A monitoring programme and protocols for wetland and terrestrial habitats at Ghar el Melh, Tunisia

December 2019

Cover image: The southern face of Jebel Nadhour looking west from Ras Ettarf, with Sidi Ali el Mekki and Ghar el Melh Lagoons in the distance (image E. Véla)

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The GEMWET project is the product of a partnership between WWF, BirdLife Europe, Tour du Valat, UICN Med, CAR-PAP, Global Water partnership Mediterranean (GWP-Med), AAO/BirdLife en Tunisie et INAT, with financial support from the MAVA foundation.

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1 INTRODUCTION

This is a note on potential for development of monitoring protocols to assess trends in the condition of Jebel Nadhour and Ghar el Melh KBA and Sidi ali el Mekki KBA, including the Lagune de Ghar el Melh et Delta de la Mejerda Ramsar site in north-eastern Tunsia as part of the GEMWET project. The GEMWET project involves a range of partners, including Association Amis des Oiseaux (BirdLIfe Tunisia), Stichting BirdLife Europe; Global Water Partnership Mediterranean (GWP-Med); IUCN Malaga, The Coastal Management Center of UNEP Mediterranean, Action Plan (PAP/RAC); Institut de Recherche pour la Conservation des Zones Humides Méditerranéens (Tour du Valat). GEMWET seeks to conserve the present biodiversity and improve the conservation status of specific wetland systems by advocating a better understanding of natural dynamics and processes, by means of employing integrated management approaches. It also seeks to fully involve all stakeholders in the integrated management process, by encouraging shared commitment and responsibilities, appropriation of project activities, valorisation of local know-how, contributing to the identification and prioritisation of key issues and the drafting of feasible solutions.

The area covered by this report extends from the outskirts of Tunis in the south, north to Raf Raf and east to the settlement and peninsula of Sidi Ali el Mekki, mainly following the C69 from Tunis through Utique and Aousja toward Raf Raf in the west (Figure 1). The report forms part of a series of documents supporting work toward the conservation of the Ramsar Site: Lagune de Ghar el Melh et Delta de la Mejerda, Jebel Nadhour and Ghar El Melh KBA and Sidi Ali el Mekki KBA. The lagoon is located in north-eastern Tunisia, approximately 50 kilometers north of the capital, Tunis and 40 kilometers east of the town of Bizerte.

