BIODIVERSITY ANALYSIS OF MURREE BIODIVERSITY PARK

Summary

The baseline study of Murree Biodiversity Park was carried out to determine the distribution and abundance of representative vertebrate fauna. Field surveys carried out during April and June 2011 involved detailed faunal collection throughout the Park and one kilometer surrounding areas. A total of 56 herpeto-faunal, avian and mammalian species were recorded in the Park. These included 1 species each of frog and lizard, 43 species of birds and 12 species of mammals. Out of all the recorded fauna, one species of bird and one species of mammal are categorized as endangered, 2 species of mammals as vulnerable and two as near threatened on the IUCN Red Data List.

Most of the birds found in the Park are common and have their own significance. Forty three species of birds belonging to 35 genera, 26 families and 8 orders were recorded. Three amongst them were abundant, 12 common, 14 rare and 14 were scarce. Seasonal fluctuation in the bird occurrence was also noted. At least 10 species of birds which were found in April were not observed in June. Similarly 11 species of birds observed in June were not recorded in April. This indicates the seasonal migration and local movement of birds. The mammalian species specially the large mammals are permanent residents while some occasionally visit the Park in particular season. Wild boar and jackal are permanent residents in the Park area and their association was found with thick forest cover, water channels and near by localities (Hotels and Restaurants). The flying squirrels were found associated with old pine and large fruit bearing trees in the Park. Small mammals were distributed throughout the Park area. This report contains detailed systematic list of vertebrate fauna recorded in the Park and surroundings. The report also entails recommendations for the management and conservation of vertebrate fauna found in the Park area.

INTRODUCTION

Pakistan located within the latitudinal and longitudinal extensions of 24 to 37°N and 61 to 76°E spans a remarkable variety of the world's ecological regions, encompassing mangrove forests fringing the Arabian Sea to spectacular mountain peaks where the Western Himalayan, Hindukush, and Karakorum ranges meet housing a rich variety of plants, mammals, birds, reptiles, amphibians, fish, and invertebrates. Pakistan is the only place where these three great mountain ranges meet. Besides the northern mountains, there are western highlands separated by Kabul river from the mountainous north and consist of series of dry and lower hills. The eastern half of the country is mostly dominated by the flood plains of the river Indus and its tributaries viz. Jhelum, Chenab, Ravi and Sutlej rivers. Parts of Balochistan and Sindh provinces constitute deserts (Sheikh and Manzoor, 2004).

The well forested Murree Hills situated in District Rawalpindi lying between 33, 54°N and 73.22°E form an interesting alpine transition zone between dry plains of the Punjab to the south, and the towering mountains of the north. The ecosystem support temperate coniferous forest, temperate broadleaf and mixed forest with an average elevation of 8000 feet (2400 m) above the sea level. They are at the edge of seasonal monsoon, and receive abundant rainfall (60''). They are covered with rich forest of spruce, silver fir and blue pine, and usually have deep soils. These forests receive the highest rain and snowfall and are the source of fresh water for the region including the twin cities of Islamabad and Rawalpindi. Murree Hills are of utmost importance due to their watershed value and the highly fragile forest ecosystem (Woods 1997).

Murree Hills are rich in biodiversity assets harboring 203 species of birds, 31 species of mammals and a dozen species of reptiles. According to Roberts (2005) animals such as the Asiatic Leopard, leopard cat, Himalayan palm civet, Hill Fox, barking deer, rhesus monkey and Flying Squirrels can be found here.

Murree hills are much significant for avian fauna. It has typical species of mountainous region. A number of bird species of lower plainer areas ascend as summer breeding visitors while species of high mountains of northern areas descend in winter in lower laying hills of Murree. Threatened species of birds like khalij pheasant (*lophura lucomelana*) occur in the region.

Considering importance of the area a number of studies have been undertaken on the fauna of the area. Cock & Marshal (1873) published a paper "Notes on the collection of eggs made at Murree". Rattray (1905) compiled "Birds Nesting in Murree Hills and Gilgit". Magrath (1909 a) compiled a paper "Birds Notes form Murree & Galies" Corfield (1983) undertaken studies on "Birds of Islamabad & Murree". Roberts (1991-94). Published 2 volumes of the book "Birds of

Pakistan" and referred the Avian species found in the area. Rattray (1905) undertook studies on "Birds Nesting in the Murree hills and Gallies and produced 2 papers.

There are no comprehensive studies undertaken for mammals in Murree Hills except Roberts (1992). Roberts has reported 31 species of mammals from the Murree Hills. Arshad (1991) studied the Ecology of Murree vole (*Hyperacrius Wynnei Blanford*) in Galliat and Murree hills and recorded its existence upto Sunni Bank Area.

Increasing human population and demand for food and fodder has lead to natural land cover degradation, resulting in habitat degradation, biodiversity loss and ecological instability. Thus proper measures are required for conservation of habitat and biodiversity at broad landscape level. Establishment of protected areas is necessary for promoting sustainable biodiversity conservation and management (Sherma *et al.,* 2010).

According to IUCN Red Data list (2003) 11.16% of the total area of Pakistan has been declared as protected which include National Parks, Wildlife Sanctuaries and Game Reserves. These protected areas support a variety of indigenous fauna and flora and help in conservation. For proper management of biodiversity of the country, it is necessary to declare more protected areas.

The Government of the Punjab is establishing the Murree Biodiversity Park at Chitta Mor, Murree on an area of 40 acre land through its Environment Protection Department, Housing, Urban Development and Public Health Engineering Department in collaboration with the International Union for Conservation of Nature and Natural Resources (IUCN).

The present study was conducted by Zoological Survey Department in collaboration of IUCN to provide baseline findings for conservation and management of the Muree Biodiversity Park.

AIMS OF FAUNAL SURVEY

Present baseline study was carried out to meet the following objectives;

1. Conducting census of wildlife including birds, mammals, amphibians and reptiles focusing on their abundance and diversity
2. GIS mapping of population status and distribution with special reference to preferred habitats
3. Identification of potential corridors for mammals
4. Assessment of threats to wildlife of Murree Hills and suggest mitigation measures

5. Preparation of species inventory with information including species local, common and scientific name, local status of the species (common, rare, endangered or locally extinct).
6. Documentation of economically and ecologically important species
7. Preparation of baseline study reports.

STUDY AREA

The area is located on the southern slopes of the Western Himalayan foothills as they ascend to the northeast towards Kashmir. Murree features a subtropical highland climate. The region has cold, snowy winters, relatively cool summer with drastically escalated rain in relation with lower altitudes and frequent fog. Precipitation is received year round, with two maximas, first during winter months (December, January and February) and second during summer (July–August). Total annual mean precipitation is 1,789 mm (70.4 in).

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Soil topography of the hills varies with vegetation type and density and the level of biological activity in the soil. The soils are classified as Entisols and Inceptisols, with more acid forms predominating above 2000m and alkaline forms below this altitude. Rates of soil erosion are estimated to be around 150 t ha^{-1} y^{-1} on average in higher altitude areas of recent deforestation, and around 50–75 t ha^{-1} y^{-1} in areas of overgrazing at lower altitude. Susceptibility to erosion is high due to steep slopes, high silt and/or fine sand contents and low organic matter contents. Erosion control is being attempted by replanting the lower areas and by policing illegal felling of the higher forested areas.

A 40 acres site for the Murree Biodiversity Park (N 37’53878, E 43’35069) is situated near Chitta Morr and only few kilometers in the west of main Murree town a subdivision of Rawalpindi district. The area is well-known for its natural scenic beauty and a famous historical hill-station also called as Malika-e-Kohsar or Murree Hills used as a military cantonment post during the British Rule from nineteenth to the mid of twentieth century. The site can easily be approached by Islamabad-Kohala Highway some 40 kilometers in the north-east of Islamabad Capital Territory

The area has rich cover of Chirpine in the south-west and north-west, while grassy slopes in the east and south east sides of the park has mix variety of trees which include, *Pinus wallichiana* (Blue pine) *Aesculus indica* (Banakhor/Ban akhrot), *Quercus spp* (oak), *Pyrus pashia* (batangi), *Berberis lyceum* (simbloo), *Viburnum cotinifolium* (chamkat), *Prunus cornuta* (kalakath), *Viola canescens* (Banafsha*), Diospyros lotus* (Amlook), *Pyrus pashia* (batangi), *Cornus macrophylla* (Kandar), *Salix spp*. (bis/willow), *Cynodon dactylon* (Khabbal) and *Rosa burnonii* (Wild rose). Many small seasonal tributaries join the main stream which flows through the center of the site

catching the drainage and sewage of western side of the Murree town and bisecting the forested ridges at its left flanks and the rugged and arid-denuded dilating terrain at its right. From the mid of the site it falls down narrowing and forming a deep gully to the northwest of the study site.

