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Quantitative Analysis of Biodiversity of Palandri District, Azad Jammu & Kashmir, Pakistan

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Abstract

Quantitative analysis of biodiversity in district Palandri was undertaken from September, 2022 to May 2023 in district Palandri, AJK to collect data on the distribution and status of its wildlife. Point count method was used to observe the species in nine different habitats in the study area A total of 1049 individuals of 126 species of amphibians, birds, reptiles and mammals are observed in the study area belonging to 23 orders and 57 families. The Aves group had the most species variety, with 87 species followed by Mammals that were the second most varied group, with 18 species. Reptiles and amphibians contained 16 and 5 species, respectively. The most abundant species were Indus Valley Toad (n=11), Bengal Monitor (n=13), Russet sparrow (n=41) and House mouse (n=14) were recorded in district Palandri, AJK. Calculated values of Shannon Wiener (H) and Simpson index (1-D) of the district Palandri were 4.60 and 0.99 respectively. Anthropogenic activities such as logging, Settlements, deforestation, forest fires, hunting, extensive grazing of cattle were the reasons for decline in vertebrate species. By implementing conservation strategies, we can help ensure the long-term survival of these species and the ecosystems.

Keywords: Point count method, habitats, anthropogenic activities, conservation strategies.

INTRODUCTION

Ecosystem health and function depend on biodiversity, which is the variety of life in all its forms, levels, and combinations (Cardinale *et al.*, 2012). Globally, biodiversity is significantly threatened due to habitat degradation, environmental change, contamination, and overexploitation of resources (IPBES, 2019; Sala *et al.*, 2000). This rapid reduction emphasises the necessity of recording and comprehending regional biodiversity patterns, which assist guiding conservation efforts and encourage sustainable natural resource management (Hooper *et al.*, 2012).

A region's biodiversity is influenced by a number of elements, including terrain, climate, and human activity. Azad Jammu and Kashmir (AJK) is an area in northern Pakistan recognised for its various ecosystems, ranging from subtropical woods to alpine meadows, housing a great variety of flora and wildlife (Qamar *et al.*, 2020). However, many parts of AJK, notably District Palandri, are understudied. Palandri District, with its steep terrain, varied forest cover, and mild climate, has the potential to be an area of outstanding biodiversity (Ahmad *et al.*, 2021).

Palandri District is home to a diverse range of ecosystems, including subtropical pine forests and temperate high-altitude regions (Khan *et al.*, 2020). These ecological systems support a diverse range of plants and wildlife, numerous of which are endemic or threatened by fragmentation of habitat and environmental changes (Raza *et al.*, 2021). This area is also inhabited by multiple key species that are indications of ecosystem health, including large animals like as the common leopard (*Panthera pardus*), Himalayan black bear (*Ursus thibetanus*), and different bird species, which are crucial for sustaining the harmony of the environment (IUCN, 2022). According to recent studies, these areas in Pakistan are crucial because of their rich biodiversity, which is threatened by unrestrained development, deforestation, and illicit hunting (Mahmood *et al.*, 2022).

In District Palandri, the absence of updated and complete biodiversity assessments impedes effective conservation activities (Khan *et al.*, 2021). Despite

AJK's natural richness, little research has been conducted on the biodiversity of District Palandri. Forest clearing, alterations to land use, and agricultural development are all expected to have an impact on biodiversity patterns in Palandri. Understanding the species diversity, abundance, and ecological roles in this region might help inform conservation initiatives that alleviate these impacts (Ahmed *et al.*, 2022). Thus, research on local biodiversity is essential since they provide the baseline information required for planning for conservation and sustainable growth, especially in light of growing environmental concerns such as loss of habitat and climate change (Newbold *et al.*, 2016). Additionally, local biodiversity assessments contribute to global efforts in documenting species richness and understanding the ecological processes that support biodiversity (Chaudhary *et al.*, 2018).

This study seeks to fill a knowledge vacuum by doing a quantitative analysis of biodiversity in District Palandri, with an emphasis on both flora and wildlife. The goals of this study are to describe species richness, assess species conservation status, and identify potential risks to biodiversity in the region. This will provide crucial insights for conservation planning in AJK, as well as help to Pakistan's broader biodiversity protection efforts.

MATERIALS AND METHODS

Study Site:

The Palandri district study area in Azad Jammu and Kashmir (AJ&K) is located between 33°.40′ and 33° 50′ north latitude and 73.40′ and 73° 50′ east longitude. It has an altitude range of approximately 600 to 2100 meters above sea level (m.a.s.l). The area is characterized by hills, mountains, valleys, and plains, and has a total area of about 564.77 square kilometres. The average summer temperature ranges from 20 to 35 degrees Celsius, while the average winter temperature ranges from 5 to 20 degrees Celsius.

