Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park

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(MSF-2020-132)

Division of Wildlife Sciences

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(Wildlife Sciences)
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DEDICATED

MY THESIS TO

MY Adored Brother

“Mudasir”

The one who always aspires and inspires me for pursuing my goals. He is the one who always have my back. I am grateful for having him.

Sher-e-Kashmir
University of Agricultural Sciences and Technology of Kashmir
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Certificate – I

This is to certify that the thesis entitled, **"Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"** submitted in partial fulfilment of the requirements for the award of the degree of **Master of Science in Forestry (Wildlife Sciences)**, to the **Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir** is a record of bonafide research work carried out by **Ms. Ruhee Jon (Regd. No. MSF-2020-132)** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

It is further certified that information received during the course of investigation has duly been acknowledged.

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We, the members of the Advisory Committee of **Ms. Ruhee Jon (Regd. No. MSF-2020-132)** a candidate for the degree of **Master of Science in Forestry (Wildlife Sciences)** have gone through the manuscript of the thesis entitled, **"Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"** and recommend that it may be submitted by the student in partial fulfilment of the requirements for the award of the degree.

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Certificate – III

This is to certify that the thesis entitled, **"Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"** submitted by **Ms. Ruhee Jon (Regd. No. MSF-2020-132)** to the **Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir** in partial fulfilment of the requirements for the award of the degree of **Master of Science in Forestry (Wildlife Sciences)** was examined and approved by the Advisory Committee and External Examiner on ……...

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Title of the Thesis : **"Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"**

ABSTRACT

The present investigation entitled, "Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park" was conducted in Dachigam National Park Jammu and Kashmir, India from 2021-2022. Data was recorded on direct sightings and indirect evidences during regular intensive surveys along eight (08) transects laid down in four habitat types in an intensive study area during winter, spring, summer, and autumn. Overall, 320 sampling plots were scanned in all four different seasons. Plant community composition were studied in four fixed habitats of the study area. Quadrants of 10 m×10 m and 5 m×5 m for trees and shrubs respectively were laid at all the four habitats. Line intercept method was adopted to estimate the ground cover percentage. A total of nine (09) animal species representing eight (08) families were recorded from the study area. Wild boar was more encountered in autumn season with mean encounter rate of 0.103 individuals/Km followed by encountered rate of 0.099 individuals/Km and 0.081 individuals/Km in winter and spring. Among all habitats riverine was most frequently used habitat in all seasons with an encounter rate of 0.15 individuals/Km followed by mixed woodland (0.106 individuals/Km). The plant

community composition revealed a total of forty (40) species belonging to nineteen (19) families from the study area, out of which twenty-one (24) were tree species and sixteen (16) shrub species. Out of the total families recorded, *Rosaceae* was the largest family with thirteen (13) species followed by *Fabaceae, Salicaceae and Pineceae* with three (03) species each. *Fagaceae, Ulmaceae, and Sapindaceae* had two (2) species each. *Moraceae, Platanaceae, Juglandaceae, Simaroubaceae, Anacardeceae, Taxaceae, Berberidaceae, Caprifolaceae, Hsmamelidaceae, Adoxaceae, Oleaceae and Scrophulariaceae* was represented by one (1) species each. The riverine habitat was dominant with twenty -one (21) tree species and sixteen (16) shrub species. Ground cover shows significant differences between different seasons and habitat types. The riverine habitat shows maximum diversity among all habitats. The study revealed that the diet of Wild boar was mainly comprised of plant matter (about 85-90%) with small percentage of animal matter (10-15%) in all four different seasons i.e., (spring, summer, fall and winter). In spring and summer, grasses and herbs were the most frequently consumed food items, while in autumn and winter seeds made the major proportion of the diet of wild boar. The most preferred grass species in all the four seasons was *cynodon dactylon* (91.30%, 93.33%, 52.42%, and 65.00%). Acorns were frequently consumed during autumn (91.42%) and winter (50%). Other species found in the diet of wild boar were*; Imperata brevifolia, Conium maculatum, Dryopteris intermedia, Rumex dentatus, Poa annua, Trifolium spp, Anthraxon prinodes, Strobilanthes capitata, rubus spp, Prunus spp. Avena fatua* (43.47%) and *Oryza sativa* (66.66%) were also consumed by wild boar during spring and summer seasons respectively. The results also showed the consumption of animal matter (Insects and Hairs). The consumption of insects was more in spring (26.08%) and summer (26.66%). Wild boar has significant impact on vegetation. Maximum impact (6.32%, 5.17%, 6.50%, and 6.80%) was recorded in riverine habitat followed by mixed woodland (5.13%, 4.66%, 4.94%, and 5.32%) and grassland (4.31%, 4.44%, 4.66%, and 4.79%) and no disturbance was seen in mixed coniferous in all four different seasons i.e. (winter, spring, summer and winter).

Key words: Wild boar, Habitat, Season, Transect, Line intercept method, Diet

Signature of Student

Dated_____

Signature of Major Advisor

Dated _____

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Ruhee Jon

Place: Benhama, Ganderbal
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Chapter 1

INTRODUCTION

The wild boar (*Sus scrofa*), a member of the family Suidae, Artiodactyla is a widespread ungulate known for its high reproductive rate, adaptability and opportunistic feeding behavior (Herrero *et al*., 2006; Cuevas *et al*., 2010; Ballari and Barrios-García, 2014). While wild boars are considered pests in many areas due to crop damage and disease transmission to livestock (Meng *et al*., 2009), they also play a key role as prey for endangered large carnivores, thereby relieving pressure on other wildlife species (Karanth and Sunquist,1995; Barrios-García and Ballari, 2012). Wild boars are medium-sized mammals. They are characterized by a dense, coarse double coat that can display a range of colors including black, brown, red or dark grey, depending on their geographical location. Although their vision is limited, they have a keen sense of smell, which is facilitated by their long, straight snout (Khan and Ilyas, 2018).

The Wild boar is classified as Least Concern (LC) in the IUCN Red List due to its extensive range, large population and adaptability to different habitats (Khan and Ilyas, 2018; IUCN 2018). Found in Southeast Asia, from Western Europe and the Mediterranean to eastern Russia and Japan, the wild pig consists of 16 recognized subspecies, divided into four regional groups based on skull height and lacrimal bone length (Grub, 2005). The western group includes five high-skull subspecies found in Europe, northwestern Africa and western Asia, characterized by dense wool and a poorly developed mane (except in certain subspecies). The eastern group includes six species found in northern Asia, characterized by a whitish stripe from the corners of the mouth to the lower jaw and features with a high skull. The Indian group is represented by two subspecies, *Sus scrofa davidi* and *Sus scrofa cristatus*, inhabiting the tropical jungles of Southeast Asia. These subspecies have sparse or absent wool, long manes and distinctive stripes on the muzzle. The Indonesian group is represented exclusively

by *Sus scrofa vittatus*, found exclusively in Indonesia, with distinctive features such as sparse hair, lack of undercoat, relatively long mane and a broad reddish stripe from the muzzle to the side of the neck. This group is considered the most basal, showing primitive dentition, unspecialized cranial structure and the smallest relative brain size (Hemmer, 1990).

In India, wild boar is spread across the country, including neighboring countries such as Myanmar and Thailand. However, the exceptions are the dry areas of Rajasthan and Gujarat, as well as the high Himalayas, where wild boar populations are absent. The northernmost limits of feral pigs in India extend into the Himalayan foothills, including Jammu and Kashmir (Ahmad *et al*., 2017).

Wild boars usually live in open territories and form social groups called sounders, consisting of breeding females and their young, 6 to 30 members in total. Male boars generally live alone except during the breeding season when they engage in combat to mate with a female (Khan and Ilyas, 2018). After mating, female boars give birth to 4-6 piglets in a nest located in dense thickets and the mother stays with them to protect them from predators. Piglets become independent and leave the nest around two months of age. The maximum lifespan of wild boars can reach 12 years, although hunting practices often result in an average lifespan of only 23 months (Massei and Genov, 2014). Wild boars usually live in open territories and form social groups called sounders, consisting of breeding females and their young, 6 to 30 members in total.

As omnivores, wild boars primarily consume plants and adapt their diet to the available resources in their habitat. Plant matter makes up 80-90% of their diet and their preferences vary by location and season. In seasonal climates, they choose high-energy foods such as acorns and beech mast but are capable of eating a wide variety of things they can fit in their mouths. In addition, wild boars can scavenge on the remains of other animals (Schley and Roper 2003; Massei and Genov, 2014).

Boar density is directly correlated with the extent of rooting, which can have a significant impact on animal and plant communities. In areas of high feral pig density, extensive rooting can reduce herbaceous cover by up to 80–90% and even lead to the local extinction of certain plant species (Braxton, 1974; Howe *et al*., 1981). Their keen sense of smell and nocturnal feeding make them adept at raiding crops. In addition, soil loosening caused by rooting can lead to erosion on steep slopes.

During the Dogra era, wild boars were introduced to the mountains of Kashmir in Dachigam National Park and surprisingly, their population thrived after the introduction. However, the increasing population of wild boars in Kashmir has raised concerns among locals, who view them as invasive animals. Attempts were made to eradicate these invasive species, leading to the extermination of the last wild boar from Dachigam National Park in 1984 (Mansoor 1989). Nevertheless, the resurgence of wild boars in Dachigam National Park in 2013 (Ahmad *et al*., 2014), as well as in Ajas, Bandipora and Limber-Lachipora Wildlife Sanctuary in Baramulla (Ahmad *et al*., 2017), along with the subsequent population growth in Dachigam National Park and its surrounding areas in recent years, pose a threat to the existing endemic wildlife, their habitats and agricultural crops. Therefore, it was crucial to investigate the origins of these boars and monitor their population growth with the aim of eradicating this invasive species in Kashmir (Ahmad *et al*., 2013). The present study aims to assess the presence, seasonal distribution and feeding habits of wild boars in Dachigam National Park, specifically focusing on the following objectives:

1. To assess the status, distribution and habitat use of Wild Boar (*Sus scrofa*) in Dachigam National Park.
2. To assess and evaluate the food and feeding habits of Wild Boar (*Sus scrofa*) viz-a-viz Hangul and Black Bear.

3. To assess the impacts of Wild Boar (*Sus scrofa*) on the vegetation of selected habitats for species conservation planning in the National Park.

Chapter 2

REVIEW OF LITERATURE

The pertinent information related to present investigation entitled, "**Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"** has been revived under following headings:

2.1 Status, distribution and habitat use of wild boar in Dachigam National Park.

2.2 Food and feeding habit and Habitat use of Wild Boar in Dachigam National Park.

2.3 Impact of wild boar rooting on vegetation in Dachigam National Park.

2.1 Status, distribution and habitat use of wild boar in Dachigam National Park

Fattorni and Feretti (2020) assessed wild boar density and rooting activity in a Mediterranean protected area. Wild boar number and rooting activity was estimated during 2018-2019 using plot based faecal counts in conjunction with precise estimates of daily defecation rates, which was 6.7 feces per individual, significantly lower than the rate for ruminants. In both years, they estimated densities between 70.0 feces/km² and 70.5km² corresponding to about 10.5 wild boars per square kilometer (Relative standard error: 18%). Faecal incidence in plots was significantly more often in ecotones than in cultivated lands than in cultivated areas and natural/ semi-natural areas.

Markov *et al*. (2019) investigated the distribution of wild boar (*Sus scrofa*) in northeastern range with a set of climatic and habitat variables at three spatial scales- the permanently occupied area, the area of potential expansion and the total area. The results showed that the potential range increase of the species is

due to the combined effect of habitat and climatic variables. However, the possibility for future expansion of wild boar is promoted not by shifts in resource use, but by behavioral adaptations and by climate change.

Khan and Ilyas (2018) assessed the distribution of wild boar (*Sus scrofa*) in Pench Tiger Reserve, MP. The faecal matter of wild boar was collected from January to June in the Karmajhiri range. The results indicated that the faecal matter density of wild boar in Pench Tiger Reserve was 8.2/ha and the densities were high in beats that are close to human habitation. The maximum density was found in Sapath beat followed by Tikadi beat and minimum in Turia beat.

