

Research Article

Wildlife diversity along the altitudinal gradients in the Garhwal Himalaya

Ravindra Singh¹, Renu Raturi¹, Rakesh Dhodi², Rashmi Dhodi², Sarvesh Uniyal², Sneha Sharma¹,
Ramchander Merugu³, Chandni Prasad¹, Akash Deep¹ and Rahul Kumar^{1,*}

¹Department of Environmental Sciences, H.N.B. Garhwal University (A Central University),
Srinagar Garhwal- 246174, Uttarakhand, India

²Centre for Mountain Tourism and Hospitality Studies, Chauras Campus, H.N.B. Garhwal University
(A Central University), P.O. Kilkeleshwar, Tehri Garhwal 249161, India

³Department of Biochemistry, Mahatma Gandhi University, Annaparthi, Nalgonda- 508254, Telangana State, India

(Received: July 27, 2020; Revised: January 27, 2021; Accepted: January 29, 2021)

ABSTRACT

Rich biodiversity is of fundamental significance for the foundation and adaptability of the precipitous biological system. In any case, this huge biodiversity begins vanishing at a quick rate because of human interference and over-exploitation of timberland and other common assets. The status of wildlife in Uttarakhand at Himalaya is much better than in other regions of India. But it becomes slowly disappearing due to the human encroachment and over-exploitation of forest and other natural resources. Musk Deer along the higher spans and Sambar, Yelping Deer, and so forth underneath the tree line are significant warm-blooded creatures. The present investigation was done in the Garhwal Himalayan region of Uttarakhand to uncover the effect of height and microclimatic conditions on wildlife. It is extremely vital and very fundamental for the individuals of the present era to go profoundly through the world of wildlife.

Key words: Altitudinal-gradient, birds, climate, wild animals, Uttarakhand.

INTRODUCTION

Physical attributes like temperature and altitudinal gradient impact the wide diversity and density of wildlife in the Uttarakhand state of India (Gairola *et al.*, 2011). Rich biodiversity is of paramount importance for the foundation and adaptability of the mountain ecosystem (Korner, 2004). The faunal diversity is very unique in Uttarakhand, as it is a Himalayan state (Kumari and Tewari, 2009). The Himalayan pheasant, Monal is the state bird of Uttarakhand that is one of the most wonderful feathered creatures found in the state. The Shivalik Slopes (a progression of scopes of external lower regions of Himalaya) is very rich in the number of inhabitants in Asiatic elephants. Tiger (*Panthera tigris*) the most charming and biggest cat in the world, has been reported from Dugadda, a little city in Pauri Garhwal located in the province of Uttarakhand (Jhala *et al.*, 2011). Human has been extremely excited about biodiversity since the beginning of human civilization. They chased the wildlife for their utilization, attire, fun, sports, enhancement and other monetary qualities. In India, the possibility of conservation and preservation of biodiversity (widely varied vegetation) has been a basic factor of religion and culture since antiquated history. The term and the idea of biodiversity have been remarkable events in recent culture evolution (NRCPB, 1992). The word "Biodiversity" did not exist twenty years ago but, today it is one of the most commonly

used expressions in biological science.

The term biodiversity alludes to the presence of a wide variety of flora and fauna (Clark *et al.*, 2014). The assortment of micro-climatic conditions accessible in the lower regions of Uttarakhand reflected in a wide assortment of common vegetation including different sorts of grasses, bushes and various types of wild creatures (Negi *et al.*, 2019). Diversity of surface relief resulting in sharp variations in temperature and rainfall mainly controls the conditions of growth, distribution and density of forest cover in the entire region (Nautiyal and Thapliyal, 2011, Adepoju *et al.*, 2019). Temperature, which is regulated or modified by the altitudinal variations particularly in the outer Himalayan ranges of the region, is primarily responsible for determining the pattern and spatial distribution of vegetation and habitat type throughout the area (Saikia *et al.*, 2017; Kharakwal *et al.*, 2005). As one move up from the low-lying Tarai belt to the Bhabar tract and a similar range in the north, different types of vegetation and numerous types of wildlife are generally found (Nautiyal, 2013). The natural life status in the Himalayan state is much better than in some other Himalayan states. But, this immense biodiversity begins vanishing at a quick rate because of the human encroachment and over-exploitation of forests and other natural resources (Hunter, 2007).

Numerous significant endeavors have been made so far to investigate the floral or plant diversity

*Corresponding Author's E-mail: rahul.khadwalia@gmail.com

along with an increase in the altitudinal gradient. This incorporates the work of Sánchez-González and López-Mata (2005) on plant diversity along the high altitude in Mexico; Kharkwal *et al.* (2005) on plant diversity and development in light of altitudinal gradient; Chawla *et al.* (2008) on plant assorted diversity along the increasing altitude; Sharma *et al.* (2009) on species richness and diversity along the altitudinal gradient in the Garhwal Himalaya; Fischer *et al.* (2011) on effect of altitudinal gradient in exploring the natural diversity; Nautiyal and Thapliyal (2011) on effect of micro-climatic conditions on plant diversity along the increasing altitude; Dehling *et al.* (2014) on important diversity of frugivorous feathered creatures along an altitudinal gradient; Khan and Ahsan (2015) on frugivorous birds and fruit plants located in a deciduous forest of Bangladesh; Willig and Presley (2016) on animal diversity along the altitudinal gradient; Zhang *et al.* (2016) on the species diversity along the elevation in the Northern China; Boscutti *et al.* (2018) on bush and plant assorted diversity along the altitude; Rawal *et al.* (2018) on diversity of plant species along the altitude in Uttarakhand; Behera *et al.* (2019) worked on the recent advancements in biodiversity and climate change. Hence, the literature available in the public domain proves that no applicable commitment has been made so far on the effect of microclimatic variations on the animal diversity along altitudinal gradients in the Garhwal Himalaya. In this way, the current research work on animal diversity and the micro-climatic factors influencing animal diversity along the altitudinal gradient in the Garhwal Himalaya is a lot of significance for topping off the hole in human information. The present study was carried out in the Garhwal Himalayan region of Uttarakhand to explore (i) the effect of elevation and micro-climatic conditions on animal diversity and (ii) evaluation of progress made by the Government to protect and conserve the animal diversity in the Uttarakhand Himalaya at different altitudes.

MATERIALS AND METHODS

Study area

The Garhwal Himalaya lies between latitude 29°26' to 31°28' N and longitude 77°4' to 80°6' E with a total covering area of about 30,000 Km². The region incorporates the districts of Uttarkashi, Chamoli, Rudraprayag, Tehri, Pauri, Haridwar and Dehradun. The monsoon commences towards the end of June and it stays up to the mid of September or till the end of the month. The winter season begins during the long stretch of December and it stays till the end of February. The period from April to June is known as the late spring time frame. October and November are known for the harvest time season. The zone of most extreme precipitation during both summer and winter lies between 1,200m to 2,100 m. The zone above 2,400 m encounters little measures of summer precipitation. Based on physiographic qualities, the Garhwal Himalaya might be gathered into the greater Himalaya, the Lower Himalaya and the Shivalik (Figure 1) and on the basis of altitude into five zones: Subtropical zone (below 1,200 m), Temperate zone (1,200 m-1,800 m), Sub-alpine forest zone (1,800 m-

3,000 m), Upper sub-alpine (3,000 m-4,200 m) and Alpine forest zone (3,000 m-4,500 m) (Figure 2). A significant piece of the Garhwal Himalaya is covered under forest, which constitutes an enormous wealth of the region.

