
Flora of Wadi Al-Quff Protected Area, Hebron Governorate, Palestine

Banan Al Sheikh^a and Mohamed Mahassneh^b

^a National Agricultural Research Council, Jenin, Palestine and Palestine Museum of Natural History, Bethlehem University, Bethlehem, Palestine
banansh@yahoo.com

^b Environmental Quality Authority, Ramallah, Palestine

ABSTRACT

We present data based on a preliminary survey of the flora of the Wadi Al-Quff Protected Area (WAQPA), Hebron Governorate in the Occupied Palestinian Territories (OPT). A total of 231 identified species plus ferns were reported through quadrates 20x20m for trees and shrubs and 1x1m for herbaceous plants. Dominant trees and shrubs include *Pinus halapensis*, *Rhamnus palaestina*, *Quercus calliprinos*, *Sarcopotrimum spinosum*, and *Cistus creticus*. *Crataegus aronia*, *Origanum syriacum*, *Pistacia lentiscus*, and *Styrax officinalis* are less common in the reserve and need special attention. Twenty three species are rare at OPT level but were found at WAQPA and thus require protection.

Key words: Wadi Al-Quff, Hebron, Protected areas, flora.

INTRODUCTION

Palestine enjoys a rich flora in spite of its small area due to its geographical position as a meeting point between Asia and Africa, where three phytogeographical regions intersect: Mediterranean, Irano-Turanian and Saharo-Arabian. There have been some studies of the flora of our region (Post, 1933; Zohary, 1966, 1972; Feinburn-Dothan, 1978; Zohary & Feinbrun-Dothan, 1986; Danin, 1992; Fragman *et al.*, 1999; Al-Shaikh *et al.*, 2000). An estimate of 2655 plant species occur in historic Palestine, while 1591 species were recorded from the West Bank (Al Sheikh *et al.*, 2000). More recently 21 additional species were added to the flora of the West Bank (Al-Shaikh, personal communication).

As part of biodiversity assessment and drawing management plans for the first Palestinian administered protected area, we performed a study of the flora of Wadi Al-Quff, Protected Area (WAQPA) the first Palestinian protected area to receive detailed study and a management plan (EQA, 2014). This protected area was afforested in stages that started in 1927 during the British mandate with planting nearly 100 hectares mainly by *Pinus halapensis*. 150 hectares were planted starting in 1962 during the Jordanian rule. This was followed by 90 hectares in 1970, and two hectares in 2010

(mainly in Tarqoumia Park). *Pinus halapensis*, *Cupressus sempervirens*, *Pistacia* sp. and few other local trees now constitute the main canopy elements. This study aimed to survey the existing flora of WAQPA and comment briefly on threats and opportunities for saving this fragile ecosystem.

METHODS

WAQPA is located in the southern part of the central mountainous ridge in Palestine. It has a Mediterranean climate with elevations of 520-820 m asl, transected by valleys sloping west towards the Mediterranean Sea. With 400-600 mm annual rain fall, the area is characterized by degraded maquis wooded areas mixed with planted pine and cypress trees to garrigue vegetation. On-site vegetation survey was carried out through systematic sampling. Quadrates were set-up along a transect covering varied areas of the reserve for systematic sampling. The starting point for the transect placement was selected randomly. The transect length depends on the distance from mountains tops to the wadi. The first 20x20 meters quadrat was the starting point of the transect then quadrates of 20x20 meters were placed regularly each 50 meters. These larger quadrates were used for large trees and shrubs. 1x1 meter quadrates in the center of the 20x20 meters quadrat were used for the herbaceous plants. The aim of 20x20 meters and 1x1 meter quadrates in many places is to capture the entire range of vegetation along gradients of altitude, slope and slope exposition within the protected area. Recording all plant species and cover percentage for each species was carried out according to Braun-Blanquet scale.

Flora survey was carried out through 60 quadrates (20x20 meters) for trees and shrubs and 60 quadrates (1x1 meter) for grasses in 20 linear transects in different slopes in the targeted area. The coordinates and elevation were recorded at the starting and at the end point of each transect. The 20 transects covered elevations from 550 - 896m above sea level and were chosen to represent as much habitats as possible. The number of quadrates in each transect ranged from 2 to 4 depending on the transect length.

The data analysis produced information including: general habitat structure, dominant species, species composition, plant species richness, existing disturbance. We recorded all plant species in quadrates and some that were out of the quadrates. We recorded obvious existing disturbance such as logging, grazing, and fires.