Guo *et al*. (2017) studied population dynamics and space use variation of wild boar in a Tropical Forest, Southwest China. Study investigates that the population of wild boar fluctuated annually and across years, with females slightly more abundant than males. The space use variations differed by age class, with piglets preferring forest interior and adults were active near villages.

Ballari *et al*. (2014) determined the distribution, impact and management of wild boar in the protected areas of Argentina. Boars were recorded in wetlands, forests and shrub lands. The negative impact includes soil disturbing, vegetation damage and animal predation. Many control methods were used, but their effectiveness was low, suggesting the need of an urgent plan, to minimize negative impacts of this species.

Belda *et al*. (2012) predicts the potential distribution areas for wild boar in Mediterranean region, using GIS and Kilometric abundance indices. Six potential areas were obtained that represent 39% of the region and are best for the species. The dominant landscape in these areas was natural vegetation, followed by agricultural land.

Srivastava and Khan (2009) conducted study on wild pig population in Keoladeo National Park, Bharatpur during 2007. Seventy-eight groups were sighted during whole study period. Total density was estimated to be 15.78 wild

pigs per sq. km (%CV=17.99). Pellet group density was found significantly different (F=6.894, df=5, P=<0.001) among all the habitats, with highest in short grassland open area (522 pellet/ha) and in tall grassland savannah (20 pellet groups/ha). Male to female ratio 1:1.01 and female to young ratio was 1:2.85, which represents growing population of wild pig in the park. Mean group size exhibited by the population was (3.79±0.44). Larger groups were found in habitats where food was abundant. Grass density, quality forage, dense cover and easily accessible water source were suggested to be the dominant factors in determining the habitat utilization patterns of wild pig populations in Keoladeo National Park.

Cahill *et al.* (2003) assessed spacing and nocturnal activities of wild boar in Mediterranean region. Data on their activity and habitat use were collected by prospecting of non-linear transects and periodic monitoring of sign-survey plots. Pellet group density varied between habits being higher in agricultural habitats followed by riparian woodland and wooded slopes.

2.2 Food and feeding habit of Wild Boar in Dachigam National Park

Lee and Lee (2019) studied diet of wild boar in forest-agriculture and urban environments in South Korea. From 2012-2017, stomach contents of wild boar killed by hunters in two different environments in Geochang and Seoul, South Korea were examined. Feeding behaviours of wild boar were compared between seasons and sites and investigated the relationship between the number of earth worms and their primary diet. It was found that the diet of wild boar living in two habitats varied seasonally. When crops are available, wild boar in Geochang preferred them to other food resources. Despite the fact that wild boar in Seoul also preferred crops, their diets contained a higher proportion of natural foods due to limited availability of crops. Although there was no difference in earthworm eating between two studies sites, but there are seasonal variations because of availability.

Khan and Ilyas (2018) studied feeding habit of wild boar in Pench Tiger Reserve, MP. Faecal samples were collected and results showed 75% of the diet of wild boar consisted of plant, matter and remaining 25% of animal matter, stones and earthworms.

Mikula *et al*. (2018) studied the importance of natural dietry components in the diet of wild boar in the four predominantly oak forests in the Czech Republic during autumn and winter. The diet of wild boar is closely correlated with the management of the species and severity of its negative impacts. They also investigated, how supplementary feed, particularly maize affects feeding preferences. A wide variety of natural food components were found in the samples after analysis, including herbs, wood, tubers, fruit, pine needles, acorns, earthworms and other unidentified items of animal origin. Maize, wheat, barley, oats, cereal husks and beet root were among the identified supplemental feeding components. A significant share of acorns and maize were a staple food at all sites. The comparison of expected values for the proportion of natural food items in the stomachs at four sites showed statistically significant differences ($H(3,178) = 40.0682$, $P<0.001$). The proportions of maize and natural food in stomachs negatively correlate ($t(4) = -2.7978$, $p= 0.0489$) at -0804, suggesting that the proportion of natural food decreased as the proportion of maize in the diet increased.

Massei and Genov (2014) analyze food availability and habitat use by the wild boar in a Mediterranean area. Twenty wild boars were radio tracked for data collection. Results showed that wild boar use pinewood and the meadows more intensively.

Ballari and Barrios-Garcia (2014) conducted a literature search on the diet of wild boar in native and introduced ranges. The literature search showed wild boar's diet consists primarily of plat matter both in native as well as in introduced ranges. But animal matter and fungi are consumed in greater proportion in the introduced range.

Cuevas *et al*. (2013) studied seasonal variation in feeding habit and diet selection by wild boar in semi-arid environment of Argentina. Faecal samples were over two seasons (dry and wet) in one year. Results revealed that wild boar selects items of high forage quality and high carbohydrate, in order to survive in a semi-arid environment. Herbs most frequently consumed in both seasons.

Cuevas *et al.* (2013) studied multi-scale pattern of habitat used by wild boar in the Monte Desert of Argentina and found positive association between herb cover and wild boar presence.

Mauro and Vila (2012) assessed habitat use of wild boar (*Sus scrofa*) in Los Alerces Park, Argentina. 262 transects were surveyed, searching fresh signs of the species. Results showed that wild boar tended to use lower elevations (600m-700m) more intensively than higher elevations. The distribution of fresh signs indicated that wild boar did not use plant communities uniformly. They used forests dominated by *Nothofagus dombeyi* and *Nothofagus Antarctica* than other vegetation.

Sharma *et al*. (2010) conducted study on the habitat use and food habits of Kashmir Red Deer or Hangul (*Cervus elaphus hanglu*) at Dachigam National Park, Kashmir, India, from April 2007 to June 2009. On the basis of vegetation, study area was classified into five Hangul habitats viz., Riverine (1600m-1900m), Lower Temperate Mixed (1800m-2200m), Lower Temperate Pine Mixed (1800m-2400m), Mid Temperate Mixed (2300m-2600m) and Temperate Mixed Grassland (1900m-2900m). Overall, 404 visual encounters and signs of Hangul was recorded and found that the habitat use was significantly different across seasons ($\chi^2 = 32.33$, df= 4, $P<0.001$). Maximum sightings and evidences (39%) were recorded in Temperate Grassland/Scrub habitat followed by Riverine (26%) and Lower Temperate Pine (9%). Temperate Grassland/Scrub habitat was used more than its availability ($0.36 \leq P \leq 0.487$) in all seasons.

Skewes *et al*. (2007) assessed diet of wild boar in South-Central Chile based on examination of 20-stomachs that were found near the Vicente Perez Rosales National Park and Mocho Choshuenco Volcano. Animals, plants and fungi are all included in the diet. Both epigeal and hypogeal of plants and fungi as well as fruits and seeds are consumed. The two most prevalent plant components in the diet are fungi and *Gunnera tinctoria* rhizomes.

Herrero *et al*. (2006) conducted study on diet and crop damage caused by wild boar in the Middle Ebro Valley, semi-arid area in northeast Iberia. Stomach content was analyzed and crop damage was surveyed. Results revealed wild boar showed a clear preference for a few types of food. Maize, barley, wheat and alfa-alfa comprised more than 75% of stomach content. Among this maize was the main food.

Herrero *et al.* (2005) assesses 234 stomach contents of wild boar collected in autumn and winter during three consecutive hunting seasons, in order to understand the diet of wild boar during the cold season. Results revealed that plant material was the most important food item in the wild boar's diet in all three seasons. The most important items of abundance and frequency were beech nuts and acorns. The amount of animal matter was small but consumed frequently.

Massei and Genov (2004) studied environmental impact of wild boar and found that wild boar can adapt a wide range of foods and can have very substantial environmental impact and affect many ecosystem components. Results showed that wild boar can feed directly on whole plant or on vegetative parts. Plants represent between 80% and 90% of the diet of wild boar. Wild boar can also feed on a very wide range of vertebrate and invertebrate species.

Schley and Roper (2003) assessed the diet of wild boar in Western Europe. Data were taken from 21-studies that provide quantitative information about the consumption of different food types by wild boar. It was found vegetative food

occurred more frequently in the diet than animal food. Wild boar always consumed at least one energy rich plants such as acorns, beech nuts, chestnuts.

Keuling *et al*. (2001) assessed habitat use of wild boar. Five ear tagged boar groups were observed during night time in summer and autumn. Results indicated the wild boar preferred young coniferous woodland and avoided grasslands and old coniferous woodlands.

Massei (1996) analyses diet of wild boar in a Mediterranean coastal area. Faecal matter of wild boar was collected and analyzed. It was found that plants comprised on an average of 86.3% of volume.

Chambrillon *et al.* (1995) assessed the diet of Mediterranean wild boar in two successive years by means of stomach and faecal matter analysis. Results revealed that the wild boar is omnivorous with a definite frugivorous tendency. It was found that plants represent 96% of diet. Animal part represents only 3%. Wild fruits make 57% of annual diet, among which holly oak acorns are the staple food.

Gerard *et al.* (1991) assessed habitat use of wild boar in a French agro ecosystem. Data were collected from radio collared individuals and results revealed wild boars preferred natural habitats, as most significant activities taking place there.

Dardaillon (1987) investigated seasonal feeding habit of wild boar by means of stomach content analysis and seasonal observation of rooted sites. About 149 stomach contents collected during the autumn and winter seasons have been analyzed. Results revealed that wild boars consume relatively high proportions of animal matter, mainly composed of vertebrates. In early autumn, their diet is composed of fruits, seeds and grains.

Singer *et al*. (1981) studied home range, movements and habitat use of European wild boar. It was found that seasonal home range of males was larger than females. Certain males were more dominant, aggressive and sexually

motivated, moved significantly greater distances per hour and have larger seasonal ranges than other males.

2.3 Impact of wild boar rooting on vegetation in Dachigam National Park

Carbon *et al*. (2022) studied soil disturbances caused by wild boar in urban grasslands in European cities. In 22 dry grasslands, samples of flora, grasshoppers and sand lizards were collected and monitored wild boar activities. Results showed that plant diversity declined with rooting intensity, but not species richness. Relationships with animals were generally positive. Rooting was positively correlated with grasshopper diversity, overall richness and richness of specialists and endangered species. Sand lizard abundance was also positively correlated with rooting. The first multi-taxa study to be conducted in a big city reveals that wild boar disturbance of soil does not necessarily threat to biodiversity.

Khattak *et al*. (2022) studied impacts of wild boar on the livelihood of rural communities in Pakistan. Economic losses caused by wild boar were investigated in two north-western districts of Pakistan- Peshawar and Nowshera. 589 respondents from 53 communities were surveyed between May and June 2022. The findings showed that the wild boar was primarily responsible for crop raiding, which costs the economy USD 12,030 annually (USD20.42/household). The highly plundered crops included maize (40.24%), followed by wheat (24.95%), vegetables (22.65%) and sugarcane (6.29%).

Cuevas *et al.* (2020) investigated impact of Wild boar on vegetation in the Monte Desert, Argentina. Results showed that Wild boar rooting reduces plant cover and thus decreases plant richness and diversity.

Lombardini *et al. (*2017) studied factors influencing wild boar damage to agricultural crops in Sardinia, Italy. The purpose of this study was to develop a prediction model of damage risk and offer a comprehensive description of agricultural damage caused by wild boar (*Sus scrofa*) over seven-year period.

There were 221 instances of wild boar attacks, resulting in economic losses of 483,982 Euros. Damage occurrences primarily affected vineyards, meadows and oat fields. Peak of incidences were found in the summer and early fall and minimal incidences in the spring.

Khanal and Singh (2017) carried study on human-wild boar conflict in Western Nepal. The purpose of this study was to document the crop damage and human casualties caused by wild boar. The data were gathered by using simple random sampling. Total of 209 household heads were questioned face-to-face using structured questionnaire. Wild boars caused an estimated NPR 26, 06,156 (USD 23,962) worth of crop damage. Paddy, wheat, mustard, legumes, vegetables and other crops were damaged. The most negatively impacted crops were vegetables (8.8%) and pulses (8.7%). Ten injuries to people above age of fifteen were also reported.

Cuevas *et al*. (2016) carried out study on impact of Wild boar on ecosystem processes. It was found that impacts of Wild boar are negative and generate a variety of impacts viz; increased soil disturbances, reduces species composition and alters structure and functioning of ecosystem.

