

Project: Estimation and Mapping Of The Soil Nutrient Status In Various Forest Compartments Of North Bengal Plains.



Final Report submitted by The Research Wing
Directorate Of Forest,
Government of West Bengal
to
THE WEST BENGAL FOREST AND
BIODIVERSITY CONSERVATION SOCIETY

PREFACE

Forests are a dynamic structure and sustain life through a complex system that has societal significance because they can be managed, maintained, and conserved. Forestry research entails the measurement and analysis of the natural systems and its components. This aids in promoting evolution and sound forest management practices.

All terrestrial life is dependent on soil. The irreversible degradation of this resource due to natural and anthropogenic reasons leads to grave perturbation of the biota. Overexploitation of natural resources, especially land; the prevalence of acidic soils that limit the uptake of nutrients and faulty management practices have led to reduced productivity and slowed down the growth of plantation forestry. Widespread deficiencies in secondary and micronutrients are a cause for concern among researchers, policymakers and development departments. Reversing this trend calls for soil testing to go hand in hand with the adoption and implementation of good practices that can achieve desired results. Thus, research has to be focussed on the maintenance and rehabilitation of soil.

The importance of soil health in supporting society and ensuring plantation output and future environmental stability, as well as to identify significant concerns and research needs, that are connected to sustainable development of the forest compartments can hardly be overemphasized. To realize this feat of paramount importance, this project for the estimation & mapping of the soil nutrient status in various forest compartments of north bengal plains is deemed indispensable towards ameliorating the soil of the forest compartments before undertaking any plantation activities.

The information gleaned from the deployment of the project will furnish information regarding the recommendations, selection and preparation of plantation species to augment microplanning activities in the plantation areas of North Bengal plains. However, similar project need to be undertaken for North Bengal Hills and South Bengal.



Principal Chief Conservator of Forests
Research, Monitoring and Development
West Bengal

ACKNOWLEDGEMENT

Forest soil nutrients are essential components of forest tree. Forests growth and development, and their availability to the forest is determined by their state in the soil. The distribution of forest soil nutrients is directly related to the growth and health of forests and has an important influence on forest ecosystem restoration and sustainable management. Available nutrients are water-soluble and exchangeable elements in the soil. They can be directly absorbed and used by plants or quickly exchanged from soil colloid for plant use. Availability of alkali-hydro-nitrogen, phosphorus and potassium, have a significant correlation with soil fertility. Organic matter (OM) is all kinds of carbon-containing organic compounds in the soil, one of the primary sources of plant nutrition. Thus, soil nutrient maps, which gives a picture of nutrient availability are a major factors for forest culture, forest management policies, regional soil degradation, and climate change study.

The project on Estimation of Soil Nutrient in Forest Soil of North Bengal Plains was started on 2018 funded by JICA (WBFBCP). Firstly we thank to The Principal Chief Conservator of Forests (Research, Monitoring & Development) Dr. Jose T. Mathew, IFS to conceptualise the proposal for doing such type of Research Work and initiated the work in the field and in laboratory. Thanks to the Chief Project Director of WBFBCP, Sri Debal Roy, IFS who approved the project. Thanks to The Principal Chief Conservator of Forests, Research, Monitoring & Development, Shri V.K. Yadav, IFS for his kind support and permission to compile the research finding and compilation of the report. Thanks to the Additional PCCF, R&M, SmtPratibha Raj, IFS for going through the project document and getting it approved in the Committee for Scrutiny and approval of the final project report. Thanks to the Chief Conservator of Forests, R&D Shri D. Mallick, IFS for guidance and Dr S C Das, IFS, Chief Conservator of Forest, Soil Conservation for their support to compile the findings of the experimental work. Thanks to Shri B. Sarkar, IFS, Conservator of Forest, Research Circle, West Bengal for guidance to the field work and data collection.

Thanks to the Scientists, Research Associates and Field Staffs of SLUSI for data compilation and making of the soil nutrition availability map.

Contribution of Sri T. T Bhutia, IFS to soil sample collection and testing of the sample in the laboratory for estimation of the nutrient which is acknowledged. Thanks to Sri DebashisChakraborty,FR, Range Officer of Salugara Soil Lab Range, Sri Subrata Roy, Soil Chemist and other staff of the Range and all the staff of Silviculture (North) Division who worked hard for this project from the beginning to till end.



Divisional Forest officer
Silviculture North Division

PROJECT PROFILE

1. Title of the Project:-Project on Estimation & Mapping of the Soil Nutrient Status in various Forest compartments of North Bengal Plains.

2. Implementing Team – Silviculture North Division

Principal Investigator	Divisional Forest Officer	Silviculture North Division
Co-Principal Investigator	Debashis Chakraborty, FR	Salugara Soil Lab Range
	Subrata Bhowmik	Soil Chemist, Salugara Lab
Support Staff	Sujit Roy	Assistant Soil Chemist
	Madhumanti Sarkar	Lab Assistant
	Subir Sarkar, DrFR	Beat officer
	Banashree Das	Forest Guard
	Shambhu Pal	Forest Guard

SLUSI -

Chief Coordinator	Smt. Rajni Taneja, Chief Soil Survey Officer
Coordinator	Dr. S. Roychowdhury, Soil Survey Officer
Co-Coordinator	Mrs. D. C. Sarkar, Field Officer Ms. P. P. Mitra Nag, Sr.C.A Sk .Mohitpasha S.S., Asstt. Field Officer Ms. Surama Neogi, Asstt. Field Officer

3. Project Location - Forest Compartments of the following Divisions -

SI No	Division	District	No of Compartment
1	Baikunthapur Division	Jalpaiguri	88 No
2	Jalpaiguri Division	Jalpaiguri	101 No
3	Coochbehar Division	Coochbehar	30 No
4	Kurseong Division	Darjeeling	27 No
5	Jaldapara Wildlife Division	Alipurduar	39 No
6	Buxa Tiger Reserve West Division	Alipurduar	81 No
7	Buxa Tiger Reserve East Division	Alipurduar	37 No

4. Project Commencement Date – June, 2018

5. Project Completion Date – November, 2021

6. Project Cost – 28,20,000.00

7. Funding Agency – West Bengal Forest and Biodiversity Conservation Project

1. INTRODUCTION:

Soil is the biologically active loose surface material that covers the majority of the land made up of both inorganic and organic particles. Soil provides structural support to plants as well as a source of water and nutrients through the global ecosystem. The chemical and physical properties of soils vary greatly.

Soil structure is important for soil and plant health because it allows water and air to move into and through the soil profile. While some soils are naturally better structured than others, good management can change some physical characteristics of soils. To understand soil condition, it is critical to monitor the physical characteristics of soil. With the augment of forestry, there has arisen a necessity of practical awareness of soil and their management. Soil is an essential component of forest and woodland ecosystems because it regulates critical ecosystem processes such as nutrient uptake, decomposition, and water availability. Soils provide anchorage, water, and nutrients to trees. With the clearance of tree vegetation and the subsequent loss of millions of hectares of productive land, the significance of these effects has frequently been overlooked in the past. Furthermore, as forests continue to be cleared, exposing the land to direct wind and rain attack, soil erosion and land degradation continue to erode plantation's resource base. We must protect our trees and forests in order to protect our soils. The relationship between soils and forests is far more complex and extensive. Soils and forests are inextricably linked, with significant effects on each other and the wider environment. The interactions between forests and forest soils contribute to the preservation of the environmental conditions required for production. These positive effects have far-reaching consequences, ultimately ensuring a productive food system, improved rural livelihoods, and a healthy environment in the face of change.

