

Biodiversity of Sikkim

Exploring and Conserving a Global Hotspot

Editors

M. L. Arrawatia, IFS
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Cover page designed by Dr. Pankaj Kumar, Wildlife Institute of India, Dehradun

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

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

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

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

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Pawan Chamling
(*Honoris Causa*)
Chief Minister of Sikkim

FOREWORD

The Mount Khangchendzonga (8,598 m), globally the third highest mountain, and the highest peak in the country and revered as a guardian deity, has influenced and nurtured a unique ecosystem - the Sikkim Himalaya, which constitutes a global biodiversity hotspot. Sikkim is a part of the Eastern Himalaya, and across its entire length, the Himalayas are narrowest here, spanning a total width of just 80 km, resulting in an extremely steep terrain and telescoping of the various eco-zones. Bio-geographically it is enriched by both west and east Himalayan biogeographic provinces. It has close proximity to both the Tibetan Plateau in the north and Bay of Bengal towards the south, thereby having affinities with tropical moist forests in the south and cold desert in the north, within a short distance.

In a landmass of just 7,096 square kilometres, it houses elevations ranging between 300 to 8,598 meters. The diverse forest types include deciduous Sal, wet hill forests, dense Oak forests, extensive conifer forests and unique Rhododendron thickets giving way to rolling alpine meadows. Ecosystems range from humid tropical valleys to temperate montane habitat, alpine meadows and trans-himalayan cold desert. It is a veritable nature's Noah's Arc teeming with biodiversity, housing nearly half of the nation's bird diversity, wild trees, orchid and Rhododendron wealth, one third of the country's flowering plants, no wonder as many as 165 plants have been named after Sikkim.

It is the noble duty of my Government to ensure that this nature's bounty is sustained for the future generations, and to leave it in a richer state than what was bequeathed to us. In this direction the State has taken exemplary strides by making the forests free from grazing thereby significantly increasing the forest cover, making the human habitations plastic-free, the farming systems organic and having an overall pro-environment model of development, with a record one third of the area kept aside as sacrosanct under sanctuaries and national park under the protected area network.

It was my cherished dream to publish a comprehensive account of the biodiversity wealth of Sikkim, a topic that has fascinated me unendingly. This book is a result of contribution covering a wide range of topics from eminent authors affiliated to reputed research institutes. I am certain that it will help to fill the knowledge gap on the exploration, conservation and management of biodiversity and will be of immense help for students, researchers, policy planners, tourists and the civil society. This will also further our mission in showcasing the rich biodiversity of Sikkim in the national and international fora. I am confident that this book will inspire the upcoming generations to strive towards taking the baton of conservation ahead and further the green image of brand Sikkim.



(Pawan Chamling)

Dated 1st June 2011

PREFACE

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

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

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

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

506 of the total 2302 species of Lichens

480 of the total 1200 species of Ferns

527 of the total 1229 species of Orchids

58 of the total 102 species of Primulas

38 of the total 90 species of Rhododendrons

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

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

tree line in the alpine zone having glaciers, snow capped peaks and alpine meadows. Forest and tree cover has grown to as much as 85.82% of the area below the tree line (4000 m).

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

Ban on green felling in forest, no standing green trees are cut or harvested

Ban on grazing in reserved forest areas, plantation areas and water sources areas

Ban on use of non-biodegradable materials like plastic and poly-bags

Launch of *Smriti Van* or memorial forests program

Introduction of compulsory environment education in schools

Blanket ban on scaling of sacred peaks and also defilement of sacred caves, sacred rocks, sacred lakes, chortens and sacred hot springs

Being a high altitude state, the consumption of firewood in the rural households is substantial. Hence 100% subsidy on gobar gas and LPG in large quantities is being provided every year and has resulted in a substantial reduction in firewood use over the year

Abandoned and closing down of “G” Firing Range over an area of 17,250 hectares acquired by the army establishment in North Sikkim

Creation of Eco-Club, Green Funds in schools and colleges

Ban on commercial exploitation and transit of medicinal plants from the wild

Launching of Sikkim Green Mission

Launching the spring water source conservation program - *Dhara Vikas* to enhance rural water security

“Ten Minutes to Earth” is observed on 25th June, when people of Sikkim plant saplings in large numbers, making this event as an annual feature. This day is observed every year as a green day throughout the State

To better understand the climate change impacts, the state has proactively taken up studies in collaboration with national institutions on glaciers and different aspects of climate change. Studies related to wetland mapping, snow cover mapping, forest fire impacts have been taken up

The State Action Plan on Climate Change is under preparation in consonance with the National Action Plan on Climate Change

The Sikkim State Council of Climate Change has been constituted for providing policy direction and institutional mechanism for effective implementation of various climate change programs

Assessment of climate change related vulnerability of the rural communities at Gram Panchayat level has also been taken up

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

The novel idea of having an academic book celebrating the unique biodiversity of Sikkim was conceptualized by the Chief Minister of Sikkim, Shri Pawan Chamling. The book has been made possible by sharing of knowledge by several authors, who have contributed in more ways than one. Several experts have also selflessly contributed their photographs. This effort has benefitted from the able guidance of Shri R. S. Basnet, Principal Secretary to the Chief Minister, Shri M. G. Kiran, Commissioner - cum - Secretary, Information and Public Relations Department and Ms. Karma Youtso,

Deputy Secretary-Chief Minister's Office. We are also grateful to Shri G. S. Rawat, Professor, Wildlife Institute of India, for support in the review work. There are also many others who helped in the making of this book in so many ways, that it would be difficult to recount even in small measure. We would like to express our heartfelt thanks to all of them. Whatever insights have been gained, emanate from the dedicated labour of the contributing authors, the blemishes are however all ours. If this work is able to bring about a clearer understanding of the magical landscape of Sikkim, then it would have served its purpose.

Place: Gangtok
Date: 28th May, 2011

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

