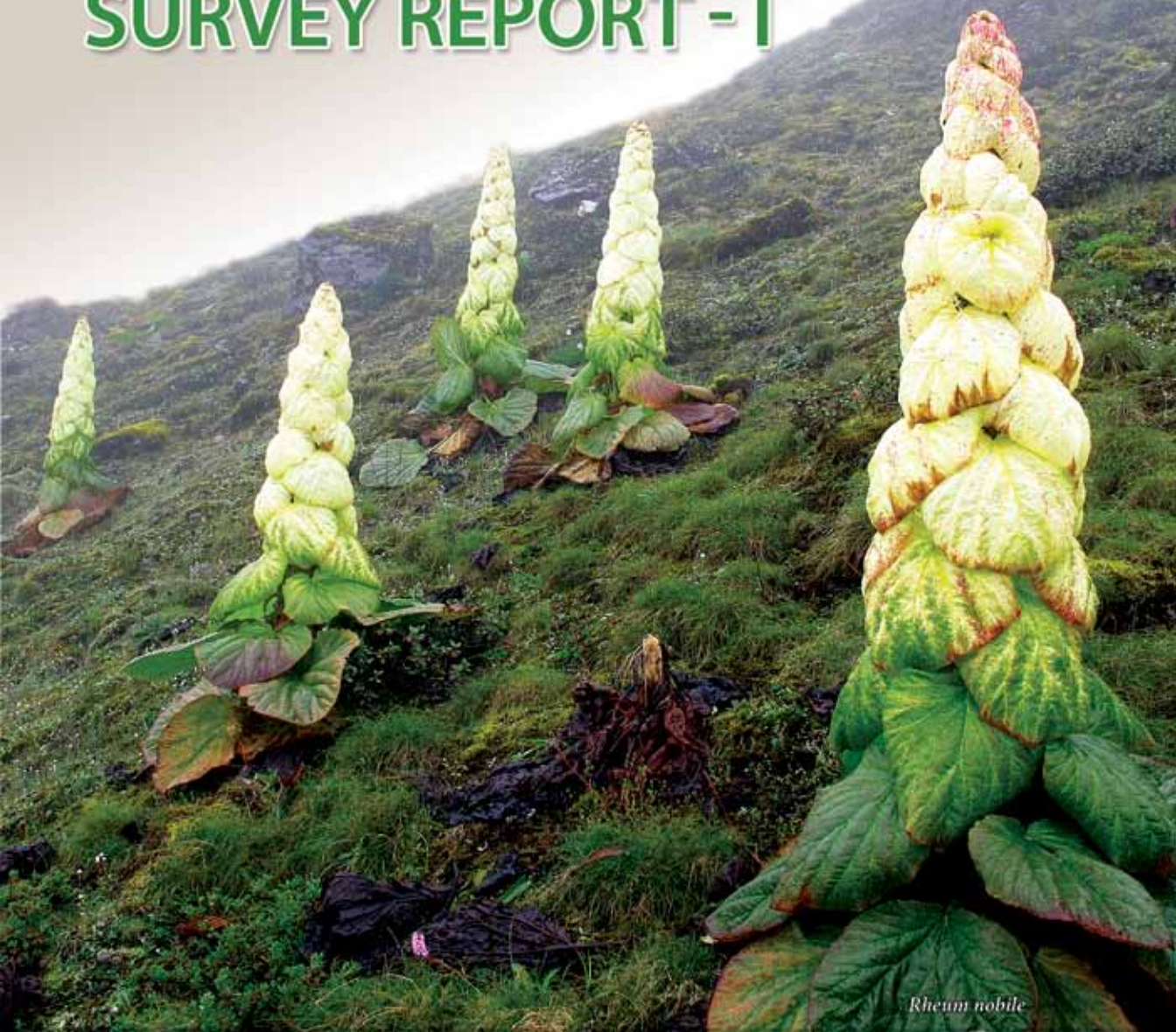


RAPID BIODIVERSITY SURVEY REPORT - I



Rheum nobile



Sikkim Biodiversity Conservation and Forest Management Project (SBFP)
Forest, Environment and Wildlife Management Department
Government of Sikkim

RAPID BIODIVERSITY SURVEY REPORT - I



Bistorta vacciniifolia



Sikkim Biodiversity Conservation and Forest Management Project (SBFP)
Forest, Environment and Wildlife Management Department
Government of Sikkim

Rhododendron barbatum



Published by :

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Rhododendron trail, Yuksom-Dzongri, West Sikkim



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Pawan Chamling
(Honoris Causa)
Chief Minister of Sikkim

Message

Sikkim is a biodiversity rich hotspot and has been a much coveted area for botanical exploration by scientists over centuries. We hear many a times new species of endemic plant and animals being discovered in Sikkim because of which, Sikkim is receiving national as well as international attention in terms of scientific research.

We are indeed fortunate to be given the opportunity to work with Japan International Cooperation Agency (JICA) on Biodiversity Conservation. It has provided an opportunity for not only developing holistic expertise on varied sectors related to biodiversity conservation but also aided in augmenting and strengthening the management of biodiversity.

Rapid Biodiversity Assessment approach is a tool developed by Conservation International for systematic biodiversity data collection and has been well accepted throughout the world as one of the best approaches in

collecting field information required for framing management policies. The same tool has been replicated in Sikkim and the Forest Environment and Wildlife Management Department has been able to come out with the first of the series of a compilation of biodiversity surveys carried out in different areas of Sikkim aptly titled as the "Rapid Biodiversity Survey – Report I".

I am sure that the information contained in the book will be resourceful and every individual will be benefitted from such a publication. I also congratulate the Forest Environment and Wildlife Management Department for their dedicated effort in publishing the book. I wish the Department all success and await the publication of the series.

(Pawan Chamling)
Chief Minister of Sikkim

Foreword



T.W. Lepcha

It gives me immense pleasure to release the book titled “Rapid Biodiversity Survey- Report I” being published by the JICA - assisted Sikkim Biodiversity Conservation and Forest Management Project (SBFP), Department of Forest, Environment and Wildlife Management Department, Government of Sikkim.

The State of Sikkim is biodiversity hotspot, acclaimed throughout the world for its diverse variety of floral and faunal species. The main reason for this richness is the altitudinal variation over short distances. In order to facilitate scientific management of forests it is imperative for forest managers to understand the species diversity, the varied types of ecosystem etc, prevalent in the different forest types. Hence a biodiversity survey in selected forest types and eco-zones is essential.

This survey output will aid in developing baseline information on key biological elements of forest, alpine, freshwater and agro-ecosystems for monitoring the impacts of forest and biodiversity management. Through the survey, critical areas can be identified that would require immediate protection by means of forest management based on sound scientific principles. In this era when issues on environment and climate change are discussed on a global level, the conservation and protection of forest is important. It is therefore crucial for managers to identify best practices for forest management for long term conservation of biodiversity.

I am confident that this book will serve as a base for forest managers to develop protocols for better scientific management of Sikkim forests.

(T.W. Lepcha)

Minister for Forests Environment & Wildlife Management Department/Mines,
Minerals & Geology, Science and Technology Department,
Government of Sikkim.

Preface



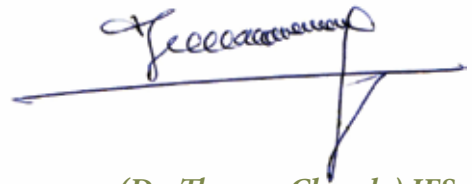
Dr. Thomas Chandy

Biological diversity or biodiversity in short describes the variety of living organisms that inhabit a particular area. Most commonly, biodiversity is measured by the number of species in an ecosystem JICA assisted Sikkim Biodiversity Conservation and Forest Management Project has made an effort to initiate a series of species enumeration in Sikkim for the first time.

Inventories of various species are frequently used as surrogates for estimating total biodiversity. The contribution that nature makes to human well-being is often not adequately appreciated or integrated in decision making which results in considerable cost to the society. Hence enumeration of various species in the State is one of the prerequisites to appreciate the enormous contribution of an ecosystem towards civilization.

One of the paradigm shifts in conservation biology over the last decade has been a shift from species centred conservation towards landscape-approach management and conservation. So it is pertinent to conserve the communities as a whole than to contemplate over an individual species.

This book is an effort to give an overview about enumeration of various species of flora, fauna and avi-fauna in the State of Sikkim and to project our common obligation to bring about conservation.



(Dr. Thomas Chandy) IFS,
Principal Chief Conservator of Forest-cum Principal Secretary,
Sikkim Conservation and Forest Management Project,
Forest Environment & Wildlife Management Department.

Acknowledgement

This book the Rapid Biodiversity Survey Report-I is an effort to simply bring out the list of flora and fauna in selected locations of Sikkim. This book nearly lists out plant species encountered during the few survey being carried out by the Biodiversity Conservation Division under SBFP.

Sincere appreciation to the Biodiversity Conservation Division and its dynamic and energetic SBFP Survey, Research and GIS team for going into the field, staying in forest for days laying out plots and data compilation. This book would not have been possible with the support and encouragement from the Honorable Minister of Forests Shri T.W. Lepcha and PCCF-cum-Principal Secretary Dr. Thomas Chandy.

Udai Gurung, IFS

Additional Project Director - II

Sikkim Biodiversity Conservation & Forest Management Project
Department of Forests, Environment & Wildlife Management
Government of Sikkim



Introduction

Sikkim, a north-eastern Himalayan State, is globally renowned for its rich biological diversity and is a part of global biodiversity hotspot. It is located in the Eastern Himalaya and is the 22nd State of the Indian subcontinent. It is the 2nd smallest State in the country. The State has unique biogeographical features having varied altitudinal range and climate which makes it a home to diverse type of flora and fauna from tropical to trans-Himalaya. In addition to this, the State is also a home to 3 different ethnic communities having unique culture, tradition and life style and living in harmony with each other.

Sikkim is known to harbour approximately 4500 species of flowering plants, which includes over 450 tree species, 37 species of

rhododendrons, over 500 species of medicinal plants, 523 orchid species, 480 species of fern & fern-allies, 8 tree fern species, 11 oak species, 16 conifer species, 23 bamboo species, 60 Primula species, etc.

The state has 82.31 percent of the total geographical area (7096 Sq. Km.) under the forests, which harbours several endemic floral species, viz. *Acronema pseudotenera*, *Anaphalis cavei*, *Anemone demissa*, *Coelogyne treutleri*, *Mahonia sikkimensis*, *Podophyllum sikkimense*, *Rhododendron sikkimense*, etc. The species of the eastern Himalaya endemic to Sikkim includes *Abies densa*, *Betula utilis*, *Larix griffithii*, *Rhododendron baileyi*, *Rhododendron camelliiflorum*, *Rhododendron ciliatum*, *Rhododendron glaucophyllum*, *Rhododendron*

grande, *Rhododendron lanatum*, *Rhododendron lindleyi*, *Rhododendron wallichii*, *Rhododendron wightii*, etc. The endemic orchid of Sikkim includes *Bulbophyllum trichocephalum* var. *capitatum*, *Calanthe anjanii*, *Calanthe yuksomensis*, *Cremastra appediculata* var. *sonamii*, *Cymbidium whiteae*, *Dendrobium eriiflorum* var. *sikkimensis*, *Pantlingia paradoxa*, etc. Several plant species, over 160 species have also been named after Sikkim such as *Acer sikkimense*, *Berberis sikkimensis*, *Elaeocarpus sikkimensis*, *Primula sikkimensis*, *Podophyllum sikkimense*, *Ranunculus sikkimensis*, *Rhododendron sikkimense*, *Swertia sikkimensis*, etc.

On the basis of variability in altitudes, Sikkim is divided into three different vegetation zones, tropical, temperate and alpine with their distinguishable plant species composition. For example, the tropical regions (220 m asl to 1500 m asl) are covered with the forests of *Shorea*, *Adnia*, *Dalbergia*, *Dillenia*, *Artocarpus*, *Ficus*, *Bahunia*, *Litsea*, *Terminalia*, *Schima*, *Syzgium*, *Engelhardtia*, *Castanopsis*, *Pandanus*, *Cythia*, *Michelia*, *Saurauia* sp., etc. Apart from these, several varieties of orchids, laurels, bananas are available in this region. In the temperate regions (1500 m asl to 4000 m asl), forests comprises of *Alnus*, *Acer*, *Betula*, *Magnolia*, *Rhododendron*, *Larix*, *Berberis*, *Michelia*, *Engelhardtia*, *Quercus*, *Nyssa sessiliflora*, *Abies densa*, *Tsuga dumosa*, *Larix griffithiana*, *Taxus baccata*, etc. Besides, numerous species of herbs of medicinal importance such as, *Aconitum*, *Podophyllum*, *Picrorhiza*, *Rheum*, *Swertia*, *Nardostachys*, *Polygonatum*, etc., are found in this zone. The Alpine region (4000 m asl to 6000 m asl) consists of shrubs and scrubs of rhododendrons, junipers, etc. In addition, there exists various species of *Primula* and *Meconopsis*. The altitude above 6000 m asl remains permanently under snow cover.

For its floral richness, several botanical explorations have been made in Sikkim by famous botanist and naturalist from all over the world including Sir J.D. Hooker, Sir G. King, C.B. Clarke, G.H. Cave, W.W. Smith, and J.M. Cowan all of whom have published detail account of their findings.

The beauty and variety of plant diversity in Sikkim is further enhanced by the presence of a wide variety of faunal diversity, which includes 150 species of mammal, 552 species of birds, 700 species of butterflies and 1500 species of moth, 29 species of reptiles, 10 amphibian species and over 48 fish species. Amongst the important and rare animals found in Sikkim, the Snow leopard (*Uncia uncia*), Red Panda (*Ailurus fulgens*), Musk deer (*Moschus* sp.), Barking deer (*Muntiacus muntjak*), Himalayan Thar (*Hemitragus jemlahicus*), Goral (*Naemorhedus goral*), Blue sheep (*Pseudois nayaur*), Serow (*Capricornis milneedwardsii*), Tibetan Gazella (*Procapra picticaudata*), Tibetan wolf (*Canis lupus chanco*), Himalayan black bear (*Ursus thibetanus*), Clouded leopard (*Neofelis nebulosa*), Leopard cat (*Prionailurus bengalensis*), Jungle cat (*Felis chaus*), Himalayan marmot (*Marmota himalayana*), etc. are prominent. Many of these species are now listed in the IUCN red data book. Some of these animals have also been included in Schedule I of the Wildlife (Protection) Act, 1972, including the Blue sheep, Clouded leopard, Himalayan Thar, Musk deer and Red Panda.

With regard to the avifaunal diversity, Sikkim represents the highest bird richness in terms of total geographical area. About 50 percent of the bird species of the Indian sub-continent (1400 species) are present in Sikkim. The Blood Pheasant (*Ithaginis cruentus*), Crimson horned Pheasant (*Tragopan satyra*), Forest

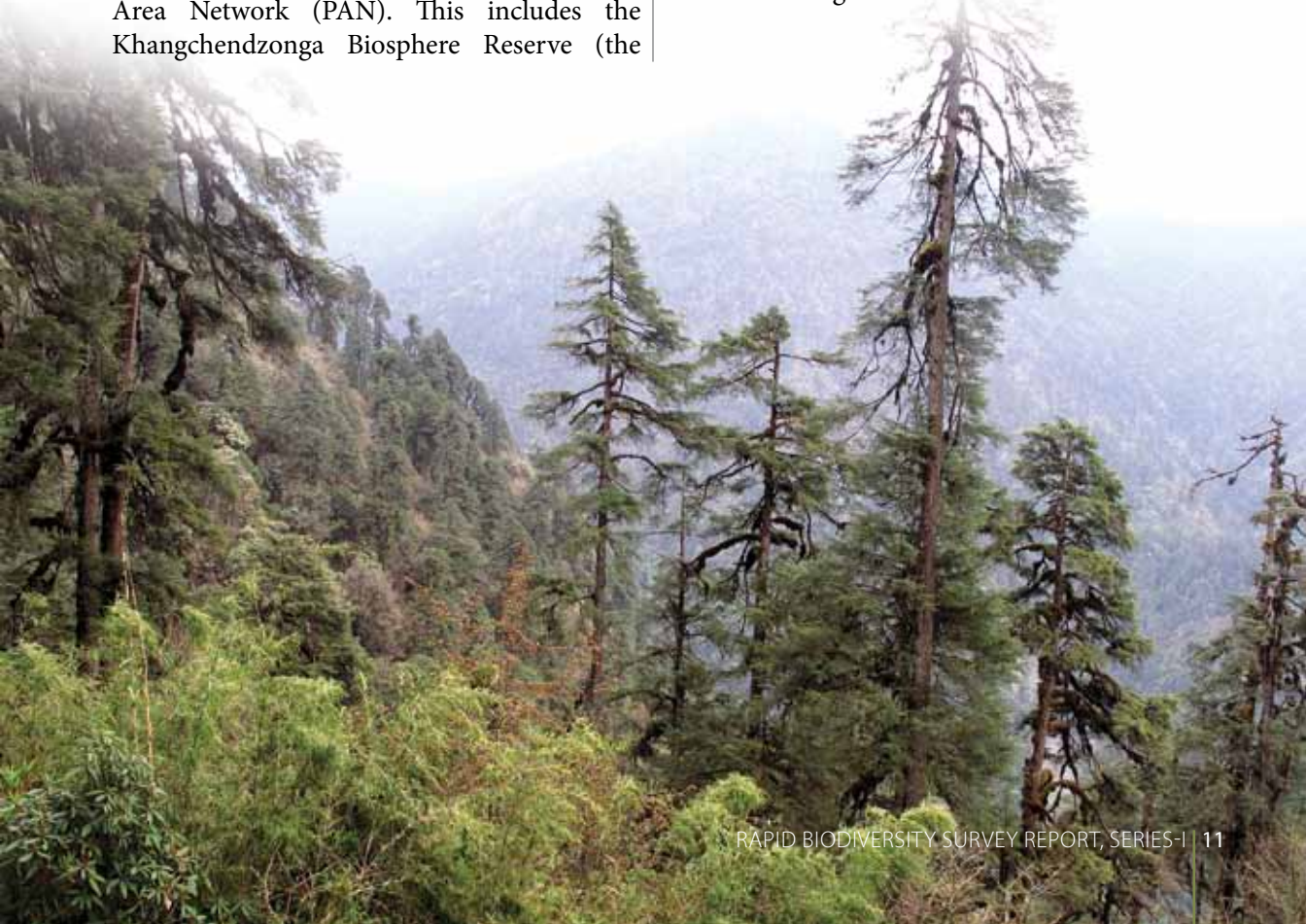
eagle owl (*Bubo nipalensis*), Himalayan golden eagle (*Aquila chrysaetos daphanea*), Monal Pheasant (*Lophophorus impejanus*), Lammergeyer (*Streptopelia orientalis*), Tibetan snowcock (*Tetraogallus tibetanus*), etc., are listed in Schedule I of the Wildlife (Protection) Act, 1972. It has also been reported that species like the Black necked Crane (*Grus nigricollis*), the Himalayan Griffon Vulture (*Gyps himalayensis*), the Tibetan Snowcock (*Tetraogallus tibetanus*), Snow Partridge (*Lerwa lerwa*), Snow Pigeon (*Columba leuconota*), Snow Finch (*Montifringilla* sp.), Mountain Finch (*Leucosticte brandti*), etc., have become endangered.

In order to protect the rich biodiversity of the state, 46.93% of the total geographical area has been brought under the Protected Area Network (PAN). This includes the Khangchendzonga Biosphere Reserve (the

highest Biosphere Reserve in the country), Fambong Lho Wildlife Sanctuary, Kyongnosla Alpine Sanctuary, Barsey Rhododendron Sanctuary, Maenam Wildlife Sanctuary, Shingba Rhododendron Sanctuary, Kitam Bird Sanctuary and Pangolakha Wildlife Sanctuary.

Several measures have also been taken up by the Government of Sikkim with regard to biodiversity conservation, such as

- Ban on grazing
- Ban on commercial exploitation of medicinal plants
- Launch of Smriti Van programme
- Launch of Dhara Vikash programme
- Launch of Green Mission programme
- Launch of Paryavaran Mahotsav programme
- Ban on felling of trees from the forest



Rapid Biodiversity Survey and Sikkim Biodiversity Conservation and Forest Management Project (SBFP)

Rapid Biodiversity Assessment approach is a tool developed by Conservation International for systematic biodiversity data collection and has been well accepted throughout the world. It is a medium of quickly collecting information on the floral and faunal species present in a given area and provides key information that can be used to manage and protect species of conservation concern and overall biodiversity.

Rapid biodiversity survey (RBS) is being carried out as part of the biodiversity conservation component of the JICA (Japanese International Cooperation Agency) assisted Sikkim Biodiversity Conservation and Forest Management Project (SBFP). Prior to the RBS, there has been a long series of studies undertaken to document the biological wealth of Sikkim, and the RBS is envisage in building upon this. In the 19th century, European explorers Sir JD Hooker, Peter and Kenneth Cox, David Chamberlain, amongst others, enriched international herbaria and renowned botanical gardens, and their taxonomic analyses and treaties established the scientific knowledge based on the flora of the region. Indian and regional scientific institutions like the Botanical Survey of India (BSI) and Zoological Survey of India (ZSI), Wildlife Institute of India (WII), GB Pant Institute of Himalayan Environment and Development (GBPIHED), International Centre for Integrated Mountain Development (ICIMOD), and many NGOs including WWF,

Ashoka Trust for Research in Ecology and Environment (ATREE), and the National Centre for Biological Sciences (NCBS), further enhanced the scientific understanding of the subject. Botanical Survey of India undertook a 'Hooker's Trail' survey in the 1960s.

Much of the available information on biodiversity of Sikkim has been collated by Subba (2002), Arrawatia & Tambe (2011). Documents like the Important Bird Areas (IBAs) of Sikkim, priority sites for conservation (Lachungpa et al., 2007), Ecosystem profiles: Eastern Himalayas Region prepared through the Critical Ecosystem Partnership fund (CEPF) by the WWF-US, Asia Programme, publications by BSI like Ferns and Fern-allies of Sikkim - Part I & II (Kholia, 2010 & 2014), Mushrooms of Sikkim (Das, 2009) and GBPIHED, provide an account of the rich biodiversity the state harbours. Indian Statistical Institute (ISI), Kolkata documented those elements of biodiversity which are of ethno botanical and ethno zoological significance to local communities of the state.

It is pertinent to mention here that baseline information on density of some of the dominant tree species in early 20th century was undertaken by Shri Bardhan Roy Chaudhary while preparing the Working Plans for the state of Sikkim. Reserved and unreserved forests of Sikkim were stratified against altitudinal gradients and density of major tree

species expressed in terms of number of stems per hectare. In the recent past, enumeration of biodiversity features and biodiversity rich locations in the state were undertaken by the North East Space Application Centre (NESAC) and Indian Institute of Remote Sensing (IIRS), Government of India through its initiative on Biodiversity characterization at landscape level. Salim Ali Centre for Ornithology and Natural History (SACON) in 2010 and Space Application Centre (SAC), Ahmedabad in 2012 prepared the Wetland Atlas of the State. Collections of germplasm of agro-biodiversity and profiling the same are being carried out by the Indian Council of Agricultural Research (ICAR). Forest Survey of India and Department of Forests, Environment and Wildlife Management (FEWMD), Government of Sikkim estimated the biomass and carbon stock of the forests of the state. The Working Plan Division of the Department of Forests, Environment and Wildlife Management has laid 23 preservation plots of 0.1 ha. across the different forest types and data is being collected as per the prescriptions of the National Inventory Manual prepared by Government of India.

Objectives

The objective of the RBS under the aegis of Sikkim Biodiversity Conservation and Forest Management Project is to further enhance the previous work on biodiversity studies in the state with a long term perspective and bring the data so produced under the Geo Spatial platform. The RBS envisages assessing the biodiversity of different forest types of Sikkim by laying around 1000 plots across the State. In addition, the project suggests laying around 300 plots in the known biodiversity ‘hotspots’ of the state. The surveys have to be conducted in alpine, forests, aquatic and agro-ecosystems.

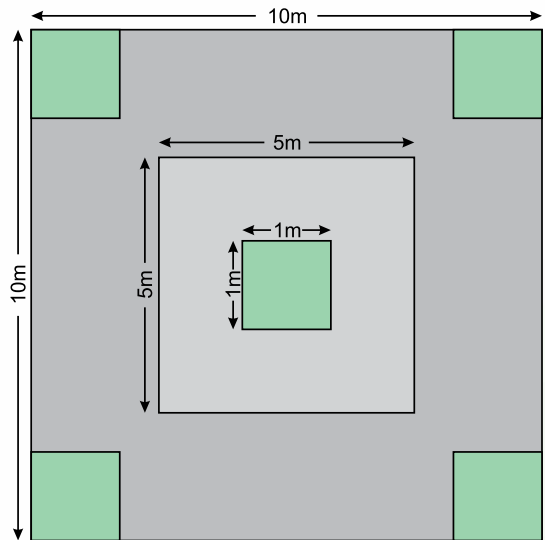


Lycopodium japonicum



Flora

In the field, floral biodiversity of the area was recorded using a standard quadrat method. The size of the main plot (10m x 10m) was finalized after undertaking several trials in the field. The plot was laid at every 0.5 to 0.6 km approximate distance, depending upon the site feasibility. Within the main plot (10m x 10m), all the standing tree species were enumerated and girth (1.3 m above the ground) were measured for the individual trees having CBH >30 cm. At the centre of the main plot, a quadrat of 5m x 5m were laid for recording the number of saplings and their height; the same plot was used to record the presence of the shrub/shrublet species. The seedling availability were recorded using 5 number of 1m x 1m quadrat, which were placed at the 4 corner and the centre of the main plot; the same plot was used for recording the percent cover of the herb species in the area. General listing of all the tree/shrub/herb species, outside



Sampling plot design for vegetation survey

the plots as well as along the sampling path, were also done to have fair idea on the species available in the area.

Floras were identified in the field using previous field experiences as well as the published references including standard floras. Photographs were taken for most of the species for the future reference. Web references (www.eFloras.org; www.flowersofindia.net) were made and expert's help taken after returning from the field, on species verification and identification.

Statistical analyses and the interpretation of the collected field data are underway. Global / regional threat status of each species was identified using web resources (www.iucnredlist.org; www.icimod.org/hkhconservationportal) and the available literature.

Fauna

To record the faunal element, trail sampling (walking through the trail) and sign surveys (recording of digging sign, foraging sign, hoof mark, etc.) were carried out in the wilderness areas. During the sampling, direct evidences like call sound and indirect evidences like feather, pellets, scats, droppings, etc. wherever encountered, were recorded. Photo capture was also done, depending upon the feasibility.

In addition to this, camera trapping, method was applied to ascertain the presence of the above said species. Apart from these, one to one interview was conducted with the local people as well as field staff of the Forest department in order to have fair idea on the probable area of their location.

Survey Outcomes

Five Rapid Biodiversity Surveys were conducted along following sampling paths

1. Sang – Tinjurey sampling path in Fambong Lho Wildlife Sanctuary, East Sikkim

2. Yuksom – Dzungri – Goche La sampling path in Khangchendzonga Biosphere Reserve, West Sikkim
3. Ravangla – Bhaley Dhunga sampling path in Maenam Wildlife Sanctuary, South Sikkim
4. Tholung – Kishong sampling path in Khangchendzonga Biosphere Reserve, North Sikkim
5. Shingba Rhododendron Sanctuary - Yumthang Valley - Shiv Mandir in Lachung Range, North Sikkim

Apart from the above RBS study, inventorization of the floral species were also conducted in some of the locations as under

1. Tendong State Biodiversity Park, Damthang, South Sikkim
2. Floriculture Nursery, Bulbuley, East Sikkim
3. Proposed Biodiversity Training Institute, Pangthang, East Sikkim
4. Proposed Butterfly Park, Rang Rang, North Sikkim
5. Gyam Tsona Lake, North Sikkim



Anaphalis sp.

