

Full Length Research Paper

Conservation status of plant species in Tehsil Takht-e-Nasrati, District Karak, Khyber Pakhtun Khawa, Pakistan

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In the present study, the conservation status of 45 species belonging to 26 families of 22 trees and 23 shrubs were determined on the basis of IUCN conservation criteria in Tehsil Takht-e-Nasrati, District Karak, which was conducted in spring, summer and winter 2010 to 2011. There were 20 (44.44 %) vulnerable, 16 (35.56 %) rare, 7 (15.56 %) endangered and 2 (4.44 %) were infrequent. After two years extensive field studies on the basis of IUCN conservation criteria, we concluded that *Gymnosporia royleana* is endangered (EN) species. From the study, it was concluded that extinction and declines in plant diversity is due to a range of factors including population growth, high rates of habitat modification and deforestation, over-exploitation, the spread of invasive alien species, pollution and climate change.

Key words: Conservation, tree, shrubs, Tehsil Takht-e-Nasrati, Pakistan.

INTRODUCTION

Habitat loss and degradation, introduction of alien species, pollution and diseases, over-exploitation and climate change are some threats faced by plants which are an integral part of our ecosystem because native plants are key components of the global biological diversity (Sudharsan et al., 2003). Conservation status of a species depends upon many factors like grazing, fuel demand, agriculture land, deforestation, breeding success rates and known threats. Based on the sample of species that have been evaluated through 2006, the percentage of endangered species as 40 percent of all organisms was calculated by the International Union for Conservation of Nature (IUCN) (Anon, 2008). It is estimated that some 270,000 to 425,000 vascular plant species are already known (Govaerts, 2001) with perhaps a further 10 to 20% still to be discovered and described (Hawksworth and 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 extreme-

ly limited information is available on this subject (Alam and Ali, 2009). According to Nasir (1991), 580 to 650 flowering plant species (12%) are expected to be threatened. Chaudhri and Qureshi (1991) reported 709 taxa as threatened plants from Pakistan. However, both these studies are mainly based on field observation and literature, without any support of quantitative data. In contrast, in 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 and Ali (2009), who classified *Astragalus gilgiteensis* as a Critically Endangered (CR). Khan et al. (2011) shows the conservation status of Tehsil Karak while Khan et al. (2012) shows the the conservation status of trees in Tehsil Karak.

Research area

The Tehsil Takht-e-Nasrati is situated 32.47° to 33.28° at 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