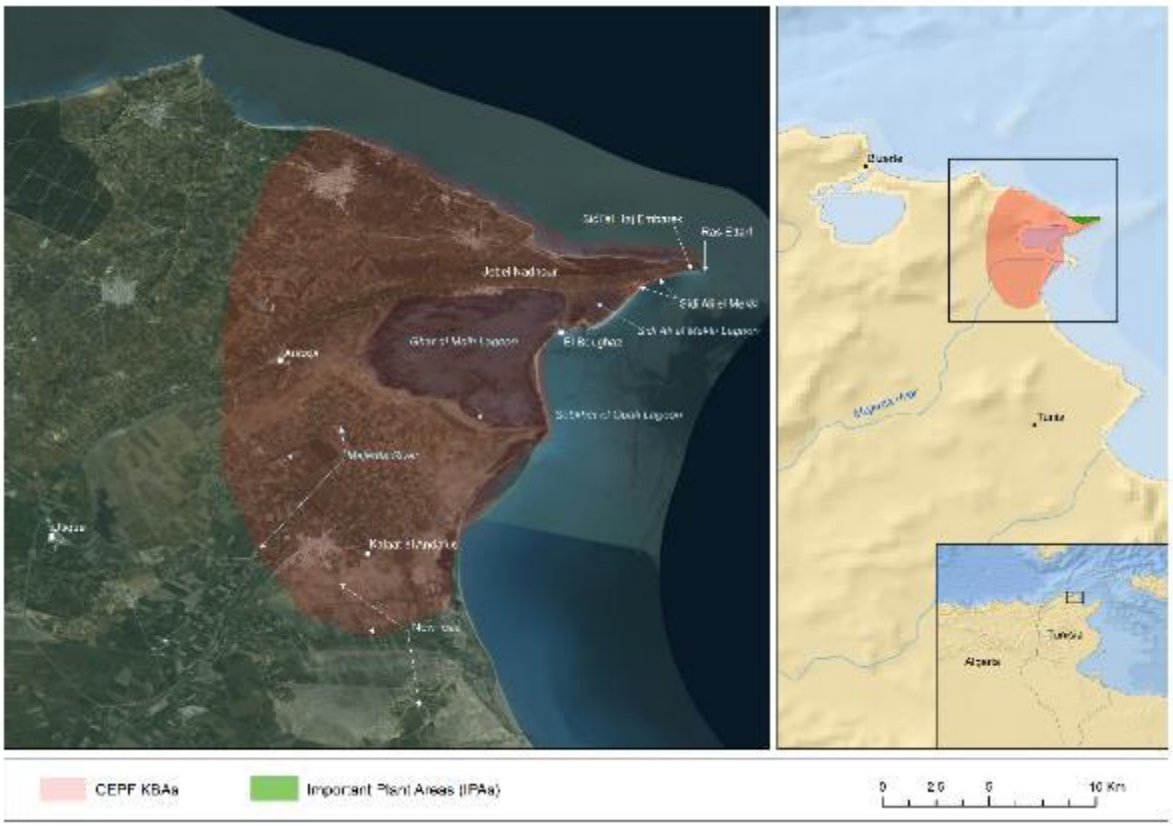

Figure 1. Study area

Monitoring may be taken to mean a wide range of actions, but all include as a minimum, recording data against a baseline to document trends in particular parameters. However, to serve an active useful purpose for conservation of sites and habitats, recording of comparative data against a baseline should be linked to the identification of targets for trends in parameters and identification of trigger values which initiate a pre-defined response.

Two approaches to monitoring are considered here:

1. Documenting organisms and habitats to measure trends in population and habitat condition.

2. Measurement of change in natural parameters toward achievement of a target end-state for habitats.

The first of these will enable an understanding of the current situation and the likely future condition of habitats and species without intervention. If conservation actions are implemented, the effects of these on the monitored parameters can also be measured if the parameters and monitoring methods are suitable. The monitoring options of this type for terrestrial species and habitats are discussed in Chapter 2.

The second type of monitoring requires a more comprehensive and detailed baseline involving detailed description of the existing situation, definition of a target end-state for all habitats within the area and then monitoring to assess success in moving from the current situation to the desired end-state. This type of monitoring is described in Chapter 3.

2 HABITAT MONITORING

We know that the main trend for most habitats in the area is toward increasing degradation because of pollution, increasing tourist and development pressure and direct habitat destruction. The only habitat which can be seen to be improving in quality involves the phrygana which is at a stage of abandonment which suits some of the notable plants and except where still heavily grazed, is recovering toward higher scrub and woodland. A simplistic habitat map is presented as Appendix A, however this needs to be refined using high resolution satellite imagery, combined with ground-truthing.

A recording method which has been employed in relation to a number of species in recent years (e.g. Lansdown 2019) is to use the encounter-rate along transects in different habitats. The transect length and width, as well as the subdivisions vary in relation to the nature of the habitat. Thus, for example in woodland, transects could be 100-500 m long, and 4-5 m wide. The presence of notable species should be recorded assigning a score of 1 (present) or 0 (not recorded) to each taxon on each 10 m length, measured by pacing, a tally is then made of the number of 10 m length per 50 m length of transect with positive records. This will provide an average and range of variation for each taxon for each area surveyed. Enough transects should be recorded to reliably document each different area surveyed. For the purposes of monitoring, the aim would not be to attempt to repeat individual transects, but each time to record enough transects to characterise the area and vegetation surveyed. The same basic system can be applied to other habitats. thus, for example, in saltmarsh transects might be 50-100 m long and 3 m wide, with the presence of selected species recorded in 5 m lengths.

