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Sikkim State Council of Science and Technology

Annual Report 2009-10

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Science & Technology Department in the State was created in the year 1996 mainly for generation of scientific awareness and for transfer of appropriate technologies for economic up-liftment of weaker sections of the society.

Keeping in view the importance of Science & Technology for overall development of the State and to provide sufficient autonomy for implementation of various scientific programmes, the Sikkim State Council of Science & Technology was also created.

The Department of Science & Technology through Sikkim State Council of Science & Technology has implemented various scientific programmes related to (i) Bio-Technology (Bioinformatics & Tissue Culture, Medicinal Plants, Scientific programmes on biofertilizers and biopesticides related to Organic farming; 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.

Various activities taken up in different fields are as given below-

CAPACITY BUILDING AND SKILL DEVELOPMENT TRAINING PROGRAMMES

Entrepreneurship Development Programme:

Programme on Entrepreneurship development in Biotechnology:

Programme on Entrepreneurship development in Biotechnology was held at Sikkim Science Centre Marchak from 24th to 27th February 2007. The programme was organized in collaboration with Biotech Consortium India Limited (BCIL) New Delhi and it was sponsored by the Department of Biotechnology, Government of India, New Delhi. 60 participants consisting of Field functionary from Sikkim Marketing Federation (SIMFED), Local entrepreneurs, participants from Sikkim Manipal University and Sikkim State Council of Science & Technology had participated in training programme. Various technical topics regarding *herbal extracts, enzymes, orchid culture, bio-fertilizers and bio-pesticides, micro propagation and Fundamental of Intellectual Property Rights* were discussed in detail. *Various issues regarding marketing management, financial management & managerial accounting, human resource management and Entrepreneurial Opportunities in Biotechnology & Govt. of India Initiatives to promote Biotech Entrepreneurship* were also deliberated by the experts.

Entrepreneurship Development programme on fruits & vegetable processing:

Entrepreneurship Development programme on fruits & vegetable processing was organized by our Department jointly with North Eastern Industrial & Technical Consultancy Organization Limited (NEITCO) at Sikkim Science Center, Marchak from **August 17 to October 05 2009**. 58 participants from various Self Help Groups had participated in the programme. The training programme covered the following thematic areas-

- Entrepreneurial Trait;
- Achievement Motivation Training;
- Definition and concepts related to SSIs;
- Feasible Food Processing Industries in the districts;

- Assistance from DICC & Procedures therefore and provisional registration formalities;
- How to sell a product;

Women Empowerment through Capacity Building on Back yard Poultry and Mushroom Cultivation:

Two training programmes were conducted by the Sikkim State Council of Science & Technology jointly in collaboration with Indian Council of Agriculture Research, Sikkim Centre, Tadong in July 2009 on Women Empowerment through Capacity Building on Back yard Poultry and Mushroom Cultivation.

Skill Development and Technology Transfer Centre for SC and ST:

The Department has proposed for **establishment of State of The Art technology demonstration and training centre** at Marchak, East Sikkim for Scheduled Caste and Scheduled Tribes under TSP and SC & ST. This Centre is expected to benefit entire SC & ST population of the state by way of providing in hose trainings in various technologies and trades.

SCIENCE AWARENESS, COMMUNICATION AND SCIENCE POPULARIZATION PROGRAMS

District level and State Level Programmes for National Children's Science Congress:

National Children's Science Congress is the programme funded by National Council of Science & Technology Communication (NCSTC), DST, Government of India. The primary objective is to make a forum available to children of the age group of 10-17 years both from formal school system as well as from out of school to exhibit their creativity and innovativeness and more particularly their ability to solve a societal problem experience locally using the method of science.

The Sikkim State Council of Science & Technology under the Department of Science & Technology has been organizing the District and State level Children's Science Congress (CSC) every year.

The CSC prompt children to think of some significant societal problems ponder over its causes and subsequently try and solve the same using the scientific processes. This involves close and keen observations, raising pertinent questions, building models, predicting solutions on the basis of a model trying out various possible alternatives and arriving at an optimum solution using experimentation, field work, research and innovating ideas. The Children Science Congress encourages a sense of discovery. It emboldens the participants to question many aspects of our progress and development and express their findings in vernacular.

The Focal Theme for this year Children Science Congress was "**The Planet Earth; Our Home; Explore, Care and Share**" with six identified sub-themes. The Congress is organized at three levels. The district level congress is the first forum in which projects compete with one another and are screened for the state level congress. The district level CSC was organized in collaboration with the District HRDD where Joint Directors of respective Departments are the District Coordinators.

Resource Teachers Workshop for the year 2009 was organized in July 24-25, 2009 at Sikkim Science Centre and was attended by forty five Science Teachers from various schools of the state. Mr. D.G.Shrestha, Sr. Scientific Officer, Sikkim State Council of Science & Technology, Mr. D.T.Bhutia, Sr. Scientific Officer, Sikkim State Council of Science &

Technology and Dr. Ghan Shyam Sharma, Incharge, The Mountain Institute-India (TMI), Sikkim Unit were the Master Resource Persons during the Workshop.

District Level Children Science Congress was organized by District Coordinators (Joint Directors, HRDD) in respective districts. Total of 57 schools had participated in the programme.

The State Level Congress was organized by Sikkim State Council of Science & Technology on December 3, 2009, at Sikkim Science Centre, Marchak. There were total of fifteen projects selected from the district level for state level competition. Mrs. Usha Lachungpa, Sr. Research Officer, Forest Env. & WL Management Dept; Mr. L. K. Rai, Research Officer, G. B. Pant Env. & Himalaya, Pangthang, Mr. D.T. Bhutia, Sr. Scientific Officer and Mr. D.G. Shrestha, Sr. Scientific Officer were the judges during the programme.

During the Science Congress Programme, total sixty projects were presented in all four districts out of which fifteen projects were selected for State Level Children Science Congress. **Out of fifteen the best four projects were selected to represent the National Level CSC which was held at Science Centre, Ahmedabad during December 27-31, 2009.** The best four projects were 1) A Case Study of Paheli, Giner Disease by Mangalbaria Sr. Secondary School represented by Lakho Bhutia and Topden Bhutia 2) Water Quality Status & Statistics by Lingdok Govt. Secondary School represented by Roma Chettri, Anand Rai and their team mate 3) Effect of Burnt Plastic Remnants on the growth of the Plant of PNG School represented by Anjali Gupta, Khusboo Shah and others and 4) Changes in Agriculture Pattern due to Climate Change in South Sikkim of Namchi Govt. Girls Sr. Secondary School represented by Nilima Rai, Yamuna Limboo and other team mates. Four students and two teachers from the selected projects also participated in the National Science Congress held at Ahmedabad.

National Science Day:

National Science Day is celebrated all over the country to commemorate Dr. C.V. Raman for the discovery of Raman Effect:

The objective of celebration NSD is to popularize Science & Technology among student community, to bring scientific temperament, curiosity and nurture creativity among children and to bring sense of belongingness to the society they live in.

National Science Day 2009 celebration commenced on February 28, 2009 with free science centre visit to all the visitors and around 1000 students were invited. To mark the day the Centre provided free entry and show such as Tara Mondal were shown to the students. Lectures on the given theme and importance of celebration of National Science Day were also made to the students by the Sr. Scientist of the Department. Two hours film show was organized for all the participants.

