

PROCEEDINGS OF THE
**WORKSHOP ON CONSERVATION AND MANAGEMENT
OF BIODIVERSITY IN TEESTA VALLEY, SIKKIM**

16 - 17 October 2006

FOREST CONFERENCE HALL, GANGTOK, SIKKIM



**SÁLIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY
&
CISMHE, UNIVERSITY OF DELHI**



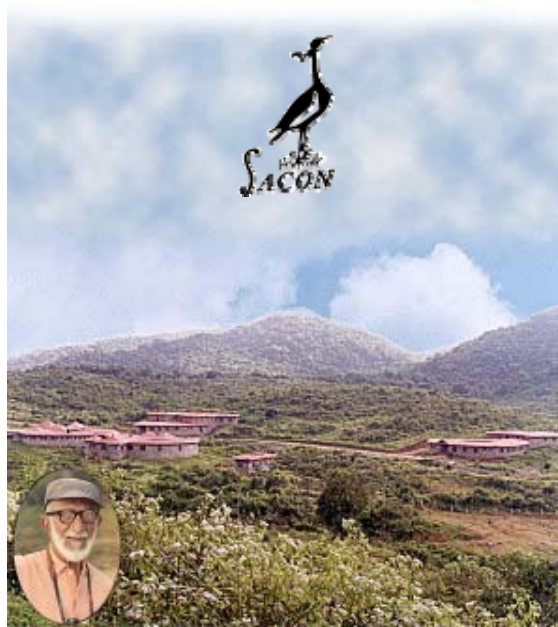
Hon'ble Forest Minister Shri. S.B. Subedi delivering presidential address. Dignitaries (L to R): Dr. Lalitha Vijayan, Shri. S. Lama, Shri. T.R. Poudyal and Dr. J. P. Tamang



Presentations

Shri. Sandeep Tambe (top)
Ms. Usha Lachungpa (middle)
Dr. Dipankar Ghose (bottom)





One of the cherished dreams of late Dr. Sálim Ali, the father figure of Indian Ornithology, was to have a national centre to perpetuate studies in Ornithology and Natural History. Thanks to the ceaseless efforts of the Bombay Natural History Society (BNHS), the country's oldest NGO, his dream came true in 1990 when the Ministry of Environment and Forests (MoEF), Government of India came forward to support such a centre. The centre was befittingly named after Dr. Sálim Ali, in appreciation of his monumental contribution to Ornithology as Sálim Ali Centre for Ornithology and Natural History (SACON).

The Centre was set up with a mission to "Help conserve India's biodiversity and its sustainable use through research, education and people's participation with birds at its centre stage", SACON focuses on the following broad areas:

- Conservation of endangered birds
- Impact of anthropogenic activities on the biodiversity
- Environmental contamination
- Tropical rain forest ecosystem conservation
- Conservation and sustainable use of wetland resources
- Environmental Impact Assessment, and
- Nature Education

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Compiled & edited by

Lalitha Vijayan, S. Bhupathy, Bhoj Kumar Acharya & Basundhara Chettri



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2007

ACKNOWLEDGEMENTS

We thank the Ministry of Environment and Forests (MoEF), Government of India, Centre for Interdisciplinary Studies on Mountain and Hill Environment (CISMHE), University of Delhi and National Hydroelectric Power Corporation (NHPC) for providing fund to conduct this workshop.

We are grateful to the Department of Forest, Environment and Wildlife Management, Government of Sikkim for logistic support to organize this workshop.

Sikkim Government College, The Mountain Institute, WWF-Sikkim, various government departments and NGOs supported and actively participated in the deliberations of this workshop, and we are thankful for the same. Locals of Sikkim were always supportive and cooperative to our studies along the Teesta valley.

WORKSHOP ORGANISERS

- Dr. Lalitha Vijayan, SACON, Coimbatore
- Dr. S. Bhupathy, SACON, Coimbatore

PROGRAMME COMMITTEE

- Dr. J. P. Tamang, Sikkim Government College, Gangtok
- Mr. Sandeep Tambe, Project Manager, The Mountain Institute, Gangtok
- Mr. Bhoj Kumar Acharya, SACON, Coimbatore
- Ms. Basundhara Chettri, SACON, Coimbatore

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Special Address

Shri. T.R. Poudyal, PCCF cum Secretary, Department of Forests, Govt. of Sikkim

Shri. H.P. Pradhan, CF, Department of Forests, Govt. of Sikkim

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Bhoj Kumar Acharya & Lalitha Vijayan

Herpetofaunal Diversity along the Teesta Valley, Sikkim

Basundhara Chettri & S. Bhupathy

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Session II: Bio-diversity of Sikkim (October 17, 2006)

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Tourism as a Tool for Conservation
Nima Tashi Bhutia

List of Participants

Summary and Recommendations

The Workshop, “Conservation and Management of Biodiversity in Teesta Valley, Sikkim” was conducted at Gangtok during 16 - 17 October 2006. This was organized as a part of the Research Project, “An ecological study on mammals, birds, herpetofauna and butterflies in Sikkim” by Sálím Ali Centre for Ornithology and Natural History (SACON) undertaken as a component of the multi-institutional project “Carrying capacity studies on the Teesta basin, Sikkim” coordinated by the Centre for Interdisciplinary Studies on Mountain and Hill Environment (CISMHE), University of Delhi. The objective of this workshop was to disseminate information gathered during the study from 2002-2006 to a wider audience and stakeholders such as forest managers, local communities, researchers and policy makers.

The workshop was conducted at the Forest Conference Hall, Forest Secretariat, Gangtok, Sikkim. Dr. S.K. Pradhan, Principal, Sikkim Government College, Gangtok inaugurated the workshop, after welcome and a brief introduction by Dr. Lalitha Vijayan, Senior principal Scientist, SACON. In his inaugural address, Dr. Pradhan pointed out the importance of Sikkim in terms of biodiversity and emphasized further research on this aspect. Shri H.P. Pradhan, Conservator of Forests (Wildlife), Government of Sikkim, in his special address emphasized the importance of research in conservation of Biodiversity and provided historical aspects of wildlife conservation in the state.

The programme had three technical sessions; two on the first day (16 October 2006) and one the subsequent day. The first Session had four presentations based on research undertaken by SACON along the Teesta Valley; one each on butterflies, herpetofauna, birds and mammals. Ms. Usha Lachungpa, Senior Research Officer, Department of Forest, Environment and Wildlife Management, Government of Sikkim, chaired this session. The Session II was chaired by Dr. M.P. Thapa, Head, Department of Zoology, Sikkim Government College, which had five invited presentations on general biodiversity of Sikkim and its conservation. The abstracts of all the presentations were compiled and circulated during the workshop.

The second day of the workshop had interactive panel discussion (Technical Session III) in the forenoon and valedictory function in the afternoon. Shri Sandeep Tambe, Project Manager, The Mountain Institute (TMI), Gangtok, chaired this session. The theme of the discussion was “Conservation and Management Strategies in Sikkim”. About 60 representatives from various Institutions, Government Departments, Non-Government Organizations (NGOs) and Community Based Organizations (CBOs) took part in the discussions. Scientists and managers answered the queries related to floral and faunal conservation. Director, Tourism Development Corporation cleared doubts raised by participants related to tourism and wildlife. Conservation problems pertaining to butterflies, birds and wetlands were highlighted.

Butterflies

Sikkim harbors 690 species of butterflies that makes up around 50% species that occur in Indian subcontinent. Need for their conservation was emphasized by researchers and



foresters. Researchers of SACON mentioned that low altitude areas in Sikkim are hotspots for butterflies and hence, emphasized to promote these areas as eco-tourism destinations. Since these areas are very rich in butterflies and peak butterfly season coincides with the tourist influx in Sikkim, Forest and Tourism Department, Government of Sikkim, agreed to collaborate in identification and designation of these sites as tourism destination points. Department of tourism requested researchers for information such as photographs and notes on butterfly species and specific hotspots so that they can prepare brochures, which will be useful for tourists as well as local people. The department also felt the shortage of trained tourist guides in the state. SACON Scientists and researchers expressed keen interest and willingness to collaborate with the concerned departments for preparing brochures and training members of the local community.

