



## Himalayan harmony: Balancing biodiversity conservation and development in great Himalayan National Park, Western Himalayas

Bandna Kumari

Department of Zoology, Sardar Patel University (SPU), Mandi, Himachal Pradesh, India

### Abstract

The Great Himalayan National Park located in Banjar Subdivision of Kullu District of Himachal Pradesh characterized by wide range of flora and fauna, alluring elevated peak, alpine meadow, riverine forests. It is part of Himalayan biodiversity hotspot including twenty five forest type and supports substantial portion of faunal species including 31 mammals, 181 birds, 3 reptiles, 9 amphibians, 17 molluscs, 127 insects. Due to high elevations and undisturbed habitat GHNP supports a great flora approximately 50% of endemic angiosperm species. It is home to many endemic species which is threatened and rare like brightly plumed pheasant western tragopan locally known as jujurana (the king of birds) which is a vulnerable species as per IUCN. The Great Himalayan National Park Conservation Area (GHNPCA) as a Natural Site was inscribed into UNESCO world heritage site under criteria "outstanding significance for biodiversity conservation" during the session of 38<sup>th</sup> World Heritage Committee in Doha (Qatar) on 23<sup>rd</sup> June 2014. The inscription confirms GHNPCA outstanding Universal value as a site containing the most important and significant natural habitats for in-situ conservation of Western Himalayan biodiversity, including those containing threatened species of universal value from the point of view of science or conservation. Biodiversity in western Himalayas is threaten by habitat destruction, overhunting, poaching, overexploitation of forest resources, climate change, natural disaster and several development activities like road constructions, hydroelectric projects, rapid expansion of tourism industry putting pressure on wildlife and causing threat to ecosystem of park. Present paper discuss the emerging issue and challenges in protection and conservation of biodiversity of GHNP.

**Keywords:** Biodiversity, GHNP, conservation, world heritage site, endemic, western tragopan

### Introduction

Biodiversity shorts for biological diversity, refers to sum total of all the variety and variability of life in a defined area. It emphasize the many complex kind of variations that exist within and among organism at different level of organization. It is defined as the totality of genes, species and ecosystems of a region. Biodiversity comprises Genetic diversity, Species diversity and Ecosystem diversity (level of biodiversity). Genetic diversity enables the population to adapt to its environment and respond to natural selection. Base of genetic variation is Speciation. It occurs at several level of organization such as among higher taxonomic categories. Species diversity refers to variety of species within a region i.e. species richness, species evenness as well as taxonomic diversity. A more taxonomically diverse community is therefore considered richer as compare to the less taxonomically diverse community. Ecosystem diversity refers to diversity of all the species and all abiotic factor characteristics of a region. India is rich in its unique flora and fauna and famous world wide for this incredible heritage. It is estimated that about 45,000 species of plants and 65,000 species of animals are found in India. The flowering plants comprise 15,000 species of which several hundred (5000-7500) species are endemic. Among the animal species diversity more than 50,000 species of insects, 4,000 molluscs, 6,500 other vertebrates, 2,546 fishes, 197 amphibians, 408 reptiles, 1224 birds and 350 species of mammals are found in different habitats. Therefore, this great strength of flora and fauna put the country in the list of mega biodiversity centers (Hot-Spot) of the world.

The natural world provides us with food, water, shelter, medicine and many of the basic ingredients we need for our

modern lives. To ensure they remain healthy and vibrant, ecosystems - no matter where they are - require a diverse range of life within them. This biodiversity plays a role in regulating important natural systems including the exchange of nutrients, the water cycle, and the climate. Over-exploitation of the natural world and widespread landscape change, as natural habitats are cleared to make way for agriculture and urban development, are eroding biodiversity. Alongside this, the climate change caused by human activities is driving further biodiversity loss. Human activity impacts the planet's biodiversity in multiple ways, both deliberate and accidental. The biggest threat to biodiversity to date has been the way humans have reshaped natural habitats to make way for farmland, or to obtain natural resources, but as climate change worsens it will have a growing impact on ecosystems. The main direct cause of biodiversity loss is land use change (primarily for large-scale food production) which drives an estimated 30% of biodiversity decline globally. Second is overexploitation (overfishing, overhunting and overharvesting) for things like food, medicines and timber which drives around 20%. Climate change is the third most significant direct driver of biodiversity loss, which together with pollution accounts for 14%. Invasive alien species account for 11%.

The increase in depletion and extinction of world biodiversity has led to a greater interest from global community to protect the environment and safeguard natural habitats and thousand of species (Burgess, 2012) [2]. In developing country like India factors like growth and development of rural and urban areas, industrialization and its effects, along with high population growth rate has added extra pressure to both country's biodiversity and natural environment. For this reason, there has been an increase in

the number of protected areas established, especially national parks, that are firstly established to protect biodiversity and secondly, established for education and recreation.

