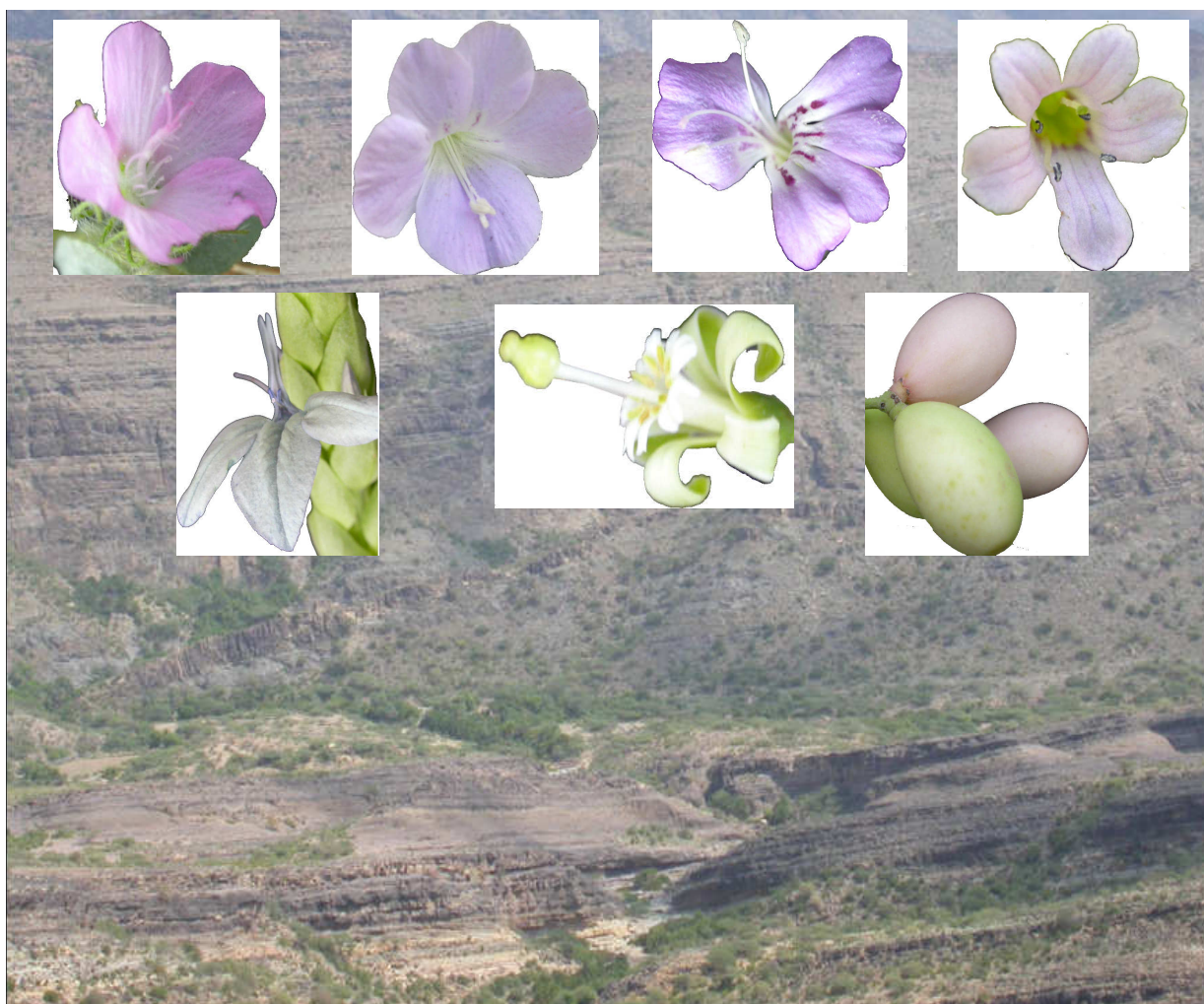


**Natural Plant species inventory for the Jabal Adhaeif (Bani Omar),  
Taiz**

**November 2007**



**Prepared by Dr. Abdul Wali Ahmed Al Khulaidi**

## **Abstract**

The aim of the study is to investigate the natural vegetation cover and plant biodiversity of the area and to evaluate the possibility to be the natural protected site.

The vegetation of the region has never been studied or surveyed. The climate of the study areas is arid and semi-arid characterised by high temperatures and low average annual rainfall.

Almost 135 plant species are counted from the region, in which 12 were endemic and near endemic with intensive survey this figure can be at least doubled. The study revealed also 7 vegetation associations.

The main wadis are covered by big trees such as *Ficus sycomotus*, *F. cordata*, *Salvadora persica* *Tamarix aphylla* and *Ziziphus spina-christi*. The rocky slopes and the plateau surface are covered by vegetation dominated by *Acacia asak*, *Ormocarum yemenense*, *Jatropha varigata* and *Anisotes trisulcus*.

## **Acknowledgements**

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Especial thanks to Mr Abdul Habib Al Qadasi for his help in the field. Especial thanks also to Mr Muhammed Atran, and Mohammed Al Maemari for they support during the field work.

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# Natural plant species inventory of Jabal Adhaeif (Bani Omar), Taiz

## 1- Introduction

The vegetation of the region has never been studied or surveyed. The climate of the study areas is arid and semi-arid characterised by high temperatures and low average annual rainfall.

Natural protected areas are the in-situ method for the conservation of biological diversity and special entities with unique or endemic or rare flora and fauna (Al Khulaidi, 2006). Protected areas offer protection for all the plant species from over-use and degradation and they provide suitable sites for field studies and research on biodiversity and natural resources, and provide suitable sites for training and monitoring environmental change. It is therefore, an ancillary objective of this research to propose clearly defined areas which deserve protected status

### 1.2- The aim of the study

The aim of the study is to investigate the natural vegetation cover and plant biodiversity of the area and to evaluate the possibility to be the a natural protected site.

### 1.3- Location of the study area

The study area is located on the western mountain areas of Bani Omar, Turbat Ash shamaitayn in Taiz Governorate, it is located between latitude  $13^{\circ} 10' N$  to  $13^{\circ} 18'$  and longitude  $43^{\circ} 50'$  and  $44^{\circ} 00'$  (see figure 1).



