RAJAJI TIGER RESERVE- A UNIQUE REPOSITORY OF BIODIVERSITY IN UTTARAKHAND, INDIA

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ABSTRACT

Indian Himalaya is well known for its rich and diverse biodiversity. For effective *in situ* conservation, India has elaborated protected area network. Rajaji Tiger Reserve (RTR) is the second largest protected area in Uttarakhand state after Corbett Tiger Reserve in Shivalik region of outer Himalaya. The continuous loss of species and degradation of ecosystems in the reserve since its establishment have raised various concerns within Shivalik landscape. We have collected information from published data, field investigation, as well as by conducting interviews with local people. Here we have presented the current scenario of ecological and biological diversity as well as the eco- tourism potentials in RTR. Further we have alsoanalyzedthe conservation status of flora and faunal species in RTR as per the status of IUCN.

Keywords: Biodiversity, Species diversity, Rajaji Tiger Reserve, Shivalik

INTRODUCTION

The Himalaya is well known for its biodiversity richness and diverse cultural mosaic**.** It supports about 18,440 species of plants (Singh *et al.*, 1996) 1,748 species of medicinal plants (Samant *et al.,* 1998), 241 mammalian species and 979 birds species. The representative biodiversity rich areas of the Indian Himalayan region have been protected through a Protected Area Network (PAN) programme in the Uttarakhand state (Western Himalaya). Protected forests constitute approximately 28.52% of the total forested area of the country (Forest Survey of India 2011). The world famous RTR is the second largest protected area of Uttrakhand state after Corbett Tiger Reserve, representing vast flora and faunal wealth (Roy 2016), and approximately 90% of the total of 750 elephants occur in both Rajaji- Corbett Tiger Reserve and adjacent reserve forest of the state (Johnsingh *et al.*, 1994). In Uttarakhand approximately, 1839 elephants are present as per the survey carried out by the forest department in 2015. The Chilla range of the reserve is one of the great centre of attractions for tourists (Akash *et al.,* 2018b). The entire belt is a natural home of *Elephas maximus* besides many other wild animals like *Panthera tigris, Panthera pardus, Melursus ursinus, Hyaena hyaena, Muntiacus muntjak, Nemorhaedus goral, Axis axis, Cervous unicolor, Sus scrofa, Ophiophagus Hannah.* Additionally, the tiger reserve is the western-most limit for distribution of tiger, elephant and king cobra.

Rajai Tiger Reserve: an overview

Rajaji National park (Now Rajaji Tiger Reserve) has inherited its name from Rajaji Sanctuary, which was one of the constituent unit by amalgation in which the National Park was created in 1983, (Rasily 2008). Rajaji Sanctuary was named after Rajaji C. Rajagopalachari lovingly known as Rajaji, the first Governor General of independent India, as it was on his behest that this sanctuary was created in Uttarakhand state. The intent notification of Rajaji Sanctuary as Rajaji National Park was issued on 12th august 1983 and recently changed to Rajaji Tiger Reservefor conservation of viable population of tigers. The whole area encompasses the Shivalik range, near the foothills of Himalayas spread in 820.42sq km within the three districts i.e., Dehardun, Haridwar and PauriGarhwal. The RTR is an essentials part of the terai landscape between Sharda and Yamuna river in Shivalik landscape (Akash *et al.*, 2018a). The Chilla forest range of the RTR lies in the east of the river Ganges and attached to the Garhwal forest Division at an elevation between 302 and 1000m above sea level. The Chilla range of the reserveis one of the great centre of attractions for tourists (Akash *et al.*, 2018c). The RTR extends over the Shivalic range from Dehradun-Saharanpur road in the north west to the Rawasanriver in the southeast, which falls within the Gangetic biogeographic zone (Rodgers *et al.*, 2002). The topography, altitude and climate of RTR vary greatly, due to which it supports a rich floristic diversity in Shivalik landscape.

The reserve has ten forest range which are playing significant role in conserving of biodiversity. The Chilla range of the reserve is one of the great centre of attractions for tourists (Akash *et al.,* 2018b). The RTR is distinct in terms of scenic beauty and rich biodiversity which is foliated by number of different types of forest (Joshi *et al.,* 2010). It includes northern dry deciduous and *Acacia-Dalbergia* forest, mixed forest of *Shorea- Mallotus* and some area represents the Savannah. The area has the different weather condition. Winter start from november to February when the days are pleasant (approx. 20-25^{0}C), nights are cold but low in humidity. The temperature rises rapidly from 40-45^{0}C in the summer season (March to June) but the rainfall increases with the occasional thunderstorm. The level of humidity is high in the rainy season (July to October). The annual rainfall ranges from 1200-1500mm. Soils are generally poor and infertile, with accumulation of humus in only at few places of the tiger reserve. The area has traditionally been inhabited by Gujjars (a pastoralist community). They herd buffalo between high Himalayan pastures in summer and lower foothills in winters. There are different types of Gujjar community settlements within the tiger reserve.The Shivalik and foothills of the Himalayas arecollectly called as'Bhabar'. The terai belt consists of dense tall grasses along withthe Asiatic elephants andlarge number of mammalian fauna attracts the tourists most.