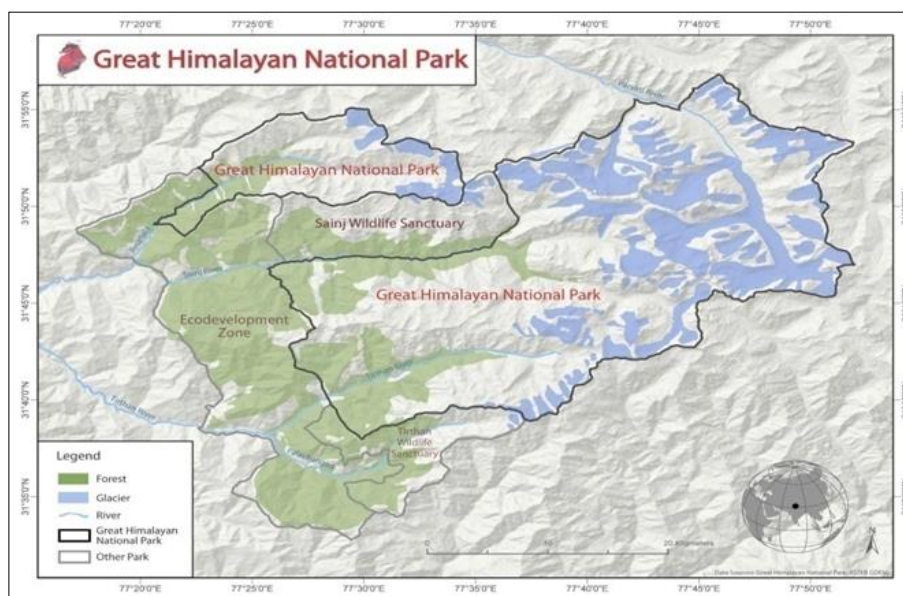
Despite the moral, cultural and economic reasons for conserving biodiversity and its ecosystem services, biodiversity is being lost and degraded at an unprecedented rate as a result of human activities. The state of the world's ecosystems have recently been assessed in detail by an international team of experts under the Millennium Ecosystem Assessment – MEA (2005), who concluded that “Human actions are fundamentally, and to a significant extent irreversibly, changing the diversity of life on Earth, and most of these changes represent a loss of biodiversity. Changes in important components of biological diversity were more rapid in the past 50 years than at any time in human history” (Tucker, 2006) [15]. It is important to preserve and conserve biodiversity because each species contributes unique role in ecosystem. Biodiversity is the life support system of our planet- we depend on it for the air we breathe, the food we eat, and the water we drink. Medicines originating from wild species, including penicillin, aspirin, taxol, and quinine, have saved millions of lives and alleviated tremendous sufferings. Wetlands filter pollutants from water, trees and plants reduce global warming by absorbing carbon. Bacteria and fungi break down organic material and fertilize the soil. It has been observed that native species richness is linked to the health of ecosystems, as is the quality of life for humans. The connections between biodiversity and our sustainable future appear closer and closer the more we look. We literally need to conserve biodiversity as our lives depend on it (Agarwal & Rawat, Biodiversity: Concept, threats and conservation, 2015) [1]. Therefore Protected areas have great importance necessary in protection of ecosystem and sustaining ecosystem services. the main objectives of Pas (protected area) are the conservation of biological resources and natural heritage as well as the protection of representative

ecosystems, habitats of endangered species, and genetic resources. PAs currently cover approximately 16.64% of global lands and inland water ecosystems and 7.74% of coastal waters and the ocean (Xiaoting & Wenguang, 2023) [17]. National park is one of the example of protected area and have an important role in conservation of biodiversity and ecosystem services. Risk of biodiversity loss is increasing globally and it led to more ways of protecting irreversible resources and one of the ways of doing this is establishing protected areas like National Parks. According to IUCN protected area management category II National Park are natural or near natural area set aside to protect large scale ecological processes, along with the complement of species and ecosystem characteristics of the area, which also provides a foundations for environmentally and culturally compatible, spiritual, scientific, educational, recreational and visitors opportunities. Natural Parks are a country's natural wealth and they come with a great variety of advantages both to mankind and the environment, and thus they need to be protected at any cost.

