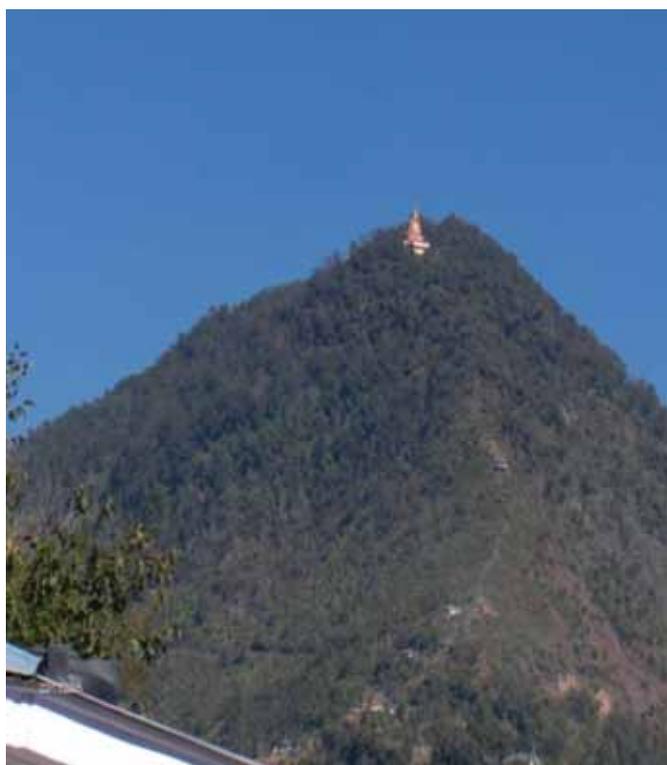


DEVELOPMENT AND PROMOTION OF ECO-TOURISM IN SIKKIM

S.B.S. Bhaduria IFS

Secretary Tourism, Government of Sikkim, Gangtok



The main objective of this is to promote Sikkim as preferred destination for visitors and provides opportunities for Community Based Ecotourism (CBET) in Sikkim particularly using latest approaches of Participatory Forestry Management for sustainable development of the Forests and thereby generates revenue for the State. A harmony is to be fostered between people, environment, conservation and development. ***The involvement of local communities in the tourism (called 'eco-tourism' herein after) would support their livelihood needs and consequently create their direct stake in conservation of local culture, ecology and environment.*** "This concept of 'community based eco-tourism' would go a long way in providing better income generation options to the rural people. This would also mean less dependence upon the natural resources in as far as it amounts to removal of

produce from these areas. There would be, moreover, greater incentive in conservation of local traditions, culture, heritage and environs, as these would be seen as aiding in local economy rather than an impediment to it."

Ecotourism is:

"Responsible travel to natural areas that conserves the environment and improves the well-being of local people." (TIES, 1990)

The Responsibilities of Ecotourists & of the Host Community

If a community wants to host ecotourism, it has a central role to play. The host community's success in bringing ecotourism to it and ensuring that the level and type of tourism is compatible with the community's aspirations are matters the community can control.

- Help conserve habitats of flora and fauna as well as any site, natural feature or culture, which may be affected by tourism.
- Make no open fires and discourage others from doing so. If water has to be heated with scarce firewood, use as little as possible. Where feasible, use kerosene or fuel-efficient wood stoves. Remove litter, burn or bury paper and carry back all non-degradable litter.
- Keep local water clean and avoid using pollutants such as detergents in streams or springs. If no toilet facilities are available, relieve yourself at least 30 metres away from water sources and bury or cover the waste.
- Leave plants to flourish in their natural environment and avoid taking away cuttings, seeds and roots.
- Leave campsites clean after use.
- Help guides and porters to follow conservation measures.
- Do not allow cooks/porters to throw garbage in streams or rivers.
- Respect the natural and cultural heritage of the area and follow local customs.
- Respect local etiquette and do not wear tight-fitting clothes. Remember that kissing in public is disapproved of in India.
- Respect privacy of individuals and ask permission to take photographs of local inhabitants.
- Respect holy places; do not touch or remove religious objects.
- Strictly follow the guidelines for personal safety and security and always take your own precautions and safety measures.
- Realize and respect the value of the environment, the flora and fauna, the monuments and your cultural heritage.
- Practice conservation of nature and culture as a way of life.
- Establish guidelines to protect valuable local

resources and foster tourism management.

- React to the potential threat of investors who see opportunities in development but lack sensitivity to local values.
- Become effective nature guides and conservationists of natural areas by utilizing practical and ancestral knowledge of the natural features of the area.
- Be friendly to the visitors and help them to practice ecotourism principles.

Finally there is a role for others, such as scientific and research institutions and non-government organisations, in promoting ecotourism. The things they can do include: (i) create awareness, among all concerned, about the importance of sound eco-practices in tourism development; (ii) motivate the local community to increase their involvement in sustainable tourism activities; and (iii) organize training programs to prepare the local people to take up various vocations related to ecotourism.

Motivations for Involvement in Ecotourism

Hotel and travel companies in our country function in a relatively free environment. The country is slowly but surely moving towards a market economy where commercial considerations dictate motivation for the private sector to take up various activities. Crass commercial considerations have, however, to be controlled by the government on behalf of the public. The environment has to be protected through awareness-generation, legislation, policy and administrative action.

The travelling public is also becoming conscious of the need to protect the environment, to some extent at least. As a result, many enterprises in the hospitality sector have adopted environment-friendly practices like conserving energy and water and recycling unutilized hotel outputs. These can be powerful marketing tools for hotel groups. Furthermore, with the increase in cost of vital inputs like energy, water etc., companies are motivated to conserve limited resources by adopting practices which reduce levels of consumption. Many hotel companies advise their clients to be careful in the use of lights, water and other hotel services. Civil society has also begun to exercise control over the environment.

Many non-government organisations have been generating awareness about environmentally destructive practices. Individuals have taken recourse to public interest litigation to stop environmentally

destructive practices. The print and electronic media have been very active in India in investigating environmentally injurious activities by highlighting such issues and creating public opinion for environmentally compatible practices.

The Ministry of Tourism has issued ecotourism guidelines for adoption by all concerned introduced an ecotourism pledge which requires their members to adopt environment-friendly practices. Conclusion Tourism has proved to be an engine of growth in many economies in the world. It provides for the generation of income, wealth and employment, and helps in the sustainable development of remote areas. In Sikkim, tourism provides direct employment to more than 40,000 people (minimum) and indirect employment is substantial. Its contribution to the economy of state is significant.

India is recognized as one of the 12 mega diversity centres of the world. India has two out of the 18 BIODIVERSITY hot-spots in the world, which are in the Western Ghats and Eastern Himalayas. Sikkim, covering just 0.2 % of the geographical area of the country, has tremendous biodiversity and has been identified as one of the HOT-SPOT in the Eastern Himalayas.

The Sikkim Himalayas falls under the Himalayan (2) Bio –geographic Zones and Central Himalaya (2C) Biotic Province. As per the Champion & Seth 1968 new classification of Forests Typesp about 9 Types of Major Forests Types are found in the State. Sikkim Himalayas has more than 26% of flowering plants of the country and is very important phytogeographical reserve of the country.

- There are 10 bio-geographic zones & 25 biotic provinces--- which have 16 major forests types & > 200 sub types as per (Champion & Seth 1968).
- Sikkim falls under “Himalayan (2) Biogeographic zone & Central Himalaya (2c) biotic province--- having about 9 types of forests types (Champion & Seth).

1. Forest Area Details as per the State Records:

Total geographical area----- =7096 sq. kms.
 Recorded forest land:
 1. (A) Reserved Forests----- =2261 sq. kms.

Biodiversity	Nos
Flowering Plants	4500
Orchids	515
Rhododendrons	36
Conifers	16
Bamboos	23
Ferns and Ferns allies	362
Tree Ferns	8
Primulas	60
Oaks	11
Medicinal Plants	424
Mammals	150
Birds	552
Butterflies	690
Fishes	48
Mountain & Peaks	28
Glaciers	21
Lakes and Wetlands	227
Rivers and Streams	>104

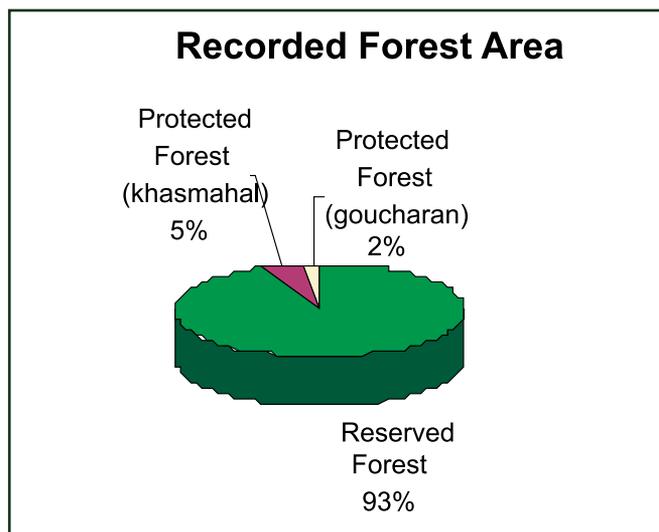
(B) Khasmal Forests----- =285 sq. kms.

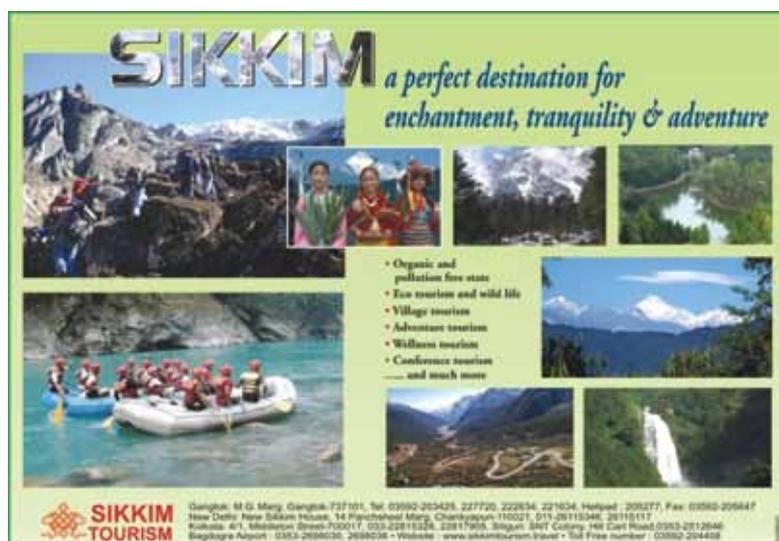
(C) Gorucharan Forests----- = 104 sq. kms.

