ACHIEVEMENTS OF SCIENCE & TECHNOLOGY AND CLIMATE CHANGE DEPARTMENT

Sikkim State Council of Science & Technology
Department of Science & Technology and Climate Change
Government of Sikkim

Pawan Chamling

CHIEF MINISTER
Government of Sikkim
Gangtok

MESSAGE

I am pleased to know that Department of Science, Technology & Climate Change, Government of Sikkim is bringing out a special publication on its past achievements since inception.

We are aware that, the age in which we live can rightly be called the age of science and technology, the progress of which has led to many useful contributions in every field of our life. I firmly believe that science and society will have to co-evolve continuously. Scientific and technological innovations and economic growth are two sides of the same coin, and are deeply interconnected with each other. Scientific awareness and promotions of successful novel technologies will surely benefit our people in the long run.

Pressure on the natural resources is a big challenge for a developing society like ours. Solutions for this has to come from adopting emerging technological innovations and building scientific aptitude amongst the people of the State. Upcoming sectoral technological roadmaps and solutions need to be adopted by scientists and decision makers alike.

It has been our consistent endeavour in the last 20 years to spread awareness on science and build scientific temper amongst our people, with special focus on the younger generation.

I hope the Officers of the Department, particularly the scientists carry out more research on scientific technology and knowledge for the benefit of the State and the people.

Best Wishes

Pawan Chamling

T. W. Lepcha

Minister

Science & Technology and Climate Change Dept.,
Forest Env. & Wildlife Management Department,
Mines, Minerals and Geology Department
Government of Sikkim, Gangtok

MESSAGE

International experience has shown that the science and technology tools can be effectively used for social and economic transformation of a nation. In the year 1996, with an objective of integrating science and technology in the developmental process, a separate department of Science and Technology was established in Sikkim. Initiated in a rented premises, with a very few manpower a beginning was made.

Now with the addition of the 'Climate Change', the Department of Science, Technology and Climate Change, Government of Sikkim has its own Vigyan Bhawan at Deorali under the visionary leadership of our Chief Minister Sh. Pawan Chamling. The major areas of activities are Technology Transfer, Communication and Popularization of Science, Intellectual property Rights, Biotechnology, Tissue Culture, Remote Sensing and Climate Change.

Presently, various Ministries of the Government of India are supporting large number of demonstration and research-oriented projects. We greatly acknowledge the support provided by the Ministries of the Government of India, especially, Department of Science and Technology, Department of Biotechnology, Department of Space, Ministry of Environment, Forest & Climate Change etc. for contributing to the growth and development of the state.

The research and application projects on Biotechnology, Technology transfer, Remote sensing & GIS, Glaciers, Climate Change undertaken by this Department has facilitated for collection of primary data on various resources of Sikkim and these are being disseminated to various sections. The personnel engaged in the projects have completed Ph.D. or are in the process of enrolling/completion of Ph. D.

I am very glad that the Department is bringing out the activities report highlighting the major achievements since inception. I congratulate all the officers and staff and extend my best wishes for attaining greater heights for overall growth and development of Sikkim.

Tshering Wangdi Lepcha

Dr. Anil Mainra

Principal Secretary
Science & Technology and Climate Change Dept.,
Government of Sikkim,
Deorali, Gangtok

FOREWORD

Fundamental requisite for growth and development of a society is easy access to latest inputs of science and technology. It is important therefore, to foresee future needs of the society and make available technologies and scientific inputs that can be used for solving the problems and thus contribute to the socio economic development. Keeping this pivotal role in view, Science and Technology Department was created in the state in year 1996, just after Sh Pawan Chamling, Hon'ble Chief Minister took over.

Various activities of the department are undertaken through the Sikkim State Council of Science & Technology, which is an autonomous organization under the department and was created soon afterwards. The Department and the Council has worked for whole spectrum of technologies and scientific inputs in the last 20 years of its creation, for fulfillment of the aspiration of various segments of society in the State by undertaking various projects funded by the central as well as state government.

Wide dissemination of scientific knowledge is taken up to build scientific temperament amongst various levels of the society particularly the youth. Efforts are being made to conceptualize and implement programmes and projects that help people understand implications of various emerging scientific options that impinge directly on their lives.

Climate Change was added to the mandate in year 2009 and the department was re-designated as Department of Science, Technology and Climate Change. With the advancement of technology in the field of remote sensing and its applications, it has been possible to do mapping of natural resources especially in the remote and inaccessible areas of the state along with validation by ground truthing. Likewise Biotechnology section amongst its diverse activities has prepared database on certain species of plants like Orchids, Rhododendrons etc. and is undertaking research for agricultural and horticultural crops specially for producing disease free plantlets by using tissue culture technology .

This document provides information on various projects and plans undertaken by the Department as well as Council in brief since its creation to develop and build technological environment for surging ahead in all socio economic initiatives.

(Dr. Anil Mainra) IFS

INTRODUCTION

Department of Science& Technology in the State was created during 1996 with the mandate of carrying out for research and development in various identified areas relevant to the state, generation of scientific awareness and also for transfer of appropriate technologies for economic upliftment of the weaker section of the society.

Further, Sikkim State Council of Science & Technology was also created in year 1997 keeping in view the importance of science & technology for overall development of the state and with a view to provide sufficient autonomy for implementation of various scientific programmes. The Council takes up various programmes funded by the State Government as well as projects funded by various agencies of Government of India like the Department of Science & Technology, Ministry of Environment & Forests, Department of Bio-technology and Department of Space among others. The Sikkim State Council of Science & Technology is the functional arm of State Science & Technology Department for implementation of various scientific programmes in the State.

The Department has taken up through the Council various scientific programmes related to (i) Bio-Technology (Bioinformatics & Tissue Culture, Medicinal Plants, Scientific programme on Planting Stock Improvement; Establishment of Sikkim Biotechnology Research and Application Centre) (ii) Glaciers and Climate Studies (iii) Environmental Information System; (iv) Patent Information Centre; (v) Remote Sensing and GIS; and (vi) Technology Transfer and Scientific Awareness, Capacity Building and Skill Development programmes.

The broad objectives of the Department and the Sikkim State Council of Science & Technology are as under:

- To increase the Science & Technology infrastructure for meeting the challenging demands in basic research, technological development and scientific services.
- To identify the areas where Science & Technology intervention could significantly improve the existing socio-economic conditions.
- To identify areas of long term development of the State by ensuring application of science and technology developed so far.
- Pilot scale demonstration projects.

- Replication of success models and undertaking pilot scale demonstrations projects.
- Develop appropriate mechanisms for reducing the time lag between an invention and its commercialization.
- To supplement the efforts of the State Government in implementing various projects whenever and wherever called for.
- To popularize technologies and initiate scientific attitude and temperament amongst the people of the State through awareness and training programmes.
- To facilitate the scientists and the entrepreneurs in promoting technology transfers, establishing a strong relationship among the academics, research institutes and industry, guidance for developing entrepreneurship.

A full fledged Climate Change wing was added to the mandate of the Council and the Department was re-designated as the Department of Science & Technology and Climate Change in the year 2009. The premise of the Department has moved from a rented building to a newly constructed building in Deorali in February, 2014 that was inaugurated by Sh Pawan Chamling, Honorable Chief Minister of Sikkim.

Vigyan Bhawan, Department of Science, Technology and Climate Change

Inauguration of Vigyan Bhawan, Department of Science, Technology and Climate Change by Shri. Pawan Chamling, Honorable Chief Minister on 22.02.2014.

Activities of the Department are carried out by three Divisions viz. Biotechnology Division; Transfer of Technology and Communication Division and Remote Sensing and Climate Change Division. Following account briefly indicates the activities of these three divisions.

BIOTECHNOLOGY DIVISION

Background

Biotechnology division was created with the objective to undertake research and development work on biotechnology, its promotion in the state and sustainable utilization of biological resources with its application. Biotechnology in the state made its beginning with the establishment of tissue culture laboratory in 1994 as then under the state forest department which was later transferred to Science and Technology along with existing manpower in 1998. With the humble beginning with a tissue culture laboratory, the division has made significant progress and established state of art biotechnology laboratory in the state. The exploration and sustainable utilization of state's rich bioresources and their sustainable utilization has been enhanced through the application of biotechnological tools in the recent years.

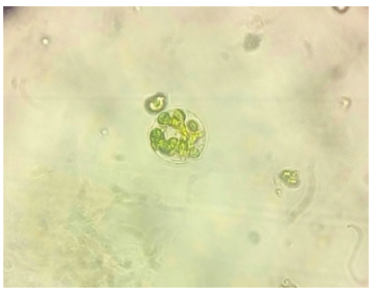
Tissue culture of Orchids

Tissue culture of large cardamom

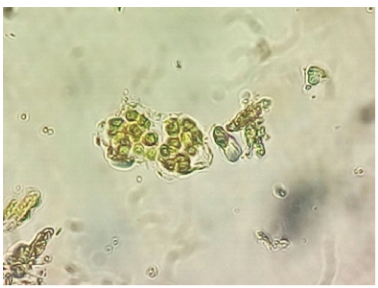
Works and achievements since inception: The pioneer work of plant tissue culture in the state was carried out in our laboratory and successful initiation and multiplication protocols of economically important plant species such as orchids, cardamom, medicinal plants has been developed. The establishments of government and private labs are the direct or indirect results of our successful laboratory. Number of successful private as well as government laboratory have been established and are producing quite a good number of tissue cultured plantlets taking lead from our laboratory.

