



# ENVIS SIKKIM

On Status of Environment and Related Issues



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1<sup>st</sup> Quarter 2008-09 Vol. II, Issue 1

## NEWSLETTER

Dear Readers,

I am happy to inform you that Environmental Information System set up by the M&E, Govt. in the State Forests, Environment & Wildlife Management Department has been doing remarkable job in collecting, collating and disseminating useful information on environment. Our recent publication 'State of Environment Report' details the status of our environment with several government initiatives, the synopsis of which has been incorporated in this newsletter. This issue highlights some of the state's achievements and also brings articles from resource persons on our natural wealth. I hope you will find our newsletter useful and enjoy reading it. From our past issues we have received very good suggestions/feedback and I hope to receive your valuable contributions this time too.



C. Lakshmi, IFS  
Programme Coordinator (ENVIS)  
1st - CF & E D/ Field Officer (CA)



### Inside.....

pg 10 Sikkim adjudged 1<sup>st</sup> Rank in Conservation of Natural Resources: ESI Ranking

## RASHTRIYA NIRMAL GRAM PURASKAR FOR SIKKIM

Sikkim becomes the first state in the country to achieve 100% sanitation pg 9



Major Bamboo Diseases in Nurseries and their Control pg 1



Ornithological Wealth of Sikkim pg 3



Reptiles of Sikkim pg 5



Moths- The First Cousins of Butterflies pg 7



Abstract - SoE Report Sikkim 2007 pg 11



pg 13 Milestones- Conservation of Environment



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## MAJOR BAMBOO DISEASES IN NURSERIES AND THEIR CONTROL

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Bamboo is a versatile group of plants, capable of providing ecological, economical and job security to the people. India possess one of the largest bamboo resources in the world, covering an area of 10.03m. ha (Luna, 1996). Bamboo is naturally found in almost all parts of our country, however state like Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura and Northern parts of West Bengal have large bamboo resources. The Andaman, Baster region of Madhya Pradesh, Western Ghats and Shiwalik hills of Uttar Pradesh are also quite rich in bamboo.

Recent technological advancement and researches have put bamboo into more and more new uses such as bamboo mat boards, bamboo mat veneer composites, bamboo mat corrugated sheets, bamboo charcoal and the packaging materials etc. Even in today's world of plastics and steel, bamboo not only continues to make its age-old contributions but is also rapidly gaining importance as a renewable plant with its multifarious uses. But the productivity of bamboos is reduced considerably due to various diseases inflicting the crop. A large number of diseases occur in bamboo nurseries, plantations and natural forests. A total of 440 fungi, two viruses, one phytoplasma and one bacterium like organism have been reported to be associates with this diseases (Salam & Deka, 2007). The present paper deals with major diseases of bamboos in nurseries and their control.

**1. Leaf Roller:** Leaf Roller is a very serious nursery disease of bamboo in Sikkim.

Causal organism: *Crypsiptya coclesalis*



**Symptoms:** The leaves webbed together. The outer leaves of the roll gradually withered, turned pale or straw colour and eventually dropped off. The rolled leaves harbored 1-5 caterpillars, which feed on the inner green leaves. Caterpillars after feeding abandoned the rolls and migrate to fresh leaves, which were webbed together in a roll. This type of damage is very conspicuous on the top of culms and branches; however leaves on the lower branches were less attacked. The larval population of leaf rollers appeared with the onset of rain and the population builds up reached their peak in August and September.



**Control measure:** A solution of 0.2% fenitrothion or 0.1% carbaryl in water with a surfactant has been recommended (Singh, 1990).

**2. Damping-Off:** Damping-off is another serious nursery disease of bamboo, causing considerable loss to seedlings.

Causal organisms: *Fusarium moniliforme*, *F. oxysporum* and *Rhizoctonia solani*,



**Symptoms:** Damping-off occurs in two stages, pre emergence and post emergence phase. In Pre emergence damping -off phase, the young seedlings are killed before they reach the surface of the soil. The radicle and plumule, when they come out of the seed, undergo complete rotting. In Post emergence damping -off phase the infected seedlings are toppled down any time after emergence from the soil. Infection usually occurs at or below the ground level and the infected tissue appears soft and water-soaked.

**Control measures:** The main control measures include the use of any seed protectants to keep away the pre-emergence phase and to adopt sanitary precautions in the nursery to check the appearance of post-emergence damping off. Other control measures are excessive watering and shading should be avoided. Nursery soil should be light, having good proportion of sand and combination of seed treatment and soil drenching with broad spectrum fungicides (0.2-0.5% suspension) such as Bevistin, Captan, Copper Oxycloride etc.

### 3. Black Mildew

Causal organism: *Meliosia species*, *Haraea japonica* and *Sternella hiugensis*



Symptoms: Powdery black patches appear on the upper surface of leaves. Infections also occurs on leaf sheaths and minor branches

Controls measures: Opening the canopy will reduce the infection.

### 4. Rhizomes Bud Rot

Causal organism: *Pythium middletonii*

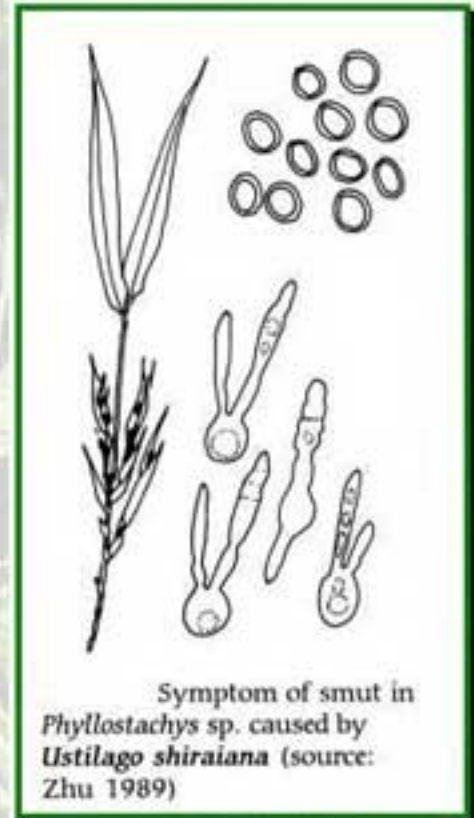


Symptoms: Browning and rot of the rhizome buds and tender tissues around the buds. Both pointed scaly buds, which give rise to new shoots and flat buds, which promote rhizome proliferation, are affected by the disease. Since the scaly buds, flat buds and the tender portions are affected, new shoot production and rhizome proliferations are greatly affected, causing stunted growth and death of the plants.