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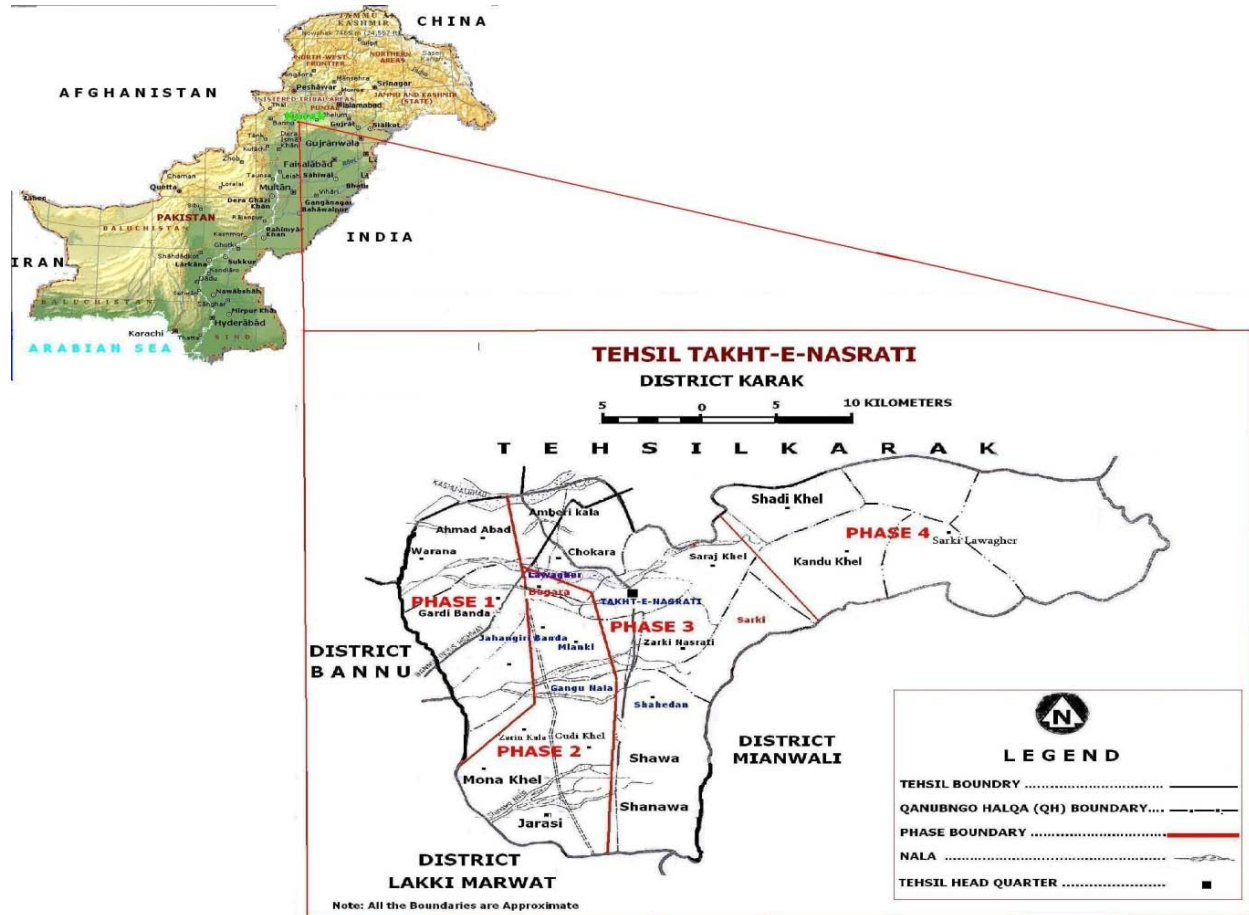


Figure 1. Map of Tehsil Takht-e-Nasrati, Karak.

West and Tribal area Adjoining District Bannu on the West (Figure 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. (323.97 Sq. kilometers) and the 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. The people bring drinking water from the remote area. In year 2001 to 2010, 121.6 mm of rainfall per 10 year was 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 year 2001 to 2010, the mean maximum temperature was 39.5° C, in the month of the June, whereas the mean minimum temperature was as low as 4.26°C, in the month of January (Figure 2) (Khan, 2012).

MATERIALS AND METHODS

Field survey

The study was conducted by frequent surveying in winter, spring and summer during 2010 to 2011. The area was divided into plain and mountain. Habit, habitat, altitudinal range, population size, dis-

tribution range, impacts of multiple threats like habitat destruction, erosion, fuel wood cutting, grazing, poultry farms and invasive species were studied for two years in the habitat.

Plant collection and determination

Plant specimens were collected from different parts of Tehsil Takht-e-Nasrati. 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.

Biodiversity conservation criteria

The conservation status of plants was determined according to IUCN 2001, Red Data List Categories and Criteria (Table 1). Analysis of data was made with the help of group discussions and questionnaires among different age classes of Tehsil Takht-e-Nasrati that include both genders of the society. The data was classified, tabulated, analyzed and concluded for final report.

RESULTS AND DISCUSSION

Tehsil Takht-e-Nasrati is unfamiliar in all features of plant life and no effort has been done concerning taxa restora-

