Brief Activity Report of 2019-20

Logo Council

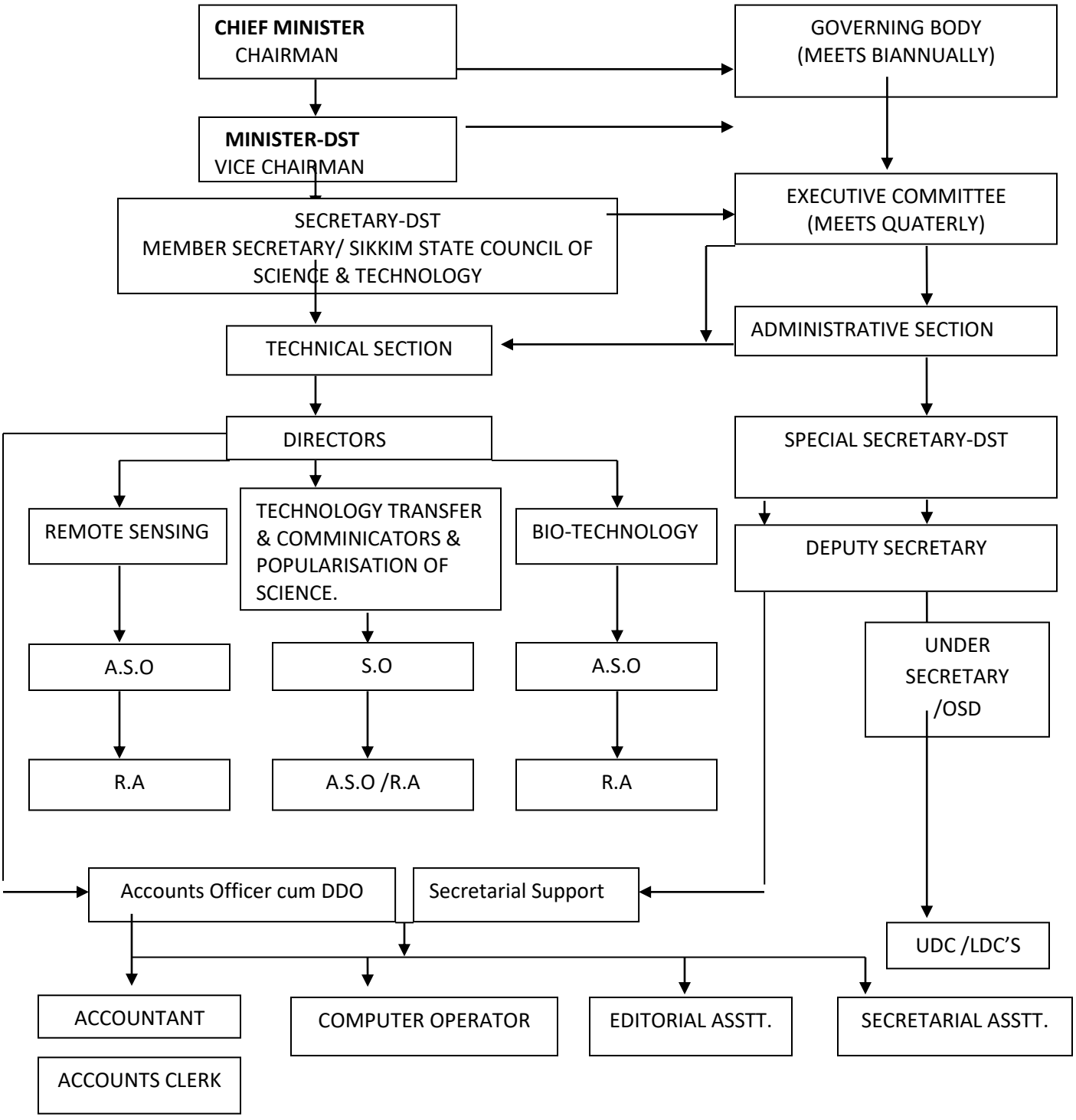
SIKKIM STATE COUNCIL OF SCIENCE AND TECHNOLOGY,
VIGYAN BHAWAN
P.O. DEORALI, GANGTOK, EAST SIKKIM

1. **Structure of the Council:**

a. **Date of Establishment: November 1997.**

b. **Organization Structure**

ORGANISATIONAL STRUCTURE OF THE DST & SIKKIM STATE COUNCIL OF SCIENCE & TECHNOLOGY.



CORE MANPOWER OF SIKKIM STATE COUNCIL OF SCIENCE & TECHNOLOGY-2019-20.

Name	Designation	Pay scale Upto June 2019 (Rs)	Pay scale from July 2020 (Rs)	Approximate monthly emoluments (Rs.)
Shri K.C.Lepcha	Member Secretary			
Supported by DST,GOI Grants-in-Aid				
Shri Suman Thapa	Scientific Officer	73000	75400	Rs 1,03,298.00
Shri Nabeen Sharma	Research Assistant	34200	34700	48,039.00
Shri Dadul Lepcha	Accounts Clerk	30400	30,400	42,148.00
Shri Rajdeep Gurung	Sr. Research Asst.	37,100	37,100	51,327.00
Shri Laydong Lepcha	Sr. Research Asst.	37,100	37,100	51,327.00
Dr. Sushan Pradhan	Sr. Research Asst.	37,100	37,100	51,327.00
Shri Radha Kri. Sharma	Sr. Research Asst.	37,100	37,100	51,327.00
Shri Pranay Pradhan	Sr. Research Asst.	37,100	37,100	51,327.00
Shri Tseten Pradhan	Sr. Research Asst.	37,100	37,100	51,327.00
Mr Pravakar Gurung	Research Assistant	33,700	33,700	46,669.00
Mrs Binita Shrestha	Research Assistant	33,700	33,700	46,669.00
Ms P. Pradhan	Research Assistant	33,700	33,700	46,669.00
Ms. Ongkit Lepcha	Editorial Assistant	25,400	25,400	35,750.00
Ms Pema Z. Lepcha	ASO	20000	20000	240000.00
Supported by State Grants-in-Aid				
Shri Bhasker Gurung	Peon	Fixed	-	9,300.00
Mrs Yden Bhutia	Peon	Fixed	-	9,300.00
Ms Bashanti Rai	Peon	Fixed	-	9,300.00
Shri Shrep P.Dong	Peon	Fixed		9,300.00
Ms Puja Pradhan	Peon	Fixed		9,300.00
Shri Arpan Lepcha	Peon	Fixed		9,300.00

PROJECT MANPOWER 2019-21

Name	Designation	Pay scale	Approximate monthly emoluments
Mr Sandeep Chettri	RA	Consolidated	18,400.00
Ms. Dipa Rupa Sharma	Project Assistance	Consolidated	15,000.00
Mr. Kishor Gautam	DEO	Consolidated	14,000.00
Mr Niraj Sharma	Information Officer	Consolidated	32,229.00
Ms. T.Chung Chung Bhutia	Project Assistant	Consolidated	12,100.00
Mr Loden D.Bhuta	JRF	Consolidated	19,200.00
Ms Arpana Thapa	Project Assistant	Consolidated	14,000.00
Mr Robin Chettri	JRF	Consolidated	18,400.00
Shri Bhaichung Lepcha	SRF	Consolidated	20,700.00
Shri Subhana Chettri	JRF	Consolidated	19,200.00
Dr. Bushan Gurung	RA	Consolidated	39,600.00
Mr Udai Biswakarma	TA	Consolidated	8,000.00
Mr S. Sharma	FS	Consolidated	5,000.00
Mr Nikel Chettri	FA	Consolidated	5,000.00
Ms Pedenla Bhutia	FA	Consolidated	5,000.00
Shri Sajesh Chettri	TA	Consolidated	25,000.00
Mrs Zumshey Bhutia	Chawkidar	Consolidated	8,000.00