Controls measures: The disease can be managed by using a healthy planting stock, as well as by improving the cultural and management practices in the plantations. During the dismantling of seedbeds and pulling out the bare root seedling for planting, care should be taken to avoid causing injuries to the seedling rhizome.

### 5. Smut

Causal organisms: *Ustilago shiraiana* and *Tilletia bambusae*



Symptoms: The fungal attack young developing tillers and often completely replaces the seeds with black fungal spores, causing smut.

Control measures: Application of Carboxin, etaconazole and other systemic fungicides are effective in controlling smut fungi.

### 6. Cutworms and Termites

Treatments of soil with 5% Somicidin dust @ 60 kg per ha is an effective protection against damage.

## ORNITHOLOGICAL WEALTH OF SIKKIM

Bhoj Kumar Acharya\* and Lalitha Vijayan

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Birds are the most beautiful creature and one of the diverse groups in the animal world. They occupy different niches and are found everywhere – in forests, streams, farmlands, grasslands, deserts, wetlands and snow. Associated with mythology, folklore and culture in different parts of the world, birds have fascinated people since prehistoric time. They play very crucial role in the maintenance of the ecosystem, which benefit all other organisms including human beings. Hence, birds have been the centre of attraction for study by scientists in understanding various complex ecological factors.

Birds play many important roles in nature. Most of the species are insectivores and hence control insects and pests. Having specialized on carnivorous diet, owls, eagles and kites feed on rats which destroy our crops. Similarly, vultures, kites and crows clean the environment by consuming on carcasses of our surroundings. Apart from these, most plant species are dependent on birds for pollination of flowers and dispersal of seeds. Birds and plants display unique ecological interaction as pollination and dispersal in many cases are species specific. The survival of plants and beauty of forests is, thus, depends on the presence of birds. The typical example is the decline in population of *Clevaria major* (a tree species found in Mauritius whose seeds are dispersed by Dodo bird) due to the extinction of Dodo bird. Hence, birds serve as an indicator of the health of our ecosystem.

Birds also have immense economic importance. Because of their beautiful coloration they have high aesthetic value and attract tourists. Body parts or nests of some species are good revenue source of the country. Nest of Edible- nest Swiftlet *Collocalia fuciphaga*, which is thought to have medicinal value, cost around Rs 1, 72,000/- per kg. Bird droppings are good fertilizer to vegetation as well as to the crops.

Cultural values of the birds are noteworthy. Our epics and holy literatures described them as a sign of fortune and goodwill. Still people release birds in many parts of our country before starting a new venture, be it a business, job or house construction. Birds such as Barn Owl *Tyto alba*, Hill Myna *Gracula religiosa*, Crow *Corvus* sp., Common Hoopoe *Upupa epops*, Malkhoa *Phaenicophaeus tristis* and Bar-headed Goose *Anser indicus* are worshipped by peoples of different faiths. Parrots are being used as fortune tellers. Pigeons, a symbol of peace, were used as messengers in earlier days. Jungle crow is considered as the journalist of the nature.

Around 9,600 species of birds are found worldwide out of which above 1200 species occur in the Indian subcontinent. Eastern Himalaya and Western Ghats are two global hotspots of biodiversity in India. Sikkim is an important part of the Eastern Himalaya hotspot.

Out of total species of birds of India, around 548 (45%) belonging to 244 genera and 60 families are reported to occur in Sikkim. The high diversity is because of the high variation in elevation, climate and other ecological factors which has resulted in the diverse vegetation types. The elevation ranges from 300 m to above 8000 m. The climate varies from hot tropical in the lower valleys, cool temperate at mid and arctic cold in the high elevation. Similarly, vegetation changes from tropical to sub-tropical, temperate broadleaved, mixed coniferous, sub-alpine and alpine. Alpine zone represents typical trans-himalaya which is an extension of the Tibetan plateau. Gradation of all these factors created several suitable niches for birds. Furthermore, Sikkim occupies a location where various biogeographic realms and regions overlap representing avifauna from these regions in addition to the species of its own.

With the variation in elevation and vegetation characteristics, species richness and the community composition of birds also changes. Maximum species are found at the middle elevation at around 2000 m with declining trends at both higher and lower elevation. This might be due to high diversity of resources available at this elevation, as is the case in most parts of the Himalaya. Tropical forests of low elevation areas (<900 m) are dominated by woodpeckers, kingfishers, bulbuls, cuckoos and drongos; tropical broad-leaved forests (900 – 1800 m) harbors doves, yuhinas, sunbirds and minivets, whereas temperate broad-leaved forest (1800 – 2800 m) is represented mostly by undergrowth species such as babblers, laughing thrushes and fulvettas. Mixed conifer forests (2800 – 3800 m) have species such as tits, warblers, rose finches and tree creepers. The higher vegetation zones (>3800 m) are the habitat of larks, accentors and finches. Tibetan Snowcock *Tetraogallus tibetanus*, Black-necked Crane *Grus nigricolis*, Blood Pheasant *Ithaginis cruentus*, Snow Pigeon *Columba leuconota*, and many species of larks, finches and accentors inhabit high altitude meadows in the alpine region. These zones are the breeding grounds for many migratory waterfowl including globally threatened species, Black-necked Crane.

