

Biodiversity of Sikkim

Exploring and Conserving a Global Hotspot



Government of Sikkim



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Editors

M. L. Arrawatia, IFS
Sandeep Tambe, IFS



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Cover page designed by Dr. Pankaj Kumar, Wildlife Institute of India, Dehradun

Front spread: *Rhododendron glaucophyllum* - Sikkim is home to as many as 38 species of Rhododendrons

Inner Before Title: Tso Lhamo in North Sikkim is home to the country's most significant population of Tibetan Gazelle (*Procarpa picticaudata*)

Back Inner: *Cyananthus lobatus* along with other alpine flowers, creates a valley of flowers effect in the alpine meadows during the monsoons

Back spread: Glacial lake above Dawathang in the Khangchendzonga National Park, Upper Kishong, North Sikkim

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PREFACE

Biological diversity, encompasses all forms of life on earth and maintains the ecological balance and sustains evolutionary processes. This diversity is the outcome of over 3.5 billion years of evolution, shaped by natural processes and recently, by the influence of mankind. The ecosystem services provided through biodiversity include photosynthesis, pollination, transpiration, hydrological cycles, nutrient cycling, pest control etc. Biodiversity also has aesthetic and recreational value. Conservation and sustainable use of biodiversity is therefore fundamental to ecologically sustainable development.

Biodiversity manifests itself at three levels: species diversity, genetic diversity and ecosystem diversity. Biodiversity is not distributed uniformly across the globe, certain countries are characterized by high species richness and more number of endemic species. These countries are known as mega diverse countries. India is one of the identified mega diverse countries of the world. With only 2.4% of the land area, it accounts for 7-8% of the recorded species of the world. Over 45,000 species of plants and 91,000 species of animals have been recorded so far.

In India, Sikkim is located in the Eastern Himalayas and is globally renowned for its biological diversity and the traditional knowledge associated with it. It is a part of the global biodiversity hotspot. The unique terrain, climate and biogeography of the state have resulted in the sustenance of varied eco-zones in close proximity. Also the harmonious presence of several ethnic groups having their distinct identity and practising their traditional livelihood adds to the treasure house of knowledge related to this biodiversity.

Sikkim harbours nearly 4,458 out of the total 15,000 species of flowering plants in the country. These include:

- 506 of the total 2302 species of Lichens
- 480 of the total 1200 species of Ferns
- 527 of the total 1229 species of Orchids
- 58 of the total 102 species of Primulas
- 38 of the total 90 species of Rhododendrons

Nearly 165 plant species have been named after the state, as they were first collected from here. The State possesses about 31% of the mammals, 45% of the birds and 50% of the butterflies of the country. The Tso Lhamo cold desert in Sikkim supports India's only population of the Southern Kiang (*Equus kiang polygodon*), and also significant populations of the Tibetan gazelle (*Procapra picticaudata*) and the Tibetan argali (*Ovis ammon hodgsonii*).

The continued pristine status of the ecosystems, conservation ethos of the local community and sustainable development initiatives of a pro-environment government has resulted in the conservation of this unique biological resource, while maintaining a high trajectory of economic growth and prosperity. In many aspects, the State has been a leader in the environment sector, having not only successfully pioneered nature conservation policies, but also having implemented them successfully. Nearly, one third of the land area has been directly conserved by establishing an extensive protected area network of sanctuaries and national park. This is the highest in the country in percentage terms. 82.31% of the geographical area of the State has been recorded as forest area and classified as reserve forests and protected forests and is under the administrative control of the Forest, Environment and Wildlife Management Department, and diversion for non-forestry purposes is regulated under the Forest Conservation Act, 1980. The forest and tree cover including private areas is increasing and presently stands at 47.6%, despite having large tracts above the tree line in the alpine zone having glaciers, snow capped peaks and alpine meadows. Forest and tree cover has grown to as much as 85.82% of the area below the tree line (4000 m).