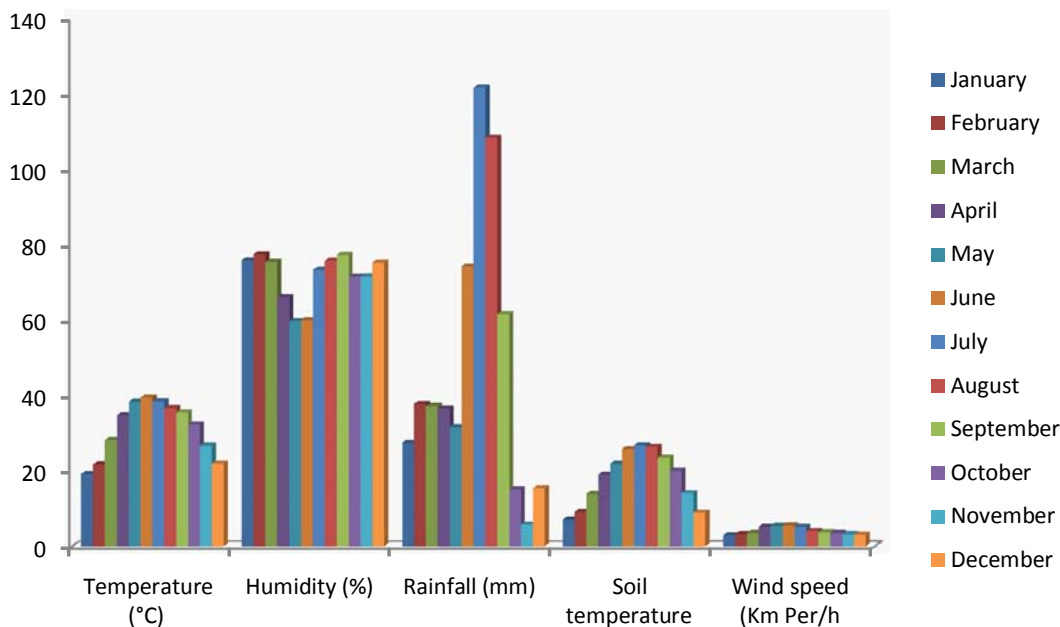


Figure 2. Climatic Data of Tehsil Takht-e-Nasrati, Karak for the year 2001 to 2010.

Table 1. IUCN 2001, red data list categories and criterion for the selection of species.

Local Name:	Botanical Name
Availability	Collection
0 = Uncommon or very rare	0 = More than 1000 kg/yr
1 = Less common or rare	1 = Consumed from 500-1000 kg/yr
2 = Occasional	2 = Consumed from 300-500 kg/yr
3 = Abundant	3 = Consumed from 100-200 kg/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

tion and biodiversity conservation. It is populated and composed of numbers of settlement. It is one of the exploited area of Khyber Pakhtun Khawa. People depend on plant life for their individual provisions. Tree and shrubs species are also a source of their livelihood. Locals harshly cut off the plants and use it as a source of

their income. In the present study, the conservation status of 45 species belonging to 26 families of 22 trees and 23 shrubs were determined on the basis of IUCN conservation criteria. There were 20 (44.44 %) vulnerable, 16 (35.56 %) rare, 7 (15.56 %) endangered and 2 (4.44 %) were infrequent (Table 2, Figure 3).

Table 2. Floristic list and conservation status of shrubs and tree species of Tehsil Takht-e-Nasrati, District Karak.