### Himalayan Region- A Unique Gift of Biodiversity

The Himalayas, which literally mean the abode of snow, is the youngest and highest range of Fold mountains consist three parallel ranges, The Greater Himalayas known as the Himadri, the Lesser Himalayas called the Himachal, and the Shivalik hills,

which comprise the foothills. It extends between 28° N-36° N latitude and 72° E-96° E longitude run almost without break for about 2500 km. and with a width about 200-400km. Biogeographically, the Himalayan mountain range straddles a transition zone between the Pale-arctic and Indo-Malayan realms. Species from both realms are represented in the hotspot. In addition, geological, climatic and altitudinal variations in the hotspot, as well as topographic complexity, contribute to the biological diversity of the mountains along their east-west and north-south axes. (Chopra & Kumar, 2009) [4]



**Fig 1:** Map of Great Himalayan National Park (GHNP)

The Great Himalayan National Park (GHNP) is located in tehsil Banjar of Kullu District of Himachal Pradesh the Himalayan state of India (between 31°38'28"N and

31°54'58"N and 77°20'11"E and 77°45'00"E) and lies between 2000m and 5500m above sea level (Singh & Rawat, 2005) [14] India. Initially constituted in 1984, GHNP

was formally declared a National Park in 1999, covering an area of 754.4 sq kms. In 1994, two major changes were made in land use around the Park. A buffer zone of 5 km from the Park's western boundary, covering 265.6 sq km, and including 2,300 households in 160 villages, was delineated as an Ecozone. Most of the population (about 15,000 to 16,000 people) in the Ecozone. The second change was the creation of the Sainj Wildlife Sanctuary (90 sq km) around the three villages of Shagwar, Shakti, and Marore. On the southern edge of the GHNP, another Protected Area (PA) was declared, known as Tirthan Wildlife Sanctuary. This covers 65 sq km and is without habitation. More recently, in 2010, both the Sainj and Tirthan Wildlife Sanctuaries were added to GHNP, but will not be formally incorporated until a process known as settlement of rights has occurred. Thus the initiated merger of Sainj and Tirthan Wildlife Sanctuaries with GHNP will be followed by a process of settlement to relocate inhabitants and make the area free of traditional pressures, which may take some time. The total area under Park administration (National Park, Wildlife Sanctuaries and Ecozone) is 1171 sq km, which is together referred to as the Great Himalayan National Park Conservation Area (GHNPCA).



Fig 2: Base map of GHNP

The Great Himalayan National Park (GHNP) was the first major area of unique species assemblage in the Western Himalayas to be protected by the Indian government as part of its commitment to ecosystem conservation.

The monsoon-affected forests and alpine meadows of the Himalayan front ranges support a unique biota comprised of many distinct altitude-sensitive ecosystems and are home to many plants and animals endemic to the region.

The Western Himalayas are considered an endemic bird area (EBA) by Birdlife International, supporting many restricted-range species, as well as a Conservation International Biodiversity Hotspot.

Human population exists only on the western and the park is contiguous with the Rupi Bhaba wild life sanctuary in south east, Pin valley national park in north east and Kanwara wild life sanctuary in north. A 90Km<sup>2</sup> (9000 hectares) Sainj wild life sanctuary divides

the park into two equal parts. Tirthan wild life sanctuary exists on the southern tip of Great Himalayan National Park. These areas together form the great Himalayan national and conservation area (GHNPCA). Four major rivers Tirthan, Sainj, Jiwa Nala and Parvati originating from the glaciers are the main source of water in park. These rivers flow in the east west direction and flow into the river Beas (Mehra and Mathur 2001) [7].

Table 1: Area of Nominated property buffer zone (in sq km)

Total Area: 1,171.0 sq km	
Name of Property	Area
GHNP	754.4 sq km
Tirthan and Sainj Wildlife Sanctuaries	151.0sq km
Buffer (Ecodevelopment zone)	265.6 sq km

### Unique Factors About GHNP

- GHNP was declared a UNESCO Heritage Site on 23 June 2014.
- The park is largest centres of endemic flora and fauna and is home four globally threatened species i.e. Snow Leopard, Himalayan Tahr, Musk Deer, Western Tragopan, Koklas, Cheer pheasants and provides sanctuaries for these species
- Confirmed sighting of rare and elusive Serow made in GHNP, in month of May 2015
- GHNP is home to 209 confirmed bird species, which attract birdwatcher from across the globe. These includes the endangered Western tragopan and four other pheasants species.
- GHNP is part of Himalaya hotspot-one of the conservation International's 34 biodiversity hotspots.
- 832 plant species, representing 128 families and 427 genera, have recored in GHNP.
- The rocks of GHNP range were emplaced in current location 19 to 21 million years ago.
- The Himalayan musk deer depends on *Usnea longissima* (also known as Methuseleh's beard, the world longest species of lichens) for food during winters.
- The little over half of GHNP lies above 4,000m.
- The upper part of park's forest zone holds world's largest known population of Western tragopan.
- GHNP, s thick forests of three major oak type – Ban, Mohru, and Kharsu- contribute to the continuity of the regional hydrological cycle and help maintain water quality for ten millions of people on the Indian plains.
- The park's high altitude, above 3,500, are home to endemic species.
- 10% of the world's known plant species can be found in GHNP.
- GHNP is home to 34 of the 47 medical plant categorized as threatened in Himachal Pradesh.