During the last one and half decades, the pace of conservation has accelerated under the visionary leadership of the Greenest Chief Minister, Shri Pawan Chamling, and several policy decisions to conserve the Himalayan ecosystem have been taken and implemented successfully, namely:

- Ban on green felling in forest, no standing green trees are cut or harvested
- Ban on grazing in reserved forest areas, plantation areas and water sources areas

- Ban on use of non-biodegradable materials like plastic and poly-bags
- Launch of *Smriti Van* or memorial forests program
- Introduction of compulsory environment education in schools
- Blanket ban on scaling of sacred peaks and also defilement of sacred caves, sacred rocks, sacred lakes, chortens and sacred hot springs
- Being a high altitude state, the consumption of firewood in the rural households is substantial. Hence 100% subsidy on gohar gas and LPG in large quantities is being provided every year and has resulted in a substantial reduction in firewood use over the year
- Abandoned and closing down of “G” Firing Range over an area of 17,250 hectares acquired by the army establishment in North Sikkim
- Creation of Eco-Club, Green Funds in schools and colleges
- Ban on commercial exploitation and transit of medicinal plants from the wild
- Launching of Sikkim Green Mission
- Launching the spring water source conservation program - *Dhara Vikas* to enhance rural water security
- “Ten Minutes to Earth” is observed on 25th June, when people of Sikkim plant saplings in large numbers, making this event as an annual feature. This day is observed every year as a green day throughout the State
- To better understand the climate change impacts, the state has proactively taken up studies in collaboration with national institutions on glaciers and different aspects of climate change. Studies related to wetland mapping, snow cover mapping, forest fire impacts have been taken up
- The State Action Plan on Climate Change is under preparation in consonance with the National Action Plan on Climate Change
- The Sikkim State Council of Climate Change has been constituted for providing policy direction and institutional mechanism for effective implementation of various climate change programs
- Assessment of climate change related vulnerability of the rural communities at Gram Panchayat level has also been taken up

The book comprises large number of articles based on years of in-depth research in the state by scholars who are affiliated to premier research institutes. It covers topics related to biogeography, lichens, Mushrooms, ferns, flowering plants, trees, orchids, alpine vegetation, NTFP, fishes, amphibians, reptiles, butterflies, insects, birds, pheasants, mammals, red panda, cold desert, agro-biodiversity, pollinators and aspects of forest conservation and management including green governance. This book will help to consolidate the growing scientific literature in the state and assist budding scientists to assess the present state of knowledge. Amateurs, nature lovers, students, scientists and tourists wanting to know more about the fascinating natural wealth of Sikkim will also find the book of immense use. It is hoped that this knowledge series will continue to expand and cover other themes of relevance in the days to come.

The novel idea of having an academic book celebrating the unique biodiversity of Sikkim was conceptualized by the Chief Minister of Sikkim, Shri Pawan Chamling. The book has been made possible by sharing of knowledge by several authors, who have contributed in more ways than one. Several experts have also selflessly contributed their photographs. This effort has benefitted from the able guidance of Shri R. S. Basnet, Principal Secretary to the Chief Minister, Shri M. G. Kiran, Commissioner-cum-Secretary, Information and Public Relations Department and Ms. Karma Youtso, Deputy Secretary-Chief Minister’s Office. We are also grateful to Shri G. S. Rawat, Professor, Wildlife Institute of India, for support in the review work. There are also many others who helped in the making of this book in so many ways, that it would be difficult to recount even in small measure. We would like to express our heartfelt thanks to all of them. Whatever insights have been gained, emanate from the dedicated labour of the contributing authors, the blemishes are however all ours. If this work is able to bring about a clearer understanding of the magical landscape of Sikkim, then it would have served its purpose.

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Editors
M. L. Arrawatia, IFS
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Mr. Siniolchu (6,888 m) situated near the green lake in North Sikkim, has been described as the most beautiful snow mountain in the world

SIKKIM HIMALAYA: UNIQUE FEATURES OF BIOGEOGRAPHY AND ECOLOGY

G. S. Rawat and Sandeep Tambe

ABSTRACT

The Sikkim Himalaya stands out as smallest but biologically most diverse Himalayan states in India. It is unique in several ways - most importantly, it's close proximity to both the Tibetan Plateau and Bay of Bengal thereby having affinities with tropical moist forests in the south and cold desert in the north within a short distance of less than 100 kms. Heavy precipitation during winter as well as summer season has given rise to lush green vegetation. The state has strong influence of both west and east Himalayan biogeographic provinces. The west Himalayan elements in the state include Himalayan tahr (*Hemitragus jemlahicus*) and blue sheep (*Pseudois nayaur*). However, the state exhibits more affinities with the eastern Himalaya as evident from the presence of red panda (*Ailurus fulgens*), clouded leopard (*Neofelis nebulosa*), serow (*Capricornis milneedwardsii maritimus*) and high diversity of orchids and rhododendrons. The state is said to be the historical range of golden takin (*Budorcas taxicolor*). Angiosperms and lower groups of plants and animals exhibit high levels of endemism. This article deals with a few unique features of biogeography and ecology of the state along with priority areas of research and conservation.

