COST Action Short Term Scientific Mission – Lake Akrotiri, Cyprus

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Summary

Jodey Peyton, Owen Mountford and Oli Pescott from the NERC Centre for Ecology and Hydrology (CEH), Wallingford, UK, together with Marilena Onete of the Institute of Biology (Romanian Academy), spent two weeks in mid-October 2015 mapping the extent of several invasive alien plant species around the salt lake on the Akrotiri, Cyprus. They mapped over 100 ha of invasive alien woody species around the lake and completed 112 vegetation quadrats throughout the survey area that also incorporated information on canopy cover and vegetation structure. The following Cyprus Plant Red Data Book (RDB) species were found during the surveys; *Cladium mariscus, Crypsis factorovskyi, Isolepis cernua, Linum maritimum, Mentha aquatica, Juncus littoralis*, *Pancratium maritimum* and *Phyla nodiflora.* Through the surveys and the correspondence with local scientists and natural historians, it is considered that *Acacia saligna* is the most potentially damaging invasive alien species. It is considered to be the one most likely to have implications on both human health (through potentially providing suitable habitat for harbouring pest species such as mosquitos) and a detrimental impact on native biodiversity through encroachment into the saltmarsh areas and competition; as such management options should be considered.

Introduction

Jodey Peyton, Owen Mountford and Oli Pescott from the NERC Centre for Ecology and Hydrology (CEH), Wallingford, UK, together with Marilena Onete of the Institute of Biology (Romanian Academy), spent two weeks in mid-October 2015 mapping the extent of several invasive alien plant species around the salt lake on the Akrotiri peninsula (34°37'N 32°58'E), Cyprus. The work was partly funded through the COST Action TD1209 ALIEN Challenge, a Short Term Scientific Mission (STSM), working with the UK Sovereign Base Area (SBA) Joint Services Health Unit (JSHU) and the SBA Environment Centre at Akrotiri. Lake Akrotiri and the surrounding area form part of a UK Overseas Territory in Cyprus; this was established in 1960 when Cyprus achieved independence from the British Empire.

The work of these scientists focussed primarily on mapping the presence of woody invasive alien species (IAS) to the north of the lake in the area known as the Akrotiri forest.

Figure 1. Location of the Sovereign Base Area of Akrotiri (©google maps)

The area surveyed, historically marshland, was planted with non-native eucalyptus and other (almost entirely Australian) tree species in the early 20th century in an effort to dry out the marsh and reduce the impact of mosquitoes breeding in the wetland. The extent to which mosquito control and drainage have been successful is unclear due to the lack of long-term monitoring in the area, but currently this

dense woodland is considered to be problematic in terms of harbouring pest species such as rats and mosquitoes, creating challenges for its future management.

The forest area is suspected of creating a home for large numbers of mosquitoes, due to the area being very damp / undergoing times of flood and potentially providing resting habitat for them. Their presence is a major nuisance for both staff at the base, business owners and the public. The JSHU is considering how to minimise the impact of mosquitoes and other pest species such as rats as a high priority, alongside protecting the native species present on this important Ramsar wetland site.

This site is considered to be one of the most important wetland areas in the eastern Mediterranean and as well as over 70% of the 370 bird species of Cyprus being recorded there, is home to hundreds of plant species, many of which are endemic, rare and or protected (SBA Environment Centre http://english.akrotirienvironment.com/Natural-Environment.php *accessed October 2015*).

The following extract is from the Joint Nature Conservation Committee fact sheet on Lake Akrotiri (JNCC, 2008):

"*The site qualifies under Criterion 1 of the Ramsar Convention as it is one of the very few major salt lakes within the eastern Mediterranean in semi-natural condition that exhibits a wide range of saline and freshwater influences. The site contains many good examples of inland saline and freshwater wetland habitats, a combination that is unique within the biogeographic region of the eastern Mediterranean, including permanent and seasonal saline pools, salt marsh, sand flats and freshwater marshes. The site is the largest aquatic system in Cyprus. The site qualifies under Criterion 2 as it supports an appreciable number of rare, vulnerable or endangered species or subspecies of plant or animal including 13 endemic and rare plant species such as* Ophrys kotschyi *and* Linum maritimum*, as well as over 32 bird species listed on Annex I of the European Birds Directive. The site qualifies under Criterion 3 as it supports populations of plant and animal species that are important for maintaining the biological diversity of the eastern Mediterranean biogeographic region. Many species of plant and animal, including a number of endemic plant and invertebrate species, are wholly dependent on habitat types represented within the site of which there are few remaining examples on Cyprus. The site qualifies under Criterion 6 by regularly supporting an internationally important wintering population of greater flamingo* Phoenicopterus ruber*. In the five-winter period 1998-2002, an average peak count of 6,000 was recorded, being approximately 2% of the eastern Mediterranean/SW& S Asian population*."