### Biodiversity of National Park

The Himalayan region is signified by a large number of uncommon, endemic and Threatened species of flora and fauna. Varying eco-climatic conditions directly influence the structure and behaviour of the living organisms in Park region. The total number of plant species in the Himalayan region is estimated to be 25,000, which is 10% of the world's known species. This includes 7,020 species of fungi, 1,159 species of lichens, and 2,000 species of bryophytes,

with the remainder ferns, angiosperms and other plant species. As a whole, the Indian Himalayas harbours about 50% of the endemic Indian flora. The vertebrates are represented by 218 species of fishes, 74 species of amphibians, 149 species of reptiles, 528 species of birds and 241 species of mammals. Faunal diversity in this region is unique in the sense that they are distinctly different from the species found in the plains, and significant proportions of them are endemic to the Himalaya. The Great Himalayan National Park boasts a rich biodiversity. A total of 832 plants species representing 128 families and 427 genera (which cover 26% of the total flora of Himachal Pradesh) have been recorded from the GHNP. This includes 794 species of angiosperms, 11 species of gymnosperms and 27 species of ferns. Various components of biodiversity were also surveyed in the last decade, resulting in a list of 31 species of mammals, 209 species of birds, 12 species of reptiles, 9 species of amphibians and 125 species of insects.

**FLORA:** About one third area of the park supports closed canopy forest, which extends from the valley bottoms to 3,300-3,600 m, depending on the aspect. A little over half of the area lies above 4,000 m, which is approximately the upper boundary of the subalpine and alpine scrub vegetation in this part of the Himalaya.

The forested areas support good examples of most vegetation types representative of the area, including extensive stands of Kharsu Oak, Horse Chestnut, Birch, Himalayan Blue Pine, West Himalayan Silver Fir, West Himalayan Spruce and Himalayan Cedar, as well as smaller areas of the lower altitude oaks, Ban and Moru.

Himalayan Yew is an important understory tree in places. Pure stands of any species are relatively rare, most of the forest being mixed to some degree. The plant communities are representatives of the temperate, sub-alpine and alpine regions, which includes oak and coniferous forests, high altitude mixed forests and sub-alpine and alpine pastures. Fourteen forest types of (Champion & Seth, 1968) [3] classification are represented in the GHNP viz.,

1. Ban Oak Forest,
2. Moist Deodar Forest,
3. Western Mixed Coniferous Forest,
4. Moist Temperate Deciduous Forest,
5. Kharsu Oak Forest,
6. Western Himalayan Upper Oak – Fir Forest,
7. Montane Bamboo Brakes,
8. Himalayan Temperate Park Land,
9. Himalayan Temperate Pastures,
10. Western Himalayan Sub-Alpine Fir Forest,
11. Sub-Alpine Pastures,
12. Birch/Rhododendron Scrub Forest,
13. Deciduous Alpine Scrub and
14. Alpine Pastures.

### Trees

They largely dominate the temperate belt of GHNP. The conifer species are widely distributed at various altitudes (e.g., blue pine, cedar, spruce, and fir) in the successive low to high altitudinal zones. All the upper coniferous belts have their characteristic oaks that provide acorns for birds and rodents. The Ban Oak is associated with Chir Pine and Blue Pine; Moru oak with fir and spruce. Kharsu Oak mainly forms a pure community at the tree line. A number of lichens and fungi that occur on the oak trees provide food for mammals and birds. Himalayan yew is the most abundant in

the fir forest, where it gives the appearance of an old forest and provides a distinctly cool microclimate. *Rhododendron arboreum* dominates between 1,500 and 3,000 m, with a tendency to prefer the lower elevation on the north side. Four species of maple (*Acer* spp.) occur with a wide range of altitude from 1,500 to 3,500 m. Horse chestnut, Alder, Poplar, Birch, and willows (*Salix* spp.) are common near the streams. an old forest and provides a distinctly cool microclimate. *Rhododendron arboreum* dominates between 1,500 and 3,000 m, with a tendency to prefer the lower elevation on the north side. Four species of maple (*Acer* spp.) occur with a wide range of altitude from 1,500 to 3,500 m. Horse chestnut, Alder, Poplar, Birch, and willows (*Salix* spp.) are common near the streams.