Sikkim lies within the Eastern Himalaya Endemic Bird Area displaying high endemism. Endemics are those species having restricted distribution in a particular area. In total 19 species and one genus (*Sphenocichla*) are endemic to this endemic bird area and are not found elsewhere in the world. Of these, ten are reported to occur in Sikkim. Species such as *Spelaeornis caudatus*, *Harpactes wardii* and *Babax waddelli* are very rare, whereas other species are locally common.



Ruddy Shelduck *Tadoma ferruginea*  
A migrant to high altitude lakes



Common Pochard *Aythya ferina*  
Transient visitor to Sikkim



Chestnut-crowned Laughingthrush  
*Garrulax erythrocephalus*  
An undergrowth species of temperate forests



Blue Whistling Thrush *Myophonus caeruleus*  
A common bird of Sikkim

Despite high diversity and endemism, many species are facing extinction threat. They have declining population and might disappear from the world if immediate protection measures are not executed. The disappearance is mostly because of habitat destruction and poaching. The species with declining population are called threatened. Out of the 548 species found in Sikkim 17 are considered to be threatened and two are near threatened which include four endemics. The species such as Palla's Fish Eagle *Haliaeetus leucoryphus*, Chestnut-breasted Partridge *Arborophila mandchurica*, Black-breasted Parrotbill *Paradoxornis flavirostris*, Beautiful Nuthatch *Sitta formosa* and Satyr Tragopan *Tragopan satyra* are reported to have wider range of distribution but Black-necked Crane *Grus nigricollis* and Rusty-bellied Shortwing *Brachypteryx hyperythra* are restricted to narrow range. The occurrence of White-rumped Vulture *Gyps bengalensis*, Long-billed Vulture *Gyps indicus*, Baer's Pochard *Aythya baeri*, Wood Snipe *Gallinago nemoricola* and Hodgson's Bushchat *Saxicola insignis* in Sikkim has become the story of the book. These species were not sighted during our recent three year's long study (2003 – 2006). Two species - Himalayan Quail *Ophrysia superciliosa* and Pink-headed Duck *Rhodonessa caryophyllacea* found in the Himalaya have already gone into extinction and are lost for ever.

Systematic study of birds is known as Ornithology. The excavation of ornithological wealth of Sikkim dates back to 19<sup>th</sup> century. The surveys were done by the Britishers for the collection purpose. Salim Ali, the father of Indian Ornithology, has done careful study on birds of Sikkim in 1962. Ali's works appear as a book "Birds of Sikkim", which is the only exhaustive literature available till date.

A few ecological studies of bird communities and casual observations of some rare species are also available at present.

Bird watching is a joy, an adventure and at the same time a knowledgeable feat. Sikkim is the ultimate destination for bird watching. Birds can be watched in forests, river banks, open habitat or alpine meadows. Some of the key bird watching sites in Sikkim are Damthang-Tendong, Ravangla-Maenam peak, Yuksom-Dzongri, Lingzia-Tholung, Chauridara-Maenam peak, Lachen-Green Lake, Menshithang-Lachen, Hilley-Barsey and high elevation meadows (Yumesamdong, Giagong, Gurudongmar). In addition, there are many smaller patches and trails where wonderful observations can be made if time does not permit for well planned trip. Patience and a binocular are two important equipments for this purpose. Carrying a camera and a pictorial guide is highly suggested. Deliberate observations results into many exciting and unique sightings.

Considering the importance in ecosystem, their economic and aesthetic value conservation of birds is very crucial. Conservation of birds means the conservation of its habitats and ecosystem and thus the conservation of the life supporting system of man. Let us join hands to conserve birds and their habitat. Let us not take away their fundamental rights of survival.

## SCARY ANIMALS IN NATURE: THE REPTILES OF SIKKIM

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We get scared when we just think of snakes. To many of us, it is a dangerous enemy, a symbol of fear, and anxiety. This dangerous animal belongs to class Reptilia under the vertebrate group. Reptiles include the extinct gigantic dinosaurs, long bodied pythons, massive anaconda, ambush crocodiles, sluggish turtles and tortoises, and many other small and large sized lizards and snakes. Reptiles form the base for all living birds and mammals as evidenced by the fossil *Archaeopteryx*, a bird having many reptilian features. Reptiles can be separated from other vertebrates by the presence of dry skin covered with epidermal scales/plates.

Reptiles were the first true terrestrial vertebrates. The conquest of land by reptiles was a major landmark in the evolutionary history. They dominated the earth during Mesozoic era (230 million to 63 million years ago) which is known as the Golden age of reptiles. The most dominant of that period were the dinosaurs, the huge terrestrial vertebrate represented by largest herbivore, the *Brachiosaurus* (weighing approx. 78 tonnes) and carnivore, the *Tyrannosaurus* (8 tonnes). Present day crocodiles are surviving on earth without much change since the time of dinosaurs.

These fascinating creatures extends from the hot lowland to the cold mountain summit and from scorching desert to cool forest and even in the sea but the majority are restricted to hot climatic conditions. Since they are cold blooded animals (body temperature changes according to environmental temperature), tropical condition may be more favorable for them. Thermoregulation plays an important role in the life history of reptiles. It is a behavioral function that allows reptiles to maintain their body temperature either by basking in the sun when heat is required and moving away from the sun when heat is more.

The modern reptiles are represented by four orders belonging to 8163 species in the world. Of the four orders, Crocodylia (crocodiles and gharial), Sphenodontia (tuatara), Squamata (lizard and snake), and Testudines (turtles and tortoise), all are found in India except Sphenodontia which is found only in New Zealand. India, one among the mega biodiversity countries in the world, represents 552 species (almost 6.4% of the total reptiles of the world).

