



Impact of Environmental Change on the distribution of Floral Biodiversity of Khunjerab National Park and Central Karakorum National Park District Hunza-Nagar Gilgit-Baltistan Pakistan

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Abstract

The significance of this study is the presence of two national parks in the study area; the Khunjerab National Park (KNP) which is wholly present in the study area, and the Central Karakoram National Park (CKNP) which has roughly 40% of its area in the study area. Both the KNP and part of CKNP in the study area are located in the Alpine and Subalpine zones, though KNP has a greater altitude. Floristically both showed striking differences in spite of belonging to similar ecological zones and situated not far away from each other. Although both had Compositae as the largest family, in KNP its number of species (38) was disproportionately higher than all other families. On the other hand, in the CKNP, the distribution of species in the larger families and genera was comparatively more even. Except the first largest, the other large families were different in both the Parks, and both had totally different sets of the largest genera. The overall species richness was greater in CKNP (200 spp.) than the KNP (160 spp); One reason for the floristic difference between both of these parks may be the availability of moisture and environmental conditions.

Keywords: Environmental change, floral biodiversity.

Introduction

Founded in 1975, the Khunjerab National Park with an area of 226,913.83 hectares (560,714 acres) is one of the highest national parks in the world. the national park includes three valleys, namely Khunjerab, Ghujerab, and Shimshal in the upper Hunza. Located between 34° 44' N-75° 17' E, the park varies in altitude from 3,660m at the entrance to 6000m in certain places; with the most of it above 4,000m and the Khunjerab Pass at 4,934m above sea level. Primarily the park was established for the protection of the Marco Polo Sheep, but many other species of animals like Himalayan Ibex, Brown Bear, Snow Leopard, Tibetan Red Fox, Tibetan Wolf, Blue Sheep, Marmot, Tibetan Wild Ass, and 66 bird species are also present. Much information about the flora is not available. The Park lies adjacent to the Taxkorgan National Nature Reserve in China. While the CKNP, with an area of 10,000 sq. km was established in 1993. It is the largest national park of Pakistan with most of its altitude above 2000m, while the highest point in the park is 8611m K-2 Peak. The park encompasses some of the world's highest peaks and largest glaciers; there are sixty peaks above 7000m, and ten of the world's highest and most famous mountains including Gasherbrum, Broad peak, and Masherbrum are located within the Park's boundaries.

The CKNP glaciers feed the Indus river and its tributaries, therefore this park is the largest source of freshwater for Pakistan and one of the largest mountain glacial systems in the world with the Siachen (75 km long), Baltoro (57 km long), and Hispur-Biafo (122km long) glaciers all originating within the Park boundaries. Major part of the CKNP lies in the Skardu district of Gilgit-Baltistan; about 40% part lies in the study area¹. Any detail information about Park's plant biodiversity is not available.

Material and Methods

The reconnaissance study was conducted in the Khunjerab National Park (KNP) and the part of Central Karakorum National park (CNP), situated in the districted Hunza Nagar Gilgit-Baltistan. The study area was thoroughly surveyed by field trips in different seasons of the year 2013. It provides an opportunity to make plant collection observation. During the field surveys along the collection of plant specimen we observed the impact of environmental change between these parks in terms of Dominant taxa in the current flora and their distribution. The collected specimens were identified with the help of Flora of Pakistan^{2,3} and using available literature and comparison of specimen at Karachi University Herbarium.

Results and Discussion

In spite of this global importance, the plant biodiversity of most of the Karakoram Range has not been studied, and even the most basic information is not available. Functional ecology of the alpine plants in the subtropics and tropics is largely underrepresented in the literature; and in the Asian subtropics most research is only from the southern Himalayas⁴. Mountains create habitat for a vast amount of biodiversity and are typically richer than the neighbouring plains in genetic, species, and ecosystem diversity⁵. Many of the world's hot spots are in the mountain regions, as are many protected areas⁶. The research in alpine region demonstrates enormous intra-specific variation even within small area, for example in flowering rhythms⁷. The physical complexity of alpine environment encourages rapid speciation; especially because mountain fauna tend to be highly mobile^{7,8}. The plant biodiversity of high mountains are often richer than those of the surrounding low lands⁹. The floristic composition of vegetation varies along the altitudinal gradient. Plants along the altitudinal gradient are exposed to gradients of solar radiation, temperature, and precipitation¹⁰. Temperature is the major driver of the elevational stratification of life zones and the distributional ranges of plants species¹¹. The solar energy including the UV received by the mountain surface increases with altitude while the air density decreases, temperature decreases by 1°C to 2°C per 300m, and precipitation usually increases with altitude^{12,13}. The upper altitudinal limit of trees and the maximum elevation of plant growth in general, decrease with distance from the equator¹⁴. Due to the gradients of radiation, temperature, and moisture the microclimate varies along the altitudinal gradient. The microclimate plays a crucial role in the maintenance of ecosystem structure and ecological processes particularly those of plant communities^{15,16}. Both the KNP and part of CKNP in the study area are located in the Alpine and Subalpine zones, though KNP has a greater altitude. In the present study, 160 species have been recorded from KNP and 200 species from CKNP. The 160 species of KNP belong to 97 genera and 36 families; while the 200 species of CKNP belong to 102 genera and 34 families (table-1).

