricultural practices on the South side are not influencing the ecology of the area negatively, they should be maintained. The fields here are an important part of the cultural landscape of il-Majjiesa, and should be preserved. Agricultural activity along cliffs were quite common in the past in the Maltese Islands, but since the Second World War, they have fallen out of use. Many of the fields have been abandoned to be reclaimed by vegetation. This cultural landscape (so called because it is an integral part of the Maltese culture) is becoming either rare, or modernised. It is not uncommon anymore to see greenhouses in some cliffs around the Maltese Islands. Secondly, the fact that these farmers have been here for generations and have kept the site in such a good state gives praise to their traditional practices. The only thing that needs to be done here is to remove the rubbish that has accumulated in a few areas.

- Apiculture could also be encouraged, since the garigue is very rich in thyme and other species needed in the production of high quality honey. Traditional apiaries should be constructed if possible. These have become very rare nowadays, and few are known to be still in working condition.

- Fruit trees grafted on native species should be encouraged. One particular example is the wild pear. There are two species of native wild pear which used to be used as root stocks, *Pyrus syriaca* and *Pyrus communis,* both of them being very rare. They have become rare since the introduction of foreign varieties as rootstocks. Specimens of *Pyrus syriaca* can be obtained from Wied Has-Sabtan, whereas *Pyrus communis* can be obtained from Wied Ghomor. Other archaeophytic trees which could be used as root stocks include *Prunus dulcis,* and *Cydonia oblonga* which can be obtained from Rdum il-Majjiesa itself.

- A few of the fields could also be converted into traditional vineyards using Maltese varieties. Many different varieties of Maltese grapes exist, and most of them have become rare out of disuse.

- Native fruit trees should also be encouraged, such as the extinct *Mespilus germanica.* Specimens of the latter can be re-introduced from South-East Sicily, since none are available in the Maltese Islands any more.

- Alien species, including *Acacia* and *Agave,* should be removed immediately before they are allowed to spread. *Agave americana* is a bigger problem since it regenerates and spreads very easily. Introduction of other alien species should also be discouraged, except in the case of fruit trees.

- The dirt road leading into the *rdum* should not be surfaced. It was along this road that the rare *Senecio pygmaeus* was found.

- The boathouses are one of the biggest problems here. Their use should be discouraged, but since they have already been built, demolishing them in such a sensitive area would end up causing an even greater ecological impact. Instead we suggest expropriating the ones that were built illegally, and use them as a Visitors Information Centre.

- Planting should be restricted to the already human influenced areas, and only native species typical of such habitats should be used. Apart from the species which are already found in the area*, Tetraclinis articulata, Olea europaea* ssp. *oleaster, Rhamnus oleioides* and *Chamaerops humilis* could also be used. Locally found species which should be encouraged here include *Periploca laevigata* ssp. *angustifolia, Erica multiflora, Coronilla valentina* and *Teucrium fruticans.*

3.1.3 Clay slopes

The clay slopes can be divided into two areas according to their state of degradation. In the case of the more degraded slopes, intervention is needed to restore them.

3.1.3.1 Clay slopes needing restoration

The degraded clay slopes are those which are bare of vegetation and are eroding at a fast rate. Planting trees here will not be sufficient since they will be swept away with the first landslide. The main problem here is that the base of the clay slope is unstable, and every time there is an increase in tension, either through water logging or trampling, the slope collapses under its own weight. Secondly, this phenomenon happens only where the clay slope meets the sea (as mentioned earlier), and the eroding action of the sea at the base of the cliff destabilizes the whole slope. In our opinion the best way to stabilize the base of the slope is by having permanent vegetation at the base, thus reducing the risk of erosion from the sea. This can be done by using bioengineering techniques which will help establish a sustainable vegetation on the slope. Two methods will be used as follows. The first is called a Live Wooden Cribwall, while the second is the Wattle Fence method. The wooden cribwall will provide the support at the base of the cliff, whereas the Wattle Fence will keep the rest of the slope together.