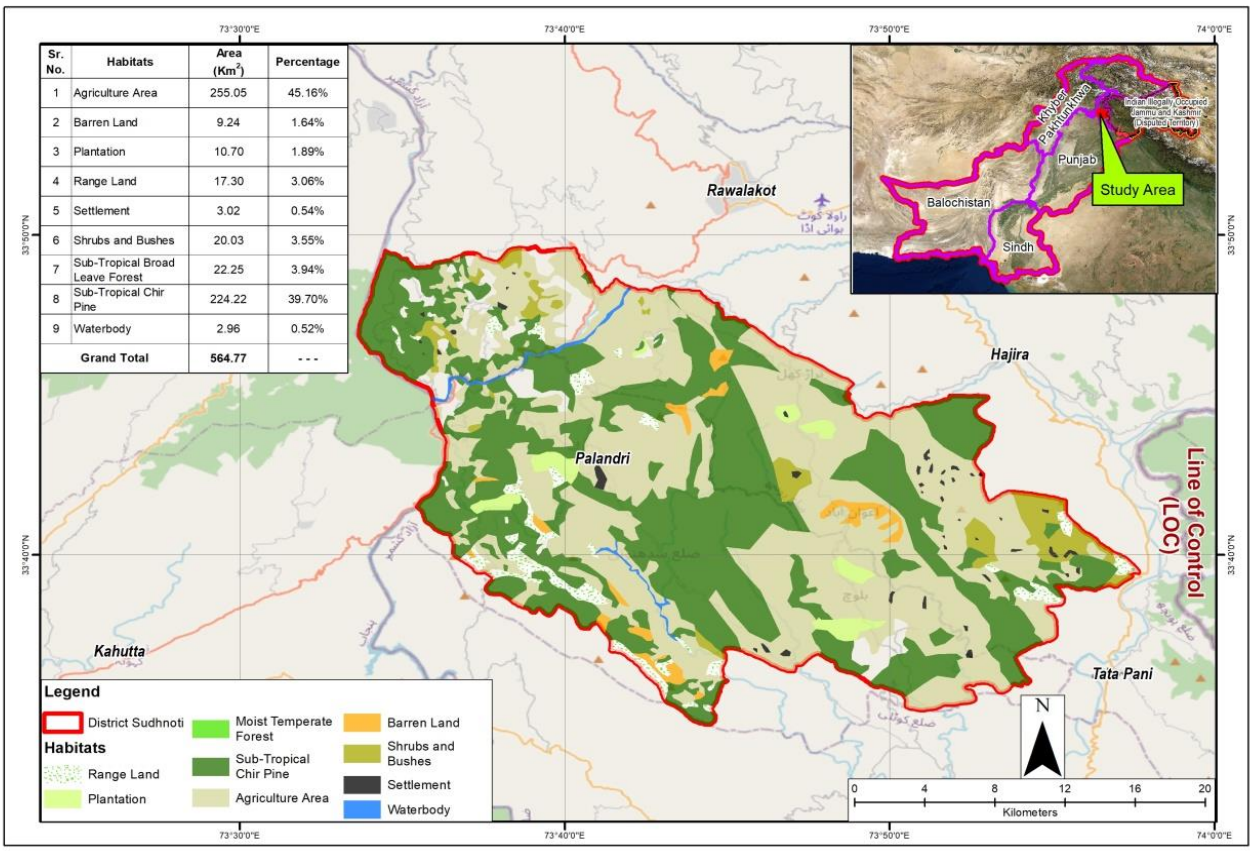

Figure 1: Map of study area

Materials/Equipment

The equipment used for the current study included: GPS (to record the coordinates of the survey and observation points), Binoculars (to see the animals from distance and identify), Camera (Nikon p-900) (to take pictures of fauna and habitats), Spotting scope (for bird observation) and Field Guides.

The surveys were conducted on a monthly basis to cover the large stretch and numerous habitats in the area. Initially, information about the presence of

particular habitat in specific valley and location was gathered with the help of Geographic Information System (GIS), to avoid redundancy and missing any habitat.