KEYWORDS: *Biogeography, Conservation, Endemic species, Orchids, Rhododendrons*





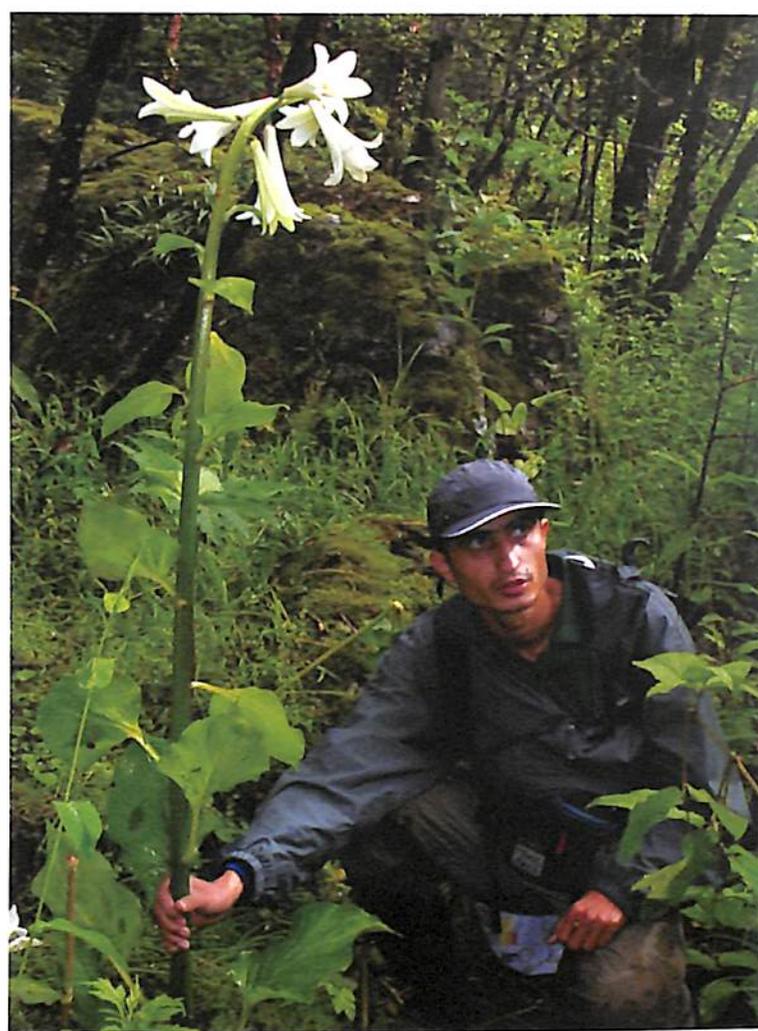
INTRODUCTION

Sikkim (ca. 7096 km²; 27° 05' to 28° 07' N latitudes and 87° 59' to 88° 56' E longitudes), wedged between Nepal and Bhutan is a small and most beautiful state of India well known for its scenic beauty, immensely rich biological diversity manifested by diverse eco-climatic conditions and wide altitudinal variation from about 300 m to 8500 m asl. Mount Khangchendzonga, the third highest peak in the world, and adjacent Singalila range strongly govern the relief features on the western part of the state while Chola range plays prominent role in determining physiography on the eastern part of the state. Together, these ranges, not only, strongly influence the atmospheric circulation and regional climate in the region but also affect the climate of adjacent regions. In the north, the state forms international boundary with Tibetan Autonomous Region of China while in the south it is bordered by West Bengal. The state is the major catchment of river Teesta that originates from Tso Lhamo lake in the north.