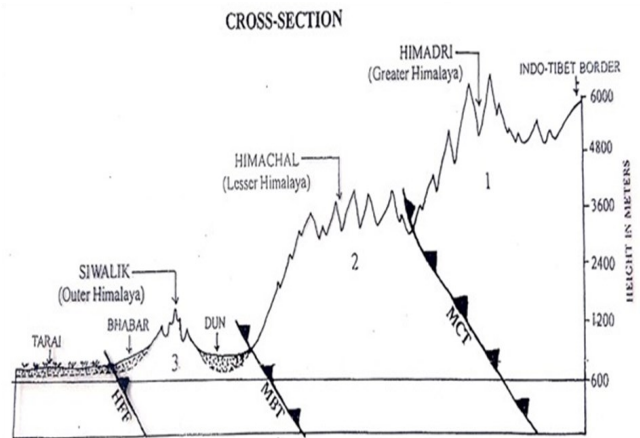


Figure 1. Physiographic divisions of Garhwal Himalaya

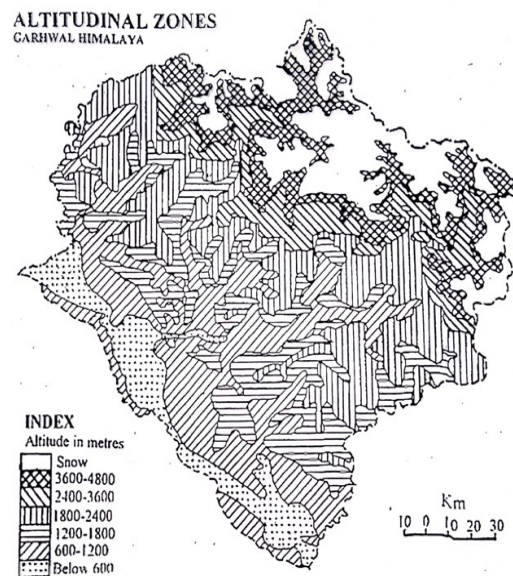


Figure 2. Altitudinal Zones of Garhwal Himalaya

A total of five observation sites (Kotdwara, Srinagar Garhwal, Khirsu, Ukhimath, and New Tehri) were identified for the current study (Figure 3). Kotdwara (latitude 29.75° N and longitude 78.53° E) is located at an elevation of 448 m above m.s.l. Its annual temperature ranged from 10°C to 40°C with an average annual precipitation of 2,374 mm. Srinagar Garhwal (latitude 30.23° N and longitude 78.80° E) is located at an elevation of 570 m above m.s.l. Its annual temperature ranged from 2°C to 44°C with an average annual precipitation of 1,371 mm. Ukhimath (latitude 30.28° N and longitude 78.98° E) is located at an elevation of 1,318 m above m.s.l. Its annual temperature ranged



Figure 3. Map showing location of Uttarakhand in India (left) and location of the study area in Uttarakhand (right).

from -2°C to 31°C with an average annual precipitation of 2,296 mm. Khirsu (latitude 30.22°N and longitude 78.87°E) is located at an elevation of 1,773 m above m.s.l. Its annual temperature ranged from -4°C to 33°C with an average annual precipitation of 2,180 mm. However, New Tehri (latitude 30.37°N and longitude 78.43°E) is located at an elevation of 1,698 m above m.s.l. Its annual temperature ranged between -3°C to 30°C with an average annual precipitation of 1,934 mm.

Field survey

To contemplate the wildlife (wild animal and avian) diversity along the altitudinal gradient, the whole study area was divided into three distinct zones: Sub-Montane Zone (up to 1,200 m above m.s.l.); Montane Zone (1,200 m to 3,000 m above m.s.l.) and Alpine Zone (3,000 m above m.s.l. to above). The present study was carried out for a time period of eight months from July 2017 to February 2018. The data was collected by visiting the study areas or field surveys at regular intervals. The description is also based on a collection made by the other authors or published literature, to represent the complete spectrum of the fauna. The animals were given zoological names identifying them from the published literature, however; vernacular names were gathered during the field visits under ethnozoological examinations of the region. Description of each species included habit, habitat and salient features were observed during the field visit and also gathered through personal interactions with the nearby residents & forest officials and published literature. The meteorological data was collected with the help of instruments by visiting personally and also collected from the instruments planted at regional meteorological data recording centers (G.I.C. Kotdwara, G.I.C. Srinagar Garhwal, G.I.C. Ukhimath, G.I.C. Khirsu and G.I.C. New Tehri). The air temperature of the study areas was recorded by using an advanced digital thermometer having a temperature range from -50°C to $+300^{\circ}\text{C}$. The relative

humidity was additionally recorded with the assistance of a hygrometer and precipitation with the help of a Rain Gauge.

RESULTS

Climatic Zones

In the foothills and Outer Himalayas, the climate is almost similar to subtropical Gangetic plains, except higher annual precipitation (200-250 cm per annum) and a lower average temperature of $19-21^{\circ}\text{C}$, covering the elevation 300-900 m. The Shivalik and Lower Montane Zone cover the elevation range of 900-1,800 m above m.s.l., with an average annual temperature of $14-18^{\circ}\text{C}$ and much higher precipitation (250-300 cm per annum). This zone represents a humid subtropical climate. The central part of the Montane Zone represents a cold temperature like climate and covers the elevation range of 1,800-2,400 m above m.s.l. with an average annual temperature of $10-14^{\circ}\text{C}$, and lower annual precipitation as compared to the earlier zone. This zone is characterized by more showers and occasional snowfall during winters. However, the Upper Montane Zone is colder, with an average annual temperature of $4.5-10^{\circ}\text{C}$, and covers the elevation range of 2,400-3,000 m above m.s.l. Annual precipitation is comparatively low, but the showers are gentle and more frequent. Winter experiences more frequent snowfall. Geo-Environmental Characteristics of different physiographic zones of the Garhwal Himalaya are given in Table 1.

Land Utilization

The land is a non-renewable, inelastic, and the most valuable resource in Uttarakhand. Due to an increase in the human population, and an increasing need for forestry products, the land has been overexploited. Grasslands and wastelands are highly denuded and lack semblance management. Such land uses are causing excessive runoff. The basic problem is to reduce the

Table 1. Geo-Environmental Characteristics of Different Physiographic Zones of the Garhwal Himalaya

Geo-Environmental Characteristics		Physiographic Divisions					
	Tarai	Bhabar	Shivaliks	Doons	Lower Himalayan Zone	Higher Himalayan Zone	Tethyan Himalayan Zone
1	2	3	4	5	6	7	8
Average Altitude (m)	200-300	300-400	700-1400	335-762	800-1500	1500-2700	2700-3600
Geology	Recent fine deposits	Pebbles, Cob- bles and Coarse material	Tertiary formations with great thickness of clays and con- glomerate. Mostly sandstones and con- glomerates	Unstratified and unassorted boul- der, pebbles, clays, alluvium, colluviums. Coarse material consists of quartz- ite and krol lime- stone	Granite and other crystalline rocks of unfossiliferous sedi- ments. Mostly phyl- lites, slates, ferrugi- nous, quartzite	Rock lacks fossils. Mostly granite, gneisses out- cropped within metamorphic phyl- lites	Complete sequence of fossiliferous stra- ta. Mostly mica schist, ferruginous slates, sandstones, limestone etc.
Wildlife	Tiger, Elephant, Deer, Leopard, Birds, Chital, Wild Boar, Hog Deer, Barking Deer	Tiger, Ele- phant, Deer, Leopard, Birds, Wild Hog Boar, Barking Deer	Tiger, Elephant, Deer, Leopard, Birds, Sambar, Chi- tal, Wild Boar, Hog Deer, Barking Deer	Tiger, Elephant, Deer, Leopard, Birds, Sambar, Chital, Wild Boar	Bear, Leopard, Goral, Sambar, Civet Cat, Chital, Serow, Khalij Peas- ant, Hog Deer	Brown and Black Deer, Pine Marten, Goral, Serow, Civ- et Cat, Thar, Musk Deer, Khalij Pheasant, Vultures, Eagles	Snow Leopard, Black and Brown Deer, Musk Deer, Civet Cat, Thar, Serow, Hangul, Snow Crow, Vul- tures and Goral
Soils	Luvissols consisted of layers of fine stiff material interstrati- fied with sand and stones	Regosols with high percentage of coarse mate- rial	Regosol, Cambisol, and Luvisol, well developed soil over alluvium	Humic, Acrisols, Regosols, Luv- isols, Cambisols	Cambisols and Reg- osols, Brown For- est Soils	Cambisols, Ac- risols and Gleysols, Brown Forest Soils, Pod- zolic, Meadow Soils	Cambisols, Bruni- zum, Brown Forest Soils, Dark Grey Soils

Table 2. Land Use in Uttarakhand

S. No.	Land Use	Area in Sq. km.	%
1	Reporting Area	53266	100
2	Forest	32280	60.6
3	User and Non Cultivable Waste	2876	5.4
4	Land pillow Non Agricultural Areas	1172	2.2
5	Cultivable Waste	3142	5.9
6	Permanent Pastures and Other Grazing Lands	2610	4.9
7	Other Fallow Land Net Area Sown	7031	13.2
8	Area Sown more than once	4155	7.8

Table 3. Variation in the Diversity of Mammals and their Natural Habitat in Garhwal Himalaya

