ANNUAL REPORT

FINANCIAL YEAR 2022-23

सत्यमेव जयते

Department of Science & Technology
Govt. of India

Submitted to:

SSTP DIVISION
DEPARTMENT OF SCIENCE AND TECHNOLOGY
GOVERNMENT OF INDIA
TECHNOLOGY BHAWAN
NEW MEHRAULI ROAD, NEW DELHI – 110016

Submitted by :

SIKKIM STATE COUNCIL OF SCIENCE AND TECHNOLOGY
VIGYAN BHAWAN, DEORALI, GANGTOK, SIKKIM - 737102

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1. Details of State/UT Science &Technology Council:

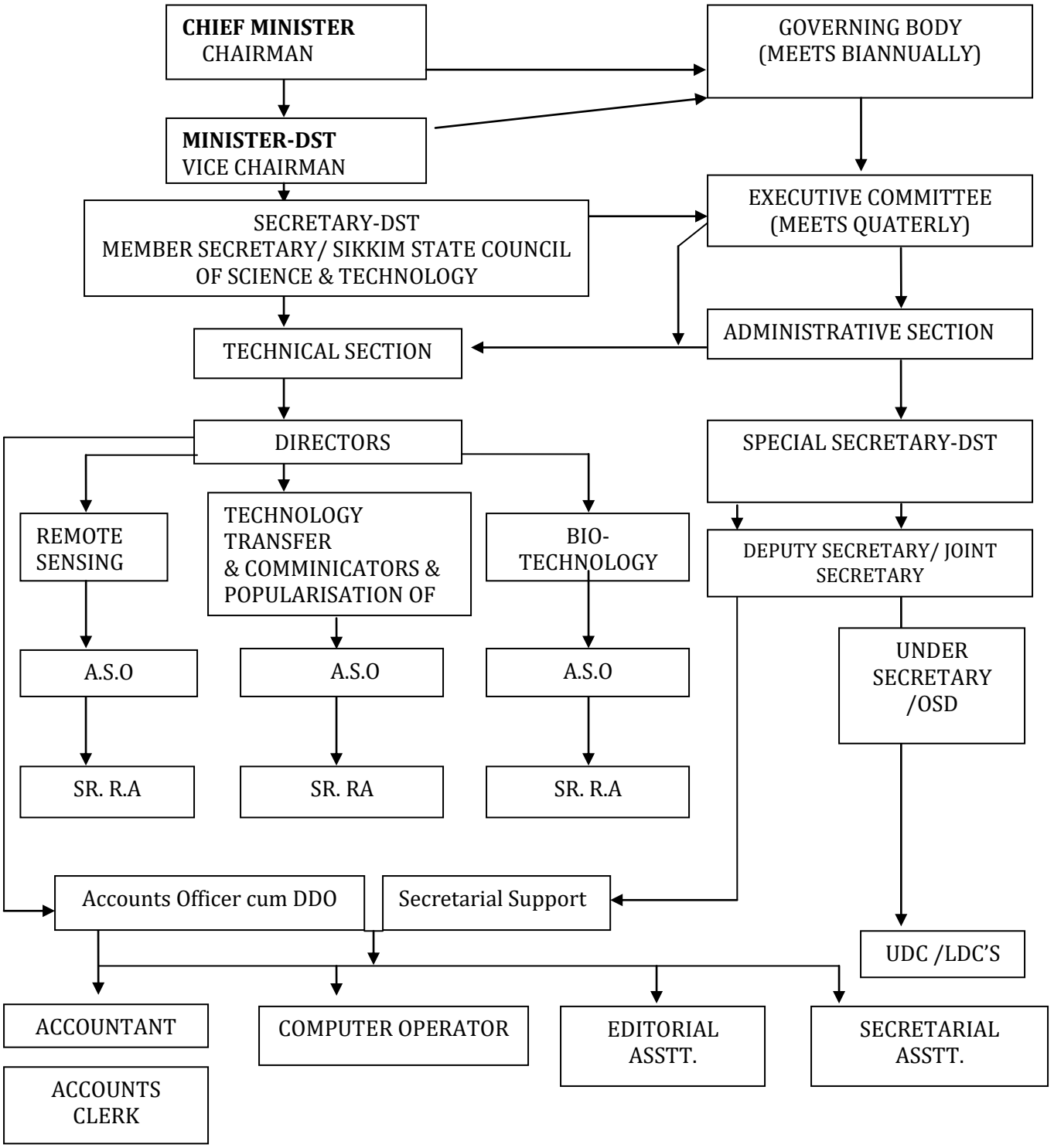
I.	Name of the State S&T Council:	Sikkim State Council of Science and Technology
II.	Name of the Secretary & Member Secretary:	Shri B.P. Pradhan, IFS
III.	Address, Email and mobile number	Secretary cum Member Secretary Department of Science and Technology Vigyan Bhawan P.O. Deorali 'East Sikkim 737102 secydst@gmail.com Ph: 03592 280002

2. Structure of the Council:

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

b. **Organization Structure**

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



3. Strength of human resources supported by DST

i. Scientific / Technical Positions:

Sl. No	Name of the Post	Name of the Employee	Monthly Emoluments (Received during FY 2022-23)	Yearly Emolument (Received during FY 2022-23)	Remarks
A. DST Supported Human Resource:					
Shri B.P.Pradhan, IFS- Secretary cum Member Secretary, SSCS&T.					
a. Scientific & Technical Position:					
1.	Director	Shri Suman Thapa	166532.00	18,52,392.00	Promoted
2.	ASO	Shri Nabeen Sharma	73654.00	8,41,820.00	-do-
3.	ASO	Shri Rajdeep Gurung	73654.00	8,41,820.00	-do-
4.	ASO	Shri Laydong Lepcha	73654.00	8,35,184.00	-do-
5.	ASO	Dr. Sushen Pradhan	73654.00	8,41,820.00	-do-
6.	ASO	Shri Rinzing N. Lepcha	73654.00	8,41,820.00	-do-
7.	ASO	Shri Radha Kri. Sharma	73654.00	8,41,820.00	-do-
8.	ASO	Shri Pranay Pradhan	73654.00	8,41,820.00	-do-
9.	ASO	Shri Tseten Pradhan	73654.00	8,41,820.00	-do-
10.	Sr. RA	Shri Prabhakar Gurung	60856.00	7,13,998.00	-do-
11.	Sr. RA	Mrs Binita Shrestha	60856.00	7,13,998.00	-do-
12.	Sr. RA	Ms Prerna Pradhan	60856.00	7,13,998.00	-do-
13.	ASO	Ms Pema Z. Lepcha	25000.00	3,00,000.00	
b. Administrative Position:					
14	Accountant	Shri Dadul Lepcha	59118.00	6,93,616.00	
15	Asst. Programmer	Ms. Ongkit Lepcha	53,746.00	5,94,550.00	Promoted
c. State grant supported staffs:					
	ASO (Consolidated)	Jai Narayan Karki	25,000.00	3,00,000.00	
16	Peon	Shri Bhasker Gurung	9,300.00	1,11,600.00	
17	Peon	Mrs Yden Bhutia	9,300.00	1,11,600.00	
18	Peon	Ms Bashanti Rai	9,300.00	1,11,600.00	
19	Peon	Shri Shrep P. Dong	9,300.00	1,11,600.00	
20	Peon	Ms Puja Pradhan	9,300.00	1,11,600.00	
21	Peon	Shri Arpan Lepcha	9,300.00	1,11,600.00	

4. State Government Supported Human Resource:

a. Strength of Human Resource supported by the State Government:

Sl.No	Name of the Officer	Designation	Office/Section
Administrative:			
1	Shri B. P. Pradhan, IFS	Secretary	
2	Ms. Neeta Gazmere	Additional Director (Adm.)	Administrative
3	Shri K.S. Chhetri	Chief Account Officer	Accounts
4	Mrs. Baby Mukhia	Additional Secretary	Administrative
5	Mrs. Neetu Gajmer	Sr. Private Secretary	Office of the Secretary
6	Mrs. Chuni O. Lepcha	Under Secretary	Administrative
7	Mrs. Nisha Gurung	Private Secretary	Office of the Principal Director
8	Mrs. Takendra Gurung	Head Assistant-I	Administrative
9	Mr. Udai Chandra Rai	Head Assistant-II	Administrative
10	Mrs. Durga D. Sharma	Head Assistant-III	Administrative
11	Mrs. Sonam Ongmu Bhutia	UDC-I	Administrative
12	Ms. D.Eden Bhutia	Computer Operator	Administrative
13	Mr. Sangay W. Lepchak	UDC-II	Administrative
14	Mrs. Neeta Maya Rai	Librarian	Administrative
15	Mrs. Poonam Pradhan	LDC-I	Administrative
16	Ms. Lakpa Doma Tamang	LDC-II	Administrative
17	Mrs. Anita Basnett,	LDC-III	Administrative
Technical:			
1	Dr. B.C. Basistha	Principal Director	Biotechnology Division
2	Shri D.G. Shrestha	Principal Director	Remote Sensing Division
3	Shri D. T. Bhutia	Principal Director	Technology Transfer Division
4	Mr. K.B. Subba	Scientific Officer	Biotechnology Division
5	Mr. N.P. Sharma	Scientific Officer	Remote Sensing Division
6	Mr. Sanman Subba	Assistant Director	Communication and popularization
7	Mr. Benoy Kr. Pradhan	Assistant Scientific Officer	Remote Sensing Division
8	Ms. Tshering Youden Bhutia	Lab Attendant	Innovation Hub
9	Mrs. Saroj Lepcha	Lab Attendant	Laboratory
10	Mrs. Dawa G.Bhutia	Lab Attendant	Laboratory
11	Mr. Tika Pd. Sharma	Lab Assistant	Laboratory
12	Mr. Inchung Lepcha	Lab Attendant	Laboratory

5. List of Project Manpower

Sl. No	Name of Project Staff	Designation
1	Mr Baichung Lepcha	Sr. Research Fellow
2	Mrs. Deepa Rupa Sharma	Project Assistant
3	Ms. Bhawana Chettri	Project Scientist
4	Ms. Priya Darshini Gurung	Project Scientific
5	Dr. Sundeep Chettri	Research Assistant
6	Mr. Niraj Sharma	Information Officer
7	Mr. Arpana Thapa	Project Assistant
8	Ms. Tseten Chung Lachungpa	Data Entry Operator
9	Ms. Palmu Bhutia	I. T. Officer/GIS
10	Ms Jamyang Palmu Bhutia	Scientist B
11	Mr Youa Raj Cintury	Field Asst.
12	Mr Dup Wangyal Tamang	Project Asst.
13	Dr. Smriti Subba	Project Coordinator
14	Ms. Sushnim Golay	Field Worker
15	Mr. Kishore Psd. Sharma	Project Asst.
16	Mr. Udai Biswakarma	Field Worker.
17	Ms Kalzen Dolma Tamang	Project Associate-I
18	Ms Pema Youden Bhutia	Project Associate-I
19	Mr Bayvesh Luitel	Project Asst.
20	Mr Suman Subba	Technical Asst.
21	Ms. Primula Sharma	Programme Officer

6. Budget allocation to your state S&T council for the last five financial years including central government, State Government & any other sources.

(Amount in lakhs)

Sl. No	Financial Year	State Govt. Grants in Aid	Central Govt. Allocation	Remarks
1	**2019-20**	**35.00**	**104.63**	**Received**
2	**2020-21**	**48.00**	**78.00**	**Received**
3.	**2021-22**	**70.30.**	**82.76**	**Received**
4	**2022-23**	**213.00**	**88.76**	**Received**
5.	**2023-24**	**545.00**		

FORM GFR 12A
GFR 12 – A
[(See Rule 238(1)]

FORM OF UTILIZATION CERTIFICATE
FOR AUTONOMOUS BODIES OF THE GRANTEE ORGANIZATION
UTILIZATION CERTIFICATE FOR THE YEAR April 2022- March 2023 in respect
Of Non-recurring
GRANT-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS

1. Name of the Scheme **State Science & Technology Programme**
2. Whether **Non-Recurring grants**
3. Grant position of the beginning of the financial year: **2022-23**
   (i) Cash in Hand/Bank **Rs. 2,00,000/-**
   (ii) Unadjusted advances: **NIL**
   (iii) Total **Rs. 2,00,000/-**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as of Sl.No.3 (iii)]	Interest Earned thereon	Interest deposited back to the Government	Grant received during the year			Total Available funds (1+2+3+4)	Expenditure incurred (In Rupees)	Closing Balance (5-6) (In Rupees)
1	2	3	4			5	6	7
			Sanction No.(i)	Date (ii)	Amount (iii)			
NIL	NIL	NIL	**DST/SSTP/Core Grant/Sikkim/2020-21**	**09/03/2023**	**2,00,000.00**	**2,00,000.00**	**1,99,774.00**	**226.00**

5. Component wise utilization of grants:

Grant-in-aid-General	Grant-in-aid-salary	Grant-in-aid-creation of capital assets	Total (In Rupees)
		Rs. 2,00,000/-	**1,99,774.00**

Details of grants position of the end of the year: 2022-23.
(i) Cash in Hand/Bank
(ii) Unadjusted advances
(iii) Total **Rs. 226.00**

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

FORM GFR 12A

Certified that I have satisfied myself that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

(i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.

(ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.

(iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.

(iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.

(v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.

(vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.

(vii) It has been ensured that the physical and financial performance under the State Science & Technology Programme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the funds resulted in outcomes given at Annexure-I duly enclosed.

(viii) The utilization of the funds resulted in outcomes given at Annexure-II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)

(ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure-III (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

(x) The UC has been uploaded on PFMS portal with ID NO: SSCS&T.

Date: 30/08/2023
Place: Gangtok

Signature
Name: K.S Chettri
Chief Finance Officer
(Head of the Finance)

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

Signature
Name: B.P. Pradhan, IFS
Head of the Organisation
(Member Secretary)

MEMBER SECRETARY
Sikkim State Council of Science & Technology
Tadong, Deorali, Gangtok, Sikkim

FORM GFR 12B

GFR 12 – B
[(See Rule 256(2)]

FORM OF UTILIZATION CERTIFICATE

(1) Certified that out of the grant of Rs. 2,00,000.00 (Rupees Two Lakhs) only SANCTIONED under Non-Recurring Grant Dated 09/03/2023, in favor of Member Secretary, Sikkim State Council of Science and Technology during the year April 2022-March 2023 an amount of Rs 1,99,774/- has been utilized for the purpose for which it was sanctioned, and that the balance of Rs. 226/- remaining unutilized at the end of the year March 2023 has been surrendered to the Government (vide NIL dated: NIL)/ will be adjusted towards the loan payable during the next financial year.

(2) Certified that I have satisfied myself that the conditions on which the loan was sanctioned have been duly fulfilled/are being fulfilled and that I have exercised the following checks to see that the money was actually spent for the purpose for which the loan was mode.

Kinds of checks exercised.

Signature……..

Designation: Chief Account Officer

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council of Science & Tech.
Govt. of Sikkim, Gangtok

Date: 30/08/2023

FORM GFR 12A

GFR 12 – A
[(See Rule 238(1)]

FORM OF UTILIZATION CERTIFICATE
FOR AUTONOMOUS BODIES OF THE GRANTEE ORGANIZATION

UTILIZATION CERTIFICATE FOR THE YEAR April 2022- March 2023 in respect
Of Recurring
GRANT-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS

4. Name of the Scheme — **State Science & Technology Programme**
5. Whether — **Recurring**
6. Grant position of the beginning of the financial year: **2022-23**
   (iv) Cash in Hand/Bank — **Rs. 86,76,000/-**
   (v) Unadjusted advances
   (vi) Total — **Rs. 86,76,000/-**
6. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as of Sl.No.3 (iii)]	Interest Earned thereon	Interest deposited back to the Government	Grant received during the year			Total Available funds (1+2+3+4)	Expenditure incurred (In Rupees)	Closing Balance (5-6) (In Rupees)
1	2	3	4			5	6	7
			Sanction No.(i)	Date (ii)	Amount (iii)			
NIL	NIL	NIL	DST/SSTP/Core Grant/Sikkim/2020-21	09/03/2023	86,76,000	86,76,000	86,76,210	(-)210.00

7. Component wise utilization of grants:

Grant-in-aid-General	Grant-in-aid-salary	Grant-in-aid-creation of capital assets	Total (In Rupees)
Rs. 86,76,000/-	**Rs. 82,76,000/-**		**86,76,210.00**

Details of grants position of the end of the year: 2022-23.
(iv) Cash in Hand/Bank
(v) Unadjusted advances
(vi) Total **Rs. -210**

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

FORM GFR 12A

Certified that I have satisfied myself that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

(xi) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.

(xii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.

(xiii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.

(xiv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.

(xv) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.

(xvi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.

(xvii) It has been ensured that the physical and financial performance under the State Science & Technology Programme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the funds resulted in outcomes given at Annexure-I duly enclosed.

(xviii) The utilization of the funds resulted in outcomes given at Annexure-II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)

(xix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure-III (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

(xx) The UC has been uploaded on PFMS portal with ID NO: SSCS&T-SIKKIM.

Date: 30/08/2023
Place: Gangtok

Signature
Name: K.S. CHETTRI
Chief Finance Officer
(Head of the Finance)

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

Signature
Name: B.P. Pradhan IFS
Head of the Organisation
(Member Secretary)

MEMBER SECRETARY
Sikkim State Council of Science & Technology
Vigyan Bhawan, Deorali, Gangtok, Sikkim

FORM GFR 12B

GENERAL FINANCIAL RULES 2017
Ministry of Finance
Department of Expenditure

GFR 12 – B
[(See Rule 256(2)]

FORM OF UTILIZATION CERTIFICATE

(3) Certified that out of the grant of Rs. 8676000.00 (Rupees eighty six lakhs seventy six thousand) only SANCTIONED under Recurring Grant Dated 09/03/2023, in favor of Member Secretary, Sikkim State Council of Science and Technology during the year April 2022- March 2023 an amount of Rs 86,7210/- has been utilized for the purpose for which it was sanctioned, and that the balance of Rs. (-) 210.00 remaining unutilized at the end of the year 2023-24 has been surrendered to the Government (vide No NIL .dated: NIL)/ will be adjusted towards the loan payable during the next financial year.

(4) Certified that I have satisfied myself that the conditions on which the loan was sanctioned have been duly fulfilled/are being fulfilled and that I have exercised the following checks to see that the money was actually spent for the purpose for which the loan was mode.

Kinds of checks exercised

Signature……..

Designation: Chief Account Officer

Date: 30/08/2023

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

Annexure- A

REQUEST FOR ANNUAL INSTALMENT WITH
UP—TO—DATE STATEMENT OF EXPENDITURE

(Year Means Financial Year i.e. 1st April 2022 to 31st March 2023.)

1. Sanction Letter No.	DST/SSTP/Core Grant/Sikkim/2020-21
2. Total Project Cost	Rs. 86,76,210.00
3. Sanctioned/Revised Project cost	Rs. 86,76,000.00
4. Date of Commencement of Project	2023-24
5. Duration 1 Year months	
6. Grant Received in each year	
a. I Year	Rs: 86,76,000.00
d. Bank Interest received on grant (mandatory)	Rs. NIL
7. Total expenditure	Rs. 86, 76,210.00
8. Funds required for next year 2023-24	Rs. 1, 50, 00,000/-

Contd./-

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

Annexure – A *(Contd.)*

STATEMENT OF EXPENDITURE
(Period April 2022 to March 2023)

Sl No	Sanctioned Heads	Funds Allocated (*)	Fund Released	Expenditure Incurred				Balance as on date	Requir-ement of funds upto 31 March 24	Rem arks (if any)
				I Yr	II Yr	III Yr	Total			
I	II	III	IV	V			VI	IV – VI		
1	Manpower	82,76,000	82,76,000	82,76,000			82,76,000	0	1,29,39,734.00	
2	Permanent Equipments	2,00,000	2,00,000	1,99,774			1,99,774	226	5,00,000.00	
3	Other Costs								2,00,000.00	
4	Consumables								3,00,000.00	
5	Travel	2,00,000	2,00,000	205296			205296	(-)5296	5,00,000.00	
6	Contingencies	2,00,000	2,00,000	194914			194914	5086	5,00,000,00	
7	Overhead Charges (5%)									
9	**Total**						**88,75984**	**16.00**	**1,49,39,734.00**	

(Say Rupees one Crore fifty lakhs) only

Name & Signature
Principal Investigator :

D T Bhutia
Principal Director
Deptt. of Science & Technology
Govt. of Sikkim

Signature of Competent
Financial authority: Chief Account Officer
Date: 30/08/2023

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Counsil Science & Tech.
Govt. of Sikkim, Gangtok

* Indicate sanctioned /revised allocation as applicable.

a) Expenditure under the sanctioned heads, at –any point of time, should not exceed funds allocated under that head, without prior approval of DST i.e. Figures in Column (V) should not exceed the corresponding figure in Column (III).

b) Utilization Certificate for each financial year ending 31st March has to be enclosed, along with request for carry-forward permission to next year.

STATEMENT OF EXPENDITURE NON RECURRING

(Period April 2022 to March 2023)

Sl No	Sanctioned Heads	Funds Allocated (*)	Fund Released	Expenditure Incurred				Balance as on date	Requir-ement of funds upto 31 March 24	Remarks (if any)
				I Yr	II Yr	III Yr	Total			
I	II	III	IV	V			VI	IV – VI		
1	Manpower									
2	Permanent Equipments	2,00,000	2,00,000	1,99,774			1,99,774	226	5,00,000.00	
3	Other Costs									
4	Consumables									
5	Travel									
6	Contingencies									
7	Overhead Charges (5%)									
9	**Total**						1,99,774	226	5,00,000.00	

Name & Signature
Principal Investigator :

D T Bhutia
Principal Director
Deptt. of Science & Technology
Govt. of Sikkim

Signature of Competent
Financial authority: Chief Account Officer
Date: 30/08/2023

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

* Indicate sanctioned /revised allocation as applicable.

a) Expenditure under the sanctioned heads, at –any point of time, should not exceed funds allocated under that head, without prior approval of DST i.e. Figures in Column (V) should not exceed the corresponding figure in Column (III).

b) Utilization Certificate for each financial year ending 31st March has to be enclosed, along with request for carry-forward permission to next year.

Annexure – A *(Contd.)*

STATEMENT OF EXPENDITURE RECURRING

(Period April 2022 to March 2023)

Sl No	Sanctioned Heads	Funds Allocated (*)	Fund Released	Expenditure Incurred				Balance as on date	Requir-ement of funds upto 31 March 24	Rem arks (if any)
				I Yr	II Yr	III Yr	Total			
I	II	III	IV	V			VI	IV – VI		
1	Manpower	82,76,000	82,76,000	82,76,000			82,76,000	0	1,29,39,734.00	
2	Permanent Equipments									
3	Other Costs								2,00,000.00	
4	Consumables								3,00,000.00	
5	Travel	2,00,000	2,00,000	205296			205296	(-)5296	5,00,000.00	
6	Contingencies	2,00,000	2,00,000	194914			194914	5086	5,00,000,00	
7	Overhead Charges (5%)									
9	**Total**						**86,75984**	**16.00**	**1,49,39,734.00**	

(Say Rupees one Crore fifty lakhs) only

Name & Signature
Principal Investigator :

D T Bhutia
Principal Director
Deptt of Science & Technology
Govt. of Sikkim

Signature of Competent
Financial authority: Chief Account Officer
Date: 30/08/2023

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

* Indicate sanctioned /revised allocation as applicable.

a) Expenditure under the sanctioned heads, at –any point of time, should not exceed funds allocated under that head, without prior approval of DST i.e. Figures in Column (V) should not exceed the corresponding figure in Column (III).

b) Utilization Certificate for each financial year ending 31st March has to be enclosed, along with request for carry-forward permission to next year.

