University of Madras

School of Earth and Atmospheric Sciences

DEPARTMENT OF GEOGRAPHY

GUINDY CAMPUS, GUINDY, CHENNAI - 600 025

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150 Years "ENHANCING EXCELLENCE SINCE 1857"
UNIVERSITY OF MADRAS

Dr.R.Jaganathan
Professor & Head
Principal Investigator - DST-NRDMS Winter School

11.09.2020

To
The Division Head
DST-NRDMS
Department of Science and Technology
Technology Bhavan, New Mehrali Road
New Delhi – 110016.

Dear Madam/Sir,

Sub: Submission of Report of Winter School and UC &SOE – Reimbursement-Reg.
Ref: Letter No: NRDMS/11/1848/011-5 dated 31.12.2018
Ref: Our Email Request dated Feb 27, 10:08 AM

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Herewith please find attached the Report of DST-NRDMS Winter School and UC&SOE of the DST-NRDMS "21 days Training Programme on "Geospatial Technologies (Winter School) which was held on 17.02.2020 - 08.03.2020.

I would like to intimate that as the amount provided for the contingencies head were not sufficient to effectively conduct the program and based on requirements and considering the distance between participant accommodation and the venue of the program (10 Kms) we were compelled to spend more amount in Contingencies Head. The amount has been spent on Location based and Mobile based Fieldwork for Modeling Spatial data like Temperature, Humidity, Noise, and other geographic parameters. We added more RAM to some computing systems for processing the integration of GPS data in Digital Image Processing of satellite data and other unexpected items for handling classes (Visit to Indian Meteorological Department, Science City and nearby places). For the above purpose, an amount of Rs 70,000/- has been reappropriated to Contingencies Head from Travel Cost Head. So kindly this may be approved. The total amount spent on the training program was Rs.6,98,941/-. Hence I request you to kindly reimburse the extra amount Rs.1,98,941.00 (Received Fund: Rs.5,00,000/-)

I kindly apologize for the delay in submission due to the COVID 19 pandemic.

Thanking You

Yours Sincerely

(R.Jaganathan).

Natural Resources Data Management System (NRDMS)
Department of Science and Technology
New Delhi

21 days Training Programme on "Geospatial Technologies"

NRDMS/11/1848/011-5 dated 31.12.2018

(Winter School conducted during 17.02.2020 - 08.03.2020)

University of Madras
Guindy Campus
Chennai – 600 025

Submitted by

Prof. R. Jaganathan
Professor and Head
Department of Geography
Email: rjnathan@gmail.com
Phone No: 044-22202886,
Mobile: +91 9444917006

1.	**Title of the project**	21 days Training Programme on "Geospatial Technologies"
2	**DST reference No.**	NRDMS/11/1848/011-5
3	**PI's name, designation and Address**	Prof. R. Jaganathan Professor and Head Department of Geography Email: rjnathan@gmail.com Phone No: 044-22202886, Mobile: +91 9444917006
4	**Date of Start of the project**	17.02.2020
5	**Extension period, if any**	Nil
6	**Closing Date**	08.03.2020
7	**Total cost of the project**	**Rs. 10,00,000**
8	**Funds Received**	Rs.5,00,000/-
9	**Sanction No./Date and Amount**	NRDMS/11/1848/011-5 dated 31.12.2018 Rs. 10,00,000/-
10	**Total expenditure incurred on closing date**	**Rs. 6,98,941**

11.0 Participant Profile

11.1 Total number of participants in the Summer/Winter School: **13**

11.2 Proportion of external: 11 internal candidates: 2

11.3 Provide names and institutional affiliations, complete postal address and contact details as

Annexure - I

12.0 Program Details

12.1 Kindly attach program schedule with resource persons as ***Annexure - II***

12.2 Has there been any deviation in schedule as uploaded on the DST-IGET portal? Kindly provide details:

Yes. The schedule had been modified based on the requirement and feedback from the participants during the training programme.

12.3 What innovations have you made in the content of the program / delivery of the program. Kindly provide details.

One major innovative aspect of the programme was the introduction of GPS essentials to the participants and they were taught about how to handle the application. They used the application in collecting the wind data and noise pollution data. An effort was taken to demarcate the differences between a hand held GPS device and Mobile based GPS application which helped the participants to understand the application part of those devices. Another interesting approach that was initiated during the field visits was to Geotag photos of locations where GPS points are taken.

12.4 Kindly provide examples of any best practices you used for conduction of the summer/winter school. (these could be in administration of the program, delivery of the program, content of the program, evaluation, etc.)

Lab – Field – Lab Approach:

The Lab sessions provided a good base for the implementation of best practices where small tasks are provided for every individual participant with a purpose and connect with the previous lab/theory sessions which kept the participants more interested towards the subject. Another area which was given focus is trying to bring the participant out to explain their work and the approach used by them for a specified task given. Final assessment of each task was carried out by every participant also rather than the instructor alone. This gives a chance for more interaction and confidence building in the participant.