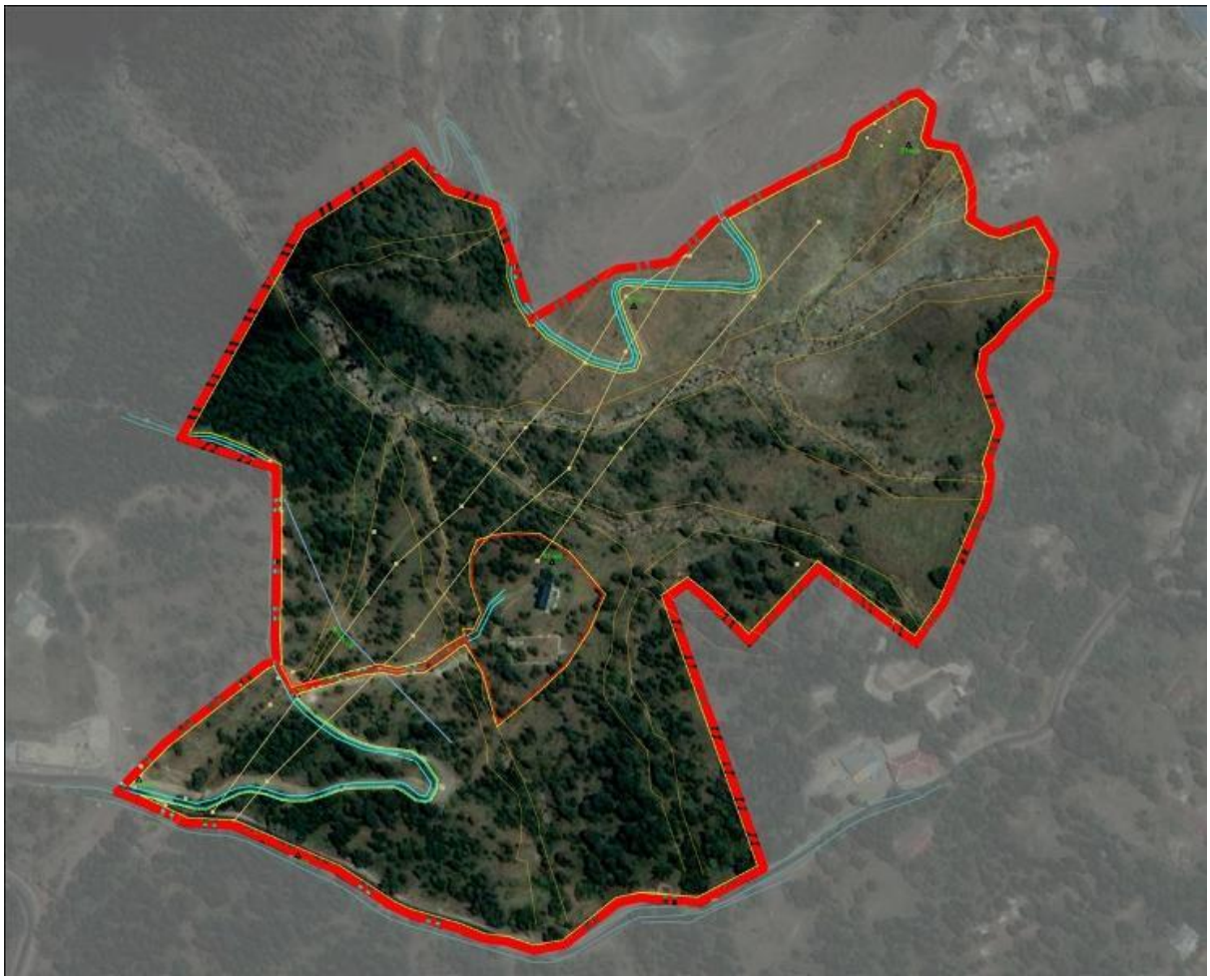


Fig 1: Map of the Murree Biodiversity Park (IUCN-Pak)

SURVEY METHODOLOGY

The current surveys were carried out from 7th to 10th April 2011 and 24th to 27th June 2011. Each survey consisted of four days. Keeping in view the size of the Park following methods were used for survey of different faunal groups.

1. Herpeto-fauna:

The survey commenced in the evening of June 21 and ended at the same time on 24th June 2011. The field investigation continued day and night to establish the baseline about the existence, distribution and current status of herpeto-fauna in the study area.

1.1: Survey Methodology for Herpeto-fauna:

The investigation techniques used to explore the species were stone turning and searching at and through bushes. Bush flora is so important around the rocks and big stones as it provides necessary food requirement. For snakes, lizards, and amphibians especially for toad, stone turning technique helps a lot for the location and estimation of population of different species. This technique is specially used in the mountainous or sub-mountain areas where scattered stones or big rocks are found. It is not easy to remove or turn large and heavy stones or rocks but small and loose stones can be turned to see the hiding reptiles and amphibians. Snakes, lizards and toads always hide and take rest under the stones. These should be placed at the same position and at the same place like natural setting so that the natural habitat and ecology may not be disturbed. To record the species of frogs the fresh water pools or ponds (water bodies) are important which form in the way of fresh water streams or by rains because during summers they spend most of their time in the water or in the grassy flanks of the streams or fresh water ponds.

For agama species (lizards) the big rocks or stones along the boulders of the running streams or dry beds of seasonal streams are best places. In mountainous area agama species are found abundantly. They usually come just after sunrise from under the huge rocks. When the rocks become slightly warm, agama species come out of the cracks or crevices and enjoy sunshine on the top and sides of the rocks.

For nocturnal species spotlighting was used particularly for snakes. Snakes are mostly nocturnal. Their food includes rodents i.e. mice, moles and rats or amphibians (frog and toads). The best timing for diurnal species (amphibians and lizards) is between dawn and mid-morning or shortly before sunset (Minton, 1966). In general the best season to record the species like lizards and snakes is soon after the monsoon rains and for amphibians during the summer rains.

2. Avian Fauna:

2.1: Transact or Coordinate Method:

The strip census method entail walker a predetermine line, counting the animal observed and recording the distance at which they are seen or flushed. The average of the flushing distance is determined and used to calculate the effective width of the strip covered by the observer. The population for the entire area is considered to be the number of animals flushed, divided by the area of the strip and multiplied by the total area.

$$P = \frac{AZ}{2YX}$$

Where;

P = Population

A= Total area of study

Z= Number flushed

Y= Average flushing distance.

X= length of strip

2.2: Call method:

Calls count method was used for population estimates of Galliformes i.e. partridges, Pheasants, etc. Random samples were taken in the distribution area of the concerned species calls of the bards were counted and multiplied by 2 as calls give the number of males only. The populations of birds were estimated in the survey area.

2.3: Flushing:

A strip or quadrate was taken, members of the survey team spread in width of the strip at determined standard distance. Birds were counted by flushing along the strip or quadrate. Than population of total surveyed area was estimated.

2.4: Fixed Spot Counting:

Randomly spots were fixed in the field and were observed for a specified time period. Birds seen during this time were recorded.

3. Mammalian Fauna:

3.1: Large Mammals:

Large mammals are mostly nocturnal in their feeding habit so particular night surveys were carried out by using the torch. Surveys were carried out from 9:00 pm onwards for at least 3 hours in the field during each survey for the consecutive four days. Line transect method was applied for the survey of large mammals. Pre-determined tracks were used to record the mammalian species in the park. Direct sightings and vocal calls of large mammals were noted. The area has potential habitat of flying squirrels (*Petaurista*

petaurista and *Hyloptes fimbriatus)*, so large pine trees were scanned by using the torches. During the day time, park was thoroughly searched for indirect evidences like holes/ burrows, foot prints, fecal pallets, spines and bones of the large mammals.

3.2: Small Mammals:

For the Small mammals i.e. rodents, trapping was carried out. Live Sherman traps baited with coconut butter and oats were used. Fifty traps were placed at a distance of 15 to 20 feet from each other keeping in view habitat type. Traps were placed in evening and checked in early morning before dawn. Animals captured within the traps were identified; and released back in the park.

3.3: Indirect Information:

Local people including the Park staff were interviewed regarding the current and previous status of mammals and other fauna in the park area.

RESULTS

1. Herpeto-fauna:

The present study deals with the distribution and status of reptiles and amphibians occurring in the Murree Biodiversity Park, district Rawalpindi. During this short single field trip we could confirm only 2 species, one each of amphibians and reptilians.