Among four orders, squamates (lizards and snakes) are the most diverse group. Lizards are widely distinguished from snakes with the presence of limbs and eyelids. They are represented by smallest gecko measuring a few centimeters to Komodo dragon (*Varanus komodoensis*) of 3 meters. On contrary to common belief, all lizards are non-poisonous except Gila monster (*Heloderma suspectum*) which is found only in Australia.

Most people consider gecko as deadly poisonous. The death because of consumption of gecko drowned food is certainly not by poison but due to bacterial infection. Snakes fascinate the human being on the earth more than other creatures both by their beauty and aggression. However, many of us are ignorant about them, their behavior and importance. Hence, they are always misunderstood, feared and killed rampantly. Most of the people considered all snakes as venomous; the perception does not vary much with the educated folks. But the fact is different. Most of the Indian snakes are harmless and all human deaths are caused only by four species. They are- cobras, kraits, Russell's viper and Saw-scaled viper. Most of them are rodent hunters and hence are found in and around human habitation bringing them in contact with human beings.

The order crocodylia representing crocodiles and gharial are surviving for million years without much change. Though having prehistoric origin, they are yet complex group of reptiles. Their survival over these years is due to their ability to use both water and land resources as they live on the edge between two eco-zones. Gharial can be easily distinguished from crocodiles with its longer and slender snout. The name gharial has been derived from its snout which resembles ghara (earthen pot with long neck). Though crocodiles are both fresh water and marine, gharials are restricted to rivers such as Indus, Ganga, Brahmaputra and Mahanadi.

The order Chelonia includes marine turtles and fresh water tortoises and terrapins. With their characteristic bony shell they can be easily distinguished from other reptiles. They bury their eggs either in sand or soil. Of the 26 non-marine chelonians of India, 19 are found in the north-east region making it highly important areas for conservation.

Sikkim harbors very rich diversity of flora and fauna representing one of the key regions in Eastern Himalaya biodiversity hotspot. Due to topography, international political boundary and harsh climatic condition, the reptilian wealth of Sikkim remained unexplored till recently. Apart from sporadic notes of the Britishers, no systematic work on reptiles of Sikkim is available. Recently a comprehensive checklist has been brought out based on field surveys and past records. The list reports a total of 78 species of reptiles that occur within the state of Sikkim (Chettri and Bhupathy, 2007). It includes 60 species of snakes and 18 lizards. Crocodiles, turtles and tortoise have never been scientifically reported from this region. Though there are scattered reports on the occurrence of tortoise from the state, no reliable information is available till date. Considering the continuity of the lowland area of the state with the West Bengal where the turtles and tortoise are found, the chances of their occurrence within Sikkim can not be completely ruled out.

To maintain balance ecosystem we need to conserve all creatures from minute insects to gigantic whales. Reptiles has got its unique role in ecosystem functioning. Apart from ecological role, they also have economic importance. Due to their agility, beauty and frightfulness, they are able to draw considerable attention of people in various zoos. Some tribal communities have earned their livelihood as snake charmers. Reptiles have been variously depicted for religious purposes since time immemorial. People have worshipped reptiles as Nag in Indian custom and Dragon in Chinese culture. Turtles and tortoises have been portrayed in the sculptures of many temples especially in Southern parts India.

Of the total reptiles found in India 26 are listed as threatened in the Red List of Threatened Animals (IUCN, 2006). Indiscriminate killing has threatened many species of reptiles at global as well as at local level. Despite their immense role in ecosystem and in our culture, snakes are declining due to habitat loss and rampant killings for various purposes. Snake venom (fluid secreted from poison gland in snakes) has been extracted from venomous snakes for medicinal purposes such as preparation of anti-venom. Poaching of reptiles for skin trade has threatened the survival of many species such as monitor lizard, pythons and crocodiles. Skins of many reptiles were used for making bags and shoes and hence are traded illegally. Besides, many snakes, lizards and turtles are consumed by tribal people of Northeast India on nutritional and medicinal ground. Improper fishing, various development activities and deterioration of breeding habitats has critically threatened some species such as Olive Ridley Turtle. Poaching for flesh and its large sized eggs are also prime factors for its decline. All these factors coupled with habitat loss are making reptiles vulnerable for extinction. In Sikkim, as the breeding season of most snakes coincides with the tourist season, large numbers are killed due to heavy vehicular movement. During night, tarred road will be comparatively hotter than surroundings and attract many snakes for thermoregulation. Due to high speed of the vehicle, snakes especially vipers which are sluggish in nature, get crushed by speeding vehicle.

Considering ecological, economical and religious roles of reptiles, conservation of reptiles is vital. Conservation, however, is possible only through community participation. Hence, awareness of the communities is required at various level such as students (school and college), villagers, foresters and policy makers.



*Takydromus sp.*



*Japalura variegata*



*Oreophis porphyraceus*



*Ovophis monticola*

## Moths – The First Cousins of Butterflies

Karma Zimpa Blutia, IFS & Sandeep Tambe, IFS

(Photographs identified by Dr. Kailash Chandra, ZSI)

The State of Sikkim is a blessed haven for floral and faunal diversity. Its varying altitudinal zonation from near sea level to the third highest destination of the world creates a unique habitat for numerous life forms. Moths, being one of them, are found in abundance in the state. Moths are more abundant in and around the hot and humid valleys of the state.

Their abundance and diversity decreases with the increase in elevation. About 1500 species have already been identified and classified. Another 500 new species could possibly be added to the list as well. The diversity of moths in Sikkim is almost three times to that of the butterflies in the state, the number of which has been pegged at 650 species. Moths, like the butterflies, belong to the same order of Lepidoptera. In Sikkim, most of the families of moths are well represented. There are about 500 species alone in the family Geometridae. The majority of the moths of the state are rather small in size, but several are amongst the largest of the insect race. The largest of them all is the Atlas Moth (*Attacus atlas*) which could grow as big as a foot across.