Soil status report is important information for forest management, choice of species, microplanning, biodiversity conservation etc. As a ready reckoner, soil nutrient status map is useful for ameliorative measure before plantation activity.

OBJECTIVE:

- To prepare compartment-wise soil nutrient status report

- Preparation of soil nutrient status map for the forest areas
- To prescribe compartment-wise recommendation of any amelioration before plantation activity is taken up
- To provide information to working plan wing for selection of species and preparation of micro-plans

PROJECT AREA:

Soil sample has been collected from all the Divisions of North Bengal plain where plantations are likely to be taken up. For territorial Divisions, sample collected from all the compartments and for the wildlife division it only from the buffer areas. The details of the area are as

SI No	Name of Division	No of Compartment	Total Sample collected
1.	Baikunthapur Forest Division	88 No	381 No
2.	Jalpaiguri Forest Division	101 No	434 No
3.	BTR West Division	81 No	518 No
4.	BTR East Division	37 No	227 No
5.	Kurseong Forest Division	27 No	143 No
6.	Jaldapara Wildlife Division	39 No	164 No
7.	Coochbehar Forest Division	30 No	133 No

TOTAL NO. OF COMPARTMENTS =403

TOTAL NO. OF SOIL SAMPLES=2000

TOTAL NO. OF ESTIMATION=16000

NO. OF PARAMETERS=8

VARIOUS SOIL PARAMETERS FOR EACH SAMPLE TESTED AT SALUGARA SOIL LABORATORY UNDER SILVICULTURE (N) DIVISION

- Soil pH
- Organic Carbon
- Available Phosphorus
- Available Nitrogen
- Available Sulfur
- Available Potassium
- Exchangeable Calcium
- Exchangeable Magnesium

2. METHODOLOGY

For Soil Nutrient mapping was done in three different steps

A.Collection of Soil Samples as per guidelines of National Bureau of Soil Survey and Landuse Planning (NBSS/LUP)

- Each sample was collected by trained person.
- Soil samples were collected from 3-4 places in each compartment with GPS reading.
- First 15cm of surface soil having decomposed and half decomposed materials, pebbles were removed from the place of soil sample collection.
- At each place sample to be collected by digging 60cm deep pit (45cm x 45cm) and chiseling the soil from 15cm-60cm deep uniformly.
- About 1 kg soil was collected for each sample in a packet having zipper/ air lock..

B. Analysis of Soil Sample

- In laboratory informations of Soil samples was entered in SLR lab soil register.
- Before sending the soil for analysis, the soil was kept for air-drying for 4-5 days
- After drying soil was passed through 2 mm seive and was stored for analysis.
- Presence of soil parameters namely- Ph, Total Nitrogen, Available Nitrogen, Available phosphorus, Available Potassium, Available Sulphur, exchangeable Calcium & Magnesium and Organic Carbon are to be tested in each sample.

C. Preparation of Soil sample Map

- Soil nutrient status map will be prepared by Soil and Land Use Survey of India, Govt. of India on the basis of nutrients present at location and GPS reading of that location.



Soil samples for air-dry



Soil samples in airlock packets
with proper tag

3.SOIL ANALYSIS

1. Soil pH

It refers to the degree of acidity & alkalinity. It is determined by electrometric method using pH Meter.

2. Available Nitrogen

Nitrogen is important because it is the major component of chlorophyll and amino acid to build proteins. It is determined by alkaline potassium permanganate method using Kjeldahl distillation unit (semi automatic) model- CLASSIC- DX VATS B

3. Available Phosphorus

Phosphorus helps in photosynthesis, protein synthesis and root development. It is determined by Bray's 1 method using photo Electric colorimeter/Spectrophotometer

4. Available Potassium

Potassium is essential for formation of carbohydrate, proteins as well as it regulates the water content within the plant cell. It is determined by Flame photometric method.

5. Available sulfur

Sulfur is required in synthesis of vitamins. It is determined by Turbidimetric method using photo electric colorimeter/ Spectrophotometer.

6. Organic Carbon

It is a source of nutrients and essential for improving soil physical properties. It is determined by Walkley and Black rapid titration method.

7. Exchangeable Calcium

Calcium is needed mainly for cell division is important constituent of chlorophyll. It is determined by Complexometric titration with EDTA di-sodium salt.

8. Exchangeable Magnesium

Magnesium is important constituent of chlorophyll. It is determined by Complexometric titration with EDTA di-sodium salt.

4. LIST OF FOREST COMPARTMENTS OF VARIOUS DIVISIONS FROM WHERE SOIL SAMPLES WERE COLLECTED

1. Baikunthapur Division

SI No		SI No		SI No		SI No	
1	Dabgram-2	24	Farabari-1	47	Adabari-1	69	SMG-2
2	Dabgram -3	25	Farabari-2	48	Adabari -2	70	SMG-4
3	Dabgram -5	26	Farabari-3	49	Adabari -3	71	SMG-5
4	Dabgram -6	27	Farabari-4	50	Adabari -4	72	SMG-7
5	Dabgram -7	28	Farabari-5	51	Adabari -5	73	SMG-3
6	Dabgram -8	29	Farabari-6	52	Adabari -6	74	SMG-6
7	Dabgram -9	31	Farabari-7	53	Adabari -7	75	SMG-10
8	Dabgram -10	32	Farabari -9	54	Adabari -8	76	SMG-11
9	Dabgram -11	33	Farabari -10	55	Adabari -9	77	SMG-12
10	Dabgram -12	34	Farabari -11	56	Chengmari-1	78	Phuljhora-1
11	Dabgram -13	35	Farabari -12	57	Chengmari-2	79	Phuljhora-2
12	Dabgram -14	36	Mantadari-2	58	Chengmari-3	80	Phuljhora-3
13	Hanskhali-1	37	Mantadari -3	59	Chengmari-4	81	Phuljhora-4
14	Hanskhali-2	38	Mantadari -4	60	Chengmari-5	82	Phuljhora-5
16	Hanskhali-3	39	Mantadari -5	61	Sealdoba-1	83	Apalchand-1
17	Hanskhali-4	40	Mantadari -6	62	Sealdoba-2	84	Apalchand -3
18	Batasivita-1	41	Saraswatipur-1	63	Sealdoba-3	85	Apalchand -4
19	Batasivita-2	42	Saraswatipur -2	64	Gourikon-1	86	Oodlabari-2
20	Batasivita-3	43	Saraswatipur -3	65	Gourikon -2	87	Oodlabari-3
21	Chelriver-1	44	Saraswatipur -4	66	Gourikon -3	88	Oodlabari-4
22	Chelriver-2	45	Churabhija-2a	67	Oodlabari-1		
23	Churabhija-1	46	Oodlabari Extension	68	SMG-1		