Total = 2650 sq. kms. = 37.34%

2. Area under alpine pasture & scrub-(RF) = 1024 sq. kms. = 14.44 %
3. Area under perpetual snow cover (RF) = 2091 sq. kms. = 29.5

Thus the total recorded forest land in the state > 81.28 % of total geographical area and the Revenue area =1643.59 sq Kms





SIKKIM FOREST AREA AND FOREST COVER and ECO-TOURISM

2. As per the Remote Sensing Data 1988: Area statistics for total state (in sq. Kms.)

Sl. No.	CLASS	RESERVE FOREST	REVENUE BLOCK	TOTAL	%OF TOTAL
1	Crop land (Terraced/Semi Terraced)	0.00	604.85	604.85	8.52
2	Fallow/Scrub in Revenue Blocks	0.00	155.69	155.69	2.19
3	Sal dense forest	5.30	0.77	6.07	0.09
4	Sal open forest	15.93	1.54	17.47	0.25
5	Sal degraded forest	3.32	0.71	4.03	0.06
6	Mixed dense forest	464.46	138.88	603.34	8.50
7	Mixed open forest	433.37	333.38	766.75	10.81
8	Mixed degraded forest	194.56	235.06	429.62	6.05
9	Dense conifer forest	351.94	16.14	368.08	5.19
10	Open conifer forest	340.63	21.55	362.18	5.10
11	Degraded conifer forest	156.89	16.30	173.19	2.44
12	Oak-Rhododendron forest	100.34	26.24	126.58	1.78
13	Scrubs in reserve forest	101.87	0.00	101.87	1.44
14	Forest blanks	90.56	0.00	90.56	1.28
15	Alpine scrub	611.44	27.72	639.16	9.01
16	Alpine pastures	431.32	0.00	431.32	6.08
17	Alpine barren	815.80	2.35	818.15	11.53
18	Snow	1018.23	5.41	1023.64	14.43
19	Glaciers	208.23	0.00	208.23	2.93
20	Lakes	32.30	0.70	33.00	0.47
21	Rivers/major streams	31.81	32.50	64.31	0.91
22	Dry river beds	31.49	9.10	40.59	0.57
23	Built-up area	0.30	3.24	3.54	0.05
24	Land slide areas	5.37	5.16	10.53	0.15
25	Miscellaneous	6.93	6.30	13.23	0.19
	TOTAL	5452.39	1643.59	7095.98	100.00

3. As per the Forest Survey of India (FSI): The recorded forest area in the State is as under:

(Area in sq. kms)

Geographic area	Reserved Forests	Protected Forests (Khasmal)	Protected Forests (Gorucharan)	Recorded Forests of State's Geographic area		Of Country's Forest area
7,096	5,452.39	285	104	5,841.39	82.31%	0.75%

The recorded forest area of the State is 5,841 km², constituting 82.31% of the geographical area of the State. Legally this area has been classified into Reserved Forest and Protected Forest, which constitute 93.34% and 6.66% of the forest area respectively.

Wildlife (Protected Area Network):

Sl. No.	Name	Area in Sq km.	District	Biogeographic Province	Altitude	Notification Dated
1	Barsey Rhododendron Sanctuary	104.00	West	2 C	2200-4100m	08.06.96
2	Fambong Iho Wildlife Sanctuary	51.76	East	2 C	1524-2749	02.04.84
3	Kyongnosla Alpine Sanctuary	31.00	East	2 C	3292-4116m	05.12.92
4	Maenam Wildlife Sanctuary	35.34	South	2 C	2300-3263m	09.03.87
5	Pangolakha Wildlife Sanctuary	128.00	East	2 C		07.11.00
6	Shingba Rhododendron Sanctuary	43.00	North	1 B	3048-4575m	05.12.92
7	Khangchendzonga National Park	1784.00	North/West	1 B		26.08.77
8	Kitam Bird Sanctuary	6.00	South		320-875	03.02.05
	Total area	2183.10				
	Total Geographical area of State	7096.00				
9	Khangchendzonga Biosphere Reserve	2620.00	North/West	1 B & 2 C	2725-5537	17.05.97
	National Park (as core area)	1784.00	North/West			
	Buffer area	836.00	North/West			

NOTE:

1. Protected Area Network does not include area under buffer zone of a biosphere reserve.
2. Total area under Protected Area Network of State is 2183.10 sq. km. (i.e. 30.77% of the total geographical area of the State).
3. Total area under Protected Area Network including the buffer zone of biosphere reserve in State is 3019.10 sq. km. (i.e. 42.55 % of the total geographical area of the State).
4. Total protected area including the biosphere reserve area = 51.68 % of the total recorded Forest area of the State.

FOREST LANDS, AREAS, LOCATIONS & ECO-TOURISM

For promotion and development of eco-tourism in forest areas, it is not required that entire forest area would be used in any location. Only a small degraded or barren land may be put to the use along with the landscaping, plantation, regeneration and protection components which would be jointly managed by the Tourism Department and Forest Department for which no specific diversion may be required. For specific project only diversion may be considered. The areas which are reserved for any specific conservation programme would not be proposed.

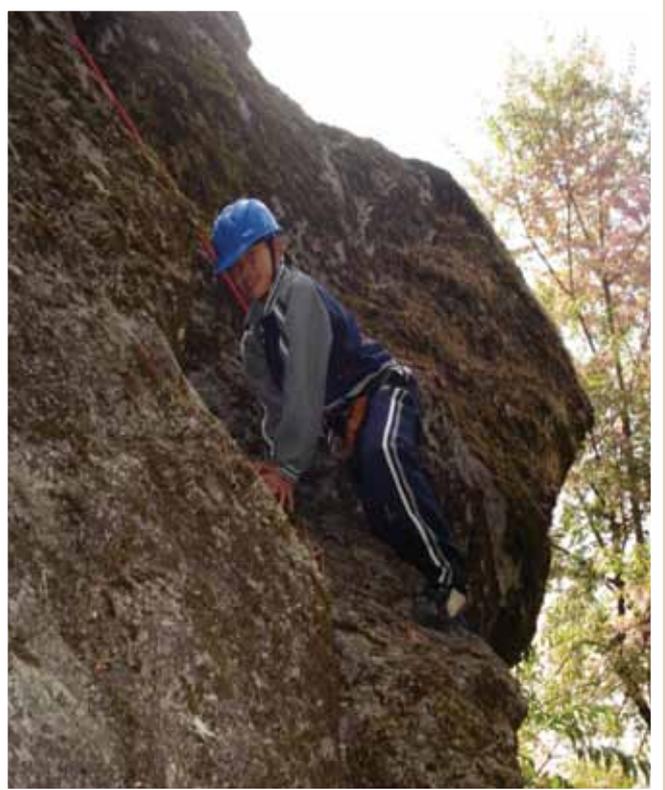
There would be no major construction programme other than which is minimum required for Tourism and Forest management as well may only be taken up. Reserve Forests, Khasmal Forests, Goucharan Forests, National parks, Sanctuaries, Biosphere reserve, Lakes/water bodies and other forest lands may be involved only in limited under the joint management concept. There would be no felling of any trees while the and plantation would be an integrated part of the programme. For each location and area the impact assessment shall be done on annual basis and necessary corrective and improvement programme shall be taken up immediately.

IMPORTANT COMPONENTS OF ECO-TOURISM PROJECTS:

For the promotion and development of Eco-tourism, the activities to be taken up would be eco-friendly and they would be also used for management, conservation, regeneration of Forests, Environment and Wildlife in the area and in the State as well. Some of the important components of eco-tourism programme are:

- Improvement of surroundings of the destination. This would include activities like landscaping, development of parks, fencing, compound wall etc.
- Illumination of the Tourist destination
- Providing for improvement in solid waste management and sewerage management, Public Conveniences etc.
- Improvement of road connectivity leading to the tourist sites, especially from the National Highways/State highways and other entry points.
- Construction of Wayside Public Conveniences.
- Construction of Budget Accommodation, Restaurant & Wayside Amenities
- Procurement of equipments directly related to tourism, like Water Sports, Adventure Sports, Eco-friendly modes of transport for moving within the Tourism Zone
- Refurbishment of the Monuments.
- Signages and display boards showing Tourist Area Maps and documentation on places of interest at the locations.
- Tourist Arrival Centers, Reception Centres, Interpretation Centres.
- Improvement of municipal services directly related to Tourism.
- Other work/ activities directly related to tourism.
- Improvement of the surroundings of the village. This would include activities like landscaping, development or parks, fencing, compound wall etc.
- Improvements to roads within the Panchayat limits. This shall not include any major road which connects the village.
- Illumination in the village.
- Providing for improvement in solid waste management and sewerage management.
- Construction of Wayside Amenities.

- Procurement of equipments directly related to tourism, like Water Sports, Adventure Sports, Eco-friendly modes of transport for moving within the tourism zone.
- Refurbishment of the Monuments.
- Signages.
- Reception Centres.
- Other work/activities directly related to tourism.
- Tourist Accommodation
- Trekking route, mountain biking, skiing, Adventure in general



Tourist Facilities

- Develop rules and Regulations in consultation with the Division level coordination Committee. These rules will be site-specific (a FRH/camp site in remote area may have different set of rules as compared to the FRH/camp site located on the roadside).
- The rules will incorporate items such as FRH/camp-site/film-shooting fee, Do's and Don'ts in nature, and other locality specifics. Display the rules and regulations at the prominent points in English and Local language

- Conduct regular surveys for the tourists coming to a popular `Heritage FRH'/forest trails/other FRH/camp-sites/film-shooting grounds. They may be Backpackers who rely mostly on local availability of food, shelter and other services, such as school children, NCC cadets, trekkers from Youth Hostel of India, some tight-budget foreigners; Do-it-yourself Trekkers who come prepared with own food, tents, etc. A number of foreigners are in this category, and Pre-planned Trekkers with pre-planned, organized trips, which are executed by a trekking agency. Develop plans to cater to these trekkers, accordingly.
- Ensure safeguards/regulations to various activities are followed earnestly and the f Laws/ rules/regulations in this respect are followed.
- Invest timely in infrastructure e.g. timely repairs/maintenance of FRH, trekking routes, bridle paths, etc. Conduct regular scouting trips arranged by the Division level Coordination Committee on different routes through the forest/Wildlife areas (PAs) and report back on trail conditions, wildlife, forest use, littering by trekking groups, etc.
- Improve the waste disposal around `Heritage FRH'/forest trails/other FRH/camp-sites/film shooting grounds.
- Wherever needed, use alternative energy sources e.g. indane cooking gas, solar lights, solar geysers, green houses. Introduce fuel sufficiency rule, whereby LPG will be used in the kitchen and firewood will be provided for the fire-places in FRH rooms (which is in good demand from the tourists).
- Let there be dedicated firewood plantations in association with the HPFD (about 10,000 trees of fast growing firewood species per hectare to be planted in three to ten hectares for each FRH, and develop a rotation so that the wood is available on annual basis) for the selected / prioritized FRHs and camping sites. Let tourists pay for this facility. Till it happens, make alternative arrangements
- Create herbal gardens of local medicinal plants with information about plants, their uses. A well maintained medicinal plant nursery is part of nature conservation education and a big attraction for the tourists.