Various other activities such as Quiz competition at Secondary level students and on the spot painting competition for Jr. level Students of far off schools (Villages) in the identified of centre (school) were also conducted. Officers and staff from the department/ Council were also engaged in organizing the programme. Film show on Climate Change, the phenomenon of Total Solar Eclipse and other related topics were shown after the competitions. Series of lecture were also made on the topic National Science Day and the given theme.

In addition to the competitions and lectures, Workshop on Small Telescope Making was also organized in Sikkim Science Centre, Marchak on 21.09.2009. The Workshop was attended by Teachers and students from around 20 schools (60 students and teachers) from

different regions in Sikkim. They were trained to build an astronomical telescope by Resource Person, Mr. Samir Dhurde from University Centre for Astronomy and Astrophysics (IUCAA) Pune. The cost of telescope raw material (Rs.2000/-per telescope) was borne by the Sikkim State Council of Science & Technology and after the completion of Workshop a set of telescope were distributed to respective schools. The primary objective behind the workshop was to encourage hands-on experience in understanding of scientific principles and to inculcate interest and motivation to the students on the subjects like physics, astronomy and astrophysics at an early age.

Training workshop for State Master Resource Persons on "Total Solar Eclipse 2009" at Sikkim Science Centre, Marchak:

Sikkim State Council of Science & Technology had taken up a massive awareness programme starting with State Level Resource Persons Training on 8th July 2009 in which about thirty five Physics PGT & GT teachers were trained to organize similar programme in their schools & locality covering feeder schools. This was followed by awareness lectures & demonstrations by Master Resource Persons at different identified schools covering all four districts of the state. A panel discussion was also arranged for the benefit of the public regarding various issues related to **Total Solar Eclipse 2009**.

School Project on Traditional Knowledge:

On 25th August, 2009, an Orientation Workshop on Documentation of Traditional Knowledge especially on Medicinal and Aromatic plants of Sikkim was held at Sikkim Science Centre for the Science Teachers from various schools of Sikkim. The programme was attended by 45 science teachers. Dr. Ghan Shyam, In charge, TMI, Sikkim branch, was the identified Resource Person.

Resource Person Dr. G. Shyam presented a power point presentation and explained about how one can document the Traditional knowledge of the use of medicinal plants. He emphasized on documentation of medicinal plants that are available in and around school campus/village within the periphery of max.100m. He also explained the documentation method of various other plants like fodder trees/fruit trees etc and animals (both domestic and wild animals) with the help of National Biodiversity Documentation Standard Register.

Scientific evaluation of water purification system in Sikkim:

The scientific evaluation of water purification system in Sikkim under water technology initiative programme of DST Gov. of India has been carried out for 45 schools of Sikkim.

Peers Review Ambitious Radio Serial on Astronomy;

The year 2009 was observed as the International Year of Astronomy to commemorate the 400th anniversary of the first astronomical use of a telescope by Galileo 400 years back.

A two days review meeting cum regional workshop on the radio serial on Astronomy was held at Sikkim Science Center, Marchak on 9-10 July 2009 organized by the Sikkim State Council of Science & Technology. The workshop was participated by scientists, lecturers and representatives from different fields from the North Eastern States, West Bengal and Orissa.

Regional Resource Agency for Coordination of DBT Natural Resources Awareness (DNA) Clubs in Sikkim State:

The Ministry of Science & Technology, Department of Biotechnology, Government of India has sanctioned a project 'Regional Resource Agency for Coordination of DNA Clubs in North East States'.

The objectives of the project are as follows:

- To enhance understanding among students about the immense value of biological diversity of our country, the importance of locally available bioresources, their sustainable use and conservation;
- To equip them with relevant skills for bioresource conservation;
- To familiarize students with scientific and technological issues related to biotechnology;
- To provide students with an experimental learning opportunity;
- To create opportunities for hands on experiments in the field at the school level;
- To organize field trips to National Institutes and National Biological parks of the country;
- To facilitate interaction with leading experts in the field including the core and visiting faculty at the Institutions.

In Sikkim 35 schools has been identified for taking up DNA club programme. The programme was formally launched by Hon'ble Chief Minister of Sikkim on 14th October 2009 during Platinum Jubilee celebration of Namchi Senior Secondary School at Namchi, South Sikkim.

Setting up of Village Resource Centre in the State:

The Department of Science & Technology has taken up a joint collaboration project jointly with Indian Space Research Organization for setting up of Village Resource Centers (VRCs) which have the unique facility for societal application using satellite communication and remote sensing technology. The VRCs promote a need based single delivery system for the services in the areas of health care, education, agriculture, weather, environment disaster resilience and livelihood support to the rural population and empower them towards improvement of quality of life. 16 such centers have been established in various Block Administrative Centers and three Master Resource Centers have been set up at the Rural Management and Development Department, Sikkim Science Centre, Marchak as well as State Institute of Rural Development, Jorhang in South Sikkim. Numbers of training and awareness programmes have been conducted through VRC Network.

Setting up of Sikkim Science Centre:

- 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. It was inaugurated and dedicated to the people of Sikkim on 22nd February, 2008 by the Hon'ble Chief Minister of Sikkim.
- The Science Centre has a number of thematic galleries, outdoor science park and facilities for training and capacity building programme.
- The further extension of Sikkim Science Centre is also being taken up with the support of National Council of Science Museums, Government of India. This will

include 8 metre diameter planetarium as well as thematic galleries on recent advances in science and learning science through fun, space & biotechnology gallery.

- The first of its kind of experiment in purifying the water in Sikkim have been initiated by Central Glass and Ceramic Research Institute (CGCRI), Kolkata by installing a ceramic membrane plant at the premises of Sikkim Science Center at Marchak. The project have been sponsored by Department of Science and Technology, Government of India. A workshop on performance of community model plants for supply of quality drinking water was also held on November 20, 2009 which was attended by Hon'ble Minister DST Sikkim and Dr. GJ Samathnam, the Advisor in the Department of Science and Technology, Government of India and Dr. Sibdas Bandhopadhaya, the senior scientist of CGCRI and other experts from various departments of the State Government.

Environmental Information System (ENVIS) centre on Eco-tourism:

The Ministry of Environment & Forests, Government of India has provided Environmental Information System (ENVIS) Centre on **Eco tourism theme for the whole country at Sikkim State Council of Science & Technology**. This Centre has taken up various activities for promotion of Eco-Tourism and also publishes ENVIS newsletter on Eco-Tourism regularly. A website www.scstsenvis.nic.in provides various information's on Eco-Tourism. The project is funded by the Ministry of Environment and Forests, Government of India. The Center is functioning since December 2000.

ENVIS is a decentralized system using the distributed network of data bases to ensure integration of national efforts in environmental information collection, storage, retrieval and dissemination to all concerned including policy planners, decision makers, research workers and the public.

The Objectives of the ENVIS Center are as given below:

1. Long-term objectives:

- to build up a repository and dissemination centre in Environmental Science and Engineering.
- to gear up the modern technologies of acquisition, processing, storage, retrieval and dissemination of information of environmental nature; and
- to support and promote research, development and innovation in environmental information technology.

2. Short-term objectives:

- to provide national environmental information service relevant to present needs and capable of development to meet the future needs of the users, originators, processors and disseminators of information;
- to build up storage, retrieval and dissemination capabilities with the ultimate objectives of disseminating information speedily to the users;
- to promote, national and international cooperation and liaison for exchange of environment related information;
- to promote, support and assist education and personnel training programmes designed to enhance environmental information processing and utilisation capabilities;
- to promote exchange of information amongst developing countries.

