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Conserving wildlife, not their clinics: A case study of wild herbal clinic (Berberis) across alpine pastures in Karakoram Mountain Ranges

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Abstract

Shepherds take care of their livestock but who cares wildlife? Conservation agencies flag certain species which become threatened. Many single-species oriented conservation programmes have negatively impacted, become self-annihilating and causing threats to the concerned species or the others. Ignorance towards wildlife-human synergy level and symbiotic relationship is the core source of ecological imbalance and failure. Several mountain ungulates and carnivores are in conservation list in the area. Almost all of them directly or indirectly rely on Berberis species for their healthcare but none of the conservationist so far thinks of its conservation, which, itself has become critically endangered. It is highly medicinal and serves a wild herbal clinic for wildlife, livestock and humans equally. *Berberis pseudumbellata* subsp. *gilgitica* grows above 2500 masl and climbing into the alpine pastures (3500 m). EOO and AOO are less than 100 km^2 and 10 km^2 respectively. Overgrazing and habitat loss are principal degenerative agents. Besides, long-term conservation of *Berberis pseudumbellata* subsp. *gilgitica*, comprehensive studies of these fragile ecosystems are important to make conservation effort more fruitful. Present research will improve knowledge gap to improve overall biodiversity conservation paradigm.

Key words : Berberis, wildlife, wild herbal clinic, ecological zonation, Karakoram, Critically endangered, Endemic

INTRODUCTION

Berberis species are highly medicinal, therefore, have been integral parts of different healthcare systems around the world [1, 2]. It is effective for more than 100 diseases including various types of cancer, diabetes, AIDS, Alzheimer, bone fractures, ocular diseases, hepatic disorders, internal and external wounds, jaundice etc. [3]. There are two subspecies of *Berberis pseudumbellata* are i.e. *B. pseudumbellata* subsp. *umbellata* and *B. pseudumbellata* subsp. *gilgitica* [3]. Subsp. *gilgitica* is endemic to the area and has become critically endangered [4]. These two subspecies have distinctive geographic and altitudinal zonation [5].

Berberis uses are diverse including ethnomedication, zoopharmacological, heating, fencing, fodder, grazing and income generation [6,7,8,9,10] .Increasing human and livestock populations have a direct but adverse impact on Berberis population [11,12,13,14] . Changes underway have lead to server threat of existence [15,16] . Climate change is adding to the complexity [17,18,14].

According to Red list criteria (IUCN 2001), a species qualifies for one of the three threatened categories (Critically endangered, Endangered, or Vulner) by meeting the threshold for that category in one of the five different available criteria (AE) [19,20]. Extent of occurrence and area of occupancy are the degree of risk spreading amongst the occurrences and general measure of how robust the distribution will be to stochastic and directional threatening processes respectively [21]. Alam and Ali [4] reported less than 50 plants of *B. pseudumbellata* subsp. *gilgitica* from Naltar valley.

It is assumed that anthropo-climatic agencies have expedited floral depletion a rate of one species each day, which is 1000-10000 times faster than its natural pace [22,23,24]. Therefore, it is critical to collect data on biodiversity threats and current management [18]. Lack of information about species status [25] hampers conservation efforts [26,27,28]. Present study helps in bridging such knowledge gap [29,30,31] to overcome long-term conservation of critically endangered Berberis species.

MATERIAL AND METHODS

Geography

Research area constitutes western part of Central Karakoram National Park, which is a Category II World Conservation protected area (Figure). It stretches from 35°N-36.5°N and 74°E-77°E and covers an area of 10,000 km^2. It accumulates the biggest glacial mass outside poles [32]. Elevation ranges from 1200-6000m above sea level (asl).

Climate

Predominantly, climate is cold arid and temperate in the lower elevations. Most of the alpine areas (≥3000 m) are perennially snow covered and very cold with a limited growing season [33]. Area lacks significant rainfall, averaging in 120 to 240 millimeters annually [34]. Most of rainfall occurs during winter and early spring. The land lies amidst towering mountains, snow-clad peaks and narrow valleys.

Sampling and sampling techniques

Most common approach to calculate the area of distributions determined from range-wide occurrences [35,36,37,38,39]. Current investigation has focused population estimation of both subspecies in the field at 11 sampling sites (table 1). Following Range-wide occurrences estimation of population, detailed visits of each village were also made to count mature plant. Various anthropogenic and natural impacts were explored in length as guided by the IUCN criterion (A-E) (table 2).