Management Committee of Forest Division level/ Wildlife Division level/ Divisional Engineer level:

The Division level coordination shall be done by Management Committee comprising of DFO(T)/DFO(WL)/FD (KNP) and DE/AE (Tourism Department) with local Tourism Committee

Revenue and Investment in site for development:

Since, the objectives are clear like: minimize impact, build environmental and cultural awareness and respect, provide positive experiences for both visitors and hosts, provide direct financial benefits for conservation and to local people and hence the revenue sharing model for each project may be worked out on case to case basis and location to location basis which shall be used for site in question only. The Government may be approached to create the specific budget head for all such locations and the revenue received shall be utilized for such sites only. **This concept and prescriptions may apply to all the four districts/divisions East, West, North and South with specific conditions for area specific.**



म ताक्छु मुढो

- के० एन० शर्मा

आमाकेँ काख के होइन खाटमाथि सुताउने
देहेँ निर्धक्क पोलेर हाक्रो खाना पकाउने
इत्रेका फूल लौ हेर तरुणी कुरकुराहट
बोकेर बच्चरो दाजै कता हिँड्यौ फटाफट ।।

ज्यानेँ थुपुक्क थाकेको मेटिने शीतलो बर
गाएर गीत दोहोरी रचौला प्यारको घर
झकाफल पाक्योङ्ग नसुन्दामा लाग्छ नी कति अस्पष्ट
बोकेर बच्चरो दाजै कता हिँड्यौ फटाफट ।।

टिठ्याउने धुधा प्यार मायालु भूल औ फल
मधौरु ताँग्रिने गर्छ पिएर ओखाति जल
उमर्को हुन्छ झैँ लाग्छ देखेर यो सफाचट
बोकेर बच्चरो दाजै कता हिँड्यौ फटाफट ।।

ज्यूँदोको आबरु ढाक्ने गरे संस्कार दाहन
स्यालकेँ हुल्ल के खाजा मारिए यो सबै वन
यस्तो आसन्न आशंका सख्दैत किन त्यो घट
बोकेर बच्चरो दाजै कता हिँड्यौ फटाफट ।।

आऊ आज मिलेरौ लौ सबैले कल्पना गरौं
उद्भिद छाडी अरुले नै समग्र विश्व यो भरो
घरै पोल्थौं भने छ के खरानी निमित्त छट्पट
बोकेर बच्चरो दाजै कता हिँड्यौ फटाफट ।।

THE TREE



When rain came lashing on you with full fury,
You managed even without an umbrella.
And the dust of the soil and dirt,
Covered the leaves blocking the stomata,
You might have trouble breathing,
And also getting food from the Sun.

Neither had you asked for a blanket,
In the night of winter's chilled cold,
Nor did you ask for a cooler,
In the hottest days of summer.

Those days when autumn arrived,
I envied the richness of your golden fruits,
And each time while passing by,
I injured you by throwing stones,
Each time, you sent down fruits from you.

You gave me shade when hot on head,
You gave fresh air to me to breath,
You protect the soil and make it fertile,
For the food which we eat and the water to drink,
Oh tree! No one can be alive without you,
But you can live without me.

When my body was brought to the funeral pyre,
My dearest shed a tear once or twice,
But you came quietly as wood,
And flamed yourself laying with me.

To avoid this all, I thought I had better,
Wished to have been buried on my death,
To add the nutrient to the mother earth,
You would have come as my coffin,
To be with me together for eternity.

D. C. NEPAL, JOINT DIRECTOR

IMPLEMENTATION OF NATIONAL AFFORESTATION PROGRAMME IN SIKKIM- SUCCESS STORIES OF JFMCs WORKING UNDER WEST TERRITORIAL DIVISION

Anjan Kumar Mohanti, IFS • Brijendra Swaroop, IFS • Ravikumar, IFS



ANR Works (Seed Dibbling- Nambu JFMC)

BACKGROUND:

The scheme National Afforestation Programme (NAP) has been formulated by merger of four 9th Plan centrally sponsored afforestation schemes of the Ministry of Environment & Forests, namely, Integrated Afforestation and Eco-Development Projects Scheme (IAEPS), Area Oriented Fuel wood and Fodder Projects Scheme (AOFFPS), Conservation and Development of Non-Timber Forest Produce including Medicinal Plants Scheme (NTFP) and Association of Scheduled Tribes and Rural Poor in Regeneration of Degraded Forests (ASTRP), **with a view to reducing multiplicity of schemes with similar objectives, ensuring uniformity in funding pattern and implementation mechanism, avoiding delays in availability of funds to the field level and institutionalising peoples participation in project formulation and its implementation.**

Long-term objectives of National Afforestation Programme:

- Protection, Conservation of natural resources through active involvement of the people.

- Checking land degradation, deforestation and loss of biodiversity.
- Ecological restoration and environmental conservation and eco-development,
- Evolving village level people's organisation which can manage the natural resources in and around villages in a sustainable manner,
- Fulfillment of the broader objectives of productivity, equity, and sustainability for the general good of the people.
- Improve quality of life and self-sustenance aspect of people living in and around forest areas.
- Capability endowment and skill enhancement for improving employability of the rural people.

Joint Forest Management is a recent phenomenon in Sikkim and the same came into being vide notification no. 202/F dated 26/6/1998 soliciting people's participation in protection, rehabilitation and development of degraded forest areas mainly Khasmal



Control burning of Zoom RF during dry season- JFMCs of Dentam Range and Zoom JFMC

& Gorucharan and simultaneously meeting the bonafide needs of the people regarding small timber, fodder, firewood and minor forest produce. This new approach of forest management has brought a paradigm shift in management of forest areas facing acute biotic pressure due to increase in population and consequently ever increasing needs. ***The sea change in approach is from looking people and forest as antagonistic mutually and the new way of management is building long term partnership between forest and people*** for its protection, development and regeneration. This approach requires sharing of duties, powers, functions and responsibilities with people, which earlier was sole responsibility of the Department of Forests, Environment and Wildlife Management.

The onset of this new management practice has opened new areas, which have never been explored before. Working in forest areas with ***people's participation*** is an approach, which requires ***changes in the mindset of the officials, field level functionaries and people participating.***

The advent of this concept in West Sikkim was in the beginning of 2003 when 38 JFMCs on the fringe areas of forest were constituted and registered for the implementation of the "West Sikkim Forest Development Agency" project under NAP (National Afforestation Programme). The constitution of the committees was a mandatory

requirement as per the FDA guidelines issued by NAEB, MOEF, Government of India. After constitution of JFMCs with wide mass base, ***micro-planning exercise with PRA tools of each JFMC was carried out in detail with the help of a NGO KCC, Yuksum.*** During micro-planning objectives of the project with details and specific inputs on duties, functions of each JFMC regarding forest protection & rehabilitation was provided to the people.

The ***participatory mode of working of forest areas has ingredient of people understanding forest as common property resource*** rather resource belonging to the government. Tangible benefits from forests also started accruing to the public like generation of gainful employment in village itself etc. All round involvement of people in forestry activity as per their micro-plan with putting them as local natural resource manager has transferred the responsibility of taking care of the forest areas in their vicinity. This transformation has provided solutions/assistance in major problems faced by field level managers like illicit felling, issues related with grazing in forest areas, encroachment of forestland, forest fire etc. In fact, the perception of common property resource has also motivated people to seek equitable access to natural resources and equitable distribution of benefits accruing out of natural resources on the basis of sustainable use.



Removal of cardamom encroachment Bhutey Khasmal- Martam Mazgaon JFMC

ACHIEVEMENTS/SUCCESS STORIES:

Few examples of West Territorial Division as reported from different Ranges and JFMCs are provided in a tabular manner, where JFMCs have provided assistance or taken up lead in forest protection related issues:

Forest Fire Related Issues			
1	Begha-Mangmoo & Sankhu JFMC	Detection, information transmission & Control of huge forest fire in third week of Feb 2005 in Chitrey Ghairi Barsey Wild Life Sanctuary. (21 st Feb, 2005 to 23 rd Feb, 2005)	Mobilization of people of the villages, students in control of forest fire, which was spread over an area having geographical extent appx 80 ha.
2	All JFMCs of Dentam Range and Zoom JFMC	Control Burning of strip along Zoom – Nayabazaar Road (preventive measure) which is fire prone area of Zoom RF. (11/3/05)	Voluntarily taken measure has resulted in reduction of fire incidence from one of the most vulnerable fire prone area of West Sikkim in the last forest fire season. This work was achieved without incurring money from government exchequer.
3	G y a l s h i n g Omchung & Kyongsa JFMC	Control of forest fire on 11/1/2005 & 20/2/2005 in Rethang RF & Srithang RF	Mobilization of people of the villages in beating the forest fire and creation of temporary fire lines to check the spread.
4	Sakyong JFMC	Control of forest fire in Sakyong Khas	Mobilization of people of the villages in beating the forest fire and creation of temporary fire lines to check the spread.
Assistance in Eviction of Encroachment from forest land			
1	Nambu JFMC	Removal of encroachment from Nambu Gorucharan of extent approximately 3 ha	Area was encroached by Aita Raj Subba, Nupu Passang Bhutia, Lama saila Bhutia by putting cardamom in Gorucharan. The encroachment was removed through convincing them and later on WSFDA afforestation works were carried out by the JFMC.
2	Martam Mazgaon JFMC	Removal of encroachment from Bhutey Khasmal of extent approximately 2 ha	The encroachment of Phurba Sherpa was removed through convincing them and later on WSFDA afforestation works were carried out by the JFMC. The cardamom plantation inside Khas was removed. Shri Passang Namgayal Bhutia JFMC member has done commendable work in removal of cardamom encroachment.
3	L u n g c h u k Solongdong JFMC	Removal of encroachment from Solongdong Khasmal of extent 1.197 ha	The encroachment was removed through pressure from JFMC and Panchayats and area was handed over back to the FEWMD.
4	Simpheing JFMC	Eviction of encroachment at Paireny Khas and Mandaney RF	The encroachment was removed through convincing them and later on WSFDA afforestation works were carried out by the JFMC.
5	Tashiding JFMC	Removal of Mali house (wind up nursery of RVP) from Lasso Khasmal	Through combined pressure of JFMC and West Territorial Division Mali house inside Khasmal was removed and Artificial Regeneration works of FDA were taken up.
Control in Grazing/Removal of Cattle sheds from forest areas			
1	All JFMCs and EDCs working in West Sikkim	Removal of 122 Yak sheds from high altitude forest areas existing on Singalala Ridge	A mass operation starting from Hilley to Dzongri was carried out and eviction process was duly supported by the Panchayats, members of JFMCs and EDCs.
1	M a n e b o o n g Sopakha JFMC	Removal of 6 cattle shed from Sopakha RF with individual location at Darwa RF, Meshkharka, Kazi Barkhey, Bhalumarey, Kanthey, Majbarkheng	Name of the illegal cattle shed owners whose cattle shed was removed with the active support of JFMC are Shri Harka Bdr Subba, Shri P Subba, Shri Maker Lall Subba, Shri Mani Raj Rai, Shri Chandra Bdr Rai, Shri Bal Ram Subba. This removal took place in the summer of 2004.
2	Yuksum JFMC	Removal of 2 Yak shed from buffer RFs of KNP in June 2005 (Doban RF)	Name of the illegal cattle shed owners whose cattle shed was removed with the active support of JFMC are Shri Sonam Bhutia and Ms Doma Bhutia. Through constant persuasion of JFMC and pressure from territorial field staff, livestock has been sold outside Sikkim.
3	Nambu & Simpheing JFMC	Removal of cattle shed from Simpheing RF, Sliganey, Protokley, Laxmi chok, Bukchuley, Aglochok, Jowbari, Lalichok	Through constant pressure from JFMC these cattle shed have been removed and JFMC have taken up plantation works as per microplan in these areas.