The laboratory has imparted number of training on plant tissue culture and nursery techniques to the entrepreneurs. Some of them have established laboratories and nurseries.

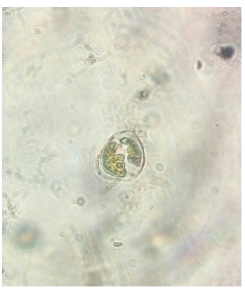
The laboratory is working on the development of resistant variety of large cardamom through protoplast fusion, cell culture and significant progress has been made in this field also.



Isolated protoplast from large cardamom



Protoplast fusion



After fusion

Besides laboratory work, the centre has developed and maintained germplasm of large cardamom, ginger and herbal garden for research and educational purpose. The centre has maintained 7 cultivars of large cardamom and 6 cultivars of ginger and numbers of medicinal plants are being planted in the herbal garden. The centre is also working on the new type of farming method which may give a strong support to the organic farming in the state.

New method of farming

Germplasm of large cardamom maintained at Sajong farm

Under the Biotechnology Division, there are two Government of India funded established centres.

I. Bioinformatics centre

Background

Bioinformatics Sub DISC (Distributed Information Sub-Centre) under Sikkim State Council of Science &Technology, was set up in the state in the year 2001 with the support of Department of Biotechnology, Government of India. Bioinformatics is an emerging field where the complex biological data generated out of research is analyzed with the help of computer science.

Research Area: Biodiversity, Biotechnology and Bioinformatics

Activities

Bioinformatics centre since its establishment conducted number of trainings, workshops and seminar and actively involved in the promotion of bioinformatics in the state. Special programme on bioinformatics for school students was carried out as Bioinformatics educational programme. Maximum schools were covered and made aware of the newly emerging field of bioinformatics and its scope in the coming years. The centre is publishing quarterly newsletter "Biogyan" relating to bioinformatics and biological sciences and distributes the same in the conferences, seminars, workshops, research institutes, colleges and schools for wide awareness and knowledge. The centre has created database on flora and fauna of Sikkim such as Rhododendrons of Sikkim, medicinal plants of Sikkim, birds of Sikkim etc. for wider exchange & sharing of information/data among the scientific community for research and educational purpose. The centre has also developed animation on biological process such as cell division, protein synthesis, HIV/AIDS to help the students to understand the process by visual means. The centre has compiled and published research paper relevant to the Sikkim Himalayan region and published number of research papers in national and international journals. The centre is equipped with e-library facility which is being used by the researchers.

II. Patent Information Centre

Patent Information Centre (PIC) is established in the year 2001 under the aegis of Sikkim State Council of Science & Technology (SSCS&T), Department of Science, Technology & Climate Change (DST&CC), Govt. of Sikkim. PIC, is funded and supported by Department of Science and Technology (DST), Government of India.

Objective:

Objective is to create awareness about Intellectual Property Rights (IPR) especially Patents, Geographical Indication (GI), Copyright, Trademark, Protection of Plant Variety & Farmers Right (PPV&FR), Integrated Circuit & Layout, etc. PIC also facilitates filing and search relatedto IPR to the universities, industry, government departments & R&D institutions, students and teachers. Sensitization on IPR to the rural innovators and block level officers is also taken up.

Awareness and sensitization activities were conducted through opening IPR cells in the state Govt. colleges, writing article in daily local paper, radio talk, workshop, seminar, IPR camps, brochure, palm plates, flex display, hoardings etc.

Summary of the progress:

PIC, SSCS&T has organized many workshops, seminars and camps on IPR (GVK, school, college and village level/community level). The centre is also actively involved in filing and Registration of different IPR like Geographical indication (GI), Patent, Copyright, Protection of Plant Variety & Farmers Right (PPV&FRA), Trademark and Logo, etc. PIC has published many articles on IPR in the local newspaper of the state, Research Journal and Books. The centre has opened eight IPR cells in the different colleges and universities with the objective to create awareness and sensitization on IPR. PIC has also broadcast Radio talk on IPR in the All India Radio, Gangtok. The centre provides Patent search facilities to the researcher, scholar and visitors free of cost. The centre has maintained hoarding and Flex display on IPR at Vigyan Bhawan, Deorali, Gangtok and Sikkim Science Centre, Marchak.

PIC, identified six potential local items for Geographical Indication (GI) registration from Sikkim.

1. Sikkim Mandarin *(Sikkim Soontala),*
2. Sikkim DzonguLepcha Hat *(SumokThyaktuk),*
3. Sikkim DzonguLepchaDarri*(Thokro/Darrey),*
4. Sikkim Temi Tea *(Sikkim TemiChiyapatti)*
5. Sikkim Chilly Pickle, *(Dalleykhorsanikoacchar)*
6. Sikkim Ginger, (var; *Bhaisey, Majauley)*

Geographical Indication Registration filed to Technology Information Forecasting Assessment Council (TIFAC), New Delhi (TIFAC):

The centre has applied for four items to the TIFAC for providing support for GI registration. Among four which includes Sikkim Temi Tea, Sikkim Mandarin, Sikkim Dzongu Lepcha Hat (*Sumok Thyaktuk*) & Sikkim Dzongu Lepcha Darri (*Thkro*), two items has been accepted for the process GI registration by the TIFAC. These are Sikkim Temi Tea & Sikkim Mandarin. (Registration under process)

Sikkim Mandarin Pic

Sikkim Temi Tea

Eight IPR cells opened in the colleges and universities.

Biotechnology division has executed number of Research & Development and extension projects. Some highlights of the projects are as under:

1. Establishment of State Biotech Hub in Sikkim

The project for "Establishment of State Biotech Hubs (SBT hubs) in Sikkim" funded by Department of Biotechnology (DBT), Govt. of India under special programme for North Eastern States of India was taken up. The project is being coordinated and supported by Biotech Consortium India Limited (BCIL), a Government of India enterprise promoted by the Department of Biotechnology, Government of India. The project has a component of establishment of state of art biotechnology infrastructure facilities in the state and act as a nucleus research centre for biotechnological research. The total project cost is Rs. 304.03 lakhs and it is of three years duration. The main objective of the project is the establishment of major biotechnology infrastructure facility in the state, to train the coordinators of the institutional hubs, to provide support for research and training and to have a linkage with other institutional hubs in the respective state.

Some major work is being done under the project. The state of the art biotechnology infrastructure facility both at Vigyan Bhawan and cell and tissue culture laboratory, Sajong, Rumtek were established under the project. The laboratory has 43 newly procured high end instruments and machineries and most consumables required for the molecular and biochemical studies.

State Biotech hub at Vigyan Bhawan

Under the project, number of workshops, trainings and outreach programme has been conducted and published research papers in national and international journals. More than 20 workshops, seminars and trainings has been conducted. The outreach programme to inculcate interest on biotechnology amongst the students has been conducted in 21 senior secondary and secondary schools.

Hands on training on molecular Biology techniques

Outreach programme on biotechnology

2. Distribution, habitat, protocol development and economic potential of sea-buckthorn in Sikkim"

The project was funded by Department of Biotechnology, Government of India and was of three years duration commencing from 1998.

The Seabuckthorn plant is considered to be a wonder plant of the fragile mountain ecosystem is found to be growing in the Lachen and Lachung valley of north Sikkim. The Scientific study of the plant in terms of its distribution, habitat protocol development for its propagation and economic potential is felt necessary to be carried as preliminary works. The project was completed as per the objective set and significant findings were made.

3. Training on propagation, cultivation and agro-techniques of orchids for rural women of Sikkim.

The project was funded by Department of Biotechnology, Ministry of Science & Technology, Government of India in the year 1998 and was of three years duration.

Batch wise training consisting of 20 per training in two months per batch were conducted at the then tissue culture laboratory at Metro point, Tadong. The course included were practical hands on training on orchid potting mix preparation, hardening of orchid seedlings, transplanting to subsequent bigger pot, dividing of orchids, pasteurization of potting mix, tissue culture of orchids, seed culture of orchids, theoretical classes on nursery management, pest and disease control, nutrient application, vase life increase, cut-flower, post production management and marketing. The trainees were taken to nurseries at Kalimpong, nurseries in and around Gangtok. After the training programme, the trainees were provided with tissue culture grown orchid saplings to start with. Those intending to go for large scale orchid growing were assisted in project preparation and financing from the bank. About 140 trainees were provided training of 3 years duration. Some of the trainees have started their nursery recently with the government assistance.

4. Training on propagation and cultivation of mushroom for rural women of Sikkim.

The project was funded by Department of Science & Technology, Ministry of Science & Technology, Government of India in the year 1999 and was of three years duration. Batch wise training was conducted with hands on training on substrate preparation, spawning, growing, pest management, harvesting, packing and marketing. About 120 rural women were given in-house training and trainings were also imparted in different places like, Rongli, Rhenock, Dentam etc.

5. Ecological Studies of Sea buckthorn and Genetic diversity of *Frankia* associated with it in Sikkim.

The project was being funded by Department of Biotechnology, Govt. of India in the year 2009 and was of three years duration. The objective of the second project on same plants was different than the previous one.

As per the objective of the project, the total survey of *Hippophae* growing areas in Sikkim was carried out. The cuttings from the selected accession have

been sent to IHBT, Palampur for germplasm collection and maintenance. Ecological as well as morphological studies of *Hippopahe* plant were carried out using standard descriptors. The study on the *Frankia*, an organism responsible for nitrogen fixation in *Hippopahe* was thoroughly carried out including in-vitro culture and genetic studies. Soil analysis of native *Hippopahe* with reference of pH, moisture, organic carbon, nitrogen and other macro and micro nutrients was carried out.