3.1.3.1.1 Live Wooden Cribwall

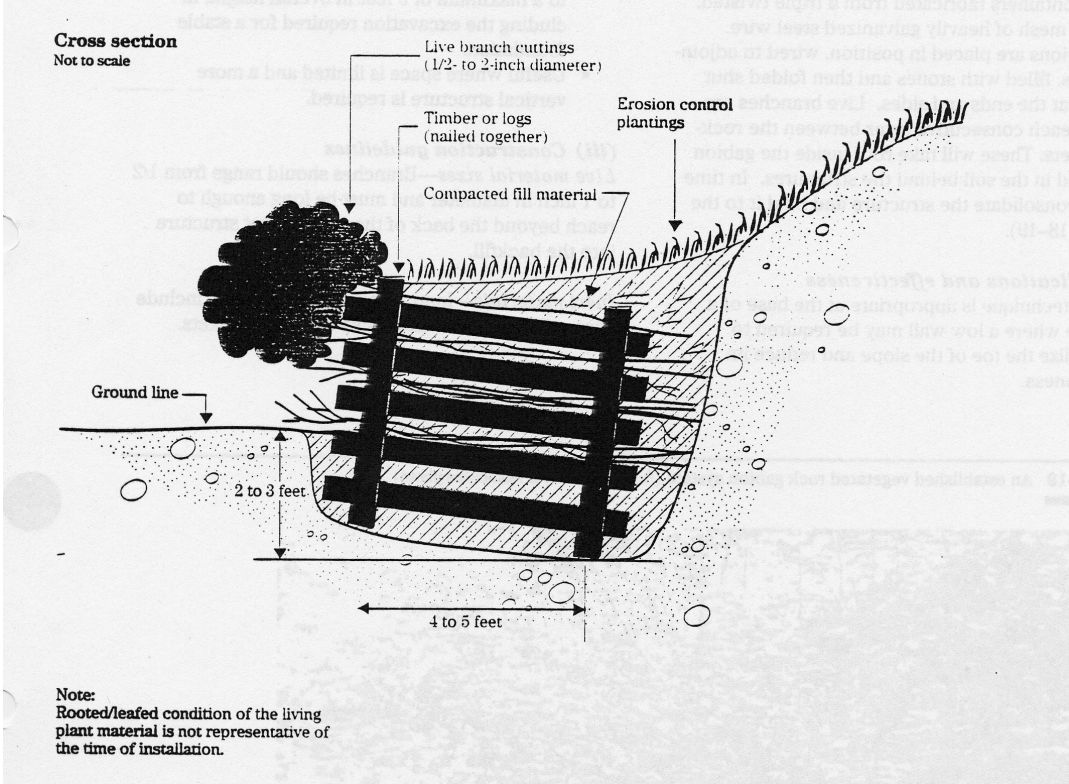


Fig 1 – Wooden crib wall

A live cribwall consists of a hollow, box-like interlocking arrangement of untreated log or timber members. The structure is filled with suitable backfill material (in our case clay) and layers of live branch cuttings (*Tamarix africana*) which root inside the crib

structure and extend into the slope. Once the live cuttings root and become established, the subsequent vegetation gradually takes over the structural functions of the wood members (see fig1).

Construction guidelines

- Live material sizes - Live branch cuttings should be 0.2 to 2 inches in diameter and long enough to reach the back of the wooden crib structure.
- Inert materials - Logs or timbers should range from 4 to 6 inches in diameter or dimension. The lengths will vary with the size of the crib structure.
- Large nails or reinforcement bars are required to secure the logs or timbers together.