Funding

This work was funded by a COST Action TD1209 Alien Challenge, a European-wide project on invasive alien species. This project enabled botanists from CEH to give the JSHU and the SBA Environment Centre a clearer understanding of the extent of the spread of these invasive species, and to provide a context in which future *essential* baseline surveys can be targeted looking at other species (birds/pest predators), as well as hydrology and water chemistry. The ecology of the lake and surrounding habitats is extremely complex, with different stakeholders having conflicting priorities and opinions as to the value of the forest.

Purpose of the Short-term Scientific Mission

As set out in the agreed COST proposal, the STSM had four basic objectives for work on the Akrotiri salt-lake and peninsula: 1) to map the spread of invasive non-native species, especially *Oxalis pes-caprae, Acacia saligna* and *Eucalyptus* spp., around the salt lake and adjacent areas; 2) to ascertain the climatic factors contributing to the spread of these species; 3) to review the impact of these species on ecosystem services, biodiversity and community composition; and 4) to suggest suitable management advice to minimise the impact of these species within the local unique habitats.

The expected outputs of the mission included: a) GIS maps of the extent of invasive species around the saltmarsh of Akrotiri; b) environmental data including data on vegetation composition; c) data on the climatic requirements of these species; d) materials to aid revision of the Akrotiri management plan; and e) a short paper documenting biological invasions within Cyprus and evaluation of the key factors influencing such invasions.

Both objectives and deliverables were adapted in the light of discussions between the STSM team and the host institution JSHU. The changes in approach were influenced partly by the time of year and partly by attempting to integrate the investigation of Invasive Alien Species (IAS) with the clear local need for information on the habitats of pest species (mosquitoes and rats) in such a way as to improve the management of the lake and its associated habitats within the SBA.

The final agreed objectives, and the background to their modification, were:

I. To map the spread of IAS around the salt lake and adjacent areas. Mapping was to focus particularly on woody species whose spread might markedly affect the habitats *i.e. Acacia saligna, Casuarina* (and *Allocasuarina*) spp. and *Eucalyptus* spp. Attention was also paid to other woody IAS (e.g. *Lycium ferocissimum* and *Nicotiana glauca*) and to some forbs,

especially *Aster squamatus*. However, the expected focus on *Oxalis pes-caprae* proved impractical at the end of the long dry summer, with almost all plants only present as bulbs with no above-ground growth.

II. To characterise the composition of the different types of scrub/woodland dominated by IAS and to describe their physical structure in terms of cover in 3 horizontal layers of woody growth: a) above 10 m (tree layer); b) between 5-10 m (scrub layer); and c) below 5 m (field layer). This objective sought to illuminate both the community composition where IAS occurred and the variation in physical structure that might influence the presence of pest species such as mosquitoes and rats.

III. To review the impact of these species on ecosystem services, biodiversity and community composition. Delivery against this objective will be an important activity in the forthcoming months, as the outputs of the STSM are developed in collaboration with the host institution.

IV. To suggest suitable management advice to minimise the impact of these species within the local unique habitats. This report contains some preliminary thoughts on this objective but the main inputs by the STSM team into the Akrotiri management plan will also be made over the next few months.

The revised outputs for the mission include the GIS maps of the extent of invasive species around the saltmarsh of Akrotiri (see Figures 2-4) and 112 vegetation quadrats expanding the qualitative description of the mapped habitat polygons. Some materials to aid the revision of the Akrotiri management plan are included in the later sections to this report.

Work on the short paper that documents biological invasions within Cyprus (together with the key factors influencing such invasions) has begun. Immediately prior to the mission in Cyprus, the CEH team submitted a review of IAS to the JSHU, detailing for 222 plant species: a) the native range; b) habitat, status and trends in Europe; c) status and distribution in Cyprus (from Meikle 1977, 1985); d) status in all European countries including Cyprus as documented by the DAISIE programme (see references); and e) status and trends reported for Cyprus by Hadjikyriakou & Hadjisterkotis (2002).

The next two sections describe the activities followed during the STSM and the methods employed to meet the project objectives.

Information on main IAS species present in the forest

(derived from review by Mountford and Peyton, 2015)

Species Name	Biotope	Brief description (Meikle)	Native range (*Flora Europaea etc*)	Habitat, trends & status (western Palaearctic - Europe)	Cyprus status according to Meikle - note Division 3 includes Akrotiri. Distribution (from herbarium specimens) and trends were those as of publication dates (Vol. 1 1977 & Vol. 2 1985)	DAISIE - http://www.europe-aliens.org/ - European territories where mapped as an alien, excluding Iceland & Macaronesia [* Full factsheet downloaded]	Hadjikyriakou & Hadjisterkotis (2002) - paper on Cyprus invasive plants
Acacia saligna	terrestrial	Diffuse shrub 3-5 m high	SW Australia	Widely naturalised and invasive in Mediterranean climates, notably within South Africa	Included only as a possible synonym for *A. cyanophylla*	Cyprus; Balearics; Corsica; France; Greece; Israel; Italy; Portugal; Sardinia; Sicily; Spain; (European) Turkey	**PROBLEM -** Full description - planted for firewood, and previously controlled through harvesting for that purpose. Also used to reforest traditionally garigue/phrygana and to provide green cover along roads and preevnt erosion. Said in recent decades that wattle plantations near Akrotiri salt lake are invading the wetland, favoured by drought. Widespread - typical habitats are phrygana & maquis