6. DBT's mission for the production of quality planting materials and utilization for the North East'

The project titled 'DBT's mission for the production of quality planting materials and utilization for the North East' was being funded by Department of Biotechnology, Ministry of Science and Technology, Government of India and was coordinated by The Energy Resources Institute (TERI), New Delhi. The project was of three years duration and commenced from 2008.The project was executed in almost all North East region of India including Sikkim through Sikkim State Council of Science & Technology, Gangtok.

The production of Quality Planting Material of **Sikkim mandarin, Large Cardamom and Ginger** and their demonstration in the farmer's field was the main objective of the project. The project had taken up all the three crops and demonstrated in their farm with scientific cultivation methods. Under the project in line with the objective, quality planting material of large cardamom, ginger and citrus (mandarin) were distributed and demonstrated in the farmers' field. Total of 32 ha area was covered by these three crops at various locations.

Sikkim State Remote Sensing Applications Centre (SSRSAC)

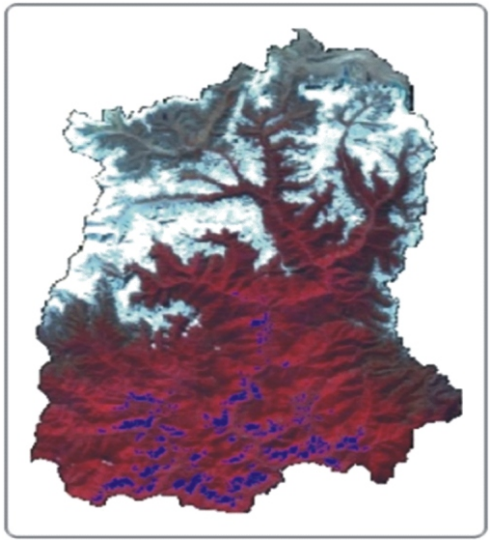
The Sikkim State Remote Sensing Applications Centre (SSRSAC) has started with the Department of Science and Technology in the year 1997. The Centre has one of the states of art- machineries and Software and Hardware like photogrammetry LPS-11, Arc Info-10 and ERDAS-9 with A0 size plotter and Scanner.

The SSRSAC has well trained manpower in the field of Remote Sensing and GIS. The Centre has provided different trainings in the field of Geo-informatics and also provide short term training to Student of different Colleges, in the field of RS and GIS. It has been undertaking various project funded by Central Government as well as State Government and also provides the necessary data to the user department for various developmental activities in the state. Sikkim State Remote Sensing Centre also coordinating the Climate Change programme with various department of State, Central and other agencies like GIZ UNDP etc.

1. Integrated Missions on Horticulture Development

This Project is carried out under the "Technology Mission for Integrated Development of Horticulture in North Eastern States including Sikkim" of Ministry of Agriculture, Govt. of India.

Under this project we highlights the suitable areas for the cultivation of Mandarin orange in the Sikkim that can be taken up for orchard expansion plan under the Technology Mission. Total 24,000 ha of land are fall under the suitable area for the cultivation of orange in Sikkim.



FCC overlaps with Suitable Area for Orange

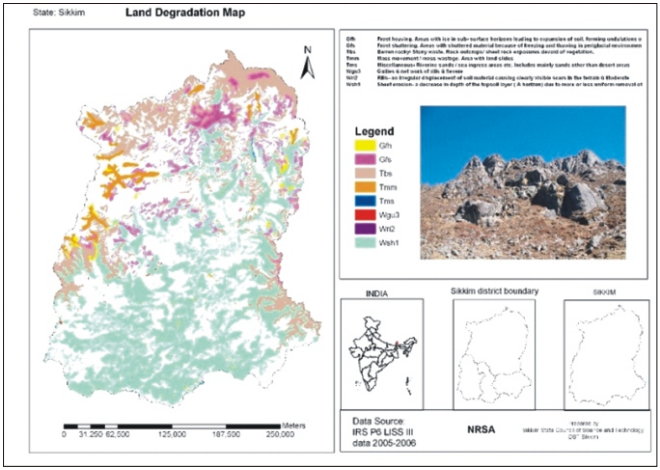
The project duration was from 2001-2006 and was funded by: Ministry of Agriculture, Govt. of India through SAC, ISRO Ahmedabad.

2. National (Natural) Resources Information System (NRIS)

The objectives of NRIS project is to create computer based natural resource information system that provides various sets of capabilities to handle geo-referenced data. This data set was create using the computer system works on Arc/info GIS software. The dataset includes the latest land use/cover from IRS IC/ID satellite data; creation and updating of village wise a spatial data as per the 2001 census records. Creation of the village wise location as per the latest data of Census. Digitization of land use/cover from latest satellite data at 1:50,000 scale. Digitization of other resources like drainage, Road, Village boundary, Soil layers, etc. this dataset was use for the other project as a base data set. The project duration was from 2001-2006 and was funded by: **Department of Space, GoI.**

3. Land Degradation mapping in Sikkim

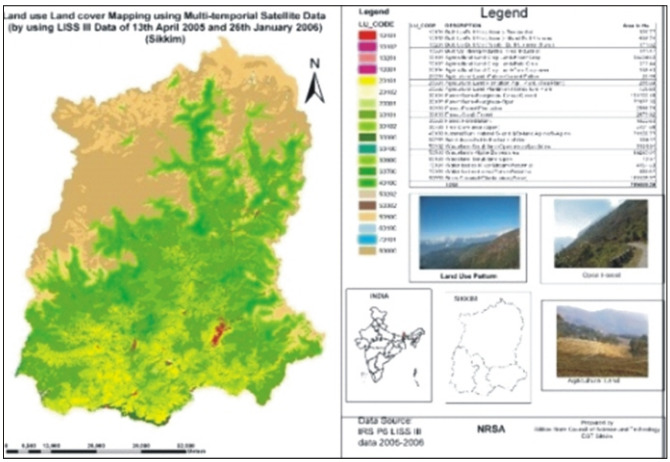
The objective of this project is to identify the degraded land of Sikkim, using the Satellite imagery. For delineation and mapping of land degradation classes, multi-temporal geo-rectified Resourcesat-1 LISS-III data was used for kharif, rabi and zaid seasons of 2005-2006. About 365sqkm of Sikkim was mapped in different classes of degraded area of Sikkim under this project.



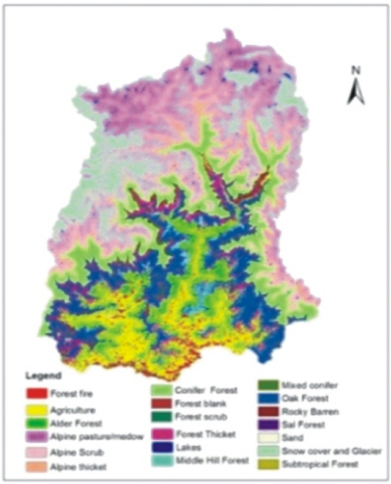
The different classes of land degradation found in Sikkim are Gfh (frost heaving), Gfs (frost shattering), Tbs (barren rocky/ stony waste), Tmm (mass

movement/mass wastage), Tms (miscellaneous-riverine sands/sea ingress areas), Wgu3 (gullies), Wri2 (rills), Wsh1 (sheet erosion). In accordance with the percentage of the state area North district contribute 28.4%, followed by 9.1%, 7.5%, 6.4% in West, East and South district respectively. The project duration was from 2008-2010 and was funded by**: Department of Space, GoI.**

4. Land Use Land Cover mapping of Sikkim Phase I



The objectives of the project are to generate land use/land cover data base on 2005-06 three seasons (Kharif, Rabi and Zaid) LISS III satellite data. Under this project we mapped the Landuse and Landcover map of Sikkim. This can be input for planning exercises at various levels. According to the data generated, 26.95% of total area of Sikkim is cover by semi evergreen forest which is the largest occupant in the state followed by snow cover and glacial area by 25.52%, followed by waste land (Alpine barren area) is 13.99%. Similarly 10.26% of total area is occupied by Forest/Semi-Evergreen-Open, 10.02% by Natural/Semi natural Grass-land & Grass-land Alpine/Sub-Alpine, 9.64% by Agricultural Land and 3.42% area occupied by other landuse and landcover classes in Sikkim. The project duration was from 2008-2010 and was funded by: Department of Space, GoI.