2. Jalpaiguri Division

SI No		SI No		SI No		SI No	
1	Lataguri-1	27	Sipchu-1	53	Central Moraghat-1	78	KhoriaBander-1
2	Lataguri -2	28	Sipchu-2	54	Centre Moraghat-2	79	KhoriaBander-2
3	Lataguri-3	29	Chapramari-1	55	Centre Moraghat-3	80	Choraimahal-1
4	Lataguri-4	31	Central-1	56	Centre Moraghat-4	81	Choraimahal-2
5	Lataguri-5	32	Central-2	57	Centre Moraghat-5	82	North Moraghat-1.
6	Lataguri-6	33	Central-3	58	Centre Moraghat-6	83	North Moraghat -2.
7	Bichabhanga-1	34	Reti-1	59	Centre Moraghat-7	84	North Moraghat -3.
8	Bichabhanga-2	35	Reti-2	60	Centre Moraghat-8	85	North Moraghat -4.
9	Sursuti-1	36	Udlajhora-2	61	Centre Moraghat-9	86	B.C Tondu res
10	Sursuti-2	37	Udlajhora-3	62	Centre Moraghat-10	87	Nepania Res
11	Sursuti-3	38	Udlajhora-4	63	Centre Moraghat-11	88	Bandapani res
12	Sursuti-4	39	Udlajhora-5	64	Centre Moraghat-12	89	Bandapani res
13	Sursuti-5	40	Hillajhora-1	65	South Moraghat-1.	90	Aibhil Resume
14	Khairanti	41	Hillajhora-2	66	South Moraghat -2	91	Kathalguri res
16	Panjhora-1	42	Hillajhora-3	67	South Moraghat -3.	92	Dheklapara res

17	Panjhora-2	43	Hillajhora-4	68	South Moraghat -4.	93	DalgaonSalbari
18	Panjhora-3	44	Central Diana	69	South Moraghat -5.	94	Kalabari resumed
19	Panjhora-4	45	South Diana	70	South Moraghat -6.	95	Red Bank Res
20	Panjhora-5	46	North Diana	71	South Moraghat -7.	96	Saogaon resumed
21	Panjhora-6	47	Dalgaon-1.	72	South Moraghat -8.	97	Surti resumed
22	Panjhora-7	48	Dalgaon-2.	73	South Moraghat -9.	98	Makrapara
23	North Indong	49	Dalgaon-3.	74	South Moraghat -10.	99	Dalmore Resume
24	Ramshai	50	Dalgaon-4.	75	South Moraghat -11.	100	Jaldhaka-1
25	Gossaihat 1	51	Gossaihat 3	76	Gossaihat 5	101	JaldhakaultaDanga
26	Gossaihat-2	52	Gossaihat-4	77			

3. Buxa Tiger West Division

SI No		SI No		SI No		SI No	
1	NRVK-10	22	Checo -6	42	Damanpur -1	62	Raimatong-1
2	N.R.V.K-11	23	Checo -7	43	Damanpur-2	63	Raimatong -2
3	N.R.V.K-15	24	Checo -8	44	Damanpur -3	64	Raimatong -3
4	NRVK-16	25	Checo -9	45	Damanpur -4	65	Raimatong -4
5	Dima 1	26	Gadadhar-1	46	Damanpur -5	66	Raimatong -5
6	Dima 2	27	Gadadhar -2	47	Damanpur -6	67	Raimatong -6
7	Dima 3	28	Gadadhar -3	48	Damanpur -7	68	Raimatong -7
8	Dima 4	29	Gadadhar -4	49	Damanpur -8	69	Raimatong -8
9	Dima RL	30	Gadadhar -5	50	Damanpur -9	70	Raimatong -9
10	SRVK-1	31	Gadadhar -6	51	Poro -1	71	Raimatong -10
11	SRVK-2	32	Panbari -4	52	Poro -2	72	Adma-1
12	SRVK-7	33	Panbari -5	53	Poro-3	73	Adma -2
13	SRVK-8	34	Panbari-10	54	Poro -4	74	Adma -3
14	SRVK-9	35	Nimati-1	55	Poro -5	75	Godamdabri-3
16	SRVK-10	36	Nimati -2	56	Poro -6	76	Godamdabri -2
17	SRVK-15	37	Nimati -3	57	Poro -7	77	Godamdabri -1
18	SRVK-16	38	Nimati -4	58	Poro -8	78	Godamdabri -4
19	Checo -3	39	Nimati -5	59	Poro -9	79	BHUTRI-5
20	Checo-4	40	Nimati -6	60	Poro -10	80	BHUTRI-3 (P)
21	Checo -5	41	Nimati -7	61	Poro -11	81	Phoskadanga

4. Buxa Tiger East Division

SI No		SI No		SI No		SI No	
1	NRVK-1	11	Phaskhawa 1	21	South Rydak -2	31	SBH-2
2	NRVK-2	12	Phaskhawa-2	22	South Rydak -3	32	SBH-3
3	NRVK-3	13	Phaskhawa-3	23	South Rydak -4	33	SBH-4
4	NRVK-4	14	Dhawla-1	24	South Rydak -5	34	SBH-5
5	NRVK-5(B)	15	Dhawla-2	25	South Rydak -6	35	SBH-6
6	NRVK-6(B)	16	Dhawla-3	26	South Rydak -7	36	Madhya Haldibari
7	NRVK-8	17	Hatipota-2	27	Sankosh-3	37	NBH-4
8	NRVK-9	18	Rydak USF	28	NBH-3		
9	NBH-1	19	NBH-2	29	Kumargram-2		
10	NBH-5	20	South Rydak-1	30	SBH-1		

5. Jaldapara Wildlife Division

SI No		SI No		SI No		SI No	
1	Borodabri 1a	8	Bania-7	15	Borodabri-4	22	Khairbari-1
2	Borodabri-3	9	Bania-6	16	Borodabri-5	23	Khairbari-2a
3	Borodabri-6a	10	Bania-5	17	Borodabri-8	24	Khairbari-2b
4	Borodabri-7a	11	Mandabari-1	18	TiTi EXT.	25	Khairbari-3
5	Chilapata -3a	12	Mandabari-2	19	Huntupara RL	26	Dumchi-2
6	Chilapata -4a	13	MandabariEXT	20	Gargunda RL	27	Dumchi-1
7	Bania-8a	14	Nilpara	21	Lankapara RL		