### Medicinal Plants

The wonderful medicinal plants found in GHNP has been mixed blessing adding colour to landscape on one hand and drawing herb hunters affecting their very survival on the other. These healing herbs have been a source of traditional health care practices and now modern pharmacology.

**Table 2:** Local Names for Common Medicinal Herb

Local Name	Scientific Name
Jatamansi	<i>Valeriana</i>
Hathpanja	<i>Dactylorhiza</i>
Shingli Mingli	<i>Dioscorea</i>
Karoo	<i>Picrorrhia</i>
Dhoop/Googli dhoop	<i>Jurinea macrocephala</i>
Atees, Patish	<i>Aconitum heterophyllum</i>
Mushakbala, Nihanu	<i>Valeriana jatamansii</i>
Ban kakri	<i>Podophyllum hexaandrum</i>
Rakhal, Birmi, Thuna	<i>Taxus wallichia</i>

**Source:** website

<https://greathimalayannationalpark.com/medicinal-plants/#>

### Lichens

total of 192 species of lichens representing 65 genera and 31 families have been identified in GHNP, which is more than 10% and 50% of the lichens recorded from India and central Himalaya respectively. Tirthan and Jiwa valleys have relatively higher diversity of lichens represented by 101 (53%) and 100 (52%) species respectively, while the diversity of lichens in Sainj valley comprises of 67 species (35%). *Saxicolous* species (rock inhabiting) has higher diversity (40 species) in both Tirthan and Sainj valleys, which can probably be attributed to their large alpine meadows with exposed rocks. Interestingly, 78% (149) of the species were representatives of the corticolous category while the other groups such as *saxicolous*, *terricolous*, and *folicolous* were represented by only 54, 29, and 3 species respectively. The elevation ranges between 2,500 and 3,000 m harbours the maximum diversity of lichens. This can probably be attributed to a lower degree of pollution and higher tree density in these are as total of 192 species of lichens (Singh & Rawat, 1999) [13]

### Fauna

GHNP is known to host a wide variety of vertebrate fauna, including several charismatic, Threatened and regionally endemic species. Mammalian fauna is represented by over 31 species belonging to six orders: Primates, Carnivora, Artiodactyla, Insectivora, Rodentia and Lagomorpha. Among these, the Himalayan Musk Deer, and Snow

Leopard are endangered species (as per IUCN categorization), while the Himalayan Tahr is endemic to the Western Himalaya. Birds form a significant constituent of the biodiversity of the study area. There were 183 species of birds (both resident and migrant) reported by (Gaston, Garson, & Hunter, 1983) [5]. (Ramesh, 2003) [10] added 26 more species to the list, bringing the total number of species confirmed to 209. The mammalian fauna of GHNP and its buffer zone is typical of the several ecoregions of the Western Himalaya. It is relatively diverse, reflecting the fact that there are several habitats and a variety of climatic zones in the Park and buffer zone. Mammalian diversity is significantly higher than other areas. Most of the Himalayan fauna has been given protection under the high priority protection category of Schedule I of the Indian Wildlife (Protection) Act, 1972. Prominent mammals of Schedule I are the Blue Sheep, Snow Leopard, Common Leopard, Himalayan Brown Bear, Himalayan Tahr, Musk Deer, and Serow (a goat like antelope). The state government of Himachal Pradesh has banned hunting in the state for more than 10 years and the ban continues. Among the large mammals, there are several species of herbivores that are characteristic of the Park: the Himalayan Goral, a small goat antelope found in the lower forests, the Himalayan Tahr a wild goat, and the Bharal, or Blue Sheep above the tree-line. These mammals are prey for Common Leopards (in the forest zone) and Snow Leopards (above tree-line). Himalayan Black Bears inhabit the forests, while Asiatic Brown Bears are found in the alpine meadows. The Snow Leopard is one of the most beautiful of the large cats, with a handsomely marked coat. It inhabits the highest inner portions of the Park. Regular sightings of this species are reported from GHNP. The Himalayan Musk Deer, a primitive member of the deer family, produces valuable musk and is found in GHNP. In some parts, they reach a relatively high density of six to nine deer per sq km. Serow, a heavily built goat antelope of about 1 m height, is one of the least studied mountain animals. It lives solitarily in moist gorges with thick vegetation and moves with amazing speed.