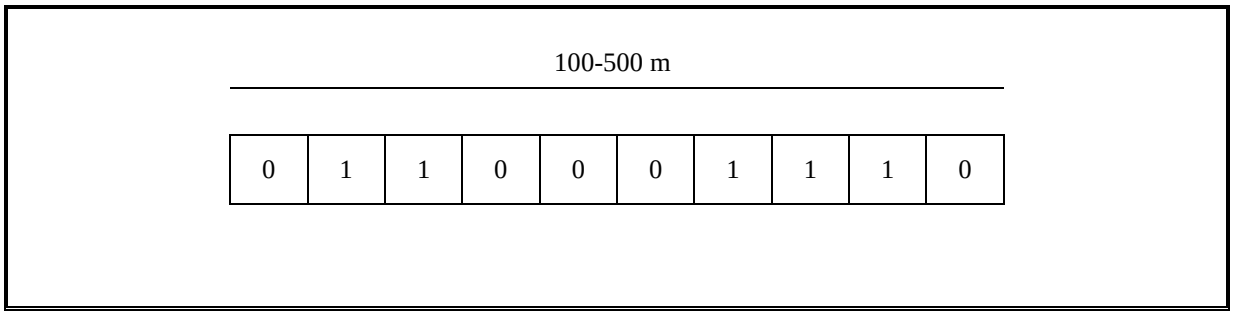

Figure 2. Hypothethical example of a sampling design in a woodland for habitat monitoring

Lagoon margins and saltmarsh - The most important action is to develop a precise and detailed map of the balance of land-use between dune, saltmarsh, lagoon, agriculture, settlement and industrial zones. Further work to document the distribution of degradation of saltmarsh would enable monitoring of trends. Transects carried out for the research into *Aedes* mosquitoes (Daoud-Bouattour in litt.) can be repeated to demonstrate changes in the vegetation. However, it is not clear how to interpret change using these data. Alternatively encounter-rate transects could be employed, as described above.

Agricultural land - The extent and distribution of agricultural land needs to be mapped using high-resolution aerial imagery. It should be feasible to use direct comparison to identify areas where the extent of land under agriculture is increasing.

Rivers and streams - Streams on Jebel Nadhour are important, both for their freshwater input to the lagoons and almost certainly for the bryophyte communities which they support which may not include notable taxa but are likely

to support invertebrates which would not occur elsewhere. There is a need to monitor the installation of dams on these streams. Other flowing water courses are currently so modified and degraded that there is nothing to be gained from monitoring until and unless restoration measures are taken.

Ditches and other non-lagoon wetlands - Apart from the oxbow lake at Utique, there are currently no important non-lagoon wetlands on the plain and there is no merit in monitoring these habitats. There is a need for a formal survey of the oxbow at Utique to establish whether it supports any notable plant species, particularly charophytes. If notable plant species are found, then a monitoring protocol needs to be developed.

Sandy habitats

a) Coastal dunes - there is a need for thorough survey to fully document the vegetation of this habitat. Transects to document the gradation from the beach through dunes to the lagoons and saltmarsh could be informative and should employ the same method as used for the work on *Aedes* mosquito habitat (Douad-Bouattour in litt.), resulting in sketches indicating the dominant species and transitions between habitat-types.

b) Jebel Nadhour - Encounter-rate transects could be used to record change in the abundance of notable taxa such as *Daucus rouyi*, *Linaria heterophylla* var. *dichroa* and *Malcolmia doumetiana*. This should be combined with remote mapping to document habitat conversion.

Rocky Coast - Encounter-rate transects could be used to record change in the abundance of notable taxa such as *Daucus rouyi*, *Limonium intricatum*, *L. pyramidatum*, *Linaria heterophylla* var. *dichroa* and *Malcolmia doumetiana*. This should be combined with remote mapping to document habitat conversion.

Woodland - Current trends in habitat degradation or regeneration are from phrygana to bare ground, phrygana to scrub, maquis to phrygana and woodland to maquis or scrub. These trends could be measured but it is difficult to see what purpose the information acquired would serve. Even mapping is only useful at a scale where changes recorded are fairly catastrophic. Collection of quadrat data from woodland toward the eastern tip of Jebel Nadhour (Appendices B and C) showed that variation across the habitats is so great that unless the location of quadrats is formally fixed, it will not be possible to interpret change or differences in any meaningful way. Collection of encounter-rate transect data (as described above) would enable monitoring both of the condition of the habitat and trends in the abundance of notable taxa. Taxa recorded should include the two *Juniperus* species and *Quercus coccifera*, distinguishing between mature trees, saplings and seedlings.

Rock exposures - These habitats are generally fairly secure at the moment, although there are areas where clearance of vegetation could cause the loss of bryophyte stands. Monitoring of the woodland and scrub habitats can inform monitoring of the condition of these habitats.

Settlements - Whilst there may be a trend for an increase in the density of settlements and reduction in the semi-natural habitats within settlements, this is not considered significant and there is no benefit to be had from monitoring.

