Conserving wild plants and habitats for people in the South and East Mediterranean. (IPA-Med)

Conservation Suggestions & Action Plans: Egypt 2015-2016

St. Katherine IPA
Elomayed IPA

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Reference: Field data collection for plant species in Egypt. IPAS MED project

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Fieldwork 2015
Target PAs reports

St. Katherine IPA

Threat Assessment:

St. Katherine Important Plant Area (SKIPA) is one of very few protected areas in Egypt that have local communities working and living inside its boundaries. These interactions sometimes cause conflicts and threats on the natural resources of the IPA.

It was observed that donkey's distribution is affected by vegetation cover (donkeys use to concentrate on areas with high vegetation cover) which actually is affected by good water supply. Donkey's distribution showed a negative relation with Bedouin community distribution (donkeys use to distribute away from human presence). It was recorded that hotspots areas for target species that are located within elevations, range from 1800 m to 2000 m, such as Abu Tweita, Wadi Gebal, Farsh Elromana and Farsh Emsila showed the highest presence for feral donkeys. Grazing by donkeys usually causes uprooting of the plants as indicated by Bedouins and field observations and this prevents plant regrowth. Soil compaction is associated with the presence of these animals and causes destruction to a variety of plant species through continuous trampling (Khafaja et al., 2006, Omar *et al.* 2013). *Salvia multicaulis, Polygala sinaica, Bufonia multiceps, Anarrhinum pubescens,* and *Rosa arabica* are the species most negatively affected by this threat. Notwithstanding, all these effects, much more research is needed on these feral donkeys especially regarding their distribution dynamics in the hotspots and the direct and indirect effect on plant species distribution.

Sites like Abo Hebik, Elgalt Elazrak, Abu Tweita, Sherige, Shak Musa, Elmesirdi and W. Eltalaa are the most targeted for plant collection by Bedouin. These sites are characterized by water supply and high plant biomass; however, plant collection increases with precipitation and is usually heavily between March and December each year (flowering season). It was observed that plants collection may be affected by economic factors. In other words, when tourism levels fall, Bedouin themselves start to collect plants for income. Local communities mentioned that women are the most common collectors of plants, and they collect 5 times per season. Although the reasons for collecting these plants are always for trade or personal use as fuel, the use of plants as fuel has decreased sharply with the advent of butagaz (Assi, 2007, Omar *et al*. 2013). Results showed that *Origanum syriacum,* and *Salvia multicaulis* are the most collected species for trade within the study area because of their medicinal value (Assi, 2007). *Rosa arabica* is also collected by local community for medicinal use but not for trade.

Gabal Musa, Gabal Katherine, Wadi Gebal, Farsh Elromana, Elgalt Elazrak, Abu Tweita, Wadi Tenia, W. Sherige and W. Eltalaa are the sites that present the highest tourism activity. About 3 million visitors from 51 nationalities have visited St. Katherine Protectorate (SKP) from 2003 to 2011. This means 335.000 people per year (SKP Management). Most of them are focused on the northern part of SKP, especially in World Heritage site.

Many of the tourists do safari and camping in remote areas. Usually, safaris extend for many days using different camping points. Farsh Elromana, W. Tenia and W. Gebal are the sites with the most number of camping points.

Tourism is another threat to these plants as some of the negative impacts come from tourists collecting these plants as a souvenir. These plants also collected for for fuel in tourism activities. Also soil compaction of trespassing comes from continuous walking and leads to poor vegetation cover. Furthermore, camping take place in shelter sites which give water source to tourists and this led to water consuming and direct effect on vegetation community. Although the impact for these activities is considered low, much more research is needed in this field.

Regarding to grazing activities inside SKIPA Omar *et al.* (2013) found that Elmesirdi, Sheiage, Elgabal Elahmar and Shak Musa are the sites with the highest presence for goats. This can be explained by their proximity to local communities' settlements.

Elawitein, W. Gebal, W. Tenia, Abu Tweita and Farsh Elromana are the sites with the highest presence for camels which can be explained by their good accessibility and their intense used by tourists. Tourists use camels as a way of transport between camping points.

Results showed that Tebook, Abo Twita, Ain Shekia, Shak Sakr and Elmesirdy represent the highest number of grazed individuals among the different locations, because these locations are stressed by tourism and human activity which are combined by the presence of camels and donkeys as transportation tools to and from historical sites.

Bedouin communities are also settled beside these locations and this gives goats high presence in these locations. *Bufonia multiceps, Anarrhinum pubescens, Polygala sinaica, Salvia multicaulis, Hypericum sinaicum* and *Rosa arabica* are the target species most negatively affected by grazing.