Ficetola *et al*. (2014) studied damage caused by Wild boar to croplands in a mosaic of agricultural natural areas. They used records of Wild boar damages occurred over the years. It was found that crops like cereals, legumes and vineyards were frequently damaged.

Sandom *et al*. (2013) quantifies behavioral foraging ecology of Wild boar in Scottish Highlands. Five boars were monitored by using GPS. Results indicated that rooting was more prominent during the autumn and winter, while during spring and summer grazing was dominant.

Bueno *et al*. (2011) assessed Wild boar rooting on ecological and pastoral values of Alpine Pyrenean Grasslands. Results revealed that Wild boar rooting

affects Pyrenean Grasslands moderately, with more impact on pastoral values than ecological values.

Chauhan *et al*. (2009) investigated human-wild pig conflict in five different states in India. The wild pig populations in these states are dispersed and mostly isolated. The destruction of agricultural crops and attacks on people by wild pigs are serious issues. In these states wild pigs were responsible for 309 human killings and injury instances between 1990 and 2008. More people were killed by wild pigs in forests (73.8%) than in farms (21.7%) or towns (4.5%). Damage to agricultural crops ranged from 5% to 36%.

Chapter 3

MATERIALS AND METHODS

The current investigation, titled **"Assessment of status, distribution, habitat use and feeding habit of wild boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"**, was conducted in Dachigam National Park, Jammu and Kashmir, India in 2021-2022. Dachigam National Park is located at 34°05' N-34˚11' N and 74°54' E-75˚09' E at an altitude between 1700 m-4700 m above mean sea level, at a distance of 21 km from Srinagar and covers an area of 141 km². Dachigam National Park lies within the Greater Himalayan Range (Rodgers and Panwar, 1988). Dachigam National Park is bounded by the Sindh Valley to the northeast; Tarsar, Lidderwath, Kalhai of the Lidder Valley and Overa Aru Nature Reserve in the Far East; The Tral range in the south-east and Harwan, Brain, Nishat in the west and south-west. The National Park (NP) is approximately 22.5 km long and 8 km wide and covers about half of the Dal Lake basin.

Based on vegetation types and density of dominant plant species, which are determined by various physical and biological factors (Singh & Kachroo, 1978; Ahmad, 2006), the study area in Dachigam was broadly stratified into seven habitat types differing in land cover, viz. riverine (8.26 km²), mixed woodland (11.17 km²), pine Parrotiopsis (25.83 km²), grassy/rocky slopes (17.11 km²) grassland/scrub with alpine pastures (17.66 km²) and mixed conifer dominated by blue pine and silver fir forests (28.49 km²) (Ahmad *et al*., 2009; Ahmad and Farooq, 2018).

The climate of the study area can be described as sub-Mediterranean to typically mild, with higher degrees of rainfall variability and drought. Snow is the main source of precipitation and in some parts, it stays until June. The average recorded temperature ranges from a high of 27.30 C in summer and a low of 2.0 C

in winter. The average recorded rainfall is 660 mm, but there is no definite rainy season like the monsoon season in other parts of the country (Ahmad *et al*., 2005).

In addition to Wild boar (*Sus scrofa*), which is an introduced species the Dachigam National Park is the home to the last viable population of Kashmir Red deer or Hangul (*Cervus hanglu hanglu*). Other large mammals found in the area include Kashmir musk deer (*Moschus cupreus*), serow (*Capricornis sumatraensis*), Asiatic black bear (*Ursus thibetanus*), brown bear (*Ursus arctos*) and common leopard (*Panthera pardus*). The meso-mammals found in the area are Himalayan grey langur (*Semnopithecus ajax*), red fox (*Vulpes vulpes*), golden jackal (*Canis aureus*), Kashmir flying squirrel (*Eoglaucomys fimbriatus*), small Indian civet (*Viverricula indica*) and yellow-throated marten (*Martes flavigula*).

The details of the experimental plots, materials used and methodologies adopted for this study are discussed below:

3.1 To assess the status, distribution and habitat use of Wild Boar (*Sus scrofa*) in Dachigam National Park.

Due to the hilly terrain, it was not possible to use the line transect method (Burnham *et al*., 1980) to monitor and estimate the animal population. We designed a standard network of transects along trails, null (streams) and contours using the strip count and bounded count methods of Hayne (1949), Holloway (1971), allowing observers to move as quickly as possible through the different habitat types in the area and record occurrence data and the spread of the wild boar.

The study was conducted in lower Dachigam and the area was divided into four different habitats, i.e., riverine forest, mixed forest, mixed conifers and meadows based on flora composition. To assess the status and distribution of feral pigs, data were collected based on direct observations and circumstantial evidence. Population monitoring and sampling was carried out by walking 1-2 km transects in all selected habitats and two transects were laid in each. Ten plots

were established on each transect every 100 m and a total of 320 plots were sampled seasonally in four different habitats. Regular surveys were conducted along the transects on a rotating basis four times a month in the morning (6-10 am) and evening (4-6 pm) in all four seasons (winter, spring, summer and autumn) to collect data on daily activity of wild pigs in relation to habitat use parameters. For each animal sighting, data on time of sighting, group composition, habitat use, location and activity were recorded.

Habitat use

At each animal observation site, data on animal occurrence and habitat use in relation to resource availability are available, viz. vegetation (trees, shrubs and ground cover in terms of grass/herb, litter, bare soil and habitat parameters, i.e., altitude, location, latitude/longitude) using global positioning system (GPS) were recorded according to Wilson *et al*. (1996). At the location of each wild boar sighting or indirect evidence of its presence, resource availability and habitat parameters were recorded and quantified in quadrants. Quadrants of 10 m × 10 m and 5 m × 5 m for trees and shrubs were laid out in different habitats of Dachigam National Park. Percent ground cover (litter, grass/herb, bare soil, snow and rock) was quantified using the line intercept method (Canfield, 1941). The stick was placed on the ground in four directions and the trapping material (herbs/grass, litter, bare soil, snow and rock) was recorded at 5 cm intervals. Shannon-Wiener index and Simpson diversity index were calculated using the following formulas:

$$\text{Shanon-Wiener Index (H)} = -\sum P_i \ln P_i)$$

Where,

H =Shannon Weaver diversity index value

P_i = No. of individual of species/Total no. of species

Ln = Natural logarithm function

Simpson's Diversity Index

$$D = 1 - \left[\sum \left(\frac{n}{N}\right)^2\right]$$

Where,

n= total number of a organisms of a given species

N= total number of organisms of all species

3.1.1 Encounter rate:

Feacal samples, hairs, rooting, hoof marks as well as direct sightings were used to calculate encounter rate per kilometer for all habitats. Encounter rate was compared across different habitats to find the suitable habitat of wild boar.

Encounter rate of the wild boar was calculated using formula (Gowda and Kumara, 2009)

$$Encounter\ rate = \frac{No.of\ sightings\ or\ Evidence}{Total\ distance\ travelled\ (km)}$$

3.1.2 Relative abundance:

Relative abundance is the study of numerical strength of a species in relation to the total number of all the species and was calculated as:

$$\text{Relative abundance} = \frac{Number\ of\ species\ of\ a\ particular\ species}{Number\ of\ individuals\ of\ all\ species} \times 100$$

Misra, 1969

3.2 To assess the diet of Wild Boar (*Sus scrofa*) in Dachigam National Park

3.2.1 Faecal sample collection

The faecal samples were collected systematically as well as opportunistically during regular field surveys along the transects in Dachigam National Park. Faecal collection was done seasonally along 8 transects with 320

sampling plots (10×8×4) and. A total of ninety-three (93) feacal samples were collected with twenty-three (23) in spring, fifteen (15) in summer, thirty-five (35) in autumn and twenty (20) in winter. The time, location, date and geographic coordinates were recorded for each faecal sampling location using Global Positioning System. In addition to feacal analysis, direct observations (binoculars) were also made following scan sampling (Altman, 1952) to observe and understand the feeding behaviour of wild boar.

3.2.2 Faecal sample analysis

All feacal samples were carried in air- tight bags and then sun dried. Feacal analysis was carried out according to Dacar and Giamnoni (2001). Feacal samples were crushed and then sieved through a sieve of 5mm mesh size. After this, material was boiled (5-10 minutes) in nitric acid and distilled water in the ratio of 1:3. The material was then washed in distilled water till nitric acid was completely removed. Reference slides were prepared to identify dietry components that are unknown. For this purpose, vegetative parts of plants were collected from the same area and were processed just like feacal samples. Then frequency of occurrence was calculated for each identified dietry components by using following formula:

$$\mathrm{FOi}(\%) = \frac{ni}{N}$$

Where, N is the total number of feacal samples and ni is the number of samples containing species I (Corbett, 1989).

3.3 To assess the impacts of Wild Boar (*Sus scrofa*) on the vegetation of selected habitats for species conservation planning in the National Park

In order to achieve this objective, each delineated habitat was stratified into four strata based on the composition of flora. In each stratum five plots (1m×1m) were laid in order to assess the impact of wild boar rooting on vegetation.

Percentage of plant cover was quantified before and after the rooting damage on each plot by line interception method. Attempts were also made to compare the plant cover and species composition by sampling 50m either side of each impacted side. A total of 320 animal used and available plots were studied during the whole study period and sampling was done on seasonal basis.

3.4 Statistical analysis

The statistical analysis for each objective was carried out and data generated from present investigation was subjected to analysis using standard tools and procedures. The analysis was performed through R SOFTWARE and MS-EXCEL.

Chapter 4

EXPRIMENTAL FINDINGS

The silent findings of present investigation entitled **"Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"** conducted in Dachigam National Park in Srinagar district of Jammu and Kashmir during 2021-2022 are presented in this chapter under the following heads:

4.1 Status, distribution and habitat use of Wild Boar (*Sus scrofa*) in Dachigam National Park.

4.2 Food and feeding habit of Wild Boar in Dachigam National Park.

4.3 Impact of wild boar rooting on vegetation in Dachigam National Park.

4.1 Status, distribution and habitat use of Wild boar in Dachigam National Park

The seasonal occurrence, distribution and habitat use of Wild boar in Dachigam National Park are shown in Table 01-08.

A total of nine animal species representing eight (08) families were recorded from Dachigam National Park. The family *Canidae* comprised of two species Red fox and Golden jackal. The other species recorded include Wild boar (*Suidae*), Kashmir gray langur (*Cercopithecidae*), Kashmir red deer or Hangul (*Cervidae*), Indian Porcupine (*Erethizontidae*), Yellow-throated marten (*Mustilidae*), Asiatic black bear (*Ursidae)* and Common leopard (*Felidae*) (Table 1).

Table 1: List of mammals during different seasons in Dachigam National Park 2021-2022

S.No.	Scientific name	Family	Common name	IUCN status
1	*Canis aureus*	*Canidae*	Golden jackal	Least concern
2	*Cervus hanglu*	*Cervidae*	Kashmir stag	Critically endangered
3	*Erethizon dorsatum*	*Erethizontidae*	Porcupine	Least concern
4	*Martes flavigula*	*Mustelidae*	Marten	Least concern
5	*Panthera pardus*	*Felidae*	Leopard	Vulnerable
6	*Semnopithecus ajax*	*Cercopithecidae*	Himalayan grey langur	Endangered
7	*Sus scrofa*	*Suidae*	Wild boar	Least concern
8	*Ursus thibetanus*	*Ursidae*	Black bear	Vulnerable
9	*Vulpes vulpes*	*Canidae*	Red fox	Least concern

4.1.2 Encounter rate based on direct sightings

The data reveals that the Wild boar used all the habitats except mixed conifer habitat. However, the mean encounter rate of Wild boar varied significantly between the habitats (0.002) and seasons (0.001). The riverine was the most frequently used habitat in all with a seasonal mean encounter rate of 0.15individuals/km followed by mixed woodland with a mean seasonal encounter rate of 0.106individuals/km and grassland (0.08individuals/km) (Table 2).