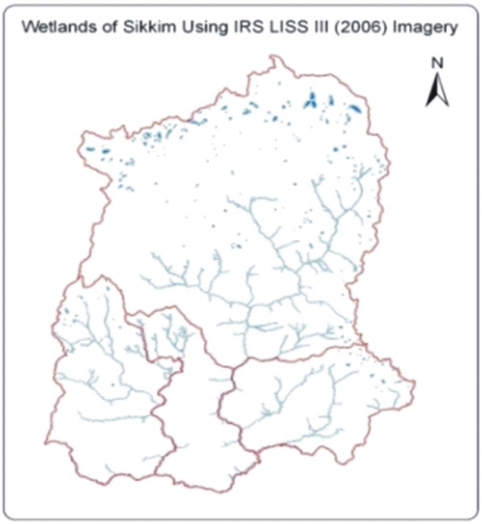
5. Forest Fire Mapping of Sikkim

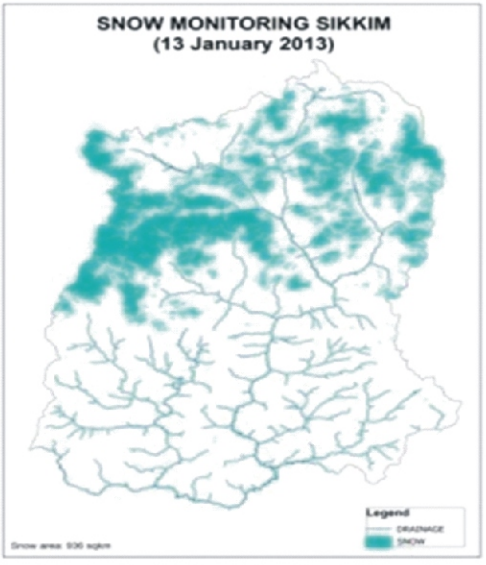
In this project, an attempt has been made to prepare the database on forest fires in Sikkim using IRS LISS III imagery at 1:50,000

scale. For the study, three seasons' satellite imageries viz. 10th January 2009, 23rd March 2009 and 10th May 2009 of IRS P6 LISS III were used for the study. During the visual interpretation of 10th January 2009, 4 number of forest fires have been identified, while 23rd March 2009 imagery 201 forest fires have been identified and using10th May 2009 imagery, 82 additional fire incidences have been identified with the total burnt area of 0.2214 sq. km, 22.975 sq. km, and 9.995 sq. km were recorded, respectively. The project duration was from 2009-2010 and it is under the climate change study in Sikkim.

6. Wetland mapping of Sikkim

The objectives of the project are mapping the wetlands of Sikkim using IRS LISS III digital data following a standard wetland classification system. Total 553 wetland of Sikkim has been mapped including High altitude Lakes, low altitude lake and major rivers with the total area of 7196ha. Comparative study of wetland with 1998 atlas also done which seen the increase number and area of wetland of Sikkim. The project duration was from 2008-2010 and was funded by: Department of Space, GoI.





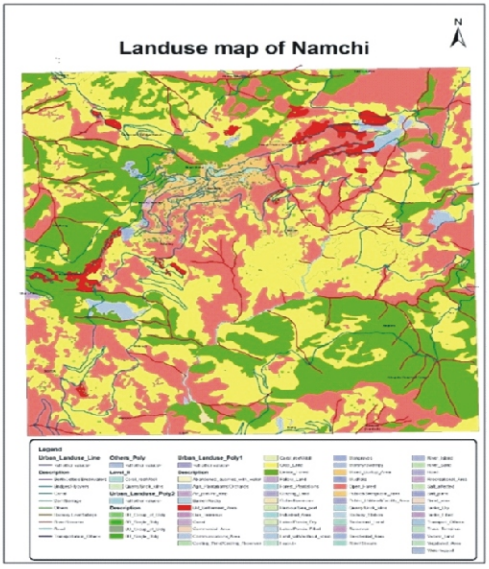
7. Snow monitoring of Sikkim Himalayas Phase -I

The project " Snow monitoring of Sikkim Himalayas Phase -I" was started by the Department of Science and Technology in the year 2008 in collaboration with Space Application Centre, Ahmedabad. Under this

project the snow cover area of every 5daily and 10 daily were mapped using the Awifs satellite imagery. This project was funded by the Department of Space, Government of India.

8. NUIS (National Urban Information System)

The major objective of NUIS project is to design, organize and establish a comprehensive information system in the urban local bodies for planning, management and decentralized governance. For Sikkim state it was assign 10 towns, for different thematic mapping, and we have completed mapping of all 10 towns. The towns are Pakyong, Rabong, Rangpo-Singtam, Mangan, Jorethang, Rongli, Geyzing-Pelling, Soreng and Namchi. The required thematic layer was prepared and submitted to the NESAC. The project duration was from 2011-2013 and was funded by: Ministry of Urban Development, Govt. of India through NESAC, Dept. of Space GoI, Shillong.



9. Application of Remote Sensing and GIS in Sericulture Development in Sikkim

This project covers application of Remote Sensing and GIS in sericulture development in south district of Sikkim. The suitable areas for the cultivation of Mulberry, Eri

and Muga food plants in south district of Sikkim has been identified at the scale of 1: 50,000. The detail mapped and report is prepared and submitted to Central silk Board through NESAC, Shillong. The final suitable areas for the sericulture food plants (Eri and Muga) has been found to be very less as compare to Mulberry food plants. Therefore, other districts of Sikkim may also be taken for the study. Now the second phase of the project has been sanction for West district of Sikkim. The project duration was from 2008-2010 and was funded by: Central Silk Board, GoI, through NESAC, Dept. of Space GoI, Shillong.

10. "Strong motion seismometry, probabilistic seismic hazard, vulnerability and risk Microzonation of Darjeeling-Sikkim Himalaya (SHH)"

The Microzonation of Sikkim region was started with an objective to assess the Seismic Hazard and Microzonation of Sikkim region through setting up of an array of strong motion observatories mostly covering lesser Sikkim Himalaya and a sparse distribution of the network in the Higher Sikkim Himalaya.

- It is a MoES, Govt. of India, funded project initiated by IIT, Kharagpur in the year 1996.
- It's been 25 years IIT, Kharagpur in collaboration with Sikkim State Council of Science and Technology has been monitoring seismic activities in Sikkim.
- Seismic Hazard and Microzonation Atlas of the Sikkim Himalaya has been released in 2011.

Locations of Earthquake Monitoring Station:

Science centre, Singtam and Phademchen in East Sikkim, Melli Dara in South Sikkim, Pelling and Uttarey in West Sikkim, Mangan and Chungthang in North Sikkim and Darjeeling in West Bengal.

Manpower and job profile:

One SPO/RA deputed on project basis at Sikkim State Council of Science, Technology & Climate Change, is involve in maintenance of Seismometer located at different locations of Sikkim and Darjeeling and to collect Seismic data from all the station during an earthquake event and send the raw data to IIT, Kharagpur. Under Sponsored Research and Industrial Consultancy (SRIC), IIT, Kharagpur.

11. Establishment of Landslide database Centre in Sikkim

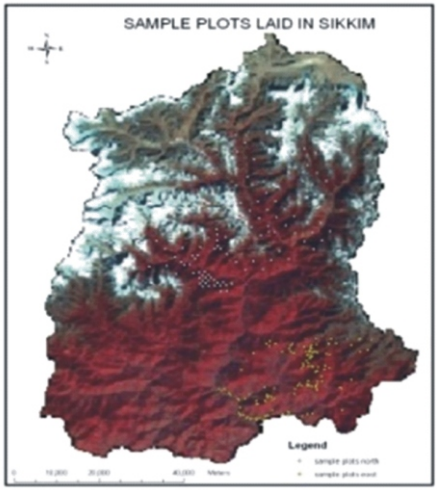
Landslide is an important disaster of hilly areas like Sikkim and other mountainous regions of the world. Sikkim State council of Science and Technology is being carrying out the landslide studies with objectives to create the database on the landslides of Sikkim that not only help in understanding the spatial nature and characteristics of landslides but also help in monitoring the landslides. The landslide inventories from IRS LISS III 2006 image were used more than 300 landslides were mapped using the Remote Sensing and GIS software. We have also prepared the database of landslide of Sikkim with Location, and number. The project duration was from 2008-2010 and was funded by: Government of Sikkim.

12. Programme on climate change research in terrestrial environment (PRACRITI)

Mapping of Glacial lake was conducted under this project. With the help of regression equations, the calculations of snow line altitude have been going on for both Tista and Ranit basins from 2005 to 2010. For the correlation of meteorological data with SLA, the IMD has been contacted, Using time series satellite data, the present study would be a great source of information in terms of change detection in the area of Glaciers and glacial lakes/ moraine dammed lakes. The study will provide the valuable information on the role of temperature when correlating with snow line altitude.

The project duration was from 2008-2013 and was funded by: Space Applications Centre (ISRO), Ahmedabad.

13. Vegetation carbon pool assessment project in north Sikkim



Under this North District of Sikkim was Selected as a project site. Tree with cbh (circumference at breast height) more than 10cm has been taken for the estimation of biomass and carbon. Volume and Biomass has been estimated using volume equations and specific gravity from the literature and other related parameters like height and cbh. The project duration was from 2008-2010 and was funded by: Indian Institute of Remote Sensing, Dehradun.

14. SIS-DP (Spatial Information Support System for Decentralization Planning)

The Space Based Information Support for Decentralized Planning project started in Sikkim from July 2011. The main objective of the project is mapping of various thematic layers of Sikkim at 1:10K scale for decentralized planning. Land Use and Land Cover (LULC), Roads, Drainage, Village, GPUs, Slope, Soil and Ground Water Prospect and other legacy data sets were prepared. The entire thematic layers were uploaded in bhuvan.nrsc.gov.in website. The project duration was from 2011-2015 and was funded by: NRSC, DoS, GoI, Hyderabad.

