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Ecological characteristics, and conservation assessments of vegetation of Jaban Wartair Hills, Malakand Division, Khyber Pakhtunkhwa

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The documentation of flora is widely recognized as essential all around the world since it helps to preserve a region's cultural and natural resources in major ways. An accurate account of the region's flora, as well as any new species identified there and the effects of climate, can only be obtained by thorough documenting of local flora and descriptive writing. The current work aims to screen out the floristic, ecological and conservation status of vegetation of Jaban Wartair Hills, Malakand Division, Pakistan which lies in the Sino-Japanese type of floristic region. The study comprised of 162 plant species belonging to 135 genera and 65 families in which family Asteraceae was the leading with highest number of species (18 spp) followed by Poaceae (13 spp), Lamiaceae (10 spp) and Fabaceae (7 spp). Biological spectrum revealed that therophytes were the dominant life form class (51.2%), followed by phanerophytes (28.3%), while leaf size spectrum illustrated that nanophylls (77 species) and leptophylls (62 species) dominated the area. Conservation status revealed that 89 species were threatened, including 24 endangered species (14.8%), 11 critically endangered (6.79%), 50 vulnerable (30.86%), 4 commercially threatened (2.4%). Beside 73 (45%) species are reported to be common. The major threats observed in the region are over browsing, overgrazing, deforestation of the natural resources, land sliding, high rain & snowfall, over harvesting, unpleasant weather, over collection of high valued medicinal plants, land use and other anthropogenic activities.

Keywords: Floristic list, life form, leaf size spectra, conservation status, Malakand division.

INTRODUCTION

The documentation of flora is widely recognized as essential all around the world since it helps to preserve a region's cultural and natural resources in major ways. An accurate account of the region's flora, as well as any new species identified there and the effects of climate, can only be obtained by thorough documenting of local flora and descriptive writing. According to recent study, there are currently 308,312 known vascular plant species throughout the world (Khan et al. 2022). Malakand Division is part of the Sino-Japanese phytogeographical constituency of the world, which has been shown to have a significant floristic variety with over 2500 species identified in northern parts (Rahman, 2012). The great degree of temperature variability in the region, which is predominantly controlled by height gradients, is unquestionably the cause of such a diversified floristic composition (Khan et al. 2010).

All of a plant's environmental adaptations are included in the biological spectrum (Raunkiaer, 1934). It corresponds to the physiognomy of the vegetation in a particular place. Biological spectrum designations included a phanerophyte community as well as the phytoclimate of the respective environments. This could be determined by the distribution and variances of life forms between the normal and biological spectrums, as well as which life form represents the vegetation or phytoclimate that is being studied. According to Galán de Mera et al. (1999),

the biotic spectrum is characterized by the adaptations of plants to specific ecological environments. The life type and leaf size spectrum of a given place provide information about climate and human disturbance. It is possible that knowledge of leaf size and life form spectra will aid in the learning and comprehension of physiological growths in plant communities if these variables are known. Raunkiaer offered a taxonomy of leaf sizes that included leptophyll, nanophyll, microphyll, mesophyll, macrophyll, macrophyll, and megaphyll among others (Oosting, 1956). Plant conservation refers to a broad range of operations that are carried out with the goal of preventing plants from becoming endangered or extinct. One of the most important components of biodiversity is plants, which are critical for the planet's long-term health. For individuals in need, they provide food, medicine, firewood, and a place to live. Ecosystem stability is dependent on plants, and without them, it would be in great jeopardy. The rapid and widespread extinction of plant species is unprecedented, and biodiversity protection is one of the most important global environmental issues facing the world today (Thomas et al. 2004). Estimating worldwide industrial turnover is impossible, although there is evidence that it is in the billions of dollars or more (Wijesekera, 1991). With overexploitation, habitat loss, pollution, and changes in the climate placing plants at risk of extinction in the near future; they are now at an extremely high risk. One of the most pressing issues facing human populations around the globe is the extinction of so many plant species in such large numbers. Since many people around the world are interested in cultivating essential medicinal plants, they are widely used by locals and considered to be of great importance (Elisabetsky, 1990). Botanist studied that herbs may improve their health and that they are safe to use, according to research (Klesper et al. 2000). As the world's flora and fauna suffer from habitat loss and some are even at risk of extinction, there has been a huge decrease in population numbers (Myers et al. 2000). Resources extraction and urbanization have both contributed to the degradation of indigenous plant communities, with endemic species suffering the brunt of the harm. Indigenous plant communities. Plants all across the world may be negatively affected by the effects of other stressors, such as climate change. One way to classify the species of plants found in a certain area is according to the degree to which they are endangered, endangered, fragile, rare, commercially threatened, or common. With extinction rates between 100 and 1000 times higher than those reported before the arrival of humans, ecosystems are losing species at a rate that has only been seen during prior mass extinction events by Hails, (2008); Barnosky et al. (2011). (Pimm et al. 1995) What we call "In-Situ Conservation" describes a strategy that incorporates designation, monitoring and management in order to preserve plants in their natural habitats. It is the goal of this type of conservation that biodiversity can thrive within the context of the ecosystem in which it was discovered. It is called "ex-situ conservation" when processes are used to remove a target species from its natural habitat and store it safely somewhere, such a seed bank or botanical garden, in order to preserve and do study on it. By confirming the survival of endangered species and maintaining the genetic variety that is linked with them, this research aims to support conservation. Seeds, pollen, and shoots were stored in slow or paused growth conditions to create ex-situ collections of plants (Bowkett, 2009). As a result, the current study seeks to determine the biological properties of vegetation in the Jaban Wartair Hills, Malakand Division, KP, Pakistan, as well as the status of vegetation's conservation.