A comparison of the flora of both national parks reveals notable difference in their floristic structures. In case of KNP, the members of family Compositae were in disproportionately higher number as compared to other families. The second largest family Poaceae had less than half number of species (about 40%) as compared to Compositae; while the families at 3rd 4th and 5th positions had even smaller numbers of species. In case of CKNP, the family Compositae was the largest family here as well; however the families on 2nd to 5th positions did not have abruptly smaller number of species, i.e. there was relatively more evenness in the number of species in different families (table-1). Except the 1st largest family, both National Parks differed in their large families. In KNP, the families ranking from 1st to 5th position were: Compositae (38), Poaceae (15), Brassicaceae (14), Boraginaceae (9), and Cyperaceae (8); while in case of CKNP, the families ranking from one to five

were: Compositae (29), Rosaceae (18), Brassicaceae (15), Papilionaceae (15), Umbelliferae (14), and Poaceae (9). Interestingly both national parks did not share even a single large genus among them.

Two remarkable species were *Peganum harmala* and *Phragmites karka*; these normally Desert zone species occur all over Pakistan from sea-level to usually 2000m in the Desert zone of the study area; however in KNP these were found in the Subalpine zone. Species and their populations can respond to climate change by adoptive evolution or by migrating geographically to track their favoured climate⁸.

Floristically both showed striking differences in spite of belonging to similar ecological zones and situated not far away from each other. Although both had Compositae as the largest family; one reason for the floristic difference between both of these parks may be the availability of moisture. The CKNP receives more water from the snow-melt of the glaciers than KNP. Another factor may be the presence of the Karakoram Highway in the KNP which is source of constant disturbance in the ecosystem. Qureshi *et al.* reported 62 plant species from KNP. The present findings are in sharp contrast to Qureshi *et al.*, in various aspects, for example they found only six species of Compositae compared to 38 species in the present work.

Conclusion

During this study, it was observed that a comparison of the flora of both national parks reveals notable difference in their floristic structures, composition and microclimate due to environmental change. Although both parks are situated in alpine and subalpine zone, but the gradual change in the temperature pose to the species for upward shifting to high altitude. While the plant family (Compositae) was found dominantly in both national parks due to its large distribution range.

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Table-1
Comparison of families in Khunjerab National Park and Central Karakoram National Park with number of genera and species

Khunjerab National Park			Central Karakoram National Park		
Family	No. of genera	No. of species	Family	No. of genera	No. of species
Cupressaceae	1	1	Cupressaceae	1	3
Ephedraceae	1	3	Pinaceae	2	2
Apocynaceae	1	1	Balsaminaceae	1	2
Berberidaceae	1	2	Boraginaceae	3	6
Betulaceae	1	1	Brassicaceae	5	15
Boraginaceae	8	9	Campanulaceae	1	1
Brassicaceae	9	14	Caryophyllaceae	4	4
Campanulaceae	1	1	Chenopodiaceae	3	3
Capparidaceae	1	1	Compositae	18	29
Caprifoliaceae	1	2	Crassulaceae	3	9
Caryophyllaceae	2	3	Fumariaceae	1	2
Chenopodiaceae	4	6	Gentianaceae	3	5
Compositae	15	38	Geraniaceae	1	5
Crassulaceae	3	3	Grossulariaceae	1	3
Cuscutaceae	1	1	Labiatae	2	7
Elaeagnaceae	1	1	Onagraceae	1	1
Fumariaceae	1	1	Papilionaceae	5	15
Gentianaceae	4	6	Parnassiaceae	1	1
Labiatae	4	4	Polygonaceae	4	4
Papaveraceae	1	1	Primulaceae	3	9
Papilionaceae	2	4	Ranunculaceae	6	8
Plantaginaceae	1	1	Rosaceae	4	18
Polygonaceae	1	1	Rubiaceae	2	3
Primulaceae	1	1	Salicaceae	1	2
Ranunculaceae	3	4	Saxifragaceae	2	2

Khunjerab National Park			Central Karakoram National Park		
Family	No. of genera	No. of species	Family	No. of genera	No. of species
Rosaceae	3	5	Scrophulariaceae	3	5
Rubiaceae	2	3	Umbelliferae	7	14
Saxifragaceae	1	6	Urticaceae	2	3
Scrophulariaceae	1	5	Valerianaceae	1	3
Solanaceae	1	1	Violaceae	1	2
Tamaricaceae	2	3	Alliaceae	1	3
Umbelliferae	2	2	Juncaceae	1	1
Violaceae	1	1	Liliaceae	1	1
Zygophyllaceae	1	1	Poaceae	7	9
Cyperaceae	2	8	Total	102	200
Poaceae	12	15			
Total	97	160			

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