Installation

- Starting at the lowest point of the slope, excavate loose material 2 to 3 feet below the ground elevation until a stable foundation is reached.
- Excavate the back of the stable foundation (closest to the slope) slightly deeper than the front to add stability to the structure. Place the first course of logs or timbers at the front and back of the excavated foundation, approximately 4 to 5 feet apart and parallel to the slope contour.
- Place the next course of logs or timbers at right angles (perpendicular to the slope) on top of the previous course to overhang the front and back of the previous course by 3 to 6 inches.
- Each course of the live cribwall is placed in the same manner and nailed to the preceding course with nails or reinforcement bars.
- While each course is being set, place live branch cuttings on the backfill perpendicular to the slope; then cover the cuttings with sediment and compact.
- Live branch cuttings should be placed at each course to the top of the cribwall structure with growing tips oriented toward the slope face. Follow each layer of branches with a layer of compacted soil to ensure soil contact with the live branch cuttings. Some of the basal ends of the live branch cuttings should reach the undisturbed soil at the back of the cribwall with growing tips protruding slightly beyond the front of the cribwall.

Tamarix africana was chosen firstly because of its soil binding ability, and secondly because it roots easily through cuttings. It is important however to do this work during the winter months to increase the success rate of the cuttings. The best possible time is

in early January since almost all the cuttings root at this time of the year. It is also important to plant the cuttings immediately, since their viability decreases once they are cut. Ideally they should be planted on the same day they are cut.

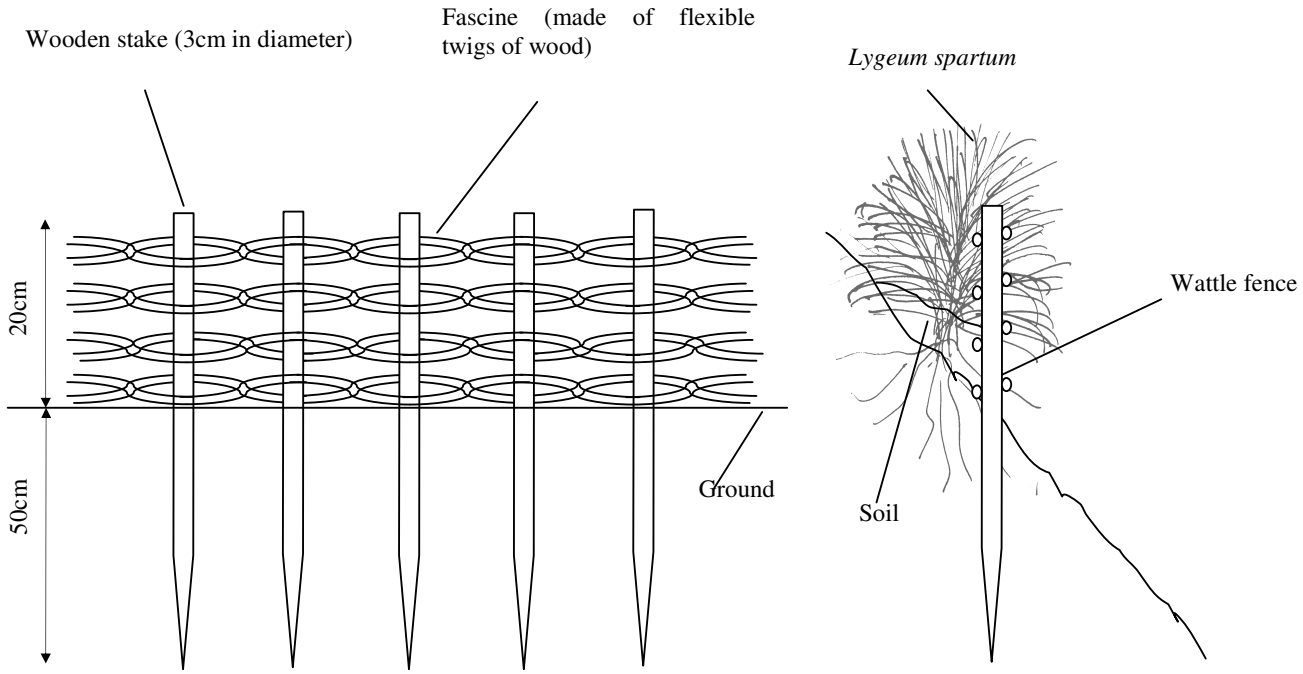
The source of the cuttings should be strictly monitored. Ideally the trees already present there should be used as a source. If these are not enough, cuttings can be taken from individuals which are known to be of Maltese origin.