Figure 1. Location of the study area ■

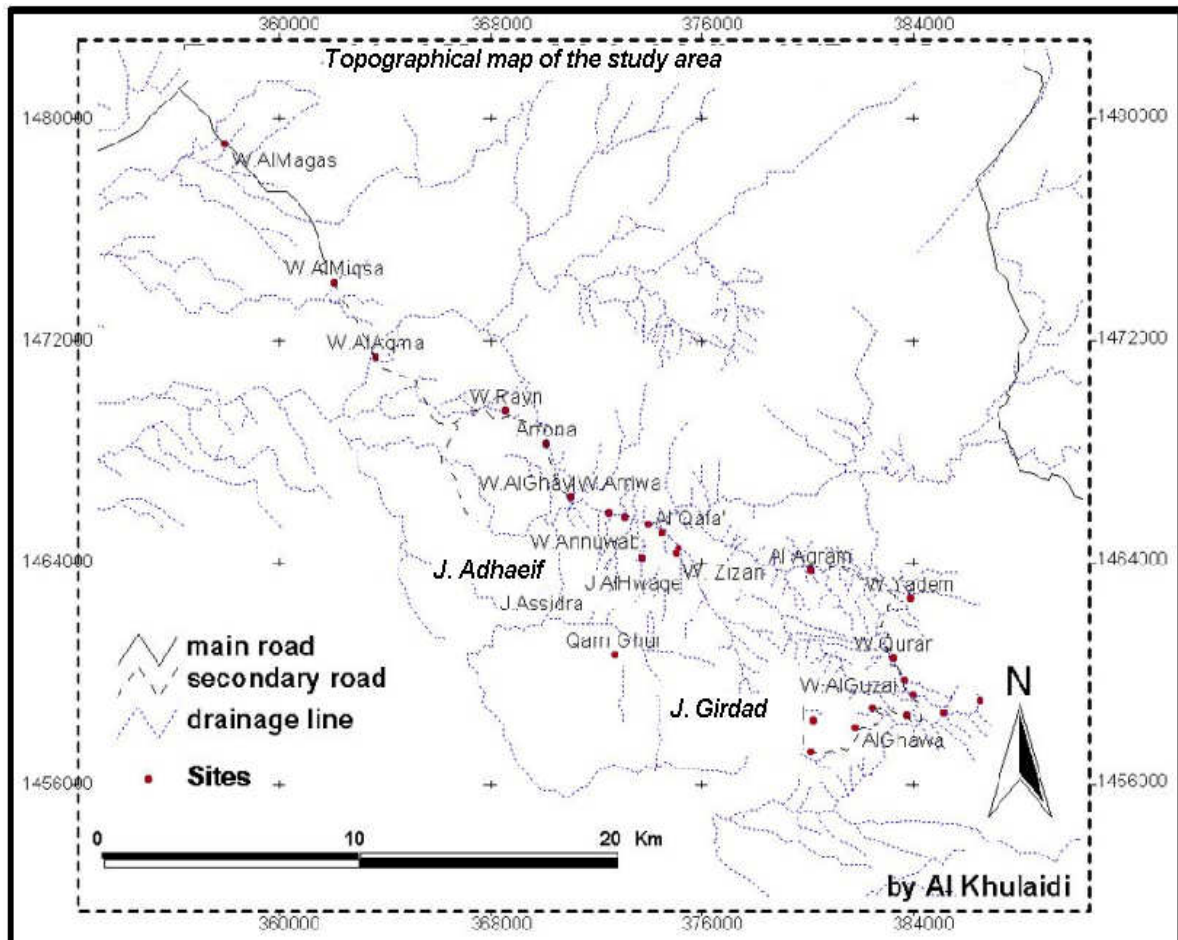


Figure 2. The topographical units of the study area.

#### 1.4- Topography

The study area consists of mountain slopes, plateaus, wadis and rocky plains. The main wadis are Wadi Al Ajram and Wadi Qurar. The altitude of the area ranges between 440 and 1440 m above sea level (Figure 2).

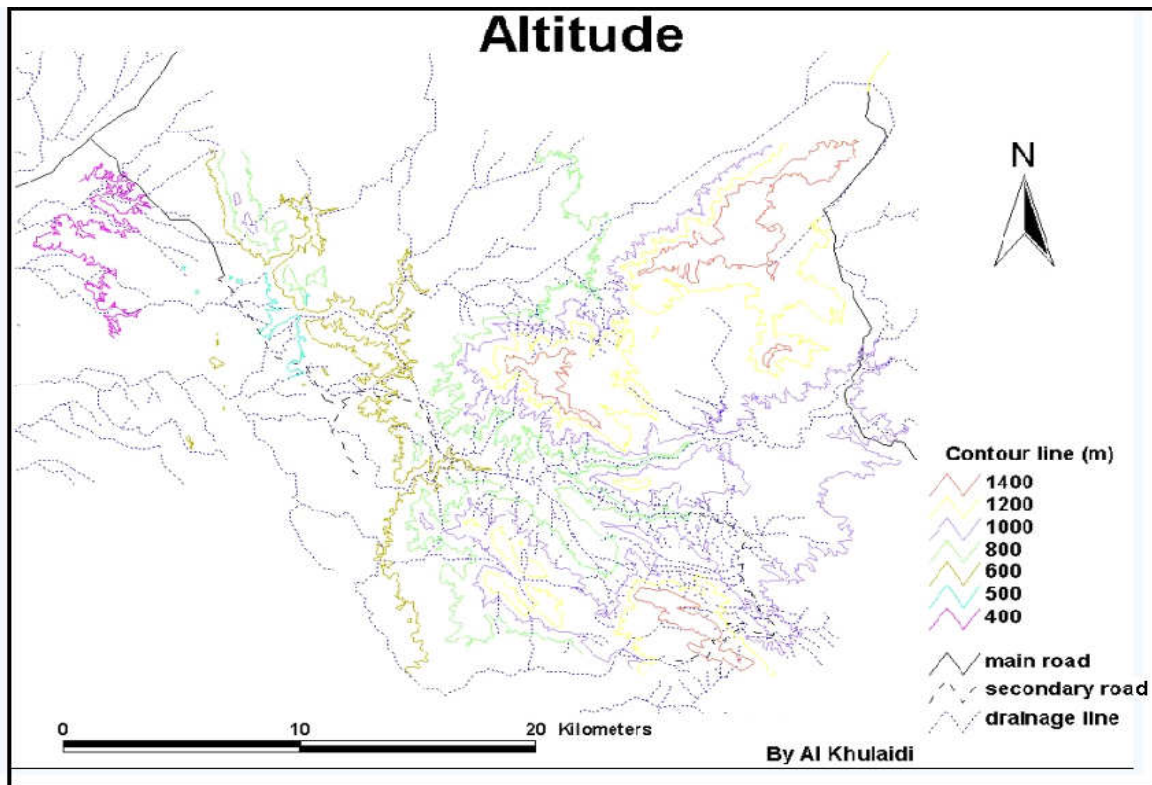


Figure 2. The altitude (m) of the study area.

## 2- Vegetation

Almost 135 plant species are counted from the region, in which 12 were endemic and near endemic (Appendix 3), with intensive survey this figure can be at least doubled. The vegetation in the main wadis consists of woodland with tall trees (e.g. *Ziziphus spina-christi*, *Ficus cordata*, *F. Sycomorus* and *Trichelia emetica* with *Phoenix dactylifera*), low woody-herb cover and scattered shrubs (e.g. *Salvadora persica*, *Indigofera oblongifolia* and *Jatropha curcus*). The vegetation of the plateau consists mainly of communities dominated by the near-endemic *Rhus flexicaulis* and *Acacia etbaica* with *Grewia schweinfurthii*, *Ormocarpum yemenense*, *Cadia purpurea*, *Ficus vasta* and others. The vegetation of the mountain slopes consist of woodland dominated by *Acacia tortilis* and *Anisotes trisulcus* with *Acacia mellifera*, *A. hamulosa*, *A. asak*, *A. laeta*, *Commiphora spp.*, *Grewia spp.*, *Jatropha spinosa* and many others.