RESULTS

Total of 231 species were identified plus unidentified ferns. The non-fern species belong to 51 plant families. 54 species are trees and shrubs. 23 species are rare on the country level (Table 1).

Table 1. Floral species list in WAQ. Abundance is at West Bank Level (C = common, F = frequent, R = rare). Growth Form for each species: C = Chemophyte (dwarf shrub), G = geophytes, H = Hemicryptophyte (perennial), S = Shrub, T = tree, V = Vines. Constancy is number of quadrants out of 60 quadrants in which the species occurs. Blank constancy quadrants indicates one observation within the quadrants or one or more observations outside of the selected quadrants.

Speices	Family	Abundance	Growth Form	Constancy
<i>Aegilops peregrina</i>	Gramineae	C	A	
<i>Ajuga chia</i>	Labiatae	C	C	
<i>Alcea acaulis</i>	Malvacea	R	H	
<i>Alcea setosa</i>	Malvacea	C	H	
<i>Allium neopolitanum</i>	Liliaceae	C	G	
<i>Allium stamenium</i>	Liliaceae	C	G	
<i>Allium truncatum</i>	Liliaceae	F	G	
<i>Alopecurus utriculatus</i>	Gramineae	C	A	
<i>Anacamptis pyramidalis</i>	Orchidaceae	F	G	
<i>Anagalis arvensis</i>	Primulaceae	C	A	
<i>Anagyris foetida</i>	Papilionaceae	F	S	
<i>Anarrhinum forskahlII</i>	Scrophulariaceae	C	C	
<i>Anchusa aegyptiaca</i>	Boraginaceae	C	A	
<i>Andrachne telephioides</i>	Euphorbiaceae	C	C	
<i>Andropogon distacyus</i>	Gramineae	C	A	
<i>Anemone coronaria</i>	Rununculaceae	C	G	
<i>Anthemis pseudocotula</i>	Compositae	C	A	
<i>Arbutus andrachne</i>	Ericaceae	C	T	
<i>Arenaria leptoclados</i>	Caryophyllaceae	R	A	
<i>Arisarum vulgare</i>	Araceae	C	G	
<i>Aristolochia maurourum</i>	Aristolochiaceae	R	H	
<i>Arum palaestinum</i>	Araceae	C	G	
<i>Asparagus aphyllus</i>	Liliaceae	C	V	20
<i>Asphodelus aestivus</i>	Liliaceae	C	G	
<i>Astragalus bethlehemiticus</i>	Papilionaceae	C	C	
<i>Astragalus epiglottis</i>	Papilionaceae	F	A	
<i>Astragalus tribuloides</i>	Papilionaceae	C	A	
<i>Atractylis cancellata</i>	Compositae	F	A	
<i>Atractylis comosa</i>	Compositae	C	H	

<i>Avena barbata</i>	Gramineae	C	A	
<i>Avena sterilis</i>	Gramineae	C	A	
<i>Ballota saxatilis</i>	Labiatae	C	C	3
<i>Ballota undulata</i>	Labiatae	C	C	11
<i>Bellevalia flexuosa</i>	Liliaceae	C	G	
<i>Biscutella didyma</i>	Cruciferae	C	A	
<i>Brachypodium distachyon</i>	Gramineae	C	A	
<i>Briza major</i>	Gramineae	C	A	
<i>Briza minor</i>	Gramineae	R	A	
<i>Bromus alopecuroides</i>	Gramineae	C	A	
<i>Bromus madretensis</i>	Gramineae	C	A	
<i>Bromus tectorum</i>	Gramineae	C	A	
<i>Calendula arvensis</i>	Compositae	C	A	
<i>Calycotome villosa</i>	Papilionaceae	C	S	10
<i>Campanula erinus</i>	Campanulaceae	C	A	
<i>Campanula rapunculus</i>	Campanulaceae	C	H	
<i>Capparis spinosa</i>	Capparaceae	C	S	5
<i>Carduus argentatus</i>	Compositae	C	A	
<i>Carlina hispanica</i>	Compositae	C	H	
<i>Carthamus glaucus</i>	Compositae	C	A	
<i>Carthamus tenuis</i>	Compositae	C	A	
<i>Catananche lutea</i>	Compositae	C	A	
<i>Centaurea iberica</i>	Compositae	C	A	
<i>Ceratonija siliqua</i>	Caesalpiniaceae	C	T	2
<i>Ceterach officinarum</i>	Aspleniaceae	C	H	
<i>Chaetosciadium trichospermum</i>	Umbelliferae	C	A	
<i>Cichorium pumilum</i>	Compositae	C	A	
<i>Cistus creticus</i>	Cistaceae	C	C	37
<i>Cistus salvifolius</i>	Cistaceae	C	C	24
<i>Clematis cirrhosa</i>	Rununculaceae	C	V	2
<i>Clypeola jonthlaspi</i>	Cruciferae	C	A	
<i>Conium maculatum</i>	Umbelliferae	F	H	
<i>Convolvulus siculus</i>	Convolvulaceae	C	A	
<i>Coridothymus capitatus</i>	Labiatae	C	C	20
<i>Coronilla scorpioides</i>	Papilionaceae	C	A	
<i>Crataegus aronia</i>	Rosaceae	C	T	8
<i>Crepis hierosolymitana</i>	Compositae	C	A	