3. The responsibilities of the ENVIS Centre on Ecotourism are:

- Establishment of linkages with all information sources, and creation of data bank on selected parameters in the subject area assigned.
- Identification of information gaps.
- Publish newsletters and Bulletins.
- Develop library facility and provide support to the focal point on the subject area.

Most importantly serve as interface for the users on the assigned subject.

Activities of the ENVIS Centre Sikkim on Ecotourism during 2009-10

1. Database on the parameters specified by the Ministry as **Status of Eco-tourism, Flora and Fauna and Research and Literature** has been worked upon and the information added in the ENVIS website www.scstsenvis.nic.in for proper dissemination.
2. Information has been updated in the website in the form of monthly news clippings collected from local and national dailies/internet/books and magazines, ecotourism events worldwide with a linkage to their websites, case studies and articles on ecotourism and other issues pertaining to the ecotourism of the country.
3. The ENVIS homepage has been worked upon and made more dynamic with adding more photos on the photo gallery and bringing changes to make it more users friendly.
4. The Centre has brought out newsletter addressing issues related to climate change and tourism and health tourism and also a compilation of abstracts from research papers on Ecotourism of India.
5. Important linkages to the tourism websites of the country and the state as well has been given in the ENVIS homepage.
6. The queries coming to the Centre in the form of emails, telephone, letters or personal visits has been effectively responded and books from the ENVIS library has been effectively made use of thus assisting the research workers, students and the general public in the area.
7. The infrastructure of the Centre has been developed rendering benefits on the usage of facilities to the visitors.

REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM (GIS)

Following projects have been taken up using Remote Sensing & GIS Technology

Applications of Remote Sensing and GIS in Sericulture Development:

The Sikkim State Council of Science & Technology and Sericulture wing for the State Forests Department in collaboration with the North Eastern Space Application Centre (NESAC), Shillong, Government of India, Department of Space had taken up a pilot project in May 2009 regarding "Applications of Remote Sensing and GIS in Sericulture Development" in South District of Sikkim. In this project potential areas for sericulture are being mapped on 1:50,000 scale using Remote Sensing and GIS.

National Urban Information System (NUIS) (Using High Resolution Satellite data and Geospatial Techniques):

The Sikkim State Council of Science & Technology is working as partner institute for mapping of towns in Sikkim State under National Urban Information System (NUIS). The project is jointly executed by the National Remote Sensing Centre, Survey of India and State Government. The 9(nine) towns viz Rangpo, Singtam, Namchi, Jorethang-Naya Bazar, Geyzing-Pelling, Mangan, Pakyong, Rongli, Soreng and Ravongla have been identified in

Sikkim. A thematic mapping on 1:10,000 scale using satellite data is being prepared by the Sikkim State Council of Science & Technology.

The major objective of the NUIS Scheme is to design, organise and establish a comprehensive information system in the urban local bodies for planning, management and decentralised governance listed in the 12th schedule in the context of implementation.

Forest Fire Mapping

- During recent years the winter rains have become quite erratic and this has created drier situation in forests areas and the number of fire incidences has increased many folds. Forest Fire studies has been carried out in Sikkim using three sessions satellite imagery viz. 10th January 2009, 23rd March 2009 and 10th May 2009 of IRS P6 LISS III. The field data on forest fire recorded by the Forest department government of Sikkim, along with GPS coordinates of forest fire, were collected for various fire incidences which were used as ground truth information for satellite mapping.
- The total agricultural area is 578.09 sq km in which fire burnt area due to fire was 10.47 sq km (1.81%). The forest cover of Alder forest was 445.83 sq km in which burnt area due to forest fire was 3.94 sq km (0.88%). In sub-tropical forest, total area is 64 sq km and burnt area was 3.59 (5.61%). In Sikkim Sal forest area is only 19.02 sq km and burnt area was 1.10 sq km (5.80%). In Rocky barren 2.92 sq km is burnt area and the area of Oak forest in Sikkim is 887.71 sq km in which burnt area was 0.30 sq km (0.03%). In forest blank the burnt area is 1.68 sq km and in the forest scrubs the burnt area was 0.19 sq km. In Alpine forest, Conifer forest, Forest thickets no forest fire incidence was observed using the satellite imagery.
- It has been observed that , not only have the number and intensity of forest fires increased, there is an ascending trend in high altitude and even temperate oak forests which were not affected earlier to fires are now being impacted.

Land Degradation in Sikkim Mapping using Remote Sensing and GIS:

Degraded lands include those lands whose condition has deteriorated to such an extent that it cannot be put to any productive use as such, except current follows due to various constraints.

The main objective was to generate land degradation data base for the year 2005-06 using three seasons (kharif, rabi, zaid) IRS LISS- III satellite data based on NNRMS standards for easy query and retrieval of Geo database.

The classification system was adopted from NNRMS standards and broadly consists of Land degradation process, Land degradation type, Severity of the problem, Landform and Land use.

The study provides spatial database on land degradation on 1:50,000 scale for planning reclamation programmes at district level and can be monitored the same at 5 years time interval to see the impact of reclamation programmes. It also helps in identifying areas of rapid change (hot spots) and serves as a primary database for regional/ global environment studies etc.

The product database being generated will be useful for different departments like Agriculture, Rural Development, Environment and Forests, Water resources to take up further measures for reclaiming degraded lands.

Land use land cover project:

Sikkim State council of SCEince and Technology with support of North Eastern Space Application Center has taken up Landuse and Land cover Mapping project using satellite data on 1:50,000 scale.

Sikkim is a state with variety of natural resources and the present project is a part of 'National Land Use Land Cover mapping' in which land use land cover is classified upto level three (3) classification scheme using multi-temporal satellite data.

Wet land mapping of Sikkim

Wetlands are one of the most important and reproductive ecosystems of earth and provides wide array of benefits to mankind. Keeping this in view, we made an effort to study the different type of wetlands and their distribution in different geographical regions of Sikkim, which is located in Eastern Himalayas, using satellite data of IRSP6 imagery of the year 2006. The major wetland types in the state are High-altitude lakes (above 3000 meters), rivers and major streams. There are only few lakes below 3000 meters altitude. Ground truth data was collected for selected wetland sites and Standard Performa was adopted to record the field data. Field photographs were taken to record the water quality (subjective), status of aquatic vegetation and water spread. The location of the features was recorded by using GPS.

The present study is an attempt to prepare the database on Wetlands of Sikkim using IRSP6 on 1:50,000 scale. Total 272 lakes (larger than 2.25 ha) have been mapped. In addition, 281 lakes (smaller than 2.25 ha) have also been identified. In all 553 lakes were detected. Total area of wetlands (lakes and rivers/major streams) is 7196 ha in post-monsoon season (2006) which is 1.01 per cent of total the geographic area of state (7096sq.km.). In pre-monsoon (2006) satellite data, total area of wetlands is 5035 ha. According to our study High altitude lakes above 3000 meters accounting for 42.38% of the wetlands (3050 ha), river/ major streams accounting 57.41% (4131 ha), lake/ponds below 3000 meters altitude is only 0.21% (15 ha).

The wetlands of Sikkim has low turbidity (2380 ha in post-monsoon and 885ha in pre-monsoon) and moderate turbidity (4809 ha in post-monsoon and 4151ha in pre-monsoon). High turbidity wetlands were not detected.