MATERIALS AND METHODS

Study site details:

The study was carried out to prepare a complete floristic list of plants of Jaban Wartair Hills of Malakand division (Fig 1). The total area of this region is 952 km^2 having 34^o 37' north latitude and 71^o 56' east longitude with high mountains, water tributaries with rivers, plains and agricultural lands (Ali et al. 2017). This valley falls by the vegetation of moist temperate and subtropical zones with high snow and rainfall. Climate of the area is long term pattern of weather and is so severe that summers are hot and clear, while winters are chilly and partially overcast. Throughout the year, the temperature typically ranges from 39°F to 105°F, with temperatures rarely falling below 33°F or rising above 111°F (Khan et al. 2022). The area is hilly and comprised of small villages including Kwanj, Qadam Khela, Spero Gat, Bijligar Jaba etc.

Figure 1: Map of the research site

The Economic sources are scarce, however farming, Gujar activity, and acquiring fuel wood are common sources of income. The villagers of this area are generally poor with native language Pashto and Gujro (Khan et al. 2011a).

Data Collection and Observations

The study area is frequently visited in blooming and flowering seasons during 2016-17 with the aims to collect different plant taxa. Information were collected from local peoples including men, women, literate, illiterate, farmers, shepherds and other old aged peoples. Local name, flowering season, soil type were noted in field dairy during interview. Conservation statuses of each plant were confined from online database, published literature and Wikipedia.

Preservation and Identification

After collection, the plants were dried in newspaper and then mounted on herbarium sheets and subjected for identification. All the taxa were identified with the help of flora of Pakistan by (Ali and Qaiser 1986; 1989-1991; 1993-2017, Ali et al. 1978; 2001) and other available literature by Stewart, (1967; 1972), Barkatullah & Ibrar (2011), Shinwari *et al.* (2011). Voucher numbers will be given to all herbarium specimens, arranged in alphabetical orders, make a complete floristic checklist, and submitted the herbarium sheets to the herbarium, department of Botany, Islamia College Peshawar, Pakistan for future referee.

Biological spectrum

The biological spectrum is a depiction of the number of species in a given flora that are suited for each life-form, as well as the percentage of various kinds of life forms (Shimwell, 1971). It is an important physiognomic representation and has been widely employed in vegetation research. As a result, the Raunkiaerian biological spectrum was utilized to identify plants life form and leaf size classes. According to Protocol of Raunkiaer (1934), life form and leaf size were determined followed by Hussain,1989; Badshah et al. 2013; Hussain et al. (2014); Khan & Badshah, (2019); Ibrahim et al. (2019); Khan et al. (2019); Khan et al. (2022).

RESULTS

Eco-Taxonomic study

We have collected total of 162 taxa belonging to 135 genera and 65 families in which the most prominent family were Asteraceae having 18 taxa, Poacaeae with 13 taxa, Lamiaceae with 10 taxa and Fabaceae 7 taxa while the remaining families had less than 7 taxa. Phytoclimatic spectra of the area revealed that majority of vegetation possess therophytic life form having 83 taxa (51.2%), followed by phanerophytes with 46 taxa (28.3%). Similarly vegetation of the area also represents hydrophytes (13 taxa), geophytes (11 taxa), and chaemophytes (9 taxa) and shows varying percentages (8%, 6.7% and 5.5%) as shown in Table 1 & Fig 2. Phytoclimatic spectra also dominated by leaf size and majority of plants were nanophylls with highest number of taxa (77 taxa), followed by leptophylls (62 taxa), microphylls (18 taxa). Some taxa also confined the presence of mesophylls leaves (2 taxa) with varying percent (47.5%, 38.2%, and 1.2%) and 2 taxa were also found to be aphyllus which possess no leaves. Thorns were also observed in *Opuntia moncantha* (Fig 3). Tree diversity in the area is very low which is due to altitudinal variations, human interference and climatic conditions.