### 3- Main vegetation types of the surveyed areas

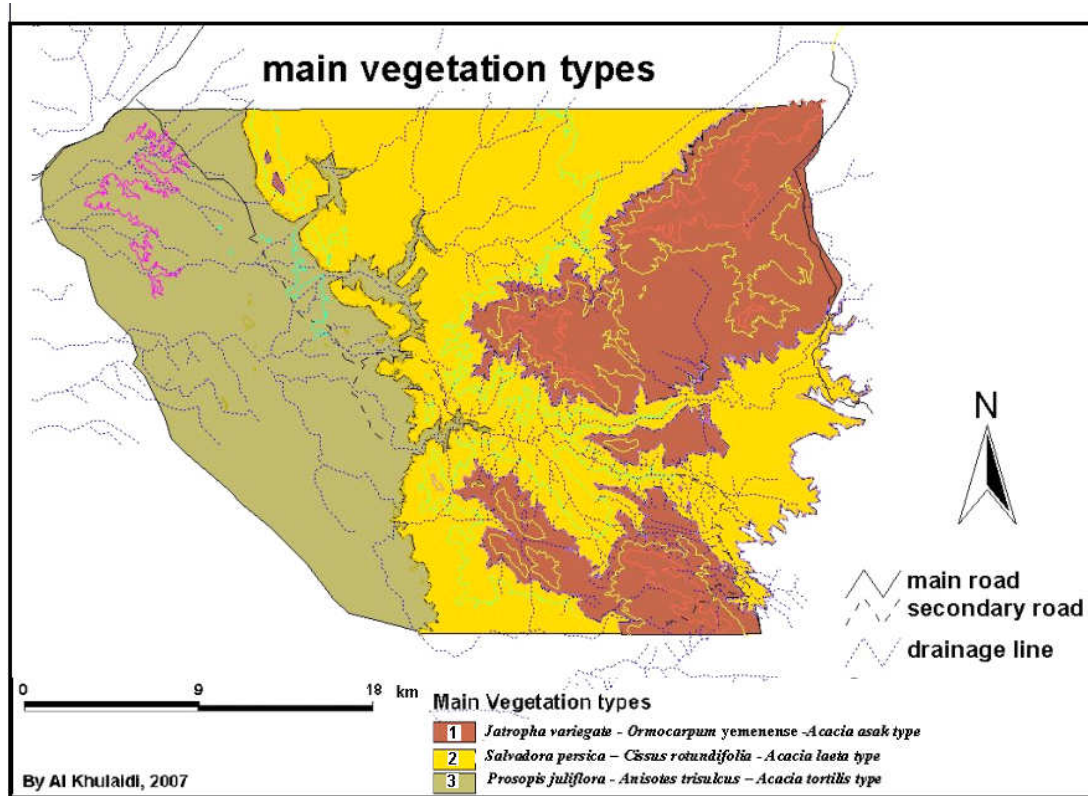


Figure 3. Main vegetation types of the study area.

#### 1- *Jatropha variegata* - *Ormocarpum yemenense* - *Acacia asak* type

It is found on rocky slopes, drainage lines and plateaus between 1000 and 1435 m. The vegetation is composed of woodland and shrub land dominated by *Rhus flexicaulis*, *Acacia asak* with *Grewia schweinfurthii*, *Ormocarpum yemenense*, *Acacia etbaica*, *Cadia purpurea*, *Cyphostemma digitatum*, *Ficus vasta*, *Commiphora habessinica*, *Kleinia odora*, *Barleria bispinosa*, *Dodonaea viscosa* and others. This type has quite high quantity of endemic and near-endemic plant species as well as economic plants.

This type consists of 2 vegetation associations:

#### a- *Rhus flexicaulis* - *Acacia asak* association

This association is found mainly on plateaus and mountain slopes between 1180 and 1435 m above sea level. The dominant species of this association is *Acacia asak* with association of *A. etbaica*, *Grewia schweinfurthii*, *Ormocarpum yemenense* and *Jatropha variegata*. *Rhus flexicaulis*, *Cyphostemma digitatum*, *Ficus vasta* and

*Kleinia odora*, *Dodonaea viscosa*, *Segetaria thea*, *Barleria bispinosa*, *Maytenus parvifolia* and *Pavetta longiflora* are only found in this association.

#### **b- Pulicaria somalensis – Acacia asak association**

This association is found on the mountain slopes and rocky plain between 1000 and 1145 m above sea level. The dominant species is *Acacia asak* with *Jatropha variegata*, *Euphorbia inarticulata*, *Cissus quadrangularis*, *Ormocarpum yemenense*, *Anisotes trisulcus* and *Sarcostemma viminale*. *Aloe niebuhriana*, *Pulicaria somalensis*, *Barleria trispinosa*, *Seddera latifolia* are only found in this association.

#### **2- Salvadora persica – Cissus rotundifolia - Acacia laeta type**

It is found on rocky slopes and wadis between 600 and 970 m. The vegetation is composed of woodland and shrub land dominated by *Cissus rotundifolia*, - *Acacia laeta* with *Sansevieria ehrenbergiana*, *Acacia tortilis*, *Dobera glabra*, *Ficus cordata*, *Jatropha spinosa*, *Salvia papposa* and many others. This type covers a large part of the study area and has about 6 endemic and near-endemic plant species as well as contains important economic plant species.

This type consists of 3 vegetation associations:

##### **a- Ficus sycomorus – Ziziphus spina-christi – Ficus cordata association**

This association is found mainly in fertile wadis between 590 and 965 m above sea level. The dominant species of this association are *Ficus cordata* and *Ziziphus spina-christi* with *Phoenix dactylifera*, *Ficus sycomorus*, *Tamarix aphylla*, *T. Arabica*, *Arundo donax*, *Trichelia emetica*, *Jatropha curcus*, *Ficus sycomorus*, *Ficus palmata*, *Annona squamosa*, *Mimusops laurifolia*, *Berchemia discolor* and *Pandanus odoriferus* are only found in this association.

##### **b- Indigofera articulata – Barleria proxima – Seddera arabica association**

This association is found on the moderate steep slope mountain of J. Adhaeif, the altitude ranges between 640 and 895 m above sea level. The dominant species is *Euphorbia cuneata* with *Grewia schweinfurthii*, *Ormocarpum yemenense*, *Acacia*



*tortilis*, *Aerva javanica*, *Adenium obesum*, *Indigofera spinosa*, *Sansevieria ehrenbergiana*, *Salvia papposa*, *Acacia laeta* and others. Very rare species such as *Eleocharis geniculata*, *Fimbristylis cymosa* and *Ceratophyllum demersum* were only found in this association.

### **c- *Boscia arabica* - *Acacia tortilis* – *Acacia laeta* association**

A widespread association, found on moderate to steep rocky slopes, the altitude ranges between 660 and 970 m above sea level. The dominant species are *Acacia tortilis* and *Anisotes trisulcus* with *Acacia laeta*, *A. mellifera*, *Aerva javanica*, *Acacia asak*, *Cissus rotundifolia*, *Dobera glabra*, *Acalypha fruticosa*, *Sarcostemma viminalis*, *Fleuggia virosa*, *Jatropha spinosa* and many others. The species *Cadaba farinosa*, *C. longifolia*, *Cassia senna*, *Euphorbia qarad* and *Grewia tenax* are only found in this association.