Finally it should be mentioned that during the initial phase while the first 3 feet of clay are removed to place the timber, the slope might become unstable. Measures could be taken to hold the structure together temporarily by setting up a wooden palisade while the cribwalls are being built.

3.1.3.1.2 Wattle Fence

This method will be used further up the slope to stabilize the clay. It involves the construction of a small wooden fence along the contour of the slope (Fig 2).

Fig 2 – Wattle fence



Materials needed

- 80cm wooden stakes (use dead wood) not more than 3cm in diameter.
- Fascine, consisting of flexible twigs. Reeds could be used.
- *Lygeum spartum* plantlets.

Installation

- Starting at the lowest point of the slope, just beyond the crib wall, hammer the wooden stakes into the clay at a depth of 50cm, at a regular interval of about 50cm. The stakes should be hammered in a line along the contour of the slope. The lines should be at a distance of about 1.5m from each other.

- The twigs are now intertwined between the stakes in such a way so as to make a small fencing about 20cm high. This will hold the slope making it more stable.

- Plant *Lygeum spartum* just behind the fence in such a way that the fence supports it from being swept down the hill.

This species was chosen for two reasons. First of all it is known for its soil binding capabilities, and for being a strong element in the stabilization of clay slopes. Secondly, because the slope is too steep to support trees. Having trees there would destabilise the slope even further. Grasses tend to work better at stabilizing steep slopes.

Introducing vegetation is a key element in the success of these two methods. Once the vegetation grows, the network of roots will bind the clay together, decreasing the amount of erosion. The Tamarisk at the base of the slope will also soften the action of the waves onto the clay, thus reducing erosion of the base.

The only problem with these two methods is that until the vegetation grows they tend to be conspicuous. In the case of the cribwall, this shouldn't be a problem since after two to three years the whole wooden structure will be covered by vegetation. The wattle fence however will take slightly longer to cover. The stakes, being made of dead wood will end up rotting eventually, and not be visible anymore. Otherwise they could be cut at the place where they touch the ground and removed. To solve the eyesore problem, a small section could be built as a trial and other areas restored later on.

3.1.3.2 Other clay slopes

The more stable clay slopes, i.e. the ones which are covered by steppic vegetation do not need any bioengineering techniques since they do not show any signs of landsliding. Here, trees can be planted to try and increase the amount of permanent vegetation along the slope. The species recommended are *Tamarix africana, Lygeum spartum, Pinus halepensis, Periploca laevigata* ssp. *angustifolia, Chamaerops humilis, Lonicera implexa, Teucrium fruticans, Olea europaea, Ceratonia siliqua* and *Capparis orientalis.* These species were chosen because they are already found growing on the clay slopes in some areas either on the Southern side or on the Northern side of the peninsula. The Tamarisk should be planted closer to the sea, while the others further inland. The density of the trees should not be too high, since a lot of intervention could end up

degrading these slopes as well. The trees should not be planted more than 5m close to each other, especially in the steeper areas.

3.2 Western side of the peninsula

This area has the most preserved plant communities in the whole peninsula. Intervention should be kept to a minimum, except for the maintenance of already existing footpaths.

3.3 Northern side of the peninsula

3.3.1 Scree

As in the other two areas, the scree here does not need any intervention. Most of it has already been recolonised by native vegetation. The main problem concerns the footpaths. Currently there are many footpaths in this area crisscrossing the scree. Access should be limited to two or three paths, closing off the others for natural regeneration to take place.