<i>Crepis sancta</i>	Compositae	C	A	
<i>Crucianella macrostachya</i>	Rubiaceae	C	A	
<i>Cruciata articulata</i>	Rubiaceae	C	A	
<i>Cupressus arizonica</i>	Cupressaceae	C	T	2
<i>Cupressus macrocarpa</i>	Cupressaceae	C	T	
<i>Cupressus sempervirens</i>	Cupressaceae	C	T	16
<i>Cyclamen persicum</i>	Primulaceae	C	G	
<i>Dactylis glomeratum</i>	Gramineae	C	H	
<i>Datura innoxia</i>	Solanaceae	F	A	
<i>Daucus carrota</i>	Umbelliferae	C	A	
<i>Dianthus strictus</i>	Caryophyllaceae	C	H	
<i>Echium angustifolium</i>	Boraginaceae	C	C	
<i>Ephedra aphylla</i>	Ephedraceae	C	S	6
<i>Erodium acaulis</i>	Geraniaceae	C	A	
<i>Erodium malacoides</i>	Geraniaceae	C	A	
<i>Erodium moschatum</i>	Malvacea	C	A	
<i>Eryngium creticum</i>	Geraniaceae	C	H	
<i>Euophorbia pepus</i>	Euphorbiaceae	C	A	
<i>Fibigia clypeata</i>	Cruciferae	C	C	
<i>Filago contracta</i>	Compositae	C	A	
<i>Filago pyramidata</i>	Compositae	C	A	
<i>Fumana arabica</i>	Cistaceae	C	C	25
<i>Fumana thymefolia</i>	Cistaceae	C	C	5
<i>Galium judaicum</i>	Rubiaceae	C	A	
<i>Galium murale</i>	Rubiaceae	C	A	
<i>Geranium molle</i>	Geraniaceae	C	A	
<i>Geropogon hybridus</i>	Compositae	C	A	
<i>Gladiolus italicus</i>	Iridaceae	F	G	
<i>Gundelia tournefortii</i>	Compositae	F	H	
<i>Gynandrisis sisyrinchium</i>	Iridaceae	C	G	
<i>Hedypnois rhagadiolooides</i>	Compositae	C	A	
<i>Helianthemum salicifolium</i>	Cistaceae	C	A	
<i>Helichrysum sanguineum</i>	Compositae	C	H	
<i>Heliotrobium routundifolium</i>	Boraginaceae	C	C	
<i>Heliotropium europaeum</i>	Boraginaceae	C	A	
<i>Hippocrepis unisiliquosa</i>	Papilionaceae	C	A	
<i>Hirschfeldia incana</i>	Cruciferae	C	A	