2. Budget allocation to your State S&T Council for last five financial years including central government, State government & any other sources. (Amount in lakhs)

Sl.No.	Financial Year	State Govt. Grants in Aid	Rogrammes support	Central Govt. Allocation	Total
1	**2018-19**	**50.00**		**95.11**	
2	**2019-20**	**35.00**		**104.63**	
3.	**2020-21**	**15.00**		**Proposed**	

4. Key activities under taken:-

I. TECHNOLOGY DEVELOPMENT:

A. Long-Term Monitoring on "Glacier Dynamics of East Rathong Glacier- Sikkim Phase

The East Rathong Glacier, West Sikkim, India, is the benchmark glacier in the Himalayan State of Sikkim. It is one of the most essential glaciers in Eastern Himalaya as being a source of River Rangit, which is the largest tributary of the Teesta River. People of urban areas of Sikkim, Some Parts of West Bengal, and Bangladesh are fed by the same river. The Geodetic Mass Balance Estimation was done using digital Elevation Models. The average thickness loss through the data analyzed from toposheet of 1962 and Digital Elevation Model of 2009 is around 100m in 1962-2009. Further in order to monitor this Glacier by utilization of support from European Space Agency, the monitoring of Glacier was done for the period of 1993-2019 also. The Synthetic Aperture Radar (SAR) data from Sentinel-1 and European Remote Sensing Satellite (ERS-1) have been tested for the ice thickness change and mass balance monitoring which can be used for other Himalayan glaciers too. The ice thickness is one of the most critical factors for monitoring glacial health. The velocity was also estimated using a method called as offset tracking. The annual velocity in 1993 was around 37 ma^{-1} with standard deviation of 3.60 ma^{-1} for the whole, area and in 2019, it was around 39ma^{-1} with a standard deviation of 4.5 ma^{-1}.The ice flow law and the slope information from the SRTM 30 have been used for estimation of ice thickness and mass balance of East Rathong Glacier. The present depth is estimated to be 77.26m ± 7.7m, which was 100.50m ± 10m in 1993 with the uncertainty of 10%. The total mass loss is estimated to be 0.08 ± 0.008 Giga ton (900 Kgm^3) i.e. 85,219,438.82 Ton and the ice thickness change of 23.39m ± 2.3m i.e. reduction of ice thickness, for the current extent of the boundary for 1993-2019. In the last 27 years, the average ice loss is around 0.86 ma^{-1} ± 0.08 ma^1. Due to some technical problems in DGPS, objectives I, II and III (Given below) had errors in the estimates. The statistical analysis is being considered to rectify the error. The Statistical Software is being procured; there is a need to develop the data of 2020-21 for interpolation of 2019-20 data. So, the same project seeks extension considering present and future glacial study in Sikkim. The hydrology data is also being processed.

Geodetic Mass Balance Estimation of East Rathong Glacier from 1962-2009

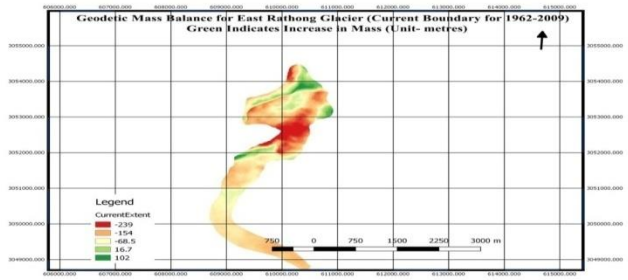


Fig: Geodetic Mass Balance (1962-2009)

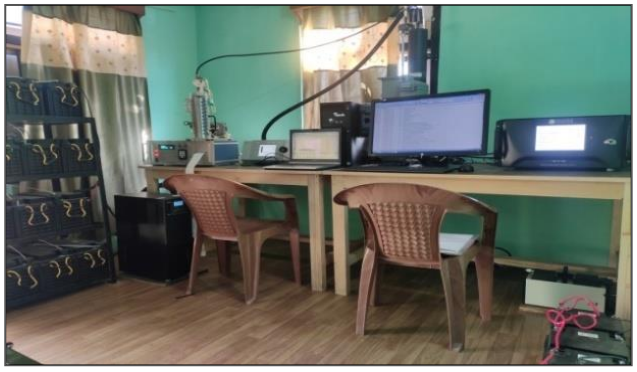
The average mass loss through the data analyzed from toposheet of 1962 and Digital Elevation Model of 2009 is around 0.8-1.5 m per annum. This is huge mass loss and one of the direct evidences of Climate Change in the State. Hence there is need to act for adaptation and mitigation.

B. **Himalayan Aerosol Experiment @ SIKKIM**

Funded by: *North Eastern Space Application Centre (NESAC), ISRO, DOS, Shillong*

The Himalayan Aerosol Experiment @ SIKKIM was started on august 2019 jointly by Space Physics Laboratory, VSSC, Trivandrum, North Eastern Space Application Centre (NESAC), Shillong and State Remote Sensing Application Centre & Climate Change Cell, Dept. of Science & Technology and Climate Change, Govt of Sikkim. The laboratory for monitoring the aerosol properties is set up lachung (27.6891°N, 88.7430°E, 2700m a.s.l.).

Various instrument viz Mictrotops sun-photometer, Aethalometer Quartz Crystal Microbalance (QCM), High volume sampler (HVS), Aerodynamic particle size and portable AWS has been installed which continuously monitors the aerosol properties since December 2018



The estimation of Black carbon and various other light absorbing particles over the eastern Himalayas will be useful to evaluate the implication of light absorbing aerosols in the hydrology of this region. The preliminary observations reveal that the columnar abundance of aerosols, which can be represented in terms of Aerosol Optical Depth (AOD) varies between 0.03 to 0.13 with an annual average of 0.08 ± 0.03.

The BC mass concentration varied from minimum values of ~830 ng m^{-3} during the month of August to maximum values of BC ~ 2100ng m^{-3} during the month of May. The higher values of BC during this time could be due to the spring time enhancement of aerosols at the high altitudes during this season as observed at other high altitudes of Himalayas. This significant amount of BC at this location can have profound implications on snow/glaciers in the near future.

C. **Development of Insar based techniques for high resolution surface topography and ice Velocity under Microwave and Hyper Spectral Techniques for Earth Resources Application and Management (MAHTRAM / मातरम्).**

The project is in collaboration with Space Application Centre, ISRO. The objective of DST, Sikkim is mainly the validation of elevation and glacier velocity derived from the module in the Himalayan Glacier area. DST, Sikkim will also take the lead role in design and validation of surface elevation and ice velocity derived from satellite data along with the project team. The field work is planned on June 2020.

D. **Development of Forest Fire Spread Model using Satellite Remote Sensing Computational Fluid Dynamics (CFD), and Non-CFD models in Sikkim Himalayas using High Performance Computing (HPC) System**

Computational Fluid Dynamics (CFD) based models with the potential of simulating fire behaviours are gaining increasing attention as a means to predict such behaviour in order to aid the fire fighting efforts.

This project is in collaboration with Indian Institute of Technology, Kharagpur and Centre for Development of Advanced Computing (C-DAC), Pune.

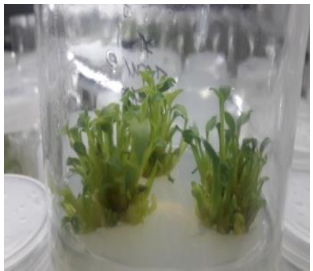
The main objectives of Department of Science and Technology, Government of Sikkim are as follows.