SIKKIM STATE COUNCIL OF SCIENCE & TECHNOLOGY , VIGYAN BHAWAN, DEORALI, GANGTOK.
Projected Salary for Block Year 2023-24

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Shri Suman Thapa	Director	PPB	86,200	86,200	86,200	88,000	88,000	1,05,400	1,05,400	1,05,400	1,05,400	1,05,400	1,05,400	1,05,400	Gross total salary
			DA 38%	32,756	32,756	32,756	33,440	33,440	40,052	40,052	40,052	40,052	40,052	40,052	40,052	
			HRA12%	10,344	10,344	10,344	10,560	10,560	12,648	12,648	12,648	12,648	12,648	12,648	12,648	
			SBCA 8%	6,896	6,896	6,896	7,040	7,040	8,432	8,432	8,432	8,432	8,432	8,432	8,432	
			Total	**136196**	**136196**	**136196**	**139040**	**139040**	**166532**	**166532**	**166532**	**166532**	**166532**	**166532**	**166532**	
															Total	**1852392**

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
2	Shri Nabeen Sharma	ASO	PPB	40,500	40,500	40,500	41,700	41,700	46,300	46,300	46,300	46,300	46,300	46,300	46,300	Gross total salary
			DA 38%	15,390	15,390	15,390	15,846	15,846	17,594	17,594	17,594	17,594	17,594	17,594	17,594	
			HRA12%	4,860	4,860	4,860	5,004	5,004	5,556	5,556	5,556	5,556	5,556	5,556	5,556	
			SBCA 8%	3,240	3,240	3,240	3,336	3,336	3,704	3,704	3,704	3,704	3,704	3,704	3,704	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	**64490**	**64490**	**64490**	**66386**	**66386**	**73654**	**73654**	**73654**	**73654**	**73654**	**73654**	**73654**	
															Total	**841820**

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3	Shri Dadul Lepcha	Accountant	PPB	34,700	34,700	34,700	35,700	35,700	37,100	37,100	37,100	37,100	37,100	37,100	37,100	Gross total salary
			DA 38%	13,186	13,186	13,186	13,566	13,566	14,098	14,098	14,098	14,098	14,098	14,098	14,098	
			HRA12%	4,164	4,164	4,164	4,284	4,284	4,452	4,452	4,452	4,452	4,452	4,452	4,452	
			SBCA 8%	2,776	2,776	2,776	2,856	2,856	2,968	2,968	2,968	2,968	2,968	2,968	2,968	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	**55326**	**55326**	**55326**	**56906**	**56906**	**59118**	**59118**	**59118**	**59118**	**59118**	**59118**	**59118**	
															Total	**693616**

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
4	Shri Laydon Lepcha	ASO	PPB	39,300	39,300	39,300	39,300	39,300	46,300	46,300	46,300	46,300	47,700	47,700	47,700	Gross total salary
			DA 38%	14,934	14,934	14,934	14,934	14,934	17,594	17,594	17,594	17,594	18,126	18,126	18,126	
			HRA12%	4716	4716	4716	4716	4716	5,556	5,556	5,556	5,556	5,724	5,724	5,724	
			SBCA 8%	3,144	3,144	3,144	3,144	3,144	3,704	3,704	3,704	3,704	3,816	3,816	3,816	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	**62594**	**62594**	**62594**	**62594**	**62594**	**73654**	**73654**	**73654**	**73654**	**75866**	**75866**	**75866**	
															Total	**835184**

K.S. CHETTRI
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Govt. of Sikkim, Gangtok

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024												Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
5	Shri Rajdeep Gurung	ASO	PPB	40,500	40,500	40,500	41,700	41,700	46,300	46,300	46,300	46,300	46,300	46,300	46,300	Gross total salary
			DA 38%	15,390	15,390	15,390	15,846	15,846	17,594	17,594	17,594	17,594	17,594	17,594	17,594	
			HRA12%	4,860	4,860	4,860	5,004	5,004	5,556	5,556	5,556	5,556	5,556	5,556	5,556	
			SBCA 8%	3,240	3,240	3,240	3,336	3,336	3,704	3,704	3,704	3,704	3,704	3,704	3,704	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	64490	64490	64490	66386	66386	73654	73654	73654	73654	73654	73654	73654	
															Total	841820

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024												Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
6	Shri Radha Krishna Sharma	ASO	PPB	40,500	40,500	40,500	41,700	41,700	46,300	46,300	46,300	46,300	46,300	46,300	46,300	Gross total salary
			DA 38%	15,390	15,390	15,390	15,846	15,846	17,594	17,594	17,594	17,594	17,594	17,594	17,594	
			HRA12%	4,860	4,860	4,860	5,004	5,004	5,556	5,556	5,556	5,556	5,556	5,556	5,556	
			SBCA 8%	3,240	3,240	3,240	3,336	3,336	3,704	3,704	3,704	3,704	3,704	3,704	3,704	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	64490	64490	64490	66386	66386	73654	73654	73654	73654	73654	73654	73654	
															Total	841820

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Council Science & Tech.
Govt. of Sikkim, Gangtok

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024												Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
7	Sri Pranay Pradhan	ASO	PPB	40,500	40,500	40,500	41,700	41,700	46,300	46,300	46,300	46,300	46,300	46,300	46,300	Gross total salary
			DA 38%	15,390	15,390	15,390	15,846	15,846	17,594	17,594	17,594	17,594	17,594	17,594	17,594	
			HRA12%	4,860	4,860	4,860	5,004	5,004	5,556	5,556	5,556	5,556	5,556	5,556	5,556	
			SBCA 8%	3,240	3,240	3,240	3,336	3,336	3,704	3,704	3,704	3,704	3,704	3,704	3,704	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	64490	64490	64490	66386	66386	73654	73654	73654	73654	73654	73654	73654	
															Total	841820

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024												Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-incremen	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
8	DR. Sushan Pradhan	ASO	PPB	40,500	40,500	40,500	41,700	41,700	46,300	46,300	46,300	46,300	46,300	46,300	46,300	Gross total salary
			DA 38%	15,390	15,390	15,390	15,846	15,846	17,594	17,594	17,594	17,594	17,594	17,594	17,594	
			HRA12%	4,860	4,860	4,860	5,004	5,004	5,556	5,556	5,556	5,556	5,556	5,556	5,556	
			SBCA 8%	3,240	3,240	3,240	3,336	3,336	3,704	3,704	3,704	3,704	3,704	3,704	3,704	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	64490	64490	64490	66386	66386	73654	73654	73654	73654	73654	73654	73654	
															Total	841820

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024												Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
9	Shri Rinzing N. Lepcha	ASO	PPB	40,500	40,500	40,500	41,700	41,700	46,300	46,300	46,300	46,300	46,300	46,300	46,300	
			DA 38%	15,390	15,390	15,390	15,846	15,846	17,594	17,594	17,594	17,594	17,594	17,594	17,594	
			HRA12%	4,860	4,860	4,860	5,004	5,004	5,556	5,556	5,556	5,556	5,556	5,556	5,556	
			SBCA 8%	3,240	3,240	3,240	3,336	3,336	3,704	3,704	3,704	3,704	3,704	3,704	3,704	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	**64490**	**64490**	**64490**	**66386**	**66386**	**73654**	**73654**	**73654**	**73654**	**73654**	**73654**	**73654**	
															Total	**841820**

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024												Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
10	Shri Tseten Pradhan	ASO	PPB	40,500	40,500	40,500	41,700	41,700	46,300	46,300	46,300	46,300	46,300	46,300	46,300	Gross total salary
			DA 38%	15,390	15,390	15,390	15,846	15,846	17,594	17,594	17,594	17,594	17,594	17,594	17,594	
			HRA12%	4,860	4,860	4,860	5,004	5,004	5,556	5,556	5,556	5,556	5,556	5,556	5,556	
			SBCA8%	3,240	3,240	3,240	3,336	3,336	3,704	3,704	3,704	3,704	3,704	3,704	3,704	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
				68850	**68850**	**68850**	**66386**	**66386**	**73654**	**73654**	**73654**	**73654**	**73654**	**73654**	**73654**	
			Total												Total	**854900**

K.S. CHETTRI
Chief Accounts Officer
Council Science & Tech.

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
11	Shri Prabhakar	Sr. RA	PPB	35,700	35,700	35,700	36,800	36,800	38,200	38,200	38,200	38,200	38,200	38,200	38,200	Gross total salary
			DA 38%	13,566	13,566	13,566	13,984	13,984	14,516	14,516	14,516	14,516	14,516	14,516	14,516	
			HRA12%	4,284	4,284	4,284	4,416	4,416	4,584	4,584	4,584	4,584	4,584	4,584	4,584	
			SBCA 8%	2,856	2,856	2,856	2,944	2,944	3,056	3,056	3,056	3,056	3,056	3,056	3,056	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	56906	56906	56906	58644	58644	60856	60856	60856	60856	60856	60856	60856	
															Total	713998

SL. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12	Mrs. Binita Shrestha	Sr.RA	PPB	35,700	35,700	35,700	36,800	36,800	38,200	38,200	38,200	38,200	38,200	38,200	38,200	Gross total salary
			DA 38%	13,566	13,566	13,566	13,984	13,984	14,516	14,516	14,516	14,516	14,516	14,516	14,516	
			HRA12%	4,284	4,284	4,284	4,416	4,416	4,584	4,584	4,584	4,584	4,584	4,584	4,584	
			SBCA 8%	2,856	2,856	2,856	2,944	2,944	3,056	3,056	3,056	3,056	3,056	3,056	3,056	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	56906	56906	56906	58644	58644	60856	60856	60856	60856	60856	60856	60856	
															Total	713998

K.S. CHETTRI
Chief Accounts Officer
Science & Tech.

Sl. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-increment	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
13	Smt. Prena Pradhan	Sr. RA	PPB	35,700	35,700	35,700	36,800	36,800	38,200	38,200	38,200	38,200	38,200	38,200	38,200	Gross total salary
			DA 38%	13,566	13,566	13,566	13,984	13,984	14,516	14,516	14,516	14,516	14,516	14,516	14,516	
			HRA12%	4,284	4,284	4,284	4,416	4,416	4,584	4,584	4,584	4,584	4,584	4,584	4,584	
			SBCA 8%	2,856	2,856	2,856	2,944	2,944	3,056	3,056	3,056	3,056	3,056	3,056	3,056	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	**56906**	**56906**	**56906**	**58644**	**58644**	**60856**	**60856**	**60856**	**60856**	**60856**	**60856**	**60856**	
															Total	**713998**

Sl. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-incremen	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
14	Smt.Ongkit Lepcha	Asst. Progra-mmer	PPB	27,000	27,000	27,000	27,800	27,800	33,700	33,700	33,700	33,700	33,700	33,700	33,700	Gross total salary
			DA 38%	10260	10260	10260	10564	10564	12806	12806	12806	12806	12806	12806	12806	
			HRA12%	3240	3240	3240	3336	3336	4044	4044	4044	4044	4044	4044	4044	
			SBCA 8%	2160	2160	2160	2224	2224	2696	2696	2696	2696	2696	2696	2696	
			TA	500	500	500	500	500	500	500	500	500	500	500	500	
			Total	**43160**	**43160**	**43160**	**44424**	**44424**	**53746**	**53746**	**53746**	**53746**	**53746**	**53746**	**53746**	
															Total	**594550**

K.S. CHETTRI
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S. No.	Name	Desgination	Total Salary Drawn from 1st April 2023 to 31st March 2024													Total Salary of 12 Months
			Sanction Scale of Pay	April	May	June	July-incremen	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
14	Mrs Pema Z.Bhutia	ASO														Gross total salary
			Consolidated	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	
															Total	300000

Gross total salary for the Financial Year 2023-24	12323556
5% Medical Reimbrusement =	616178
GRAND TOTAL =	12939734

(Rupees one cror twenty nine lakhs therty nine thousand) only

K.S. CHETTRI
Chief Accounts Officer
Sikkim State Counsil Seience & Tech.
Govt. of Sikkim, Gangtok

MAJOR ACTIVITIES/ACHIEVEMENT DURING FINANCIAL YEAR 2022-23

SUCCESS STORIES / MAJOR ACTIVITIES OF
SIKKIM STATE COUNCIL OF SCIENCE AND TECHNOLOGY 2022-23

The Department of Science & Technology was created in year 1996. Major activities of the department constitute for promotion of Science & Technology relevant to the State, generation of awareness, Research, Development and Transfer of Technologies through public interface, Research Scholars, Educational Institutions (Schools/colleges/Universities/R&D institutions), Government and non-Government agencies involve in the various fields of Science, Technology and Innovation ecosystem.

Sikkim State Council for Science & Technology was created during 1997 as an autonomous body with the primary objective on expediting decision-making process. Council is an autonomous body which is the working arm of the Department is registered under society act with Hon'ble Chief Minister as its Chairman and Hon'ble Minister for Science & Technology as Vice- Chairman and Secretary, DST&CC as Member Secretary of the Governing Body with the members drawn from Agriculture, Horticulture, Animal Husbandry/ Mines, Mineral and Geology/ Forest, Environment and Wildlife Management/Rural Management Department

The department has taken up through the Council various scientific programmes related to
(i) Bio-Technology: Bioinformatics & Tissue Culture, study on Medicinal and Aromatic Plants, Scientific programme on Planting and Stock Improvement of cultivars; Establishment of Sikkim Biotechnology Research and Application Centre at Sajong, Rumtek and Establishment of Biotech Hub and Patent Information Centre
ii) Remote Sensing and GIS: Establishment of State Remote Sensing Application Centre. Study on Geographical Information System, Glaciers and Climate Studies. A full-fledged Climate Change Cell has been established in the Council.
iii) Technology Transfer: Technology: Scouting, Incubation and diffusion of Appropriate Technology in the state, Capacity Building and Skill Development programmes and Environmental Information System.
iv) Scientific Awareness on various Science Technology and Innovation outreach for communication and popularization of science to general public and students in particular.

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PROJECTS AND ACTIVITIES UNDER TECHNOLOGY TRANSFER DIVISION

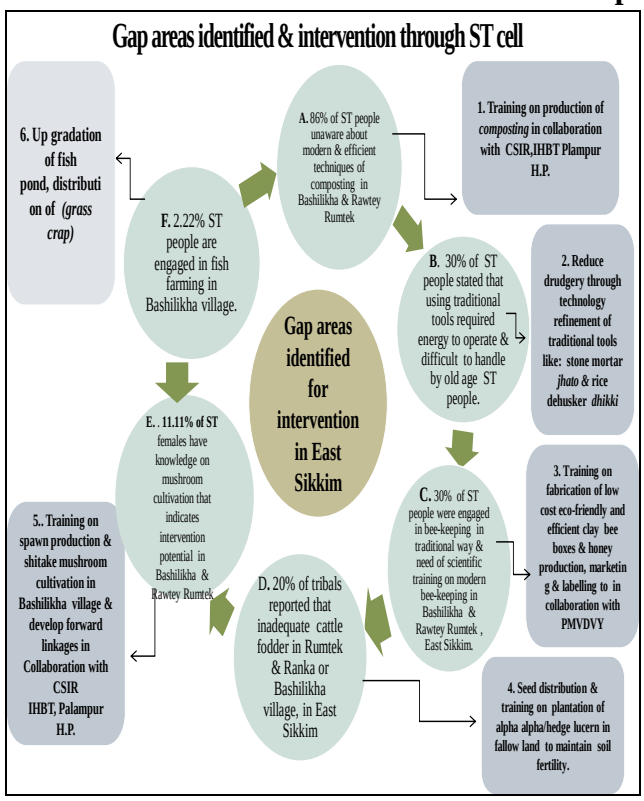
1. Setting Up of Schedule Tribe Cell in Sikkim:

Schedule Tribe cell was established in March 2021 under Sikkim State Council of Science & Technology supported by DST, Government of India. The project was started in month of July 2021for period of 36 Months. This project was initiated for Schedule Tribe people to provide S& T based solution through science for socio-economic upliftment & skill development to boost up their well-being and improve food security.
Deliverables through ST cell:
1. Analysis of predominant livelihood System in context of five capital in identified project areas.
3. Mapping of indigenous traditional knowledge and upgrade the skill building on local Innovation and knowledge system.
4. Establishment database of promising technology for widespread adaptation.
5. Mapping of data in spatial domain capacity building and sustainable development of SC/ST communities in the State.

Achievement

1. Complete Identification and categorization of S&T needs of ST community of Sikkim
2. Identification & categorization of S&T needs of SC & ST community of Sikkim
3. Identification and Spatial representation of livelihood capitals and S&T gaps within the state
4. Establishment of a database of promising technologies that can be taken up for widespread adaptation
5. Mapping of the above data and resources on a Spatial Domain

Identification of Predominant Livelihood Gap Areas



2. Pradhan Mantri Van Dhan Yojana

Pradhan Mantri Van Dhan Yojana is the scheme of Ministry of Tribal Affairs Government of India being implemented through TRIFED. The scheme aim at marketing of Minor forest produce through minimum support price and development of value chain development for minor forest produce. Sikkim State Council is the State Nodal Agency of PMVDY in Sikkim and being implemented through the State Implementing Agency the Cooperation Department.

Objective:

1. To mobilize communities of cluster level and facilitate capacity building had holding, infrastructure creation and MSP support to realize economy and MFP's traditional art and crafts there by supporting rural livelihood.
2. To create employment opportunities among different tribal and other communities by way of self-employment under MSME sector.
3. To facilitate marketing linkage for MFP with other agricultural produce besides promoting local art and craft on indigenous scale.

Achievements:

1. Formation of 80 Van Dhan Clusters each having 300 members thus involving 24000 tribal beneficiaries.
2. Fund amounting to Rs. 11.69 crores transferred to the State Implementing Agency which is being disbursed to beneficiary SHGs
3. Training provided to the Van Dhan Clusters for processing of local produce for value addition branding and marketing.

4. Products by Tribals are being marketed through various outlets within the state

3. Development of dryer for Cardamom, and other Agri-Products and allied farming activities energized by Nano-hydel power generated from local water stream

Objective of the Project :

- To develop technology for drying large cardamom without compromising its quality in Sikkim.
- To develop Nano-hydel Power Generation projects to generate power through locally available water stream which will provide energy to these driers.

S&T component in the project:

The proposed project shall be "run-of-the-river" type of power generation by Nano hydel plant. The proposed S&T shall consist of following Component;

- Development of Nano hydel projects for drying cardamom and other vegetables
- Use of Batch and Auto Temperature/Humidity controlled 'Drying Ovens' for drying of large cardamom to match International Competition/requirements.
- Study of essential oil retention in Cardamom.
- Moisture contains and retention of natural colour and flavor in the finished product of cardamom.



Summary of Progress:

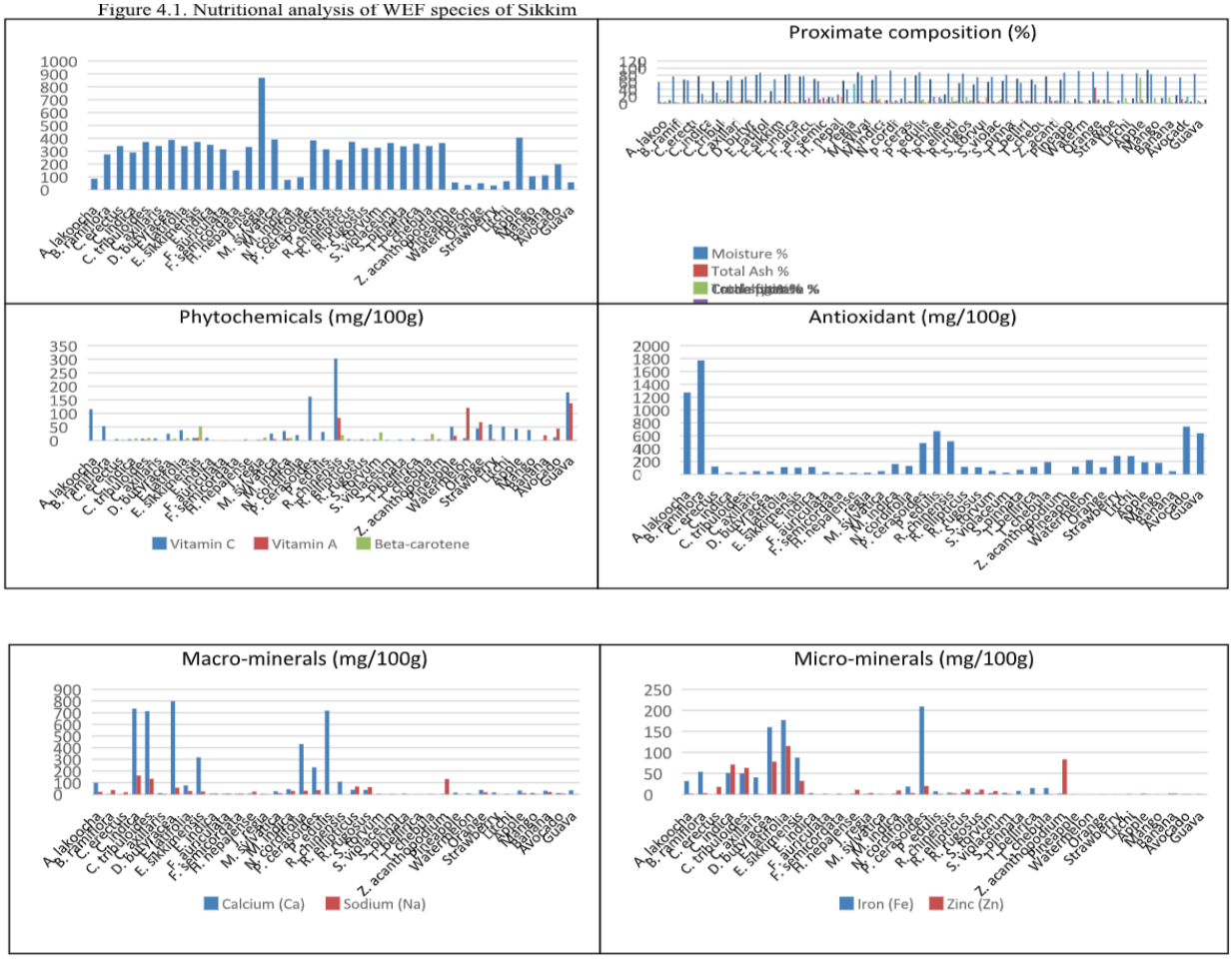
- Site identification and Selection completed in consultation with the Central Power Research Institute (CPRI) Bangalore and Block Administrate Centre.
- Assessment of discharge of selected stream, Contour survey completed.
  Work initiated by respective Block Administrative Centre.
- Civil construction along with laying of penstock, completed.
- Installation of Electro-Mechanical components, completed.
- Power generated by electro-mechanical components check, completed.
- Batch type ovens 3 nos. procured installed and trial at site completed.

4. Wild Edible fruits of Sikkim Himalaya: A study on nutritional potential, Sustainable Socio Economy, Ecology and Conservation for Tribal Population of Sikkim

Objectives:

- To document and delimit the wild edible fruits consumed in Sikkim Himalaya
- To study ecological distribution and socio-economy of common wild edible fruits.
- To determine nutritional composition such as moisture content, ash, protein, fat, carbohydrate, crude fibre, caloric content, vitamin c, beta - carotene, anti-oxidants and minerals.
- To propose a model for domestication of wild edible fruits based on nutritive value.
- To map and delimit the potential distributional areas of less-familiar wild edible fruits in Sikkim Himalaya.
- To document and delimit the wild edible fruits consumed in Sikkim Himalaya.

Figure 4.1. Nutritional analysis of WEF species of Sikkim

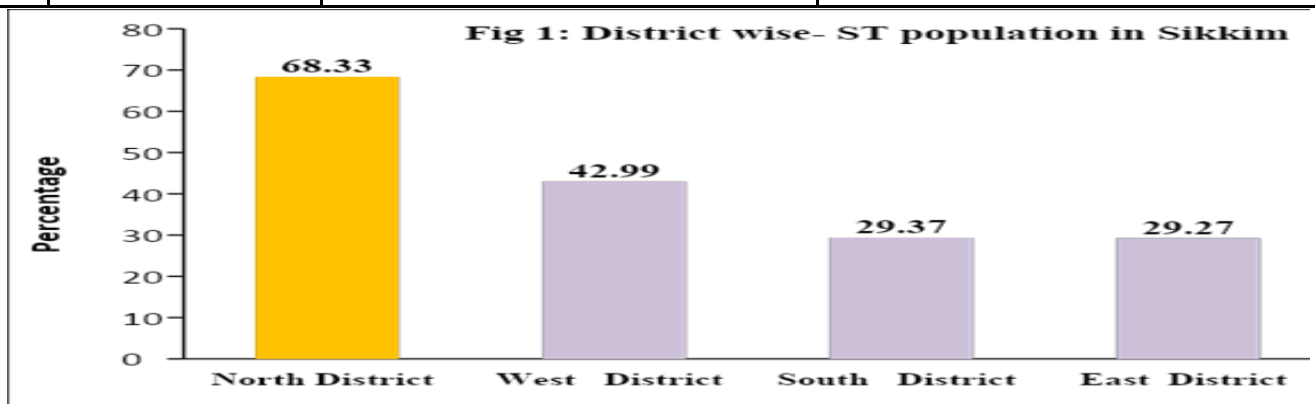


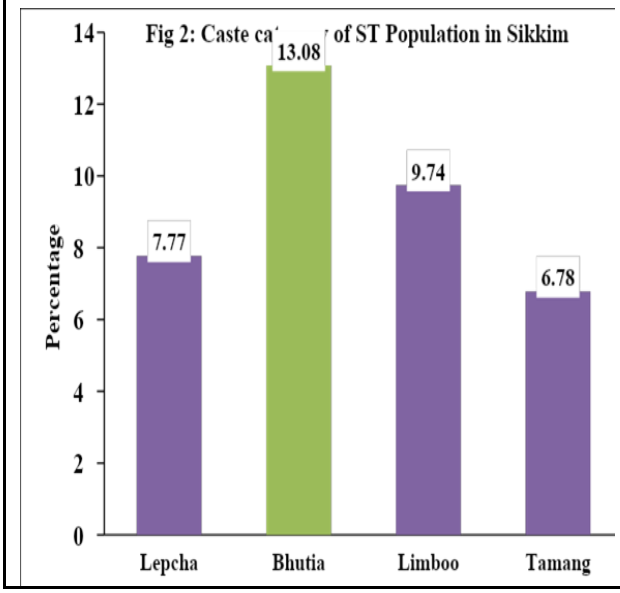
Achievements

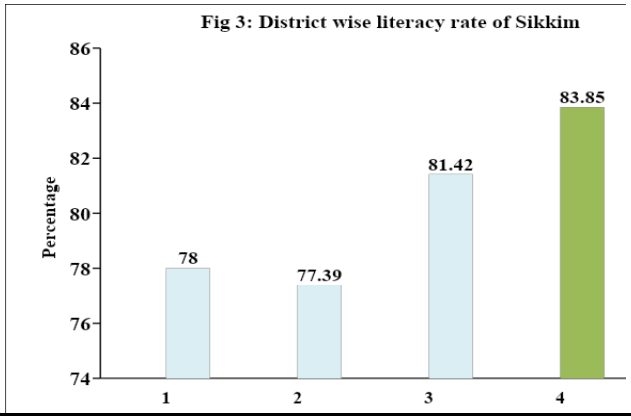
- 39 wild edible fruits species of Sikkim Himalaya with family, local names (Nepali) and their physical characteristics have been documented.
- Field survey: Household survey of East, West and South districts of Sikkim have been conducted: West Sikkim – 111 houses, South Sikkim – 118 houses, East Sikkim – 77 houses have been surveyed for information on local/ traditional uses of WEFs;
- Wild edible fruit samples were collected for nutrient analysis through field survey and market surveys.
- Nutrient analysis of 28 WEF samples of India. The results showed that most of the WEF species of Sikkim performed well in comparison with commercial fruits.
- 24 WEF species provide good energy source as of commercial fruits, where Juglans regia being highest (870.14 kcal/100g). Rhus chinensis had highest vitamin C and A (302.00 & 83.00 mg/100g respectively) while Baccaurea ramiflora had highest antioxidant (1771.53 mg/100g). Diploknema butyracea (799.00mg/100g) with highest calcium, Castanopsis indica (161.00 mg/100g) with highest sodium, Prunus cerasoides (209.12 mg/100g) with highest iron and Elaeagnus latifolia (115.18 mg/100g) with highest zinc content were recorded. Altitudinal range vary from Calamus erectus (100m) to Castanopsis tribuloides and Litsaea citrata (2700 m) amsl.