Sang – Tinjurey sampling path, Fambong Lho Wildlife Sanctuary, East Sikkim

Fambong Lho Wildlife Sanctuary is located in the east district between latitude 27°18'10"N to 27°22'50"N and longitude 88°27'15"E to 88°35'25"E. The total area of the sanctuary is 51.76 sq km and the altitude ranges between 1200 to 2624 m amsl (Tinchuli, synonym: Tinjurey). The sanctuary is very rich in floral and faunal components. The main vegetation of the Sanctuary is represented by *Quercus lamellosa*, *Castanopsis tribuloides*, *Engelhardtia spicata*, *Nyssa sessiliflora*, *Michelia doltsopa*,

Michelia velutina, *Machilus odoratissima*, *Symplocos glomerata*, *Symplocos theifolia*, *Acer* sp., *Pieris ovalifolia*, etc. Common types of shrubs available are *Aconogonum molle*, *Neillia rubiflora*, *Viburnum erubescence*, *Rubus ellipticus*, *Rubus paniculatus*, *Rubus treutleri*, *Rubus lineatus*, etc. Bamboo species such as *Arundinaria maling*, *Cephalostachym hookeriana*, *Chimnobambusa hookeriana*, etc., form dense patches in the sanctuary. Many species of rhododendrons, wild orchids,

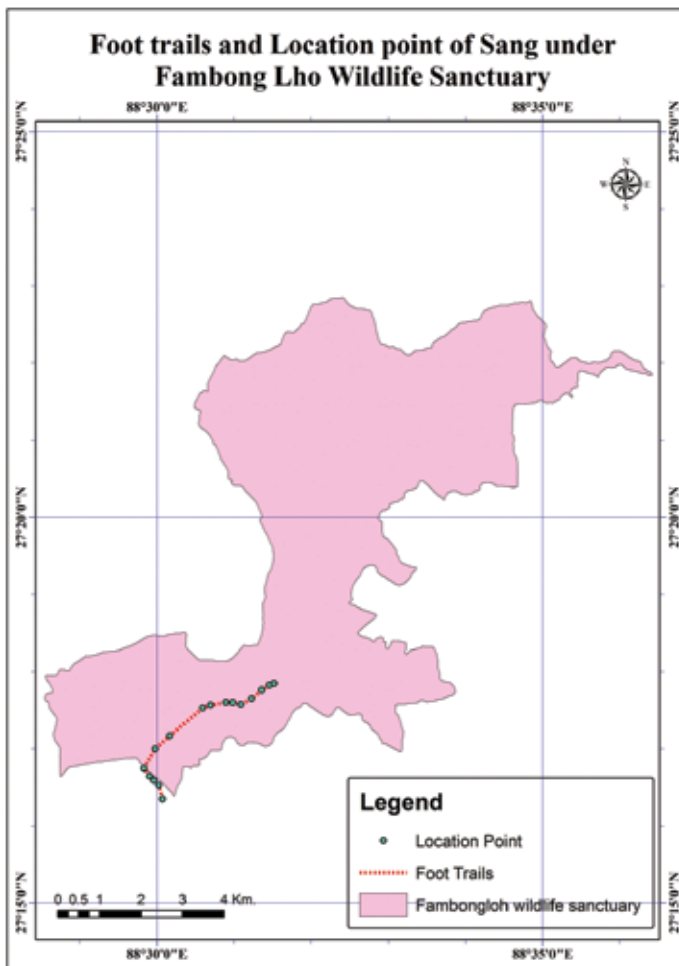


Forest composition along Sang – Tinjurey sampling path, Fambong Lho Wildlife Sanctuary, East Sikkim

mosses, ferns, etc., also find a home here.

Over 50 mammals including Chinese Pangolin, Red Panda, Civet cat, Leopard cat, Himalayan black bear and Flying squirrel have been reported from the sanctuary. It also forms a part of the important bird areas in India. Over 280 bird species have been reported from the sanctuary and its surrounding areas. The important ones include Satyr Tragopan, Kalij pheasant, Green pigeon, etc. The highest point of the sanctuary is approachable from different directions.

The altitude of the surveyed path ranged from *ca.* 1600 m asl to 2350 m asl lying between 27°16' – 27°17'N latitude and 88°29' – 88°31'E longitude on the north-eastern part of the



sanctuary. The broad vegetation of the area is wet temperate forest type; however, *Castanopsis tribuloides*, *Castanopsis hystrix*, *Prunus nepalensis*, *Quercus lamellosa* and *Quercus fenestrata* were amongst the important tree species in addition to *Rhododendron arboreum*. The other *Rhododendron* species available were *Rhododendron griffithianum*, which was in a small patch at an altitude of *ca.* 2250 m asl. The common small tree species of the area includes *Symplocos theifolia*, *Symplocos glomerata*, *Eurya acuminata*, etc. The forest floor below the dense canopy cover is almost open and is covered mostly by the fern species such as *Asplenium ensiforme*, *Asplenium laciniatum*, *Asplenium phyllitidis*, *Coniogramme intermedia*, *Lycopodium clavatum*, *Monachosorum henryi*, *Pteris* sp., *Silagenella* sp., etc. The dominant herb species present in the area were *Aconogonum molle*, *Elatostema platyphyllum*, *Pilea* sp., *Pilea umbrosa*, *Strobilanthes* sp, *Viola serpens*, etc. The area were under immense anthropogenic pressure in the past, which can be visualized from the remnants of lopped trees, open areas covered with dense shrubs like *Rubus ellipticus*, *Edgeworthia gardenierii*, *Osbeckia nepalensis* etc., and fern species such as *Gleichenia gigantean*, etc. The area has also a history of forest fire, and is in the process

of regeneration; however, the species that have regenerated are *Leucosceptrum cannum*, *Glochidion acuminatum*, etc. The forest floor at the fire affected area is fully covered with *Urtica dioica* and *Rumex nepalensis*. The lower half of the forest witnessed the plantation of tree species such as *Michelia doltsopa*, *Exbucklandia populnea*, *Cryptomeria japonica*, etc., and small bamboo species such

as *Arundinaria hookeriana*. The rain fed lake situated at an altitude of ca. 2100 m asl is the only water source for the wild animals of the area; however, the areas is shrinking and is fully occupied by species like *Acorus calamus*, *Digitaria* sp., etc. Varieties of orchids were amongst the epiphytes available in the area; nevertheless, *Calanthe* sp., was the only ground orchid species encountered during the survey.



The survey team laying plots

Findings

Flora

During the survey in 16 plots along Sang-Tinjurey sampling path, 37 tree species belonging to 30 genera and 21 families were recorded. Similarly, 8 species of shrubs (7 genera and 5 families) and 33 herb species (27 genera, 18 families and 2 unidentified) were witnessed. In addition, 19 epiphyte/climber species (14 genera, 14 families, 3 unidentified) and 3 bamboo species were also recorded from the sampling plots. Most of the species remain un-assessed for IUCN categorization. Major floral species along Sang – Tinjurey path is shown in the following Table

Checklist of Floral species along Sang – Tinjurey sampling path, Fambong Lho Wildlife Sanctuary, East Sikkim

Species	Local name	Family
Tree		
<i>Acer caudatum</i> Wallich.	Kapasey	Aceraceae
<i>Actinodaphne sikkimensis</i> Meissn.	Phurkey sissi	Lauraceae
<i>Betula alnoides</i> Wall. ex Diels	Saur	Betulaceae

Species	Local name	Family
<i>Castanopsis hystrix</i> Hook. & Thomson ex. A. DC.	Patley katush	Fagaceae
<i>Castanopsis tribuloides</i> (Smith) A. DC.	Musrey katush	Fagaceae
<i>Cedrela febrifuga</i> Blume.	Tuni	Meliaceae
<i>Cinnamomum impressinervium</i> Meisn.	Sinkoli	Lauraceae
<i>Cryptomeria japonica</i> (Thunberg ex. Linn. F.) D. Don	Dhuppi	Taxodiaceae
<i>Elaeocarpus lanceaefolius</i> Roxburgh.	Bhadrasey	Elaeocarpaceae
<i>Eurya acuminata</i> DC.	Jhingni	Theaceae
<i>Exbucklandia populnea</i> R. Br. Ex Griff	Piplee	Hamamelidaceae
<i>Glochidion acuminatum</i> Muell.	Latikaath	Euphorbiaceae
<i>Gynocardia odorata</i> Roxburgh	Bandre/Gante	Flacourtiaceae
<i>Leucosceptum cannum</i> Smith	Ghurpis	Lamiaceae
<i>Lithocarpus fenestrata</i> Roxb.	Arkaulo	Fagaceae
<i>Litsea kingii</i> Hook.	Siltimmur	Lauraceae
<i>Macaranga pustulata</i> King.	Malato	Euphorbiaceae
<i>Machilus gammieana</i> King ex. Hook. f.	Chipli kawlo	Lauraceae
<i>Machilus odoratissima</i> Wall. ex. Nees	Ghew kawlo/Lali Kawlo	Lauraceae
<i>Michelia cathcartii</i> Hook. f. Thomson	Tite chanp	Magnoliaceae
<i>Michelia doltsopa</i> Buch.- Ham. ex Dc.	Rani chanp	Magnoliaceae
<i>Myrica esculenta</i> Buch. Ham.	Kafal	Myricaceae
<i>Myrsine semiserrata</i> Wall.	Phalame	Myrsinaceae
<i>Nyssa sessiliflora</i> Hook. f. & Thomson ex Benth	Lek chilauney	Cornaceae
<i>Ostedes paniculatus</i> Blume.	Bepari	Euphorbiaceae
<i>Pieris ovalifolia</i> (Wall) D. Don.	Angeri	Ericaceae
<i>Prunus nepalensis</i> (Ser) Stendel	Arupatey	Rosaceae
<i>Pyralia edulis</i> (Wallich) A.	Amphi	Santalaceae
<i>Quercus lamellosa</i> Smith.	Buk/Bajranth	Fagaceae
<i>Rhododendron arboreum</i> ssp. <i>arboreum</i> (CB Clarke) Ridley.	Lali gurans	Ericaceae
<i>Rhododendron grande</i> Wight.	Patle korlinga	Ericaceae
<i>Rhododendron griffithianum</i> Wight.	Seto chimal	Ericaceae
<i>Rhus succedanea</i> Linn.var. <i>acuminata</i>	Rani bhalayo	Anacardiaceae
<i>Schima wallichii</i> (DC) Korth.	Chilaune	Theaceae
<i>Spondias axillaris</i> Roxb.	Lapsi	Anacardiaceae
<i>Symplocos glomerata</i> King, ex. C.B. Clarke	Kholme	Symplocaceae
<i>Symplocos theifolia</i> D. Don	Kharane	Symplocaceae
Shrub		
<i>Ardisia macrocarpa</i> Wall.	Damai phal	Myrsinaceae
<i>Daphne cannabina</i> Wall.	Kalo Algeri/Kagate	Thymeleaceae
<i>Dichroa febrifuga</i> Lour	Basak	Hydrangeaceae
<i>Edgeworthia gardenerii</i> Meissn.	Algeri/Lokti	Thymeliaceae
<i>Maesa chisia</i> Don	Bilauney	Myrsinaceae

Species	Local name	Family
<i>Rubus ellipticus</i> Smith.	Aiselu	Rosaceae
<i>Rubus paniculatus</i> (Smith) Rees.	Kalo Aiselu	Rosaceae
<i>Viburnum erubescence</i> Wall. ex DC	Asarey	Caprifoliaceae
Herb		
<i>Aconogonum molle</i> (D. Don) H. Hara	Thotne	Polygonaceae
<i>Arisaema intermedium</i> Blume	Larua/Banko	Araceae
<i>Asplenium laciniatum</i> D. Don.	Uniu	Aspleniaceae
<i>Boehmeria</i> sp.	Kamley	Urticaceae
<i>Carex</i> sp.	Harkatto	Cyperaceae
<i>Coniogramme intermedia</i> Heiron.	Uniu	Pteridaceae
<i>Digitaria sanguinalis</i> (Linn.) Scopoli.	Banso	Poaceae
<i>Diplazium dilatatum</i> Blume	Lek Chipley Ningro	Woodsiaceae
<i>Diplazium stoliczkae</i> Beddome	Lek kalo ningro	Woodsiaceae
<i>Elatostema platyphyllum</i> Weddell.	Gagleto	Urticaceae
<i>Eragrostis cilianensis</i> (All.) Lut. ex Janchen	Banso	Poaceae
<i>Eupatorium adenophorum</i> Spreng.	Kali jhar	Compositae
<i>Gerardiana diversifolia</i> (Link) Friis	Bhangre sisnu	Urticaceae
<i>Gleichenia gigantean</i> Wall. ex Hook	Kalamey	Gleicheniaceae
<i>Impatiens stenantha</i> Hook. f.		Balsaminaceae
<i>Lycopodium japonicum</i> Thunb	Nagbelli	Lycopodiaceae
<i>Monachosorum henryi</i> Christ.	Uniu	Monachosoraceae
<i>Nephrolepis cordifolia</i> (Linn.) C. Presl.	Pani amala	Davalliaceae
<i>Pilea stricta</i> (Buchanan-Hamilton ex D. Don) Weddell	Chiple	Urticaceae
<i>Pilea umbrosa</i> Blume.	Chiple	Urticaceae
<i>Pouzolzia sanguine</i> (Blume) Merrill	Chiple	Urticaceae
<i>Plagiogyria pycnophylla</i> (Kunze.) Mett.	Uniu	Plagiogyriaceae
<i>Rumex nepalensis</i> Spreng.	Halhalley	Polygonaceae
<i>Selaginella biformis</i> A. Br. ex Kuhn		Selaginellaceae
<i>Selaginella chrysocaulos</i> (Hook. & Grev.) Spring.		Selaginellaceae
<i>Selaginella monospora</i> Spring.		Selaginellaceae
<i>Smilax rigida</i> Wall. ex Kunth	Madaney kara / Kirneyghans	Smilacaceae
<i>Strobilanthes</i> sp.	Kibu ghans	Acanthaceae
<i>Urtica parviflora</i> Roxburgh	Gharia sisnu	Urticaceae
<i>Urtica dioica</i> Linn.	Patley sisnu	Urticaceae
<i>Villebrunea frutescens</i> (Thunb.) Blume	Chiple	Urticaceae
<i>Viola sikkimensis</i> W. Becker		Violaceae
	Silamey jhar	
Epiphytes/Climbers		
<i>Asplenium ensiforme</i> Wall. ex Hook. & Grev.	Uniu	Aspleniaceae
<i>Asplenium phyllitidis</i> D. Don.	Uniu	Aspleniaceae

Species	Local name	Family
<i>Cissus elongata</i> Roxb.	Charcharey lahara	Vitaceae
<i>Clematis acuminata</i> DC		Rununculaceae
<i>Clematis buchananiana</i> DC	Pinasey lahara	Rununculaceae
<i>Codonopsis viridis</i> Wallich.	Padey lahara	Campanulaceae
<i>Coelogyne flaccida</i> (Lindl.) Kuntz.	Sunakhari	Orchidaceae
<i>Davallodes membranulosa</i> (Hook.) Copel.	Uniu	Davalliaceae
<i>Mucuna macrocarpa</i> Wall.	Baldengra	Leguminosae
<i>Piper boehmeriifolium</i> (Miquel) Wallich ex C. DC	Chambo	Piperaceae
<i>Rhapidiphora decursiva</i> (Roxb.) Schott.	Kanchirno	Araceae
<i>Rubia manjith</i> Roxb. ex Fleming	Majito	Rubiaceae
<i>Smilax zeylanica</i> Linn.	Kukur dainey	Liliaceae
<i>Trichosanthes lepiniana</i> (Naud.) Cogn.	Indreni	Cucurbitaceae
<i>Viscum articulatum</i> Burm. f.	Harchur	Lorantahceae
<i>Vittaria flexuosa</i> Fee.	Uniu	Vittariaceae
	Boksi lahara	
	Chaulane lahara	
	Titey lahara	
Bamboos		
<i>Arundinaria hookeriana</i> Munro	Pareng	Poaceae
<i>Sinarundinaria intermedia</i>	Nigalo/Tite nigalo	Poaceae
<i>Schizostachyum capitatum</i>	Gope bans	Poaceae

Fauna

During the trail sampling total 11 species were recorded from Sang-Tinjurey sampling path and is presented in the Table below. Some of the evidences are from direct sightings (sighting, photo-capture) and indirect evidences (pellet, scat, killed, dung, digging/foraging sign, droppings and feathers). Total of 30 birds species were recorded from Sang-Tinjurey transect. Family Turdidae and Timaliidae represented maximum number of species.



Survey team deploying camera trap



Himalayan Black Bear on camera trap



Barking deer



Dead Yellow throated marten



Serow pellet



Red vented bulbul

Faunal species observed along Sang-Tinjurey sampling path in Fambong Lho Wildlife Sanctuary, East Sikkim

Scientific name	Species	IUCN Status	Evidences ¹
<i>Arborophila torqueola</i>	Common Hill partridge	NA	S, Pc
<i>Cannis aurens</i>	Jackal	LC	Sc, K
<i>Capricornis thar</i>	Himalayan Serow	NT	P
<i>Hylopetes alboniger</i>	Parti-colored flying squirrel	LC	K
<i>Lophura leucomelana</i>	Kalij pheasant	LC	S
<i>Martes flavigula</i>	Yellow-Throated marten	LC	K
<i>Muntiacus muntjak</i>	Barking Deer	LC	S, Pc, P, Hm
<i>Naemorhedus goral</i>	Goral	NT	P
<i>Paguma larvata</i>	Himalayan palm civet	LC	Sc
<i>Sus scrofa</i>	Wild Boar	LC	D
<i>Tragopan satyra</i>	Satyr tragopan	NT	F, D

¹S: Sighting, Pc: Photo capture, Sc: Scat, P: Pellet, HM: Hoof mark, C: Call, F: Feather, D: Droppings, Sm: Scrape marks, Ds: Digging sign, K: Kill

Checklist of bird species along Sang - Tinjurey transect in Fambonghlo Wildlife Sanctuary, East Sikkim

Scientific Name	Common Name	Local Name	Family
<i>Actinodura nepalensis</i>	Hoary Barwing		Timaliidae
<i>Aegithalos concinnus</i>	Red-headed Tit	Fista	Paridae
<i>Aethopyga nepalensis</i>	Nepal Sunbird	Kalo balchi	Nectariniidae
<i>Arborophila torqueola</i>	Common Hill Partridge	Peura	Phasinidae
<i>Certhia familiaris</i>	Northern Treecreeper	Sulsuley	Certhiidae
<i>Cissa chinensis</i>	Common Green Magpie	Doday Koilee	Corvidae
<i>Cuculus canorus</i>	Common Cuckoo	Cuckoo	Cuculidae
<i>Cutia nepalensis</i>	Nepal Cutia		Timaliidae
<i>Dendrocitta formosae</i>	Himalayan Tree pie	Kokoley	Corvidae
<i>Dicrurus macrocerus</i>	Black Drongo	Chibey	Dicaeidae
<i>Garrulax leucolophus</i>	White Crested Laughing Thrush	Kolkoley	Turdidae
<i>Garrulax striatus</i>	Striated Laughing Thrush	Kolkoley	Turdidae
<i>Hypsipetes madagascariensis</i>	Black Bulbull	Jureli	Pycnonotidae
<i>Ictinaetus malayensis</i>	Black Eagle	Chill	Accipitridae
<i>Lophura leucomelana</i>	Kalij Pheasant	Kalij	Phasinidae
<i>Malacias capistratus</i>	Rufous Sibia		Timaliidae
<i>Myophonus caeruleus</i>	Blue Whistling Thrush	Kalchura	Turdidae
<i>Parus ater</i>	Coal Tit	Fista	Paridae
<i>Pericrocotus flammeus</i>	Scarlet Minivet	Rani chari	Campephagidae
<i>Phylloscopus trochiloides</i>	Dull Green leaf Warbler	Fista	Sylviidae
<i>Rhiphidura albicollis</i>	White-throated Fantail Flycatcher	Kanchirna	Rhipiduridae
<i>Rhiphidura aureola</i>	White-breasted Fantail Flycatcher	Kanchirna	Certhiidae
<i>Sitta himalayensis</i>	White Tailed Nuthatch	Makhmali Matta	Certhiidae
<i>Streptopelia orientalis</i>	Rufous Turtle Dove	Dhukur	Columbidae
<i>Tragopan satyra</i>	Satyr Tragopan	Mudal	Phasinidae
<i>Treron sphenura</i>	Wedge-Tailed Green Pigeon	Haaleysho	Columbidae
<i>Yuhina flavicollis</i>	Yellow-naped Yuhina	Sano Jureley	Timaliidae
<i>Zoothera dixonii</i>	Long tailed Mountain Thrush		Turdidae

Yuksom-Dzongri-Gochela sampling path, Khangchendzonga Biosphere Reserve, West Sikkim

The highest biosphere reserve in the country, the Khangchendzonga Biosphere Reserve (KBR) is endowed with rich biodiversity, covering 41.31% of the total area of Sikkim. The present core zone of KBR (850 sq. km.) was first notified as Khangchendzonga National Park (KNP) in the year 1977 by the State Government of Sikkim. The area was later extended by the State Government of Sikkim to 1,784 km² under the provision of the Wildlife (Protection) Act, 1972 vide Notification No. 1/KNP(WL)/F/27 dated 19-05-1997. In 2000, the KNP was re-designated as KBR in accordance with the concept of UNESCO's Man and Biosphere (MAB) programme through a Notification No. J - 22016/76/91-BR dated 07-02-2000 by the Ministry of Environment and Forest, Government of India with the addition of 4 buffer zones i.e I, II, III and IV of area 836 sq. km. The area of KBR has been recently expanded vide Notification No. 204/KNP-KBR/WL/Forests/2009, dated 24-05-2010, with the addition of transition zone (311.80 sq. km.) covering North, West and South districts of Sikkim to 2931.12 km².

Within KBR, there exist different types of forest types, such as wet temperate broad-leaved forest, temperate conifer forest, sub-alpine forest, alpine scrubs and alpine grasslands. KBR harbours over 20 species of Rhododendrons including *Rhododendron arboreum*, *Rhododendron griffithianum*, *Rhododendron falconeri* which are trees, and the scrubs of *Rhododendron anthopogon*,

Rhododendron nivale, *Rhododendron setosum*, etc. KBR provides refuge to rare fauna like Red Panda, Snow leopard, Blue sheep, Goral, Himalayan Thar, Serow; and avifauna such as, Blood pheasant, Himalayan Monal, Kalij pheasant, Yellow billed-blue Magpie and numerous other important species.

The survey was conducted along Yuksom-Dzongri-Gochela transect covering ca. 40 km long distance in KBR through Buffer zone to core zone during April-May, 2013. The altitude of the survey area ranged from 1800 m to 4200 m asl lying between latitude 27°23' - 27°28' N and longitude 088°13' - 088°10'E which is characterized by different types of forest zones from wet temperate mixed forest to temperate conifer forest to sub-alpine forest. A total of 45 plots were laid along the transect.

The wet temperate broad-leaved forest is composed of evergreen and medium-sized trees, rarely exceeding 24m height. Oak species and laurels cover large patch and are abundantly covered with mosses and epiphytes. The forest is extremely thick and the forest floor is covered with numerous species of herbs, shrubs and ferns. Tree species such as *Acer campbelli*, *Beilschmiedia roxburghiana*, *Castanopsis tribuloides*, *Cinnamomum impressinervium*, *Elaeocarpus lanceaefolius*, *Engelhardtia spicata*, *Exbucklandia populnea*, *Garuga floribunda*, *Juglans regia*, *Lithocarpus fenestrata*, *Machilus edulis*, *Michelia catharthii*, *Michelia doltsopa*, *Michelia velutina*, *Nyssa*



Forest composition along Yuksom – Dzongri – Gochela transect, KBR, West Sikkim

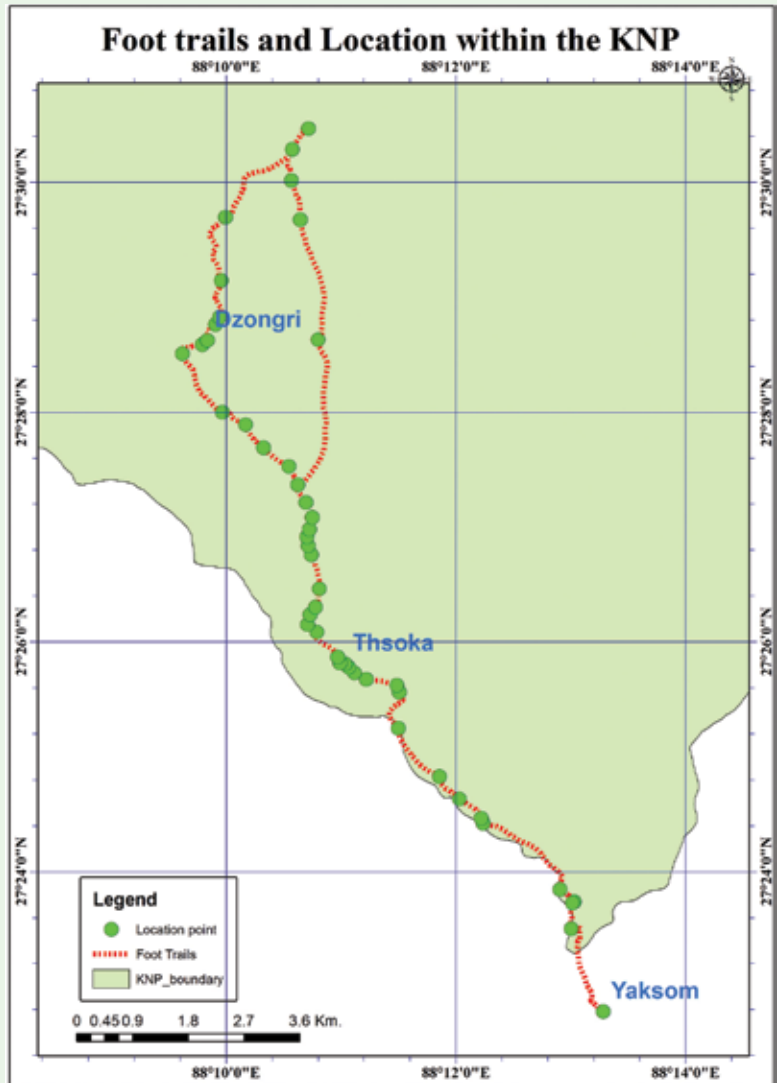
sessliflora, *Quercus lamellosa*, *Rhododendron arboreum*, *Rhus insignis*, *Rhus succedanea*, *Spondias axillaris*, etc., are very common upto 2100 m. *Alnus nepalensis* grows mainly along water courses and landslide affected areas. Among small trees, *Eurya acimunata*, *Tetradium fraxinifolia*, *Litsea elongata*, *Symplocos glomerata*, *Symplocos theifolia*, etc., are very common. *Actinodaphne sikkimensis*, *Dichroa fabrifuga*, *Edgeworthia gardenerii*, *Maesa rugosa*, *Rubus ellipticus*, *Viburnum erubescence*, *Zanthoxylum alatum*, etc., are common shrubs of wet temperate forest. The common climbers available are *Cissus elongata*, *Rhapidiphora decursiva*, *Smilax zeylanica*, *Trichosanthes lepiniana*, etc. Many epiphytic orchids and ferns can be seen growing on the trees. *Aconogonum molle*, *Anaphalis* sp.,

Arisaema sp., *Artemesia vulgaris*, *Bidens pilosa*, *Commelina benghalensis*, *Cyanodon dactylon*, *Elatostema* sp., *Eupatorium adenophorum*, *Gnaphalium* sp., *Hydrocotyle javanica*, *Juncus* sp., *Oxalis corniculata*, *Persicaria* sp., *Pilea* sp., *Pouzolzia* sp., *Swertia bimaculata*, *Swertia chirata*, etc., are the common herb species found along this altitude.

Acercaudatum, *Castanopsis hystrix*, *Castanopsis tribuloides*, *Illex sikkimensis*, *Lithocarpus feneatrata*, *Lithocarpus pachyphylla*, *Magnolia campbelli*, *Quercus glauca*, *Quercus lamellosa*, *Rhododendron arboreum*, *Rhododendron grande*, *Rhododendron griffithianum*, etc., are the prominent tree species along 2100 m – 3000 m altitude. Species such as *Eurya acuminata*, *Pieris ovalifolia*, *Prunus nepalensis*, *Symplocos*

glomerata, *Symplocos theifolia*, etc., are the most common small trees along this zone. *Mahonia sikkimensis* and *Viburnum erubescence* are the most widely distributed shrubs species. Trees are mostly covered with *Aconogonum molle* and *Ficus foveolata var. oleaeformis*, growing as an epiphyte. The forest floor below the dense canopy is covered mostly by the ferns. Still higher, dwarf bamboo, *Arundinaria maling* growing as undergrowth is very common which extends upto 3100 m asl. Variety of mushroom species is also seen upto 3000 m asl. Above this zone, soil is less exposed and the ground is fully covered by moss, such as *Sphagnum squarrosum*.