- Overall logistic support to the participating teams
- Provide current and historical departmental datasets related to forest fire and other related administrative and scientific datasets
- Carrying out field investigations/field data collection related to forest fire on continuous basis
- Providing all the necessary permissions to carry out the proposed research, including the field work permission from forest department, Sikkim
- Testing the model on field and provide feedbacks for improvement

This project was sanction in March 2020, the activities of the project will be start in next financial year.

E. Micro-propagation of Large Cardamom (*Amomum subulatum* Roxb.)

Large scale *in-vitro* multiplication of Large Cardamom is undertaken at Plant Tissue Culture Laboratory, Sajong, Rumtek, East Sikkim. The main objective is to produce elite, disease free cardamom planting material for distribution to the farmers of Sikkim. The faster micro-propagation method has been developed for production of elite planting material. It is being supported by Department of Biotechnology, Government of India under a project titled “Mass production and propagation of Large Cardamom for livelihood sustainability of rural people of Sikkim using biotechnological intervention”.



Improved method of large cardamom cultivation

An improved method of large cardamom cultivation has been developed for faster and healthier growth. The method uses the pit digging during the drier season and filling the pit with cow dung, top soil and leaves and allowed to decompose. The filled pit is marked with stick. During the planting season during June/July the saplings are planted in the filled-in pits. It will give vigorous growth and starts giving fruiting from next year. The sprinkler system is used for irrigation during drier season for judicious use of water. The old sheaths and leaves of cardamom are converted into manure in the field itself by using polysheets and used as manure for the same plant. This decreases the disease incidence especially fungal disease.



F. Development of agro-technique in Ginseng

Development of agro-technique in Ginseng found in Sikkim is undertaken and is in nursery stage. The technology developed will be transferred to farmers for large scale cultivation of Ginseng in Sikkim.

G. Developed two new cymbidium hybrid:

Two new cymbidium hybrids developed. One is hardy and long lasting type and another large flowered. In both the cases the traits of original *Cymbidium lowenium* of the region is re-expressed. Sikkim is also known for orchids. There are very few indigenously developed orchid hybrid which will have the commercial importance.

H. Low cost technology to clean greenhouse plastic:

One of the biggest problems of greenhouse farming in the Himalayan region is the accumulation of algae, fungi and dust on the greenhouse plastic due to high humidity and rainfall. After few years of greenhouse cultivation, the plastic becomes opaque and blocks the sunlight due to which the crop grown inside will be greatly hampered. Further, the pests and disease incidence increases due to congenial environment. S&T Council of Sikkim has developed a simple and easy method of cleaning greenhouse plastic.

I. Development of drying of cardamom and other vegetables by using hydel power generation from local streams at final stage:

II. TECHNOLOGY DEMONSTRATION

A. Green Skill Development Programme

Certificate Course on Value Addition and Marketing of NTFPs (Animal Origin): wild Bee Keeping and Processing:

In line with the Skill India Mission of Hon'ble Prime Minister, Ministry of Environment, Forest & Climate Change (MoEF&CC) utilising the vast network and expertise of ENVIS Hubs/RPs, has taken up an initiative for skill development in the environment and forest sector to enable India's youth to get gainful employment and/or self-employment, called the Green Skill Development Programme (GSDP). The programme endeavors to develop green skilled workers having technical knowledge and commitment to sustainable development, which will help in the attainment of the Nationally Determined Contributions (NDCs), Sustainable Development Goals (SDGs),

Training on Wild Bee Keeping and Processing

All the trainees now have been skilled and trained on Certificate Course on Value Addition and Marketing of NTFPs (Animal Origin): wild Bee Keeping and Processing was organized at Sikkim Science Centre and the field at various places during 14th February to 17th March 2020

The training was of the level of National School Qualification Framework (NSQF) level IV. Twenty five trainees were selected and trained for the said skilling programme.

First hands on training was conducted where trainees were taught on how to make clay hive and what are the local resources they can use to make clay hive. The training contained the skilling programme on Bee keeping, Bee rearing, Queen Bee production, Clay Bee hive making which is ecofriendly and low cost bee boxes.

Valedictory of the Wild Bee Keeping and Processing under Green Skill Development Programme was organized on 7th March, 2020. Two resource persons were invited from State Bank of India and Sikkim State Cooperative Bank (SISCO) for interaction with the trainees. The trainees were briefed about

various plans in the banking sector through which they can avail benefits which will help them secure their future. The function was graced by Hon'ble Minster, Department of Science and Technology, Government of Sikkim, Shri. KarmaLoday Bhutia. Hon'ble Minister distributed the certificates and bee box to the trainees.

Practical Class was conducted on identification of Queen Bee and Clay Hive by Expert .

Distribution of Bee Box to the GSDP trainees by Hon'ble Minister

B . Training on Egg incubators and Distribution:

a. Egg incubator and Hatchery at Village level:

Honble Minister of Science and Technology Shri Karma Loday Bhutia inaugurated the training programme on Egg Incubator for hatching of Chicken at the Household level during November 5 to 9, 2019. The training was attended by identified self help groups.

Poultry farming is quite popular among rural youth and one of their sources of employment and income. They often buy young chicks and feed them till they grow to a certain age for resale. However, if they install an egg incubator, they can produce the chicks in their farm itself. This will work out very economical for them. The incubators available in the market are very expensive and run on electricity. But in rural areas, there are frequent power cuts. The egg incubator developed by Milan Jyoti Das solves these problems. It is cheaper in comparison with the ones available in the market and its power source is both electricity and kerosene lamp.

After the completion of Training programme Hon'ble Minister handed over the hatcheries Machine to the beneficiaries. The programme was funded by National Innovation Foundation, an autonomous organization under Department of Science & Technology, Government of India.

C. Sanitary Napkin Production Machine and training cum distribution to be given to educated unemployed women SHG for production and sale in remote villages:

Sanitary napkin, a universally needed product, has very low penetration in India and other developing countries, partly due to its high price and partly due to the tradition of using cheaper but unhygienic old cloth piece. As a result they become the host of many infectious diseases. This is due to lack of awareness and economic inability for adopting better precautions like use of good sanitary napkins during menstruation period. Usually different varieties of sanitary napkins are found available in the market but they are very expensive and are not affordable for rural & under-privileged women and girls.

Training on production of low cost sanitary napkins was organized during Novembewr 2029 for a week period where the beneficiaries were trained to handle the machinery and equipments and production of sanitary napkins on a sterile environment.

During the valedictory function, Hon'ble Minister, Science & Tecjhnology, Shri Karma Loday Bhutia distributed sets of equipments and machinery for starting the production and sale at the village level to traineed Self Help Groups.

The project is funded by National Innovation Foundation (NIF), GOI and executed by Sikkim State Council of Science & Technology and distributed to different SHGs of Sikkim.

Sanitary Napkin Production Machine and Hatchery Machine Distribution to SHGs

D. . Monitoring of Integrated Watershed Management Programme(IWMP)

The project envisages monitoring and evaluation of IWMP projects for the state of Sikkim. It has to be monitored for five (05) years. The work under this project includes processing of high resolution satellite data, correction of Watershed boundaries, and generation of LULC maps, NDVI maps and preparation of maps showing change detection in projects.

