

PLANTS OF THE HUNZA VALLEY (CENTRAL KARAKORUM), NORTHERN PAKISTAN: ECOLOGY, DIVERSITY, AND CONSERVATION

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Abstract

The present paper elaborates the results of vegetation and floristic research carried out in the valley of Hunza, Central Karakorum Mountains, northern Pakistan. The field surveys conducted from 2011 – 2012 ended with the collection of 324 species in 183 genera and 48 families. Based on geo-climatic conditions and floristic assemblage the vegetation of the studied area can be categorized into three altitudinal belts i.e. temperate, sub-alpine, and alpine. Altitude exhibits profound impacts on the species richness, composition, and surrogacy. The species diversity declined with elevation and maximum species richness was observed at the temperate belt. Asteraceae was the most presented family with 83 species followed by Poaceae (29 spp.), Fabaceae (16 spp.), and Cyperaceous (16 spp). Perennial herbs (77%) were the leading habit with sub-dominating shrubs (11%) and annuals (9%). In life-form categories, hemicryptophytes presented 249 species followed by therophytes and nanophanerophytes with 29 species each. Similarly, the common habitat of dry mountain slopes support maximum species i.e. 106 species followed by ruderal (90 spp), and moist mountain slopes (84 spp.). The assessment for quantitative thresholds for conservation revealed that habitats of 28 taxa were observed unstable, 255 taxa exhibited habitat specificity, 75 showed small population size, and 65 presented small geographical range. The application of IUCN Red List Criteria 2001 (Version 3.1) disclosed that 38 species fell in critically endangered, 32 vulnerable, and 10 endangered categories. The current ecological and floristic appraisal of the studied area would be effective to devise and strengthen the conservation strategies of climatically fragile mountain ecosystems.

Key words: Phytodiversity, Vegetation zones, Ecology, Mountain ecosystem.

Introduction

Biodiversity is the most astounding and complex feature of our planet. Being the abundant producers, plants have vigorous role to drive ecological processes which uphold ecosystem and support life (Loreau, 2000; Pavlov and Bukvareva, 2007). An estimated total of 500,000 species of plant contribute in the global biological diversity (Corlett, 2016). Human activities have greatly altered global environments, declined biological diversity, caused extinctions and reduced the population sizes of surviving species (Yule *et al.*, 2013). The impacts of these actions are more damaging in the mountain ecosystems because of their fragile nature, rapidly changing global climate, severe environmental hazards and unsustainable resource utilization by underprivileged human societies (Beniston, 2002, 2016).

This jeopardizes all biological entities of mountain ecosystems particularly plants due to their sessile nature. It is estimated that extinction risk for 96% of all described plant species is yet to be evaluated worldwide (Brooks *et al.*, 2002; Sheth *et al.*, 2008). Therefore, a preliminary conservation assessment of the conservation status of all known plant species at national, regional and international levels was one of the prime objectives of the Global Strategy for Plant Conservation by 2010. Developed countries have been paying particular attention to identify

and protect threatened plants for two decades. They have established comprehensive criteria to detect species extinction risk (Nature *et al.*, 2001). Unfortunately, this knowledge is very limited in developing countries (Alam, 2010; Alam & Ali, 2010).

Pakistan presents remarkable phytodiversity with more than 6000 species (Ali, 1986, 2008). They experience tremendous pressure due to burgeoning human population, rampant urbanization, agricultural encroachment and unsustainable resource utilization particularly the montane flora (ABBAS *et al.*, 1998; Khan, 2007). On the other hand, we could not be able to develop red list of all threatened plants yet. In the recent decades, very little critical field work has been done on “threatened plants” of the country according to IUCN red list criteria 2001 (Nature *et al.*, 2001). To date, only 142 flowering taxa have been evaluated based on this criteria (Abbas *et al.*, 2010; Ali & Qaiser, 2010; Ali *et al.*, 2012; Majid *et al.*, 2015; Muhammad *et al.*, 2017). This figure hardly makes c. 2% of total known flowering plant species of Pakistan. Thus, it is obvious that limited information of threatened plants we have been failed to adopt restorative measures for hundreds of plants likely to be extinct in due course of time.

Therefore, the current study has been conducted in the valley of Hunza with the objectives 1) to explore the floral diversity 2) to assess the ecological features 3) to evaluate the collected plants species according to IUCN criteria 2001.

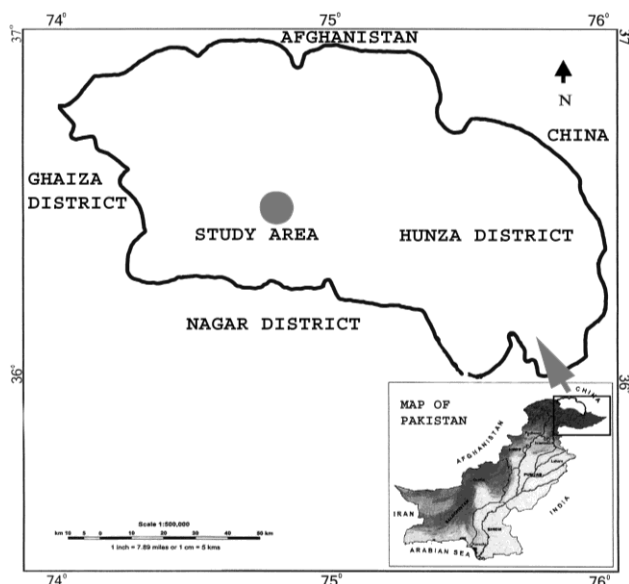


Fig. 1. Map of the study area.

Materials and Methods

Study area: Hunza valley (36.3167° N, 74.6500° E) is located at the elevation of 2000m in the western part of Central Karakorum Ranges, Gilgit-Baltistan, Pakistan (Fig. 1). Administratively, it is a newly formed district and borders with the People Republic of China in the east, Ghizir in the west, Chitral in the north and Baltistan and Nagar in the south. Topographically, the valley is rugged and dry with some high peaks above 7000m and permanent glaciers are also located like Ultar Peak-I & II, Ultar glacier & Shishpar glacier. It experiences mild summer and cool winter while the mountaintops possess arctic climate (Sidky, 1995). Below 3000m, precipitation rarely exceeds 200 millimetres annually. However, there is a strong gradient with altitude and at 6000m, the snow fall is equivalent to 2000 millimetres per year. Temperature in valley bottoms can range from extremes of nearly 40°C in the summer to less than -10°C in winter (Owen *et al.*, 2002). The Hunza River flows north to south, and is joined by several other rivers i.e. Shimshal, Batura, Passu, Ghulkin, Misgar, Chapurson, Gojal and Gulmit. The total population of Central Hunza is 20,000, of which 5,700 people live within the bottom villages of the Central Hunza Mountains—Karimabad, Haiderabad, Aliabad Hassanabad and Murtazaabad. Mostly of the human population is settled at the base of the valley (Alam & Ali, 2010; Ali, 2000). By and large, these villages are located on fluvial terraces and debris fans. Generally, growing period of the flora is from March to end of September. In the valley bottom, plant

growth starts usually from March, while in alpine and sub-alpine zone the growing season starts from May (Alam, 2010). On the irrigated fields, wheat and potatoes are the dominant crops grown. Apricot, apple and cherry trees are extensively cultivated in orchards and are intercropped with vegetables such as peas, onions, tomatoes, carrots, cabbage and other greens. Sea-buckthorn (*Hippophae rhamnoides*) and poplar trees (*Populus* spp.) are important for fodder and fuel. These woody species, interspersed with grass, growing near the glacier termini, on slopes steeper than 12° , adjacent to glacial streams or lining the irrigation channels, and are used to stabilize such locations (Eberhardt *et al.*, 2007). Ecologically this area shows a high floristic diversity in response to diverse climatic and edaphic conditions. Flora resembles with the central Asiatic elements and included in Irano-Turanian phytogeographical region (Ali & Qaiser, 1986; Eberhardt, 2004).

Data collection: Field trips were carried out in the study area in two consecutive vegetation peak seasons from 2010-2011. The studied area was delineated in different altitudinal ecological zones based on altitude, topography and environmental conditions as described by (Abbas *et al.*, 2019b) and Dickoré & Nüsser (2000). The geographical information (Latitude, Longitude and Altitude) was recorded at each collecting sites with the help of Geographical Positioning System (GPS). Habitats were examined carefully and noted the sign of environmental hazards for instance soil erosion, over-grazing, land tilling, fuel wood consumption etc. Plants species were sampled from variety of habitats and endeavored to cover the maximum elevation ranges of the area. The gathered specimens were examined carefully and classified into different growth habit and life form (Raunkiaer, 1934). The distribution and abundance of the taxa was also determined following the criteria proposed by Rabinowitz (1981) Table 1. Finally, all collected plant species were evaluated according to IUCN Red List Categories and Criteria 2001 (Nature *et al.*, 2001). The specimens were pressed, dried and mounted after going through proper herbarium techniques as per international standards (Bridson *et al.*, 1992). The nomenclature based on Flora of Pakistan [Nasir & Ali, 1970-1989 (Nos 1-190); Ali & Y. Nasir, 1989-1991 (Nos. 191-193); Ali & Qaiser 1993-2021 (Nos. 194-225)], Annotated Catalogue of the Vascular Plant of West Pakistan and Kashmir (Stewart *et al.*, 1972) and flora of China (www.efloras.org > flora_page > flora_id=2.) The specimens of concerned taxa cited in the Flora of Pakistan housed in Hazara University Herbarium (HU) and Karachi University Herbarium (KUH) were also consulted. Finally, voucher specimens were deposited at Hazara University Herbarium.

Table 1. Abundance criteria of taxa (Rabinowitz, 1981).

Abundance	Condition
Very common	If a taxon is distributed almost every ecological zone (except Permanent snow line zone) and number of individual more than 500 at each location in the study area or frequently cultivated
Common	If a taxon is distributed within two ecological zones and number of Individuals 51-499 at each location in the study area or moderately cultivated
Rare	If a taxon is distributed within a single location and confined to single habitat or sparsely distributed in few locations in the area or number of individuals are less than 50 individuals

Results

The results describe the floral attributes (families, genera, species), physiognomy (habit, life form), distribution (ecological zonation, habitat types) and conservation (habitat quality, habitat specificity, population size, geographic range, and IUCN criteria, IUCN category).