NGO sector expressed their views that existing tourist guides can be roped in for training on butterflies. This added knowledge will be a bonus and can be taken up on a short-term basis. In response to the queries raised by NGOs, foresters and researchers regarding the probable hazards to the hotspots for butterflies by the proposed dam, National Hydroelectric Power Corporation (NHPC) representative, Dr. A.K. Tripathi opined that these issues could be examined and mitigation measures adopted.

Birds

Sikkim is very rich in avifaunal diversity. Based on the research findings of SACON the following points were highlighted:

- Temperate broadleaved forests in and above 2000m elevation are hot spots for birds.
- Chungthang (its surrounding forests) and above is very rich in plants, both diversity and also endemism. Same holds true for birds and mammals as well. Hence, these areas need to be conserved.
- Both NHPC and private parties are on the anvil and identified 4-5 projects in this region for implementation of power projects. Such action should be stopped looking at fragility of the landscapes as well as unique biodiversity of the region.
- Some river basins in the state should be kept inviolate for the times to come.

Alpine Wetlands and Himal

Sikkim is abode of a large number of montane lakes and streams, and these water bodies are considered sacred by all ethnic groups of the state. The importance of these landscapes and conservation issues were discussed with active participation of NGOs (The Mountain Institute, WWF, KCC, YEC) and others. All appreciated the new initiatives taken by the Forest Department and the Government to protect high altitude landscapes including wetlands with the participation of the local communities.

Conservation and Management Issues

The following conservation issues were highlighted and discussed:

- Firewood collection, livelihood and conservation of Rhododendron in Shingba and Thangu areas in North Sikkim.
- Involvement of security agencies in nature conservation in east and north Sikkim.
- Carrying capacity related issues
- Awareness campaign and integrated plan for ecotourism

Conservation and Management of Biodiversity in Teesta Valley

The local NGOs requested SACON to prepare documents such as field guides, checklists and major findings in local language. It is learnt that this work is already in progress, and products would be available from 2007. The need of a workshop with the policy makers of the state was also felt.

Valedictory function of the workshop was held at 15:00 Hrs on 17th October 2006. The function was presided over by Shri Sher Bahadur Subedi, Hon. Forest Minister, Government of Sikkim. Dr. Lalitha Vijayan, Senior Principal Scientist, SACON, delivered welcome address and presented the summary of the proceedings of the deliberations in the workshop. Dr. J.P. Tamang, Regional Coordinator, Carrying Capacity Project and Shri. S. Lama, Member State Planning Commission gave felicitations. Shri T.R. Poudyal, Principal Chief Conservator of Forests cum Secretary, Department of Forest, Environment and Wildlife Management, Government of Sikkim, delivered special address. Honourable Forest Minister Shri Sher Bahadur Subedi delivered his Presidential address extending support to research in future. Dr. S. Bhupathy, Senior Scientist, SACON proposed vote of thanks.

A total of 87 delegates including forest managers, officials from tourism and forest department, Government of Sikkim; scientists, academicians, NHPC official, research scholars, representatives of various local NGOs and university students attended the workshop. Technical sessions were live and interactive with active participation.



**WORKSHOP ON CONSERVATION AND MANAGEMENT OF BIODIVERSITY
IN TEESTA VALLEY, SIKKIM**

Programme

Date	Time	Function
16/10/2006	09:30-10:00 10:00-11:00	Registration Inauguration Invocation Welcome & Introduction to workshop: <i>Dr. Lalitha Vijayan, SACON</i> Inaugural Address: <i>Dr. S.K Pradhan, Principal, SGC</i> Special Address: <i>Shri. H.P. Pradhan, CF</i> Vote of Thanks: <i>Mr. Bhoj Kumar Acharya, SACON</i>
	11:00-11:15	Tea break
	11:15-13:00	Technical Session I: Biodiversity of Teesta Valley Chairperson: <i>Usha Lachungpa</i> Butterfly Diversity- <i>Mr. Bhoj Kumar Acharya</i> Herpetofauna- <i>Ms. Basundhara Chettri</i> Birds- <i>Mr. Bhoj Kumar Acharya</i> Mammals- <i>Ms. Joya Thapa</i>
	13:00-14:00	Lunch
	14:00-16:30	Technical Session II: Biodiversity of Sikkim Chairperson: <i>Dr. M. P. Thapa</i> Wetland Conservation- <i>Dr. Dipankar Ghose</i> Vegetation Community in KNP- <i>Dr. S. Chettri</i> Landscape & Biodiversity – <i>Mr. Sandeep Tambe</i> Biodiversity & Tourism- <i>Mr. Nima T. Bhutia</i> Wildlife Conservation – <i>Ms. Usha Lachungpa</i>

- 17/10/2006 10:00-12:45 **Technical Session III: Panel Discussion**
Biodiversity: Conservation & Management Strategies
Chairperson: Mr. Sandeep Tambe
Panel members representing:
Forest Department- *Usha Lachungpa*
SACON - *Dr. S.Bhupathy*
Tourism - *Mr. P.K. Dong*, Director
Panchayat level Representatives
NGOs- VHAS, ECOSS
Development Sector Representative - NHPC
- 12:45-13:45 **Lunch**
- 14:00-15:00 **Valedictory Function**
Welcome Address & Summary of the Workshop:
Dr. Lalitha Vijayan, SACON, Coimbatore
Felicitations: *Shri. S. Lama*
Member State Planning Commission
Felicitations: *Dr. J.P. Tamang*
Regional Coordinator, CCP, Gangtok
Special Address: *Shri. T.R. Poudyal*
PCCF & Secretary, FEWM Dep. Sikkim
Presidential Address: *Shri. Sher Bahadur Subedi*
Hon. Forest Minister, Sikkim
Vote of Thanks: *Dr. S. Bhupathy*, SACON, Coimbatore
- National Anthem

Presidential Address

Shri. Sher Bahadur Subedi
Honourable Forest Minister, Sikkim

Sikkim state is the proud owner of the highest green cover in India. With our unique geographical position we are blessed with high faunal and floral diversity. We are also very rich in cultural diversity, and our culture and tradition have strong linkages with Central and other parts of Asia. I am happy that because of our efforts, the forest cover of the state has increased from 36% to 44%. This is achieved collectively by all of us. Sikkim is rated as the most clean, peaceful and stable border state of India. With the advice and guidance of our award winning “Green Chief Minister”, Hon. Shri. Pawan Kumar Chamling, we hope to do more for environmental safety through the recently launched “Green Mission”.

We are in the critical period of globalisation and liberalisation. We must equip ourselves to this changing scenario, but without compromising our cultural and ethnic identity, economic balance, peace and tranquillity, and environmental health. Natural wealth of Sikkim is incomparable with any other states of India or perhaps any other south and southeast parts of Asia. These resources should be conserved and used in a sustainable manner for the benefit of Sikkim people at large and development of India on the whole. One of the major revenue earning sectors is Eco-tourism. Sikkim Eco-tourism as a model has been emulated by other states. A large number of tourists visit us to enjoy nature and scenic beauty such as Kachenzonga and Yumthang Valley.

To minimise and monitor the impact of tourism, our government has recently issued notifications on Sikkim Wildlife (Regulation of Trekking) Rules 2005, *Pokhari Sanrakshan Samiti*, *Himal Rakshak*, and Singalila Ecotourism Promotion Zone. We are also in the process of strengthening many aspects in this regard, especially equal benefits sharing by all local communities.