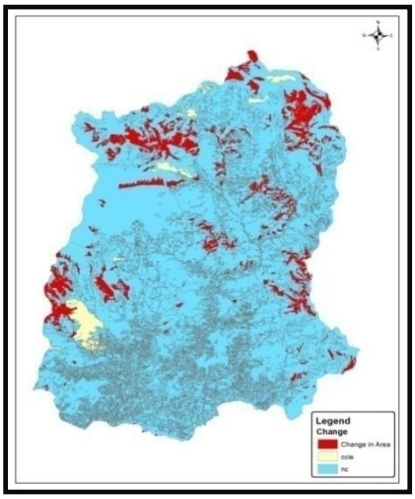
E. Space based Information Support for Decentralized Planning (SISDP) Phase II

Based on the experience gained in the execution of SISDP Phase I project activities and continuous feedback received from various stake holders on project components on database, implementation and capacity building exercise, a strong need was felt to continue this activity. So the objectives of SISDP phase I was decided to be pursued further in the phase II as a logical extension with an emphasis on updating the last geo database using latest data sets and vigorous capacity building activities at various levels. These databases would be useful in preparing developmental plans and monitoring activity. Apart from the updated database, focus shall be on value added data products, data analytics and model based products and services.

The SISDP phase II has been approved and the works for update of all thematic layers of Phase I has been started using the Cartosat imagery.

F. Land Use / Land Cover Change- Third Cycle

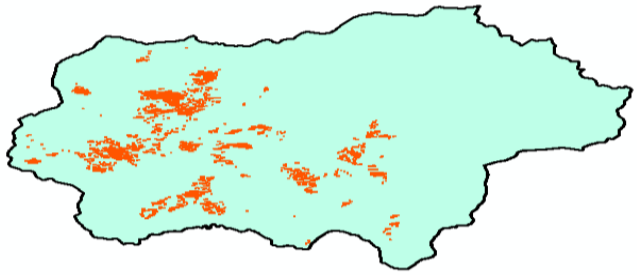
National Remote Sensing Centre, Indian Space Research Organization (ISRO), Department of Space, Government of India in collaboration with various State, Central Government Departments and Institutions has completed first and second cycle of LULC, where third cycle is still going on. Nationwide land use information becomes important, from the point of view of addressing changing pattern in land use/land cover in addition to overall reporting on the nation's land use/land cover scenario.



G. Site suitability analysis under Coordinated Horticulture Assessment and Management using geoNformatics (CHAMAN) project (Phase-II)

The Site Suitability analysis and mapping of potential areas for cultivation of **Kiwi fruit**s in **East District** of Sikkim under the guidance of Mahalanobis National Crop Forecast Centre.

The following parameters shall be used for the analysis the data.



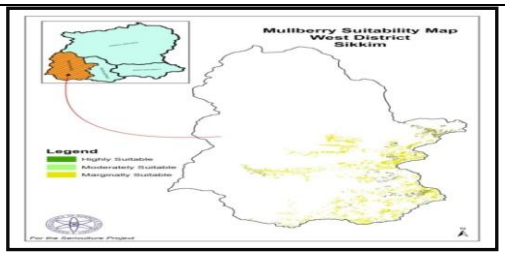
Suitability	Area (hactares)
Highly Suitable	3569
Moderately Suitable	0
Marginally Suitable	0
Total	3569
Area of East Sikkim	95400

The work is still under progress there is a chances of change in the figure in the final maps

H . Application of Remote Sensing and GIS in Sericulture Development:

The main object of this project was to identify potential areas for mulberry and non-mulberry sericulture development in west districts Sikkim and to develop Sericulture Information Linkage & Knowledge System (SILKS) for the west district.

The project was funded by Central Silk Board (CSB), Ministry of textiles, GoI through North Eastern Space Applications Centre (NESAC) Shillong



Suitability	Area (hactare)	Colour Indicator
Highly Suitable	348.81	Dark green
Moderately Suitable	8.3110	Light green
Marginally Suitable	4640.9	Yellow
Total	**4998.021**	
Total area of west Sikkim	116600 ha	

The preparation of final report under this project is under progress.

I . Ice Stupa an Artificial Glacier Demonstration

The artificial Ice stupa was demonstrated this year also in Thangu Village during November 2019. Previously, Department of Science and Technology, GoS has successfully developed a prototype of Ice Stupa at Thangu, North Sikkim in the winter month of 2018-2019 with the support of UNDP. In short, the demonstration of Ice Stupa is an experiment that could be generalize for reglaciation of the glacier and the success of the project can open up the new avenue of reglaciation of selected glacier in natural condition. The principle behind the formation of ice in the selected site is the breaking of water droplets from sprinkle system to small nuclei which gets frozen when it comes in contact with open freezing environment that accumulates to give structure of the cone that resembles Ice Stupa.

J . National Wetland Inventory and Assessment (NWIA), Phase-II

Wetlands of Sikkim are sensitive to climate, because of its climatic setup. Therefore it is crucial that these wetlands are conserved, managed and wisely used, in addition, should refurbish with accurate inventory (Finlayson 1996). However, the Himalayan state of Sikkim lacks detailed information on wetlands.

Comprehending the significance of wetlands, the Space Application Centre (ISRO), Ahmedabad, Govt. of India, lead the project on National Wetland Inventory and Assessment (NWIA), Phase-II. The ongoing project is the continuation of the national level wetland inventory project phase I.

Our final result reported 248 wetlands (Table 1), with an estimated area of 6772.40ha. The result further showed loss of one HAW, however the area of HAWs increased of ca. 185ha. Whereas other wetlands such as lakes, ponds, river and streams remained unchanged.

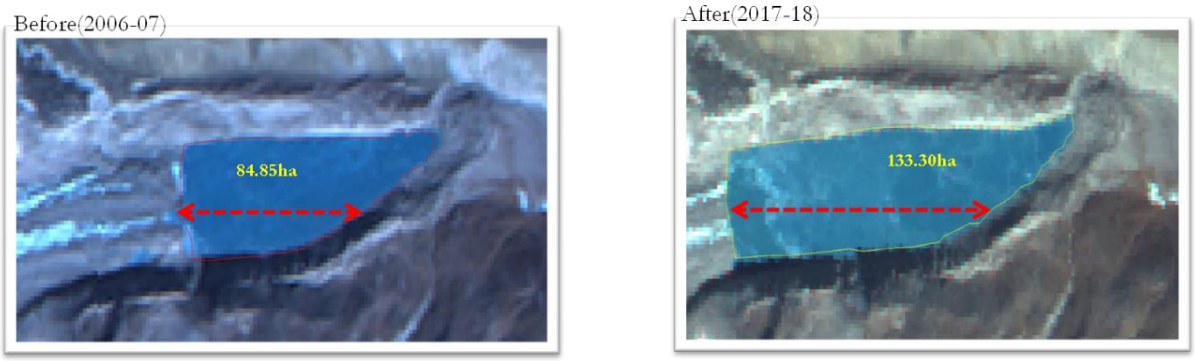


Fig. High altitude wetland (Lhonak Lake) showing increase in area from 2006-2017

- Sikkim Himalaya has 248 large wetlands, which estimates to 6772.40ha that makes about 0.95 % of the total geographic area of the state.
- Decadal change analysis showed an increase in area under wetlands, i.e. about 184.89 ha.
- The lakes, and rivers/streams did not show any change over the decades.
- But, the high altitude wetlands showed an increase in the wetland area, 2.8 %, however, the wetlands count decreased from 236 to 235.

The High Altitude Wetlands of the Himalayan region of Sikkim are extremely vulnerable. The melting of glaciers could be the potential cause, which could be the because of Global Climate Change (increase in temperature). Since, the rapid melting of these glaciers could induce GLOFs and its associated threat, immediate wetland management project should be implemented to monitor and suggest disaster management strategies.

