

Zamin M., Adnan M., Begum S., Murad W., Khan S., 2025. Plant species richness and conservation status of protected and unprotected areas of Kohat District, Northern Pakistan

Table S1 National and international conservation status of the studied plant species.

Botanical name	Locality (area/country)	Conservation status (present study)	Reason	Recommendation for improvement	Conservation status (Red list)	Remarks	Citation(s)
<i>Senegalia modesta</i>	Malakand/Pakistan	Endangered (EN)	Improper way of plant collection, unwanted incidental fire, unsustainable and unscientific use.	In-situ conservation, and sustainable use.		Not Available (NA)	(Zahir et al. 2018)
	Chamla Valley/Pakistan	Near Threatened (NT)	Excessive use, climate change, overpopulation, market pressure and deforestation.	Government and NGOs need to implement strong programs, with the participation of local people for the conservation and plantation of <i>S. modesta</i> .	Not Evaluated (NE)	Not Available (NA)	(Khan et al. 2019)
	Takht Bhai, Mardan/Pakistan	Endangered (EN)	Urbanization, agricultural and collection for medicinal purposes.	Government must take steps to control the conversion of non-cultivable areas from urbanization and agriculture.		Not Available (NA)	(Khan & Musharaf 2015)
	Mohmand Agency / Pakistan	Vulnerable (VU)	Anthropogenic disturbances and overgrazing.	Not Available (NA).		Not Available (NA)	(Khalid & Shah 2016)
	Malakand/Pakistan	Endangered (EN)	Improper way of plant collection, unwanted incidental fire, unsustainable and unscientific use.	In-situ conservation, and sustainable use.	Least Concern (LC)	Not Available (NA)	(Zahir et al. 2018)
<i>Vachellia nilotica</i>	Shangla/Pakistan	Endangered (EN)	Grazing, land use, deforestation, rapid human, and population growth.	Ex-situ conservation (Establishment of nurseries and botanical garden) in-situ conservation (local community awareness and involvement in protection).		Not Available (NA)	(Shah & Hussain 2012)
	Southern Pakistan	Critically Endangered (CR)	Habitat destruction, soil erosion, grazing and invasive species.	Minimize anthropogenic activities, introduce botanic gardens for public display, store preserved seeds in local seed banks, and use alternative energy means.	Least Concern (LC)	<i>Acacia nilotica</i> subsp. <i>hemispherica</i> .	(Abbas et al. 2013)
	Himalaya/Pakistan	Critically Endangered (CR)	Medicinal potential commercialization.	Conserving and managing these critical species is crucial to preventing their extinction.		Not Available (NA)	(Hussain et al. 2016)
	Hindu Kush Mountain/Pakistan	Vulnerable (VU)	Overexploitation, soil erosion, and climatic changes.	Appropriate strategies are needed for conservation.		Not Available (NA)	(Abdullah et al. 2021)
<i>Calamagrostis breviligulata</i>	Valencia/ Spain; Norwich/UK; Halle/ Germany; Oulu/ Finland	Vulnerable (VU)	Climate change.	Adaptation lag in banked seeds is thought to be the principal factor when managing long-lived species and preventing threatened species from disappearing through ex-situ conservation.	Not Evaluated (NE)	Not Available (NA)	(Wilczek et al. 2014)
<i>Aerva javanica</i>	United Arab Emirates (UAE)	Endangered (EN)	Overexploited due to higher medicinal importance.	Cultivation of medicinal plants, ex-situ and in-situ conservation.	Not Evaluated (NE)	In addition to medicinal uses, the <i>A. javanica</i> is also used for fuel and fodder.	(Sakkir et al. 2012)