Floral attributes

Taxonomic diversity: A total of 324 species belonging to 48 families and 183 genera were recorded from the study area. Among these, 5 (1.5%) species, 2 (1.09%) genera and 2 (1.54%) families were gymnosperms. Similarly, 56 (17.28) species of monocots were distributed in 29 (15.8%) genera and 6 (17.2%) families. The remaining 263 species (81.17%), 152 (83.06%) genera and 39 families were dicots. Asteraceae was the leading family with maximum representation of 83 species (25.6%) among dicot species. Fabaceae, Rosaceae and Caryophyllaceae were sub-dominant families with 16, 14 and 14 species respectively (Fig. 3). The remaining families contributed as, 10 families had 5-13 species, 16 families with 2-4 species and 10 families with 1 species each. Poaceae was the largest monocot family with 29 species followed by Cyperaceae with 16 species. Other 4 families were represented by 1- 6 species. A complete check list and relevant attributes of the plants of the study area is presented in the Table 2. Some representative plants species were depicted in Fig. 4.

Habit and life form: Habit-wise, perennial herbs prevailed with 250 species (77.1%), followed by shrubs with 37 species (11.41%), annual herbs having 29 species (8.95%) and arboreal habit 3(0.009%) tree species. Based on life form variability, Hemicryptophytes were maximum with 249 species (76.8%), Therophytes and nanophanerophytes made the second abundant group with 29 species (8.95%) each. The contribution of Chamaephytes (9 species, 2.77%), megaphanerophytes (4 species, 1.23%) Geophytes (3 species, 0.92%) and 1 parasitic species was recorded (Table 3).

Altitudinal zonation of vegetation

Temperate zone (TMP): Below 3000m, the area can be demarked as temperate zone. A sum of 142 species has been sampled from this zone. The upper portion of the zone consists on dry rock slopes and stream banks. Even within the irrigated land, the upper portion has been specified for fuel wood, timber, fruit and fodder-related taxa, while the lower portion is used for crop cultivation. Dry sandy slopes are also present among cultivated land. Many cultivated tree species are grown in this vegetation belt like *Populus siberica*, *Eleagnus angustifolia* and Shrubs like *Hippophae rhamnoides* subsp. *turkistanica*, *Daphne mucronata*, and *Colutea paulsenii*. Similarly many herbs like *Cichorium intybus*, *Campanula chashmiriana*, *Lectuca tatarica* grow as weeds among cultivated fields especially grasses.

Sub-alpine zone (SBA): This zone usually extends from 3000 to 3700m. Both shrubby and herbaceous species were found to occur in different combination depending upon the aspect of the slopes. One hundred two (102) taxa were recorded from this vegetational belt. Many micro habitats were seen in this zone and this was mainly due to slope aspects of the mountains. Shrubs were represented by *Ribes alpestre*, *Rosa webbiana*, *Lonocera heterophylla*,

Sorbus tianschanica, *Spiraea hypericifolia*, *Juniperus excelsa*, *Juniperus turkistanica*, *Potentilla salesviana* etc. while herbaceous species like *Hedysarum falconeri*, *Cicer microphyllum*, *Astragalus peduncularis*, *Pseudomertensia echoides*, *Aquilegia fragrans*, *Inula royleana* and *Artemisia brevifolia*, *Rosa webbiana* were recorded.

Alpine zone (ALP): This zone may be recognized from 3700m up to permanent snow line limit. Eighty (80) species were documented from this zone. Vegetation consisted of on dwarf shrubs (prostrate of less than 1m tall) and herbs. Twenty four exclusively confined species are recorded for this belt including *Primula marcropphylla*, *Anaphalis nepelensis*, *Allardia nivea*, *Allardia tomentosa* and *Anemone rupicola*. The zone exhibits several micro habitat types i.e. scree, boulders, meadows, glacial moraines etc. This provides a good pasture land for the local community (Fig. 2).

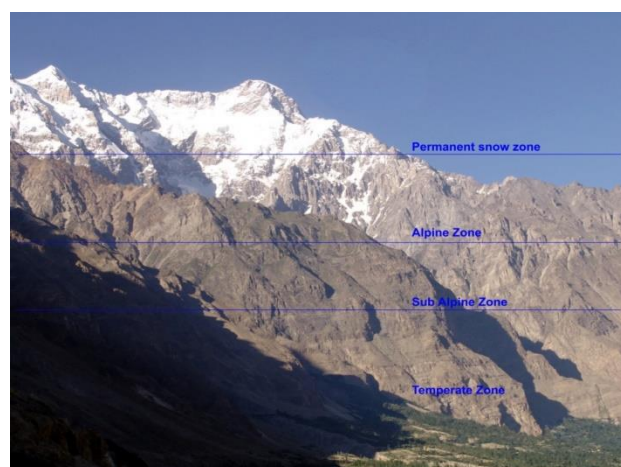


Fig. 2. Depiction of altitudinal zonation of the vegetation.

Habitat diversity: Although, the area is a home land for numerous micro habitats, however, the study area has been classified into the following five main habitats: Feld-mark, moist mountain slopes, dry mountain slopes, river-stream bank and cultivated lands.

Feld mark (FLD): This habitat can be seen in the upper portion of alpine zone. It is mostly degraded and with a thin layer of soil due heavy snow fall and fast wind blow. Vegetation is highly sparse and few species are documented from this habitat. Eight species were recorded in Feld mark habitat. Highly adaptive species can only be grown there like *Allardia tomentosa*, *Allardia nivea*, *Anaphalis nepalensis* var. *nepalensis*, and *Primula* sp.

Moist mountain slopes (MMS): Moist mountain slopes can be seen on the northern and eastern facing slopes in alpine and sub-alpine zones. Vegetation is dense and 84 species were recorded from this habitat. Direct sun intensity is less and as result moisture remains for a long period. Many shrubs like *Salix* sp., *Sorbus tianshanica*, *Clematis siberica* var. *alpina* and many herbs like *Geranium himalayense*, *Rhodiola tibetica*, *Rhodiola wallichiana*, *Saxifraga flagellaris*, *Inula royleana*, *Viola rupestris*, *Anemone rupicola*, *Aquilegia fragrans*, *Delphinium chasmeriana*, *Codonopsis clemedidea*, *Erigeron multicaulis*, *Pseudomenrtensia echoides*, *Myosotis alpestris* and *Silene kunawarensis*.

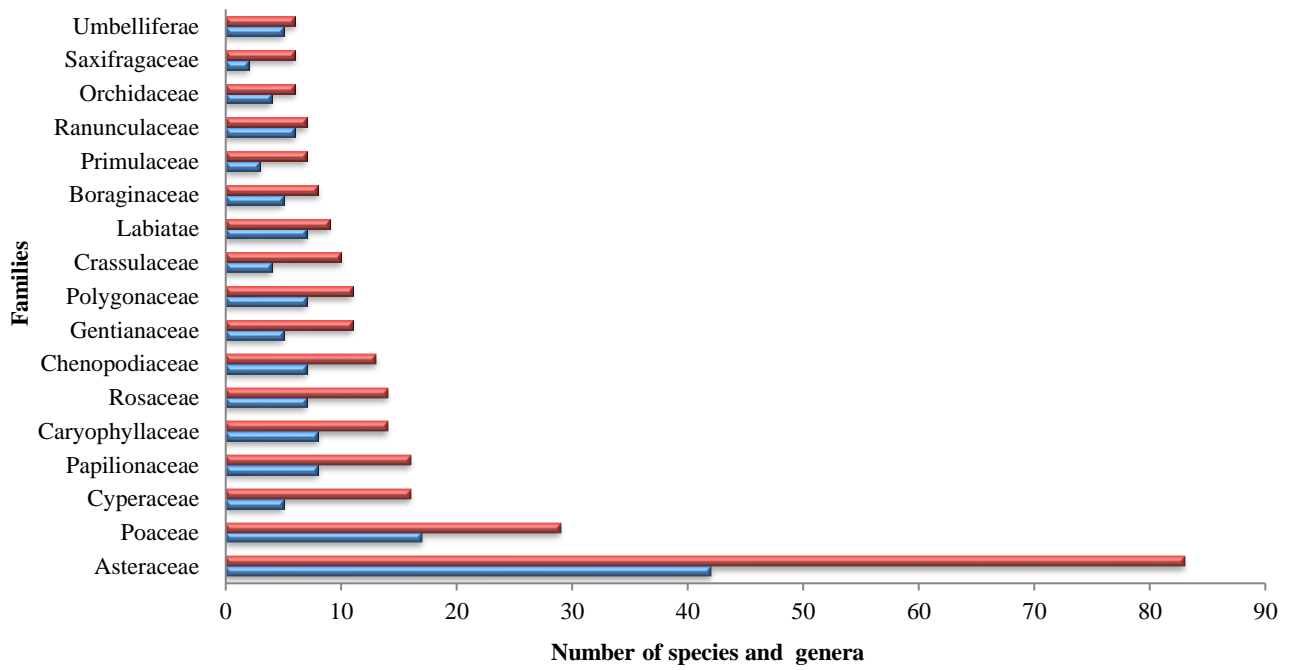


Fig. 3. Distribution of species in the ten dominant families of the study area.