15. Ground water prospects mapping for Rajiv Gandhi National Drinking Water Mission Phase-IV

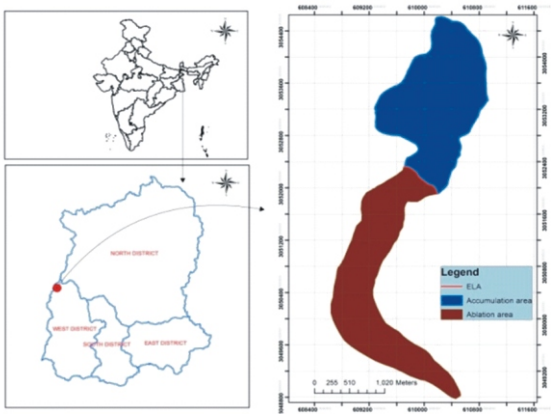
Under the Rajiv Gandhi National Drinking Water Mission (Phase-IV), ground water prospect mapping using Remote Sensing and Geographic Information System techniques in 1:50,000 scales needs to be undertaken. The final ground water prospect mapped has been prepared and submitted to NRSC Hyderabad to prepare the atlas. The project duration was from 2011-2013 and was funded by: NRSC Hyderabad, Department of Space.

16. Identification of bamboos in Sikkim using RS and GIS technique

The area of bamboo available areas of Sikkim is estimated through remote sensing technique and field visits. Multi- spectral images from IRS P6 with 23.5 m resolution was used for mapping the areal extent of bamboos in Sikkim. West district has the maximum bamboo coverage, 14.41% followed by East district 8.76%, South district comes third with bamboo coverage about 8.37% and North district rank forth in terms of bamboo availability with the coverage about 1.42% of total geographical area.

The project duration was from 2011-2014 and was funded by: Horticulture and Cash Crops Development Department, GoS.

17. Study of Glacier Dynamic of East Rathong Glacier of Sikkim Himalayas



Study of Glacier Dynamic of East Rathong Glacier is project funded by Department of Science and Technology, Government of India. East Rathong glacier located in West District of Sikkim. It originates at an elevation between 4600-6700m asl.

Following are the major studies undertaken:

Snout Mapping and monitoring: From 2013, the snout has been monitored with the help of *Topcon DGPS*. The frontal faces of snout showed continuously changing on account of excessive melting in the ablation season of 2013 and 2014-15.

Glacier Hydrology covering Discharge measurement and suspended sediment load studies. The hydrological station was established below 1.5 km downstream of the glacier's snout. The average daily discharge in the year 2013 in East Rathong melt water stream was 5.07 m^3s^{-1}, which is comparatively higher than the average discharge of 2014 (4.84 m^3s^{-1}).

Study of ablation and vertical thinning:

It was found that the glacier has retreated vertically on an **average of 3.849 m** in the ablation period of 2014 (June to September) along the centreline of the glacier, which is considerably higher than the last year melt record in the ablation season.

Meteorological studies

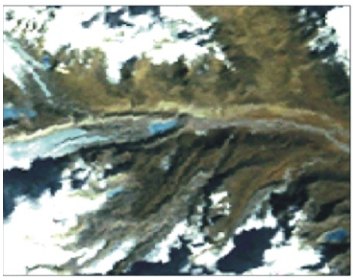
The data meteorological studies are collected by the manual equipments for the ablation period of 2013 - 2014 in East Rathong Glacier, now a Automatic weather station (AWS) was installed in the Glacier area from September 2015.

DGPS survey at East Rathong Glacier

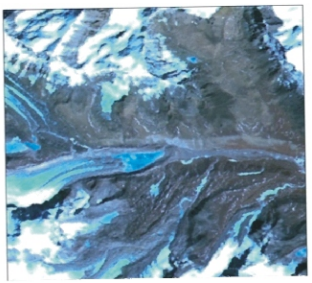
18. Mapping of glacier lakes and development of GIS based glacier lake management information system (GLAMINFORS) for the state of Sikkim

The objectives of the project are real time monitoring of the selected glacier/moraine dammed lakes in the Himalayan Region for developing preparedness and resilience in case of Glacier Lake Outburst Floods **(GLOFs)**. Design and develop a system for identification of moraine dammed lakes, their classification, river channel profiling with the help of Digital Elevation Models, installation of field sensors at potential hazardous lakes and processing of sensor data along with remote sensing data for development of models under GIS environment for GLOFs/Flash floods, and deriving flood related

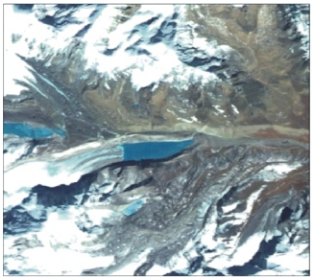
information for damage assessment for the end user in real response time and development of GIS based Glacier Lake Management Information System **(GLAMINFORS)** for the state of Sikkim.



Lhonak Lake (1976)



Lhonak Lake (1997)



Lhonak Lake (2011)

The following lake has been prioritized as potential hazardous lakes in Sikkim.

1. South Lhonak Lake, 2. Sakho Cuu Lake, 3. Teesta Khangsey Lake, 4. Unnamed lake of West Sikkim, 5. Dodh Pokhari near East Rathong Glacier, 6. Gurudogmar Lake, 7. Chho Lhamu Lake, 8. North Lhonak Lake

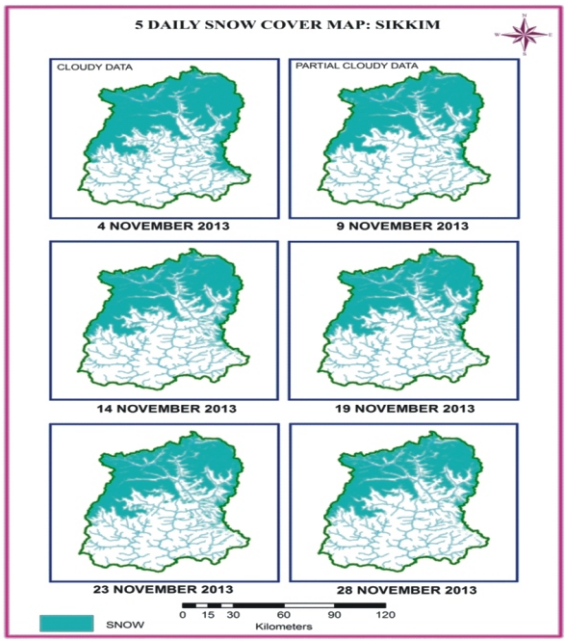
Monitoring of lake provide an early indication of changes; early warning systems, to provide downstream residents and owners of infrastructure time to take avoidance action; and mitigation measures, to physically change the situation and thus reduce the risk. The project duration was from 2010-2015 and was funded by: Ministry of Information Technology, GOI. Through CDAC Pune.

19. Land use land cover mapping of Sikkim phase-II

The objectives of the project is to generate spatial database on land use / land cover for 2011-12, to generate land use / land cover change database along with change matrix with respect to 2005-06 and to identify areas of major change. Among all we have seen major change in forest cover area increase, a change has also observed in Agricultural area, wasteland area, and snow

cover area. The project duration was from 2012-2013 and was funded by: **NRSC,** Indian Space Research Organization Hyderabad.

20. Monitoring of snow and glacier phase II



Mapping and Monitoring of snow cover is an important part of snow and glacier studies. In Sikkim mapping of and monitoring in collaboration with Space Application Centre (SAC) from the year 2004-2005 onwards considering Tista and Rangit basin and Sikkim as a whole. Snow ablation pattern was estimated for Sikkim state, Tista and Rangit basins in the Sikkim Himalaya. In Sikkim, maximum areal extent of 52% snow was observed in the month of May 2014 in cloud cover data of 29 May 2014, and 50% snow was observed in cloud free data in the month of February 2014. The highest snow extent of 59 % observed in Tista basin in the months of February and March. In Rangit basin, maximum areal extent of snow of 28% and 23% observed in the month of May 2014 and October 2013 with cloudy data and 21% snow with cloud free data in February 2014 respectively.

With this atlas the second phase of Snow Cover Monitoring is completed and new phase may start from next year onwards.

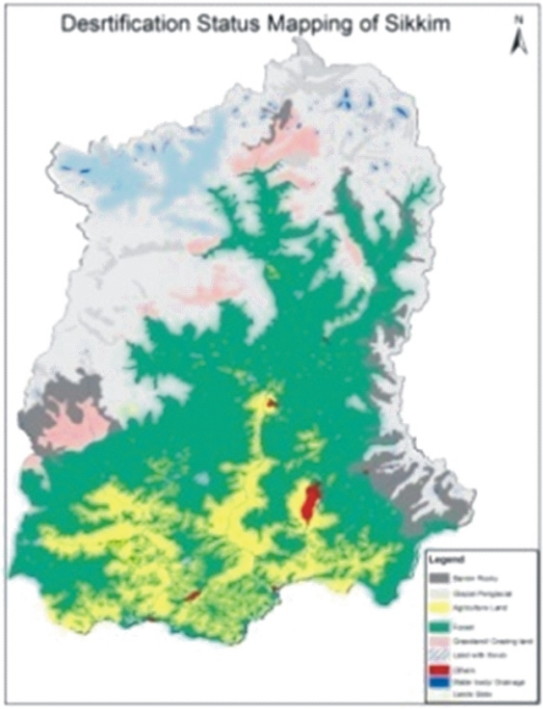
21. Glacier and Climate Change Studies

In Sikkim, a systematic inventory of Himalayan glacier was carried out in collaboration with the Space Applications Centre, Department of Space, GoI, Ahmedabad. As per the study Sikkim has 84 glaciers in Tista basin (Glacier Atlas of Tista Basin) in 2001. With the Constitution of the Sikkim Glacier and

Climate Change Commission details inventory of Glaciers, snow mapping and related studies have been taken up under the chairmanship of Prof S.I Hasnain Under this project study Glacier and climate change studies conducted in Sikkim on three glacier of Sikkim viz, East Rathong Glacier (West Sikkim), Zemu Glacier (North Sikkim), Changme Khangpu Glacier (North Sikkim). beside this Livelihood studies of Sikkimese people. Snow covers monitoring of Sikkim. Impact of Climate Change on Large Cardamom etc. The project duration was from 2008-2010 and was funded by: Government of Sikkim.