### **3- *Prosopis juliflora* - *Anisotes trisulcus* – *Acacia tortilis* type**

This type found on mountain slopes wadis and rocky plains at low altitude areas (between 440 and 600 m), the characteristic plant species of this areas are: *Acacia tortilis*, *Anisotes trisulcus*, *Acacia ehrenbergiana*, *Aerva javanica* and *Acacia mellifera*.

Two vegetation associations can be distinguished in this type:

#### **a- *Acacia tortilis* – *Anisotes trisulcus* association**

It is found on rocky slopes and plains between 525 and 600 m above sea level. The dominant species is *Acacia tortilis* with *Anisotes trisulcus*, *Prosopis juliflora*, *Acacia mellifera*, *A. ehrenbergiana* and others. *Cassia senna* and *Cadaba rotundifolia* are only found in this association.

#### **b- *Prosopis juliflora* – *Tamarix aphylla* association**

It is found in wadis and adjacent slope, the altitude ranges between 445 and 600 m above sea level. The dominant species are *Prosopis juliflora* and *Phoenix dactylifera* with *Tamarix aphylla*, *T. arabica*, *Indigofera oblongifolia*, *Acacia ehrenbergiana*, *Anisotes trisulcus*, *Aerva javanica* and others.

For more detail see table 2.





### 3- Frequency:

Frequency is defined as the number of times a plant species is present within a given number of sample quadrats of uniform size placed repeatedly across a stand of vegetation (Mueller-Dombois et al. 1974; Daubenmire, 1968).

Plant frequency, by itself, is useful for monitoring vegetation changes over time at the same locations or for comparisons of different locations. Frequency was calculated by dividing the number of sample sites in which a species occurs into the total number of plots sampled.

The following plant species were the most abundant in the surveyed area:

*Anisotes trisulcus*, *Acacia tortilis*, *Cissus rotundifolia*, *Acacia asak*, *Aerva javanica*, *Acacia mellifera*, *Ormocarpum yemenense*, *Commiphora myrrha*, *Ziziphus spin-christi* and *Acacia laeta* (see Table 1).

*Phoenix dactylifera*, *Ziziphus spin-christi*, *Ficus sycomorus*, *Tamarix arabica* and *Ficus cordata* were most abundant species recorded in wadis, while *Acacia etbaica*, *Cissus rotundifolia*, *Jatropha variegata*, *Ormocarpum yemenense* and *Rhus flexicaulis* were most abundant on the rocky plateau. *Acacia tortilis*, *Anisotes trisulcus*, *Acacia asak*, *Aerva javanica* and *Commiphora myrrha* were the most abundant plant species on the mountain slopes.

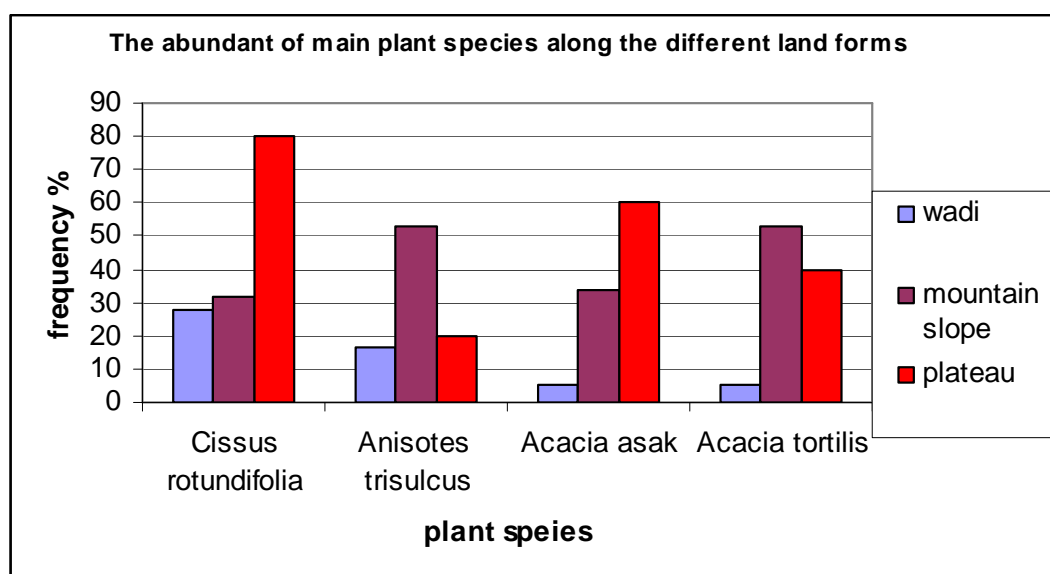


Figure 4. The abundant of main plant species along the different land forms

*Cissus rotundifolia*, *Anisotes trisulcus*, *Acacia asak* and *Acacia tortilis* were widespread plant species, with a considerable variation in abundance from one landform to another. The frequency of *Acacia asak* and *Cissus rotundifolia* significantly increased from the main wadis to the adjacent slopes, and then to the rocky plateaus (see Figure 4).

Table 1. The frequency for each plant species. Variations in frequency can be observed. Some species occur at high frequencies in one site and at low frequencies or absent in other site.

<b>Plant species</b>	<b>plateau</b>	<b>wadi</b>	<b>slope</b>
<i>Abrus bottae</i>	0.0	0.0	4.3
<i>Abutilon fruticosum</i>	0.0	0.0	2.1
<i>Acacia asak</i>	60.0	5.6	34.0
<i>Acacia ehrenbergiana</i>	0.0	11.1	2.1
<i>Acacia etbaica</i>	100.0	0.0	4.3
<i>Acacia hamulosa</i>	20.0	11.1	14.9
<i>Acacia laeta</i>	20.0	5.6	31.9
<i>Acacia mellifera</i>	20.0	11.1	31.9
<i>Acacia nilotica</i>	20.0	0.0	2.1
<i>Acacia tortilis</i>	40.0	5.6	53.2
<i>Acalypha fruticosa</i>	40.0	22.2	17.0
<i>Acokanthera schimperi</i>	0.0	5.6	2.1
<i>Adenium obesum</i>	40.0	0.0	14.9
<i>Aerva javanica</i>	20.0	16.7	34.0
<i>Aerva lanata</i>	0.0	5.6	6.4
<i>Agave sisalana</i>	0.0	0.0	2.1
<i>Aloe niebuhriana</i>	20.0	0.0	2.1
<i>Andropogon sp.</i>	0.0	0.0	4.3
<i>Anisotes trisulcus</i>	20.0	16.7	53.2
<i>Annona squamosa</i>	0.0	5.6	0.0
<i>Aristida sp.</i>	0.0	0.0	6.4
<i>Arundo donax</i>	0.0	22.2	0.0
<i>Bacopa monniera</i>	0.0	5.6	0.0
<i>Barleria acanthoides</i>	60.0	0.0	6.4
<i>Barleria bispinosa</i>	20.0	0.0	0.0
<i>Barleria proxima</i>	0.0	0.0	8.5
<i>Barleria trispinosa</i>	20.0	0.0	0.0
<i>Becium filamentosum</i>	0.0	0.0	2.1
<i>Berchemia discolor</i>	0.0	5.6	0.0
<i>Blepharis ciliaris</i>	40.0	0.0	8.5
<i>Boscia arabica</i>	0.0	5.6	12.8
<i>Cadaba farinosa</i>	0.0	0.0	2.1