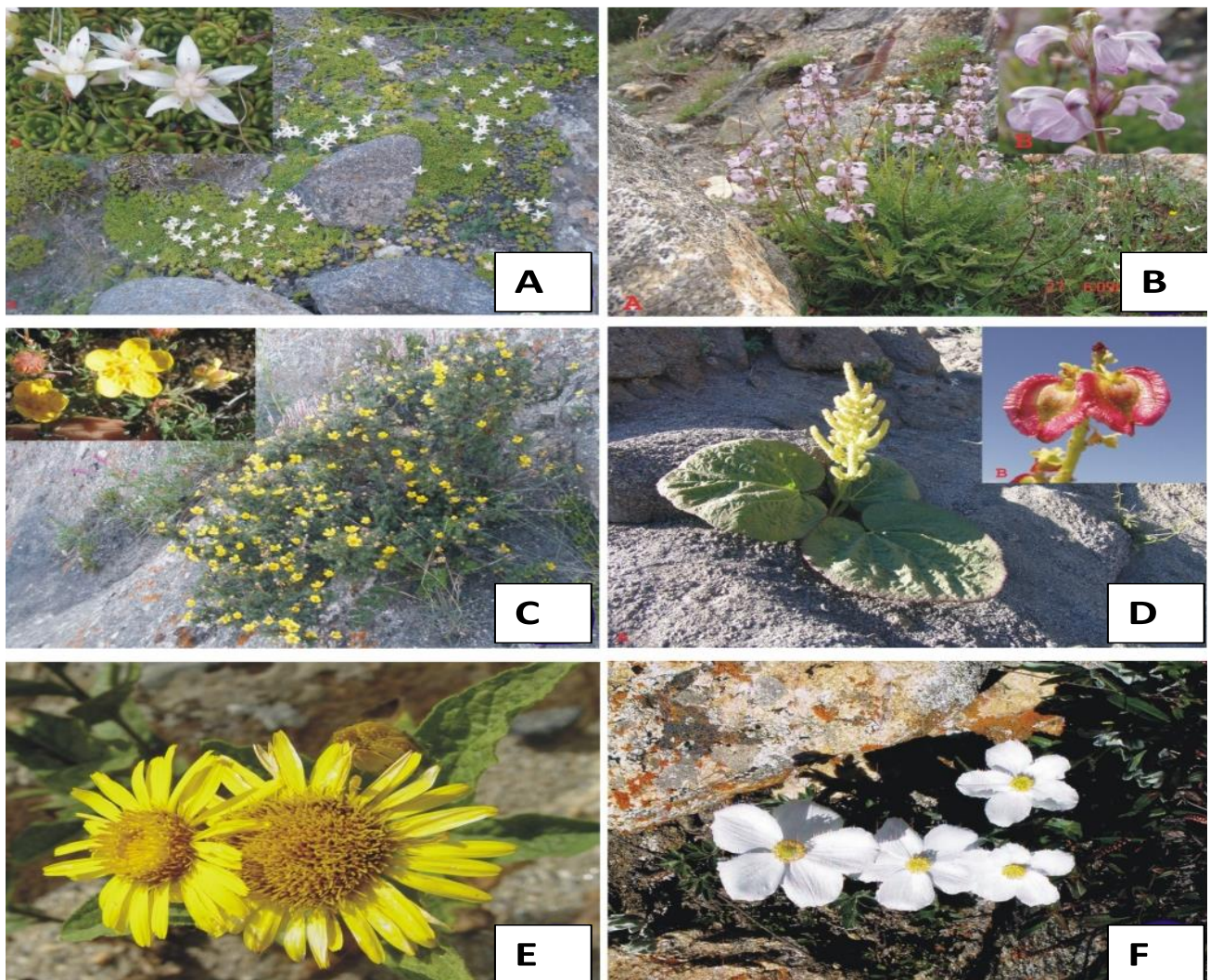


Fig. 4. Some representative species of the study area A) *Rhodiola saxifragoides* B) *Pedicularis staintonii* C) *Potentilla ochreatea* D) *Rheum tibeticum* E) *Inula obtusifolia* F) *Anemone rupicola*.

Table 2. Diversity, ecological characteristics and conservation status of plants of the Hunza valley, Karakorum Mountains, Northern Pakistan.

Family	Scientific name	Habit	Life form	Alt. zone	Abun.	Habitat types	Habitat quality	Habitat specificity	Small population size	Small geographic range	IUCN criteria (A-E)	Category
Amaranthaceae	<i>Aerva lanata</i> (L.) Juss. ex J.A. Schultes	Sh	Np	TMP	R	CLD	ST	+	+	+	B, C	CR
Amaryllidaceae	<i>Allium carolinianum</i> DC.	Bh	Ge	ALP	R	MMS	ST	+	+	+	B, C	CR
Amaryllidaceae	<i>Allium consanguineum</i> Kunth	Ph	Ge	ALP	CN	DMS	ST	+	+	-	B, C	VU
Amaryllidaceae	<i>Allium roylei</i> Stearn	Bh	Ge	SBA	R	MMS	ST	+	+	-	-	-
Asclepiadaceae	<i>Cynanchum acutum</i> L.	Ph	Ch	TMP	CN	CLD	ST	+	+	+	B, C	CR
Asclepiadaceae	<i>Vincetoxicum canescens</i> (Wild.) Decne.	Ph	Ch	TMP	R	DMS	ST	+	+	+	D	CR
Asteraceae	<i>Ajanita fruticososa</i> (Ledeb.) Poljakov	Sh	Ch	TMP	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Allardia glabra</i> Decne.	Ph	He	ALP	R	FLD	ST	+	-	-	-	-
Asteraceae	<i>Allardia nivea</i> Hook. f. & Thomson ex C. B. Clarke	Ph	He	ALP	R	FLD	ST	+	-	-	-	-
Asteraceae	<i>Anaphalis boissieri</i> E. Georgiadou	Ph	He	TMP	CN	RSB	ST	+	-	-	-	-
Asteraceae	<i>Anaphalis nepalensis</i> (Spreng.) Hand.- Mazz. var. <i>monocephala</i> (DC.) Hand.- Mazz.	Ph	He	ALP	CN	FLD	ST	+	-	-	-	-
Asteraceae	<i>Anaphalis nepalensis</i> (Spreng.) Hand.- Mazz. var. <i>nepalensis</i>	Ph	He	ALP	CN	FLD	ST	+	-	-	-	-
Asteraceae	<i>Anaphalis virgata</i> Thomson ex C.B. Clarke	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Asteraceae	<i>Artemisia biennis</i> Willd.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Asteraceae	<i>Artemisia japonica</i> Thunb.	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Asteraceae	<i>Artemisia macrocephala</i> Jacquem. ex Besser	Ah	Th	TMP	CN	CLD	ST	-	-	-	-	-
Asteraceae	<i>Artemisia ruifolia</i> Spreng.	Sh	Np	SBA	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Artemisia salsoloides</i> Willd.	Ph	He	TMP	CN	CLD	ST	-	-	-	-	-
Asteraceae	<i>Artemisia santolinifolia</i> Turcz. ex Krasch.	Sh	Ch	TMP	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Artemisia sieversiana</i> Ehrh.	Ah	Th	TMP	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Axellia flexuosa</i> (Ledeb.) W.A. Weber	Ph	He	TMP	CN	RSB	DR	+	-	-	-	-
Asteraceae	<i>Aster flaccidus</i> Bunge	Ph	He	ALP	CN	MMS	ST	+	-	-	-	-
Asteraceae	<i>Aster peduncularis</i> Wall. ex Nees	Ph	He	SBA	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Brachyactis pubescens</i> (DC.) Aitch.	Ph	He	TMP	VCN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Chondrilla yosii</i> Kitam (P.H)	Ph	He	SBA	R	RSB	DR	-	-	-	-	-
Asteraceae	<i>Cichorium intybus</i> L.	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Cirsium arvense</i> (L.) Scop.	Ph	Ch	TMP	CN	RSB	ST	+	-	-	-	-
Asteraceae	<i>Cirsium griffithii</i> Boiss.	Ph	Ch	TMP	R	RSB	DR	+	-	-	-	-
Asteraceae	<i>Conyza bonariensis</i> (L.) Cronquist	Ah	Th	TMP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Crepis aitchisonii</i> Boiss	Ph	He	ALP	CN	RSB	ST	+	-	-	-	-
Asteraceae	<i>Crepis sancta</i> (L.) Babc.	Ph	He	TMP	R	RSB	DR	+	-	-	A, B	CR
Asteraceae	<i>Dolomiaea macrocephala</i> Royle	Ph	Ch	ALP	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Echinops cornigerus</i> DC.	Ah	Th	TMP	CN	DMS	ST	+	-	-	-	-
Asteraceae	<i>Erigeron acer</i> L.	Ph	He	ALP	R	MMS	ST	+	-	-	-	-
Asteraceae	<i>Erigeron acer</i> L. var. <i>multicaulis</i> (Wall. ex DC.) Clarke	Ph	He	ALP	CN	MMS	ST	-	-	-	-	-
Asteraceae	<i>Erigeron alpinum</i> L.	Ph	He	ALP	CN	MMS	ST	-	-	-	-	-
Asteraceae	<i>Erigeron petroketes</i> Rech.f.	Ph	He	ALP	CN	MMS	ST	-	-	-	-	-
Asteraceae	<i>Filago hircuatica</i> (Wall. ex DC.) Wagenitz in Willdenowia	Ph	He	SBA	CN	CLD	ST	-	-	-	-	-
Asteraceae	<i>Heteropappus altaicus</i> (Willd.) Novopokr.	Ph	He	TMP	R	DMS	ST	+	-	-	-	-
Asteraceae	<i>Hieracium prenanthoides</i> Vill.	Ph	He	SBA	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Hieracium robustum</i> Fries	Ph	He	SBA	CN	MMS	ST	-	-	-	-	-
Asteraceae	<i>Hieracium umbellatum</i> L.	Ph	He	SBA	CN	MMS	ST	+	-	-	-	-

Table 2. (Cont'd.)..