We need to document all the resources and these resources could be developed using the advanced scientific and technological measures for the economic growth of the state and well being of our people. Economic and ecological values of the biodiversity have to be realized. We are doing our best for the protection and conservation with our limited resources. Promotion of conservation outside Protected Areas, in reserved forests and private lands is also critical. It is important to have participation from all sectors of the government, research organizations and the communities in conserving our rich biodiversity.

We need to further develop human resources. I am glad that Sálím Ali Centre for Ornithology and Natural History (SACON) has completed a study, and three students from this region are doing their Ph.D. with the support from this Project. I believe that presentations and deliberations during the Workshop on the “Conservation and Management of Biodiversity of Sikkim” organized by SACON for the last two days were useful, and will be helpful in planning strategies. We look forward to have many more research programmes in Sikkim, and I assure that all possible support would be extended to any such effort initiated in this region.



Inaugural Address

Dr. S.K. Pradhan, Principal

Sikkim Government College, Gangtok – 737 102

Sikkim is undoubtedly the richest in culture and biodiversity, as it is located at the cross roads of various biogeographic realms and zones. Our culture and tradition have strong linkage with Central Asia. Our faunal and floral diversity have affinities and similarities with Indochinese and Indo-Malayan biotic sub-regions. Various climatic conditions and altitudinal variations would have assisted these biodiversity to flourish. As academicians and researchers, we have ample opportunities to conduct research on them. It is hypothesised and doubted that many of our biodiversity would go extinct before we discover them as habitat destruction and hunting is rampant in many parts of the world, and we are no exception from this. Thanks to the conservative and religious sentiments of the region, which have some provisions for conservation of natural resources- sacredness of the area, a lake for instance. Various government departments are now reviewing their strategies to conserve nature for posterity. In this regard the services and efforts rendered by the Forest, Environment and Wildlife Management Department are commendable.

Lack of resources and trained personnel, change of our attitude bias towards more materialistic approach are important reasons for not undertaking studies on classical zoology or botany. Interest to study the fauna and flora of the region by various government and non-government agencies is increasing. The ongoing research programmes by Sálím Ali Centre for Ornithology and Natural History (SACON), Coimbatore, Wildlife Institute of India, Dehra Dun, Botanical surveys of India, G.B. Pant Institute, Bombay Natural History, Mumbai, WWF- India and ATREE are a few examples to mention. Policy changes in the Forest and Wildlife Management strategies by the Sikkim Government supporting research activities are welcome signs to note.

SACON is a national Institute dedicated to research on Biodiversity in Indian subcontinent. Since its inception in 1991, scientists and research scholars are working in different taxa in almost every parts of the country including Andaman and Nicobar Islands. SACON's research programme was extended to Sikkim in 2002 focusing largely on major vertebrate groups such as Mammals, Birds and Herpetofauna. Attempts are also made to study invertebrate fauna such as Butterflies. I am happy to note and make you aware that three of the students from this region are pursuing their higher studies (doctoral programmes) through the efforts made by SACON. Apart from academic and conservation interest, one of the major objectives of SACON is to disseminate information gathered during the study to wider audience and stake holders such as forest managers, local communities, researchers and policy makers. I understand and appreciate efforts taken by SACON to conduct Nature awareness workshops for Sikkim School and College students during 2005 at Singtam, East Sikkim. The present workshop, "Conservation and Management of Biodiversity" organized by SACON is an important step forward in disseminating findings of their research along the Teesta valley for the past three years or so. This workshop also brings together various organizations including NGOs to evolve strategies to be adopted in future.



Special Address

Shri. T.R. Poudyal, IFS

Principal Chief Conservator of Forests cum Secretary
Department of Forests, Environment and Wildlife Management
Government of Sikkim, Gangtok

Sikkim harbors very rich biodiversity with a multitude of species and a variety of habitats. The rivers and wetlands, although occupy a very small area, supported by the glaciers and forests, provide ample water and wetland resources which are of great significance for the life of the people. The biodiversity is undoubtedly the richest among all the states in India relative to its geographical area. The terrain being very tough, very few extensive investigations have been conducted. The above diversity is best experienced if one traverses the course of River Teesta, the major river in Sikkim, from an altitude of about 200 m to above 6000 m.

The Sálim Ali Centre has conducted a study with the support from the NHPC through the Ministry of Environment and Forests, Govt. of India on the faunal diversity of the Teesta basin as a part of the multidisciplinary study coordinated by the Centre for Interdisciplinary Studies on the Mountain and Hill Environment, Delhi University. The study by SACON focused on vertebrates such as reptiles, birds and mammals, and butterflies as well. They have provided specific and detailed information on these taxa from the Teesta basin. The results are very interesting which shows that 41% of these fauna recorded from Sikkim could be observed during their 3-year study in this area.

Documenting all the resources and mapping them should be the primary requirement for planning sustainable resource use. We are doing our best for the protection and conservation with our limited resources. Promotion of conservation outside protected areas, in reserved forests and private lands is also critical. It is important to have participation from all sectors of the government, research organizations and the communities in conserving our rich biodiversity. Our State should develop on all sectors. But development and conservation should go hand in hand. Development without proper plans would become futile. Hence, we must have well thought out road map prior to initiation of any development activities in the state. We need to develop human resources, and in this direction the work done by SACON in this region is commendable.

Special Address

Shri. H. P. Pradhan IFS

Conservator of Forests (Wildlife)

Department of Forests, Environment and Wildlife Management

Government of Sikkim, Gangtok

It gives me immense pleasure in meeting you all today in an ambience of research and its priorities in Sikkim. The ethics of conservation is very dear to the Sikkimese mind. A green Sikkim, a verdant Sikkim is what is ingrained into our soul. Over twenty-five years after we joined the national mainstream, we continue to excel in our efforts for conservation of our forest resources. The recorded forest cover in the State has gone up from 36% to 44% over the past decade according to published reports of Forest Survey of India. In the recently past our Hon'ble Chief Minister was adjudged the greenest Chief Minister in the country. As against a figure of 5% or so for the country, we have set aside more than one third of our geographical area for the Protected Area (PA) network consisting of National Park, Sanctuaries and Biosphere Reserve. In our forested areas hitherto unspotted animals like Takin are re-appearing. Wild animals are breeding in our ex-situ conservation centre. We have successfully bred Red Panda in our Zoological Park at Bulbuley.

Lest a sense of complacency develops we have already taken steps to lay down the parameters for environmental conservation by enunciating and adopting a State Environment, Forest and Land Use Policy. We have strengthened the legal framework for protection of our forests and to this effect brought about suitable amendments to our State Forest (Conservation) Act, 1980. The concept of J.F.M (Joint Forest Management) has been institutionalized and practice of participation in forestry activities has been devolved into the hands of Panchayats and the Non-Governmental Organizations (NGOs). Research Collaboration with ICFRE (Indian Council for Forest Research and Education) is in the offing. The Bamboo Project for which Sikkim is a natural choice has been introduced. A new biosphere reserve by the title of Khangchendzonga Biosphere Reserve was declared in North and West Sikkim.

As you will agree with me, Sikkim's mountainous ecology is closely linked with the stability of natural features in neighbouring North Bengal both in the hills and plains. Any imbalance in environmental stability will have consequential devastation in the hills of Darjeeling and the plains of North Bengal. An environmentally and ecologically safe, secure and stable Sikkim ensures a secure economy and meaningful development. Sikkim's geographical location, its strategic international linkages with respect to its rich and unique biodiversity 'hot-spot' status in the north-east and above all its servicing role for a host of other development sectors like tourism, power generation, animal husbandry, agriculture only qualifies it to be declared and Eco-Security Zone. Realizing this importance, our Chief Minister Dr. Pawan Chamling declared the State as Ecological Security Zone on the floor of recently concluded State Assembly Session. For this purpose, it needs the required dimension of managing, protecting and monitoring techniques, tools and mechanism in that order.