Casuarina cunninghamiana (N.B. species presence not confirmed by STSM team due to time constraints on identifying all species, but known from area through local knowledge)	terrestrial		Eastern Australia	Widely planted for ornament in warm temperate zones and invasive in Florida (Everglades) and in South Africa	Cultivated tree; listed sites at Nicosia & Dhekelia	Cyprus; Corsica; Italy; Madeira; Sardinia; Sicily; Spain	Specifically listed for Akrotiri Salt Lake wetlands, where it is invasive, locally replacing reeds
Eucalyptus camaldulensis	terrestrial	Tree 15-24 (-30) m	South Eastern Australia	Commonly planted tree throughout much of southern Australia and numerous overseas countries	One of the most extensively planted eucalypts in the world and extensively planted in Cyprus	Cyprus (not listed in DAISIE); Canary Islands; Corsica; France; Greece; Israel; Italy; Portugal; Sardinia; Sicily; Spain; Turkey	Not listed
Eucalyptus gomphocephala	terrestrial	Tree 18-20 (-40) m	Western Australia	Tolerates strong coastal winds and sandy, alkaline soils derived from limestone. It performs best in coastal or subcoastal sites and under cultivation is a hardy, shadey tree.	Said to be one of the most widely cultivated species in Cyprus	Cyprus; Spain	Not listed

Methods

The project team approached this project in two phases. Firstly, tablet computers and a GIS mapping system were used to map around the lake. The area around the lake, bounded by either roads or citrus groves, in the north, west and south, or sea, in the east, was walked systematically, mapping locations where non-native plant species were encountered. In the Akrotiri forest to the north of the lake this was a much larger task, and, in order to carry out this task effectively, forest compartments were mapped, together with a description of the mix of species and any variation. Five mapping categories were used: *Acacia saligna, Aster squamatus*, *Eucalyptus* species (two species, *E. camaldulensis* and *E. gomphocephala* were confirmed during the survey), mixed alien woody species (*A. saligna* and *Eucalyptus* spp.) and other (generally referring to *Casuarina* spp.).

In the second phase of the project, the whole team quantified the density of shrub and tree cover in the forest compartments and recorded any other plant species they found in an effort to characterise the plant associations typical of areas where invasive plant species are dominant. Over the two weeks the team also recorded the presence of rare plants listed in the Cypriot Plant Red Data Book found around the site. This second phase was intended to establish a baseline of plant diversity present in the forest. It is important to establish this baseline, in order to inform current discussions on the future of the forest being carried out and involving a wide range of stakeholders.

Results

The mission mapped just over 102 ha of stands of IAS (Table 1), the majority of which lay on the north side of the salt-lake (Figure 2). *A. saligna, Eucalyptus* spp. and *Casuarina* spp. were the most common invasive species found around the lake. Two species of Eucalyptus was confirmed during the surveys: E. *camaldulensis* and *E. gomphocephala*.

All of the woody alien species are all readily identifiable species and could easily be identified (certainly to Genus level) by the public using identification guides should such a guide be considered necessary. Although *A. saligna, Eucalyptus* spp. and *Casuarina* spp. are all spreading, records made of seedlings indicated that *A. saligna* was the most invasive and this species was frequently noted encroaching on the salt marsh. This species is considered by the eminent Cypriot natural historian Georgios Hadjikyriakou to be the most problematic IAS in Cyprus. The evidence gathered by this STSM supports this view, and according to local entomologists, *A. saligna* also appeared to provide the most suitable resting habitat for the mosquito species considered to be problematic by the JSHU.

Table 1 Mapped species – total areas (sq m)

IAS	**Area / sq metres**
Acacia saligna	281,617
Aster squamatus	848
Eucalyptus	113,315
Mixed *Acacia, Casuarina* and/or *Eucalyptus*	627,168
Opuntia ficus-indica	98

Figure 2 shows the extent of the mapping carried out by the team and indicates the extent of the invasive plant situataion around the salt lake. The map shows areas of the different species found, plus mapped linears (normally indicating forest tracks where encountered) as well as target notes and the locations of the 112 quadrats.

As mentioned, it is possible to see that the *Acacia* is spreading into the areas of saltmarsh around the lake. From the surveys completed, it does not seem that much of the *Eucalyptus* and *Casuarina* is spreading or has much new growth. Although in NW Casuarina was spreading into fresher marsh (Fig. 5). This is the area that showed large areas of dieback, which had been assumed to be due to

long-term variation in lake water levels, but, in fact, was suggested by G. Hadjikyriakou (pers. comm.) to be due to management of the trees through burning by the foresters.

This is not the case for the *Acacia* though, for which new seedlings and young growth were found throughout the survey.