At ca 3000 m, broad-leaved semi-evergreen forest is gradually replaced by conifer species like *Tsuga dumosa*, *Abies densa*, dwarf *Rhododendron spp.* and *Junperus spp.* Along with *Acer caudatum*, *Betula utilis*, *Magnolia campbellii*, *Prunus sp.*, *Rhododendron arboreum*, *Rhododendron falconeri*, etc. *Rosa sericea*, *Daphne cannabina*, *Viburnum*



The survey plots along Yuksom – Dzongri – Gochela sampling path in Khangchendzonga Biosphere Reserve, West Sikkim

cordifolium, *Berberis insignis*, etc., are common shrubs. Scrubs of *Gaultheria spp.*, is very common sight. The ground surface is covered with variety of fern species.

Above 3100 m, *Tsuga dumosa* is replaced by *Abies densa*. *Abies-Rhododendron* forest extends upto 3900 m asl. Steady change in the rhododendron species is very distinct feature of this zone and the rhododendron diversity is high between 3000 m to 4000 m asl.



The survey team recording the plant species along Yuksom – Dzongri – Gochela transect, KBR (West Sikkim)

Along this zone, *Rhododendron arboreum*, *Rhododendron barbatum*, *Rhododendron campanulatum*, *Rhododendron campylocarpum*, *Rhododendron cinnabarinum*, *Rhododendron decipiens*, *Rhododendron falconeri*, *Rhododendron fulgens*, *Rhododendron hodgsonii*, *Rhododendron lanatum*, *Rhododendron thomsonii*, *Rhododendron triflorum*, *Rhododendron wightii*, etc., along with the shrubs and scrubs of *Rhododendron anthopogon*, *Rhododendron camelliflorum*, *Rhododendron cilliatum*, *Rhododendron lepidotum*, *Rhododendron setosum*, *Rhododendron vacinioides*, etc occur. Other species found here are *Betula utilis*, *Sorbus cuspidata*, *Sorbus foliolosa*, *Viburnum cordifolium*, etc. Rocky surfaces are fully covered with *Sphagnum squarrosum*. The lichen *Usnea himalayana* can be seen hanging down the branches of *Abies densa* and *Rhododendron* sp. The tree line extends upto 3900 m above which the vegetation is represented by the shrubs of *Rhododendron lanatum*, *Rhododendron wightii* and *Rosa*

sericea. The exposed rock crevices is covered by *Rhododendron anthopogon*, *Rhododendron lepidotum*, *Rhododendron setosum*, *Rhododendron vacnioides*, and *Juniperus recurva*, and herbs like *Anaphalis* sp., *Bistorta affinis*, *Rheum acuminatum*, *Aconitum* sp., *Primula* sp., *Potentilla peduncularis*, *Juncus* sp., etc.

Above 4200 m altitude, the mild undulated exposed ground is covered only by the scrubs of *Rhododendron anthopogon*, *Rhododendron lepidotum*, *Rhododendron nivale*, *Rhododendron setosum*, *Juniperus indica*, *Juniperus recurva* along with important herbs like *Primula* sp., *Aconitum* sp., *Rheum nobile*, *Bergenia strachyii* sp., *Bergenia ligulata*, *Bistorta affinis*, and others like *Potentilla* sp, *Peduncularis* sp, *Gentiana* sp., *Gymnadenia orchidis*, *Corydalis* sp., *Anemone* sp., *Saxifraga* sp., *Caltha* sp., etc. Between the scrubs, *Cassiope fastigiata*, *Gaultheria pyroloides* etc. is a common sight. The altitude above 3000 m asl remains completely snow-covered from December to March-April.

Flora

Floral species recorded along the Yuksom - Dzongri – Gochela sampling path

Botanical Name	Local Name	Family
Tree		
<i>Abies densa</i> Griffith. ex Parker	Gobre salla	Pinaceae
<i>Acer campbellii</i> Hook. & Thom. Ex Hiern.	Kapasey	Aceraceae
<i>Acer caudatum</i> Wallich.	Kapasey	Aceraceae
<i>Acer stachyophyllum</i> Heirn.	Dalle kapasey	Aceraceae
<i>Betula alnoides</i> Buch. Ham. Ex D. Don	Saur	Betulaceae
<i>Betula utilis</i> D. Don	Saur	Betulaceae
<i>Castanopsis hystrix</i> Hook & Thom. ex A. DC	Patley Katush	Fagaceae
<i>Castanopsis tribuloides</i> (Smith) A. DC	Musure Katush	Fagaceae
<i>Cedrela febrifuga</i> Blume	Tuni	Meliaceae
<i>Cinnamomum obtusifolium</i> Nees.	Bhaley sinkoli	Lauraceae
<i>Cinnamomum impressinervium</i> Meisn.	Sinkoli	Lauraceae
<i>Elaeocarpus lanceaefolius</i> Roxb.	Bhadrasey	Elaeocarpaceae
<i>Engelhardtia acerifolia</i> Blume.	Mauwa	Juglandaceae
<i>Eurya acuminata</i> DC	Sanu Jhingni	Theaceae
<i>Exbucklandia populnea</i> R. Br. Ex Griff	Pipli	Hamamelidaceae
<i>Ilex sikkimensis</i> Kurz.	Lise	Aquifoliaceae
<i>Juglans regia</i> Linn.	Okhar	Juglandaceae
<i>Lithocarpus fenestrata</i> Roxb.	Arkaulo	Fagaceae
<i>Lithocarpus pachyphylla</i> (Kurtz) Rehder	Sungure katush	Fagaceae
<i>Machilus edulis</i> King ex Hook. f.	Pomsi	Lauraceae
<i>Machilus odoratissima</i> Nees.	Lali kawla	Lauraceae
<i>Magnolia campbellii</i> Hook.f. & Thom.	Ghogey champ	Magnoliaceae
<i>Pieris ovalifolia</i> D Don.	Angeri	Ericaceae
<i>Prunus nepalensis</i> (Ser) Stendel	Arupatey	Rosaceae
<i>Quercus glauca</i> Thunb.	Phlant	Fagaceae
<i>Quercus lamellosa</i> Smith.	Buk/Bajranth	Fagaceae
<i>Rhododendron arboreum</i> ssp. <i>arboreum</i> (CB Clarke) Ridley	Lali gurans	Ericaceae
<i>Rhododendron arboreum</i> ssp. <i>arboreum</i> var. <i>roseum</i> Lindley.	Lali gurans	Ericaceae
<i>Rhododendron barbatum</i> Wallich ex G. Don	Lal chimal	Ericaceae
<i>Rhododendron falconeri</i> Hook. f.	Korlinga	Ericaceae

Botanical Name	Local Name	Family
<i>Rhododendron grande</i> Wight	Patle korlinga	Ericaceae
<i>Rhododendron griffithianum</i> Wight.	Seto chimal	Ericaceae
<i>Rhododendron hodgsonii</i> Hook. f.	Korlinga	Ericaceae
<i>Rhus insignis</i> Hook. f.	Kag Bhalayo	Anacardiaceae
<i>Saurauia napaulensis</i> DC	Gagun	Actinidaceae
<i>Sorbus cuspidata</i> (Spach) Hedl.	Tenga	Rosaceae
<i>Sorbus foliolosa</i> (Wallich) Spach	Thulo pasi	Rosaceae
<i>Symplocos glomerata</i> King ex C. B. Clarke	Kholmey	Symplocaceae
<i>Symplocos theifolia</i> D. Don	Kharaney	Symplocaceae
<i>Tetradium fraxinifolia</i> Hook. f.	Khanakpa	Rutaceae
<i>Tsuga dumosa</i> (D. Don) Eichler	Tengre salla	Pinaceae
<i>Zanthoxylum acanthopodium</i> DC	Boke timmur	Rutaceae
Shrub		
<i>Berberis insignis</i> Hook. f. & Thoms.	Chutro	Berberidaceae
<i>Cassiope fastigata</i> (Wallich) D. Don.	Phalu	Ericaceae
<i>Daphne cannabina</i> Wall.	Kalo argayle/Loktee	Thymelaeaceae
<i>Dichroa febrifuga</i> Lour.	Basak	Hydrangaceae
<i>Edgeworthia gardneri</i> Meissn.	Argayle/Kagate	Thymelaeaceae
<i>Fragaria nubicola</i> Lindley ex Lacaita	Vui Aiselu	Rosaceae
<i>Gaultheria</i> sp.	Dhasingre,	Ericaceae
<i>Gaultheria nummularioides</i> D. Don	Dhasingre,	Ericaceae
<i>Gaultheria pyroloides</i> Hook. f. & Thoms. ex Miq.	Dhasingre,	Ericaceae
<i>Hypericum hookerianum</i> Wight & Arn.	Urilo	Guttiferae
<i>Hypericum uralum</i> Buc. Ham. ex D. Don.	Urilo	Guttiferae
<i>Juniperus indica</i> Bertol.	Gokul dhup	Cupressaceae
<i>Juniperus recurva</i> Buch. Ham. ex D. Don	Shukpa dhup	Cupressaceae
<i>Maesa rugosa</i> C.B. Clarke.	Kalo Bilaune	Myrsinaceae
<i>Mahonia sikkimensis</i> Takeda	Kesari/Chutro	Berberidaceae
<i>Rhododendron anthopogon</i> D. Don	Sunpati	Ericaceae
<i>Rhododendron camelliflorum</i> Hook. f.	Chia phule gurans	Ericaceae
<i>Rhododendron campylocarpum</i> Hook. f.	Bango phule gurans	Ericaceae
<i>Rhododendron ciliatum</i> Hook. f.	Junge chimal	Ericaceae
<i>Rhododendron cinnabarinum</i> Hook. f.	Sano chimal	Ericaceae

Botanical Name	Local Name	Family
<i>Rhododendron fulgens</i> Hook. f.	Chimal	Ericaceae
<i>Rhododendron lanatum</i> Hook. f.	Bhutle chimal	Ericaceae
<i>Rhododendron lepidotum</i> Wallich ex G. Don	Bhale sunpati	Ericaceae
<i>Rhododendron setosum</i> D. Don	Tsallu gurans	Ericaceae
<i>Rhododendron thomsonii</i> Hook. f.	Dr. Thomson ko gurans	Ericaceae
<i>Rhododendron wightii</i> Hook. f.	Dr. Wight ko gurans	Ericaceae
<i>Rosa sericea</i> Lindl.	Bhote gulab	Rosaceae
<i>Rubus ellipticus</i> Smith	Ainselu	Rosaceae
<i>Rubus lineatus</i> Reinw. ex Blume	Ainselu	Rosaceae
<i>Rubus nepalensis</i> (Hook. f.) Kuntze	Bhui ainselu	Rosaceae
<i>Rubus splendidissimus</i> H. Hara	Phusre Aiselu	Rosaceae
<i>Viburnum erubescence</i> Wallich ex DC	Asare	Caprifoliaceae
<i>Viburnum nervosum</i> D. Don	Asare	Caprifoliaceae
<i>Vaccinium nummularia</i> Hook. & Thoms ex C. B. Clarke		Ericaceae
Herb		
<i>Aconogonum molle</i> (D. Don) H. Hara	Thotne	Polygonaceae
<i>Ajuga lobata</i> D. Don		Lamiaceae
<i>Anaphalis adnata</i> Wall. ex DC	Buki phul	Compositae
<i>Anaphalia busua</i> (Buch. - Ham. ex D. Don) DC	Buki phul	Compositae
<i>Anaphalis contorta</i> (D. Don) Hook. f.	Buki phul	Compositae
<i>Anaphalis margaritacea</i> (L.) Benth	Buki phul	Compositae
<i>Anaphalis triplinervis</i> var. <i>triplinervis</i> (Sims) C. B. Clarke	Buki phul	Compositae
<i>Anaphalis virgata</i> Thoms. x Clarke	Buki phul	Compositae
<i>Arisaema griffithii</i> Schott	Laura/Banko	Araceae
<i>Arisaema costatum</i> var. <i>sikkimense</i> (Stapf. ex Chatterjee) H. Hara	Laura/Banko	Araceae
<i>Arisaema erubescens</i> (Wall.) Schott	Laura/Banko	Araceae
<i>Arisaema intermedium</i> Blume	Laura/Banko	Araceae
<i>Arisaema nepenthoides</i> (Wallich) Martius ex Schott	Laura/Banko	Araceae
<i>Bistorta affinis</i> (D. Don) Greene		Polygonaceae
<i>Carex baccans</i> Nees.	Harkatto	Cyperaceae
<i>Carex cruciata</i> var. <i>argocarpus</i> Clarke	Harkatto	Cyperaceae
<i>Carex decora</i> Boott.	Harkatto	Cyperaceae

Botanical Name	Local Name	Family
<i>Carex filicina</i> Nees.	Harkatto	Cyperaceae
<i>Carex inanis</i> Kunth.	Harkatto	Cyperaceae
<i>Centella asiatica</i> Linn.	Gol Patta	Apiaceae
<i>Chirita urticifolia</i> Bush. -Ham. ex D. Don		Gesneriaceae
<i>Diplazium dilatatum</i> Blume	Lekh Chipley Ningro	Woodsiaceae
<i>Diplazium stoliczkae</i> Beddome	Lekh Kalo ningro	Woodsiaceae
<i>Dryopsis apiciflora</i> (Wall. ex Mett.) Holttum & Edwards	Uniu	Dryopteridaceae
<i>Dryopteris redactopinnata</i> Basu and Panigrahi	Uniu	Dryopteridaceae
<i>Elatostema platyphyllum</i> Weddell.	Gagleto	Urticaceae
<i>Eragrostis cilianensis</i> (All.) Lut. ex Janchen	Banso	Poaceae
<i>Eriophyton wallichii</i> Benth.		Labiataeae
<i>Hedychium gardnerianum</i> Sheppard ex Ker-Gawler		Zingiberaceae
<i>Hedychium spicatum</i> Buch. Ham.	Saro	Zingiberaceae
<i>Impatiens stenantha</i> Hook. f.		Balsaminaceae
<i>Impatiens urticifolia</i> Wallich		Balsaminaceae
<i>Juncus benghalensis</i> Kunth		Juncaceae
<i>Juncus concinnus</i> D. Don		Juncaceae
<i>Lecanthus peduncularis</i> (Royle) Weddell	Gagleto	Urticaceae
<i>Lycopodium japonicum</i> Thunb	Nagbelli	Lycopodiaceae
<i>Mazus dentatus</i> Wallich ex Benth.		Scrophulariaceae
<i>Persicaria capitata</i> (Buch. Ham. ex D. Don) Gross	Ratneulo	Polygonaceae
<i>Pilea stricta</i> (Buchanan-Hamilton ex D. Don) Weddell	Chiple	Urticaceae
<i>Pilea umbrosa</i> Blume.	Chiple	Urticaceae
<i>Potentilla peduncularis</i> D. Don		Rosaceae
<i>Primula</i> sp.		Primulaceae
<i>Rumex nepalensis</i> Sprengel	Halhalley	Polygonaceae
<i>Selaginella monospora</i> Spring.		Selaginellaceae
<i>Selaginella biformis</i> A. Br. ex Kuhn		Selaginellaceae
<i>Campylandra aurantica</i> Baker.	Janglee Nakima	Liliaceae
<i>Urtica dioica</i> Linn.	Patley sisnu	Urticaceae
<i>Viola serpens</i> Wallich ex Ging.		Violaceae

Botanical Name	Local Name	Family
Lichen/Moss		
<i>Usnea himalayana</i> C. Bab		Parmeliaceae
<i>Sphagnum squarrosum</i> Crome	Jhyaw	Sphagnaceae
Epiphyte/climber		
<i>Clematis buchananiana</i> DC	Pinasey lahara	Rununculaceae
<i>Piper boehmeriifolium</i> (Miquel) Wallich ex C. DC	Chambo	Piperaceae
<i>Rhapidiphora decursiva</i> (Roxb.) Schott.	Kanchirno	Araceae
<i>Rhododendron lindleyi</i> T. Moore	Lahare chimal	Ericaceae
<i>Trichosanthes lepiniana</i> (Naud.) Cogn.	Indreni	Cucurbitaceae
<i>Rubia manjith</i> Roxb. ex Fleming	Majito	Rubiaceae
Bamboo		
<i>Arundinaria hookeriana</i> Munro	Pareng	Poaceae
<i>Arundinaria maling</i> Gamble	Malingo	Poaceae



Asplenium nitidum var. *nitidum*



Acer campbellii



Berberis insignis



Gaultheria fragrantissima var. *ovalifolia*



Maesa rugosa



Piper boehmeriifolium



Rhododendron falconeri



Rhododendron fulgens



Rhododendron griffithianum



Rhododendron hodgsonii



Dendrobium nobile



Rhododendron barbatum



Primula deuteranana



Primula hookeri



Rhododendron setosum



Rhododendron wightii



Swertia chirayita



Symplocos glomerata



Vaccinium nummaruloides



Viburnum erubescence



Viola serpens



Rhododendron cinnabarinum

Fauna

During the trail sampling, a total of 15 species of animals were recorded from Yuksam-Dzongri-Thangsing (40 kms); Kockchurong-Phedang (3 kms) trail. Further, a total of 90 birds species belonging to 7 order and 28 families were recorded from this particular transect. Family Turdidae (13 species) and Muscicapidae (10 species) represented maximum number of species. During this recent survey, a pair of Tibetan Snowcock (*Tetraogallus tibetanus*) was sighted at the Somiti Lake.

Animals encountered in the trail sampling in Khangchendzonga Biosphere Reserve

Scientific name	Species	Remarks	IUCN Status
<i>Arborophila torqueola</i>	Common Hill Partridge	S	L
<i>Capricornis thar</i>	Himalayan Serow	P	NT
<i>Cuon alpinus</i>	Wild dog	Li	EN
<i>Felis temminckii</i>	Golden Cat	Pc	NT
<i>Ithaginis cruentus</i>	Blood Pheasant	S	LC
<i>Moschus moschiferus</i>	Musk Deer	Li	EN
<i>Muntiacus muntjak</i>	Barking Deer	P	LC
<i>Mustela altaica</i>	Pale Weasel	S	NT
<i>Nemorhedus goral</i>	Goral	P	NT
<i>Panthera pardus</i>	Common Leopard	Sc	VU
<i>Panthera uncia</i>	Snow leopard	Li	EN
<i>Pseudois nayur</i>	Blue Sheep	S	LC
<i>Tetraogallus tibetanus acqilonifer</i>	Sikkim snowcock	S	LC
<i>Tragopan satyra</i>	Satyr Tragopan	S	NT
<i>Vulpes vulpes</i>	Red fox	Sc	LC

S: Sighting; Pc: Photo capture; Sc: Scat; P: Pellet; Li: Local interview

Checklist of bird species encountered from Yuksam-Dzongri-Goechala trail

Scientific Name	Common Name	Local Name	Family
<i>Acridotheres tristis</i>	Common Myna	Ruppi	Sturnidae
<i>Actinodura nipalensis</i>	Hoart-throated Barwing		Timaliidae
<i>Aegithalos louschistos</i>	Rufous-fronted Tit	Fista	Paridae
<i>Aethopyga ignicauda</i>	Fire-tailed sunbird	Balchi	Nectariniidae
<i>Aethopyga nipalensis</i>	Green-tailed Sunbird	Kalo Balchi	Nectariniidae
<i>Alcippe vinipectus</i>	White-browed Fulvetta		Sylviidae
<i>Arborophila torqueola</i>	Hill Partridge	Peura	Phasinidae
<i>Carpodacus rodochroa</i>	Pink Browed Rosefinch	Tuti	Fringillidae
<i>Certhia familiaris</i>	Eurasian Tree Creeper	Sulsuley	Certhiidae
<i>Certhia hodgsonii</i>	Hodgson's Tree Creeper	Sulsuley	Certhiidae
<i>Cettia major</i>	Chestnut Crowned Warbler	Fista	Sylviidae
<i>Chelidorhynch hypoxantha</i>	Yellow billed Fantail	Kanchirna	Rhipiduridae
<i>Cinclus pallasii</i>	Brown Dipper		Cinclidae
<i>Corvus macrorhyncus</i>	Jungle Crow	Khag	Corvidae
<i>Corvus macrorhyncus</i>	Lareg billed Crow	Kag	Corvidae
<i>Cuculus canorus</i>	Eurassian Cuckoo	Cuckoo	Cuculidae
<i>Culicicapa ceylonensis</i>	Grey Headed Canary Flycatcher		Muscicapidae
<i>Dendrocopos darjellensis</i>	Darjeeling Woodpecker	Laachey	Picidae
<i>Dicrurus leucophaeus</i>	Ashy Drongo	Chibey	Dicaeidae
<i>Dicrurus macrocercus</i>	Black Drongo	Chibey	Dicaeidae
<i>Enicurus scouleri</i>	Little Forktail	Kholey Dhobini	Muscicapidae
<i>Eumyias thalassinus</i>	Verditer Flycatcher	Hareney	Muscicapidae
<i>Fulvetta vinipectus</i>	Coal Tit	Fista	Paridae
<i>Fulvetta vinipectus</i>	White browed Fulvetta		Sylviidae
<i>Garrulax affinis</i>	Black Faced Laughing Thrush	Kolkoley	Turdidae
<i>Garrulax affinis</i>	Black-faced Laughingthrush	Bhakura	Turdidae
<i>Garrulax chrysopterus</i>	Chestnut Crowned Laughing Thrush	Bhaekura	Turdidae
<i>Garrulax leucolophus</i>	White-crested Laughingthrush	Kolkoley	Turdidae
<i>Garrulax ocellatus</i>	Spotted Laughing Thrush	Kolkoley	Turdidae

Scientific Name	Common Name	Local Name	Family
<i>Garrulax straitus</i>	Straited Laughingthrush	Kolkoley	Turdidae
<i>Garrulax striatus</i>	Striated Faced Laughing Thrush	Saili Bhaekura	Turdidae
<i>Grandala coelicolor</i>	Grandala		Muscicapidae
<i>Gypaetus barbatus</i>	Lammergeier	Chill	Accipitridae
<i>Hypsipetes leucocephalus</i>	Black Bulbull	Jureli	Pycnonotidae
<i>Ictinaetus malayensis</i>	Black Eagle	Chill	Accipitridae
<i>Ithaginis cruentus</i>	Blood Pheasant	Chilimey	Phasinidae
<i>Lanius schach</i>	Long-tailed shrike		Laniidae
<i>Leucosticte nemoricola</i>	Plain Mountain Finch		Fringillidae
<i>Lophophorus impejenu</i>	Himalayan Monal	Daphey	Phasinidae
<i>Lophura leucomelana</i>	Kalij pheasant	Kalij	Phasinidae
<i>Malacias capistratus</i>	Rufous Sibia		Timaliidae
<i>Megalaima virens</i>	Great Barbet	Neual	Megalaimidae
<i>Monticola alba</i>	White Wagtail		Motacillidae
<i>Monticola solitaries</i>	Blue Rock Thrush		Turdidae
<i>Monticola solitarius</i>	Rock Thrush		Turdidae
<i>Musicapa ferruginea</i>	Ferruginous Flycatcher		Muscicapidae
<i>Mycerobas carnipes</i>	Spot Winged Grosbeak	Sungaba	Fringillidae
<i>Myophonus caeruleus</i>	Blue Whistling Thrush	Kalchura	Turdidae
<i>Myzoris pyrrhoura</i>	Fire-tailed Myzoris		Timaliidae
<i>Niltava sundara</i>	Rufous Bellied Niltava		Muscicapidae
<i>Parus dichorus</i>	Grey-crested Tit	Fista	Paridae
<i>Parus monticolus</i>	Green-backed Tit	Fista	Paridae
<i>Passer domesticus</i>	House Sparrow	Bhangera	Passeridae
<i>Passer rutilans</i>	Russet Sparrow	Bhangera	Passeridae
<i>Pericrocotus (flammeus) speciosus</i>	Scarlet Minivet	Rani chari	Campephagidae
<i>Periparus rubidiventris</i>	Rufous Vented Tit	Fista	Paridae
<i>Phoenicurus frontalis</i>	Blue Fronted Redstart		Muscicapidae
<i>Phylloscopus trochiloides</i>	Greenish Warbler	Fista	Sylviidae

Scientific Name	Common Name	Local Name	Family
<i>Phyrrcorax graculus</i>	Alpine Chough		Corvidae
<i>Picus flavinucha</i>	Greater Yellownape		Picidae
<i>Prunella collaris</i>	Alpine Accentor		Prunellidae
<i>Prunella strophciata</i>	Rufous-breasted Accentor		Prunellidae
<i>Pseudominla castaneiceps</i>	Rufous Winged Fulvetta		Sylviidae
<i>Pycnonotus cafer</i>	Red Vented Bulbull	Jureli	Pycnonotidae
<i>Pycnonotus striatus</i>	Straited Bulbull	Jureli	Pycnonotidae
<i>Pyrrhocorax graculus</i>	Yellow-billed chouch		Corvidae
<i>Pyrrhuia erythaca</i>	Grey Headed bullfinch	Tuti	Fringillidae
<i>Rhiphidura albicollis</i>	White-throated Fantail		Rhipiduridae
<i>Rhiphidura hypoxantha</i>	Yellow-bellied Fantail		Rhipiduridae
<i>Seicerus burkii</i>	Golden Spectacled Warbler	Fista	Sylviidae
<i>Sitta himalayensis</i>	White Tailed Nuthatch	Makhmali Matta	Certhiidae
<i>Stroptopelia orientalis</i>	Oriental Turtle Dove	Dhukur	Columbidae
<i>Tarsiger indicus</i>	White Browed Bush Robin		Muscicapidae
<i>Tetraogallus tibetanus</i>	Tibetan Snowcock		Phasinidae
<i>Tragopan satyra</i>	Satyr Tragopan	Mudal	Phasinidae
<i>Treron sphenura</i>	Wedge-Tailed Green Pigeon	Haaleyshe	Columbidae
<i>Treron sphenurus</i>	Snow Pigeon	Malewa	Columbidae
<i>Troglodytes troglodytes</i>	Winter Wren		Troglodytinae
<i>Turdus albocinctus</i>	White-collared Blackbird		Turdidae
<i>Turdus bouboul</i>	Grey wing Blackbird		Turdidae
<i>Upupa epops</i>	Common Hoopoe		Upupidae
<i>Urocissa ornata</i>	Yellow Billed Blue Magpie	Laampucharey	Corvidae
<i>Yuhina bakeri</i>	White-naped Yuhina	Megma	Timaliidae
<i>Yuhina flavicollis</i>	Whiskered Yuhina	Megma	Timaliidae
<i>Yuhina gularis</i>	Striped Throated Yuhina	Megma	Sylviidae
<i>Zoothera dauma</i>	Scaly Thrush		Turdidae



Urocissa ornata



Ithaginis cruentus



Grandala coelicolor (Male)



Golden Cat captured with camera trap at Ghunsa



Herd of Blue Sheep seen at Lamuney

Ravangla - Bhaleydonga sampling path, Maenam Wildlife Sanctuary, South Sikkim

Maenam Wildlife Sanctuary, situated in South Sikkim, was established in the year 1987. The altitude of the sanctuary ranges from 2100 m to 3252 m asl. It is located between latitude 27°18'N and 27°20' N and longitude 88°22'E and 88°24' E. and covers an area of 35 sq. km. The sanctuary is located on the Maenam-Tendong ridge and is drained by the Teesta River in the East and Rangit River in the West. Despite the narrow altitudinal range and frequent disturbances caused by the local inhabitants from the nearby urban areas, it supports a wide range of microclimates. The sanctuary is very rich in floral and faunal diversity. The vegetation is characterized by wet temperate broad-leaved mixed forest and temperate coniferous forest. The Sanctuary has a very important watershed value. Bermali *Khola* (stream) running through the sanctuary is the only source of water, not only for the villages downstream, but also to Namchi, the south district headquarter.

The prominent tree species between 2100 to 2300 m asl are *Acer campbellii*, *Castanopsis tribuloides*, *Cinnamomum zeylanicum*, *Machilus edulis*, *Machilus odoratissima*, *Quercus lamellosa*, *Rhododendron arboreum*, etc. Small tree species are represented by *Eurya*



Sampling path along Ravangla-Bhaley Dhunga Transect,
Maenam Wildlife Sanctuary

acuminata, *Symplocos glomerata*, *Symplocos theifolia*, *Zanthoxylum acanthopodium*, *Pieris ovalifolia*, *Prunus nepalensis*, etc. The commonly occurring shrubs at these altitudes are *Daphne cannabina*, *Edgeworthia gardnerii*, *Rhododendron dalhousiae*, *Rubus ellipticus*, *Rubus reticulatus*, *Rubus paniculatus*, *Viburnum*

erubescens, *Osbeckia stellata*, etc. The ground species at this altitude includes many fern and fern-allies along with herb species like *Pilea* sp., *Elatostema* sp., *Strobilanthus* sp., *Aconogonum molle*, *Bistorta affinis*, *Anaphalis margaritaceae*, *Begonia* sp., *Cautleya spicata*, *Eragrostis* sp., *Hedychium spicatum*, *Swertia bimaculata*, etc. The area also harbours many climbers such as *Rubia cordifolia*, *Herpetospermum pedunculatum*, etc.

