Journal of Wildlife and Ecology (2022). 6(3):141-149

Review Open Access

Ecology of Mountain Ranges in Pakistan-a review

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SUMMARY

Pakistan contains four mountain ranges: (i) the Karakoram, (ii) the Himalayan, (iii) the Hindu Kush, and (iv) the Sulaiman. The Karakoram is a vast mountain range that runs across Pakistan, India, and China. The K2 in Pakistan is the world's second highest summit at 8,611 metres. Pakistan, India, Nepal, and Bhutan all have this mountain range. The Hindu Kush mountain range stretches over 800 kilometers through Afghanistan, Pakistan, Tajikistan, and China. It unites into the Kabul River. The range contains many high snow-capped peaks, the highest of which is Tirich Mir, Chitral, Pakistan. The Sulaiman mountain range is a north-south extension of Pakistan's and Afghanistan's southern Hindu Kush mountain chain. They comprise the eastern border of the Iranian plateau and Balochistan Plateau. They are found in Kandahar, Loya Paktia and Zabul, in Afghanistan, as well as areas of Pakistan's Balochistan and southwestern Khyber Pakhtunkhwa and Punjab provinces.

Keyword: Mountain, Pakistan, Gligit, Koh-e Sulayman, Balochistan

Citation: Altaf, M. and Umair, M. 2022. Ecology of Mountain Ranges in Pakistan-a review Journal of Wildlife and Ecology. 6: 141-149.

Received: August, 2022**; Accepted**: September, 2022

INTRODUCTION

Pakistan contains about a hundred peaks that are higher than 7,000 metres. Pakistan is home to four of the world's fourteen tallest peaks. These tallest peaks are mostly found in the Karakoram Range (DAWN, 2021). The Karakoram Range contains the majority of Pakistan's high peaks; K2 is the tallest and 8611 meter long, the 2nd highest mountain of the world. In Pakistan, the highest peak of Himalayan range is Nanga Parbat i.e. 8,126 meters, and this is the 9th highest peak of the earth (Phillips *et al.*, 2000; Iturrizaga, 2001; Ahmed *et al.*, 2010; Zanchi and Gaetani, 2011; Houston and Bates, 2020). Pakistan has following mountain ranges in Pakistan; Karakoram (Hassan *et al.*, 2018), Himalayan, Hindu Kush (Ashraf *et al.*, 2012), and Sulaiman (Saif-Ur-Rehman *et al.*, 2020).

KARAKORAM MOUNTAIN RANGE

Geography

The name Karakoram comes from the Turkic word for black gravel. The Karakoram is a vast mountain range that runs across Pakistan, India, and China, including

sections in Ladakh, Xinjiang and Gilgit-Baltistan. It is one of Asia's Great Ranges and is well thought-out a subrange of the Himalayas. The K2 in Pakistan is the world's second highest summit at 8,611 metres. The range is nearly 500 kilometers long and is the world's most glaciated region outside of the Polar Regions. The Karakoram is limited on the northeast by the Tibetan Plateau's edge and on the north by the Pamir Mountains. The Karakoram's southern boundary is created, west to east, by the Indus, Shyok and Gilgit rivers, that separate the mountain range from the northwestern end of the Himalayan mountains range as they join southwestward into Pakistan's plains (Burrard, 1929; Myadventure, 2022).

Climate

The Karakoram Range is primarily continental and semiarid. The southern slopes are subject to wet monsoon breezes from the “Indian ocean”, but the northern slopes are exceedingly dry. Rain and snow fall in tiny amounts on the lower and middle slopes; average annual precipitation is “4 inches”. Precipitation always assumes a solid form above “4,900 metres”, but snow is common even at low elevations in June. At elevations of roughly “5,700 metres”, the average temperature (T^{o}) during the hottest month is less than 0 degrees Celsius, and between “3,900 metres” and “5,700 metres”, the temperature is less than 10 degrees Celsius (Armstrong, 2010; Bishop *et al.*, 2010; Bessarabov, 2014; Meteoblue, 2022).