Table 3: Threats on *Target species* based on IUCN Threats Classification Scheme

Code	Threat	Timing	Scope	Severity	Impact Score
2.3.1.	Agriculture & aquaculture -> Livestock farming & ranching -> Nomadic grazing	Ongoing	Majority (50-90%)	Slow, Significant Declines	Medium Impact: 6
5.2.1.	Biological resource use -> Gathering terrestrial plants -> Intentional use (species is the target)	Ongoing	Minority (<50%)	Slow, Significant Declines	Low Impact: 5
6.1.	Human intrusions & disturbance -> Recreational activities	Ongoing	Minority (<50%)	Causing/Could cause fluctuations	Low Impact: 5
6.3.	Human intrusions & disturbance -> Work & other activities	Ongoing	Minority (<50%)	Slow, Significant Declines	Low Impact: 5
7.2.5.	Natural system modifications -> Dams & water management/use -> Abstraction of ground water (domestic use)	Ongoing	Minority (<50%)	Slow, Significant Declines	Low Impact: 5
8.1.2.	Invasive and other problematic species, genes & diseases -> Invasive non-native/alien species/diseases -> Equus asinus	Ongoing	Majority (50-90%)	Slow, Significant Declines	Medium Impact: 6
11.2.	Climate change & severe weather -> Droughts	Ongoing	Whole (>90%)	Very Rapid Declines	High Impact: 9
11.3.	Climate change & severe weather -> Temperature extremes	Ongoing	Whole (>90%)	Very Rapid Declines	High Impact: 9
11.4.	Climate change & severe weather -> Storms & flooding	Ongoing	Whole (>90%)	Very Rapid Declines	High Impact: 9

Very few sites were affected by scientific/research collections (Herbarium, phytochemistry and genetics). The collection of specimens for herbarium affects because the collectors sometimes collect a big amount of plants with flowering parts and roots which may lead to decrease of future population. Also collection for phytochemistry affects as more than one kilo is required for good extraction.

Results showed that the most affected sites were Kahf Elghola, Wadi Alarbein, Wadi Tennia, Abu Tweita, Elmesirdi, Abu Kasaba, Shak Musa, Shak Elgragenia, and Elgalt Elazrak. *Salvia multicaulis, Hypericum sinaicum, Rosa arabica, Bufonia multiceps, Anarrhinum pubescens, Polygala sinaica, Origanum syriacum,* and *Nepeta septemcrenata* are the target species most affected for this activities.

Due to climate change, the wild population of these species could be in extreme danger in a relatively near future. The most important natural threats are the long-lasting droughts and the difficulties of some species to reproduce as a result of long seed dormancy (*Rosa arabica*), or as a result of the herbivores overgrazing. Herbivores eat the reproductive organs and decrease the chance of creating new generations (this has been observed in *Bufonia multiceps, Anarrhinum pubescens, and Polygala sinaica*).

Other important natural threats are the very scarce irregular precipitation during the year, the fragmentation inherent to its habitat, and the possibility that rare floods may cause harm such as uprooting (1-5% loss observed).

Water is being relocated in some localities from elevated wadis which are rich in water to supply to low wadis. This activity leads to consumption of water from wells and results in habitat deterioration and declines in plant population size. This has been observed clearly in Wadi Gebal, Farsh Elromana, Wady Tenia and Abu Tweita. *Hypericum sinaicum* is the target species most negatively affected by water lose. There is an urgent need to focus and to study the direct and indirect effects of dams and water management/use inside SKIPA.

Most of threats come from the lack of awareness, weak law enforcement, the lack of suitable strategies, a weak financial support and the lack of stakeholder's cooperation. Since human activities have a strong effect on biodiversity, a population/community level approach is considered to be the level that can help in exploring the responses of the whole ecological system to various kinds of disturbance as reported by Hanski and Gilpin, (1991) and Barbault and Hochberg, (1992).

In general, these species are severely threatened by both natural (aridity of the area and climate change-flooding) and human factors (over-grazing by domestic animals and feral donkeys, over-collection, and unmanaged tourism activities). All these factors are pushing target species to the brink of extinction.

Endemics plant species like *Rosa arabica, Anarrhinum pubescens,* and *Bufonia multiceps* are the most negatively affected species by these threats.

Conservation actions and Specific recommendations:

The entire world distribution of the endemic target species is inside the St. Katherine IPA (SKIPA). While the situation of the near endemics is partly unknown (partly protected at national scale for *Origanum* and totally protected by SKP in case of other targets) the situation about the conservation status of these species outside Egypt is inadequate.

Parts of some subpopulations are already protected by fenced enclosures, and regular monitoring by SKP rangers takes place every two years to detect the effect of this protection on population trends (Shabana *et al.* 2011). On average 20 checks are made every year to keep a watch on the current situation for the plant and its habitat, and to record any detrimental activities.

Undertaken by the United Nations Development Program (UNDP), the Global Environment Facility (GEF) and the Egyptian Environmental Affairs Agency (EEAA), the Medicinal Plants Conservation Project (MPCP) has tried to conserve some important species, target species were among of them. Conservation was promoted trough using cultivation inside greenhouses, rehabilitation, as well as collecting and storing their seeds for future use.

The MPCP was launched in January 2003 and ended in 2013. It was a national project that aims at examining and eliminating the root causes to the loss in biodiversity and addressing the

threats to the conservation and sustainable use of medicinal plants in Egypt through a number of interventions. At the same time the project aims at empowering the Bedouin community to use and manage its resources in a sustainable manner.

It aims at conserving the medicinal plant species within the ecosystem (*in situ*) through the development of sustainable management practices, including the protection of hotspots and individual plants or populations wherever it is not possible to use the resources sustainably.