A large number of Naturalists, Field Biologists, Ecologists and Scientists have contributed to the current knowledge on the ecology and biogeography of Sikkim Himalaya. Pioneer among them was Sir Joseph Dalton Hooker who made historical botanical forays to the interiors of the state during 1848 – 49 (Hooker 1853). Subsequent to Hooker's exploration several European Botanists collected plants from the state, notably Sir George King, C.B. Clarke, D. Prain, J.S. Gamble, Sir George Watt, R. Pantling, G.A. Gammie, W.W. Smith and G.H. Cave. Hooker also made natural history observations on a few animal species during his expeditions. Most of these botanists have acknowledged the significant contributions made by the Lepcha community of Sikkim in documenting the floral and



Magnolia campbellii in bloom



Cardiocrinum giganteum
Giant lily in Zemu Valley, Sikkim

faunal wealth of the state (Smith and Cave 1911). During the past few decades quite a few Indian botanists have updated the information on various taxonomic groups such as rhododendrons, orchids and ferns and made significant contributions (Pradhan and Lachungpa 1990; Lucksom 2007; Kholia 2010). However, information on the distribution of animal communities for the state is rather limited except detailed observations on the birds by Salim Ali and on butterflies by Meena Haribal (Ali 1962; Haribal 1992). More recently, Ms. Usha Lachunpa has collected ample information on the distribution of various faunal groups in the state which have been incorporated in the State Biodiversity Strategy and Action Plan (SBSAP) of the state (Lachungpa *et al.* 2003). Detailed ecological studies on the faunal communities have been undertaken by Dr. Nakul Chettri on birds and butterflies of KNP, Dr. Bhoj Kumar Acharya on birds of Sikkim, Dr. Basundhara Chettri on herpetofauna and Dr. Joya Thapa on mammals. Tambe (2007) conducted a detailed study on the ecology and management of alpine vegetation in Khangchendzonga National Park. A short study on the habitat use and food selection by wild and domestic ungulates in Tso Lhamo plateau was conducted by Chanchani (2007). Currently, a survey of small mammals and pheasants of Khangchendzonga BR by the Wildlife Institute of India is underway. Besides, Department of Science & Technology, Government of Sikkim has initiated a few ecological studies on various aspects in the state.

This article gives a brief overview of unique features of ecology and biogeography of Sikkim Himalaya based on published information. We flag a few issues of conserving unique floral and faunal assemblages and recommend further ecological investigations and biogeographic analysis of hitherto least studied groups

UNIQUE FEATURES

Despite several commonalities of Central and Eastern Himalaya, Sikkim exhibits a few unique features. Notable among them are: contiguity of habitats from sub-tropical forests of Sal (*Shorea robusta*) to cold deserts within a distance of less than 100 kms; Sikkim plateau - one of the smallest biogeographic provinces in India; wide *Krummholz* zone in subalpine - alpine ecotone; intact transboundary biological corridors along horizontal axis and highest number of species named after any state in India. Sikkim has exceptionally diverse orchids and it is also believed to be centre of origin for *Cymbidium*. These features are further elaborated below:



Subtropical Sal forests with Chir pine along the Rangit river valley in South Sikkim

Contiguity of habitats from sub-tropical forests to cold deserts: The state exhibits great compression of eco-climatic zones owing to wide altitudinal gradient and fairly high degree of slopes. Perhaps no other Indian state would have such a contiguity of diverse habitat types from sub-tropical forests to dry alpine steppe within a short distance of less than 100 kms. Majority of the habitats are divided through two great river systems i.e., the Teesta and Rangit which are drained by numerous tributaries. Each eco-climatic zone is represented by its own distinct floral and faunal communities, some of which occupy more than one habitat and wider altitudinal range, especially a few migratory species. A large number of altitudinal migrants especially leaf-warblers reach treeline and adjacent alpine scrub to breed during summer and descend to foot-hills and further to peninsular India during winter. The foot-hill forests in the state harbour several floral and faunal elements, typical of eastern Himalaya. Notable among the floral assemblages are a variety of epiphytic orchids, aroids, wild banana, *Pandanus* and bamboos, while prominent avifauna include Rufous-necked Hornbill *Aceros nipalensis*, Great Indian Hornbill *Buceros bicornis homrai*, Chestnut-breasted Partridge, Black-breasted Parrotbill, Grey-crowned Prinia and Ward's Trogon. This region also exhibits a narrow range of *Sal - Chir* pine transition.