Sl. No.	Name	Zoological Name	Habitat
1	Snow Leopard	<i>Panthera unica</i>	From 3000 m to 5000 m
2	Tiger	<i>Panthera tigris</i>	Up to 1200 m
3	Jungle Cat	<i>Felis chaus affinis</i>	Up to 2800 m
4	Leopard Cat	<i>Felis bengalensis</i>	Up to 250 m
5	Fishing Cat	<i>Prionailurus viverrinus</i>	Up to 1200 m
6	Sloth Bear	<i>Melursus ursinus</i>	Up to 1000 m
7	Himalayan Black Bear	<i>Ursus thibetanus laniger</i>	From 1000 m to 3000 m
8	Small Indian Civet	<i>Viverricula indica wellsi</i>	Up to 800 m
9	Himalayan Palm Civet	<i>Paguma larvata gayi</i>	From 700 m to 3500 m
10	Jackal	<i>Canis aureus</i>	Up to 3500 m
11	Indian Fox	<i>Vulpes bengalensis</i>	Up to 1500 m
12	Red Fox	<i>Vulpes vulpes montana</i>	From 1300 m to 4000 m
13	Common Otter	<i>Lutra lutra monticola</i>	From 800 m to 2700 m
14	Indian Hare	<i>Lepus nigricollis ruficaudatus</i>	Up to 2800 m
15	Indian Elephant	<i>Elephas maximus indicus</i>	Up to 450 m
16	Nilgai	<i>Boselaphus tragocamelus</i>	Up to 900 m
17	Hog Deer	<i>Axis porcinus</i>	Up to 1000 m
18	Spotted Deer	<i>Axis axis</i>	Up to 800 m
19	Barking Deer	<i>Muntiacus muntjak vaginalis</i>	From 400 m to 2700 m
20	Musk Deer	<i>Moschus chrysogaster</i>	From 2400 m to 4200 m
21	Indian Wild Boar	<i>Sus scrofa cristatus</i>	Up to 2800 m
22	Common Langur	<i>Presbytis entellus entellus</i>	Up to 3500 m
23	The Himalayan Thar	<i>Hemitragus jemlahicus</i>	From 2400 m to 4000 m

enormous losses of water, which causes floods, soil erosion, and landslides. The land comprises the physical environment including climate, relief, soils, hydrology, and vegetation to the extent that these influence potential for land use. Land use is a subdivision of land in its major uses such as agriculture, forest, grassland, recreational land, etc. in Uttarakhand. Agriculture is not mainland use. Table 2 represents the land use data in the state of Uttarakhand.

Animal Diversity

Important Mammals found in Uttarakhand Himalaya

The mammalian fauna of the ecosystem is most fascinating and diverse because of varied ecological conditions at different altitudes (Table 3 and Table 4). Over 100 major species of mammals are known to occur presently, some of which are greatly endangered. The description of some important wildlife mammals of Uttarakhand Himalaya is given below. Altitudinal Distribution of animal Diversity in Different Microclimatic Zones of Garhwal Himalaya is given in Figure 4.

Table 4. Distribution of Wild Mammals in different Microclimatic Zones of Garhwal Himalaya

Microclimatic Zone	Common Name	Zoological Name
Tropical (300-900 m)	Tiger	<i>Panthera tigris tigris</i> (Linnaeus, 1758)
	Leopard Cat	<i>Felis bengalensis</i> (Kerr, 1722)
	Jungle Cat	<i>Felis chaus affinis</i> (Guldenstaedt, 1776)
	Sloth Bear	<i>Melursus ursinus</i> (Meyer, 1973)
	Nilgai	<i>Boselaphus tragocamelus</i>
	Indian Elephant	<i>Elephas maximus indicus</i> (Linnaeus, 1758)
	Small Indian Civet	<i>Viverricula indica wellsi</i> (Pocock, 1933)
	Indian fox	<i>Vulpes bengalensis</i> (Blyth, 1845)
	Rhesus Macaque	<i>Macaca mulatta villosa</i> (Zimmerman, 1780)
	Fishing Cat	<i>Felis viverrina</i> (Bennett, 1833)
	Common Langur	<i>Presbytis entellus entellus</i> (Dufrene, 1797)
	Indian Porcupine	<i>Hystrix indica</i> (Kerr, 1792)
	Jackal	<i>Canis aureus</i> (Linnaeus, 1758)
	Indian Hare	<i>Lepus nigricollis ruficaudatus</i> (Pearson, 1839)
	Leopard	<i>Panthera pardus</i> (Linnaeus, 1758)
	Indian Wild Boar	<i>Sus scrofa cristatus</i> (Wagner, 1839)
	Spotted Deer	<i>Axis axis</i>
Hog Deer	<i>Axis porcinus</i>	
Indian Pangolin	<i>Manis crassicaudata</i>	
Warm Temperate (900-1800 m)	Leopard Cat	<i>Felis bengalensis</i> (Kerr, 1792)
	Jungle Cat	<i>Felis chaus affinis</i> (Guldenstaedt, 1776)
	Leopard	<i>Panthera pardus</i> (Linnaeus, 1758)
	Jackal	<i>Canis aureus</i> (Linnaeus, 1758)
	Indian fox	<i>Vulpes bengalensis</i> (Blyth, 1845)
	Indian Hare	<i>Lepus nigricollis ruficaudatus</i> (Pearson, 1839)
	Sambar	<i>Cervus unicolor</i> (Kerr, 1792)
	Indian Wild Boar	<i>Sus scrofa cristatus</i> (Wagner, 1839)
	Common Langur	<i>Presbytis entellus entellus</i> (Dufrene, 1797)
	Rhesus Macaque	<i>Macaca mulatta villosa</i> (Zimmerman, 1780)
	Common Otter	<i>Lutra lutra monticola</i> (Hodgson, 1839)
	Clawless Otter	<i>Aonyx cinerea concolor</i> (Illger, 1815)
	Barking Deer	<i>Muntiacus Muntijakevaganalis</i> (Zimmerman, 1780)
Himalayan Palm Civet	<i>Paguma larvata gayi</i> (Smith, 1827)	
Goral	<i>Naemorhedus goral goral</i> (Hardwick, 1825)	
Indian Porcupine	<i>Hystrix indica</i> (Kerr, 1792)	
Cold Temperate (1800-2400 m)	Wild Pig	<i>Sus scrofa</i> (Linnaeus, 1758)
	Leopard	<i>Panthera pardus</i> (Linnaeus, 1758)
	Jungle Cat	<i>Felis chaus affinis</i> (Guldenstaedt, 1776)
	Leopard Cat	<i>Felis bengalensis</i> (Kerr, 1792)
	Jackal	<i>Canis aureus</i> (Linnaeus, 1758)
	Red Fox	<i>Vulpes vulpes montana</i> (Linnaeus, 1758)
	Serow	<i>Capricornis sumatraensis</i> (Bechsteem, 1799)
	Himalayan Weasel	<i>Mustela sibirica</i>
	Himalayan Black Bear	<i>Ursus thibetanus laniger</i> (G. Cuvier, 1823)
	Common Otter	<i>Lutra lutra monticola</i> (Hodgson, 1839)
	Clawless Otter	<i>Aonyx cinerea concolor</i> (Illger, 1815)
	Goral	<i>Naemorhedus goral goral</i> (Hardwick, 1825)
	Sambar	<i>Cervus unicolor</i> (Kerr, 1792)
	Common Langur	<i>Presbytis entellus entellus</i> (Dufrene, 1797)
	Rhesus Macaque	<i>Macaca mulatta villosa</i> (Zimmerman, 1780)
	Himalayan Palm Civet	<i>Paguma larvata gayi</i> (Smith, 1827)
	Barking Deer	<i>Muntiacus muntijakevaganalis</i> (Zimmerman, 1780)
Indian Porcupine	<i>Hystrix indica</i> (Kerr, 1792)	
Indian Wild Boar	<i>Sus scrofa cristatus</i> (Wagner, 1839)	