Ex situ conservation measures will be applied when the threat to a species is considered severe and warrant such measures (MPCP Egypt, 2010).

Great work has been done in this scope but unfortunately, there is no continuity for such activities after the end of this project. There is an absence of clear future plan for managing such activities as well as the financial abilities become unstable for step forward.

Table 4: Conservation Actions In-Place for target species inside the St. Katherine IPA

Conservation	**In situ**				**Ex situ**	
Species	PA	Enclosures	Responses	Recovery	seed bank	gen bank
Buf.	yes - 100%	14	Positive	Inactivate	Inactivate	Inactivate
Euph.	yes - 100%	0	0	Inactivate	Inactivate	Inactivate
Phlo.	yes - 100%	30	Partly Negative	Inactivate	Inactivate	Inactivate
Rosa	yes - 100%	5	Positive	Inactivate	Inactivate	Inactivate
Anarh.	yes - 100%	7	Negative (long time conservation, Positive (inside vs outside)	Inactivate	Inactivate	Inactivate
Hype.	Yes - National	5	Negative (long time conservation, Positive (inside vs outside)	Inactivate	Inactivate	Inactivate
Nep.	Yes - National	19	Positive	Inactivate	Inactivate	Inactivate
Poly.	Yes - National	5	Partly Negative	Inactivate	Inactivate	Inactivate
Salvia	Yes - National	3	Negative (long time conservation, Positive (inside vs outside)	Inactivate	Inactivate	Inactivate
Org.	Yes - Local	11	Negative (long time conservation, Positive (inside vs outside)	Inactivate	Inactivate	Inactivate

However all these activities and efforts the situation of the target species is threatened. This may come from the weak financial support to PA management, insufficient staff numbers to do the main role of monitoring and conservation efficiently in the large protected area (4350 km^2), and the weak linkage between PA Management and higher decision makers in Egyptian Environmental Affairs Agency (EEAA). Several legislation was set to protect natural resources and regulate its uses such as Law 102/1983. Ministerial Decree 1067/1983, Prime Ministerial Decree 264/1994, Law 4/1994, Prime Ministerial Decree 613/1986. Law 2/1973. Law 117/1983. Ministerial Decree 66/1983, Presidential Decree 374/1991, Ministerial Decree 1611/1989 (Ministry of Justice), Ministerial Decree 1353/1996, etc. Despite all these laws and regulations,

the species are still in extreme danger. One of the most important threats that may lead to extinction is collecting. There is urgent need to held specific Critically Endangered species conservation convention, influencing legislations appropriations and to harsher punishment for endangered plant species assembly without a clear permission from the main authorities (Table 5).

Table 5. Important Conservation Actions Needed for *Target species* conservation.

Action Needed	Status
1 Land/water protection	
1.1 Site/area protection	Done
1.2 Resource & habitat protection	Need active enforcement
2 Land/water management	
2.1 Site/area management	Maintenance of habitat, maintenance of enclosures, area hands off, training staff
2.2 Invasive/problematic species control	Not applicable
2.3 Habitat & natural process restoration	Habitat restoration, water rights, to reduce of stop species collecting.
3 Species management	
3.1 Species management	
3.1.1 Harvest management	Highly needed - *Salvia, Origanum*
3.1.2 Trade management	Highly needed – *Salvia, Origanum*
3.1.3 Limiting population growth	Not applicable
3.2 Species recovery	
3.3 Species re-introduction	Highly needed
3.3.1 Reintroduction	Highly needed
3.3.2 Benign introduction	Highly needed
3.4 Ex-situ conservation	Highly needed
3.4.1 Captive breeding/artificial propagation	Seed collection, artificial propagation from seeds, botanical garden, seed storage, tissue culture, Cultivation
3.4.2 Genome resource bank	Seed bank, freezing cuts from the plant, or stocking the seeds, Tissue bank, Cryobank, Pollen bank, Field gene bank
4 Education & awareness	
4.1 Formal education	Universities, Scientific Research Centers, School student
4.2 Training	Enhance knowledge about conservation importance to species for staff and stakeholders.
4.3 Awareness & communications	Media, web blogs, journal articles
5 Law & policy	
5.1 Legislation	
5.1.1 International level	Endangered species conservation convention
5.1.2 National level	Influencing legislations appropriations
5.1.3 Sub-national level	Harsher punishment for endangered plant species assembly without clear permission from the main authorities

Based on the information extracted from this study about the conservation status of some endemic and near endemic species we can conclude and recommend the following actions:

- There is an urgent need to integrate the knowledge derived from ecological, demographic and geographical approaches extracted from this study to species conservation in order to be able to formulate management strategies that will take into account all different considerations.
- *Rosa arabica,* and *Salvia multicaulis* will have the first priority when species recovery will take place through rehabilitation, restoration, reintroduction, and benign introduction in areas that have similar environmental conditions (these conditions could be extracted from this study).
- There is an urgent need to conserve the target species outside its habitat (*ex situ*) though seed collection, artificial propagation from seeds, botanical garden, seed storage, tissue culture, cultivation, freezing cuts from the plant, or stocking the seeds. *Ex situ* conservation could be implemented with the collaboration of Seed bank, Tissue bank, Cryobank, Pollen bank, and Field gene bank by planting plants for the conservation of genes.
- There is an urgent need to work in two directions to ensure the conservation of these species:

1) *Ex-situ* conservation through a seed bank, genome resource bank, and artificial propagation,

2) *In-situ* conservation through rehabilitation and restoration and fenced enclosures. It is important to carry out a wide range of educational and awareness activities in universities and scientific research centers about the sensitivity of these important threatened species.