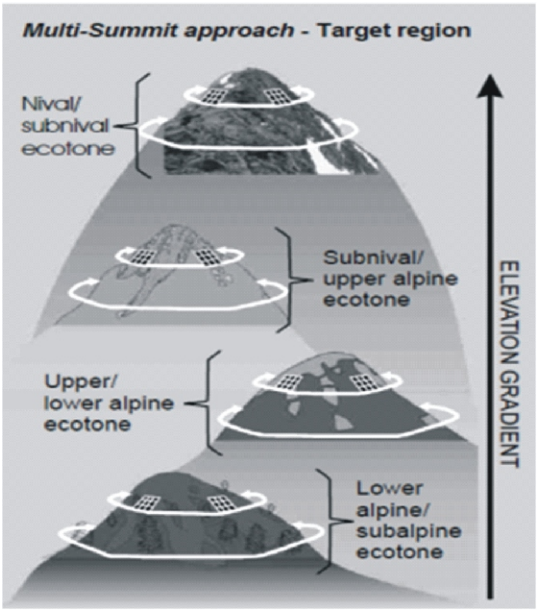
22. Desertification mapping of Sikkim

The major objective of the project is to map the desertification status of entire country (DSM) using AWiFS data (2012-13) on 1:500,000 scale. To map the desertification status of selected vulnerable districts of India using LISS III (2012-13) data on 1:50,000 scale. Desertification Vulnerability Modelling (DVM): To prepare Desertification Vulnerability Map on 1:50,000 for one district in each state. Development of methodology for preparation of desertification combating plans at larger scale for selected watersheds.



The 1:500,000 scale map has been completed and submitted to funding agency, the atlas of the same is under publication. The 1: 50,000 scale desertification map has been prepared and submitted the funding agency, the preparation of atlas is under progress. For vulnerable mapping, East district of Sikkim has been selected and the preparation of required thematic layers for the generation of desertification vulnerability mapping is under progress. The project duration was from 2013-2015-16 and was funded by: Space Application Centre, Ahmadabad.

23. Alpine ecosystem dynamics and impact of climate change in Indian Himalaya



The primary objectives of the project are establishment of long term ecological records in alpine ecosystems of Indian Himalaya. Understanding alpine ecosystem response using remote sensing data, *in-situ* data and modeling. The long term study was started since 2013-14, previously we have selected the site at Gnathang for the long term study, but due to the anthropogenic activities we have sifted site at Kabi-Tingda. The three summits were selected at Kabi tingda reserve forest North Sikkim. The field data was collected continuously from every year from the site finally it was correlated with climate change data. This Project is sanctioned by Space Applications Centre, ISRO, Ahmadabad, under the Himalayan Alpine Dynamic Research Initiative (HIMADRI).

24. Sikkim State Climate Change Cell *(established under National Mission for sustaining the Himalayan Ecosystem* **(NMSHE)***)* **funded by;** Department of Science and Technology, Government of India. The **Objective of the project:**

- Vulnerability and Risk Assessment at Gram Panchyat Unit (GPU) and ward level: The state has total number of 176 GPU and 1001 wards in its four district of Sikkim. Vulnerability and risk assessment provides level of vulnerability within ward/GPU to prioritize the adaptation measures.
- Institutional Capacity building to attain the capability to handle climate change program and to find the solutions to address the problem of climate change in the state. To carry out Research and Development

activities for data base generation as per the SAPCC and NMSHE requirements.

- Training programmes for stakeholders including Government officials, researchers, community based organizations, media etc in the state to work for the minimizing the affect of climate change in the state and to achieve the sustainable development.
- Involving masses to work for minimizing the impact of climate Change through awareness programme.

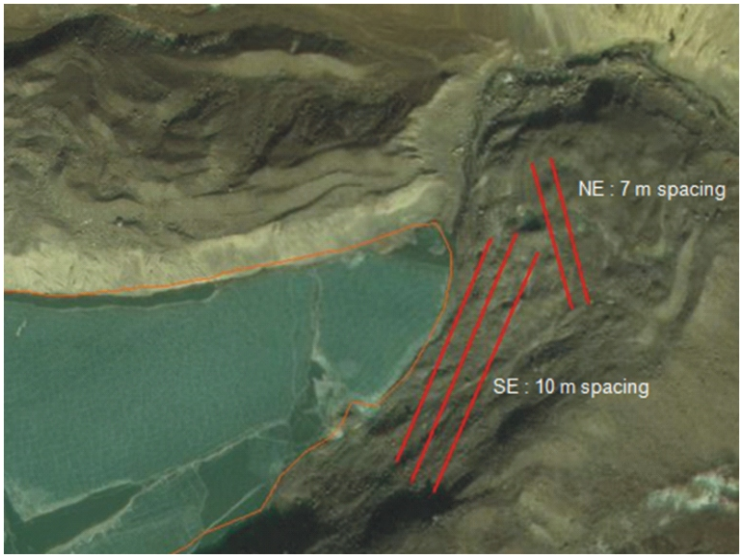
The Centre will also focus on Glaciological studies as well as various studies on Climate Change. Apart from that the Centre will also work on awareness programme on climate change. The Cell will work in close coordination with various stake holders based on the state in order to fulfill the goal of climate change adaptation programme.

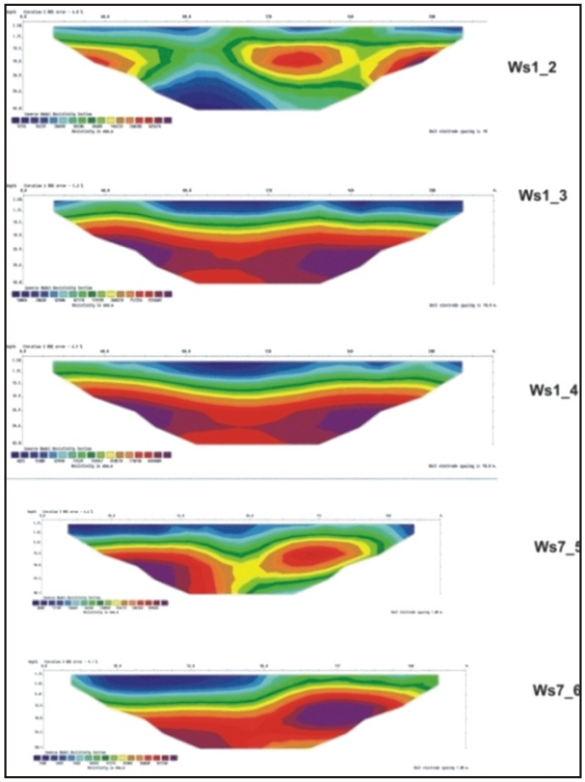
25. Study on South Lhonak Glacial Lake of Sikkim in terms of GLOF

Sikkim State Remote Sensing Applications Centre under Sikkim State Council of Science and Technology is being monitoring the South Lhonak glacial lake from the past few years. South Lhonak glacial lake, located in the extreme North-western parts of Sikkim, is one of the fastest growing lakes in Sikkim. The lake formed right at the snout of the glacier is located in the geographical coordinates of N 27^0 54' 56.7'' and E 088^0 12' 33.7'' at an altitude of 5201m. The analysis of satellite imagery revealed that the lake is growing very fast. The lake is dammed by loose moraines debris brought down by the glacier. The lake was a small glacial lake in 1960s, which grows its size from 18 ha 1976 to 126 ha in within a short period of time makes it one of the vulnerable lakes in Sikkim in terms of glacial hazard, in the form of glacial lake outburst flood (GLOF).

Based on the suggestions made by the working group committee, a field study of the lake carried out in the end of August 2014. Following studies was conducted during this field visit:

Electrical Resistivity Survey of Moraine Damming the South Lhonak Lake

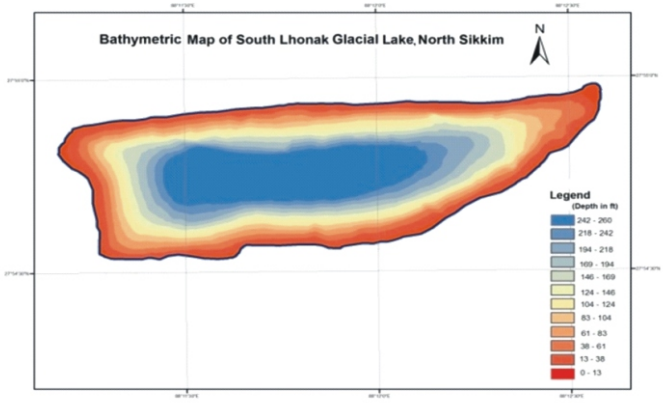


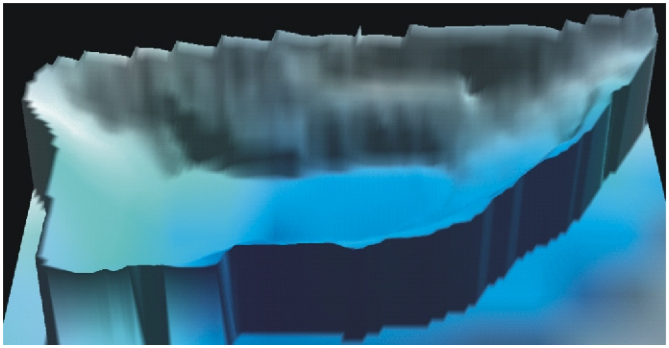


Location of Electrical resistivity survey site (5 longitudinal profiles)

Bathymetric Survey of South Lhonak Lake

The maximum depth of the lake is **260 feet.** The storage volume of the lake is 5, 36,38,863.54 m^3 (say **53 million m^3** = 536 billion litres of stored water) corresponding to the maximum depth of 260 feet.