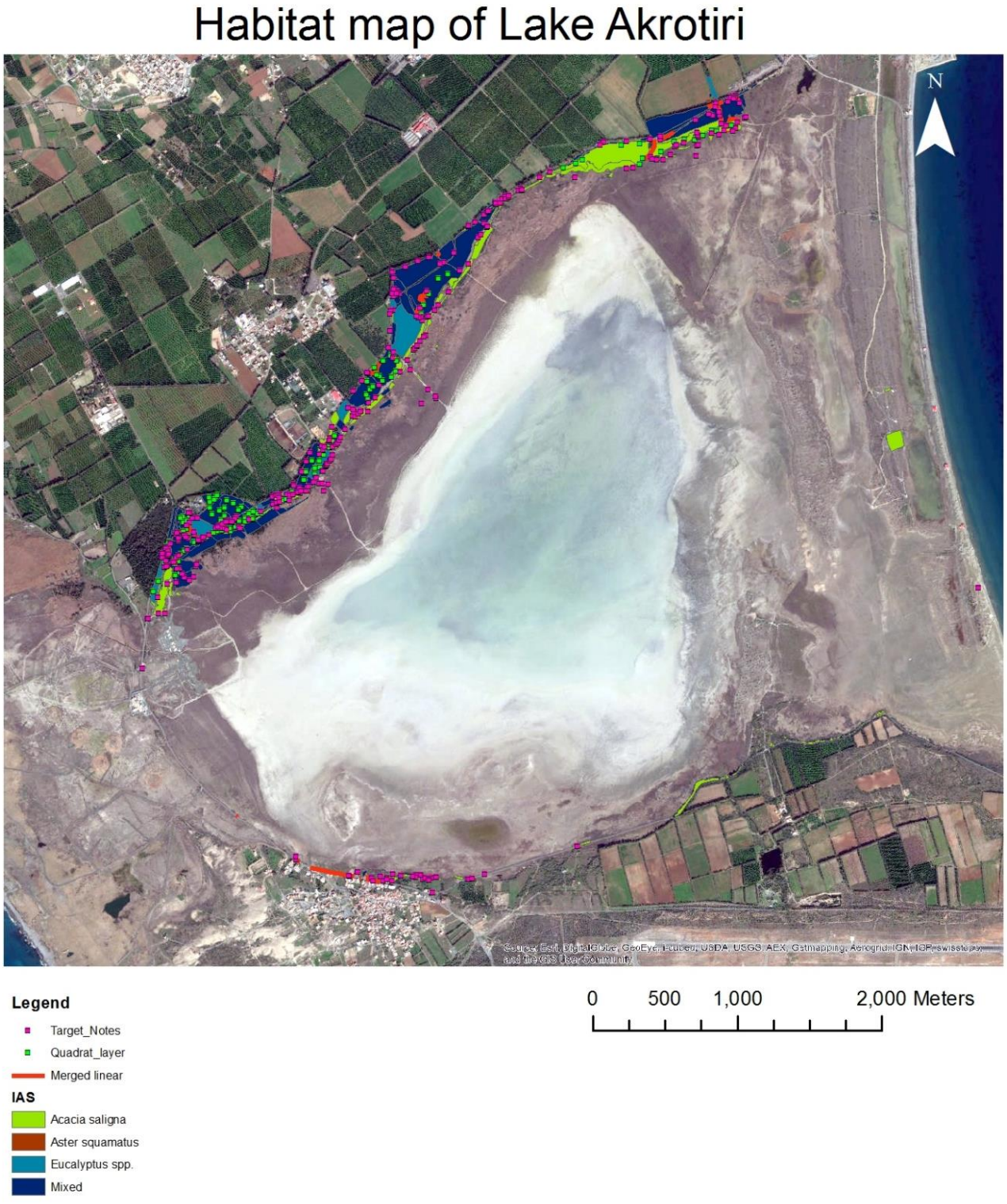

Figure 2 Map of polygons dominated by invasive species in Akrotiri salt-lake area