Table 4 continued in next page

Cold (2400-3000 m)	Himalayan Musk Deer	<i>Moschus chrysogaster</i> (Hodgson, 1839)
	Leopard	<i>Panthera pardus</i> (Linnaeus, 1758)
	Jungle Cat	<i>Felis chaus affinis</i> (Guldenstaedt, 1776)
	Himalayan Black Bear	<i>Ursus thibetanus laniger</i> (G. Cuvier, 1823)
	Jackal	<i>Canis aureus</i> (Linnaeus, 1758)
	Red Fox	<i>Vulpes vulpes montana</i> (Linnaeus, 1758)
	Common Otter	<i>Lutra lutra monticola</i> (Hodgson, 1839)
	Clawless Otter	<i>Aonyx cinerea concolor</i> (Illger, 1815)
	Himalayan Weasel	<i>Mustela sibirica</i>
	Serow	<i>Capricornis sumatraensis</i> (Bechsteem, 1799)
	Himalayan Tahr	<i>Hemitragus jemlahicus jemlahicus</i> (Hodgson, 1841)
	Common Langur	<i>Presbytis entellus entellus</i> (Dufrene, 1797)
	Indian Porcupine	<i>Hystrix indica</i> (Kerr, 1792)
Indian Hare	<i>Lepus nigricollis ruficaudatus</i> (Geoffroy, 1826)	
Alpine (3000-4000 m)	Himalayan Tahr	<i>Hemitragus jemlahicus jemlahicus</i> (Hodgson, 1841)
	Himalayan Black Bear	<i>Ursus thibetanus laniger</i> (G. Cuvier, 1823)
	Blue Sheep or Bharal	<i>Pseudois nayaur</i> (Hodgson, 1833)
	Leopard	<i>Panthera pardus</i> (Linnaeus, 1758)
	Snow Leopard	<i>Panthera unica</i> (Schreber, 1775)
	Himalayan Mouse-Hare	<i>Ochotona roylei</i> (Ogilby, 1839)
	Himalayan Musk Deer	<i>Moschus chrysogaster</i> (Hodgson, 1839)
	Jackal	<i>Canis aureus</i> (Linnaeus, 1758)
	Red Fox	<i>Vulpes vulpes montana</i> (Linnaeus, 1758)
	Brown Bear	<i>Ursus arctos</i> (Linnaeus, 1758)
	Common Langur	<i>Presbytis entellus entellus</i> (Dufrene, 1797)
Himalayan Weasel	<i>Mustela sibirica</i>	
Glacial (4000—4800 m)	Himalayan Tahr	<i>Hemitragus jemlahicus jemlahicus</i> (Hodgson, 1841)
	Blue Sheep or Bharal	<i>Pseudois nayaur</i> (Hodgson, 1833)
	Snow Leopard	<i>Panthera unica</i> (Schreber, 1775)
	Himalayan Mouse-Hare	<i>Ochotona roylei</i> (Ogilby, 1839)
	Himalayan Musk Deer	<i>Moschus chrysogaster</i> (Hodgson, 1839)
	Brown Bear	<i>Ursus arctos isabellinus</i> (Linnaeus, 1758)
Himalayan Weasel	<i>Mustela sibirica</i>	
Above 4800 m	Blue Sheep or Bharal	<i>Pseudois nayaur</i> (Hodgson, 1833)
	Snow Leopard	<i>Panthera unica</i> (Schreber, 1775)

Table 5. Primates of Uttarakhand Himalaya and their status

Species	Habitat	Food	Main Threat	Status	Distribution	Characteristic Features
<i>Rhesus macaque</i> (Bandar): <i>Macaca mulatta</i>	Forests, orchards and around human habitations	Flowers, fruits, grains, insects and scraps discarded by humans.	Diminishing habitat and human encroachment	Endangered	All over the Uttarakhand Himalaya	<i>Rhesus macaque</i> or Bandar has a yellowish coat tinged with red, especially at the rear and a relatively short curved tail. Bright red shin on the buttocks and generation is a further characteristic
Common Langur or Hanuman Monkey: <i>Presbytis entellus entellus</i>	Close to water founding regions and near to forest dweller	Fruits, buds, shoots and young leaves of plants	Human encroachment and demising habitat	Threatened	All over the Uttarakhand Himalaya.	This is larger monkey than the macaque and has a longer tail and limbs, being more arboreal than the latter. The coat is an ashy grey color with a black face and very white bushy forehead

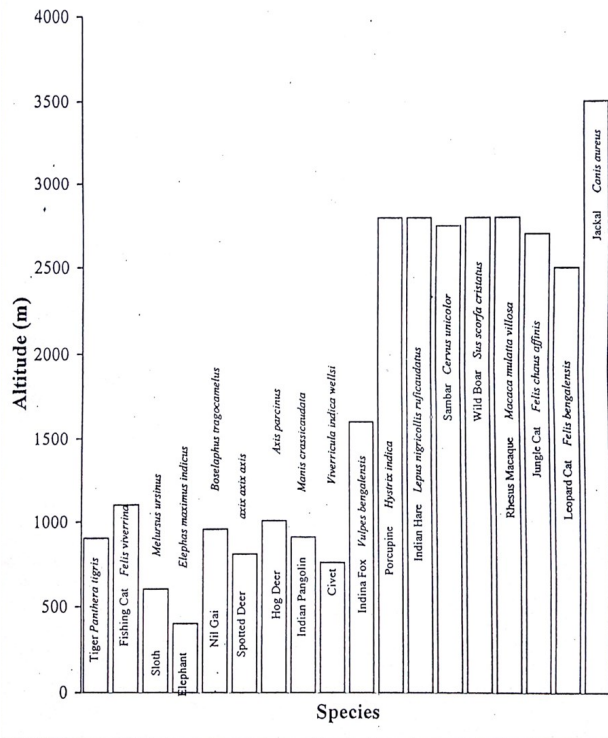


Figure 4. Altitudinal Distribution of Mammalian Diversity in Different Microclimatic Zones of Garhwal Himalaya.

Primates:

Apes, monkeys, and men are known as primates. The term primates referring to the highest order of mammals were first used by the naturalist Carl Linnaeus (1707-1778), to indicate that these animals are the primary animals that are superior to others. The brains of the primates are more highly developed than those of other mammals. A brief account of the primates in Uttarakhand Himalaya and their status is given below in Table 5.

The Cat Family:

The domestic cat, the lion, and the leopard belong to the same family, Felidae. They are the most adapted carnivores, with an agile body built for speed, teeth specially designed to bite and tear flesh (but not for chewing), and sharp claws to strike and hold the prey. There are a number of other members of the cat family such as a marbled cat, golden cat, leopard cat, fishing cat, jungle cat, desert cat, etc. On account of habitat loss and poaching, almost all members of the cat family are endangered today (Table 6).

The Bear Family:

The bears include the large, modern land-dwelling carnivorous or eaters. All bears have heavy long fur and stubby tails. The skeleton is massive. The limbs are strong and are furnished with powerful claws for digging and fighting (Table 7).

Table 6. Cat Family of Uttarakhand Himalaya and their status

Species	Length	Weight	Habitat	Food	Life Span	Main Threat	Status	Distribution	Characteristic Features
Tiger (Bagh, Sher): <i>Panthera tigris</i>	279-290 cm (between pegs)	180-230 kg (average)	Open jungles, deciduous forests, evergreen jungles and mangrove forests	Sambar, other deer, Gaur, Antelope, Wild boar etc.	15-20 years	Poaching and diminishing habitat	Endangered	All over Uttarakhand Himalaya	Among the most magnificent animals of the cat family, characterized by rich-colored well-striped animal, nocturnal in habit. It has been declared as the national animal of India
Leopard or Panther (Guldar) <i>Panthera pardus</i>	100-150 cm (Average)	90-110 kg	Forest, scrub jungles and semi desert or rocky and treeless areas	Deer, monkey, cattle, rodents, birds, reptiles etc.	15-20 years	Poaching and diminishing habitat	Threatened	All over Uttarakhand Himalaya	The leopard is one of the most beautiful and agile animals, characterized by generally having a rich, sleek, yellowish, or grayish coat marked with small black rosettes.
Snow leopard: <i>Panthera uncia</i>	100-110 cm (body)	36-40 kg (average)	Highest inner ranges of the Himalaya	Wild sheep, ibex and marmot	15-18 years (approx.)	The skins of the snow leopard are fashion items and hence these animals are hunted down	Endangered	All regions of Himalaya	The snow leopard is one of the most beautiful members of the cat family. Its fur is stone gray with elongated black rings and black spots and lines on the spine. It has a creamy white belly.

Table 7. Bear Family of Uttarakhand Himalaya and their status

Species	Height	Weight	Habitat	Food	Life Span	Main Threat	Status	Distribution	Characteristic Features
Sloth Bear: <i>Melursus ursinus</i>	82 cm at shoulder	150-175 kg (average)	Rocky terrain and forest close to sources of water	Fruits, flowers, tubers, honey, white ants, bird's eggs etc	15-20 years	Habitat loss and Poaching	Endangered	All over the Uttarakhand Himalaya	The sloth bear has a long coarse and shaggy black hair and a 'V' shaped white mark on the chest. It has a broad head and a long muzzle making the face triangular in appearance. The legs are bowed with flat feet ending in long whitish claws on the fore.
Himalayan Brown Bear: <i>Ursus arctos isabellinus</i>	90 cm at shoulder	170-230 kg (average)	North-western and central areas of the Uttarakhand Himalaya	Wild fruits, berries, rats, insects and sometimes big animals	20-30 years	Fur poachers	Endangered	Only in the Himalayan region of India	Characterized by a brown coat which during winter is thick and shaggy but gets shorter and darker in summer. Slight variations of color occur, ranging from brown to reddish-brown or silvery grey.