4	Sindraboong JFMC (Non FDA JFMC)	With the help of TMI, Gangtok a change in attitude is being felt in cattle rearing village of Chowri, through establishment of dairy stall feeding has initiated and cattle shed herder are now ready to take up ecotourism and dairy as livelihood instead of age old practice of migratory cattle grazing.	
As per the independent survey of TMI, it has been observed that high altitude grazing has reduced by around 25% and reduction in cattle is around 20% on Singalila ridge in last two years.			
Monitoring & Evaluation Report of FDA Submitted by M/s Naensy Associates, Jam Nagar appointed evaluators of NAEB, MOEF, GOI, New Delhi has also pointed out role of JFMCs in removal of encroachment and cattle shed from forest areas.			
Illicit Felling Related Issue			
1	G e e t h a n g Karmatar Pherek JFMC	Detection of Illicit felling in Pherek RF.	Illicit felling of 4 Champ, 3 Katus tree was detected and JFMC helped us in apprehending seven accused Sandup Lepcha, Tendup Lepcha, Dup Tshering Lepcha, Pemba Lepcha, Gyaltso Lepcha, Laku Tshering Lepcha and IB Rai. The accused were send to Rongyek Jail. The case is under investigation.
2	Rimbik & Sindraboong JFMC (Non FDA JFMC)	Detection of Illicit felling in Lungyang RF	Illicit felling of 5 Champ, 5 Sissi tree was detected and JFMC helped us in apprehending four accused Suk Lal Subba, Suk Bdr Subba, Santa Bir Subba, Nima Bhutia. The accused were send to Rongyek Jail. The case is under investigation.
Poaching or Wildlife related issues			
1	Sangadorjee JFMC	Detection of barking deer hunting in Tafel Gangep Forest and information to Wildlife Division West Sikkim	

CONCLUSION:

These examples clearly indicate that there is a viable chance of adoption of Joint Forest Management concept and people are willing to share responsibilities with Department. Conservation of natural resources is not sole prerogative of FEWMD it certainly requires more local support especially from forest fringe population. Few relevant areas where Department and policy makers can focus in coming future to strengthen Joint Forest Management are:

- Devolution of more power and responsibilities in cases of minor forest offences to JFMCs/EDCs. This issue will require major changes in JFM notification and dove-tailing JFM notification with SFA-1988.
- Change in attitude of forest managers, frontline staff through training.
- Capacity building of JFMCs to make them more effective in solving forest related issues & conflict resolution at the village level.
- Provision of alternate livelihood to forest fringe population to move them from unsustainable practices towards sustainable through developing linkages in implementation of various schemes and obtaining synergy.

Though this will be premature to conclude that JFM is panacea to all problems/issues related to forestry sector of Sikkim till this working sustains for a longer period i.e. minimum one decade and symbiosis between forest and people is established. This issue is just like wet clay whose destiny is in the hands of artisan.



STATE MEDICINAL PLANTS BOARD

THINLAY GYATSO BHUTIA

ACTIVITIES

In order to develop & conserve the existing Medicinal plant resources available in the state and their sustainable use, the State Medicinal Plant Board is implementing schemes such as Promotional and Contractual Farming funded by the NMPB.

Promotional Scheme

Objectives

1. To disseminate awareness about importance of Medicinal Plants
2. To survey and inventorise medicinal plants
3. To promote In-Situ & Ex-Situ Cultivation & conservation of Medicinal Plants for production of quality planting materials
4. Research and Development of Medicinal Plants
5. To promote co-operative efforts amongst growers and collectors of the medicinal plants



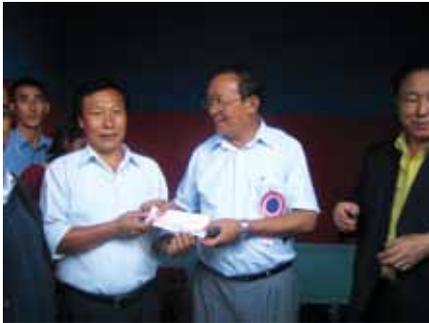
The State Medicinal Plants Board (SMPB) was set up under Forest, Environment and Wildlife Management Department, Government of Sikkim as a state level body by Notification no. 100/FEWMD dated 10th June 2002 as per guidelines issued by

National Medicinal Plants Boards, Department of AYUSH, Govt. of India.

OBJECTIVE

1. To look after the formulation of policy for development of medicinal plants in the State,
2. Co-ordination with other departments & organizations, relating to the matters of developments,
3. To promote sustained availability of Medicinal plants and its sustainability use.





- Herbal Gardens: 13 Herbal Gardens and Herbal Nurseries established (*Ex-Situ* cultivation) under this scheme in 2002-2003 for production of quality planting material

Locations of Herbal Gardens (10 Ha each; total 130 Ha)

North District

- Dombang Valley
- Thangu RF
- Zema RF

East District

- Rateychu RF
- Tamzey RF
- Kongnosla RF

South District

- Samduptse RF
- Kitam RF
- State Biodiversity Park, Tendong
- Maenam Wildlife Sanctuary

West District

- Guransay/Nunthalay
- Barsey Rhododendron Sanctuary.
- Yuksam/Khechiiperi RF

Total = 130 Ha.

Commercial Scheme: Contractual farming: Under this scheme 30%

subsidy is provided by NMPB as financial assistance for cultivation of Medicinal Plants in private holdings by farmers for commercial purpose.



Objectives

- To produce and ensure supply of quality planting materials in bulk



- Area expansion for cultivation of selected species of medicinal plants (more than 2 Ha)
- Value Addition – for developing proper

harvesting technique and semi processing units such as collection, grading, drying, storage and packing etc.

- Development of marketing mechanism

NMPB has identified and prioritized 32 species which has been now extended to 58 species for cultivation by farmers. Out of these species the State Medicinal Board has identified and prioritized 10 species which are suitable for cultivation by the farmers.

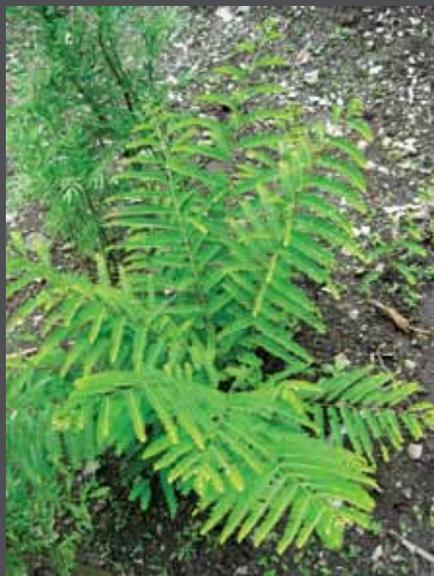
Low Altitude

- Asparagus racemosus* (N-Kurilo, H-Shatavari)
- Gloriosa superba* (N-Longurey tarul, H-Kalihari)
- Stevia rebaudiana*-(Stevia)
- Ocimum sanctum*-(Tulsi)

High Altitude

- Aconitum heterophyllum* -(Attes)
- Aconitum ferox*-(Bikh)
- Picrorhiza kurrooa*-(Kutki)
- Nardostachys jatamansi* - (Jatamanasi)





v. *Swertia chirata* - (Chirata)
 vi. *Piper longum* - (Pipla)

3. Shatavari - 89.00
 4. Stevia - 7.00
 Total - 175.20

8. Sarpagandha - 5.00
 Total - 254.50

GRAND TOTAL - 837.83

During 11th Five Year Plan 45 (forty five) nos. of Contractual Farming Projects were approved by NMPB in the year 2007-2008

North District: Acres
 1. Atees - 51
 2. Chiraita - 6
 3. Kutki - 18
 4. Jatamansi - 3
 Total - 78

District Wise Area under Cultivation of Medicinal Plants from 2003-04 to 2006-07

North District Area in Acres
 1. Atees - 110.98
 2. Chiraita - 5.00
 3. Jatamansi - 15.00
 Total - 130.98

East District
 1. Chiraita - 7.00
 2. Kalihari - 72.20



South District
 1. Chiraita - 63.00
 2. Kalihari - 83.00
 3. Shatavari - 93.50
 4. Stevia - 5.00
 5. Ashwagandha - 6.00
 6. Tulsi - 4.00
 Total - 254.50

West District
 1. Atees - 2.00
 2. Chiraita - 73.25
 3. Kalihari - 124.90
 4. Shatavari - 55.00
 5. Stevia - 9.00
 6. Tulsi - 2.00
 7. Pipla - 6.00





East District:

1. Chiraita	-	14
2. Kalihari	-	75
3. Shatavari	-	7
4. Stevia	-	15
Total	-	111

South District:

Acres

1. Kalihari	-	53
2. Shatavari	-	1
3. Stevia	-	9
Total	-	63

West District:

1. Chiraita	-	7
2. Kalihari	-	33
3. Stevia	-	6
Total	-	46

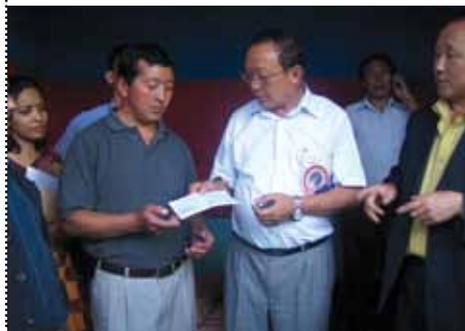
GRAND TOTAL - 298

JARI BUTI KOSH

- The Jari Buti Kosh (Herbal Medicine Fund)

was launched by the State Government in the year 2004-05 under State Medicinal Plants Board of Sikkim with an aim of revitalization of traditional knowledge of herbal medicine for health security to the local community, documentation of indigenous knowledge of medicinal plants and their uses and transmission of traditional knowledge of medicinal culture to younger generations.