Family	Scientific name	Habit	Life form	Alt. zone	Abun.	Habitat types	Habitat quality	Habitat specificity	Small population size	Small geographic range	IUCN criteria (A-E)	Category
Asteraceae	<i>Himalaiella chenopodiifolia</i> (Klatt) Raab-Struabe	Ph	He	SBA	CN	RSB	ST	+	-	-	-	-
Asteraceae	<i>Inula obtusifolia</i> Kem.	Ph	He	TMP	R	RSB	ST	+	-	-	-	-
Asteraceae	<i>Inula orientalis</i> Lam.	Ph	He	SBA	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Inula rhizocephala</i> Schrenk	Ph	He	SBA	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Inula royleana</i> DC.	Ph	He	SBA	CN	MMS	ST	+	-	+	B, C	VU
Asteraceae	<i>Jurinea ceratocarpa</i> (Dcne.) Benth.	Ph	He	SBA	CN	MMS	ST	+	-	+	-	-
Asteraceae	<i>Koelpina linearis</i> Pall var. <i>linearis</i>	Ah	Th	TMP	CN	DMS	ST	-	+	+	B, C	EN
Asteraceae	<i>Lactuca dissecta</i> D. Don	Ph	He	SBA	R	DMS	ST	+	-	-	-	-
Asteraceae	<i>Lactuca tatarica</i> (L.) C.A. Meyer	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Asteraceae	<i>Leontopodium brachyactis</i> Gand.	Ph	He	SBA	R	DMS	ST	+	-	-	-	-
Asteraceae	<i>Leontopodium leontopodium</i> (DC.) Hand. -Mazz.	Ph	He	SBA	CN	DMS	ST	-	-	-	-	-
Asteraceae	<i>Lipschitzia congesta</i> (Decne) Kamelin var. <i>congesta</i>	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Asteraceae	<i>Melanoseris decipiens</i> (Hook. f. & Thomson ex C.B. Clare) N. Killian & Z.H. Wang	Ph	He	TMP	R	MMS	ST	+	-	-	-	-
Asteraceae	<i>Pteris hieracioides</i> L.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Asteraceae	<i>Pteris hieracioides</i> L. subsp. <i>hieracioides</i>	Ph	He	ALP	CN	RSB	DR	-	-	-	-	-
Asteraceae	<i>Pteris karimaensis</i> Kitam.	Ph	He	ALP	R	RSB	DR	+	-	-	-	-
Asteraceae	<i>Pteris nuristanica</i> Bornm	Ph	He	ALP	CN	RSB	DR	-	-	-	-	-
Asteraceae	<i>Pilosella echinoides</i> (Cumm.) C.H. & f. W. Schultz	Ph	He	ALP	R	DMS	ST	-	+	+	A, B	CR
Asteraceae	<i>Pseudonaphthium leotoalbum</i> (L.) O.M. Hilliard & B.L. Burt	Ph	He	SBA	CN	CLD	ST	+	-	-	-	-
Asteraceae	<i>Psychrogeton andryaloides</i> (DC.) Novopokr. ex Krasch.	Ph	He	ALP	CN	MMS	ST	+	-	-	-	-
Asteraceae	<i>Pulicaria salvifolia</i> Bunge	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Asteraceae	<i>Saussurea gnaphalodes</i> (Royle) Sch. Bip.	Ph	He	ALP	R	RSB	ST	+	-	-	-	-
Asteraceae	<i>Scrozonera hondae</i> Kitam.	Ph	He	TMP	R	CLD	DR	+	-	+	B	VU
Asteraceae	<i>Scrozonera virgata</i> DC.	Ph	He	SBA	CN	RSB	DR	-	-	-	-	-
Asteraceae	<i>Senecio krascheninnikovii</i> Schischkin	Ah	Th	TMP	CN	RSB	ST	-	-	-	-	-
Asteraceae	<i>Seriphidium brevifolium</i> (Wall. ex DC.) Ling & Y. R. Ling	Ph	Ch	TMP	R	DMS	ST	+	-	-	-	-
Asteraceae	<i>Shanjinia jacea</i> (Klotzsch) Yu J. Wang & Raab-Straube	Sh	Np	TMP	CN	RSB	DR	+	-	-	B, C	VU
Asteraceae	<i>Solidago virga-aurea</i> L.	Ph	He	SBA	CN	RSB	ST	+	-	-	-	-
Asteraceae	<i>Sonchus oleraceus</i> L.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Asteraceae	<i>Sonchus tenerrimus</i> L.	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Sonchus wightianus</i> DC.	Ph	He	TMP	CN	CLD	ST	-	-	-	-	-
Asteraceae	<i>Tanacetum artemisioides</i> Schultz -Bip. ex Hook. f.	Ph	He	SBA	R	DMS	ST	+	-	-	-	-
Asteraceae	<i>Tanacetum baltistanicum</i> Podlech	Sh	Np	SBA	CN	DMS	DR	+	-	-	-	-
Asteraceae	<i>Tanacetum falconeri</i> Hook. f.	Ph	He	SBA	R	DMS	ST	+	-	-	-	-
Asteraceae	<i>Taraxacum canum</i> Soest	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Taraxacum gilgense</i> S. A. Beedin	Ph	He	TMP	CN	CLD	ST	-	-	-	-	-
Asteraceae	<i>Taraxacum janalamii</i> S. A. Beedin	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Taraxacum javanicum</i> Soest	Ph	==	ALP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Taraxacum kjellmanii</i> Soest	Ph	He	ALP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Taraxacum polyodon</i> Dahlst	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Taraxacum purpurea-pettiolatum</i> Soest	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Taraxacum stenolepium</i> Hand	Ph	He	SBA	R	MMS	ST	+	-	-	-	-

Table 2. (Cont'd.)..

Family	Scientific name	Habit	Life form	Alt. zone	Abun.	Habitat types	Habitat quality	Habitat specificity	Small population size	Small geographic range	IUCN criteria (A-E)	Category
Asteraceae	<i>Taraxacum xanthophyllum</i> G.Hagl	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Asteraceae	<i>Tragopogon dubius</i> Scop.	Ph	He	SBA	R	MMS	ST	+	+	+	B, C	CR
Asteraceae	<i>Tragopogon gracillis</i> D.Don	Ph	He	SBA	R	DMS	ST	+	+	+	B, C	CR
Asteraceae	<i>Tricholepis tibetica</i> Hook. & Thoms.	Ph	He	SBA	R	DMS	ST	+	-	-	-	-
Asteraceae	<i>Tussilago farfara</i> L.	Ph	He	SBA	R	RSB	ST	+	+	+	A, B, D	CR
Boraginaceae	<i>Artemisia euchroma</i> (Royle ex Benth.) I.M. Johnston	Ph	He	SBA	CN	DMS	ST	-	+	+	B, C	VU
Boraginaceae	<i>Cynoglossum glochidiatum</i> Wall. ex Benth.	Ph	He	TMP	R	DMS	ST	+	+	+	B, D	CR
Boraginaceae	<i>Draba stenocarpa</i> Hook. f. & Thoms.	Ph	He	SBA	CN	DMS	ST	+	-	-	-	-
Boraginaceae	<i>Eritrichium canum</i> (Benth. In Royle) Kitamura var. <i>patens</i> (Decne.) Y. Nasir	Ph	He	TMP	R	DMS	ST	+	-	-	-	-
Boraginaceae	<i>Eritrichium canum</i> (Benth.) Kitamura var. <i>fruticulosum</i> (Klotzsch) Y. Nasir	Ph	He	SBA	CN	DMS	ST	+	-	-	-	-
Boraginaceae	<i>Eritrichium canum</i> (Benth.) Kitamura var. <i>spatulatum</i> (Benth.) Y. Nasir	Ph	He	ALP	R	MMS	ST	+	-	-	-	-
Boraginaceae	<i>Myosotis alpestris</i> F.W. Schmidt subsp. <i>asiatica</i> Vestergren ex Hulten var. <i>asiatica</i>	Ph	He	ALP	VCN	MMS	ST	-	-	-	-	-
Boraginaceae	<i>Pseudomertensia echioides</i> (Benth.) Riedl	Ph	He	ALP	CN	MMS	ST	+	+	+	-	-
Boraginaceae	<i>Pseudomertensia molkioides</i> (Royle ex Benth.) Kazmi var. <i>primuloides</i> (Decne.) Kazmi	Ph	He	ALP	R	MMS	ST	+	+	+	-	-
Brassicaceae	<i>Malcolmia africana</i> (Linn.) R. Br. in Aiton	Ph	He	SBA	CN	RSB	DR	+	-	-	-	-
Campanulaceae	<i>Campanula cashmiriana</i> Royle	Ph	He	SBA	R	RSB	ST	+	+	+	-	-
Campanulaceae	<i>Campanula pallida</i> Wall. var. <i>tibetica</i> (H. & T.) Hara	Ph	He	ALP	R	CLD	ST	+	+	+	B, C	CR
Campanulaceae	<i>Campanula clematidea</i> (Schrenk) C. B. Clarke	Ph	He	SBA	R	MMS	ST	+	+	+	B, C	EN
Caprifoliaceae	<i>Lonicera asperifolia</i> (Decne.) Hook. f. & Thoms.	Sh	Np	SBA	CN	MMS	ST	-	-	-	-	-
Caprifoliaceae	<i>Lonicera heterophylla</i> Decne.	Sh	Np	SBA	CN	MMS	ST	+	+	+	-	-
Caryophyllaceae	<i>Arenaria neelgherrensis</i> Wight & Arn.	Ah	Th	TMP	CN	CLD	ST	-	-	-	-	-
Caryophyllaceae	<i>Cerastium thomsonii</i> Hook. f.	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Caryophyllaceae	<i>Dianthus crinitus</i> Sm.	Ph	He	TMP	CN	RSB	ST	-	-	-	-	-
Caryophyllaceae	<i>Lepydactylis holosteoides</i> (C.A. Mey) Fenzl ex & Mey	Ah	Th	SBA	R	CLD	ST	-	-	-	-	-
Caryophyllaceae	<i>Minuartia biflora</i> (L.) Schinz & Thall.	Ph	He	TMP	CN	DMS	ST	-	-	-	-	-
Caryophyllaceae	<i>Minuartia kashmirica</i> (Edgew.) Matff.	Ph	He	TMP	R	DMS	ST	-	-	-	-	-
Caryophyllaceae	<i>Sagina saginoides</i> (L.) Karst.	Ph	He	SBA	CN	MMS	ST	+	-	-	-	-
Caryophyllaceae	<i>Silene conoidea</i> L.	Ph	TH	TMP	CN	CLD	ST	+	-	-	-	-
Caryophyllaceae	<i>Silene gonosperma</i> (Rupr.) Bocquet subsp. <i>himalayensis</i> (Rohrb.) Bocquet	Ph	He	SBA	CN	RSB	ST	-	-	-	-	-
Caryophyllaceae	<i>Silene kunawarensis</i> Benth.	Ph	He	TMP	CN	MMS	ST	-	-	-	-	-
Caryophyllaceae	<i>Silene moorcroftiana</i> Wall. ex Benth.	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Caryophyllaceae	<i>Silene viscosa</i> (L.) Pers.	Ph	He	SBA	CN	DMS	ST	-	-	-	-	-
Caryophyllaceae	<i>Stellaria montioides</i> (Edgew. & Hook.f. A.A. Ghazanfar)	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Caryophyllaceae	<i>Stellaria persica</i> Boiss.	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Chenopodiaceae	<i>Atriplex iljin</i>	Ah	Th	TMP	CN	CLD	ST	+	-	-	-	-
Chenopodiaceae	<i>Chenopodium album</i> L.	Ah	Th	TMP	CN	CLD	ST	+	-	-	-	-
Chenopodiaceae	<i>Chenopodium botrys</i> L.	Ah	Th	TMP	CN	CLD	ST	+	-	-	-	-
Chenopodiaceae	<i>Chenopodium foliosum</i> Asch.	Ph	He	SBA	CN	DMS	ST	+	-	-	A, B, C	CR
Chenopodiaceae	<i>Chenopodium nepalense</i> Colla	Ah	Th	TMP	CN	CLD	ST	+	+	+	B, D	CR

Table 2. (Cont'd.)..