<i>Hordeum bulbosum</i>	Gramineae	C	H	
<i>Hymenocarpus circinnatus</i>	Papilionaceae	C	A	
<i>Hyparrhina hirta</i>	Gramineae	C	H	
<i>Hypericum lanuginosum</i>	Hyperaceae	C	C	
<i>Inula viscosa</i>	Compositae	C	S	
<i>Iris palaestina</i>	Iridaceae	R	G	
<i>Isatis lusitanica</i>	Cruciferae	C	A	
<i>Kickxia aegyptiaca</i>	Scrophulariaceae	C	C	8
<i>Lactuca tuberosa</i>	Compositae	C	H	
<i>Lagoecia cuminoides</i>	Umbelliferae	C	A	
<i>Lamarckia aurea</i>	Gramineae	C	A	
<i>Lathyrus aphaca</i>	Papilionaceae	C	A	
<i>Lathyrus blepharicarpus</i>	Papilionaceae	C	A	
<i>Leontice leontopetalum</i>	Berberidaceae	R	G	
<i>Leontodon tuberosa</i>	Compositae	C	H	
<i>Linum pubescens</i>	Linaceae	C	A	
<i>Linum strictum</i>	Linaceae	C	A	
<i>Lolium rigidum</i>	Gramineae	C	A	
<i>Lonicera etrusca</i>	Caprifoliaceae	C	V	3
<i>Lotus peregrinus</i>	Papilionaceae	C	A	
<i>Malcolmia chia</i>	Cruciferae	R	A	
<i>Medicago coronata</i>	Papilionaceae	C	A	
<i>Medicago rugosa</i>	Papilionaceae	R	A	
<i>Mercurialis annua</i>	Euphorbiaceae	C	A	
<i>Micromeria fruticosa</i>	Labiatae	C	C	4
<i>Micromeria myrtifolia</i>	Labiatae	C	C	
<i>Micromeria nervosa</i>	Labiatae	C	C	21
<i>Minuartia hybrid</i>	Caryophyllaceae	C	A	
<i>Nigella ciliaris</i>	Rununculaceae	R	A	
<i>Noaea mucronata</i>	Chenopodiaceae	C	C	
<i>Noaea ventricosa</i>	Boraginaceae	C	A	
<i>Notobasis syriaca</i>	Compositae	C	A	
<i>Olea europaea</i>	Oleaceae	C	T	
<i>Onobrychis caput-galli</i>	Papilionaceae	C	A	
<i>Onobrychis squarrosa</i>	Papilionaceae	C	A	
<i>Ononis mollis</i>	Papilionaceae	R	A	
<i>Ononis natrix</i>	Papilionaceae	C	C	

<i>Ononis ormithopodiodes</i>	Papilionaceae	R	A	
<i>Ophrys bornmuelleri</i>	Orchidaceae	R	G	
<i>Orchis caspia</i>	Orchidaceae	C	G	
<i>Orchis galilaea</i>	Orchidaceae	R	G	
<i>Origanum syriacum</i>	Labiatae	C	C	5
<i>Ornithogalum narbonense</i>	Liliaceae	C	G	
<i>Osyris alba</i>	Santalaceae	C	C	6
<i>Pallens spinosa</i>	Compositae	C	H	
<i>Parietaria judaica</i>	Urticaceae	C	A	
<i>Paronychia argentea</i>	Caryophyllaceae	C	C	
<i>Paronychia sinaica</i>	Caryophyllaceae	R	C	
<i>Phagnalon rupestre</i>	Compositae	C	C	8
<i>Phlomis viscosa</i>	Labiatae	C	S	13
<i>Phragmites australis</i>	Gramineae	C	H	
<i>Picnomon acarna</i>	Compositae	C	A	
<i>Picris altissima</i>	Compositae	C	A	
<i>Pinus halapensis</i>	Pinaceae	C	T	50
<i>Piptatherum miliaceum</i>	Gramineae	C	H	
<i>Pistacia lentiscus</i>	Anacardiaceae	C	T	7
<i>Pistacia palaestina</i>	Anacardiaceae	C	T	22
<i>Plantago afra</i>	Plantaginaceae	C	A	
<i>Plantago cretica</i>	Plantaginaceae	C	A	
<i>Poa bulbosa</i>	Gramineae	C	H	
<i>Prasium majus</i>	Labiatae	C	S	22
<i>Pterocephalus plumosus</i>	Dipsaceae	C	A	
<i>Pyrus syriaca</i>	Rosaceae	F	T	
<i>Quercus calliprinos</i>	Fagaceae	C	T	43
<i>Ridolfia segetum</i>	Urticaceae	C	A	
<i>Reseda alba</i>	Resedaceae	C	A	
<i>Rhagadiolus stellatus</i>	Compositae	C	A	
<i>Rhamnus palaestina</i>	Rhamnaceae	C	S	44
<i>Rhus coriaria</i>	Anacardiaceae	C	T	
<i>Ricinus communis</i>	Euphorbiaceae	C	T	
<i>Rochelia disperma</i>	Boraginaceae	O	A	
<i>Rosa canina</i>	Rosaceae	R	S	
<i>Rubia tenuifolia</i>	Rubiaceae	C	V	13
<i>Ranunculus asiaticus</i>	Ranunculaceae	C	G	