3 CONSERVATION PLANNING

Three management plans have already been prepared for the area (APAL 2010, WWF-DGF 2011, WWF-DGF 2012), only the last and most recent of which has been available for this work. This plan provides a detailed breakdown of the regulatory context for habitat protection and management in the region, together with a costed review of potential methods of controlling human activities. It covers a relatively narrowly defined zone involving the saltmarsh and lagoon areas of both lagoons extending north to include the southern face of Jebel Nadhour and south along the coast to include the two small lagoons east of Kalaat al Andaluus (WWF-DGF 2012: 16).

The most effective means of establishing a set of monitoring protocols for natural sites or habitats is to develop a plan which identifies the ultimate target end-state for each habitat and species within the area involved. For wetlands, the logical approach is usually to establish a catchment management plan, however the factors and zones which influence the condition of the habitats within both the Jebel Nadhour and Ghar El Melh KBA and the Sidi Ali el Mekki KBA extend beyond any one catchment. There is therefore a need to develop a plan which involves areas beyond the hydrological catchment of both these lagoons. The plan may be aspirational, but must be practical. There is a need to recognise existing factors which cannot realistically be undone (e.g. it would not be realistic to propose removal of all buildings in Ghar el Melh and Sidi Ali el Mekki, even though this would undoubtedly have a beneficial effect on the water quality of the lagoons), as well as existing features which can be changed (e.g. it is reasonable to propose re-

wilding the River Mejerda to restore its hydrological function, by restoring a dynamic and varied channel) and thus design an overall plan for the area.

In developing a monitoring protocol, the tendency to record things in case the data are useful should be avoided and parameters should only be selected for monitoring if:

1. They reliably indicate an element of the condition of the site or habitat.
2. They can be recorded in a way that enables comparison against a pre-defined target.
3. Trigger thresholds can be identified to initiate relevant responses.

Therefore, realistically, before a detailed monitoring plan can be drawn up for individual parameters within or in relation to the two KBAs, there is a need for an overall conservation plan which details as a minimum the ultimate balance between different habitats and land-uses to enable development of targets for species and habitats. The following are the steps needed:

1 - Develop map of existing habitats, land-uses and pressures

↓

2 - Develop a plan for the ultimate balance of habitats, land-uses and pressures

↓

3 - Identify methods of achieving the plan working from the current situation

↓

4 - Identify quantifiable targets for habitats and species which will indicate achievement of the plan

↓

5 - Develop protocols for measuring the change from the existing situation to successful implementation of the plan, using the targets to measure success

↓

6 - Collect data to serve as the baseline for measurement against targets, using the protocols identified

Data have now been collected which would enable preparation of a fairly simplistic map of the existing distribution of different habitats and land-uses. This could be prepared by refining the habitat map developed by the Tour du Valat (Appendix A). These data need to be formalised and subject to ground-truthing. Some ideas have been put forward for monitoring, however until the long-term plan is developed, it will not be possible to be confident that these proposed methods will serve to measure trends in the condition of the two KBAs.

The method for monitoring can only be fully designed when the target end-state has been identified for all habitats. Once this is available, then a table can be produced along the following lines:

Parameter	**Method**	**Baseline condition**	**Target condition**	**Negative trigger**	**Response**
Plant diversity in Ghar el Melh Lagoon	Point sampling	<5 species per sample except near El Boughaz	≥10 species throughout	< 10 species in 5 of 10 samples	Install or upgrade wastewater collection and treatment facilities at Klaat al Andaluus, Aousja, Ghar el Melh and Sidi Ali el Mekki

There is therefore a need for the following:

1. Preparation of the baseline map (field data and satellite images are available and this should be straightforward).
2. Ground-truthing of the map.
3. A workshop to develop a long-term plan for the balance of different habitats and land-uses within the area.

4. For each taxonomic discipline and each habitat type, identify the actions needed to progress from the existing situation to the long-term plan.
5. Develop the monitoring protocols for relevant parameters.

