



Conservation Status of Tree species in Tehsil Takht-e-Nasrati, Karak Pakistan

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Abstract

The present study documents the conservation status of 21 trees belonging to 14 families on small scale in Tehsil Takht-e-Nasrati, Karak through field surveys, frequently conducted in spring, summer and winter 2009-2010. Among these 9 species were found to be rare, vulnerable (6 species), Infrequent (3 species), endangered (one specie) and dominant (2 species). The conservation status of plants is determined according to IUCN 2001, Red Data List Categories and Criteria. After two years extensive field studies on the basis of questioner including availability of plant, collection of plant, growth of plant, plant parts, population size, geographic range and habitat we have concluded that *Salvadora oleoides* is endangered (EN) specie.

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Introduction

The conservation status of organisms indicates whether the group is still extant or not and if yes, how likely the group is to become extant in the near future. Conservation status of a species depends upon many factors like grazing, fuel demand, agriculture land, deforestation, breeding success rates and known threats (Khan, *et al.*, 2011). Based on the sample of species that have been evaluated through 2006, the percentage of endangered species as 40 percent of all organisms has calculated by the International Union for Conservation of Nature (IUCN) (Anon., 2008). Habitat loss and degradation, introduction of alien species, pollution and diseases, over-exploitation and climate change are some threats facing by plants which are an integral part of our ecosystem because native plants are key components of the global biological diversity (Sudhersan *et al.*, 2003). It is estimated that some 270,000-425,000 vascular plant species are already known (Govaerts, 2001) with perhaps a further 10-20% still to be discovered and described (Hawksworth & Kalin-Arroyo, 1995). Pakistan's scenario is not different from the rest of the world. Plant biodiversity is also under tremendous pressure due to its population explosion, unplanned urbanization, deforestation and over-exploitation of natural resources. Unfortunately, very little work has been done on threatened plants of Pakistan and extremely limited information is available on this subject (Alam & Ali, 2009). According to Nasir (1991) 580-650 flowering plant species (i.e. 12%) are expected to be threatened. Chaudhri & Qureshi (1991) reported 709 taxa as threatened plants from Pakistan. However, both these studies are manly based on field observation and literature without any support of quantitative data. In contrast, the recent red list of IUCN (Anon., 2008) only 19 flowering plants species has been listed from Pakistan. Regarding Pakistan previous workers have classified the plant species as threatened or rare on the basis of literature or herbarium specimen. No work has been done according to IUCN red list categories or criteria (Anon., 2001) except Alam & Ali (2009), who

classified *Astragalus gilgitensis* as a Critically Endangered (CR).

The Tehsil Takht-e- Nasrati is situated at 32.47° to 33.28° North and 70.30° to 71.30° East. The research area is bounded by Tehsil Karak on the North East, District Mianwali on the East, District Lakki Marwat on the South West and Tribal area Adjoining District Bannu on the West (Fig. 1). The total area of Tehsil is about 613.66 Sq. kilometers. Majority of the area consists of rigged dry hills and rough fields areas i.e. 323.97 Sq. kilometers and agriculture land is about 289.7 Sq. kilometers. The area is situated at 340 m above the sea level. The major problem of the area is shortage of drinking water and over grazing (Fig.2). The people bring drinking water from the remote area (Fig.3). In the year 2001 - 2010, 121.6mm of rainfall per 10 year recorded. The area is very hot in summer and very cold in winter. June and July are the hottest months, whereas December and January are the coldest months. In the year 2001 - 2010 the mean maximum temperature was 39.5° C, in the month of the June, where as the mean minimum temperature was as low as 4.26° C, in the month of January (Table.1). Write down the aim and necessity of your study here.

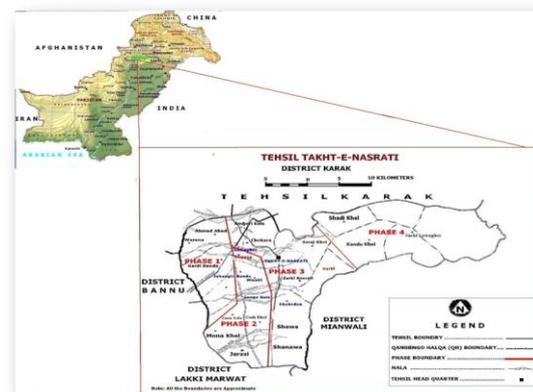


Fig. 1. Map of Tehsil Takht-e-Nasrati, Karak

Materials and methods

Field survey

The study was conducted by frequently surveying in spring, summer and winter during 2009 to 2010. The area is divided into plain and mountain. Habit,

habitat, altitudinal range, population size, distribution range, impacts of multiple threats like habitat destruction, erosion, fuel wood cutting,

grazing, poultry farms and invasive species have been studied for two years in the habitat.