Sikkim is endowed with natural features and attributes which makes it a unique place to reckon with in terms of integrated approach to conservation. The slopes and valleys, its folds and fissures harbour a veritable store house of medicinal plants, birds and butterflies, rhododendrons and orchids, glaciers and hot springs. And all of them need protection in conjunction with forest trees. More than 80% of the land area is legally vested with this Department for management and protection. Wastelands and degraded areas are where our thrust activities should naturally adhere.

Some of our concerns and priorities at the moment could be condensed and short listed as follows:

1. Greater flow of funds from Government of India for forest protection and wildlife conservation.
2. Recognition of the declaration of Sikkim as Ecological Security Zone and follow-up action on it as suggested earlier.
3. Setting up of a Medicinal Plants Research Institute for development, conservation and propagation of medicinal herbs, many of which have not been surveyed realistically, or potentiality quantified and regeneration status ascertained.
4. Special habitat conservation projects for designated threatened species like Red Panda, Himalayan Thar and Snow Leopard, all of which are facing stiff competition for survival.
5. Rhododendrons for which Sikkim is internationally recognized as being the only place having the largest varieties of them need carefully stipulated protection ingredients to keep them in their pristine majesty and glory.
6. A master plan and a blue print for tackling and treating the menace of landslides and land sinking, toe-cuttings and flash floods which destroy and deface our beautiful landscape. The annual loss to life and property, communication infrastructure and supplies runs into colossal figures. A stable forestry will always prevent such catastrophes and hence our emphasis on forest protection.
7. The Forest, Environment and Wildlife Department have not been able to initiate any meaningful measures so far as, research activities in Forestry sector is concerned due to paucity of funds. The Ministry of Environment and Forests should formulate a Centrally Sponsored Scheme for research and development activities in the State so that thrust could be provided to this neglected sector because research forms the back-bone of all field activities.

Let us join our hands to rally around to protect our beautiful state Sikkim.

Felicitation

Shri. S. Lama

Member, State Planning Commission, Sikkim

Sikkim possesses a wealth of natural resources, which needs to be harnessed targeting development. However, this requires meticulous planning and inputs from various sectors such as Scientific, Local, Industrial and Bureaucrats for sustainable use. This will help our political leadership to plan and take appropriate action without hampering the interest of the people.

Development programmes without peoples' participation may become futile. Hence, it is important to involve people including grass root level in the planning stage. Small area of the state (Sikkim) with increasing population and the influx of a large number of tourists are some of the problems that the state needs to address. For instance, at present there are not enough infrastructures to accommodate the growing influx of tourists. Balance between the development activities and holding capacity of the region needs to be carefully reviewed so that appropriate mitigatory measures can be proposed for implementation.

Many of you are aware that the Sikkim Himalayas is very young and prone for disturbance such as earthquake. Any large scale development should be carefully planned to avoid ill effects, if any. I am sure, you would have heard from many speakers about the forest cover, wildlife, ecological balance etc. It is our duty to protect what we have been provided with.

State Planning Commission of Sikkim has major plans to improve the present environment using the advanced scientific technology. This is very important to maintain the delicate balance of nature. We have to use the expertise available with the government and non-government agencies. I appreciate the efforts taken by SACON in generating the baseline information on the biodiversity and the environment involving local students.

Felicitation

Dr. Jyoti Prakash Tamang

Regional Coordinator of Carrying Capacity Project
Sikkim Government College, Tadong

The Sikkim Himalayas is a genetic treasure house of plants, animals and microorganisms collectively called bio-resources. The Sikkim Himalayas being one of the important hot spots of diversity, the region is active centre of evolution of many new gene pools. These gene pools contain valuable components which have many applications for sustainable development of the region. Large cardamom, ethnic fermented foods and beverages, edible wild plants and their fruits, wild honey, etc. give food security to the region. Medicinal herbs, ornamental and wild flowering plants including orchids are 'cash-dispenser' for Sikkim. The sustainable development and utilization of bioresources depend on the application of modern sciences. Moreover, their application also offers potential to create opportunities for employment generation and to add to the economic progress of the nation through environmentally sustainable industrial development.

The multi-disciplinary mega research project entitled: **Carrying Capacity Study of Teesta Basin in Sikkim** was started in November 2001 and ended in March 2006. This project was funded by NHPC through the Ministry of Environment and Forest, New Delhi, involving six research and academic institutions:

- 1) Centre for Inter-Disciplinary Studies of Mountain and Hill Environment (CISMHE), Delhi University, Delhi
- 2) Centre for Atmospheric Sciences, Indian Institute of Technology, New Delhi
- 3) Water and Power Consultation Services (WAPCOS), New Delhi
- 4) Sálím Ali Centre for Ornithology and Natural History (SACON), Coimbatore
- 5) North Bengal University, Siliguri
- 6) Sikkim Government College, Gangtok

The research team had Prof. M.K. Pandit (National Coordinator), myself (Regional Coordinator), Dr. Arun Bhaskar, Dr. Lalitha Vijayan, Dr. S. Bhupathy, Prof. Pramila Goyal, Dr. A.K. Aggarwal, Prof. M.M. Jana, Dr. Maitry Choudhary, Dr. M.P. Thapa and Dr. S. Bisht as PI/Co-PIs, with around 10 Research Scholars, pursuing their Ph.D. degrees.

The study team has already submitted a full report (8 volumes) to Ministry of Environment and Forest. Copies of this report have also been submitted to Forest Department, Sikkim. This can be downloaded in websites of Delhi University as well as Govt. of Sikkim. The recommendation of the project is based on the detailed accounts of seismo-tectonics, geophysical, density of hydro-meteorological and hydrological observations, biological environments including flora and fauna, food security, and socio-economical status of Teesta Basin in Sikkim. The team highlighted that some endangered species of plants endemic to the Eastern Himalayas are now restricted to small populations in some pockets of North Sikkim and many wild mammals are found in areas above 1800m in the dense forests on the slopes of Teesta river in North Sikkim which

constitute some of the last refuges of critically endangered faunal species. The report also stressed on the food tourism and domestication of edible wild plants, which may sustain the regional economy. The glacial moraines, temporarily forming glacial lakes and debris cones are potential source of hazards in North Sikkim. The team has further suggested to setting up gene bank and creating institutional mechanisms for income generation in Sikkim. It was suggested that for conservation and sustainability of the fragile ecosystems in the Teesta basin in Sikkim, an autonomous Research Centre would be set up.

Today, at the valedictory function of the Workshop organized by SACON, I put forward a few suggestions to the Honourable Minister of Forest, and Science & Technology:

- 1) A full-fledged Forest Research Institute (like State Forest Research Institute of Arunachal Pradesh) may be set up in Sikkim as an autonomous institute of the Department of Forest, State Govt. Sikkim.
- 2) State Biodiversity Board which is probably in its way to be commissioned soon, should have a provision to act as a funding agency to cater the minor research projects/grants to researchers in Sikkim who are working in biodiversity and conservation biology.
- 3) Since yesterday, most of the presentations made by young and mid-career researchers of Sikkim show that the trends in research activities in biodiversity and conservation biology have increased considerably in recent years. Many young researchers are working in Forest Department as well as Science and Technology Department, and even in Sikkim Government College, mostly in the co-terminus projects. I request the Honourable Minister for both Forest, and Science & Technology to frame a policy to initiate the scientific cadre and recruitment of scientists in the state so that we will not have the brain drain.
- 4) It would be the best forum to express an idea of having a regional branch of SACON in Sikkim. I request Dr. Lalitha Vijayan to take up this issue with their Management and also Ministry of Environment and Forest.

Whether we work on flora or fauna or microorganisms, we all belong to the earth, which should be cared and nurtured.