The state has four districts and North District has highest concentration of wetlands with 63.1 % of total wetland area in state and it covers 0.64% of total geographic area of state. The other three districts i.e. West District, East District and South District have 14.6%, 12.2% and 10.2% area under wetlands respectively.

High Altitude Lakes was observed only in three districts (North, West and East). The districts with very high concentration of small lakes (<2.25 ha) are North District with 221 followed by East and West Districts with 42 and 16 respectively, while south district has lowest with 2 such wetlands only

The wetland mapping of Sikkim state has been taken up jointly with Space Application Center (SAC) Department of Space, Government of India for mapping of waste lands using IRSP6 LISS III (2006) data.

Preparation of Landslide Database:

Landslide hazard is one of the major hazards of the state. The weak geological formations is one of the main causes of landslide hazard in the state. The problem is further aggravated because of very high rainfall. The state is located in the seismic hazard zone V. The disaster due to frequent occurrence of landslide brings the misery by frequent road blockage and damage to life, property, houses and the other communication facilities.

The study includes Inventory Mapping, Identification of the major landslides, Collection of data on past landslides, correlation and comparison. The information available with various departments are being used for database preparation. The detailed mapping of selected landslide using Remote Sensing and GIS is also being taken up.

Project on 1:10,000 scale thematic mapping (10K) & geospatial database generation for Project on 'Space Based Information Support for Decentralized Planning (SIS-DP):

The Sikkim State Council of Science & Technology in collaboration with the National Remote Sensing Centre, Department of Space, Government of India has started a project on thematic mapping and setting up of a geospatial data base for using at decentralized planning purposes.

Project on setting up of Geo-informatics Centre in a phased manner:

The Geo-informatics Centre is being set up under the Sikkim State Council of Science & Technology which is an autonomous body under the Department of Science & Technology, Government of Sikkim and acts as functional arm of the Department by strengthening existing remote sensing facilities.

The aim for setting up of full fledged Geo-informatics Centre in a phased manner is for fully utilizing modern technology of Remote Sensing (GIS) and also Global Positioning System (GPS) for utilizing the facilities in the field of various natural resources of survey. This facility will also provide unique training opportunities to younger generation in the field of Geo-informatics. Field equipments like GPS, Hypsometers, Silva ranger compass, workstation for digital analysis and latest version of ERDAS software for image analysis is being procured using State fund provided to the tune of Rs.5.00 lakhs.

GLACIER AND CLIMATE CHANGE STUDIES AND CLIMATE CHANGE ADAPTATION PROGRAMME :

Glacier and Climate Change Studies: Following programmes have been taken up for Glacier and Climate change studies.

- An Advisory Council viz. 'Sikkim State Council of Climate Change for providing policy direction and institutional mechanism for effective implementation of various climate change adaptation programmes has been constituted by the State Government.
- The name of Science and Technology Department has been re-designated as **Department of Science and Technology and Climate Change**" the State Government has also approved for creation of full fledged **Climate Change Wing** by strengthening the facilities and manpower in a phased manner under this department with the mandate on climate change related issues to undertake detailed research and survey regarding impact of climate change in addition to already assigned mandate
- Sikkim may be the first Himalayan State who has carried out basin wise glacier inventory way back in 1999 by Science & Technology Department of the State Government with Space Application Centre, Department of Space, Government of

India. The inventory of glaciers of Sikkim was carried out using satellite data of 1st January 1997. Based on this work, an atlas of the Glacier Inventory maps was also prepared. As per this study, Sikkim has 84 glaciers covering an area of 440 sq km. The total extent of permanent snowfields was measured as 251 sq.km. This makes total extent of an area under glaciers and permanent snowfields as 691 sq.km. Most of the glaciers have an area of less than 5 sq.km. There are only two glaciers having an area of more than 20 sq.km. The total glacial and permanent snow cover-stored water is estimated at 145.05 cubic km. **The Department is again monitoring the status of glaciers of Sikkim jointly with the Space Application Center using satellite data of year 2004.**

- The glacier field studies for Zemu Glacier, which is largest glacier in Eastern Himalayas, has been taken up jointly with Prof. Milap Chand Sharma, Jawaharlal Nehru University, who is also a member of the Sikkim Glacier Commission. According to his observations Sikkim gets precipitation round the year from the south west monsoons, winter rains and Mediterranean westerlies due to its advantageous location in the eastern Himalayas. At higher altitudes, the precipitation is in the form of snow. The triple precipitation in Sikkim will always cater to better input for the glaciers compared to the Western Himalayas, Sharma, who carried out an extensive study of the state of glaciers said. Even the Zemu glacier, the largest in Sikkim, has retreated by only five to seven meters since 1977 despite its surface thinning, he said. The condition of glaciers depended on factors beyond climate change and global warming like morphology of valley, its shape, size and slope, he said. While there have been a number of glaciers which have retreated during the past several years, there have been other glaciers which have advanced during the same period.
- Collaboration project with TERI regarding Systematic Mass Balance, Energy Balance studies of East Rathong Chu Glacier in Sikkim jointly with Sikkim State Council of Science & Technology has also been taken up. This glacier will be monitored with the state-of-art scientific instruments on a regular basis for various parameters like Energy Balance, Mass Balance and Hydrological Balance for the glacierized region.
- In order to broaden the scope of glacier research, that may represent all the micro-climatic settings across Sikkim Himalaya, and may ensure highly accurate predictions for the future flow patterns of Sikkim Himalayan rivers, leading to the development of regional stream flow models, more benchmark glaciers need to be included in network of Glacier Monitoring Observatories.
- Installation of Automatic Weather Stations at block levels with the support of the Department of Space, Government of India at each of the Block Development Centers in a phased manner has also been taken up. First phase of 15 Automatic Weather Stations are already in the process of installation.

Snow Cover Monitoring in the Sikkim Himalaya:

Systematic monitoring of seasonal snow cover is an important aspect of cryospheric studies in the Sikkim Himalaya. Presently hardly any information is available for the region and this significantly influences any serious investigation in the region. Therefore, a joint investigation by Space Applications Centre, Ahmedabad and Department of Science and

Technology, Government of Sikkim was initiated. In this investigation AWiFS data of Indian Remote sensing satellite at an interval of 5-days were used. To estimate seasonal snow cover normalized difference Snow Index was used.

The Sikkim Eastern Himalayan ranges feed river Tista of its fresh water, influencing the life pattern and economy of the Sikkimese and others in Eastern India. Seasonal snow cover is one of the important natural resources of the Himalayas. Snow Cover represents a major storage of fresh water, which is released during the spring-melt period. The high surface reflectivity of snow makes albedo and area study an important component of earth's radiation balance. The study shows distribution of snow cover in Sikkim for 4 years; from 2004 to 2008. Snow cover has been monitored using Advanced Wifs data of RESOURCESAT-I. The sensor capability of higher temporal frequency of 5-day intervals, better radiometric resolution and detection of snow under shadow has facilitated monitoring of snow in Sikkim Himalayas. Approximately 200 imageries have been monitored. Tista and Rangit sub basins have been monitored in a fully automatic mode using Normalised Difference Snow Index (NDSI) algorithm. Snow covers almost 30.5% of Sikkim, with maximum extent of ~49% in the month of February. Particular peaks in the snow depletion curve is observed in the months of October and February. Similar trends have been observed in Tista and Rangit sub basins. The early increase in snow cover suggests monsoon snowfall. Snow areal extent is comparatively high (35-40%) even in the summer months, indicating less snow pack ablation compared to Western Himalayas. Data was not available from May onwards due to cloud cover. With development of newer microwave technique, RISAT data would be of prime importance for thorough month wise analysis.