- State medicinal plants board has identified 30



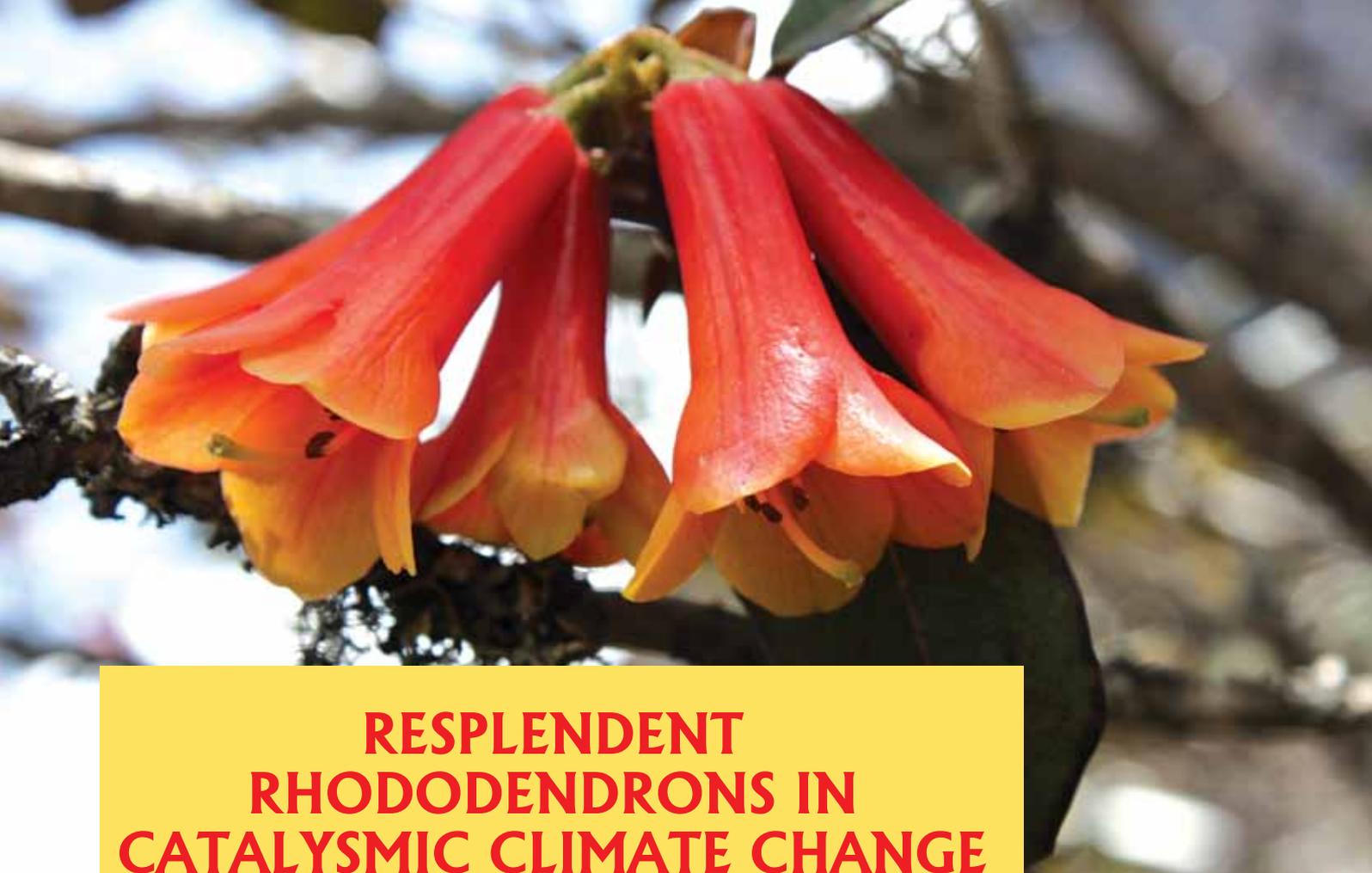
(thirty) herbal practitioners from different villages with the help of Block Panchayats and village elders. The identified folk healers have been registered under State Medicinal Plants Board as Traditional Herbal Practitioners of Sikkim.

- A small grant of Rs. 5 lakhs has been distributed to the 27 renowned herbal practitioners under the Jari Buti Kosh Scheme as a financial assistance for development of their home herbal gardens and to provide the infrastructural support.
- The State Medicinal Plants Board has completed the documentation of 18 (eighteen) renowned local herbal practitioners to preserve their indigenous knowledge of herbal medicine being practiced by them in the year 2008.

SMPB has registered 620 farmers as Cultivators, 230 as Collectors and 26 as Traders so far.

Contractual Farming Project:- Under this scheme 84 nos. of contractual farmers projects were approved by NMPB for cultivation of medicinal plants in the private holdings during the 10th Five Year Plan. The details are:-

Sl No.	Project Period	No.	Area in acres	Financial Assistance in Lakhs	Projects
1	2003-04	2	20	1.95	2005-06
2	2004-05	19	187	40.70	2006-07
3	2005-06	4	45	9.26	2007-08
4	2006-08	59	587.83	115.81	2008-09
	Total	84	839.83	167.72	



RESPLENDENT RHODODENDRONS IN CATALYSMIC CLIMATE CHANGE

**-PRADEEP KUMAR IFS,
CONSERVATOR OF FORESTS**

The Sikkim Himalayas constitute highly bio-diverse and fragile ecosystem. The climate change poses an uncertain future for the biodiversity of Sikkim. Unfortunately, the climate data for Sikkim is very poor on both spatial and chronological coverage. The only way at the moment to compare the situation in terms of climate is to look towards adjoining areas like Tibet and Nepal which are topographically more or less similar and where some studies have been done. This whole Himalayan region, including the Tibetan Plateau, has shown consistent trends in overall warming during the past 100 years (Yao et al. 2006). Various studies suggest that warming in the Himalayas has been much greater than the global average of 0.74°C over the last 100 years (IPCC 2007). For example, warming in Nepal was 0.6°C per decade between 1977 and warming in Nepal and Tibet has been progressively greater with elevation. The increase in temperature over the Tibetan Plateau during the period from 1955–1996 is about 0.16°C per decade for the annual mean and 0.32°C per decade for the winter mean, and these exceed the increases in the northern hemisphere and for the same latitudinal zone in the same period.

INTRODUCTION: Climate is probably the most important determinant of vegetation patterns globally and has significant influence on the distribution, structure and ecology of forests. Several climate–vegetation studies have shown that certain climatic regimes are associated with particular plant communities or functional types. It is therefore logical to assume that changes in climate would alter the configuration

of forest ecosystems. The varied ability of mountain species to respond as temperature warms, glaciers retreat, and weather extremes become more common threatens extinction for some species and is a threat to biodiversity in general. Equally critical are issues related to the structure, processes, and resilience of ecosystems and human adaptations to them. In general, local impacts of climate do not follow single or simple paths, whether in terms of plant ecology, stream hydrology, erosion and sedimentation, extreme events, or human activities.

Much of the mountain cryosphere system is sensitive to sustained changes in atmospheric temperature. Already many Himalayan glaciers are shrinking, some extremely rapidly in the global context. Global climate change impacts can be tracked by biological indicators such as phenology. There is an evident sign of advancing unfolding, blossoming, and ripening in the leaves and fruit of wild plants; and of hibernation, migration, and breeding of wildlife in mountain regions. Previous synchronous relationships between predators and prey, as well as those between insects and plants, are disturbing the balance species and their ecosystems.

As temperatures rise and glaciers retreat, species shift their ranges to follow their principal habitats and climatic optima. However, the ability of species to respond to a changing climate varies. Shifts in species' ranges during past major global climate changes indicate that all species have climatic

limitations beyond which they cannot survive. Scientific evidences that substantiate the same are accumulating. Biodiversity is most sensitive to global warming and is now showing signs of fragmentation and degradation caused by exogenous forces such as temperature increases and human activities. Species in high-elevation ecosystems are projected to shift higher. In the higher elevated areas, the rates of vegetation change are expected to be slow, and colonization constrained by increased soil erosion. Alpine plant species on mountain ranges with restricted habitat availability above the tree line will experience severe fragmentation, habitat loss, or even extinction if they cannot move to higher elevations. Within a species there may be significant variations in climate tolerance among individuals. This can result in the evolution of new phenotypes, even the formation of novel species' associations and other ecological surprises. The disappearance of some extant climates increases the risk of extinction for species with narrow geographic or climatic distributions and disruption of existing communities. Most endemic plant species are unable to respond successfully as the rate of climate change increases and resultant invasions of weedy and exotic species from lower elevations bring accompanying problems. The possibility of alterations in overall albedo, water balance, and surface energy balance on high altitude grasslands with increasing degradation and desertification in the arid areas is causing concern. Signs of the effects of climate change on the grasslands have been documented from the northeast Tibetan Plateau where Kobresia sedge and alpine turf communities are changing to semi-arid alpine steppe.



niveum. Since the phenological responses provide one of the best biological indicators of climate change, the first flowering dates of some species show striking correlation with the average temperature of particular month. For example *R.ponticum* shows a striking correlation with the average temperature of April-May indicating that the species is sensitive to temperature changes. Rhododendrons, with its distribution in the temperate forests along an altitudinal gradient would be an ideal species to explore. Plant communities

can respond to climate change in three ways: Through plasticity, micro-evolution and migration or range of change. The experiments at Rhododendron phenology project at Royal Botanical Garden, Edinburgh have indicated that rhododendrons have high plasticity (about 12.5 days/degree centigrade) and high phenological variability (up to 63 days). Thus they may be able to produce viable seeds under a wide range of climatic conditions, perhaps enabling them to adapt to climate change. On the other hand individual rhododendron cones can be long lived (>100 years) and slow to colonize new regions.

Modeling of realized niches of four common evergreen broad-leaved species in the central Himalayas (i.e. *Rhododendron arboreum* Sm., *R. campanulatum* D. Don, *R. barbatum* Wall., and *R. wallichii* Sm) demonstrate that an extreme cold temperature may represent an absolute boundary for tree species' survival, whereas warm temperatures do not. This is in agreement with the hypothesis that several tree species may survive global warming in-situ because of high temperature tolerance, but its effect on regeneration is uncertain. In lieu of this there may be a significant time lag between change in climate and transient tree species distribution. Thus the effect of global warming on tree species distribution may be very difficult to predict. Consequently the future for natural rhododendron communities remains uncertain without active and well planned conservation measures.

In Sikkim villages located in or near forests depend heavily on forest resources for their livelihood activities. Climate change is likely to impact forest biodiversity through changing biome types and shifting forest boundaries. It is extremely difficult to capture the signatures of the impact of climate change on plants in the face of other threats and pressures and often absence of baseline information exacerbates the problem. However in some cases the impacts of climate change in plants are now becoming more visible. and evident.

RHODODENDRONS IN THE RIGORS OF CLIMATE: Rhododendrons, large genera, with over 1000 species of trees, herbs, shrubs and even epiphytes are distributed in the North Temperate Zone with largest concentration of diversity in the Sino Himalayan region. In India there are more than 90 species of Rhododendrons of which about 36 species are found in Sikkim. Even the state flower of Sikkim is Rhododendron i.e. Rhododendron



On the other side the phenology or seasonal biological events, particularly flowering in species like Rhododendron *arboreum* with sensitive meristematic cells can be used to track the climate change. Rhododendrons offer a unique opportunity to expand the present dendrochronological network into extreme environments beyond the survival limit of normal trees. The alpine snowy rhododendron can offers new research directions to investigate the environmental history of the in those regions where up to now there was no chance of applying dendrochronology.