- There is an urgent need to carry out annual monitoring on species population and habitat trends and fluctuations.
- Further scientific studies are needed to achieve the maximum accuracy for the best conservation practices for the target species (Table 6); this include population and habitat trend, direct and indirect effect of threats, threat management, species genetics, increasing productivity of medicinal plants, etc.

Table 6: Important Research needed for *target species*

Code	Research Needed	Specification
1.2.	Research	Population size, distribution & trends
1.5.	Research	Threats
2.1.	Conservation Planning	Species Action/Recovery Plan
2.2.	Conservation Planning	Area-based Management Plan
3.1.	Monitoring	Population trends
3.4.	Monitoring	Habitat trends

- SKIPA need to ensure sufficient financial resources, to increase the efficiency of the management to equal global levels and to provide permanent tributaries of funding to modernize the scientific methods of protection systems. Without such funding and without qualified trained staff all this study will be ink on paper.
- It is recommended to use this study and specially these species as a base line to detect the effect of global warming on species distribution by annual monitoring.

Changes in the shapes of IPA boundaries

- The current IPAs Profile of Egypt presents in good way the highest Important Plant Areas in Egypt.
- The only IPA that should change the shape of its boundaries is St. Katherine IPA. The old one covers all mountain areas including areas outside St. Katherine area (Toor, Ras Mohammed, and Sharm Elshike) and ignores important areas like those areas close to Tabe PA and Dahab City).
- The new boundary is the original one for St. Katherine Protectorate.