Table. 1. Climatic Data of Tehsil Takht-e-Nasrati, Karak for the year 2001-2010

Months	Temperature (C°)		Humidity (%)		Rainfall (mm)	Soil temperature (C°) Average	Wind speed (Km Per Hour)
	Max	Min	Max	Min			
January	19.18	4.26	75.80	35.24	27.43	7.03	2.9
February	21.69	7.29	77.39	42.23	37.72	9.14	3.2
March	28.20	12.06	75.38	35.23	37.17	13.89	3.5
April	34.74	17.94	66.12	29.42	36.54	19.02	5.2
May	38.32	22.33	59.66	30.73	31.6	21.87	5.4
June	39.50	25.9	59.96	32.89	74.24	25.78	5.5
July	38.44	25.76	73.33	38.76	121.6	26.77	5.2
August	36.66	25.29	75.68	42.61	108.3	26.37	4.1
September	35.47	21.95	77.21	39.29	61.58	23.49	3.7
October	32.33	16.79	71.55	35.51	15.13	20.09	3.5
November	26.71	10.01	71.56	36.66	5.80	14.10	3.2
December	21.93	5.67	75.20	35.90	15.38	8.96	3.1
Mean	31.1	16.27	71.57	36.21	47.71	18.04	4.04

Source: Agricultural Research Farm Ahmadwala Karak.

Plant collection and determination

Plant specimens were collected from different parts of research area. The population size was determined by counting the mature individuals. The seedlings were also counted separately. Nature of habitat was analysed by soil erosion, invasive species and impacts of anthropogenic activities.

Questioner development

Information on demographic (age, gender) and conservation status was gathered from each site by using a semi-structured questionnaire. Information about the availability of plant, collection of plant, growth of plant, plant parts i.e. root, stem etc, local uses of the species as medicinal, fuel wood, timber and fodder etc were obtained through random sampling by interviewing more than 1000 respondents from different aged and young gender and sex. During survey personal observation was also recorded. The data was collected through following formula:

$$CSP = A + C + G + P$$

Where

CPS = Conservation status of Plants

A = Availability of plant species

C = Collection of plant species

G = Growth of plant species

P = Part used of plant species

Analysis of data was made with the help of group discussions and questioners among different age classes of research area that include both genders of the society. The data was classified, tabulated, analyzed and concluded for final report.

Conservation classes

The plants were divided into following 5 classes on the basis of conservation status:

1. Endangered species: The specie which are few in number in the area due to environmental factors and they may be at risk.
2. Vulnerable species: The specie which is unprotected against any attack in the area.
3. Rare species: The specie which is very rare in the area.
4. Infrequent species: The specie which is common in the area.
5. Dominant species: The specie which is very common in the area.



Fig. 2a. The lesser the vegetation, greater depth of wells.



Fig. 2b. Deepening of well due to low water level.

Result

In the present study the conservation status of trees were determined in research area. Total 21 species belonging to 14 families were found. The Mimosaceae with 4, Moraceae, Myrtaceae, Rhamnaceae and Tamaricaceae with 2, Caesalpiniaceae, Cappariaceae, Celastraceae, Meliaceae, Palmae, Papilionaceae, Punicaceae, Salvadoraceae and Sapotaceae with single specie (Table.2). The plants were divided on the basis of conservation into five classes i.e. endangered, vulnerable, rare, infrequent and dominant. In the present investigation the 9 species were found to be rare, vulnerable (6 Spp) Infrequent (3 Spp), dominant (2 Spp) and single specie was endangered.

Discussion

The area is mostly divided into hilly area, sandy soils, floody river banks and plain with limestone silt.

From the present investigation, it is noticed that each species have confined to a narrow distribution range and specific habitat. With the changes in environment, plant life habitat was disturbed. A large scale stone excavation and road construction activity was the major cause of disturbance and destruction in the habitat of plant in the area. Gully erosion (Fig.4) was causing a severe damage during rains, individuals of plants species growing in sandy and river bank were found more prone to erosion than the plants found on rocky slopes and cliffs. Our observations were agreed with the workers (Myers, 1988) and he reported that species were almost similar habitats from other parts of the world.

The invasion of invasive species change habitat in the plain area. In research area *P. juliflora* was found as invasive species. According to Huston, (1994) the invasion of invasive species is widely considered as second greatest cause of species endangerment and extinction after habitat loss around the globe. The invasion of *P. juliflora* was a great ecological problem in the area and it changed the habitat of native plant life. *P. juliflora* was also observed as aggressively growing invasive species in the habitat of native plant life. However, concentration of the population was mostly found on plain areas rather than hilly area (Fig.5). The process is still occurring in South Africa, Australia and coastal Asia (Pasiiecznik, 1999) and having serious consequences on ecological, economic and social systems (Primental, *et al.*, 2000). Due to devastating effects of *P. juliflora*, it has been included in the IUCN's list of 100 world's worst invasive species (Pallewatta, *et al.*, 2003). According to El-Keblawy & Al-Rawai (2007) *P. juliflora* is causing extirpation of the native flora, resulting in the reduction of species richness and diversity. Noor *et al.*, (1995) reported that *P. juliflora* is playing a vital role in Pakistan in the elimination of natural vegetation due to its allelopathic effects.