Table 2: Wild Boar encounter rates (#/Km) based on direct sightings during different seasons in Dachigam National Park during 2021-2022

S .No.	Habitat Season	Riverine	Mixed woodland	Grassland	Pine parrotiopsis	Mean
1	**Winter**	0.186	0.107	0.105	0.00	0.099
2	**Spring**	0.146	0.095	0.086	0.00	0.081
3	**Summer**	0.121	0.096	0.041	0.00	0.064
4	**Autumn**	0.184	0.127	0.103	0.00	0.103
	Mean	0.15	0.106	0.08	0.00	
	CD($p \leq 0.05$)	H=0.002 S=0.001 H×S=0.003				

Winter

Spring

Summer

Autumn

Plate 1: Direct encounter of Wild boar in Dachigam National Park

4.1.3 Encounter rate based on indirect evidences

Based on indirect evidences, results also indicated that Wild boar was most frequently seen in riverine habitat (0.72 individuals/Km) in all four different seasons followed by mixed woodland (0.47 individuals/Km) and grassland (0.128 individuals/Km). The signs were recorded maximum in autumn season (0.458 individuals/Km) followed by winter season with sign encounter rate of 0.350 individuals/km (Table 3).

Table 3: Wild Boar encounter rates (#/Km) based on indirect evidences during different seasons in Dachigam National Park during 2021-2022

S. No.	Habitat / Season	Riverine	Mixed woodland	Grassland	Mixed coniferous	Mean
1	Winter	0.635	0.537	0.231	0.00	0.350
2	Spring	0.829	0.495	0.068	0.00	0.348
3	Summer	0.315	0.303	0.069	0.00	0.172
4	Autumn	1.126	0.563	0.144	0.00	0.458
	Mean	0.72	0.47	0.128	0.00	
CD(p≤0.05)		H=0.001 S=0.002 H×S=0.004				

4.1.4 Seasonal relative abundance of Wild boar and other associated large mammals based on direct sightings

The data indicated the relative abundance of mammal species estimated from their direct sightings. Highest abundance was recorded for Himalayan grey langur followed by Hangul and Wild boar in all four different seasons. The maximum seasonal relative abundance of Wild boar was recorded during autumn (24.53±9.82) followed by winter (21.45±8.18), spring (21.33±9.59) and summer (19.74±8.77) season (Table 4).

The relative abundance of Wild boar also showed variations between habitats. Maximum relative abundance of Wild boar was recorded in riverine (39.76±0.52) and mixed woodland (33.91±2.60) habitats and minimum in grassland (13.37±2.03) (Table 5).

Table 4: **Relative abundance of principal mammal species based on direct sightings during different seasons in Dachigam National Park 2021-2022**

Mean± S. E				
Season / Species	**Winter**	**Spring**	**Summer**	**Autumn**
Wild boar	21.45±8.18	21.33±9.59	19.74±8.77	24.53±9.82
Hangul	29.87±5.71	31.66±6.13	22.19±5.83	26.82±5.84
Black bear	5.09±0.82	12.58±0.67	24.72±4.53	16.66±1.44
Himalayan langur	43.62±9.18	34.51±6.95	33.32±4.28	31.88±7.46

Table 5: Relative abundance of wild boar based on direct sightings in different habitats of Dachigam National Park 2021-2022

Mean± S. E				
Habitat / Species	**Riverine**	**Mixed woodland**	**Grassland**	**Mixed coniferous**
Wild boar	39.76±0.52	33.91±2.60	13.37±2.03	0.00

4.1.5 Floristic composition of Dachigam National Park

The data tabulated in Table 08 present the preliminary information regarding the tree and shrub species in selected study habitats of Dachigam National Park. During the present investigation, a total of 40 species were recorded distributed among nineteen (19) families in different habitats. Based on the number of species within the families, *Rosaceae* was the largest family with thirteen (13) species followed by *Fabaceae, Salicaceae and Pineceae* with three (03) species each. *Fagaceae, Ulmaceae and Sapindaceae* had two (2) species each. *Moraceae, Platanaceae, Juglandaceae, Simaroubaceae, Anacardeceae, Taxaceae, Berberidaceae, Caprifolaceae, Hsmamelidaceae, Adoxaceae, Oleaceae and Scrophulariaceae* was represented by one (1) species each.

Table 6: Species (Trees and Shrubs) composition in different habitats of Dachigam National Park 2021-2022

S. No.	Scientific name	Common name	Local name	Family	Riverine	Mixed woodland	Grassland	Mixed coniferous
1	*Abies pindrow*	Fir	Budulu	Pinaceae	-	-	-	+
2	*Acer caesium*	Indian maple	Trikan	Sapindaceae	+	+	-	-
3	*Aesculus indica*	Horse chestnut	Handoon	Sapindaceae	+	+	+	-
4	*Ailanthus altisima*	Tree of heaven	Alamthras	Simaroubaceae	+	+	+	-
5	*Cedrus deodara*	Himalayan cedar	Deodar	Pinaceae	-	-	-	+
6	*Celtis australis*	European nettle tree	Brimij	Ulmaceae	+	+	+	+
7	*Juglans regia*	Walnut	Doon	Juglandaceae	+	+	-	-
8	*Malus*	Apple	Chonth	Rosaceae	+	+	+	-
9	*Morus spp.*	Mulberry	Tul	Moraceae	+	+	+	+
10	*Pinus wallichiania*	Kail	Kayur	Pinaceae	+	+	+	+
11	*Platanus orientalis*	Chinar	Booen	Platanaceae	+	-	-	-
12	*Populus alba*	Poplar	Phres	Salicaceae	+	+	-	-
13	*Prunus armeniaca*	Apricot	Chaer	Rosaceae	+	+	+	-
14	*Prunus dulcis*	Almond	Badam	Rosaceae	+	-	-	-
15	*Prunus persica*	Peach	Chunun	Rosaceae	+	-	-	-
16	*Pyrus calleryana*	Bradford pear	Tang	Rosaceae	+	-	+	-

Contd…

Table 6: contd….

S. No.	Scientific name	Common name	Local name	Family	Riverine	Mixed woodland	Grassland	Mixed coniferous
17	*Quercus ilex*	Holm Oak	-	Fagaceae	+	-	-	-
18	*Quercus robur*	English Oak	Palekul	Fagaceae	+	+	-	-
19	*Rhus succededanea*	Japanese wax tree	Arkhool	Anacardiaceae	+	+	+	-
20	*Robinia pseudoacacia*	Black locust	Kikar	Fabaceae	+	+	+	-
21	*Salix alba*	Willow	Dud vir	Salicaceae	+	-	-	-
22	*Salix babylonica*	Weeping willow	Vir	Salicaceae	+	-	-	-
23	*Taxus*	Yew	-	Taxaceae	-	-	-	+
24	*Ulmus vilosa*	Elm	Brein	Ulmaceae	+	+	-	-
Shrubs								
25	*Berberis lyceum*	Indian barberry	Kawdach	Berberidaceae	+	+	+	+
26	*Buddleja davidii*	Butterfly bush	Posh kul	Scrophulariaceae	+	+	-	-
27	*Cotoneaster nummalaria*	Open fruit cotoneaster	Lunn	Rosaceae	+	+	+	-
28	*Crategus songarica*	Hawthorn	Ringkul	Rosaceae	+	+	-	-

Contd…

Table 6: contd….

S. No.	Scientific name	Common name	Local name	Family	Riverine	Mixed woodland	Grassland	Mixed coniferous
29	*Desmodium elegans*	Elegant desmodium	-	Fabaceae	+	+	-	-
30	*Indigofera herantha*	Himalayan indigo	Zand	Fabaceae	+	+	+	-
31	*Jasminum officinale*	Common jasmine	Jasmine	Oleaceae	+	+	-	-
32	*Lonicera queinquelocularis*	Translucent honeysuckle	Heet her	Caprifoliaceae	+	-	-	-
33	*Parratriopsis jacquemontiana*	Parrotia	Posh/Hatab	Hsmamelidaceae	+	+	+	+
34	*Prunus ceracifera*	Cherry plum	Gordael	Rosaceae	+	+	+	+
35	*Prunus tomentosa*	Nanking cherry	Weshkhand	Rosaceae	+	+	+	+
36	*Rosa cymosa*	-	-	Rosaceae	+	+	+	+
37	*Rubus fruticosa*	Blackberry	Chaanch	Rosaceae	+	+	+	+
38	*Rubus niveus*	Hill raspberry	Chaanch	Rosaceae	+	+	+	+
39	*Rosa webbiana*	Wild rose	Jangli gulab	Rosaceae	+	+	+	+
40	*Viburnum grandiflorum*	Grand viburaum	Kulmach	Adoxaceae	+	+	-	+

*+= Presence and - = Absent

4.1.6 Percentage ground cover in different habitats of Dachigam National Park during different seasons 2021-2022

The ground cover percentage in different habitats of Dachigam National Park during different seasons is given in Table 7. The data revealed that the percentage of Heb/Grass was maximum (57.50%, 76.25%, 87.50%, 76.25%) in grassland habitats in all four different seasons i.e. (winter, spring, summer, autumn), bare ground was maximum (26.25%, 36.25%, 38.75%, 37.50%) in mixed conifer, litter was maximum (21.25%, 26.25%, 26.25%, 35.00%) in mixed woodland, rock was maximum (22.50%, 12.50,20.00%, 22.50%) in riverine habitats, while snow was recorded maximum (13.75%) in mixed coniferous habitats.

Table 7 Percentage ground cover in different habitats of Dachigam National Park during different seasons 2021-2022

Habitat		Herb/Grass (%)	Bare ground (%)	Litter (%)	Rock (%)	Snow (%)	Total (%)
WINTER	Riverine	50.00	10.00	11.25	22.50	6.25	100.00
	Mixed woodland	53.75	8.75	21.25	10.00	5.00	100.00
	Grassland	57.50	11.25	16.25	7.50	7.50	100.00
	Mixed coniferous	46.25	26.25	5.00	8.75	13.75	100.00
SPRING	Riverine	63.75	13.75	16.25	12.50	0.00	100.00
	Mixed woodland	55.00	15.00	26.25	3.75	0.00	100.00
	Grassland	76.25	5.00	26.25	6.25	0.00	100.00
	Mixed coniferous	31.25	36.25	25.00	7.50	0.00	100.00
SUMMER	Riverine	66.25	3.75	10.00	20.00	0.00	100.00
	Mixed woodland	57.50	13.75	26.25	2.50	0.00	100.00
	Grassland	87.50	3.75	6.25	2.50	0.00	100.00
	Mixed coniferous	43.75	38.75	15.00	2.50	0.00	100.00
AUTUMN	Riverine	58.75	8.75	10.00	22.50	0.00	100.00
	Mixed woodland	50.00	12.50	35.00	2.50	0.00	100.00
	Grassland	76.25	6.25	11.25	6.25	0.00	100.00
	Mixed coniferous	41.25	37.50	11.25	10.00	0.00	100.00

4.1.7 Shannon-Weiner diversity index and Simpson's index of dominance of trees and shrubs

Shannon-Weiner index and Simpson's diversity index for trees and shrubs are presented in Table7. Shannon-Weiner index of trees showed that the maximum (2.20) diversity index was recorded in riverine habitat followed by mixed woodland (2.05) and minimum was recorded in grassland (1.58). In case of shrubs, maximum (2.59) diversity was found in riverine habitat followed by mixed woodland (2.51).

Simpson's Diversity Index of different habitats in Dachigam National Park indicated that maximum tree (0.852) and shrub (0.921) was recorded in riverine habitat followed by mixed woodland (0.832 and 0.916).