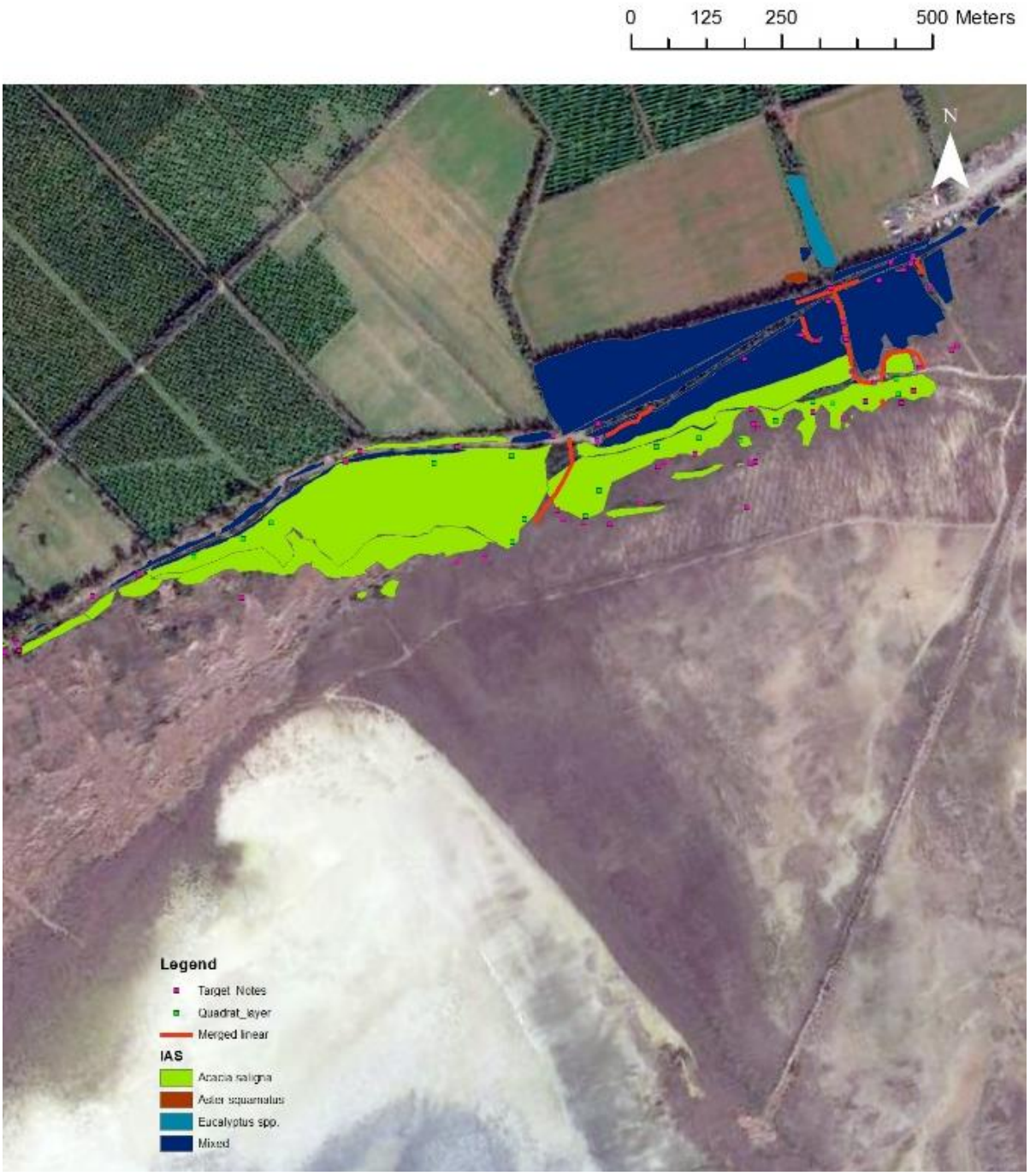

Figure 3. Acacia saligna invasion into salt marsh along north-eastern shore of lake