*Fascellina chromatoria*



*Ganisa plana*



*Loepa sikkima*



*Diaphania indica*



*Sinna dohertyi*



*Macrauzata fenestraria*



*Boarmia sp.*



*Erebus caprimulgus*



*Abraxas sp.*

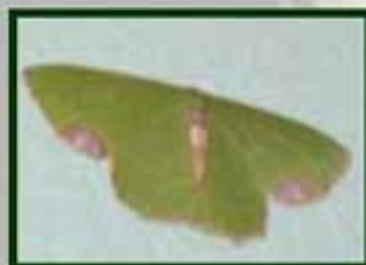


*Dysphania militaris*



*Corymica spatiosa*



*Callospistria maillardi**Histia flabellicornis**Phalera sp.**Ischya manlia**Archaeobalbis sp.**Gazalina chrysolopha**Trabala sp.**Ourapteryx picticaudata**Heterostegane subtessellata**Rhomborista monosticta*

Moths, much like butterflies, play an important ecological role in pollination. They also serve as a food base for birds, reptiles, spiders and predatory insects. Moths are easily affected by slightest disturbances in climate and also by pollution. A sudden variance in the abundance or decline in moth population is often a clear indicator of climatic upheavals or increased levels of pollutants in the environment.

Moths are often mistaken for butterflies. To an untrained eye, both these scaly winged insects look one and the same. Moths can be equally colorful and attractive to look at. There are however, some simple methods to distinguish both these insects. While butterflies can be seen flitting during day time, most moths with exception of a few, are nocturnal in nature. Butterflies sit with their wings closed over their back or fully open, while as moths sit with their wings spread out horizontally and their forewing partly covering the hindwings. While butterflies have clubbed or hooked antennae, moths have antennae of various shape, sizes and sometimes hairy in nature. Observing moths is a simple and pleasurable exercise.

Since moths are attracted towards sources of bright light, lighting a bulb or a CFL tube in the courtyard/balcony would attract quite a few of them. The best season for observing or photographing moths is during the monsoons. One can expect moths of various colours, shapes and sizes during the rains. For the more adventurous, a CFL tube can be lit more towards the wilderness and a white piece cloth can be placed underneath to see more interesting varieties of moths. For some reasons, it has been noticed that there is an increased number of moths at sources of light near bamboo grooves. Moths in Sikkim can best be observed in places like Namprikthang, Dikchu, Labarbhoday, Legship Sirwani and other low lying areas.

A more detailed and exhaustive inventorization of moths is the need of the hour for us foresters and wild lifers alike. These insects deserve equal importance as that of its more glamorous cousin-the butterfly. For this, a general awareness needs to be created about its existence and its role in the ecological cycle.

# RASHTRIYA NIRMAL GRAM PURASKAR FOR SIKKIM

Sikkim becomes the first state in the country to achieve 100% sanitation



*Chief Minister of Sikkim, Dr. Pawan Chamling receiving the first Nirmal Rajya Puruskar from the President of India, Ms. Pratibha Patil at Pune.*

Pune, 8<sup>th</sup> December, 2008: In a glittering award giving ceremony, Sikkim earned the distinction of being the first State in the country to achieve 100 percent sanitation. The award including citation and a gold medal was presented by the President of India, Mrs. Pratibha Patil to the Chief Minister of Sikkim, Dr. Pawan Chamling on December 8. Speaking on the occasion, Mr. Chamling said that on behalf of the people of Sikkim, it was indeed a proud moment for him to accept the first Rashtriya Nirmal Gram Puraskar from the President. This rare honour and recognition bestowed will further continue to guide us to achieve many more milestones for the State and the Nation in times to come, he said.

Addressing the function, Union Minister for Rural Development, Dr. Raghuvansh Prasad Singh welcomed the Chief Minister and his team to the function.

Elaborating on the comprehensive programme of the Central Ministry of Rural Development, Dr. Singh said that the ultimate mission was to wipe out poverty and make the nation more prosperous and progressive.

The meeting was also addressed by Panchayat representatives of Southern States. The Chief Minister was accompanied by Mrs. Tika Maya Chamling, Minister, RMDD, Mr. K. N. Rai, all four Adhyakshyas and Up-Adhyakshyas of the State, Panchayat representatives, Principal Secretary to HCM, Mr. R. S. Basnet, Secretary (RMDD), Mr. Anil Ganerwala, Resident Commissioner, Sikkim House, Mr. Arvind Kumar, Officials of RMDD, Government of Sikkim. The meeting was also attended by over 7500 people and stakeholders from different parts of the country.