ABSTRACTS

Session I: Bio-diversity of Teesta Valley

Overview of Research Undertaken by SACON along the Teesta Valley, Sikkim

Lalitha Vijayan & S. Bhupathy

Sálim Ali Centre for Ornithology and Natural History
Anaikatti (PO), Coimbatore- 641 108

Among all the Indian states, Sikkim is undoubtedly the richest in biodiversity. This is largely due to the geographical location of the state, and unique altitudinal and climatic regime. However, in-depth studies on the biodiversity of the state are scanty. The Sálim Ali Centre for Ornithology and Natural History (SACON), Coimbatore initiated research work on biodiversity along the Teesta River valley as a part of a larger project, “Carrying capacity studies of Teesta Riiver Basin in Sikkim” funded by National Hydroelectric Power Corporation (NHPC) through the Ministry of Environment and Forests, Government of India and Centre for Interdisciplinary Studies on Mountain and Hill Environment (CISMHE), University of Delhi as the coordinator for the multidisciplinary study. Among various objectives of the larger project, SACON covered the following two areas: (i) Distribution, abundance and ecology of mammals, birds, reptiles, amphibians and butterflies in major vegetation types along Teesta River Basin and propose measures for their conservation and management, and (ii) Develop local expertise in biodiversity research and monitoring.

SACON initiated ecological studies along the Teesta valley during 2002 and continued up to early 2006. All research students and assistants utilized in this project were from the region, and the students were encouraged to take up higher studies while working in the project. Field stations were established near Singtam and at Chungthang for overall coordination of the project and periodical collection of systematic data on the target taxa. Major thrust was given to study the ecology of select community of mammals, birds, reptiles, amphibians and butterflies in different altitudes and habitats along the Teesta basin. In all, 798 vertebrates and 689 species of butterflies have been reported from Sikkim including 169 mammals, 541 birds, 61 reptiles and 20 amphibians. During our study, 446 species of vertebrates (47 mammals, 42 reptiles, 15 amphibians, 352 birds) and 223 species of butterflies were observed along the Teesta Valley. These records form 45% of the total species present in the state. The sampling area of the present study is restricted within two kilometres (on either side) of the Teesta River covering about 600 sq km, which is about 8.5% of the total area of Sikkim (7096 sq km). The record of over 40% species within this small area within couple of years of field sampling indicates that Teesta valley is very rich in biodiversity. It is expected that further intensive and long-term sampling would result in more species. Hence, Teesta valley is vital for the conservation of biodiversity in Sikkim.

Several long-term and short-term recommendations and suggestions to conserve the biodiversity of Sikkim emerged from this study, including protection of crucial habitats and locations and monitoring programmes involving various stake holders. During research work in Sikkim, our researchers interacted with local communities and students, and participated in several seminars and workshops organised at local level. We have also conducted workshops for School and College Students to create awareness among them on nature and natural resources available in Sikkim.



Butterfly Diversity of Teesta Valley, Sikkim

Bhoj Kumar Acharya & Lalitha Vijayan

Sálim Ali Centre for Ornithology and Natural History

Anaikatti (PO), Coimbatore- 641 108

Butterfly diversity of Teesta valley, Sikkim was studied during 2002 - 2006 covering five vegetation types/altitudinal zones. Fixed width circular plot method was followed covering 2617 points spread along 23 transects. All together, 8248 butterflies belonging to 223 species were observed during this study. Butterfly species richness, abundance and species diversity was highest in Tropical semi-deciduous forest of low altitude and lowest in alpine meadows. Monotonic decline in the richness of butterflies was found with increasing altitude showing negative correlation ($r = -0.972$, $p < 0.01$). Similarly, significant negative correlation was observed between species abundance and altitude ($r = -0.947$, $p < 0.05$) as well as species diversity and altitude ($r = -0.962$, $p < 0.01$).

At the family level, Nymphalidae was the most dominant in terms of species richness followed by Lycaenidae. With respect to abundance, Pieridae was the second dominant family following Nymphalidae. Hesperidae was the least dominant butterfly family. Nymphalidae dominated all the vegetation types in all the seasons. Nymphalidae, Papilionidae and Pieridae showed linear decrease in species with altitude, whereas Lycaenidae showed peak at mid altitude tropical broad-leaved forest. In terms of abundance, all butterfly families showed negative correlation with altitude. Most of the butterflies had narrow distribution range, about 36% species confined to single vegetation type. Percentages of exclusive species also declined with elevation. Low altitude forests (Deciduous to Evergreen) shared maximum number of species compared to high altitude forests (Coniferous to Alpine meadows). Since butterflies showed narrow tolerance to elevation, vegetation change and disturbance, and each forest types harbours unique assemblages, conservation of Teesta valley is important for conservation of diversity of butterflies. With the record (including literature) of 689 species of butterflies in Sikkim, which comprise almost 50% of that found in the Indian subcontinent, the diversity of butterflies in Sikkim is probably the highest in the world when the geographical area is taken in to account.



Herpetofaunal Diversity along the Teesta Valley, Sikkim

Basundhara Chettri & S. Bhupathy

Sálim Ali Centre for Ornithology and Natural History

Anaikatti (PO), Coimbatore- 641 108

A study on herpetofauna of Teesta valley was conducted during 2002-2006. The area was divided into seven altitudinal zones with 500m intervals. In addition to transect, Road cruising and time constrained Visual Encounter Survey (VES) were used for sampling herpetofauna. In all, 1596 reptiles (933 lizards, 663 snakes) and 1165 amphibians were observed along the Teesta valley. A total of 42 species of reptiles (14 lizards, 28 snakes) and 14 amphibians comprising 10 and four families respectively have been observed which includes opportunistic sightings. Overall encounter of reptiles (0.66/ hour) was higher than amphibians (0.46). Reptile species richness showed significant negative correlation with altitudinal zones ($r = -0.929$, $p < 0.01$), whereas amphibians showed no correlation with altitude. The reptile species richness was high in lower altitude (<1500m above sea level). However, the abundance was high in relatively higher altitude areas (2000m). High abundance of reptiles in this zone was due to the clumped distribution of species such as *Trachischium guentheri* and *Leiolopisma sikkimensis*. Richness of amphibians was high in 1000-1500m followed by 2500-3000m, whereas abundance was higher in 2000-2500m and 2500-3000m above sea level. Only one species of amphibian *Scutigera sikkimensis* was found in the alpine and sub-alpine habitat, whereas no reptiles were encountered beyond 3000m during this study.

Including unconfirmed reports, a total of 99 species of reptiles have been reported from Sikkim and Darjeeling Hills. Including 42 species that were observed along the Teesta valley during this study, 78 species have confirmed distribution within Sikkim. Variations in number of species (i.e. 26-75) reported by previous workers in Sikkim Himalayas may be attributed to the past confusion in geographical boundary of the state, taxonomy of species and lack of in-depth systematic studies in the region. Analysis with respect to number of species, whose identity is fairly confirmed showed that reptile fauna of Darjeeling Hills and Sikkim Himalayas is similar ($C_s = 0.93$). Further systematic studies in other parts of Sikkim would provide a complete list of herpetofauna of the state and pertinent information on their endemism at regional level.

Bird Diversity along the Teesta Valley, Sikkim

Bhoj Kumar Acharya & Lalitha Vijayan

Sálim Ali Centre for Ornithology and Natural History

Anaikatti (PO), Coimbatore- 641 108

We studied the species richness, diversity and abundance pattern of birds along the Teesta valley, Sikkim covering five major vegetation types/altitudinal zones ranging from 300m to 4600m above sea level. Open -width circular point method was used along the predetermined transects covering 2599 points from 2002 to 2006. A total of 22,979 birds belonging to 352 species and 41 families were observed along the Teesta valley during the present study. Out of 352 bird species recorded during this study, 300 were observed during regular sampling, and the remaining (52 species) was recorded opportunistically. Species richness (171), abundance (7765) and diversity ($H' = 3.97$) were the highest in temperate broad-leaved forest.