Field Photographs of Bathymetry survey in South Lhonak Glacial Lake

26. **Support to the User Departments/Agencies**

Centre, being nodal for Remote Sensing and GIS applications in Sikkim, has contributed handsome support to many user department and agencies in Sikkim. Some of the support includes-

- Preparation of various GIS map for General Election 2014
- GPS data collection and mapping of the polling station of Sikkim for the Election Department
- Catchment area mapping for the various projects of Irrigation and Flood Control Department.
- GIS maps provided for Agriculture Department, GoS to submit project proposal.
- Training on Remote Sensing and GIS application to the students of Sikkim Government College.

TECHNOLOGY TRANSFER AND COMMUNICATION DIVISION

Communication and popularization of science is one of the area of activity of the Council which pervades through all initiatives of the Council. This is a common platform where all divisions meet for popularization of the scientific extension work. The communication and information sharing is taken up at various levels for various target groups and by identifying various location specific problems in which science & technology can play a manifested role for preparing young minds for dealing with future challenges. Many planned activities are taken up every year which can be summarized as follows:

1. Extension of Sikkim Science Centre, Marchak

The Sikkim Science Centre is one of the important facilities created for communication, popularization and outreach of science and technology in the State .This Centre has been set up at Marchak, East Sikkim with the support of National Council of Science Museums, Government of India. The Science Centre has a number of thematic galleries, outdoor science park and facilities for training and capacity building programme.

Sikkim Science Centre at Marchak (East Sikkim).

Newly constructed Planetarium (Bottom)

Further extension of Sikkim Science Centre is being taken up with the support of National Council of Science Museums, Government of India. The new extension will have thematic gallery on recent advances in science and learning science through fun, space & biotechnology gallery with Bioresources of Sikkim, Climate Change and 25 seater 3D galleries for science shows.

2. Setting up of 8m diameter Planetarium:

Sikkim State council of Science & Technology is setting up a 52 seater 8 meter dia Planetarium within the area of Sikkim Science Centre, Marchak in collaboration with National Council of Science Museums, Government of India. The main objective of setting up of various galleries and planetarium is to shoulder the leading role in propelling science dissemination activities in the state. The civil construction work is complete and installation of equipment and furnishing is underway and is expected to be completed soon.

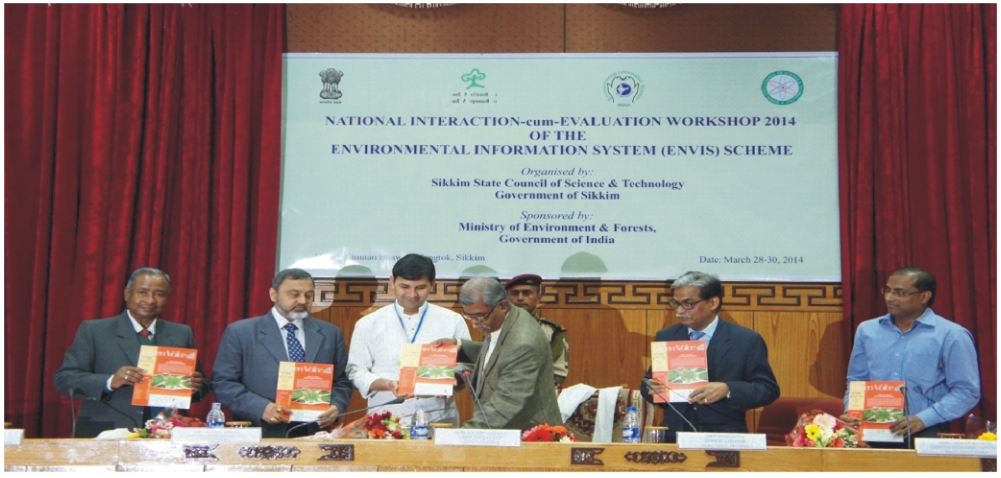
The Planetarium is a sincere attempt to reach the young and scientifically inclined minds and provide them a glimpse of the available treasure trove assembled over centuries by the human explorers. The special shows projected on a dome shaped overhead screen are the star attraction of the Planetarium.

3. Setting up of Innovation Hub

This project aims to establish an Innovation Hub in the vicinity of Sikkim Science Centre for the benefit of rural as well as urban students who are innovative and will provide platform for experimenting in the problems and encourage the students to express their innovative ideas. The Innovation Hub is proposed to be set up under central funding 'Scheme for Promoting Innovation, Creativity and Engagement in Science' (SPICE) to inspire young minds and to develop a culture of innovation in the country.

The Innovation Hub will have the following components, Discovery Hall; Innovation Resource Centre & Hall of Fame ; Idea Lab; Design Studio; Mentor/ Guides where students can utilize the facilities.

4. ENVIS Centre Sikkim on Eco-tourism (Ongoing):



National ENVIS Workshop held at Gangtok w.e.f 28-30th March 2014

Environmental Information System is a plan programme of the Ministry of Environment & Forests, Government of India. ENVIS is a decentralized system using the distributed network of databases to ensure integration of national efforts in environmental information collection, storage, retrieval, dissemination to all concerned including policy planners, decision makers, research workers and the public.

The Centre has been working on the various parameters like:

- Region wise Network of Eco-tourism sites, Wildlife and Avian Ecology in India, Number of Endemic Birds, Wildlife by sites, Location wise distribution of threatened animals and birds in India, Institutional Network of museums in India, State wise Domestic and Foreign tourists, Receipts from domestic, foreign tourists, Situation of Agri-Tourism by region, Ecotourism travel infrastructure, Information system of eco-tourism, Economic benefits of birds and animals

  State of Art of R&D in Eco-tourism, Documentation on Species-wise details, habitat, food, human interaction, Educational, Research Institutions, Situation of wild life crime, misuse, Legal, regulatory network within the region.

5. Bio-Informatics infrastructure Facility (BIF) for the Biology Teaching through Bio-Informatics(BTBI) under BTISnet DBT at Sikkim Science Centre, Marchak (Ongoing)

Activities of BIF:

i. Developing the website to creating awareness of biotechnology through bioinformatics.

ii. Development of interactive information and interpretation kiosk with visuals on different facets of biodiversity of Sikkim

iii. Collection, collation, compilation & dissemination of biotechnology related information to students.

iv. Nature interpretation facility about wild life Sanctuaries and National Park.

v. Development of interactive computer based quizzes on bio resources of Sikkim.

6. Scientific evaluation of Water purification system in State of Sikkim phase II

The project pertains to installation of UV and UF based purifier with prefilter stage upto 10 micron in 20 schools for which water testing was under

taken during phase I of the project. Based on the report of Phase I, these water filter were selected and installed followed by continuous assessment during the project period. List of schools are as below:

1. Mangan Senior Secondary School
2. Sombaria Senior Secondary School
3. Pelling Senior Secondary School
4. Kaluk Senior Secondary School
5. Temi Senior Secondary School
6. New Namchi Senior Secondary School
7. Singtam Senior Secondary School
8. Tadong Senior Secondary School
9. Tashi Namgyal Senior Secondary School
10. Sikkim Science Centre, Marchhak
11. Soreng Senior Secondary School
12. Dentam Senior Secondary School
13. Legship Senior Secondary School
14. Gayzing Girl's Senior Secondary School
15. Namchi Senior Secondary School
16. Namchi Girl's Senior Secondary School
17. Dikling Senior Secondary School/ Melli Dara
18. PNG Senior Secondary School
19. Ranipool Senior Secondary School
20. Phodong Senior Secondary School

Materials & Fund Provided:

- Cost of Pipes, Platform for taps & platform for water tanks
- 2 nos. of Water tanks
- Ultra filtration & UV system filter
- Honorarium to the concerned teacher
- Field testing kit for regular evaluation of filtered water

7. Cane/Rattan Conservation and Promotion of Cane handicrafts for Sustainable Livelihood for Dzongu tribal Reserve Area (DTRA)"

The project was initiated in the year March 2010 and completed on May 2014. The project was funded by Department of Science & technology. Government of India. The important aim of the project was to revive the scanty population of the cane and for its future conservation in Sikkim through the involvement of the local farmers. While executing the project we have trained 150 farmers for the propagation of the cane and also for the value addition of the cane made items of Sikkim. The newly developed portable tools and technique have also been distributed to the trainers through the hands on training. The project also provided essential support to file GI (Geographical Registration) of Lepcha traditional hat, which is a unique item and eligible for such registration according to the patent law. More than 2000 sapling have been raised through the seeds and these saplings were distributed to the beneficiaries the appropriate season for transplantations in June, 2015. One of the important achievement of the project is that the new propagation technique of cane in Sikkim has been developed, which was never been tried in Sikkim except few places in North-east. The outcome of the project was appreciated by the expert committee, during the Group Monitoring Workshop being held at New, Delhi (June-2014).