Table 8: Shannon-Weiner diversity index and Simpson's index of dominance of trees and shrubs

Index	Habitat / Life form	Riverine	Mixed woodland	Grassland	Mixed coniferous
Shannon-Weiner index	**Tree**	2.20	2.05	1.58	1.61
	Shrub	2.59	2.51	1.99	2.29
Simpsons diversity index	**Tree**	0.852	0.832	0.762	0.779
	Shrub	0.921	0.916	0.849	0.894

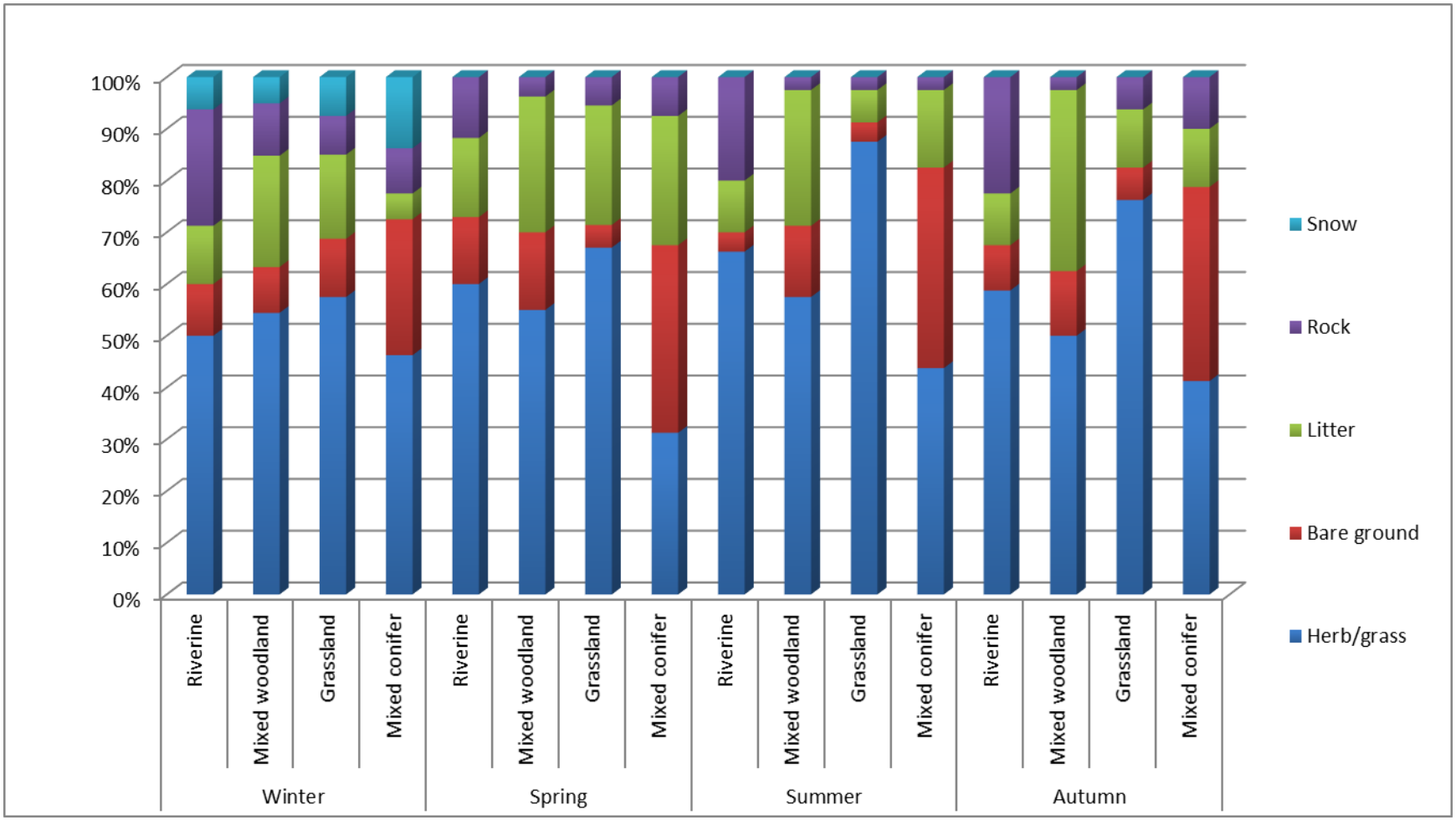


Figure 1: Percentage ground cover in different habitat types during different seasons in Dachigam National Park

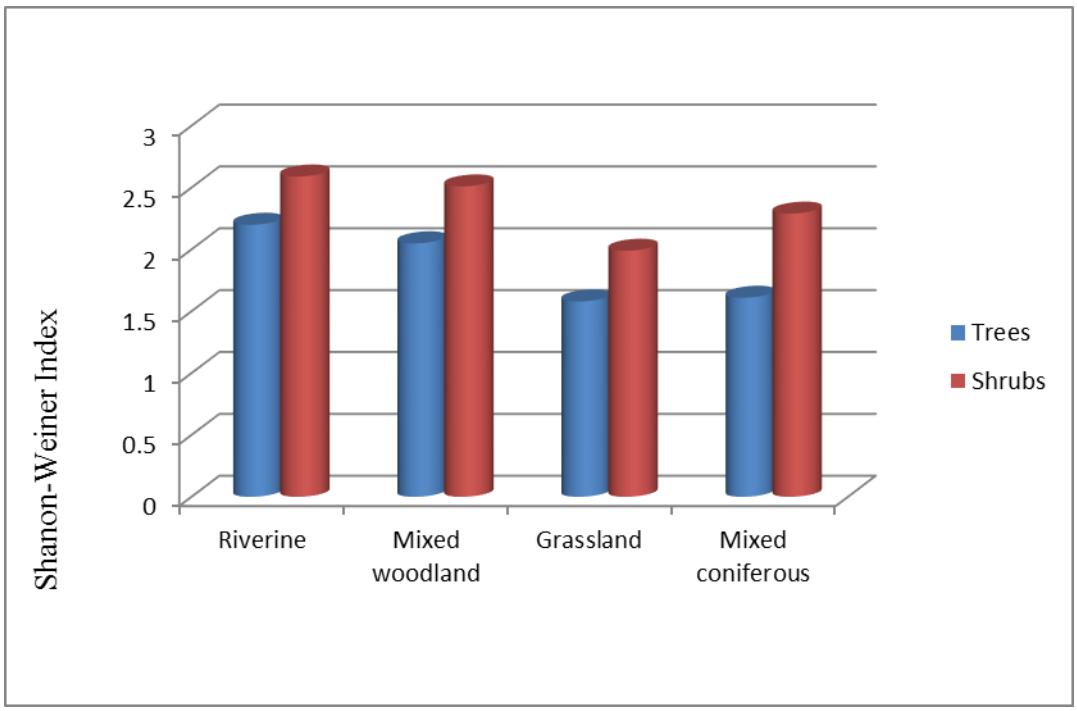


Figure 2: **Shanon-Weiner diversity of trees and shrubs in different habitats of Dachigam National Park**

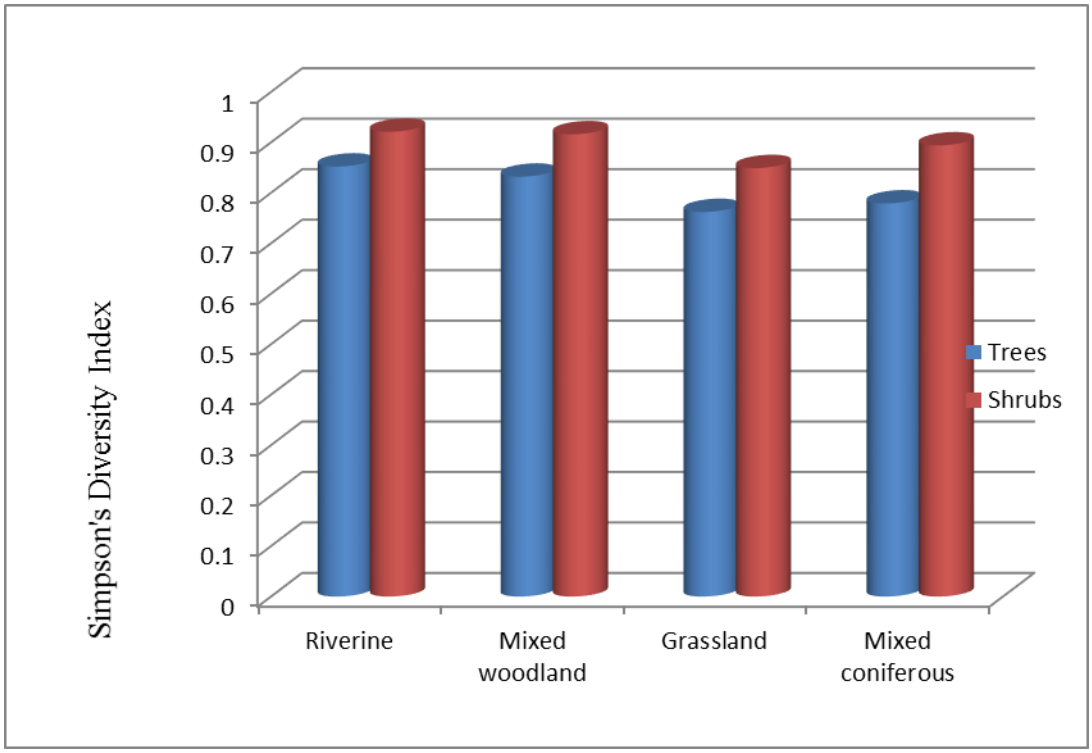


Figure 3: **Simpson's Diversity Index of trees and shrubs in different habitats of Dachigam National Park**

4.2 Feeding habit and Habitat use of Wild Boar in Dachigam National Park

A total of ninety-three (93) feacal samples were collected and analyzed with twenty-three (23) in spring, fifteen (15) in summer, thirty-five (35) in autumn and twenty (20) in winter. The results indicate that the diet of wild boar mainly comprises of plant matter (about 85-90%) with small percentage of animal matter (10-15%) in all four different seasons i.e. (spring, summer, fall and winter) in Dachigam National Park. Plant matter included leaves, seeds, fruits, roots, bark, while animal matter mainly was insects and hairs. In spring and summer, grasses and herbs were the most frequently consumed food items, while in autumn and winter seeds made the major proportion of the diet of wild boar. The most preferred grass species in all the four seasons was *cynodon dactylon* (91.30%, 93.33%, 52.42% and 65.00%). Acorns were frequently consumed during autumn (91.42%) and winter (50%). Other species found in the diet of wild boar were*; Imperata brevifolia, Conium maculatum, Dryopteris intermedia, Rumex dentatus, Poa annua, Trifolium spp, Anthraxon prinodes, Strobilanthes capitata, rubus spp, Prunus spp.*

Avena fatua (43.47%) and *Oryza sativa* (66.66%) were also consumed by wild boar during spring and summer seasons respectively. Both of which are not found in Dachigam National Park but indeed in the agricultural fields located in the fringe areas.

The results also showed the consumption of animal matter (Insects and Hairs). The consumption of insects was more in spring (26.08%) and summer (26.66%).

In addition, some unidentified food items (bark and roots) and stones were also identified in the feacal samples of wild boar (Table 09-13).

Feacal sample collection

Sample Analysis

Plate 2: Experimental analysis of feacal samples using microhistological analysis

Plate 3: Group of Wild boar feeding.