Biodiversity

Common flora from Karakoram (Pakistan) is noted as *Artemisia fragrans-Ephedra*, *Artemisia brevifolia-Haloxylon thomsonii, Artemisia brevifolia-Stipa, Koeleria cristata-Artemisia, Calamagrostis stoliczkae-Hedysarum, Elymus schugnanicus-Comarum, Oxytropis humifusa-Festuca, Anaphalis nubigena-Salix, Poa attenuata-Bistorta affinis, Poa attenuata-Epilobium angustifolium, Bistorta affinis-Potentilla venusta, Delphinium brunonianum-Waldheimia tridactylites, Hippophae rhamnoides, Salix pycnostachya, S. sericocarpa groves, Tamarix ramosissima, Betula jacquemontii,* and *Blysmus compressus* (Eberhardt *et al.*, 2007; Abbas *et al.*, 2013; Khan *et al.*, 2016). Important fauna of the Karakoram is as; *Capra ibex sibirica, Ovis orientalis vignei, Ovis ammon polii, Panthera uncia, Ursus arctos,* and *Canis lupus* (Schaller, 1976; Roberts, 1997; Roberts, 2005b, a). Karakoram has rich diversity of birds i.e. *Passeriformes, Charadriiformes, Accipitriformes, Columbiformes, Galliformes, Falconiformes, Pelecaniformes, Coraciiformes, Gruiformes, Bucerotiformes, Apodiformes, Caprimulgiformes, Piciformes, Suliformes and Strigiformes* (Roberts, 1991, 1992).

HIMALAYAN MOUNTAIN RANGE

The Himalayan mountain range may be found throughout south Asia. This is the world's largest mountain chain, with over “110 peaks” reaching to altitudes exceeding “7,300 metres”, including Mount Everest. The system stretches “2,500 kilometers” from the east to the west and encompasses approximately “595,000 sq km”. From north to south, it is split into four parallel ranges: *Tibetan Himalayas* also known as the Tethys, the *Great Himalayas*, which include the main peaks, the *Lesser Himalayas*, which include peaks of “3,700 to 4,500 m”, as well as the *Outer*

Himalayas including the lowest peaks in Indian states, as well as the kingdoms of Nepal and Bhutan, are located between the vast Himalayan arc's eastern and western extremes. It operates as a significant climatic divide, generating heavy rain as well as snow on south side but aridity documented in north of the range, and is nearly unreachable by air at many spots. The Himalayas, which have long formed a cultural and physical border between Central and South Asia, form the subcontinent's north rampart, and its western ranges encompass whole north end of Pakistan, stretching nearly 320 km into the nation. The western Himalayan system divides Kashmir and northern Pakistan into three different ranges, the Zaskar Range, the Ladakh Range and the Pir Panjal Range (Searle and Treloar, 2019; Bishop, 2022).

Climate

Existing data show that the temperature is rising faster in Nepal and China's Himalayan areas than in the rest of the Himalayas. Monsoon precipitation and stream flow have increased in many sections of the Tibetan Plateau, despite a dropping tendency in the western Indian Himalayas and an increasing trend in the eastern Indian Himalayas. The bulk of glaciers in the eastern and western Himalayas are retreating, however the majority of glaciers in Karakorum are either stable or advancing slowly. Glacier lakes are expanding, with Nepal and Bhutan seeing the greatest rate of expansion. The majority of the research forecasts future increases in temperature and monsoon precipitation, as well as declines in winter precipitation, resulting in monsoon floods and increased sediments in stream flow. Available hydrological simulations show lower rainfall and glacier shrinking, resulting in a winter water supply constraint for power production and agriculture, particularly in heavily glaciated basins. The projected economic repercussions of glacial lake outburst floods on established river basins with infrastructure and population centres might be significant. However, there is a significant vacuum in understanding of the economic implications of climate change in the Himalayas (Gautam *et al.*, 2013)

Biodiversity

Himalayan flora varies according to altitude, climate, and soils, rainfall, and incorporates components from evergreen forests, low-lying places, temperate East Asia, the Deccan Plateau, the Palaearctic region and tropical Indochina. Though the majority of the “semi-evergreen woods” have long since been changed to human purposes, remnant pieces can still be found in tiny conserved and managed areas. The “alluvial grasslands” and “savannas” that line the “foothill valleys” are among the worlds’ highest. The species in highly productive grasslands comprise *Imperata cylindrica, Phragmitis kharka, Erianthus ravennae, Arundo donax, Aristida ascensionis* and *Andropogon* spp. And low hill slopes over 1,000 m are less prone to drought and cooler. Subtropical evergreen broadleaf woods dominate these locations. In the lower portions of the east Himalayas, temperate forests are prominent by mixed conifers, evergreen broadleaf trees and winter-deciduous broadleaf species. The southern slopes of forests have species *Rhododendron* species, which may co-occur with oak “*Quercus semecarpifolia*” and “*Lyonia ovalifolia”*. A diverse epiphytic population of dicots, orchids, ferns, and mosses thrives in these temperate woodlands. Bamboo “*Arundinaria* spp.” is prevalent in unexploited areas, particularly when it

offers early successional ground cover after fire. Subalpine conifer woods begin about "3,000 metres" and continue to 4,000 metres. "*Tsuga", "Picea"*, or "*Larix"* dominate these forests between "3,000" and "3,500 m" in the eastern Himalayas, whereas "*Abies"* predominate above 3,500 m. Junipers are common at the timberline and can produce dwarf krummoltz formations above 4,700 metres. On basic limestone soils, the dry slopes and inner valleys support "*Pinus"* and "*Cupressus"* (Abbasi *et al.*, 2011).