The most ecological problem in the area is dryness. The area is very hot in summer and cold in winter. The rain is very scanty in the area (Table.1). Due to

dryness the herbs species are very rare because the plants cannot reached to their reproductive stage in the area and the animal directly depend upon the tree species. According to Baggs & Maschinski, (2000) population size is often affected by dry periods during the growing season, when plants may not produce any viable seed and there will be no

natural recruitment. No natural recruitment was observed in *S. oleoides* during the present studies. Hence, it is concluded that the population sizes of rare trees are continuously reducing at an alarming rate, without having natural recruitment.

Table.2. List and conservation status of trees in Takht-e-Nasrati, Karak.

Species Name	Family	Conservation classes				
		E	V	R	I	D
<i>Acacia modesta</i> Wall.	Mimosaceae	-	-	-	+	-
<i>Acacia nilotica</i> (L.) Delice.	Mimosaceae	-	-	-	+	-
<i>Albizia lebbeck</i> (L.) Benth.	Mimosaceae.	-	-		+	-
<i>Capparis deciduas</i> (Forssk). Edge worth.	Capparidiaceae	-	-	+	-	-
<i>Dalbergia sissoo</i> Roxb.	Papilionaceae	-	-	+	-	-
<i>Eucalyptus globules</i> L.	Myrtaceae	-	-	+	-	-
<i>Eucalyptus lanceolatus</i> L	Myrtaceae	-	-	+	-	-
<i>Gymnosporia royleana</i> Wall.	Celastraceae	-	+		-	-
<i>Melia azedarach</i> L.	Meliaceae.	-		+	-	-
<i>Monothecha buxifolia</i> (falk) A.DC.	Sapotaceae.	-	+	-	-	-
<i>Morus alba</i> L.	Moraceae	-	+	-	-	-
<i>Morus nigra</i> L.	Moraceae	-	-	+	-	-
<i>Parkinsonia aculeate</i> L.	Caesalpinaceae	-	+		-	-
<i>Phoenix dactylifera</i> L.	Palmae	-	-	+	-	-
<i>Prosopis juliflora</i> (Sw.) DC.	Mimosaceae	-	-	-	-	+
<i>Punica granatum</i> L.	Punicaceae	-	-	+	-	-
<i>Salvadora oleoides</i> Decne.	Salvadoraceae.	+	-		-	-
<i>Tamarix aphylla</i> (L.) Karst.	Tamaricaea	-	+		-	-
<i>Tamarix decidua</i> Roxb.	Tamaricaea	-	+		-	-
<i>Zizyphus maurtiana</i> Lam.	Rhamnaceae	-	-		-	+
<i>Zizyphus oxyphylla</i> Edgew	Rhamnaceae	-	-	+	-	-

E: Endangered, V: Vulnerable, R: Rare, I: Infrequent, D: Dominant

Cutting of trees was ecological problem in the area due to the demand of fodder and fuel. The people of the area were very poor and due to unavailability of natural gas the local communities depend upon the native trees for both purposes (Fig.6). According to (Hirway & Goswami, 2007; Engler, 2008) over-exploitation of plant species for fodder and fuel purpose by local communities and nomads is a complex problem and a major cause of plant extinction. Regarding impacts of unsustainable use of

plant species, no accurate information has been published (Davis, *et al.*, 1995) but there is no doubt about its consequences. Another major concern is that local inhabitants and commercial scale poultry farms have no access to the natural gas and electricity for maintaining their living. Fuel wood chopping exercise is quite prominent in the habitat of tree species, thus badly affecting its population and in next decat the rare tree will become vulnerable. Rabinowitz, (1981) suggests that those species which

are found over a wide geographic range but are consistently rare throughout their distribution need immediate attention as they are more vulnerable from extinction point of view.



Fig. 3. In search of water that becomes extinct due to use of natural resource.



Fig.4. Gully erosion is common in area excessive.

Grazing is another ecological problem observed, more in hilly area than plain area to change the habitat of native flora. Grazing activity was observed in the habitat (Fig. 8), but its impact was quite prominent and devastating for tree species. Uncontrolled and expanding grazing activities have a deep and long term impact on the local vegetation and it is disastrous for the local plant wealth which is already in stress. It was also observed that the erosion was increased proportionally with increasing the grazing. According to Pieper, (1994) impact of grazing ranges from almost undetectable removal of plant material to severe depletion of vegetational resources and extensive erosion.