Table 9: Percentage occurrence of food items consumed by Wild boar in Dachigam National Park during winter 2021-2022

S No.	Food components	No. of occurrence (N=20)	Frequency of occurrence percentage (FO %) (N=20)
1	*Cynodon dactylon*	13.00	65.00
2	*Imperata brevifolia*	9.00	45.00
3	*Conium maculatum*	0.00	0.00
4	*Rumex nepalensis*	0.00	0.00
5	*Poa annua*	0.00	0.00
6	*Trifolium repens*	0.00	0.00
7	*Oryza sativa*	0.00	0.00
8	*Anthraxon prinodes*	0.00	0.00
9	*Avenua fatua*	0.00	0.00
10	*Strobilanthes capitata*	0.00	0.00
11	*Dryopteris nigropalaceae*	11.00	55.00
12	*Clematis vitalba*	0.00	0.00
13	*Celtis australis*	7.00	35.00
14	*Quercus robur*	10.00	50.00
15	*Juglans regia*	3.00	15.00
16	*Rubus spp.*	5.00	25.00
17	Malus	0.00	0.00
18	Roots	3.00	15.00
19	Bark	2.00	10.00
20	Insects	2.00	10.00
21	Hairs	4.00	20.00
22	Stones	1.00	5.00

Table 10: Percentage occurrence of food items consumed by Wild boar in Dachigam National Park during spring 2021-2022

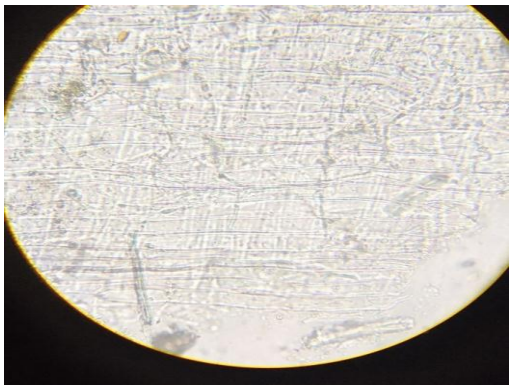
S No.	Food components	No. of occurrence (N=23)	Frequency of occurrence percentage (FO %) (N=23)
1	*Cynodon dactylon*	21.00	91.30
2	*Imperata brevifolia*	12.00	52.17
3	*Conium maculatum*	11.00	47.82
4	*Rumex nepalensis*	7.00	30.43
5	*Poa annua*	11.00	47.82
6	*Trifolium repens*	8.00	34.78
7	*Oryza sativa*	0.00	0.00
8	*Anthraxon prinodes*	09.00	39.13
9	*Avenua fatua*	10.00	43.47
10	*Strobilanthes capitata*	10.00	43.47
11	*Dryopteris nigropalaceae*	4.00	17.39
12	*Clematis vitalba*	0.00	0.00
13	*Celtis australis*	0.00	0.00
14	*Quercus robur*	0.00	0.00
15	*Juglans regia*	0.00	0.00
16	*Rubus spp.*	0.00	0.00
17	Malus	0.00	0.00
18	Roots	3.00	13.04
19	Bark	2.00	8.69
20	Insects	6.00	26.08
21	Hairs	4.00	17.39
22	Stones	0.00	0.00

Table 11: Percentage occurrence of food items consumed by Wild boar in Dachigam National Park during summer 2021-2022

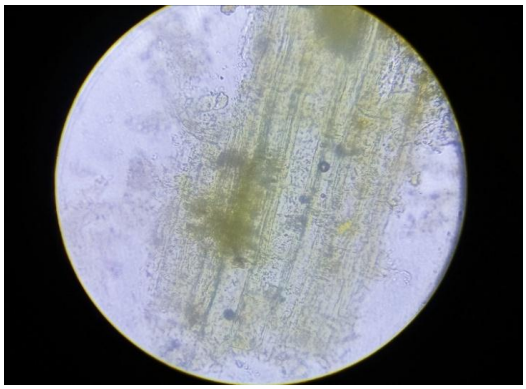
S No.	Food components	No. of occurrence (N=15)	Frequency of occurrence percentage (FO %) (N=15)
1	*Cynodon dactylon*	14.00	93.33
2	*Imperata brevifolia*	10.00	66.66
3	*Conium maculatum*	8.00	53.33
4	*Rumex nepalensis*	5.00	33.33
5	*Poa annua*	9.00	60.00
6	*Trifolium repens*	7.00	46.66
7	*Oryza sativa*	10.00	66.66
8	*Anthraxon prinodes*	7. 00	46.66
9	*Avenua fatua*	0.00	0.00
10	*Strobilanthes capitata*	8.00	53.33
11	*Dryopteris nigropalaceae*	2.00	13.33
12	*Clematis vitalba*	0.00	0.00
13	*Celtis australis*	0.00	0.00
14	*Quercus robur*	0.00	0.00
15	*Juglans regia*	0.00	0.00
16	*Rubus spp.*	3.00	15.00
17	Malus	6.00	40.00
18	Roots	4.00	26.66
19	Bark	1.00	6.66
20	Insects	4.00	26.66
21	Hairs	0.00	0.00
22	Stones	0.00	0.00

Table 12: Percentage occurrence of food items consumed by Wild boar in Dachigam National Park during autumn 2021-2022

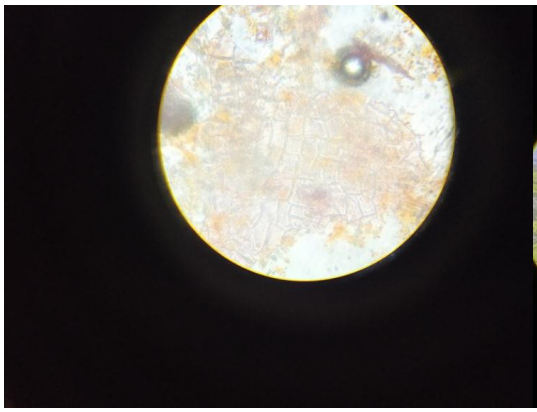
S No.	Food components	No. of occurrence (N=35)	Frequency of occurrence percentage (FO %) (N=35)
1	*Cynodon dactylon*	18.00	51.42
2	*Imperata brevifolia*	12.00	34.28
3	*Conium maculatum*	9.00	25.71
4	*Rumex nepalensis*	13.00	37.14
5	*Poa annua*	0.00	0.00
6	*Trifolium repens*	11.00	31.42
7	*Oryza sativa*	0.00	0.00
8	*Anthraxon prinodes*	11.00	31.42
9	*Avenua fatua*	0.00	0.00
10	*Strobilanthes capitata*	7.00	20.00
11	*Dryopteris nigropalaceae*	6.00	17.14
12	*Clematis vitalba*	10.00	28.57
13	*Celtis australis*	20.00	57.14
14	*Quercus robur*	32.00	91.42
15	*Juglans regia*	23.00	65.71
16	*Rubus spp.*	16.00	45.71
17	Malus	8.00	22.85
18	Roots	5.00	14.28
19	Bark	2.00	5.70
20	Insects	3.00	8.57
21	Hairs	4.00	11.42
22	Stones	2.00	5.70



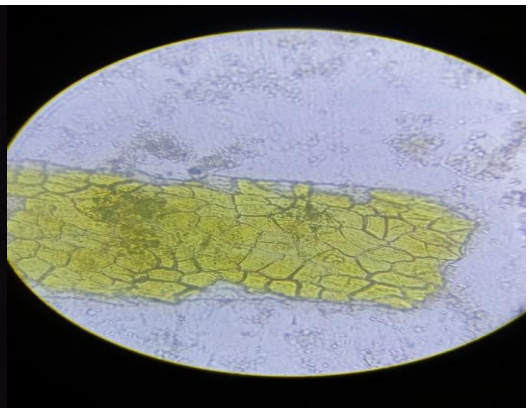
Reference slide of *Cynodon dactylon*



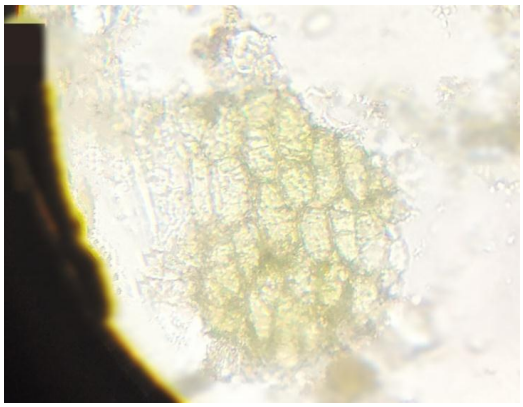
Observed cell structure of *cynodon dactylon* under microscope



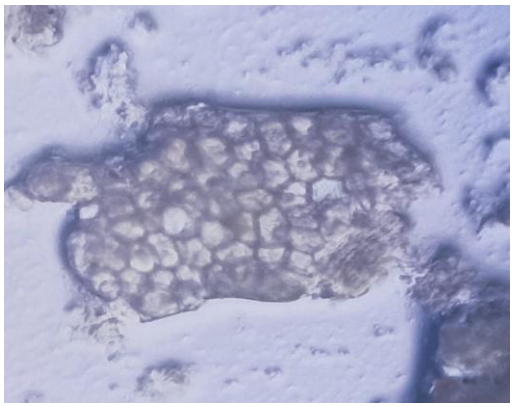
Reference slide of *Imperata brevefolia*



Observed cell structure of *Imperata brevefolia* under microscope



Reference slide of *Trifolium repens*



Observed cell structure of Trifolium repens under microscope

Plate 4: Reference slides of vegetation present in Dachigam National Park.

Table 13: Percentage occurrence of food items consumed by Wild Boar in Dachigam National Park in all four different seasons 2021-2022

S. No.	Food components / Seasons	Frequency of occurrence percentage (FO%)			
		Spring	Summer	Autumn	Winter
1	*Cynodon dactylon*	91.30	93.33	51.42	65.00
2	*Imperata brevifolia*	52.17	66.66	34.28	45.00
3	*Conium maculatum*	47.82	53.33	25.71	0.00
4	*Rumex*	30.43	33.33	37.14	0.00
5	*Poa annua*	47.82	60.00	0.00	0.00
6	*Trifolium spp.*	34.78	46.66	31.42	0.00
7	*Oryza sativa*	0.00	**66.66**	0.00	0.00
8	*Anthraxon*	39.13	46.66	31.42	0.00
9	*Avenua fatua*	**43.47**	0.00	0.00	0.00
10	*Strobilanthes capitata*	43.47	53.33	20.00	0.00
11	*Dryopteris intermedia*	17.39	13.33	17.14	55.00
12	*Clematis vitalba*	0.00	0.00	28.57	0.00
13	*Celtis australis*	0.00	0.00	57.14	35.00
14	*Quercus robur*	0.00	0.00	91.42	50.00
15	*Juglans regia*	0.00	0.00	65.62	15.00
17	*Rubus spp*	0.00	15.00	45.71	25.00
18	*Malus*	0.00	40.00	22.85	0.00
19	Roots	13.04	26.66	14.28	15.00
20	Bark	8.69	6.66	5.70	10.00
21	Insects	26.08	26.66	8.57	10.00
22	Hairs	17.39	0.00	11.42	20.00
23	Stones	0.00	0.00	5.70	5.00

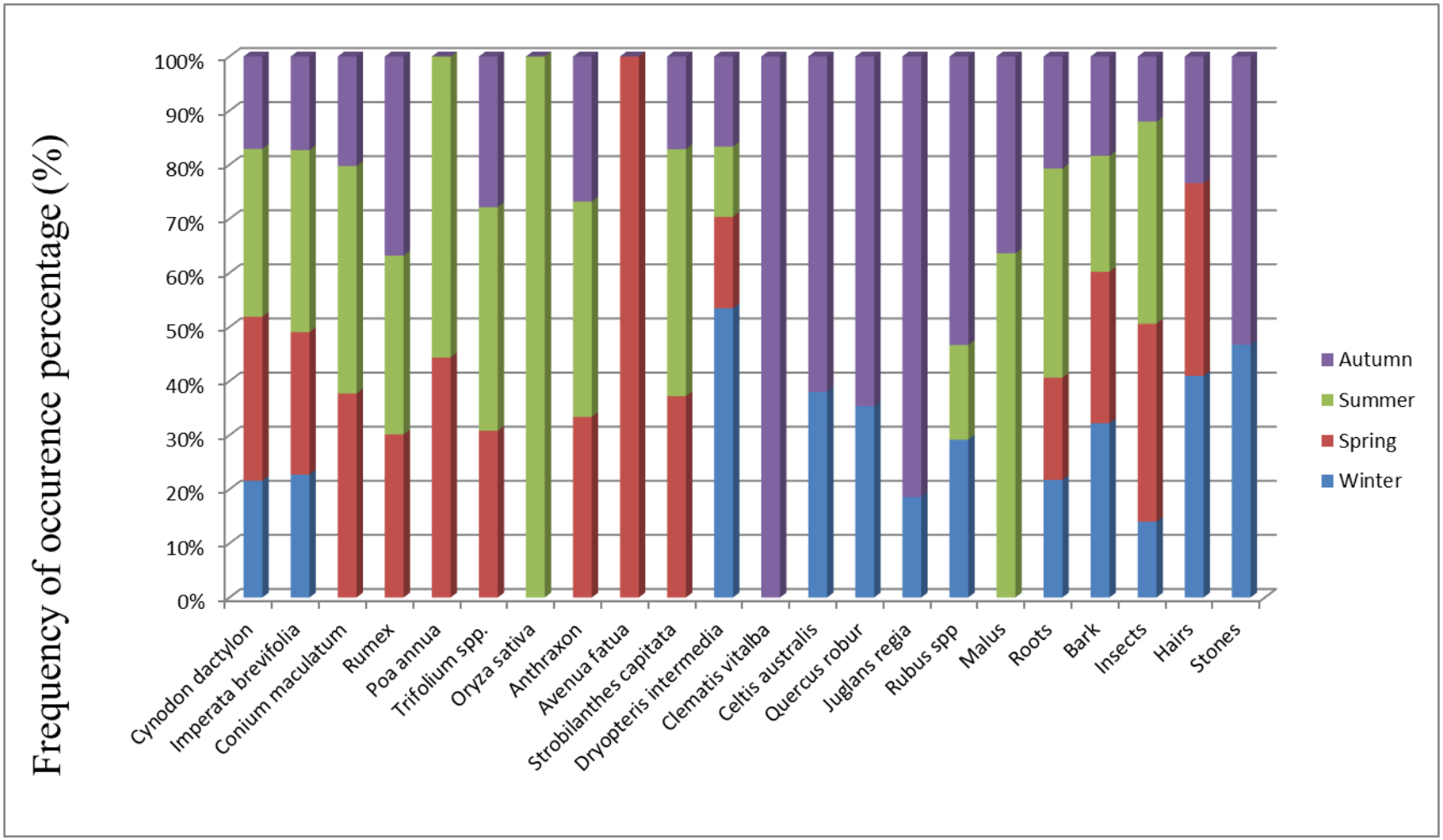


Figure 4: **FO% of food components consumed by Wild boar in Dachigam National Park in all four different seasons.**

4.3 Impact of wild boar rooting on vegetation in Dachigam National Park.

The analyzed data pertaining to the impact of Wild boar rooting on vegetation is presented in Table 14-17.