1.1: Amphibians:

There are 22 species from 7 genera of amphibians identified in Pakistan.

1.1.1: Family Ranidae:

1. Euphlyctis cyanophlyctis (Schneider, 1799) Skittering Frog: Daddoo

1.1.2: Description:

The Skittering frog *Euphlyctis cyanophlyctis* belongs to the broad-mouth frogs group; dorsum surface light grey, olive-green or light brown, sometimes reflects blackish with irregular black spots. Thighs posteriorly dark with one or two yellow or white irregular longitudinal stripes but regular vertical stripes have been clearly observed in tadpoles (pers obs). Ventrum is white without spots or with dark markings. Tadpoles are dark-grey with oval swollen body, broadest at midbody, ventrum greyish extremely soft and flat. The eyes are large, tail is long muscular with wider dorsal and narrower at ventral fins, and tail tip is thick and broad. Total length of the tadpole 42-46 mm, tail 23-24 mm. Large tadpole remains solitary, minors in small groups, stay most of the time at the bottom, if alarmed they hide

themselves in the debris (pers obs). They feed mostly on debris. Examination has proved that usually no fresh vegetation is detected in its digestive tract. It also feeds on dead tadpoles, drowned animals like earthworms or other decayed materials (Khan and Tasnim, 1989).

Euphlyctis c. cyanophlyctis is a common frog everywhere they exist and their tadpoles are most common in water bodies throughout the plains of Punjab and Sindh from late February to mid-September. We collected five tadpoles during this study. This frog has a spectacular unique habit of skittering over the water surface.

Euphlyctis c. cyanophlyctis is a voracious feeder, feeding mostly on aquatic insects, beetles, tadpoles, dragonflies, grasshoppers, etc. It is pest exterminator, feeds voraciously on different insects and their larvae. The frog is known to come out of the water during the night and goes to foraging in the surrounding grasses, returning to the pond at dawn (khan and Tasnim, 1989).

1.1.3: Habitat, Distribution and Status:

Euphlyctis c. cyanophlyctis is a greatly aquatic and littoral species. It remains permanently resident in different types of habitats with pooled water in the plains and sub-mountainous parts of Pakistan. The frog is remarkably capable of adjusting itself to the uncertain aquatic conditions in temperate arid parts of

Pakistan (Minton, 1966). The common skittering frog is one of the most widely distributed Oriental species. It extends from Thailand to Nepal, throughout India, Sri Lanka, almost throughout Pakistan below 1800m (Khan, 1997). It extends westwards to Iran and Afghanistan. Recently Khan (1997) described a spinulate race *E. c. microspinulata* of this species from northwestern plateau of Hindukush and Balochistan.

In the study site, we could not observe any adult of this frog although efforts were used day and night; however we observed its different tadpole stages in the pooled water at two places in the way of a small fresh water stream surrounded by dense grasses and herbaceous layer. In the pool we detected a large quantity of debris in the bottom growing ferns and fungi which provided them dietary requirements (see photographs).

1.2: Reptiles:

The accounts of lizards has been gradually increasing from Minton's (1966) record 65, Mertens (1969) accounted 82 while Khan. (1980b) listed 88 and Khan (2002) finalized with 101 species and sub species from 35 genera.

1.2.1: Family Agamidae:

1. Laudakia tuberculata (HARDWICKE & GRAY 1827) Blue Rock Agama: Neela kirla

Agama tuberculata HARDWICKE & GRAY, Zool. J., London 3: 218.

Type locality: Bengal.

1.2.2: Description:

Body is lightly built but tail is heavier and relatively shorter as compared to other agamids comprising 163-194 percent of snout-vent length. Colour slightly varies with its distribution in different eco-regions. In adults it is brownish to bluish or greenish, ventral surface of males deeply marbled with dark blue. Females are lighter in colour and shine creamy, young looks similar to adults but on dorsal, markings are more conspicuous (Minton 1966). According to Khan (2009) the adults were paler at head, throat and chest bluish and the ventral side whitish.

1.2.3: Habitat, Distribution and Status:

Laudakia tuburculata is a common species in northern Pakistan. It does not occur above 2500m altitude (Khan, 1999b) and lower than 1250m (Minton, 1966). In a recent study (Khan, 2009) the species has been collected at 4000m in Khunjerab National Park, northern Pakistan. The species is mostly herbivore but also feeds on insects if available in its domain and reach (pers. obs.). During the present study particularly juveniles and sub-adults were commonly seen preferring insects which included ants, termites and beetles while an adult was observed picking soft sprouting buds and leaves from the herbs grown adjacent to its nesting rocks (pers. obs.). It inhabits big rocks of running or dry beds of streams in the study site. Surrounding major habitat is dominated by Blue Pine, *Pinus wallichiana* and Sumbal *Berberis lyciumn.* The macrohabitat includes a number of herbaceous flora. It is common in the study site as well as throughout its wide distribution in northern Pakistan at elevations of 1500-2500m; extralimitally eastern Afghanistan, and Kashmir up to Nepal.

2. Avian Fauna:

Two surveys one in April and the other in June 2011 were conducted to study the avian fauna of the Biodiversity Park at Murree. During the first survey in April (7^{th} to 10^{th} 2011), 32 species belonging to 27 genera, 20 families and 8 orders were recorded. Of these 3 (9.37%) species were abundant, 11(34.38 percent) were common, 11 (34.38 %) were rare and 7 (21.87%) were scarce. During the second survey 33 species belonging to 30 genera, 24 families and 7 orders were recorded. Of these 3 (9.09 %) were abundant, 12 (36.37%) common, 10 (30.30%) rare and 8 (24.24%) were scarce. As total of 43 species belonging to 35 genera 26 families and 8 orders were recorded. Of these 3 (6.97%) were abundant, 12 (27.91%) common, 14(32.56%) rare and 14 (32.56%) were found scarce.

A fluctuation in the occurrence and abundance of birds was recorded. Ten species of birds were those which were seen in the first survey but could not be observed in the second survey. These include *Milvus migrans* (Black Kite), *Hieratatus fasciatus* (Booted Eagle), *Columba palumbus* (Common Wood Pigeon), *Hirundo rustic*a (Barn Swallow), *Motacilla flava* (Yellow Wagtail), *Motacilla cineria* (Grey Wagtail), *Metacilla alba* (White Wagtail), *Pycnonotus cafer* (Redvented Bulbul), *Chiamarrornis leucocephalus* (White caped Redstart), and *Turdus ruficollis* (Black-throated Thrush). There were some other species of birds which were not found in the first visit while seen in the second visit. These included *Psittacula cyanocephalus* (Plumheaded Parakeet), *Megalaima virens* (Great Barbet), *Dendrocopos auriceps* (Brown fronted Woodpecker), *Hypsipetes madegascariensis* (Black Bulbul), *Saxicola carpata* (Pied Bushchat), *Enicurus scoaleri* (Little Forktail), *Oriolus oriolus* (Golden Oriole), *Garrulus lineatus* (Streaked Laughing Thrush), and *Carpedacus erythrinus* (Common Rosefinch).

Some species of birds were found common and abundant in both the visits. These mainly include *Corvus macrorhynches* (Jungle Crow), *Acridotheris tristis* (Common Myna), *Aegitholiscus concinnus* (Black throated Tit), *Streptopelia senegalensis* (Little Brown Dove), *Psittacula himalayana* (Sglyheaded Parakeet) etc. Slaty headed Parakeet was more frequent in the second as compared to first visit. Common Myna was also more frequent and relatively widely distributed in the park during second survey. Some of the species have decreased in population. These include Yellow billed Magpie and Blue Whistling Thrush. Black throated Tit was found in large parties during April while they were seen in pairs or single birds in June. Status of different species is as follows.

2.1: *Milvus migrans* (Black Kite):

The species regularly occur around Murree town in summer, though evidence of breeding is not available (Roberts, 1991). During the first visit in April two flying birds were seen.

2.2: *Hieraactus pennatus* (Booted Eagle):

It is a winter migrant to Indus plain and may occur in summer in mountainous area. It has been recorded in summer in Naltar valley, Gilgit, in the Kaghan valley and the Murree hills. A single flying bird was seen during first survey.

2.3: *Lephura leucomelana* (Kalij Pheasant):

Kalij Pheasant is a resident endemic species typically associated with foothills country extending from Wild Olive (*Olea cuspidata*) and Phulai (*Acacia modesta*) scrub forest up to the sub tropical pine zone. It is sparsely found in some areas of Hazara and Azad Kashmir.