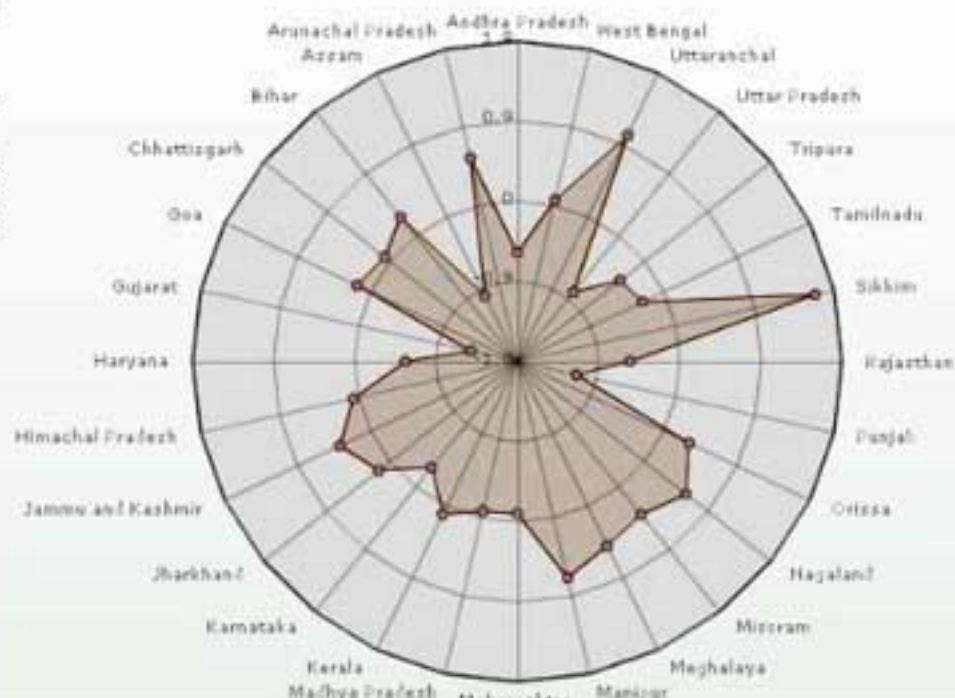
## Sikkim Stands 1<sup>st</sup> Rank in Conservation of Natural Resources

Centre for Development Finance (CDF) at the Institute for Financial Management and Research (IFMR) ranks Sikkim 1<sup>st</sup> among the Indian States in Conservation of Natural Resources and Performance in Land use for the year 2008. Sikkim has been adjudged high at 2<sup>nd</sup> rank in the overall ESI ranking.

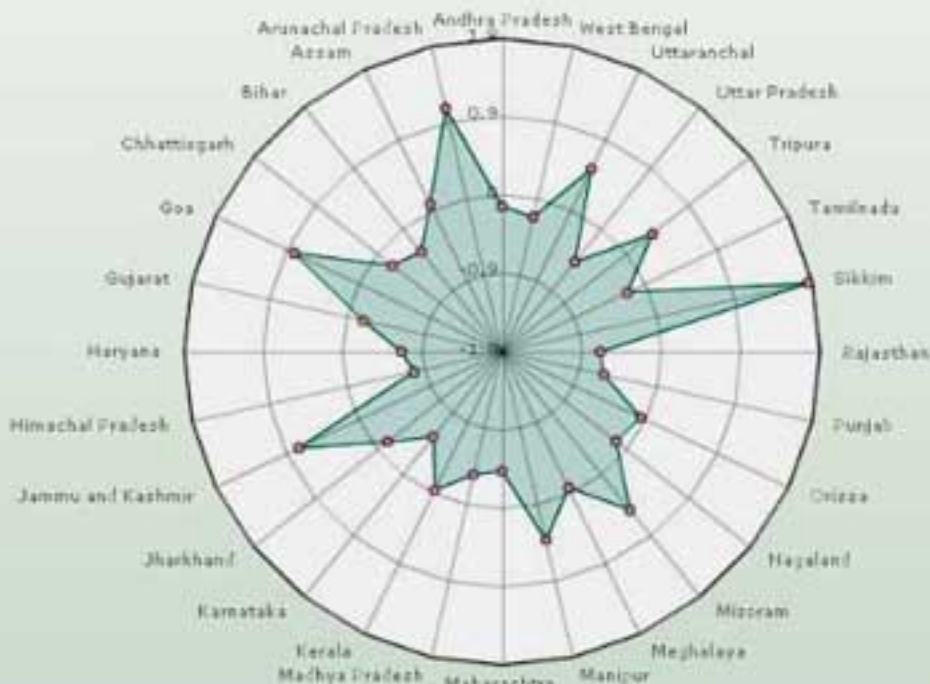
The Environmental Sustainability Index (ESI) tracks the environmental performance of 28 States of India. ESI tries to capture the state of environment in multiple dimensions based on 44 variables aggregated in to 15 indicators which in turn are aggregated in to one index i.e. ESI.

States	ESI Score	ESI Rank
Manipur	100.00	1
Sikkim	90.99	2
Tripura	85.81	3
Nagaland	82.08	4
Mizoram	81.58	5
Arunachal Pradesh	75.45	6
Chhattisgarh	74.09	7
Orissa	71.88	8
Uttaranchal	71.18	9
Assam	70.15	10
Meghalaya	66.79	11
Jharkhand	64.33	12
Himachal Pradesh	61.26	13
Karnataka	55.79	14
Kerala	53.71	15
Bihar	51.98	16
Jammu and Kashmir	48.73	17
Goa	45.16	18
Madhya Pradesh	43.01	19
Maharashtra	37.28	20
West Bengal	35.72	21
Tamilnadu	33.75	22
Andhra Pradesh	32.55	23
Rajasthan	26.52	24
Haryana	25.59	25
Uttar Pradesh	21.40	26
Gujarat	10.46	27
Punjab	0.00	28

### Natural Resource Conservation



### Performance in Land Use



*Mr. Pradeep Kumar IFS, Conservator of Forests in the Department of Forests, Environment and Wildlife Management receiving the prize on behalf of Sikkim State Government.*





# SoE Report

## State of Environment Sikkim 2007

### ABSTRACT

SoE Report focuses on providing information on key issues of environment, such as, Wildlife & Biodiversity, Water Resources, Soils, Wetlands, Forest Cover, Medicinal Plant Resources, Farm Resources, Environmental Pollution, and several Government Initiatives on Environment. It tries to bring forth the need for adopting the path of sustainable development rigorously by both, the people and the Government. It hopes to break the inertia inherent in societies by raising their information level about the current state of their Environment. This report highlights issues that warrant immediate remedial measures and prompt towards positive action.