Distribution of cane saplings by Zilla Adhaksya, North to the beneficiaries of Dzongu

8. Documentation of traditional ethno-veterinary practices:

The project was a young scientist award to Dr. S.R. Lepcha, Deputy Director from DST, GOI. The project was initiated in the year March, 2010 and completed in May, 2014. While implementing the project we have created the complete database of 200 traditional plants which are being exclusively applied on the traditional treatment of cattle and livestock in the state. All the traditional practitioners have been incorporated from all four districts of the state. 50 new formulations have been documented, which are hitherto not being reported in any journals and books. The digital Library of the Traditional knowledge has been created for traditional use of the plants in the treatment of cattle ailments.

Local folk healer collecting
Ethno Veterinary Medicinal Plant

The herbarium specimens have also been maintained and are also available at Sikkim State Council of Science & Technology.

9 Innovation in Science Pursuit for Inspired Research (INSPIRE):

INSPIRE Programme is centrally funded programme of the Department of Science & Technology, Govt. of India which is being implemented through State Governments and UT administrations. The objective of this programme is to develop scientific temper amongst the young and to motivate them to take up scientific career for the scientific and technological advancement of the country.

Three Students of Sikkim represented the south Asian Student interactive meet at Japan in June, 2015

This programme has five components covering entire range of education and research from class VI to post doctoral stage of a student. The first component of this programme is INSPIRE Award which recognizes the talents among students at a very early stage is being implemented by Sikkim State Council of Science & Technology as the Nodal Agency for this programme.

10. State level Science & Sanitation awareness Campaign

The Sikkim State Council of Science & Technology has successfully completed awareness campaign on science for sanitation & health -hygiene in 13 selected schools located mostly at the higher altitudes from 4 districts of the state. The campaign was jointly organized with Rural Management Development Department (RMDD) and supported by NCSTC division, Department of Science & Technology, Govt. of India. The campaign was

initiated from Tingvong Sec. School, North Sikkim on 24.6.2014 and was conclude on 29.08.2014 at Gongyap Sec. School, West Sikkim. The schools that have been covered under south district are Temi Sr. Sec. School, Damthang Sec. school, Sec. Rabangla Sec. school and Tashiding Sr. Sec. School, Khecheopari Sr. Sec. school, Gongyap Sec schools were covered under West Sikkim. One of the important aims of the campaign is to bring awareness among the student of age group of 8 years to 18 years on science for sanitation & health hygiene. While campaigning the students of 13 schools, were made aware on proper maintenance of health hygiene, management of school sanitation and also highlighted on precautionary measures to be taken against the diseases associated with poor sanitations. During the campaign the students were also informed about the proper management of waste and its disposals. The systematic segregations of waste and proper utilization of the Community Resource Centre constructed at various places in the state have been informed to the children. The films on sanitation & waste management have been screened for the students. The readymade handbook on Sanitation Waste Management in schools have been distributed for the library in each school.

National Children Science Congress, State level science and sanitation campaign- 2013-14


GOVERNMENT SENIOR SECONDARY SCHOOL
TASHIDING WEST SIKKIM
ESTD. 1948

11 National Children Science Congress: It is a regular annual activity of the Department with support of Department of Science and Technology, Government of India. About 40 to 50 schools are covered under this programme every year.

12. National Science Day: It is also a regular annual activity of the Department with support of Department of Science and Technology, Government of India. Programme are organised in about 40-50 schools every year. In year 2015-16 the NSC programme was conducted in 25 BACs.

13 Master Resource Person's Training on Weather & Climate Change.
This MRP training was organized to bring awareness among the Teachers and students of the state on Weather and Climate Change through the trained Masters Resource Person's (School Teachers) participating in this training programme. 75 school teachers were trained as MRP to carry forward the programme. The topics covered were:

a. A Perspective on Understanding Weather & Climate

b. Introduction to Weather & Climate'.

c. demonstration on Weather & Climate Study Kit & Hands on activity on weather & climate Change.

d. "Role of pollution, fossil fuels, toxic wastes in Global Warming".

e. Knowing Atmosphere" and various initiatives taken by Govt of Sikkim on Climate Change.

f. Remote Sensing, Extreme weather phenomena and natural disasters & preparedness

g. Field trip to Meteriological Department

14. State Level Workshop on Comet ISON

Sikkim State Council of Science & Technology (SSCS&T) in association with Paschim Banga Vigyan Manch (PBVM) organized two days workshop on Comet "ISON" at Sikkim Science Centre, Marchak. The programme was catalyzed and supported by the National Council of Science & Technology Communication (NCSTC), Department of Science & Technology, Govt of India, New Delhi. Vigyan Prasar, an autonomous organization of Department of Science & Technology, Govt of India, New Delhi was also the part of the programme for academic content and resource material.

State level workshop during November 18-19, 2013

The main objective of this programme was to bring awareness about the Comet ISON, its origin; structure, when, how and where it shall be visible and its possible fate. Starting with an exceptional manner the superstitions related with the comets and ended his presentation with a hope to success of the workshop. On the same day Dr. Gautam Kumar Biswas talked about our solar system with emphasis on structure, possible formation with possible relation to comet origin. Shri. Puspak Pal conducted the role play activity mainly focusing on the ways and techniques so that the participants can make the students understand the basic astronomical facts in a joy full manner. The awareness programme was concluded with field visit to observe Comet ISON.

15. Organization of series of workshop in collaboration with Vigyan Prasar:

Series of Workshops are conducted with assistance of Vigyan Prasar on regular basis frequently. The programmes are was funded by Vigyan Prasar, DST, GOI, New Delhi. In 2016 training on HAM radio was conducted for participants including NGO from all districts and Land Revenue and Disaster Management Department officials. In 2014 and 2015 the orientation programme was conducted for Science teachers from various schools and interactive sessions arranged with experts from outside to improve their skills.

In 2013 three days consecutive workshop on Innovative Experiments on Chemistry and Observing Nature and Bio-Diversity for teachers and students of Sikkim was organized during October 24-26.Dr. Arindam Rana, Associate Professor, Kolkata the Resource Person for Innovative Experiment on Chemistry, expressed his happiness for conducting such workshops for school teachers and gave a presentation on understanding the chemistry of life. He demonstrated how to use the kit. He explained the objectives of the workshops and how the workshop may help teachers in doing hand-on activities in classroom teaching for better appreciation and understanding of science by students and experiments with natural products and their comparable synthetic substitutes were performed. A number of activities based on

chemistry in daily life were demonstrated. He demonstrated how to use the kits developed by Vigyan Prasar and also demonstrated a number of innovative activities related to qualitative analysis; fundamentals of pH metric titration, quantitative analysis, and acid-base chemistry were carried out by the participants. Many participating teachers demonstrated different innovative activities related to classroom teaching involving the hand-on activities. A module "Teaching chemistry- an activity based approach", specially designed for the workshop, explained by Dr. Rana.

Similar programmes were conducted in previous years

Low cost science teaching aids in Chemistry & Physics for science teachers:

A series of Low cost Science Teaching Aids in Chemistry & Physics for the science teachers of the state has been successfully conducted during the month of March 2015 in support of Vigyan Prasar, Department of Science & Technology, Govt. of India. The training was held in two places one at Sikkim Science Centre on 26th & 27th February 2015 for teachers representative from South & west district. The another programme was being held at Zilla Bhawan at North Sikkim for East and North districts on 2nd & 3rd March 29015.

During the workshop the participants were given hands on training on methods to teach science by using a very minimal cost waste materials. The programme is mainly to supports schools that belong to tribal villages and schools without appropriate facilities for scientific experimentations.

During the workshop, a key lecture cum demonstration on phenomena on physics was conducted by Dr. B. N. Das, a retired Professor in Physics, and a Guest Faculty at the Presidency College, Kolkata He. demonstrated a number of phenomena in physics. His activities were mainly focused on light, in order to celebrate the International Year of Light, 2015. Experiments on presence of atmosphere and its pressure was demonstrated. Many experiment were shown to the gathering using soap, broken screen of mobile phones, etc. The participants were also given hands on training with innovative experiments.

Training on low cost science teaching aids

"PARTNERSHIP AWARD-2015" BY NATIONAL INNOVATION FOUNDATION (NIF) INDIA

The team led by Shri T.W. Lepcha , Hon'ble Minster with Principal Secretary and other officials of Department of Science, Technology and Climate Change called upon Hon'ble Chief Minister at Samman Bhawan on 19th March 2015 to apprise about the award being conferred by National Innovation Foundation (NIF- India).

The Sikkim State Council of Science & Technology has been conferred **"Partnership Award-2015"** by **National Innovation Foundation (NIF) India**, an autonomous body under the Department of Science and Technology, Government of India. This award has been *awarded for furthering the cause of grassroots innovation movement.* The award consisting of a trophy, a certificate and cash prize of Rs 50,000/- was received by Shri. D.T. Bhutia, Additional Director and Dr. S. R. Lepcha Deputy Director of the Department of Science and Technology, Govt.of Sikkim from Dr. R.N Mashelkar, Chairperson of NIF, the former Director General of Council of Scientific & Industrial Research (CSIR)and member of the Scientific Advisory Council to the Prime Minister during a function held in the Rashtrapati Bhawan, New Delhi on 7th March 2015.Only two States have been awarded such awards, the other State being Uttar Pradesh.

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