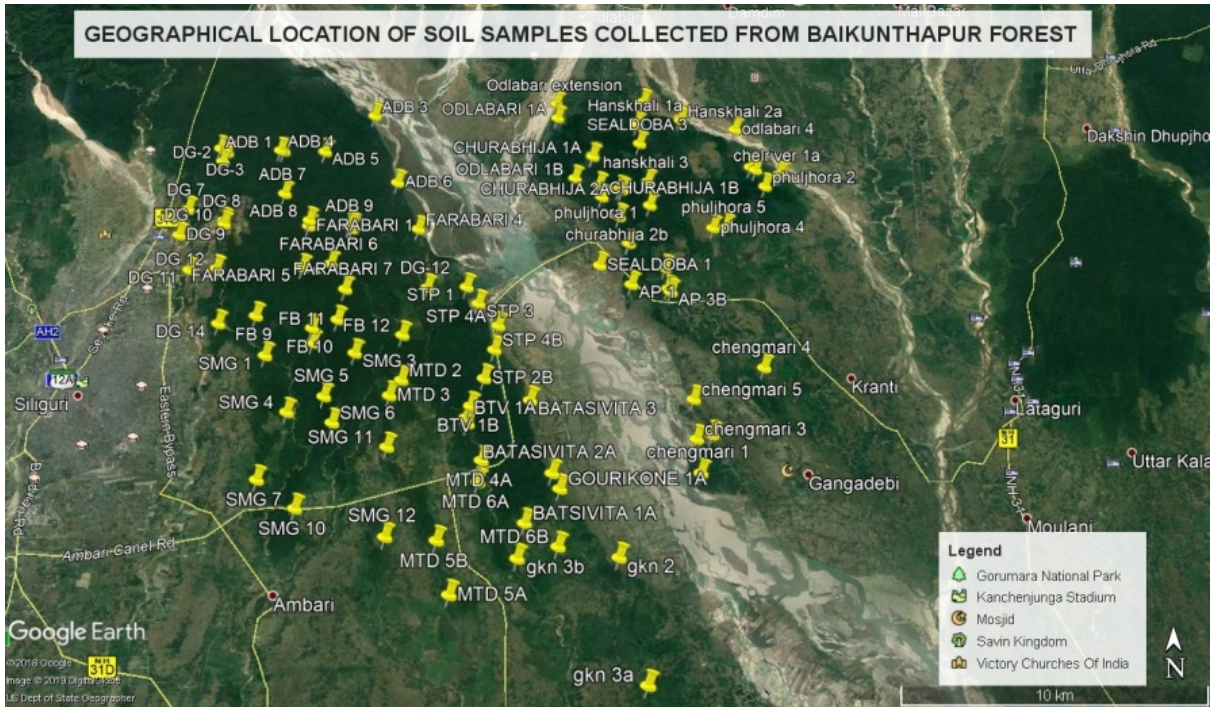
6. Kurseong Division

SI No		SI No		SI No		SI No	
1	Bagdogra	11	Pantapuri	21	Central Mechi	31	ChotaChenga Resumed
2	Harrulia	12	Taipu	22	Upper Mechi	32	Kolabari
3	Rishabari	13	Dauhara	23	Gurabadi	33	Tukriajhar
4	Bengdubi	14	Kadma	24	Surajbar	34	SabaiMauza R.L
5	Lalfa	15	Bauhara	25	Lower Mechi	35	Dangerbhita
6	Central	16	Tirihana	26	Nepania	36	Rangeli
7	Multa	17	Borobhita	27	Nepania-3	37	Uttam C.C
8	Dalka	18	Boiranti	28	Khairbari	38	Naxalbari Resume
9	Tarabari	19	Panighatta	29	Rongmohan Resumed	39	Phargomia
10	Latua	20	Lohagarh	30	Bora Chenga		

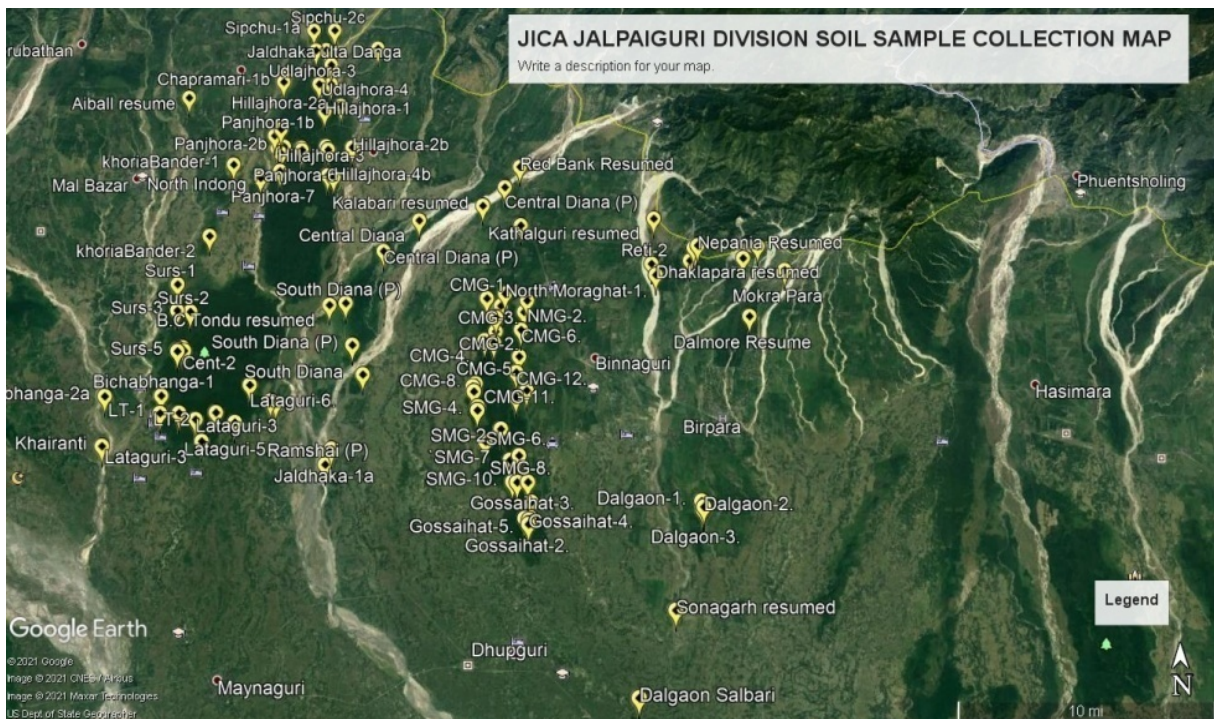
7. Coochbehar Division

SI No		SI No		SI No		SI No	
1	Khagribari	9	ChotoSalbari	17	Baroibari-II	25	ChhatBholka
2	Takoamari	10	PutimariBaxirbas	18	Baroibari	26	BasdahaNatibari
3	Paglirkuthi	11	SingimariPachnirpur	19	Sorbeswarjoydhar	27	KharimalaKhagribari
4	Atiamochar	12	ChhatSingimari	20	ChotoSalbari	28	SajherparGhoramara
5	Rashikbill	13	Mekhliganj	21	Mohismuri	29	Salmara (P-I-III)
6	Chengtimari	14	Daibangi	22	Uchalpohri	30	SajherparKathalbari
7	Dorko	15	Mohimerkuthi	23	Dwarikamari		
8	Barasalbari	16	Bhojanerchara	24	CharakerkuthiDewanbas		