Sikkim is a part of hot spot zone and is rich with about 4500 species of flowering plants, 362 species of ferns and its allies, 11 species of oaks, 9 species of tree ferns, 30 species of Primulas and 28 species of bamboos, 550 species of Orchids and 36 species of Rhododendrons. In fauna, the state is also very rich, 144+ species of Mammals, 550 species of birds, over 600 species of butterflies and many times more of moths.



Sikkim is one of the smallest and the least populous states in India. It covers an area of 7,096 sq. km, extending approx. 114 km from North to South and 64 km from East to West. A miniature of rich and varied depository of biodiversity,

Sikkim is shelved in the womb of the mighty Mt. Khangchendzonga and her beautiful ranges extending from west to north. North by the Khangchen Gyao, Gurudokmar and Dongkhyala peak forming cold desert plateau with abundance of rare and endangered faunal resources.



The eastern boundary of the state extending from Chimochi peak at the tri-junction of Tibet, Bhutan and India (Sikkim) and follows up to Shankhidhar Gnanchung (Eastern Blue Dragger shaped mountain) along Thangkarla ranges. The eastern part of the state has unique composition of floral distribution and faunal dominance. The entire lab of the Himalayas has bountiful of water bodies in the form of fresh water lakes attributed by the glaciers and perennial snow capped mountains. These lakes are the transitory halting habitats of a large convey of migratory waterfowls. The Rangit and the Teesta rivers form the main channels of drainage and run nearly North-South.



Forestry is the major land use in the State and nearly 82 % of the total geographical area of the State is under the administrative control of the State Forest Department. Developmental activities was greatly accelerated in every sector soon after 1975 when Sikkim got merged in the Indian union, as a result, state revenue enhanced to 120.59 cores in 2006 which was only 48.44 cores in 1994. The economy of Sikkim is mainly based on Agriculture and Animal Husbandry. Approximately 11% of the total geographical area is under Agriculture. Tourism is one of the important service sector business activities in the state, about 3 Lakhs tourists visit this tiny Himalayan state annually.

Sikkim is a land of vast variation in altitude within very short distances ranging from 300m to 8585m. Elevation plays a prime role in fashioning the ecoregions of the state. Broadly speaking there are five altitudinal zones of vegetation. All have a unique and distinct distribution of vegetation pattern as per their altitude. Protected area network has been playing an important role in maintaining the natural resources of this fragile eco-system and to the economy of the State, providing a base for recreation and tourism. Total area under Protected Area Network of State is 2177.10 sq. km (i.e.30.68 % of state's total geographical area).

## HYDEL PROJECTS IN SIKKIM



Name of Project	Capacity (MW)	Name of Project	Capacity (MW)
1. Teesta Stage-I HEP	280	16. Rangit-II HEP	60
2. Teesta Stage-II HEP	330	17. Rangit-IV HEP	120
3. Teesta Stage-III HEP	1200	18. Dikchu HEP	96
4. Teesta Stage-IV HEP	495	19. Jorethang Loop HEP	96
5. Teesta Stage-VI HEP	500	20. Lingza HEP	120
6. Lachen HEP	210	21. Thangchi HEP	40
7. Panam HEP	300	22. Bhimkyong HEP	99
8. Rangyong	117	23. Bop HEP	90
9. Rongni Chu HEP	96	24. Ting Ting HEP	70
10. Sada Mangder HEP	71	25. Ratey Chu-Bakcha Chu HEP	40
11. Chuzachen HEP	99	26. Teesta Stage-V HEP	510
12. Bhasmey HEP	32	27. Tashiding HEP	60
13. Rolep HEP	36	28. Surtaley Tar HEP	30
14. Chakung Chu HEP	50	29. Rangit-III HEP	60
15. Ralong HEP	40		

Harnessing the hydro electric power is yet another important industrial activity undergoing in the state.

In Sikkim, the role of water resources in the environment is paramount. The Teesta is the major river system in the state. Sikkim has only natural inland wetlands belonging to the category lakes/ponds. Physiographically, two-third of the state consists of largely snow-covered high hills with deep ravines/gorges. About 46 % of the state is forest covered.

The state has cool humid temperatures ranging from 3 - 30° C. Average annual normal rainfall in Sikkim is about 2534 mm. The month of July receives maximum rainfall of the order of 480 mm and minimum normal rainfall of 19 mm is recorded in the month of December. Mean daily Relative Humidity varies from 63.8 % to 88.7 % over the basin.

Soils of Sikkim belong to 3 orders, 7 suborders, 12 great groups and 26 subgroups. It is observed that Inceptisols are dominant (42.84 %) followed by Entisols and Mollisols occupying 42.52 % and 14.64 % respectively. The flora of Sikkim Himalaya has partly been studied by the famous Taxonomist Shri J. D. Hooker as early as 1948 as a part of Flora of British India published in 1872 -1897. Since then, the Botanical Survey of India has been exploring the approachable pockets in parts of Sikkim.

Sikkim harbors an enormous biodiversity of medicinal plants that occur right from the humid river valleys to the cold trans-Himalayan desert. Also we have a vast repository of local health traditions and practitioners (Baidya, Amji, Bongthing, Jhankri, etc). The contribution of horticulture to the state's domestic product has been quite significant. Floriculture also has tremendous potential. The state government has promoted packages of extension and training programme which has received tremendous response from the village community. Poultry farming also is a commercially viable and employment oriented activity aimed at perceptible improvement in the economic condition of the rural poor. The Dairy Development programme in the East, West and South district is being implemented through Sikkim Milk Union Ltd. Fisheries are an important area of economic activity. The Sikkim State Pollution Control Board (SPCB) has a regular Ambient Air and Water Quality Monitoring Programme to assess the status of pollution in the natural environment.