Prominent herbs including *C. arvensis, C. distans, D. annulatum, F. indica, P. lanceolata, P. barbatum* and *S. asper* were reported from the area. They grow in the month of March and April (Monsoon). *Calotropis procera, Withania somnifera* and *Ziziphus nummularia* were the major reported shrubs. A lot of work has been done on floristic study from time to time and from different areas of Pakistan but these hills are still unexplored. For the exploration of these plants we have prepared a complete floristic checklist and presenting its life form and leaf size for easy identification for ecologists. Our work are agreed with that of Asim *et al*. (2016) and Haq, (2011), Khan et al. (2022) and Badshah et al. (2013). Asim et al. 2016 reported the biological spectrum of Kokarai valley, Swat, Pakistan and evidences the therophytic and microphyll as leading classes. The therophytes implies disturbed vegetation, however the microphyll leaf size shows that the regions is moist temperate with plenty of rain. This is due to changes in the area's environmental conditions and altitude. Haq, 2011 also reported the conservation importance of critically endangered and endangered taxa from Nandiar Khuwar, Battagram, Pakistan. Khan et al. 2022 also reported 307 taxa, 94 families and 236 genera from hilly zone of Marghazar valley, Swat, Pakistan and observed therophytes and microphylls as dominant phytoclimatic classes. Similar results also made by Badshah et al. 2013 and reported two hundred five taxa and fifty six families from Tank rangeland, Pakistan.