Botanical name	Locality (area/country)	Conservation status (present study)	Reason	Recommendation for improvement	Conservation status (Red list)	Remarks	Citation(s)
<i>Asparagus officinalis</i>	Islamabad/Pakistan	Vulnerable (VU)	Numerous factors must be considered, including part used in the system, growth rate, quantity consumed, overgrazing and erosion pressures.	To be conserved by domestication and regeneration techniques.	Least Concern (LC)	Not Available (NA)	(Shinwari & Khan 2000)
	Kurram Valley, Parachinar / Pakistan	Critically Endangered (CR)	Unwise collection for culinary and medicinal purposes, and overgrazing.	Not Available (NA)		Locally well-known Shaghai or Lakhbukai	(Hussain et al. 2012)
<i>Buxus wallichiana</i>	Rajouri-Poonch Uttarakhand/ India	Near Threatened (NT)	Overexploitation, and anthropogenic habitat destruction.	Long-term conservation and management.	Least Concern (LC)	Shamshad	(Wani et al. 2022)
	Jammu and Kashmir region/ India	Vulnerable (VU)	Overexploitation, and human-caused environment destruction.	Alternative methods for propagating tree species, conventional nursery raising, and in-vitro protection.		Not Available (NA)	(Pant & Pant 2011)
	Chamla Valley/ Pakistan	Near Threatened (NT)	Excessive and unwise use, overgrazing, climate change, increase in population, poor method of collection, market pressure, and deforestation.	Government and NGOs need to implement strong programs, with the participation of local people, for the conservation and plantation of <i>B. wallichiana</i> .		Not Available (NA)	(Khan et al. 2019)
<i>Calotropis procera</i>	Bannu/Pakistan	Vulnerable (VU)	Land degradation, livestock grazing, and collection for medicinal purposes, urbanization, and agriculture.	Proper collection of plants, pasture management, and conservation of medicinally important plant species.	Least Concern (LC)	Not Available (NA)	(Khalil 2020)
<i>Echinops echinatus</i>	Bannu/ Pakistan	Endangered (EN)	Urbanization and agriculture	To stop the collection of whole plants.	Not Evaluated (NE)	Not Available (NA)	(Hussain & Khalil 2020)
	Maharashtra/ India	Vulnerable (VU)	Road widening in Ghats and construction activities on forts.	Awareness among the common populace of its importance.		Least Concern (LC)	(More et al. 2020)
<i>Ficus drupacea</i>	Saharo-Macaronesian and Southern-Mediterranean/ Italy	Critically Endangered (CR)	Invasive species and urban expansion have changed the way land is used.	Conservation measures and establishment of a micro-reserve. Italian lists of protected plants include <i>F. drupacea</i> at regional (Calabria) and national scales.	Not Evaluated (NE)		(Spampinato et al. 2018)
<i>Gymnosporia royleana</i>	Karak/Pakistan	Vulnerable (VU)	Stone excavation, road construction, gully erosion, overgrazing, Deforestation and invasion of invasive species.	Hybridization and grafting should be introduced for the conservation and expansion of species.	Near Threatened (NT)	It was formerly known as <i>Maytenus royleana</i> .	(Khan et al. 2011)
	Malakand/ Pakistan	Vulnerable (VU)	Extensive harvesting, deforestation, and land sliding.	In-situ conservation, and sustainable use.		Not Available (NA)	(Zahir et al. 2018)
	Mwingi/Kenya	Near Threatened (NT)	Ethnoveterinary medicinal uses, and fodder.	Requires conservation measures, ability building and awareness.		Unfortunately, most people know the significant threat <i>G. royleana</i> faces in the wild.	(Njoroge 2010)

Botanical name	Locality (area/country)	Conservation status (present study)	Reason	Recommendation for improvement	Conservation status (Red list)	Remarks	Citation(s)
<i>Indigofera heterantha</i>	Dachigam Kashmir Himalaya/ India	Vulnerable (VU)	Grazing, human activities including fuel and fodder collection, harvesting of medicinal herbs, burning of ground vegetation.	Improve the vegetation cover, regular monitoring of livestock grazing, protection, and regeneration.	Least Concern (LC)	Not Available (NA)	(Yaqoob et al. 2014)
	Malam Jabba, Swat/ Pakistan	Near Threatened (NT)	Unsustainable mode of collection, conversion of natural habitat into agricultural land, and overgrazing.	Careful conservation, and monitoring restoration programs.		Not Available (NA)	(Rashid et al. 2011)
	Malakand/ Pakistan	Endangered (EN)	Improper way of plant collection, unwanted incidental fire, unsustainable and unscientific use.	In-situ conservation, and sustainable use.		Not Available (NA)	(Zahir et al. 2018)
<i>Justicia adhatoda</i>	Manipur/India	Endangered (EN)	Extensively used as ethno-medicine as well as food.	Careful collection for medicinal and fodder purposes.	Least Concern (LC)	Also known as <i>Adhatoda vasica</i> .	(Singh & Huidrom 2013)
	Himalayas/ India	Vulnerable (VU)	Establishment of a forest watershed, allelopathic effects of <i>Lantana camara</i> and <i>Murraya koenigii</i> .	Eradication and replacement of <i>Lantana</i> species through the plantation of native plants.		Represented by its formerly known name: <i>Adhatoda vasica</i> .	(Sharma et al. 2009)
	Dayalbagh Educational Institute, Agra/ India	Critically Endangered (CR)	Population growth, high rates of habitat modification, deforestation, climate change, pollution, the spread of invasive alien species, and over-exploitation.	Not Available (NA)		Represented by its formerly known name: <i>Adhatoda vasica</i> .	(Gautam & Gupta 2015)
<i>Nannorrhops ritchiana</i>	Khyber Pakhtunkhwa / Pakistan	Endangered (EN)	Collection in massive amounts for domestic and commercial uses, porcupine grazes the roots and leaves.	Conservation of <i>N. ritchiana</i> in its natural geographical range, and its cultivation should be encouraged under the Billion Tree Afforestation Program (BTAP).	Least Concern (LC)	NA	(Abdullah et al. 2019)
	Mohmand Agency/ Pakistan	Endangered (EN)	The plant is locally made for handicrafts including mats, caps, and other traditional utensils.	There is an urgent need for local awareness of the importance and conservation of this species.		Mazara	(Khalid & Shah 2016)
	Hindu Kush Mountain/ Pakistan	Vulnerable (VU)	Overexploitation, Soil erosion, and climatic change.	Appropriate strategies are needed for conservation.		NA	(Abdullah et al. 2021)
<i>Olea europaea</i>	Shangla/ Pakistan	Endangered (EN)	Grazing, land use, deforestation, and rapid human population growth.	Regeneration of woody tree species, distribution of saplings by the Government among the citizens, and establishment of nurseries.	Data Deficient (DD)	In the paper, <i>O. europaea</i> is mentioned by its formerly known name, <i>Olea ferruginea</i> Threats, Conservation Status and Genetic Diversity of <i>Olea ferruginea</i> .	(Shah & Hussain 2012)
	KozAbakhel (Swat)/ Pakistan	Vulnerable (VU)	Use of timber and wood for fuel, Unsustainable collection, and overexploitation.	Knowledge about genetic diversity and its distribution in the genotypes of <i>O. europaea</i> is necessary for its sustainable use.		(Muhammad et al. 2019)	