Herbivore Animals:

The large number of herbivore animals that we have in Uttarakhand includes elephants, buffaloes, and a wide variety of deer. Varying in size and form, they are adapted to survive in different habitats and feed on a variety of plant species. Their teeth are modified for a vegetarian diet and their digestive system has special features to suit their feeding habit. The description of the main wildlife faunal species of this family is given below (Table 8).

Important Birds found in Uttarakhand Himalaya

Ranging from mysteries of migration to the marvels of nest building the fascinating world of birds is full of color, beauty, romance, and music.

Birds are the only animals with feathers. Their forelimbs are modified into wings that enable them to fly. 528 species of birds have been reported from the Himalayan ecosystem, which includes pheasant hill stream birds, forest birds, and a large number of water birds. A number of migratory waterfowl from the temperate regions visit the natural lakes and manmade wetlands in this region in lakhs during winter. The description of birds of Uttarakhand Himalaya is as follows (Table 9-11).

Description of National Parks and Wildlife Sanctuaries in Uttarakhand Himalaya**National Parks**

A national park is a park in use for conservation purposes, created and protected by national governments. Often it is a reserve of natural, semi-natural, or developed land that a sovereign state declares or owns (Table 12-13).

A. Corbett National Park:

India's first and the finest national park spread over 530.82 sq. km. along the banks of Ram Ganga River, just 300 km northeast of Delhi in the foothills of the Himalaya is the Corbett National Park established initially as Haily National Park on August 8, 1936, in honor of Sir Malcolm Haily the governor of united provinces. But since 1956 it is known as Corbett National Park in honor of Jim Corbett.

B. Gangotri National Park:

It is located in Uttarkashi District in the upper ranges at a distance of 102 km from Uttarkashi. It covers an area of 239 sq. km. initially, it is established as a protected area but later it is declared as a national park.

C. Govind National Park:

It is located in the Uttarkashi district at a distance of about 190 Km. from Dehradun. It covers an area of about 472.08 sq. km.

D. Nanda Devi National Park:

Spread over an area of 630 sq. km. just next to the Nanda Devi Peak (which is the second-highest mountain peak in India 7816 m) is the Nanda Devi National Park. It is located in Chamoli district. It covers an area of about 650 sq. km.

E. Rajaji National Park:

Covering an area of about 820 sq. km. established in 1966 on the edge of the Dehradun valley. It is located in the Dehradun district.

Table 8. Herbivore Animals of Uttarakhand Himalaya and their status

Species	Height	Weight	Habitat	Food	Life Span	Main Threat	Status	Distribution	Characteristic Features:
Asian Elephant: <i>Elephas maximus</i>	305 cm at shoulder (average)	4,000-5,000 kg (average)	Foothills of Uttarakhand Himalaya	Wood plants, palms, bamboo and other grasses	70-80 years	Ivory, poachers, shrinkage and fragmentation of habitat	Endangered	Doon valley and dome parts of Kumaon region	The largest of all living land animals, the elephants are known from the dawn of civilization in India. Elephants are featured with tusks variably 13 cm long (average).
Chital or Spotted Deer: <i>Axis axis</i>	90 cm at shoulder (average)	85 kg (average)	Light forest and plains country with open land	Grasses, leaves, fruits and shrubs	15-20 years	Carnivores such as tiger, leopard and wild dog	Protected (Common)	All over Uttarakhand Himalaya	Considered one of the most beautiful deer in the world. The chital is the chief prey animal of carnivores.
Sambar: <i>Cervus unicorn</i>	150 cm at shoulder (average)	225-320 kg (average)	Hilly and plain forest with open grassy land for grazing	Grasses, leaves, fruits of shrubs	15-20 years	Habitat loss and hunting	Endangered	Foothills and in Doon valley of Uttarakhand Himalaya	Sambar is the largest Indian deer. Males being darker than females and bearing a rugged pair of three times antlers.
Nilgai or Blue Bull: <i>Boselaphus tragocamelus</i>	Height: 150 cm at shoulder (average)	Weight: 250-280 kg (average)	Habitat: Dry savanna grassland and thorny scrub	Food: Leaves, grasses, fruits of shrubs	15-20 years	Habitat degradation and hunting	Status: Threatened	South side of the Shivaliks, possibly representing a relict population from the adjacent hills	The mature adult has a striking shiny coat of dark steel grey, sometimes with a bluish tinge. It also bears a tuft of dark hairs on the throat and a pair of short, forwardly directed horns, which look too small for such a heavy muscular animal. Both males and females have white socks and a white throat patch
Musk Deer: <i>Moschus moschiferus</i>	150cm at shoulder (average)	75 kg (average)	Slippery and rocky grounds	Leaves, grasses and shrubs	7-8 years	Hunting	Highly endangered	High altitudes of Uttarakhand Himalaya	Musk deer is characterized by the presence of globular musk gland in the male species located beneath the skin of the abdomen near the navel. The musk has a strong odor which helps to attract the female during the breeding season and moving at night. It is declared as the State Animal of the Uttarakhand
Wild Boar (Suar): <i>Sus scrofa</i>	40 cm at shoulder (average)	70 kg (average)	In foothills, Shivalik forest and adjacent scrub forest of Uttarakhand Himalaya	Fleshy stem, roots, carrion and even insects	8-15 years	Hunting and loss of habitat	Endangered	All over Uttarakhand Himalaya	A typical pig in appearance, the wild boar has sparse coarse hair of a grayish-brown color and a mane of stiff bristles down the neck and back, males tend to be very dark or even black in color and are armed with heavy rushes

Table 9. Variation in the Diversity of Avian fauna and their Natural Habitat in Garhwal Himalaya

Sl. No.	Name of Birds	Scientific Name	Status	Habitat
1	Crested Honey Buzzard	<i>Pernis ptilorhynchus</i>	RM	Up to 1800 m
2	Pariah Kite	<i>Milvus migrans</i>	R	Lower areas
3	Large Indian Kite	<i>Milvus migrans govinda</i>	RM	Up to 2400 m
4	Sparrow Hawk	<i>Accipiter nisus</i>	RM	Lower areas
5	Himalayan Golden Eagle	<i>Aquila chrysaetos daphanea</i>	R	From 1800m to 5000 m
6	Black Eagle	<i>Ictinaetus malaiensis</i>	R	Up to 2700 m
7	Black or King Vulture	<i>Sarcoramphus papa</i>	R	Up to 2700 m
8	Himalayan Griffon Vulture	<i>Gyps himalayensis</i>	R	Up to 2500 m
9	Scavenger Vulture	<i>Neophron percnopterus</i>	RM	Up to 3600 m
10	Crested Serpent Eagle	<i>Spilornis cheela</i>	R	Lower area of Sanctuary
11	Snow Partridge	<i>Lerwa lerwa</i>	R	In Bugyals (2000 m to 5000 m)
12	Himalayan Snow Cock	<i>Tetraogallus himalayensis</i>	R	From 2400 m to 5000 m
13	Black Partridge	<i>Melanoperdix niger</i>	R	Up to 2000 m
14	Rufous throated Hill Partridge	<i>Arborophila rufogularis</i>	R	Up to 2400 m
15	Red Jungle Fowl	<i>Gallus gallus</i>	R	In moist deciduous forests and scrub jungle
16	Koklass Pheasant	<i>Pucrasia macrolopha</i>	R	From 1000 m to 4200 m
17	Cheer Pheasant	<i>Catreus wallichii</i>	R	From 1500 to 3500 m
18	Woodcock	<i>Scolopax</i>	RM	From 2000 m to 4000 m
19	Wedge-tailed Green Pigeon	<i>Treron sphenurus</i>	R	Up to 2500 m
20	Orange-breasted Green Pigeon	<i>Treron bicinctus</i>	R	Lower areas
21	Green Imperial Pigeon	<i>Ducula aenea</i>	R	In Evergreen Moist deciduous forests
22	Himalayan Snow Pigeon	<i>Columba leuconota</i>	R	From 3000 m to 4500 m
23	Speckled Wood Pigeon	<i>Columba hodgsonii</i>	R	From 1800 m to 4000 m
24	Rufous Turtle Dove	<i>Streptopelia orientalis</i>	RM	Up to 4000 m
25	Indian Ring Dove	<i>Streptopelia capicola</i>	R	In lower areas
26	Indian Spotted Dove	<i>Spilopelia chinensis</i>	R	In lower areas
27	Indian Emerald Dove	<i>Chalcophaps indica</i>	R	In Evergreen Moist deciduous forests
28	Large Hawk Cuckoo	<i>Hierococcyx sparveriioides</i>	RM	From 1200 m to 3200 m
29	Indian Cuckoo	<i>Cuculus micropterus</i>	RM	In Evergreen and deciduous forests
30	Spotted Scops Owl	<i>Otus spilocephalus</i>	R	Up to 270m
31	Himalayan Wood Owl	<i>Strix newarensis</i>	R	Up to 4000 m
32	Himalayan Pied Kingfisher	<i>Megaceryle lugubris</i>	R	Up to 2000 m
34	Little Green Bee Eater	<i>Merops orientalis</i>	R	In lower areas
35	Fulvous-breasted woodpecker	<i>Dendrocopos macei</i>	R	Up to 2000 m
36	Red-rumped Swallow	<i>Cecropis daurica</i>	RM	In lower areas
37	Black drongo	<i>Dicrurus macrocercus</i>	R	In deciduous forests
38	Common or Indian Myna	<i>Acridotheres tristis</i>	R	In lower areas
39	Jungle Myna	<i>Acridotheres fuscus</i>	R	In lower areas
40	Jungle Crow	<i>Corvus macrorhynchos</i>	R	In all forests
41	White cheeked Bulbul	<i>Pycnonotus leucotis</i>	R	Up to 3500 m
42	Great Parrotbill	<i>Conostoma aemodium</i>	R	From 2000 m to 3600 m
44	Spotted Bush Warbler	<i>Locustella thoracica</i>	R	Up to 3400 m
45	Pallas's Leaf Warbler	<i>Phylloscopus proregulus</i>	R	From 2200 m to 4500 m
46	Indian Blue Chat	<i>Larvivora brunnea</i>	RM	Dense under growth in open oak and conifer forests
47	Blue -Capped Rock Thrush	<i>Monticola cinclorhyncha</i>	RM	Open forests and rocky slopes, in winters evergreen and moist deciduous forests
49	Black Bird	<i>Turdus merula</i>	RM	From 3000 m to 4500 m
50	Himalayan Brown Dipper	<i>Cinclus pallasii</i>	R	From 1200 m to 5000 m