SINGTAM TERRITORIAL RANGE: AN UNLIKELY HERITAGE TROVE

Singtam Territorial Range (STR) in East Sikkim was established in 1964 by the then Monarch of Sikkim for protection and conservation of different species of flora and fauna and also so that villagers could easily approach the forest officials. There are three Block Offices under this Range namely Song, Singtam and Rangpo covering a total area of 13931.40 ha. Similarly, there are four towns, namely Rangpo, Singtam, Sang and Makha where the people of composite communities live together harmoniously from time immemorial despite different faiths, cultures and traditions. STR is surrounded by the mighty and sacred river Teesta in the South and the river Rangpo in the East. The National Highway 31A also passes through this Range. While the river Teesta is regarded as the most sacred river both by Hindu and Buddhist, National Highway 31A is the lifeline of Sikkim.

On the way, one can come across a unique tunnel road at Topakhani and Bagey Khola Forest Nursery alongside the Highway. Surprisingly, this small but unique nursery produces over two lakhs of different species of seedlings every year. These seedlings are distributed to the villagers free of cost as per their requirement.

Under STR, there are nine Joint Forest Management Committees namely Chanday, Phegyong-Zingla, Beyong, Namgaythang, Tirkutam,



**B. S. Tamang,
Range Officer**

Nagitam, Dochum-Sirwani, Patuk and Central Pandam. These JFMCS are involved with activities pertaining to protection and conservation of forest and wildlife.

The story of Gauri Sankh

Within the area under this Range, there are many places of historical importance that need to be properly preserved as our heritage. Just 20 km away from Singtam, one can see 'Rameetay Danra' a view point from where one can overwhelmingly enjoy a panoramic view of mighty river Teesta and beautiful hamlets full of greenery. At a distance of 5 km from Rameetay Danra, Khamdong, there is a stream named Sumik-Aaritaar Pabong Khola and a big conch-shaped stone cave where

a "Gauri Sankh (a unique type of conch) was believed to have resided some 200 years ago. Now, the question is where has the 'Gauri Sankh' gone! According to hearsay almost 200 years ago, there was a big lake named 'Phakchu Pokhari' three km above Sumik-Aaritaar Pabong Khola near which an ox, white in colour, used to graze. It was that fateful day when the ox was slaughtered ruthlessly by a wicked man, when the water level of Phakchu Pokhari and Sumik-Aaritar Pabong Khola started drying up gradually and soon completely dried up causing the Gauri Sankh to fly away from here to Bhalley Dhunga across Teesta in today's Maenam Wildlife Sanctuary and stay over there permanently. The day Gauri Sankh took up residence at Bhalley Dhunga, spring water originated there which can be easily seen from Sumik-Aaritar.

Budang Gadi Fort of Chigyal Chador Namgyal and Origin of name 'Pendam'

Just 16 kms away from Rangpoo, a fort-ruin named Budang Gadi is situated. This Gadi or Pandam Budang Gadi was created in the year 1717 by the then Monarch of Sikkim, Chogyal Chador Namgyal to resist the invasion of Bhutanese Army. During the invasion, Pendi Ongmu the daughter of Chogyal Tensung Namgyal took shelter in this Gadi, Pendam, therefore, derived from the name Pandi. This 1000 ft long, 100 ft high and 4 ft wide structure is

spread over 5.0 acres of land.

Having been recognized as a historical monument by the Government of Sikkim and the Indian National Trust for Art and Cultural Heritage, New Delhi, the Cultural Affairs and Heritage Department of the Government of Sikkim, has undertaken renovation works through Forest, Environment and Wildlife Management Department, Singtam Range.

If this entire area of Pendam Budang Gadi ruins is developed as an important tourist destination, the local people of the area would be benefited.

Kalika Devi Temple

On the top of this rocky cliff, Kalika Devi Temple is situated. This temple is believed to be a contemporary of Pendam Budang Gadi. A natural spring near the temple is believed to have originated due to blessings

of Goddess Kalika Devi. This water is now being used by priests and devotees who visit the temple for offering Puja and is regarded as most sacred and wish fulfilling. It was a remarkable effort of the Joint Forest Management Committee, Central Pendam that a water harvesting tank has been constructed for the benefit of devotees and visitors.

Siddi Baba

There is an unbelievable but true story about Siddi Baba, who is also known as Lattay Baba who lived in a cave at 'Vikhari Veer' at Kameray, East Pendam under Singtam Range. According to hearsay, about 200 years ago the hermit lived in this cave in deep meditation and practiced occult science. As he had mystical power, he terraced entire paddy field at Arangthang, 2 km away from Kameray at night with the help of Spirits (Masans). Even today, Baba's great grandsons and

granddaughters live in and around Pachak and Rangpoo. This place where the Baba lived could perhaps be developed as 'Shakti Pith' and pilgrimage site.

Though Sikkim merged with Indian mainstream only in 1975, the Department of Forest was established by the Chogyal of Sikkim 100 years ago. The present Government under the dynamic and farsighted leadership of Dr. Pawan Chamling, Hon'ble Chief Minister of Sikkim had done a lot in the field of green revolution, environment, tourism, health, education, women empowerment, eco-friendly industries, e-governance, arts, culture, etc. and Sikkim has become a pioneer in these fields. Sikkim is known as a most peaceful State where there is peace, tranquility, security, communal harmony and by and large is an ideal place to live in. Undoubtedly "Sikkim" is an Eden on Earth!!!



LIST OF ENVIS PUBLICATIONS



Snapshot of ENVIS Website Homepage: www.sikenvis.nic.in

Newsletters



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Vol 1. No.2

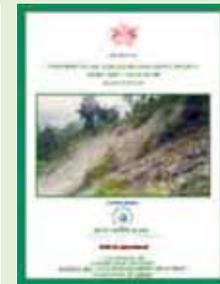


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Reports



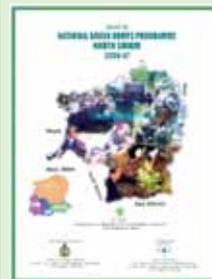
SoE Report



Treatment of Landslide and Erosion Control in South Sikkim



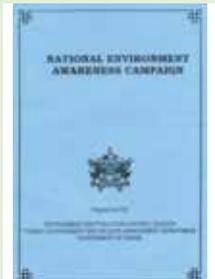
Treatment of Landslide and Erosion Control in West Sikkim



National Green Corps Programme in North Sikkim



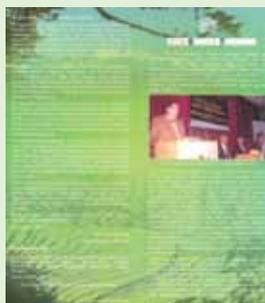
Compilation of Gazette Notifications on forest, env. & wildlife



National Environment Awareness Campaign on Solid Waste Management



ENVIS Pamphlet



State Green Mission Pamphlet



Climate Change Pamphlet



Solid Waste Management Booklet



Panda Newsletter



Nursery Action Plan

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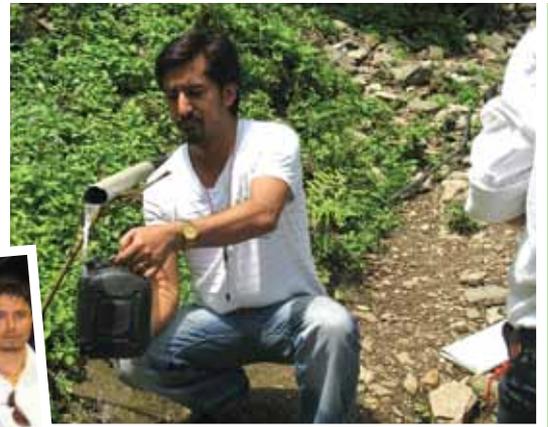
TEAM: C. LACHUNGPA, RAJEN PRADHAN,
SANDHYA PRADHAN, LAXUMAN DARNAL



NEAC-2008 ACTIVITIES AT LACHUNG, NORTH SIKKIM

SIKKIM STATE POLLUTION CONTROL BOARD





GEO-TEXTILES APPLICATION IN SIKKIM

C. LACHUNGPA IFS

Application of Geo-Textile technology was applied for treatment of landslide and control soil erosion in degraded and depleted forest area. The Geo-Mats are spread over loose soil formation and fragmented landslide areas. Planting of cuttings, fibrous rooted plants suitable for degraded land are also planted through the Geo-Mats. Loose soils are gradually stabilized and soil erosion controlled. The growth of plant material support further firm stabilization, strengthens the loose soil formation and improves the site quality. The Geo-Textile contains lignin materials which helps soil rejuvenation and develops soil profile thereby controlling soil erosion and establishing land against landslide and erosion. The technology has been tried in landslide treatment at Donak-Seti-Khola Watershed, South Sikkim, Landslide in West Sikkim and Rangrang Watershed in North Sikkim. The results of Geo-

Textile application to these landslides indicated encouraging result of soil erosion and landslide control treatment.



THE YAMBONG SUCCESS STORY

Sandeep Tambe, Nima Tashi Bhutia and G. S. Rawat



In the Greater Himalaya of Khangchendzonga National Park, sheep were traditionally grazed while the yak, cattle yak hybrids (*urang*) and the pack animals (dzo and horse) are recently introduced. The yak and *urang* pastoral systems have substantially impacted the oak and fir forests with bamboo under storey, which is also the habitat of the endangered red panda. Comparatively the sheep which descend down to the agricultural fields during winter and pack animals that are free ranging without an attendant herder have lesser impacts. Yak herding livelihood showed the highest inequity with benefits concentrated amongst a few followed by *urang* herding. Relatively the sheep and pack animal herding provided benefits to a larger section of society and were more equitable. Lower impacts and greater equity in benefit sharing made the sheep and pack animal herding relatively more sustainable than the high

impact and inequitable yak and cow yak crossbreeds pastoral systems.