5 DAILY SNOW COVER IMAGES: TISTA BASIN



04 DECEMBER



09 DECEMBER



14 DECEMBER



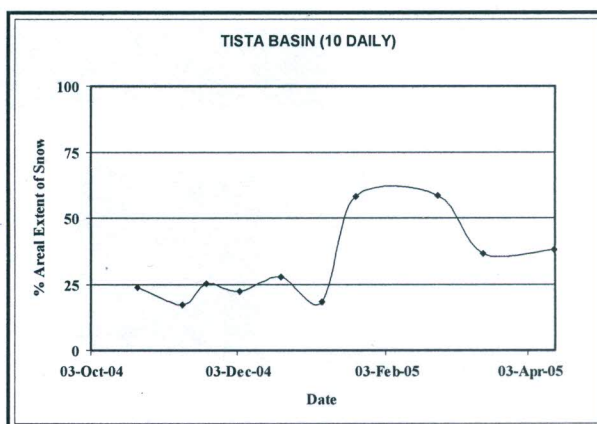
28 DECEMBER



DATA USED DECEMBER 2004



- Snow cover depletion curve



Joint Collaboration Project on Climate Change Research in Terrestrial Environment (PRACRITI) with Space Application Center, Department of Space, Govt. of India:

The Sikkim State Council of S & T jointly with the Space Application Center, Department of Space, Govt. of India has undertaken a project on Climate Change Research in Terrestrial Environment (PRACRITI).

The objective of the project will have following component:

1. Mass balance of selected glaciers in Tista basin;
2. Retreat estimation of selected glaciers in Tista basin;
3. Glacier depth estimation using Ground Penetrating Radar.

The project duration will be of three years starting from 2010.

Joint collaboration programme for assessment of vegetation and soil carbon pool assessment jointly with the Indian Institute of Remote Sensing under ISRO Geosphere Biosphere programme:

Carbon dioxide is among the major green house gases (GHG) contributing to global warming and associated impacts. Under the Kyoto protocol of United Nations Framework Convention on Climate Change (UNFCCC) most of the countries have agreed to reduce the GHG emissions and also report these emissions regularly. This reporting is necessary and is done as a National Communication to UNFCCC. The National Vegetation Carbon Pool assessment project aims to assess the phyto-mass and carbon in different ecosystem, e.g. forest ecosystem, forest strips, trees outside the forest, plantations, agricultural ecosystem, rural and urban ecosystems and other ecosystem. In India several studies have been carried out in different ecosystems, forests and some for out-side trees or forests. The data/information available on phyto-mass and carbon are based on different objectives and purposes. Therefore, this data/information has limitations while extrapolating in larger areas. Since data collection was not uniform hence not comparable. The present project attempts to collect data for phyto-mass and carbon pool assessment following uniform methodology during a period of 2008-10. It is also envisaged that the data will be processed uniformly for mapping phyto-mass and carbon in country.

The main objective of the project are:

- Assessment of terrestrial vegetation biomass in the country using ground sampling and satellite remote sensing data;
- To generate geospatial data of the terrestrial phytomass carbon of India along with estimates of uncertainty.

In Sikkim the project is being implemented jointly by Forest Department and Sikkim State Council of Science & Technology to find out how much carbon per hector is sequestrated by the green forests of Sikkim. In addition to the taking the field plots for biomass carbon assessment. Soil samples are also being collected for soil carbon pool assessment in Sikkim.

The field work for collection of information by laying out field plots are in progress.

Mapping of Glacier Lakes and development of GIS based Glacier Lake Management Information System for the State of Sikkim:

The Sikkim State Council of Science & Technology jointly with Center for Development of Advanced Computing (C-DAC), Pune is taking up Mapping of Glacier Lakes and development of GIS based Glacier Lake Management Information System for the State of Sikkim.

The objectives of the Project are:

- Mapping of various Glacier lakes using High Resolution optical/microwave satellite data.
- Classification of lake types and identification of hazardous lakes.
- Generation of Digital Elevation Models (DEMs).
- Estimates of volume of water in the lakes.
- Development of model for river channel profiling.
- Development of model for prediction of Glacial Lake Outburst Floods (GLOFs)/Flash Floods, areas likely to be inundated/affected by GLOF's, and Impact assessment of GLOF's.
- Developing preparedness and resilience in the event of GLOF's.
- Organizing important stake holders meet about the potential danger of GLOF's.
- Development of GIS based Glacier Lake Management Information System for the state of Sikkim.
- Installation and commissioning of the Glacier Lake Management information System at user site.
- Installation of sensors on potential hazardous lakes on pilot basis (may be taken up in the next phase of the project).

This project will be very helpful keeping in view the following aspects;

- Mapping of various Glacier lakes using High Resolution optical/microwave satellite data will provide us information regarding occurrence, distribution and aerial extent and classification of lake types and identification of hazardous lakes which will be very useful for monitoring of these lakes.

- The High resolution (Ikonos/QB/Cartosat data etc) are essential because size of the lakes will be very small many a times it may be fraction of a hectares. Sikkim being high rain fall area and most of the time area will be covered with the clouds, so we propose to use Microwave data because area could be seen even during the cloudy weather.
- Sikkim being totally hilly state with steep slopes so, Digital Elevation Models (DEMs) of the area will be very useful in Development of model for river channel profiling and Estimation of volume of water in the lakes.
- The Development of model for prediction of Glacial Lake Outburst Floods (GLOFs)/Flash Floods, areas likely to be inundated/affected by GLOFs, and Impact assessment of GLOFs will be very useful and it will help in developing preparedness and resilience in the event of GLOFs and will also helpful in Disaster management at large scale.
- The Installation of sensors on potential hazardous lakes on pilot basis will be useful in case of lake breach/outburst and various types of information is expected from the proposed sensor network. Linking of Sensor data with GIS software and modeling will yield different type of information that will be very useful for disaster preparedness and management.
- Special tools/menus with the proposed GIS based Glacier Lake Management Information System for the state of Sikkim will be very useful for creation of data base for modeling/prevention of disaster etc.

The joint collaboration project has been started from January 2010 and the first meeting for finalizing the modalities for implementation of the project has been discussed during the meeting at CDAC on 1st & 2nd February 2010.

Seismic Hazard and Risk Assessment project for Sikkim Himalayas:

The Ministry of Earth Sciences sponsored this project in January 2010. The project will be taken up jointly by Geology & Geophysics Department, Indian Institute of Science, Kharagpur and Sikkim State Council of Science & Technology. In this project, a network of twelve strong motion stations will be maintained for earthquake monitoring on long term basis in Sikkim Himalayas.

Impact of Climate Change on Large Cardamom of Sikkim:

Large Cardamom (*Amomum subulatum* Roxb.) is the most important cash crop of Sikkim. India has been the largest producer and exporter of large cardamom, however, the area and production of large cardamom has been decreasing in the recent years and in context of Sikkim, the production is rapidly decreasing at alarming rate.

In the present study, total of 141 cardamom fields were visited all over Sikkim, which comprises 56 fields in North, 69 Cardamom fields in East and 16 fields in West Sikkim. A standard Performa /Data collection Sheet was used for the collection of data which includes location, altitude, land and soil description, production and diseases, vegetation details in different cardamom fields and climatic study of different areas. Using GPS, the locations, Aspects and Elevation of the different areas were collected.