Future work

- The same assessment will be conducted using Resourcessat-2/2A LISS-IV data using finer scale of 1:25K.

K . Training on molecular techniques

State Advance Level Biotech Hub, Department of Science & Technology, Government of Sikkim organized three days hands-on training on Biotechnological techniques and tools commencing from 5.8.2019 at Molecular Biology Laboratory, Vigyan Bhawan, Deorali. The training programme was formally inaugurated by Secretary, Department of Science & Technology, Shri. K. C. Lepcha. The hands-on training was conducted on isolation of plant DNA, its quantification, gel electrophoresis, polymerase chain reaction, analysis of molecular data using bioinformatics tools. The resource persons of the training were Dr. B. C. Basistha, Director (Biotechnology), K. B. Subba, Assistant Scientific Officer, Dr. Sushen Pradhan, Research Associate, Dr. Bhusan Gurung, Research Associate, Laydong Lepcha, Information Officer (Bioinformatics). The training programme concluded with the distribution of certificate by Secretary,

Science & Technology. The participants were BSc. (Botany) students and Professor of SRM University.

L. . Hands-on training on molecular tools and techniques

Hands on training on molecular tools and techniques were conducted at Molecular Biology Laboratory, Vigyan Bhawan for Class XII Bioscience students and teachers of Enchey Sr. Secondary School 30-31st July, 2019. They were taught the technique of DNA isolation, quantification, Gel electrophoresis, Polymerase chain reaction.

III. POPULARIZATION OF SCIENCE

A. INSPIRE- Programme 2019-20:

Department of Science & Technology (DST), Government of India flagship programme 'Innovation in Science Pursuit for Inspired Research (INSPIRE) is being implemented continuously since 2010. The scheme covers students in the age group of 10-32 years and has five components. The first component, INSPIRE Award aims to motivate students, in the age group of 10-15 years and studying in classes 6 to 10, to pursue Science and a career in Research. Ten (10) students from Sikkim already visited JAPAN through the programme. This year DST, GOI awarded 136 students from Sikkim. The districts and State level exhibition-cum project competition has already been completed.

B . Sikkim Science Center, Marchak

The Sikkim Science Centre located in Marchak, Gangtok, has been added with the additional facilities for the benefit of the students and public

New facilities like Digital Planetarium, 3D Theatre, Biodiversity Galery based on States Biodiversity has been added up. In addition, Innovation Hub has been functionised by Hon'ble Minister for Science & Technology, Shri Karma Loday Bhutia.

All these new facilities are ready for inauguration.

Innovation Hub.

C. 52 episode- Radio-Serial on Sustainable development funded by Vigyan Prasar, GOI.

A weekly radio talk transmission is continuing through All India Radio for popularization of Science among the radio listeners. Fifty two episodes of Radio Talk for 52 weeks is under ttansmission during 2019-20. The theme of the Radio talk for these 52 episodes is **Climate Change and Global Warming** where various aspects of climate change and global warming is covered every week.

D. Organising "Udyam Samaagam-2019"

The "Udyam Samaagam-2019,Exploring Exports for Heritage Industries in Sikkim" event was held on 27th and 28th June at Sikkim Science Centre, Marchak, East Sikkim.In this mega event, many entrepreneurs from all over the country took part and showcase their products.

On 27th June 2019, "Udyam Samaagam-2019" was inaugurated by the Hon'ble Minister Shri. Karma Loday Bhutia, Department of Science, Technology and Climate Change , Department of Forest, Environment &Wildlife Management and Department of Mines, Minerals & Geology.

The programme was organized by Micro, Small and Medium Enterprises-Development Institute, Guwahati & Gangtok, Sikkim State Council of Science & Technology (an autonomous organization under Department of Science), Technology and Climate Change and Government of Sikkim. During his inaugural address Hon'ble Minister stressed on departmental priorities into the rural and vulnerable areas especially and spread the awareness among the rural population for economic upliftment among the society. He also emphasized on digital documentation for mass awareness at a larger scale. He also urged the department to utilize the fund provided by the central government for the betterment of the society.

In the Valedictory program the present dignitaries were-

The Department emphasized the credibility of the event, Also he highlighted that this kind of event provides opportunity for the entrepreneurs to showcase their product and help improving their competitiveness. He congratulates all the participants for their valuable time.

Shri. M. Shreenivasulu, Director, MSME-DI, Guwahati. In his speech, explains the need of such type of event mainly in Sikkim.

During the technical seasons, there was workshop/seminar on : Different scheme of DC MSME., Different schemes of NSIC, especially SC/ST hub., Different scheme of State Govt., Different scheme of Oil Board, Different scheme of Khadi and village industry board.

During the technical seasons one to one discussion was also held. Also there were awareness programme on GST, Digital Advertising, Govt. E-Market portal (GeM) and

E-Market platform.

E. . **Popularization of Science: Various programme organized during 2019-20.**

i. Awareness programme on Organic Farming to farmers / NGOS and Panchayat Members in all four districts of Sikkim during 2019-10
ii. Awareness workshop on Climate Change Adaptation in 15 senior Secondary Schools on all four districts of Sikkim during 2019-20
iii. Awareness programme on Biodiversity and its preservation and sustainable utilization
iv. Master Trainers Workshop on Low Cost Teaching Aid for teaching Physics and Chemistry to 100 science teachers at Sikkim Science Centre, Marchak
v. Awareness workshop on Traditional Knowledge with respect to medicinal plants of Sikkim to College Science Students and NGOs
vi. 15 days workshop on tools and techniques of Animation to students at Vigyan Bhawan

F. Establishment of Sikkim State Climate Change Cell under NMSHE:

Sikkim State Climate Change Cell was established in October 2014 under Sikkim State Council of Science and Technology (SSCS&T). SSCS&T is engaged in fulfilling the needs and objectives of National Mission for Sustaining the Himalayan Ecosystem in Sikkim NMSHE. Sikkim State Climate Change Cell is working in this field since its establishment as according to the mandate given by NMSHE.

The Objectives fulfilled by State Climate Change Cell:

a. The Long Term Monitoring of "Study on Glacier Dynamics of East Rathong Glacier"
b. Mitigation of GLOF in South Lhonak lake
c. Constructing Ice-stupas in Thangu, North Sikkim.
d. Representing Sikkim in the World Mountain Forum 2018 “Mountains in a Changing World.
e. Participation in COP 24, Katowice, Poland

G. Awareness Programme:

Awareness Generation Programme cum Training, on Climate Change was conducted by Sikkim State Council of Science and Technology, Gangtok in collaboration with Himali Vikash Sansthan (HSV), Bermiok West Sikkim for Panchayat, Progressive Farmers, NGO’S, SHG’s and Youth. The one day training was conducted at Community Centre Bermiok, 13 Mile West Sikkim during march 2020.

H. Lecture series on Biotechnology

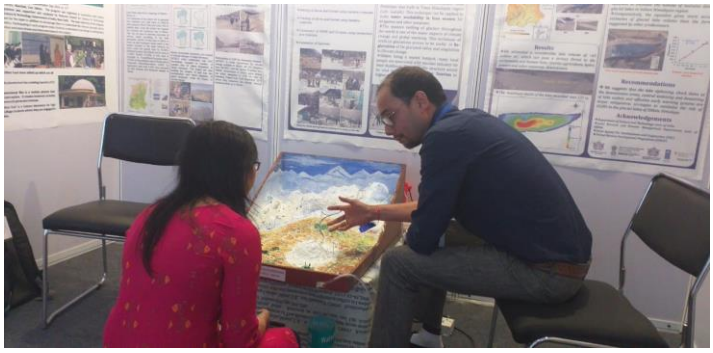
State Biotech hub organized lecture series on Biotechnology and allied subjects. The resource persons were invited from different scientific organization and delivered lecture on various topics on biotechnology and allied subjects. The participants were undergraduate students, post-graduate and research scholars.