<i>Cadaba longifolia</i>	0.0	0.0	2.1
<i>Cadaba rotundifolia</i>	0.0	0.0	2.1
<i>Cadia purpurea</i>	60.0	0.0	4.3
<i>Calotropis procera</i>	0.0	22.2	6.4
<i>Caralluma</i> sp.	0.0	0.0	2.1
<i>Cassia senna</i>	0.0	0.0	2.1
<i>Chloris</i> sp.	0.0	0.0	2.1
<i>Cissus quadrangularis</i>	40.0	5.6	17.0
<i>Cissus rotundifolia</i>	80.0	27.8	31.9
<i>Combretum molle</i>	40.0	11.1	4.3
<i>Commiphora gileadensis</i>	0.0	5.6	2.1
<i>Commiphora habessinica</i>	20.0	0.0	4.0
<i>Commicarpus helenae</i>	0.0	0.0	4.3
<i>Commiphora kataf</i>	20.0	5.6	10.6
<i>Commiphora myrrha</i>	20.0	0.0	34.0
<i>Commicarpus plumbagineus</i>	20.0	5.6	2.1
<i>Commiphora schimperi</i>	0.0	0.0	6.4
<i>Conyza pyrotechnica</i>	0.0	11.1	0.0
<i>Corchorus tridens</i>	0.0	0.0	2.1
<i>Cymbopogon schoenanthus</i>	0.0	0.0	6.4
<i>Cyphostemma digitatum</i>	40.0	0.0	2.1
<i>Dactyloctenium scindicum</i>	0.0	0.0	2.1
<i>Delonix regia</i>	0.0	5.6	0.0
<i>Dobera glabra</i>	20.0	0.0	17.0
<i>Dodonaea viscosa</i>	20.0	0.0	0.0
<i>Ecbolium viride</i>	20.0	5.6	0.0
<i>Euphorbia cuneata</i>	20.0	0.0	29.8
<i>Euphorbia inarticulata</i>	40.0	5.6	10.6
<i>Euphorbia qarad</i>	0.0	0.0	2.1
<i>Fagonia indica</i>	20.0	0.0	6.4
<i>Ficus cordata</i>	20.0	50.0	0.0
<i>Ficus glumosa</i>	20.0	11.1	8.5
<i>Ficus ingens</i>	0.0	11.1	0.0
<i>Ficus palmata</i>	0.0	5.6	0.0
<i>Ficus populifolia</i>	0.0	22.2	0.0
<i>Ficus sycomorus</i>	0.0	66.7	0.0
<i>Ficus vasta</i>	40.0	0.0	0.0
<i>Fleuggia virosa</i>	20.0	5.6	12.8
<i>Grewia erythraeae</i>	40.0	0.0	8.5
<i>Grewia schweinfurthii</i>	60.0	0.0	21.3
<i>Grewia tembensis</i>	0.0	0.0	10.6
<i>Grewia tenax</i>	0.0	0.0	2.1
<i>Grewia trichocarpa</i>	20.0	11.1	8.5
<i>Indigofera arabica</i>	0.0	0.0	2.1
<i>Indigofera articulata</i>	0.0	0.0	10.6

<i>Indigofera oblongifolia</i>	0.0	27.8	4.3
<i>Indigofera sp.</i>	0.0	0.0	2.1
<i>Indigofera spinosa</i>	40.0	0.0	19.1
<i>Jatropha curcus</i>	0.0	27.8	0.0
<i>Jatropha spinosa</i>	0.0	5.6	23.4
<i>Jatropha variegata</i>	80.0	0.0	10.6
<i>Jatropha glauca</i>	0.0	0.0	2.1
<i>Justicia odora</i>	0.0	0.0	4.3
<i>Kanahia laniflora</i>	0.0	5.6	0.0
<i>Kleinia odora</i>	40.0	0.0	2.1
<i>Leptadenia pyrotechnica</i>	0.0	11.1	2.1
<i>Maytenus parvifolia</i>	20.0	0.0	0.0
<i>Mimusops laurifolia</i>	0.0	5.6	0.0
<i>Ormocarpum yemenense</i>	80.0	0.0	27.7
<i>Pandanus odoriferus</i>	0.0	5.6	0.0
<i>Pavetta longiflora</i>	20.0	0.0	0.0
<i>Phoenix caespitosa</i>	0.0	27.8	0.0
<i>Phoenix dactylifera</i>	0.0	77.8	0.0
<i>Pithecellobium dulce</i>	0.0	38.9	0.0
<i>Premna resinosa</i>	0.0	0.0	6.4
<i>Prosopis juliflora</i>	0.0	16.7	2.1
<i>Pulicaria jaubertii</i>	0.0	0.0	2.1
<i>Pulicaria somalensis</i>	20.0	0.0	8.5
<i>Pupalia lappacea</i>	0.0	0.0	2.1
<i>Rhus flexicaulis</i>	80.0	0.0	4.3
<i>Ricinus communis</i>	0.0	5.6	0.0
<i>Ruellia grandiflora</i>	20.0	5.6	4.3
<i>Ruellia patula</i>	20.0	0.0	2.1
<i>Salsola spec</i>	0.0	0.0	2.1
<i>Saltia papposa</i>	0.0	5.6	17.0
<i>Salvadora persica</i>	0.0	22.2	10.6
<i>Sansevieria ehrenbergiana</i>	20.0	0.0	27.7
<i>Sansevieria Forskohlea</i>	20.0	0.0	2.1
<i>Sarcostemma viminalis</i>	40.0	0.0	25.5
<i>Seddera arabica</i>	20.0	0.0	14.9
<i>Seddera latifolia</i>	20.0	0.0	0.0
<i>Segetaria thea</i>	20.0	0.0	0.0
<i>Selaginella imbricata</i>	20.0	0.0	6.4
<i>Senna italica</i>	20.0	0.0	0.0
<i>Senna obtusifolia</i>	0.0	5.6	0.0
<i>Senna occidentalis</i>	0.0	11.1	0.0
<i>Solanum incanum</i>	40.0	0.0	8.5
<i>Stipagrostis hirtigluma</i>	0.0	0.0	2.1
<i>Tamarix aphylla</i>	0.0	38.9	0.0
<i>Tamarix arabica</i>	0.0	55.6	2.1

Tarenna graveolens	0.0	0.0	6.4
Tetrapogon sp.	0.0	0.0	2.1
Trichelia emetica	0.0	27.8	0.0
Turraea parvifolia	20.0	0.0	14.9
Typha domingensis	0.0	11.1	0.0
Ziziphus spin-christi	40.0	72.2	4.3

#### 4- Discussion:

The existing protected areas in Yemen fall in the following categories (Khulaidi and Al Ghouri, 1996):

- woodlands and/or shrubland that are formed and protected naturally and mostly situated in remote areas,
- Woodland or forest areas that are situated around agricultural land and surrounding areas, and normally managed by local communities,
- National parks, artificially afforested areas and most areas run by public sector and are considered to be well protected.