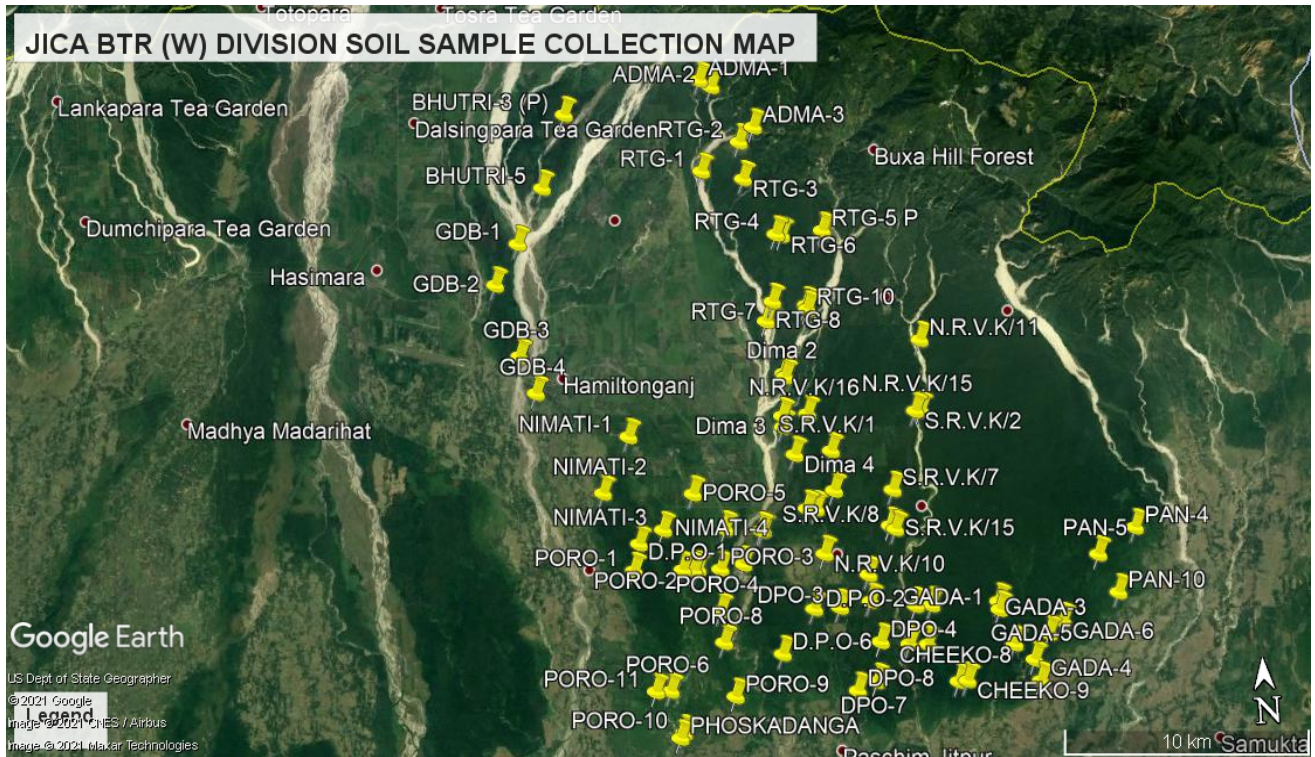
Map no.1: Location map of soil samples collected from various forest compartments of Baikunthapur Division



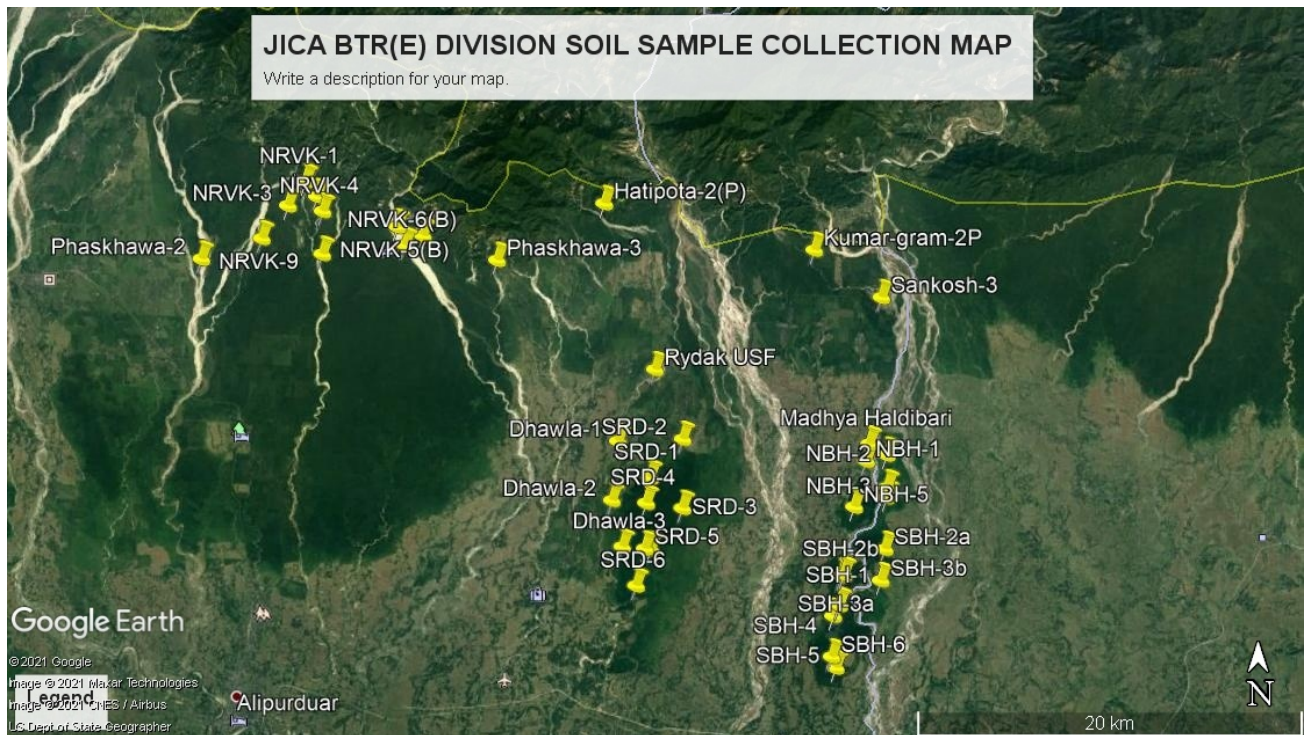
Map no.2: Location map of soil samples collected from various forest compartments of Jalpaiguri Division