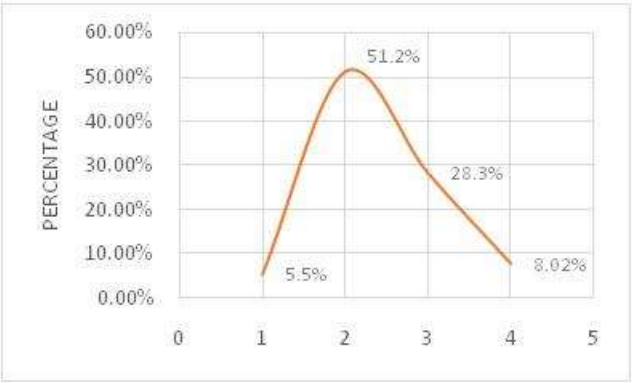

Figure 2: Summary of Life form of vegetation of Jaban Wartair Hills

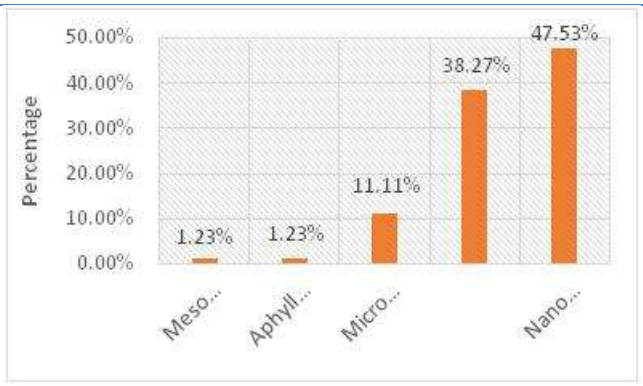

Figure 3: Summary of Leaf size spectrum of *v*egetation of Jaban Wartair Hills

Conservation status of vegetation of Jaban Wartair Hills

Conservation status of the plants in the area showed that most plants species are threatened in the area, included endangered species, critically endangered species, vulnerable species, and commercially threatened species which are summarized as that the total of 162 species were recorded which includes threatened taxa (89), endangered (24 taxa, 14.8%), critically endangered (11 taxa, 6.7%), vulnerable (50 taxa, 30%), and commercially threatened (4 taxa, 2.4%). Similarly 73 taxa are reported to be common (45%) as shown in Table 1, Fig 4. Eleven critically endangered taxa including *C. eriocarpa, S. acmophylla, Z. armatum, Z. nummularia, Z. jajuba, C. australis*, *C. grata, F. palmata, F. carica* and *O. ferruginea*. Overgrazing, deforestation, altitudinal gradient, and certain anthropogenic activities are the major problems of this vegetation. 26 taxa are endangered which include *Calotropis procera, Filago hurdwarica, Lepidium pinnatifidum, Mallotus philippensis, Alhagi maurorum, Robinia pseudoacacia, Ocimum basilicum, Ajuga bracteosa, Acacia modesta, Acacia nilotica and Broussonetia papyrifera*. Over-exploitation for timber, fuel, fodder, medicine, shelters are the main reasons and the plants may also be endangered due to overexploitation. 4 taxa are commercially threatened including *D. sissoo, M. alba, M. nigra* and *P. roxburghii*. Local peoples utilized these taxa for fuel wood, timber, medicine, fodder, agriculture tools, and utensils. 35 taxa are observed which vulnerable including *N. ritchiana, A. lavenia, A. vulgaris, B. tripartite, I. acaulis, P. vestitum, S. heteromalla, and B. crispa*. Similarly 12 taxa (7.4%) are rare and 74 taxa (45.6%) are common species in the study area. Our work are agreed with that of Hussain *et al.* (2012) reported critically endangered, vulnerable, endangered, and secured taxa from Parachinar, Pakistan. Ullah & Rashid (2014) identified vulnerable, endangered, critically endangered species from different regions of Pakistan. Khan & Hussain (2013) also worked on conservation status District Karak, Pakistan and reported 45 species including vulnerable (44.4%), rare (35.5%), endangered (15.5 %) and infrequent (4.4%). Similarly, Khan and Musharaf (2015) documented 34 plant species including 12 species (rare), 11 species (vulnerable), 9 species (endangered), and remaining 2 species (infrequent). They indicated that the primary drivers of plant extinction in the area were population increase, habitat degradation, deforestation, over-exploitation, and climate change. They indicated that the primary drivers of plant extinction in the area were population increase, habitat degradation, deforestation, over-exploitation, and climate change. These research mainly back up our findings. It is discovered that the native peoples of the research region are destitute, with a very low literacy rate. They are unaware of the proper utilization of natural resources, particularly flora. They utilize the plants unlawfully and in an injudicious manner, posing a major threat to the local vegetation. Agriculture, Gujar activity (keeping livestock), and the purchase of fuel wood are major sources of income for them. The population living on the hillsides utilizes a huge amount of wood from forest areas as fuel, whilst people living farther away from the hillsides must purchase wood or natural gas from the market.

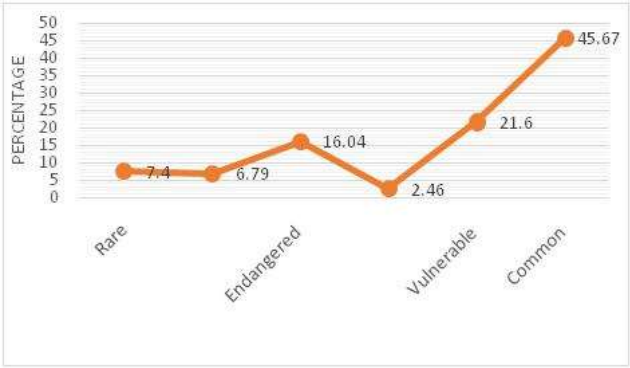

Figure 4: Summary of Conservation status of vegetation of Jaban Wartair Hills

CONCLUSION

The study regarding plant resources of Jaban Wartair Hills, Malakand Division with the scenario of floristic and conservation status revealed that vegetation of Jaban Wartair Hills comprised of 162 plant species belonging to 135 genera and 65 families. The most prominent families were Asteraceae, Poaceae, Lamiaceae and Fabaceae on the basis of species diversity. Phytoclimatic spectra of the area are therophytic and nanophyllus life form and leaf size classes, majority of vegetation were threatened while minimum number of taxa were common type in the area and the climatic conditions of the valley are influenced by over browsing, overgrazing, deforestation of the natural resources, land sliding, high rain & snowfall, over harvesting, unpleasant weather, over collection of high valued medicinal plants, land use and certain anthropogenic activities. The majority of the mountainous woods are unprotected, and many sections in this area

are not exploited for vegetation. It is necessary to utilize the plants appropriately and to regulate the overuse of the space in order to repair or preserve the vegetative cover. Priority should be given to ensuring the application of natural resource rights, concessions, and obligations, as well as managing the village's natural vegetation, reforestation, and afforestation.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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Not applicable

AUTHOR CONTRIBUTIONS

BU designed the survey work, MK, MNK and KURperformed the field work, QA, MB and SWwrote the manuscript. MG, LF and ZR performed the data analysis. KUR, MNK and HA reviewed the manuscript. All authors read and approved the final version

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