Fig. 5. *P. juliflora* was found as invasive species in plain.



Fig. 6. Cutting of trees so bad for growth.

Many threatened plant species are predisposed to threat due to their small population sizes (Rabinowitz, 1981; Kruckeberg & Rabinowitz, 1985). The conservation status of a species was mainly based on the number of mature individuals of some species. The current study was conducted, according to the IUCN red list categories and criteria (Anon., 2001), which describes in detail that if population size is fewer than 250 mature individuals with a continuous decline in their number along with no sub-populations, making the tree species eligible to be placed under Critically Endangered (CR) category. *S. oleoides* (Fig. 9) with a population size of 11 is placed under Critically Endangered category and is under threat of extirpation. These findings suggest that low population size along with continuous decline in their numbers without having any subpopulations is critical for its survival.



Fig. 7. Soil erosion due to deforestation.



Fig. 8. Uncontrolled grazing.



Fig. 9. *S. oleoides* present in graveyard.



Fig. 10. A view of research area.

The conservation status of tree species was determined on the basis of geographic range and number of localities. From the point of view of number of localities the *S. oleoides* was reported from single locality in the research area. Based on the small geographic range and single locality, *S. oleoides* was placed under Endangered Category. According to Anon., (2001), the conservation status of a trees species was also based on the geographic range and number of localities/sub-populations. The categories and criteria clearly explain that if a plant species had less then 500 km² extent of occurrence with one locality or severely fragmented localities should be considered as Endangered (EN) in addition to other parameters. These findings according to IUCN criteria suggest that the restricted distribution range of concerned *S. oleoides* and other rare tree species in a single locality is critical for its survival. On the basis of multiple threats i.e., habitat specificity, restricted distribution range, habitat loss through commercial scale stone excavation activities, invasion of invasive species i.e., *P. juliflora*, over exploitation in the form of grazing and fuel wood cutting and low population size along with negligible natural recruitment, the current study concluded that *S. oleoides* was highly prone to extirpation and eligible to be placed under Endangered (EN) category and other rare tree were protected from vulnerable species. The result was similar with that of Khan *et al.*, (2011). In context with global biodiversity, conservation of a rare species at national level is very important. Hence, urgent conservation steps should be taken as suggest below, to avoid its extirpation from research area.

1. The *S. oleoides* should be included in the Red Data list of threatened species for Takht-e-Nasrati, Pakistan.
2. Conservation status assessment of *S. oleoides* and other rare trees in other area of Pakistan should also be initiated to assign the category in international perspective.
3. Efforts should be made to protect *S. oleoides* by minimizing anthropogenic activities in the habitat

(i.e. stone excavation, wood cutting, grazing and poultry business).

4. Seeds of *S. oleoides* and other trees should be preserved in local seed banks (if not present, should be infrastructured) and also distributed to other regional conservation organizations so that in case of any natural disaster it can be protected and recovered.

5. Alternate environmental and sustainable jobs should be provided for the local inhabitants to prosper their living standard.

6. Alternate means of energy like electricity and natural gas should be provided in the area to avoid wood cutting.

7. The study of plant conservation status should be done on small scale in Pakistan to aware the citizen from the importance of plant life.

Annexure 1
Conservation status of Plants
Criterion for the Selection of Species

Local Name: Botanical Name

Availability	Collection
0 = Uncommon or very rare	0 = More than 1000kg/yr
1 = Less common or rare	1 = Consumed from 500-1000kg/yr
2 = Occasional	2 = Consumed from 300-500kg/yr
3 = Abundant	3 = Consumed from 100-200kg/yr
Growth	Part used
0 = Regrowth in more 3 years	0 = Root/Whole plant
1 = Regrowth within 3 years	1 = Bark
2 = Regrowth within 2 years	2 = Seeds, Fruits
3 = Regrowth within 1 year	3 = Flowers
4 = Regrowth in a season	4 = Leaves/Gum/Latex

Total Score for plant conservation

0 - 4 =	Endangered
5 - 8 =	Vulnerable
9 - 12 =	Rare
13 - 14 =	Infrequent
15 - 16 =	Dominant

Conclusion

The method and technique of hybridization and grafting should be introduced which will be a good effort in conservation and expansion of many species. A lot of fruits, especially *Zizyphus* species, *M. buxifolia* and *A. nilotica* are wasted annually due to non-availability of market. The market availability has good effect on plants and on people. Medicinal farm should be set up in the study area to promote

the vital importance of the plants and its conservation. The plants should be introduced in botanic gardens for public display and exhibition. Alternate means of energy like electricity and natural gas should be provided in the area to reduce the wood cutting activities.

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