**Table 3:** Large Mammals of GHNP

Common Name	Scientific Name
Serow	<i>Nemorhardus sumtraensis</i>
Himalayan Goral	<i>Naemorhedus goral</i>
Himalayan Tahr	<i>Hemitragus jemlahicus</i>
Blue Sheep	<i>Pseudois nayaur</i>
Himalayan Musk Deer	<i>Moschus chrysogaster</i>
Red Fox	<i>Vulpus vulpus</i>
Asiatic Black Bear	<i>Ursus thibetanus</i>
Himalayan Brown Bear	<i>Ursus arctos</i>
Common Leopard	<i>Panthera pardis</i>

### Birds

The birds of GHNP are an important part of the Park's biological diversity, in their own right and as indicators of diversity within the wider ecosystem. They are also an attraction for bird watchers at an international level. The Park is well known as the most important locality in India for the endangered Western Tragopan.

Four other species of pheasant occur in or adjacent to the Park; the one most likely to be seen by visitors is the Monal, an abundant bird in the higher forests, although rather shy.

Raptors are also a prominent feature of the Park, with Lammergeiers, Himalayan Griffon Vultures and Golden Eagles being seen regularly.

A great variety of other birds occurs (a total of 209 species), some of which reach their western limit in the Park. The GHNP falls within one of the more than 200 globally important Endemic Bird Areas (D02: Western Himalaya) identified by the International Committee for Bird Protection (ICBP)

### Western tragopan (State bird of Himachal Pradesh)

Western Tragopan, also known as Western Horned Tragopan, is considered among the rarest of all living pheasants. This Threatened (status vulnerable) pheasant is endemic to the northwest Himalaya with a narrow range. Due to its beautiful plumage and large size, this bird is locally called "*Jujurana*", which means "King of Birds".

It is reported to inhabit upper temperate forests between 2,400 and 3,600 m in summer, and in winter, dense coniferous and broad leaf forests between 2,000 and 2,800 m elevations. They mostly feed on leaves, shoots, and seeds, but also consume insects and other invertebrates. Like most pheasants, they roost on trees singly or in pairs except during nesting, which is reported to be on the ground or in trees.

The population of Western Tragopan is threatened by several anthropogenic factors throughout its range. The declining world population of this species has been estimated at 1,600 to 4,800 (Gaston, Garson, & Hunter, 1983) [5], including the captive population that currently numbers less than 25 birds.

A preliminary study of herpetofauna of GHNP lists four amphibians viz., Himalayan toad *Bufo himalayanus*, *Bufo stomaticus*, Beautiful stream frog *Amolops formosus*, Stolickza's frog *Rana vicina* Stolickza and six reptile species viz., Kashmir rock agama *Laudakia tuberculata*, Himalayan ground skink *Sincella himalayanus*, Karakoram bent-toed gecko or Kashmir rock gecko *Gymnodactylus Stolickzai*, Eastern keelback *Tropidonotus platyceps*, Indian rat snake *Ptyas mucosus*, Himalayan pit viper *Halys himalayanus*.

### Invertebrates

The invertebrates have been recognized as providers of "ecosystem services. Only six insect orders (beetles, wasps, flies, plant bugs, dragonflies, and butterflies) have been studied in the Park. The selected six orders represented 37 families, 108 genera and 125 species among the specimens identified so far. 44 kinds of butterflies have been recorded. The common blue Apollo is resident of alpine areas at about 4,000 m elevation in the Tirthan and Sainj valleys of GHNP. A total of 11 species of earthworms, both native and exotic, were recorded in these study sites. The list also includes two new species belonging to genus *Plutellus*. Of these species recorded in GHNP, four are native and endemic to Himachal Pradesh. The other seven are exotics that have successfully established in disturbed areas total of 14 species of molluscs were recorded from the GHNP. The majority of the species are terrestrial (nine species of land snails and three species of slugs), constituting 85.7% of the Park's molluscan fauna. Of these, *Anadenus modestus* and *Macrochlamys kuluensis* are endemic to Himachal Pradesh

### **Biodiversity Conservation and Development in GHNP**

Biodiversity conservation means saving life on Earth in all its forms keeping natural ecosystems functioning and healthy. Conservation includes the preservation, maintenance, sustainable use, recovery and enhancement of the components of biological diversity. Where - *Conservation* - is the sustainable use of resources and encompasses protection as well as exploitation and, *Preservation* - is an aspect of conservation meaning to keep something without altering or changing it. Sustainable development is another intricate aspect of biodiversity conservation. This refers to development that meets the needs of the current generation without compromising the ability of future generations to meet their needs. It simply refers to intra and intergenerational equity. (Agarwal, Biodiversity: Concept, Threats and Conservation, 2015) <sup>[1]</sup>

### **Importance of biodiversity conservation**

Biodiversity is essential for the processes that support all life on Earth, including humans. Without a wide range of animals, plants and microorganisms, we cannot have the healthy ecosystems that we rely on to provide us with the air we breathe and the food we eat. And people also value nature of itself. It is the life support system of our planet, we are dependent for all are needs on it for the air, the food, and the water. For Medicines originating from wild species, including penicillin, aspirin, taxol, and quinine, have saved millions of lives and alleviated tremendous sufferings. Wetlands filter pollutants from water, trees and plants reduce global warming by absorbing carbon. Bacteria and fungi break down organic material and fertilize the soil. It has been observed that native species richness is linked to the health of ecosystems, as is the quality of life for humans. We literally need to conserve biodiversity as our lives depend on it.