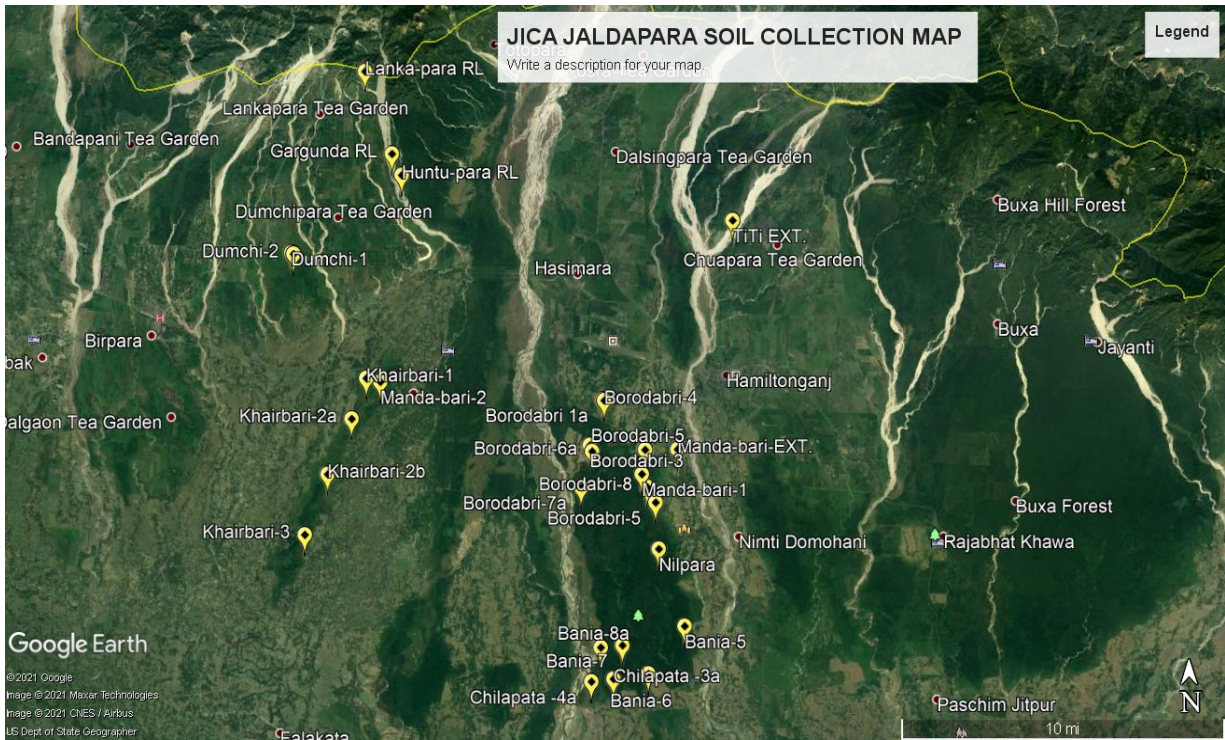
Map no.3: Location map of soil samples collected from various forest compartments of BTR (W) Division



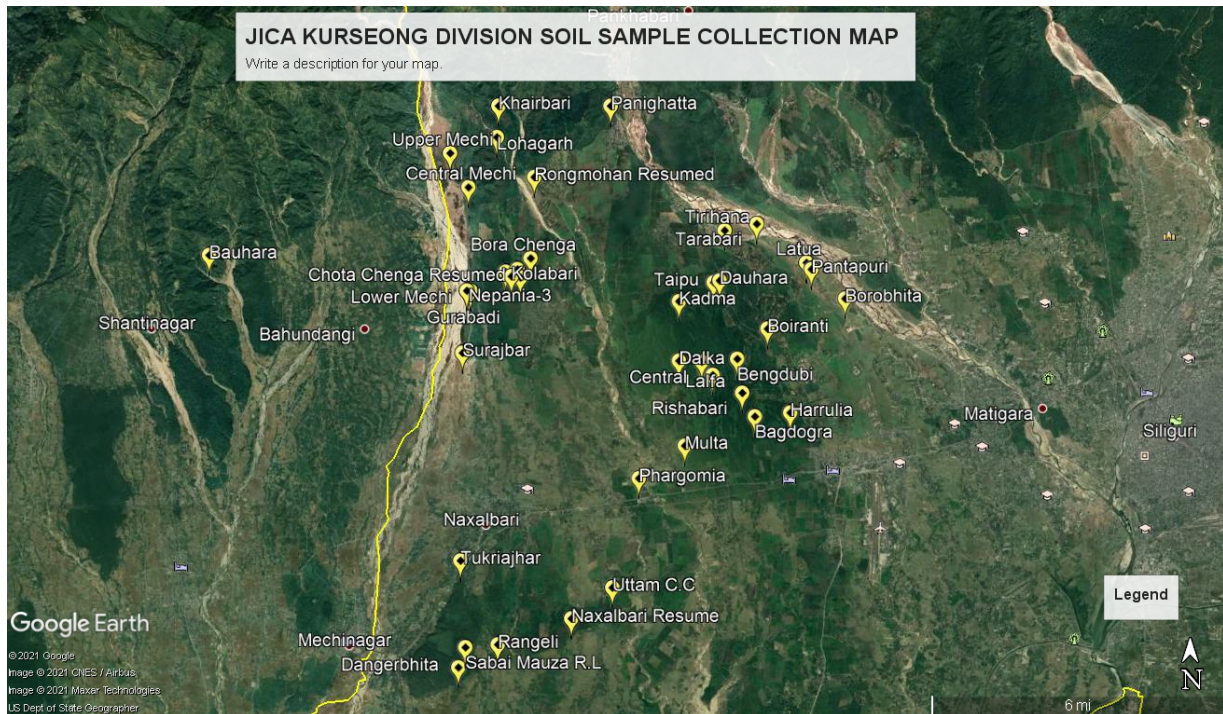
Map no.4: Location map of soil samples collected from various forest compartments of BTR (E) Division



Map no.5: Location map of soil samples collected from various forest compartments of Jaldapara Division



Map no.6: Location map of soil samples collected from various forest compartments of Kurseong Division



Map no.7: Location map of soil samples collected from various forest compartments of Coochbehar Division