Its main surviving population now extends from the Margalla hills through Lehtrar to Punjar and Kahuta. They occur at the foot of the Margalla hills as low as 457 meters elevation just west of Islamabad and have been flushed at Ghora Gali 2081 meters (6500 feet) elevation.

During both the surveys of Murree Biodiversity Park 5 birds were seen wandering in the park in the evening or early in the morning.

They are usually active mainly in evening and early morning sometimes venturing into open roads to pick up grit and regularly coming at such times to drink from a few permanent springs. They scratch in the leaf litter for crustacean, insects and molluscus. They also eat black berries of *Carissa* and *Zizphus* along with green leaves, shoots and seeds and at higher elevation, the acorns of *Quercus incana* in season. At night they fly into trees to roost. The nest is well concealed under a bush or overhanging roots, but is scantly lined with grass or dried vegetation.

2.4: *Columba palumbus* (Wood Pigeon):

A resident bird very local in distribution, being confined to lower attitude and hill tracts with the *Olea cuspidata* and *Acacia modesta* scrub forest cover such as in parts of the Punjab Salt Range. Perhaps its greatest stronghold is the Olive scrub forest of the Kala Chita hills in Attock district Northern Punjab. They feed on all kinds of seeds and gleaned grains from cropland, also tender shoots of Mustered

(*Brassica compestris*). Roberts (1991) has seen them feeding upon the berries of *Pistacia integerrina* and also says that the bird must also depend on the wild fruits of the *Olive Olea cuspidata* . In the Salt Range they built their nest in *Dalbergia sissio* or *Ziziphus jujuba* trees and in Balochistan Juniparus macropoda. A single bird was seen up near road at the margin of the park.

2.5: *Streptopelia chinensis* (Spotted Dove):

Spotted Dove is largely a summer visitor in Pakistan confined to sub-tropical pine zone *(Pinus roxburghii)* and lower or outer foot hills regions of the Himalayas in a relatively narrow belt from lower Chitral, Dir, Swat and Murree foothills and is rarely found above about 1829 meters (6000 feet) elevation (Roberts, 1991).

Three solitary birds were seen in both the surveys.

They are found mainly on the ground picking up grain and seeds but also occasionally berries *(Barberis ceratophylla)* and green shoots and birds.

2.6: *Streptopelia senegalensis* (Little Brown Dove):

It is a resident and breeding bird in all the plains and semi-mountainous areas. In the Murree foothills it ascends to 914 meters (3000 feet).

In the Murree Biodiversity Park the bird was found with good numbers. It is mainly ground feeder and not very gregarious. It is largely grainivorous in diet taking, grass and seeds as well as cultivated cereals.

2.7: *Psittacula himalayana* (Slaty headed Parakeet)*:*

It is adapted to mountainous region normally preferring to breed around 2,134 up to 2,468 meters. In winter they move around in the lower valleys and outer foot hills but do not extend down into plain. They are only summer visitor but can be seen around Murree from early march. In January they can occasionally be seen as low as 460 meters (1500 feet) in Margalla hills ravines adjacent to Islamabad. They are essentially associated with Himalaya's moist forest and mixed coniferous and deciduous, forest.

The species was commonly found in both the visits of the park. In the second visit birds were found in relatively higher numbers. The birds were seen mostly in the upper eastern part of the park and were almost absent from the low lying areas of the park. Their nests were found in the holes of trees. Their diet comprises the wild fruits and seeds of various trees in season as well as flowers of trees and damage cultivated orchard fruits specially apples and pears. They have been seen feeding in flocks on the downy seeds of *Populus ciliata* and flowering racemes of *Pistacia intergerrima* in mid April (Kao forest Donga Gali) also eating the rind off green walnuts *Juglans regia* (Roberts, 1991).

Roberts (1992) states that in a *Quercus dilatata* groves along the water pipe Donga gali there were an estimated fourteen breeding pairs with at least one nest in *Pinus wallichiana* but majority of nests were excavated in the rotten stumps of the higher up lateral branches of the Hill Oak *(Quercus dilatata).* Most nest holes are found high up and inaccessible because of the steep ground on which these magnificent Oaks grow. Egg laying starts as early as April or late as June.

2.8: *Psitta cyanocephala* (Plum headed Parakeet):

This parakeet is largely a resident breeding species in the lower Murree foothills with some parts of population dispersing in winters down to plain areas particularly Jhelum and Sialkot. It is very restricted in distribution in parakeets and not been noted above the subtropical pine zone (*Pinus roxburghi*) north west of Murree in similar sub-tropical pine zone which stretches across. The species was not seen in Murree Biodiversity Park during the first survey while during the second survey it was found in good number.

They are more frugivorous parakeets than the other species and they also eat nectar bearing flowers. They prefer small seeds of tall herbs and weeds and also large grains. Generally this species sticks to well wooded areas and forest and does not feed on the ground as often as *Psittacula krameri.*

2.9: *Megalaima virens (*Great Barbet):

This barbet is a Himalayan species. It only extends westwards into the Murree hills range and the Jhelum valley of Azad Kashmir where it is resident and breeds. It is a bird of mixed coniferous forest and deciduous forest in the temperate climate zone occurring between 600 meters and 2600 meters in height. In winter there is some altitudinal migration or drift into warmer snow free zones.

The species was not observed in the Murree Biodiversity Park in the first survey tour during 7th April to 10th April. In second tour birds were rarely scattered in the park areas. The bird is largely arboreal and poor flier. They feed principally upon berries and fruits but will take large insects where available. In Donga Gali they have been noted upon orange berries of climbing *Hedera nepalensis* and the black berries of *Prunus cornuta.* They make nests in the holes of large trees. (Roberts, 1991)

2.10: *Apus affinis* (Alpine Swift):

It is summer migrant to the more accessible northern areas such as main vale of Swat, the Murree hills and around Abbotabad. In Sind and Punjab it is resident.

Birds of this species were found commonly during both the visits. They are aerial feeders mainly on insects. There nests are usually accumulations of straw, feathers etc.

2.11: *Upapa epops* (Hoopoee):

Hoopoee is summer breeding visitor in northern Himalayas. In Sind it is mainly a winter visitor with a marked autumn passage migration. In Punjab it is partially resident and breeding through out the Indus plain. A few pairs breed in summer in the Murree hills up to 2438 meters elevation.

In the Murree diversity park the species is sparsly distributed mostly in the eastern part of the park. The species was observed in both the visits. This species is specialized feeder being insectivores and obtaining most of its food from beneath the ground surface by probing with its bill. It has been recorded as feeding upon small worms, larvae of Anti Lions (Myrmeleonidae).

2.12: *Picus squamates* (Scaly bellied Woodpacker):

According to Roberts (1991) it is a resident species preferring Himalayan coniferous forest but adaptable to a wide altitudinal range over extending sparsely down to sub-mountain or foot hills regions. They feed principally upon ants and forage by chiseling and hammering into bark crevices and the outer wood of vertical tree holes and branches. The species is rarely found in the wooded areas of the Park and was found during both the visits.

Both sexes share in nest hole excavation. In Donga Gali, Murree hills however some tree holes have been used for four successive years. Deciduous trees appear to be preferred over coniferous trees in the Murree hills (Roberts 1991).

2.13: *Hirundo rustica* (Barn Swallow):

According to Roberts (1992) in Pakistan this swallow is a widespread summer breeding bird in the western hill tracts and in northern mountainous areas. It is rare breeding bird in the Murree hills (Whistler, 1930). A single bird was seen on the margin of the park in April.

2.14: *Ptyonoprogne rupestris* (Crag Marten) :

Hugh Whistler (1930) considered that they were locally migratory from the Murree hills where they breed in May and June spending the winter in the river valley such as Harro and Sohan. (Ibis1930). In both the surveys birds were seen flying in the park area.

2.15: *Motacilla cinerea* (Grey Wagtail):

Roberts (1994) states that because of lack of suitable streams it is quite rare as a breeding bird in the Murree

hills and there is marked passage of birds through the Murree hills in spring and Autum.

As there are small streams passing through the park area, the birds were seen aggregated near these streams during the first visit. No bird of the species was found during the second survey. So it appears that the species is passage migrant.

2.16: *Motacilla alba* (White Wagtail):

Matacilla alba has many varieties. One of the sub-species is breeding bird in Pakistan. It was very rarely seen in the park only during the first survey.

2.17: *Pycnonotus leucogenys* (White cheeked Bulbul):

White cheeked Bulbul is common in the plain areas of the country. It is also found in the Murree foothills, Margalla, main vale of Swat and extending west wards to Dir and Chitral. The Himalayan sub-species with its curly head crest is quite widespread and common. It is not found much above 1675 meters (5500 feet) and avoids coniferous forest but a small population is resident around Murree town.