Along 2400 m to 2700 m asl, the forest is dominated by the tree species viz., *Acer*

campbellii, *Acer palmatum*, *Castanopsis tribuloides*, *Cinnamomum zelynicum*, *Lithocarpus pachyphylla*, *Magnolia campbellii*, *Illex* sp., *Machilus edulis*, *Quercus lamellosa*, *Rhododendron arboreum*, *Rhododendron griffithianum*, etc. The shrubs are represented by *Daphne cannabina*, *Edgeworthia gardnerii*, *Mahonia sikkimensis*, *Rosa* sp., *Rubus* sp., *Viburnum cordifolium*, *Viburnum erubescens*, etc. The small tree species viz., *Symplocos theifolia*, *Eurya japonica*, *Pieris ovalifolia*, etc., are abundantly available. *Rhododendron falconeri* starts appearing at 2600 m asl.



Survey team laying plots in Maenam Wildlife Sanctuary, South Sikkim

Lithocarpus pachyphylla and *Rhododendron falconeri* predominates along 3000 m asl with *Acer campbellii*, *Acer caudatum*, *Rhododendron barbatum*, etc. With the increase in altitude,

the ground species becomes less prominent except in the open areas which were found to be covered with different types of *Aconogonum* sp., *Aster* sp., *Bistorta* sp., *Fragaria nubicola*,

Selaginella sp., *Swertia* sp., etc.

Between 3100 to 3800 m altitude, *Abies densa* forms the dominant tree species and species like *Acer campbellii*, *Acer caudatum*, *Acer pectinatum*, *Rhododendron hodgsonii*, *Rhododendron barbatum*, etc., are scatteredly available. The common small tree species available along these altitudes are *Betula alnoides* and *Sorbus* sp. The shrub species includes *Rhododendron thomsonii*,

Rhododendron campanulatum, *Viburnum erubescence*, *Rosa sericea*, *Rubus* sp., etc.

Flora

During the survey, 34 tree species, 15 species of shrubs, 48 herb including 2 orchid species, 10 climber/epiphyte species, 13 species of fern and fern-allies including 1 unidentified were recorded, which are listed in the following Table.

List of floral species recorded along Ravangla – Bhaley Dhunga Sampling path

Scientific Name	Local Name	Family
Tree		
<i>Abies densa</i> Griff.	Gobre salla	Pinaceae
<i>Acer caudatum</i> Wallich	Lekh Kapasey	Aceraceae
<i>Acer caudatum</i> Wallich	Kapasey	Aceraceae
<i>Acer palmatum</i> Thunb.	Kapasey	Aceraceae
<i>Berberis insignis</i> Hook. f. & Thoms	Chutro	Berberidaceae
<i>Betula alnoides</i> Buch. Ham. Ex D. Don	Saur	Betulaceae
<i>Castanopsis tribuloides</i> A. DC	Musrey Katus	Fagaceae
<i>Daphne cannabina</i> Wall	Kalo algeri	Thymelaceae
<i>Daphniphyllum himalayense</i> (Benth.) Mull. Arg.	Lall Chandan	Euphorbiaceae
<i>Edgeworthia gardeneri</i> Meissn.	Argayle	Thymelaceae
<i>Eurya acuminata</i> DC	Jhinganey	Theaceae
<i>Ilex</i> sp.	Lise	Aquifoliaceae
<i>Lithocarpus pachyphylla</i> (Kurz) Rehder	Sungurey katush	Fagaceae
<i>Litsaea elongata</i> Wall.	Siltimmur	Lauraceae
<i>Lyonia ovalifolia</i> Wall.	Angeri	Ericaceae
<i>Machilus</i> sp.	Kawlo	Lauraceae
<i>Machilus edulis</i> King ex Hook. f	Pomsi	Lauraceae
<i>Machilus odoratissima</i> Nees.	Lali Kawlo	Lauraceae
<i>Magnolia campbellii</i> Hook. f. & Thom.	Ghogey champ	Magnoliaceae
<i>Michelia doltsopa</i> Buch.-Ham. ex DC	Rani champ	Magnoliaceae
<i>Michelia velutina</i> DC	Phusray champ	Magnoliaceae

Scientific Name	Local Name	Family
<i>Pieris</i> sp.	Lekh angeri	Ericaceae
<i>Prunus nepalensis</i> (Ser) Stendel	Arupatey	Rosaceae
<i>Quercus lamellosa</i> Smith.	Bajranth	Fagaceae
<i>Rhododendron arboreum</i> ssp. <i>arboreum</i> (CB Clarke) Ridley	Lali Gurans	Ericaceae
<i>Rhododendron barbatum</i> Wallich ex D. Don	Lal Chimal	Ericaceae
<i>Rhododendron falconeri</i> Hook. f	Korlinga	Ericaceae
<i>Rhododendron grande</i> Wight.	Korlinga	Ericaceae
<i>Rhododendron griffithianum</i> Wighti.	Gurans	Ericaceae
<i>Rhododendron hodgsonii</i> Hook.f	Korlinga	Ericaceae
<i>Saurauia napaulensis</i> DC	Gagun	Actinidiaceae
<i>Sorbus cuspidata</i> Hedlund.	Pasi	Rosaceae
<i>Symplocos glomerata</i> King	Kholmay	Symplocaceae
<i>Symplocos theifolia</i> D. Don	Kharanay	Symplocaceae
Shrub		
<i>Actinodaphne sikkimensis</i> Meissn	Phirphirey	Lauraceae
<i>Gaultheria hookeri</i> Clarke	Dhasingre	Ericaceae
<i>Gaultheria nummulariodes</i> D. Don	Dhasingre	Ericaceae
<i>Gaultheria</i> sp.	Dhasingre	Ericaceae
<i>Neillia rubiflora</i> D. Don	Kirkeray	Rosaceae
<i>Osbeckia stellata</i> Buch.-Ham. ex D. Don	Chulesi	Melastomataceae
<i>Oxyspora paniculata</i> (D. Don) DC		Melastomataceae
<i>Rhododendron camelliflorum</i> Hook. f.	Chia phule gurans	Ericaceae
<i>Rubus ellipticus</i> Smith	Ainselu	Rosaceae
<i>Rubus lineatus</i> Reinw. ex Blume	Ainselu	Rosaceae
<i>Rubus niveus</i> Thunb		Rosaceae
<i>Rubus</i> sp.		Rosaceae
<i>Vaccinium retusum</i> (Griffith.) Hook. f. ex Clarke	Mussikane	Ericaceae
<i>Vaccinium</i> sp.	Mussikane	Ericaceae
<i>Viburnum erubescence</i> Wallich ex DC	Asaray	Caprifoliaceae
Herb		
<i>Anaphalis triplinervis</i> C.B. Clarke	Buki Phool	Asteraceae
<i>Anaphalis virgata</i> Thoms. x Clarke	Buki phul	Asteraceae
<i>Arisaema erubescens</i> (Wall.) Schott	Laura/Baako	Araceae
<i>Arisaema nepenthoides</i> (Wallich) Martius ex Schott	Laura/Baako	Araceae

Scientific Name	Local Name	Family
<i>Astilbe rivularis</i> Ham	Buriokhati	Saxifragaceae
<i>Begonia</i> sp.	Magarkachi	Asteraceae
<i>Bidens pilosa</i> Linn.	Kuro	Asteraceae
<i>Bistorta affinis</i> D. Don		Polygonaceae
<i>Campylandra aurantica</i> Baker	Janglee Nakima	Liliaceae
<i>Centella asiatica</i> Linn.	Golpatta	Apiaceae
<i>Cheilocostus speciosus</i> (J. konig) C. Specht.		Costaceae
<i>Cyanotis vaga</i> (Loour.) Roem & Schult.		Commelinaceae
<i>Cynodon dactylon</i> Linn.		Poaceae
<i>Dichroa febrifuga</i> Lour.	Basak	Hydrangeaceae
<i>Diphylax</i> sp.		Orchidaceae
<i>Drymaria cordata</i> Wild.	Abijalo	Caryophyllaceae
<i>Elatostema platyphyllum</i> Weddell	Gagleto	Urticaceae
<i>Eragrostis</i> sp.	Kirkirey banso	Poaceae
<i>Eragrostis</i> sp.	Chitrey banso	Poaceae
<i>Eragrostis</i> sp.	Banso	Poaceae
<i>Fragaria nubicola</i> Lindley ex. Lacaíta	Vui Aiselu	Rosaceae
<i>Galinsoga parviflora</i> Cavanilles		Asteraceae
<i>Galium</i> sp.		Rubiaceae
<i>Hackelia</i> sp	Kuro	Boraginaceae
<i>Hedychium spicatum</i> Buch. Ham	Saro	Zingiberaceae
<i>Hemiphragma heterophyllum</i> Wallich		Scrophulariaceae
<i>Hypericum</i> sp.		Guttiferae
<i>Impatiens</i> sp.		Balsaminaceae
<i>Impatiens stenantha</i> Hook. f		Balsaminaceae
<i>Juncus</i> sp.		Juncaceae
<i>Laportea terminalis</i> Wight	Patle sisnu	Urticaceae
<i>Mussaenda roxburghii</i> Hook. f	Dhobi Phul	Rubiaceae
<i>Nepeta</i> sp.		Lamiaceae
<i>Nepeta</i> sp.		Lamiaceae
<i>Nepeta</i> sp.		Lamiaceae
<i>Oxalis corniculata</i> Linn.	Amilo jhar	Oxalidaceae
<i>Persicaria capitata</i> (Buch. Ham. ex D. Don) Gross	Ratneulo	polygonaceae
<i>Pilea scripta</i> (Buch.-Ham. ex D. Don) Wedd.		Ulmaceae

Scientific Name	Local Name	Family
<i>Pilea umbrosa</i> Blume.	Chiple	Urticaceae
<i>Poa</i> sp.		Poaceae
<i>Polygonum molle</i> D. Don	Thotney	Polygonaceae
<i>Polygonum runcinatum</i> Buch. – Ham. ex D. Don	Ratnaulo	Polygonaceae
<i>Rumex nepalensis</i> Sprengel	Halhalley	Polygonaceae
<i>Satyrium nepalensis</i> D. Don		Orchidaceae
<i>Selinum</i> sp.		Apiaceae
<i>Swertia bimaculata</i> Hooker & Thomson ex C.B. Clarke	<i>Bhaley Chirowto</i>	Gentianaceae
<i>Swertia chirayita</i> (Roxb. ex Fleming) H. Karst.	<i>Chirowto</i>	Gentianaceae
<i>Urtica dioica</i> Linn.	Garia Sisnu	Urticaceae
Climber/Epiphyte		
<i>Aeschynanthus sikkimensis</i> (C.B. Clarke) Stapf		Gesneriaceae
<i>Cissus elongate</i> Roxb.		Vitaceae
<i>Holboellia angustifolia</i> Wall.	Gulfa	Lardizabalaceae
<i>Piper</i> sp.		Piperaceae
<i>Rhaphidophora decursiva</i> (Roxb.) Schott	Kanchirno	Araceae
<i>Rhaphidophora</i> sp.	Kanchirno	Araceae
<i>Rubia cordifolia</i> Roxb.	Manjith	Rubiaceae
<i>Smilax aspera</i> L.		Liliaceae
<i>Stephania</i> sp.		Menispermaceae
<i>Viscum articulatum</i> Burm. F.		Santaceae
Fern and Fern allies		
<i>Araiostegia beddomei</i> (Hope) Ching		Davalliaceae
<i>Asplenium ensiforme</i> Wall. ex Hook. & Grev		Aspleniaceae
<i>Asplenium lacinatedum</i> D. Don		Aspleniaceae
<i>Coniogramme intermedia</i> Herion		Pteridaceae
<i>Dryopteris sikkimensis</i> (Bedd.) O. Ktze		Dryopteraceae
<i>Lycopodiella cernua</i> (L.) Pichi-Serm		Lycopodiaceae
<i>Monachosoram henryi</i> H. Christ		Monachosoraceae
<i>Plagiogyria pycnophylla</i> (Kunze) Mett		Plagiogyriaceae
<i>Selaginella</i> sp.		Selaginellaceae
<i>Sphagnum</i> sp.		Sphagnaceae
Unidentified		
<i>Vittaria flexuosa</i> Fee		Vittaraceae



Satyrium nepalense



Diphylax sp.



Aconogonum molle



Hedychium spicatum



Astilbe rivularis



Swertia bimaculata



Paris poplyphylla



Herpetospermum pedunculatum



Cautleya spicata



Hemiphragma heterophyllum

Fauna

With narrow altitudinal difference ranging from 2100 m to 3252 m asl, the area holds an array of Wildlife habitats that support rich faunal diversity. The sanctuary is known to harbor many of the critically threatened species such as Red Panda, Common leopard, Himalayan Black bear and many other carnivores, ungulates including Serow,

Barking deer, Goral, etc., as well as pheasants of global conservation significance. The sanctuary also forms a home to a varieties of birds including Magpies, Common Hill Partridge, Laughing thrush, Warblers, Babblers, Yuhina, Drongo, etc.

During the survey, many species were observed through direct and indirect sightings. Barking deer (female & young

ones in same frame) and Hill partridge were captured through the camera trap. Through direct sighting, Barking Deer (Albino form, yet to be confirmed), Common Hill Partridge, Khalij Pheasant and Pika were seen. Apart from this, indirect evidences like scat, pellet, fethers, etc., of Himalayan Black Bear, Binturong, Serow, Wild Boar, Red fox,

Jackal, Satyr tragopan, Civet and Marten were found.

During the trail sampling many avi-faunal species such as Straited laughing thrush, Mrs Gould sunbird, Ashy drongo, Long tail shrike, Jungle crow, Olive back tit, Wiskered yuhina, Fire tailed myzornis, Crested Brown tit, Coal tit, etc. were recorded.



Ochotona dauurica (Pika) and its dorppings



Arborophila torqueola (feather)



Droppings of Barking Deer

List of avi faunal species in Maenam Wildlife Sanctuary, South Sikkim

Scientific Name	Common Name	IUCN Status
<i>Actinodura nepalensis</i>	Hoary Barwing	LC
<i>Aegithalos concinnus</i>	Red-headed Tit	LC
<i>Aethopyga nepalensis</i>	Nepal Sunbird	LC
<i>Arborophila torqueola</i>	Common Hill Partridge	LC
<i>Certhia familiaris</i>	Northern Treecreeper (Brown creeper)	LC
<i>Cissa chinensis</i>	Common Green Magpie	LC
<i>Cuculus canorus</i>	Eurasian Cuckoo	LC
<i>Cutia nepalensis</i>	Nepal Cutia	LC
<i>Dendrocitta formosae</i>	Grey Treepie	LC
<i>Dicrurus adsimilis</i>	Black Drongo or King crow	LC
<i>Garrulax leucolophus</i>	White Crested Laughing Thrush	LC
<i>Garrulax striatus</i>	Striated Laughing Thrush	LC
<i>Heterophasia capistrata</i>	Blackcapped Sibia	LC
<i>Hypsipetes madagascariensis</i>	Black Bulbull	LC
<i>Ictinaetus malayensis</i>	Black Eagle	LC
<i>Lophura leucomelanos</i>	Kalij Pheasant	LC
<i>Myiophonus caeruleus</i>	Blue Whistling Laughing Thrush	LC
<i>Parus ater</i>	Coal Tit	LC
<i>Pericrocotus flammeus</i>	Scarlet Minivet	LC
<i>Phylloscopus trochiloides</i>	Dull Green Leaf Warbler	LC
<i>Rhiphidura albicollis</i>	White Throated Fantail Flycatcher	LC
<i>Rhiphidura aureola</i>	White Browed Fantail	LC
<i>Sitta himalayensis</i>	White Tailed Nuthatch	LC
<i>Streptopelia orientalis</i>	Rufous Turtle Dove	LC
<i>Tragopan satyra</i>	Satyr Tragopan	NT
<i>Treron pompadora</i>	Pompadour Green Pigeon	
<i>Yuhina flavicollis</i>	Whiskered Yuhina	LC
<i>Zoothera dixonii</i>	Long tailed Mountain Thrush	LC

LC: Least Concern; NT: Near Threatened

Tholung - Kishong sampling path, Khangchendzonga National Park, North Sikkim

Dzongu, the homeland of the original inhabitants of Sikkim, the Lepchas, lies in the North district of Sikkim. The territory was designated a special reserve for the Lepcha community during 1960s. Dzongu landscape, as a whole, spreads along 700 m to 6000 m asl., belonging to different ecological zone falling within and outside the boundary of KBR, representing tropical forests to alpine pastures. It has striking natural beauty, with pristine glacial streams, countless waterfalls and hot springs. A majority of area is covered by thick virgin forests harbouring astonishing floral and faunal diversity. Physiographically, the area is characterized by diverse snowy mountainous landscape with steep and narrow valleys and gorges with well drained flanking slopes having loamy surface, moderate erosion and slight stoniness in which lie hidden numerous caves and lakes.

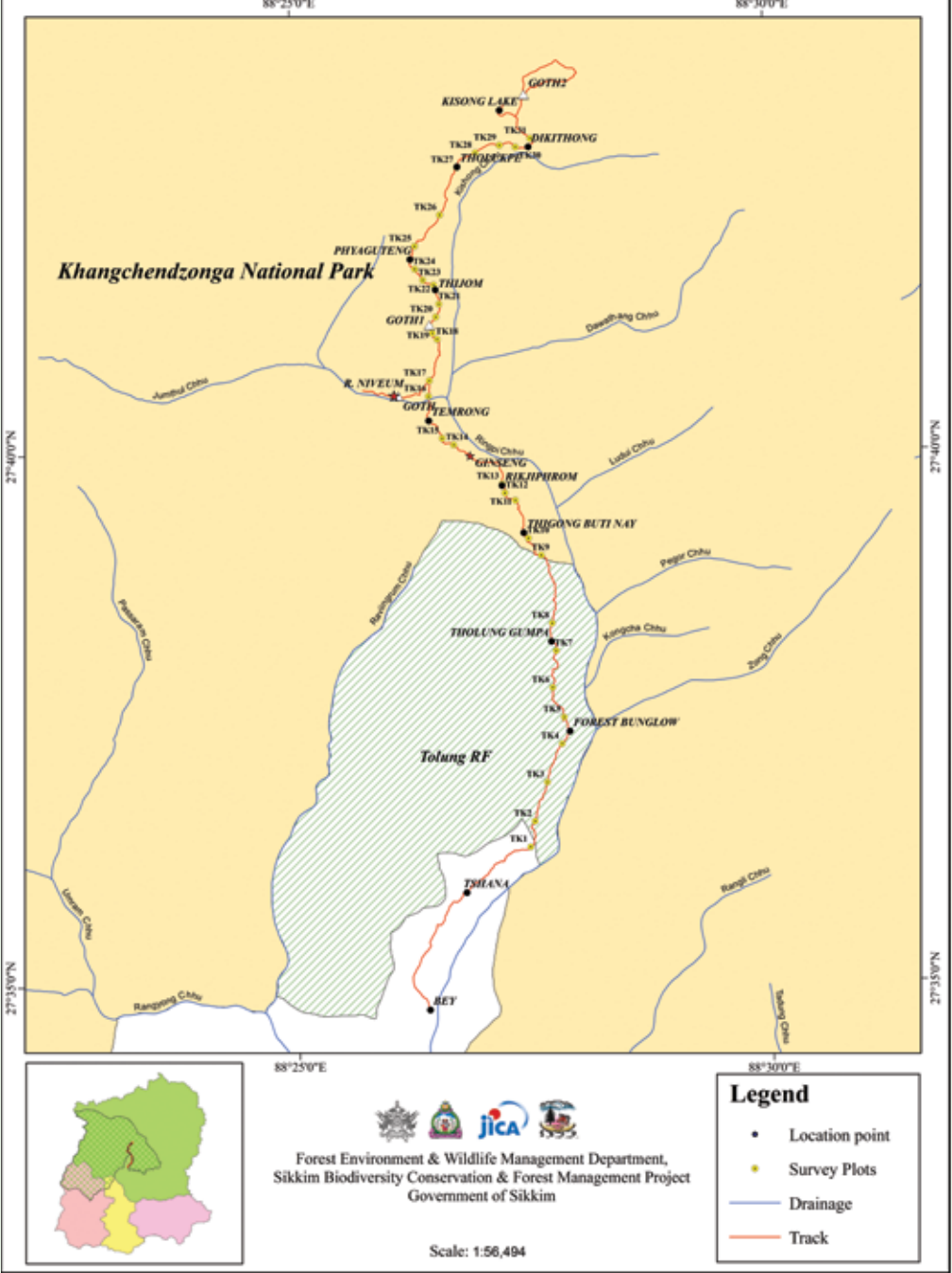
The study was conducted along Tholung-Kisong transect, recently promoted as trekking trail under Dzongu Eco-tourism Promotion Zone by the Government of Sikkim through Forest, Environment and Wildlife Management Department Notification no. 1975/F dated 11.12.2006 in Khangchendzonga Biosphere Reserve. The altitude of the study area ranged from 1800 m to 4200 m asl lying between latitude 27°36' and 27°43' N and longitude 88°26' and 88°28' E. The floristic wealth of the Dzongu and its surrounding area is rich and diverse, both in composition and aesthetic and economic value. Forests represent a variety of plant communities of diverse vegetation types corresponding to variation in climate and edaphic factors. The valley is enriched with variety of woody tree

species, shrubs, lichens, epiphytes and mosses. The forest in the Dzongu valley is characterized by the tropical forest (700 to 1000 m); sub-tropical forest (1000 to 1800 m); wet temperate mixed broad leaved forest (1800 to 3000 m); sub-alpine forest (3000 m - 4000 m); alpine scrubs/pastures/grassland (4000 m and above).

Along the sub-tropical region, the tree species widely distributed are *Alnus nepalensis*, *Juglans regia*, *Macaranga denticulata*, *Macaranga pustulata*, *Oroxylum indicum*, *Spondias axillaries*, etc. *Pandanus nepalensis* (shrub) can be seen all along the Teesta valley.

The wet temperate mixed forest comprises of evergreen tree species, which are completely covered by the moss and the large number of epiphytes. The ground is densely covered by the shrubs, herbs and ferns. Under the dense forest cover, the ground bears nothing except ferns (*Pteris* sp., *Dryopteris* sp., etc.) where the humus content is very high and the ground always remains moist. The tree species occurring at the lower altitude are *Alnus nepalensis*, *Beilschmiedia sikkimensis*, *Castanopsis hystrix*, *Castanopsis tribuloides*, *Echinocarpus dasycarpus*, *Glochidion acuminatum*, *Laurocerasus acuminata*, *Macaranga denticulata*, *Rhus succedanea*, etc. *Rhododendron arboreum* and *Rhododendron grande* are scatteredly available. The small tree species comprise of *Brassaiopsis hispida*, *Brassaiopsis mitis*, *Ficus nemarolis*, *Meliosma wallichii*, *Pieris ovalifolia*, *Saurauia nepalensis*, *Tetradium fraxinifolia*, etc. The shrubs are represented by *Edgeworthia gardenierii*, *Maesa rugosa*, *Rubus ellipticus*, *Rubus reticulatus*, *Urtica parviflora*, *Viburnum cordifolium*, etc.

Rapid Biodiversity Survey Plots Along Tholung-Kisong Transect, Dzongu



Survey plots along Tholung - Kisong sampling path, North Sikkim



Temperate broad-leaved forest along Tholung-Kisong sampling path

Ascending above 2000 m, the species viz., *Acer campbellii*, *Acer caudatum*, *Cinnamomum tamala*, *Machilus edulis*, *Michelia doltsopa*, *Quercus lamellosa*, etc. becomes prominent. Small tree species, viz., *Eurya japonica*, *Symplocos glomerata*, *Symplocos theaefolia*, etc., completely dominates the forest. *Aconogonum molle* and *Mahonia nepalensis* are few of the dominating shrubs at ca. 2100 m altitude along with *Viburnum cordifolium*.

Between 2400 to 2700 m, the forest is completely dominated by the tree species viz., *Acer campbellii*, *Acer stachyophyllum*, *Cinnamomum tamala*, *Illex sikkimensis*, *Lithocarpus pachyphylla*, *Machilus edulis*, *Magnolia campbellii*, *Michelia doltsopa*, *Quercus glauca*, *Quercus lamellosa*, *Rhododendron arboreum*, etc. The shrubs are

represented by *Daphne canabina*, *Viburnum cordifolium*, etc. The small tree species viz., *Micromeles thomsonii*, *Myrsine semiserrata*, *Prunus nepalensis*, etc., are abundantly available along with *Eurya japonica*, *Pieris ovalifolia*, *Symplocos theifolia*, etc. The ground species becomes less prominent along the increasing altitude. As one reaches 3000 m altitude, the temperate mixed forest abruptly changes to *Abies - Rhododendron* forest. In this part of the KBR, *Tsuga dumosa* is very sparsely available at an altitude of 2900 m asl. *Betula alnoides*, *Prunus nepalensis*, *Symplocos theifolia* are among the small trees and *Daphne cannabina*, *Viburnum cordifolium* are among the shrub species available. *Arundinaria* sp. also forms patches at this altitude along with *Rhododendrons*.

Above 3000 m altitude, *Abies densa* trees appeared as dominant species, along with scattered presence of *Acer pectinatum* trees. The dominance of *Abies densa* could be seen till 3600 m asl. which become dwarf beyond 3800 m. Various species of dwarf Rhododendrons along with the *Betula utilis* can also be seen. The prominent rhododendron species found along this altitudinal range are *Rhododendron campylocarpum*, *Rhododendron ciliatum*, *Rhododendron glaucophyllum*, *Rhododendron hodgsonii* and *Rhododendron thomsonii*. The shrub species like *Eurya* sp., *Ribes griffithii*, *Rosa sericea*, *Viburnum cordifolium*, *Viburnum erubescens* and others are also available along the study transect. Small bamboos can be observed along 3200 m–3300 m altitude.

Ascending above 3600 m altitude, the slope became steeper and the ground rocky through which the plant species emerges out. The soil hardly contains any significant humus due to sandy texture. The tree species completely disappeared above this altitude and different shrub species became more prominent. The ground is inaccessible due to the presence of shrubs. Different species of rhododendrons dominates the area above this altitude. The common rhododendron species available between 3600 m to 4200 m altitude were *Rhododendron anthopogon*, *Rhododendron aeruginosum*, *Rhododendron fulgens*, *Rhododendron lepidotum*, *Rhododendron setosum* and *Rhododendron wightii*. The *Gaultheria* sp., *Juniperus recurva*, *Rosa sericea*



Temperate coniferous forest along Tholung - Kisong sampling path



Alpine shrub along Tholung - Kisong sampling path



Alpine pasture along Tholung - Kisong sampling path

and some unidentified species are amongst the other species present in the area. Along 4200 m altitude, *Juniperus recurva*, *Juniperus squamata*, *Rhododendron anthopogon* and *Rhododendron setosum* are more prominent. Above 4200 m asl, the valleys are very steep (almost 60–70 degree) as well as rocky/bouldery and is characterized by steep rocky outcrops covered with *Aconitium* sp., *Calanthus* sp., *Kobresia* sp., *Primula* sp., *Silene* sp. The common species available above this altitude are *Rhododendron anthopogon*, *Rhododendron setosum*, *Juniperus recurva*, *Juniperus squamata*, *Rheum nobile*, *Saussurea obvallata*, *Saussurea gossypiphora*, *Swertia multicaulis*, etc. The area above 3000 m asl remains under perpetual snow cover during winter.

The thick virgin forest along Tholung-Kisong transect is enriched with numerous varieties of butterflies, birds and animals. Some of the rare and threatened faunal and avifaunal species includes Himalayan Thar, Musk Deer, Red Fox, Tibetan Sand Fox, Red Panda, Himalayan Black Bear, Himalayan Langur, Blood Pheasant, Kalij Pheasant, etc. To protect the rich biological diversity of Dzongu valley from emerging threats, several conservation zones such as Dawathong Himalayan Thar Conservation Zone, Thepa La (north-east) Alpine Bird Conservation Zone, Thepa La (south-west) Medicinal Plant Conservation Zone, Panch Pokhari (Lungdoh Nay) Musk Deer Conservation Zones, etc., have been designated along the Tholung-Kisong eco-trail.