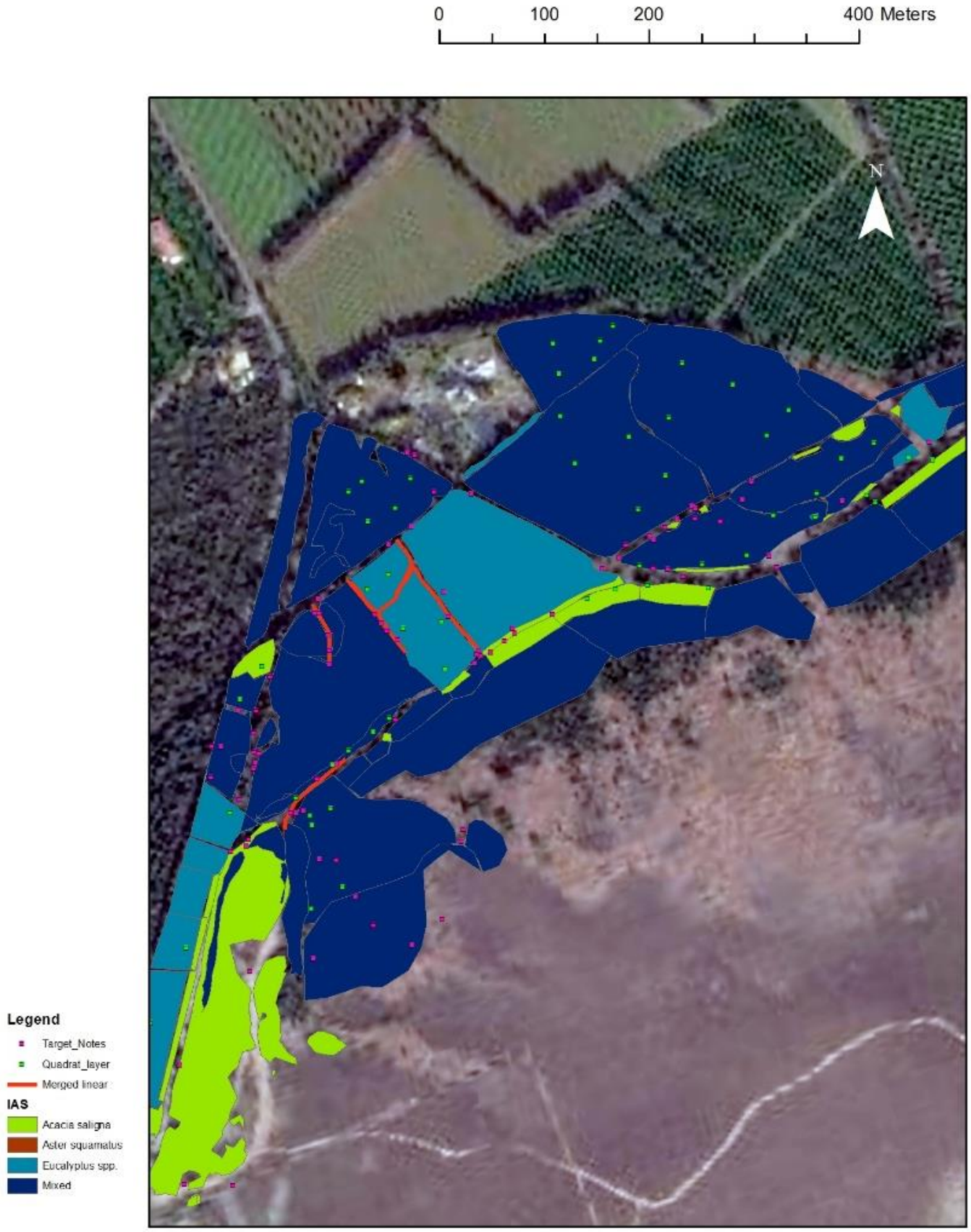

Figure 4 North-western side of lake with large areas of mixed woodland and glades with tracks de-lineated

Populations of RDB species for Cyprus were mapped: *Cladium mariscus, Crypsis factorovskyi, Isolepis cernua, Linum maritimum, Mentha aquatica, Juncus littoralis*, *Pancratium maritimum* and *Phyla nodiflora. Juncus maritimus*, although known for the site (Brown *et al.* 2002), was not observed during the STSM.

As part of the second phase of the fieldwork, the team recorded 112 quadrats within stands of IAS in order to characterise the vegetation structure and community composition. The samples were distributed from the upper edge of the saltmarsh, through a zone where *Phragmites* is prominent, into the plantations and including areas where dry grassland patches formed a mosaic with the upper edge of the forest. Table 2 lists the species recorded within these samples. The second half of October represents the culmination of a dry summer, and was not an ideal season at which to assess the non-wetland vegetation. Hence, although the quadrats gathered should be representative for the broad composition of saltmarsh, wetland and plantation, those samples toward the upper edge of the surveyed zone may appear less-species-rich than had they been recorded in April.

Table 3. Species (and bare ground) recorded from quadrats

Acacia saligna	*Inula crithmoides*
Aeluropus lagopoides	*Juncus spp* (unidentified - not flowering)
Agropyron elongatum	*Juncus heldreichianus*
Allium trifoliatum	*Juncus littoralis*
Anagallis arvensis s.l.	*Lactuca serriola*
Arthrocnemum macrostachyum	*Limonium virgatum*
Arundo donax	*Linum maritimum*
Asparagus acutifolius	*Lotus corniculatus* var. *tenuifolius*
Asphodelus cf. fistulosus	*Lycium ferocissimum*
Asteraceae (unidentified)	*Myrtus communis*
Atractylis cancellata	*Oryzopsis milieacea*
Avena barbata	*Oxalis pes-caprae*
Bare ground	*Panicum repens*
Bolboschoenus maritimus	*Phragmites australis*
Brachypodium pinnatum	*Pistacia lentiscus*
Carex divulsa	*Plantago maritima*
Carex extensa	*Polypogon maritimus*
Carex hispida	*Pulicaria dysenterica* ssp. *uliginosa*
Casuarina/Allocasuarina spp.[1]	*Ranunculus* sp.
Cladium mariscus	*Rubus sanctus*
Conyza bonariensis	*Samolus valerandi*
Conyza canadensis	*Scariola viminea*
*Cynareae (*unidentified thistle)	*Schoenoplectus littoralis*
Cynodon dactylon	*Schoenus nigricans*
Cynoglossum creticum	*Smilax aspera*
Dittrichia viscosa	*Solanum nigrum*
Equisetum ramosissimum	*Sonchus oleraceus*
Eucalyptus spp.	*Tamarix smyrnensis*
Ficus carica	*Teucrium scordium* spp. *scordioides*
Galium aparine	*Torilis arvensis*
Hordeum bulbosum	*Typha domingensis*

[1] The trees recorded as *Casuarina* may include some *Allocasuarina* spp.