Bird species richness showed a weak positive correlation, but followed unimodal mid-elevation peak. Similarity in species composition was high in low altitude forests with abrupt transition of species in high altitude vegetation. Turnover rate of bird species was high at habitat edges (ecotone). Very few species were found common to all five vegetation types, whereas most of were restricted to narrow altitudinal gradients. Bird abundance did not follow any particular pattern. Out of 10 endemics, four species each were observed in tropical and temperate broadleaved forests. Overall, Insectivorous birds dominated the bird community of this river valley contributing about 60%, and Carnivores, Granivores, and Frugivores contributed equally. Bird species richness based on their food habits showed different pattern with respect to altitude. Vegetation and habitat variables correlated positively with bird community parameter. Including records from literature, a total of 548 species of birds has been reported to occur in Sikkim, which includes 10 endemics and 17 threatened. High diversity and unique community composition of birds at each vegetation types reflect the conservation importance of the forests along the Teesta valley. Considering the bird species richness, habitat specialists and endemics, areas around Chungthang and above require special attention for conservation.



Mammal Diversity along the Teesta Valley, Sikkim

Joya Thapa & Ajith Kumar¹

Sálim Ali Centre for Ornithology and Natural History
Anaikatti (PO), Coimbatore- 641 108

¹Director, WCS - M. Sc. Course in Wildlife & Conservation Biology, NCBS, Bangalore.

Studies on mammals of Sikkim are very few. Sikkim harbors a reported 169 mammalian species. Among them, some species are highly endangered globally. For example, Red Panda, the state animal of Sikkim is an endangered species along with other lesser known species such as the Marbled cat (VN/ Schedule I) and Serow (VN/ Schedule I). The Himalayan marmot is also an endangered species found in sub-alpine zones above the tree line in the higher altitudes. The importance of such mammals goes up due to its restricted range in Northeast India as well as the Himalayan range. New addition to the mammalian species list of Sikkim is the Nepal Langur, which has been accepted as a distinct species.

In this study, a total of 47 species of mammals excluding bats were observed to occur in the four major vegetation and altitudinal zones starting from tropical semi-deciduous forest (up to 900 m), tropical moist and broad-leaved forest (900 – 1800 m), temperate broad-leaved forest (1800 – 2800 m) and the coniferous forest (2800 – 3800 m). The observations were made from both direct sightings as well as indirect evidences obtained from scats, hairs and tracks. The highest of 28 species of mammals was observed along the altitudinal gradient 1800-2800 m above sea level followed by 900-1800 m (eighteen species). Among all regions in the Teesta Valley, the area of highest conservation priority for mammals was found above Chungthang up to an altitude of 2800 m. Protection and conservation of different kinds of vegetation assemblage where the mammals are found along the Teesta river basin has become more important because of the pressures from development. Major threats like hunting of mammals need to be checked. There is still a dearth on information on the ecology of individual species of mammals from Sikkim. More studies on these will help to implement effective conservation measures particularly in broad-leaved forest (1800 – 2800 m).

Human Resource Development in Environment Sector: Nature Awareness Workshop for Sikkim Students- A Report

S. Bhupathy, Bhoj Kumar Acharya, Basundhara Chettri & Joya Thapa

Sálim Ali Centre for Ornithology and Natural History

Anaikatti (PO), Coimbatore- 641 108

As a part of the research initiatives in Sikkim by SACON, we have organized two Nature awareness workshops for Sikkim students during 13-16 September 2005 at Singtam, East Sikkim. Major objective of the workshop was to disseminate the information/ data generated on wildlife among local students and general public.

The workshop for school children was organized during 13-14 September 2005. In all, 40 (36 students, 4 teachers) participated in the programme. The workshop was inaugurated by Dr. S.K. Pradhan, Principal, Sikkim Government College, Gangtok. Shri S. Lama, Member, State Planning Commission, Sikkim delivered keynote address. On the first day, presentations were largely covering the Biodiversity of Sikkim, Eastern Himalayas and Northeastern India by SACON researchers and scientist. Special emphasis was given to major taxa, such as butterflies, amphibians, reptiles, birds and mammals, and the following day, school students were taken to nearby forest area to have a feel of wilderness and wildlife in their area. Subsequently, in the interactive indoor session students and teachers presented their views on the importance of biodiversity conservation.

On 16 September 2005, a workshop was conducted for college students on nature and natural resources of Sikkim. A total of 38 (34 college students and four teachers) of Sikkim Government College, Gangtok and Pakim Palatine College, Pakyong participated in the workshop. Dr. Ghanashyam Sharma, Lecturer, Pakim Palatine College, delivered the inaugural address on the involvement of local communities in conservation and management of Himalayan biodiversity. Presentations covering the Biodiversity of Sikkim, Eastern Himalayas and Northeastern India were given by SACON researchers. Dr. Jyoti Prakash Tamang, Sikkim Government College, Gangtok delivered the valedictory address and gave away certificates and prizes to the participants. Both the workshops were well received by students and teachers, and covered widely by local and national newspapers.

ABSTRACTS

Session II: Bio-diversity of Sikkim

WWF-India's initiatives for participatory conservation of wetlands in Sikkim

Dipankar Ghose & Lak Tsheden Theengh

WWF-India Sikkim Programme Office

Deorali, Near Forest Secretariat, Gangtok 737 102

Email: dghose@wwfindia.net

The Indian state of Sikkim with an area of 7086 km² is located within the Indo-Burma Biodiversity Hotspot and has 227 wetlands with a total area of 1985 ha. WWF-India, Sikkim Programme Office in 2005 identified the need of conserving the high altitude wetlands in Sikkim through stakeholders' participation. Prior to this, a national level consultation was organized by WWF-India in Sikkim during 2003. Subsequent to this consultation during 2005 with various stake holders, WWF-India identified 11 wetlands in Sikkim which required conservation interventions. Among them three each are found in East district, North district and five in West district. The work for conservation of wetlands in Sikkim is facilitated by the pro-conservation state government, sacred values of the lake and their remote location.

WWF-India initiated its work by conducting a study for documenting the cultural and sacred values of the important lakes of Sikkim. This was followed by the preparation of an inventory of the biodiversity of select wetlands. They were also prioritized for conservation based on threats and opportunities. Tsomgo Lake or Tangyek Tsho in East Sikkim has been identified as the lake requiring urgent attention. WWF-India along with The Mountain Institute (TMI) also assisted the Forest, Environment and Wildlife Management Department (FEWMD) for preparation of "Guidelines for lake conservation in partnership with Gram Panchayats and *Pokhri Sanrakshan Samitis* in Sikkim". Currently WWF-India is involved in constitution, strengthening and capacity building of the PSS in Tsomgo lake.

Biodiversity and Conservation Issues in Sikkim

Usha Ganguli-Lachungpa

Department of Forest, Environment and Wildlife Management, Gangtok, Sikkim.

Despite Sikkim having the maximum area under wildlife conservation in the country, the state government has so far not been able to establish a strong research base to generate a database for evolving its wildlife management plans. This has been sought to be corrected through sporadic surveys and studies over the past two decades through the small research wing of the department. State-wide field surveys since the inception of the annual Asian Waterfowl Count in 1988 and documentation of wetlands and waterbirds, butterfly surveys, experimental butterfly breeding, faunal surveys of some wildlife protected areas like Fambong Lho Wildlife Sanctuary, experimental bird-banding studies in and around wildlife protected areas from the highest to lowest altitudinal zones, baseline bird surveys in lowland forests of Sikkim, literature surveys, preliminary studies on faunal inventory of Khanchendzonga Biosphere Reserve, studies under the Alpine Grassland Ecology Project of the BNHS on wildlife of trans-Himalayan and cold desert regions of Sikkim, status surveys of some endangered and globally threatened species like Tibetan Wild Ass *Equus kiang*, Great Tibetan Sheep *Ovis amnion hodgsoni*, Snow Leopard *Uncia uncia*, Red Panda *Ailurus fulgens* and Galliformes, updating of the State Forest Herbarium, collaborative botanical expeditions, biodiversity and 'bush-meat' surveys, documentation of the Important Bird Areas of Sikkim, were some of the research activities undertaken.