They are omnivores and feed upon insects, berries and nectars from the flowers. Small numbers of birds were seen in both the survey and there was no considerable variation in the population which shows it is resident.

2.18: *Cafer* (Red vented Bulbul):

Red vented Bulbul in also commonly distributed avian species in the Indus plain in Punjab and Sindh and also in KPK. It is absent from most of the areas of Balochistan and extensive desert tracts in Sind and Punjab. It is found in the Murree hills up to 1500m.

This species was found only in the first survey and was not seen during second survey. It appears that though the bird is not migratory yet it has some kind of local movement. Their diet comprises both insects and vegetative matter. In winter they feed mainly upon young buds, green leaves and fallen seeds.

2.19: *Hypsipetes madegascariensis* (Black Bulbul):

A breeding bird confined to the lower valley slopes or outer foothills zones of the Himalayas where sufficient mixed broad leaved forest exist or deciduous tree plantation and orchard provide food supplies.

In winter there is some local altitudinal migration according to available food supply, but they do not penetrate far into plain areas. In summer time they penetrate to the summit of the Murree ridge for breeding but rarely ascend above 2100 meters.

The species was found only during the second survey and was found with small numbers in the park. The bird is found in loose noisy associations throughout the year. They are largely fruigivorous subsisting upon berries and wild fruits and also feed upon insects. Nesting starts in early May and continues through out the June. The nests are hard to locate being built on the upper horizontal surface of tree forks often at a considerable height from the ground and on the extremity of tree branches. However Bates and Lowther (1952) found nests in Kashmir as low as 3 meters from the ground.

2.20: *Chalmarrornis leucocephalus* (White caped Redstart):

The species is confined to the immediate vicinities of Himalayan mountain Rivers and streams and partially migratory in winter right down to streams in the outer foothills and adjacent plain (Roberts, 1991). Occasional birds have been seen as far as south as a Maralla Barrage on the Chenab and in Jhelum districts (Waite, 1948). They are insectivores foraging for flying insects. They will supplement their diet with barriers. During the first visit of the park a single bird was seen on the margin of a stream in the park.

2.21: *Saxicola ferrea* (Grey Bushchat):

The bird is mainly of the higher mountains range of western Himalayas. It is subject to limited altitudinal migration in winter, with birds straggling down to adjacent lower valleys or slopes and a few descending to the outer foothills zone and the edge of plains. It is a common and familiar breeding bird of Murree hills. The species was found common in the areas of the park during both the surveys.

They are largely insectivores; some seeds beside insects are included in the diet. Roberts (1992) states nesting commence from late April. The nest is usually on ground and in the hollow under overhanging roots of *Adiaantum ferns* in eroded banks. Nest was found in a thicket of *Skimmia laureola* situated about 23 cms from ground (Roberts 1994).

2.22: *Myiophoeus caeruleus* (Blue Whistling Thrush):

This is a very widespread breeding bird in the northern mountainous region, always associated with proximity to stream. It performs some altitudinal migration. It is a breeding bird in the Murree hills. It adopts to coniferous forest as well as to bare open hill sides.

Blue Whistling Thrush was found common in the Park area. However it was observed that the birds were found relatively in smaller number during the second survey as compared to the fist survey. They forage on the ground often along the banks of streams and rivers digging vigorously in soft ground for insect larvae. The pair bond is stable and sometimes two broods are reared in a season. Nesting often begins in early spring and a second brood generally starts in late June or early July.

2.23: *Turdus ruficolis* (Black throated Thrush):

In Pakistan it is winter visitor and first comes in October in the mountain region of the north and spreads down through the upland region of Balochistan invading the Indus plains in winter. In the Murree hills range first arrival recorded in Donga Gali was on 17 October (Roberts, 1991).

The bird was commonly found mainly in the eastern part of the park during the first visit but was absent during the second visit which indicates that the bird has movements to some extent during different seasons.

2.24: *Siylvia curruca* (Lesser Whitethroat):

Lesser Whitethroat winter right through Peninsular India and down to Sri Lanka In the Handbook of Ali & Ripley (1973). The breeding range includes Murree, but according to Roberts (1992) it may occur in Murree hills during in passage.

Only 3 birds of this species were observed in the park area during both the surveys. Whitehead (1910) found them breeding freely in Oak scrub *Quercus ilex*

between 1800 to 2400 meter height at the upper end of Kurrum valley and lower steeps of the Sufed koh. Three to Five eggs are usual.

2.25: *Oriolus oriolus* (Golden Oriole):

In Pakistan this is summer breeding visitor, mainly in the northern parts of country. It occurs in different areas of Balachistan, Punjab and KPK. There preferred habitat is thin deciduous forest or well wooded but fairly open and dry country. They are arboreal in habits, rarely descending to the ground when attracted by particularly large insects. Their diet is mainly insectivorous but they will take all kind of fruits in season.

Very few birds were found wandering in the park area during survey of June, 2011. In southern Punjab they have been found feeding upon ripe Mulberries *(Morus alba)* and are known to take fig of *Ficus bengalensis* and *F. religiosa*. They also feed upon different kinds of insects. The pair bond is stable. Usually the nest is built entirely by the female (MacDonald, 1960) but the male sometimes assist in bringing nesting material (Demantev 1954 and Witherby and Jourdain , 1943). The nest is usually built fairly high up and near the outer extremity of a tree branch.

2.26: *Muscicapa thalassina* (Verditer Flycatcher):

It is a summer breeding visitor to the North West Himalays and Pakistan, with rather a limited distribution occurring throughout the Murree hills range, sparingly in Neelam valley and uncommonly in lower parts of Kaghan valley.

The species is found in the park in good numbers and was observed during both the visits. Generally hunts by making aerial fly catching quite high up in trees. It rarely forages in the under story or near the ground, occasionally forage by creeping along branches.Nesting starts shortly after arrival and in the Murree hills some nests with eggs have been found by late April (Whistler, 1930).

2.27: *Aegithalos concinnus* (Black throated Tit):

In Pakistan it is very limited in distribution occurring only in the lower side valleys of Neelum valley Azad Kashmir where there are patches of deciduous forest, all along the lower forested slopes of the Murree hill range and in lower part of Kaghan valley where deciduous forest predominates.

The species is gregarious except during the nesting season, and where they are numerous, they sometime associates in flocks over 40 birds. Black throated Tit was found very common mainly in the low lying slopes of the Park. The birds were found in parties of good numbers during first survey but were found in pairs or single during second survey. They feed mostly upon small larvae of Insects but have also been found feeding on berries and seeds. Pair formation starts in Murree from mid March and nest building has been observed close to Murree town between 18 and 21 April (Davidson, Ibis, 1898).

The nest is an elaborate structure. It is an oval structure with the long axis vertical and an entrance hole near the top at the side. Most nests are located quite low down in bushes and in the fork of thorn bush but Rattray once found a nest near Murree built between clumps of fir cones, some 12 meter high in a fir tree (Rattray 1905).

2.28: *Parus major* (Great Tit):

In Pakistan it is locally migratory in winter while it over summers and breeds in the mountainous regions of Balochistan, higher hills of KPK and northern Himalayas. According to Roberts (1994) it occurs in the Murree hill range typical on the lower slopes but is absent from the Galis further north. During first survey of the Park the species was found rarely on the south western margin of the park. During the second survey it was relativity common having concentration in the middle of the park.

They are omnivores having seeds, nuts and fruits in their diet. Nests are typically built in holes in man made buildings, natural burrows and crevices. Christian (1940) found most nests in April and May and noted woodpeckers holes used as well as cracks and holes in rocks and with clutch size varying from 4-6.

2.29: *Carpodacus erythrinus* (Common Rosefinch):

Rosefinch is local migrant species and has different races. *Carpodacus erythrinus roseatus* occurs in the region of Murree Hills. It is mainly passage migrant through this region. Roberts (1992) states that birds on passage swarm around the

Margalla hills, the Punjab Salt Range and Murree foothills up to the end of the first week of May. However in the current study a party of birds was seen during the second survey of 21st to 24th June, 2011.

2.30: *Dicrurus macrocercus* (Black Drongo):

The Black Drongo is widely distributed throughout India Sri Lanka and eastward to China and Indonesia. In Pakistan it is common bird throughout the Indus plains. In summer it ascends to Murree hills a few birds reaching Donga Gali each year as high as 2400 meter.