Sl. No.	PAC Suggestions	Compliance by PI
1.	Project activities to be linked up with predominant livelihood system	Number of beneficiaries: 345 household. Common facility Poly-house being established: 04 nos. ▪ Initiated plantation of 26 species of wild edible fruits saplings out of 45 species taken for studies having market and nutritional value. ▪ 345 beneficiaries identified and trained duly identifying the needs and gap areas as per suggestion. ▪ 345 Beneficiaries have been distributed Saplings for plantation in the homestead: ▪ *Juglans regia* being highest (870.14 kcal/100g). *Rhus chinensis* with highest **vitamin C and A** (302.00 & 83.00 mg/100g respectively), Baccaurea *ramiflora* had highest **antioxidant** (1771.53 mg/100g). *Diploknema butyracea* (799.00 mg/100g) with highest **calcium**, *Castanopsis indica* (161.00 mg/100g) with highest **sodium**, *Prunus cerasoides* (209.12 mg/100g) with highest **iron** and *Elaeagnus latifolia* (115.18 mg/100g) with highest **zinc** content were recorded. ▪ Convergence with Pradhan Mantri Vandhan Yojana beneficiaries (28 clusters – 345 nos)) are facilitated for value addition and forward linkages for marketing as an additional source of income. ▪ The project is being implemented in coordination with line department to avoid duplicity.
2.	GIS platform to be used for representation and linking up the livelihood system with concerned department like linking up horticulture with tribal department	▪ GIS platform used for mapping of ecological distribution of 45 wild edible fruits of Sikkim is completed. ▪ Through GIS platform suitable area for plantation of 45 wild edible fruits is has been identified using Elevation, slope and aspect and 86 locality / study area names recorded. ▪ Sikkim S&T Council is the nodal department for implementation of Pradhan Mantri Vandhan Yojana under TRIFED – Ministry of Tribal Affairs is being mapped for marketing in the local haat, state outlet and finally national outlets for linking up forward linkages with Tribal Departments.
3.	Health related data to be correlated with nutritional requirement and further correlated to a particular tribe living in a certain geographical location	▪ As per Sikkim: Disease Profile, 1990-2016 out of 11.9% death, 1.8% children from age 0-14 years are due to Nutritional Deficiency. ▪ Most of the Tribe people in North Sikkim complaints suffering from common disease like: Rheumatoid Arthritis Gout, Gonorrhea (STD), Indigestion, Hyper Tension, Diabetic, Stomach Cancer (as per the population based cancer registry)PVCR 2003-08 ▪ Viral illness: Fever, Flu, Asthma, diarrhea, Cough and Cold ▪ As such 25 species have been found to be rich in one or the other nutritional composition. ▪ 07 species; ***Juglans regia*** being highest energy source, ***Rhus chinensis*** with high vitamin C and A , ***Baccaurea ramiflora*** as highest antioxidant, ***Diploknema butyracea*** containing high calcium, ***Castanopsis indica*** with high sodium, ***Prunus cerasoides*** has rich iron and ***Elaeagnus latifolia*** having high zinc content are suitable edible plants for plantation in this area as per the GIS tagging and vulnerability assessment for healthy leaving in terms of communicable and non communicable diseases data provided by Health Department.

4.	Extensive database to be prepared for pooling tribe wise data on different aspects of livelihood system		Area: 7096 sq km. No. of Districts : 4, No. of Sub-division:14 Population : 6,10,577, Sex ratio: M/F: 889/1000 Literacy rate: 81.42% Current occupation: Main worker: 37.73% Marginal worker:12.73% Non-worker: 49.53% including students Major cash crop: Large Cardamom, Ginger, Orange, Buckwheat, Broom grass & Turmeric (Source MOVCD) Food crops: Maize , finger-millet, wheat & Paddy etc.







5. Project output and outcome indicators specification to be submitted

Sl. No.	Output	Outcome			
1.	Field survey and sample collection	District	Locality/ study area	No. of study area	Suggestion by experts
		West	Tashiding, Laso, Tinjiling, Razang, Fambong, Nerdang , Rangit, Umchung, Tikjeck, Yangthang, Chumbong, Darab-Sindrong, Rimbi, Pelling, Hee-Bermiok, Sordon, Sirinagi (Dentam), Upper Bermiok, Lower Bermiok, Jaubari,	22	• Moisture weight • Fruit

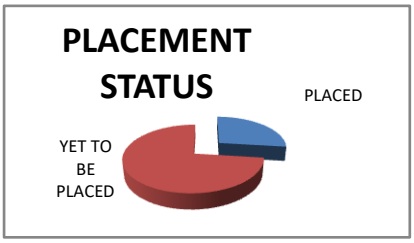
			Budhabarey, Begha (Dentam)		Measurement • GPS reading • Collection • Biodiversity/ Ecology/ Vegetation • Distribution pattern
		South	Yangang, Satam, Karung, Sripatam, Manglay, Aifaltar, Temi –Tarku, Amalay, Dalep, Rashyap, Pabong, Daring, Tokal Bermiok, Namchi, Kamrang, Ghurpisay, Jaubari, Damthang, Ravangla, Burfung, Khop, Rankey , Ben, Simkharka, Changay, Namthang, Rateypani, Ruchung, Pasi, Nagi, Tangji, Turuk, Daragaon, Panchgharey, Tarul, Ramabong	36	
		East	Pakyong, Kartok, Namchebong, Yakten, Damlakha, Navgaon, Dikling-Pacheykhani, Rhenock, Aritar, Dalapchand, Rongli , Khamdong, Makha, Rakdong	14	
		North	Mangan, Chungthang, Lachung, Singringphu, Beechu, Phakha, Sarchok, Thomchi, Dzongu, Hee Gyathang, Lachen, Kalep, Chaten, Thongu	14	
			Total	86	

2.	Documentation of the traditional knowledge and information of the wild edible fruits	45 wild edible fruits documented with their common names, traditional importance and uses.
3.	Ecological study and distribution pattern survey of wild edible plants with respect to livelihood	Completed ecological study on 45 wild edible fruits and their distribution pattern considering elevation, slope and aspect using GIS platform. List of beneficiaries have been recorded.
4.	Nutritional Analysis	By studying and analyzing the Nutritional analysis report we have shortlisted 25 wild edible fruits having good Nutritional value. ***Artocarpus lacucha, Baccaurea ramiflora, Castanopsis indica, Castanopsis tribuloides, Choerospondias axillaris, Diploknema butyracea, Docynia indica, Elaeagnus latifolia, Elaeocarpus sikkimensis, Ficus auriculata, Juglans regia, Mangifera sylvatica, Nephrolepis cordifolia, Prunus cerasoides, Pyrularia edulis, Rhus chinensis, Rubus ellipticus, Rubus rugosus, Solanum torvum, Solanum violaceum, Spondias pinnata, Terminalia bellirica, Terminalia chebula, Tetrataenium nepalense and Zanthoxylum acanthopodium.*** The above listed potential wild edible fruits are identified for the farmers for domestication in addition to the existing agricultural system for boosting up the nutritional/ health status of the Tribal communities.
5.	Study on marketing and socioeconomic profile	By studying and analyzing the Market survey (06) report we have shortlisted 26 wild edible fruits having good market value. The above listed potential wild edible fruits are identified for farmers for domestication in addition to the existing agricultural system for boosting up the economical status of the Tribal communities. 26 species have been surveyed in all the districts of Sikkim mostly during local haats and market days. According the demand for the fruits and their value addition forward linkages have been converged with the Pradhan Mantri Van Dhan Yojana programme under the Council which consists of 30 clusters involving 350 unemployed members who are being directly and indirectly being benefitted by the project.

6. Green Skill Development Programme – 2021-22

A Certificate Course of 400 hrs on Value Addition and Market of NTFPs (Plant Origin): Bamboo Crafts under Green Skill Development Programme of NSQF level – 5 was conducted by Sikkim State Council of Science & Technology under the project ENVIS RP Sikkim on Ecotourism from 9th December 2021 – 22nd January 2022 in Patuk Singbel, Singtam and Dragon Inn, Tathanchen, Gangtok. The project is funded by Ministry of Environment, Forests and Climate Change, Government of India.

1. National Skill Qualification Framework (NSQF) level- 5
2. Number of unemployed youths skilled – 26
3. Number of Placement – 9
4. Duration – 9th December 2021 – 22nd January 2022



Activity under Communication and Popularisation of Science

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

7. Setting up of Innovation Laboratory in Eighty eight Schools and Innovation Hub in Science Centre

An innovation Laboratory have been set up in eighty eight government senior secondary schools where state of the art science and geography equipments have been provided to the schools which will benefit the schools in terms of setting up science based experiments and study and data collection on weather and climate change which will help in baseline study and reference for researchers and professionals, Some of the equipments which have been installed in the laboratory are :-

- LCD/ Digital Microscope
- Automatic Weather Station for weather data documentation
- Work Station for data mining, collection, processing and collation
- Digital camera / Binocular/ Herbarium for study of nature study and documentation of biodiversity

- Laboratory equipments

Further Innovation Hub laboratory has been set up in Sikkim Science Centre which will be the nodal point for all the innovative laboratory. All schools and students have taken the membership of the Innovation Hub at Sikkim Science Centre. The Innovation Hub project aims to the benefit of rural as well as urban students who are innovative and will provide platform for experimenting in the problems and encourage the students to express their innovative ideas. The Innovation Hub has been set up under central funding 'Scheme for Promoting Innovation, Creativity and Engagement in Science' (SPICE) to inspire young minds and to develop a culture of innovation in the country. Following components will be made available:

- Discovery Hall
- Innovation Resource Centre & Hall of Fame
- Idea Laboratory
- Design Studio
- Mentor/ Guides

8. Innovation in Science Pursuit for Inspired Research (INSPIRE):

INSPIRE Programme is centrally funded programme of the Department of Science & Technology, Govt. of India which is being implemented through State Governments and UT administrations. The objective of this programme is to develop scientific temper amongst the young and to motivate them to take up scientific career for the scientific and technological advancement of the country. This programme has five components covering entire range of education and research from class VI to post-doctoral stage of a student. The first component of this programme is INSPIRE Award which recognizes the talents among students at a very early stage is being implemented by Sikkim State Council of Science & Technology as the Nodal Agency for this programme.

So far 1714 students from Sikkim have taken the benefit of INSPIRE Award. Out of these 10 students were selected for exchange and exposure programme to Japan.

9. Vigyan Sarvatra Pujyate:

Sikkim State Council of Science &Technology in collaboration with VIGYAN PRASAR, an autonomous organization under DST, GOI organized the week long VIGYAN SARVATRA PUJYATE programme under AZADI KA AMRIT MAHOTSAV under SCoPE (Science Communication Popularization & its Extension)- Science Festival from February 22nd to 28th 2022.Theprogramme comprised of various activities like Poster Display/QUIZ competition/Video Screening/Panting Competition/Lecture & Science Awareness at different districts. Total outreach was 15000 public and students

Remote Sensing and Climate Change Division

1. Capacity Building Trainings:

a. Capacity Building Programme on Apache 3 Unmanned Survey Vehicle (USV):

Figure : Capacity Building Programme on the usage of Apache 3 Unmanned Survey Vehicle

b. Capacity Building workshop on " Climate Change Risk Assessment and Mapping in the states of the Indian Himalayan Region" at IIT Guwahati

Fig: Capacity Building workshop at IIT Guwahati

2. Installation of Automatic Weather Stations across Sikkim:

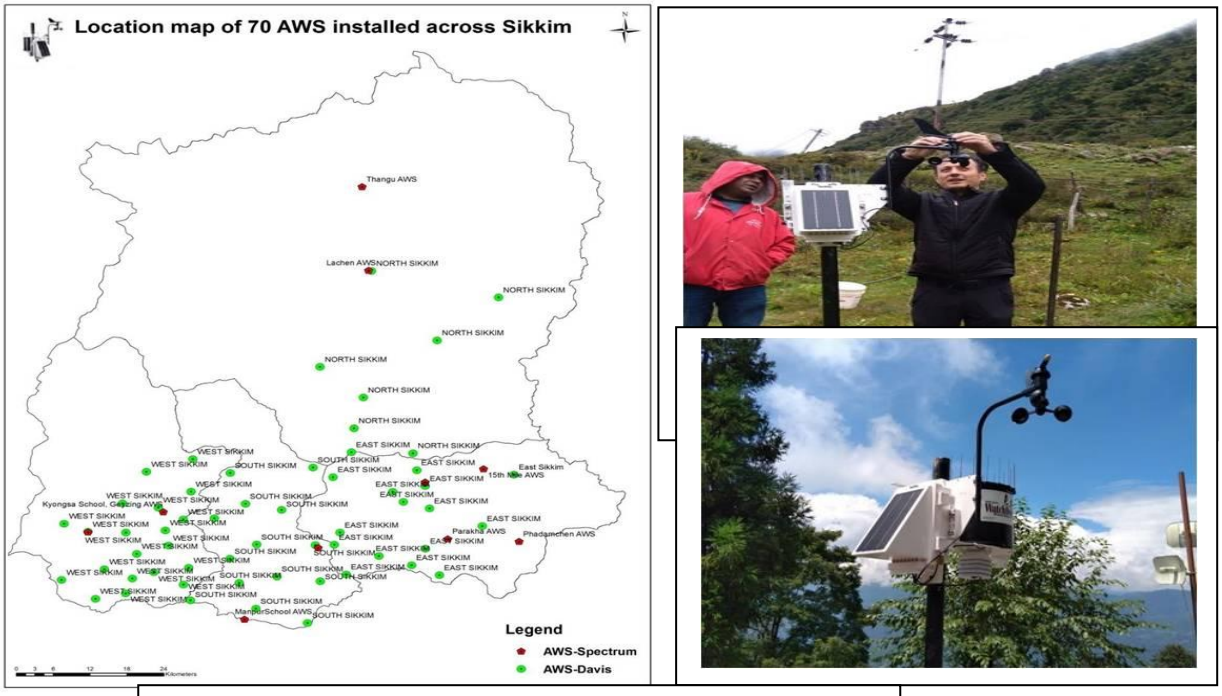


Fig 48: Installation of Automatic Weather Stations across

3. Bathymetric Survey of Shakho Cho Lake (using Apache 3 unmanned survey vehicle):

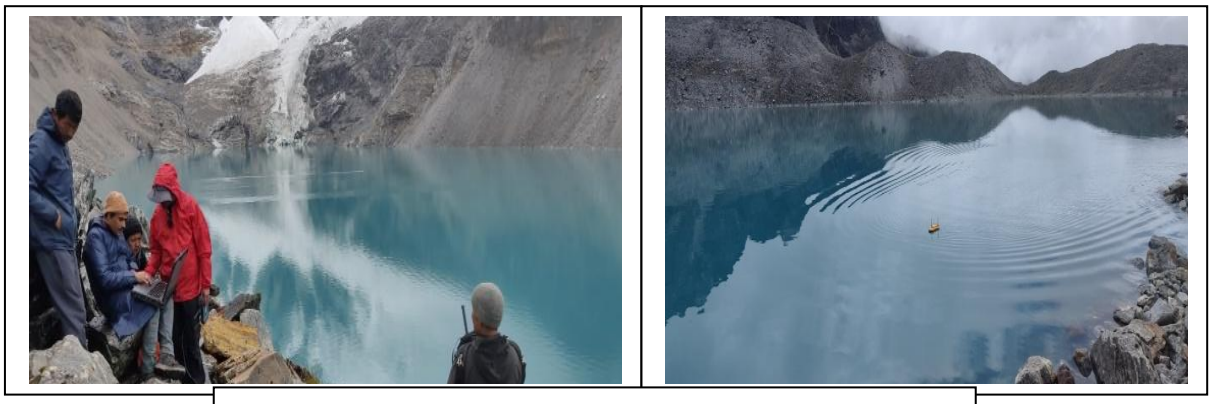


Fig 49: Bathymetric Survey of Shakho Chu Lake

4. Monitoring of Lhonak Lake, North Sikkim:

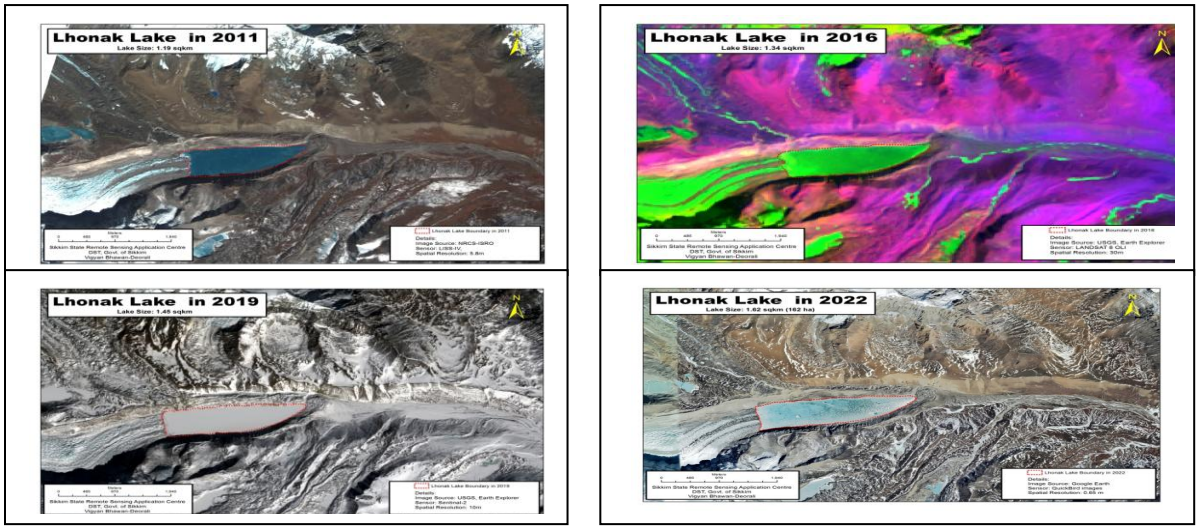


Fig : Monitoring of Lhonak Lake

5. Publications:

- Climate Change Initiatives for the Indian Himalayan Region under National Mission for Sustaining the Himalayan Ecosystem (NMSHE) 2022. (A book released in COP27 Sharm-El-Sheikh, Egypt 2022). Climate Change Programme, Department of Science and Technology (DST), Ministry of Science and Technology, Government of India. Compiled and Designed by Sikkim State Climate Change Cell (under NMSHE), DST Sikkim

- Sharma RK, Kumar R, Pradhan P, Sharma A (2022) Climate-Induced Glacier Retreats and Associated Hazards: Need for Robust Glaciers and Glacial Lake Management Policy in Sikkim Himalaya, India. In: S. Rani and R. Kumar (eds.), *Climate Change*, Springer Climate, https://doi.org/10.1007/978-3-030-92782-0_8

- Sharma RK, Kumar R, Shrestha DG (2021) Suspended sediment dynamics and associated hydro-meteorological interrelations in East Rathong Glacier, Eastern Himalaya, India. *Material Today Proceedings. http://doi.org/10.1016/j.matpr.2021.01.082*

6. Trainings/Meetings:

Climate Projection

Climate projection was primarily conducted to understand the region's past and present climate and to assess how changes in global societal, demographical, and economic scenarios are going to impact the statistics of essential climate variables (e.g., temperature and precipitation).

We conducted the detailed analysis of past and future climate change trends, including changes in temperature and precipitation, discussing specific impacts, climate risks, and socioeconomic consequences. The analysis was mainly done based on the topographical and climatological similarities of the state.

The analysis overall projected a slight increase in different temperature variables however the annual rainfall showed high variability.

Sectoral meeting

Sectoral meeting was held under SAPCC with Nine different sectors or department namely Tourism, Disaster, Water, Agriculture, Energy, Socioeconomic, Health, Urban & Transport and Forest & Diversity w.e.f. 3rd April 2023 to 26th may 2023. The report for SAPCC is being prepared. Important point highlighted during the meeting were as follows

Fig : Sectoral meeting with Agriculture sector

Fig : Sectoral meeting with Tourism

7. Climate Change Awareness Programmes:

A. Awareness Programme on climate change at the Gram Panchayat Units and Educational Institutes:

Community awareness and sensitization of public at the grass root level is one of the main objectives of Sikkim State Climate Change Cell under National Mission for Sustaining the Himalayan Ecosystem (NMSHE). In this regard awareness programmes were conducted at nine Gram Panchayat Units (GPUs) and nine educational institutes across Sikkim. GPUs were chosen for the climate change sensitization programme as Gram Panchayats are the basic unit of governance in a decentralized system acting as a bridge between the public and the different departments. A total of **520 people** participated in the events. Block Development Officers, Panchayat Presidents, Ward Panchayat members, students, teachers and general public graced the occasions with their presence. The nine GPUs that were selected for the awareness drive were:

Sl. No.	Name of The GPU	District	Date
1	Lingdong	Mangan	10th May 2022
2	Lingdok	Gangtok	12th May 2022
3	Riwa- Machong	Pakyong	13th May 2022
4	Tangzi- Bikmat	Namchi	19th May 2022
5	Upper Samdong	Gangtok	23rd August 2022
6	Mikhola Singithang	Namchi	26th August 2022
7	Regu BAC	Pakyong	29th August 2022
8	Chakung	Soreng	2nd September 2022
9	Chungthang	Mangan	8th September 2022

Sl. No.	Name of The Educational Institutes	District	Date
1	Makha Sr. Sec. School	Gangtok	27/04/2022
2	Melli Bazaar Sr. Sec. School	Namchi	31/08/2022
3	Yuksom Sr. Sec. School	Gyalshing	01/09/2022
4	Soreng Sr. Sec. School	Soreng	03/09/2022
5	Mangan Sr. Sec. School	Mangan	07/09/2022
6	Khamdong Sr. Sec. School	Gangtok	13/09/2022
7	Chujachen Sr. Sec. School	Pakyong	20/09/2022
8	Nar Bahadur Bhandari Govt. College	Gangtok	14/11/2022 16/11/2022
9	Yangang Sr. Sec. School	Namchi	21/11/2022

Topics covered during the event were:

1. General concepts on climate and weather
2. Initiatives taken at international, national and state level towards fighting climate change with special focus on what Panchayats could do to fight climate change.
3. Different activities undertaken by state climate change cell under NMSHE.
4. Climate Change and its effects on health.

Lingdong GPU

Lingdok GPU

Machong GPU

Tangzi- Bikmat GPU

Mikhola- Singithang GPU

Chungthang GPU

Regu BAC

Chakung GPU

Chujachen Sr. Sec. School

Mangan Sr. Sec. School

Soreng Sr. Sec. School

Yuksom Sr. Sec. School

Fig : Awareness Programmes at different Gram Panchayat Unit and educational institutes across Sikkim

8. Vulnerability Assessment (VA): Vulnerability profile of Sikkim, a sectoral analysis at district level

Introduction:

Based on the framework presented in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014), the 'risk' of climate change is determined at the interaction of "Hazard – Exposure – Vulnerability" (Intergovernmental Panel on climate Change, 2014). Among the three drivers, in the short to medium term, government and development agencies can address climate change most effectively by reducing vulnerability. The vulnerability of a natural ecosystem or socio-economic system is assessed as a function of its 'sensitivity' (i.e. the susceptibility to harm that determines the first-order impact of a hazard/stressor on the system) and lack of 'adaptive capacity' to cope with or to overcome such sensitivity (Dasgupta, Barua, Vyas, & Ravindranath, 2019-20).

Therefore, assessing vulnerability to climate change is an important first step towards adaptation planning as it helps to understand the impact of potential climate risks and provides information to formulate measures to be taken to adapt to climate change (Sharma, et al., 2018).

Objective:

- To conduct sectoral vulnerability assessment at the district level for the state of Sikkim for agriculture, socioeconomic, disaster, forest, health, and gender sectors.
- To assign the vulnerability ranking of districts to help policymakers prioritize the districts for adaptation interventions and to formulate climate-resilient policies in each sector.
- To identify and categorize the most vulnerable district in Sikkim and the drivers of vulnerability for each sector and each district.
- To assist the state to prioritize adaptation planning and investment at a district-level for the identified sectors

Key findings:

- The assessment showed that the vulnerability indices (VI) of 4 districts across 6 sectors are within a small range (0.30 - 0.67). This indicates that all districts are vulnerable (with no district having VI value <0.3) with little difference. This means all districts across the selected sectors should consider efforts to reduce their vulnerability in the face of growing climate concerns. However, some sectors in some districts are relatively more vulnerable than the others, potentially requiring prioritization of adaptation interventions.
- The assessment indicates that the sectoral vulnerability for each district varies, which implies that vulnerability is unique for each district and so the interventions needs to be sector/ district specific.
- In the North district, vulnerability is driven by socio economic factors, whereas in the South both forest and disaster drives the vulnerability. In the East district, vulnerability to agriculture sector is highest compared to other sectors and for the West district health sector needs to be prioritised to reduce vulnerability (Figure 1)
- The gender vulnerability is although not very pronounced across all the sectors there should be an effort to increase women's participation in the labour force and to provide better health facility to cater to the specific needs of women and the state must prepare adaptation plans with a gender lens.