Compilation of the Sikkim State Biodiversity Strategy and Action Plan, reconnaissance for EIA and EMP for Pakyong Airport Project, inputs in the Conservation and Sustainable Utilization of Medicinal Plants of Sikkim project, Butterfly and Bird Park projects, monitoring of wildlife and conservation issues in the proposed Tso Lhamo Cold Desert Conservation Reserve, instituting the ban on drug Diclofenac, involvement in Avian Flu issues in collaboration with relevant agencies, extension and education activities are some of the ongoing initiatives. Lack of publication of the data generated so far due to budget constraints and need of easier access to information from various institutions working in Sikkim are some of the key issues that need to be addressed for building a strong biodiversity research base in this unique hotspot, Sikkim.

Vegetation structure, diversity and wood biomass and increment of Khangchendzonga Biosphere Reserve with reference to buffer zone

Santosh K. Chettri

Ashoka Trust for Research in Ecology and the Environment (ATREE),
Eastern Himalaya Office, Dr. B.L. Dixit Road, Kalimpong- 734 301, W. Bengal

Khangchendzonga area in Sikkim after being declared a Biosphere Reserve continues to face biotic pressure from peripheral settlements. The present study focuses primarily upon the vegetation structure, diversity, wood biomass and increment in Khangchendzonga Biosphere Reserve (KBR), and attempts to seek valuable insight through data analysis along disturbance gradients in four altitudinal zones. Sites corresponding to three levels of disturbance were identified as: i) undisturbed site (UDS), ii) partially disturbed site (PDS), and iii) disturbed site (DS) based on differing degrees of proximity to habitation.

Analysis revealed disturbance at different levels along all altitudinal gradients to be positively correlated with decrease in values of tree species density, basal area, and importance value index (IVI). Generally, seedling and sapling number decreased towards proximity of disturbance level except in one case. Wood biomass and increment pertinently increased in undisturbed site. From the present study, it was observed that diversity is significantly correlated with increase in species richness. Woody biomass (branch + bole) was maximum in UDS of all stands. It was in the range of 325.8-436.7 t ha⁻¹ in UDS, 195-317.5 t ha⁻¹ in PDS, and 65-272.5 t ha⁻¹ in DS. The woody biomass at DS of 2730 m (65.0 t ha⁻¹) was much lower than DS of other sites (173.3-272.5 t ha⁻¹). Values of yearly increment in branch and bole were 4.2-15.0 t ha⁻¹ yr⁻¹. The anthropogenic impacts in the buffer zones seem to be more pronounced at elevations that have proximity to the human settlements. This has highlighted that anthropogenic pressure had a substantial impact on KBR vegetation.

Ecology and Management of the Alpine Landscape in the Khangchendzonga National Park, Sikkim Himalaya, West Sikkim

Sandeep Tambe & G.S. Rawat¹

The Mountain Institute
Development Area, Gangtok

¹ Wildlife Institute of India, Chandrabani, Dehra Dun, Uttranchal

This study is an attempt to address the concerns raised about the sustainability of pastoralism lifestyle in the third highest mountain ecosystem of the world – “The Khangchendzonga”. Located in the Eastern Himalayas, and spanning varying ecozones from sub-tropical to arctic (2020 – 8598 m above sea level) it is amongst the most significant biodiversity hotspots of India. Guru Padma Sambhava, is considered to have blessed this landscape and Mt. Khangchendzonga is revered as the guardian deity of the region.

The rich ethnic mix of the local communities residing adjacent to the Khangchendzonga National Park gives rise to a diverse assemblage of livestock including sheep, cows, buffaloes, yak, yak hybrids, horses and their associated pastoral systems. Data were collected by conducting interviews, village meetings, remote sensing and habitat surveys in the alpine pastures. These data were analyzed to model the diverse pastoral systems using dimensions such as social, cultural, ecological, economical, political and legal sustainability. Based on the outputs of this, six dimensional modeling a pastoral management plan has been prepared which proposes a phased removal of the female yak and yak herders, allow regulated herding of the sheep and pack animals and also deliberates on the diverse strategy to achieve the same.

Also during the course of the study critical habitats of mountain ungulates, and medicinal plants were identified and demarcated. The Honorary Mountain Guardians (*Himal Rakshak*) policy was also framed to institutionalize the role of the indigenous people in conservation of the alpine landscape. In order to provide livelihood options to the herders and villagers living in the remote villages adjacent to the National Park, three new trekking trails and 27 camping sites were designated. In order to reduce the impacts of trekking, the code of conduct for tourism was also given a legal basis with the preparation of the Sikkim Wildlife Trekking Regulations. In an increasing democratized world where restoring wilderness to wild lands does not make good political sense, the results of this study demonstrate the importance of a strong political will for nature conservation. Since this study is being conducted jointly in partnership with the Forest Department and local NGOs, the implementation of the research findings are already underway through policy changes and action on the ground. All this has resulted in the study actually resulting in conservation action.

Tourism as a Tool for Conservation

Nima Tashi Bhutia

General Secretary

Yambong Ecotourism Committee, Nambu
C/O TMI, Development Area, Gangtok.

Tourism provides a novel opportunity for the development of often remote, poor and resource rich mountain communities. Yambong Singalila, a remote village along the Rimbi watershed and at the door step of the Khangchendzonga National Park (KNP), is one of them. Since time immemorial nomadic yak herding and trade in medicinal and aromatic plants were the main source of livelihood for the villagers in this region. Yak herding is a single biggest threat to environment and impacts in the alpine eco region include use of Rhododendron and Juniper firewood in large quantities, poaching of wildlife, smuggling of endangered medicinal plants, trampling by yaks causing landslides, and dogs disturbing ground nesting birds and smaller mammals.

In early 2005, the local communities put in a joint effort to promote tourism along the Yambong Singalila Trek. To begin with the Yambong Ecotourism Committee (YEC) was constituted which comprised proactive youths. Starting in October 2005, Yambong Singalila received 17 overseas tourist groups with a total of 146 tourists. This gave a total income of Rs. 5.90 lakhs of which Rs. 2.98 lakhs went directly to the pack animal operators who were especially yak herders. A total of 146 porters from Nambu, Rimbick, Topung, Lungang, Singpheng, Sangkhola and Chongri earned an income of Rs. 2.84 lakhs.

Yambong Ecotourism Committee has been further trying to conserve Yambong Singalila thus by ensuring Eco friendly tourism practices. All yak herders and ranchers are now a part of this tourism venture and are associated with Yambong Ecotourism Committee. In 2005, there was more than 1200 yak, now after motivating them and also law enforcement this has gone down by 50% in just one year. But what is the present income source for those herders? Participating in Community Based Tourism they were able to earn almost the same as they used to earn from herding in 12 months. Now some of our ex-herders work as tourist guides, porters coordinator, assistant guide and earn a minimum of Rs. 250/day. The herders who used to depend on natural resources are now having earnings in a non-extractive manner. They also realize that tourism can sustain longer if nature is preserved. The impact of tourism are minimized at the most, the service providers have been given alternative fuel such as kerosene and kerosene stove to discourage them using firewood and, with the new Wildlife trekking rules the travels operators are motivated to bring back the garbage.