During both the surveys the species was found with good numbers at margins of the park. It is an insect eater, hunting from a fairly high observation post and capable of seizing flying insects.

Nesting starts quite late in the Northern areas, KPK and northern Punjab usually in May and continuing throughout June. The usual clutch in Sind and Punjab is 3 to 4 eggs (Waite, 1948).

2.31: *Uroass flavirostris* (Yellow billed Magpie):

This is sino Himalayan endemic species occurring across the Himalayas from Pakistan to South-western China, northern Burma, Assam and southern Tibet.

It is confined largely to Himalayan moist temperate forest with some admixture of deciduous and coniferous tree species and in summer can be found as high as 3,350 meters (11000 feet) in Swat and lower part of the Kaghan valley, down to about 1900 meters, (6500 feet) at the Murree hill range.

The species is omnivores and they will exploit ripe fruit and berries when available as well as soil born arthropods, insects and their larvae and small reptiles, bird

eggs and nestling and probably carrion and small animals. According to Roberts (1994) in the Murree hills nesting season can be quite extended from early July but most nests with eggs are found from mid May to mid June.

Yellow billed Magpie is commonly found and breeding bird in the park. The species was found more frequently during the first survey while relatively in smaller number during the second survey. Nests of the species were observed during first survey which shows its breeding starts from April in the area.

2.32: *Corvus macrorhynchos* (Jungle Crow):

In Pakistan it is typically a Himalayan forest bird associated with valleys and mountainous slopes over which there are patches of forest. It is absent from plains of Pakistan except as winter visitor in the areas adjacent to foot hills.

They were commonly found in the park areas and abundant along the road sides on the margin of the park during both the surveys. They are omnivores and the Himalayan population will feed in summer largely upon soil born insects and their larvae. It is believed that the pair bond is long. They build their nests in tall trees often placed high up on a lateral branch.

2.33: *Corvus splendens* (House Crow):

House Crow occurs mostly on the upper margins of the park in the adjacent areas of Murree city.

2.34: *Acridotheris tristis* (Common Myna):

Indian Myna occurs everywhere except in the remoter mountainous areas and avoids Himalayan coniferous forest or extensive desert tract. They have penetrated the main vale of Swat upto Bahrain and upto Murree and the Gali in the Murree hills.

They are omnivores in diet, exploiting kitchens refuge, berries and fruits when ripe, flowers, nectars and all kinds of insects. They normally nests in holes or cavities, frequently in occupied buildings, in holes under cover or roofs, natural tree cavities are preferred. Common Myna was commonly found during both the surveys. However it was observed that the species was found with higher numbers and wildly distributed in the park area during the second visit.

2.35: *Passer domesticus* (House Sparrow):

House sparrow is an abundant bird in the human habitation in plain areas. It is found in and around Murree city. The bird is omnivorous. It nests usually in holes. Nesting starts from February and continues till July, August.

2.36: *Tersiphone paradisi* (Asian paradise Flycatcher):

It is widespread and not uncommon breeding bird throughout the northern foothills areas adjacent plains and penetrate into the broader valleys of the Himalayas (Roberts 1992). It is found in Chitral, around the main vale of Swat and quite commonly in the lower Kaghan valley and less commonly in Abbotabed and Murree foothills.

It occurs in most of Sindh and Punjab as a passage migrant and with an influx of post breeding birds in Margalla hills. With the powerful bill and large grip it is capable of seizing larger insects. It is a woodland bird, preferring the vicinity of streams. In and around the valley of Kashmir, Bates and Lowther (1952) found nests with eggs from Mid May until July and Whistler (Ibis, 1930) also gives May to July as the nesting season in the Murree foothills area.

Typical locations of the nests are in the vertically hanging branches of trees or climbing wild roses growing near water. The nest is often woven around one single vertical hanging branch. The bird is gregarious in winter especially while on passage, usually seen in flocks of 20 to 30 birds. In summer they are encountered in pairs or singly. Their diet is varied, but mainly seeds and vegetable matter. A single bird was recorded during the second survey in June.

2.37: *Emberiza cia* (Rock Bunting):

In Pakistan this species is very widespread breading bird in the northern mountainous region but found nesting from as low as 2000 meter (6500 Feet) in some of the lower parts of Murree hills and up to 4500 meters (15000 feet) in Hazara and Gilgit (Roberts, 1992).

In the park area the species was mainly found on the slopes of hills. It is typically a ground feeding bird usually encountered in small scattered parties of 3 or 4 birds and not much gregarious. Their diet is mostly seeds gleaned from ground. However in summer they take more insects. Normally nests are placed on the

ground, often hollows under stones or grass clumps. Very rarely they may be placed in bushes or sapling trees. Typically nests are cup shaped structure built to fit into a natural hollow and woven grass and lined with fine rootlets and animal hair.

3. Mammalian Fauna

The Murree hills are rich in faunal diversity due to their habitat type and support a number of threatened species of wildlife like Common Leopard, Barking Dear and also some species of birds. The Murree hills are one of the most visited tourist spot of the country which causes too much disturbance to local fauna. The concept of establishment of Biodiversity Park will help in the conservation of local fauna and flora.

During the current survey of the park area out of 31 mammalian species reported by Roberts only 12 species of large and small mammals were observed in the Park. Leopard visits the area regularly in the winter and a den (local people call it Khud) was also located at an about half kilometer out of Park area in the west side of the Park. According to local people leopard and its cube were observed in the area in the month of January 2011. The leopard also killed some livestock of villagers of Darjava and used to rest in the Khud (den) during the day time. The authors also took photographs of the den where visible foot prints were present of a carnivore but could not be ascertained whether there were the foot prints of Leopard or its cube. According to local people the leopard cat (*Prionailurus bengalensis*) was also found in the Park area but it has not been observed for last many years. According to Roberts (1997) the Yellow throated Marten (*Martes flavigula*) also occurred in Murree hills but now it has become scarce due to human persecution. The local people had no clue of the Yellow throated Marten from the Park area.

The small mammals are important components of terrestrial ecosystems. They are major consumers of primary productivity as well as being an important food base for many predators (including birds). These factors affect the abundance and diversity of species throughout the food chain. During the current survey of the park three species of rodents were recorded from the park including *Mus musculus* (House Mouse), *Apodemus rusiges* (Wood Mouse) and *Rattus turkestanicus* (Turkestan Rat). It was observed that House Mouse was found abundant and during six trapping nights 20 specimens were trapped and released back in the field after identification, while 2 specimens of Turkestan rat and 1 specimen of wood mouse were also trapped in the park area.

Indian Crested Porcupine (*Hystrix indica*) was also observed in the center of the park. The dens and spines were frequently observed in the park area which indicates the common

occurance of this species in the park. The porcupine is herbivore and feeds on tree barks, all kinds of rhizomes and succulent roots.

Two species of Flying Squirrels i.e. Giant Red Flying Squirrel (*Petaurista petaurista*) and Small Kahsmir Flying Squirrel (*Hyloptes fimbriatus*) have been reported from Murree Hills (Roberts 2005). During the survey some evidences of both these species were recorded in the park area. According to local people they can be observed during evening times in the Park area while eating young cones. The watchman of the Park reported that a dead specimen of Giant Red Flying Squirrel was found electrocuted on the road near PSO Petrol pump in to the east of the Park. The authors also observed young half eaten cones in the park which indicates the presence of flying squirrels.

3.1: *Sus scrofa* (Wild Boar) locally called Khanzir and Barley:

Wild Boar is very common in Pakistan and usually found in agricultural tracts avoiding the high altitudes and steep mountains. They are omnivorous in diet and subsist on succulent roots and crops. They live in groups of upto dozens and are mostly considered as agricultural pest. In the Murree hills they are common and feed on maize crop and town rubbish.

Common in the Park and observed at three occasions in the lower as well as near upper limits of the Park near Chitta Morr in groups of 3 to 6 individuals. Wild Boar can be observed during the night and dawn throughout the Park while in the day time resting in thick forest near down stream.

3.2: Asiatic Jackal (*Canis aureus*) locally called Gidarr:

Jackal is widely distributed and adapted to all the regions of Pakistan including foothills but avoid very steep mountainous tracts. They are omnivorous in diet and have also reputation of being scavengers of refuse and of frequenting of town rubbish dumps.

Asiatic Jackals are common in the Park and were observed on two occasions in the thick forest cover they resting in the day time. Night calls could be heard at dusk time throughout the park but mostly common in the lower limits in the North-west. They are associated with thick forest cover of Pine (*Pinus wallichiana)* and can be observed near hotels and homes in the vicinity of the Park in the night.