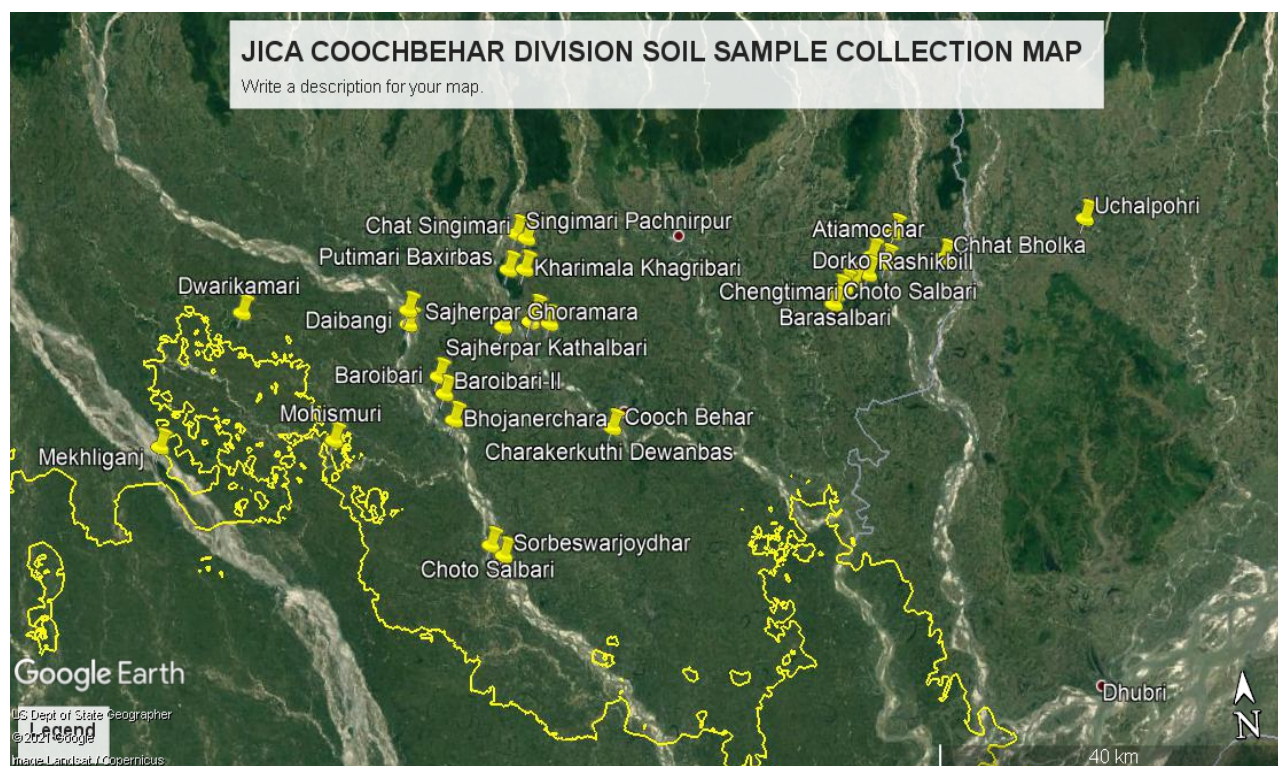


Table no. 1: Details of soil collection and report submission of various forest divisions for the project.

	Name of Division	No of compartments	Starting date of soil sample collection	Ending date of soil sample collection	No of Soil sample Received	Date of soil report despatch	Memo no.of soil report
1	Baikunthapur	88 Nos	21/09/2018	08/01/2019	381 Nos	24/05/2019	86/SLR-22
2	Jalpaiguri	101 Nos	25/06/2019	17/02/2020	434 Nos	16/10/2020	226/SLR-13
3	BTR (W)	81 Nos	13/12/2019	19/03/2020	518 Nos	16/01/2021	16/SLR-13
4	Kurseong	39 Nos	18/12/2020	07/01/2021	143 Nos	18/02/2021	42/SLR-13
5	BTR (E)	37 Nos	12/12/2020	30/01/2021	227Nos	03/03/2021	70/SLR-13
6	Jaldapara WL Division	27 Nos	30/01/2021	06/02/2021	164 Nos	12/03/2021	94/SLR-13
7	Coochbehar	30 Nos	01/02/2021	16/03/2021	133Nos	24/03/2021	101/SLR-13
	Total	403 Nos			2000 No.s		

PHOTOS OF SOIL SAMPLE COLLECTION



PHOTO OF SOIL COLLECTION AND TESTING TEAM WITH PCCF, RMD



5. Soil test results, Nutrition Map and Discussion-

Soil testing is an important tool to assess the fertility status as well as suitability of soil to raise a crop. Soil information for forests is based on the results of testing the soil samples in the laboratory and in this project 8 different parameters of the soil related to nutrient availability and have influence on the tree growth were measured. A total of 2000 samples collected from 403 forest compartment were tested and the details results are given in the Annexure 1.

Based on the results, the SLUSI had prepared a soil nutrition sufficiency/deficiency map of seven Forest Division of North Bengal Plains which are given in Annexure 2.

The scale used for measure of nutrient/parameter sufficiency or deficiency are given below -

Status of soil pH:	Status of available potassium	Status of available phosphate
<4.5- Strongly acidic	<120 kg/ha- Low	<34 kg/ha- Low
4.5-5.5-Moderately acidic	(120-280) kg/ha- Medium	(34-68) kg/ha- Medium
5.5-6.5- Slightly acidic	>280 kg/ha- High	>68 kg/ha- High
Status of available nitrogen:	Status of available organic carbon:	Status of available sulfur:
<280 kg/ha- Low	<0.5% - Low (0.5-0.75)%- Medium >0.75%- High	<10 PPM- deficient >10 PPM- sufficient
Status of Exchangeable Calcium: <1.5 C mol (P ⁺)/kg- deficient	Status of Exchangeable Magnesium: <1.0 C mol (P ⁺)/kg- deficient	

Based on this scale the status of nutrient availability of each Division were marked and given in the following table.

Baikunthapur Division: As per soil nutrient map the detail status is given below.

Sl No	Soil Nutrient parameter	Observation
1.	Exchangeable Calcium	All compartments are deficient in exchangeable Calcium.
2.	Available Potassium	All compartments are low
3.	Exchangeable Magnesium	All compartments are deficient in exchangeable magnesium
4.	Available Nitrogen	All compartments are low in available nitrogen
5.	Organic Carbon	All compartments are high
6.	Available Phosphorus	Medium:- Targhera, machbasti, Phuljhora, Kathambari, Neem, Farabari, Mantadari, Lalitabari, Shikarpur. Low:- Rest compartments are low
7.	p^H	Moderately acidic:- All compartments are moderately acidic in nature
8.	Available Sulfur	All compartments are sufficient

Jalpaiguri Division : As per soil nutrient map the detail status is given below.

Sl No	Soil Nutrient parameter	Observation
1.	Exchangeable Calcium	Deficient:- Lataguri, Kalamati, Ramsai head quarter , Central, Borodighi, Khariabandar, Sipchu, Nagrakata, Panjhora, Totapara, Khutimari, Gosaighat, Sonakhali. Sufficient:- Rest compartments are sufficient
2.	Available Potassium	Medium:- Kalamati, Khutimari. Low:- Rest compartments are low.
3.	Exchangeable Magnesium	Sufficient:- Carron, Diana, Tollgate, Sulkapara, Khaikata, Nathua Head quarter, Godhearkuthi.

		Deficient:- Rest compartments are deficient.
4.	Available Nitrogen	All compartments are low
5.	Organic Carbon	Medium:- Carron, Sulkapara, Godhearkuthi Low:- Khairkata. High: - Rest compartments are high.
6.	Available Phosphorus	High:- Khariabandar, Borodighi, Sulkapara. Low:- Sipchu, Khairkata, Nathua head quarter, carron, Dina tollgate, Khutimari, lower rethi. Medium:- Rest compartments are medium.
7.	p^H	Moderately acidic:- Sipchu, Nagrakata, Khariabandar, Panjhora, Borodighi, Central, Lataguri, Kalamathi, Ramsai Head quarter. Slightly acidic:- Sulkapara, Khairkata, Nathua head quarter. Strongly acidic:- Totapara, Gosaighat, Sonakhali, Khutimari. Slightly alkaline:- Godhearkhuti. Normal:- Rest compartments are normal.
8.	Available Sulfur	All compartments are sufficient.

Coochbehar Division : As per soil nutrient map the detail status is given below.

Sl No	Soil Nutrient parameter	Observation
1.	Exchangeable Calcium	Deficient:- Pundibari Head quarter Sufficient:- Mathabhanga, Khagribari, Sitalkuchi, Gosanimari.
2.	Available Potassium	All compartments are low.
3.	Exchangeable Magnesium	Sufficient:- Sitalkuchi, Khagribari. Deficient:- Rest compartments are deficient.
4.	Available Nitrogen	All compartments are low.
5.	Organic Carbon	Medium:- Sitalkuchi, Gosanimari, Mathabhanga, Pundibari

		head quarter. High: - Rest compartments are high.
6.	Available Phosphorus	Medium: -Jamaldha, Pundabari. Low: -Rest compartments are low.
7.	pH	Moderately acidic: -Jamaldha Slightly acidic: -Mathabhanga, Khagribari, pundibari . Slightly alkaline: -Sitalkuchi. Normal: -Gosanimari.
8.	Available Sulfur	All compartments are sufficient.