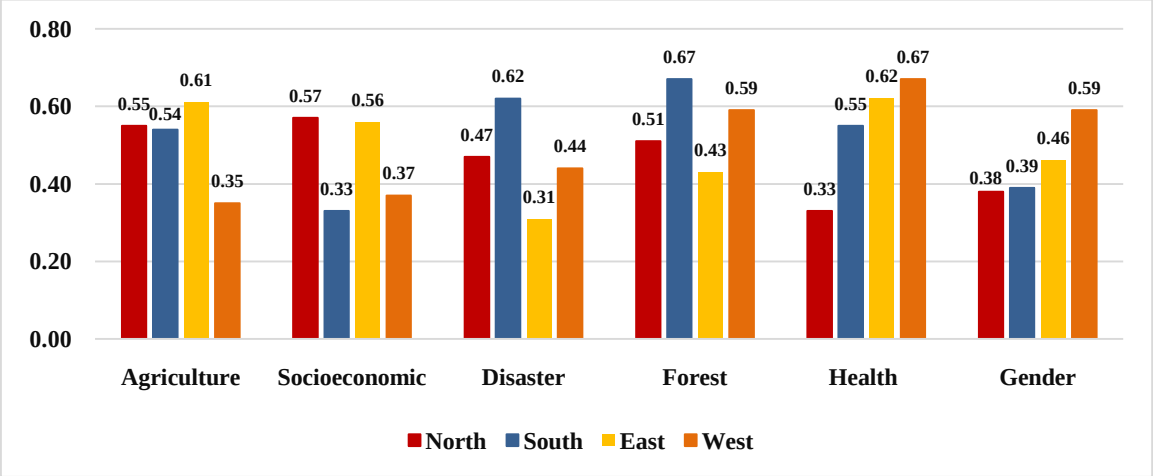


Figure: Ranking of districts in each sector

BIO-TECHNOLOGY DIVISION

	Sikkim Temi Tea (No. 796)		Hee-Goan Seremna Cardamom (No. 783)
	Sikkim Lepcha Hat (No. 851)		Sikkim Orange (No. 925)

I. Research & Development

- Phytochemical Analysis of six traditional medicinal plants of Sikkim Himalaya

Sikkim State Council of Science and Technology successfully conducted phyto-chemical analysis of six important medicinal plants of Sikkim Himalayas.

Following are the testing reports: ***Hippophae salicifolia***

NO	Compound	HS yield from 100gm leaves%
1	Quercetin	0.460
2	Isorhamnetin	≤0.005
3	Kaempferol	0.000
4	Gallic acid	0.220
5	Ellagic acid	0.330

Aconitum Ferox

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether	**0.11**	ursolic acid STD β-sitosterol	1) **aconitine,** **2) pseudoaconitine,** **3) atisine**
Chloroform extract	**0.29**	ursolic acid STD β-sitosterol	1) **aconitine,** **2)pseudoaconitine,** **3)atisine**
Methanol extract	**2.29**		1)**aconitine,** **2)pseudoaconitine,** **3)atisine**

Paris polyphyllaa

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether extract	0.08	ursolic acid STD, βsitosterol STD,	1) βsitosterol, 2)Stigmasterol, 3)Diosgenin

Chloroform extract	0.06	ursolic acid STD, βsitosterol STD,	1) βsitosterol, 2)Stigmasterol, 3)Diosgenin
Methanol extract	1.63	ursolic acid STD, βsitosterol STD,	1) βsitosterol, 2)Stigmasterol, 3)Diosgenin

Picrorhiza kurroa

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether	**0.11**	ursolic acid STD β-sitosterol	1)**β-sitosterol, usolic acid, 2) apocynin, picroside-2, 3) Cucurbitacin -, and 4) gulgulsterone**
Chloroform extract	**0.15**	ursolic acid STD β-sitosterol	1)**β-sitosterol, usolic acid, 2) apocynin, picroside-2, 3) Cucurbitacin -, and 4) gulgulsterone**
Methanol extract	**3.25**	ursolic acid STD β-sitosterol	1)**β-sitosterol, usolic acid, 2) apocynin, picroside-2, 3) Cucurbitacin -, and 4) gulgulsterone**

Panax sokpayensis

Plant material

Rhizome were used for the study.

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether extract	0.05	Sterols, Phenols, Alkaloids.	Ginsenosides (Rg1, Rg2, Rf, Re, Rd, Rc, Rb1 and Rb2)
Chloroform extract	0.09	Sterols, Phenols, Alkaloids	Ginsenosides (Rg1, Rg2, Rf, Re, Rd, Rc, Rb1 and Rb2))
Methanol extract	2.65	Sterols, Phenols, Alkaloids,	Ginsenosides (Rg1, Rg2, Rf, Re, Rd, Rc, Rb1 and Rb2)
Panax bipinnatifidus			Ginsenosides (Rg1, Rg2, Re, Rd, Rb1)

Nardostachys jatamansi

Plant material

Nardostachys jatamansi roots were used for the study.

Results

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis

Petroleum Ether extract	**0.15**	Flavonoids, Sterols, Phenols, Alkaloids, Terpenoids, Tannins, Glycosides, ursolic acid, β-sitosterol	1. Nardo-stachysin, 2. Sesquiterpenes
Chloroform extract	**0.25**	Flavonoids, Sterols, Phenols, Alkaloids, Terpenoids, Tannins, Glycosides ursolic acid.	1. Nardo-stachysin, 2. Sesquiterpenes
Methanol extract	**4.25**		1. Nardo-stachysin, 2. Sesquiterpenes 3. Coumarins

Development of Saffron agro-techniques in Sikkim:

Department of Science and Technology, Government of Sikkim has taken initiative in development of agro-technique of saffron in collaboration with North East Centre for Technology Application and Reach (NECTAR). Multi-locational trial cultivation has been conducted and as per the report of NECTAR highest survival rate of saffron was recorded from Yuksom site among the whole of other North East region. Successful flower and growth has also been observed. The initial pilot scale cultivation was found to be successful and the area of cultivation is going to be expanded in the second phase of cultivation. The increase in bulb/corms formation was also recorded highest among the other north east state which was around 900%.

Saffron, the dried stigmas of saffron flower, is the most expensive spice in the world. Known locally as kesar or zaffran, it is also referred to as "red gold" due to its high cost and high demand. Saffron is a slender, reddish-brown flattened stigma of saffron flower which is a rich source of carotenoids. Chemically, saffron is composed of more than 150 bioactive compounds including crocin, picrocrocin, safranal, kaempferol and quercetin.

ANNUAL PROGRESS REPORT

FINANCIAL YEAR 2022-23

सत्यमेव जयते

Department of Science & Technology
Govt. of India

Submitted to:

SSTP DIVISION
DEPARTMENT OF SCIENCE AND TECHNOLOGY
GOVERNMENT OF INDIA
TECHNOLOGY BHAWAN
NEW MEHRAULI ROAD, NEW DELHI – 110016

Submitted by :

SIKKIM STATE COUNCIL OF SCIENCE AND TECHNOLOGY
VIGYAN BHAWAN, DEORALI, GANGTOK, SIKKIM - 737102

Key activities and systemic interventions undertaken during the last financial year under the following components of the STI ecosystem:

I. Research & Development

1. **Study on Wild Edible fruits of Sikkim Himalaya:**
   A study on Nutritional Potential, Sustainable Socio Economy, Ecology and Conservation for Tribal Population of Sikkim

Objectives:

- To document and delimit the wild edible fruits consumed in Sikkim Himalaya
- To study ecological distribution and socio-economy of common wild edible fruits.
- To determine nutritional composition such as moisture content, ash, protein, fat, carbohydrate, crude fiber, caloric content, vitamin c, beta - carotene, anti-oxidants and minerals.
- To propose a model for domestication of wild edible fruits based on nutritive value.
- To map and delimit the potential distributional areas of less-familiar wild edible fruits in Sikkim Himalaya.
- To document and delimit the wild edible fruits consumed in Sikkim Himalaya.

Achievements:

- 39 wild edible fruits species of Sikkim Himalaya with family, local names (Nepali) and their physical characteristics have been documented.
- Field survey: Household survey of East, West and South districts of Sikkim have been conducted: West Sikkim – 111 houses, South Sikkim – 118 houses, East Sikkim – 77 houses have been surveyed for information on local/ traditional uses of WEFs;
- Wild edible fruit samples were collected for nutrient analysis through field survey and market surveys.
- Nutrient analysis of 28 WEF samples of India. The results showed that most of the WEF species of Sikkim performed well in comparison with commercial fruits.
  By studying and analyzing the Nutritional analysis report we have shortlisted 25 wild edible fruits having good Nutritional value.
  Artocarpus lacucha, Baccaurearamiflora, Castanopsis indica, Castanopsis tribuloides, Choerospondias axillaris, Diploknemabutyracea, Docynia indica, Elaeagnus latifolia, Elaeocarpus sikkimensis, Ficus auriculata, Juglans regia, Mangifera sylvatica, Nephrolepis cordifolia, Prunus cerasoides, Pyrularia edulis, Rhus chinensis, Rubus ellipticus, Rubus rugosus, Solanum torvum, Solanum violaceum, Spondias pinnata, Terminalia bellirica, Terminalia chebula, Tetrataenium nepalense and Zanthoxylum acanthopodium.

  The above listed potential wild edible fruits are identified for the farmers for domestication in addition to the existing agricultural system for boosting up the nutritional/ health status of the Tribal communities.

- 24 WEF species provide good energy source as of commercial fruits, where Juglans regia being highest (870.14 kcal/100g). Rhus chinensis had highest vitamin C and A (302.00 & 83.00 mg/100g respectively) while Baccaurearamiflora had highest antioxidant (1771.53 mg/100g). Diploknemabutyracea (799.00mg/100g) with highest calcium, Castanopsis indica (161.00 mg/100g) with highest sodium, Prunus cerasoides (209.12 mg/100g) with highest iron and Elaeagnus latifolia (115.18 mg/100g) with highest zinc content were recorded. Altitudinal range vary from Calamus erectus (100m) to Castanopsis tribuloides and Litsaeacitrata (2700 m) amsl.

- GIS platform used for mapping of ecological distribution of 45 wild edible fruits of Sikkim is completed.

- Through GIS platform suitable area for plantation of 45 wild edible fruits is has been identified using Elevation, slope and aspect and 86 locality / study area names recorded.

- Sikkim S&T Council is the nodal department for implementation of Pradhan Mantri Vandhan Yojana under TRIFED – Ministry of Tribal Affairs is being mapped for marketing in the local haat, state outlet and finally national outlets for linking up forward linkages with Tribal Departments.

2. Development of Saffron agro-techniques in Sikkim:

Department of Science and Technology, Government of Sikkim has taken initiative in development of agro-technique of saffron in collaboration with North East Centre for Technology Application and Reach (NECTAR). Multi-locational trial cultivation has been conducted and as per the report of NECTAR highest survival rate of saffron was recorded from Yuksom site among the whole of other North East region. Successful flower and growth has also been observed. The initial pilot scale cultivation was found to be successful and the area of cultivation is going to be expanded in the second phase of cultivation. The increase in bulb/corms formation was also recorded highest among the other north east state which was around 900%.

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3. Vulnerability Assessment (VA): Vulnerability profile of Sikkim, a sectoral analysis at district level

Introduction:

Based on the framework presented in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014), the 'risk' of climate change is determined at the interaction of "Hazard – Exposure – Vulnerability" (Intergovernmental Panel on climate Change, 2014). Among the three drivers, in the short to medium term, government and development agencies can address climate change most effectively by reducing vulnerability. The vulnerability of a natural ecosystem or socio-economic system is assessed as a function of its 'sensitivity' (i.e. the susceptibility to harm that determines the first-order impact of a hazard/stressor on the system) and lack of 'adaptive capacity' to cope with or to overcome such sensitivity (Dasgupta, Barua, Vyas, & Ravindranath, 2019-20). Therefore, assessing vulnerability to climate change is an important first step towards adaptation planning as it helps to understand the impact of potential climate risks and provides information to formulate measures to be taken to adapt to climate change (Sharma, et al., 2018).

A. Objective:

- To conduct sectoral vulnerability assessment at the district level for the state of Sikkim for agriculture, socioeconomic, disaster, forest, health, and gender sectors.

- To assign the vulnerability ranking of districts to help policymakers prioritize the districts for adaptation interventions and to formulate climate-resilient policies in each sector.
- To identify and categorize the most vulnerable district in Sikkim and the drivers of vulnerability for each sector and each district.
- To assist the state to prioritize adaptation planning and investment at a district-level for the identified sectors

B. Key Findings:

- The assessment showed that the vulnerability indices (VI) of 4 districts across 6 sectors are within a small range (0.30 - 0.67). This indicates that all districts are vulnerable (with no district having VI value <0.3) with little difference. This means all districts across the selected sectors should consider efforts to reduce their vulnerability in the face of growing climate concerns. However, some sectors in some districts are relatively more vulnerable than the others, potentially requiring prioritization of adaptation interventions.
- The assessment indicates that the sectoral vulnerability for each district varies, which implies that vulnerability is unique for each district and so the interventions needs to be sector/ district specific.
- In the North district, vulnerability is driven by socio economic factors, whereas in the South both forest and disaster drives the vulnerability. In the East district, vulnerability to agriculture sector is highest compared to other sectors and for the West district health sector needs to be prioritised to reduce vulnerability (Figure 1)
- The gender vulnerability is although not very pronounced across all the sectors there should be an effort to increase women's participation in the labour force and to provide better health facility to cater to the specific needs of women and the state must prepare adaptation plans with a gender lens.

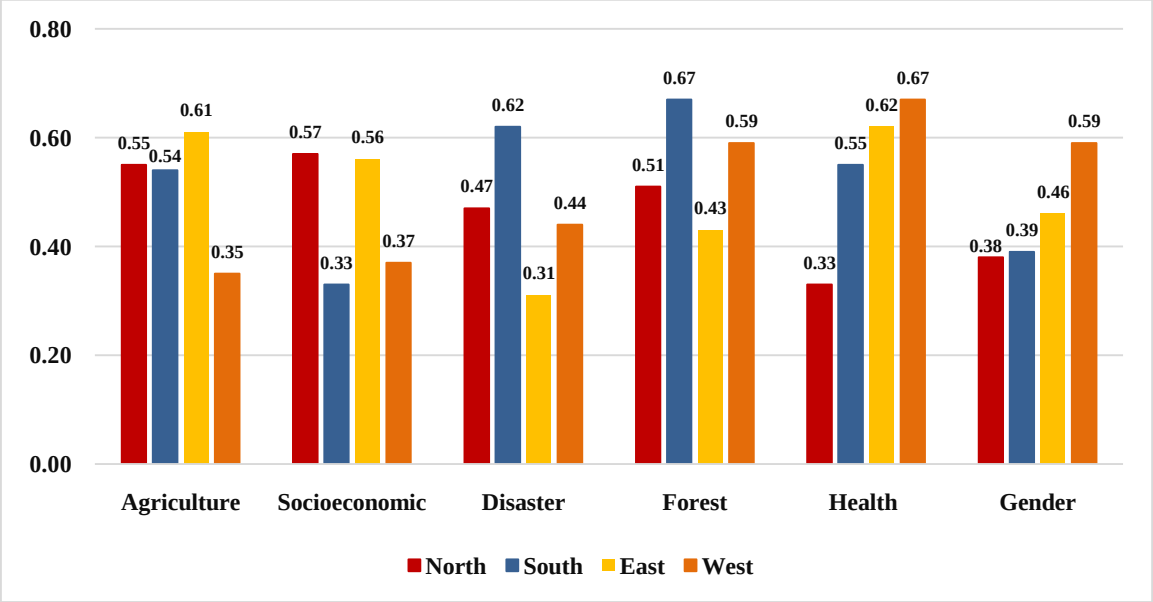


Figure: Ranking of districts in each sector

4. **Bathymetric Survey of Shakho Cho Lake** (using Apache 3 unmanned survey vehicle)**:**

Minimizing the threat of glacial lake outburst flood in Sikkim through in- situ monitoring of high-altitude glacial lakes is one of the core objectives of Sikkim state climate change cell under NMSHE. In this regard, a bathymetric survey of Shakho Chu Lake in North Sikkim was carried out in September 2022. This was done using Apache 3 unmanned survey vehicle. Data was collected from 2800 discrete points. The post processing analysis of this survey is currently underway. The deepest point registered was 96m and the average depth of the lake was found to be 65m.

Fig : Bathymetric Survey of Shakho Chu Lake

5. **Installation of Automatic Weather Stations across Sikkim:**

Understanding the effect of climate changes on the microclimate of Sikkim Himalaya is one of the core objectives of Sikkim State Climate Change Cell under NMSHE II. This is done mainly to generate microclimate variables along the altitudinal gradients and to assess the microclimate variability trends. For this purpose Sikkim state climate change cell under NMSHE-II has installed 70 automatic weather stations (AWS) all over Sikkim. 60 AWS were installed in different government schools while the remaining 10 automatic weather stations (AWS) was installed at different altitudes.

The installation of AWS was carried out between May 2022 and October 2022. The station records mainly five major parameters such as temperature, rainfall, humidity, wind velocity and wind direction. For the retrieval of data, at least 2 post graduate teachers from the respective schools were given basic training on how to retrieve data from AWS. As of now, all the AWS are functional and have started recording weather data. However, there were some issues with few schools regarding data downloading. So, the teachers were again provided training using remote desktop connecter such as Team viewer/Anydesk. Currently the concerned teachers are mailing the AWS data to the State climate change cell where they are being analyzed.

Fig : Installation of Automatic Weather Stations

6. Monitoring of Lhonak Lake, North Sikkim:

South Lhonak Lake (SLL) located in extreme NW part of Sikkim bordering China has been continuously expanding in its area and volume due to melting of its parent glacier. The lake is a glacial moraine dammed lake situated at the elevation of 5200 m. At present the lake has attain a length of ~2.63 km as per the recent satellite image. The lake is east to west elongated with a free-flowing outlet. The continuous expansion of the lake has pose a threat of GLOF in future, if in case of outbursts.

The multi-temporal satellite data analysis revealed that the SLL continuously expanded over the period of four decades (1976-2016).The lake was a small supraglacial glacial lake in 1960s), which expanded to 2.415 ± 0.132 km in length in 2016. The lake area substantially increased from 0.20 ± 0.020 km^2 to 1.31 ± 0.001 km^2 since 1976. Spatial changes in the lake boundary were recorded to be highly significant (R^2=0.97) due to glacier retreat. The average rate of lake expansion was found to be 0.027 km^2/year. However, the rate of lake expansion was recorded substantially high (0.038 km^2/year) during the last 16 years (2000-2016). The length of the lake also increased from 0.779 ± 0.129 km (1976) to 2.415 ± 0.132 km (2016). Significant length change has been observed towards the west side and is attributed to the glacier melting and ice calving from the snout. Substantial calving of ice in the lake is observed during both field investigations (2014 and 2016). Despite the intervention, the imagery of South Lhonak Lake shows further increase of the area of the lake which is a matter of concern and need to work further in the mitigation of GLOF in the lake. The lake was around 162 hectares in 2022.

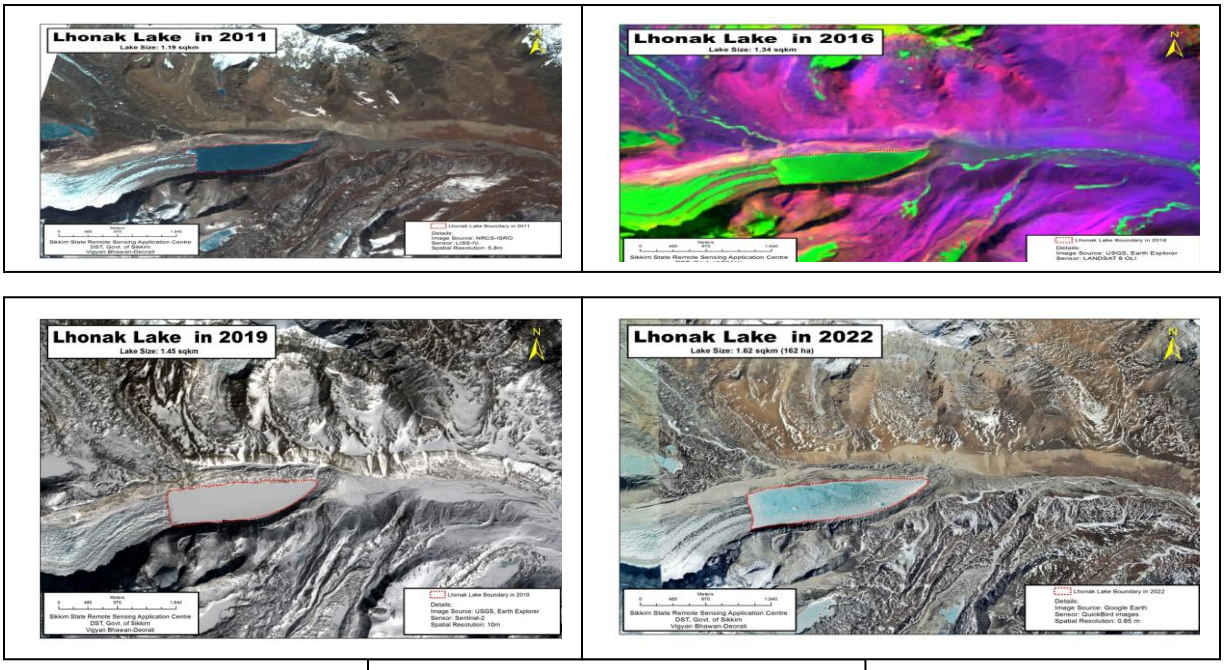


Fig : Monitoring of Lhonak Lake

A. Surface Area To Volume Ratio (Sa Calculation:

a. Segregate the leaves:

The leaves of each plot were segregated into large, medium and small categories. Then one leaf from each category was taken and measured.

b. Measuring Lamina thickness:

The lamina thickness for leaves in each category was done using digital vernier caliper and the readings noted.

c. Measuring mid-vein and Veins:

The mid-veins and veins for leaves in each category were also measured using digital vernier caliper and readings noted.

Fig : Measuring vein of the fuel sample.

d. Weighing Lamina, mid-vein and veins:

The lamina, mid-vein and veins of leaves in each category (large, medium and small) was calculated using digital balance.

e. Data Analysis:

LARGE LEAF					
PLOT:15	Vegetation type: Scrubland Dense		Latitude: 27◦19'8" N		ngitude:88◦19'21" E
Lamina thickness(mm)	lamina weight (gm)	vein diameter(mm)	vein weight(gm)	mid vein diameter (mm)	mid vein weight(gm)
0.49	0.6784	0.56	0.0534	1.22	0.1215
0.31		0.41		1.2	
0.45		0.51		1.15	
0.39		0.38		0.98	
0.27		0.28		1.05	
0.35		0.57		0.82	
0.39		0.44		0.55	
0.26		0.37		0.59	
0.42		0.43		0.48	
0.3		0.45		0.37	

Fig : Separating mid vein from leaf.

Fig : Weighing lamina using digital balance.

B. Capacity Building Workshop:

Capacity building workshop on forest fire monitoring and management conducted by C-DAC, Pune was held on 17-18 January, 2023. Experts from many reputed institutions of different states had participated and shared their knowledge. The participants from our department were Dr. Narpati Sharma (Scientific Officer), Miss Ningwa Hangma Limboo (Project Assistant), Sundeep Chettri (Project Associate I) and Pema Yoden Bhutia (Project Associate I). The live demonstration of usage of High-Performance Computing System (HPC) and software tools in wildfire spread simulation was also carried out. Hands on training was provided to the Sikkim Forest Department on the use of Sikkim Wildfire Forecasting and Monitoring System (SWFMS).

C. Conclusion:

The initiative is to develop forest fire spread model to monitor and forecast the Sikkim wildfire because the frequency of forest fire in hilly regions of Sikkim is high and this spread model will help the forest department officials, local people, Joint Forest Management committee (JFMCs) members to tackle the fire as early as possible.

If the sample data for 2-3 more years will be collected, then the forest fire spread model would be more precise and accurate.

7. 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).

Introduction

Space borne interferometric synthetic aperture radar (InSAR) techniques for measuring ice flow velocity and topography have developed rapidly over the last decade and a half, revolutionizing the study of ice dynamics. Space borne interferometry has contributed to major progress in many areas of glaciological study by: providing the first comprehensive measurements of ice-stream flow velocity over the major outlets of Greenland and Antarctica; revealing that ice-stream and outlet-glacier flow can change rapidly (months to years); improving understanding of several ice-sheet and ice-shelf processes; providing velocity for flux-gate based mass-balance assessment; mapping flow of mountain glaciers; and capturing the geomorphic traces of past ice flow.

Generation of Digital elevation model (DEM) and glacier velocity mapping are the two most important applications of SAR interferometry or interferometric SAR (InSAR) used in cryosphere. Space- borne InSAR techniques for measuring ice flow velocity and topography have developed rapidly over the last decade. InSAR is capable of measuring ice motion that has radically changed the science of glaciers and ice sheets. Space-borne InSAR has contributed to major evolution in many research areas of glaciological study by measuring ice-stream flow velocity, improving understanding of ice-shelf processes, yielding velocity for flux-gate based mass- balance assessment, and mapping flow of mountain glaciers.

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.

Objective:

The major objectives in this study are developing the modules and establish the methodologies for application of SAR Interferometry to

- high resolution Surface Topography,
- high resolution glacier velocity

Work Completed

Bamboo Stakes have been installed in East Rathong Glacier to monitor the glacier velocity in the start of ablation season.