Table 9 continued in next page

51	Coal Tit	<i>Periparus ater</i>	R	From 1800 m to 3600 m
52	Himalayan Tree Creeper	<i>Certhia himalayana</i>	R	Pine, Deodar, Fir and Spruce forests
53	Himalayan Cinnamon Sparrow	<i>Passer cinnamomeus</i>	R	Up to 2700 m
54	Common Rosefinch	<i>Carpodacus erythrinus</i>	R	In rocky bush covered slopes
55	Dark-breasted Rosefinch	<i>Procarduelis nipalensis</i>	R	In rocky bush covered slopes
56	Pink Browed Rose Finch	<i>Carpodacus rodochroa</i>	R	Up to 4200 m
57	White Browed Rose Finch	<i>Carpodacus thura</i>	R	Up to 4200 m
58	Rock Bunting	<i>Emberiza cia</i>	RM	Up to 4200 m
59	Black Headed Bunting	<i>Emberiza melanocephala</i>	RM	Up to 2700 m
60	Crested Bunting	<i>Emberiza lathami</i>	R	From 1200 m to 1800 m

Abbreviations: R- Resident; RM- Resident Migrant

Table 10. Avian diversity of Uttarakhand Himalaya and their status

Species	Size	Habitat	Food	Major Threat	Status	Distribution	Characteristic Features
Himalayan Monal Pheasant: <i>Lophophorus impejanus</i>	68 cm (average)	Higher regions of Uttarakhand Himalaya	Fruits, figs, insects, worms etc.	Poaching and habitat loss	Endangered	Uttarkashi, Chamoli, Rudraprayag and hilly region of Uttarakhand	The male Monal pheasant is a brilliantly colored bird with metallic green feathers, long green colored crest and purple-blue throat and neck. The female is brown, molted and streaked with darker and lighter browns. It is declared as State Bird of Uttarakhand
Himalayan Pled Kingfisher: <i>Megaceryle lugubris</i>	41 cm (average)	Mountain Rivers	Insects, worms, fruits, figs, berries, fishes, etc.	Pollution and habitat loss	Endangered	Resident Himalayan, all stagnant inland water	Evenly barred wings and tail lacks super cilium and spotted breast. It is met with at all stagnant inland waters. Its method of fishing hovering stationary ten meters or so up in the air, standing on its tail and dropping like a plummet upon fish within striking depth is a fascinating and spectacular performance
Cheer Pheasant: <i>Catreus wallichii</i>	50 cm (average)	Higher region and in scrub forest	Fruits, cereals, figs, insects etc.	Human encroachment and Habitat destruction	Endangered	High altitude of Garhwal Himalaya	Distinguished by its long tail, long narrow and backwardly directed crest which is blackish-brown in color. The feathers are buffy white and pale rusty in color. The female is comparatively smaller.
The White Breasted Kingfisher: <i>Halcyon smyrnensis</i>	45 cm.	Far inland and largely independent of water	Terrestrial insect, lizard, mice etc.	Human encroachment and Habitat destruction	Endangered	Around the Doon valley and in Shivalik forest	About the same size as the pied kingfisher is brilliant turquoise above with chocolate brown neck and parts except for a glistening shirt front
The Golden Backed Woodpecker: <i>Dinopium benghalense</i>	51 cm	On the tree trunks in open wood country, orchards, plantation etc	Insects, worms, ants etc.	Demising habitat and encroachment	Endangered	Middle and lower region of Uttarakhand Himalaya	It is golden yellow and black above, buffy white below boldly streaked with black especially on the breast, the throat is black with fine white streaks and spots. The crown and the occipital crest are crimson in the male, in the female the fore crown is black finely stippled with white, with only a red tuft on the hind crown
The Pygmy Collared Owlet: <i>Glaucidium brodiei</i>	20-30 cm (Average) Weight: 1-2 kg (approx)	Hill forest from about 6,000 to 10,000 feet	Small birds, insects, lizards etc.	Habitat destruction and human encroachment	Endangered.	Hilly region of Uttarakhand Himalaya	The pigmy collared owlet is not very nocturnal but is more frequently heard than seen

Table 10 continued in next page

Indian Great Horned Eagle Ghughu Owl: <i>Bubo bengalensis</i>	20-25 cm. Weight: 2-3 kg (approx)	Woodland and grassy hill forest	Rodents	Habitat destruction and shortage of food	Endangered	Hilly region of Uttarakhand Himalaya	The Indian great horned or Eagle-owl is a nocturnal bird, which has two horns that are started from its forehead. They also evolved special feathers that allow them to fly silently, to supplement their acute sight which enabled them to hunt at night
The Hoo Poe: <i>Upupa epops</i>	20 cm (average)	Grassy fields and open forest	Grass, fruit, insect and larvae	Habitat destruction and use of pesticides	Endangered	All over Uttarakhand Himalaya	The remarkable bird, with its full crest and with plumage bore with the black site and amber is common in Uttarakhand. It feeds largely on grassy lawns, digging up cockchafer and other larvae
Pea Fowl or Mor: <i>Pavo cristatus</i>	40-50 cm (average)	Grassy fields and open forest	Insects, frogs, larvae, lizards etc	Hunting, habitat destruction, loss of food etc	Endangered (Protected)	Around the Doon valley and Kumaon Uttarakhand Himalaya	This is magnificent bird used to be extremely common in Doon valley and Kumaon hills, and with a little protection, it would soon be again very numerous. The nature of the country, with its scattered woods, perennial streams and cultivated areas are ideal

Table 11. Distribution of Avian fauna in Different Microclimatic Zones of Garhwal Himalaya

Microclimatic Zones	Common Name	Zoological Name
Sub Tropical (300-600 m)	Crow Billed Drongo Black Crested Yellow Bulbul Brown-eared Bulbul Great Parrotbill Black-throated Sunbird	<i>Dicrurus annectans</i> <i>Pycnonotus melanicterus</i> <i>Hypsipetes flavalus</i> <i>Conostoma aemodium</i> <i>Aethopyga saturata</i>
Tropical (600-1200 m)	Small Niltava White Crested Laughingthrush Himalayan Treepie Red Billed Blue Magpie Lesser Racket Tailed Drongo	<i>Niltava macgrigoriae</i> <i>Garrulax leucolophus</i> <i>Dendrotocitta formosae</i> <i>Urocissa erythrorhyncha</i> <i>Dicrurus remifer</i>
Warm Temperate (1200-2400 m)	Common Hill Partridge Large Hawk Cuckoo Himalayan Pied Wood Pecker Yellow Browed Tit Crested Black Tit	<i>Arborophila torqueola</i> <i>Cuculus sparveriodes</i> <i>Dendrocopos himalayensis</i> <i>Sylvi parus modestus</i> <i>Parus melanolophus</i>
Cold Temperate (2400-3000 m)	Monal Pheasant Cheer Pheasant Golden Bush Robin White Browed Bush Robin Tree Creeper Pink Browed Rosefinch	<i>Lophophorus impejanus</i> <i>Catreus wallichii</i> <i>Tarsiger chrysaes</i> <i>Tarsiger indicus</i> <i>Certhiidae</i> <i>Carpodacus rodochroa</i>
Alpine (3000-4800 m)	Snow Partridge Himalayan Snow Crow Black Redstart Red Breasted Rosefinch	<i>Lerwa lerwa</i> <i>Tetraogallus himalayensis</i> <i>Phoenicurus ochrurus</i> <i>Carpodacus puniceus</i>