### **Challenges in conservation and Development in GHNP**

#### **Development Pressure**

Western Himalayan region have two richest resources among all i.e. Forest and Water. Mountains are young and fragile therefore pace of industrial development and resource exploitation is slow and limited. But pressure on forest resources is increasing by introducing many development activities like Hydropower projects. Deforestation is major severe problem during construction of hydropower projects. (Sharma, 2015) <sup>[12]</sup>. Increasing rate of deforestation led to soil erosion and landslides.

Hydropower projects have adverse effects on both flora and fauna and greatly affects the ecology of the region. (pillai, 1995) <sup>[9]</sup> explains that most of hydropower projects are located in the mountain areas and submergence of forest areas become inevitable. The direct adverse impacts observable on natural vegetation are largely close to the sites of dam, quarrying and muck disposal. Illegal and unscientific dumping of muck in the valley together has caused damage to many Cedrus deodara (deodar trees) and other coniferous species, due to which a fine of more than 2.75 crore of rupees is imposed on National Hydropower Corporation. (Pandit & Grumbine, 2012) <sup>[8]</sup> conducted study on 292 on going and proposed dams in the Indian Himalaya and investigated 90% Indian Himalayan valley would be affected by dam building and 27% these dams would affects dense forest. Deforestation due to dams building would likely result in extinction of 22 angiosperm and 7 vertebrate

Tex, it will reduce tree species richness by 35%, tree density by 42% and tree basal cover by 30% in dense forest". Therefore Construction of hydro electric projects i.e. Parvati hydro project stages I, II and III and Sainj hydro power project are major challenges in conservation strategies. The construction of dams require leads to anthropogenic disturbance in landscape, diversion and alteration of river having major effect on fish and aquatic life specially in case of migratory species, where they act as barriers. The other important impacts include change in sediment transport and water quality. From biodiversity conservation point of view filling of dam/reservoir result in permanent flooding of riverine and terrestrial habitat and the loss of these terrestrial habitats due to flooding are usually much more valuable than the aquatic habitats created by the reservoir. (McAllister & Hamilton, 1999) <sup>[6]</sup>

### **Grazing pressure**

Domestic grazing is one of the cause of wildlife and habitats destruction. Grazing has modified the understory vegetation considerably, reducing the amount and diversity of shrubs and ground vegetation. Along grazing routes in particular, large areas of meadow consist almost entirely of dock – and other herbs that favour nitrogen-rich soils. The understory is best developed in areas subject to little or no grazing, such as the upper Sainj and Tirthan valleys. Comparisons of heavily and lightly grazed areas lead us to the conclusion that grazing by domestic animals is causing severe alteration of the natural forest

### **Hunting Pressure**

In 1982 most hunting was banned in Himachal; the ban was specifically imposed in GHNP when it was notified in 1984, but this is likely to have very little effect on wildlife populations because even prior to the ban very few people bothered to obtain the permits required by the Forest Department. (Gaston, Garson, & Hunter, 1983) <sup>[5]</sup>, in Tirthan valley they found evidence of musk deer and goral hunting and many wire snares clearly set for ungulates. Herds of tahr seen were very small suggesting that populations have been severely reduced by hunting pressure.

### **Visitors/ Tourist pressure**

Despite its popularity as a tourist destination, the Great Himalayan National Park faces challenges related to sustainable tourism and conservation. Pressure from increasing visitor numbers, infrastructure development, and waste management pose threats to the park's fragile ecosystems and biodiversity. The high dependence on tourism has led to issues like water scarcity and traffic congestion in the State. Apart from this, there are negative impacts on biodiversity due to improper disposal of waste, increased construction in the fragile landscapes, land clearing for construction, excessive fuel wood collection.