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<i>Periploca aphylla</i>	Lehri/Jindi Reserved Forest, Jhelum, Pakistan	Endangered (EN)	Human and livestock activities and habitat destruction.	Fencing, and conservation.		Not Available	(Nawaz et al. 2012)
	Bahadur Khel Karak/ Pakistan	Vulnerable (VU)	Collection for medicinal purposes, overgrazing, and browsing pressure. Trampling of the animals makes the soil compact, and seed germination is retarded.	Restoration and improvement of the original vegetation.	Least Concern (LC)	Not Available (NA)	(Rashid et al. 2011)
<i>Rhazya stricta</i>	Kohat Plateau/ Pakistan	Near Threatened (NT)	Local population fragmentation, and habitat destruction.	Conservation intervention for the habitat and species types is needed.	Not Evaluated (NE)	Not Available (NA)	(Gilani et al. 2014)
	Karak/Pakistan	Vulnerable (VU)	Stone excavation, road construction, gully erosion, overgrazing and deforestation.	Hybridization and grafting should be introduced for the conservation and expansion of species.		Formerly known as <i>Monotheca buxifolia</i> (Falk) A. DC.	(Shinwari et al. 2011)
<i>Sideroxylon mascatense</i>	Western Hajar Mountains (Samali Gap to Jebel Sarah)/ Oman	Near Threatened (NT)	Habitat destruction Climate change, human encroachment, and grazing pressure by domesticated and feral animals.	Recruitment of seedlings and saplings, thereby preserving the fragile ecosystem.	Least Concern (LC)	Not Available (NA)	(Hopkins, Al-Yahyai & Lupton 2021)
	Mohmand Agency/ Pakistan	Vulnerable (VU)	Anthropogenic disturbances and overgrazing.	Not Available (NA).		<i>Monotheca buxifolia</i>	(Khalid & Shah 2016)
	Pakistani Afghan borders	Endangered (EN)	Unsustainable collection for medicinal uses, and grazing.	Conservation strategies should be adopted for the protection of medicinal plants.		<i>W. coagulans</i> sometimes along with <i>W. chevalieri</i> may be investigated.	(Hussain et al. 2018)
<i>Withania coagulans</i>	Jaipur/India	Critically Endangered (CR)	Collection for medicinal uses.	In-vitro conservation.		Not Available (NA)	(Jain, Kachhwaha & Kothari 2012)
	United Arab Emirates (UAE)	Near Threatened (NT)	Overexploited due to their higher medicinal importance.	Cultivation of medicinal plants, ex-situ and in-situ conservation.	Critically Endangered (CR)	Not Available (NA)	(Sakkir, Kabshawi & Mehairbi 2012)
	Dir Kohistan/ Pakistan	Critically Endangered (CR)	Clearing of wilderness or cleanliness-derived bulldozing, cutting, and burning of wild plants.	All these activities should be stopped once to save the remaining plant species.		Not Available (NA)	(Hazrat & Wahab 2011)
<i>Ziziphus nummularia</i>	Malakand/ Pakistan	Vulnerable (VU)	Overgrazing, excessive collection, burning, and other anthropogenic activities.	In-situ conservation policy, and sustainable use.	Not Evaluated (NE)	Karkana is the most delicious fruit locally used.	(Muhammad 2018)