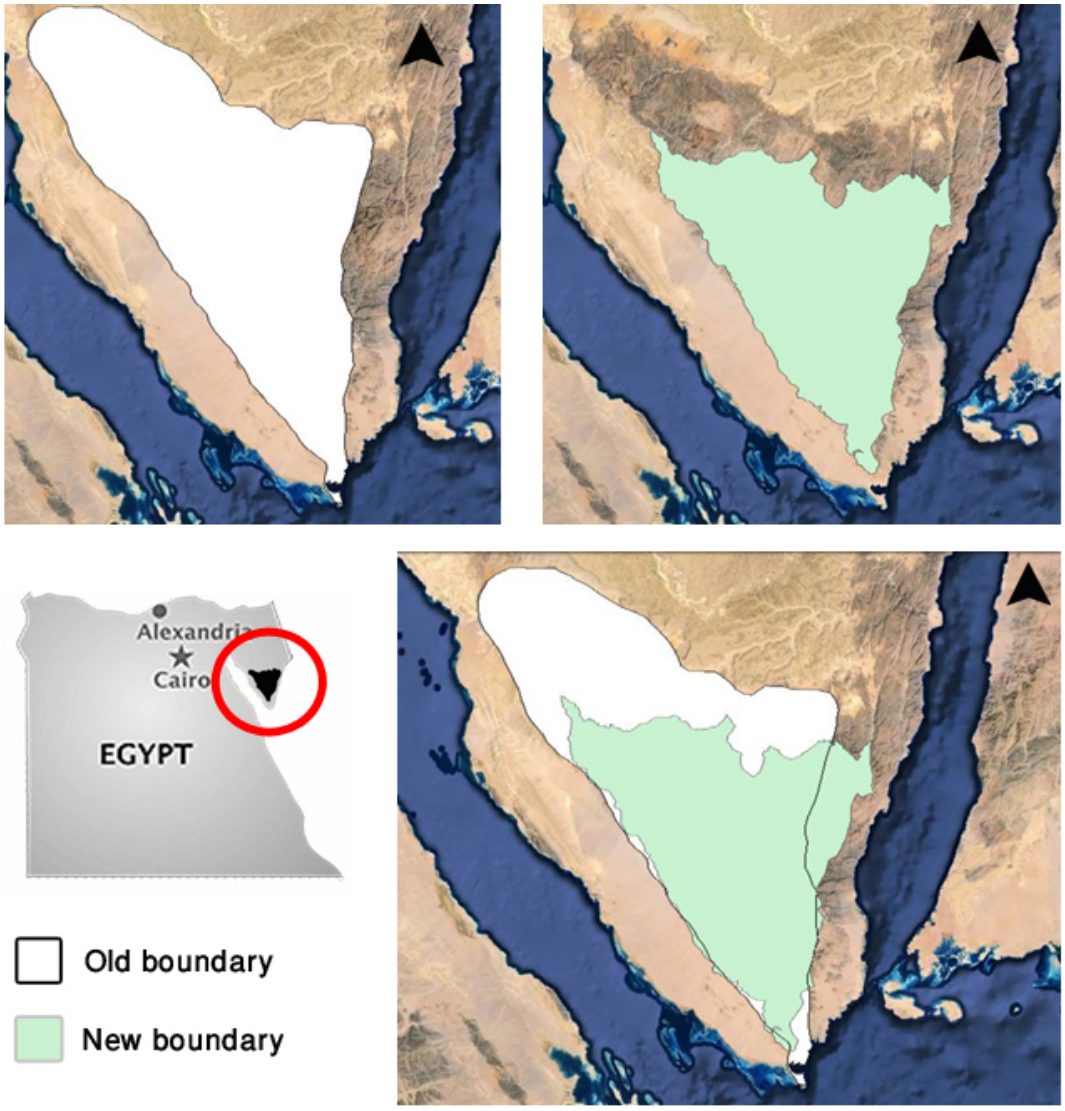


Figure 1: Changes in the shapes of St. Katherine IPA boundarys

Elomayed IPA

Elomayed Important Plant Area (EIPA) is one from 30 protected areas in Egypt, This IPA it face many conservation challenges regarding to conflicts between conservation and high demand of community needs.

Results found that the most frequently species to the coastal calcareous dunes are *Artemisia monosperma* Delile, *Cressa cretica* L, *Pancratium maritimum* L., *Thymelaea hirsuta* (L.) Endl., *Ammophila arenaria*(L.) Link., *Zygophyllum album* L. f., *Euphorbia paralias* L., *Crucianella maritima* L., *Plantago albicans* L., *Elymus farctus* (Viv.) *Runemark ex Melderis*, *Ononis vaginalis* Vahl., *Noaea mucronota* (Forssk.) Asch. & Schweinf. These results mostly agree with Kassas, *et al.* (2002).

The target species *Helianthemum sphaerocephalum* and *Zygophyllum aegyptium* are near endemic; Kassas *et al.* (2002) noted that the former is disappearing rapidly outside Elomayed IPA under the impact of habitat destruction caused by the extensive building of summer resorts so that it is considered to be on the brink of extinction. Actually the two species were not recorded in 2015 survey, costal sand dunes is the preferable habitat for *Helianthemum sphaerocephalum.* This habitat mostly found as destructed areas resulted from extensive building activities for recreation sites. This may answer the question why we didn't find this species?

A great work have done under "Roselt Project /IRD (1999-2008)" from year 1999 to 2008 to determine the changes in vegetation composition in 16 fixed transect. In our work we have extracted the distribution of some recorded species within the study and have determined the ecology and density of these species from field observation and review of previous studies.

Globularia arabica Jaub. & Spach, *Gymnocarpos decandrus* Forssk., *Helianthemum lippii* (L.) Dum. Cours., *Thymelaea hirsuta* (L.) Endl., and *Noaea mucronota* (Forssk.) Asch. & Schweinf. were chosen and data about their distribution and density were extracted from both fieldwork 2015 and El-Omayed Roselt Project /IRD (1999-2008).

- ***Globularia arabica* Jaub. & Spach**

This species was recorded 3 times only, in altitudinal range 20 to 80 m. The number of individuals range from 25 to 30. *Centaurea calcitrapa*, *Plantago albican*s, *Scorzonera undulata*, *Echinops spinosissimus*, *Noaea mucronata*, and *Gymnocarpos decandrus* are the most associated with this species.

- ***Gymnocarpos decandrus* Forsk.**

This species was recorded 9 times only in altitudinal range 15 to 95 m. The number of individuals range from 20 to 100. *Anabasis articulata*, *Asphodelus ramosus*, *Deverra turtuosa*, *Artemisia monosperma*, *Echiochilon fruticosum*, *Carduncellus eriocephalus*, *Plantago albicans*,

Scorzonera undulata, *Echinops spinosissimus*, *Helianthemum lippii*, and *Noaea mucronata* are the most associated with this species.

- ***Helianthemum lippii* (L.) Dum. -Courset**

This species was recorded 10 times only in altitudinal range 10 to 85 m. The number of individuals range from 15 to 60. *Centuarea calcitrapa, Erodium hirtum, Lotus creticus, Plantago albicans, Deverra turtuosa, Anabasis articulata, Asphodelus ramosus, Gymnocarpus decander, Artemisia monosperma, Echiochilon fruticosum, Carduncellus eriocephalus, Scorzonera undulata,* and *Noaea mucronata* are the most associated with this species..

- ***Thymelaea hirsuta* (L.) Endl.**

This species was recorded 14 times only in altitudinal range 10 to 105 m. The number of individuals range from 6 to 40. *Anabasis articulata, Asphodelus ramosus, Gymnocarpus decander, Atractylis carduus, Plantago albicans, Scorzonera undulata, Echinops spinosissimus, Deverra turtuosa, Helianthemum lippii,* and *Noaea mucronata* are the most associated with this species.

- ***Noaea mucronata* (Forssk.) Asch. & Schweinf.**

This species was recorded 17 times only in altitudinal range 4 to 125 m. The number of individuals range from 20 to 125. *Plantago albicans, Deverra turtuosa, Helianthemum lippii, Anabasis articulata, Asphodelus ramosus, Gymnocarpus decander, Atractylis carduus, Artemisia monosperma, Echiochilon fruticosum, Carduncellus eriocephalus,* and *Centaurea calcitrapa* are the most associated with this species.