Table 12. National Parks in Uttarakhand

S. No.	Name of National Park	District	Area (sq. km.)	Wildlife Faunal Speies
1	Corbett National Park	Nainital	530.82	Elephant, Tiger, Panther, Sloth, Bear, Nilgai, Sambar, Chital, Wild Boar
2	Gangotri National Park	Uttarkashi	2390	Panther, Snow Leopard, Musk Deer, Kakar, Monal Pheasant, Sambar
3	GovindPashuVihar National Park	Uttarkashi	472.08	Panther, Snow Leopard, Musk Deer, Kakar, Monal Pheasant, Sambar
4	Nandadevi National Park	Chamoli	650.0	Panther, Tiger, Snow Leopard, Musk Deer, Monal Pheasant, Cheer Pheasant
5	Rajaji National Park	Dehradun	820	Tiger, Panther, Elephant, Black Buck, Wild Boar, Chital, Sambar, Tree Pie, Pea Fowl
6	Valley of Flowers National Park	Chamoli	87.5	Himalayan Brown Bear, Musk Deer, Panthar, Snow Leopard, Kakar, Monal Pheasant

Table 13. The wildlife fauna of National Park of Uttarakhand

Sl.No.	National Park	Mammals	Birds	Reptiles
1.	Corbett National Park	Tiger, Leopard, Elephant, Fishing Cat, Sloth Bear, Nilgai, Sambar, Chital, Wild Boar, Goral	Pea Fowl, Red Jungle Fowl	Mugger, Ghariyal, Monitor Lizard and Python
2.	Gangotri National Park	Brown and Black Bear, Snow Leopard, Bharal, Musk Deer, Thar, Goral, Panther, Tiger	Monal Pheasant, Snow Pigeon, Green Pigeon	Lizard, Rock Python and other species of snakes
3.	Govind National Park	Snow Leopard, Leopard, Fishing Cat, Musk Deer, Serow, Thar and Leopard	Monal Pheasant, Snow Pigeon, Green Pigeon	Indian Rock Python, Lizard, Common Indian Monitor
4.	Nanda Devi National Park	Snow Leopard, Musk Deer, Bharal, Himalayan Thar, Cheetal	Monal pheasant	Common Indian species of snakes and lizards
5.	Rajaji National Park	Elephant, Tiger, Panther, Bear, Wild Boar, Chital, Sambar, Kakar	Himalayan Tree Pie, Jungle Crow, Green Magpie	Python, Cobra, Monitor Lizard.
6.	Valley of Flowers	Tiger, Panther, Bear, Wild Boar, Chital, Sambar, Kakar	Himalayan Tree Pie, Jungle Crow, Green Magpie	Python, Cobra, Monitor Lizard

Table 14. Wildlife Sanctuaries in Uttarakhand

S. No.	Name of Wildlife Sanctuary	District	Area (sq. km.)	Wildlife Faunal Species
1	2	3	4	5
1	Askot Musk Deer Wildlife Sanctuary	Pithoragarh	600.0	Musk Deer, Himalayan Thar, Black Buck, Sambar, Chital, Snow Cocks, Snow Leopard, Thar, Bharal, , Koklass, Chir Pheasant, Monal Pheasant
2	Govind Pashu Vihar Wildlife Sanctuary	Uttarkashi	48.104	Snow Leopard, Leopard, Musk Deer, Kakar, Wild Boar, Himalayan Brown and Black Bear Monal Pheasant
3	Kedarnath Wildlife Sanctuary	Chamoli	975.24	Leopard, Snow Leopard, Leopard Cat, Musk Deer, Himalayan Thar, Snow Cock, Khalij Pheasant, Monal Pheasant
4	Mussoorie Wildlife Sanctuary	Dehradun	11.00	Leopard, Chital, Kakar, Goral, Tree Pie, Hornbill
5	Binsar Wildlife Sanctuary	Almora	45.59	Leopard, Chital, Musk Deer, Khalij Pheasant, Monal Pheasant

F. Valley of Flowers:

It is located in Chamoli district in the upper ranges at a distance of 333 km. from Dehradun and at a distance of 290 km. from Rishikesh. It covers an area of 87.5 sq. km. The wildlife fauna found here is similar to that found in Nanda Devi National Park.

Wildlife Sanctuaries

A wildlife sanctuary is an area where animal habitats and their surroundings are protected from any sort of disturbance. The capturing, killing, and poaching of animals are strictly prohibited in these regions (Table 14).

DISCUSSION

Among the absolute noblest and wonderful animal species on the planet earth, a huge proportion of biodiversity is known to exist in Uttarakhand Himalayas. Around 60.6% of total land use in Uttarakhand accounts for

forest areas. Different characteristic features such as geology and soil of various physiographic zones contribute to the varied forms of wildlife in the Garhwal Himalayas. Variation in the diversity of wild species and their natural habitat in the Garhwal Himalayas results in a wide distribution of wild mammals including species of primates, birds, bears, elephants, etc., ranging in different microclimatic zones of the region (Rawal *et al.*, 2018). The wildlife and human beings are considered complementary to each other; hence, an attempt should be made to incorporate the same extent of beliefs with respect to the savage of untamed life, in contrast with being inconsiderate to their reality (Bender *et al.*, 2019). The gross mass should have an intention that "Although it is excellent to have a giant's strength it is tyrannous to use it as a giant". The various factors such as hunting, poaching, habitat destruction, the release of toxins like harmful gases, pesticides, and pollution are responsible for the tremendous rate of decline in wild animal species. Despite numerous attempts, the

declining status of biodiversity is becoming an alarming concern all over the world and these concerns can only be conquered by a sustainable approach and reliable set of actions that can enable the restoration of the natural environment in order to facilitate the longevity of both human and wildlife (Mace et al., 2018). As far as the matter of correspondence goes on today, mostly the educated mass has a cool and calm intention of conserving and managing the wildlife (Jhala et al., 2011). So having this consideration, mankind should be completely flashed in the field of protection and management of wildlife by quite considerably following the various approaches and acts directed by the Government of India for the animal world. Different species of animals are sensitive to a minute change in the environment and hence become ecologically crucial to indicate environmental and climatic changes (Arya et al., 2018). Thus, it is extremely vital and very fundamental for the individuals of the present era to go profoundly through the world of wildlife (Adepoju et al., 2014). Conflict and strife among wildlife will lead them to endure a jackpot disadvantage acting as an undiminishable brake because of natural life exhaustion as it is clearly visible fact known not only to entire India but to the whole world that "Wildlife and humankind are complementary interactions to one another, leads to axial as a lock without a key. In order to overcome the rapidly declining situation 'a comprehensive intelligence network' is perhaps the most effective way to bring the illegal wildlife trade under control (Behera et al., 2019). Hence, in an attempt to restore the natural habitat and conserve the biodiversity of Garhwal Himalayas different national parks and wildlife sanctuaries like Corbett national park and Kedarnath wildlife sanctuary respectively have been established in Uttarakhand, where species such as elephant, tiger, panther, sloth bear, nilgai, sambar, chital, wild boar, musk deer, kakar, monal, pheasant, etc. inhabit. The current study is an attempt to change the mindset of individuals and promote knowledge to conserve the wildlife and their natural habitat for healthy and sustainable growth.

DEPLETION OF WILDLIFE IN UTTARAKHAND

The wellbeing and prosperity of wildlife, both plants and animals rely on various factors or elements. The proper atmosphere, food, water, and shelter are among the essential necessities of every living being. Every environment is an example of how plants and animals share these assets, adapt and healthy populations, characteristic to their natural habitat. The environment of Earth has experienced changes and the living creatures discovered today are the product of evolution and adaptation to the changing environment. There are many folds responsible for the exhaustion of wildlife, among these are the fast expansion of industries and agriculture, urbanization and large scales development ventures like dams, highways, mining and increased intensification of human activities. These activities have prompted the devastation of the natural habitats, population and overutilization of bioresources, which have resulted in the rapid disintegration of Himalayan biodiversity in poaching and trade in wildlife and wildlife products. Around 20 species are categorized as possibly extinct, as these have not been sighted during the last 6-10 decades. Mountain Quail, an endemic species of birds comes extinct, 81 species of warm-blooded animals, 47 species of birds, 15 species of reptiles, 3 species of amphibians and similarly an enormous number

of butterflies, moths and beetles. The percentage of the threatened taxa in their biological system or ecosystem is relatively much higher with a break up as vertebrates 38%, birds 21%, reptiles 20% and beetles 2% of the respective groups. Freshwater and soil fauna are under tremendous stress because of organic and chemical contamination of lakes, ponds, streams and wetlands.