I. Biotechnology outreach programme

Conducted outreach programs on biotechnology in 30 different schools of Sikkim to inculcate interest on biotechnology. Students were given lectures and demonstrations on biotechnology and biotechnological tools, and also their sustainable uses along with importance in our daily life.

J. State Biotech and Scientific team participated at India International Science Festival 2019 at Kolkata

India International Science Festival (IISF) launched in 2015 is a celebration to promote Science and Technology and demonstrate how science could lead India towards a developed nation within a short span of time. The aim is to engage the public with science and celebrate the joy of science and show the ways how science, technology, engineering and mathematics (STEM) provide us with the solutions to improve our lives. Ministry of Science and Technology and Ministry of Earth Sciences in association with Vijnana Bharati (VIBHA), has created a unique platform of India International Science Festival which intends to inspire curiosity and make learning more rewarding.



Scientific team of Sikkim State Council of Science & Technology participated in the India International Science Festival held at Science City, Kolkata on 5 – 8 November, 2019. The team showcased the scientific activities of Sikkim State Council of Science & Technology which included the activities of Biotechnology division, Remote Sensing division and Technology Transfer division. The activities were displayed through flex and scientific model.

K. State Biotech team participated at Global Bio-India 2019.

Global Bio-India 2019
Power to Transform Lives
Bioscience to Bioeconomy-USD 100 Bn By 2025
Led by Department of Biotechnology, Govt. of India

The mega event was organized by Department of Biotechnology, Government of India in collaboration with Confederation of Indian Industries with theme "Power to Transform Lives-

Bioscience to Bioeconomy-USD 100 Bn by 2025" Led by Department of Biotechnology, Government of India. Biotechnology division represented Sikkim in this mega event and showcased the Biotechnology and allied activities of state.

L. Minor Awareness Programmes:

- Awareness programme on Organic Farming to farmers / NGOS and Panchayat Members in all four districts of Sikkim
- Awareness workshop on Climate Change Adaptation in 15 senior Secondary Schools on all four districts of Sikkim
- Awareness programme on Biodiversity and its preservation and sustainable utilization
- Master Trainers Workshop on Low Cost Teaching Aid for teaching Physics and Chemistry to 100 science teachers at Sikkim Science Centre, Marchak
- Training to the College student on the Remote Sensing and GIS application, Geoinformatics and Climate change.
- Awareness workshop on Traditional Knowledge with respect to medicinal plants of Sikkim to College Science Students and NGOs
- 15 days workshop on tools and techniques of Animation to students at Vigyan Bhawan
- Training on tools and techniques of Biotechnology to Research Scholars and College Students of Sikkim at Biotechnology laboratory at Vigyan Bhawan, Deorali, Gangtok
- Biotechnology outreach and awareness programmes in 30 school in all four districts of Sikkim
- Awareness lecture series on Intellectual Property Rights in Colleges, University and students and public
- Training on Bioinformatics to Research Scholars and College faculty
- Laboratory exposure of science students of various schools of Sikkim.
- National Science Day 2020 at State Level
- National Children Science Congress 2019

IV. ANY NEW INNOVATIVE ACTIVITIES

A. Integrated farming of large cardamom, coffee and passion fruit

Multi-tier cropping system is introduced in large cardamom cultivation to increase the income of the farmer. Passion fruit, a climber plant is introduced in shade tree. In the next line is coffee plant and large cardamom

B. Preparation of hand sanitizer

Hand sanitizer as per WHO recommendation is prepared in sufficient quantity for frontline worker and distributed in the wake of Covid19 pandemic.

Successfully developed new cultivation practices of large cardamom in which a plant starts giving fruiting within one year of plantation as compared to 2-3 years of plantation. The technology developed shall be transferred to the farmers.

C. Characterizing Patterns and Processes of Alpine Ecosystem in Indian Himalaya, Studies on Harnessing Remote Sensing for Environment and Climate (SHRESTI)

The specific objective of the programme for Sikkim Himalaya is to establish the long-term ecological site in alpine ecosystem for monitoring tree-line shift, phonological changes and record changes in soil microbial community.

The period under consideration is 2019, the project focuses on identifying and creating baseline information and data for further project and is not a comprehensive report. The till date finding of the project activities is as under:

- Long term ecological monitoring sites for tree-line shift was identified and established in Kabi, which is a village in North district of Sikkim. Three summits were chosen where total 12 quadrates of 3x3m were established. In each quadrate of 3x3m, soil temperature loggers were placed for generating temperature data.
- Total 67 species of plants (including shrubs and herbaceous plants), were identified in the 12 quadrates which belongs to 29 families (Appendix I). Based on the availability of species and ecological concerns associated with the species, at present three species of trees were shortlisted for the further studies and the species were *Betula utilis, Abies densa* and *Acer pectinatum*.
- A study on changes in tree-line position and phenology over 37 years apart was carried out in Sikkim Himalaya using Landsat2 (MSS), Resourcesat-2 (LISS-III) and NOAA-AVHRR derived NDVI. Satellite imagery analysis of 37 years reveals that there is an upward shift in tree-line position and an increased in mean minimum temperature leading to significant changes in start and length of growing season.

5 . SUCCESS STORY:

a. Demonstration of Ice Stupa in Sikkim

Himalaya is one of the vulnerable areas in terms of climate change. 'Ice Stupa' is an artificial glacier build in natural environment which resemble the Stupa, a cone shape structure named as 'Ice Stupa'. The massive melting of glacier and ice field throughout the world is one of the major impacts of climate change and global warming. This technique of artificial glaciations proves to be useful for re-glaciation if we put some more efforts in it.

Glaciers are one of the important sources of water for drinking and irrigation purpose in the Himalayas. The techniques can make water availability possible during dry for irrigation.

b. New Agro technology for Hilly region of Sikkim introduced.

Integrated fish farming, vermicomposting and azolla cultivation has been developed. Multilayered cropping system of cardamom cultivation with passion fruit and other fruit trees developed

c. Developed two new cymbidium hybrid:

Two new cymbidium hybrids developed. One is hardy and long lasting type and another large flowered. In both the cases the traits of original *Cymbidium lowenium* of the region is re-expressed. Sikkim is also known for orchids. There are very few indigenously developed orchid hybrid which will have the commercial importance.

d. Low cost technology to clean greenhouse plastic:

One of the biggest problems of greenhouse farming in the Himalayan region is the accumulation of algae, fungi and dust on the greenhouse plastic due to high humidity and rainfall. After few years of greenhouse cultivation, the plastic becomes opaque and blocks the sunlight due to which the crop grown inside will be greatly hampered. Further, the pests and disease incidence increases due to congenial environment. S&T Council of Sikkim has developed a simple and easy method of cleaning greenhouse plastic.

e. Development of drying of cardamom and other vegetables by using hydel power generation from local streams at final stage:

f. Successfully developed the protocol for tissue culture of large cardamom for propagation of elite quality planting material:

The protocol for tissue culture of large cardamom for propagation of elite quality planting material is successfully developed for all the popular cultivars. In the next phase, large scale production will be made and distributed to the farmers under a project funded by DBT, GOI.