3.3.2 Human induced habitats

The little evidence of recent human influence here is the presence of a few recently abandoned fields in the North-Eastern part. Natural regeneration here is still at an early phase. A few trees can be planted here to stimulate the regeneration process. Species already found present will be used, together with *Tetraclinis articulata* and *Chamaerops humils,* since they are typical of such plant communities. The other species include *Periploca laevigata* ssp. *angustifolia, Olea europaea, Anthyllis hermaniae, Coronilla valentina, Teucrium fruticans* and *Erica multiflora.* The seed origin should be from Rdum il-Majjiesa itself, except for *Tetraclinis articulata* which could be collected from the closest population at Ta' Pennellu in Mellieha. The *Chamaerops humilis* should be collected from the specimens at Argotti Botanical Gardens, since they are originating from the original native population which became extinct more than a hundred years ago.

3.3.3 Clay slopes

The clay slopes here can be restored in the same way as we mentioned earlier for the South side of the peninsula. The only difference is that probably the material would have to be taken in by boat since the only other means of access is a staircase.

3.4 Watercourses

Currently there is no risk of erosion along the watercourses since they are already thickly covered by vegetation. The only problem is that the niche usually occupied by watercourse trees is empty. There are very few watercourse trees found here except for a few individuals of *Vitex agnus-chastus.* A few trees could be planted to occupy this important yet rare ecological niche. First of all more *Vitex agnus-chastus* can be planted. Efforts should be made to obtain seeds from the already existing population. Apart from this species, *Salix alba, Salix pedicallata* and *Ulmus canescens* can also be used. These latter species are very rare, and are found in fragmented populations around the Maltese islands. This habitat can offer a very important refuge for such species.

The *Vitex agnus-chastus* should be planted closer to the sea, while the others can be planted further up the slope (starting from 50m inland).

4 Recommendations for Protection

Rdum il-Majjiesa is currently designated as an Area of Ecological Importance (AEI), Site of Scientific Importance (SSI) and Area of High Landscape Value (AHLV) through Government Notice 400 of 1996.

This legislation offers 4 different levels of protection, starting at Level 1, being the most protected, till level 4, within which level some degree of development can be done. Currently the site is protected under Level 2. In view of the species found and the plant communities present, we suggest that parts of the site be upgraded to level one protection as follows (Map 2):

- The Western part of the peninsula, known as Ras il-Wahx, has a good example of coastal garigue dominated by *Periploca laevigata* ssp. *angustifolia* and *Coronilla valentina*. Being inaccessible, this garigue has grown into one of the thickest and highest maquis communities of this type in the country. Its status should be upgraded to level 1 as an Area of Ecological Importance (area shown within the blue line on map 2). This scheduling should be extended to the scree on the Northern and Southern slopes since it extends along that area as well.

- Some localised places in the North and South of the peninsula should also be upgraded to level 1 on the basis of the rare species found growing here. In the South *Senecio pygmaeus*[1] was found, together with *Fagonia cretica*[2]. On the North we recorded *Trifolium lappaceum*[3], *Parietaria lusitanica*[4] and *Vitex agnus-chastus*[5]. These should be scheduled as level 1 under the designation Sites of Scientific Importance (area shown within the pink line on map 2).

- The springs should also be upgraded to level 1 as Areas of Ecological Importance (the watercourse as a habitat should be protected, this being evidenced by the presence of various watercourse plants). Permanent watercourses have become a rare and endangered habitat in the Maltese Islands. The large amount of freshwater springs (four in the north and three in the south) makes this peninsula an important site for the conservation of these habitats (areas shown as blue on map 1).