Specie	Availability				Collection				Growth					Plant used					Total score	Status
	0	1	2	3	0	1	2	3	0	1	2	3	4	0	1	2	3	4		
<i>Acacia modesta</i> Wall.	-	-	2	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	9	Rare
<i>Acacia nilotica</i> (L.) Delice.	-	-	2	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	9	Rare
<i>Albizia lebbbeck</i> (L.) Benth.	-	-	2	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	9	Rare
<i>Alhagi maurorum</i> Medic.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	-	-	4	11	Rare
<i>Astragalus psilocentros</i> Fisch.	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infrequent
<i>Calligonum polygonoides</i> L.	-	-	2	-	0	-	-	-	-	-	2	-	-	0	-	-	-	-	4	Endangered
<i>Calotropis procera</i> (Wild) R.Br.	-	-	-	3	-	-	-	3	-	1	-	-	-	-	-	-	-	4	11	Rare
<i>Capparis decidua</i> (Forssk). Edgeworth.	-	1	-	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	8	Vulnerable
<i>Capparis spinosa</i> L.	-	1	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-	4	9	Rare
<i>Cassia angustifolia</i> Vahl.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	2	-	-	9	Rare
<i>Dalbergia sissoo</i> Roxb.	-	1	-	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	8	Vulnerable
<i>Datura metel</i> L.	-	-	-	3	-	-	-	3	-	-	-	-	4	-	-	-	3	-	13	Infrequent
<i>Dodonaea viscosa</i> L.	-	1	-	-	-	1	-	-	-	-	2	-	-	0	-	-	-	-	4	Endangered
<i>Eucalyptus globules</i> L.	-	1	-	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	8	Vulnerable
<i>Eucalyptus lanceolatus</i> L	-	1	-	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	8	Vulnerable
<i>Gymnosporia royleana</i> Wall.	-	1	-	-	0	-	-	-	-	-	-	3	-	0	-	-	-	-	4	Endangered
<i>Melia azedarach</i> L.	-	1	-	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	8	Vulnerable
<i>Monothecha buxifolia</i> (Falk) A.DC.	-	1	-	-	-	1	-	-	-	-	-	3	-	0	-	-	-	-	5	Vulnerable
<i>Morus alba</i> L.	-	1	-	-	0	-	-	-	-	-	-	3	-	0	-	-	-	-	4	Endangered
<i>Morus nigra</i> L.	-	1	-	-	0	-	-	-	-	-	-	3	-	0	-	-	-	-	4	Endangered
<i>Ocimum basilicum</i> L.		1			0								4	0					5	Vulnerable
<i>Opuntia ficus indica</i> (L.) Mill.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	2	-	-	9	Rare
<i>Otostegia Limbata</i> (Benth) Boiss.	-	1	-	-	-	-	-	3	-	-	2	-	-	-	-	-	-	4	10	Rare
<i>Parkinsonia aculeate</i> L.	-	1	-	-	-	1	-	-	-	-	-	3	-	0	-	-	-	-	5	Vulnerable
<i>Periploca aphylla</i> Decne.	-	-	2	-	-	-	2	-	-	-	-	3	-	-	1	-	-	-	8	Vulnerable
<i>Phoenix dactylifera</i> L.	-	1	-	-	0	-	-	-	-	-	-	3	-	-	-	-	-	4	8	Vulnerable
<i>Prosopis farcta</i> (Banks & Sol.) J.F. Macbr.		1			0							3		0					4	Endangered

The biodiversity of vulnerable species of the area included *Saccharum bengalense*, *Saccharum spontaneum*, *Periploca aphylla*, *Rhazya stricta*, *Vitex negundo*, *Zizyphus nummularia*, *Monothecha buxifolia*, *Tamarix aphylla*, *Tamarix decidua*, *Capparis decidua*, *Dalbergia sissoo* and *Melia azedarach*. Hamayun et al. (2006) reported

the conservation status of taxa and described that 49% of medicinal plants are threatened in the area due to unsustainable cropping and increased mistreatment of plant life. In the same way, Ahmad et al. (2006) and Shaheen et al. (2011) observed that the Himalayan forests which is exceptional property for researcher use changes

driven by increasing anthropogenic activities and fast population growth of human being. It is recognized that locals regularly used wood as fuel of the forest and this endemic species in Turkey in which the least concern composed of 56 species, near threatened was 9 spp. and vulnerable risk categories was 4 is the major reason of plant life

Table 2. Contd.

<i>Prosopis juliflora</i> (Sw.) DC.	-	-	2	-	0	-	-	-	-	-	3	-	-	-	-	4	9	Rare
<i>Punica granatum</i> L.	-	-	2	-	-	1	-	-	-	-	3	-	-	-	-	4	10	Rare
<i>Rhazya stricta</i> Decne.	-	-	2	-	-	1	-	-	-	1	-	-	-	-	-	4	8	Vulnerable
<i>Ricinus communis</i> L.	-	-	2	-	-	-	2	-	-	-	-	-	-	2	-	-	10	Rare
<i>Rosa indica</i> L.	0	-	-	-	-	-	-	3	-	-	3	-	-	2	-	-	8	Vulnerable
<i>Saccharum bengalense</i> Retz.	-	-	-	3	-	-	-	3	0	-	-	-	0	-	-	-	6	Vulnerable
<i>Saccharum spontaneum</i> L.	-	-	2	-	-	-	-	3	-	1	-	-	0	-	-	-	6	Vulnerable
<i>Salvadora oleoides</i> Decne.	-	-	2	-	0	-	-	-	-	-	2	-	0	-	-	-	4	Endangered
<i>Tamarix aphylla</i> (L.) Karst.	-	-	2	-	0	-	-	-	-	-	-	3	-	-	2	-	7	Vulnerable
<i>Tamarix decidua</i> Roxb.	-	-	2	-	0	-	-	-	-	-	-	3	-	-	2	-	7	Vulnerable
<i>Vites vinifera</i> L.	0	-	-	-	-	-	-	3	-	-	-	3	-	-	2	-	8	Vulnerable
<i>Vitex trifolia</i> L.	-	-	2	-	-	-	-	3	-	1	-	-	-	-	2	-	8	Vulnerable
<i>Vitex negundo</i> L.	-	-	2	-	-	-	-	3	-	1	-	-	-	-	2	-	8	Vulnerable
<i>Withania coagulans</i> (Stocks) Dunal.	-	-	2	-	-	-	-	3	-	-	2	-	-	2	-	-	9	Rare
<i>Withania somnifera</i> (L.) Dunal.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	2	-	9	Rare
<i>Zizyphus maurtiana</i> Lam.	-	-	-	3	0	-	-	-	-	-	-	3	-	-	-	4	10	Rare
<i>Zizyphus nummularia</i> (Burm.f.) W.&A.	-	-	2	-	-	1	-	-	-	1	-	-	-	-	2	-	5	Vulnerable
<i>Zizyphus oxyphylla</i> Edge.	-	-	2	-	-	1	-	-	-	-	-	3	-	-	-	4	10	Rare