1. Technology Demonstrations:

b. Demonstration of Ice Stupa for storage of water resources for lean season and reglaciation efforts in Sikkim
c. Demonstration of Tissue Culture techniques and transfer of technology
d. Demonstration of modified cultivation practices of large cardamom for shortening gestation for fruiting from three years to two years.
e. Rain Water Harvesting for drinking purpose at Suldung Kamling GPU funded by UNDP
f. Development of dryer for Cardamom, Ginger, Mushroom and ether herbs and vegetables energized by Nano Hydel Power generated by Local Water Streams of Sikkim
g. Micro Solar Dome for rural households for 24 x 7 solar lighting
h. Azolla is found to have multiple use such as cow feed, pig, chiken, fish feed. They are also used in rice field to control weed and enrich the soil. The use and method of azolla cultivation is demonstrated to the farmers of the locality.

District Vulnerability Assessment in Sikkim

Climate change is a reality and its impact can be seen in natural ecosystems and human societies. The impact of climate change is likely to be severe in the coming decades. The vulnerability assessment will help the policy makers and planners to identify the vulnerable areas/district/ Gram Panchyat/wards based on the performance of indicators in that particular area and considered

techniques. It will help in reducing the biasness in selecting the areas for the adaptation and other development plan.

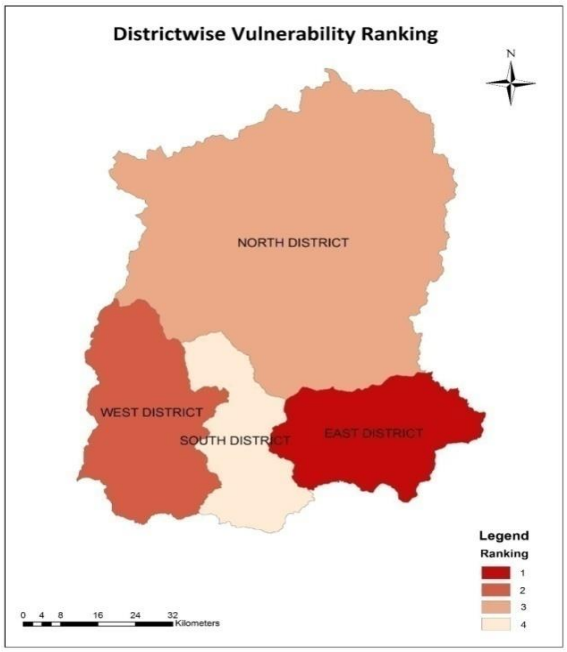
A demonstration of the activities: In this exercise, the assessment has been done to identify, rank and prioritise the most vulnerable districts in Sikkim based on the identified indicators. Identification and prioritisation of most vulnerable districts is an essential step for prioritizing investment in adaptation.

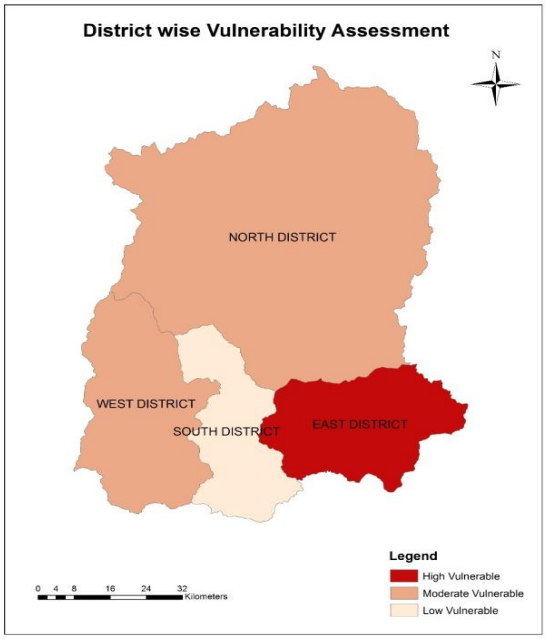
The assessment would be helpful for the following target group:

- Policy Makers, State line departments- Land Revenue & Disaster Management Department and Rural Management & Development Department etc
- Technical supporters- UNDP, GIZ,National and international funding agencies for climate change mitigation and adaptation programmes and Submission to NMSHE nodal Agency (DST-GoI) and technical partner, SDC

In this assessment, an effort has been made to identify the vulnerable district in Sikkim based on the socio economic parameters identified through the considered indicators. The vulnerability assessment can also be done sector wise like in water sector, agriculture sector, health sector, forest sector etc or according to the need of the assessment. Different assessment in different sectors gives different result. For instance if we are working on water security, the indicators concerned with water such as availability of number of springs, perennial stream, number of availability of tanks etc has to be considered and in such assessment, we will get the vulnerable district in terms of water security. The present assessment has been done based on the training provided by IISC Banglore, IIT Guwahati and IIT Mandi under capacity building programme of manpower of State Climate Change Cell of the Himalayan state of India. This is an example of the assessment which reflects the ways and methodology to be followed to carry out the assessment and build up capacity of the state in carrying out such exercises in Sikkim. So, the kind of exercises shall be very helpful to the government and the planners to identify the weaker and backward areas in the state.

Map of districts with vulnerability ranking and Assessment are given below





2. Geodetic Mass Balance estimates of East Rathong Glacier

- According to the preliminary results of Geodetic Mass Balance estimates there is maximum upto 80-120m of ice thickness change. The vertical retreat in East Rathong glacier has been increased every year.
- The Microwave Remote Sensing and GIS has been tested for the study area, it has showed promising results in the thickness estimation using laminar ice flow equation and the velocity estimation. The current ice thickness has been recorded as 77.5m in 2020 which was 100.8m in 1993. The overall ice thickness loss is 23.3m in last 27 years.
- A conclusion was made for the use of Interferometric and Differential Interferometric Synthetic Aperture Radar data. They showed high standard deviations in Mass Balance Estimations due to high de-correlation.

Proposed Programme

1) **Long-Term Monitoring on "Glacier Dynamics of East Rathong Glacier- Sikkim Phase III**
   Submitted to: Science and Engineering Research Board, Department of Science and Technology, Government of India
2) **Development of a computational assessment model for glacier study using machine learning approach for glaciers in Sikkim.**
   Submitted to: Science and Engineering Research Board, Department of Science and Technology, Government of India
3) Establishing/Strengthening the State Climate Change Cell under NMSHE in the State of SIKKIM (Phase-II)
   Submitted to: Department of Science and Technology, Government of India

6. Has the council developed any specific state related S&T and innovation policy? If so the details to be provided.

NA

7. How strong are the links between other state government / departments if so provide details.

- Sikkim State council of Science & Technology works in close coordination with the line departments as well as the state government
- Sikkim State Council of Science & Technology is the Nodal Institution in the State for Climate Change initiatives. Second Phase of State Action Plan for Climate Change has been under preparation with the support of GIZ All government departments are involved as the member of the steering committee for Climate Change.
- Linkages with UNDP, Swiss Development Cooperation and GIZ on Climate Change adaptation programmes.
- INSPIRE Programme of DST; Govt. of India has been taken up in coordination with Human Resource Development Department. State Nodal Office is the Council while District Joint Directors of HRDD are the district Coordinators.
- **Support to the user departments/ agencies:** S&T Council being nodal for Remote Sensing and GIS applications in Sikkim, has contributed technical support to many user department and agencies in Sikkim. Some of the support includes-
- Preparation of various GIS map for General Election 2014 and 2018
- 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, Govt. of Sikkim.

(i) Council is responsible for all patent work related to intellectual property in the state.

8. How strong are the links of the council with local industry units/associations?

Sikkim being a hilly landlocked state, there is not many local industries except for cottage industries and handicraft. The council is striving to have linkages with such local industries by formulating projects in the areas of handicraft.

S&T Council with the support of GIZ organized one training on weaving of fine handlooms during 2017-18

9. List 5 major technology area, where the council can play an important role by finding convergent technological solutions.