Family	Scientific name	Habit	Life form	Alt. zone	Abun.	Habitat types	Habitat quality	Habitat specificity	Small population size	Small geographic range	IUCN criteria (A-E)	Category
Chenopodiaceae	<i>Chenopodium pamicriticum</i> Iljin	Ah	Th	TMP	CN	CLD	ST	+	+	+	B, D	CR
Chenopodiaceae	<i>Halogeton glomeratus</i> (M.Bieb.) C.A. Mey.	Ah	Th	TMP	R	DMS	ST	+	-	-	-	-
Chenopodiaceae	<i>Haloxylon griffithii</i> (Moq.)Boiss subsp.wakhtanicum(Paulsen)Hedge in Rech.f.	Ph	Th	TMP	CN	DMS	ST	-	-	-	-	-
Chenopodiaceae	<i>Kochia prostrata</i> (L.)schrard	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Chenopodiaceae	<i>Salsola callina</i> Pall.	Ah	Th	TMP	R	DMS	ST	+	-	-	-	-
Chenopodiaceae	<i>Salsola tragus</i> L.	Ah	Th	TMP	R	DMS	ST	+	-	-	-	-
Chenopodiaceae	<i>Suaeda heterophylla</i> (Kar. & Kir.)Bunge	Ah	Th	TMP	CN	DMS	ST	+	-	-	-	-
Crassulaceae	<i>Chenopodium glaucum</i> L.	Ah	Th	TMP	CN	CLD	ST	+	-	-	-	-
Crassulaceae	<i>Hylotelephium ewersii</i> (Ledeb.) H. Ohba	Ph	He	SBA	CN	DMS	ST	+	-	-	-	-
Crassulaceae	<i>Pseudosedum lievenii</i> (Ledeb.) A. Berger	Ph	He	ALP	CN	RSB	ST	+	-	-	-	-
Crassulaceae	<i>Rhodiola fastigiata</i> (Hook. f. Thomson) S. H. Fu	Ph	He	ALP	CN	MMS	ST	+	-	-	-	-
Crassulaceae	<i>Rhodiola heterodonta</i> (Hook. f. & Thomson) Boriss.	Ph	He	ALP	CN	DMS	ST	+	-	-	-	-
Crassulaceae	<i>Rhodiola quadrifida</i> (Pallas) Schrenk	Ph	He	ALP	R	DMS	ST	+	-	-	-	-
Crassulaceae	<i>Rhodiola saxifragoides</i> (Fröd.) H. Ohba	Ph	He	ALP	CN	DMS	ST	+	-	+	B	VU
Crassulaceae	<i>Rhodiola tibetica</i> (Hook. f. thoms.) S.H.Fu	Ph	He	ALP	CN	DMS	ST	-	-	-	-	-
Crassulaceae	<i>Rhodiola wailichiana</i> (Hook.) S.H.Fu	Ph	He	ALP	CN	FLD	ST	+	+	+	B, C	CR
Crassulaceae	<i>Rosularia alpestris</i> (Kar. & Kir.) Boriss.	Ph	He	SBA	CN	DMS	ST	+	-	-	-	-
Crassulaceae	<i>Rosularia sedoides</i> (Decne.)H. Ohba	Ph	He	SBA	CN	DMS	ST	+	-	-	-	-
Cupressaceae	<i>Blymus compressus</i> (L.)Danzer ex Link subsp. <i>Brevifolius</i> (Decne.) Kukkonen	Ph	He	TMP	CN	MMS	ST	+	-	-	-	-
Cupressaceae	<i>Carex diluta</i> M.Bieb	Ph	He	SBA	R	CLD	ST	+	-	-	-	-
Cupressaceae	<i>Carex infuscata</i> Ness	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Cupressaceae	<i>Carex kashimirensis</i> C.B.Clarke	Ph	He	ALP	R	MMS	ST	+	-	-	-	-
Cupressaceae	<i>Carex nivalis</i> Boott in Trans	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Cupressaceae	<i>Carex stenocarpa</i> Turcz. ex V.Krecz	Ph	He	ALP	CN	MMS	ST	-	-	-	-	-
Cupressaceae	<i>Carexhaematostoma</i> Nees	Ph	He	TMP	CN	MMS	ST	-	-	-	-	-
Cupressaceae	<i>Elepcharis uniglumis</i> (Link)schultes	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Cupressaceae	<i>Juniperus excelsa</i> M.Bieb.	Tr	Mp	ALP	R	DMS	DR	+	-	+	A, B	CR
Cupressaceae	<i>Juniperus turkestanica</i> Komarov	Tr	Mp	ALP	CN	DMS	DR	+	-	+	B	CR
Cupressaceae	<i>Kobresia capillifolia</i> (Decne.)C.B.Clarke	Ph	He	TMP	CN	MMS	ST	+	-	-	-	-
Cupressaceae	<i>Kobresia humilis</i> (C.A.Mey.)Serg.	Ph	He	TMP	CN	MMS	ST	+	-	-	-	-
Cupressaceae	<i>Kobresia laxa</i> Nees	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Cupressaceae	<i>Kobresia nitens</i> C.B.Clarke	Ph	He	TMP	R	MMS	ST	-	-	-	-	-
Cupressaceae	<i>Kobresia schoenoides</i> (C.A.Mey.)Steud	Ph	He	ALP	CN	MMS	ST	+	-	-	-	-
Cupressaceae	<i>Schoenoplectus triquetri</i> (L.)Palla	ph	He	ALP	R	CLD	ST	-	-	-	-	-
Cyperaceae	<i>Carex psychrophila</i> Nees	Ph	He	ALP	R	FLD	ST	+	+	-	-	-
Cyperaceae	<i>Carex vulpinaris</i> Nees	Ph	He	TMP	VGN	MMS	ST	-	+	-	-	-
Ephedraceae	<i>Ephedra Gerardiana</i> Wall. ex Stapf	Sh	Np	SBA	R	DMS	ST	+	-	-	-	-
Ephedraceae	<i>Ephedra intermedia</i> Schrenk & Mey.	Sh	Np	TMP	R	DMS	ST	+	-	-	-	-
Ephedraceae	<i>Ephedra regeliana</i> Florin	Sh	Np	TMP	R	MMS	ST	+	+	+	B, D	CR
Ephedraceae	<i>Hippophae rhamnoides</i> L. subsp. <i>turkestanica</i> Rousi	Sh	Np	TMP	CN	CLD	ST	+	-	-	-	-
Fabaceae	<i>Astragalus falconeri</i> Bunge	Ph	He	SBA	CN	CLD	ST	+	+	-	-	-

Table 2. (Cont'd.)..