Creating national parks bound by strict national laws and providing adequate funding support is not sufficient to secure their future. The challenge of using these funds to forge partnerships with the local community, providing livelihood support for subsistence level of dependencies, and forcing out commercial level of dependencies has to be met. Multi-disciplinary ecological and socio-economic research is needed to distinguish between the need and greed based livelihoods and their impacts. Such studies will provide a basis for shaping political will which is vital for bringing about change. (*Study in Western part of Khangchendzonga Biosphere Reserve was supported by McArthur Foundation, Forest Department, Wildlife Institute of India and local NGOs KCC and SKES. For more details, contact Dr. Sandeep Tambe <sandeep_tambe@yahoo.com>, or Nima Tashi Bhutia <nima_star@hotmail.com>.*)



Assessing priorities for sustainable forest management in Sikkim, Eastern Himalaya, India: A REMOTE SENSING BASED APPROACH

Sandeep Tambe and M. L. Arrawatia

Abstract

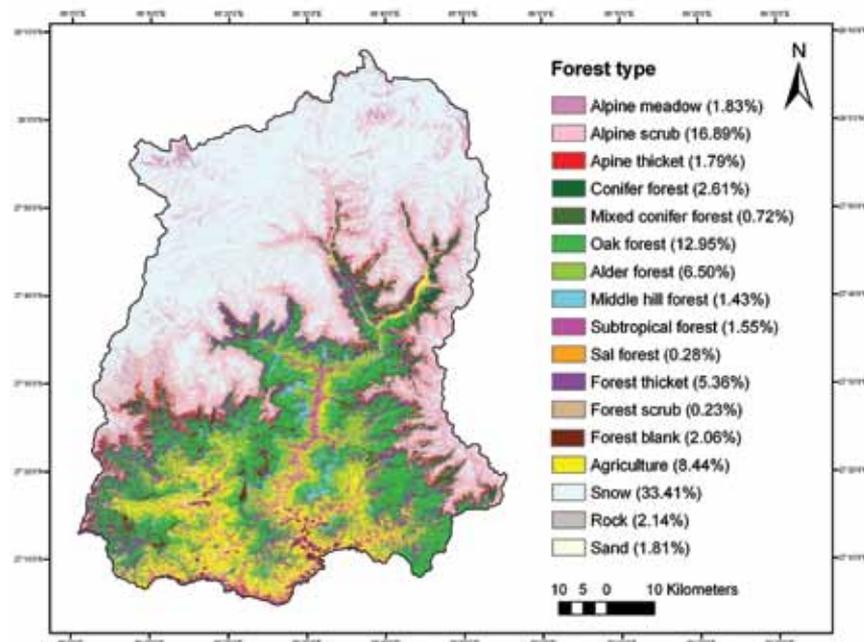
Sikkim is a small, mountainous, Indian state (7096 km²) located in the eastern Himalayan region. Though a global biodiversity hotspot, it has been relatively less studied and for the first time a detailed forest type, density and change dynamics study was undertaken, using fine scale remote sensing data and intensive field verification. The landscape was found to be dominated by alpine

well. However on a positive front over the past decade, ban on grazing and felling of trees in forests has been implemented. In order to expand the extent of dense forests, further efforts are needed for the restoration of oak forests, fire protection, providing alternatives to firewood, promotion of alder-cardamom agro-forestry in the private lands and protection of the small-sized, fragmented forest patches in the subtropical belt.

Discussion

Mountain regions like Sikkim pose several challenges for the natural resource managers and ecologists in terms of understanding linkages between the landscape features and spatio-temporal changes in the composition and extent of vegetation caused by both natural and anthropogenic factors. A substantial proportion of the Eastern Himalaya remains largely inaccessible for physical verification as many areas are far from roads, not easily approached on account of un-forded rivers and steep terrain. Despite the advantages of remote sensing tools, relief-induced factors limit utilization of potential of these tools. Reflected signal values carry high variability and distortion caused by terrain complexity, shadow effects and cloud and snow cover. Persistent cloud

cover during the summer months and snowfall in winter create only a small window of 2-3 months in early winter when the alpine zone can be adequately remotely sensed by satellites. Though these challenges result in certain uncertainty in the accuracy of vegetation classification, careful choice of the images, hybrid classification procedure and few post processing steps could overcome some of these problems. Extensive field surveys of vegetation structure and knowledge of altitudinal variation in major formations coupled with



and nival ecosystems, with a large portion above the tree line, considerable snow cover, and a sizeable area under forest cover (51%, 3,591 km²). A total of 21 landscape components including 18 vegetation classes could be delineated, with the major ones being alpine scrub, oak forest and alder-cardamom agro-forestry. Of the 2,389 km² of forests below the tree line, 39% were found to be dense (> 40% tree canopy cover). A sizeable portion of the non dense forests below the tree line was contributed by the degradation of oak forests, which was confirmed by change detection as

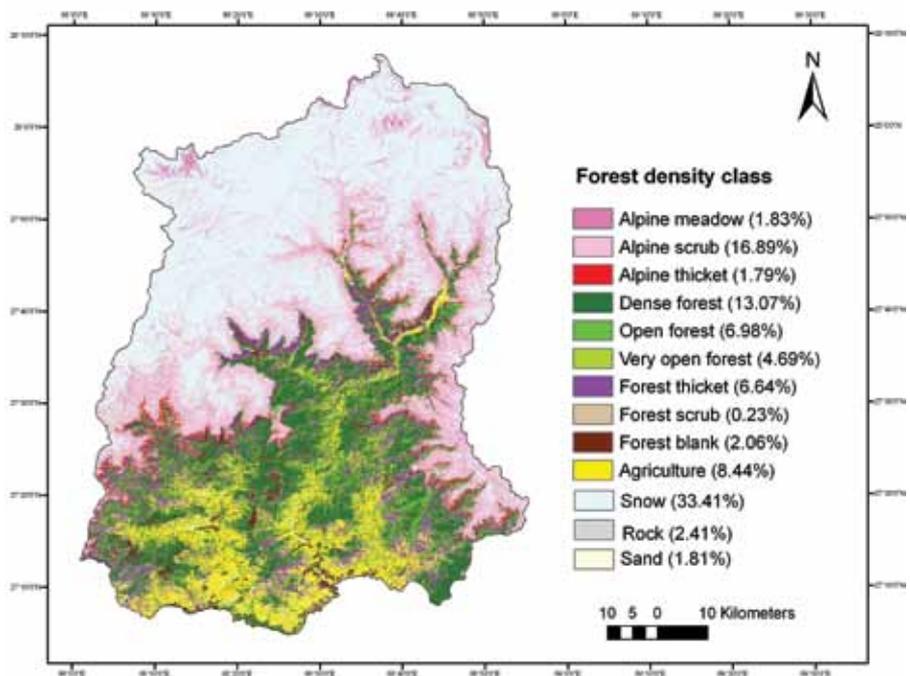
intensive ground truthing proved necessary to enhance the accuracy of classification.

The reserve forest area of 5,514 km² was reasonably close to the recorded reserve forest area 5,451 km². The FSI (2005) study is based on 23.5 m resolution IRS P6 satellite data of December 2004, while our study is based on 23 m resolution IRS-1C satellite data of February 2002, hence the source and resolution of the two datasets are quite similar. The area under dense forests as per our study comes to only 928 km² which is about 30% of the land below the tree line and 39% of the forests below the tree line. FSI (2005) assessed the area under very dense (498 km²) and moderately dense forests (1912 km²) in the state to be significantly higher at 2410 km². Our assessment is nearer to other contemporary, satellite data based forest mapping studies like Pandit *et al.* (2007), who assessed extent of dense forests to be 1040 km² based on the satellite image of the year 2000. Other studies by Kushwaha *et al.* (2005) in the south west portion of Sikkim also highlight the fragmentation of temperate forests. Earlier studies by Forest Department (1994) using 72.5 m IRS-1A satellite data assess the extent of dense forests in the state to be 975.14 km². One of the reasons for the over estimation by FSI could be the unique structure of the temperate and sub-alpine forests. These forests have a multi layered structure, with a characteristic middle canopy of *Rhododendron* and bamboo thickets. So on degradation, when the top canopy of trees is opened, due to the dense middle canopy, these forests still appear dense in remotely sensed satellite images. Nearly 600 km² of forests in the state are classified as alpine, sub-alpine and temperate thickets.

56 of the 58 reserve forest polygons are considerably small (mean extent of 1.57 km²), and comprise just 1.59% (87.88 km²) of the total reserve forest area. These are distributed in the lower elevation, having *Shorea robusta* (sal), subtropical forests and warm broad leaved forests as the dominant landuse and surrounded by agricultural fields. There is an urgent need to demarcate, protect and regenerate these small sized, fragmented forests, as they are more susceptible

to encroachment and degradation.

Out of the 15 forest classes, 4 classes namely sal forest, subtropical forest, warm broad-leaved forest and mixed conifer forest were found to have a limited extent (area less than 110 km²) and relatively higher degree of degradation. Protection of these forests is critical to prevent the loss of the characteristic biodiversity that they possess. The subtropical forests have limited extent and occur mostly outside reserve forests. These forests occur along river valleys where several hydro power development projects are being commissioned (CISMHE 2005b). Innovative programs need to be designed to encourage the private owners to preserve these forests. Also where ever these forests are government owned,



they need to be given a higher conservation status.

Cardamom farming is a perennial, low-volume, high-value, non-perishable, cash crop and it demands less nutrients and other inputs in comparison to other crops. Alder forest occurs in private lands and is grown as a shade tree for large cardamom - a valuable native horticulture plant (Sharma *et al.* 2000). Farming of large cardamom (*Ammomum subulatum*) is the main source of cash income in the 1000-2000 m zone. It is grown in an agro-forestry model and the preferred fast growing canopy trees mostly alder (*Alnus nepalensis*) provide valuable firewood for curing the cardamom pods as well as to replenish the soil with valuable nitrogen.

Most of the firewood, fodder, NTFP and other biomass requirements of the local community are met from these plantations. In the 1000 - 2000 m zone these forests have a sizeable extent of 272 km² which can be potentially increased to 461 km² by encouraging this landuse to bring more and more areas under forest cover and also to have an eco-friendly buffer to shield the temperate oak forests.

During the last three decades of the 20th century, 317 km² of degradation has taken place, with the impacts mostly concentrated (196 km², 62%) in the temperate oak forests, which have been converted into thickets, scrub and blank areas. This degradation was caused mainly due to open grazing, forest fires, selective felling of commercially important mature trees from forests and clear felling of temperate forests for meeting the demand for timber, firewood and charcoal. Ralang abandoned tea gardens, Ralang public coup and Maenam gumpa area in south district, Payongchu ridge (Dzongu) and Tshunghang in north district, Deoningaley Dhaap, Thulo Dhaap and Taungedar areas within Barsey Rhododendron sanctuary in west district are some of these degraded areas. Thickets of secondary, unpalatable shrubs and bamboos like *Symplocos theifolia* (kharane), *Edgeworthia gardeneri* (argeli), *Sorbus ellipticus* (ainselu), *Viburnum erubescens* (asare), *Arundinaria hookeri* (pareng) and *Arundinaria maling* (malingo) have increased substantially in these degraded forests. Accessible silver fir forests along roads have been clear felled in some valleys. The true right bank of the Lachen and Lachung valleys in north district, as well as some of the valleys in east district are bereft of top canopy trees and the middle storey of Rhododendrons and bamboo thickets is exposed. Since 1995 several conservation initiatives have been taken up like implementation of the ban on open grazing in reserve forests, ban on green felling of trees in forests and increasing the coverage under the protected area network.