Significant influence of rooting on vegetation was observed. Maximum impact (6.32, 5.17, 6.50 and 6.80) was recorded in riverine habitat followed by mixed woodland (5.13, 4.66, 4.94 and 5.32) and grassland (4.31, 4.44, 4.66 and 4.79) and no disturbance was seen in mixed coniferous in all four different seasons i.e. (winter, spring, summer and autumn).

Table 14: Effect of rooting on plant cover (%) during winter season in Dachigam National Park 2021-2022

Plot / Habitat	Before rooting	After rooting	Mean
Riverine	51.58(7.18)	28.53(5.34)	40.05(6.32)
Mixed woodland	33.50(5.78)	19.17(4.37)	26.33(5.13)
Grassland	25.00(5.00)	12.30(3.50)	18.65(4.31)
Mixed conifer	0.00(0.70)	0.00(0.70)	0.00(0.70)
Mean	27.50(5.24)	15.00(3.87)	

CD (p≤0.05)

H : 0.72

P : 0.94

H×P : 1.09

Figures within parentheses are Square root transformed values.

Table 15: Effect of rooting on plant cover (%) during spring season in Dachigam National Park 2021-2022

Plots / Habitat	Before rooting	After rooting	Mean
Riverine	35.00(5.91)	18.60(5.63)	26.80(5.17)
Mixed woodland	27.50(5.24)	16.00(4.35	21.75(4.66)
Grassland	24.40(4.93)	15.20(4.07)	19.80(4.44)
Mixed conifer	0.00(0.70)	0.00(0.70)	0.00(0.70)
Mean	21.72(4.66)	12.45(3.52)	

CD (p≤0.05)

H : 0.21

P : 0.72

H×P : 1.10

Figures within parentheses are Square root transformed values.

Table 16: Effect of rooting on plant cover (%) during summer season in Dachigam National Park 2021-2022

Plots / Habitat	Before rooting	After rooting	Mean
Riverine	53.00(7.40)	31.70(5.63)	42.35(6.50)
Mixed woodland	30(5.47)	19.00(4.35)	24.50(4.94)
Grassland	27(5.19)	16.60(4.07)	21.80(4.66)
Mixed conifer	0.00(0.70)	0.00(0.70)	0.00(0.70)
Mean	25.50(5.24)	16.82(4.10)	

CD (p≤0.05)

H : 0.25

P : 0.93

H×P : 1.13

Figures within parentheses are Square root transformed values.

Table 17: Effect of rooting on plant cover (%) during autumn season in Dachigam National Park 2021-2022

Plots / Habitat	Before rooting	After rooting	Mean
Riverine	54.80(7.40)	37.70(6.14)	46.25(6.80)
Mixed woodland	36.00(6.00)	20.70(4.54)	28.35(5.32)
Grassland	28.30(5.31)	17.70(4.20)	23.00(4.79)
Mixed conifer	0.00(0.70)	0.00(0.70)	0.00(0.70)
Mean	29.77(5.45)	19.02(4.36)	

CD (p≤0.05)

H : 0.41

P : 0.78

H×P : 0.94

Figures within parentheses are Square root transformed values.

Chapter 5

DISCUSSION

The results of present study entitled **"Assessment of Status, Distribution, Habitat use and Feeding habit of Wild boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"** are discussed in this section to establish cause and effect relationships among the various parameters studied:

5.1 Status, distribution and habitat use of Wild Boar (*Sus scrofa*) in Dachigam National Park.

5.2 Assess and evaluate the food and feeding habits of Wild Boar (*Sus scrofa*) in Dachigam National Park.

5.3 Impacts of Wild Boar (*Sus scrofa*) on the vegetation of selected habitats for species conservation planning in the National Park.

5.1 Status, distribution and habitat use of Wild Boar (*Sus scrofa*) in Dachigam National Park.

The primary objective of this study was to assess the status, distribution and habitat use of Wild Boar (*Sus scrofa*) in Dachigam National Park. Understanding the species' distribution and relative abundance across different habitat types is essential for effective species management and conservation (Sheng *et al*., 2010). Preliminary surveys have revealed the presence of nine mammal species in Dachigam National Park, including wild boar (*Sus scrofa*), Kashmiri gray langur (*Semnopithecus ajax*), Kashmiri deer or hangul (*Cervus hanglu hanglu*), Asiatic black bear (*Ursus thibetanus*), Leopard (*Panthera pardus*), golden jackal (*Canis aureus*) and red fox (*Vulpes vulpes griffithi*), Indian porcupine (*Erethizon dorsatum*) and yellow-necked marten (*Martes flavigula*) belonging to eight families. The occurrence of these nine (09) large mammals including the globally threatened Kashmir deer or Hangul langur and Kashmiri gray langur highlights the ecological importance of Dachigam National Park and

highlights the need for priority management interventions to ensure long-term conservation of these species. The relative abundance of major mammal species, estimated from direct observations, showed the highest abundance of Himalayan gray langur, followed by Hangul and wild boar in all four seasons. Among the mentioned species, the main research was focused on the wild boar.

Throughout its distribution from Western Europe to Southeast Asia, including India, wild boar flourished in marginal regions due to specialization and the development of agricultural practices ((Massei and Genov, 2004; Aimici *et al*., 2018). Other factors, such as climate change and decline in hunting also affected the abundance of feral pigs (Geisser and Reyer, 2005). Although not native to the Kashmir Valley, wild boar was introduced there during the reign of Maharaja Gulab Singh (1846-1857) of Jammu and Kashmir (Lawrence, 1895; Ahmad *et al*., 2017). Following the Dogra Raj (Maharaja rule), the Wild Boar came to be regarded as an invasive species in Kashmir and consequently, no conservation efforts were undertaken for its preservation (Ahmad *et al*., 2017).

The reappearance of the Wild Boar in Dachigam National Park, where the species was extirpated by 1984, has been a significant development. This reappearance of Wild boar in Dachigam National Park was reported in 2013 by Ahmad *et al*. (2014). Since then, the population of Wild Boar in the park has experienced rapid growth, increasing from only three individuals reported in 2013 to over 150 individuals at present. This sudden population increase could have lasting impacts on the ecology of native wild mammals within the park.

The reoccurrence of Wild Boar in Dachigam National Park has brought about both opportunities and challenges. On one hand, the presence of Wild Boar signifies the restoration of a historically extant population of the species, contributing to the park's biodiversity and ecosystem dynamics. On the other hand, the rapid population growth of Wild Boar raises concerns regarding potential ecological consequences.

With the population reaching over 150 individuals, the expanded presence of Wild Boar in the park could lead to increased competition for resources and habitat with native wildlife species. The foraging behavior and dietary preferences of Wild Boar may impact vegetation dynamics and availability, potentially affecting the feeding habits and survival of other herbivorous mammals within the ecosystem.

Moreover, as Wild Boar are known to be prolific breeders, their population growth may outpace the capacity of the park to sustainably support such numbers. This could lead to overgrazing, habitat degradation and potential conflicts with human activities, as Wild Boar may encroach upon agricultural lands in search of food.

Wild boar was sighted in all habitats except mixed coniferous. Among all habitats, riverine habitats were most frequently used in all seasons, with an encounter rate of 0.186 individuals/Km (winter), 0.146 individuals/Km (spring), 0.121 individuals/Km (summer) and 0.184 individuals/Km (autumn), followed by mixed woodlands (0.107, 0.095, 0.096, 0.127 individuals/Km). The frequent occurrence of wild boar in riverine and mixed woodland habitats can be attributed to the abundant food supply, accessibility to water, dense cover and proximity to arable lands and human habitation. Wild boars also lack sweat glands due to which they need to undergo process of wallowing in order to maintain their body temperature. Riverine and mixed woodlands provide these Wild boars with such facilities. These results are consistent with the findings of Popczyk *et al*. (2022) in Poland and Khan and Ilyas (2018) in Madhya Pradesh, India.

Wild boar encounters were highest in the autumn season, with a mean encounter rate of 0.103 individuals/Km, followed by winter (0.099 individuals/Km) and spring (0.081 individuals/Km). The higher sightings of wild boar in autumn and winter can be attributed to the increased availability of forest fruits mainly acrons. Wild boars are mono-gastric and have limited ability to extract carbohydrates from cellulose, relying heavily on energy- rich foods such

as acorns and beech mast. This dietary preference influences their movement patterns. These results align closely with the findings of Gaudiano *et al*. (2022), Groot *et al*. (1994), Singer *et al*. (1981) and Massei and Genov (2004).

Indirect evidences also indicated that Wild boar was most frequently observed in riverine habitats (0.72 individuals/Km) across all four seasons, followed by mixed woodlands (0.47 individuals/Km). Signs of Wild boar presence were recorded maximum in autumn season (0.458 individuals/Km), followed by the winter season with a sign encounter rate of 0.350 individuals/km.

The relative abundance of Wild boar based on direct sightings indicated the overall mean relative abundance was highest during autumn season (24.53±9.82) and winter season (21.45±8.18). The maximum relative abundance of Wild boar was recorded in riverine habitat (39.79±0.52) followed by mixed woodland (33.91±2.60).

Forest composition, community structure and diversity patterns are crucial ecological attributes influenced by environmental and anthropogenic variables (Ahmed *et al*., 2010; Bisht and Bhat, 2011). In our study, we recorded a total of 40 species distributed among 19 families in different habitats. The *Rosaceae* family showed the highest representation with 13 species, followed by Fabaceae, Salicaceae and Pinaceae with three species each. *Fagaceae, Ulmaceae and Sapindaceae* had two species each, while *Moraceae, Platanaceae, Juglandaceae, Simaroubaceae, Anacardiaceae, Taxaceae, Berberidaceae, Caprifoliaceae, Hamamelidaceae, Adoxaceae, Olehulariaceae* were represented by one species each.

The data revealed that the percentage of Heb/grass was maximum (57.50%, 76.25%, 87.50%, 76.25%) in grass habitats in all the four seasons i.e. (winter, spring, summer, autumn), bare soil was maximum (26.25%, 36.25%, 38.75%, 37.50%) in mixed conifer, litter was maximum (21.25%, 26.25%, 26.25%, 35.00%) in mixed forest, rock was maximum (22.50%, 12.50, 20.00%), 2

in river habitats while snow was recorded maximum (13.75%) in mixed coniferous habitats. Ground cover shows significant differences between different seasons and habitat types (Ahmad and Farooq, 2018).

The Shannon-Weiner tree index showed that the maximum (2.20) diversity index was recorded in riverine habitat, followed by mixed woodland (2.05) and the minimum was recorded in grassland (1.58). In the case of shrubs, the maximum (2.59) diversity was found in the riverine habitat followed by the mixed woodland (2.51). Simpson diversity index of different habitats in Dachigam National Park also showed that maximum trees (0.852) and shrubs (0.921) were recorded in riverine habitat followed by mixed forest (0.832 and 0.916). This may be because coastal zones are among the most diverse and dynamic plant habitats in the world (Naiman and Decamps, 1997).