Surveys and Sampling:

In this study, nine habitat categories in District Palandri were chosen for wildlife research, including agricultural land (AL), barren land (BL), range land (RL), plantation (P), settlements (S), shrubs and bushes (SB), subtropical broad leave forests (STBLF), sub-tropical chir pin forest (STCPF)and water bodies (WB). Amphibians were surveyed both during the day and at night, utilising fast evaluations and visual estimations in open spaces, marshes, and agricultural fields. Binoculars and visual observation were employed in reptile surveys to identify probable breeding sites and microhabitats. At night reptile surveys were carried out with torches and protective clothing. Bird observations were made throughout varied environments using binoculars, and species were recognised with the assistance of guidebooks and guidance from experts. Mammal diversity was investigated using direct observations and indirect indications such as nests, tracks, and faecal granules with field guides assisting with identification.

Methodology for Biodiversity Estimation

Faunal diversity was assessed using multiple indices. Relative Abundance (RA) was calculated by dividing the number of individuals of each species by the total fauna in the area or habitat.

Simpson's Index (1-D) quantified species diversity based on abundance.

Shannon Wiener Index (H') measured diversity, with higher values indicating greater diversity. through the equation given below following Shannon and Weaver (1963). H' = H' = [Σ pi ln pi].

RESULT AND DISCUSSION

A total of 1049 individuals of 126 species of amphibians, birds, reptiles and mammals were observed in the study area belonging to 23 orders and 57 families (see figure 2).

The results showed that agricultural land had the highest number of 92 species with 166 individuals from four taxonomic groups, including 5 amphibians, 14 reptiles, 62 avifauna, and 11 mammalian species, followed by water bodies with 79 species with 124 individuals, including 4 amphibians, 11 reptiles, 51 aves, and 13 mammalian species, and settlements with 79 species and 98 individuals, including 2 amphibians, 10 reptiles, 57 aves, and 10 mammalian species. In Subtropical Chir Pine, 78 species with 151 individuals were reported, including 1 amphibian, 11 reptiles, 53 aves, and 13 mammal's species. There were 74 species in the subtropical broad leaf forest, with 115 individuals, including two amphibians, ten reptiles, 52 avians, and ten mammal's species. Range land included 63 species with 109 individuals, including one amphibian, seven reptiles, 46 birds, and nine mammals species. Barren land had 67 species with 108 individuals, including 3 amphibians, 8 reptiles, 47 avians, and 9 mammals species. Shrubs and shrubs had 72 species with 98 individuals, including 2 amphibians, 10 reptiles, 55 avians, and 3 mammals species The plantation had 66 species with 80 individuals, including 2 amphibians, 9 reptiles, 47 avians, and 8 mammals species (See figure 3 and 4).

During the current study, the Indus Valley Toad was the most abundant species in all habitats, with relative abundances of 1.81% in AL, 0.93% in BL, 1.25% in P, 0.92% in RL, 2.04% in S, 1.02% in SB, 0.87% in STBLF, 0.66% in STCPF, and 0.81% in WB. North Punjab has the highest abundance of this species (23.15%) (Rais *et al.,* 1997). Masroor (2011) also reported this species in Margalla Hill National Park.

Bengal Monitors were abundant among reptiles, with relative abundances of 1.20%, 2.5%, 2.04%, 1.02%, 0.87%, 1.99%, and 1.61% in AL, P, S, SB, STBLF, STCP, and WB, respectively. However, it was not documented from the other two habitats. It's because this species prefers forests and agricultural areas. Haider *et al.,* (2019) also reported this species from the Pir Lasura National Park.

Russet sparrow 41 was found abundant among avifauna with 2.41%, 0.93%, 1.25%, 0.92%, 1.02%, 5.10%, 0.87%, 1.99% and 0.81% in AL, BL, P, RL, S, SB, STBL, STCP and WB respectively. This species was reported in Bagh district during breeding season (Grewal 2002).

House mice were commonly seen in AL (2.41%), BL (0.93%), P (1.25%), RL (3.67%), and S (1.02%) among mammals. However, this species was not observed in any other locations. Large carnivore species such as the Kashmir fox, golden jackal, and Asiatic black bear have been documented in STBLF, STCPF, and WB from the research region. Kashmir Fox (1.74%) was found in STBLF, (1.32%) STCPF, and (1.61%) WB. Faiz and Fakhar (2016) regularly reported these species in Tolipir National Park. These species have larger home ranges and need more room to thrive. While common leopards and black bears are important on national and international levels, their population expansion may create anxiety among residents.

The Shannon-Wiener diversity index values for different habitats in the study area were as follows: agricultural land (4.28), barren land (3.80), plantation (3.99), rangeland (3.83), settlements (4.27), shrubs and bushes (4.12), subtropical broad-leaved forest (4.01), subtropical Chir pine forest (3.96), and water bodies (4.21) while Simpson index was 0.82 at agricultural land, 0.90 at barren land, 0.91 plantation, 0.90 at range land, 0.92 at settlement , 0.90 at shrubs and bushes , 0.94 at

sub-tropical broad leave forest, 0.89 at sub-tropical Chir pine and 0.91 at water. Species evenness of the area is 0.92 which indicates relatively high diversity (see table 1).