In many parts of the country traditional small protected areas can be found, these areas mainly situated around or near villages and privately or communally owned. Traditional rules are used as measure to these protected areas and mainly used for grazing. The implementation of those rules are deferent from place to another, the commoner rules are formed by agreement with a specific fine or animals for cutting trees from the protected areas. The protected areas are represent the better managed areas of the Yemen, and normally managed by local communities, village leaders or Sheikh.

There are three criteria for protected areas (Miller, et al 2007):

Criterion A: the site holds significant populations of one or more species that are of global or regional conservation concern

Criterion B: the site has an exceptionally rich flora in relation to its biogeographic zone

Criterion C: the site is an outstanding example of a habitat type of global or regional conservation or botanical importance.



The conservation of species in their natural habitats or *in situ* conservation, has long been the conservation method of choice for wild species and ecosystems (OECD, 2003). It involves the process of protection and conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural habitat (Moore and Tymowski, 2004). Criteria and priorities that attract funds are necessary for conservation (Spellerberg, 1992). The main goal of *in situ* protection is the conservation of eco-systems through developing and maintaining a comprehensive and adequate network of protected areas.

Some important areas have already been proposed by scientists and at workshops (Al Khulaidi and El-Ghouri, 1996; Miller et al, 2006). Amongst these areas are the Jol plateau in the Hadhramaut – to date this has no protection. In 1999 Otuma, in the Western part of Yemen in the province of Dhamar, was the first locality to be declared a protected area in Yemen. Two more will be declared as protected areas shortly (UNEP, 2004), these areas are Jabal Bura' on the SW escarpment mountains and Huf, in the Al Mahara Governorate in the eastern part of the country. These protected areas fall within IUCN Protected Area Category II, under which the area is to be managed mainly for ecosystem protection and recreation (IUCN, 2004, Anon, 1994).

The National Biodiversity Strategy Development Process in Yemen has recently been strengthened by the Global Strategy for Plant Conservation (GSPC), a global initiative, which could have an important impact on conservation in Yemen. Countries, such as Yemen, which are signatories to the Convention on Biological Diversity (CBD) are now also obliged to adhere to the GSPC. The ultimate and long-term objective is to halt the current and continuing loss of plant diversity. Under the GSPC, a series of global targets has to be met by the year 2010.

Plant ecology studies such as this survey will directly help the government of Yemen in reaching some of these targets and thus fulfilling its international commitments. The following three targets are most directly relevant:

Target (1) a widely accessible working list of known plant species.

Target (2) a preliminary assessment of the conservation status of all known plant species, at national, regional and international levels.

Target (3) protection of 50% of the most important areas for plant conservation assured – the most Important Plant Areas (IPAs) for plant diversity are to be identified according to the criteria including endemism, species richness, and/or uniqueness of habitats, including relict ecosystems.

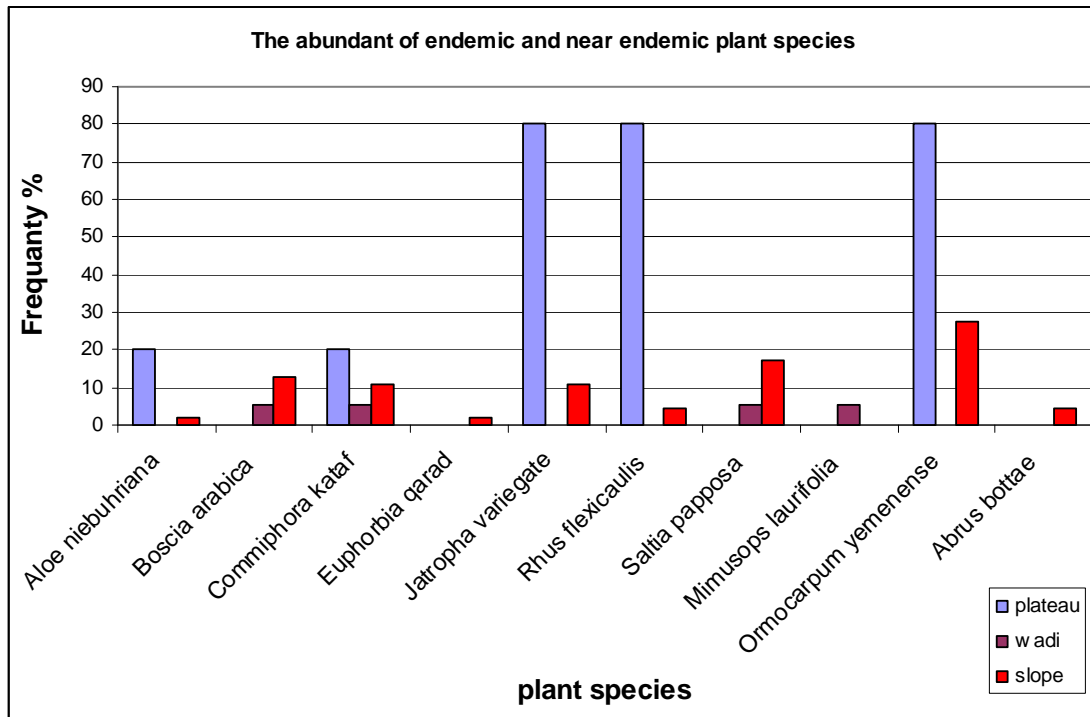
The GSPC is being coordinated in the countries of the Arabian Peninsula by the Arabian Plant Specialist Group (APSG), a Specialist Group of the Species Survival Commission of the IUCN, and consisting of a group of botanists with an interest in the region. The results of this present study will feed directly into the GSPC process, through the APSG.

## 5- Conclusion

The study area represents two different ecosystems of Yemen and both are located within western mountains. One represents the moderate altitude area, more than 1000 m (type 1) and the other represents the low altitude areas, less than 1000 m (types 2 & 3). The vegetation of the study area is almost similar to those of western mountain areas and is characterized by woodland and shrubland dominated by *Acacia* spp. – *Commiphora* spp Community.

The study area holds significant populations of plant species of regional conservation concern, these species are

*Aloe niebuhriana*, *Saltia papposa*, *Rhus flexicaulis*, *Commiphora kataf*, *Boscia arabica*, *Euphorbia qarad*, *Jatropha variegata*, *Abrus botte*, *Ormocarpum yemenense* and *Mimusops laurifolia*. The frequency of these species varies from land form to other, generally none of these species are abundant in the entire region (see Figure 5).



name	plateau	wadi	slope
<i>Aloe niebuhriana</i>	20	0	2
<i>Boscia arabica</i>	0	6	13
<i>Commiphora kataf</i>	20	6	11
<i>Euphorbia qarad</i>	0	0	2
<i>Jatropha variegata</i>	80	0	11
<i>Rhus flexicaulis</i>	80	0	4
<i>Saltia papposa</i>	0	6	17
<i>Mimusops laurifolia</i>	0	6	0
<i>Ormocarpum yemenense</i>	80	0	28
<i>Abrus bottae</i>	0	0	4

Figure 5. The abundant of endemic and near endemic plant species in the study area. The frequency of these species are varies from land form to other. *Ormocarpum yemenense*, *Jatropha variegata* and *Rhus flexicaulis* are more abundant on the rocky plateau of high altitude area. *Commiphora* species is the only species which found on all land forms.