BTR West Division - As per soil nutrient map the detail status is given below.

SI No	Soil Nutrient parameter	Observation
1.	Exchangeable Calcium	Sufficient: -Adma, Panbari (North). Deficient: -Rest Compartments are deficient.
2.	Available Potassium	Medium: - Pana, Bhutri, Adma. Low: - Rest compartments are Low.
3.	Exchangeable Magnesium	Sufficient: -Adma, Dima, Panbari (North). Deficient: - Rest compartments are deficient.
4.	Available Nitrogen	All compartments are low.
5.	Organic Carbon	Medium: -Barnabari, Bhutri, Gram west, Gram east, Damunpur, Cheko, Range head quarter beat. Low: Godamdabri, Dima, west rajabhathkhawa. High: - Rest compartments are high.
6.	Available Phosphorus	Low: -Poro west, Poro east, Gram west, Gram east, Damanpur, Cheko, Gadadhar, Panbari (South). High: -South Rajabhathkhawa. Medium: - Rest compartments are medium.
7.	pH	Slightly acidic: -Godamdabri, Panbari (North) . Strongly acidic: -Raimatong, Gongutia, Nimati west, Damanpur, Cheko, South Rajabhathkhawa.

		Moderately acidic:- Rest compartments are moderately acidic in nature.
8.	Available Sulfur	All compartments are sufficient.

BTR East Division: As per soil nutrient map the detail status is given below.

Sl No	Soil Nutrient parameter	Observation
1.	Exchangeable Calcium	Deficient:- Chunabhati, Boxaduar, Santrabari, Boxaroad, Sankosh, New land, Kumar gram, Chuniajhora, Mainabari, Narathali, Chipra, Marakhata, South rydak, Changmari, Ghoramara, Barobisa, Sufficient:- Rest Compartments are sufficient.
2.	Available Potassium	Medium:- Balapara, Marakhata, Chunjihora, Hatipota, Mainabari. Low: - Rest compartments are Low.
3.	Exchangeable Magnesium	Sufficient:- Hatipota, Bhutiabasti, Jainti (North), Jainti (south), Chuniajhora, Kartic, Changmari, Balapara. Deficient:- Rest compartments are deficient.
4.	Available Nitrogen	All compartments are low.
5.	Organic Carbon	Medium:- Balapara, Ghoramara. High: - Rest compartments are high.
6.	Available Phosphorus	High:- Chunabhati, Boxaduar, Santrabari, Phashkhawa, Boxaroad. Low:- Bhutiabasti,Chuniajhora, Jainti (South), Kartic, South rydak, marakhata, Teamari, Balapara. Medium:- Rest compartments are medium.
7.	pH	Slightly acidic:- Bhutiabasti, Kartic, Jainti (North), Changmari, Ghoramara. Strongly acidic:- South Rydak, Boxaroad.

		Normal: Jainti (South), Chuniajhora. Moderately acidic:- Rest compartments are moderately acidic in nature.
8.	Available Sulfur	All compartments are sufficient.

Jaldapara Wildlife Division : As per soil nutrient map the detail status is given below.

SI No	Soil Nutrient parameter	Observation
1.	Exchangeable Calcium	Deficient:- All compartments are deficient in exchangeable calcium.
2.	Available Potassium	All compartments are low in available potassium.
3.	Exchangeable Magnesium	All compartments are deficient in exchangeable magnesium.
4.	Available Nitrogen	All compartments are low in available nitrogen.
5.	Organic Carbon	All compartments are high in organic carbon.
6.	Available Phosphorus	High:- Lankapara, Dumchi, Nilpara. Low:- North khairbari. Medium:- Rest compartments are medium.
7.	p^H	Strongly acidic:- Dumchi, Mantharam, Kodalbasti, Mendabari, Bania, Lankapara. Moderately acidic:- North khairbari, South Khairbari, Nilpara, Chilapata.
8.	Available Sulfur	All compartments are sufficient.

Kurseong Division: As per soil nutrient map the detail status is given below.

SINo	Soil Nutrient parameter	Observation
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1.	Exchangeable Calcium	Deficient: -Uttam CC, .Tukriajhar, Bengdubi, Bagdogara, Taipu, Kolabari, Bamanpokhri, Lamagumba, Mana, Latpanchor, Kalijhora, Berrik. Sufficient: -Lohagarh, Khairbani, Panighata, Singbuli, Dowhill, Shivkhola, Phuguri, Chattakpur, Bagora, Majua.
2.	Available Potassium	Low: -Bagdogara, Bengdubi, Taipu, Bamanpukhri, Panighata, Lamagumba, Shibkhola, Mana, Latpanchor, Kalijhora, Berrik, Kolabari, Tukriajhar, Uttam cc, Lohagarh, . Medium: -Khairbani, Singbuli, Phuguri, Chattakpur, Bagora, Majua, Dowhill.
3.	Exchangeable Magnesium	Sufficient: -Khairbani, Singbuli, Phuguri. Deficient: -Rest compartments are deficient.
4.	Available Nitrogen	All compartments are low in available nitrogen.
5.	Organic Carbon	High: -Tukriajhar, Uttam cc, Bengdubi, Bagdogara, Taipu, Bamanpukhri, Panighata, Khairbani, Lamagumba, Singbuli, Phuguri, Shivkhola, Dowhill, Chattakpur, Bagora, Majua, Mana. Low: -Kalijhora. Medium: -Kolabari, Lohagarh, Berrik, Latpanchor.
6.	Available Phosphorus	High: -Taipu, Panighata, Khairbani, Singbuli, Phuguri, Dowhill, Chattakpur, Majua, Bagora. Low: -Tukriajhar, Uttam cc. Medium: -Bengdubi, Bogdogra, kolabari, Lohagarh, Bamanpukhri, Lamagumba, Shibkhola, Mana, Latpanchar, Kalijhora, Berrik.
7.	pH	Slightly acidic: -Lohagarh, Khairbani. Moderately acidic: - Rest compartments are moderately acidic in nature.
8.	Available Sulfur	All compartments are sufficient.

As per recommendation, after soil analysis fertility status of the soil to be maintained by manuring in time with proper doses to sustain the soil productivity for a better stand of tree in future.

Status of different parameters given by the soil & land use survey of India in the soil nutrient map prepared in collaboration with the research wing of the forest directorate, Govt. of west Bengal.

CONCLUSION – In summary, this soil nutrition deficiency or sufficiency map will be help to plan reforestation, liming, utilization intensity, tree species selection, and to estimate forest productivity. Soil test report along with the map also guides to prepare the amelioration measue for tree growth and provide information to determine the site quality with in the forest compartments. In most of the area, the content of organic carbon is very high; where as the availability of nitrogen is low. For making a generalized prescription for fertilizer application for growth of chosen species, and enhancing productivity this study to be continued.