8. Phytochemical Analysis of six traditional medicinal plants of Sikkim Himalaya

Sikkim State Council of Science and Technology successfully conducted phyto-chemical analysis of six important medicinal plants of Sikkim Himalayas. Following are the testing reports:

(a). *Hippophaesalicifolia*

NO	Compound	HS yield from 100gm leaves%
1	Quercetin	0.460
2	Isorhamnetin	≤0.005
3	Kaempferol	0.000
4	Gallic acid	0.220
5	Ellagic acid	0.330

(b). AconitumFerox

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether	0.11	ursolic acid STD β-sitosterol	1) aconitine, 2) pseudoaconitine, 3) atisine
Chloroform extract	0.29	ursolic acid STD β-sitosterol	1) aconitine, 2)pseudoaconitine, 3)atisine
Methanol extract	2.29		1)aconitine, 2)pseudoaconitine, 3)atisine

(c).Parispolyphyllaa

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether extract	0.08	ursolic acid STD, βsitosterol STD,	1) βsitosterol, 2)Stigmasterol, 3)Diosgenin
Chloroform extract	0.06	ursolic acid STD, βsitosterol STD,	1) βsitosterol, 2)Stigmasterol, 3)Diosgenin
Methanol extract	1.63	ursolic acid STD, βsitosterol STD,	1) βsitosterol, 2)Stigmasterol, 3)Diosgenin

(d). Picrorhizakurroa

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether	0.11	ursolic acid STD β-sitosterol	1)β-sitosterol, usolic acid, 2)apocynin, picroside-2, 3) Cucurbitacin -, and 4) gulgulsterone
Chloroform extract	0.15	ursolic acid STD β-sitosterol	1)β-sitosterol, usolic acid, 2)apocynin, picroside-2, 3) Cucurbitacin -, and 4) gulgulsterone
Methanol extract	3.25	ursolic acid STD β-sitosterol	1)β-sitosterol, usolic acid, 2)apocynin, picroside-2, 3) Cucurbitacin -, and 4) gulgulsterone

(e). Panax sokpayensis

Plant material

Rhizome were used for the study.

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether extract	0.05	Sterols, Phenols, Alkaloids.	Ginsenosides (Rg1, Rg2, Rf, Re, Rd, Rc, Rb1 and Rb2)
Chloroform extract	0.09	Sterols, Phenols, Alkaloids	Ginsenosides (Rg1, Rg2, Rf, Re, Rd, Rc, Rb1 and Rb2))
Methanol extract	2.65	Sterols, Phenols, Alkaloids,	Ginsenosides (Rg1, Rg2, Rf, Re, Rd, Rc, Rb1 and Rb2)
Panaxbipinnatifidus			Ginsenosides (Rg1, Rg2, Re, Rd, Rb1)

(f). Nardostachysjatamansi

Plant material

Nardostachysjatamansi roots were used for the study.

Results

Plant Solvent Extracts	Total Weight (in gm)	TLC	HPLC and Mass spectrometric analysis
Petroleum Ether extract	0.15	Flavonoids, Sterols, Phenols, Alkaloids, Terpenoids, Tannins, Glycosides, ursolic acid,	3. Nardo-stachysin, 4. Sesquiterpenes

		β-sitosterol	
Chloroform extract	0.25	Flavonoids, Sterols, Phenols, Alkaloids, Terpenoids, Tannins, Glycosidesursolic acid.	3. Nardo-stachysin, 4. Sesquiterpenes
Methanol extract	4.25		4. Nardo-stachysin, 5. Sesquiterpenes 6. Coumarins

9. Himalayan Aerosol Experiment in Sikkim

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

Introduction:

Aerosol are microscopic, solid, liquid or mixed particles that remain suspended in the air. Himalayas generate large quantities of natural aerosols that play an important role in cloud formation and Earth's climate. The Himalayas act as giant barrier to wind flow, facilitating the accumulation of aerosols that are then transported to high altitudes by mountain winds. Aerosol are airborne particles that are formed from both natural sources, such as gases released by plants, and pollutants emitted by human activities.

In this context, the highest mountain plateau system in the world- the Himalayas and the Tibetan Plateau are very sensitive to climate change. The Himalayas pose a key location and act as a background site to monitor the aerosols. But there is a gap in data. To bridge the gap in the chain of aerosol measurements over the Himalayas, eastern parts of Himalayas are suitable for examining the long-range transport of aerosols from South Asian region. The continuous measurements from this region will also contribute to the regional aerosol database and climate models.

Sikkim is highly suitable in order to understand the optical, physical and chemical properties of aerosols associated with the transport from the polluted Indian land mass, in addition to understanding the influence of local activities over the high altitude site. Moreover, there are several glaciers in the proximity of Sikkim, which will provide additional handle to look in to the aspects on aerosol-cryosphere interaction.

With the above mentioned justifications "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

Details about the experiment *site*

Sl No	Place	Dist.	Lat	Long	Alt. (m), amsl	Accessibility	Address
1	Lachung	North Sikkim	27 Deg 41 Min 27.5 Sec	88 Deg 44 Min 35.6 Sec	2700	~120 km from Gangtok. Takes 4.5 hour from Gangtok	Range Office, Lachung (T), Range Dept. of FEWM Govt. of Sikkim

Objectives:

- To quantify the efficiency of aerosol radiation interaction at the eastern Himalayan site owing to their micro-physical and chemical properties
- To evaluate distinct source processes of aerosols (local and synoptic)
- To estimate the concentrations of Black Carbon/Dust/Water Insoluble Organic in Snow and quantify the impact on snow albedo

Work Completed:

Aerosol Scattering Coefficients

Continuous measurements of aerosol total and backscattering coefficients at a time interval of 20s were carried out using a three- wavelength (450 nm, 532 nm, and 632 nm) integrating

Nephelometer (Model: IN 102, Air Photon).

From the multispectral measurements of scattering coefficients (σsca) at three wavelengths, Scattering Angstrom Exponent (SAE, αsca) is estimated as,

$$SAE = \frac{log(\sigma sca, \lambda 1 \,/\, \sigma sca, \lambda 2)}{log(\lambda 2/\lambda 1)}$$

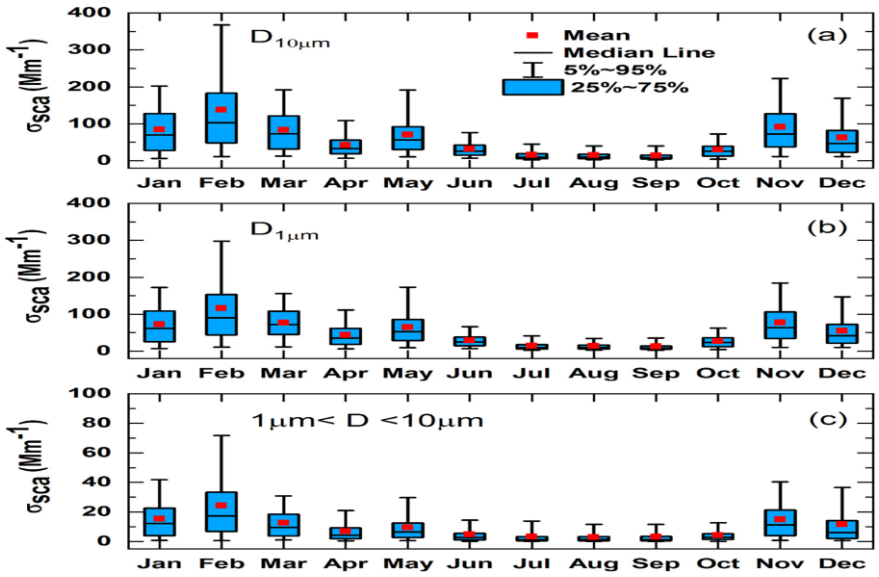
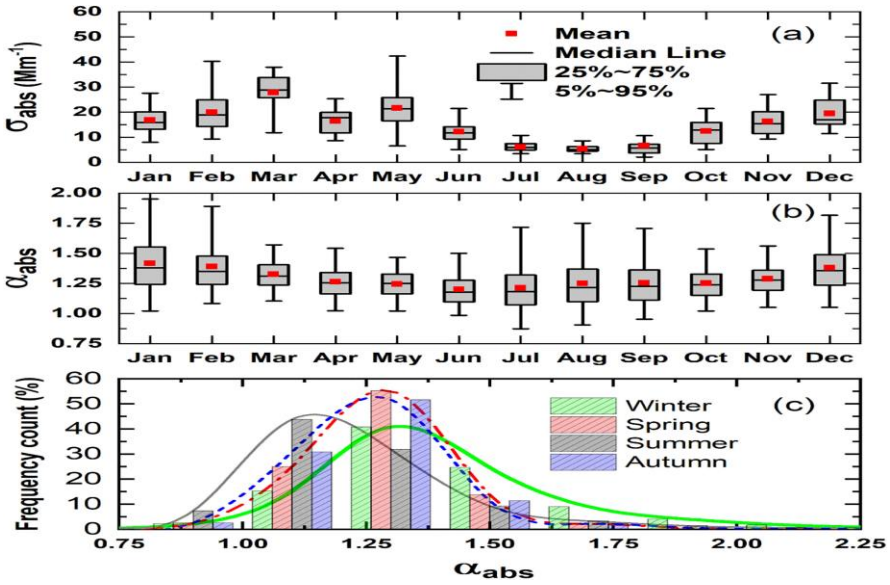


Fig 1. Annual variation (climatological monthly mean values) of aerosol scattering coefficients (σsca) at 532 nm for(a) particles <10 μm and
(b) particles <1 μm and
(c) particles between 1 and 10 μm, averaged for the period between February 2019–February 2020. The box indicates 25th and 75th percentiles, while the whisker is for 5th and 95th percentiles, respectively. The red dots indicate the mean and the horizontal black lines show the median values respectively

Aerosol absorption coefficients

Continuous measurements of aerosol absorption coefficients (σabs) were carried out using a seven-channel (370, 470, 520, 590, 660, 880, and 950 nm) dual-spot Aethalometer (Model: AE-33, Magee Scientific) at the regular 1-min interval, the absorption coefficient (σabs) is estimated



As,

$$\sigma abs(\lambda) = \frac{-S.(\Delta ATNn(\lambda)/100}{Fn(1-\zeta)C.(1-k.ATNn(\lambda))\Delta t}$$

Fig. 2.Annual variation of
(a) Aerosol absorption coefficient (σabs) at 550 nm; with box representing the 25th and 75th percentiles and whisker 5th and 95th percentiles; the red dots indicate the mean and horizontal black lines show the median values,
(b) Annual variation (climatological monthly mean values) of absorption angstrom exponent (αabs),
(c) Frequency distribution of αabs at the four different seasons of winter (DJF), spring (MAM), summer-monsoon (JJAS), and autumn (ON).

Aerosol single scattering Albedo

From the concurrently measured spectral σsca and σabs, aerosol single scattering albedo (SSA) at each 1-min interval is estimated as

$$SSA(\lambda) = \frac{\sigma sca(\lambda)}{\sigma sca(\lambda) + \sigma abs(\lambda}$$

For pairing the nephelometer and aethalometer data sets, 1-min average values of σsca were calculated from the individual data sets measured at each 20 s intervals. For spectral consistency, the values of σsca and σabs were interpolated to common wavelengths using the Ångstr¨om power-law relation described in Eqs. (2) and (5). The uncertainties in the calculation of SSA are estimated to be in the range of 12%–13%.

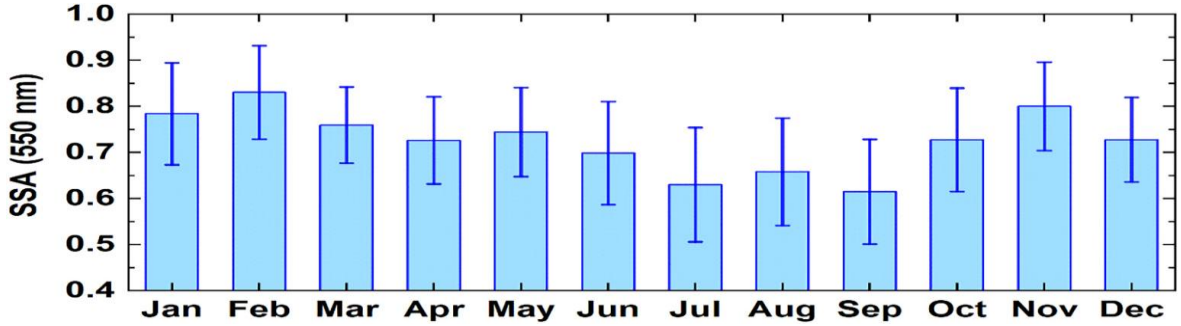


Fig. Monthly variation of aerosol single scattering albedo (SSA) at 550 nm at the measurement site during the study period.

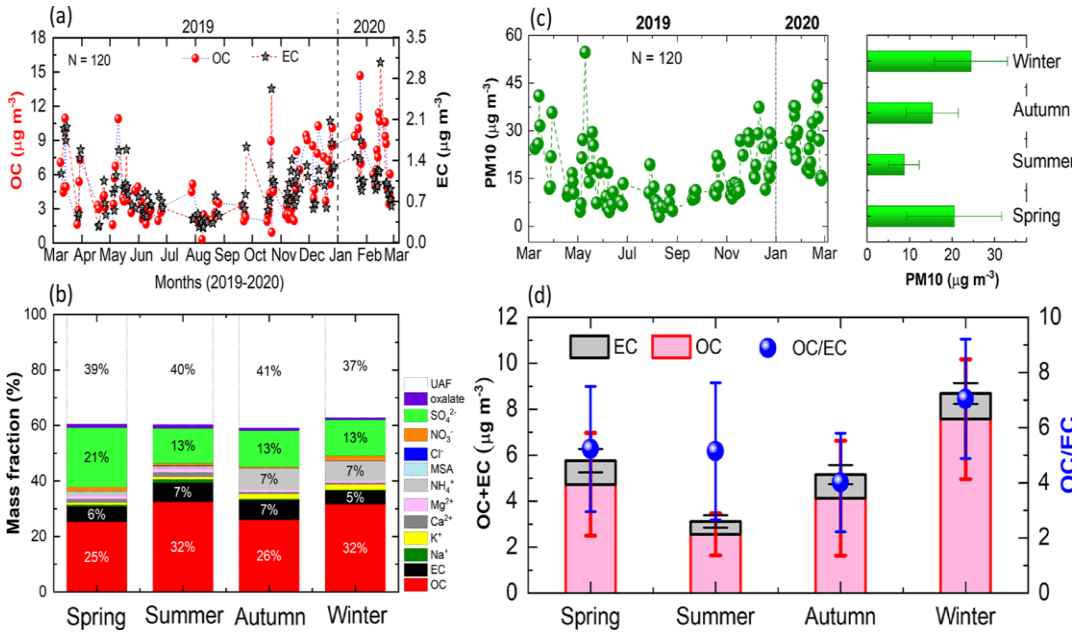


Figure 4. (a) Temporal evolution of OC (left Y-axis) and EC (right Y-axis). (b) Percentage contribution of chemical components to PM_{10}. (c)Temporal variation of daily and seasonal mean PM_{10} aerosols. (d) Seasonal variation of OC, EC, and total carbon (OC + EC) concentrations. The OC/EC ratio (right-y axis) at the observational site is also shown right-y axis.

The OC/EC ratio is highest in winter ~7.0 (3.0−14.8), followed by spring ~5.3 (1.9−12) and summer ~5.1 (1.2−12.9), and lowest in autumn ~4 (0.9−8). While the principal sources of OC and EC are fossil fuel combustion and biomass burning, carbonaceous aerosols from biomass burning sources are known to enrich in OC compared to EC, yielding substantially higher OC/EC levels. Thus, the OC/EC ratios are used to distinguish the relative contribution of fossil fuel or biomass burning sources, with lower OC/EC ratios (<2.0) characterizing the vehicular and industrial emissions, whereas higher OC/EC ratios (> 2.0) indicating the presence of secondary OA. Similarly, an OC/EC ratio of 3.8−13.2 indicates biomass combustion.The higher OC/EC ratio (>5 for more than 90% of cases) at Lachung occurring in most parts of the year could be due to the substantial influence from biomass burning and biogenic sources.

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

Funding Agency: Space Applications Centre, ISRO, Ahmedabad

Introduction:

The alpine ecosystem being exposed to low temperature conditions, are generally considered particularly sensitive to climate change (Beniston 1994, Prise and Barry 1997). Less influence by anthropogenic activities and comparatively low ecological complexity, the alpine ecosystems can be considered as “natural laboratories” where the impact of climate change are expected to be more pronounced than on biota at lower altitude. The transition zones like tree-line from where the alpine meadows starts are consider most sensitive and changes can be observed in minimum time. Various studies have reported a shift in tree-line due to climate warming (Walther et al. 2005; Hickling et al. 2006, Parmesan 2006, Chen et al. 2011; Schickhoff et al. 2015), but due to lack of long term data available for Himalaya, Space Application Centre (SAC), Ahmadabad Department of Space, Government of India in collaboration with the Sikkim State Council of Science and Technology, jointly undertake the programme in Sikkim.

In mountain ecosystem where elevation gradients are prominent, temperature gradient based phonological and morphological variability can be high. Diversity and morphology of alpine vegetation across elevation gradient of Kyongnosla Alpine Sanctury, Sikkim Himalaya was

investigated. Furthermore, time-lapse cameras was installed to study temporal tree phenology and land use/land cover maps of alpine and subalpine regions (>3000m. a.s.l.) for the year 1987 and 2008 was prepared and compared the changes in land used patterns for better understanding of ongoing changes in land used pattern due to global climate change.

Objectives:

1. Identification of potential field site for the study.
2. Identification of tree species for further study based on their viability in the field site and its ecological importance.
3. Monitor tree morphology across elevation gradient.
4. Study vascular plant community responses across elevation gradient.
5. Establish phenocam in the selected field site to monitor the tree species phenology.
6. Assessment of Alpine Ecosystem of Sikkim Himalaya using satellite data

Site Characteristics

1st High Summit Point (HSP): First summit was at an altitudinal range of **4046m asl** (meters above sea level).
2nd HSP: The second summit was at an altitudinal range of **3923m asl**.
3rd HSP: The third summit was at an altitudinal range of **3811m asl**.

Fig41: Plot location details. The yellow points are summit point (HSP) numbers and the 20x20 meters vegetation plots at tree-line and below tree-line at each summit.

Methodology

Three summits were selected using the GLORIA (Global Observation Research Initiative in Alpine Environments) protocol representing an elevation gradient. The selected summits covers the elevation gradient starting from subalpine (> 3000m a.s. l. (meters above sea level)) to highest summit point (4046 m asl). Standard GLORIA Multi-Summit approach was followed to set-up the monitoring sites at each summit.

Work Completed:

70 plant species belonging to 31 plus families including 14 tree species were identified. Among these tree species, *Betula utilis* is one of the key indicator species of climate change in the Himalaya. Difference in Shannon-Wiener diversity indices for tree and herb species across elevation gradient was observed. Statistically significant differences ($p < 0.05$), between the tree height of lowest elevation summit site and highest elevation summit site was observed. However, no differences in tree girth as well as species richness and percent cover of herbaceous species among

the three-summit site was observed. Elevational diversity gradient (EDG) is an ecological pattern where biodiversity changes with elevation, similar trend were observed where the diversity of tree and herbaceous species changes along the three summits with different elevations.

Long term continuous monitoring of life-cycle events is important, in understanding the effects of climatic/environmental changes on the ecosystem. Therefore, three time-lapse cameras to monitor tree phenology across the elevation gradient was installed, as seasonal patterns of development in forest trees have a major influence in determining reproductive success in plant species, and have a major influence on animal populations. Temporal change in tree morphology with season was observed and for better understanding of the influence of environment on phonological events long term monitoring is needed.

Furthermore, LULC maps help us to **study the changes** that are happening in our ecosystem and environment, therefore to understand the alpine ecosystem dynamics of Sikkim Himalaya LULC maps of alpine and subalpine regions (>300m .a.s.l.) of Sikkim Himalaya for the year 1987 and 2008 was prepared and the changes in land used patterns over year was compared. Loss in glacier and increased in lake and ricer over time was oberved. This may be due to rapid increased in temperature recorded for the Himalayas. There is also a loss of closed forest and alpine pasture, and an increased in roads and open forest giving as serious challenge in management and conservation of the ecosystem.

Conclusions: Elevational diversity gradient (EDG) is an ecological pattern where biodiversity changes with elevation, similar trend were observed where the diversity of tree and herbaceous species changes along the three summits with different elevations. The observed decreased in tree height with elevation reveal the capacity of some tree species to change their morphology with environment. Furthermore, the observed temporal changes in tree phenology with season indicate that, for better understanding of the influence of environmental factors on tree phenology long term monitoring is needed. Additionally, the observed loss in glacier and increased in lake and ricer over time may be the influence of rapid increased in temperature recorded for the Himalayas. There is also a loss of closed forest and alpine pasture, and an increased in roads and open forest giving as serious challenge in management and conservation of the ecosystem.

Monitor tree morphology across elevation gradient.

The Shannon-Weiner diversity index of tree species (Fig. a) in summit number 3 (HSP3) was slightly more diverse than at HSP1 and HSP2 (Keuskal- Wallis H test: H= 2.0466 (2, N = 23), p = 0.35941). However, the result is not significant at $p < 0.05$. The Shannon- Weiner diversity index of tree species in TL and BT (Fig. b) was similar (Keuskal- Wallis H test: H= 0.6395 (1, N = 28), p = 0. 42389).

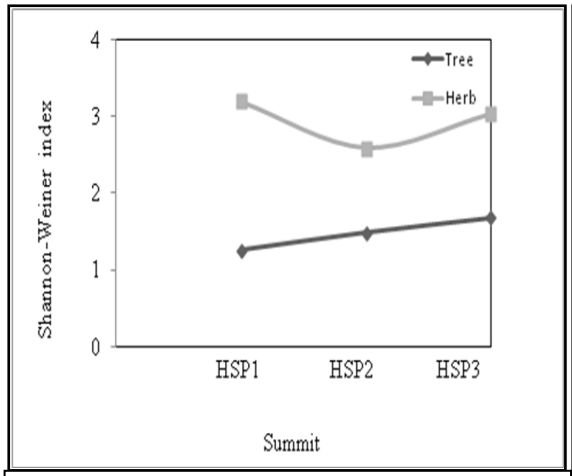


Fig: Shannon-Wiener diversity of tree and herbaceous plant species for three summit zones based on Shannon-Wiener diversity measures for plots in each summit zones.

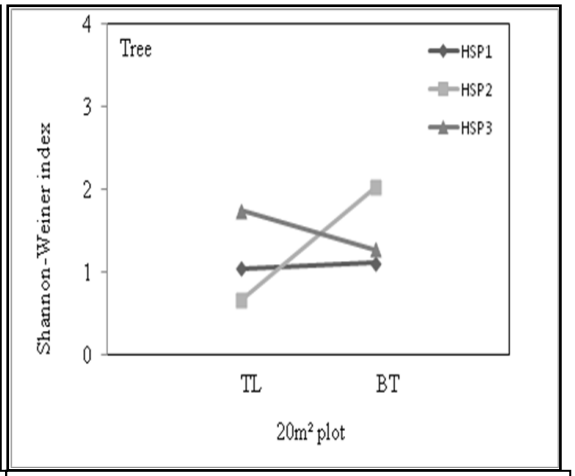


Fig: Shannon-Wiener diversity of tree species for three summit zones based on Shannon-Wiener diversity measures for plots at above tree-line (AT), tree-line (TL) and below tree-line (BT) plots in each summit zones respectively.

Table 1: Two-way ANOVA, interaction model.

	Sum-of-Squares	p-value
Summit	60.3	0.033755 *
Plot	0.0	0.983851
Summit: Plot	144.3	0.000483 ***

In the output table 1, the "Summit:Plot" variable has a high sum-of-squares value and a low p-value, which means there is a high variation that can be explained by the interaction between Summit and tree-line and Below tree-line plots. The interaction model appears to be the best fit model as it has the lowest AIC value, and 99% of AIC weight, which means that it explains 99% of the total variation in the dependent variable that can be explained by the full set of models.
From the post-hoc (Tukey) test results, we see that there are statistically significant differences ($p < 0.05$) between the tree height of HSP3 and HSP1 ($p = 0.03$), but the difference between the tree height of HSP2 and HSP1 and also the tree height of HSP3 and HSP2 are not statistically significant. There is also no difference between the tree height of tree-line (TL) and below tree-line (BTL) plots

Table 2: Two-way ANOVA, interaction model.

	Sum-of-Squares	p-value
Summit	0.527	0.1069
Plot	0.018	0.6934
Summit: Plot	0.830	0.0313 *

In the output table 2, the "Summit: Plot" variable has a high sum-of-squares value and a low p-value, which means there is a high variation that can be explained by the interaction between Summit and tree-line and Below tree-line plots. The interaction model appears to be the best fit model as it has the lowest AIC value, and 50% of AIC weight, which means that it explains 50% of the total variation in the dependent variable that can be explained by the full set of models.
From the post-hoc (Tukey) test results, we observed no differences in tree girth among the three summit site (HSP1, HSP2 and HSP3) and also between the tree-line (TL) and below tree-line (BTL) plots.

Study vascular plant community responses across elevation gradient.

A total of 70 plant species belonging to the 31 plus family were identified including 14 tree species were recorded in our plots. The tree species were *Abis, Acer, Betula utilis, Lyonia, R. aeruginosum, R. barbatum, R. campanulatum, R. campylocarpum, R. cinnabarium, R. fulgens, R. hodgsonii, R. wightii, Salix calyculata*and *Sorbus.*

Shannon-Wiener diversity indices was calculated for herbaceous plant species along the summits and among AT, TL and BT plots.

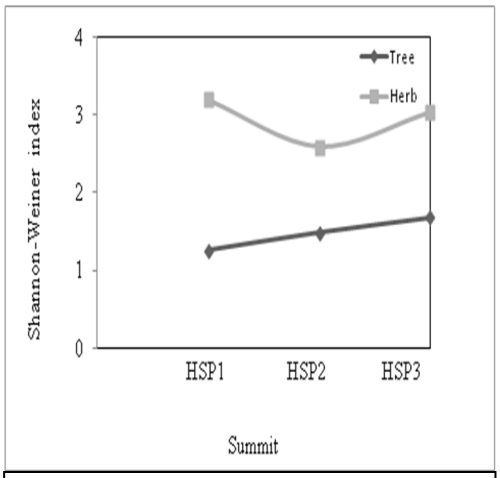


Fig: Shannon-Wiener diversity of tree and herbaceous plant species for three summit zones based on Shannon-Wiener diversity measures for plots in each summit zones.