[1] Recorded as very rare in the red Data Book
[2] Only known in Gnejna/Ghajn Tuffieha area and in Rdum il-Majjiesa
[3] Previously thought to be extinct. This is the only known locality.
[4] Recorded as rare in the Red Data Book.
[5] Although not uncommon in Gozo this species is very rare in Malta

5 Species List

Below is a list of species encountered during the study. Their status as mentioned in the Red Data Book is also mentioned. Below is an explanation of the details given:

Vul → taxon is vulnerable locally
Rest (MI) → taxon has a restricted distribution in the Maltese Islands
Rest (MED) → taxon has a restricted distribution in the Mediterranean region

Class – Filicopsida

Family	Adiantaceae	
	Adiantum capillus-veneris	
Family	Gymnogrammaceae	
	Anogramma leptophylla	

Class Pinopsida

Family	Pinaceae	
	Pinus halepensis	

Order Dicotyledons

Family	Moraceae	
	Ficus carica	
Family	Urticaceae	
	Parietaria judaica	
	Parietaria lusitanica	Rare, Rest (MI)
Family	Chenopodiaceae	
	Beta marittima	
	Anthrocnemum macrostiachum	
	Suaeda maritima	
	Salsola soda	

Family	Aizooaceae	
	Mesembryanthemum nodiflorum	
Family	Caryophyllaceae	
	Silene vulgaris	
	Silene sedoides	
Family	Lauraceae	
	Laurus nobilis	Rare, Rest (MI)
Family	Ranunculaceae	
	Clematis cirrhosa	
Family	Capparidaceae	
	Capparis orientalis	
Family	Papaveraceae	
	Papaver rhoeas	
	Glaucium flavum	
Family	Fumariaceae	
	Fumaria tymifolia	
Family	Crassulaceae	
	Sedum sediforme	
	Sedum caespitosum	Very Rare, Rest (MI)
	Umbilicus rupestris	
Family	Resedaceae	
	Reseda alba	
Family	Rosaceae	
	Prunus dulcis	
	Prunus persica	
	Prunus domestica	
	Eriobotrya japonica	
	Cydonia oblonga	
	Malus domestica	
Family	Fabaceae	
	Ceratonia siliqua	
	Acacia cyanophylla	

	Psoralea bituminosa	
	Ononis mitissima	
	Ononis ornithopodoides	
	Melilotus indica	
	Medicago minima	
	Medicago polymorpha	
	Medicago ciliaris	
	Medicago doliolata	
	Trifolium campestre	
	Trifolium scabrum	
	Trifolium lappaceum	Very Rare, Rest (MI)
	Lotus edulis	
	Lotus cytisoides	
	Tetragonolobus purpureus	
	Scorpiurus muricatus	
	Anthyllis hermaniae	
	Coronilla scorpioides	
	Coronilla valentina	
	Hedysarum coronarium	
	Lathyrus clymenum	
	Lathyrus cicera	
Family	Oxalidaceae	
	Oxalis pes-caprae	
Family	Geraniaceae	
	Geranium purpureum	
	Geranium molle	
Family	Zygophyllaceae	
	Fagonia cretica	Vul, Rest (MED+MI)
Family	Linaceae	
	Linum strictum	
	Linum triginum	
Family	Euphorbiaceae	
	Euphorbia melitensis	Endemic
	Euphorbia peploides	
	Euphorbia pinea	

Family	Vitaceae	
	Vitis vinifera	
Family	Malvaceae	
	Malva parviflora	
Family	Clusiaceae	
	Hypericum aegyptiacum	
Family	Tamaricaceae	
	Tamarix africana	Rare, Rest (MED+MI)
Family	Frankeniaceae	
	Frankenia hirsuta	
Family	Cucurbitaceae	
	Ecballium elaterium	
Family	Cactaceae	
	Opuntia ficus-indica	
Family	Punicaceae	
	Punica granatum	
Family	Apiaceae	
	Crithmum maritimum	
	Foeniculum vulgare	
	Ferula communis	
	Daucus carota	
	Daucus lopadusanus	Rest (MED)
	Ammoides pusilla	
	Torilis nodosa	
Family	Ericaceae	
	Erica multiflora	
Family	Primulaceae	
	Anagallis arvensis	
	Samolus valerandi	
Family	Plumbaginaceae	
	Limonium melitense	Endemic