Table 3 Top ten species (including bare ground) recorded (and mean presence)

Species	No. quadrats recorded in (112)	% quadrats recorded in	Mean cover
Acacia saligna	73	65	33.16
Eucalyptus sp.	71	63	24.11
Allocasuarina spp.	34	30	14.43
Bare ground	25	22	10.19
Oryzopsis milieacea	25	22	8.72
Brachypodium pinnatum	24	21	4.71
Cladium mariscus	17	15	4.50
Schoenoplectus littoralis	25	22	4.08
Juncus sp. (not flowering)	18	16	3.67
Limonium virgatum	16	14	3.50

Appendix 2 summarises the quadrat data in terms of species presence and frequency, together with the mean percentage cover over the 112 quadrats, but the ten most prevalent species recorded are listed in Table 3 above. These data will contribute to the next stage of analysis. The information on woodland structure (cover of woody plants in the tree, scrub and field layers) will also be used to characterise the habitat for mosquitoes (and rats).

Table 4 summarises these structural data over the 112 quadrats, although it should be borne in mind that communities with significant populations of the mapped woody IAS ranged from high forest (as much as 20 m tall) to low scrub of open *Acacia* (maximum height possibly only 2 m).

Table 4 Structural aspects of vegetation with populations of woody IAS

Structural measure	**Mean % cover (except * mean depth in cm)**
Leaf litter (loose)	88%
Leaf litter depth	* 18 cm
Cut woody material (fallen or felled woody material)	18%
Tree layer (height > 10 m)	24%
Scrub layer (height 5-10 m)	26%
Field layer (woody plants < 5m)	71%

Table 4 highlights the prevalence of leaf litter in the forest areas. This litter was on average 18cm thick and so it is easy to understand that native plant species (unless able to scramble across the top of

this), would be unable to survive the levels of shading and probable soil chemistry changes that such leaf deposition would lead to. This table also highlights that the majority of the cover of vegetation was at the ground layer, this being the layer in which *A. saligna* was mostly recorded.

Options for management of the forest plantations

Among the scenarios for future management of the forest is that it be felled entirely to eradicate the habitat in which pest species can be harboured. There are both potential benefits and problems that would inform this decision.

Factors in favour of retaining the forest

- Buffer to chemical and noise pollution from neighbouring farmland and road systems
- Provides timber and fire wood
- Provides a nectar source for bees
- Provides shelter to escape summer heat and a local cooling effect
- Provides important roost sites for migratory birds
- Provides a location for recreational activities, such as dog-walking, mountain-biking and nature photography

Factors that support clearance of the forest

- Harbours mosquitoes and rats
- Provides areas for antisocial human activity; for example, there are numerous instances of fly tipping
- Non-native plant species affecting soil and native species communities, resulting in probable decreases in species diversity
- Encroaching onto salt marsh and lake that is itself important for biodiversity (Ramsar site and designated under EU directives)

Other factors affecting the salt lake and its associated habitats

1. Global climate change
2. Mosquito control
3. Rat control
4. New golf course, urban development and reduced agriculture (citrus groves) may affect salinity of the lake and local water budget
    a. Increased salinity through diversion (greater consumption) of water
    b. Decreased salinity through greater runoff into the lake.

5. Scrub clearance on the dunes of Lady's Mile Beach
6. Woodland management to protect ornithological value of lake

Issues for consideration and for future research

In addition to the mapping and vegetation composition phases, the STSM included a series of meetings with staff of the JSHU and other stakeholders. As well as discussing the STSM, these meetings identified issues that will form the subject of further discussions between the STSM team and local stakeholders with a view not only to amending the existing management plans for the Sovereign Base Area but also to developing new monitoring and research initiatives. Among these issues, initiatives and potential projects are:

1. Catalogue the non-native plants that are encountered in the salt lake forested area.
2. Production of a photographic guide to these plants.
3. Evaluation of whether all these species are invasive, which amongst these are currently the most invasive and which have the potential to become invasive in the near or distant future. Would this still be the case if they are managed?
4. How do the alien plants of Akrotiri, especially the most invasive, currently affect biodiversity and can future scenarios be predicted?
5. Could these plants affect public health (directly or indirectly)?
6. Does the forested area as it is now provide economic or other benefits to the local people and the residents of Lemesos?
7. Could the forested area be modified to provide economic or other benefits to people, especially to the locals but also for tourists *etc*?
8. Having assessed the opinions of different stakeholders, what options for forest management meet the widest range of interests and what option would deliver the greatest biodiversity benefits regardless of stakeholder considerations?
9. Outline a range (and programme) of prioritised projects for the salt lake and plantation areas, in terms or research, monitoring or awareness raising

Conclusions

During the STSM, over 100 ha of IAS habitat were mapped, with *A. saligna, Eucalyptus* spp. and *Casuarina* spp. being found to be the most prevalent species within the forest area. Discrete stand of *Eucalyptus* spp. and *A. saligna* were mapped but the majority of the area mapped was marked as *mixed*, as separation of the different species would have been too time consuming and beyond the scope of this study. Acacia and was the most dominant species that was found to be invasive, with new growth and frontiers being marked into new areas of saltmarsh but with areas of Casuarina being found also in the north-west section. Through these surveys and the correspondence with local scientists and natural historians, it is considered that *Acacia saligna* is the most potentially damaging IAS and the one that is most likely to have implications on both human health (through potentially providing suitable habitat for harbouring pest species such as mosquitos) and detrimental impact on native biodiversity through encroachment into the saltmarsh areas and the resulting competition. It is recommended that a management plan is undertaken at least for this species due to the potential negative impact that it could have on the Ramsar saltmarsh site.