Measuring CBH of tree



Sampling in different forest types along Tholung - Kisong sampling path

Flora

During the survey along Tholung - Kisong sampling path, 59 tree species belonging to 40 genera and 26 families and 1 unidentified were recorded. Similarly, 41 species of shrubs (17 genera and 11 families and 1 unidentified) and 136 species of herbs (100 genera, 18 families) were confirmed along the sampling path. In addition, 25 fern and fern-allies species belonging to 20 genera and 12 families (both epiphytic and terrestrial) and 5 climber species were observed, which are listed in

the Table below. Besides, numerous orchids like *Calanthe* sp., *Diphylax* sp., etc. and small bamboos like *Arundinaria hookeriana* (Pareng), *Arundinaria* sp., (Hange malingo), *Drepanostachyum intermedium* (Nigalo/Tite nigalo), etc. were also recorded along the Tholung-Kisong sampling path.

In the case of tree species, Ericaceae was the dominant family (6 species) followed by Fagaceae (5 species); Aceraceae, Araliaceae, Betulaceae and Lauraceae represented 4 species each.

Floral species recorded along Tholung – Kisong sampling path in Dzongu landscape, North Sikkim

Botanical name	Local name	Family
Tree		
<i>Abies densa</i> Griffith. ex Parker	Gobre salla	Pinaceae
<i>Acer campbellii</i> Hook. & Thom. Ex Hiern.	Kapasey	Aceraceae
<i>Acer caudatum</i> Wall.	Lekh Kapasey	Aceraceae
<i>Acer pectinatum</i> Wall. ex Nicholson	Lekh Kapasey	Aceraceae
<i>Acer stachyophyllum</i> Hiern.	Dalle kapasey	Aceraceae
<i>Alangium begoniaefolium</i> (Roxb.) Baill	Akhaney	Alangiaceae
<i>Alnus nepalensis</i> Don.	Utis	Betulaceae
<i>Beilschmiedia sikkimensis</i> King ex Hook. f.	Tarsing	Lauraceae
<i>Betula alnoides</i> Buch. Ham ex Don	Saur	Betulaceae
<i>Betula cylindrostachya</i> Wall.	Saur	Betulaceae
<i>Betula utilis</i> Don.	Bhojpatra	Betulaceae
<i>Brassaiopsis alpina</i> Clarke	Bhote phutta	Araliaceae
<i>Brassaiopsis hispida</i> Seem.	Phutta	Araliaceae
<i>Brassaiopsis mitis</i> Clarke	Chuletro	Araliaceae
<i>Castanopsis hystrix</i> Hook. & Thom. ex A. DC	Patle katush	Fagaceae
<i>Castanopsis tribuloides</i> (Smith) A. DC	Musre katush	Fagaceae
<i>Cinnamomum impressinervium</i> Meisn.	Sinkoli	Lauraceae
<i>Cryptomeria japonica</i> (Thunb. Ex Linn. F.) D. Don	Dhuppi	Taxodiaceae
<i>Daphniphyllum himalayense</i> (Benth.) Mull. Arg.	Lal chandan	Euphorbiaceae

Botanical name	Local name	Family
<i>Echinocarpus dasycarpus</i> Benth.	Gobre	Elaeocarpaceae
<i>Elaeocarpus lanceaefolius</i> Roxb.	Bhadrasey	Elaeocarpaceae
<i>Erythrina arborescens</i> Roxb.	Phaledo	Fabaceae
<i>Eurya acuminata</i> DC	Sanu jhingni	Theaceae
<i>Ficus nemarolis</i> Wall.	Dudhilo	Moraceae
<i>Glochidion acuminatum</i> Muell.	Latikath	Eophorbiaceae
<i>Ilex sikkimensis</i> Kurz.	Lise	Aquifoliaceae
<i>Juniperus</i> sp.	Shukpa dhup	Cupressaceae
<i>Laurocerasus acumanata</i> Roem.	Lali	Rosaceae
<i>Leucosceptrum cannum</i> Smith.	Ghurpis	Labiatae
<i>Lithocarpus pachyhylla</i> (Kurtz.) Rehder.	Sungurey katush	Fagaceae
<i>Macaranga pustulata</i> King ex Hook.	Malata	Euphorbiaceae
<i>Machilus edulis</i> King ex Hook. f.	Pomsi	Lauraceaea
<i>Machilus odoratissima</i> Nees.	Lali kawlo	Lauraceaea
<i>Magnolia campbellii</i> Hook.f. & Thom.	Ghogy chanp	Magnoliaceae
<i>Meliosma wallichii</i> Planch. Ex Hook. f	Lekh dabdabey	Sabiaceae
<i>Michelia doltsopa</i> Buch.-Ham.ex DC.	Rani chanp	Magnoliaceae
<i>Michelia velutina</i> DC.	Phusrey chanp	Magnoliaceae
<i>Pentapanax leschenaultii</i> Seem	Chinde	Araliaceae
<i>Pieris ovalifolia</i> (Wall) D. Don	Angeri	Ericaceae
<i>Quercus lamellosa</i> Smith.	Bajranth	Fagaceae
<i>Quercus lineata</i> Blume.	Phlant	Fagaceae
<i>Rhododendron arboreum</i> ssp. <i>arboreum</i> (CB Clarke) Ridley.	Lali gurans	Ericaceae
<i>Rhododendron barbatum</i> Wall. ex G. Don	Lal chimal	Ericaceae
<i>Rhododendron falconeri</i> Hook.f.	Korlinga	Ericaceae
<i>Rhododendron grande</i> Wight.	Patley korlinga	Ericaceae
<i>Rhododendron hodgsonii</i> Hook.f.	Korlinga	Ericaceae
<i>Rhododendron niveum</i> Hook.	Hiu pate gurans	Ericaceae
<i>Rhus insignis</i> Hook.f.	Kag Bhalayo	Anacardiaceae
<i>Saurauia nepalensis</i> DC	Gagun	Actinidaceae
<i>Sorbus ursina</i> (Wall.) Decne.	Lek Pasi	Rosaceae
<i>Symplocos glomerata</i> King ex C. B. Clarke	Kholmey	Symplocaceae
<i>Symplocos theaefolia</i> D. Don	Kharaney	Symplocaceae

Botanical name	Local name	Family
<i>Tetradium fraxinifolia</i> (Hook.) T.G. Hartley	Khanakpa	Rutaceae
<i>Tsuga dumosa</i> (D. Don) Eichler.	Tengre salla	Pinaceae
<i>Viburnum cordifolium</i> Wall. ex DC	Bara asarey	Caprifoliaceae
<i>Viburnum</i> sp.	Asarey	Caprifoliaceae
<i>Hydranga heteromalla</i> D. Don	Bogotey	
<i>Zanthoxylum acanthopodium</i> DC	Boke timmur	Rutaceae
Shrub		
<i>Berberis aristata</i> DC	Chutro	Berberidaceae
<i>Daphne cannabina</i> Wall.	Kalo argeli	Thymelaeaceae
<i>Decaisnea insignis</i> (Griffith.) Hook. f. & Thom.		Lardizabalaceae
<i>Edgeworthia gardeneri</i> Meissn.	Argayle/Kagate	Thymelaeaceae
<i>Gaultheria nummularioides</i> D. Don	Dhasingre	Ericaceae
<i>Gaultheria fragrantissima</i> Wall.	Dhasingre	Ericaceae
<i>Gaultheria hookeri</i> Clarke	Dhasingre	Ericaceae
<i>Gaultheria trichophylla</i> Royle	Dhasingre	Ericaceae
<i>Hypericum choisyianum</i> Wall. ex Rob.	Urilo	Clusiaceae
<i>Hypericum</i> sp. (smallest, creeping)	Urilo	Clusiaceae
<i>Juniperus indica</i> Bertol.	Gokul dhup	Cupressaceae
<i>Juniperus recurva</i> Buch. Ham. Ex D. Don	Shukpa dhup	Cupressaceae
<i>Mahonia sikkimensis</i> Takeda	Chutro	Berberidaceae
<i>Rhododendron aeruginosum</i> Hook. f.	Nilo pate chimal	Ericaceae
<i>Rhododendron anthopogon</i> D. Don	Sunpati	Ericaceae
<i>Rhododendron camelliflorum</i> Hook. f.	Chia phule gurans	Ericaceae
<i>Rhododendron campylocarpum</i> Hook. f.	Bango phule gurans	Ericaceae
<i>Rhododendron cilliatum</i> Hook. f.	Junge chimal	Ericaceae
<i>Rhododendron edgeworthii</i> Hook.		Ericaceae
<i>Rhododendron fulgens</i> Hook. f.	Chimal	Ericaceae
<i>Rhododendron glaucophyllum</i> Rehder.	Takma chimal	Ericaceae
<i>Rhododendron lanatum</i> Hook. f.	Bhutle chimal	Ericaceae
<i>Rhododendron lepidotum</i> Wall. ex G. Don	Bhale sunpati	Ericaceae
<i>Rhododendron pendulum</i> Hook.	Jhundine chimal	Ericaceae
<i>Rhododendron setosum</i> D. Don	Tsallu gurans	Ericaceae

Botanical name	Local name	Family
<i>Rhododendron thomsonii</i> Hook. f.	Dr. Thomson ko gurans	Ericaceae
<i>Rhododendron wightii</i> Hook. f.	Dr. Wight ko gurans	Ericaceae
<i>Ribes griffithii</i> Hook. & Thom.		Saxifragaceae
<i>Rosa sericea</i> Lindl.	Bhote gulab	Rosaceae
<i>Rubus acuminatus</i> Smith	Sanu Aiselu	Rosaceae
<i>Rubus ellipticus</i> Smith	Aiselu	Rosaceae
<i>Rubus lineatus</i> Reinw. ex Blume	Ainselu	Rosaceae
<i>Rubus nepalensis</i> (Hook. f.) Kuntze	Bhui ainselu	Rosaceae
<i>Salix calyculata</i> Hook. ex Anderson	Bais	Salicaceae
<i>Salix psilostigma</i> Anderson	Bais	Salicaceae
<i>Salix wallichiana</i> Anderson	Bais	Salicaceae
<i>Schefflera impressa</i> (C.B. Clarke) Harms.	Bhalu Chinde	Araliaceae
<i>Smilax rigida</i> Wall. ex Kauth	Kirnay jhar	Smilacaceae
<i>Vaccinium retusum</i> (Griffith.) Hook. f. ex Clarke	Mussikane	Ericaceae
<i>Viburnum erubescence</i> Wall. ex DC	Asare	Caprifoliaceae
<i>Viburnum nervosum</i> D. Don	Asare	Caprifoliaceae
Herb		
<i>Aconitum ferox</i> Wallich ex Seringe	Bikhma	Rununculaceae
<i>Acorus calamus</i> Linn.	Bojo	Acoraceae
<i>Ageratum conyzoides</i> Linn.	Elame jhar	Asteraceae
<i>Amomum subulatum</i> Roxb.	Alaichi	Zinziberaceae
<i>Anaphalis adnata</i> Wall. ex DC	Bukiful	Asteraceae
<i>Anaphalis contorta</i> (D. Don.) Hook. f.	Bukiful	Asteraceae
<i>Anaphalis margaritaceae</i> Linn.	Bukiful	Asteraceae
<i>Anaphalis triplinervis</i> (Sims.) Sim ex Clarke	Bukiful	Asteraceae
<i>Anemone vitifolia</i> Buch. – Ham. Ex DC.		Rununculaceae
<i>Angelica archangelica</i> Linn.		Apiaceae
<i>Aralia</i> sp.		Araliaceae
<i>Arisaema concinnum</i> Schott.	Larua/Banko	Araceae
<i>Arisaema echinatum</i> (Wall.) ex Schott.	Larua/Banko	Araceae
<i>Arisaema griffithii</i> Schott.	Larua/Banko	Araceae
<i>Arisaema intermedium</i> Blume	Larua/Banko	Araceae
<i>Arisaema nepenthoides</i> (Wall.) Mart	Larua/Banko	Araceae

Botanical name	Local name	Family
<i>Artemisia wallichiana</i> Bess.	Titepati	Asteraceae
<i>Aster himalaicus</i> Clarke		Asteraceae
<i>Aster</i> sp.		Asteraceae
<i>Aster</i> sp.		Asteraceae
<i>Astilbe rivularis</i> Buch. – Ham. Ex D. Don	Budi okhati	Saxifragaceae
<i>Astilbe</i> sp.		Saxifragaceae
<i>Begonia rubella</i> Buch. – Ham. Ex D. Don	Magarkachi	Begoniaceae
<i>Bergenia ligulata</i> (Wall.) Engl.	Leko ko Pakhanbet	Saxifragaceae
<i>Bidens pilosa</i> Linn.	Kuro	Asteraceae
<i>Bistorta affinis</i> (D. Don) Greene		Polygonaceae
<i>Bistorta vacciniifolia</i> (Wall. ex Meisn.) Greene		Polygonaceae
<i>Boehmeria platyphylla</i> D. Don	Kamley	Urticaceae
<i>Boehmeria</i> sp.	Kamley	Urticaceae
<i>Campylandra aurantiaca</i> Baker	Janglee Nakima	Liliaceae
<i>Cardiocrinum giganteum</i> (Wall.) Makino		Liliaceae
<i>Carex setigera</i> D. Don	Sanu Harkatto	Cariceae
<i>Carex</i> sp.	Harkatto	Cariceae
<i>Cassiope fastigata</i> (Wall.) D. Don		Ericaceae
<i>Chirita urticifolia</i> Buch. – Ham. ex D. Don		Gesneriaceae
<i>Cirsium</i> sp.		Asteraceae
<i>Clinopodium umbrosum</i> (M. Bieb.) Kuntze	Bilajor	Lamiaceae
<i>Clintonia udensis</i> Trautv. & Meyer		Liliaceae
<i>Commelina paludosa</i> Blume.	Kane jhar	Commelinaceae
<i>Coriaria terminalis</i> Hemsl. var. <i>xanthocarpa</i>		Coriariaceae
<i>Corydalis</i> sp.		Papaveraceae
<i>Cyananthus lobatus</i> Wall. ex Benth.		Campanulaceae
<i>Cyanodon</i> sp.	Dubo	Poaceae
<i>Cyperus brevifolius</i> (Rottb.) Hasska	Mothey	Cyperaceae
<i>Cyperus rotundus</i> Linn.	Mothey	Cyperaceae
<i>Delphenium</i> sp.		Rununculaceae
<i>Dichrocephala integrifolia</i> (L.f.) Kuntze	Hacheu jhar	Asteraceae
<i>Drymeria cordata</i> Willd.	Abhijalo	Caryophyllaceae
<i>Elatostema platyphylloides</i> Shih & Yuen	Gagleto	Urticaceae
<i>Elatostema</i> sp.	Gagleto	Urticaceae

Botanical name	Local name	Family
<i>Epilobium sikkimense</i> Hausskn.		Onagraceae
<i>Eragrostis</i> sp.	Kirkirey banso	Poaceae
<i>Eragrostis</i> sp.	Chitrey banso	Poaceae
<i>Eragrostis</i> sp.	Banso	Poaceae
<i>Eragrostis</i> sp.	Banso	Poaceae
<i>Eupatorium adenophorum</i> Spreng.	Kali jhar	Asteraceae
<i>Euphorbia sikkimensis</i> Boiss.?		Euphorbiaceae
<i>Fimbristylis dichotoma</i> Linn. (Vahl.)		Cyperaceae
<i>Fragaria nubicola</i> Lindley ex Lacaita	Vui Aiselu	Rosaceae
<i>Galinsoga parviflora</i> Cav.	Udase	Asteraceae
<i>Galium acutum</i> var. Himalayense (Klotzsch & Garcke) R. R. Mill		Asteraceae
<i>Galium</i> sp. (white flower)		Rubiaceae
<i>Galium</i> sp. (purple flower)		Rubiaceae
<i>Gentiana affinis</i> Griseb.		Gentianaceae
<i>Gentiana</i> sp.		Gentianaceae
<i>Gerenium</i> sp.		Gerniaceae
<i>Hackelia</i> sp.	Kuro	Boraginaceae
<i>Hackelia</i> sp.		Boraginaceae
<i>Hedychium spicatum</i> Smith.	Sara	Zingiberaceae
<i>Hemiphragma heterophyllum</i> Wall.	Lalgeri	Scrophulariaceae
<i>Heracleum nepalense</i> D. Don	Chimping	Apiaceae
<i>Heracleum wallichii</i> DC	Chimping	Apiaceae
<i>Houttuynia cordata</i> Thunb.	Gandhey jhar	Saururaceae
<i>Hydrocotyle javanica</i> Thunb.	Dhungri jhar	Umbelliferae
<i>Impatiens falcifer</i> Hook. f.		Balsaminaceae
<i>Impatiens racemosa</i> DC.		Balsaminaceae
<i>Impatiens urticifolia</i> Wall.		Balsaminaceae
<i>Juncus himalensis</i> Klotzsch		Juncaceae
<i>Juncus sikkimensis</i> Hook.		Juncaceae
<i>Juncus thomsonii</i> Buch.		Juncaceae
<i>Kobresia</i> sp.		Cyperaceae
<i>Laportea terminalis</i> Wight.	Patle sisnu	Urticaceae
<i>Lecanthus peduncularis</i> (Wall. ex Royle) Wedd.		Urticaceae

Botanical name	Local name	Family
<i>Ligularia fischeri</i> (Ledeb.) Turcz.		Asteraceae
<i>Lobelia</i> sp.		Campanulaceae
<i>Lycopodium clavatum</i> Linn.		Lycopodiaceae
<i>Mazus surculosus</i> D. Don		Scrophulariaceae
<i>Myriactis nepalensis</i> Less.		Asteraceae
<i>Neanotis ingrata</i> (Wall. ex Hook. f.) Lewis		Rubiaceae
<i>Nepeta</i> sp.		Lamiaceae
<i>Oxalis corniculata</i> Linn.	Amilo jhar	Oxalidaceae
<i>Oxyria digyna</i> (Linn.) Hill		Polygonaceae
<i>Oxytropis</i> sp.		Fabaceae
<i>Panax bipinnatifidus</i> Seem.	Ginseng	Araliaceae
<i>Panax sikkimensis</i> Benerjee	Ginseng	Araliaceae
<i>Paris polyhylla</i> Smith	Paris	
<i>Parnassia</i> sp.		Parnassiaceae
<i>Parnassia</i> sp.		Parnassiaceae
<i>Parochetus communis</i> Buch. – Ham. ex D. Don		Fabaceae
<i>Pedicularis elwesii</i> Hook.		Scrophulariaceae
<i>Persicaria capitata</i> (Buch.-Ham. ex D. Don) H. Gross	Ratneulo	Polygonaceae
<i>Phlomis</i> sp.		Lamiaceae
<i>Pilea umbrosa</i> Wall. ex Blume	Chipley	Urticaceae
<i>Plantago major</i> Linn.		Plantaginaceae
<i>Polygonatum cirrhifolium</i> (Wall.) Royle		Liliaceae
<i>Polygonum molle</i> D. Don	Thotney	Polygonaceae
<i>Polygonum runcinatum</i> Buch. – Ham. ex D. Don	Ratneulo	Polygonaceae
<i>Polygonum polystachyum</i> Wall. ex Meisn.	Lek Thotne	Polygonaceae
<i>Potentilla peduncularis</i> D. Don		Rosaceae
<i>Primula sikkimensis</i> Hook.		Primulaceae
<i>Prunella vulgaris</i> Linn.		Lamiaceae
<i>Rheum acuminatum</i> Hook. f. & Thom.	Khokim	Polygonaceae
<i>Rheum nobile</i> Hook. f. & Thom.	Padamchal	Polygonaceae
<i>Rhodiola fastigata</i> (Hook. f. & Thom.) S. H. Fu		Crassulaceae
<i>Rumex nepalensis</i> Spreng.	Halhalley	Polygonaceae
<i>Rununculus</i> sp.		Ranunculaceae

Botanical name	Local name	Family
<i>Satyrium nepalense</i> D. Don		Orchidaceae
<i>Saussurea fastuosa</i> (Decne.) Sch. Bip.		Asteraceae
<i>Saussurea nepalensis</i> Spreng.		Asteraceae
<i>Saussurea obvallata</i> (DC) Edgew.	Topko gola	Asteraceae
<i>Saxifraga</i> sp.		Saxifragaceae
<i>Sedum multicaule</i> (Rose) Fedde.		Crassulaceae
<i>Sedum</i> sp.		Crassulaceae
<i>Selaginella</i> sp.		Selaginellaceae
<i>Selinum tenuifolium</i> Salisb.		Umbelliferae
<i>Senecio</i> sp.	Toriphoole	Asteraceae
<i>Silene</i> sp.		Caryophyllaceae
<i>Smilacina oleracea</i> (Baker) Hook. f.		Smilacaceae
<i>Smilacina</i> sp.		Smilacaceae
<i>Stachys</i> sp.		Lamiaceae
<i>Stellaria lanata</i> Hook. f. ex Edgew		Caryophyllaceae
<i>Strobilanthes</i> sp.	Kibu ghans	Acanthaceae
<i>Strobilanthes wallichii</i> Nees.	Kibu ghans	Acanthaceae
<i>Swertia petiolata</i> D. Don		Gentianaceae
<i>Thalictrum chelidonii</i> DC		Rununculaceae
<i>Trifolium repens</i> Linn.		Fabaceae
<i>Triosetum himalayanum</i> Wall.		Caprifoliaceae
Fern and Fern allies		
<i>Arthromeris himalayensis</i> (Hook.) Ching		Polypodiaceae
<i>Asplenium ensiforme</i> Wall. ex Hook. & Grev.		Aspleniaceae
<i>Coniogramme procera</i> (Wall.) Fee		Pteridaceae
<i>Cyrtomium caryotideum</i> (Wall. ex Hook. & Grev.) C. Presl		Dryopteridaceae
<i>Cyrtomium hookerianum</i> (C. Presl) C. Chr.		Dryopteridaceae
<i>Dennstaedtia scabra</i> (Wall. ex Hook) T. Moore		Dennstaedtiaceae
<i>Deparia petersenii</i> (Kunze) M. Kato		Woodsiaceae
<i>Diplazium dilatatum</i> Blume	Lek Chipley Ningro	Woodsiaceae
<i>Diplazium stoliczkae</i> Beddome	Lek Kalo Ningro	Woodsiaceae
<i>Dryopsis apiciflora</i> (Wall. ex Mett.) Holttum & Edwards		Dryopteridaceae

Botanical name	Local name	Family
<i>Dryopteris redoactopinnata</i> Basu & Panigrahi		Dryopteridaceae
<i>Dryopteris sparsa</i> (Ham. ex D. Don) O. Ktze.		Dryopteridaceae
<i>Elaphoglossum marginatum</i> (Wall. ex Fee) T. Moore		Lomariopsidaceae
<i>Lepisorus mehrae</i> Fraser – Jenk		Polypodiaceae
<i>Lepisorus loriformis</i> (Wall. ex Mett.) Ching		Polypodiaceae
<i>Lycopodium clavatum</i> Linn.		Lycopodiaceae
<i>Lycopodium japonicum</i> Thunb.		Lycopodiaceae
<i>Monachosorum henryi</i> H. Christ		Dennstaedtiaceae
<i>Odontosoria chinensis</i> (L.) J. Smith		Lindsaeaceae
<i>Oleandra wallichii</i> (Hook.) C. Presl		Oleandraceae
<i>Onychium japonicum</i> (Thunb.) Kuntz		Pteridaceae
<i>Plagiogyria pycnophylla</i> (Kuntze) Mett.		Plagiogyriaceae
<i>Polypodiodes amoena</i> (Wall. ex Mett.) Ching		Polypodiaceae
<i>Pteris spinescens</i> C. Presl	Lek Thare Uniu	Pteridaceae
<i>Pteris wallichiana</i> J. Agardh	Chatey Uniu	Pteridaceae
<i>Vittaria flexuosa</i> Fee		Vittariaceae
Climber		
<i>Coscuta reflexa</i> Roxb.	Pahelo/dabai lahara	Convolvulaceae
<i>Holboellia angustifolia</i> Diels.	Gulfa	Lardizabalaceae
<i>Rubia cordifolia</i> Linn.	Majito	Rubiaceae
<i>Rubia manjith</i> Roxb. ex Fleming	Majito	Rubiaceae
<i>Trichosanthes lepiniana</i> (Naud.) Cogn.	Indreni	Cucurbitaceae



Saussurea obvallata



Rheum nobile



Bistorta vacciniifolia



Rheum acuminatum



Panax sikkimensis



Paris polyphylla



Aralia sp.



Parnassia wightiana



Triosetum himalay anum



Saxifraga sp

Fauna

During the trail sampling, a total of 14 species of mammals and 27 bird species were recorded along Tholung – Kisong trail (approximately 45 km). Amongst the mammalian species, Assamese macaque and Goral have been assessed as near threatened by the IUCN whereas Himalayan black bear as Vulnerable. Of the 27 bird species recorded, most of the bird species occupied disturbed forest.

Mammal species encountered in the trail sampling along Tholung – Kisong trail in Dzongu landscape, North Sikkim

Scientific Name	Species	Evidences ¹	IUCN Status ²
<i>Canis aurens</i>	Jackal	C	LC
<i>Felis benghalensis</i>	Leopard Cat	Pm	LC
<i>Felis chaus</i>	Jungle cat	C	LC
<i>Lagomys roylei</i>	Himalayan Pika	S	LC
<i>Macaca assamensis</i>	Assamese macaque	Pc	NT
<i>Muntiacus muntjak</i>	Barking Deer	P, Hm	LC
<i>Mustela or Martes flavigula</i>	White Cheeked Martin	S	LC
<i>Naemorhedus goral</i>	Goral	Hm	NT
<i>Presbytes entellus</i>	Himalayan Langur	S	NA
<i>Sciurus locria</i>	Orange-bellied Hill Squirrel	S, Pc	LC
<i>Sus scrofa</i>	Wild Boar	Ds	LC
<i>Ursus thibetanus</i>	Himalayan Black Bear	Ds, Fs	VU
<i>Vulpes ferrilatus</i>	Small Tibetan Grey Fox	S	LC
<i>Vulpes vulpes</i>	Red Fox	S	LC

¹C: Call, **Ds**: Digging sign, **Fs**: Foraging sign, **Hf**: Hoof mark, **P**: Pellet, **Pc**: Photo capture, **Pm**: Pug mark, **S**: Sighting ²LC: Least concern, NA: Not assessed, NT: Near threatened, VU: Vulnerable

Checklist of bird species encountered along Tholung – Kisong trail in Dzongu landscape, North Sikkim

Scientific Name	Species	Local Name	IUCN Status
<i>Acridotheres tristis</i>	Common Myna	Ruppi	LC
<i>Arborophila torqueola</i>	Hill Partridge	Pewra	LC
<i>Carpodacus rodochroa</i>	Rose Finch	Tuti	LC
<i>Chaimarrornis leucocephalus</i>	White capped Redstart	Dhobi Chara	LC
<i>Cissa chinensis</i>	Green Magpie	Doday Koilee	LC
<i>Cissa flavirostris</i>	Yellow billed blue-Magpie	Lamphusray	LC
<i>Corvus macrorhynchos</i>	Jungle Crow	Kag	NA
<i>Dicrurus macrocerus</i>	Black Drongo	Chibey	LC
<i>Garrulax striatus</i>	Striated Laughing Thrush	Kolkolay	LC
<i>Hypsipetes madagascariensis</i>	Black Bulbull	Jureli	LC
<i>Ictinaetus malayensis</i>	Black Eagle	Cheel	LC
<i>Ithaginis cruentus</i>	Blood Pheasant	Chilimey	NA
<i>Lanius schach</i>	Black-headed or Rufous-Backed shrike		LC
<i>Lophura leucomelanus</i>	Kaleej Pheasant	Kaleej	NA
<i>Megalaima asiatica</i>	Blue Throated Barbet	Kuturka	LC
<i>Muscicapa thalassina</i>	Verditer Flycatcher	Hareney	LC
<i>Myiophoneus caeruleus</i>	Blue Whistling Thrush	Kalchura	LC
<i>Parus monticolus</i>	Green Backed Tit	Chichink Kotey	LC
<i>Pericrocotus flammeus</i>	Scarlet Minivet	Rani Chara	LC
<i>Pyrrhoplectes epaulette</i>	Gold- Crowned Black Finch	Tuti	LC
<i>Sitta himalayensis</i>	White Tailed Nuthatch	Makhmali Matta	LC
<i>Streptopelia orientalis</i>	Rufous Turtle Dove	Dhukkar	LC
<i>Tadorna ferruginea</i>	Ruddy Shelduck (Brahminy Duck)	Hans	LC
<i>Tragopan satyra</i>	Satyr tragopan	Mudal	NT
<i>Treron sphenura</i>	Wedge tailed Green Pigeon	Halesso	NA
<i>Yuhina flavicollis</i>	Yellow naped Yuhina	Megma	LC
<i>Zoothera dixonii</i>	Long tailed Mountain Thrush	Kolkolay	LC

LC: Least concern, NA: Not assessed, NT: Near threatened



Acridotheres tristis
(Common Myna)



Ctinaetus malayensis
(Black Eagle)



Pericrocotus flammeus
(Scarlet Minivet)



Turdoides striatus
(Jungle Babbler)



Chaimarrornis leucocephalus
(White - capped Redstart) *ayanum*



Eumyias thalassina
(Verditer Flycatcher)



Carpodacus rhodochrous
(Pink-Browed Rose Finch)



Zosterops palpebrosus
(Oriental White-eye)

Tholung–Kisong trail is very rich in terms of floral and faunal biodiversity because it lies in the northern part of Sikkim in Dzongu landscape which is a restricted areas. Further, upper reaches of the trail falls within Khangchendzonga National Park, where illegal activities are a punishable offence. However, the recent earthquake of 18th September 2011 has caused massive 12-13 landslides in the area, between Bey to Thijom. This has caused severe damages to human settlement as well as to the flora and the wildlife. For example, Bey village situated at an altitude of *ca.* 1750 m asl which used to be a human habitation, has now become unfit for human settlement. Areas like Tumlong (*ca.* 2000 m asl), along the Ringpi Chu which also has a cultural significance and consisted of lush green vegetation of Oak and Acer species, have been entirely devastated by the landslides. This has led to habitat degradation of the important faunal elements of the area. In addition, sulphur odour was also emanating from the place which indicates the formation of hot water springs, which needs scientific investigation. Similarly, Thijom (*ca.* 3600 m asl) which is a potential habitat for the *Rhododendron niveum* has met with the same fate and the population of the species does not exist anymore. However, a new small population of *Rhododendron niveum* was observed along Jhumthul Chu towards Jhumthul Phuk glacier. This indicates the probability of existence of *Rhododendron nivem* in other wilderness areas of Sikkim and needs more detailed investigation.