4 ECOTOURISM

There is no single natural feature in the area surveyed which would be sufficiently attractive to members of the public to sustain a local ecotourism industry. The avifauna is fairly typical of Western Mediterranean North Africa with only a few species such as Audouin's Gull (*Larus auduinii*) and Bonelli's eagle (*Hieraaetus fasciatus* or *Aquila fasciata*) which might be of particular interest to birdwatchers. There appears to be no information on the mammals which occur on Jebel Nadhour but local people suggested that there were many species present and the abundance of tracks in sand along the Jebel would support this. It seems likely that there are caves in the Jebel which would support bats, but there appears to be no information on this. There are a few species of plant which are local endemics, such as *Daucus rouyi* (*Thapsia polygama*) but few people would travel any distance to see these. Equally there is no evidence that other animals or plants would attract international tourists to the area, rather than going elsewhere. It is possible that with suitable facilities and publicity, the area could be added to existing tours, however this would have only a minimal financial effect on the area and might carry a concomitant burden of development and on services.

Some aspects of the culture of the area, particularly the Guettayas could be of interest as part of wider tours and this is already being investigated by IUCN.

In contrast, the area is extremely popular with Tunisian tourists and this tourism is enough to stimulate a thriving industry with extensive construction of apartments, houses and even a hotel, as well as beach huts, cafes and restaurants. It is possible that elements of the wildlife of the area could be highlighted to introduce Tunisian tourists to the importance of the natural history of the area.

Acknowledgements

The author would like to thank Catherine Numa (IUCN Mediterranean) for support and administration of the project. The work described here was funded by IUCN Med under a grant from the MAVA Foundation.

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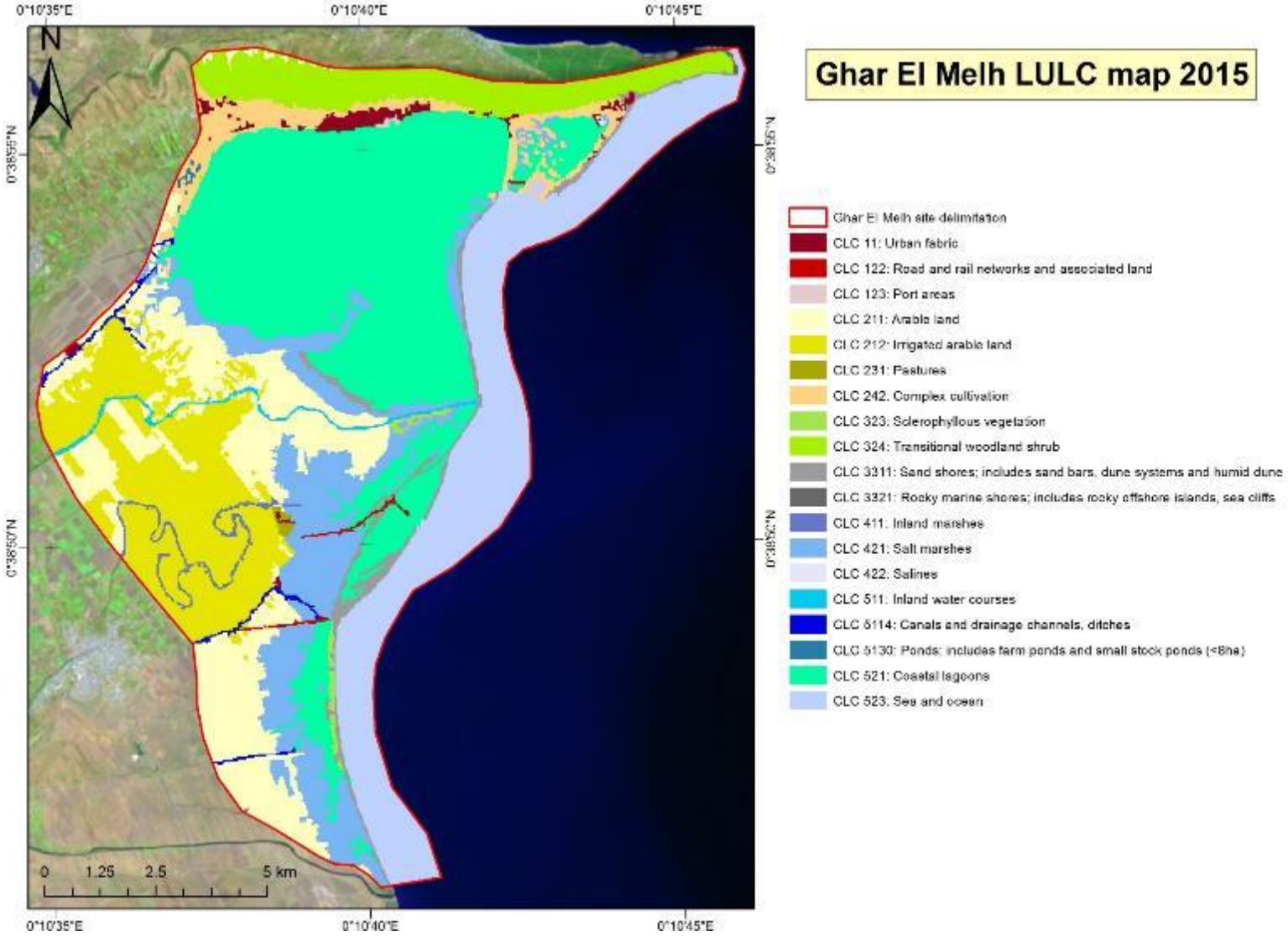
WWF-DGF 2012. Etude du plan de gestion et d'aménagement intégrés du site RAMSAR de la zone humide de Ghar El Melh : Site RAMSAR n°1706. Volume C : Plan de gestion intégrée. Projet « Zones Humides en Tunisie : un Habitat pour l'Homme et la Nature », Avril 2012. 58p.