5.2 Feeding habit and Habitat use of Wild Boar in Dachigam National Park

Wild boars exhibit remarkable adaptability to diverse habitats and sustain healthy populations due to their highly varied diets (Baubet et. al, 2004). As opportunistic omnivores, their diet composition depends on the quantity and Variety of available food items. Wild boars show a preference for nutritious foods particularly acorns and various cereals (Schley and Roper, 2003), which are energy –rich and easily digestible (Herrero et.al, 2004).

One of the objectives of our study was to assess and understand the food habits and diet composition of wild boars in their extant distribution range in Dachigam National Park, within its temperate climatic conditions. Our results indicated that wild boars primarily consume plant matter accounting for85-90% of their diet, with the remaining 10-15% comprising animal matter. These finding align with Baubet *et al*. (2004), who observed a similar diet composition of Wild boars in the French Alps, where 77% of their diet consisted of plant materials such as fleshy fruits, roots and green parts of the plant, while the remaining 23%

included mushrooms, corns and animal parts like hairs. During spring and summer, grasses and herbs were the most frequently consumed food items, while seeds made up a significant portion of their diet in autumn and winter. The most preferred grass species in all the four seasons was *cynodon dactylon*, a grass species, was the most preferred food item across all four seasons, with consumption percentages ranging from 52.42% to 93.33%. However, a study by Khan and Ilyas (2018) on the diet pattern of wild boars in Pench Tiger Reserve, Madhya Pradesh, reported a diet composition of approximately 75% vegetative matter and 25% animal matter.

Seasonal variations were observed in the diet of wild boars, with grasses and herbs being their preferred food source during spring and summer. These findings align with the research conducted by Schley and Roper (2003) in Western Europe. During autumn and winter, wild boars consumed a significant number of acorns, which may be attributed to their abundance, high nutritional value and ease of digestion during that season. Similar dietary patterns were documented by Herrero *et al*. (2004) in the southwestern Pyrenees, further supporting the significance of acorns in the wild boar diet during colder months.

Identifying animal matter consumed by wild boars through fecal analysis proved challenging, as such matter is often digested in their gastrointestinal tracts. However, we attempted to identify animal matter through the identification of insect setae, animal hairs and bones. The consumption of insects varied seasonally, with 5% in winter, 21.73%-in spring, 26.66%-in summer and 8.5% -in autumn. This indicates that the Wild boars consume a high quantity of insects during summer and spring, likely due to the increased moisture content in the soil, which supports insect growth. A similar study by Lee and Lee (2020) conducted in South Korea, reported that wild boars' consumption of earthworms varies seasonally in correlation with precipitation. Consumption of animal matter by wild boars may play a vital role in their growth and survival (Schley and Roper, 2003)

Wild boars were also observed consuming *Avena fatua* (43.47%) and *Oryza sativa* (66.66%) during spring and summer seasons, respectively. These food items are not found within Dachigam National Park but rather in the agricultural fields nearby, suggesting that wild boars' diet relies not only on seasonal forest food sources but also on agricultural crops. Ballari and Barrios-Garcia (2013) similarly identified the consumption of agricultural crops by wild boars during the summer season in Argentina.

Our study's results demonstrate the seasonal variations in the diet patterns of wild boars in Dachigam National Park. The findings also highlight the species' high adaptability and ability to adjust their diet according to changing conditions, which may explain their wide distribution and ability to thrive in various habitats. A comprehensive examination of wild boars' diet can provide crucial insights into the target species and vulnerable habitats that require focused management efforts.

5.3 Impact of Wild Boar (*Sus scrofa*) on the vegetation of selected habitats for species conservation planning in the National Park.

Wild boars are widely recognized as highly destructive and persistent pests worldwide. They are considered ecosystem engineers due to their ability to modify soil and plant communities through their rooting and nest building behaviors (Crook, 2002). Their predation and habitat destruction can significantly impact animal communities (Barrios-Garcia and Ballari, 2012). By directly consuming entire plants or vegetative parts such as fruits, bulbs and tubers, wild boars can influence the abundance and richness of plant species (Genov and Massei, 2004). Rooting, in particular, poses a major disturbance to plant communities, often resulting in a reduction of herbaceous cover by up to 80%-90% in areas with high wild boar densities. The soil surface loosening caused by rooting may also lead to erosion (Bratton, 1974) and hinder the regeneration of native species. Additionally, wild boar rooting has been associated with increased abundance of exotic plant taxa (Siemann, 2009). Fruit and seed consumption by

wild boars can further alter plant community composition by decreasing the availability and abundance of seeds (Barrios-Garcia and Ballari, 2012).

Our investigation aimed to assess the impact of wild boar rooting on vegetation in Dachigam National Park. The results revealed significant vegetation disturbances caused by wild boars. The highest impact was recorded in the riverine habitat (6.32%, 5.17%, 6.50% and 6.80%), followed by mixed woodland (5.13%, 4.66%, 4.94% and 5.32%) and grassland (4.31%, 4.44%, 4.66% and 4.79%). No disturbance was observed in the mixed coniferous habitat during all four seasons (winter, spring, summer and winter). These findings are consistent with those of Cuevas *et al*. (2012), who also reported a significant reduction in plant cover, herbaceous vegetation, perennial grasses, shrubs and overall plant richness and diversity due to wild boar rooting. Similar results have been observed in studies conducted by Carbon *et al*. (2022) in Europe, Fattorini and Fretti (2020) in Mediterranean protected areas and Bueno *et al*. (2020) in Spain.

While the effects of wild boars on vegetation have been studied in various parts of the world, further research is necessary. With increasing numbers and geographical range, wild boars pose a growing threat to native flora and fauna. Our study provides clear evidence that rooting activities significantly reduce plant cover, providing strong justification for wild boar control measures.

Chapter 6

SUMMARY AND CONCLUSION

The study titled **"Assessment of Status, Distribution, Habitat Use and Feeding Habit of Wild Boar (*Sus scrofa*) and its Impact on Vegetation in Dachigam National Park"** was conducted in Dachigam National Park, located in the Srinagar district of Jammu and Kashmir, during the period of 2021-2022. This study aimed to assess the status, distribution, habitat use, feeding habits of wild boars and their impact on vegetation in order to facilitate effective management and conservation planning. To achieve these objectives, standard methodologies such as transect/trail monitoring and fecal analysis were employed across all four seasons (winter, spring, summer and autumn).

The findings of this study provided valuable insights into the behavior of wild boars in Dachigam National Park. Wild boars were observed in all habitats except for the mixed coniferous habitat. Among the habitats, the riverine habitat was the most frequently used by wild boars throughout all seasons, with encounter rates of 0.186 individuals/km (winter), 0.146 individuals/km (spring), 0.121 individuals/km (summer) and 0.184 individuals/km (autumn). The mixed woodland habitat also showed significant usage by wild boars, with encounter rates of 0.107 individuals/km, 0.095 individuals/km, 0.096 individuals/km and 0.127 individuals/km across the four seasons. Notably, the autumn season recorded the highest encounter rate of wild boars, with a mean of 0.103 individuals/km, followed by winter (0.099individuals/km) and spring (0.08individuals/km).

Indirect evidence indicated that the riverine habitat (0.72 individuals/km) and mixed woodland (0.47 individuals/km) were the most frequented habitats by wild boars across all seasons. The presence of signs was highest in the autumn season (0.458 individuals/km) and followed by the winter season (0.350 individuals/km).

Based on direct sightings, the relative abundance of principal mammal species indicated that the Himalayan grey langur was the most abundant, followed by Hangul and wild boar throughout all four seasons. Specifically, the relative abundance of wild boars based on direct sightings was highest during the autumn season (24.53%±9.82) and winter season (21.45±8.18). The riverine habitat recorded the maximum relative abundance of wild boars (39.76±0.52) followed by the mixed woodland habitat (33.91±2.60).

A total of 40 species belonging to 19 families were recorded in different habitats during the investigation. The Rosaceae family had the highest number of species (13), followed by Fabaceae, Salicaceae and Pinaceae with three species each. Fagaceae, Ulmaceae and Sapindaceae had two species each, while Moraceae, Platanaceae, Juglandaceae, Simaroubaceae, Anacardiaceae, Taxaceae, Berberidaceae, Caprifoliaceae, Hamamelidaceae, Adoxaceae, Oleaceae and Scrophulariaceae were represented by one species each.

Among the habitats, the riverine habitat of Dachigam National Park recorded the highest number of tree species (21) and shrub species (16), followed by the mixed woodland habitat with 14 tree species and 15 shrub species. This observation can be attributed to the riparian zones being amongst the world's most diverse and dynamic plant habitats.

This study also investigated the diet composition of wild boars, which was found to primarily consist of plant matter (85-90%) with a smaller percentage of animal matter (10-15%) across all four seasons in Dachigam National Park. Plant matter included leaves, seeds, fruits, roots and bark, while the animal matter mainly comprised insects and hairs. Grasses and herbs were the most frequently consumed food items in spring and summer, while seeds formed a significant portion of the diet in autumn and winter. *Cynodon dactylon* was the most preferred grass species throughout the four seasons (91.30%, 93.33%, 52.42% and 65.00%). Acorns were frequently consumed during autumn (91.42%) and winter (50%). Other plant species identified in the diet of wild boars included *Imperata*

brevifolia, Conium maculatum, Dryopteris intermedia, Rumex dentatus, Poa annua, Trifolium spp, Anthraxon prinodes, Strobilanthes capitata, Rubus spp and Prunus spp. Notably, Avena fatua (43.47%) and *Oryza sativa* (66.66%) were also consumed by wild boars during spring and summer seasons, respectively, although these species were not found within Dachigam National Park but rather in the agricultural fields located in the fringe areas.

In addition to plant matter, the consumption of animal matter (insects and hairs) was also observed, with insects being more prominent during spring (21.73%) and summer (26.66%). Some unidentified food items such as bark, roots and stones were also identified in the fecal samples of wild boars.

The study also demonstrated the significant impact of wild boar rooting on vegetation across all four seasons. The riverine habitat showed the maximum disturbance (6.32%, 5.17%, 6.50% and 6.80%), followed by the mixed woodland habitat (5.13%, 4.66%, 4.94% and 5.32%), while no disturbance was observed in the mixed coniferous habitat throughout all seasons.

Conclusion:

- Wild boars were most commonly encountered during the autumn and winter seasons, with a preference for riverine and mixed woodland habitats.
- Their diet mainly comprised plant matter, with grasses and herbs being consumed in spring and summer and seeds playing a significant role in autumn and winter.
- The rooting behavior of wild boars had a notable impact on vegetation, with the riverine habitat experiencing the highest disturbance.
- The study provides valuable data on the distribution, behavior and diet of wild boars in Dachigam National Park, contributing to effective management and conservation planning efforts. Considering the ecological implications of the rapid increase in the Wild Boar

population, it becomes crucial to strengthen monitoring and assessment of the species' interactions with the native wildlife and their impact on vegetation dynamics. Long-term studies and comprehensive ecological research are necessary to understand the population dynamics, habitat use patterns and potential effects of Wild Boar on the native mammal species within Dachigam National Park.

- The reappearance and rapid population growth of Wild Boar in Dachigam National Park since their reintroduction in 2013 have significant implications for the park's ecology. While the restoration of this non- native extant species is noteworthy, careful monitoring and management are necessary to mitigate potential ecological impacts and promote the long-term conservation of both Wild Boar and native wildlife species in the park. Proactive management strategies should be implemented to ensure the sustainable coexistence of Wild Boar with other wildlife species and mitigate any potential negative consequences on the park's ecology. These strategies may involve habitat management, population control measures and public awareness programs to minimize conflicts between Wild Boar and local communities.

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CERTIFICATE

Certified that all the corrections/ amendments as suggested by External Examiner **Dr. Parag Nigam,** Scientist G, WII during viva-voce examination held on **01-09-2023** have been incorporated in the manuscript entitled **"Assessment of status, distribution, habitat use and feeding habit of Wild Boar (*Sus scrofa*) and its impact on vegetation in Dachigam National Park"** submitted by **Ms. Ruhee Jon (Regd. No. MSF-2020-132).**.

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