Family	Scientific name	Habit	Life form	Alt. zone	Abun.	Habitat types	Habitat quality	Habitat specificity	Small population size	Small geographic range	IUCN criteria (A-E)	Category
Fabaceae	<i>Astragalus frigidus</i> (L.) A. Gray	Ph	He	SBA	CN	MMS	ST	+	+	+	B, C	VU
Fabaceae	<i>Astragalus grahamianus</i> Royle ex Benth.	Sh	Np	TMP	CN	CLD	ST	+	+	+	-	-
Fabaceae	<i>Astragalus peduncularis</i> Royle ex Benth.	Ph	He	SBA	CN	DMS	ST	+	-	-	-	-
Fabaceae	<i>Astragalus rhizanthus</i> Royle ex Benth.	Ph	He	SBA	R	DMS	ST	+	-	-	-	-
Fabaceae	<i>Astragalus tibetanus</i> Benth. ex Bunge	Ph	He	SBA	CN	RSB	ST	+	+	-	-	-
Fabaceae	<i>Chesneya cuneata</i> (Benth.) Ali	Ph	He	TMP	CN	DMS	ST	-	+	-	-	-
Fabaceae	<i>Cicer microphyllum</i> Benth.	Ph	He	TMP	R	RSB	DR	+	-	-	-	-
Fabaceae	<i>Colutea paulsenii</i> Freyn subsp. <i>paulsenii</i>	Ph	He	TMP	R	DMS	DR	+	-	-	-	-
Fabaceae	<i>Hedysarum falconeri</i> Baker	Ph	He	SBA	CN	CLD	ST	-	-	-	-	-
Fabaceae	<i>Melilotus officinalis</i> (L.) Pall.	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Fabaceae	<i>Oxytropis humifusa</i> Kar. & Kir.	Ph	He	SBA	CN	MMS	ST	-	-	-	-	-
Fabaceae	<i>Oxytropis hypoglottoides</i> (Baker) Ali	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Fabaceae	<i>Oxytropis lapponica</i> (Wahl.) Gay	Ph	He	ALP	R	MMS	ST	+	-	-	-	-
Fabaceae	<i>Oxytropis mollis</i> Royle ex Benth.	Ph	Mp	ALP	CN	CLD	ST	-	-	-	-	-
Fabaceae	<i>Papaver nudicaule</i> L.	Ph	He	ALP	CN	MMS	ST	+	+	+	B, C	VU
Fumariaceae	<i>Corydalis flabellata</i> Edgew.	Ph	He	TMP	R	DMS	DR	+	+	+	B	VU
Gentianaceae	<i>Aloitis stoliczkae</i> (Clarke) Omer, Qaiser & Ali	Ah	Th	ALP	CN	CLD	ST	+	-	-	-	-
Gentianaceae	<i>Aloitis umbellata</i> (M.Bieb.) Omer, Qaiser & Ali	Ah	Th	SBA	CN	MMS	ST	+	-	-	-	-
Gentianaceae	<i>Corydalis pseudocritlimifolia</i> Jafri	Ph	He	TMP	R	DMS	ST	+	-	+	B, C	VU
Gentianaceae	<i>Gentianodes barkillii</i> (H. Smith) Omer, Ali & Qaiser	Bh	He	TMP	CN	MMS	ST	+	-	-	-	-
Gentianaceae	<i>Gentianodes alii</i> Omer & Qaiser	Ah	Th	ALP	R	CLD	ST	+	-	-	-	-
Gentianaceae	<i>Gentianodes eumarginata</i> Omer var. <i>Scabromarginata</i> Omer	Ph	He	TMP	CN	MMS	ST	+	-	-	-	-
Gentianaceae	<i>Gentianodes tianshanica</i> (Rupr. ex Kusn.) Omer, Ali & Qaiser	Ph	He	TMP	CN	MMS	ST	+	-	-	-	-
Gentianaceae	<i>Gentianopsis vvedenskii</i> (Grossh.) V. V. Pis'Yaukova	Ph	He	TMP	CN	MMS	ST	+	+	-	B, C	VU
Gentianaceae	<i>Jaeschkea oligosperma</i> (Griseb.) Knobloch	Ph	He	ALP	CN	CLD	ST	+	-	-	-	-
Gentianaceae	<i>Swertia cordata</i> (G. Don) Clarke	Ph	He	ALP	R	CLD	ST	+	-	-	-	-
Gentianaceae	<i>Swertia tetragona</i> (Edgew.) Clarke	Ah	Th	SBA	CN	CLD	ST	-	-	-	-	-
Geraniaceae	<i>Geranium himalayense</i> Kl.	Ph	He	ALP	CN	MMS	ST	+	-	-	-	-
Geraniaceae	<i>Swertia petiolata</i> D. Don	Ph	He	ALP	R	MMS	ST	+	-	-	-	-
Geraniaceae	<i>Geranium pratense</i> L. subsp. <i>stewartianum</i> Y. Nasir	Sh	Np	SBA	CN	MMS	ST	+	-	-	-	-
Glossariaceae	<i>Ribes alpestre</i> Decne.	Sh	Np	SBA	CN	DMS	ST	+	+	+	B, C	CR
Juncaceae	<i>Juncus membranaceus</i> Royle ex Don	Ph	He	SBA	CN	MMS	ST	+	-	-	-	-
Labiatae	<i>Dracocephalum bipinnatum</i> Rupr.	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Labiatae	<i>Isodon rugosus</i> (Wall. ex Benth.) Codd	Sh	Ch	ALP	CN	CLD	ST	+	-	-	-	-
Labiatae	<i>Mentha longifolia</i> (L.) L.	Ph	He	TMP	R	RSB	ST	+	-	-	-	-
Labiatae	<i>Mentha royleana</i> Benth.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Labiatae	<i>Nepeta discolor</i> Royle ex Benth.	Ph	He	TMP	R	DMS	ST	+	-	-	-	-
Labiatae	<i>Nepeta leucolaena</i> Benth. ex Hook.f.	Ph	He	ALP	R	DMS	ST	+	-	-	-	-
Labiatae	<i>Perovskia abrotanoides</i> Karel.	Ph	He	TMP	R	DMS	DR	+	-	-	-	-
Labiatae	<i>Stachys tibetica</i> Vatke	Sh	Np	TMP	R	RSB	ST	+	-	-	-	-
Labiatae	<i>Thymus linearis</i> Benth. subsp. <i>linearis</i>	Ph	He	SBA	CN	DMS	ST	-	-	-	-	-
Liliaceae	<i>Lloydia serotina</i> (L.) Reichenb.	Ph	He	ALP	CN	MMS	ST	-	+	+	B, C	CR
Morinaceae	<i>Morina coulteriana</i> Royle	Ph	He	SBA	R	DMS	ST	+	+	+	A, B, C	CR

Table 2. (Cont'd.)..

Family	Scientific name	Habit	Life form	Alt. zone	Abun.	Habitat types	Habitat quality	Habitat specificity	Small population size	Small geographic range	IUCN criteria (A-E)	Category
Onagraceae	<i>Epilobium angustifolium</i> L.	Ph	He	SBA	R	RSB	DR	+	+	+	A, B, C	CR
Onagraceae	<i>Epilobium latifolium</i> L. subsp. <i>latifolium</i>	Ph	He	TMP	R	RSB	DR	+	-	-	-	-
Onagraceae	<i>Spiranthes sinensis</i> (Pers.) Ames	Ph	He	TMP	CN	CLD	ST	-	-	-	-	-
Orchidaceae	<i>Cypripedium cordigerum</i> D. Don	Ph	He	TMP	R	CLD	ST	+	+	+	B, C	EN
Orchidaceae	<i>Dactylocriza hatogirea</i> (D. Don) Soo	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Orchidaceae	<i>Dactylocriza kafiriana</i> Renz	Ph	He	TMP	CN	CLD	ST	+	+	+	B, C	EN
Orchidaceae	<i>Epilobium royleanum</i> Hausskn.	Ph	He	ALP	CN	RSB	DR	+	+	+	B, C	VU
Orchidaceae	<i>Epipactis gigantea</i> Douglas ex Hook.	Ph	He	ALP	CN	CLD	ST	+	+	+	B, C	VU
Orchidaceae	<i>Epipactis veratrifolia</i> Boiss. ex Hohen	Ph	He	SBA	R	RSB	ST	+	+	+	B, C	VU
Orchidaceae	<i>Orobanchae alba</i> Steph.	Ah	He	SBA	R	DMS	ST	+	+	+	A, B, C	CR
Papaveraceae	<i>Orobanchae cernua</i> Leofl.	Bh	He	TMP	CN	CLD	ST	+	+	+	A, B, C	CR
Parnassiaceae	<i>Sophora mollis</i> (Royle) Baker subsp. <i>Mollis</i>	Ph	He	TMP	CN	DMS	ST	+	-	-	B, C	VU
Plantaginaceae	<i>Parnassia rubicola</i> Wall. ex Royle subsp. <i>occidentalis</i> Schönbeck-Temesy.	Ph	He	SBA	R	RSB	DR	-	-	-	-	-
Plantaginaceae	<i>Plantago lanceolata</i> L.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Plumbaginaceae	<i>Acantholimon lycopodioides</i> (Girard) Boiss.	Sh	Np	SBA	CN	DMS	ST	-	-	-	-	-
Plumbaginaceae	<i>Limonium macrorrhodon</i> (Boiss.) O. Kuntze	Ph	He	TMP	R	MMS	ST	+	-	-	-	-
Plumbaginaceae	<i>Plantago major</i> L.	Ph	He	TMP	CN	CLD	ST	+	+	+	-	-
Poaceae	<i>Agrostis stolonifera</i> L.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Agrostis vinealis</i> Schreb	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Aristida adscensoides</i> L.	Ah	Th	TMP	CN	CLD	ST	+	-	-	B, C	VU
Poaceae	<i>Arrhaxon laccifolius</i> (Trin.) Hochst	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Poaceae	<i>Calamagrostis pseudophragmites</i> (Hall.f.) Koel	Ph	He	TMP	CN	CLD	DR	+	-	-	-	-
Poaceae	<i>Cymbopogon jvarancusa</i> (Jones) Schult. subsp. <i>olivieri</i> (Boiss.) Soenarko	Ph	He	TMP	CN	DMS	ST	-	-	-	-	-
Poaceae	<i>Cymbopogon pospilschillii</i> (K. schum) C.E. Hubbared	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Poaceae	<i>Dactylis glomerata</i> L.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Danthoria cachemyriana</i> Jaub. stach.	Ph	He	ALP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Elymus canius</i> (L.) L.	Ph	He	SBA	CN	MMS	ST	+	-	-	-	-
Poaceae	<i>Elymus longearistatus</i> (Boiss.) Tzvelev subsp. <i>canaliculatus</i> (Nevski) Tzvelev	Ph	He	SBA	CN	MMS	ST	-	-	-	-	-
Poaceae	<i>Enneapogon persicas</i> Boiss	ph	He	SBA	R	CID	ST	+	-	-	-	-
Poaceae	<i>Festuca rubra</i> L. subsp. <i>rubra</i>	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Koeleria macrantha</i> (Ledeb) Schult	Ph	He	TMP	CN	CLD	ST	-	-	-	-	-
Poaceae	<i>Pennisetum lanatum</i> Klotzsch	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Pennisetum orientale</i> L.C. Rich.	Ph	He	TMP	R	CLD	ST	+	-	-	-	-
Poaceae	<i>Piptatherum gracile</i> Mez	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Piptatherum vicarium</i> (Grig.) Rozhev.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Poa alpina</i> L.	Ph	He	ALP	CN	MMS	ST	+	-	-	-	-
Poaceae	<i>Poa annua</i> L.	Ah	Th	SBA	R	MMS	ST	+	-	-	-	-
Poaceae	<i>Poa attenuata</i> Trin	Ph	He	ALP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Poa nemoralis</i> L.	Ph	He	ALP	R	MMS	ST	-	-	-	-	-
Poaceae	<i>Poa pratensis</i> L.	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Poaceae	<i>Saccharum filifolium</i> Nees ex Steud.	Ph	He	TMP	R	RSB	DR	+	-	-	-	-

Table 2. (Cont'd.)..