Tso Lhamo Plateau – India's smallest biogeographic province: The Sikkim plateau or popularly known as Tso Lhamo lies in the Trans-Himalayan region of the state, covering an area of about 400 sq. km and perhaps represents India's smallest biogeographic province (Rodgers and Panwar 1988). This province harbours populations of a few highly threatened mammalian fauna (Table 1) such as Tibetan argali (*Ovis ammon hodgsoni*), Tibetan gazelle (*Procapra picticaudata*) and southern kiang (*Equus kiang polyodon*). This area has also been the historical range of Tibetan antelope (*Pantholops hodgsonii*). The plateau is also used extensively by the native Dokpa herders for livestock (yak and sheep) grazing. Compared to 1A and 1B (Ladakh), this plateau is reported to have higher densities of Tibetan argali and Tibetan gazelle but these populations are susceptible to decline due to heavy human influx and livestock grazing. Given the strategic location of this area for national security and stake of local communities for pastures, this area would need a different model of protected area. Hence it is recommended that this plateau be notified as Conservation Reserve.



An extensive *Krummholz* zone: One of the interesting features of the state is perhaps widest and most extensive zone of *krummholz* (stunted forest) in the Himalayan region. The following associations are easily identifiable within *krummholz* zone viz., *Rhododendron wightii* – *R. fulgens*, *R. thomsonii*, *R. hodgsonii*, *R. lanatum* and *R. campanulatum*. These associations are usually found between 3500 - 4200 m asl on rocky and shady moist slopes. General height of the vegetation varies between 2 – 2.5 m and most of the formations are thick and impenetrable. Ground vegetation is dominated by mosses and lichens. *Krummholz* zone forms ideal habitat for a number of avian (e.g., blood pheasant, satyr tragopan) and mammalian fauna (e.g., Himalayan musk deer). Some of the protected areas well known for their extensive *krummholz* zone and high diversity of rhododendrons include Shingba WS (North), Kyongnosla WS (East), Pangolakha WS (East), Barsey WS (West) and Khangchendzonga Biosphere Reserve. Shingba Rhododendron Sanctuary is home to the endemic *Rhododendron nivaleum*, which has been designated as the State tree of Sikkim.



Dwarf *Rhododendron nivale* - mats at 4000 meters elevation in North Sikkim

Most congenial habitats for orchids in the Himalaya: Contiguous riverine habitats along sub-tropical and warm temperate belts surrounded by rich forests of *Duars* of north-west Bengal form congenial habitat for a variety of epiphytic as well as ground orchids. The deep valleys and lower hills retain considerable moisture throughout the year owing to summer as well as winter precipitation. The sub-tropical belt has a number of tall trees which form excellent host for epiphytes such as *Shorea robusta*, *Duabanga sonneratioides*, *Gmelina arborea*, *Terminalia tomentosa*, *Schima wallichii*, *Toona ciliata*, *Engelhardtia spicata*, and *Machilus odoratissima* to name a few. The common genera of orchids in these forests include *Dendrobium*, *Ascocentrum*, *Aerides*, *Acampe*, *Vanda*, *Cymbidium*, *Bulbophyllum*, *Flickingeria*, *Smitinandia*, *Phalaenopsis* and *Porpax*. This belt is also extremely rich in ground orchids represented by the species of *Nervillia*, *Galeola*, *Tropidia*, *Anoectochilus*, *Goodyera* and *Zeuxine*. Other notable species of orchids along foot-hills are snow orchid (*Diplomeris hirsuta*), Lady's slipper orchid (*Paphiopedilum venustum*) and Bamboo orchid (*Arundina graminifolia*) among others. In all, the state has over 525 species of orchids, including several endemic species reported by earlier workers and recently by Lucksom (2007).