APPENDIX A MAP OF THE MAIN HABITATS REPRESENTED WITHIN THE STUDY AREA
(produced by the Tour du Valat 2019)



APPENDIX B QUADRAT DATA FROM WOODLAND ON JEBEL NADHOUR

Species	Quadrat 1	Quadrat 2	Quadrat 3
Acacia saligna	1	3	3
Pistacia lentiscus	2	2	3
Cistus salvifolius	1	3	2
Retama raetam subsp. *bovei*	1	2	3
Asparagus acutifolius	2	1	2
Cutandia divaricata	2	2	1
Calicotome villosa	1	1	1
Caryophyllaceae sp.	1	1	1
Poaceae (2)	1	1	1
Juniperus phoenicea (tree)	3		3
Juniperus phoenicea (sapling)	2		2
Juniperus oxycedrus (sapling)		1	2
Pinus halepensis	2		1
Acacia cyclops	1		1
Ephedra fragilis	1	1	
Juniperus oxycedrus (tree)	1		1
Lagurus ovatus	1		1
Phillyrea media	1		1
Rubia peregrina	1		1
Satureja barceloi		1	1
Silene arenarioides	1	1	
Thymbra capitata	1	1	
Thymus sp.	1		1
Quercus coccifera (sapling)	2		
Quercus coccifera (tree)	2		
Timmiella barbuloides	2		
Brachypodium ramosum	1		
Daucus rouyi (*Thapsia polygama*)		1	
Delphinium verdunense	1		
Erica multiflora	1		
Galium lucidum	1		
Juniperus oxycedrus (seedling)		1	
Juniperus phoenicea (seedling)	1		
Opuntia ficus-indica			1
Phillyrea angustifolia/*latifolia*	1		
Pinus sp.			1
Poaceae (1)	1		
Poaceae (3)	1		
Prasium majus	1		
Quercus coccifera (seedling)	1		
Rhamnus myrtifolia			1
Rosmarinus officinalis subsp. *officinalis*	1		
Stipa tenacissima	1		
Number of taxa	**46**	**23**	**35**