Family	Scientific name	Habit	Life form	Alt. zone	Abun.	Habitat types	Habitat quality	Habitat specificity	Small population size	Small geographic range	IUCN criteria (A-E)	Category
Poaceae	<i>Saccharum ravennae</i> (L.)Murr	Ph	He	TMP	R	CLD	ST	+	-	-	B, C	VU
Poaceae	<i>Schimus arabicus</i> Nees	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Setaria viridis</i> (L.) P. Beauv.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Poaceae	<i>Stipa jaccquemontii</i> Jaub. & Spach	Ph	He	TMP	R	DMS	ST	+	-	-	-	-
Poaceae	<i>Stipa sibirica</i> (L.) Lam.	Ph	He	SBA	R	DMS	ST	+	+	+	B, D	CR
Polygonaceae	<i>Aconogonon tortuosum</i> (D. Don) Hara var. <i>tibetanum</i> (Meisn.) S.-P. Hong	Sh	He	SBA	CN	MMS	ST	+	-	-	-	-
Polygonaceae	<i>Bistorta affinis</i> (D. Don) Green	Ph	He	ALP	CN	DMS	ST	-	-	-	-	-
Polygonaceae	<i>Bistorta vivipara</i> (L.) S.F. Gray	Ph	He	SBA	CN	MMS	ST	+	-	-	-	-
Polygonaceae	<i>Fallopia convovulus</i> (L.) A. Love	Ph	He	TMP	R	CLD	ST	+	-	-	B	VU
Polygonaceae	<i>Oxyria digyna</i> (L.) Hill	Ph	He	SBA	R	MMS	ST	+	-	-	-	-
Polygonaceae	<i>Persicaria nepalensis</i> (Meisn.) H. Gross	Ph	He	TMP	CN	CLD	ST	+	-	-	B, C	VU
Polygonaceae	<i>Polygonum alivascens</i> Rech.f.&Schiman	Ph	He	ALP	R	CLD	ST	+	-	-	-	-
Polygonaceae	<i>Polygonum aviculare</i> L.	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Polygonaceae	<i>Polygonum paronychioides</i> C.A.Mey	Ph	He	SBA	R	DMS	ST	+	-	-	-	-
Polygonaceae	<i>Rheum tibeticum</i> Maxim. ex Hook. f.	Ph	He	TMP	R	DMS	ST	+	-	-	-	-
Polygonaceae	<i>Rheum webbianum</i> Royle	Ph	He	SBA	R	MMS	ST	+	+	-	B	VU
Primulaceae	<i>Androsace muscoidea</i> Duby	Ph	He	ALP	CN	DMS	ST	+	-	-	-	-
Primulaceae	<i>Androsace septentrionalis</i> L.	Ah	Th	SBA	CN	MMS	ST	+	-	-	-	-
Primulaceae	<i>Androsace thomsonii</i> (Watt) Y. Nasir	Ph	He	ALP	CN	DMS	ST	+	+	+	B	VU
Primulaceae	<i>Cortusa brotheri</i> Pax ex Lipsky	Ph	He	TMP	CN	MMS	ST	+	+	+	B, C	CR
Primulaceae	<i>Primula obtusifolia</i> Royle	Ph	He	ALP	CN	RSB	ST	+	-	-	B, C	CR
Primulaceae	<i>Primula schlagintweitiana</i> Pax	Ph	He	ALP	CN	MMS	ST	+	-	-	B, C	VU
Primulaceae	<i>Primula warshenewskiana</i> B. Fedtsch. subsp. <i>warshenewskiana</i>	Ph	He	ALP	CN	FLD	ST	+	-	-	B	VU
Primulaceae	<i>Rumex hastatus</i> D. Don	Sh	Np	TMP	R	CLD	ST	+	-	-	-	-
Ranunculaceae	<i>Anemone rupicola</i> Camb.	Ph	He	ALP	R	MMS	ST	+	+	+	B, C	CR
Ranunculaceae	<i>Aquilegia fragrans</i> Benth. var. <i>fragrans</i>	Ph	He	SBA	R	RSB	ST	+	-	-	B, C	VU
Ranunculaceae	<i>Clematis alpina</i> (L.) Miller var. <i>sibirica</i> (L.) O. Kuntze	Sh	Np	SBA	CN	MMS	ST	-	+	+	B, C	CR
Ranunculaceae	<i>Clematis orientalis</i> L.	Sh	Np	TMP	CN	CLD	ST	+	-	-	-	-
Ranunculaceae	<i>Delphinium cashmerianum</i> Royle	Ph	He	ALP	CN	FLD	ST	-	+	+	B, C	EN
Ranunculaceae	<i>Paraquilegia anemonoides</i> (Willd.) Ulbr.	Ph	He	ALP	CN	MMS	ST	+	+	+	B, C	CR
Ranunculaceae	<i>Thalictrum alpinum</i> L.	Sh	Np	ALP	R	DMS	ST	+	-	-	-	-
Rhamnaceae	<i>Rhamnus prostratus</i>	Sh	He	TMP	R	MMS	ST	+	-	-	-	-
Rosaceae	<i>Cotoneaster integerrimus</i> Medikus	Sh	Np	TMP	CN	CLD	ST	-	-	-	-	-
Rosaceae	<i>Fragaria nubicola</i> (Hook.f.) Lindl. ex Lacaita	Ph	He	SBA	CN	MMS	ST	+	+	+	B, C	EN
Rosaceae	<i>Potentilla atrosanguinea</i> Lodd.	Ph	He	ALP	CN	DMS	ST	+	+	-	-	-
Rosaceae	<i>Potentilla bifurca</i> L.	Ph	He	ALP	R	DMS	ST	+	+	-	-	-
Rosaceae	<i>Potentilla dryadanthoides</i> (Juz.) Viroshilov	Sh	Np	ALP	R	DMS	ST	+	-	-	-	-
Rosaceae	<i>Potentilla evestita</i> Th. Walp	Ph	He	ALP	R	DMS	ST	+	-	-	-	-
Rosaceae	<i>Potentilla gelida</i> C.A. May	ph	He	TMP	R	DMS	ST	+	-	-	-	-
Rosaceae	<i>Potentilla ochreate</i> Lindl.	Sh	Ch	ALP	R	DMS	ST	+	-	-	-	-

Table 2. (Cont'd.).

Family	Scientific name	Habit	Life form	Alt. zone	Abun.	Habitat types	Habitat quality	Habitat specificity	Small population size	Small geographic range	IUCN criteria (A-E)	Category
Rosaceae	<i>Potentilla pamirica</i> Th. wolf	Ph	He	ALP	CN	DMS	ST	+	-	-	-	-
Rosaceae	<i>Potentilla salesovitana</i> Staph.	Sh	Np	TMP	CN	DMS	ST	+	-	-	-	-
Rosaceae	<i>Rosa webbiana</i> Wall. ex Royle	Sh	Np	TMP	VCN	CLD	ST	-	-	-	-	-
Rosaceae	<i>Sibbaldia procumbens</i> L.	Sh.	Np	SBA	CN	DMS	ST	-	-	-	-	-
Rosaceae	<i>Sorbus tianshanica</i> Rupr.	Tr	Mp	SBA	CN	MMS	ST	+	+	+	B, C	EN
Rosaceae	<i>Spiraea hypericifolia</i> L.	Sh	Np	SBA	CN	DMS	ST	-	-	-	-	-
Rubiaceae	<i>Asperula oppositifolia</i> Reg. & Schmalh. subsp. <i>baltistanica</i> Nazim	Sh	He	TMP	CN	DMS	ST	+	+	+	B, C	CR
Rubiaceae	<i>Asperula oppositifolia</i> Reg. & Schmalh. subsp. <i>pseudocynanchica</i> Ehrend.	Sh	He	SBA	R	DMS	ST	+	-	-	-	-
Rubiaceae	<i>Galium verum</i> L.	Ph	He	SBA	R	CLD	ST	+	+	+	B	VU
Rubiaceae	<i>Rubia cordifolia</i> L.	Ph	He	SBA	CN	CLD	ST	+	-	-	-	-
Rubiaceae	<i>Rubia karelinii</i> Turcz.	Sh	Np	SBA	CN	CLD	ST	+	+	+	B	VU
Rubiaceae	<i>Salix karelinii</i> Turcz.	Sh	Np	SBA	CN	CLD	ST	+	-	-	-	-
Saxifragaceae	<i>Bergenia stracheyi</i> (Hook.f. & Thoms.) Engl.	Ph	He	SBA	R	DMS	ST	+	-	-	-	-
Saxifragaceae	<i>Saxifraga flagellaris</i> Willd. ex Sternb. subsp. <i>stenophylla</i> (Royle) Hulten.	Ph	He	TMP	CN	DMS	ST	+	+	+	B, C	VU
Saxifragaceae	<i>Saxifraga moorcroftiana</i> (Ser.) Sternb.	Ph	He	SBA	CN	DMS	ST	+	+	+	B, C	CR
Saxifragaceae	<i>Saxifraga pulvinaria</i> H. Smith	Ph	He	SBA	CN	DMS	ST	+	-	-	-	-
Saxifragaceae	<i>Saxifraga sibirica</i> L.	Ph	He	TMP	CN	MMS	ST	-	+	+	B, C	EN
Saxifragaceae	<i>Saxifraga unguipetala</i> Engler & Irmscher	Ph	He	ALP	R	DMS	ST	+	-	-	-	-
Scrophulariaceae	<i>Pedicularis stantonii</i> R.R. Mill	Ph	He	TMP	CN	MMS	ST	+	+	+	B, C	EN
Scrophulariaceae	<i>Scrophularia jafri</i> Khatoon & Qaiser	Ph	He	SBA	CN	DMS	ST	+	+	-	B, C	VU
Tamaricaceae	<i>Myricaria germanica</i> (L.) Desv. subsp. <i>alopecurioides</i> (Schrenk) Kitam.	Sh	Np	SBA	CN	RSB	DR	+	-	-	B, C	VU
Tamaricaceae	<i>Tamaricaria elegans</i> (Royle) Qaiser & Ali	Sh	Np	TMP	R	RSB	DR	+	-	-	C	VU
Thymelaeaceae	<i>Daphne mucronata</i> Royle	Sh	Np	TMP	R	DMS	ST	-	+	+	B, C	CR
Umbelliferae	<i>Bupleurum gracillimum</i> Kl.	Ph	He	SBA	R	CLD	ST	+	+	-	B, C	VU
Umbelliferae	<i>Bupleurum longicaule</i> Wall. ex DC. var. <i>himalayense</i> (Kl.) C.B. Clarke	Ph	He	TMP	R	CLD	ST	+	+	-	-	-
Umbelliferae	<i>Heracleum pinnatum</i> Clarke	Ph	He	TMP	R	MMS	ST	+	+	+	B, C	CR
Umbelliferae	<i>Platytaenia lasiocarpa</i> (Boiss.) Rech. f. & Riedl subsp. <i>thomsonii</i> (Clarke) Rech.f. & Reidl	Ph	He	SBA	CN	DMS	ST	+	-	-	-	-
Umbelliferae	<i>Pleuropernum candollei</i> (DC.) Clarke	Ph	He	SBA	R	MMS	ST	+	+	+	B, C	CR
Umbelliferae	<i>Seseli libanotis</i> (L.) Koch	Ph	He	TMP	CN	DMS	ST	+	-	-	-	-
Urticaceae	<i>Parietaria judaica</i> L.	Ph	He	TMP	CN	CLD	ST	+	-	-	-	-
Urticaceae	<i>Urtica hyperborea</i> Jacq. ex Wedd.	Ph	He	SBA	CN	DMS	ST	-	-	-	B, C	CR
Valerianaceae	<i>Valeriana clarkei</i> Briq.	Ph	He	ALP	R	MMS	ST	+	+	+	B, C	CR
Valerianaceae	<i>Valeriana himalayana</i> Grub.	Ph	He	ALP	R	MMS	ST	+	+	+	B, C	VU
Violaceae	<i>Viola biflora</i> L.	Ph	He	ALP	R	MMS	ST	+	+	+	B, C	CR
Violaceae	<i>Viola rupestris</i> Schm.	Ph	He	ALP	R	MMS	ST	+	+	+	B, C	CR
Zygophyllaceae	<i>Peganum harmala</i> L.	Ph	He	ALP	R	MMS	ST	+	+	+	A, B, C	EN
Zygophyllaceae	<i>Tribulus terrestris</i> L.	Ah	Th	TMP	R	CLD	DR	+	-	-	-	-
Zygophyllaceae	<i>Tribulus terrestris</i> L.	Ah	Th	TMP	CN	DMS	ST	-	-	-	-	-