<i>Salvia dominica</i>	Labiatae	C	C	
<i>Salvia hierosolymitana</i>	Labiatae	C	H	
<i>Salvia indica</i>	Labiatae	R	H	
<i>Salvia palaestina</i>	Labiatae	R	H	
<i>Sarcopodium spinosum</i>	Rosaceae	C	C	53
<i>Satureja thymbra</i>	Labiatae	C	C	
<i>Scabiosa prolifera</i>	Dipsaceae	C	A	
<i>Scandix pecten-veneris</i>	Umbelliferae	C	A	
<i>Scorpiurus muticus</i>	Papilionaceae	C	A	
<i>Scorzonera papposa</i>	Compositae	C	H	
<i>Scutellaria subvelutina</i>	Labiatae	C	H	
<i>Sedum sediforme</i>	Crassulaceae	F	C	
<i>Sideritis pillulans</i>	Labiatae	C	H	
<i>Silene muscipula</i>	Caryophyllaceae	R	A	
<i>Silene vulgaris</i>	Caryophyllaceae	C	H	
<i>Sinapis alba</i>	Cruciferae	C	A	
<i>Smilax aspera</i>	Liliaceae	C	V	11
<i>Sonchus oleraceus</i>	Compositae	C	A	
<i>Stachys neurocalycina</i>	Labiatae	C	A	
<i>Stipa bromoides</i>	Gramineae	C	H	
<i>Stipa capensis</i>	Gramineae	C	A	
<i>Styrax officinalis</i>	Styracaceae	C	T	5
<i>Tamus communis</i>	Dioscoreaceae	C	V	2
<i>Taraxacum cyprium</i>	Compositae	C	H	
<i>Tetrapogon villosus</i>	Gramineae	R	H	
<i>Teucrium capitatum</i>	Labiatae	C	C	11
<i>Teucrium creticum</i>	Labiatae	F	C	3
<i>Teucrium divaricatum</i>	Labiatae	C	C	37
<i>Theligonum cyanocrambe</i>	Theliugonaceae	C	A	
<i>Thesium humile</i>	Santalaceae	R	A	
<i>Thymbra spicata</i>	Labiatae	F	C	
<i>Tolpis varigata</i>	Compositae	C	H	
<i>Torilis arvensis</i>	Urticaceae	C	A	
<i>Trachynia distachys</i>	Gramineae	C	A	
<i>Tragopogon coelesyriacus</i>	Compositae	C	H	
<i>Trifolium campestre</i>	Papilionaceae	C	A	
<i>Trifolium cheleri</i>	Papilionaceae	F	A	

<i>Trifolium clypeatum</i>	Papilionaceae	C	A	
<i>Trifolium pilulare</i>	Papilionaceae	F	A	
<i>Trifolium scabrum</i>	Papilionaceae	C	A	
<i>Trifolium stellatum</i>	Papilionaceae	C	A	
<i>Trifolium tomentosum</i>	Papilionaceae	C	A	
<i>Trigonella berythea</i>	Papilionaceae	F	A	
<i>Tulipa systola</i>	Liliaceae	R	G	
<i>Umbilicus intermedius</i>	Crassulaceae	C	H	
<i>Urginea maritima</i>	Liliaceae	C	G	
<i>Urospermum picroides</i>	Compositae	C	A	
<i>Valantia hispida</i>	Rubiaceae	C	A	
<i>Varthemia iphionoides</i>	Compositae	C	C	16
<i>Verbascum jordanicum</i>	Scrophulariaceae	C	C	
<i>Verbascum sinaiticum</i>	Scrophulariaceae	C	H	
<i>Vicia hybrid</i>	Papilionaceae	C	A	
<i>Vicia palaestina</i>	Papilionaceae	C	A	
<i>Ziziphora capitata</i>	Labiatae	F	A	
Ferns (two species)		R	H	

Dominant trees and shrubs were *Pinus halapensis*, *Rhamnus palaestina*, *Quercus calliprinos*, *Sarcopodium spinosum*, *Cistus creticus* and *Teucrium divaricatum*. *Fumana arabica*, *Cistus salvifoliosus*, *Pistacia palaestina*, *Micromeria nervosa*, *Asparagus aphyllus* and *Coridothymus capitatus*, were found in fairly good numbers. *Calycotome villosa*, *Crataegus aronia*, *Origanum syriacum*, *Pistacia lentiscus*, and *Styrax officinalis* were less common in the reserve and require special attention.