Pleione praecox, a delicate orchid on moss beds in temperate forests

An important trans-boundary biological corridor: The Khangchendzonga Biosphere Reserve (KBR) and adjacent forested tracts on other side of Teesta are contiguous with Chola Range in the east. The KBR forms contiguous habitat with Khangchendzonga Conservation Area in Nepal (on the western side) and Singalila National Park in Darjeeling (Gorkha Hill Council) as well as several other protected areas in Sikkim (Maenam and Barsey). Thus the entire landscape covering over an area of more than 11,500 km² forms a transboundary conservation complex extending from Nepal through Sikkim, Chumbi valley of Tibet and further into Bhutan, providing one of the most important biological corridor in the region. The landscape provides connectivity from west to east and south to north and includes relatively intact subtropical and temperate forests which are otherwise fragmented in other parts of Himalaya, especially in Nepal (Sharma 2002). Besides several avian communities, these corridors would be used by a variety of other faunal groups in the long run.

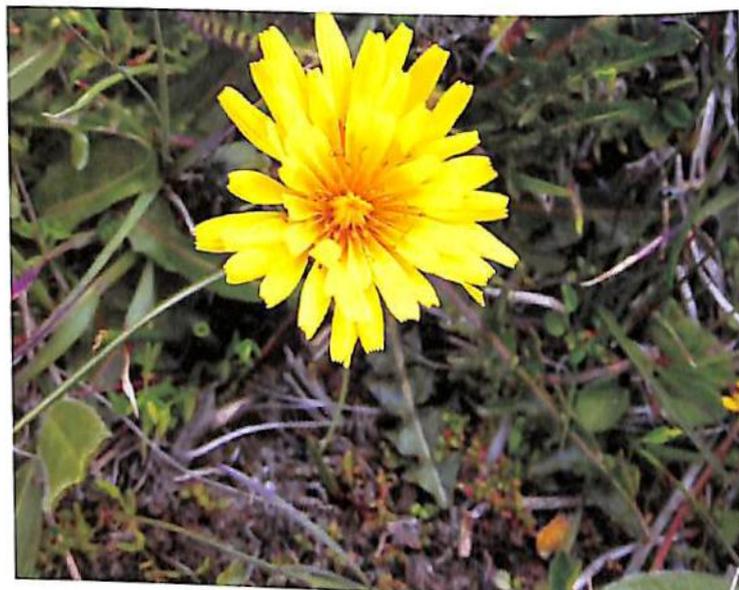
Highest number of vascular plants named after any Indian state: The state has been a place of attraction for a large number of plant explorers and systematic botanists since the time of Sir J.D. Hooker. Owing to its peculiar geographical location, wedged between Nepal and Bhutan, Sikkim has always rewarded the plant explorers. This is evident from the

large number of taxa named after the state. A cursory look at the published literature on the flora of Bhutan and parts of Sikkim reveals that as many as 165 species named after Sikkim (Grierson and Long 1983-1991). This forms the largest number of vascular plants named after any Indian state. Notable taxa are:

Astragalus sikkimensis, *Cleisostoma sikkimensis*, *Euphorbia sikkimensis*, *Hedysarum sikkimense*, *Liparis sikkimensis*, *Cirrhopetalum sikkimense*, *Elatostema sikkimense*, *Salvia sikkimensis*, *Rubia sikkimensis*, *Vittaria sikkimensis*, *Salix sikkimensis*, *Gentiana sikkimensis*, *Lomatogonium sikkimense*, *Lettsomia sikkimensis*, *Primula sikkimensis*, *Rubus sikkimensis*, *Saxifraga sikkimensis*, *Clematis sikkimensis*, *Corydalis sikkimensis*, *Kobresia sikkimensis*, *Draba sikkimensis*, *Ranunculus sikkimensis*, *Pedicularis sikkimensis*, *Prenanthes sikkimensis*, *Scrophularia sikkimensis*, *Taraxacum sikkimense*, *Allium sikkimense*, *Commelina sikkimensis*, *Agapetes sikkimensis*, *Ampelocissus sikkimensis*, *Begonia sikkimensis*, *Canarium sikkimense*, *Epilobium sikkimense*, *Ilex sikkimensis*, *Osbeckia sikkimensis*, *Pyrola sikkimensis*, *Vaccinium sikkimense* and *Viola sikkimensis*.



Salix sikkimensis - Sikkim willow



Taraxacum sikkimensis



Ephedra gerardiana var sikkimensis



Hedysarum sikkimensis

Sikkim Himalaya is regarded as hot spot of *Pedicularis* diversity in Himalaya, having about 55 species i.e., 70% of the Indian Himalayan taxa (Hussain *et al.* 2010). Of these, nearly 16% species are said to be endemic to Sikkim Himalaya. Globally, Sikkim and adjacent Yunnan province of China is said to be centre of origin and diversification of this species. This may be true for several other plant groups. A detailed phytogeographic analysis may reveal more interesting facts about the state.