The recent study found that human activities and changes have the power to disrupt ecological balance. Water reduction in wetlands, growing urbanisation, and agriculture development all have a detrimental effect on forests. As a result, numerous animals have relocated to areas near human population (Altaf *et al.*, 2014).

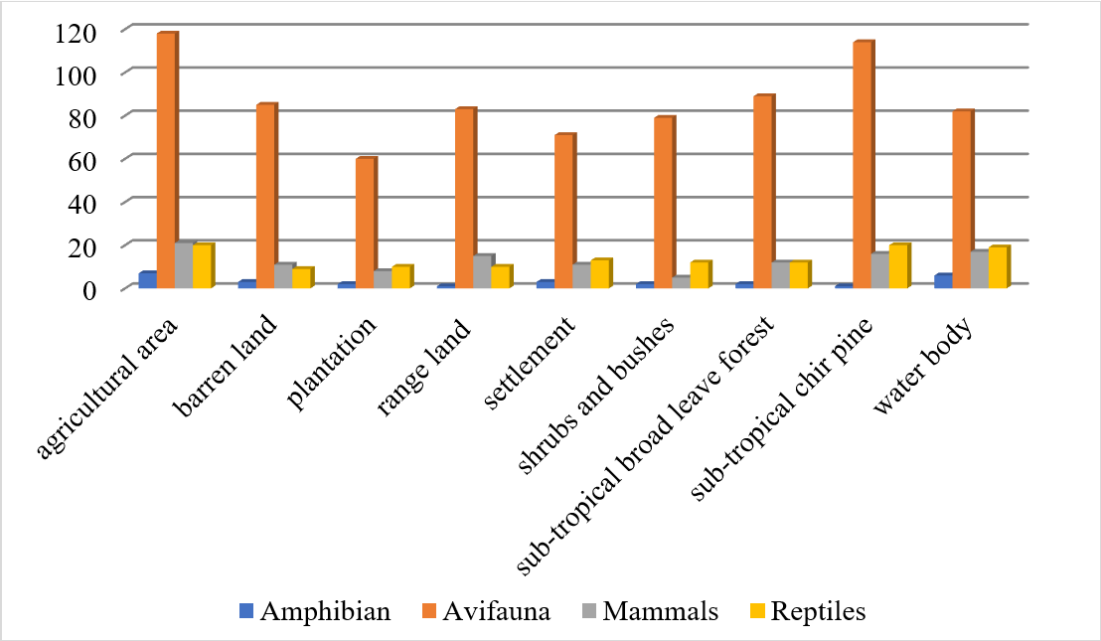

Figure 2: Relative abundance of species in various habitats

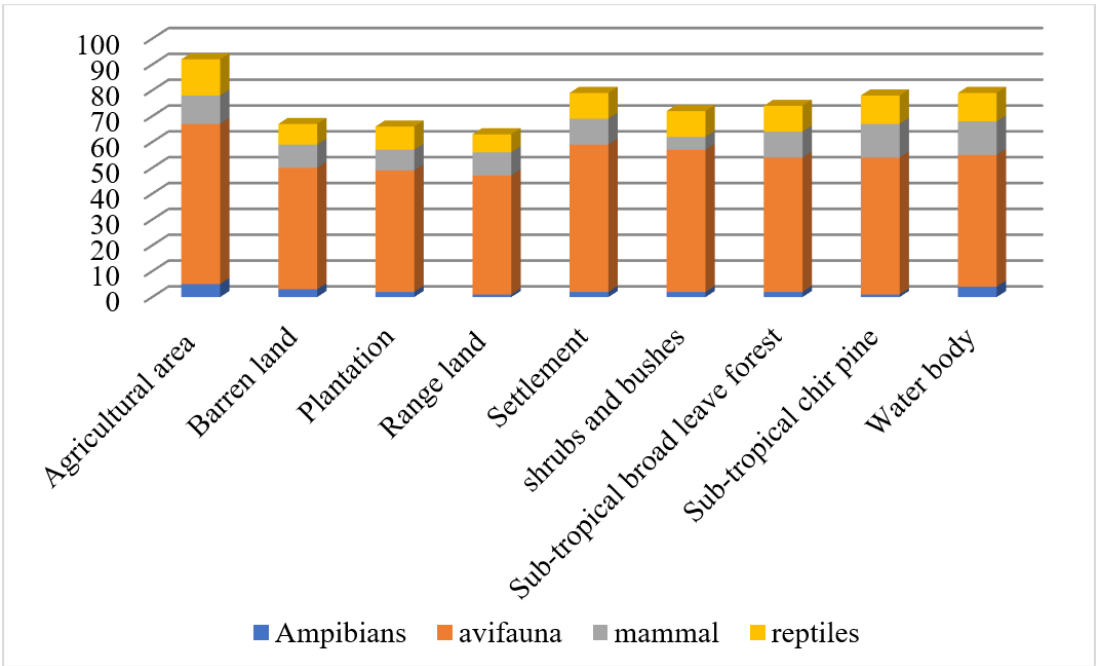

Figure 3: Distribution of species in various habitats

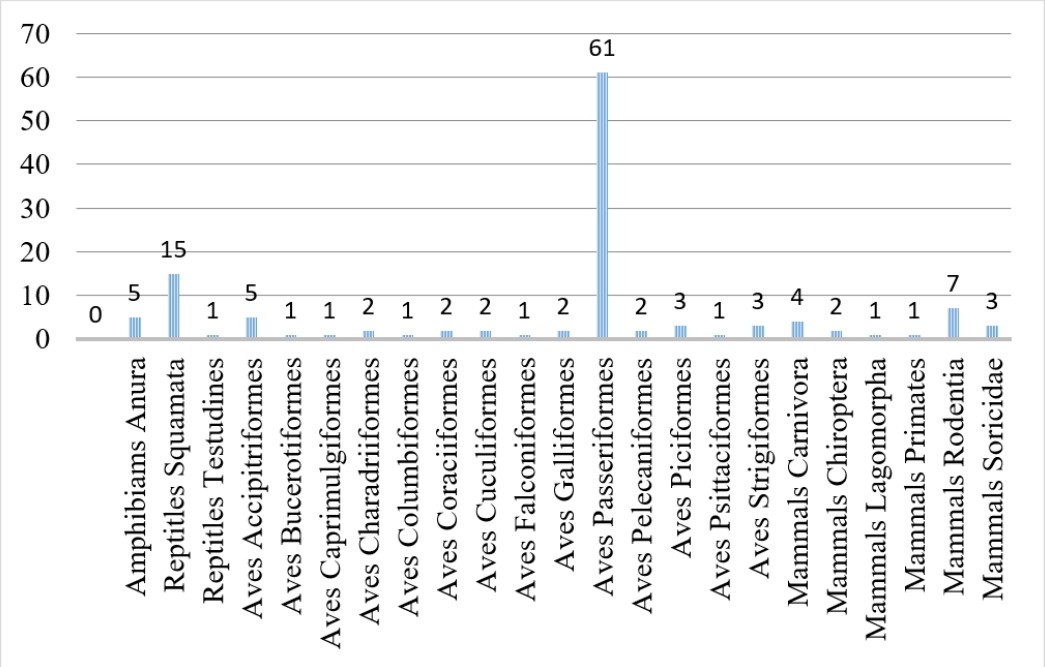

Figure 4: Distribution of species according to order

Table 1: Diversity indices values for various habitats

S. N	Habitats	Shannon wiener (H')	Simpson Index (D)
1	Agricultural area	4.28	0.82
2	Barren land	3.80	0.90
3	Plantation	3.99	0.91
4	Range land	3.83	0.90
5	Settlement	4.27	0.92
6	shrubs and bushes	4.12	0.90
7	Sub-tropical broad leave forest	4.01	0.94
8	Sub-tropical chir pine	3.96	0.89
9	Water body	4.21	0.91

Threats

Deforestation, habitat interconversion, and forest fires, whether natural or human-induced, contribute to significant biodiversity loss and ecological disruption, high-lighting the urgent need for conservation efforts. Habitat fragmentation, driven by human activities like agriculture and urbanization, isolates wildlife populations, diminishing biodiversity and disrupting ecological processes. Unsustainable wood logging practices for timber and fuelwood lead to forest loss, negatively impacting plant and animal species and contributing to biodiversity decline.

CONCLUSION AND RECOMMENDATIONS

The research region, which includes a variety of habitat types, has significant ecological value because of its rich species diversity and the presence of essential wildlife species. Agricultural lands, water bodies, and subtropical forests, in particular, emerge as crucial ecosystems for the survival of both common and unusual species. However, the presence of large carnivores in wooded regions emphasises the importance of cautious management to prevent human-wildlife interactions. To preserve the region's biodiversity, further conservation efforts must prioritise ecological protection, especially in human-modified settings.

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