Common mammalian species of lesser Himalayan region are as; *Canis aureus*, *Macaca mulatta*, *Martes flavigula*, *Paguma larvata*, *Panthera pardus*, *P. uncia*, *Paradoxurus hermaphroditus*, *Semnopithecus entellus*, *Ursus thibetanus*, *Viverricula indica* and *Vulpes vulpes*, while the most common birds are as; grey-billed cuckoo, Indian cuckoo, Eurasian cuckoo, Eurasian sparrow hawk, common myna, common sandpiper, Oriental skylark, rosy pipit, little swift, common swift, cattle egret, European goldfinch, common rosefinch, red-rumped swallow, common pigeon, red-billed chough, large-billed crow, house crow, Asian house martin, rafous treepie, Himalayan woodpecker, black drongo, ashy drongo, little egret, spotted froktail, little froktail, Asian koel, verditer flycatcher, western tragopan, isabline shrik, kentish plover, northern lapwing, black-winged silt, mountain scopus owl, Asian barred owlet, griffon vulture, bam swallow, brown-flanked bush warbler, black bulbul, long tailed shrike, bay-backed shrike, yellow -crowned woodpecker, scaly-breasted munia, Himalayan monal, red crossbill, Asian paradise-flycatcher, black kite, chestnut-bellied rock thrush, citrine wagtail, Indian glogen oriole, common tailor bird, great tit, russet sparrow, house sparrow, plumbeous water redstart, tickills leaf warbler, lemon-rumped warbler, tytlers leaf warbler, scaly-bellied wood pecker, rufous-fronted prinia, straited prinia, graceful prinia, grey breasted prinia, plain prinia, ashy prinia, blue-throat barbet, great barbet, plum-headed parakeet, Alexander parakeet, rose–ringed parakeet, slaty-headed parakeet, koklas pheasant, red–vented bulbul, Himalayan bulbul, white-eared bulbul, alpine chough, white throated fantail flycatcher, grey bush chat, common stone chart, spotted dove, Oriental turtle dove, spotted owlet alpine swift, Himalayan blue-tail robin, common wood shrike, white throated king fisher, streak laughingthrush, yellow-billed magpie and Oriental white-eye. And the common amphibian and reptiles are as; spiny skittering frog*,* Indian bullfrog*,* Asian grass frog*,* Murree frog/ Himalaya paa frog*,* striped grass skink*,* common Indian monitor*,* fat tail gecko and cobra (Roberts, 1991, 1992; Roberts, 1997; Khan, 2006; Hakeem *et al.*, 2017; Rauf *et al.*, 2017; Bibi *et al.*, 2019; Mughal *et al.*, 2020; Saleem *et al.*, 2021).

HINDU KUSH MOUNTAIN RANGE

The "Hindu Kush" is a range of mountain in south and central Asia that extends 800 kilometres west of the Himalayas. It reaches northern Pakistan and far southeastern Tajikistan from central and western Afghanistan. The "Hindu Kush Himalayan Region" present in Pakistan, Afghanistan and China. In the north, the east end of the Hindu Kush merges with the Karakoram Range. It links with the "Spin Ghar Range" at the "Kabul River" towards its southern end. It separates the "Amu Darya i.e. ancient Oxus" valley to northern from the "Indus River valley" to the south. Tirich Mir also known as Terichmir, located in the "Chitral, Khyber Pakhtunkhwa,

Pakistan", is the highest point in the range, standing at 7,708 metres (Heuberger, 2004; Bloom *et al.*, 2009; Elalem and Pal, 2015). Many of the range's peaks are between "4,400 m" and "5,200 m" in height, with others much higher, with an average peak height of "4,500 m" (Scott-Macnab, 1994). In Pakistan, following peaks are present i.e. Tirich Mir, Noshak, Istor-o-Nal, Saraghrar, Udren Zom, Kohe Shakhawr, Lunkho e Dosare, Sakar Sar and Kohe Mondi.

Climate

Summers from July to September in this region are wet or snowy while winters are dry. However, the western and central and Hindu Kush region is hot, dry summers and cold, rainy or snowy winters. Climatic changes between these opposites occur as well, resulting in frequently startling local disparities (Maraini, 2022).