Flora of the park

In the Himalaya, approximately 8,000 species of flowering plants occur, out of which 1748 plants are mostly used for ethno medicinal purpose for curing different diseases (Akash *et al.,* 2018; Wani *et al*., 2015, 2016). Rajaji Tiger Reserve presents a rich and diverse forest ecosystem. Different studies revel that the forests of the RTR comprises of important plant associations such as the *Shorea – Mallotus- Adina* community, *Shorea– Terminalia- Bridelia* community, *Dalbergia- Acacia* community as well as the *Syzgiumcummini, Terminalia bellerica, Terminalia alata, Trewia nudiflora, Cassia fistula, Flacourtia indica* (Akash *et al.,* 2018; Joshi *et al.,* 2009; Joshi *et. al.*, 2010). All of the ranges of the RTR have great diversity of plant species. The area of the Chilla forest division comes under the protected area network but undergoing rapid changes in its ecological status and flora and fauna pattern due to the large scale anthropogenic forcing at some places in the form of lopping, grazing and hydro-power project, scraping, trampling and extraction of non timber products (Akash *et al*., 2019). But at the same time the RTR maintains its integrity due to large forest area. Based on the Physiognomy, vegetation of the park may be classified broadly under the northern tropical moist deciduous forest and can be grouped according to (Champion *et. al.,* 1988): (a). Sal forest (b). Mixed forest (c). Riverine forest (d). Scrubland (e). Grassland (f). Sub tropical Pine forest.

The Sal forest occupies the major part of the park and can be divided into two types; namely, tropical moist deciduous forest and tropical dry deciduous forest. The tropical moist deciduous forest is represented by the dominated tree species, *Shorea robusta* which forms pure tracts. The common species associated of the Sal forest are *Terminalia alata, Anogeissus latifolia, Adina cordifolia*, *Terminalia bellerica, Lannea corommandelica, Garuga pinnata, Sterospermum suaveolens, Mallotus philipensis* etc. Whereas the tropical dry deciduous represents *Terminalia bellerica, Cassia fistula, Mallotus phillipensis, Bombex ceiba* etc.

The mixed forest of the park is generally comprises of *Anogeissus laitolia, Albiza procera, Mallotus phillipensis, Bombex ceiba, Terminalia bellerica, Acacia catechu, Mitragyna parviflora, Erythrina suberosa, Embilica officinalis, Bredelia squamosa,Gmelina arborea, Listea glutinosa, Trewia nudiflora, Cassia fistula, Sterculia villosa, Zizypus xylopyra, Z. Mauritiana, Butea monosperma etc.* The mixed forest community also faced species depletion by various activites of the locals (Johnsingh *et al*., 1990).

The Riverine forests occur in the low –lying waterlogged areas, along nullahs, riverbands and streambed and consist of evergreen species which are able to withstand the wetness of the occupied sites. The common species of this forest are *Syzium cumini, Ficus racemosa, Bischofia javanica, Trewia nudiflora, Pterospermum acirifolium, Albizzia procera, Toona ciliata, Calamus tenuis* etc.

The Scrub forest of the park generally represents degradation of the dry deciduous forests which are formed due to the biotic stresses like overgrazing, lopping, felling and fires. *Aegle marmelos, Lannea coromandelica, Erythrina suberosa, Cassia fistula, Flacourtia indica, Zizypus mauritiana, Z. xyloporaare* the main tree species of this forest.

The Other plant community of the park is Savannah (Grassland) which doesn't represent a climax stage in the park but have developed due to the various disturbance and anthrpogenic disturbance on the natural flora. *Desmostachya bipinnata, Phragmites karka, Cymbogon flexuosus, Digitaria* spp, *Eragrostris japonica, E. tennela, Setaria* spp, *Vetiveria zizaniodes,*

Heteropogon contortus, Butea monosperma, Acacia catechu, Helicteres isora, Carrisa opaca, Dendrocalamus strictus are the important plant species of the Grassland community. The sub tropical Pine forest occurs between dry deciduous forest and sal forest. The extent of this forest is very small and *Pinus roxburghii* occurs on the higher slopes of the Shivaliks, mixed with stunted forests.

Table. 1. Some of the rare plant species of Rajaji Tiger Reserveand with their IUCN status