Eight Cyprus Plant Red Data Book species were found; *Cladium mariscus, Crypsis factorovskyi, Isolepis cernua, Linum maritimum, Mentha aquatica, Juncus littoralis*, *Pancratium maritimum* and *Phyla nodiflora.* These species were found in the forest predominantly at the edge of tracks and in glades (excepting *I. cernua, J. littoralis,* and *P. maritimum*, which were uncommon, common, and locally abundant components of other vegetation types respectively), where the IAS species were not forming dominant stands (with minimal ground flora).

Removing all the woody alien species from this area (a suggestion raised by some stakeholders) may possibly provide short term relief from mosquitoes, but may also have detrimental impacts through the loss of roost sites for migrating birds and so would not supported from an ecological viewpoint until the importance of this area for roosting is quantified. There is also potential for an increase in the levels of pollution of the lake if the forest was cleared, due to the fact that the forest and its soils are most likely currently acting as a buffer to pollutants from adjacent road networks and farmland. The forest does have real benefits and these could be further quantified by more studies, but equally, left unmanaged and leaving the *Acacia saligna* to spread unchecked could severely negatively affect the area.

We recommend future work on monitoring a number of different taxa in order to understand the dynamics of this complex system.

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Appendices

Appendix 1: Summary of quadrat data and observed species

(N.B. note 2 d.p. to allow for low values of certain species)

Species name	Number of quadrats on which recorded (max 112)	% frequency	Mean % cover
Acacia saligna	73	65	33.16
Aeluropus lagopoides	2	2	0.04
Agropyron elongatum	4	4	0.08
Allium cf trifoliatum	1	1	0.01
Anagallis arvensis s.l.	3	3	0.00
Arthrocnemum macrostachyum	6	5	0.64
Arundo donax	10	9	0.65
Asparagus acutifolius	33	29	3.02
Asphodelus cf fistulosus	9	8	0.39
Asteraceae (unidentified)	2	2	0.05
Atractylis cancellata	6	5	0.23
Avena cf barbata	3	3	0.01
Bare ground	25	22	10.19
Bolboschoenus maritimus	9	8	1.79
Brachypodium pinnatum	24	21	4.71
Carex divulsa	1	1	0.04
Carex extensa	8	7	0.99
Carex hispida	4	4	0.27
Casuarina verticillata	34	30	14.43
Cladium mariscus	17	15	4.50
Conyza bonariensis	9	8	1.99
Conyza canadensis	2	2	0.00
Cynareae (unidentified thistle)	3	3	0.05
Cynodon dactylon	1	1	0.00
Cynoglossum creticum	2	2	0.22
Dittrichia viscosa	14	13	2.27
Equisetum ramosissimum	2	2	0.08
Eucalyptus sp.	71	63	24.11
Ficus carica	2	2	0.06
Galium aparine	4	4	0.14
Hordeum bulbosum	3	3	0.14
Inula crithmoides	3	3	0.72
Juncus sp (not flowering)	18	16	3.67
Juncus heldrechianus	4	4	0.25
Juncus littoralis	4	4	0.47
Lactuca serriola	9	8	1.34
Limonium virgatum	16	14	3.50
Linum maritimum	3	3	0.07
Lotus corniculatus var. tenuifolius	2	2	0.07
Lycium ferocissimum	3	3	0.07
Myrtus communis	8	7	0.82
Oryzopsis milieacea	25	22	8.72
Oxalis pes-caprae	1	1	0.00
Panicum repens	11	10	2.66
Phragmites australis	11	10	0.53
Pistacia lentiscus	1	1	0.01

Plantago maritima	1	1	0.02
Polypogon maritimus	0	0	0.00
Pulicaria dysenterica ssp. uliginosa	8	7	2.46
Ranunculus sp.	2	2	0.01
Rubus sancta	1	1	0.00
Samolus valerandi	1	1	0.09
Scariola viminea	3	3	1.34
Schoenoplectus littoralis	25	22	4.08
Schoenus nigricans	1	1	0.00
Smilax aspera	2	2	0.13
Solanum nigrum	1	1	0.00
Sonchus oleraceus	1	1	0.00
Tamarix smyrnensis	3	3	0.09
Teucrium scordium spp. scordioides	0	0	0.00
Torilis arvensis	0	0	0.00
Torilis sp.	0	0	0.00
Typha domingensis	0	0	0.00