Threat Assessment:

Simple threat analysis were done to extract the main threats and pressures in Elomayed IPA based on management staff experiences, field observations, and simple aerial photograph comparison (Google earth 2004-2015). Results found that Agriculture expansion and Tourism & recreation areas, and Human intrusions & disturbance are the most destructive threats to the biodiversity of Elomayed IPA (Table 7). The coastal area is mostly fulfilled by recreation resorts. Resulting from the presence of water irrigation canal divide the IPA into 2 pieces, the agriculture areas and its pollution regarding to waste water and chemicals rapidly increase with destruction effect on the plant communities and biodiversity health.

As a species with an ever-growing population, humans have had to invent new ways to keep themselves nourished. Throughout recorded history, the feeding process has involved using fertilizer to increase seasonal crop output. Since the development of the Haber-Bosch process, chemically produced fertilizers have come into widespread use. Nitrogen and phosphate fertilizers, for instance horse manure, bat guano, or artificially produced ammonium nitrate, have allowed for huge improvements in the productivity of world agriculture. The increased use of fertilizers to expand food supplies have come at a large cost to our environment (Litterman *et al.,* 2004).

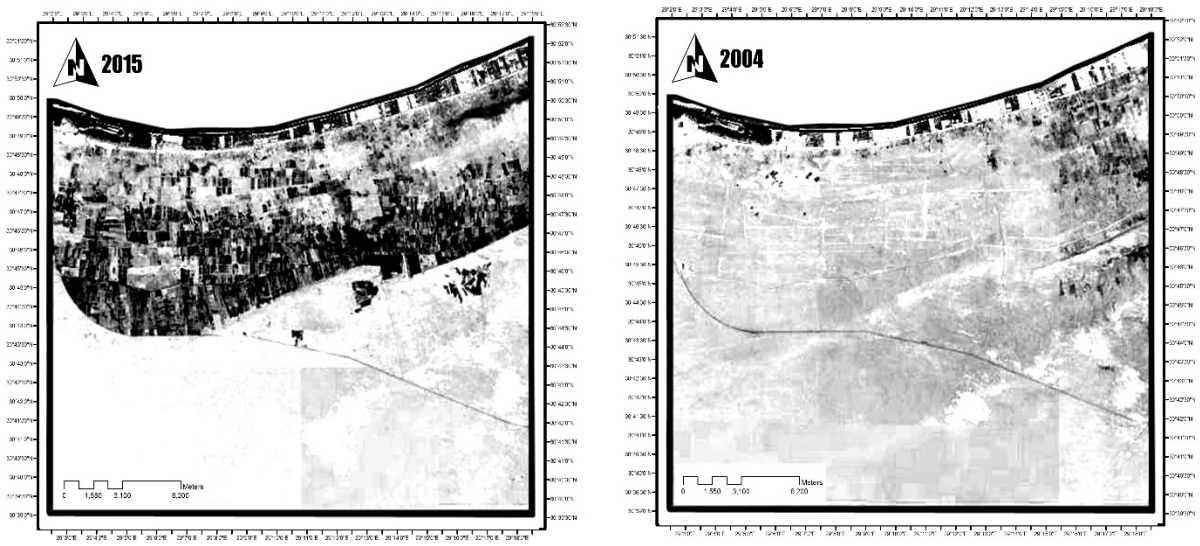
Table 7. Threats on plant communities inside Elomayed IPA

Threat	Timing	Scope	Severity	Impact Score	Urgency
Agriculture & aquaculture -> Livestock farming & ranching -> Nomadic grazing	Ongoing	Majority (50-90%)	Slow, Significant Declines	Medium Impact: 6	Medium: 6
Human intrusions & disturbance -> Recreational activities	Ongoing	Minority (<50%)	Very Rapid Declines	High Impact: 11	High: 11
Human intrusions & disturbance -> Work & other activities	Ongoing	Minority (<50%)	Slow, Significant Declines	Low Impact: 5	Low: 5
Invasive and other problematic species, genes & diseases -> Invasive non-native/alien species/diseases	Ongoing	Majority (50-90%)	Slow, Significant Declines	Medium Impact: 6	Medium: 6
Climate change & severe weather -> Droughts	Ongoing	Whole (>90%)	Very Rapid Declines	High Impact: 9	High: 9
Housing & urban areas	Ongoing	Minority (<50%)	Very Rapid Declines	High Impact: 10	High: 10
Tourism & recreation areas	Ongoing	Minority (<50%)	Very Rapid Declines	High Impact: 11	High: 11
Roads & railroads	Ongoing	Minority (<50%)	Slow, Significant Declines	Medium Impact: 6	Medium: 6
Domestic & urban waste water	Ongoing	Minority (<50%)	Slow, Significant Declines	Medium Impact: 6	Medium: 6
Agricultural & forestry effluents	Ongoing	Majority (50-90%)	Very Rapid Declines	High Impact: 11	High: 11
Agriculture Expansion	Ongoing	Majority (50-90%)	Very Rapid Declines	High Impact: 12	High: 12

Results of the analysis of aerial photos extracted from Image 2015 Digital Global (Google earth) showed great rapid changes between years 2004 to 2015 in the field of Agriculture expansion. The photos showed that the presence of water canal (comes from the river Nile) inside the Elomayed IPA increase the rapidity for transforming lands to agriculture lands (Map 1). It is clear that agriculture causes harmful levels of pathogens and chemicals in our water and increases levels of greenhouse gases in the air as a result of agriculture.