The work includes study of pollinators, temporal and environmental variations, distribution of rainfall, temperature, anthropogenic activities and water drainages etc.

The study indicates that not only the large cardamom but the other important crops like apples, ginger, potatoes etc are also in great threat. Furthermore, it is realized that

elaborative and intensive studies is required to study the impact of climate change on livelihoods of the people at the community level.

Climate change and society of Sikkim:

A socio-economic survey was conducted in all the districts of Sikkim taking at least three villages in each of the district and interactions with inhabitants were carried out and data collection sheets were filled. Farmer's perceptions on the related issues of climate change were recorded. Impact of climate change on various fields like society, agriculture, economy, hydrology, environment, rainfall, temperature, rise in level of mosquitoes etc, were studied and correlated in the report.

A Standard Performa (Questionnaire) was prepared and survey was conducted. GPS (Global Positioning System) was used to determine location, altitude, slope and aspects of the study areas of Sikkim.

Most of the respondents informed that climatic, environmental and phonological changes are common nowadays in Sikkim. The work includes surveying of rainfall pattern, incidence of mosquitoes in winters, seasonal variation in temperature, drying of water springs, fluctuating spring season, production of large cardamom and phonology.

We are also pursuing with the Indian Meteorology Department, Ministry of Earth Sciences and Government of India for strengthening of network of snow gauges and weather stations in Alpine areas of Sikkim for long term climate change studies. We have also requested to the Ministry of Earth Sciences, Government of India for installation of Doppler Radar System for having large coverage for weather prediction and snow and glacier monitoring.

Climate Change Adaptation Project in Sikkim under the frame work of Indo-German Development Cooperation:

Since Sikkim State Government has taken pro active role on various issues related to Climate Change, the Government has approved Climate Change Adaptation Project in Sikkim under the framework of Indo-German Development Cooperation.

Some of the thrust areas where support could be taken up through this project are:

- Training, Awareness and Skill Development and Capacity Building as well as appropriate technology transfer related to Climate Change Adaptation programme. A Training and Skill Development Center could be set up with the help of this programme.
- Spring water recharge and rain water harvesting programmes in dry belt of Sikkim with the technological input.
- Vulnerability analysis both sectoral as well as on geographical pattern for identification most vulnerable areas due to climate change in Sikkim.
- Identification of best practices and replication on pilot basis for climate change adaptation programmes.
- Taking the pilot programmes on cardamom rejuvenation and ginger with technological input under climate change adaptation programme.
- Identification of indigenous crop varieties which are more resilient to climate change and its propagation on pilot demonstration.
- The pilot demonstration programmes for fuel wood and energy saving devices such as solar water heater, solar lighting system in temperate and alpine areas.

The proposed project will be mainly for reducing the adverse effect of the climate change by undertaking climate change adaptation field programmes in the areas of water security in rural areas, rural livelihood and income generation programmes through sustainable development and management of Natural Resources mainly in the field of Horticulture, Agriculture and Forestry. Through the project, awareness and capacity building programmes of rural people will also be taken.

In the last Indo German Negotiation held in 2009, the German Government has committed EUR 76 million (approx. Rs. 500 crores) for climate change adaptation programmes for North Eastern States including Sikkim. The proposed project as of now will be implemented in Sikkim, Meghalaya, Assam, Manipur and Nagaland. **Detailed mechanism for implementation of the project and preparation of detailed project report (DPR) will be taken up shortly through consultants identified by KFW and the Ministry of DoNER.**

BIOTECHNOLOGY RESEARCH AND APPLICATION CENTRE AND TISSUE CULTURE FACILITIES:

Following programmes have been initiated:

Project on "Ecological studies of Sea buckthorn and Genetic Diversity of *Frankia* Associated with it in Sikkim:

The Department of Biotechnology (DBT), Ministry of Science & Technology, Government of India has sanctioned a Project titled '**Ecological studies of Sea buckthorn and Genetic Diversity of *Frankia* Associated with it in Sikkim**' to the Sikkim State Council of Science & Technology in January 2009.

The objectives of the project are:

- Collection and maintenance of *Hippophae* germplasm from Sikkim.
- Ecological and Taxonomical studies of native *Hippophae* and *Frankia* of Sikkim using descriptors.
- Analysis of soil of native *Hippophae* with reference to pH, moisture, amount of organic carbon, available nitrogen, calcium, magnesium potassium and phosphorus.
- Providing research materials like fruits, leaves, etc. of *Hippophae* to different institutes of the country under the DBT Network for biochemical research.
- Isolation of *Frankia* associates with roots of native *Hippophae*.
- Genetic diversity studies of *Frankia* spp. Associated with native *Hippophae* root nodules.

The various studies under the project are under progress.

Mr. B. C. Basistha, Senior Scientific Officer, Sikkim State Council for Science & Technology, Sikkim attended IVth International Sea Buckthorn Association Conference 2009 in Belokuria, Russia from September 1-6, 09 and presented Oral paper on "**Understanding Agro-Techniques of *Hippophae Salicifolia* D. don (Sea buckthorn) of Sikkim Himalayas.**"

Mapping and Quantitative Assessment of Plant Resources of Sikkim as a part of Eastern Himalayan Region:

The Department of Biotechnology under the Ministry of Science & Technology, Government of India has sanctioned a project entitled 'Mapping and Quantitative Assessment of Plant Resources of Sikkim as a part of Eastern Himalayan Region' to Sikkim State Council of Science & Technology.

The main objectives of the project are:

- Quantitative assessment of the geographic distribution and population status of the plant resources of the Sikkim Himalaya.
 - a. Enumerating the plant resources, their population levels and structure in the Sikkim Himalaya.
 - b. Developing thematic maps of the density and distribution for Sikkim Himalaya.
 - c. Quantitative estimation of available resource levels of plants of Sikkim Himalaya.
- Identifying the threats on plant resources and enlisting the threatened species.
 - a. Identifying the threats on the specific plant resources in Sikkim Himalaya.
 - b. Reviewing the existing opinion-based RED list and arriving at an objective and data-based RED list of the plant species of economic importance in Sikkim Himalaya.
- Setting up Sikkim Himalayan Eco-Region specific database on plant resources.
 - a. Combining the database from the field survey of the project with the secondary data sources already available.
 - b. Setting up a suitable programme systems for updating the retrieving the datasets in spatial and digital forms by the end users.
 - c. Analyzing the spatial and temporal patterns of change in specific plant resources in Sikkim Himalaya.

The orientation training under the project has been completed with the support of Prof. Uma Shanker, Department of Botany, North Eastern Hill University, Shillong. More than 240 field sample plots are required to be carried out. The field work is in progress.

Patent Information Center:

Intellectual Property Rights (IPR) plays a key role in gaining an advantageous position in the competitive technological game for economic growth. India enjoys a large asset of R&D personnel and infrastructural facilities. Scientists and policy makers need more information orientation and facilities for protecting the products of intellectual prowess of Indian scientists. As a step in this direction, a single window Patent Information Center was created in 2002 under the Sikkim State Council of Science & Technology, an autonomous body under DST, Government of Sikkim by the Department of Science & Technology, Government of India at the Technology Information, Forecasting and Assessment Council (TIFAC).