The trail has a potential to be developed into important eco-trail having natural and cultural significance because apart from being rich in biodiversity, the trail passes through one of the oldest monastery, Tholung Gumpa situated

amidst the Tholung Reserve forest, Thyugong Bhutti Nay, etc., beyond which the trail is not maintained and needs attentions from the tourism point of view. Another significant observation made was that a particular *Rubus* species has widely spreaded between 3000 – 4200 m asl which may become a problem in future, if not controlled because invasive species has a potential to encroach and adapt to any kind of climatic condition. At the same time, it has been observed that the fruit of the same species is relished by the Himalayan Black Bear as evidenced from the foraging mark and the bear population has increased tremendously in the area which is a cause of concern from the tourism point of view.

Though the altitude between 3900 – 4500 m asl consisted of good pastures, wildlife was completely absent, except few bird species, from the area and this is very important from the conservation and ecological point of view. Even the Blood Pheasant, which normally are found from 3000 m asl was available above 4500 m asl. The reason could be the non availability of the foraging ground due to excessive regeneration of the non-palatable plant species which is directly linked with the presence/absence of the wildlife.

The locals revealed that area above 4000 m asl along the trek is probable site for *Cordyceps ophioides*, also known as caterpillar fungus which has high international trade value. Large number of collectors from Dzongu and Lachen area visits the place for collecting the species during June-July. As revealed, huge quantities of *Juniperus* species, mostly *Juniperus squamata*, is also collected from the area which fetches high market price. The species is used as incense by the Buddhists.

Shingba Rhododendron Sanctuary - Shiv Mandir sampling path, North Sikkim

Sikkim, a small state with barely 7,096 sq. km area, has an elevation from 300 m to 8585 m above sea level. Geographically, the state is dominated by the magnificent mountain chain including the Mt. Khangchendzonga, which is worshipped as the guardian deity by the local people. The natural beauty of the Sikkim has always been attracting not only the tourists but also researchers from around the world. For the administrative purpose, Sikkim is divided into four districts, of which, the north district is the largest (4426 sq. km.); however, is the least populated district as compared to east, west and south district. The main areas in north district are Mangan (the district headquarter), Dzongu, Choongthang, Lachen, and Lachung.

The north district has always been an attraction for the local, national as well as the international visitors due to its uniqueness in terms of landscape like mountains ending to cold deserts. These areas have been explorer's paradise since many centuries and have been visited by the famous explorers like Sir J. D. Hooker (1847-49), G. Gammie (1892), J. C. White (1887-1908) and others, the account of which is beautifully described in *Himalayan Journal, Account of Botanical Tour in Sikkim during 1892, Sikkim and Bhutan: Twenty one years on the north-east frontier*. Further, there lies famous Shingba Rhododendron Sanctuary, Yumthang valley and hot water spring, Yumey Samdong (*syn.* Momey Samdong), and several high altitude

lakes viz., Gurudongmar, Tsho Lhamu, Gyam Tshona (the only high altitude brackish water lake) and others. The Yumthang valley, an alpine pasture with snow clad mountains all around, is popular for the beauty of multiple varieties of flowers including the beautiful Primulas that cover the ground during May-June giving every visitor a feeling of colourful carpet spread on the ground. The Shingba Rhododendron Sanctuary in Lachung-Yumthang valley, with an area of 43 sq. km. is bordered with high rugged Chuba-Sagochen mountain ranges on the east and Chomzomei Tso extending up to Lava pass on the west. The sanctuary is approachable by road. It is rich in natural vegetation and is known to harbour over 25 species of Rhododendrons (Badola and Pradhan, 2009). For some of the rhododendron species, different form and varieties can also be seen in the valley. For example, *Rhododendron arboreum* is known to have three forms with red (*ssp. arboreum*), pink (*ssp. arboreum* var. *roseum*) and white (*ssp. cinnamomeum*) flower; all these forms are present in the Lachung – Yumthang valley; nevertheless, white form (*ssp. cinnamomeum*) is very rare and are spotted well below Singring village in Lachung valley by some of the Rhododendron experts from Sikkim. Similarly, for *Rhododendron thomsonii*, three forms with red, maroon and pink flower and for *Rhododendron cinnabarinum*, both cinnabar and pink form are present in the valley. However, at the higher elevations,

Rhododendron arboreum, normally a tree species occurs in shrub form.

The forest in the area being sub-alpine type, the conifer tree species like *Abies densa*, *Tsuga dumosa*, *Larix griffithii*, *Picea spinulosa*, etc., dominates the whole area in and around the Shingba Rhododendron Sanctuary. The succession in forest tree species can easily be observed from Lachung village, the last human inhabited area, itself with *Populus jaquemontiana* being taken over by mixed forest of *Tsuga dumosa*, *Larix griffithii*, *Picea spinulosa* and then by *Abies densa* at the upper end. *Picea spinulosa* is endemic to Sikkim and is localised to Lachung and Lachen range in north Sikkim. Those trees can be seen covered with numerous epiphytes including *Pleione hookeriana* as well as several species of lichens and mosses. The fern species are less prevalent in sub-alpine region compared to the wet temperate mixed broad-leaved forest. The special feature of the area is that, with the increasing altitude, change in rhododendron species can easily be made out even by the beginners who do not have much idea about rhododendrons. It is a natural habitat to *Rhododendron niveum*, the State tree of Sikkim which was known as the only area having natural population of the species till the discovery of new population of *Rhododendron niveum* by Badola and Pradhan (2010) in Khangchendzonga National Park.

The valley is also rich in high valued medicinal plant species like *Aconitum ferox*, *Panax sikkimensis*, *Panax bipinnatifidus*, *Paris polyphylla*, *Podophyllum hexandrum*, *Podophyllum sikkimensis*, *Picrorhiza kurrooa*, *Rheum acuminatum*, *Rheum nobile*, etc. The valley provides refuge to some of the important faunal species like *Capricornis thar* (Serow),

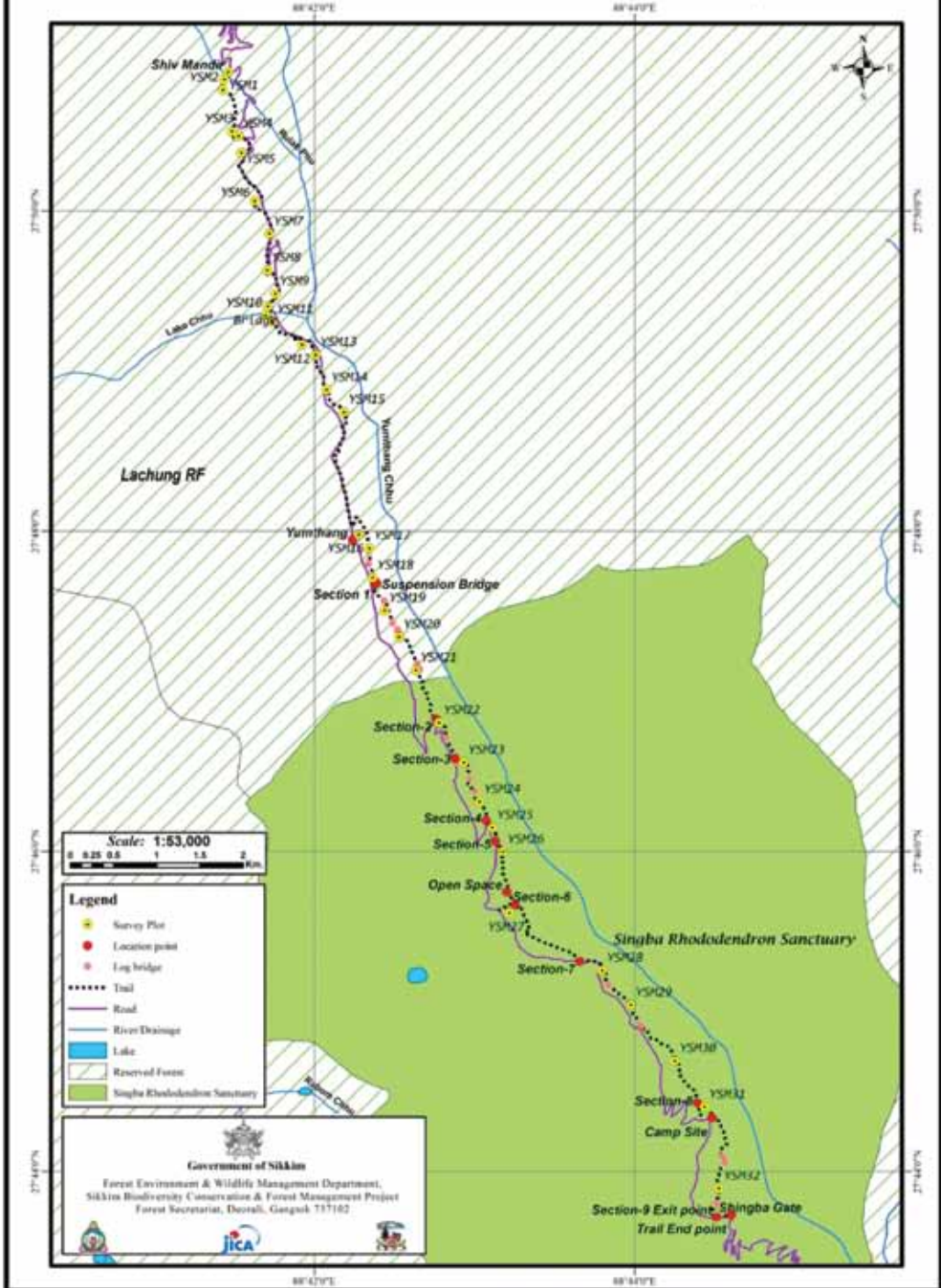
Ochotona sp. (Pika), *Martes flavigula* (Yellow Throated Marten), *Ithaginis cruentus* (Blood Pheasant), *Aethopyga ignicauda* (Fire-Tailed Sunbird), *Dendrocopos darjellins* (Darjelling Woodpecker), *Columba leuconata* (Snow Pigeon), etc.

Survey Area

The current survey was carried out covering Shingba Rhododendron Sanctuary upto Shiv Mandir (approx. 30 km stretch) in Lachung range in north district of Sikkim. The elevation of the survey area ranged from 3200 – 4000 m asl lying between 27°43' – 27°50' N Longitude and 88°44' -88°41' E Latitude. The entire area is rocky and is bisected by Yumthang chu. The valley is heavily affected by the avalanche and the landslides which is a continuous phenomenon especially during monsoon and winters. This has caused severe damages to the biodiversity of the area.

The forest is characterized by the sub-alpine type and the tree species are less prevalent in the area. The forest is largely dominated by *Abies densa*; nevertheless, other prominent tree species present in the area are *Acer caudatum*, *Betula utilis*, *Larix griffithii*, *Prunus nepalensis*, *Sorbus microphylla*, etc. which can be seen interspersed with the *Abies densa* at places. In this region, the tree species extends upto Shiv Mandir above which, the ground is covered with the shrubs and scrubs of rhododendrons, *Juniperus* sp. and other species. Since the valley is famous for rhododendrons which starts occurring well below Lachung valley and extends beyond the survey area to Yumey Samdong and above. Of the 36 species reported from Sikkim (Pradhan and Lachungpa, 1990), the species that is present in the valley includes *Rhododendron aeruginosum*, *Rhododendron anthopogon*, *Rhododendron arboreum*,

MAP SHOWING RAPID BIODIVERSITY SURVEY SITES IN LACHUNG RANGE, NORTH SIKKIM



Rapid Biodiversity Survey sites in Lachung Range, North Sikkim



Vegetation composition inside Shingba Rhododendron Sanctuary

Rhododendron baileyi, *Rhododendron barbatum*, *Rhododendron campanulatum*, *Rhododendron camelliflorum*, *Rhododendron campylocarpum*, *Rhododendron ciliatum*, *Rhododendron cinnabarinum*, *Rhododendron campanulatum*, *Rhododendron decipens*, *Rhododendron fulgens*, *Rhododendron glaucophyllum*, *Rhododendron grande*, *Rhododendron hodgsonii*, *Rhododendron lepidotum*, *Rhododendron nivale*, *Rhododendron niveum*, *Rhododendron pendulum*, *Rhododendron setosum*, *Rhododendron sikkimense*, *Rhododendron thomsonii*, *Rhododendron triflorum*, *Rhododendron virgatum*, *Rhododendron wallichii*, *Rhododendron wightii* and *Rhododendron vaccinioides*. Of all these rhododendrons, *Rhododendron campanulatum* and *Rhododendron hodgsonii* has a wide range of distribution in the valley.

Interestingly, all these species are regenerating profusely throughout the valley.

The common shrub/shrublet that prevails in association with the rhododendrons in the area are represented by *Berberis sikkimensis*, *Cassiope fastigata*, *Daphne cannabina*, *Gaultheria trichophylla*, *Ilex intricata*, *Ribes griffithii*, *Rosa sericea*, *Salix longiflora*, *Salix sikkimensis*, *Vaccinium retusum*, *Viburnum erubescence*, etc. The ground flora of the area is represented by *Aconitum ferox*, *Artemesia* sp., *Bistorta affinis*, *Fragaria nubicola*, *Inula* sp., *Juncus himalensis*, *Ligularia* sp., *Meconopsis* sp., *Myricaria rosea*, *Panax bipinnatifidus*, *Panax sikkimensis*, *Pedicularis siphonantha*, *Persicaria capitata*, *Potentilla fruticosa*, *Potentilla peduncularis*, *Polygonatum*



Representation of Sub-alpine forest, Lachung Range, North Sikkim



Survey team recording the herb species



Survey team recording tree girth

cirrhifolium, *Primula calderiana*, *Primula ontanate*, *Rumex nepalensis*, *Ranuculus* sp., *Senecio* sp., *Viola* sp., and numerous fern species. Beyond Yumthang valley, *Cardamine macrophylla*, a wild edible herb with purple flower, *Fritillaria* sp., with purple-white flower and *Clintonia udensis* with white flower, are a very common sight; nevertheless, the ground are mostly covered with *Sphagnum squarrosum* and the trees are covered with *Usnea himalayana*. Besides, the valley is full of edible as well as non-edible mushrooms.



Survey team laying quadrat for trees

Outcome of the Survey

Flora

Of the 171 species recorded during the survey, herbs represented the highest number of species (97 species; 67 genera and 28 family) including 1 bamboo species, *Arundinaria maling*, followed by shrub/shrublet (34 species; 14 genera and 10 family); whereas, species in small tree/large shrub category were represented by 12 species belonging to 7 genera and 5 family. Family wise analysis revealed that for species belonging to the small tree / large shrub and shrub / shrublet category, Ericaceae was the dominant family

with 7 and 19 species, respectively, while in the case of herbs, Asteraceae (16 species) appeared as the dominant family followed by Liliaceae (14 species) and Cyperaceae (13 species) family. Further, for herbs, 12 of the 28 families represented single species each.

From the survey area, 12 fern and fern allies (belonging to 8 genera and 6 families) and 8 orchid species (belonging to 8 genera) were also recorded; nevertheless, moss, lichens and vines were represented by single species.



Rhododendron aeruginosum

Checklist of the floral species recorded between Singhba Rhododendron Sanctuary - Shiv Mandir, North Sikkim

Species	Local Name	Family	Altitudinal Range (m asl)
TREE			
<i>Abies densa</i> Griffith. ex Parker	Gobre salla	Pinaceae	2800 – 3700
<i>Acer caudatum</i> Wall.	Lekh Kapasey	Aceraceae	1800 – 2700
<i>Betula utilis</i> Don.	Bhojpatra	Betulaceae	2500 – 3800
<i>Larix griffithii</i> Hook. f.		Pinaceae	2400 – 4000
<i>Prunus nepalensis</i> (Ser.) Stud.	Arupatey	Rosaceae	1200 – 3100
<i>Rhododendron arboreum</i> ssp. <i>arboreum</i> (CB Clarke) Ridley	Lali gurans	Ericaceae	1800 - 3600
SMALL TREE / LARGE SHRUB			
<i>Enkianthus deflexus</i> (Griff.) C.K. Schneid	Rato angeri	Ericaceae	2500 – 3300
<i>Hydrangea heteromalla</i> D. Don	Bhogote	Hydrangeaceae	2400 – 3300
<i>Lyonia ovalifolia</i> (Wall.) Drude	Angeri	Rosaceae	700 – 3000
<i>Rhododendron barbatum</i> Wall. ex G. Don	Lal chimal	Ericaceae	3000 – 3400
<i>Rhododendron decipiens</i> Lacaíta	Jhukaune Chimal	Ericaceae	3300 – 3800
<i>Rhododendron hodgsonii</i> Hook. f.	Korlinga	Ericaceae	3000 – 3600
<i>Rhododendron niveum</i> Hook.	Hiu pate gurans	Ericaceae	3000 – 3800
<i>Rhododendron thomsonii</i> Hook. f.	Dr. Thomson ko gurans	Ericaceae	2600 – 4200
<i>Salix daltoniana</i> Andersson	Bais	Salicaceae	3000 – 4400
<i>Salix</i> sp.	Bais	Salicaceae	Encountered between 2500 – 3800
<i>Sorbus microphylla</i> (Wall. ex J. D. Hooker) Wenzig	Pasi	Ericaceae	3000 – 4000
<i>Viburnum nervosum</i> D. Don	Asare	Caprifoliaceae	3000 – 4000
SHRUB / SHRUBLET			
<i>Acanthopanax</i> sp.		Araliaceae	At 3200
<i>Berberis concinna</i> J.D. Hooker	Chutre kada	Berberidaceae	At 3700
<i>Berberis ignorata</i> C.K. Schneider	Chutre kada	Berberidaceae	2700 - 3800
<i>Berberis virescens</i> J.D. Hooker	Chutre kada	Berberidaceae	3600 - 4100
<i>Cassiope fastigata</i> (Wall.) D. Don	Phallu	Ericaceae	3000 – 4000
<i>Daphne cannabina</i> Lour. ex Wall.	Kalo argeli	Thymelaeaceae	1700 – 3300
<i>Gaultheria hookeri</i> C. B. Clarke	Dhasingre	Ericaceae	1000 – 3800

Species	Local Name	Family	Altitudinal Range (m asl)
<i>Gaultheria pyrolloides</i> Hooker f. & Thomson ex Miquel	Dhasingre	Ericaceae	3600 – 4000
<i>Gaultheria trichophylla</i> Royle	Dhasingre	Ericaceae	3000 – 4700
<i>Ilex intricata</i> J. D. Hooker		Aquifoliaceae	3000 – 4000
<i>Juniperus recurva</i> Buch.-Ham. ex D. Don	Shukpa dhup	Cupressaceae	3500 – 4600
<i>Rhododendron baileyi</i> I.B. Balfour	Bailey ko chimal	Ericaceae	3000 – 4800
<i>Rhododendron campanulatum</i> D. Don	Nilo Chimal	Ericaceae	3000 – 4300
<i>Rhododendron camelliflorum</i> Hook. f.	Chia phule gurans	Ericaceae	3300 – 4000
<i>Rhododendron campylocarpum</i> Hook. f.	Bango phale gurans	Ericaceae	3000 – 3600
<i>Rhododendron ciliatum</i> Hook. f.	Junge chimal	Ericaceae	3000 – 3800
<i>Rhododendron cinnabarinum</i> Hook. f.	Sano chimal	Ericaceae	3100 – 3800
<i>Rhododendron fulgens</i> Hook. f.	Chimal	Ericaceae	3000 – 3800
<i>Rhododendron glaucophyllum</i> Rehder.	Takma chimal	Ericaceae	3600 – 4500
<i>Rhododendron lepidotum</i> Wallich ex G. Don	Bhale sunpati	Ericaceae	2500 – 5000
<i>Rhododendron pendulum</i> Hook.	Jhundine chimal	Ericaceae	3400 - 4300
<i>Rhododendron sikkimense</i> Pradhan & Lachungpa	Sikkime gurans	Ericaceae	1200 – 4300
<i>Rhododendron wallichii</i> Hook. f.	Wallich ko chimal	Ericaceae	3000 – 4300
<i>Rhododendron wightii</i> Hook. f.	Dr. Wight ko gurans	Ericaceae	3500 – 4500
<i>Ribes griffithii</i> Hook. & Thoms		Grossulariaceae	3000 – 4000
<i>Ribes</i> sp.		Grossulariaceae	Encountered above 2500
<i>Rosa sericea</i> Lindl.	Bhote gulab	Rosaceae	3000 – 4000
<i>Rubus</i> sp.		Rosaceae	Encountered above 3200
<i>Salix calyculata</i> Hook. f. ex Andersson	Bais	Salicaceae	3400 – 4700
<i>Salix longiflora</i> Wall. ex Andersson	Bais	Salicaceae	500 – 4000
<i>Salix sikkimensis</i> Andersson	Bais	Salicaceae	3700 – 4500
<i>Vaccinium retusum</i> (Griffith) Hook. f. ex C.B. Clarke	Mussikane	Ericaceae	ca. 2500 (Encountered upto 3300)
<i>Vaccinium vacciniaceum</i> (Roxburgh) Sleumer	Mussikane	Ericaceae	2400 – 2700; (Encountered at 3200)
<i>Viburnum erubescence</i> Wall. ex DC	Asare	Caprifoliaceae	1500 – 2700 (Encountered upto 3300)

Species	Local Name	Family	Altitudinal Range (m asl)
HERB			
<i>Aconitum ferox</i> Wall. ex Ser.	Bikhma	Rununculaceae	2100 – 3800
<i>Aconogonum molle</i> (D. Don) H. Hara	Thotne	Polygonaceae	1300 – 3200
<i>Anaphalis adnata</i> Wall. ex DC	Bukiful	Asteraceae	1200 – 3300
<i>Anaphalis busua</i> (Buch.-Ham. ex D. Don) DC	Bukiful	Asteraceae	1800 – 3600
<i>Anaphalis hookeri</i> Clarke ex Hook. f.	Bukiful	Asteraceae	3000 – 3700
<i>Anemone</i> sp.		Rununculaceae	Encountered between 3000 – 3600
<i>Arisaema echinatum</i> (Wall.) Schott.	Banko/larua	Araceae	2700 – 3300
<i>Arisaema flavum</i> (Forssk.) Schott.	Banko/larua	Araceae	1700 – 3600
<i>Arisaema griffithii</i> Schott.	Banko/larua	Araceae	2400 – 3600
<i>Artemesia myriantha</i> Wall. ex Bess	Titeypati	Asteraceae	1200 – 3900
<i>Arundinaria maling</i> Gamble	Malingo	Poaceae	1800 – 3600
<i>Aster albescens</i> (DC.) Hand.-Mazz.		Asteraceae	2400 – 3900
<i>Astilbe rivularis</i> Buch.-Ham. ex D. Don	Budi okhati	Saxifragaceae	1500 – 3200
<i>Bistorta affinis</i> (D. Don) Greene		Polygonaceae	3500- 4800
<i>Bulbostylis densa</i> (Ball.) Hand. – Mazz		Cyperaceae	300 - 4100
<i>Cacalia mortonii</i> (Clarke) Kitam ex H. Koyama		Asteraceae	2400 – 3600
<i>Carex alpine</i> Swartz.	Harkatto	Cyperaceae	Encountered above 3000
<i>Carex fragilis</i> Boott.	Harkatto	Cyperaceae	2700 - 3300
<i>Carex gracilentia</i> Boott.	Harkatto	Cyperaceae	3300 - 4200
<i>Carex haematostoma</i> Nees	Harkatto	Cyperaceae	3300 – 5100
<i>Carex lehmannii</i> Drejer	Harkatto	Cyperaceae	3600 – 3900
<i>Carex monopleura</i> Kretz.	Harkatto	Cyperaceae	2700 – 3600
<i>Carex psychrophila</i> Nees	Harkatto	Cyperaceae	At 3600
<i>Carex pulchra</i> Boott.	Harkatto	Cyperaceae	2100 – 3300
<i>Carex rara</i> Boott.	Harkatto	Cyperaceae	3000 – 3900
<i>Cardamine macrophylla</i> Willdenow	Bhotey Saag	Brassicaceae	2100 – 4000
<i>Cardocrinum giganteum</i> (Wall.) Makino		Liliaceae	1800 – 3300
<i>Cirsium argyracanthum</i> DC		Asteraceae	2400 – 3600
<i>Clintonia udensis</i> Trautvetter & C. A. Meyer		Liliaceae	1600 – 4000
<i>Coriaria terminalis</i> Hemsley		Coriariaceae	1800 – 3700

Species	Local Name	Family	Altitudinal Range (m asl)
<i>Cremanthodium decaisnei</i> Clarke		Asteraceae	3600 – 4800
<i>Cremanthodium</i> sp.		Asteraceae	Encountered between 3000 – 3600
<i>Delphinium</i> sp.		Rununculaceae	Encountered between 2600 – 3200
<i>Deschampsia caespitose</i> (Linn.) P. Beauv.		Poaceae	3600 - 4800
<i>Euphorbia wallichii</i> J. D. Hooker		Euphorbiaceae	2000 – 4200
<i>Fragaria nubicola</i> (J. D. Hooker) Lindley ex Lacaíta	Vui aiselu	Rosaceae	1800 – 3800
<i>Fritillaria cirrhosa</i> D. Don		Liliaceae	1500 – 4800
<i>Fritillaria delavayi</i> Franch.		Liliaceae	3000 – 5000
<i>Galium rebae</i> R.R. Mill		Rubiaceae	2000 – 4000
<i>Gentiana ornata</i> (Wallich ex G. Don) Grisebach		Gentianaceae	3300 – 5000
<i>Geranium nepalense</i> Sweet		Geraniaceae	1000 – 3600
<i>Inula hookeri</i> Clarke		Asteraceae	2700 – 3600
<i>Iris goniocarpa</i> Baker		Iridaceae	3600 – 4400
<i>Isolepis setacea</i> (Linn.) R. Br.		Cyperaceae	3600 – 3900
<i>Juncus benghalensis</i> Kunth		Juncaceae	1800 – 4000
<i>Juncus clarkei</i> Buchen.		Juncaceae	3000 – 4100
<i>Juncus concinnus</i> D. Don		Juncaceae	2100 – 4000
<i>Juncus himalensis</i> Klotzsch		Juncaceae	3200 – 5200
<i>Juncus sikkimensis</i> Hook. f.		Juncaceae	3300 – 4300
<i>Kobresia</i> sp.		Cyperaceae	above 3900
<i>Kobresia uncinoides</i> (Boott.) Clarke		Cyperaceae	Above 3300
<i>Lactuca bracteata</i> Hook. f. & Thoms		Asteraceae	2400 – 4000
<i>Ligularia</i> sp.		Asteraceae	Encountered between 2400 – 3300
<i>Luzula</i> sp.		Juncaceae	Encountered above 3200
<i>Maianthemum oleraceum</i> (Baker) La Frankie		Liliaceae	2100 – 3300
<i>Meconopsis paniculata</i> Prain		Papaveraceae	3000 – 4100