The Government of Sikkim has launched a unique and innovative programme through the active participation of community called "State Green Mission" with the view to raise avenue plantation along the roads and beautification of all vacant and waste lands to further reinforce wide spread recognition of Sikkim being a Green State.

### Conclusion

The present report is an attempt to integrate information on the driving forces and pressures acting on the environment; the existing state of the environment, the resulting impact and the responses developed to reduce the pressures and improve environmental conditions. In order to mitigate negative impacts on the environment, protect, preserve & improve its quality and strengthen the endeavors of government and all agencies, as well as, ensure participation of masses in environment protection.



# Milestones

## Conservation of Environment

### Government's Initiative on Environment

- 1995:**
- Ban of Green felling in forests & no clear felling. Only dead, dying and diseased trees allowed to be removed for the bonafide use.
  - Year 1995-96 declared as "Harit Kranti" year and period 2000-2010 as 'Harit Kranti Dashak' for Green Sikkim through people's participation.
- 1997:**
- Ban on the use of non-biodegradable materials like plastics, poly-bags, Bio-medical / chemical waste.
- 1998:**
- Ban on Grazing in reserved forest areas, plantation areas and water sources areas.
  - 1998: State award "Rajya Van Samrakshan Evam Paryavaran Puraskar" constituted.
- 1999:**
- "Smriti Van" program launched.
- 2000:**
- Compulsory Environmental Education for schools
  - Eco-clubs and Green funds in Schools/Colleges.
  - Directed all Government Department & Institutions to keep compounds green & pollution free.
  - No land to be left fallow or barren.
  - Ban on lopping of Dhupi tree (*Cryptomeria japonica*) and collection of Nagbeli & Mosses.
- 2001:**
- Notified sacred peaks, caves, rocks, lakes, chhorten & hot springs.
  - Banned scaling of important peaks including Mt. Khangchendzonga (8598m).
  - Creation of network of JFMCs /EDCs & WDCs.
  - Ban of usage of plastics in Protected Area Network.
  - State Biodiversity Park at Tendong, South Sikkim created.
- 2002:**
- State Medicinal Plant Board established.
  - Treatment & reclamation of landslides/slips/erosion of areas formulated.
  - Use of bio-manure encouraged to develop Sikkim as an Organic State.
  - Free LPG connection to weaker section of the society to reduce dependence on firewood.
  - Mandatory EIA/EMP for all hydro projects.
  - Abandoned and closed Rathang Chhu HEP in West Sikkim and Firing Range 'G' in North.
- 2005:**
- Constitution of High Level Task Force (Environment Commission).
  - Ban of killing of wildlife and aquatic animals.
  - Regulation of Trekking Rules formulated.
  - State Ecology Fund Environment Cess Act formulated.
- 2006:**
- State Biodiversity Board constituted.
  - State Biodiversity Strategy & Action Plan formulated.
  - State Green Mission launched to integrate people with Nature & invoke mass support for the cause.
  - State Environment Agency Constituted.
- 2007:**
- M.G Marg, Gangtok declared spit free zone.
  - State Glacial Commission formulated.
  - National Bamboo Mission launched.
  - Wetland Conservation Programme formulated.
- 2008:**
- Hosted International Flower Show at newly renovated Saramsa Garden.
  - Eco-tourism Directorate created.
  - Bhanjakri Falls Energy Park inaugurated.
  - Ridge Park at Gangtok inaugurated.
  - M G Marg renovated to promote clean and hygienic environment.
  - Phenzang Model Village inaugurated.
  - State Green Mission – Phase III launched.
  - *Hamro Van* Media Launched.
  - The last decade and half has seen a significant rise in the forest cover from 44% to 46%.
  - Sikkim State awarded Rashtriya Nirmal Gram Puraskar for being the first state in the country to achieve 100 percent sanitation.
  - Sikkim state adjudged 1<sup>st</sup> Rank in Conservation of Natural Resources and in Performance of Land Use by the Institute of Financial Management & Research, Chennai. Adjudged 2<sup>nd</sup> in overall ESI ranking.
  - Sikkim state awarded Platinum Award for Emerging Tourism State of 2008.



# Did You Know?

A dripping tap wastes up to 22 litres of drinking water a day!



## DOs & DONTs

- Turn the tap off while you brush your teeth and rinse at the end with a mug of water. A family of four can save a bathful of water every third day this way;
- Take showers instead of baths. A bath uses up to 90 litres (18 gallons) of water. Showers use an average of only 30 litres (7 gallons). So, save time, water and energy by taking a shower;
- Wash vegetables/dishes in a bowl, not under a running tap. Soaking vegetables makes them easier to peel. A running tap wastes 10 litres (2 gallons) a minute;



**Waste NOT Want NOT  
Save Water ! Coserve our Environment !**



## ENVIS CENTRE SIKKIM

ENVIRONMENTAL INFORMATION SYSTEM  
*On Status of Environment & Related Issues of Sikkim*

This Centre is functioning under the over all administration of the PCCF-cum-Secretary, Forest, Environment & Wildlife Management Department with the supervision and guidance of Additional PCCF, CCF and Conservator of Forests of Environment sector. The day to day affairs of the ENVIS centre are being managed by the Conservator of Forests, Land Use & Environment Circle, who is also the Programme Coordinator for ENVIS Centre Sikkim. The centre also has one Programme Officer, one IT Assistant and one Technical Project Associate to look after the needs of collection, compilation, database development, updating of information on the database and websites, publication of news letter, etc.,

The Centre has been established at the ground floor of the annex-II, Forest Secretariat, Deorali, Gangtok 737102.



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\* Please send your valuable feedback at <http://www.sikenvis.nic.in/feedback.htm>

### Book Post

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To,

**Disclaimer:** The information in this newsletter has been compiled from various sources and does not necessarily depict views of the ENVIS Centre, Forests, Environment & Wildlife Management Department, Government of Sikkim