### **Environmental Pressure/ Climate Change (e.g. pollution, climate change, desertification)**

The area of the Park is well insulated, basically untouched by modern development, devoid of any habitation Therefore, local environmental pressures like water pollution, agriculture and mining are emerging problems. Regional or global pressures such as atmospheric pollution and climate change have wide-spread, on-going effects that

are beyond local management control. land degradation, forest fire have adversely affected biological resources of the sub-region induced by climatic change. The various altitudinal zones of the regions are witnessing major biodiversity, ecological and geophysical changes. The increasing unpredictability of weather and the natural catastrophes in the region are clear-cut indicators of marked shift in weather patterns in the region. adapting to the effects of climate change is one of the highest priorities for mountain people., for example, the century-old apple crop in the lower Kullu Valley area (the general region of GHNP) is steadily being replaced by warmer-adapted peach and plum crops. Increased climatic variability is already threatening Himalayan ecosystems, including the Western Himalaya. Flooding, droughts, and hail storms are occurring with greater intensity with a lack or excess of rainfall, snowfall, and physically destructive effects. These changes are imposing huge costs on local communities.

the rivers of the Great Himalayan National Park face threats from pollution, habitat destruction, and unsustainable development. Efforts are underway to address these challenges through river conservation programs and community participation.

### Conservation goal

In order to conserve the biodiversity of the Park, the challenge at GHNP has been to reduce local dependence on the Park, mitigate poverty, and create cooperative relations with local people, all on a sustainable basis. The recent efforts to conserve the biological diversity at the GHNP aim at innovative strategies and action plans involving participatory approaches with emphasis on equitable and sustainable use of natural resources by local people. This has meant a new emphasis on finding ways of deriving new economic opportunities from biological resources which do not lead to further losses of biodiversity. (Wells M, 1992)

<sup>[16]</sup> The post-settlement-of-rights situation is going to affect the Park in the following ways

- a. the biological processes, when free of current biotic disturbances, are expected to bring positive changes in the status of biological diversity in the Park;
- b. the restrictions on access to the Park area may have some negative effect on the livelihood of the local community, given their high dependence on herb collection and livestock grazing.

GHNP presents an example of gradual and sometimes alarming attrition of Indian natural heritage despite decades of good intent, want of effective action on the ground and appropriate policy response. Even as more and more species (how many we don't know) and their habitats get pushed towards the threshold of irreversible decline, the state response fluctuates between occasional flashes in the pan at best, but embedded in consistent institutional indifference (Project Tiger, 2005)

### Conservation strategy

According to logistic population growth model, resources are always limited in nature and population is growing in enormous rate, therefore there is always competition for resources because particular environment supports a definite number of population, because ecosystem have limited capacity to support population which is known as carrying capacity. Therefore Increasing threat to biodiversity has led

to formation of number of protected areas –national parks, wild life sanctuaries, botanical gardens, biosphere reserves to enhance, conserve biodiversity and protect environment. The Park has an active Conservation Education programme functioning within the Ecozone that aims at

- Helping the visitor develop awareness, appreciation and understanding of the area
- Making the visitor's experience enjoyable
- Creating conservation awareness
- Achieving Park management goals including controlling tourism impacts Building support for the GHNP
- Creating awareness and concern for endangered species and ecosystems

Local communities play a vital role in the conservation of the park's biodiversity, actively participating in initiatives such as watershed management, forest protection, and eco-tourism development.

### Implementation of Anti Poaching Operation

Poaching disrupts the population of species which further disturbs the food chain as the population of immediate next wild animal would increase. Hunting of animals impacts nature-based tourism negatively to more effectively control continued poaching, it is important to know Whether it is commercial or subsistence poaching. If it takes place during the: day or night. In what season: wet or dry. Number of people involved or size of the party. How wildlife parts are ultimately sold – to middlemen, or as trophies Poaching methods (snares/dogs/guns). Role of local villagers in the poaching case In order to conserve, protect, minimise the loss to plant and also increase revenue of the native people there is a dire need to regulate the commencement and termination of the herb collection season. The encroachers and non right holders should be restricted from these activities to conserve the biodiversity of the park. For the eco development of the GHNP government and people participatory approach is required. The inclusion of real stake holders in the park resources will lead to better and effective management of the national park. The land settlements rights also need to be addressed by the government for the protection of the park else it will remain an area of open access, vulnerable to intrusions and developmental activities. (Saberwal V, 2001) <sup>[11]</sup>

The Biodiversity Act, 2002 is a federal legislation enacted by the Parliament of India for preservation of biological diversity, for local people, conservation of biodiversity is not an isolated concept but an integrated part of their lives. They view conservation areas as integral, functional parts of the landscapes in which they live. The engagement of local people in biodiversity conservation represents a win to win situation. Local people conserve biodiversity and maintains its sustainability through many ways such as creation and protection of community conserved areas (Sacred groves, temple trees), Joint forest management etc.

Therefore Local communities play a vital role in the conservation of the park's biodiversity, actively participating in initiatives such as watershed management, forest protection, and eco-tourism development.

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