3.3: Himalyan Red Fox (*Vulpes*) locally Pandh:

This species of fox is well adapted to all the regions of the country including deserts, plains and mountains. It has many sub-species which differ slightly in coloration and body size depending on environment. The sub-species found in northern mountain regions is larger and has much thicker fur coat. They are solitary and normally hunt on small rodents, reptiles and insects in the night and rest in burrows in the day time. Only night calls were recorded on two occasions in the lower limits of the Park area in the early night hours and were also reported by local people. Although it is not common in the Park but according to local people one or two individuals can be observed in the Park area regularly.

3.4: Giant Red Flying Squirrel (*Petaurista petaurista*) locally Keese:

Giant Red flying squirrel is found in forested areas of the outer Himalayas including Murree Hills (Roberts 2005). This species is associated with an admixture of deciduous tree species, as well as conifers. It lives in old tree holes.

It is also found in the Park and in the evening time it descends in the Park from southern side and feeds on pine cones. According to watchman of the Park a specimen of this squirrel was found dead on the road near Chitta Morr. Probably it was electrocuted while descending from large pine trees from the south of the Park into Park.

3.5: Small Kashmir Flying Squirrel (*Hylopetes fimbriatus*) locally Keese:

This squirrel is much smaller than the Giant Red flying squirrel and is associated with colder, dryer forested regions (Roberts 2005). It is almost found in coniferous forests and feeds on coniferous young shoots and cones. This species was also reported in the Park by local people and Park staff and many half eaten young cones were also observed in the Park, which provides the evidence of its occurrence in the Park.

3.6: House Mouse *(Mus Musculus):*

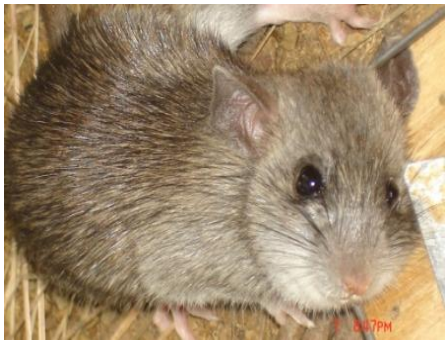
This is a small sized mouse found commonly in homes. House mouse was found very common in the Park. During six trapping nights 12 individuals were captured and released back in the Park after identification. It was observed associated with young trees of Pine (*Pinus wallichiana)* and crevices near water streams.

3.7: Turkestan Rat *(Rattus turkestanicus):*

This rate is found throughout the northern mountain areas including Murree hills and associated with pine forest far from human habitation. Two specimens of this rat were captured from the northern side of the park adjacent to houses located on the boundaries of the Park. Generally this rodent species is found in hilly tract and associated with houses and also causes considerable damage to grains and crops of maize.

3.8: Wood Mouse (*Apodemus rusiges*):

This mouse is adapted to live in mountainous forests and is wide-spread in Himalayas. It is also common in Murree hills (Roberts, 2005). The wood mouse is abundantly found in



mountainous forests and thus forms main prey species for a number of predators. Two specimens of this rat were captured in thick bushes inside the pine forest in the south of the Park.

3.9: Porcupine *(Hystrix indica)* locally Seh:

The porcupine is a rodent which possesses large quills on its back. They are found all over the country including Murree foot hills (Roberts 1997).the species feeds on the bark of trees, rhizomes and succulent root. A single sighting was recorded in the middle of the Park while, spines and scats were found throughout the park. Burrows were also found at two places in the middle of the Park. The species was found associated with small shrubs and crevices almost in the middle and east side of the Park.

3.10: Small Mongoose *(Herpestes Javanicus):*

Observed on four occasions and consisted of two to three individuals near the boundaries of the Park and also near the water streams. They are common in the Park and associated with water streams (pass through the Park), crevices and nearby homes located at the boundaries of the Park. The mongoose plays the role of small carnivore and feeds on scorpions, beetles, wasps, toads and even small snakes.

3.11: Dark Whiskered Bat (*Myotis muricola*) local Chamgadar:

Out of 5 species of Bats reported by Robert (1997) from Murree Hills only single species of bat was observed in the Park area. The Dark Whiskered Bat is a western Himalayan species found in forested areas including the Murree hills. Dark Whiskered Bat was observed in the Park area near the graveyard located in

the center of the Park.

Potential corridors for mammals in Murree Hills:

In the Murree hills no significant migration of mammals were observed. Common Leopard (*Panthera pardus*) during its seasonal migration in winters descends from higher mountains in North Kaghan towards the southern lower ranges of Galliat and Murree and stays here till the spring. Foxes are known to migrate locally within their home range in Murree Hills.

Sometimes the Jackal moves from northern side towards south to avoid cold temperatures and prefers to stay near garbage and human population. Wild Boar (*Sus scrofa*) found in the Park area and does not ascend further higher but only towards lower cultivated lands in search of food (Maize crop in the area). Flying Squirrels and other rodents have only local migrations. Flying Squirrels enter into Park area from southern dense coniferous forest (Banny kee galli area) in the evening time and feed on young cones.

Table 1: Complete Checklist of Birds Recorded from Murree Biodiversity Park April-June, 2011

Scientific Name	Common Name	Occurrence	
		April	June
ORDER: ACCIPITRIFORMES FAMILY: ACCIPITRIDAE			
Milvus migrans	Black Kite	√	×
Hieratatus fasciatus	Booted Eagle	√	×
ORDER: GALLIFARMES FAMILY: PHASIANIDAE			
Lophura leucomelana	Kalij Pheasant	√	√
ORDER: COLUMBIFORMES FAMILY: LOLUMBIDAE			
Columbia palumbus	Common Wood Pigeon	√	×
Streptopelia chinensis	Spotted Dove	√	√
Streptopelia senegalensis	Little Brown Dove	√	√
ORDER: PSITTACIFORMES FAMILY: PSITTACIDAE			
Psittacula himalayana	Slaty-headed Parakeet	√	√
Psittacula cyanocephala	Plum-headed Parakeet	×	√
ORDER: APODIIFORMES FAMILY: APODIDAE			
Apus afinis	Alpine Swift	√	√
ORDER: CORACICFORMES FAMILY: CAPITONIDAE			
Megalaima virens	Great Barbet	×	√
FAMILY: UPUPIDAE			
Upapa epops	Hoopoe	√	√
ORDER: PICIFORMES FAMILY: PICIDAE			
Picus squamatus	Scaly-bellied Woodpecker	√	√
Dendrocopos auriceps	Brown fronted Woodpecker	×	√
ORDER: PASSERIFORMES FAMILY: HIRUNDINIDAE			
Ptyonoprogne rupestris	Northern Crag Martin	√	√
Hirundo rustica	Barn Swallow	√	×
FAMILY: MOTACILLIDAE			
Motacilla flava	Yellow Wagtail	√	×
Matacila cineria	Grey Wagtail	√	×
Motacilla alba	White Wagtail	√	×
FAMILY: CAMPEPHAGIDAE			
Tephrodornis pondicerianus	Common Woodsbrike	×	√
FAMILY: PYCNONDIDAC			
Pycnonotus leucogenys	White- cheeked Bulbul	√	√
Pycnonotus cafer	Red-vented Bulbul	√	×
Hypsipetes madegascariensis	Black Bulbul	×	√
FAMILY: TURDIDAE			
Chimarrornis leucocephalus	White-caped Redstart	√	×

Soxicola carpata	Pied Bushchat	×	√
Saxicola ferra	Grey Bushchat	√	√
Myiophoneus caeruleus	Blue Whistling Thrush	√	√
Turdus ruficollis	Black-throated Thrush	√	×
FAMILY: TURDIDAE			
Enicurus scoaleri	Little Forktail	×	√
FAMILY: SYLVIDAE			
Sylvia curruca	Lesser Whitethroat	√	√
FAMILY: ORIOLIDAE			
Oriolus oriolus	Golden Oriole	×	√
FAMILY: MUSCICAPIDAE			
Muscicapa thalassina	Verditer Flycatcher	√	√
FAMILY TIMALIDAE			
Garrulus lineatus	Street Laughing Thrush	×	√
FAMILY: MONARCHIDAE			
Tersiphone paradisi	Asian Paradise Flycatcher	×	√
FAMILY: AEGITHALIDAE			
Aegitholiscus concinnus	Black-throated Tit	√	×
FAMILY: PARIDAE			
Parus major	Great Tit	√	√
FAMILY: FRINGILIDAE			
Carpodacus erythrinus	Common Rosefinch	×	√
FAMILY: DICRURIDUE			
Dicrurus macrocercus	Black Drongo	√	√
FAMILY: CORVIDAE			
Urocissa flavirostris	Yellow-billed Magpie	√	√
Corvus splendens	House Crow	√	√
Corvus macrorhynchos	Jungle Crow	√	√
FAMILY: STURNIDAE			
Acridotheris tristis	Common Myna	√	√
FAMILY: PASSERIDAE			
Passer domesticus	House Sparrow	√	√
FAMILY: EMBRIZIDAE			
Emrizia cia	Rock Bunting	√	√