Pedicularis roylei var. *speciosa* in Zemu valley

FUTURE RESEARCH AND CONSERVATION PRIORITIES

Sikkim Himalaya offers tremendous scope for further research on various aspects of ecology, biogeography and biodiversity. First and foremost, a detailed (large scale) vegetation map of the state needs to be prepared with the technical assistance from national agencies dealing with remote sensing and vegetation surveys such as Forest Survey of India and Indian Institute of Remote Sensing. Data on the distribution of various faunal groups collected by the research wing of Forest Department will need collation and projection in the form of spatial database so as to develop distribution maps of various species. Likewise, major plant communities and habitat types within various protected areas and also along Teesta and Rangit rivers need to be mapped to assess the habitat contiguity and critical areas all along the river. Under the wake of climate change baseline surveys on the populations of several endemic and ecologically sensitive species will have to be conducted along the altitudinal gradient so as to make future comparisons. Similarly, several groups of plants such as orchids, rhododendrons, primulas, ferns and other cryptogams await detailed ecological investigations.

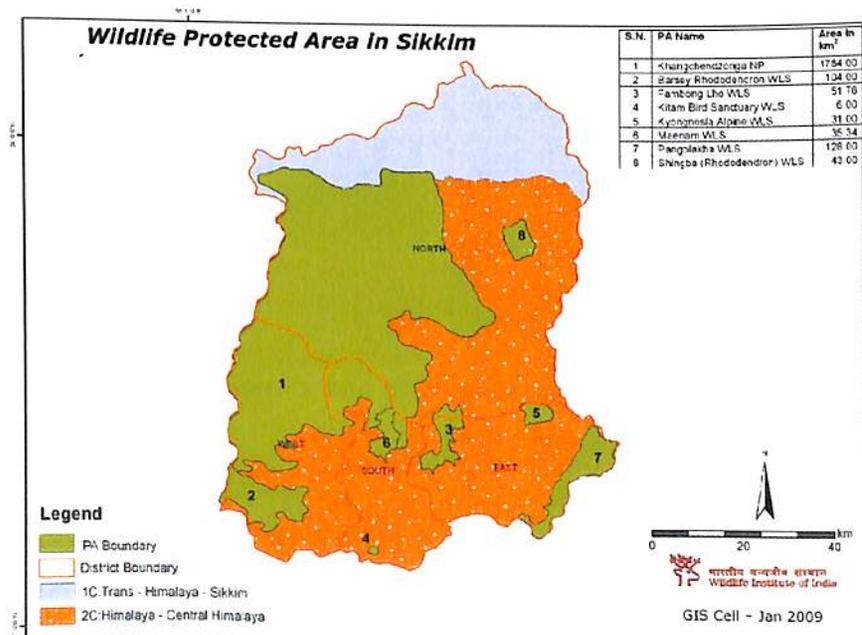
The state has already taken impressive strides in terms of protected area planning, implementation of the Wildlife (Protection) Act and gaining public support for wildlife conservation. The State boasts of 31% of the geographical area under the protected area network (sanctuary and national park) which is highest in the country as against the national average of about 5%. The state has launched an innovative and unique program for the participatory conservation of the alpine areas by enrolling local community level resource persons as *Himal Rakshaks* or Honorary Mountain Guardians. These *Himal Rakshaks* have been trained in participatory monitoring of the alpine areas. For the conservation of high altitude lakes impacted by tourism, the local community has been empowered and involved in the lake management through the *Pokhri Sanrakshan Samiti* initiative. The Chief Minister – Shri Pawan Chamling in an exemplary policy step banned the practice of grazing in forests. Blanket implementation of this ban over the last decade has resulted in phasing out of cattle from the forests and protected areas thereby making the sanctuaries and national park a haven for wildlife and as a result the populations of flagship species like blue sheep, red panda, wild dog etc are bouncing back. Also in a long term policy decision to conserve the medicinal plant germplasm, the State Government has prohibited the commercial extraction and transit of medicinal plants from forests. The state has also made remarkable progress in implementing national rural employment guarantee schemes and combining this programme with conservation activities and natural resource management.