The objectives of this centre are:

- To create awareness about IPR, especially patents, in the neighbouring region of this centre and enable patent searches for the universities, industry, government departments and R&D institutions in the State and around;
- To analyze the patent information on a regular basis and suggest new programmes for R&D based on such information.
- Guide the inventors in respect of patenting their inventions.

Activities of Patent Information Centre, Sikkim. 2009-2010

1. The exhibits are displayed for creating awareness on "Geographical Indication" (Intellectual property Rights) to the visitors in the Sikkim Science Centre, Marchak by the Patent Information Centre (PIC), Sikkim.
2. Awareness program and sensitization about Intellectual Property Rights with special reference to Geographical Indication (GI), its benefit and its potential in Sikkim along with citing an example of possible GI from Sikkim has been done on "National Science Day Program at different schools. (Gayzing, W. Sikkim, Chakung, W. Sikkim & Rangpo, E. Sikkim" from 21st July 2009 to 23rd July 2009 by the PIC, Sikkim.
3. Awareness program and sensitization about Intellectual Property Rights has also done during 'Women Empowerment through Capacity Building' program on Backyard Poultry Production & Mushroom Cultivation at ICAR, Tadong from 27th July - 1st August 2009 by the centre.
4. Awareness and sensitization program on Intellectual property Rights (IPRs) with special reference to "Geographical Indication" (GI) and "Trademark" during "Capacity Building cum Entrepreneurship Development Programme of Food & Fruit Processing" at Sikkim Science Centre Marchak from August 17th - October 5th, 2009.
5. The PIC centre has prepared & submitted research article on IPR, "A Future Prospective; An Intellectual Property Rights (IPR) in Sikkim Himalayas" which is being published in the Research Report of the Sikkim State Council of Science & Technology.
6. The centre has also published articles on IPR with special reference to Geographical Information(GI) in the local newspapers of the state,
7. The centre has also broadcast radio talk on 'importance of IPR & potential of GI & its importance' in Sikkim which was broadcast in the 'All India Radio Gangtok'.
8. The Junior Research Fellow of the centre has gave lectures and presentations on different forms of IPR and legislatives covering IPR to the students in Science Exhibition at White Hall, Gangtok along with distributing brochures and palm plates to the participants and visitors of the program.
9. PIC, Sikkim has identified six local products of Sikkim for GI registration, which are as follows:-
 1. Sikkim Mandarin, 2. Sikkim Dzongu Lepcha Hat, 3. Sikkim Dzongu Lepcha Darri, 4. Sikkim Ginger, 5. Sikkim Chilly Pickle, 6. Sikkim orange squash.

Among six items, compilation of relevant documents for GI registration of three products namely- Sikkim Mandarin, Sikkim Dzongu Lepcha Hat & Sikkim Dzongu Lepcha Darri is ready.

Furthermore, Patent Information Centre, Sikkim is actively working on creating awareness about Intellectual Property Rights (IPRs) and sensitizing about the potential, importance and its benefit of GI, Farmers Right and Plant breeders rights, etc to the local people of the state in the Sikkim Science Centre along with creating awareness about the protection of Traditional knowledge and its Practices and Biodiversity from Biopiracy. Role of different forms of IPRs is also delivered through lectures continuously in the Sikkim. Science Centre, Marchak.

Documentation of traditional ethno-veterinary practices and its formulations:

The Department of Science & Technology, Government of India has approved a project in March 2010 entitled '**Documentation of traditional ethno-veterinary practices and its formulations**' to the Sikkim State Council of Science & Technology. The project will be started shortly.

The objectives of the project are:

- Resource survey and documentation of the ethno-veterinary and its formulation;
- Database creation on ethno-veterinary & its formulation;
- Awareness generation on ethno-veterinary amongst the tribal of rural areas;
- Creation of digital library for ethno-veterinary.

'DBT's mission for the production of Quality Planting Materials and utilization for the NE region' for the year 2009-2010.

The project titled 'DBT's mission for the production of Quality Planting materials and utilization for the NE region' was established on 31st December 2007. The project is being funded by Department of Biotechnology, Ministry of Science and Technology, Government of India and is coordinated by The Energy Research Institute, New Delhi.

Objectives of the Project:

- Production of Quality Planting Materials and their demonstration in the farmer's field.
- Conduct of training on the scientific methods of cultivation and their management.
- Demonstration of Quality Planting Materials in the farmer's field in a scientific manner.
- Setting up of quality farms for the identified products.
- Establishment of marketing linkages for value products.
- Upliftment of socio-economic condition of the farmers through employment and income generation.

Sikkim State Council of Science and Technology, Government of Sikkim is coordinating the implementation of the above project in the State of Sikkim. The production of Quality Planting Material of **Sikkim mandarin, Large Cardamom and Ginger** and their demonstration in the farmer's field is the main objective of the project.

Major Activities during the year 2009-2010:

- Superior, disease free planting materials of Sikkim Mandarin, Large Cardamom and Ginger were identified and selected.
- Multiplication of large cardamom through suckers is being carried out at the ICAR farm under our supervision and ICAR.
- Published a research paper titled "Effect of various cultural conditions on in-vitro germination of immature seeds of *Citrus reticulata* Blanco" in the Journal of Hill Research with due acknowledgement to Department of Biotechnology, Government of India.
- Acceptance of a research paper titled "Effect of growth regulators on the *in-vitro* multiplication of nucellar seedlings of *Citrus reticulata* Blanco" in the Journal of Hill Research.
- *In vitro* cultures of nucellar seedlings of Sikkim mandarin is being done which is carried out from the mother trees which are 20-30 years of age with superior accessions.
- Root stocks of rough lemon (*Citrus jambhiri*) is also being produced through *in-vitro* culture for local root stock production, which is showing positive results even after transferring its plantlets to the hardening shade. This is done to carry out grafting in the citrus planting for better and larger production from a single plant.
- Demonstration and distribution of Sikkim mandarin (*Citrus reticulata* Blanco) was carried out with the help of concerned scientist of ICAR Gangtok. The scientist offered his expertise in quality disease free plant selection, field survey and supply of plants. Farmers were selected through Block Development Officer (B.D.O.) from Rural and Management Development Department (RMDD), Govt. of Sikkim and the training was imparted to 25 farmers and the plants distributed. The training was done on 2nd July 2009 at Yangyang, South Sikkim.
- Demonstration and distribution of large cardamom (*Amomum subulatum* Roxb.) was done through selected and verified plants from Sikkim Spices Board, Gangtok. Training was imparted to 11 farmers collaboratively with scientist from Sikkim Spices Board, Gangtok and distribution of planting materials to the farmers was done through B.D.O., Pakyong, East Sikkim under NREGA programme of RMDD, Govt. of Sikkim on the 17th July 2009.
- Demonstration and distribution of Ginger (*Zingiber officinale* Rose) was done with the help of concerned scientist of ICAR Gangtok. The scientist emphasized mainly on proper selection of the mother plant, preparation of the field for cultivation, sowing technique, proper drainage system in the field, maintenance and control of diseases. The training was imparted to 12 progressive farmers of Lower Sumin (BAC Duga) on 12th March 2010. The farmers were selected through Block Development Officer (B.D.O.) from Rural and Management Development Department (RMDD), Govt. of Sikkim.
- Field visits on regular basis are being carried out to monitor the growth and other aspect of the plants.

Trainings attended:

- The three Senior Technical Assistants underwent the Training of Trainers (TOTs) on 24th – 27th November 2009 under DBT, Govt. of India.