Biodiversity

These mountainous landscapes are largely barren or poorly forested, with only a few trees and stunted plants. Sclerophyllous woods with oak and wild olive predominate from around 1,300 to "2,300 m"; beyond that, up to about 3,300 m, one finds coniferous forests with *Picea, Cedrus, Pinus*, *junipers* as well as *Abies*. The interior valleys of the "Hindu Kush" receive little rain and are covered in desert flora (Iranica, 1985). Throughout the mountains, you may see wildlife that has adapted to its surroundings. The rocky crags are traversed by Siberian ibex and markhor, but Marco polo sheep and urial are rarely encountered. Black and brown bears may still be found in distant areas, while the endangered snow leopard can be seen at the Chitral Valley Wildlife Refuge. Vultures and eagles are among the numerous animals in the highlands. Brown trout abundant in the northern slope streams (Roberts, 1997; Maraini, 2022).

SULAIMAN MOUNTAIN RANGE

The Sulaiman Mountains or Koh-e Sulayman" and comprise the eastern border of the northeast border of the Balochistan Plateau and Iranian plateau. They are found in Afghanistan's Kandahar, Loya Paktia and Zabul provinces, as well as areas of Pakistan's "Balochistan" province and southwest Khyber Pakhtunkhwa as well as Punjab. The Sulaimans are bordered to northern by the dry highlands of the Central Hindu Kush, which reach heights of "3,383 metres" and to eastern by the plains of the "Indus River basin". They compose the Sulaiman-Kirthar geologic province, together with the "Kirthar Mountains" in southern Pakistan (Khan, 1991; Akroyd, 2014). The twin-peaked Throne of Solomon or Takht-e-Sulaiman, Dera Ismail Khan, Pakistan", close to Southern Waziristan as well as Zhob, Balochistan, is the most well-known peak of the Sulaimans. The highest mountain is Zarghun Ghar in Pakistan, at 3,578 m; while second highest mountain is "Khilafat Hill" at 3,475 m in Balochistan, which is located in Pakistan's "Ziarat district" and is known for the "Ziarat Juniper Forest", which is home to *Juniperus macropoda* trees (Shah, 2013; Park, 2017).

Climate

The project area's climate is prone to slight changes. It has pronounced seasonality in both temperature and precipitation. Summer temperatures can reach 35 degrees Celsius. Winters are chilly, with temperatures as low as -15^{o}C at times, and there is a significant difference between day and night temperatures (WWF, 2016).

Biodiversity

Two different types of forest present in the area are sub-tropical broad leaved evergreen forest and dry temperate forest. Flora includes *Acacia modesta*, *Artimisia maritime*, *Daphne* spp., *Fraxinus zanthoxyloides*, *Monothica buxifolia*, *Olea ferrugenia*, *Peroswskia abrotanoides*, *Pinus gerardiana*, *Pinus wallichiana*, *Pistachio cabulica*, *Pistachio khinjuk*, *Prunus eburnean*, *Salsola foetida*, and *Zizyphus nummularia. Capra falconery jerdoni* and *Ovis vigneii* populations were once plentiful across the Suleiman Range, but they are now isolated to a few locations, while Afghan Urial is extremely uncommon. *Capra falconeri,* a Kabul and Sulaiman sort of creature, dwells alone in the mountain glens and caverns. The Urial, which is now almost extinct, used to wander the lower slopes. The "*Panthera pardus"* has been spotted killing a few sheep and goats, while the Ursus thibetanus has been spotted here and there. Among the birds of note are the "chukar partridge", the "pigeon", and varieties of "falcons": the the *Falco tinnuculus* and *Falco peregrinus*. During the survey, the Cape hare was found to be highly prevalent over the whole region. There were four Indian grey wolves, two red foxes, three Asiatic jackals, and one Indian Crested Porcupine spotted. Foot prints of numerous carnivore species, including the striped hyena, Jungle cat, Afghan hedgehog, Caracal, and Indian grey wolf, were seen indirectly. Chakoor and Seesee partridges were plentiful across the area. The birds were primarily spotted around water and marshes. There were several flocks of Chakoor and saw see partridges in the neighbourhood. *Coluber rhodoracus* and *Agama* spp. are widely accessible (Ahmed *et al.*, 2001; Woodford *et al.*, 2004; WWF, 2016).

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***Competing interests**:* Authors have declared that no competing interests exist.

***Funding**:* Authors have no source of funding for this work.

Authors' contributions: Altaf has designed this project, collected data and written this article; while Umair has critically analyzed this article and approved as final.