Name	**Family**	**IUCN status**	**Remarks**
Catamixis bachharoides	Asteraceae	VN	Shrub, flowering time is june- july. Rare due to gradual crumbling of the Shivalikcliffs.
Eremostachys superb	Labiatae	EN	Herbal species with large yellow flowering stalk is generally found on the boundary of the western. Fowers bloom in feb-march. Grazing of buffaloes is the main reason for rareness.
Uraria picta	Labiatae	LC	It is small herb found on dry shivalic hills.
Euphorbia candicifolia	Euphorbaceae	LC	Small tuberous herb distriburted on the southern grasses slopes of the park.
Olax nana	Oleaceae	EN	It is a woody plant found near mansadevi temple of the Haridwar forest division.
Cordia vestita	Boraginaceae	LC	It is a deciduous tree found near Chilla range of the tiger reserve.
Coclospermum religiosum	Bixaceae	LC	It is commonly known as Buttercup tree found on dry shivalic hills.
Euphorbia fusiformis	Euphorbiaceae	LC	It is a small herb found near haridwar division the tiger reserve.
Some of the common orchids in the tiger reserve			
Genus	**Family**	**IUCN status**	**Remarks**
Aerides odorata	Epidendroideae	LC	It is common in the tiger reserve and along in wetern part of the Himalaya. it is highly fragrant and blooms in the late spring
Nervila aragoana	Orchidaceae	EN	It is a terrestrial orchid grows in the drier part of the tiger reserve. It blooms between January april.
Rhynchostylis retusa	Do	LC	It is found in the dried part of the rerserve and blooms in spring season.
Epipogium roseum	Do	Do	It is medium sized orchid grows in warmer region of the tiger reserve.
Nervilla crociformis	Do	Do	It is a terrestrial orchid found in the semi deciduous forest of the reserve.
Eulophia dabia	Do	TN	It is a small sized orchid grows in cold areas of the tiger reserve. It has beautifull yellowish green petals.
Goodyera procera	Do	LC	It is also a terrestrial orchid with beautifull flowers, blooms in eary springs.
Oberonia falconeri	Do	LC	It grows hanging underneath branches of the host plant blooms in espring season.
Peristylus lawii	Do	LC	It is a terrestrial orchid with white flowers bloom in rainy season. It is commonly found in the forest of western Himalays including Rajaji tiger reserve.
Goodyera procera	Do	LC	It is also a terrestrial orchid with white flowers, bloom in early spring.
Eulophia graminea	Do	LC	It is a terrestrial orchid with green flowers blooms in eary summer season.
Areides odorata	Epidendroideae	LC	It is also called t fragrant Fox Brush Orchid with light pinkish flowers. It blooms in summer season

(*Source: Akash et al,. 2018 a,b,c*)

EN = Endangered, LC= Least concern, TN= Threthened, VN= Vulnerable

Eco-tourism potential of Rajaji Tiger Reserve

Rajaji Tiger Reserve is opened for tourists from 15th of November to 15th of June of every year. The three ranges namely Chilla, Motichur, Ramgarh of the RTR has been opened for the last six years for tourists. The other seven ranges of the tiger reserve didn't open since last six years due to the dense forest and presence of the fauna. Some of the areas of the reserve has number of the tracks, which have great potential of eco-tourism. Asiatic elephant is one of the great attractions for tourists and during the period and elephants sighting is more common when park remained open for tourists especially in the chillla and Motichur forest dividion. On the other hand, presence of tigers, leopard, further ensures the feasibility of area for eco-tourism potentialities. Recently Motichur forest and Chilla forest of the tiger reserve is the centre of attraction for the tourist because approximately 90% tourist visit every year to enjoy wildlife safari and scenic beauty. Most of the sites inside the tiger reserve have typical diversity of species as per geographical locations (vegetation and fauna, variations in landscape) that is why some sites can be selected and diverted for eco-tourism purpose with controlled activities by the government.The tiger reserve has huge potentials of tourism in terms of elephant safari, birds watching and to enjoy scenic beauty. Birds watching are the centre of attraction and as a key for the researchers as well as scientist because the two range namely Chilla and Motichur have great diversity of birds. Months October and March are the best months for bird watching. Most of the birds area migrants and comes here from Northern part of America, south-East China, Europe, Russia, and some of the other countries which haveextreme cold climatic conditions during winter. Some of the important birds are: *Tadorna ferruginea*, *Aythyafarina*, *Anas platyrhynchos*, *Anas acuta*, *Anas clypeata*, *Anser indicus*, *Mycteria leucocephala* and *Ephippiorhynchus asiaticus* (Joshi *et al.,* 2010). These beautifull birds are key attraction for tourist.

Ecological value of the Rajaji Tiger Reserve

RTR is an important ecosystem comes under Rajaji- Corbett elephant reserve which maintains the elephants population as single entity of about 90% of 1000 odd elephants in Northern India (Singh *et al.*, 1986). The Asiatic elephants are the major attraction of the tiger reserve. In India it occurs in North-Western part. It has been estimated that, 800-1000 elephants occur in Rajaji- Corbett tiger reserve and the adjoining forest areas (Johnsingh *et al.,* 1994). The turbulent Ganges emerges from the Himalayas and begins its journey through the Indo- Gangetic plains at the park. The junctions of the Gangetic plains and the Outer Himalaya give rich eco-tone habitat in RTR that is unique in its diversity. It has vegetation representation of several distinct habitats including Chir- Pine forest, Scrublands, Broad leaves mixed forest, Riverine forest. *Shorea robusta* is the major dominant species especially along the Northern aspects. Thus unique to the rich biodiversity and the variety of ecological habitat, the RTR is unique repository of biodiversity in Northern India.

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