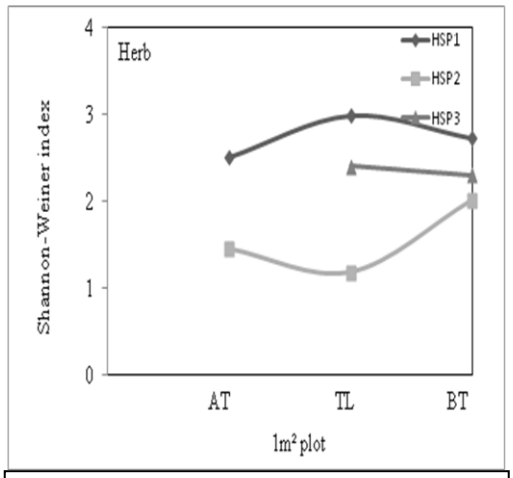


Fig: Shannon-Wiener diversity of herbaceous plant species for three summit zones based on Shannon-Wiener diversity measures for plots at above tree-line (AT), tree-line (TL) and below tree-line (BT) plots in each summit zones respectively

The Shannon- Weiner diversity index of herb species (Fig. c) in HSP1and HSP3 was slightly more diverse than at HSP2 (Keuskal-Wallis H test: H= 2.5764 (2, N = 105), p = 0.27577). However, the result in not significant at $p < 0.05$. Similarly, Shannon-Weiner diversity index of herb species in AT, TL and BT (Fig.d) of HSP1, HSP2 and HSP3 was similar, however in HSP2, herb species diversity was slightly more diverse than at BT compared to AT and TL (HSP1, Keuskal-Wallis H test: H= 0.1712 (2, N = 75), p = 0.91794; HSP2, Keuskal-Wallis H test: H= 1.2917 (2, N = 33), p = 0.52422; HSP3, Keuskal-Wallis H test: H= 0.0427 (2, N = 34), p = 0.83627). However, the result in not significant at $p < 0.05$.

Significant differences were not observed in species richness and percent cover among the three summit (HSP1, HSP2 and HSP3), within 5 meters and 10 meters boundaries as well as between the four aspect (NE, NW, SW and SE).

The study documented differences in diversity of both tree as well as herbaceous plant species across elevation gradient. Difference were observed in tree height across elevation gradient. However, no significant change in species richness and percent cover of herbaceous species were observed across elevation gradient. This study area proved an ideal elevation gradient where in each summit there is an elevational increased of approximate 100 meters. Future study on plant phenological monitoring and long term monitoring of the study area will provide a better picture of the species response to ongoing environmental changes.

II. Institutional & Human Capacity Building

1. **Setting Up of Schedule Tribe Cell in Sikkim:**

This project was initiated for Schedule Tribe to provide S& T based solution through science for socio-economic upliftment & skill development to boost up their well-being and improve food security.

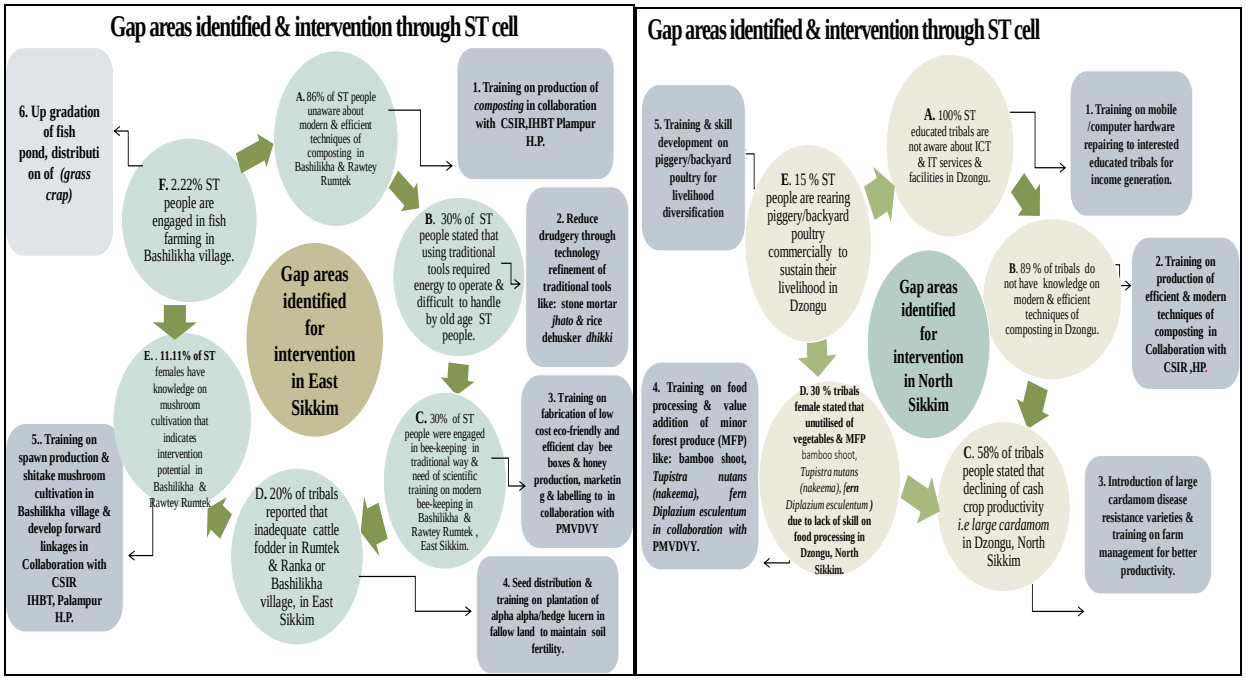
Deliverables through ST cell:

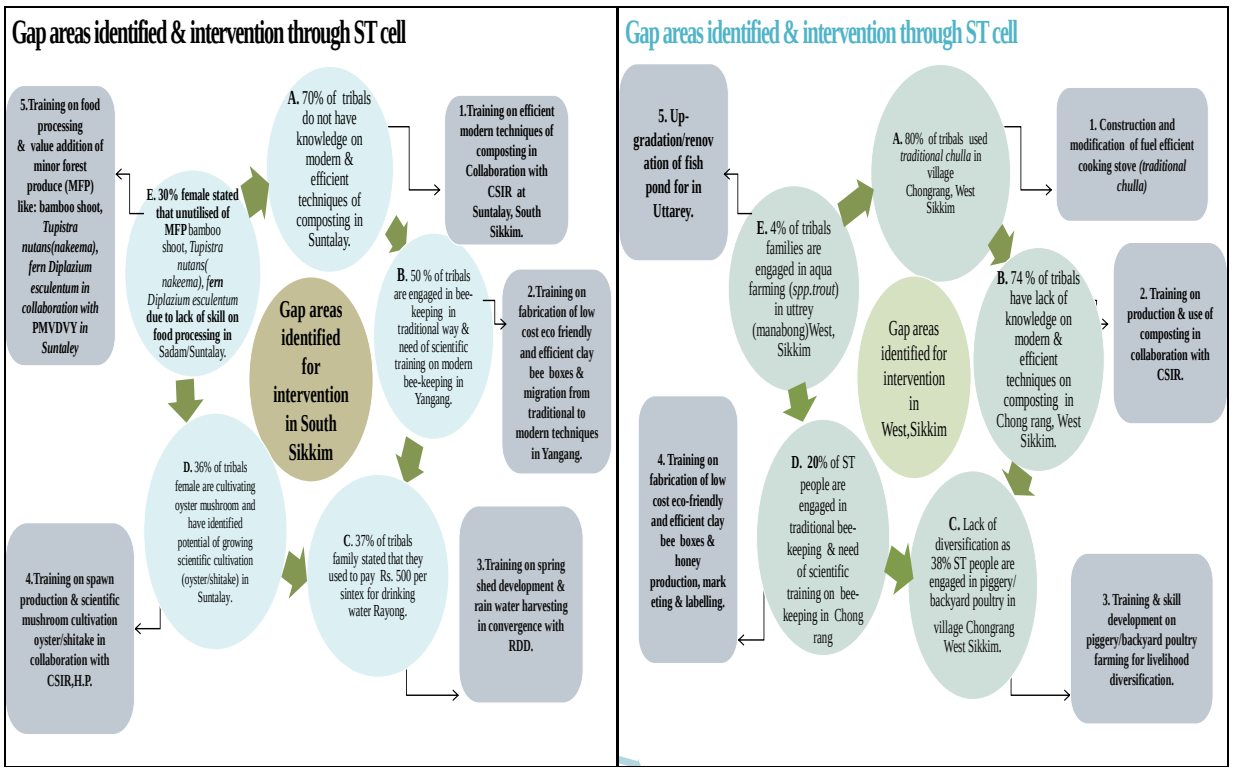
1. Analysis of predominant livelihood System in context of five capital in identified project areas.
3. Mapping of indigenous traditional knowledge and upgrade the skill building on local Innovation and knowledge system.
4. Establishment database of promising technology for widespread adaptation.
5. Mapping of data in spatial domain
   capacity building and sustainable development of SC/ST communities in the State.

Achievement

1. Completed Identification and categorization of strength and gap areas of ST community of identfid project areas in four districts of Sikkim
2. Identification & categorization of S&T needs of ST community of identified project areas
3. Identification and Spatial representation of livelihood capitals and S&T gaps within the state
4. Establishment of a database of promising technologies that can be taken up for widespread adaptation
5. Mapping of the above data and resources on a Spatial Domain

Identification of Predominant Livelihood Gap Areas





Achievements through ST Cell Phase-II (Year II)

1. Community Facilitation Center (CfC) has been established for technology demonstration by ST Cell at four Districts i.e- Dzongu, North District, Bashilakha, Pakyong District, Chongrang, West District and Sumbuk, South District with technocentric intervention as well as skill development for livelihood generation
2. Developed mapping module to identify strength and weakest links of the tribal population based on five livelihood capitalsviz Natural, Physical, Human,Social, Financial Capitals
3. Fabrication of farm equipments: traditional tools- foot pounder *(dhikki)* and stone mortor*(Jhato)* in Bashilakha, Pakyong District.
4. Farm tools & machines were setup in each district of study area for demonstration and training for socio- economic upliftment of tribal.
5. Second year project review meeting was attended at Uttarkhand State Council of Science & Technology, Dehradun on 11th and 12th May 2023.
6. Baseline survey was done in context of livelihood status for technology interventions, demonstration, training and awareness camp etc.
7. The work done was presented during XLVI Indian Social Congress during 27 -31,January 2023 at BharatidasanUniversiy, Tiruchirapally

2. Pradhan Mantri Van Dhan Yojana

Pradhan Mantri Van Dhan Yojana is the scheme of Ministry of Tribal Affairs Government of India being implemented through TRIFED. The scheme aim at marketing of Minor forest produce through minimum support price and development of value chain development for minor forest produce.

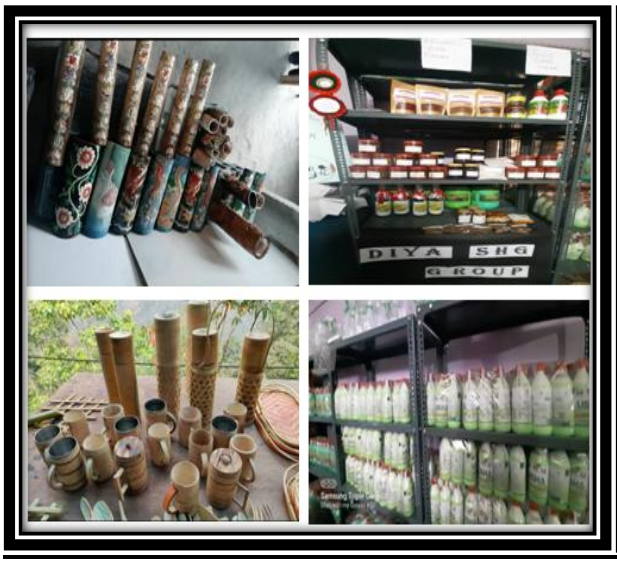
Sikkim State Council is the State Nodal Agency of PMVDY in Sikkim and being implemented through the State Implementing Agency, the Cooperation Department.

Objective:

1. To mobilize communities of cluster level and facilitate capacity building, had holding, infrastructure creation and MSP support to realize economy and MFP's traditional art and crafts there by supporting rural livelihood.
2. To create employment opportunities among different tribal and other communities by way of self-employment under MSME sector.
3. To facilitate marketing linkage for MFP with other agricultural produce besides promoting local art and craft on indigenous scale.

Achievements:

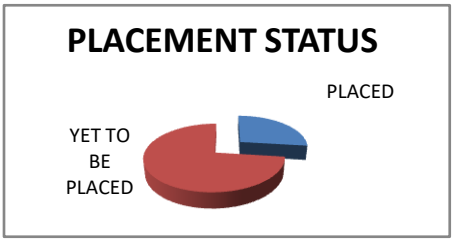
1. Formation of 74 Van Dhan Clusters each having 300 members thus involving 21000 beneficiaries outof which 56% arethe tribal beneficiaries
2. Fund amounting to Rs. 11.69 crores transferred to the State Implementing Agency which is being disbursed to beneficiary SHG. 74 clusters have received the fund out of 80 clusters
3. Training provided to the Van Dhan Clusters for processing of local produce for value addition branding and marketing.
   - Numbers of VDVKs training conducted : 34 VDVKs.
   - Numbers of operational VDVKs : 30
   - Number of value added product : 28
4. Products by Tribals are being marketed through various outlets within the state



3. Green Skill Development Programme

A Certificate Course of 400 hrs on Value Addition and Market of NTFPs (Plant Origin): Bamboo Crafts under Green Skill Development Programme of NSQF level – 5 was conducted by Sikkim State Council of Science & Technology under the project ENVIS RP Sikkim on Ecotourism from 9th December 2021 – 22nd January 2022 in PatukSingbel, Singtam and Dragon Inn, Tathanchen, Gangtok. The project is funded by Ministry of Environment, Forests and Climate Change, Government of India.

5. National Skill Qualification Framework (NSQF) level- 5
6. Number of unemployed youths skilled – 26
7. Number of Placement – 9
8. Duration – 9th December 2021 – 22nd January 2022



4. Capacity Building Trainings:

Fig : Figure: Capacity Building Programme on the usage of Apache 3 Unmanned Survey Vehicle

5. Capacity Building workshop on " Climate Change Risk Assessment and Mapping in the states of the Indian Himalayan Region" at IIT Guwahati

6. EIACP- Environmental Information Awareness, Capacity Building and Livelihood Programme supported by Ministry of Environment Forest and Climate Change, Government of India.

Plantation cum Cleanliness Drive was organised by ENVIS RP Sikkim on Ecotourism, State Council of Science and Technology, Sikkim on the occasion of **Hariyali Mahotsav/ Hariyali Saptah**. The programme was participated by ENVIS Staffs, officials of SSCST at Sikkim Science Centre, Marchak and locals. Further Banner and Standee on Single Use Plastic Ban was also displayed in Science Centre for wider promotion and for the daily visitors like students and public in Sikkim Science Centre, Marchak, Ranipool, Sikkim.

Awareness Programme on Mission LiFE

An awareness programme on LiFE (Lifestyle for Environment) was conducted by EIACP RP on Ecotourism, Sikkim State Council of Science and Technology at Rongneck Secondary School, Rongey Gangtok and Sikkim Science Centre, Marchak. Resource person Ms Usha Lachungpa (Retd Principal Chief Research Officer) gave presentation on #MissionLife and the theme for the programme was Adopt Sustainable Food System. The students were made aware about local diet, how it can be consumed and what its benefits are. Around 150 students and teachers actively participated in the programme. The programme came to an end with poster presentation and sensitization.

7. Training on Climate Projection

Climate projection was primarily conducted to understand the region's past and present climate and to assess how changes in global societal, demographical, and economic scenarios are going to impact the statistics of essential climate variables (e.g., temperature and precipitation).

We conducted the detailed analysis of past and future climate change trends, including changes in temperature and precipitation, discussing specific impacts, climate risks, and socioeconomic consequences. The analysis was mainly done based on the topographical and climatological similarities of the state.

The analysis overall projected a slight increase in different temperature variables however the annual rainfall showed high variability.

Sectoral meeting

Sectoral meeting was held under SAPCC with Nine different sectors or department namely Tourism, Disaster, Water, Agriculture, Energy, Socioeconomic, Health, Urban & Transport and Forest & Diversity w.e.f. 3rd April 2023 to 26th may 2023. The report for SAPCC is being prepared. Important point highlighted during the meeting were as follows

Fig : Sectoral meeting with Agriculture sector

Fig : Sectoral meeting with Tourism sector

8. Week long hands-on training on "In-silico Drug Designing"

Week long hands-on training on in-silico drug designing was successfully conducted for the first time in Sikkim by local resource person, Dr. Laydong Lepcha at Bioinformatics centre, Vigyan Bhawan, Deorali. He used various bioinformatics tools such as AutoDock, AutoDock Vina programming, PyMOL, BIOVIA Discovery Studio, PyRxsoftwaresetc to impart the training. The participants included the Assistant Professors, PhD scholars, PG students from various universities, scientific institutions and colleges.

III. Innovation (including the activities under PIC)

1. **Setting up of Innovation Laboratory in Eighty eight Schools and Innovation Hub in Science Centre**

An innovation Laboratory have been set up in eighty eight government senior secondary schools where state of the art science and geography equipments have been provided to the schools which will benefit the schools in terms of setting up science based experiments and study and data collection on weather and climate change which will help in baseline study and reference for researchers and professionals, Major equipments which have been installed in the laboratory are :-

- LCD/ Digital Microscope
- Automatic Weather Station for weather data documentation
- Work Station for data mining, collection, processing and collation
- Digital camera / Binocular/ Herbarium for study of nature study and documentation of biodiversity
- Laboratory equipments

Further Innovation Hub laboratory has been set up in Sikkim Science Centre which will be the nodal point for the entire innovative laboratory set up in schools. All schools and students have taken the membership of the Innovation Hub at Sikkim Science Centre. The Innovation Hub project aims to benefit rural as well as urban students who are innovative and will provide platform for experimenting in the problems and innovative ideas and encourage the students to develop designs and prototypes and express their innovative ideas. The Innovation Hub has been set up under central funding 'Scheme for Promoting Innovation, Creativity and Engagement in Science' (SPICE) to inspire young minds and to develop a culture of innovation in the country. Following components will be made available:

- Discovery Hall
- Innovation Resource Centre & Hall of Fame
- Idea Laboratory
- Design Studio
- Mentor/ Guides

2. **Filed four (04) GI products of Sikkim during 2022-23, namely**:

	Sikkim Temi Tea (No. 796)		Hee-Goan Seremna Cardamom (No. 783)
	Sikkim Lepcha Hat (No. 851)		Sikkim Orange (No. 925)

3. **Week long hands-on training on Intellectual Property Rights**

A week long certificate training on Intellectual Property Rights (IPR) was successfully held from 13th - 17th March 2023.

The program was organized by IPR Cell, Sikkim State Council of Science and Technology, Department of Science and Technology (DST), Government of Sikkim (GOS) and was supported through North East Centre for Training Application and Reach (NECTAR). The inaugural program was held at Sidkeong Tulku Conference Hall, Forest Environment and Wildlife Management Department which was inaugurated by Dr. Arun Kumar Sarma, Director General, NECTAR in the presence of Shri Bhuwan P. Pradhan, Secretary, Department of Science and Technology,

Government of Sikkim and Dr. B.C. Basistha, Principal Director, Biotechnology Division, (DST, GOS). The target participants of the program were research scholars from various state and central government research institutes including Institute of Bioresources and Sustainable Development (IBSD) and Indian Cardamom Research Institute (ICRI) and universities like Sri Ramaswami Memorial University (SRM), Sikkim Manipal Institute of Medical Sciences (SMIMS) and Sikkim University (SU).

4. **Lab exposure, training and dissertation on biotechnology and bioinformatics.**
Number of post graduate students have visited biotechnology laboratory from within and outside state and also imparted hands-on training on various tools and techniques of biotechnology. Furthermore, 3 months MSc. dissertation project works for partial fulfillment of post graduate in science was completed under the guidance of our scientific team. Four such students are pursuing project work on various topics.

Innovation (including the activities under PIC)

- Supported 04 inventors to fine tune their invention/innovations
- Established 10 IPR cells in different universities/colleges
- Filed 04 GI products from Sikkim namely:

1) Sikkim Temi Tea (GI filled no. 796)
2) Sikkim Orange (GI filled no. 925)
3) Sikkim Lepcha Hat (GI filled No. 851)
4) Hee-Goan Seremna Cardamom (GI filled no. 783)

5. **Establishing/ Strengthening the State Climate Change Cell under NMSHE (SCCC-NMSHE) in the state of Sikkim (Phase –II)**
Funding Agency: Department of Science & Technology Climate Change Programme
Introduction:
The National Mission for Sustaining the Himalayan Ecosystem (NMSHE) is one of the eight core "national missions" of the NAPCC. It is the only national mission with a regional focus. In this context Sikkim State Climate Change Cell was established under National Mission for Sustaining the Himalayan Ecosystem (NMSHE) with the support from Department of Science and Technology, Government of India in October 2014 for the period of 5 years. The project is in second phase which commenced on March 2021. The work carried on so far in 2021 has been brought to light in this report.

Objectives:

a) Identification of drivers of vulnerability and prioritization of adaptation plans through sectoral vulnerability assessment (GPU and ward levels) and facilitate the state government in development of policy documents.
b) Community awareness and sensitization on climate change impacts and consequences at Block level.
c) Building capacity of state officials on climate change adaptation through training and awareness programme.
d) Minimizing the threat of GLOF through in- situ monitoring of high altitude lakes
    - Bathymetric study of lake
    - Suggesting possible mitigation measures
e) Understanding the effect of climate changes on microclimate of Sikkim Himalaya
    - Generate microclimate variables along the altitudinal gradients
    - Assess the microclimate variability trends.

Work Completed:

NMSHE began its Phase-II in March 2021. The main focus of NMSHE is to adapt ourselves to the changing climatic condition and to mitigate the changing climatic condition through natural and environment-friendly lifestyles and development. In the year 2022-23, Sikkim state climate change cell under NMSHE carried out climate change risk assessment for the state of Sikkim. Two major hazards were taken into consideration- drought and flood.

Sensitization of public at the grass root level is one of the main objectives of Sikkim State Climate Change Cell under NMSHE. For this purpose, awareness programmes were conducted in nine educational institutes and nine Gram Panchayat Units across Sikkim. A total of 1687 personnel were present in the events. NMSHE staffs themselves underwent different capacity building trainings in the year 2022-23 such as operation of Apache 3 Unmanned Survey Vehicle, training on risk assessment, etc. In the year 2022, a total of 70 automatic weather stations were installed all across Sikkim. This was mainly done to understand the effect of climate change on the micro climate of Sikkim Himalaya. The information so obtained will help in generating micro climate profile of Sikkim which will be a key input in climate change mitigation and adaptation planning.

To minimize the threat of glacial lake outburst flood through in- situ monitoring of high altitude lakes, bathymetric survey was carried out at Shako Cho lake in North Sikkim using Apache 3 unmanned survey vehicle. Data was collected from around 2800 discrete points. Sikkim State Climate Change Cell under NMSHE also published different information, education and communication (I.E.C.) materials published to generate awareness among the masses.

IV. Technology Deployment for Socio-economic Development

1. **Developing a Medical Emergency mobile application for telemedicine support in linkage with nearest Health centre District Hospital as well as State Hospital**

Funding agency: North Eastern Space Application Centre (NESAC), Shillong

Background

The use of Information and Telecommunication technology has grown rapidly due to Technology advancement worldwide. The existing health facility seeks to improve the quality of their services especially in certain region of our Country. The need for health care services is growing rapidly especially in the rural and remote areas where the doctors and nurses are unable to render their services in times of need. The existence of health facility centres like Government hospitals, private hospitals and Primary health centres (PHCs) are there to overcome various health issues of the people, but there are some rural and remote areas in the country where getting a proper treatment is a big issue. The PHCs or the clinics in small states especially like Sikkim are mostly manned by nurses and compounders (MPHW male); the doctors are able to make their visits only once in a while due to certain reasons.

Although the Government in its effort has built many PHC's or clinics but there are still some places in Sikkim that lies beyond reach. A proper healthcare service delivery especially in such rural and remote areas is insufficient, due to many reasons. One of the reasons is lack of good road network, due to heavy rainfall and landslides. Absence of PHCs in such location is another reason and also due to poorer section of people living there, who sometimes cannot afford to make their treatments at the right time.

So looking at the situation of people living in the rural and remote areas of Sikkim, and also because of the situation caused by this pandemic, there is a dire need of proper and fast health care infrastructure in rural and remote areas of our state. There is an urgent need to fill the existing gaps between the needy and their right to proper healthcare service.

Scope & Objectives

- To develop a Medical Emergency mobile application for telemedicine support in order to reduce the existing gap between the patient and needed healthcare services
- Improved awareness on healthcare
- Easy, fast and quality healthcare services at rural and remote areas of Sikkim
- Encourage people to take care of their own healthcare
- Improved access to patients

Major Objectives and Deliverables

1. To develop a Medical Emergency mobile application for telemedicine support to fill the existing gap between the patient and needed healthcare services.
2. Improved awareness on healthcare.
3. Easy, fast and quality healthcare services at rural and remote areas of Sikkim.
4. Improved access to healthcare facilities.