Table 1: Geographic and altitudinal information of sampling sites across valleys (adopted, with permission, from Khan et al. 2014c)

S#	Valley	S#	Collection site	asl (m)
1	**Rahimabad-Goro**	1.	Rahimabad	1734
		2.	Goro	1708
		3.	Nomal	1639
		4.	Juglot Bala	2034
2	**Rakaposhi**	5.	Hupayc	2042
		6.	Ghulmet	1989
		7.	Thol	1924
3	**Naltar**	8.	Naltar MW	2724
		9.	Naltar E	2942
4	**Bagrot**	10.	Bagrot (Gasuner)	2624
		11.	Bagrot (Chirah)	2573

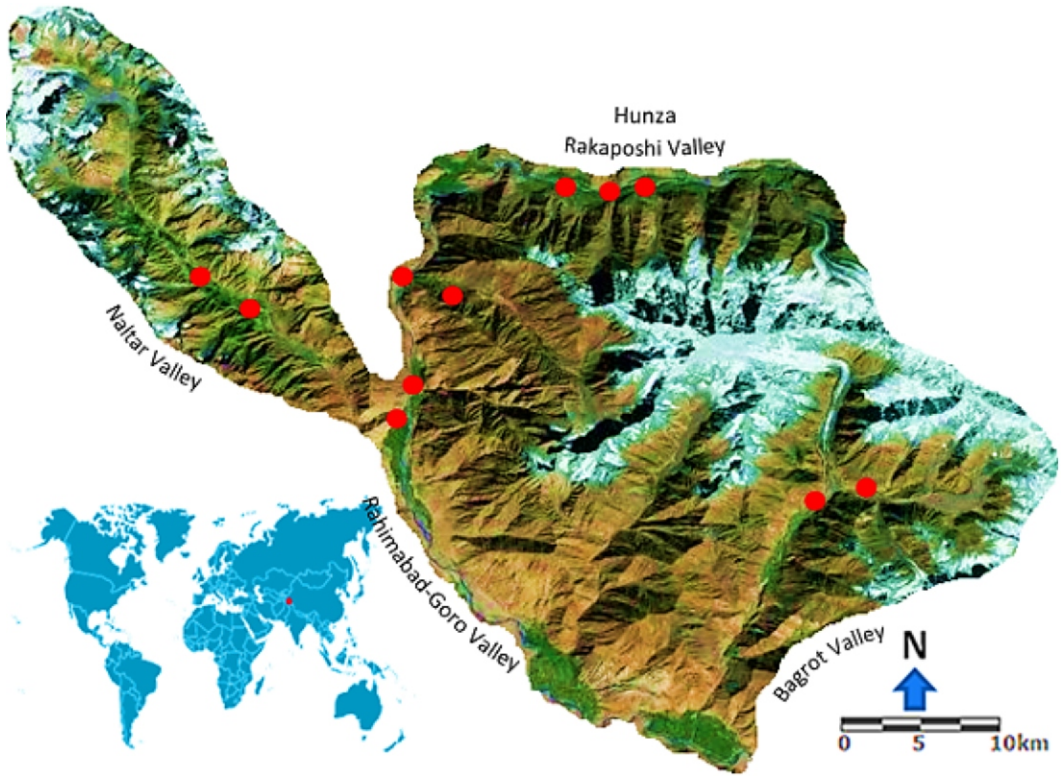

Figure: Small red dot on the globe shows location of study area. Magnified area shows geography and different valleys across in the western part of CKNP. Red dots in the study area are sampling sites. (Map optimization and creation using ArcGIS online[40] by Tika Khan, corresponding author).

Table 2: Threatened subspecies of B. pseudumbellata Parker, conservation status, summary of known localities, population size, geographic range and anthropogenic and natural impacts.