Many other species with very low constancy such as *Ballota saxitilis*, *Lonicera etrusca* (Figure 1A), *Teucrium creticum*, *Ceratonia siliqua*, *Clematis cirrhosa*, *Tamuscum communis*, *Anagyris foetida*, *Arbutus andrachne*, *Astragalus bethlehemiticus*, *Echium angustifolium*, *Noea mucronata*, *Pyrus syriaca*, *Rosa canina* (Figure 1B), *Rhus coriaria*, and *Saturja thymbra*. *Rosa canina* is a rare species on the country level. Some species were found outside the quadrates and were also rare such as *Salvia indica* (Figure 1C), *Thymbra spicata*, *Ophrys bornmuelleri* and *Orchis galilaea* (Figure 1D). The last two species are orchids and were at the end of the blooming period.

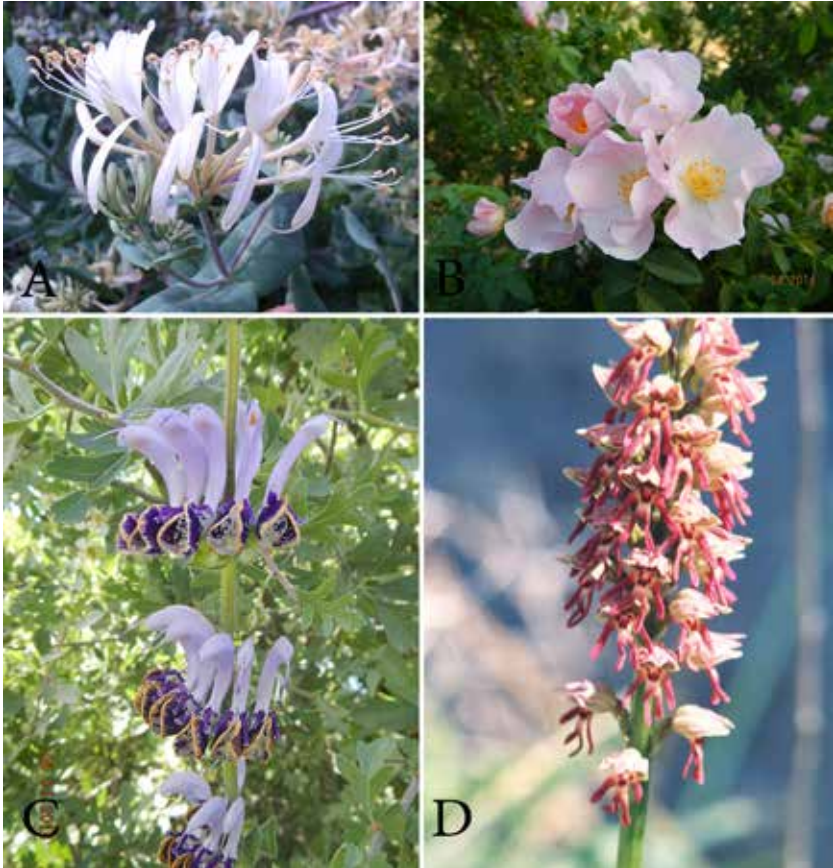


Figure 1. A. *Lonicera etrusca*. B. *Rosa canina*. C. *Salvia indica*. D. *Orchis galilaea*.

DISCUSSION

We noted rich plant biodiversity in the study area including some interesting and rare elements (Table 1). There are several threats affecting the ecosystem in the area. But we can state that as far as the flora is concerned, major threats include overgrazing, harvesting trees and medicinal plants, fires, and pollution due to human encroachment. Those threats caused degradation affecting the abundance of many species in the reserve and we are particularly concerned about *Origanum syriaca*, *Salvia indica*, and *Salvia palaestina*. We recommend limiting human disturbance for few years to allow recovery and better management of the flora. This includes preventing harvesting of medicinal plants and economically useful plants like *Salvia hierosolymitana* and

Crataegus aronia, preventing grazing, preventing fires and picnicking outside of Tarqumya park, closing the quarry which is very close to the reserve, and preventing solid and liquid waste disposal in park boundaries. We must also raise public awareness and education on the importance of this reserve. Long-term measures may include reintroduction of the rare plants especially the natural trees and shrubs of the Mediterranean climate through collecting seeds to propagate them in the nursery of the Ministry of Agriculture which is already present in WAQ.

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