Brief Status

- Mapping of new spatial data pertaining to Health sector. Updation on progress.
- Updated road layer using LISS-IV (2021) and 2022 sentinel data. This layer can be used effectively for rural areas.
- A meeting was held in DST Sikkim chaired by the Secretary, regarding the development of Telemedicine app wherein the officials from Health Dept. were also present for various discussion and inputs.
- Development of app in progress.

2. Monitoring of Integrated Watershed Management Programme (IWMP) watersheds using Geospatial technologie

Funding Agency: National Remote Sensing Centre, ISRO, Hyderabad

Introduction

IWMP is a major project taken up by NESAC for entire North East India for the Department of Land Resources. The main objective of this project is to monitor and evaluate IWMP watersheds using Bhuvan Application (Srishti) involving high resolution IRS satellite. Watershed management is one of the key interventions for improving water resources and conserving soil in the rain fed areas of the country. Space technology with high spatial and temporal resolution satellite data is envisaged for effectively monitoring and evaluating activities under watershed management.

Objectives:

- Correction of micro watershed / project boundaries.
- Land cover change analysis for watersheds using digital techniques and generating LULC maps for all the IWMP sites accordingly.
- Change assessment with cross-matrix table, map compositions and vector layer showing locations with specific change.
- Analysis of Drishti photographs/points IWMP project wise through Bhuvan portal.
- Base layer containing roads, settlements, water bodies and drainage.
- Preparation of project report.

Work Completed:

Under this Integrated Watershed Management Programme (IWMP) activities undertaken are Afforestation, Agriculture, Capacity Building, Check dams, Checks and Plugs, Percolation tanks, Entry point activities and others. For these activities land use and land cover (LULC) changes was detected and these changes were depicted in the Matrix table for specific monitoring periods. There are total of 11 (eleven) IWMP sites for Sikkim under various Batch (1 to 5). The monitoring period is different for different batch. After the monitoring was done various conclusions had to be drawn from the LULC changes and the Matrix table.

East IWMP-I/ 2009-10:

The total geographical area of the project is **18772.62 ha**. It comprises of 17 micro watersheds. In the project area, 94 Drishti points were uploaded in the Bhuvan application showing agriculture (15), check dams (30), checks & plugs (15) and others (34). Analysis for East IWMP-I/2009-10 is done for 2009-10(T0), 2013-14(T1), 2014-15(T2), and 2015-16(T3) periods. Changes in the land use and land cover of the study area for the time period from T0 (2009-10) – T2 (2014-15) were analyzed in terms of Agriculture, Built up, Forest, Wastelands, Waterbodies, Grass/Grazing Land and Snow/Glacial .

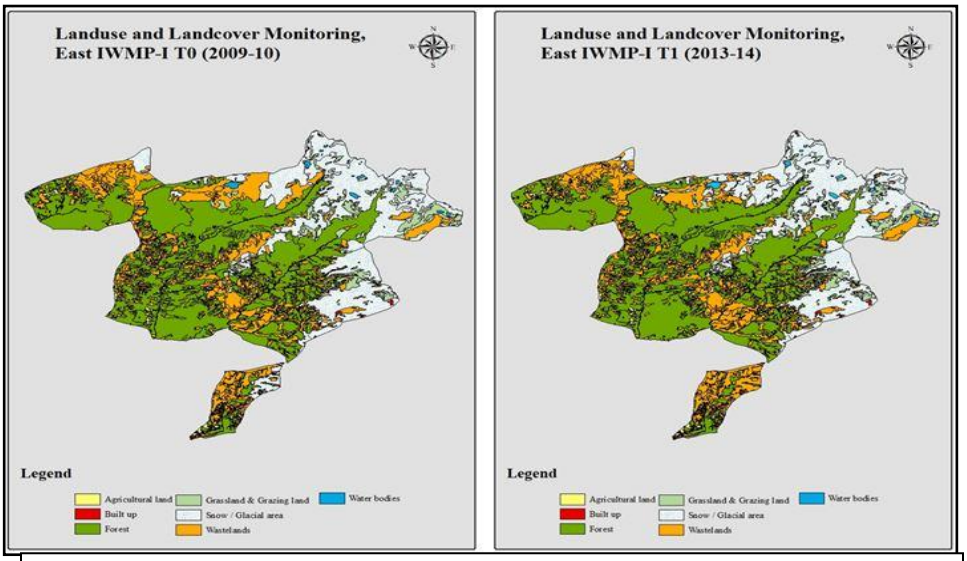


Fig 19: Comparative assessment of LULC for T0 (2009-10) and T1 (2013-14)

Monitoring Period T0 (2009-10)	Monitoring Period T1 (2013-14)							
Land Cover Classes	Agricultural land	Built up	Forest	Grassland & Grazing land	Snow / Glacial area	Wastelands	Water bodies	Grand Total
Agricultural land	95.37		3.67					99.03
Built up		76.30						76.30
Forest			8171.17		12.08	266.27		8449.52
Grassland & Grazing land				764.43	76.28	4.25		844.95
Snow / Glacial area			25.35	78.54	4013.87	336.97		4454.73
Wastelands			94.75		315.13	4225.97		4651.29
Water bodies					4.37		192.42	196.79
Grand Total	95.37	76.30	8294.93	842.97	4421.72	4833.46	192.42	18772.62

Fig 20: Table showing change matrix depicting Land cover transitions during study

Same type of work was done for the other eleven IWMP Sites for different year and different districts. In East District of Sikkim during the year 2009-2010, agriculture has decreased during the period T0 to T1, Built up has remained same over the period, Forest has decreased and portion of it has been converted to wasteland and portion covered by snow and Grass and grazing land had decreased during T0 to T1 but has increased again during T1 to T2. During 2011-12 Agriculture has decreased during both the monitoring periods. Some areas under agriculture have turned into wasteland and some to forest land due to plantation activities, Built-up has increased in a small portion, Forest has increased in both the monitoring period which is a positive change and Water bodies have shown no change. In West District of Sikkim during the year 2010-2011 Wasteland has decreased from T0 (2010-11) to T2 (2015-16) which is a positive change, Forest has also shown increase during the entire monitoring period i.e, from T0 to T2.

Agriculture has increased during the first phase of monitoring i.e, from T0 to T1 however it has slightly decreased in the second phase i.e, from T1 to T2 and Built up has overall increased and water-bodies has remained same over the period. During 2012-2013 Wasteland has increased, Water bodies and built up has shown no change and Agriculture and forestland has decreased during first few monitoring cycles however has increased during later monitoring period.

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

Funding Agency: National Remote Sensing Centre, ISRO, Hyderabad

This project was developed in order to help Panchayati Raj Institutions, the space based information support for decentralized Planning (SISDP) Phase I project was formulated by NRSAC and was implemented through the State Remote Sensing Application Centres in the country to provide basic planning inputs derived from space technology. The major deliverables viz. High Resolution Satellite Image (HRSI) of 2.5 m resolution for the entire country and thematic maps at 1:10000 scale. These products were generated for the first time in the country and are extremely useful in meeting the requirements for the developmental planning, implementation and monitoring of activities at panchayat level.

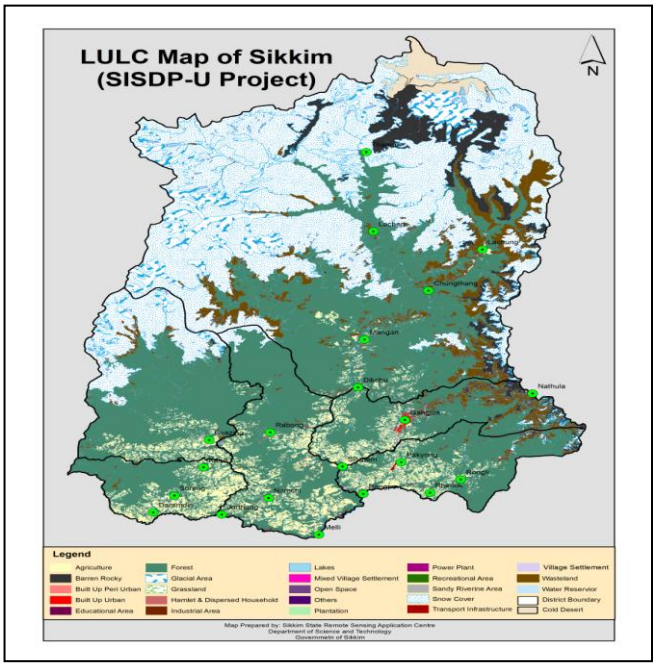
The major activities undertaken in EPRIS Project are (i) Capacity building of stake holders, (ii) Asset mapping, (iii) Activity planning in approx 10% in gram panchayats in the country covering 57 districts.

The SISDP Update is aimed at "Generation of value added geospatial products and services to meet Gram Panchayat Development Planning (GPDP) requirements by using latest high resolution satellite data and updated thematic database through user friendly web GIS portal.

Objectives

- Generation of latest high resolution satellite image base
- updating of thematic database
- development of Web GIS portal, Bhuvan Panchayat Version 3.0
- Generation of geospatial products and services
- Capacity building and outreach

Work Completed:



4. Deployment of Early Warning System and hydrodynamic modelling for Floods using Space-Based Technology in 2 Potentially Vulnerable Glacial Lakes in Sikkim

Funding Agency:North Eastern Space Applications Centre (NESAC), Shillong

Introduction:

The disaster related to the glaciers has become frequent in the Himalaya during recent decades. The Kedarnath disaster in Central Himalaya, India, is the recent example of GLOF event, which claimed lives of many people and caused massive damages of infrastructure and property due to outbursts of Chorabari glacier in Uttarakhand (Dobhal et al. 2013; Allen et al. 2015). Sikkim Himalaya consists of 14 potentially dangerous glacial lakes. There are many developmental projects like hydro-powers in the downstream of glacial lakes which are in potential threat due to floods. Many hydropower plants are already commissioned and operational since long along Teesta and Rangit rivers. Therefore, study and identification of potentially vulnerable glacial lakes is prime importance. However, it is a challenging task due to the limits imposed by high altitudes, the remoteness of locations and short accessible period of the extreme location. Therefore, the use of high resolution satellite based time series data allows us to identify and prioritize the lake in terms of their expansion over the time. Further, installation of Early warning system in the glacial lakes can be extremely important to save the human lives, infrastructure and property downstream. It is expected that effective and sustainable mitigation strategies could be developed from the present project which are significant inputs for glacial lake management plan in Sikkim Himalaya.

Objectives:

1. To identify the potential glacial lakes prone to flooding and prioritize the most vulnerable glacial lakes
2. To deploy the early warning system in most critical lakes and transmission of real-time data using Space Technology
3. To provide inputs and recommendations for adaptation and mitigation for GLOF hazards in Sikkim and assist the government, policymakers and planners in making strategies and framing specific disaster mitigation plans to address possible risks from GLOFs in the future.

Work Done:

- ToR signed. Budget Sanctioned and 28% budget released in first week of Jan 2023 as 1st installment
- Internal meetings have been conducted to discuss how to achieve the targets and for the procurement of Early warning sensors
- The EWS sensors have been finalized for the procurement Mapping of glacial lakes using recent satellite data is in progress
- Bathymetric survey of glacial lake is planned for September 2023 to measure the lake volume
- Tentative Date of Completion: June 2025

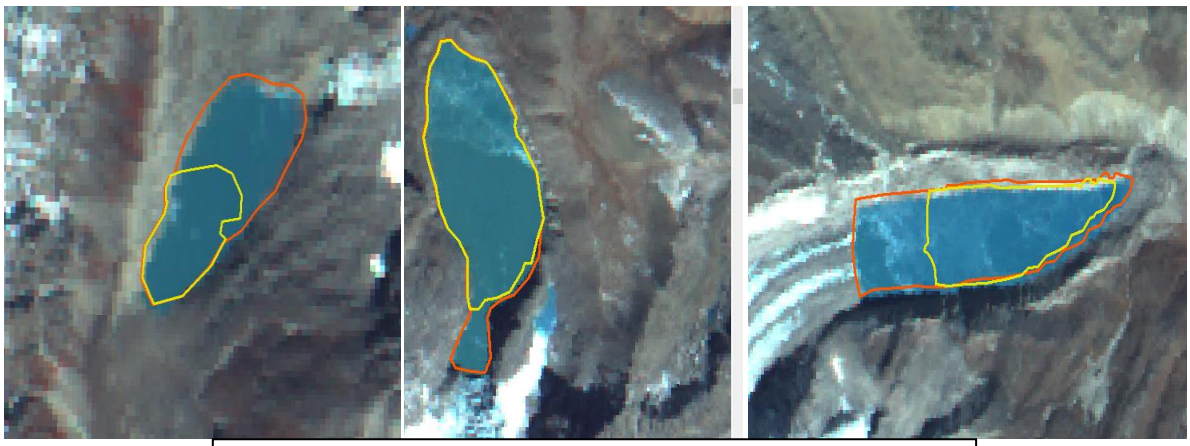


Fig 23: Potentially Vulnerable Glacial Lakes in Sikkim

5. Application of Space Technology for Agricultural Assessment in NER' (ASAAN) Project for state of Sikkim.

Funding Agency:North Eastern Space Applications Centre (NESAC), Shillong

Introduction :Agriculture, the backbone of India contribute 18.4% of total GDP (National Statistical Office, M/o Statistics & PI, 2019-20) is the major economy driver in the North Eastern Region. About three-fourths of the population depends on agriculture and allied activities for their livelihood. Rice stands first in both area and production and contributes about 89% of total food grain production. Majority of rice is cultivated in lowlands, with some rice belts located on hill slopes (jhum). Another significant cereal crop in NER is maize, which ranks second in terms of both area and production and primarily planted on hill slopes or in small patches. Apart from these two crops, wheat, potato, small millets, oilseeds, pulses, fruits, vegetables and other cash crops are also grown by the NE people. Major problem incurred in agriculture sector of NER is reliable crop acreage estimation. The conventional method of estimating area is based on mostly eye estimate of the field level workers and village head man that is lack of scientific approach resulting in inaccurate estimates. Further, inaccessibility and vagaries in landscaping put forth added problems. Hence there is utmost requirement of technology intervention for sustainable development of agriculture in NER to maintain food and nutritional security. In this direction, geospatial techniques play a crucial role in acreage estimation and paved away the conventional laborious field based surveys by keeping eye on the sky.

Expected Output:

1) Spatial maps showing the acreage of selected crops in Sikkim.
2) Visualization of reports and statistics of crop acreage with other details in the ASAAN dashboard system for Sikkim state.

Work Completed:

Total of 205 Ground truthing point collection completed for maze and paddy in all six district of Sikkim.

6. Glacier Studies of Basins in Sikkim and Bhutan region under Brahmaputra Basin.

Funding Agency:Space Applications Centre, ISRO, Ahmedabad

Introduction: Glacier are important dynamic part of the environment. It is the largest storage of fresh water over the earth's surface. As a first step of this understanding, a systematic inventory of Himalayan glacier is required for overall development of the region. Glacier inventory is particularly required for a variety of applications such as;

(i). Planning and operations of mini and micro hydroelectric power station.
(ii). Disaster warning.
(iii). Estimation of irrigation potential.

Beside these practical applications glaciers provides historical records of past climate and this can be used as valuable clues for future climatic changes. Remote sensing techniques by interpreting air borne or space borne imageries have become popular as a substitute of this. Present day's optical satellite data are mostly used for either generation and updating of glacial inventories. Delineation of glacial boundaries based on spectral information from optical images often suffers from misinterpretation of debris covered ice at the ablation area with surrounded rocks and glacial debris.

Objectives: The main objective is systematic inventory of the glacier occurring in the Sikkim and Bhutan region under Brahmaputra basins. The study will result in following;

Preparation of glacier inventory maps at 1:50000 scale with attributes, Preparation of glacier inventory data sheet. Preparation of glacier change detection at large scale (1:10000). Preparation of Maps of glacier lakes under GOLF scenarios. To include exact Geo-referencing of multi-date remote sensing data, mapping of outlines, mean altitude of snowline, mapping of pro-glacial lakes and moraine-dammed lakes, drainage from glacier and major rivers, major locations of villages amend towns will be integrated as a part of the database of Glacier inventory.

Work Completed:

1) Delineation of Glaciers, Glacial Lakes & Snow Cover. Completed

Satellite Data (image) - LISS III

Year – 2005-06

Resolution – 1:50,000

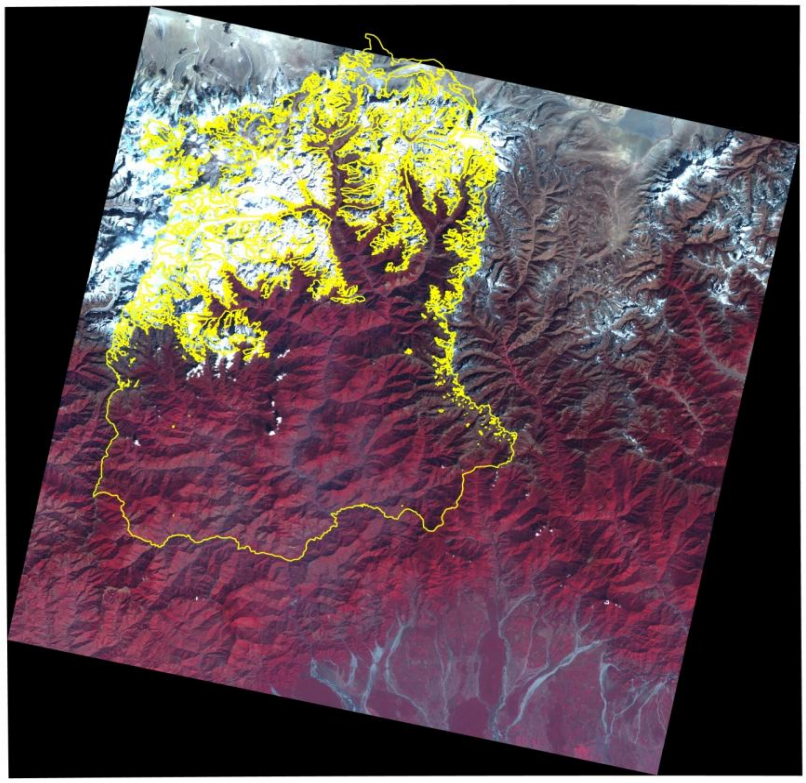


Fig 25: Digitization of Glaciers, Glacier Lakes& Snow cover area using LISS III image, 2005-06

V. Science Communication & Popularization

1. **Vigyan Sarvatra Pujyate**: The Sikkim State Council of Science & Technology -Sikkim in collaboration with VIGYAN PRASAR, an autonomous organization under DST, GOI organised the week longprogrammes under AZADI KA AMRIT MAHOTSAV'S -VIGYAN SARVATRA PUJYATE –SCoPE (Science Communication Popularization & its Extension)- Science Festival from **February 22nd to 28th 2022.** The programme comprises of various activities like Poster Display/QUIZ competition/Video Screening/Panting Competition/Lecture & Science Awareness at different districts.

2. **Workshop on Innovation Hub Activities:**
Two –day workshop on Innovation Hub activities was held at Innovation hub of Sikkim Science Centre on 26/04/2022 and 27/04/2022. Resource persons from SMIT Rongpo and Kalimpong Science Centre were engaged to execute the workshop on activities viz, basic introduction on robotics, hands on activities on electrical and electronics circuit designing, night sky show etc.

3. **Celebration of International Museum Day:**
International Museum Day was observed at Sikkim Science Centre on 18/05/2022. Public and students from surrounding areas of the centre were facilitated to explore the different facilities. The enjoyed the planetarium shows.

4. **Career Counselling and Motivational Talks:**
A programme on career counselling and motivational talks to students was conducted from 11/08/2022 onwards. Students from different govt. schools and private schools were given counselling and motivational talks. Emphasis was given on career opportunities in STEM.


5. **Awareness Program on Science Centre and Introduction about facilities available.**
Besides regular up-dation of routine activities of Sikkim Science Centre in whatsapp group and centre's face book Page, a series of awareness programs on science centre and introduction about facilities were held in the month of September -2022 duly inviting general public and students at the centre itself. The main motive was to popularise the centre among common people.


6. Celebration of Children's' Day-2022.

In order to commemorate the birth anniversary of India's first prime minister, Sikkim science centre celebrated children's day on 14/11/2022. General public and students were informed about the event through social media and facilitated them to explore the centre without paying entry fee on this auspicious occasion.


7. Celebration of National Science Day
(Essay Writing, Painting and Quiz Competition) on "Global Science for Global Wellbeing"

Sikkim Science Centre celebrated the National Science Day to mark the discovery of Raman Effect by Indian Physicist Sir. C V Raman on 28/02/2022. Different events were conducted viz; district and state level quiz completion, essay writing competition, painting competition, elocution on the theme of the day etc.

8. Activities on State Level National mathematics day-2022 to 2023.

Different activities on eve of national science day were held in the month of January, February and March-2023 at different schools and colleges of Sikkim. State level program was held at Sikkim Science Centre from 28/02/2023 aiming motivating students to create interest in learning mathematics and reduce phobia thereof.

9. National Mathematics Day 2023

The National Mathematics Day was conducted in all the six districts of Sikkim in various schools and colleges. The programme was organised by Sikkim State Council of Science and Technology catalysed by National Council for Science and Technology Communication, Department of Science and Technology, Government of India, New Delhi. The aim of the programme was to make people aware of the importance of mathematics and advancements and developments made in the field. Since 2012, India's National Mathematics Day is recognized on December 22 annually with numerous educational events held at schools and universities throughout the country.

It was organised as a of series of programme related to celebration of NATIONAL MATHEMATICS DAY (NMD) 2022 throughout the state involving the school children to create awareness in Mathematics and build interest in Mathematics. The different programmes in different venues involved awareness, interactive session, planned lectures, Olympiads, quizzes etc.

The programme was conducted with assistance from the Mathematical Society of Sikkim which comprise of Assistant Professors, Associate Professors, Ph. D. Candidates and Post Graduate students from the Maths Department of Various Colleges and Universities in Sikkim across 12 different centres across the six districts of the state. The members of the said society are as follows:

The primary targets for the programme were students of senior secondary and secondary schools within the above-mentioned districts.

On the occasion of National mathematics Day, an awareness programme was organized at Renock Govt. College, Pakyong District.

Tashiding SSS observes National Mathematics Day

SE Report

GANGTOK, March 3: On the occasion of National Mathematics Day, an awareness programme was organized at Tashiding Senior Secondary School, West Sikkim today.

The programme was organised by Sikkim State Council of Science & Technology (SSCS&T) and supported by National Council for Science and Technology Communication, Department of Science & Technology, Government of India.

The Tashiding SSS principal was present as the chief guest of the programme, informs a press release.

The resource persons for the event were NBBGC, Tadong assistant professor Kshittiz Chettri and officials from SSCS&T, Science & Technology department.

The presentation to promote and familiarize the concepts of mathematics among school students and scholars was presented.

SSCS&T research assistant Prabhakar Gurung gave an inaugural speech followed

by activities like planned lectures, olympiads and counselling session.

The programme was attended by more than 100 students and teachers from 10 different schools of Geyzing district.

The programme concluded with an interactive session and test exam for students followed by a vote of thanks from SSCS&T research assistant Binita Shrestha, the release mentions.

On the occasion of National mathematics Day, an awareness programme was organized at Tashiding Sr. Sec. School Gyalshing District.

Awareness, Olympiads mark National Mathematics Day at Darap SSS

SE Report

GANGTOK, March 4: Darap Senior Secondary School in Geyzing district observed National Mathematics Day today.

An awareness programme was organized in the school by Sikkim State Council of Science and Technology (SSCS&T) supported by National Council for Science and Technology Communication, Department of Science and Technology, Government of India.

The Darap SSS principal was the chief guest of the day. The resource persons for the programme were Kshittiz Chettri, assistant professor from NBBGC, Tadong and his team along with SSCS&T and officials from the Science & Technology department.

A presentation to promote and familiarize the concepts of mathematics among school students and scholars was presented.

Earlier an inaugural speech was given by SSCS&T research assistant Prabhakar Gurung.

The programme also witnessed presentations and activities on planned lectures, Olympiads and counselling session.

The programme was attended by more than 200 students and teachers from 10 different schools of the district.

The programme concluded with an interactive session and test exam for students followed by a vote of thanks by SSCS&T research assistant Binita Shrestha, the release mentions.

10. Sikkim Science Centre

The Sikkim Science Centre, located in Marchak, Gangtok, houses some interesting galleries such as the Unique Humankind gallery, Taramandal, Fun Science gallery, Gallery for Students' Activities and the science park.

In addition to these existing facilities, recently new facilities were inaugurated by Hon'ble Chief Minister of Sikkim on 20th November 2020. The new facilities include the 8m dia digital planetarium, 3D- Theatre, Biodiversity Gallery and Innovation Hub. The planetarium helps students grasp abstract astronomical concepts and can spark enjoyment and interests in science and offers magnetic experience every time with our Astronomy, shows unfolding their marvels and enhancing visitors' awareness and understanding of astronomy, not esoteric in nature, rather the kind one can enjoy in one's own backyard. Visitors enjoy a fast-paced, entertaining and immersive film with stunning 3D effects in a specially designed theatre meant to heighten the effect. Sikkim being the one of the richest biodiversity hotspot, the center houses a newly inaugurated Biodiversity gallery which displays the unique flora and fauna of Sikkim.

VARIOUS ACTIVITIES TAKEN UP BY SIKKIM SCIENCE CENTRE SINCE 2022-23

10th March 2023: On the occasion of National mathematics Day, an awareness programme was organized at Enchey Govt. School, Enchey, Gangtok District.

14th March 2023: On the occasion of National mathematics Day, an awareness programme was organized at Mangan Girls Senior Secondary School, Mangan, North Sikkim.

15h March 2023: On the occasion of National mathematics Day, an awareness programme was organized at Sikkim Manipal Institute of Technology, Majitar.