Another way in which the participants were allowed to express themselves comfortably was through the google forms provided for everyday feedback.

The visit to Indian Meteorological Department (IMD) is also an encouraging aspect for the participants as they get to understand the real time implementation of major applications. With the visit to Indian Meteorological Department (IMD) the participants were able to see the application of GIS and Remote Sensing in the field of Climatology which can motivate them to implement it in their own fields of expertise.

12.5 Challenges faced by you in conducting the summer/winter school

- DST may release another 25% of fund during the training programme.
- Depending on the need of the specific programme, the coordinator may be permitted to utilize the amount from one head to another head.

13. Details of Resource Persons

13.1 Names and institutional affiliations of resource persons

S.No.	Name of resource person	Institutional Affiliation	No. of theory sessions conducted	No of hands on sessions conducted	No of field sessions conducted
Internal Faculty Members					
1	Dr. R.Jaganathan	Coordinator Professor & Head, Department of Geography, University of Madras	5	6	-
2	Dr.G.Bhaskaran	Associate Professor Department of Geography, University of Madras	2	-	-
3	Dr.S.Sanjeevi Prasad	Assistant Professor Department of Geography, University of Madras	1	-	-
4	Prof.N.Sivagnanam	Former HOD, Department of Geography, University of Madras	12	11	-
5	Dr.D.Surendran	Guest Lecturer, Department of Geography, University of Madras	3	6	2
6	Dr.S.Sivasankar	Guest Lecturer, Department of Geography, University of Madras	-	2	-
7	Mr. D.S.DharshanShylesh	Junior Research Fellow, DST-NRDMS Project, Department of Geography, University of Madras	-	2	-

8	Ms. Jeenu John	Junior Research Fellow, DST-NRDMS Project, Department of Geography, University of Madras	-	2	-
9	Mr. S. Stephen Jayaseelan	Research Scholar Department of Geography, University of Madras	-	2	-
10	N.Manikandan	Teaching cum Research Fellow, Department of Geography, University of Madras	-	2	-
External Resource Persons					
1	Dr.K.Kumarasamy	ICSSR Senior Fellow, Department of Geography Bharathidasan University, Tiruchirappalli	2	-	-
2	Dr.R.Jegankumar	Associate Professor and Head, Department of Geography, School of Earth Sciences, Bharthidasan University, Tiruchirappalli	2	-	-
3	Dr. P.Shanmugam	Professor, Department of Ocean Engineering, IIT Madras	4	-	-
4	Dr. S.S Ramakrishnan	Director, Institute of Remote Sensing, Anna University	2	-	-
5	Dr. P. Shoba	Assistant Professor (Research) SRM Institute of Science and Technology Katankulathur, Chennai – 603203	-	2	-

6	Dr.Sulochana Sekar	Professor and Head, Department of Geography, School of Earth Sciences, Central University of Tamil Nadu	2	-	-
7	Dr. Aravind A. Mulimani	Professor and Head, Department of Geography, Karnatak University, Dharwad	2	-	-
8	Dr.B.Srinagesh	Professor, Department of Geography, Osmania University,Hyderabad	2	-	-
9	Mr. Narayanan Ramanathan	Global Head, Digital Engineering CDO, L&T Technology Services Limited	2	-	-
10	Dr. S. Balachandran	Deputy Director General of Meteorology, Regional Meteorological Centre, Chennai	-	-	2
			41	35	4

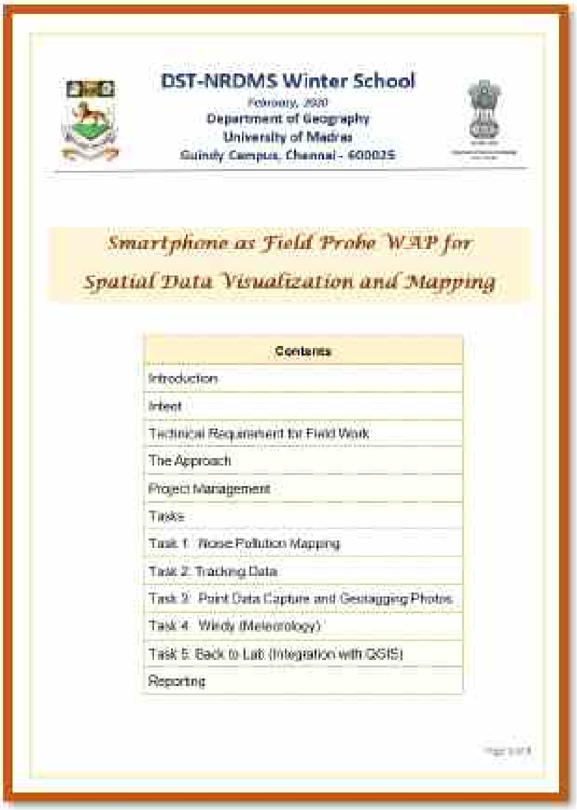
13.2 Ratio of internal: *10* external faculty 10*; (Total 80 Classes: Internal 58 External 22)*