The study area has almost rich flora and can be an example of habitat that represents of low and moderate mountain areas with low inhabitants and considered as very important source of forage for local and Bedouins who come from the costal areas and Tihama foothills. The area has important economic plant species for example forage for animals and bees, source of charcoal, and food, example of that are *Acacia* spp.(8), *Commiphora* spp. (5), *Ficus* spp.(7) and many others (see Table 1).

The rocky plateau at high altitude area that located in the western part of the study area (type 1) holds significant populations of plant species of regional conservation concern, with low diverse (see Appendix 4), but the vegetation cover is

not dense, beside that the area is characterised by high inhabitants and many settlements. The mountain slopes at middle and low altitude areas (types 2 & 3) are more diverse and characterised by dense vegetation cover, fertile wadis, and low inhabitants and settlements. The species *Boscia arabica*, *Euphorbia qarad*, *Salvia papposa*, *Mimusops laurifolia* and *Abrus bottae* are confined to this region, but as scattered and low frequency. Types 2 and 3 are more applicable to be a protected area than type 1.

## 6- Acknowledgement

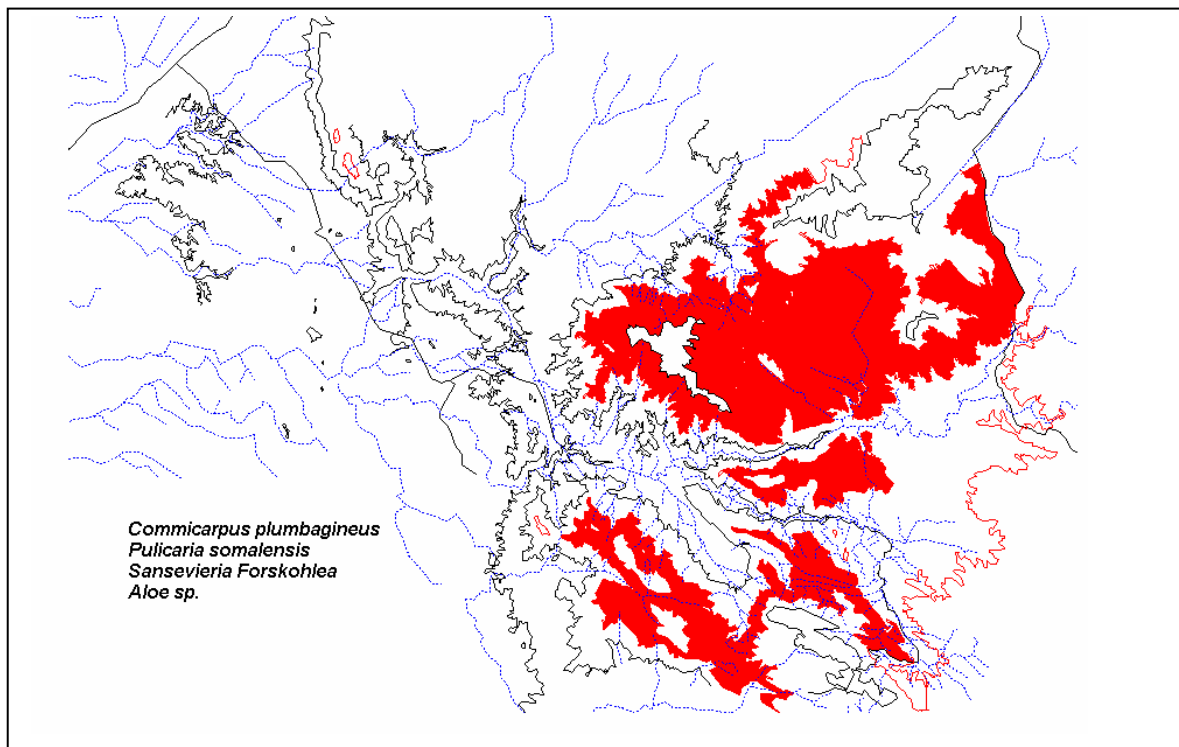
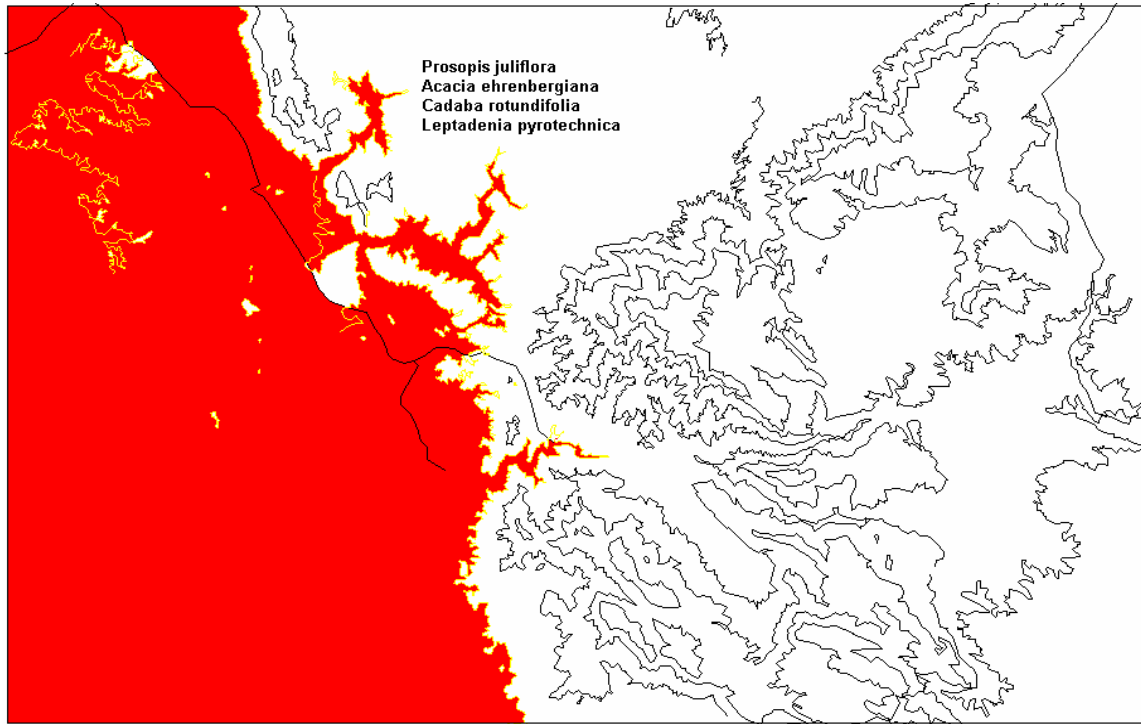
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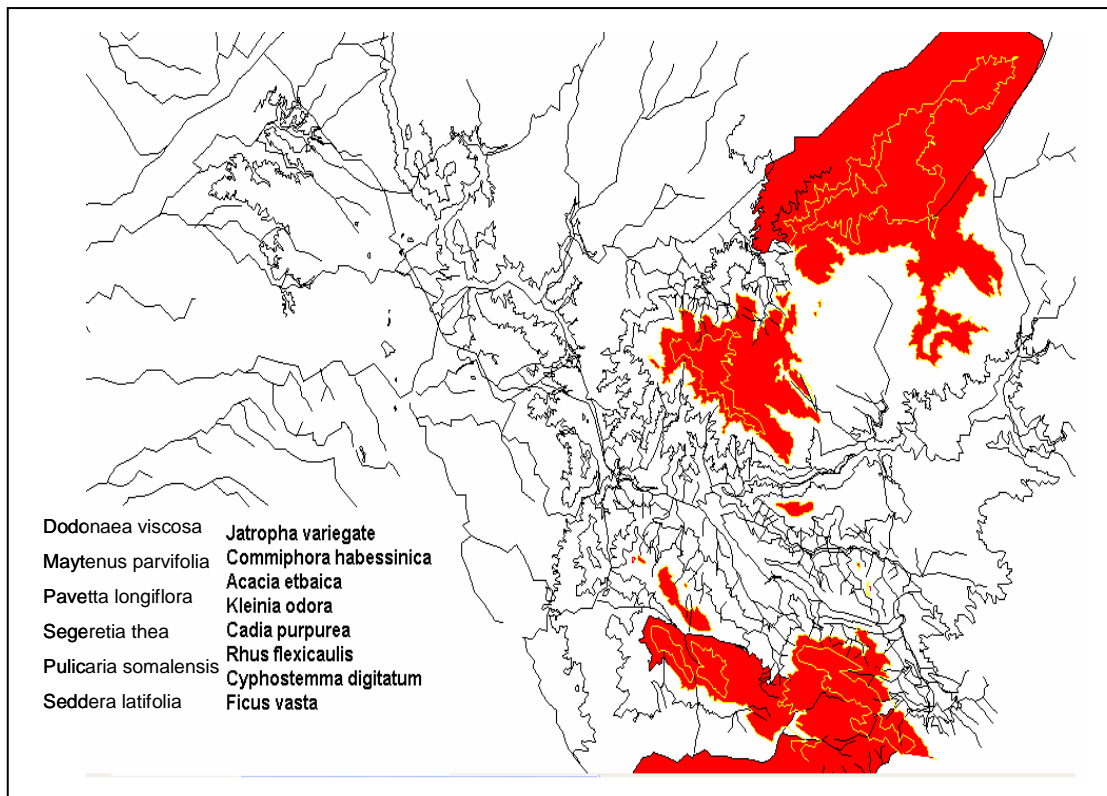
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## 8- Appendixes