There are wild native species populations surrounded by an actively farmed landscape. These lanscapes will progressively lose their more distinctive species[1]. Adaptive management of the surrounding land with a view to achieving a measure of biodiversity conservation in the context of agricultural production can increase the biodiversity value of these relict areas and the landscape as a whole. The biodiversity conservation goals for an agricultural landscape can be met by protecting and establishing local biodiversity in an integrated pattern within and across farms. Non-farmed areas can be utilised to provide patches of certain types of habitat, or to form corridors that link protected areas and enable species to maintain genetic interaction between populations that otherwise would be isolated. This involves protecting remnant native vegetation and/or re-establishing wild species.

[1] ICEM, 2003.

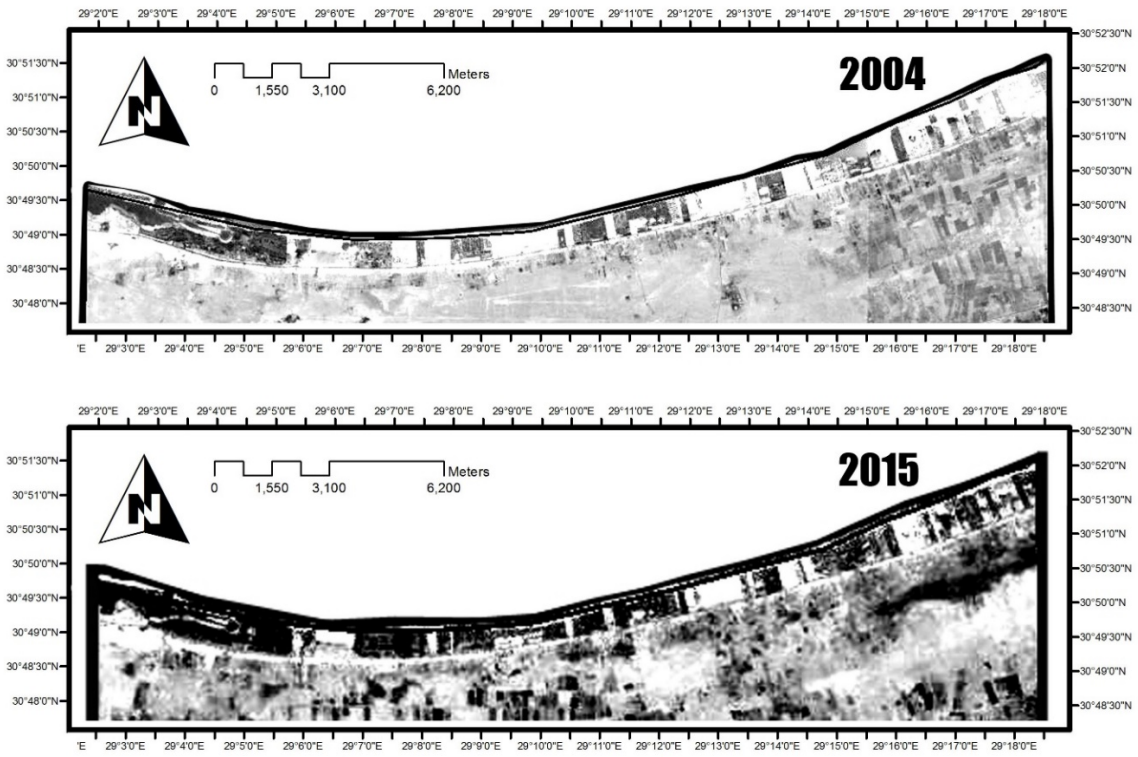


Map 1. Dramatically changes in land use (Agriculture expansion) between 2004 and 2015.

Results also found a great deterioration in the coastal areas of Elomayed IPA as a result from massive construction of recreation sites for tourism. Aerial photos show rapid changes in the costal line between 2004 and 2015 (Map 2).

Recreation and tourism in natural areas, including protected areas, is increasing worldwide (Newsome, Moore & Dowling 2002a; Worboys *et al.* 2005). The most important visitor impacts are those that: (1) affect a large area; (2) are intense; (3) are long lasting; (4) affect areas that are irreplaceable (in terms of ecosystem function); and/or (5) affect species/communities that are rare or threatened (Cole & Landres 1996). There are almost always negative impacts on natural vegetation and other components of the environment from tourism and recreation (Sun & Walsh 1998; Leung & Marion 2000; Buckley 2004a; Turton 2005). The scientific study of visitor impacts on the environment has been termed 'recreation ecology'.