CONCLUSION

The current study on the Altitudinal animal diversity of Garhwal Himalaya was carried out to obtain the various elevations and study the climatic impact on the distribution of wildlife. For study purposes, the Garhwal Himalaya is isolated into three significant zones, viz. Submontane, Montane and Elevated zones. The survey represents the salient features of wild animals. There are several elements that influence the distribution of animals, for example, temperatures, humidity and precipitation, etc. In addition to the above effect of biotic and climatic pressure on animal communities, composition, distribution and change of natural habitat are clearly articulated. Some animals move with the changing atmosphere, for example, Snow Leopard, for the most part, limits itself to the elevated zone between 3200 to 5000 m however it has also been reported that during winters Snow Panther descend as low as 2000m, perhaps to escape the harsh winter environment prevailing in the higher reaches. Some animals also migrate from one place to another for mating. The Garhwal Himalaya is very rich in wildlife. Musk Deer along the higher reaches and Sambar, Barking Deer, etc below the treeline are important warm-blooded animals. The current study reveals that temperature is the principal factor, which influences the distribution of wild animals.

Conflict of Interest

No conflict of interest exists in the submission of this manuscript. All authors above have approved the final manuscript.

ACKNOWLEDGEMENTS

The authors of this manuscript are thankfully acknowledging the local residents and the entire working staff of the forest department of the study area for meaningful information, help and kind support throughout the period of study.

REFERENCES

- Adepoju K., Adelabu S. and Fashae O. 2019. Vegetation Response to Recent Trends in Climate and Landuse Dynamics in a Typical Humid and Dry Tropical Region under Global Change. *Advances in Meteorology*.
- Arya M.K., Tamta P. and Verma A. 2018. Systematic survey on alpha diversity of anthophilous insect fauna in Binsar Wildlife Sanctuary, Western Himalaya. *Entomon* 43(2): 99-110.
- Behera M.D., Behera S.K. and Sharma S. 2019. Recent advances in biodiversity and climate change studies in India. *Biodiversity and Conservation* 28: 1943-1951.
- Bender I.M.A., Kissling W.D., Böhning-Gaese K., Hensen I., Kühn I., Nowak L., Töpfer T., Wiegand T., Dehling D.M. and Schleuning M. 2019. Projected impacts of climate change on

- functional diversity of frugivorous birds along a tropical elevational gradient. *Scientific Reports* 9: 17708.
- Boscutti F., Casolo V., Beraldo P., Braidot E., Zancani M. and Rixen C. 2018. Shrub growth and plant diversity along an elevation gradient: Evidence of indirect effects of climate on alpine ecosystems. *PLoS ONE* 13(4): e0196653.
- Chawla A., Rajkumar S., Singh K.N., Lal B. and Singh R.D. 2008. Plant Species Diversity along an Altitudinal Gradient of Bhabha Valley in Western Himalaya. *Journal of Mountain Science* 5: 157–177.
- Clark N.E., Lovell R., Wheeler B.W., Higgins S.L., Depledge M.H. and Norris K. 2014. Biodiversity, cultural pathways and human health: a framework. *Trends in Ecology and Evolution* 29(4): 198-204.
- Dehling D.M., Fritz S.A., Töpfer T., Päckert M., Estler P., Böhning-Gaese K. and Schleuning M. 2014. Functional and phylogenetic diversity and assemblage structure of frugivorous birds along an elevational gradient in the tropical Andes. *Ecography* 37: 1047–1055.
- Fischer A., Blaschke M. and Bässler C. 2011. Altitudinal gradients in biodiversity research: the state of the art and future perspectives under climate change aspects. *Waldökologie, Landschaftsforschung and Naturschutz* 11: 35-47.
- Gairola S., Sharma C.M., Ghildiyal S.K. and Suyal S. 2011. Tree species composition and diversity along an altitudinal gradient in moist tropical montane valley slopes of the Garhwal Himalaya, India. *Forest Science and Technology* 7 (3): 91-102.
- hala Y.V., Qureshi Q., Gopal R. and Sinha P.R. 2011. Status of the Tigers, Co-predators, and Prey in India, 2010. National Tiger Conservation Authority, Govt. of India, New Delhi, and Wildlife Institute of India, Dehradun. pp 25-31. TR 2011/003 pp-302.
- Hunter P. 2007. The human impact on biological diversity. How species adapt to urban challenges sheds light on evolution and provides clues about conservation. *EMBO reports* 8(4): 316–318.
- Jarvis C. E. (2019). Georg Rumphius' Herbarium Amboinense (1741–1750) as a source of information on Indonesian plants for Carl Linnaeus (1707–1778). *Gard. Bull. Singapore* 71(Suppl 2): 87-107.
- JKhan S. and Ahsan M. 2015. Frugivorous Birds and Fruit Plants in a Deciduous Forest in Bangladesh: A Case Study in the Madhupur National Park. *Bangladesh Journal of Zoology* 43(2): 173–187.
- Kharkwal G., Mehrotra P., Rawat Y.S. and Pangtey Y.P.S. 2005. Phytodiversity and growth form in relation to altitudinal gradient in the Central Himalayan (Kumaun) region of India. *Current Science* 89(5):873-878.
- Korner C. 2004. Mountain Biodiversity, its causes and function. *AMBIO A Journal of Human Environment* 13(13): 11-7.
- Kumari P. and Tewari L.M. 2009. Biodiversity in Uttarakhand Himalaya region. *Nature and Science* 7 (3): 113-125.
- Mace G.M., Barrett M., Burgess N.D. Cornell S.E., Freeman R., Grooten M. and Purvis A. 2018. Aiming higher to bend the curve of biodiversity loss. *Nature Sustainability* 1(9): 448-451.
- National Research Council (US) Panel on Biodiversity Research Priorities. *Conserving Biodiversity: A Research Agenda for Development Agencies*. Washington (DC): National Academies Press (US); 1992. 4, Biodiversity Research: The Cultural Context. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK234656/>
- Nautiyal H. 2013. Impact of Climate on Faunal Distribution in Garhwal Himalaya along Altitudinal Gradients. *Journal of Environmental Science, Computer Science and Engineering & Technology* 2(4): 1115-1127.
- Nautiyal H. and Thapliyal M. 2011. Impact of microclimatic variation on floral diversity of Garhwal Himalaya along altitudinal gradients. *International Journal of Research in Science and Technology* 1(3): 1-10.
- Negi G.C.S., Sharma S., Vishvakarma S.C.R., Samant S.S., Maikhuri R.K., Prasad R.C. and Palni L.M.S. 2019. Ecology and Use of *Lantana camara* in India. *The Botanical Review* 85: 109-130.
- Rawal R.S., Rawal R., Rawat B., Negi V.S. and Pathak R. 2018. Plant species diversity and rarity patterns along altitude range covering treeline ecotone in Uttarakhand: conservation implications. *Tropical Ecology* 59(2): 225–239.
- Sánchez-González A. and López-Mata L. 2005. Plant species richness and diversity along an altitudinal gradient in the Sierra Nevada, Mexico. *Diversity and Distributions* 11: 567–575.
- Saikia P., Deka J., Bharali S., Kumar A., Tripathi O.P., Singha L.B., Dayanandan S. and Khan M.L. 2017. Plant diversity patterns and conservation status of eastern Himalayan forests in Arunachal Pradesh, Northeast India. *Forest Ecosystem* 4: 28.
- Sharma C.M., Suyal S., Gairola S. and Ghildiyal S.K. 2009. Species richness and diversity along an altitudinal gradient in moist temperate forest of Garhwal Himalaya. *Journal of American Science* 5(5): 119-128.
- Willig M.R. and Presley S.J. 2016. Biodiversity and metacommunity structure of animals along altitudinal gradients in tropical montane forests. *Journal of Tropical Ecology* 32:421–436.
- Zhang W., Huang D., Wang R., Liu J. and Du N. 2016. Altitudinal Patterns of Species Diversity and Phylogenetic Diversity across Temperate Mountain Forests of Northern China. *PLoS ONE* 11(7): e0159995.