The main cause of degradation and fragmentation of the temperate oak and subalpine conifer forests is the heavy dependence for firewood and timber, high grazing pressure, vulnerability to forest fire, poor natural regeneration and naturally slow growing nature. While impacts of pastoralism on these forests has been substantially reduced with the removal of about 10,000 cows along with the 500 herders between 2001 and 2006, reducing firewood extraction by local communities and road construction labour force and preventing forest fire still needs to be prioritized. Chettri

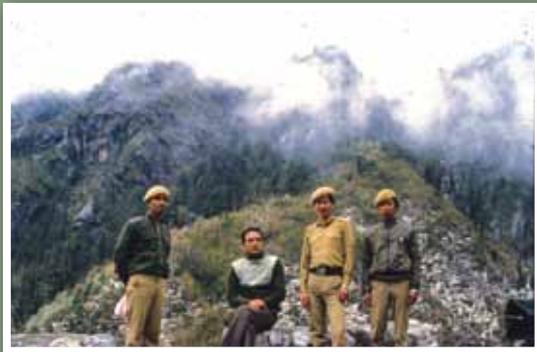
et al. (2006) documented that there is an unregulated extraction of firewood from the forests of the state, and estimated the annual dependence per rural household to be 6-8 tonnes (dry weight). Greater emphasis is needed for promoting solar water heaters, LPG and ensuring access to alternate and cheap forms of energy and fuel efficient devices will help in substantially reducing the pressure on these forests. Also there is a pressing need to take up a long term restoration program to artificially regenerate these slow growing temperate and sub-alpine conifer forests, which constitute a sizeable portion of the total non-dense forests in the state by artificial regeneration supported by scientific nursery and plantation techniques.

Unlike in other parts of the country, the long dry winter from December to March is the major fire season in the state. Winters are becoming increasingly drier, with little precipitation, possibly due to climate change impacts. As a result incidence of forest fires in temperate forests which are unaccustomed to forest fire is increasing. Due to the high calorific value and resin content, forest fire in these forests has a devastating effect and the whole stand gets raised to the ground, seriously hindering the natural regeneration for several decades altogether. There is a pressing need for a greater dissemination of mountain specific fire management technology using participatory approaches.

Conclusion

To conclude we propose the following priorities for forest management in the Sikkim Himalaya.

1. Firstly initiate a long term restoration program for the degraded oak and sub-alpine forests.
2. Secondly expand the extent of dense forests by reducing the pressure from firewood extraction, grazing and fire hazard. The extent of dense forests jointly with forest cover should be used as an impact indicator.
3. Thirdly take special steps to protect and regenerate the several small-sized, fragmented forest patches in the lower belt. Fourthly promote alder-cardamom agro-forestry in the private lands as an eco-friendly buffer and lastly protect rare forest types (sal forests, subtropical forests, warm broad leaved forest and mixed conifer forest) which are being increasingly degraded and under danger of losing their characteristic biodiversity.



Dharam Basnett with Forest Officials at Kyangnosola, East Sikkim



Rambilas at Dombang sawmill, North Sikkim



Silver Fir regeneration (Yumthang Valley)



Kundup Lachungpa at Lachung, North Sikkim



Govt Officials at Tamze, East Sikkim



Mali Chapagara at Majitar Forest Nursery



Karma Peda Bhutia & W T Lucksom at Menmoitso Trout Hatchery



Making Lachung Blankets for Tourist Lodges

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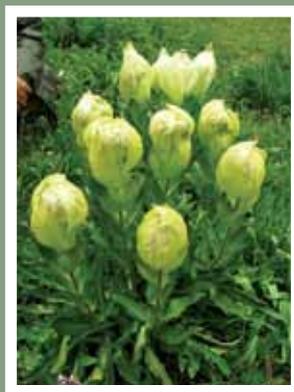


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PHOTOGRAPHS COURTESY CHEZUNG LACHUNGPA

PRELIMINARY VISIT FOR INTERNATIONAL RHODODENDRON FESTIVAL 2010 AT SHINGBA RHODODENDRON SANCTUARY



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Catch 'em young..make 'em strong



JFMC Programme, South Sikkim



JFMC Programme, South Sikkim



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JFMC Programme, South Sikkim

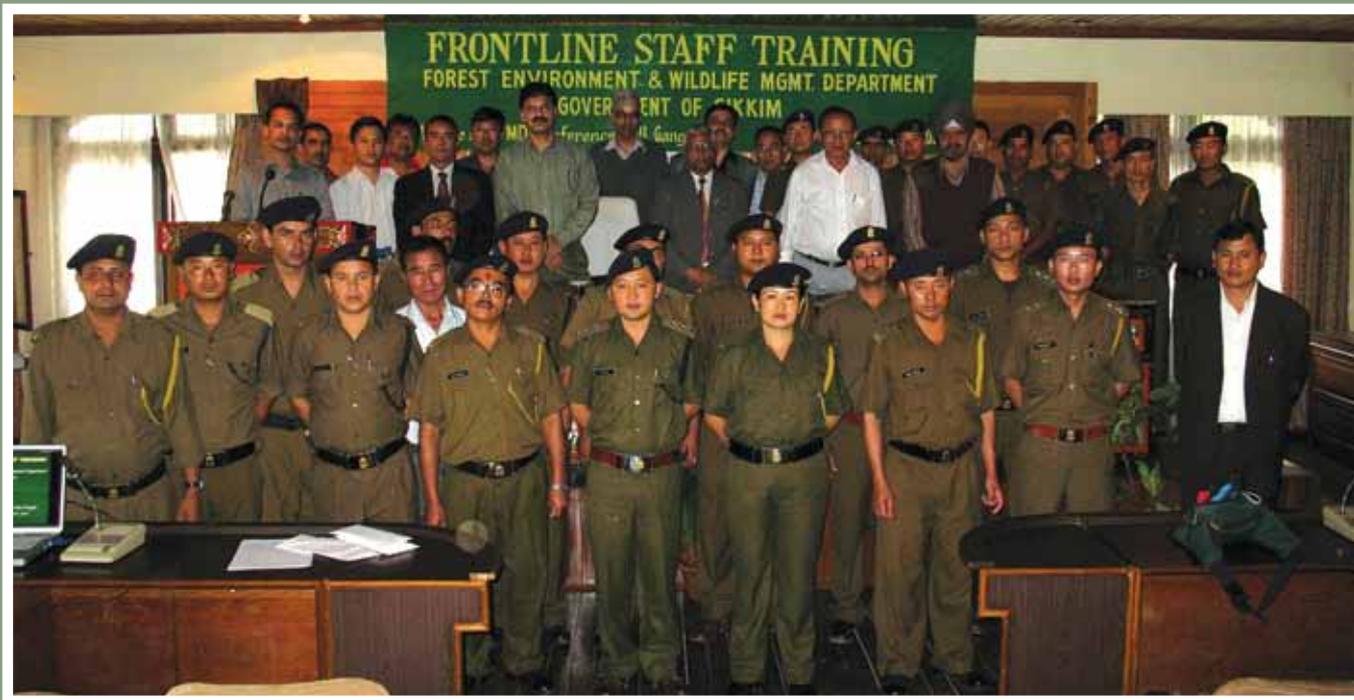


Madam Tika Maya Chamling with her mother.

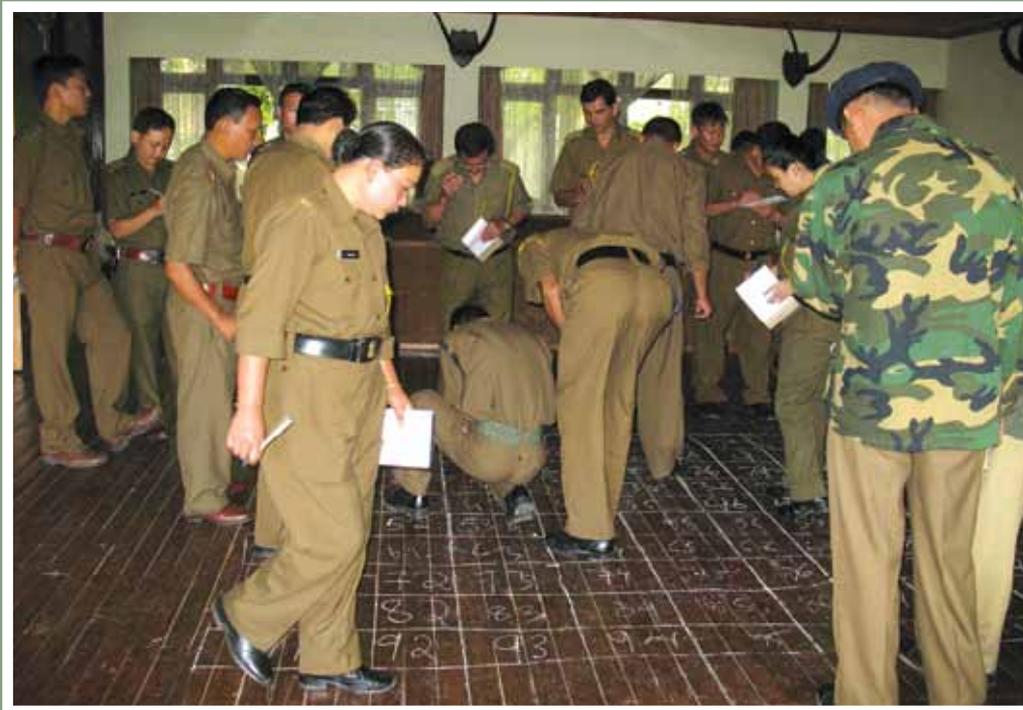


Nagi dara, Namthang, South Sikkim 15th July, 2009

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UDAI GURUNG SFS DFO



Refresher Course for Field Staff in Forest Conference Hall, Gangtok



Practical Session for Wildlife Census Techniques

PHOTOGRAPHS COURTESY USHA LACHUNGPA SR. RESEARCH OFFICER (WL)

GRASSROOTS LEVEL CONSERVATION EFFORTS THROUGHOUT THE STATE INCLUDING UNIQUE INITIATIVES LIKE HIMAL RAKSHAK



Himal_Rakshak_in_KNP



Van Mahotsav plantation by Sr. Driver Kailash Sharma and others of Forest family



Forester receiving commendation from Hon. Chief Minister during Green Mission



SCIENTIFIC INTERVENTION IN HIMALAYAN ZOOLOGICAL PARK: VISIT OF JOHN CORDER, WORLD PHEASANT ASSOCIATION



WL Week Celebrations in East Sikkim

courtesy Karma Legshey SFS DFO WL/E





Field Officials tracking Himalayan Black Bear in East Sikkim

courtesy Karma Legshey SFS DFO WL/E



Plantation at Pakyong by Shri Bhim Dhungel, then Rhenock MLA. Photo by Kusum Gurung, SFS ACF



Patrolling for Black Bear in East Sikkim by Rajni Bhandari SFS ACF



Karma Legshey SFS DFO, and staff



FDA Training

courtesy Karma Legshey SFS DFO WL/E



Survey and demarcation

courtesy Karma Legshey SFS DFO WL/E