Subspecies	Conservation status	Known Localities	Population size	Geographic range		Anthropogenic and natural impacts				
				EOO (km^2)	AOO (km^2)	A	B	C	D	E
B. pseudumbellata subsp. *gilgitica*	CR	2	1140	10.30	2.78	+	+	+	+	+
B. pseudumbellata subsp. *umbellata*	CR	9	2040	78.82	5.86	+	+	+	+	+

Key: EOO, Extent of occurrence; AOO, Area of occupancy; A, Grazing; B, Soil erosion; C, Fuel collection from habitat; D, Medicinal use; E, Land expansion for agriculture purpose

Tools used for calculation and analysis

Extent of occurrence and area of occupancy have been calculated using GE Path software (V 1.4.6) [41].Moreover, geographical information system (GIS) ArcView v. 10.1[42] and Google Earth have been used to analyze observation data from all groups recorded in the survey and census work.

RESULTS

Berberis species and their distinctive altitudinal demarcation

Repeated field visits followed by Herbarium investigation reveals that there are two subspecies of *Berberis pseudumbellata* found in the area. These subspecies are *B. pseudumbellata* Parker subsp. *pseudumbellata* and *B. pseudumbellata* Parker subsp. *gilgitica* Jafri. Plant taxonomic identification in the field was made by Dr. Jan Alam, plant taxonomist, Hazara University, KPK, Pakistan and with consultation of the Flora of Pakistan [43,4,44].

Both subspecies are sensitive towards altitude. Subsp. *pseudumbellata* does not grow above 2050 m asl. and prefers double cropping zone. In contrast, subsp. *gilgitica* nurtures above 2500 m asl. (single cropping zone) and climbs upto alpine pastures (3500 m asl). There was buffer zone of more than 500 m (2050 m 2570 m) which disconnect both the species from each other. Irrespective of its morphological difference both the subspecies prefer light and found mostly (54.54%) across south facing slopes. North facing population makes almost 45.45%.

Census (Population estimation)

Village and valley-wise population count of mature plants and estimation revealed that different valleys and altitudes exhibit differential level of population (Figure). Rahimabad-Goro (n=1640), Rakaposhi (n= 400), Naltar (n=50) and Bagrot (n=1090).Within this overall population *B. pseudumbellata* Parker subsp. *gilgitica* Jafri makes 35.84% (n=1140) and *B. pseudumbellata* Parker subsp. *pseudumbellata*64.15% (n=2040).

Extent of Occurrence and Area of occupancy

Within a total range of 89.12 km^2 EOO, only 9.69% area is under AOO (8.64 km^2). Similarly, *B. pseudumbellata* Parker subsp. *gilgitica* Jafri occupy 11.55% EOO as compared to 88.44% of *B. pseudumbellata* Parker subsp. *pseudumbellata*. Correspondingly, *gilgitica* holds only 32.17% AOO and *umbellata* 67.82% (table 2). Average area covered by each mature plant is 2.84 m^2in general; however, both subspecies show slight difference. i.e. *gilgitica* 2.80 m^2 and *umbellata* 2.88 m^2.

Agencies of population change

Several natural and human factors are impacting overall population of both the subspecies. These agents include (not limited to) grazing, soil erosion, as firewood collection, medicinal use, land use change and expansion for agrarian activities, developmental activities, fencing etc. developmental activities are the most strongest factor followed by the over grazing in the area.

With respect to healthy fruit and seed bearing, comparative assessment of both subspecies shows that *B. pseudumbellata* subsp. *gilgitica* is less under attack of borer which destroys seed endoplasm leaving berries unusable.

DISCUSSION

Single species oriented conservation strategies are no longer healthy and need a comprehensive and integrated conservation management. Such a policy not only contributes towards conservation of the species concerned but also integrates direct and indirect supportive mechanism. Which is for most of times critical to achieve real objectives of any conservation programme. *B. pseudumbellata* subsp. *gilgitica* is restricted to extremely high altitude in Bagrot and Naltar. Alam and Ali had identified its AOO and EOO earlier restricted to Naltar valley, however, we have found the same species in Bagrot valley as well. Early reports by the same researchers had identified various factors including habitat loss and overgrazing in Naltar, where the situation has gone even worse, however, such pressures are slightly increasing

in Bagrot.. In both valleys, habitat degradation and over grazing are cause of its population decline. Long-term conservation strategies are important to save *B. pseudumbellata* subsp. *gilgitica* before it is loss for ever. Its conservation is important not because to save germ plasm but also to keep continuing its vital ecological and medicinal role played for wildlife and traditional communities living in the area.

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