Institutional Participation

- Ashoka Trust for Research in Ecology and the Environment (ATREE)
- Department of Forests, Environment and Wildlife Management, Sikkim
- GB Pant Institute of Himalayan Environment and Development, Sikkim
- Kanchendzonga Conservation Committee, Yuksum, West Sikkim
- KEEP, Pastanga, Sikkim
- MLAS, Dzongu, North Sikkim
- National Hydroelectric Power Corporation
- Sálím Ali Centre for Ornithology & Natural History, Coimbatore
- Sikkim Development Foundation, Sikkim
- Sikkim Government College, Gangtok, East Sikkim
- Sikkim Tourism Development Corporation, Sikkim
- State Pollution Control Board, Sikkim
- The Mountain Institute, Gangtok, East Sikkim
- Voluntary Health Association of Sikkim (VHAAS)
- Wildlife Institute of India, Dehra Dun
- WWF-Sikkim
- Yambong Ecotourism Committee, Nambu, Sikkim

List of Participants

Workshop on Conservation and Management of Biodiversity in Teesta Valley September 16-17, 2006, Gangtok, Sikkim

No.	Name of the Participant	Address	e-mail	Phone
1	A.K.Tripathi	NHPC, Corporate Office, Faridabad	anilnhpc1@rediffmail.com	9312274509
2	Arjun Rai	KEEP, Pastanga, Sikkim		9434144161
3	ArunKr.Rai	Sikkim Government College, Gangtok	arunthulung@rediffmail.com	
4	Bhoj Kumar Acharya	SACON	acharya2_skm@rediffmail.com	
5	B.K.Sharma	Sikkim Forest Department		9434446266
6	B.K.Tiwari	AD, Sikkim Forest Department		
7	Basundhara Chettri	SACON	basundharachettri@yahoo.co.in	
8	Bhavana Rai	Sikkim Government College, Tadong		9434406969
9	Bhudiman Tamang	Sikkim Government College, Tadong	bmtamang@rediffmail.com	
10	Bikendra Kafila	Singtam, Sikkim		983213356
11	Bina Pradhan	Sikkim Government College, Gangtok		9434184002
12	Binod Adhikari	Chalamthang, Sikkim		
13	Birendra Rai	KEEP, Pastanga, Sikkim		
14	BishnuKumari Sharma	Sikkim Forest Department	bbbb_chamla@yahoo.com	9434446266
15	ChetaRam Sharma	State Pollution Control Board, Sikkim	crdabari@yahoo.com	9434485305
16	Chunda Sherpa	KCC, Yuksum, West Sikkim		9733194846
17	Chungchung Bhutia	Sikkim Government College, Tadong		9733217538
18	Dal Bd. Chettri	Sikkim Forest Department		
19	Dechen Lachungpa	ACF, Sikkim Forest Department		
20	Dipankar Ghose	WWF-India, Sikkim	dghose@wwfindia.net	9434061198
21	Dipendra Sharma	Sikkim Government College, Tadong		9832304133
22	Dorjee Chuzang Bhutia	Sikkim Government College, Tadong		9434863364
23	Dorjee Tsh. Sherpa	MLAS, Dzongu North Sikkim	dsongkup@yahoo.co.in	9434447601
24	Ganesh Chettri	Tadong, Gangtok	lalitchettri@yahoo.co.in	9841371202
25	Ganga Ram Adhikari	Sikkim Forest Department		9434488023
26	Gayatari Adhikari	Sikkim Government College, Tadong		9932296174
27	Grace Rai	Sikkim Government College, Tadong		
28	H.K.Badola	Scientist i/c, GBPIHED, Gangtok	hkbadola@rediffmail.com	9434153244
29	H.P.Pradhan	CF, Sikkim Forest Department		
30	J.P.Tamang	Sikkim Government College, Gangtok		9832061073
31	Jomeyung Bhutia	Sribadam, West Sikkim		
32	Joya Thapa	SACON	joyathapa@gmail.com	
33	Kamala Pradhan	Sikkim Government College, Tadong		3592320102
34	Karna Br. Gurung	Tashiding, West Sikkim		
35	Katherine Sangey Lepcha	ACF, Sikkim Forest Department		
36	Khusendra Bhandari	North Bengal University	khusen14_hind@yahoo.co.in	9434448156
37	Kinzong S. Bhutia	KCC, Yuksum, West Sikkim	kcc_sikkim@hotmail.com	9733158268
38	Kusum Gurung	ACF, Sikkim Forest Department	khusdee2005@yahoo.com	9474352909
39	L. Alley	Sikkim Government College, Gangtok		9434485870
40	Lak Tsheden Theengh	WWF-India, Sikkim	Laktsheden@hotmail.com	9434241477
41	Laku Tsh. Bhutia	Sindrabung, West Sikkim		973302352
42	Lal Bd. Chettri	Sikkim Forest Department		
43	Lalitha Vijayan	SACON	vijayanlalitha@yahoo.com	

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44	M.L.Arawathial	APCCF, Sikkim Forest Department		
45	M.P.Thapa	Sikkim Government College, Gangtok	madapthapa@yahoo.com	9434448670
46	Manoj Pradhan	VHAS, Tadong, Gangtok	vhas@sify.com	9832035324
47	Mitra Agarwal	Sikkim Government College, Tadong		
48	NamrataThapa	Sikkim Government College, Gangtok		9434144078
49	Nima Tashi Bhutia	YEC, Nambu	nima_star@hotmail.com	9733085127
50	P.K.Dong	CEO, STDC, Gangtok	pkdong2000@yahoo.com	9434012177
51	Pemba Sangey Bhutia	Sikkim Government College, Tadong		
52	Pradeep Kumar	CF, Sikkim Forest Department		3592280137
53	Prakash Adhikari	GBIHED, Gangtok		
54	Pratima Rawat	Sikkim Government College, Tadong		9434408566
55	Pravesh Subba	VHAS, Tadong, Gangtok	vhas@sify.com	3592271141
56	Preveen Thapa	Sikkim Development Foundation, Sikkim	sikkim.foundation@gmail.com	9932295553
57	Puja Basnet	Sikkim Government College, Tadong		9932506544
58	Puja Chettri	Sikkim Government College, Gangtok	pjs_c@yahoo.com	9434153340
59	Rajen Chettri	Sikkim Government College, Gangtok	razencht@gmail.com	
60	Ram Prasad Acharya	North Bengal University	ram24_sikkim@yahoo.com	
61	Ruksanur	Sikkim Government College, Tadong		9832315643
62	S.B.Subedi	Hon'ble Forest Minister, Govt. of Sikkim		
63	S.Bhupathy	SACON	sb62in@yahoo.co.uk	
64	S.K.Pradhan	Principal, Sikkim Government College	skpzoo@yahoo.co.in	9832376345
65	S.Lama	State Planning Commission, Sikkim		9832032720
66	Sagar Chettri	NOW, Daily	sikkimnow@rediffmail.com	
67	Sandeep Tambe	The Mountain Institute, Gangtok	stambe@mountain.org	9733091853
68	Sandhya Jain	Sikkim Government College, Tadong		
69	Sandhya Rai	Sikkim Government College, Tadong		943457689
70	Sanjay Kr. Rahut	Sikkim Forest Department		
71	Santosh Basnet	Sikkim Government College, Tadong		
72	Santosh Kr. Chettri	ATREE, Kalimpong	santoato@nmia.com	9434486130
73	Satyadeep Chettri	Sikkim Government College, Gangtok	satyadeepchettri@rediffmail.com	9434153131
74	Sonam Ongmu Sherpa	Sikkim Government College, Tadong		
75	Sonam Thundup Bhutia	Sikkim Government College, Tadong		9434866517
76	Sonam Tsh. Sherpa	Ranka Sangtong, Sikkim		9832083644
77	Srijana Sharma	Tadong, Gangtok	dosirachna@yahoo.co.in	9832506768
78	Subash Sharma	Sikkim, Manipal University, Gangtok		
79	Sujit Rai	SNOD Complex, Sikkim		
80	Sumit Lepcha	Sikkim Government College, Tadong		9733235662
81	T.B.Subba	R.O. Barshey Rhododendron Sanctuary		9434256950
82	T.P.Bhattarai	Samai Dainik, Gangtok		9434409965
83	T.P.Sharma	Sikkim Forest Department		
84	T.R.Poudyal	PCCF, Sikkim Forest Department		
85	Usha Lachungpa	SRO, Sikkim Forest Department		9434025273
86	Yog Needhi	Pakyong, Sikkim		
87	Yuraj Gurung	Sikkim Government College, Gangtok	uraj_g@rediffmail.com	