removal. The severe grazing and land used for agriculture also provide the shocking picture of the area. In the investigated area, the need for plant for fuel wood caused severe deforestation. Hamayun et al. (2006) reported that in Gabral and Utr valley, 17.61% are threatened species in which 5.67% species are vulnerable, 4.5% are endangered 4.5% are rare and 2.8% are near threatened.

The rare biodiversity of plant species of the investigated area includes *Acacia modesta*, *Acacia nilotica*, *Albizia lebbeck*, *Prosopis juliflora*, *Zizyphus maurtiana*, *Zizyphus oxyphylla*, *Capparis spinosa*, *Cassia angustifolia*, *Opuntia ficus indica*, *Withania coagulans*, *Withania somnifera*, *Otostegia limbata*, *Punica granatum*, *Ricinus communis*, *Calotropis procera* and *Alhagi maurorum*. Bocuk et al. (2009) reported 77 spp.

Land use and ruthless grazing are usually regarded to be the inexpensive way of developing plant life. On the basis of IUCN 2001, Red data list criteria, the *Cadaba heterotricha* was classified as endangered species by Abbas et al. (2010). In Battagram, the conservation status of critically endangered species was also determined by Haq (2011).

The endangered species included *Morus nigra*, *Prosopis farcta*, *Salvadora oleoides*, *Gymnosporia royleana*, *Morus alba*, *Calligonum polygonoides* and *Dodonaea viscosa*. Plants are important source and have vast impact on environment and have a vital role in socio economic conditions of the people. The locals use the plant species for different purposes like medicinal, fuel, agriculture, etc. So, it is not easy to identify that how many taxa are threatened in the area. According to

IUCN threatened plant data base, about 32,000 taxa are threatened with extermination. This number represents 13% of estimated 250,000 of plants. Hamayoun (2005) reported 92 threatened plant species in which 28 species are endangered; 40 Spp are vulnerable and 24 species are rare. In the present study, the hilly areas are under severe biotic pressure. The conservation status show that mostly trees are under harsh biotic situation. No regeneration was observable for the shrubs and trees due to the high grazing pressure and important fruiting has been recorded and regeneration looks to be entirely missing. Ghazanfar and Osborne (2010) studied the conservation status of plant species and reported that the area consist of usually a few shrubs and trees that have tolerated pressure of grazing animals and those that are inedible to goats and camel. Ubom