Further proactive steps are needed especially in ensuring conservation of a few critical wildlife areas such as Tso Lhamo plateau that harbours a unique assemblage of flora and fauna. This area needs to be managed in the lines of Conservation Reserve, keeping the security personnel and local communities in confidence and in their partnership. Dialogues with the Government of China would also be needed for ensuring the protection of threatened species such as Tibetan gazelle and southern kiang on the other side of the border and eventually managing this area as Trans-boundary Peace Park.

Some of the sanctuaries in the cool temperate belt (1500 -3000 m asl), e.g., Fambong Lho WS in East and Maenam WS in South Sikkim need detailed biological surveys to assess the ecosystem coverage, identification of sensitive habitats and establishing linkages with other areas. Similarly, Kitam Bird Sanctuary (6 km²), the only protected area in the sub-tropical belt needs to be expanded to cover the adjacent Reserved Forests. Efforts are also needed to ascertain the inclusion of threatened taxa such as Rusty-bellied and Lesser Shortwings, Kalij and Satyr Tragopans, Japalura lizard, Himalayan Bullfrog, etc., within these PAs. A patch of Reserve Forest (ca 5 km²) near Rangrang (North Sikkim) has been selected as Butterfly Park for which feasibility survey has been completed by the state Forest Department. Similarly, near Tinkitam a patch of forest (5 km²) is proposed to be declared as Ladys' Slipper Orchid (*Paphiopedilum fairrieanum*) Conservation Reserve. Reportedly (Ms. Usha Lachungpa, Senior Research Officer, *Personal communication*), the public hearing has been completed for further action. Rabdentse Bird Park in West Sikkim (2 km² area) has recently been fenced which has resulted in good recovery of *Castanopsis tribuloides*. Legally this falls under Reserved Forest and the main purpose of this park is to protect the birds and also awareness generation and entertainment of the visitors.



Bharal or Himalayan Blue sheep *Pseudois nayaur* is a caprid found extensively in the alpine zone of Sikkim Himalaya



Protected Area Network of Sikkim

The area around Himalayan Zoological Park, Gangtok (205 ha) serves as an important catchment for water supply to Gangtok city. This area and adjacent Ratey Chu Reserve Forests have been identified as Important Bird Area by BNHS (Islam and Rahmani 2004). These two areas form contiguous forest with the adjoining Fambong Lho WS. Considering their long term conservation significance they may be given the status of Wildlife Sanctuary.



Tso Lhamo supports India's only population of the Southern kiang (a sub - species) *Equus kiang polydon*

Table 1: Mammalian fauna of Tso Lhamo Plateau, Sikkim [WPA = Wildlife (Protection) Act; IUCN Categories: NT = Near Threatened; DD = Data Deficient; LC = Least Concern; VU = Vulnerable; EN = Endangered]

	Common Name	Scientific Name	IWPA	IUCN
1	Tibetan argali	<i>Ovis ammon hodgsonii</i>	I	Vulnerable
2	Tibetan gazelle	<i>Procapra picticaudata</i>	I	NT
3	Southern kiang	<i>Equus kiang polydon</i>	I	DD
4	Blue sheep	<i>Pseudois nayaur</i>	I	LC
5	Tibetan wolf	<i>Canis lupus chanko</i>	I	VU
6	Tibetan sand fox	<i>Vulpes ferrilatus</i>	I	LC
7	Pallas's cat	<i>Felis manul</i>	I	NT
8	Snow leopard	<i>Uncia uncia</i>	I	EN
9	Eurasian lynx	<i>Lynx lynx</i>	I	EN
10	Himalayan marmot	<i>Marmota bobak</i>	II	LC
11	Tibetan woolly hare	<i>Leipus oiostolus</i>	II	LC
12	Plateau pika	<i>Ochotona curzoniae</i>	II	LC
13	Siberian weasel	<i>Mustela sibirica</i>	II	LC



Congregation of Nayan *Ovis ammon hodgsoni* in Tso Lhamo cold desert in North Sikkim



Himal Rakshak Program - A novel initiative to enlist the voluntary support of community based resource persons for conservation of the alpine zone

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