Species	Local Name	Family	Altitudinal Range (m asl)
<i>Meconopsis simplicifolia</i> (D. Don) Walp.		Papaveraceae	3300 – 4500
<i>Myricaria rosea</i> Smith		Tamaricaceae	3000 – 4400
<i>Panax bipinnatifidus</i> Seem.	Ginseng	Araliaceae	3000 – 4000
<i>Panax sikkimensis</i> Ban.	Ginseng	Araliaceae	3000 – 4000
<i>Paris polyphylla</i> Smith	Satuwa	Liliaceae	2000 – 3500
<i>Pedicularis roylei</i> var. <i>speciosa</i> (Prain) T. Yamaz.		Liliaceae	
<i>Pedicularis siphonantha</i>		Scrophulariaceae	3000 – 4600
<i>Persicaria capitata</i> (Buch.-Ham. ex D.Don) Gross	Ratneulo	Polygonaceae	600 – 2400
<i>Phlomis</i> sp.		Lamiaceae	Encountered at 3200
<i>Pinguicula alpina</i> Linnaeus		Lentibulariaceae	1800 – 4500
<i>Poa himalayana</i> Nees ex Steud		Poaceae	3000 – 4000
<i>Polygonatum cathcartii</i> Baker		Liliaceae	2400 – 2900
<i>Polygonatum chirrifolium</i> (Wallich) Royle		Liliaceae	2000 – 4000
<i>Polygonatum hookeri</i> Baker		Liliaceae	3200 – 4300
<i>Polygonatum verticillatum</i> (Linn.) Allioni		Liliaceae	2100 – 4000
<i>Polygonum molle</i> D. Don.	Thotney	Polygonaceae	1200 – 3500
<i>Potentilla peduncularis</i> D. Don		Rosaceae	3000 – 4800
<i>Potentilla fruticosa</i> var. <i>pumila</i> J.D. Hook		Rosaceae	4200 – 5000
<i>Primula calderiana</i> I. B. Balfour & Cooper		Primulaceae	3200 – 4400
<i>Primula denticulata</i> Smith subsp. <i>denticulate</i>		Primulaceae	2800 – 4100
<i>Primula denticulata</i> var. <i>alba</i> Smith		Primulaceae	Encountered at 3500
<i>Ranunculus</i> sp.		Ranunculaceae	Encountered between 3000 – 3800
<i>Rheum acuminatum</i> J. D. Hooker & Thomson	Khokim	Polygonaceae	2800 – 4200
<i>Roscoea alpina</i> Royle		Zingiberaceae	2400 – 3200
<i>Rumex nepalensis</i> Spreng.	Halhalley	Polygonaceae	1200 – 4200
<i>Salvia</i> sp.		Lamiaceae	Encountered at 3600

Species	Local Name	Family	Altitudinal Range (m asl)
<i>Saussurea auriculata</i> (Spreng. ex DC) Sch.-Bip		Asteraceae	3000 – 3900
<i>Saussurea candolleana</i> Wall. ex DC		Asteraceae	3300 – 3600
<i>Senecio albopurpurens</i> Kitam.	Toriphool	Asteraceae	3600 – 5100
<i>Smilacina oleracea</i> (Baker) Hook. f.		Smilacaceae	Encountered between 3000 – 3400
<i>Streptopus simplex</i> D. Don		Liliaceae	1700 – 4000
<i>Synotis wallichii</i> (DC) Jeffrey & Chen		Asteraceae	2700 – 3750
<i>Tofieldia himalaica</i> Baker		Liliaceae	3200 – 3900
<i>Trifolium</i> sp.	Amilo jhar	Oxalidaceae	Encountered between 2400 – 3300
<i>Trillium tschonoskii</i> Maxim		Liliaceae	2700 – 4000
<i>Trisetum scitulum</i> Bor.		Poaceae	At 3600
<i>Typhonium diversifolium</i> Wall. ex Schott.		Araceae	3600 - 4000
<i>Swertia</i> sp.	Chirowto	Gentianaceae	Encountered at 3300
<i>Veronica</i> sp.		Scrophulariaceae	Encountered at 3400
<i>Viola bicolor</i> Pursh.		Violaceae	1500 – 2500 (Encountered between 3000 – 3300)
<i>Viola sikkimensis</i> W. Becker		Violaceae	1500 – 2500 (Encountered at 3400)
FERN & FERN ALLIES			
<i>Araiostigiella hookeri</i> (T. Moore ex Bedd.) Fraser-Jenk		Davalliaceae	2700 – 3800
<i>Athyrium davidii</i> Christ.		Woodsiaceae	Above 3200
<i>Deparia subsimilis</i> (Christ.) Fraser-Jenk.		Woodsiaceae	3000 – 3600
<i>Dryopteris barbigera</i> (T. Moore ex Hook.) Kunze		Dryopteridaceae	Above 3500
<i>Dryopteris subimpressa</i> Loyal.		Dryopteridaceae	2400 – 3400

Species	Local Name	Family	Altitudinal Range (m asl)
<i>Dryopteris xanthomelas</i> (Christ) C. Chr.		Dryopteridaceae	3600 – 4300
<i>Lycopodium veithii</i> Christ	Nagbeli	Lycopodiaceae	2600 – 4000
<i>Polystichum mehrae</i> Fraser-Jenk		Dryopteridaceae	2600 – 3400
<i>Osmunda claytoniana</i> L		Osmundaceae	3000 – 4000
<i>Pichisermollodes erythrocarpa</i> Mett. ex Kuhn (Fraser-Jenk)		Polypodiaceae	2600 – 3400
<i>Pichisermollodes fraser – jenkinsonii</i>		Polypodiaceae	2600 – 3400
<i>Pichisermollodes quasidivaticata</i> (Hayata) Fraser-Jenk		Polypodiaceae	3000 – 3600
ORCHID			
<i>Gymnadenia orchidis</i> Lindl.		Orchidaceae	3600
<i>Habenaria cumminsiana</i> King & Pantl.		Orchidaceae	3300
<i>Listera micrantha</i> Lindl.		Orchidaceae	3000 - 3300
<i>Malaxis muscifera</i> (Lindl.) O. Ktze.		Orchidaceae	2250 - 4050
<i>Neottianthe secundiflora</i> (Hook. f.) Schultr.		Orchidaceae	2700 - 3300
<i>Peristylus fallax</i> Lindl.		Orchidaceae	3000 - 3600
<i>Platanthera leptocaulon</i> (Hook. f.) Kranzl.		Orchidaceae	2700 - 4000
<i>Pleione hookeriana</i> (Lindl) Rollisson		Orchidaceae	1600 – 3100 Observed between (2800 - 3300)
MOSS / LICHEN / VINE			
<i>Sphagnum squarrosum</i>		Sphagnaceae	2400 – 4000
<i>Usnea himalayana</i>		Parmeliaceae	3000 – 4000
<i>Clematis montana</i> Ham. ex DC		Ranunculaceae	Seen between 2800 – 3400



Rhododendron glaucophyllum



Rhododendron wightii



Rhododendron thomsonii



Rhododendron cinnabarinum



Rhododendron setosum



Rhododendron campylocarpum



Rhododendron decipiens



Rhododendron hodgsonii



Cassiope fastigata



Primula denticulata



Cardamine macrophylla



Clintonia udensis



Clematis montana



Enkianthus deflexus



Pleione hookeriana



Pedicularis siphonantha

Fauna

During the trial sampling, existence of a total of 3 mammalian species was confirmed through direct sighting and indirect evidences. In addition, 40 bird species belonging to 4 Order and 19 families were recorded from the survey area.

Faunal species encountered along Singhba – Shiv Mandir transect, North Sikkim

Common Name	Scientific Name	Evidence	IUCN Status
Yellow Throated Marten	<i>Martes flavigula</i>	PC, DS	LC
Pika	<i>Ochotona sp.</i>	PC, DS	LC
Serow	<i>Capricornis thar</i>	DS, P, HM	NT



Pika



Dark Breasted Rose Finch



Fire Tailed Sunbird



Darjeeling Woodpecker



Yellow Throated Marten



Fresh Pellet of Serow

Bird species encountered along Shingba – Shiv Mandir Transect, North Sikkim

Common Name	Scientific Name	Local Name	Family	Order	Evidence
Ashy Throated Warbler	<i>Phylloscopus maculipennis</i>		Sylviidae	Passeriformes	PC,S
Black Bulbul	<i>Hypsipetes leucocephalus</i>	Jureli	Pycnonotidae	Passeriformes	PC,S
Black Drongo	<i>Dicrurus macrocercus</i>	Chibey	Dicaeidae	Passeriformes	PC,S
Black Faced Laughing Thrush	<i>Garrulax affinis</i>	Kolkoley	Turdidae	Passeriformes	PC,S
Blue Fronted Redstart	<i>Phoenicurus frontalis</i>		Muscicapidae	Passeriformes	PC,S
Blue Whistling Thrush	<i>Myophonus caeruleus</i>	Kalchura	Turdidae	Passeriformes	PC,S
Chestnut Crowned Laughing Thrush	<i>Garrulax erythrocephalus</i>	Bhaekura	Turdidae	Passeriformes	PC,S
Darjeeling Woodpecker	<i>Dendrocopos darjellensis</i>	Laachey	Picidae	Piciformes	PC,S
Dark Breasted Rosefinch	<i>Carpodacus nipalensis</i>	Tuti	Fringillidae	Passeriformes	PC,S
Eurasian Treecreeper	<i>Certhia familiaris</i>	Sulsuley	Certhiidae	Passeriformes	PC,S
Eurasian Woodcock	<i>Scolopax rusticola</i>		Scolopacidae	Charadriiformes	S
Fire Tailed Sunbird	<i>Aethopyga ignicauda</i>	Balchi	Nectariniidae	Passeriformes	PC,S
Golden Naped Finch	<i>Pyrrhoptectes epaulette</i>	Tuti	Fringillidae	Passeriformes	S
Green Backed Tit	<i>Parus monicolus</i>	Chi Chink Kotey	Paridae	Passeriformes	PC,S
Grey Backed Shrike	<i>Lanius tephronotus</i>		Laniidae	Passeriformes	PC,S
Large Billed Crow	<i>Corvus macrorhynchos</i>	Kag	Corvidae	Passeriformes	PC,S
Minivet	<i>Pericrococtus sp.</i>	Rani chari	Campephagidae	Passeriformes	S
Oriental Turtle Dove	<i>Streptopelia orientalis</i>	Dhukur	Columbidae	Columbiformes	PC,S
Pipit	<i>Anthus sp.</i>		Motacillidae	Passeriformes	S
Plain Backed Thrush	<i>Zoothera mollissima</i>		Turdidae	Passeriformes	S

Common Name	Scientific Name	Local Name	Family	Order	Evidence
Plain Mountain Finch	<i>Leucosticte nemoricola</i>	Tuti	Fringillidae	Passeriformes	PC,S
Plumbeous Water Redstart	<i>Rhyacornis fuliginosa</i>		Muscicapidae	Passeriformes	PC,S
Red Billed Chough	<i>Pyrhonorax pyrrhonorax</i>		Corvidae	Passeriformes	PC,S
Red Headed Bullfinch	<i>Pyrhula erythrocephala</i>	Tuti	Fringillidae	Passeriformes	PC,S
Red Tailed Minla	<i>Minla ignotincta</i>		Leiothrichidae	Passeriformes	PC,S
Rufous Gorgeted Flycatcher	<i>Ficedula strophliata</i>		Muscicapidae	Passeriformes	PC,S
Rufous Vented Tit	<i>Periparus rubidiventris</i>	Fista	Paridae	Passeriformes	PC,S
Rufous Vented Yuhina	<i>Yuhina occipitalis</i>	Megma	Timaliidae	Passeriformes	PC,S
Scaly Thrush	<i>Zoothera dauma</i>		Turdidae	Passeriformes	PC,S
Snow Pigeon	<i>Columba leuconota</i>	Malewa	Columbidae	Columbiformes	PC,S
Spotted Laughing Thrush	<i>Garrulax ocellatus</i>		Turdidae	Passeriformes	PC,S
Stripe Throated Yuhina	<i>Yuhina gularis</i>	Megma	Sylviidae	Passeriformes	S
Tickell's Thrush	<i>Turdus unicolor</i>		Turdidae	Passeriformes	PC,S
White Browed Fulvetta	<i>Alcippe vinipectus</i>		Sylviidae	Passeriformes	S
White Capped Redstart	<i>Chaimarrornis leucocephalus</i>	Dhobi Chara	Muscicapidae	Passeriformes	PC,S
White Collared Blackbird	<i>Turdus albocinctus</i>		Turdidae	Passeriformes	PC,S
Whiskered Yuhina	<i>Yuhina flavicollis</i>	Megma	Timaliidae	Passeriformes	S
Yellow Bellied Fantail	<i>Chelidorhynch hypoxantha</i>	Kanchirna	Rhipiduridae	Passeriformes	PC,S
Yellow Billed Blue Magpie	<i>Urocissa flavirostris</i>	Laampucharey	Corvidae	Passeriformes	S
Yellow Wagtail	<i>Motacilla flava</i>		Motacillidae	Passeriformes	PC,S

S: Sighting, PC: Photo capture

Observations

North Sikkim is known widely for its rich repository of biological diversity especially rhododendrons, and Sikkim is the only state in India and perhaps in the whole world to have designated / notified Rhododendron Sanctuary, Shingba Rhododendron Sanctuary in north district and Barsey Rhododendron Sanctuary in west district. Sir JD Hooker during his exploration in Sikkim-Darjeeling Himalaya during 1847-49 has reported 45 species of Rhododendrons from Sikkim including the species from Darjeeling; nevertheless, over 36 species of Rhododendron have been reported only from Sikkim by Pradhan and Lachungpa (1990). Recently, researchers have reported some new rhododendron species from Sikkim, but are yet to be confirmed.

Even though, our survey was confined between Shingba Rhododendron Sanctuary and Shiv Mandir (approx, 30 km stretch covering 700 m altitudinal amplitude), we encountered 19 of the 29 rhododendron species known to exist in the Lachung valley including Yumey Samdong area. The valley before the entrance to Shingba Rhododendron Sanctuary harbours good patch of *Picea spinulosa* in association with *Tsuga dumosa*, *Abies densa* and *Larix griffithii*. The review of literature reveals that *Picea spinulosa* is endemic to Lachung and Lachen valley in Sikkim and *Larix griffithii*, though endemic to Sikkim, Nepal and Bhutan is confined to Lachung and Lachen range in Sikkim, as per our previous field observations. It is interesting to note that the *Rhododendron arboreum*, which is included in the Guinness book of world record as the world's largest rhododendrons, with all the 3 forms i.e. red, pink and white flower are available in the valley. Of the 3 forms, white form is very rare in occurrence and is

not reported till date from any other part in Sikkim except Lachung valley in north district of Sikkim state. It is distributed between 1800 to 3600 m asl; at the lower elevations, the species can be seen as well developed trees with huge trunk and tall height; nonetheless, with the increase in elevation, the same species are seen in the form of shrubs rarely exceeding 2.5 to 3 m height. This may be the effect of the variation in climatic condition from temperate to sub-alpine type but is creating confusion on the real form (tree or shrub) of the species.

The open slope above Yakchey reserves enormous population of *Rhododendron niveum* but its categorization into tree needs to be redefined because from nowhere it resembles true tree if one carefully looks at its straggling form and structure. Even though the species has woody structure but lacks true trunk due to which, *Rhododendron niveum* has been listed as small tree / large shrub in the checklist prepared by us. Further, its vulnerable status needs reconsideration because the species was found regenerating gregariously in the area; further, in addition to new population record for the species in Khangchendzonga National Park (Badola and Pradhan, 2010), a new patch of *Rhododendron niveum* was recorded by us during August-September, 2013 along Tholung - Kisong trail towards Jumthul Phuk glacier along Jumthul chu. The altitude between 3200 to 3600 m asl in the survey area witnesses gregarious growth of *Rhododendron hodgsonii*; similarly, the species is so extensively available in Khangchendzonga National Park/Khangchendzonga Biosphere Reserve (Yuksom Dzungri, Tholung-Kishong, Indo-Nepal border) that from nowhere, the species appears endangered or vulnerable in Sikkim. The rare status of *Rhododendron cinnabarinum* needs to be redefined in Sikkim

because likewise *Rhododendron hodgsonii*, the species has wide availability in KNP/KBR in west district (Pradhan et al., 2013) and Shingba Rhododendron Sanctuary in north district.

Another species of importance available in the valley was *Enkianthus deflexus* with beautiful pink-yellow mix bell-shaped flower occurring between 3000 to 3200 m asl which has not been recorded by us from other survey locations in Sikkim. The area further holds species that has been categorised as vulnerable like *Rhododendron pendulum* and endangered such as *Aconitum ferox* by IUCN, which further enhances the importance of the Shingba Rhododendron Sanctuary.

During the survey, the area was found to be devastated by landslides at several locations,

majority of which perhaps have caused by the recent earthquake of September 2011, thereby causing great damage to the vegetation in the area. In addition, the avalanche and the flash flood caused due to heavy snowfall and torrential rain is a common natural disaster in the area resulting in huge vegetation loss. In some places, the entire area was open with the remnant of numerous cut stumps as a result of earlier mass felling of tree species, *Abies densa*, *Betula utilis*, etc. and rhododendrons for house construction and firewood collection, an indication of unregulated mass tourism in the area. Though the vegetation in some of these areas was found to be regenerating; nevertheless, the continuous occurrence of such calamities/activities may affect the



Yak grazing inside Shingba Rhododendron Sanctuary

ecology thereby altering the vegetation composition of the area. The vegetation loss whether by natural or anthropogenic means contributes to climate change or rise in local temperature in the longer run and makes the area prone to invasion by alien species which has a tendency to grow and adapt in any harsh climatic conditions. These alien species have high seed viability and faster growth rate due to which they will not take much time to spread and cover the entire area thereby suppressing the germination and growth of the indigenous species.

The Yumthang valley as a whole is one of the important tourist destinations in Sikkim and is easily approachable by road; nevertheless, the road passing through the valley often gets blocked due to the natural calamities causing inconvenience to the travellers. In some places, the water were observed gushing over the road thereby damaging the road and hindering the maintenance effort of the GREF personal. This may be checked to some extent by channelizing the water. Sikkim is widely popular for its natural beauty and people from all over the world visits Sikkim to enjoy it but this needs to be checked because unregulated tourism in north Sikkim has resulted in piling up of

garbage including plastic bottles, wrappers, etc. in the valley, which will obviously affect the beauty as well as the wildlife of the area. Since, north district is the only place in Sikkim which is run by the local governing body called *Dzumsa*, which takes care of every affair of the villages and the people. The *Dzumsa* can be taken into confidence to check and monitor the tourism in the area. Further, there are many seasonal shops in the Yumthang valley and Yumey Samdong area which are run by the locals; they along with the drivers of the tourist vehicle, owners of the hotels can be inspired through *Dzumsa* to take active participation to take up the cleanliness drive in the area.

The Yumthang valley is known to harbour many of the rare and endangered wildlife species but we did not encounter any of them except Yellow Throated Marten and the fresh pellets of Serow. Locals from Lachung revealed the presence of the Red Panda in the Yumthang valley; however, we were unable to find any sign of its presence during our survey which may be correlated to the increasing disturbances such as unregulated tourism, grazing, continuous army movement, etc. and habitat destruction due to road construction, fuel wood collection and other activities.



Fuel wood collections



Garbage accumulation

Flora of Tendong State Biodiversity Park, Damthang, South Sikkim

Tendong State Biodiversity Park in South Sikkim was established in the year 2003 by the Government of Sikkim under the Department of Forests, Environment and Wildlife Management with an aim of conservation, protection, propagation and extension of genetic resources of the State of Sikkim. Situated at a distance of approximately 2km from Damthang and lying just above the famous Temi Tea Estate along the Namchi-Gangtok highway, it forms a part of the Maenam-Tendong ridge. It has a total area of 255 hectare and the altitude varies from 1400 to 2050 m asl.

The Park has been set up inside the Tendong Reserve Forest and comprises of wet temperate broad-leaved forest which is very rich in floral and faunal components. The forest is dominated by *Quercus lamellosa* and *Castanopsis tribuloides*. Species like *Juglans regia*, *Beilschmiedia sikkimensis*, *Eriobotrya petiolata*, *Prunus cerasoides*, *Michelia doltsopa*, *Michelia cathcartii*, etc. can be seen interspersed with the dominant trees or planted along the road side. Species like *Symplocos glomerata*, *Symplocos theifolia*, *Eurya acuminata*, etc. densely appear as under storey species. The ground vegetation includes shrub species like *Dichroa febrifuga*, *Edgeworthia gardnerii*, *Rubus ellipticus*, *Viburnum erubescens*, *Osbeckia stellata*, etc.

Aconogonum molle, *Digitaria sanguinalis*, *Eragrostis cilianensis*, *Pilea* sp., *Pouzolzia* sp., etc. are the herb species found here growing along with several species of ferns. Climber like *Cissus elongata*, *Rubia manjith*, *Rhapidophora decursiva*, etc. is a common sight in the Park area. The slope is facing the northern aspect receiving less sunlight, due to which, the area is always damp. As a result of this several terrestrial herb species especially ferns grow as epiphytes in this area. Numerous bamboo species such as *Arundinaria maling* grow in dense patches. The Park is also home to various species of Rhododendrons and Orchids.

In an around the Biodiversity Park, massive plantations of the exotic species *Cryptomeria japonica* have been done in the past. The species has established itself so well that now it appear as one of the dominant tree species in the area.

The Park area is known to be inhabited by mammalian species like barking deer, flying squirrel, fox, porcupine, yellow-throated marten, etc. Being a part of the Maenam Wildlife Sanctuary–Tendong Reserve Forest IBA, it is a paradise for bird watchers as it harbours some of the rare and threatened bird species of Sikkim along with other common bird species.

Rationale for enumeration

1. At present, the park has a small interpretation centre, nurseries, etc., which is at premature stage and the majority of the area, is under natural forest cover. The interpretation centre houses pictures and specimen of several important medicinal herbs of Sikkim. Similarly, numerous important plant species including *Ginkgo biloba* (living fossil plant), rhododendron species, rattan species, etc. have been planted in the nursery area. A **Biodiversity Centre** under JICA assisted SBF Project has been proposed to be set up in the Park area. The proposed Biodiversity Centre will serve as database storage house and will have modern herbaria and other related facilities.
2. An alternate highway ‘**Gurans road**’ has been constructed via Damthang (adjoining Biodiversity Park), Gyanchung

(Naya Busty), Pabong, Tokal–Bermiok which joins Temi–Singtam highway at Amaley Dara above Sirwani.

3. There exist an old footpath which passes through the Park area leading to 10th Mile, Temi; however, it is not widely used at present but there is probability of it becoming functional in the future as it is the shortcut connecting Damthang to Temi Tea Garden.

All these inevitable developmental activities may perhaps cause damage to the existing biodiversity of the area, which calls for immediate documentation of the same.

Findings

During the survey, 28 tree species, 18 shrub species, 51 herb species (including 1 unidentified), 25 ferns and fern allies were recorded. In addition numerous climbers (12 species including 1 unidentified), epiphytes (8 species) and 2 small bamboo species were also recorded from the area.

Floral species available in and around Tendong State Biodiversity Park, South Sikkim

Botanical name	Local name	Family
Tree		
<i>Alnus nepalensis</i> D. Don	Utis	Betulaceae
<i>Beilschmiedia sikkimensis</i> King ex Hook.f.	Tarsing	Lauraceae
<i>Castanopsis hystrix</i> Hook. & Thomson ex. A. DC	Patley katush	Fagaceae
<i>Castanopsis tribuloides</i> (Smith) A. DC.	Musrey katush	Fagaceae
<i>Cedrela febrifuga</i> Blume.	Tooni	Meliaceae
<i>Cryptomeria japonica</i> (Thunberg ex. Linn. F.) D. Don	Dhuppi	Taxodiaceae
<i>Daphniphyllum himalayense</i> (Benth) Mull. Arg	Lal chandan	Daphniphyllaceae
<i>Eriobotrya petiolata</i> Hook. f.	Maya	Rosaceae

Botanical name	Local name	Family
<i>Erythrina arborescens</i> Roxb.	Phaledo	Fabaceae
<i>Eurya acuminata</i> DC.	Jhingni	Theaceae
<i>Exbucklandia populnea</i> (R. Br. ex Griff.) R.W. Br.	Pipli	Hamamelidaceae
<i>Juglans regia</i> Linn.	Okhar	Juglandaceae
<i>Lithocarpus pachyphylla</i> (Kurz) Rehder.	Sungurey katush	Fagaceae
<i>Litsea kingii</i> Hook.	Siltimmur	Lauraceae
<i>Macaranga pustulata</i> King.	Malato	Euphorbiaceae
<i>Machilus edulis</i> King ex. C.B. Clarke	Lapche kawla	Lauraceae
<i>Michelia doltsopa</i> Buch.-Ham. ex DC	Rani champ	Magnoliaceae
<i>Michelia velutina</i> D C	Phusre champ	Magnoliaceae
<i>Machilus gammieana</i> King ex. Hook. f.	Chipli kawla	Lauraceae
<i>Nyssa sessiliflora</i> Hook. f. & Thomson ex Benth	Lek chilauney	Cornaceae
<i>Pieris ovalifolia</i> (Wall) D. Don	Angeri	Ericaceae
<i>Prunus cerasoides</i> Don	Paiyoon	Rosaceae
<i>Quercus glauca</i> Thunb.	Musre phlant	Fagaceae
<i>Quercus lamellosa</i> Smith.	Bajranth	Fagaceae
<i>Rhododendron arboreum</i> ssp. <i>arboreum</i> (CB Clarke) Ridley	Lali gurans	Ericaceae
<i>Rhus succedanea</i> Linn.	Rani bhalayo	Anacardiaceae
<i>Symplocos glomerata</i> King ex. C.B. Clarke	Kholme	Symplocaceae
<i>Symplocos theifolia</i> D. Don	Kharane	Symplocaceae
Shrub		
<i>Actinodaphne sikkimensis</i> Meissn.	Madaney	Lauraceae
<i>Ardisia macrocarpa</i> Wall.	Damai phal	Myrsinaceae
<i>Brassiopsis mitis</i> CB Clarke	Chuletro	Araliaceae
<i>Daphne cannabina</i> Lour. ex. Wall.	Kalo algeri	Thymeliaceae
<i>Dichroa febrifuga</i> Lour.	Basak	Hydrangeaceae
<i>Edgeworthia gardnerii</i> Meissn.	Algeri / Lokti	Thymeliaceae
<i>Hydrangea heteromalla</i> D.Don	Bhogote	Hydrangeaceae
<i>Leucosceptum cannum</i> Smith	Ghurpis	Labiatae
<i>Maesa chisia</i> Buch. –Ham ex. D. Don	Bilauney	Myrsinaceae

Botanical name	Local name	Family
<i>Mahonia sikkimensis</i> Takeda	Kesar	Berberidaceae
<i>Neillia rubiflora</i> DC	Kirkireyjar	Rosaceae
<i>Osbeckia stellata</i> Buch.-Ham ex. D. Don		Melastomaceae
<i>Oxyspora paniculata</i> (D. Don) DC	Chulesee	Melastomaceae
<i>Rubus ellipticus</i> Smith.	Aiselu	Rosaceae
<i>Rubus</i> sp.	Aiselu	Rosaceae
<i>Vaccinium vacciniaceum</i> (Roxb.) Sleumer		Ericaceae
<i>Viburnus erubescence</i> Wall ex. DC	Asarey	Caprifoliaceae
<i>Zanthoxylum acanthopodium</i> DC	Bhaley timbur	Rutaceae
Herb		
<i>Aconogonum molle</i> (D. Don) H. Hara	Thotne	Polygonaceae
<i>Anaphalis margaritaceae</i> (Linn.) Benth.	Bukiful	Asteraceae
<i>Arisaema intermedium</i> Blume	Larua/Banko	Araceae
<i>Arisaema</i> sp.	Larua/Banko	Araceae
<i>Arisaema</i> sp.	Larua/Banko	Araceae
<i>Arisaema speciosum</i> (Wall.) Mart	Larua/Banko	Araceae
<i>Artemesia vulgaris</i> Linn.	Titepati	Asteraceae
<i>Astilbe rivularis</i> Buch.-Ham. ex D. Don	Buro okhati	Saxifragaceae
<i>Begonia</i> sp.		Begoniaceae
<i>Begonia tessaricarpa</i> C.B. Clarke	Mangarkanjey	Begoniaceae
<i>Bidens pilosa</i> Linn.	Kuro	Asteraceae
<i>Boehmeria</i> sp.	Kamley	Urticaceae
<i>Campylandra aurantiaca</i> Baker	Junglee Nakima	Liliaceae
<i>Carex</i> sp.	Harkatto	Cyperaceae
<i>Centella asiatica</i> Linn.	Golpatta	Umbelliferae
<i>Colocasia esculanta</i> (L.) Schott.	Mane	Araceae
<i>Commelina benghalensis</i> Linn.	Kaney jhar	Commelinaceae
<i>Digitaria</i> sp.	Banso	Poaceae
<i>Drymaria cordata</i> (L) Wild. ex Roem. & Schult.	Abijalo	Caryophyllaceae
<i>Elatostema platyphyllum</i> Weddell.	Gagleto	Urticaceae
<i>Epilobium</i> sp.		Onagraceae