APPENDIX C RAW DATA FROM TREE MONITORING BASELINE

NB/ Quadrat 2 is not included because it did not contain any trees

Quadrat 1

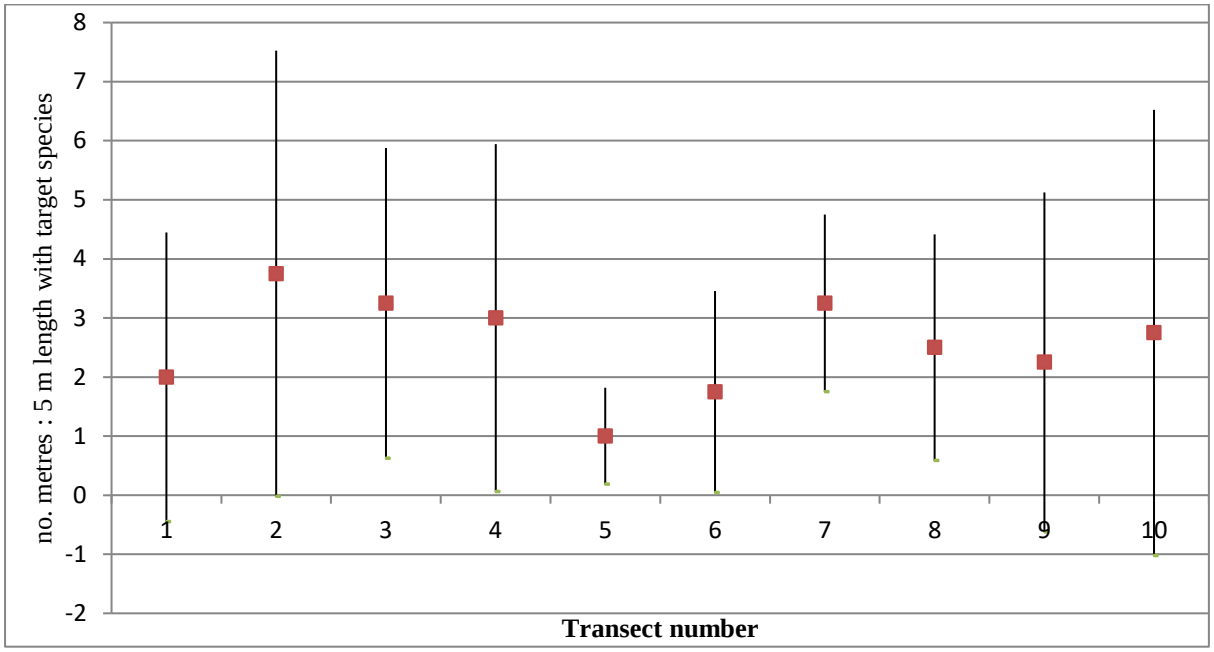
Species	**height (m)**	**dbh (cm)**
Juniperus phoenicea	3	20
		23
		23
		27
		22.5
Quercus coccifera	3	20
		13
		25
		13
Juniperus phoenicea	3	27
		16
Quercus coccifera	3.5	36
		22
		11
Juniperus phoenicea	3	26
		16
		21
		23
		16
		19
		26
		22
		22
		23
Quercus coccifera	3	17
Quercus coccifera	3	14
Juniperus phoenicea	4	31
		31
Quercus coccifera	3	27.5
Quercus coccifera	2.5	26
Quercus coccifera	3	23
Quercus coccifera	3	29.5
		25
Quercus coccifera	2.5	20
Juniperus oxycedrus	4	48
		47
		36
Juniperus phoenicea	2.5	12
Juniperus phoenicea	2.5	15
Juniperus phoenicea	2	15
Juniperus phoenicea	3.5	29
Juniperus phoenicea	3	25
Juniperus phoenicea	3.5	17
		19
		22
Juniperus phoenicea	4	13

Quadrat 3

Species	**height (m)**	**dbh (cm)**
Juniperus oxycedrus	2.5	24
Juniperus oxycedrus	3.5	51
Juniperus phoenicea	3	24.5
Juniperus phoenicea	3	26
Juniperus phoenicea	4	27
Juniperus phoenicea	3.5	28
		35
Juniperus phoenicea	3.5	28
Juniperus phoenicea	5	25
Juniperus phoenicea	5	40
Juniperus phoenicea	3	28
		25
Juniperus phoenicea	3	35
Juniperus phoenicea	3	27.5
Juniperus phoenicea	3	23
Juniperus phoenicea	4	28
Juniperus phoenicea	3	25

		20
		17
		24
Juniperus phoenicea	3	32
Juniperus phoenicea	3	23
Juniperus phoenicea	3	19
Juniperus phoenicea	3	21
Juniperus phoenicea	3	24
Juniperus phoenicea	3.5	23
Juniperus phoenicea	3.5	34
Juniperus phoenicea	3	22
Juniperus phoenicea	4	19
		19
Juniperus phoenicea	4.5	23
Juniperus phoenicea	3	27
Juniperus phoenicea	3	18
		18
		15
Juniperus phoenicea	3.5	30
Juniperus phoenicea	3	25
Juniperus phoenicea	4	40.5

APPENDIX D. EXAMPLE OF A GRAPHIC BASED ON A MONITORING QUADRANTS PROTOCOL



This figure shows how data collected using the proposed monitoring protocol can be presented to show the variation in the target species along each transect.