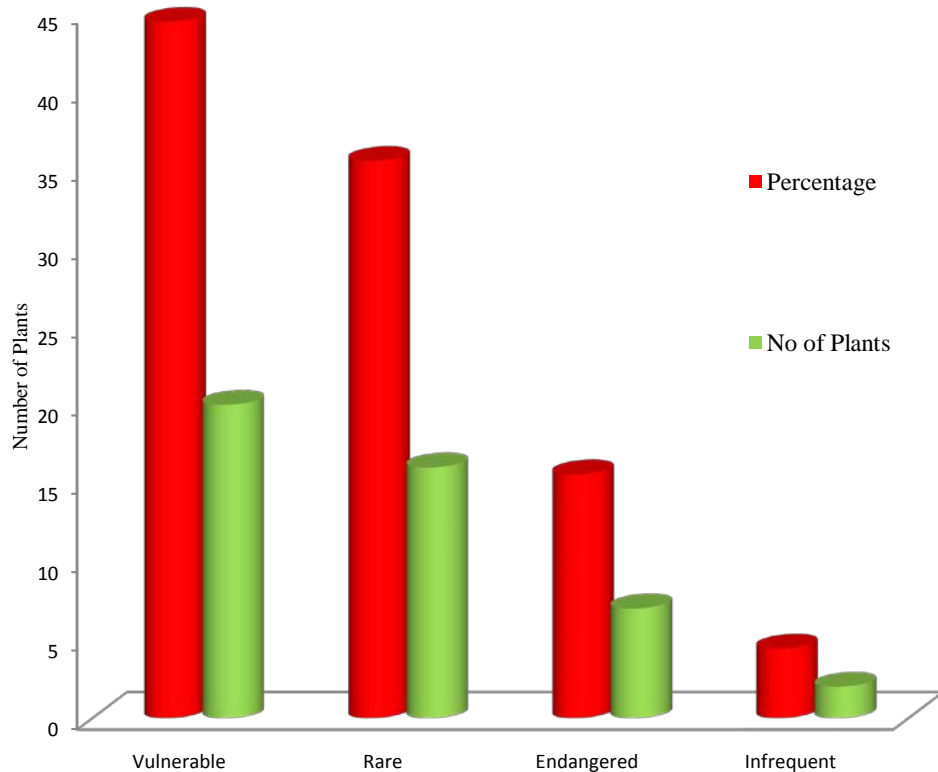


Figure 3. Conservation status of shrubs and tree species of Tehsil Takhti-e-Nasrati, District Karak.

(2010) identified 339 species in the Niger Delta, Nigeria in which 32 were endemic and 23 were endangered. Al-Quran (2011) studies the threatened status of medicinal plants of Ajloun, Jordan in which 31 species were non endangered species, 5 were vulnerable and 5 endangered that is *Alchemilla vulgaris*, *Crocus hyemalis*, *Pistacia palaestina*, *Rubia tinctorum* and *Salvia triloba* while four were critically endangered such as *Eryngium creticum*, *Majorana syriaca*, *Mandragora autumnalis* and *Matricaria aurea*. Ali et al. (2012) declared that *Delphinium nordhagenii* is an endemic species in District Chitral, Pakistan.

The infrequent species comprised of *Datura metel* and *Astragalus psilocentros*. In the investigated area, over grazing, deforestation, unplanned collection, erosion, effects of introduced species, attack of pathogens and loss of habitat were the main threats to the plant life. 37 plant species comprising 14 critically endangered and endangered (23 spp.) were reported by Haq (2011).

According to IUCN Red list categories and criteria conservation, statuses of 19 species were given by Alam and Ali (2009). Hilton-Taylor (2000) and Akeroyd (2002) stated that rate of plant loss has reached to one species per day as a result of anthropogenic activities and this is judged 100 to 10,000 times quicker than would occur naturally. Akeroyd (2002) and Bramwell (2002) stated that in the near future, 60,000 and 100,000 taxa may

withdraw if the inclinations remain constant. According to IUCN Red List categories and criteria 2001, *Gaillonia chitralensis* is considered endemic species to Chitral district by Ali and Qaiser (2009). Hence, urgent conservation steps should be taken as suggested below, avoiding its extirpation from Tehsil Takht-e-Nasrati, Pakistan:

1. The *Gymnosporia royleana* should be included in the Red Data list of threatened species for Takht-e-Nasrati, Pakistan.
2. Conservation status assessment of the *S. oleoides* and other rare tree species in other area of Pakistan should also be initiated to assign the category in international perspective.
3. Efforts should be made to protect the *S. oleoides* by minimizing the anthropogenic activities in the habitat (stone excavation, fuel wood cutting, grazing and poultry business).
4. Alternate environmentally friendly jobs should be offered for the local people for maintaining their living properly.
5. Alternate means of energy like electricity and natural gas should be provided in the area to reduce the wood cutting activities.
6. The plant conservation study condition should be done on small scale in Pakistan.

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 botanical gardens for public display. 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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