Key: Alt.: altitudinal; Abun. abundance, HT; habitat type, HQ; habitat quality, HS; habitat specificity, SPS; small population size, SRG; small geographic range, Ah; annual herb, Bh; biennial herb, Th; therophyte, Ph; phanerophytes, He; hemipterophytes, Ch; chamaephyte, Ge; geophyte, Np; nanophanerophytes, Mp; megaphanerophytes, TM; temperate; SA; subalpine, AL; alpine, R; rare, CN; common, C; common, ST; stable, DR; disturb, +; yes, -; no, EN; endangered, CR; critically endangered, VU; vulnerable

Table 3. Ecological traits of the collected plants.

Altitudinal zones	Alpine	80
	Sub alpine	102
	Temperate	142
Habitats	Feld mark	8
	Moist Mountain Slopes	84
	Dry Mountain Slopes	106
	River-stream Banks	36
	Cultivated Land	90
Habit	Perennial herbs	250
	Annual herbs	29
	Biennial herbs	5
	Tree	3
	Shrubs	37
	Hemicryptophytes	249
	Therophytes	29
Life form	Nanophanerophytes	29
	Chamaephytes	9
	Megaphanerophytes	4
	Geophytes	3
	Parasite	1

Dry mountain slopes (DMS): This habitat can be seen on the southern and western facing mountain slopes in the study area. Direct sunlight remains for a long period in each sunny day. Therefore, these slopes remain dry for most of the year. Maximum species (106) species were recorded from DMS habitat. Many trees and shrubs such as *Juniperus excelsa*, *Juniperus turkistanica*, *Potentilla ochreatea*, *Lonicera heterophylla*, *Rosa webbiana*, *Spiraea hypericifolia*, *Ribes alpestre*, *Berberis* sp., *Rhamnus postratus*, *Artemisia brevifolia*, *Acantholimon lycopodiodes* alongwith number of herbs like *Hedysarum falconeri*, *Chesneya cuneata*, *Astragalus peduncularis*.

River-stream banks (RSB): Stream and river were the major aquatic habitat types and represent unique vegetation including 36 species. Many species were confined to this habitat. *Epilobium angustifolium*, *Peonia emodi* and *Shangwua jacea* were some examples for this habitat. The established riverine forest provides fodder for the mountain agro-pastoral communities.

Cultivated land (CLD): Bottom of the valley is used for cultivation. Many species are grown there for timber, fuel wood and other purposes. A total of 90 species recorded from cultivated lands as ruderal species. Among these species, many wild species are *Campanula pallida*, *Astragalus falconeri*, *Tribulus terrestris*, *Peganum harmala*, *Swertia cordata*.

Conservation

Abundance, habitat quality and specificity: The assessment for the collected species reported that 130(40%) species were rare, 190(55%) common and only 4(1.2%) species were very common. It was noted that the species 296 species was found on stable habitats while only 11 species had disturb and unstable habitat types. The analysis of habitat preference by the documented

Table 4. Abundance and IUCN criteria and categories of taxa.

Abundance	Rare	130
	Common	190
	Very common	4
Habitat quality	Unstable	28
	Stable	296
Habitat specificity	Habitat Specific	253
	Not specific	71
Small population size	Small population size	75
	No small population	249
Geographic range	Small geographic range	65
	Large geographic range	259
IUCN Criteria	A, B, D	1
	A, B, C	6
	B, C	53
	B, D	5
	B	10
	C	1
	D	1
IUCN Category	A, B	3
	Critically endangered	38
	Vulnerable	32
	Endangered	10

species revealed that 253 species showed habitat specificity while the remaining 71 species did not show any specificity with their habitats.

Small population size and geographic range: The evaluation of population size of the collected species revealed that 75 five species were with small population. However, the proportion of those species having large and established population was in number. Similarly, 259 species showed wide geographic range while 65 plants were showed small geographic range.

IUCN red list categories and criteria, and endemism: IUCN red list categories criteria 2001 (IUCN, 2001) was consulted in order to evaluate the conservation status of the taxa. Geographic range (B), Population size (A= reduction in population size; C = small population size; D = extremely small population size) and other associated data was used for this purpose (i.e. habitat specificity, quality of habitat and exploitation of the species for various purpose etc.). It showed that maximum species (53 spp.) were fallen in BC category. Ten (10) species in B category; 3 species in A,B; 6 in A,B, C; 1 species in A, B, D; 1 in C and the remaining 1 species in D category. Finally, based on the above facts, 38 species assigned as critically endangered (CR), 10 species endangered (EN) and 32 species assigned under vulnerable (VU) Table 4. In the view of conservation, it is necessary to identify threatened species. Endemic and rare species are very important in this connection. Both categories have been discussed separately as, Six endemic species were collected from the area i.e. *Aconitum violaceum* var. *weileri*, *Rhodiola saxifragoides*, *Tanacetum baltistanicum*, *Asperula oppositifolia* subsp. *baltistanica*, *Hadysarum falconeri*, and *Pedicularis staintonii*. Among above mentioned species, *Asperula oppositifolia* subsp. *baltistanica* is exclusively endemic to the area, while the remaining species are also found some other areas of Pakistan. Even within their entire distribution area, these

taxa are rare and also in the study area due to habitat specificity, small population size or limited distribution. It should be noted that, in the above species, *Asperula oppositifolia* subsp. *baltistanica* and *Tanacetum baltistanicum* have already been declared as Critically Endangered; and *Rhodiola saxifragoides* and *Aconitum violaceum* var. *weihleri* as vulnerable for Pakistan due to limited distribution area, habitat degradation and small population sizes (Alam, 2010). Therefore, special attention should be paid in the area in order to ensure their survival.

Discussion

Study area harbors substantial floristic diversity and presents ferns and seed plants. Angiosperms were the most successful group due to their adaptations with varied habitat types. These outcomes congruence with the previous studies conducted in the range of Karakorum for instance of Abbas *et al.*, (2019b), Abbas *et al.*, (2019a), and (Abbas *et al.*, 2017). Asteraceae is one of the largest families of Pakistan flora published with 21 tribes. Family Asteraceae is known as highly advanced family with specialized morphology and ecological niche. It assorts in all world biomes from tropics to Polar Regions and represents 10% of the total angiosperm flora (Barreda *et al.*, 2012; Bremer and Anderberg, 1994). Being mountainous terrain the climatic conditions and ecological profile embolden the growth of herbaceous plants. The lower tree line comprises of cultivated tree species mostly belong to family Rosaceae e.g. *Prunus armeniaca*, *Pumila malus*, *Prunus amygdalus*, *Prunus persica*, *Prunus avium* etc. The upper tree line determines by *Betula utilis* similar to other Karakorum valleys (Abbas *et al.*, 2020). The biological diversity of plants of any region depends upon landscape and habitat diversity (Amoros, 2001; Brooks *et al.*, 2002). Although the surveyed area exhibits semi-arid region due to scanty rain fall. However, moisture, topography and climatic conditions change with respect to elevation supporting diverse habitat types. The main habitat type is the dry mountain slopes and reside maximum plants species. Nowak *et al.*, (2014) and Akhani *et al.*, (2013) reported same findings from the semi-arid region of Pamir Tajikistan and Iran respectively. Hemicryptophytes are considered to be the best adapted plant group for harsh and cold mountainous environment due to its hidden perennating buds in unfavorable conditions (Klimes, 2003; Pavón *et al.*, 2000). Maximum species were sampled from Temperate Zone. Lower temperate zone enjoys comparatively abundant moisture due to agricultural activities. Since, the waste lands also support a number of ruderal species. Being the semi- arid terrain dry mountain slopes were the most prevailed habitat type. The most of the collected species showed common distribution with stable habitat. It indicates the large extent environmental stability for the growing taxa. On the other hand, considerable taxa grow at specific habitat. This habitat specificity makes the taxa susceptible for environmental degradations and may jeopardize their survival (Alam & Ali, 2010). Small geographic range (65) and population size (75) also make the taxa more vulnerable. The assessment through IUCN red list criteria,

38 were critically endangered followed by 38, vulnerable 32 and endangered 10. During the study few endemic species and most of the species showed specific habit, low population size and small geographical range. The endemic species are consider being more susceptible of environmental fluctuations and threats due to their narrow niche and restricted distribution (Abbas *et al.*, 2013). Therefore, the study advocates the vulnerability and risk to these species inviting special attention to ensure the protection for their survival. Effective conservation action plans are needed at priority bases to protect them from local elimination and extinction.

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