Botanical name	Local name	Family
<i>Eragrostis</i> sp.	Banso	Poaceae
<i>Eupatorium adenophorum</i> Spreng.	Kalijhar	Compositae
<i>Gerardiana diversifolia</i> (Link) Friis	Bhangre sisnu	Urticaceae
<i>Hedychium gardnerianum</i> Sheppard ex Ker Gawl	Sara	Zingiberaceae
<i>Hedychium spicatum</i> Smith in Rees.	Sara	Zingiberaceae
<i>Heracleum wallichii</i> DC	Chimping	Apiaceae
<i>Houttuynia cordata</i> Thunb.	Padey jhar	Saururaceae
<i>Hypericum uralum</i> Buch.-Ham. ex D.Don	Urilo	Hypericaceae
<i>Impatiens stenantha</i> Hook. f.		Balsaminaceae
<i>Leucas lanata</i> Benth. in Wall.		Labiatae
<i>Musa balbisiana</i> Colla.	Bankera	Musaceae
<i>Neanotis ingrata</i> (Wall. ex Hook.) W.H. Lewis		Rubiaceae
<i>Persicaria capitata</i> Buch.-Ham ex D.Don	Ratneulo	Polygonaceae
<i>Pilea scripta</i> (Buch.-Ham ex D.Don) Weddell	Gagleto	Urticaceae
<i>Pilea umbrosa</i> Blume.	Gagleto	Urticaceae
<i>Polygonum</i> sp.		Polygonaceae
<i>Pouzolzia sanguinea</i> (Blume) Merrill	Chiple	Urticaceae
<i>Rumex nepalensis</i> Spreng.	Halhalley	Polygonaceae
<i>Sambucus</i> sp.		Adoxaceae
<i>Setaria palmifolia</i> (K.D. Koenig) Stapf.	Dhoti sara	Poaceae
<i>Solanum khasianum</i> CB Clarke	Boksi kara	Solanaceae
<i>Solanum nigrum</i> Linn.	Junglee bihee	Solanaceae
<i>Strobilanthes rankanensis</i> Hayata	Kibu ghans	Acanthaceae
<i>Strobilanthes</i> sp.	Kibu ghans	Acanthaceae
<i>Swertia bimaculata</i> (Siebold & Zuccarini) Hook. & Thom. ex CB Clarke	Bhaley chirowto	Gentianaceae
<i>Torenia asiatica</i> Linn		Scrophulariaceae
<i>Trifolium repens</i> Linn.	Dhungri jhar	Fabaceae
<i>Urtica dioica</i> Linn.	Gharia sisnu	Urticaceae
<i>Urtica parviflora</i> Roxb.	Patle sisnu	Urticaceae
	Ankhley ghans	

Botanical name	Local name	Family
Fern and Fern allies		
<i>Arthromeris walliachiana</i> (Spreng.) Ching		Polypodiaceae
<i>Asplenium ensiforme</i> Wall. ex Hook. & Grev.	Uniu	Aspleniaceae
<i>Asplenium laciniatum</i> D. Don	Uniu	Aspleniaceae
<i>Athyrium clarkei</i> Beddome		Woodsiaceae
<i>Coniogramme intermedia</i> Heiron.	Uniu	Pteridaceae
<i>Davallodes hirsutum</i> (J. Sm.) Copel. ex Copel	Uniu	Pteridaceae
<i>Davallodes membranulosa</i> (Hook.) Copel.	Uniu	Davalliaceae
<i>Deparia pterisii</i> (Kunze) M. Kato		Woodsiaceae
<i>Dicranopteris</i> sp.	Sottar	Gleicheniaceae
<i>Diplazium</i> sp.	Ningro	Woodsiaceae
<i>Dryopsis</i> sp.		Dryopteridaceae
<i>Equisetum debile</i> Roxb. ex Vaucher	Salli - Bisalli	Equisetaceae
<i>Gleichenia gigantean</i> Wall. ex Hook	Kalamey	Gleicheniaceae
<i>Lepisorus loriformis</i> (Wall. ex Mett.) Ching		Polypodiaceae
<i>Lepisorus mehrae</i> Fraser.-Jenk		Polypodiaceae
<i>Lycopodium japonicum</i> Thunb.	Nagbelli	Lycopodiaceae
<i>Microsorium membranaceum</i> (D.Don) Cing		Polypodiaceae
<i>Monachosorum henryi</i> Christ.	Uniu	Monachosoraceae
<i>Odontosoria chinensis</i> (L.) J. Smith	Uniu	Lindsaeaceae
<i>Oleandra wallichii</i> (Hook.) C. Presl.		Oleandraceae
<i>Plagiogyria pycnophylla</i> (Kunze.) Mett.	Uniu	Plagiogyriaceae
<i>Pteris wallichiana</i> J. Agardh	Chatey uniu	Pteridaceae
<i>Selaginella biformis</i> A. Br. Ex Kuhn.		Selaginellaceae
<i>Selaginella</i> sp.		Selaginellaceae
<i>Vittaria flexuosa</i> Fee.	Uniu	Vittariaceae
Climber		
<i>Aeschynanthus parviflorus</i> (D. Don) Spreng.		Gesneriaceae
<i>Ceropegia hookeri</i> CB Clarke ex Hook. f.		Asclepiadaceae
<i>Cissus elongata</i> Roxb.	Charcharey lahara	Vitaceae
<i>Clematis buchananiana</i> DC	Pinasey lahara	Ranunculaceae

Botanical name	Local name	Family
<i>Herpetospermum pedunculatum</i> (Seringe.) C.B. Clarke	Ban karela	Cucurbitaceae
<i>Mucuna macrocarpa</i> Wall.	Baldengra	Leguminosae
<i>Piper boehmeriifolium</i> (Miquel.) Wall. ex C. DC	Chambo	Piperaceae
<i>Rhapidophora decursiva</i> (Roxb.) Schott.	Kanchirna	Araceae
<i>Rubia cordifolia</i> Linn.	Majito	Rubiaceae
<i>Smilax zeylanica</i> Linn.	Kukur dainey	Liliaceae
<i>Trichosanthes lepiniana</i> (Naud.) Cogn.	Indreni	Cucurbitaceae
	Pani lahara	
Epiphyte/Orchid		
<i>Agapetes serpens</i> (Wright) Sleumer		Ericaceae
<i>Cautleya gracilis</i> (Smith) Dandy.		Zingiberaceae
<i>Cymbidium</i> sp.	Sunakhari	Orchidaceae
<i>Eria spicata</i> (D.Don.) Hand.-Mazz.	Sunakhari	Orchidaceae
<i>Hoya linearis</i> (Wall.) var. <i>sikkimensis</i> Hook. f.		Apocynaceae
<i>Hoya</i> sp.		Apocynaceae
<i>Liparis cespitosa</i> (Lamarck) Lindl.	Sunakhari	Orchidaceae
<i>Pholidota</i> sp.		Orchidaceae
Bamboo		
<i>Arundinaria hookeriana</i> Munro	Pareng	Poaceae
<i>Arundinaria maling</i> Gamble	Malingo	Poaceae

The survey revealed that the area where Tendong State Biodiversity Park has been set up is very rich in floral diversity. Even though, the survey was restricted to a small area within the park and the adjoining boundary area, the number of species recorded was comparatively high. Many of the species perhaps might have gone unnoticed during the survey due to damp and marshy condition, which would probably have increased the species number in the list,

especially, in the case of ground vegetation and epiphytes.

The park area harbours many rare and threatened floral species including *Ceropegia hookeri* (which has recently been rediscovered from Sikkim after 133 years) and many such other species. A record of a healthy tree of *Castanopsis tribuloides* measuring a girth of approximately 21ft. were made (Alt: 2100; 27°30'33.7N, 88°24'27.4E).



Highest girth recorded from Tendong State Biodiversity Park area, Damthang

During the survey, large open areas within the park and the Reserve Forest (Sim Kharka) and other adjoining areas like Barkhey and Pani Dara were noticed, which can be brought under plantation with indigenous species. Further, massive area towards '**Gurans Road**' has been brought under *Cryptomeria japonica* plantation, which have been able to compete with and dominate the local indigenous species. *Cryptomeria japonica* needles are poor in nutrients and decompose very slowly causing acidification of the soil. The fallen leaves get

piled up on the forest floor prohibiting the regeneration of ground vegetation. The pile of fallen leaves also increases the surface runoff aggravating the problems of landslides during rainy season in the low lying areas.

Therefore, it is highly emphasized to take measures for replacing such species with local species. In the case of inability to replace them, heavy thinning of *Cryptomeria* plantation can be carried out allowing sunlight to reach the ground, which may result in regeneration of the ground vegetation and other tree species.



Dichroa febrifuga



Herpetospermum pedunculatum



Hypericum uralum



Torenia asiatica



Neillia rubiflora



Hedychium gardnerianum



Houttuynia cordata



Epilobium wallichianum



Eria spicata & Liparis cespitosa



Lepisorus mehrae



Arisaema tortuosum



Arisaema speciosum



Gleichenia gigantean



Begonia tessaricarpa



Odontosoria chinensis



Microsorium membranaceum



Brassiopsis mitis



Dicranopteris linearis var. *linearis*

Flora of Butterfly Park, Rang Rang, North Sikkim

A butterfly park is proposed at Rang Rang, North Sikkim as the area is reported to have numerous species of butterflies. Of the estimated 20,000 – 30,000 species of butterflies occurring globally, at least 1500 species occur in India and approximately 700 butterfly species are found in the state of Sikkim. A floral survey was conducted in the area wherein 31 tree species, 11 shrub species, 15 herb species, 9 climber/epiphyte species, 14 fern and fern allies were recorded from the area and are presented in the following Table.

Species	Local Name	Family
Tree		
<i>Actinodaphne sikkimensis</i> Meissn.	Phurke sissi	Lauraceae
<i>Ailanthus grandis</i> Prain.	Gokul	Simarubaceae
<i>Alangium begoniaefolium</i> Bail.	Akhane	Alangiaceae
<i>Albizia procera</i> Benth.	Seto siris	Fabaceae
<i>Bauhinia variegata</i> Linn.	Koiralo	Caesalpinioideae
<i>Castanopsis indica</i> A.DC	Dhalne katus	Fagaceae
<i>Duabanga sonneratioides</i> Ham.	Lampate	Sonneratiaceae
<i>Engelhardtia spicata</i> Blume.	Mauwa	Juglandaceae
<i>Erythrina arborescens</i> Roxb	Phaledo	Leguminosae
<i>Ficus clavata</i> Wall.	Lute khanium	Moraceae
<i>Ficus infectoria</i> Roxb.	Kabra	Moraceae
<i>Ficus elastic</i> Roxb.	Labar	Moraceae
<i>Gynocardia odorata</i> R. Br.	Gante	Flacourtiaceae
<i>Hovenia dulcis</i> Thunb.	Bangi	Thymelaeaceae
<i>Juglans regia</i> Linn.	Okhar	Juglandaceae
<i>Leucospectrum canum</i> Smith.	Gurpis	Labiataeae
<i>Litsaea citrata</i> Blume.	Siltimur	Lauraceae
<i>Litsaea</i> sp.		Lauraceae
<i>Macaranga pustulata</i> King.	Malato	Euphorbiaceae
<i>Machilus</i> sp.	Kawlo	Lauraceae
<i>Maesa chisia</i> Buch.-Ham. ex D. Don	Bilaune	Myrsinaceae
<i>Ostodes paniculatus</i> Blume.	Bepari	Euphorbiaceae

Species	Local Name	Family
<i>Pinus roxburghii</i> Sarg.	Chirpine	Pinaceae
<i>Prunus cerasoides</i> Don.	Paiyun	Rosaceae
<i>Rhus semialata</i> Murr.	Bhakimlo	Anacardiaceae
<i>Rhus succedanea</i> Linn. var. <i>acuminata</i>	Rani bhaleyo	Anacardiaceae
<i>Schima wallichii</i> Choisy	Chilaune	Theaceae
<i>Spondias axillaris</i> Roxb.	Lapsi	Anacardiaceae
<i>Terminalia myriocarpa</i> Heurck & Muell. Arg.	Pani saj	Combretaceae
<i>Tetradium fraxinifolia</i> Hook.f	Khanakpa	Rutaceae
<i>Toona ciliata</i> Roemer	Tuni	Meliaceae
Shrub		
<i>Boehmeria</i> sp.	Kamle ghans	Urticaceae
<i>Boehmeria macrophylla</i> Hornem	Kamle ghans	Urticaceae
<i>Clerodendron</i> sp.		Verbenaceae
<i>Dichroa febrifuga</i> Lour	Basak	Hydrangeaceae
<i>Eupatorium adenophorum</i> (Spreng.) King & H. Rob	Kali jhar	Asteraceae
<i>Lantana camara</i> Linn.	Banmara	Verbenaceae
<i>Mussaenda roxburghii</i> Hook. f.	Dhobini phul	Rubiaceae
<i>Pandanus nepalensis</i> H. St. John	Tarika	Pandanaceae
<i>Rubus</i> sp.	Aiselu	Rosaceae
<i>Rubus</i> sp.	Aiselu	Rosaceae
<i>Solanum</i> sp.	Jangali bihin	Solanaceae
Herb		
<i>Arisaema</i> sp.	Larua/Banko	Araceae
<i>Begonia</i> sp.	Magar Kajay	Begoniaceae
<i>Bidens pilosa</i> Linn.	Kuro	Asteraceae
<i>Cheilocostus speciosus</i> (J. Konig) C. Specht.	Betlauri	Costaceae
<i>Cyanotis</i> sp.	Kanay jahr	Commelinaceae
<i>Cyanotis vaga</i> (Loour.) Roem & Schult.	Kanay jhar	Commelinaceae
<i>Cynodon dactylon</i> Linn.	Dubo	Poaceae
<i>Drymaria cordata</i> Wild. ex. Roem & Schult.	Abhijalo	Caryophyllaceae
<i>Galinsoga parviflora</i> Cavanilles		Asteraceae
<i>Gonatanthus pumilus</i> D. Don.	Manay	Araceae
<i>Impatiens</i> sp.	Mujuro	Balsaminaceae
<i>Oxalis corniculata</i> Linn.	Chariamilo	Oxalidaceae

Species	Local Name	Family
<i>Persicaria capitata</i> (D. Don) H. Gross	Ratnaulo	Polygonaceae
<i>Persicaria nepalensis</i> (Meisner) H. Gross	Ratnaulo	Polygonaceae
<i>Pilea scripta</i> (Buch. - Ham. ex D. Don) Wedd.	Chipley ghans	Ulmaceae
Climber/Epiphyte		
<i>Aeschynanthus sikkimensis</i> Stapf.	Baklay patay	Gesneriaceae
<i>Bulbophyllum</i> sp.	Sunakhari	Orchidaceae
<i>Dioscorea</i> sp.		Dioscoreaceae
<i>Entada rheedeii</i> Spreng.	Pangra	Mimosaceae
<i>Mikania micrantha</i> Kuntha		Asteraceae
<i>Piper boehmeriaefolium</i> (Miq.) DC.	Jungali pan	Piperaceae
<i>Rhaphidophora decursiva</i> (Roxb.) Schott	Kanchirna	Araceae
<i>Smilax</i> sp.	Kukur daine	Liliaceae
<i>Stephania</i> sp.	Tambarki	Menispermaceae
Ferns & fern allies		
<i>Asplenium phyllitidis</i> D. Don	Aule uniyun	Aspleniaceae
<i>Cyathea spinulosa</i> Wall. ex Hook.	Rukh uniyu	Cyatheaceae
<i>Diplazium esculentum</i> (Retz.) Sw.	Aule chipley nigro	Woodsiaceae
<i>Equisetum diffusum</i> D. Don	Salli – Bisalli	Equisetaceae
<i>Huperzia squarrosa</i> (G. Forst.) Trev		Lycopodiaceae
<i>Lycopodiella cernua</i> (L.) Pichi-Serm	Nagbellii	Lycopodiaceae
<i>Nephrolepis cordifolia</i> (L.) C. Presl.	Pani amala	Oleandraceae
<i>Polystichum lentum</i> (D. Don) T. Moore	Uniyu	Dryopteridaceae
<i>Pteris biaurita</i> Linn.	Thare uniyu	Pteridaceae
<i>Pyrrosia lanceolata</i> (L.) Farwell.	Uniyu	Polypodiaceae
<i>Pyrrosia</i> sp.	Uniyu	Polypodiaceae
<i>Tectaria polymorpha</i> (Wall. ex Hook.) Copel.	Uniyu	Dryopteridaceae

Species like *Spondias axillaris*, *Juglans regia*, *Terminalia myriocarpa*, etc. is extensively used as timber. Further, the fruits of *S. axillaris* are used in the preparation of pickle and fetches high market price. The edible part of *Juglans regia* is used to make 'Chutney', by crushing with chillies and salt. The paste of new leaves

and young shoots are used to poison the fishes during seasonal catch in springs/rivers. The tuber of *Nephrolepis cordifolia* tuber is taken to quench thirst and to increase appetite after fever; it is also known to reduce chest congestion. The leaves of *Thelyteris procera* are used in the preparation of yeast.



Gynocardia odorata



Nephrolepis cordifolia



Pandanus nepualensis



Asplenium phyllitidis



Entada phaseoloides



Thelypteris (Christella) procera



Cethosia cyane (Leopard Lacewing, female)



Euploea core (Common crow)



Chersonesia sp. (Common Maplet)



Parantica algea (Glassy Tiger)



Tagiades menaka (Spotted Snow flat)

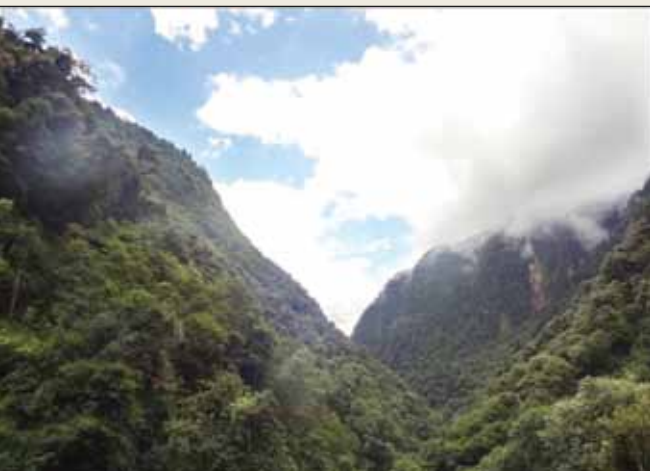


Priniceps paris paris (Paris peacock)



Golden purple flitter

Flora of high altitude Lakes: Gyam Tsona, Gurudongmar, Tsho Lhamu in North Sikkim



North Sikkim is the largest of the four districts of Sikkim. The region is deeply cut into steep slopes and gorges with dense vegetation which continues all the way up to the alpine altitudes before thinning out to the cold desert scrub of the Tibetan plateau. As the elevation increases, the vegetation changes from temperate to alpine and when the altitude exceeds 5500m, the landscape becomes more barren as it approaches the Tibetan plateau.

The visit was mainly aimed to study the reason for brackishness and drying of the Lake Gyam Tsona, bringing together all the information from different disciplines. The list of the plant species which were encountered along the way from temperate to alpine region up to the cold desert of the state have been provided. Probable reason for drying of the Lake Gyam Tsona, as well as suggestions and recommendations for the future study of brackishness has also been included.

Lachen is the gateway to the lake Gyam Tsona (an Ocean lake) and other fresh water lakes such as Gurudongmar Lake, Cho Lhamu, and others. Area between Lachen to Thangu exhibit temperate conifer forest, sub alpine forest and alpine scrubs and harbours tree species like *Tsuga dumosa*, *Abies densa*, *Betula utilis*, *Picea spinulosa*, *Larix griffithii*, *Pieris ovalifolia*, *Sorbus cuspidata*, *Tetradium fraxinifolia*, *Hippophae salicifolia*, *Salix* sp. and shrubs like *Artimesia wallichiana*, *Aconitum ferox*, *Berberis* sp., *Podophyllum hexandrum*, *Gaultheria fragrantissima*, *Juniperus recurva*, *Rhododendron lepidotum* etc., herbs species like *Anaphalis* sp., *Bluplerum candollei*, *Primula glomerata*, *Primula denticulata*, *Primula sikkimensis*, *Euphorbia wallichii*, *Potentilla peduncularis*, *Potentilla arbuscula*, *Juncus himalensis* and climbers like *Clematis montana*, *Rubia cordifolia*, etc.



Thangu valley is situated at an elevation of 4000 m asl and is covered with alpine vegetation and endowed with different species of *Primula*, *Juniperus*, *Rhododendrons*, *Meconopsis*, *Potentilla*, etc. that bloom during the months of April to May. The place remains snow covered for most of the time. Above 4000 m elevation, the slopes are mildly undulating and the ground are mostly covered with the scrubs like *Rhododendron setosum*, *Rhododendron nivale*, *Rhododendron anthopogon*, *Juniperus indica*, *Juniperus recurva*, etc. The herb species prevalent in the area includes *Bergenia ligulata*, *Corydalis* sp., *Gaultheria* sp., *Gentiana* sp., *Ephedra* sp., *Arenaria* sp., *Lectuca* sp., *Stelleria* sp., *Taraxicum* sp., *Sassurea* sp., *Aster* sp.,

Aconitum hookeri, *Agrostis* sp., *Astragalus* sp., *Oxytropis* sp., etc.

Area extending beyond Thangu (above 4000 m asl), is the Himalayan rain-shadow zone of cold desert which merges with Tibetan plateau.

Gyam Tsona, a brackish lake, is located at an altitude of 4924 m asl in the dry interior valley of north Sikkim. Also known as “the ocean lake”, Gyam Tsona is believed to be drying at an alarming rate. The vegetation there is quite different and harbours species such as *Poa* sp., *Ranunculus* sp., *Delphinium* sp., *Lonicera* sp., *Swertia* sp., *Taraxicum* sp., *Urtica* sp., *Ephedra gerardiana*, *Gentiana* sp., *Aster* sp. etc.



Findings

The floral species recorded on the way from Lachen upto the alpine altitude before reaching the cold desert of North Sikkim are presented in the following Table.

Botanical Name	Local Name	Family
Tree		
<i>Tetradium fraxinifolia</i> (Hooker) T. G. Hartley	Khanakpa	Rutaceae
<i>Hippophe salicifolia</i> D. Don		Elaeagnaceae
<i>Juniperus recurva</i> Buch Hem ex D. Don	Bhairungpati	Cupressaceae
<i>Leucoseptrum canum</i> Smith.	Ghurpis	Lamiaceae
<i>Salix</i> sp.		Salicaceae
<i>Tsuga dumosa</i> D. Don	Thinge salla	Pinaceae
Shrubs		
<i>Aconitum ferox</i> Wallich ex Seringe	Bikhma	Ranunculaceae
<i>Artimesia wallichiana</i> Besser	Titeypati	Asteraceae
<i>Berberis angulossa</i> Wallich ex Hook f. & Thoms.		Berberidaceae
<i>Gaultheria fragrantissima</i> Wallich.	Dhasingre	Ericaceae
<i>Gaultheria stapfiana</i> C. B. Clarke	Dhasingre	Ericaceae
<i>Pieris formosa</i> (Wallich) D. Don	Angeri	Ericaceae
<i>Rhododendron anthopogon</i> D. Don	Sunpati	Ericaceae
<i>Rhododendron fulgens</i> J. D. Hooker		Ericaceae
<i>Rhododendron setosum</i> D. Don		Ericaceae
<i>Rosa</i> sp.		Rosaceae
<i>Rubus paniculatus</i> Smith	Aiselu	Rosaceae
<i>Viburnum erubescens</i> Wall ex DC	Asarey	Caprifoliaceae
Herb		
<i>Aconitum hookeri</i> Stapf.		Ranunculaceae
<i>Agrostis</i> sp.		Poaceae
<i>Anaphalis</i> sp.		Asteraceae
<i>Anemone vitifolia</i> Buch-Ham ex D. Don		Ranunculaceae
<i>Arenaria</i> sp		Caryophyllaceae
<i>Aster</i> sp.		Asteraceae
<i>Astragalus donianus</i> DC.		Fabaceae
<i>Berberis angulossa</i> Wallich ex Hook f. & Thoms.		Berberidaceae
<i>Bistorta</i> sp.		Polygonaceae
<i>Brassica</i> sp.		Brassicaceae

Botanical Name	Local Name	Family
<i>Bulbophyllum</i> sp.	Sunakhari	Orchidaceae
<i>Cardamine</i> sp.		Brassicaceae
<i>Carex</i> sp.	Harkatto	Cyperaceae
<i>Cyperus</i> sp.		Cyperaceae
<i>Delphinium</i> sp.		Ranunculaceae
<i>Dracocephelum</i> sp.		Labiataeae
<i>Elshotzia</i> sp.		Lamiaceae
<i>Ephedra gerardiana</i> Wall.		Ephedraceae
<i>Erigeron</i> sp.		Asteraceae
<i>Eriophyton wallichii</i> Benth.		Labiataeae
<i>Euphorbia wallichii</i> Hook. f.		Euphorbiaceae
<i>Gentiana</i> sp.		Gentianaceae
<i>Hedysarum</i> sp.		Fabaceae
<i>Hemiphragma heterophyllum</i> Wallich	Lalgeri	Scrophulariaceae
<i>Heracleum</i> sp.		Apiaceae
<i>Impatiens</i> sp.	Mujuro	Blasaminaceae
<i>Juncus himalensis</i> Klotzsch.		Juncaceae
<i>Lectuca</i> sp.		Asteraceae
<i>Lonicera rupicola</i> Hook. f. Thoms		Caprifoliaceae
<i>Oxyria digyna</i> L.		Polygonaceae
<i>Oxytropis</i> sp.		Leguminosae
<i>Pedicularis</i> sp.		Scrophulariaceae
<i>Persicaria</i> sp.		Polygonaceae
<i>Phlomis rotata</i> Benth. ex. Hook. f.		Labiataeae
<i>Poa</i> sp.		Poaceae
<i>Podophyllum hexandrum</i> Royle	Panchpatey	Lardizabalaceae
<i>Potentilla peduncularis</i> D. Don		Rosaceae
<i>Primula denticulata</i> Smith		Primulaceae
<i>Primula glomerata</i> Pax.		Primulaceae
<i>Primula sikkimensis</i> Hook. f.		Primulaceae
<i>Prunella vulgaris</i> L.		Lamiaceae
<i>Rheum nobile</i> Hook. f. ex. Thomson	Padamchal	Polygonaceae
<i>Rhodiola</i> sp.		Crassulaceae
<i>Rosa</i> sp.		Rosaceae

Botanical Name	Local Name	Family
<i>Rumex nepalensis</i> Spreng.	Halhalley	Polygonaceae
<i>Ranunculus</i> sp.		Ranunculaceae
<i>Sassurea</i> sp.		Polygonaceae
<i>Saxifraga</i> sp.		Saxifragaceae
<i>Stellaria</i> sp.		Elaeagnaceae
<i>Swertia</i> sp.		Gentianaceae
<i>Thalictrum reniforme</i> Wallich		Ranunculaceae
<i>Thalictrum virgatum</i> Hook. f. & Thoms		Ranunculaceae
<i>Triosetum himalayanum</i> Wallich		Caprifoliaceae
<i>Urtica hyperborea</i> Jacquem. ex Wedd.		Urticaceae
Fern		
<i>Pteris</i> sp.		Pteridaceae



Potentilla arbuscula



Ephedra gerardiana



Aconitum hookeri



Oxyria digyna



Ground cover dominated by Poaceae



The region is ecologically fragile and is a vulnerable cold desert of the eastern Himalayas. The region can be considered as a Gene bank for high altitude species of Sikkim. Hence it is a natural asset which needs to be conserved and managed well.

Clear skies prevailing in the interior of the plateau which enhances radioactive heating of the ground and intensifies impacts of climate change, the continental drifts resulting from the movement of the interior plates leading to formation of cracks on the interior plate may be the major factors for the drying of the lake.

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