### Appendix 1. Distribution maps of important plant species







**Appendix 3. List of the plant species (\* = endemic, \*\* = near endemic)**

1. *Abrus bottae* \*
2. *Abutilon fruticosum*
3. *Acacia asak*
4. *Acacia ehrenbergiana*
5. *Acacia etbaica*
6. *Acacia hamulosa*
7. *Acacia laeta*
8. *Acacia mellifera*
9. *Acacia nilotica*
10. *Acacia tortilis*
11. *Acalypha fruticosa*
12. *Acokanthera schimperi*
13. *Adenium obesum*
14. *Aerva javanica*
15. *Aerva lanata*
16. *Agave sisalana*
17. *Aloe niebuhriana* \*\*
18. *Andropogon* sp.
19. *Anisotes trisulcus*
20. *Annona squamosa*
21. *Aristida* sp.
22. *Arundo donax*
23. *Bacopa monniera*
24. *Barleria acanthoides*
25. *Barleria bispinosa* \*\*
26. *Barleria proxima*
27. *Barleria trispinosa*
28. *Becium filamentosum*
29. *Berchemia discolor*
30. *Blepharis ciliaris*
31. *Boerhavia diffusa*
32. *Boscia arabica* \*\*
33. *Cadaba farinosa*



34. *Cadaba longifolia*
35. *Cadaba rotundifolia*
36. *Cadia purpurea*
37. *Calendula arvensis*
38. *Calotropis procera*
39. *Caralluma* sp.
40. *Cassia senna*
41. *Ceratophyllum demersum*
42. *Chloris virgata*
43. *Cissus quadrangularis*
44. *Cissus rotundifolia*
45. *Combretum molle*
46. *Commicarpus helenae*
47. *Commicarpus plumbagineus*
48. *Commiphora abyssinica*
49. *Commiphora gileadensis*
50. *Commiphora habessinica*
51. *Commiphora kataf*
52. *Commiphora myrrha*
53. *Conyza pyrotechnica*
54. *Corchorus tridens*
55. *Cymbopogon schoenanthus*
56. *Cyphostemma digitatum*
57. *Dactyloctenium scindicum*
58. *Delonix regia*
59. *Dobera glabra*
60. *Dodonaea viscosa*
61. *Ecbolium viride*
62. *Eleocharis geniculata*
63. *Euphorbia cuneata*
64. *Euphorbia inarticulata* \*\*
65. *Euphorbia qarad* \*\*
66. *Fagonia indica*
67. *Fimbristylis cymosa*

68. *Ficus cordata*
69. *Ficus glumosa*
70. *Ficus ingens*
71. *Ficus palmata*
72. *Ficus populifolia*
73. *Ficus sycomorus*
74. *Ficus vasta*
75. *Fleuggia virosa*
76. *Grewia erythraeae*
77. *Grewia schweinfurthii*
78. *Grewia tembensis*
79. *Grewia tenax*
80. *Grewia trichocarpa*
81. *Heliotropium strigosum*
82. *Indigofera arabica*
83. *Indigofera articulata*
84. *Indigofera oblongifolia*
85. *Indigofera* sp.
86. *Indigofera spinosa*
87. *Jatropha curcus*
88. *Jatropha glauca*
89. *Jatropha spinosa*
90. *Jatropha variegata* \*
91. *Justicia odora*
92. *Kanahia laniflora*
93. *Kleinia odora*
94. *Leptadenia pyrotechnica*
95. *Maytenus parvifolia*
96. *Mimusops laurifolia*
97. *Ormocarpum yemenense* \*\*
98. *Pandanus odoriferus*
99. *Pavetta longiflora* \*\*
100. *Pavonia arabica*
101. *Phoenix caespitosa*

102. *Phoenix dactylifera*
103. *Pithecellobium dulce*
104. *Premna resinosa*
105. *Prosopis juliflora*
106. *Pulicaria jaubertii*
107. *Pulicaria somalensis*
108. *Pupalia lappacea*
109. *Rhus flexicaulis* \*\*
110. *Ricinus communis*
111. *Ruellia grandiflora*
112. *Ruellia patula*
113. *Salsola* sp.
114. *Saltia papposa* \*
115. *Salvadora persica*
116. *Sansevieria ehrenbergiana*
117. *Sansevieria forskohlea*
118. *Sarcostemma viminale*
119. *Seddera arabica*
120. *Seddera latifolia*
121. *Segetaria thea*
122. *Selaginella imbricata*
123. *Senna italica*
124. *Senna obtusifolia*
125. *Senna occidentalis*
126. *Solanum incanum*
127. *Stipagrostis hirtigluma*
128. *Tamarix aphylla*
129. *Tamarix arabica*
130. *Tarenna graveolens*
131. *Tetrapogon* sp.
132. *Trichelia emetica*
133. *Turraea parvifolia*
134. *Typha domingensis*
135. *Ziziphus spin-christi*

**Appendix 4. Plant Richness and diversity of the study site**