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- Training on Entrepreneurship development program in Biotechnology from 24th - 27th February 2010 conducted by Biotech Consortium India Ltd, New Delhi in association with Sikkim State Council of Science and Technology was attended by all officials of Bioinformatics Center.

Sikkim Bioinformatics Center (Distributed Information Sub Center):

The Department of Biotechnology, Ministry of Science and Technology, Government of India has sanctioned a project entitled "Distributed Information Sub Center (DISC)" in the year 2001.

The objectives of the Project are:

- To provide a national bio-information network designed to bridge the inter-disciplinary gaps in biotechnology information and to establish link among scientists in organizations involved in R & D and manufacturing activities in biotechnology.
- To build up information resources, prepare database on biotechnology and to develop relevant information handling tools and techniques.
- To continuously assess information requirements, organize creation of necessary infrastructure and to provide information and computer support services to the national community of users.
- To establish linkages with international resources in Biotechnology Information (e.g. Databanks, published literature, patents and other information of scientific and commercial value).
- To evolve and implement programmes on education and training of information scientists responsible for having biotechnology information and its application to biotechnology, research and development.
- To develop, support and enhance public information resource for biotechnology e.g. Gene banks, molecular biology data and related research information resources.
- To undertake preparing and publishing survey, state-of-the-art reports and forecasts for several branches of the sector.

Major Activities during the year 2009-2010:

- The third volume of the Scientific Newsletter "Biogyan" being published by the center was released and was also up loaded in the center's website.
- Animation on Human Immuno Virus (HIV) and Acquired Immuno Deficiency Syndrome is being developed using FLASH to be used in awareness programs for AIDS and to be used as teaching aid in schools and colleges for having a pragmatic approach of teaching and for better understanding of the subject.
- An interactive meeting for establishing Bioinformatics Infrastructure Facility Centers (BIF) and to facilitate on line access to library, at various Scientific Institutions, Universities, Colleges and Senior Secondary Schools of Sikkim was organized by Bioinformatics Center, Sikkim State Council of Science and Technology supported by Department of Biotechnology, Government of India on 19th June 2009 at Sikkim Science Centre, Marchak to promote Biology and Biotechnology education facility in Sikkim. Dr T. Madan. Mohan, Adviser, Department of Biotechnology, Government of India, and the representative from various Scientific Institutions, Universities, Colleges, Schools of Sikkim and officials of Sikkim State Council of Science and

Technology, Government of Sikkim participated in the meeting. In total thirty two schools and six research institutes of Sikkim had participated in the meeting.

- Up gradation of the center's website is being carried out on regular basis. All activities of center and Databases linked to the website are up graded on regular basis. Around Eight thousand visitors have visited the site in eight months.
- Procurement of books and journals on Bioresources of Sikkim and Biodiversity was also done.

Trainings and Meet attended:

- Coordinator along with the Information Officer and Technical Assistant attend the XXth Annual BTISnet Coordinators Meet held at NEHU on 3rd and 4th of February 2009.
- Information Officer and Technical Assistant underwent the training on "In Silico approach to Genome Analysis" from 05/02/2009-11/02/2009 at North East Hill University, Shillong.
- Training on Bioinformatics - application in Biological sciences was attended by the Data Entry Operation from 5th-7th March 2009 at Dibrugarh University, Assam.
- Training on Data mining in Biology conducted by Jawaharlal Nehru, New Delhi from 20th to 25th October 2009 was attended by the Technical Assistant.
- Training on Bioinformatics conducted by Bioinformatics Infrastructure Facility Center, North Bengal University from 14th Jan -17th Jan 2010 was attended by all staffs of Bioinformatics Center.
- Training on Entrepreneurship developmental program in Biotechnology from 24th Feb- 27th Feb 2010 conducted by Biotech Consortium India Ltd, New Delhi in association with Sikkim State Council of Science and Technology was attended by all officials of Bioinformatics Center.

Bioinformatics Infrastructure Facility (BIF) for the Biology Teaching through Bioinformatics:

The Ministry of Science & Technology, Department of Biotechnology, Government of India has sanctioned a project 'Establishment of Bioinformatics Infrastructure Facility (BIF) for the Biology Teaching through Bioinformatics. The total amount of the project as one time financial grant is Rs.20.00 lakhs(rupees twenty lakhs) only.

The objectives of the BIF are as follows:

- To establish BIF to support for the teaching activities of Biology and its allied areas of the host institute in particular and the neighboring institutions in general;
- To build up information resources, in the form of databases of interest to its users and to develop relevant information handling tools and techniques;
- To assess information requirements, organize creation of necessary infrastructure and to provide information and computer support services to the users;
- To establish linkages with BTISnet of DBT for sharing Information Resources and Expertise;
- To organize Training/Workshop for training of the users of the BIF.

Joint collaboration research programme with ICAR Sikkim Center:

In order to optimize the research output by using the latest instrumentation facilities as well as scientific expertise, a proposal for joint collaboration programme between Sikkim State Council of S & T and ICAR Sikkim Center has been discussed by our scientists with the Joint Director-ICAR and other scientists of ICAR. Joint collaboration between Sikkim State Council of S & T and ICAR Sikkim Center is proposed on following aspects:

1. Molecular biology studies for important cash crops of Sikkim like ginger, mandarin, large cardamom as well as Seabuckthorn using latest instrumentation facilities.
2. Disease indexing of Viruses is required to be done at large scale in large cardamom and citrus as ICAR has ELISA laboratory.
3. Use of other instrumentation facilities for various scientific studies.
4. The ICAR will not charge any cost regarding use of any instrumentation facilities. Similarly, whenever the instrumentation facility of the Council under DST are used by the ICAR, no charges will be levied by the Sikkim State Council. However, the cost of on account of chemicals and glassware are to be borne by the respective organization when the instrumentation facility of other organization is used.
5. The cost of ELISA kit for virus indexing and cost of molecular biology and other consumables required for scientific studies by the scientists of the Council will be borne by the Council while using the ICAR latest equipments such as Polymerase Chain Reaction (PCR), Real Time Polymerase Chain Reaction (RT-PCR).
6. The scientific publications for joint works will also be a joint publication.

INFRASTRUCTURE DEVELOPMENT:

Construction of Biotechnology Research and Application Center at Sajong:

- Under the Biotechnology mission, initiatives have been taken by the Government of Sikkim for construction of Biotechnology Research and Application Centre at Sajong, Rumtek, East Sikkim. Further, sheds/green houses/polyhouses using state of the art technology will also be set up in this centre in addition to modern raised bed nursery. Emphasis is given to tissue culture/vegetative propagation of rare and endangered and economically important plants.

Construction of Technology Bhawan at Deorali, Gangtok:

For the development of Science & Technology in the State, construction of five storied building for Science & Technology Bhawan at Deorali, Gangtok with modern and state of the art facilities is in progress.

Skill Development and Technology Demonstration Center for SC and ST:

The Department is in process of establishment of state of the art Skill Development and Technology Transfer Centre for Scheduled Caste and Scheduled Tribes under TSP and SC Component of the State Plan. This Centre is expected to benefit entire SC & ST population of the state by way of providing in-house trainings in various technologies and trades.

Extension of Sikkim Science Centre:

The extension of Sikkim Science Centre is also being taken up with the support of National Council of Science Museums, Government of India. This will include 8 metre dia planetarium as well as thematic galleries on recent advances in science and learning science through fun, space & biotechnology gallery.