Tourism infrastructures within protected areas are often tracks, trails, roads, lookouts, fixed campsites, car parks and sometimes visitor centres and accommodation. Although the total area allocated to infrastructure may be relatively small compared to the total area of the protected area (about 10% of the total size of Omayed Protected Area), the impacts at that site are severe and often permanent (Smith & Newsome 2002; Pickering & Buckley 2003; Turton 2005). The most obvious and direct impact is vegetation clearance. However, damage is not restricted to the initial removal of native vegetation. There are usually indirect effects in adjacent natural vegetation (e.g. Sun & Walsh 1998).



Map 2. Dramatically changes in land use (Recreation tourism resorts) between 2004 and 2015.

A common problem is that increasing visitor use can result in incremental hardening of sites with a gradual change from a natural to an urbanised environment (Donaldson & Bennett 2004; Worboys *et al.* 2005). In addition, there may be displacement of park users and/or changes in the expectations of tourists, with those participating in mass tourism often requiring more sophisticated facilities, than those engaging in nature or adventure tourism (Worboys *et al.* 2005).

It was observed that Elomayed IPA contain railway as well as roads, it was found that the construction and use of roads and tracks can result in changes to hydrology and soils in adjacent areas including sedimentation and pollutant runoff (Spellerberg 1998; Newsome *et al.* 2002a; Turton 2005). Recent studies on this field have illustrated how road and tracks can act as corridors for the introduction and spread of weeds and pathogens and also contribute to an exponential loss of native vegetation through loss of natural ecosystem function from pollutants, sedimentation, etc. (Johnston & Johnston 2004; Pauchard & Alaback 2004; Worboys & Gadek 2004; Turton 2005). With linear disturbances such as tracks and roads, the total area of disturbance may appear small, but due to the length of the roads and verge effects, the actual footprint can be much larger (Donaldson & Bennett 2004; Johnston & Johnston 2004; Turton 2005).

With total agreement with Pickering and Catherine (2007) it is possible to identify management options to solve reduce these threats as follow:

- Regulation/restriction of activities in some sensitive areas. Examples: limiting the use of areas characterized by vegetation with low resistance and resilience, and limiting the use of open fires.
- Research: Continued research by park agencies and others into ways to minimize impacts of visitor use.
- Monitoring: Effective monitoring of visitor use, evaluation and reporting of effectiveness of visitor management
- Comprehensive study should be done on the whole IPA to determine the hotspots for biodiversity and to determine the core areas for conservation after these threats.
- In some high use areas it might be appropriate to introduce/upgrade tourism infrastructure to minimize damage to vegetation. However, the type of infrastructure should be selected to minimize direct damage to vegetation during construction and use, and to limit the spread of environmental weeds. Issues of 'impact creep' will also need to be considered.
- Continuing and increased emphasis on educating visitors to minimize impacts. Examples: encouraging visitors to avoid sensitive vegetation types when walking off track; encouraging use of hygiene procedures for walkers and park staff to prevent the spread of pathogens.

Conservation actions and Specific recommendations:

- Basic and advanced training should be done for the young researchers about survey and monitoring methodology and conservation practices.
- Regarding to threats, a comprehensive study must be done on the whole IPA area, to determine the direct and indirect effects of these threats on the biodiversity. This study must be based on fieldwork analysis.
- Based on the current legislation and administration situation the extracted threats should classified to several ranks based on area and urgency and actions must be done rabidly to stop the massive deterioration in species and habitat quality as possible.
- The current conservation status of plant communities in the coastal area are critically endangered resulting from an extensive building activities for recreation resorts on the shore line, based on the current situation some coastal areas must remain naturally to keep native plants which mostly have an economic value. These conserved areas will help these plant communities to have a minimum chance to reproduce through corridors.
- Without declaring specific areas in the available coastal sand dunes as prohibited areas for any human activities as soon as possible, the biodiversity in this habitat will become extinct in this area.

Suggestions to improve the IPA profile

From my work in two of the most important IPAs in Egypt I found that it's very important to:

Providing capacity building & support

- One of the most important areas for ensuring the sustainability of the IPAs is people. Supporting researchers, rangers, mangers, decision makers and local communities whose working and live in IPAs through training workshops, raising awareness and educational activities will support the aim of the IPAs.
- Finding a legal framework for IPAs inside governmental body will support its sustainability and strengthen its presence.

Assisting with financial sustainability

- Communicate with government agencies like protected areas to fill the gaps in conservation practices, through unifying the activities in the overlap areas.

Bringing benefits to people

To help ensure these benefits, we are working to:

- Provide support to governments and local communities for identifying the most suitable and critical places for establishing "hotspot areas for plant biodiversity protection".
- Support the community's participation in IPA conservation.
- Help developing alternative sources of income and livelihoods around IPAs through promoting tourism opportunities and market incentives.

Monitoring

- It's vital to carry out comprehensive surveys on the declared IPAs to detect and determine the "hotspot areas for plant biodiversity".
- Mapping and zoning the priority areas for conservation.
- Annual monitoring should be done every equal time to detect the changes and trends of plants population and habitat conservation status regarding to different threats.

Awareness and Media

- Awareness about IPAs importance should be done in wider scale in Egypt and around. These activities should actively involve governmental and non-governmental bodies. Media should work more on this aim.

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This publication has been produced with the financial assistance of “MAVA Fondation pour la nature”.
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