Table 2: Numbers of Birds Seen in Different Days

Scientific Name	Common Name					
Milvas migrans	Black Kite	-	1	-	-	**1**
Hocraatus fasconatus	Booted Eagle	-	-	1	-	**1**
Lophora leucomelana	Kalij Pheasant	-	2	3	-	**5**
Columbas palumbus	Common Woodpigeon	-	-	1	-	**1**
Streplopelia chinensis	Spotted Dove	-	-	1	2	**3**

Streptopelia senegalensis	Little Brown Dove	4	3	8	6	**21**
Psittacula himalayana	Slaty headed Parakeet	10	8	15	12	**45**
Apus afinis	House Swift	-	18	13	7	**38**
Picus squamata	Scaly-bellied Woodpecker	-	-	1	1	**2**
Hirundo rustica	Swallow	-	-	1	-	**1**
Ptynopvehne rupestris	Marten	-	3	7	-	**10**
Motacilla flava	Yellow Wagtail	-	2	-	-	**2**
Matacila aneris	Grey Wagtail	2	7	8	6	**23**
Motacilla alba	White Wagtail	2	-	1	-	**3**
Pycnonotus leucogenys	White cheeked Bulbar	22	24	18	27	**91**
Pycnonotus cafer	Red-vented Bulbar	-	-	6	4	**10**
Chimarrornis leucocephalus	White-caped Redstart	-	-	1	-	**1**
Saxicola ferra	Grey Bushchat	9	15	11	12	**47**
Myiophoneus caeruleus	Blue Whistling Thrush	18	15	21	25	**79**
Turdus reficollis	Black Throated Thrush	-	-	23	12	**35**
Sylvia curraca	Lesser Whitethroat	-	-	1	-	**1**
Muscicapa thalassina	Verditer Flycatcher	-	3	9	6	**18**
Aegitholus conannus	Black throated Tit	35	42	34	18	**129**
Parus major	Great Tit	6	7	5	4	**22**
Dururus macroceraus	Black Drongo	8	9	12	11	**40**
Urocissa flavirostris	Yellow billed Magpie	15	18	12	22	**67**
Corves splendens	House Crow	15	22	17	28	**82**
Corves macrorhynches	Jungle Crow	35	42	33	38	**148**
Passer domesticus	House Sparrow	18	27	22	32	**99**
Emrizia cia	Rock Bunting	4	3	-	-	**7**
Passer domesticus	Common Myna	28	34	22	32	**116**
Total:		**231**	**305**	**307**	**305**	**1148**

Table 3: List of Mammals Sighted in the Park Area

Sr. No.	Scientific Name	Common Name	Status
1	*Sus scrofa*	Wild Boar	Common
2	*Canis aureus*	Jackal	Abundant
3	*Vulpes vulpes grifithii*	Kashmir Hill Fox	Uncommon
4	*Panthera pardus*	Common Leopard	Occasional
5	*Hystrix indica*	Porcupine	Common
6	*Petaurista petaurista*	Giant Red Flying Squirrel	Uncommon
7	*Hyloptes fimbriatus*	Small Kashmir Flying Squirrel	Uncommon
8	*Herpestes Javanicus*	Small Mongoose	Common
9	*Apodemus rusiges*	Wood Mouse	Uncommon
10	*Mus Musculus*	House Mouse	Common
11	*Rattus turkestanicus*	Turkestan Rat	Common
12	*Myotis muricola*	Dark Whiskered Bat	Common

Table 4: Coordinates and Numbers of Mammals in the Murree Biodiversity Park

S.No	Animal	Location	Numbers
1	Wild Boar	N 33 5441 E 73 2311	12
2	Jackal	N 33 5453.46 E 73 237.98	8
3	Himalayan Red Fox	N 33 5452.2 E 73 234.2	2
4	Common Leopard		-
5	Porcupine	N 33 54466.2 E 73 2312.3	5
6	Giant Red Flying Squirrel	N 33 5442.3 E 73 239.42	3
7	Small Kahsmir Flying Squirrel	N 33 5443.47 E 73 236.9	2
8	Small Mongoose	N 33 5449.05 E 73 2315.9	13
9	Wood Mouse	N 33 5441.94 E 73 2315.9	2
10	House Mouse	N 33 54466.2 E 73 2312.3	25
11	Turkestan Rat	N 33 5452.74 E 73 3211.50	2
12	Dark Whiskered Bat	N 33 5447.7 E 73 2312.6	4

THREATS TO WILDLIFE IN MURREE BIODIVERSITY PARK

1. Threats to Reptilian Fauna:

1. The requirement of wood and fodder, livestock's grazing (personal observations of horses grazing in the habitat of the species) and browsing, eating or trampling regenerated shoots of the herbs and bushes prevented the growth.

2. The increasing pressure of human population has badly affected the habitats and the environment putting severe pressure especially on those areas

adjoining to their villages. The local population thinning the forest has continually declined the quality of habitat.

3. Recreation, relaxation takes a number of forms. The increasing density of habitat roads and tracks has altered the natural habitat and causes massive erosion altering hill-sides scarred and denuded of vegetation.

2. Threats to Amphibian Fauna:

1. Human wastes, tetrapacks, wrappers, plastic bags and bottles, tin cans etc. from all habitations, hotels and shops are thrown on hillsides which immediately float to the nearby riparian zone and ultimately to the water bodies. These include the biodegradable materials which contaminate the water and are detrimental for the creatures that live in the water.

2. Population of this frog is very common in every type of small or large water bodies but today a great deal of pollutants in water largely affects the numbers. In this situation, mortality rate is increased and the population migrates for its sustenance to new ponds, however, their eggs or tadpoles are perished.

3. The frog and its tadpoles are commonly attacked by egrets, herons and other water visiting birds. It is also included in the dietary needs of several common snakes, varanids and crocodiles. Droughts and drainage of waterbodies largely affect the distribution of this species.

3. Threats to Avian Fauna:

1. Small water channels having sawage water of the Murree city pass through the park. This polluted water is a threat to the biodiversity of the park.

2. Deforestation and aforestation of exotic plants may cause negative effect on the wild fauna associated with native trees.

3. There is a graveyard within the area of park which may cause disturbances.

4. Threats to Mammalian Fauna:

1. As Murree is a summer resort and increased human population due to favorable weather conditions and that may cause disturbance in the area which may negatively affect the wildlife of the area.

2. Deforestation is going on unchecked which cause loss of habitat and food for wildlife.

3. Live-stock grazing and disturbance by fires natural or man-made

4. The sewage of northern side of Murree city passes through the park and it brings a lot of runoff toxic materials, plastics bags and other garbage. When the water flow decreases plastic bags accumulate in the Park and thus increase the toxicity of the water and that may harm most of the wildlife of the Park.

5. Electric poles pass through the Park which also has negative effect on the wildlife of the Park especially on flying squirrels.

6. The movement of the livestock and local people inside the Park disturb the normal activities of wildlife.

7. The presence of graveyard in the center of the Park will have negative effect on the fauna of the Park.

RECOMMENDATIONS

1. Live-stock grazing should be controlled in the Park area.
2. Electric poles pass through the Park which also has negative effect on the wildlife of the Park especially on flying squirrels so alternate arrangements should be made so that electric poles may not be passed from the Park.
3. The sewage of northern side of Murree city passes through the park and it brings a lot of runoff toxic materials, plastics bags and other garbage. The arrangements may be made so that plastic bags and other garbage may not accumulate in the Park area.
4. The movement of the livestock and local people inside the Park may be stopped which disturb the normal activities of wildlife.
5. The eastern and northern aspects of the Park are denuded of vegetation so afforestation may be started.
6. The fencing of Park area may be more fortified so that local people may not cross the Park area.
7. Seasonal studies during autumn and winter is recommended for reptiles and birds so that maximum number of species may be observed in Park area.

8. According to the local informers, the presence of a snake species and a lizard known as Calotes versicolor definitely occur in or surrounding the study site. We could not search it because of our short single survey. Therefore, it is suggested that immediately a field trip may be conducted because the present rainy days and following few days are most important to investigate if they exist in the site.