Family	Oleaceae	
	Olea europaea	
Family	Gentianaceae	
	Centaurium pulchellum	
	Blackstonia perfoliata	
Family	Asclepiadaceae	
	Periploca laevigata ssp. *angustifolia*	Rest (Med)
Family	Rubiaceae	
	Crucianella rupestris	Rest (Med)
	Galium aparinae	
	Galium murale	
	Valantia muralis	
	Rubia peregrina	
	Sherardia arvensis	
Family	Convolvulaceae	
	Cuscuta epithymum	
	Ipomoea batatas	
	Convolvulus elegantissimus	
	Convolvulus arvensis	
Family	Boraginaceae	
	Echium italicum	
	Echium arenarium	
	Cynoglossum creticum	
Family	Verbenaceae	
	Vitex agnus-chastus	Rare, Rest (MI)
Family	Lamiaceae	
	Teucrium fruticans	
	Teucrium flavum	
	Prasium majus	
	Satureja microphylla	Rest (Med)
	Thymbra capitata	
	Salvia verbenaca	

Family	Solanaceae	
	Hyoscyamus albus	
Family	Scrophulariaceae	
	Verbascum tenuatum	
	Verbascum sinuatum	
	Antirrhinum siculum	
Family	Orobanchaceae	
	Orobanche muteli ssp. nana forma melitensis	Endemic
Family	Caprifoliaceae	
	Lonicera implexa	
Family	Campanulaceae	
	Campanula erinus	
Family	Asteraceae	
	Filago cossyrensis	
	Phagnalon graecum	Rest (MED)
	Inula crithmoides	
	Dittrichia viscosa	
	Asteriscus aquaticus	
	Chrysanthemum coronarium	
	Senecio bicolor	
	Senecio pygmaeus	Very Rare, Rest (MED+MI)
	Carlina involucrata	Rest (Med)
	Atractylis gummifera	
	Galactites tomentosa	
	Cynara cardunculus	
	Centaurea nicaeensis	
	Scolymus hispanicus	
	Cichorium spinosum	
	Hyoseris radiata	
	Urospermum picroides	
	Picris echioides	
	Reichardia picroides	
	Sonchus oleraceus	
	Sonchus tenerrimus	
	Pallenis spinosa	

Order Monocotyledons

Family	Liliaceae	
	Asphodelus aestivus	
	Urginea pancration	Rest (Med)
Family	Alliaceae	
	Allium roseum	
	Allium melitense	Endemic
	Allium subhirsutum	
	Allium commutatum	
Family	Asparagaceae	
	Asparagus aphyllus	
Family	Smilaceae	
	Smilax aspera	
Family	Agavaceae	
	Agave americana	
Family	Dioscoreaceae	
	Tamus communis	Rare, Rest (MI)
Family	Iridaceae	
	Gynandriris sisyrinchium	
	Gladiolus italicus	
Family	Juncaceae	
	Juncus acutus	
Family	Cyperaceae	
	Holoschoenus vulgaris	
	Carex flacca	
Family	Palmaceae	
	Phoenix canariensis	
Family	Orchidaceae	
	Anacamptis pyramidalis	
	Anacamptis urvilleana	Endemic, Rare, Rest (MI)

Family Araceae

Arum italicum
Arisarum vulgare

Family Poaceae

Briza maxima
Bromus hordaceus
Aegilops ovata
Hordeum marinum
Lagurus ovatus
Polypogon monspeliensis
Polypogon virile
Avena sterils
Avena barbata
Phalaris paradoxa
Arundo donax
Cynodon dactylon
Stipa capensis
Hyparrhenia hirta
Andropogon distachyus
Lygeum spartum
Trachynia distachya
Catapodium rigidum
Catapodium marinum
Dactylis hispanica
Festuca fenas
Brachypodium retusum
Parapholis incurva
Cynosurus echinatus
Vulpia ciliata
Oryzopsis miliaceae

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