16h March 2023: On the occasion of National mathematics Day, an awareness programme was organized at Rangpo Bazar Senior Secondary School, East Sikkim.

17th March 2023: On the occasion of National mathematics Day, an awareness programme was organized at Soreng Sr. Sec. School,Soreng District.

11. Climate Change Awareness Programmes in GPU and Schools

Awareness Programme on climate change at the Gram Panchayat Units and Educational Institutes:

Community awareness and sensitization of public at the grass root level is one of the main objectives of Sikkim State Climate Change Cell under National Mission for Sustaining the Himalayan Ecosystem (NMSHE). In this regard awareness programmes were conducted at nine Gram Panchayat Units (GPUs) and nine educational institutes across Sikkim. GPUs were chosen for the climate change sensitization programme as Gram Panchayats are the basic unit of governance in a decentralized system acting as a bridge between the public and the different departments. A total of **520 people** participated in the events. Block Development Officers, Panchayat Presidents, Ward Panchayat members, students, teachers and general public graced the occasions with their presence. The nine GPUs that were selected for the awareness drive were viz Lingdong,Lingdok, Riwa-Machong, Tangzi- Bikmat, Upper Samdong, MikholaSingithang, Regu BAC,Chakung, Chungthang. The awareness programme organized in the different educational institutes are; Makha Sr. Sec. School, Melli Bazaar Sr. Sec. Schoo, Yuksom Sr. Sec. School, Soreng Sr. Sec. School, Mangan Sr. Sec. School, Khamdong Sr. Sec. School, Chujachen Sr. Sec. School, Nar Bahadur Bhandari Govt. College, Yangang Sr. Sec. School.

<u>Topics covered during the event were:</u>

1) General concepts on climate and weather
2) Initiatives taken at international, national and state level towards fighting climate change with special focus on what Panchayats could do to fight climate change.
3) Different activities undertaken by state climate change cell under NMSHE.
4) Climate Change and its effects on health.

12. Bioinformatics Education Programme conducted

Bioinformatics Centre, Biotechnology Division, Sikkim State Council of Science & Technology, Department of Science & Technology, Government of Sikkim has successfully conducted Bioinformatics Education Programme (BEP) covering five senior secondary schools of the state. The five senior secondary schools where the BEP programe was conducted are Mamring Senior Secondary School, Pakyong, Rhenock Senior Secondary School, East Sikkim, Hee Gyathang Senior Secondary School, Dzongu, Tashiding Senior Secondary School, West Sikkim and Soreng Senior Secondary School, Soreng District.

13. One day awareness programme on intellectual property rights

One day awareness programme on intellectual property rights was conducted in collaboration with MSME, Gangtok at the conference hall, Vigyan Bhawan.

VI. STATE POLICIES

1. **State Action Plan on Climate Change-II**

Funding Agency: Ministry of Environment, Forest & Climate Change, Govt. of India

Introduction:

Subsequent to the introduction of National Action Plan on Climate Change (NAPCC) in 2008, State Governments were also encouraged to prepare their own State Action Plan on Climate Change (SAPCC) consistent with strategies in the NAPCC. Sikkim has formulated the State Action Plan on Climate Change (SAPCC)in 2014. The national and international climate action and policy landscape have evolved since the formulation of SAPCCs. Paris Agreement has been agreed upon in the year 2015 to limit global mean temperature within 2 degree and working towards to limit at 1.5 degree. India has submitted its Nationally Determined Contributions (NDC) goals for post-2020 with eight different goals including three major quantifiable goals related to emission reduction, renewable energy and forestry. Over the years, India has pursued major domestic policies and schemes in areas of climate change mitigation and adaptation actions, particularly in the fields of clean and renewable energy, enhancement of energy efficiency, development of less carbon-intensive and resilient urban development, promotion of waste to wealth, electric vehicles, etc. Based on the study, Sikkim State Action Plan on Climate Change (SAPCC) was formulated with strategies identified to address the challenge faced by the state. The key areas of concern for Sikkim were identified as;

1. Water.
2. Agriculture, Horticulture and Livestock.
3. Forest, Wildlife and Eco-Tourism.
4. Promotion of Energy Efficiency.
5. Urban and Rural Habitats and Communities

Objectives:

1. The main objective is to provide the implementation for up gradation of SAPCC in the presence of stakeholders involved.
2. The program would also emphasize on the revision of present work on climate change adaptation program.
3. Highlighting the methodology for Vulnerability Assessment.
4. Making future adaptation program and policy for State on climate change.

Work completed:

Under the project SAPCC II, the two important chapters/ components of revision of SAPCC have been carried out. This includes the Vulnerability Assessment and Climate Projection. Further, sectoral meetings have been carried out with different line departments to include their key strategies and actions.

A. Vulnerability Assessment (VA): VA is the first step towards the adaptation planning. It helps measure the vulnerability across different sectors for climate change and adaption planning. It is envisaged that the VA report will assist the state climate change cell to upgrade and revise the SAPCC.

The VA was done at the district level, considering all the important sectors viz. agriculture, socioeconomic, disaster, forest, health and gender. The assessment report showed varied vulnerability for different for all the four district of Sikkim, implying unique interventions in different sectors and districts.

B. Climate Projection

Climate projection was primarily conducted to understand the region's past and present climate and to assess how changes in global societal, demographical, and economic scenarios are going to impact the statistics of essential climate variables (e.g., temperature and precipitation).

The detailed analysis of past and future climate change trends, including changes in temperature and precipitation, discussing specific impacts, climate risks, and socioeconomic consequences have been carried out. The analysis was mainly done based on the topographical and climatological similarities of the state.

The analysis overall projected a slight increase in different temperature variables however the annual rainfall showed high variability.

C. Sectoral meeting

Sectoral meeting was held under SAPCC II with nine different sectors or department namely Tourism, Disaster, Water, Agriculture, Energy, Socioeconomic, Health, Urban & Transport and Forest & Diversity w.e.f. 3rd April 2023 to 26th may 2023. The report for SAPCC is being prepared. Important point highlighted during the meeting were as follows:

1) **Tourism Sector**

   Officials and delegates related to tourism sector (Tourism Deptt., TAAS and ECOSS) were invited for the meeting. The points of the discussions were Swadesh Darshan, Utilisation of DONER fund for capacity building, utilisation of pollution free and nature friendly tourism, Homestays with a purpose- Proper guidelines for eco- tourism to be provided with proper definitions of terms like homestays, Eco- tourism zones to be declared strictly, High value low impact tourism. Since tourism sector is driven by private players, so policy should involve all the stakeholders, Promotion of sustainable tourism as per the definition provided by United Nations World Tourist Organization (UNWTO), Provide impetus to travel agencies of Sikkim, Electric bus service to be introduced to control air pollution.

2) **Disaster Sector**

   Officials and delegates from SSDMA, Civil Society, IMD, Mines & Geology and SDC were invited for the meeting. The highlights of the meeting were Disaster to be taken up as a priority sector by all departments, Guidelines need to be properly analysed and implemented by all the departments, Proper study of waste generation in Sikkim, Landslide Risk Mitigation Scheme, early warning system for landslides, GPU level landslide hazard zonation map, Focus on proper adaptation strategies to climate induced disaster and generating awareness among the policy makers regarding the effects of climate change, North Eastern Space Applications Centre agreed to provide high resolution data (water), Advanced technical training to be provided across all departmental sectors, Analysis of different issues arising owing to the construction of tunnels, Highest increase in temperature observed in Sikkim, based on observed data increase in temperature is tenfold, Analysis of pre monsoon and post monsoon rainfall.

3) **Water Sector**

   Officials and delegates from different departments/ institute/ NGO were invited for the meeting. The highlights of the meeting were Based on available IMD data, present and future climate change projection was shown; Future projection- 1.5^0C rise in average temperature in East Sikkim, Roof top water harvesting, hybrid system of water harvesting and recycling of grey and black water, storage dam, and storage of water in household level, As per LPCD (Liter per

Citizen per day) the pipeline water consumption is very less for the state therefore rain water/ roof top water harvesting system is ideal for the state, Biological measure for conservation to be adapted, Cascading tank storage system, use of advanced engineering technology, Visit states (Tamil Nadu) that are fed by seasonal rain to gain the technical knowledge/ input for water security, rain water harvesting techniques that are eco-friendly in nature, Ridges are source of water for which clear policy should be formulated to keep the ridges intact, Fodder budgeting; during lean season there is water crisis in rural area so the villagers go to forest for harvesting fodder which disturbs the ecosystem, eco-friendly path in Thailand where only two wheelers run for emergency. No pitched road which helps in water percolation and ground water recharge, Irrigation Department is focusing to bring State Water Policy, Village level water security plan, people participatory plan, Bottom top approach. Climate sessions with Gram Sabha, Identify historical landslide area as they are always prone to landslide which disturbs the water source of that area, Public awareness on Conservation, Recycle, Reuse, Reduce (CRRR) of water, PMGSY should study the area before laying the road so that the sensitive zone and water recharge area will not be disturbed.

4) **Agriculture Sector**

Officials and delegates from Horticulture Department, Agriculture Department, Animal Husbandry Department, Food and Public Distribution Department and Sikkim University were invited for the meeting. The highlights of the meeting were Need for robust research centres focusing on studies on cardamom in Sikkim, Need for data on intensity of rainfall as it is very important keeping in mind the changing climatic concerns, Undergoing trial of solar based drip irrigation in Soreng district, Water tanks provided under Pradhan Mantri Krishi Sinchayee being used not for agricultural processes but for drinking in certain areas of Sikkim, Promotion of seed banks and germplasm conservation, Feasibility of introducing custard beans in Sikkim, Strict application of land use policy in Sikkim in order to curb the diversification of agricultural land for other purposes, Infrastructural development and enhancement of facilities to make winter chilling of apple successful in Sikkim, Smaller units to be considered for agricultural zonation owing to the variations found across different GPUs and wards, Altitudinal planning proposed. Planning to be different for different altitudes, Suggestion for promotion of local cuisines in the hotel. At least 20% of the items in hotel menu to be made from local products. Incentivize hotels to cook local available crops in different ways, Proposal to lease out fodder land and plant fodder grasses in forest areas close to human settlement by Forest Department, Weed harvesting in order to ensure its use as manure, Milk cooling facilities to be provided at farmer's level, Currently the food wastage is minimal (<5%), Successful introduction of strawberry, kiwi and dragon fruit in the state of Sikkim, Mission for integrated development of horticulture.

5) **Energy Sector**

Officials and delegates from Power Department and SREDA were invited for the meeting. The highlights of the meeting were Energy Conservation Act 2001: It was launched on 2009 in Sikkim. Under this Act the LED village campaign on district level was carried out. **5MW of energy saved,** Energy Clubs: 150 schools were provided with funds, 14th Dec. celebrated as Energy Conservation Day, State Energy Conservation Fund: Bureau of Energy Efficiency (BEE): Awareness programmes were conducted on energy conservation where the Govt. employee can avail interest free loan upto 1 lakh from SISCO bank to buy energy efficient electronic appliances, Energy Building Act has been proposed, E-vehicle Policy should be implemented in the state so that the E-vehicles can be registered, Solar based Infrastructure regarding E-vehicle charging stations can be developed in the state, Policies to be developed in a way that only E-vehicles are to be permitted at higher altitude tourism spots in Sikkim, Space heating based on PCM (Phase Change Material) could be popularized.

6) **Socio-economic Sector**

Officials and delegates from Rural Development Department, DESME, School Education Department and Lecturer from CCCT, Chisopani were invited for the meeting. The highlights of the meeting were MGNREGA: towards climate change adaptation and mitigation, Solar pumping of water from lower elevation areas to upper elevation areas, State rural Livelihood

mission: Upliftment of women - SHGs, Inspire Sikkim: Selection and upgradation of best SHGs into Mirco enterprises which is funded by the World Bank, Proper planning to be done ahead of any constructions so as to reduce damages on socioeconomic sector, Population migration from rural to urban areas to be controlled, Climate Smart Village proposal, Green GDP to be calculated based on climate change scenarios, Prohibition of Single use plastics in school surroundings, Waste Segregation in schools, Smagrah Siksha: setting up of mid-day meal kitchen garden in school premises, Rainwater harvesting system installed in various schools, Sanitary napkins distribution in Schools in collaboration with NGO Sachi Saheli where 134 schools were provided with pad vending machines by NHPC. Awareness on proper disposal of sanitary napkins by NGO Sachi Saheli in school, Setting up of herbal gardens in schools, Class per week to be taken on climate change, Proper burial sites for pet animals to be provided in town, solar incineration for animals could be setup, Housing design can be modified (e.g. Courtyard effect followed in Kerala), Indira Paryavaran Bhawan: Green building.

7) **Health Sector**

Officials and delegates from Department of Community Medicine, SMIMS, Health Department and Lecturer from CCCT, Chisopani were invited for the meeting. The highlights of the meeting were Building new Health Infrastructure on the concept of "Green Building", Renovating the existing old Health Infrastructure to met up with the concept of "Green Building", Initiating and formulation of "Urban Byelaws" for future buildings and infrastructure adhering to Climate Change Policies, Concept of Climate Change Resilient Fund, Creating awareness on issues of Indoor and Outdoor air pollution, Introducing a separate Research and Study Unit complying with Need Based Research for the trending issues of Climate Change at Health department, Constructing awareness and sensitization through social media platform and with IEC material targeting the common masses, Application of concept on "Decentralization" ,Notion on Water ATM, Adhering to LIFE Mission and healthy lifestyles, Research Based funding through Pai Foundation of SMIMS, Vector borne Disease zonation and geo-tagging concept

8) **Urban & Transport Sector**

Officials and delegates from Gangtok Smart City Development Limited, Roads and Bridges, Buildings and Housing and Transport Department were invited for the meeting. The highlights of the meeting were Replacement of bricks by ACC blocks which are more climate friendly, Carbon credit monetization in the state of Sikkim like the one being done in Indore, Feasibility of use of plastic and rubber components in road construction, Introduction of micro bus in Gangtok to address the traffic issue, Improvement of entire landscape to address the issue of water logging of roads in major towns of Sikkim especially Gangtok, Shift to BS VI vehicles from BS IV, Strict implementation of National Automobile Scrappage Policy according to which governmental commercial vehicles more than 15 years old and private vehicles which are over 20 years old will be scrapped. As of now **923 old vehicles** are still operating in Sikkim, Registration of EVs (Electronic Vehicle) currently in the final stage, Cash incentives to be provided to popularize the use of EVs in Sikkim, Popularisation of Vahan app in Sikkim, Popularisation of help line number 108 which is predominantly an emergency response system, primarily designed to attend to patients of critical care, trauma and accident victims etc, Bus services can be provided for Govt. officials. Timing of the bus services can be in accordance to the office timing.

9) **Forest & Biodiversity Sector**

Officials and delegates from Forest and Environment Department, G B Pant Institute, ATREE, Sikkim University, SPCB and The Mountaineering institute were invited for the meeting. The highlights of the meeting were Vulnerability assessment focusing only on Forest sector could be carried out for the better understanding of exact vulnerable areas so as to propose precise strategies for the mitigation and adaptation. The use of recent data for the analysis should be done. The pattern of decadal increase of temperature from 1970 onwards should be studied. The diurnal temperature should be studied, Restoration can be carried out. The growth of Invasive species should be controlled. Range land adaptation of pastures should be carried out. The new concept of human-wildlife co-existing should be popularized instead of human-wildlife conflict

management. Research pertaining to climate change in high altitude areas is to be taken up, winter droughts data should be incorporated, Peoples' perception should be considered while preparing SAPCC, Regulate tourism in the state. Impose Inner Line Permit. Mitigation of perennial water sources should be carried out, Research on climate change impact on high altitude areas should be carried out. Local phenomenon should be studied. Data of duration of rainfall should be incorporated. Vulnerability assessment should be done as per the elevation.

Fig : Sectoral meeting with Agriculture

Fig : Sectoral meeting with Tourism sector

2. Geo Tagging and Monitoring of NEC funded Projects/schemes in NE region using Geospatial Technology and Tools

Funding Agency: North Eastern Space Applications Centre (NESAC), Shillong

Introduction:

The North Eastern Council (NEC), Government of India, Shillong is the nodal agency for the economic and social development of the North Eastern Region which consists of eight states of Arunachal Pradesh, Assam, Mizoram, Manipur, Meghalaya, Nagaland, Sikkim and Tripura. Being a regional planning body under Government of India, NEC has been playing a vital role for formulating sector wise outline of the development plans and project with a view to accelerating the pace of development with adequate funding provision to the state departments and other Central agencies.

Objectives:

Geotagging of existing projects sites in NE region using smart phone and GAGAN dongles in quarterly intervals as per the directive of NESAC. To carry out unmanned aerial vehicle (UAV) survey in certain project sites on case to case basis and to provide support and coordination during training and outreach phases on various version of mobile and dashboard applications developed by NESAC.

Work Completed:

The work was done using NGMA NEC GEOMONITORING APP developed by NESAC. Out of 78 project location site uploaded in the app 73 has been approved and out of 26 projects assigned 25 has been approved.

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

Funding Agency: Space Applications Centre ISRO, Ahmedabad

Introduction:

National Wetland Inventory and Assessment (NWIA), is a remote sensing based project, which catalogues wetland of India. The project was primarily started with the increasing importance of wetlands, for sustainable development. Our department, the Department of Science and Technology, Govt. of Sikkim, handles the NWIA project for Sikkim, at the behest of the Space

Application Centre (SAC), with the instruction from the Ministry of Environment, Forests & Climate Change, Govt. of India.

Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by water (www. ramsarg.site).

Under the text of the Convention of Wetlands, Ramsar, 1971 (Article 1.1), wetlands are defined as: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters". Wetlands are globally important for survival of human and other living beings. They offer plethora of ecosystem services with countless benefits. The economic and biodiversity value of wetlands far outweighs many terrestrial ecosystems.

The Himalayas, with its unique topography and climatic regimes, support diverse wetland habitats across a range of altitudes. However, like other wetlands, the Himalayan wetlands also face various threats.

They are increasingly being threatened by rapid urbanization, pollution, developmental interventions, unsustainable management practices and encroachment. Climate change is an emerging issue affecting wetland ecosystems significantly (Erwin 2009). The rapid degradation of wetlands directly and indirectly impacts the health and welfare of resident communities (MEA 2005).

Wetland inventory can be used widely used in developmental activities that require environmental clearance.

Objective:

National level Wetland mapping and inventory on 1:25K scale by analysis of digital Resourcesat-2 LISS-IV data of post and pre-monsoon seasons (2017-18 or latest).

Work Completed:

- Completed wetland mapping of Sikkim using LISS-IV as per the objectives and guidelines provided by the Space Application Centre, ISRO
- The final data has been shared with the concern officials,
- Currently, working on the feedback received, which is near completion.
- In total 760 wetlands have been mapped (>0.1 ha), whereas 257 wetlands (<0.1 ha) were mapped for Sikkim (Table1).
- The wetland covered a total area of 7164.54 ha, which accounted for approximately 1% of the state, with a total geographic area of 7096 sqkm (Figure 1).
- The river was reported as the dominant wetland type contributing around 54%; whereas high altitude was represented as the second dominant wetland constituting around 46% of total wetland area in the state.

Table1. Wetland types with total count and area.

Sl.no.	Wetland Types	Total count	Area (ha.)
1.	High Altitude Wetlands (HAW, wetland above 3000m asl)	707	3288.63
2.	Low Altitude Wetlands (LAW)	2	16.65
3.	Dams	2	19.55
4.	Rivers	49	3839.71
	TOTAL	760	7164.54

1. Details of domain expertise of human resources supported by DST and contribution made:

Sl. No	Name of the Post	Name of the Employee	Domain Expertise	Contribution made during FY 2022-23
STATE SUPPORTED MANPOWER				
1.	Member Secretary	B. P. Pradhan, IFS	Forestry	Head of Institution
2.	Principal Director	B. C. Basistha	Biotechnology	Head of Sajong Research & Application Center.
3.	Principal Director	D. G. Shrestha	Remote Sensing & Climate Change	Climate Change Study/ Glaciers study & Remote sensing experts.
4.	Principal Director	D. T. Bhutia	Technology Transfer/ Science Center.	Head of Sikkim Science Center/ Innovation Activities & Technology Transfer with Science popularization programme.
DST SUPPORTED MANPOWER				
5.	Director	Suman Thapa	Technology Transfer	Awareness Activities/ PI in various projects & other Scientific Activities in the State.
6.	Sr. Research Assistant	Dr. Sushen Pradhan	Biotechnology, Molecular Biology & Tissue Culture.	Development of Tech. for production of virus free & protocol for invitro propagation large Cardamom sapling & Photochemical studies of six Medicinal plants.
7.	Sr. Research Assistant	Nabeen Sharma	Extension work & Awareness Programme.	INSPIRE Prog. of DST, GOI/ Science Awareness Prog. & Science Center activities.
8.	Sr. Research Assistant	Rinzing N. Lepcha	Bioinformatics	Awareness Programme/ Radio serial & V.P projects.
9.	Sr. Research Assistant	R.K Sharma	Climate Change & Glaciology	Field Study of East Rathong Glacier/ Developed the volume equation for Glacier lake study.
10.	Sr. Research Assistant	Tseten Pradhan	Biotechnology	Awareness Programme & Mathematical Olympiad.
11.	Sr. Research Assistant	Laydong Lepcha	Bioinformatics	Drugs Designing Experts/ Nation Workshop on Bioinformatics/ BEP Training.
12.	Sr. Research Assistant	Pranay Pradhan	Remote Sensing & Climate Change	Field work in East Rathong Glacier/ Installation of AWS/Geo-tagging of NEC Project.
13.	Sr. Research Assistant	Rajdeep Gurung	Intellectual Property Right.	IPR Training/Entrepreneurship development programme & IPR Workshop.
14.	Research Assistant	Prabhakar Gurung	Tourism & Hospitality	ENVIS Project & GSDP programme/ Science Awareness.
15.	Research Assistant	Binita Shrestha	Zoology	Woman Technology Park & Awareness Programme to school students ect.
16.	Research Assistant	Prerna Pradhan	Remote Sensing & Climate Change.	Geo-tagging & Research on Climate Change.
17.	Computer Operator	Onkit Lepcha	Computer	Computer related works of SSCS&T.

2. **List success stories regarding catalyzing the STI ecosystem during FY 2022-23.**

- Pradhan Mantri Van Dhan Vikas Yojana
- Establishment of ST Cell in Sikkim
- State Action Plan on Climate Change Phase I & II
- Green Skill Development Programme
- Development of Technology for Production of Virus free Large Cardamom
- Photochemical study of Medicinal Plants and Wild Edible Fruits

3. **Details of linkages with other stakeholders of the STI ecosystem like academia, and voluntary organizations, Industry, NGOs, other government departments, etc**.

- 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. All departments are the stakeholders of theis 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 on Climate Change adaptation programmes.
- Collaborative programme with Institute of Himalayan Bioresource Technology (IHBT), Palampur
- Collaboration on Bio-fertilisers with IARI, PUSA, New Delhi
- Collaborative programme with Sikkim University for STI project
- Pradhan Mantri Van Dhan Yojana programme funded by Ministry of Tribal Affairs and TRIFED has 80 SHGs comprising of 18000 members working on MFP for value addition and value chain development of products for commercialization.
- 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.

4. **Priority sector and area of interventions identified through the exercise of "Mapping of S&T Needs"**

- Livelihood and Skill Development
- Value addition and Value Chain Development
- Agriculture
- Horticulture
- Livestock and Animal Husbandry
- Climate Change, Water,
- Traditional Knowledge
- Ecotourism
- Intellectual Property Right

5. Details of any new systemic proposal to be submitted

- Submitted proposal for Setting up of Women Technology Park in Sikkim to DST
- Submitted Proposal for STI Hub in East District of Sikkim to DST
- Submitted proposal for baseline survey of LiFE Mission in NE and Sikkim to MoEF
- Establishment of Advance Level Institutional Hub submitted to DBT, GoI
- Submitted DBT Skill Vigyan Programme under State Partnership in Life Science and Biotechnology submitted to DBT GoI
- Submitted Study of Glacier Dynamics of East Rathong Glacier, Sikkim Himalayas to DST, GoI
- Submitted Setting of Sikkim Spatial Data Infrastructure to DST
- Submitted proposal on Technology Development for Organic Bio-pesticides to DST

6. Proposed programme and budget out lay for the 2023-24

- Establishment of Science Center in South Sikkim.
- Establishment of Technology Demonstration Centre at Marchak, East Sikkim.
- Establishment of Technology Incubation Centre in Sikkim.
- Establishment of Science & Technology Complex at Namli, Marchak.
- Establishment of Woman Technology Park in Sikkim.
- Establishment of Science Technology and Innovation Hubs in Sikkim.
- 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.
- Development of First Fire Spread Model using Satellite RS.
- Climate Change Risk reduction for potentially Dangerous Glacial Lakes In Sikkim
- Sikkim State centre for Glaciology
- Experimental Study on Reglaciation of Deglaciated Valley in Sikkim through Artificial Glaciation
- Glacier studies of basins in Sikkim and Bhutan region under Brahmaputra basin
- Deployment of early warning system for minimizing the floods hazards in potentially vulnerable glacial lakes in Sikkim using space based technology
- Estimation of Crop Acreage area in the state of Sikkim
- Bathymetry Study of 10 Vulnerable Lake in Sikkim Using the Unmanned Surface Vehicle
- Climate Change impacts on the Alpine ecosystem of Sikkim Himalaya.
- Skill Development Programmes on Bioinformatics for the PhD, Research Scholars and Post Graduate Students in different areas of Life Sciences.
- Faculty Improvement Programme on Bioinformatics for the Professors, Assistant Professors, Post-graduate, Graduate & Undergraduate Science Faculty Working in Different Areas of Life Sciences in Sikkim.

- **Budget Outlay for 2023-24**
  State : Rs 545.00 lakhs
  DST: RS. 150.00 Lakhs (Proposed)

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