(i) Biotechnology and tissue culture
(ii) Climate Change Adaptation and Mitigation
(iii) Remote sensing
(iv) Non renewable energy
(v) Post harvest technology

10. Proposed Programmes:

1. **Establishment of Science Center in South Sikkim**
2. **Establishment of Technology Demonstration Centre at Marchak, East Sikkim**
3. **Establishment of Technology Incubation Centre in Sikkim**
4. **Development of INSAR based technique for high resolution surface topography and ice velocity under microwave and hyper spectral techniques for earth resources application and management.**

5. Development of Firest Fire Spread Model using Satellite RS
6. Climate Change Risk reduction for potentially Dangerous Glacial Lakes In Sikkim
7. Sikkim State centre for Glaciology
8 Experimental Study on Reglaciation of Deglaciated Valley in Sikkim through Artificial Glaciation
9. Study on Wild Edible fruits of Sikkim Himnalayas.

B. Diffusion of grassroots innovations and documentation of innovations and outstanding traditional knowledge from Sikkim:

The project funded by National Innovation Foundation Government of India aims to document grassroots innovations from the state.

. Understanding the potential of grassroots innovations, the Department believes if systematic scouting and documentation of grassroots innovations from the state of Sikkim is undertaken, not only it will help unearth and promote local ingenuity but also may result in establishment of grassroots enterprises. NIF has had a long experience in promotion of grassroots innovations and valorization of outstanding traditional knowledge and a partnership between the two institutions is expected to benefit the people of Sikkim.

Since NIF already has a pool of a number of grassroots innovations, it is requested NIF to provide to the Department, innovations that could be included in a proposed Innovation Demonstration cum Training Centre so that people can visit, see and even get trained on the available innovations.

Area:

The state of Sikkim with focus on district(s) enlisted in Inspirational district list of NITI Aayog. The Innovation Demonstration cum Training Centre (proposed) will be setup in Gangtok.

a. Activities:

The following activities will be undertaken during 2019-20:

- Identification of needs of the people in the districts and solution.
- Dissemination of low cost useful solutions based on need assessment.
- Diffusion of useful grassroots innovations in the districts and setting up of Innovation Demonstration cum Training Centre.
- Scouting of green grassroots innovations from the districts including from farmers, artisans, mechanics, school and ITI students for scaling up.
- Organising of ideation camps in schools for INSPIRE and Dr APJ Abdul Kalam IGNITE Awards.

C. India Enterprise Portal

Brief Overview

The *India Enterprise Portal* has been architected for the Ministry of Micro, Small and Medium Enterprises under the Scheme for Promotion of MSME in the North East Region and Sikkim, on the basis of validated approaches in the earlier deployments of the skillyoungindia.com and indiaskillpedia/ techpedia portals.

The Strategic approach which guided the development and deployment of the Portal relies on presenting a unified blackboard architecture and collaboration platform, serving as a cyber eco-system, cutting across the boundaries of several Ministries, State Agencies, Industries and Institutions serving the cause of promotion and growth of entrepreneurship, start-Ups and MSME's in our nation.

The portal relies on distributed, decentralized content updating of operations, sharing of information/resources by the network of partners, state agencies as also the Enterprise Development Centers, which are proposed facilitation centers being set up across the nation on the lines of PHC/ ICDS centers and such other field Offices of the governments.

The India Enterprise Portal encompasses functionality and features for **online delivery of services- eServices**, to entrepreneurs/ start-Ups – aligned with

(a) their profile and requirements as discerned from their inputs, interactions during the use of the portal, as also from

(b) the posting of their needs by facilitators, on the basis of counseling and facilitation services offered by various field operatives and centers.

The Portal encompasses functionality features besides eServices, which includes;

(i) **Knowledge Repository** with authoring systems,

(ii) **e-Market Place**,

(iii) Unified view of information related to **programmes and schemes** for entrepreneurs notified and implemented by the Ministries of Govt. of India,

(iv) **R & D Solutions and Technologies** developed by various Institutions,

(v) **Directory Services and Profile pages** for each of the Registers Users, Industries, State Agencies and Institutions,

(vi) **Events** notification with mention of follow up action required

(vii) **Streaming blog/ YouTube anchors** and contents

(viiii) **Ideas and Opportunities in Focus Sectors** with blog contents and relevant resources to evoke interest and enthusiasm in entrepreneurs

The portal applies **cognitive methods** to enhance comprehension and ease of understanding with visual cues, tool tips, enriched GUI and interactive features and system intelligence for notifications, messages and onscreen alerts to users to draw their attention and engage them in the process of on-boarding them and promoting patronage in the use of the facilities offered on the portal.

The solution architecture for the portal subscribes to the **paradigm of Open innovation**, which is becoming increasingly relevant in the current scenario where collaboration, networking and partnerships play significant roles to determine success and outcomes.

System intelligence is built in to enable log the user activity on the basis of his consent in order to provide him customized links and recommendations adapted to his needs.

Organization of Knowledge Resources and E Services

The Knowledge and Service Clusters, Sub-Clusters and Thematic Nodal Clusters are structured and organized along

(a) the life cycle of the enterprises/start-Ups –such as inception; setting up infrastructure; planning for production & services; operation & management; sustainability, scale-up & value addition
(b) Across profiles of service agencies/ facilitators
(c) Across service clusters and categories and
(d) Across focus sectors.

Processes are built in, - to take service requests, register for redress of grievances, provide status updates, seek resolution on issues / technical assistance, view notifications seeking responses/ compliances, document uploads to enable process service requests.

Features and facilities for management of the knowledge resources, information on services and related contents, their representation and presentation under various links provided in the GUI layout are provided. Links are also presented for operations such as previews, downloads, archiving/ editing/deleting or managing metadata of contents.

6. Has the council developed any specific state related S&T and innovation policy? If so the details to be provided.

NA

7. How strong are the links between other state government / departments if so provide details.

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S&T Council with the support of GIZ organized one training on weaving of fine handlooms during 2017-18.

9. List 5 major technology area, where the council can play an important role by finding convergent technological solutions.

(vi) Biotechnology and tissue culture
(vii) Climate Change Adaptation and Mitigation
(viii) Remote sensing
(ix) Non renewable energy
(x) Post harvest technology

10. Proposed Programmes:

- To continue research and development in the field of Biotechnology.
- To promote researchers, students, scholars, faculties, etc. by permitting the use of laboratory for conducting their research activities.
- To develop human resource in Sikkim by enrolling Master degree passed candidates of Sikkim into PhD works.
- To undertake further research and develop quality planting material, and also conduct training to the farmers on agro-techniques of cardamom with distribution of quality planting material.
- To carry our research on Sikkimese orange and try rejuvenate them again. Training on agro-techniques of citrus to the farmers and distribution virus free planting materials.
- To conduct research on zinger of Sikkim to find out natural organic remedy for rhizome rot by *Pithium* sp.
- To conduct outreach programme to inculcate biotechnology, microbiology subjects in the minds of students through demonstration and lectures.
- To conduct hands on training to the researchers, PhD scholars, college and university students, teachers from schools, etc on laboratory and biotechnology techniques and laboratory ethics.
- Laboratory equipment demonstrations and their working principles to the school students.
- Project proposal on Citrus disease, biochemical analysis and development of quality planting material has been submitted and approval is awaited from Department of Biotechnology, Govt. of India.
- Project proposal on Sikkim Bio-incubation Centre has been prepared and submitted to the state Government for its clearance to be submitted again to the Department of Biotechnology, Government of India..
- Study on Wild Edible fruits of Sikkim Himalayas