14. Resource Material Provided

Kindly provide details of resource material provided with photographs

1. Using SAGA and QGIS user's cook-book *(attached as **Annexure III**)*

2. Field Work Manual *(Attached as **Annexure IV**)*

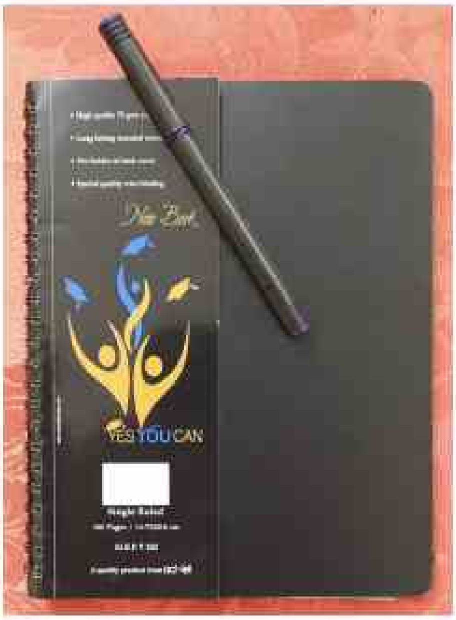


DST-NRDMS Winter School
February, 2020
Department of Geography
University of Madras
Guindy Campus, Chennai - 600025

Smartphone as Field Probe WAP for
Spatial Data Visualization and Mapping

Contents
Introduction
Intent
Technical Requirement for Field Work
The Approach
Project Management
Tasks
Task 1: Noise Pollution Mapping
Task 2: Tracking Data
Task 3: Point Data Capture and Geotagging Photos
Task 4: Windy (Meteorology)
Task 5: Back to Lab (Integration with QGIS)
Reporting

3. Accessories: a) Laptop Bag, b) Note Book & Pen, c) Memento's



15. Participant Feedback

15.1 Challenges identified by the participants in implementing the learnings from the summer/winter school

The participants are being exposed to a number of concepts, software and methods throughout the winter/summer session. The problem of implementation arises when they do not know exactly what software or technique to use for a particular task in their respective field. More involvement in the domain work of the participants into the practical sessions might make it easier to implement the learnings effectively. Since, some participants had less knowledge in geospatial gadgets they were unable to integrate data for Cartographic modelling. Participants did not have enough knowledge / skills in cartography.

15.2 Key feedback from the participants

One of the key feedbacks from the participants was to provide breaks (Sundays) during the session so that they can refresh and prepare efficiently for the next week's session.

16. Evaluation

16.1 Kindly provide details of participant mini projects. (Kindly send the mini projects as per the format given earlier) **(Valid for L1 and L2 level only)** *(Attached as **Annexure** – V)*

S.No	Name and institutional affiliations of the participants	Title of the mini project completed during the summer/winter school
1	1. Chandan Kumar Boraiaha, Department of Geology, Central University of Kerala 2. Amit Kumar, Ramadhin College, SheikhpuraMunger University, Munger 3. Akash Sonawane, K.J.Somaiya Arts Commerce and Science College 4. Vasanth Patil, Department of Applied Geology, VSK University PG centre Nandihalli, Sandur, Karnataka	Mineral resource mapping using Remote Sensing (RS) and Geographical Information System (GIS)
2.	1. Sr. Helen, Nirmala College for Women, Coimbatore 2. Ayusmita Naik, Biodiversity And Conservation Of Natural Resources	Geospatial Mapping and Assessment: Impact of Urbanization on Elephant Migration and its Conflicts with Human

	3. Geetha S, Government College for Women (Autonomous), Kumbakonam 4. Salghuna N N, International Institute of Information Technology, Hyderabad	
3	1. Gokula Krishnan T, Tamilnadu Forest Department, Erode Forest Division 2. Sangunathan U, Department of Applied Geology, University of Madras 3. Raju P, Department of Geography, University of Madras 4. Dr Kannan V, Sathyamangalam Tiger Conservation Foundation Tamil Nadu Trust 5. Dr Anita M George, Biological Oceanography Division National Institute of Oceanography	Check dam site selection in Karaipottanar sub-basin of Cauvery basin, in Tamil Nadu

16.2 Tutorials developed **(for L2 only)** (Kindly mail complete tutorial and data in format given for upload on dst-iget). ***Not Applicable***

No.	Name of the tutorial	Objectives	Software used
1			
2			
3			
4			

16.2 Provide details of assessment done for grading (please include questions, problems any if given). **(for L1 and L2 only)** *(Attached as **Annexure – VI-a and VI-b**)*

SNo	Category	Details of Assesment	Marks
1	Part 1	Multiple Choice Question	20
2	Part 2	Practical Test	30
3	Part 3	Mini Project	40
4	Part 4	Attendance	10
		Total	**100**

16.3 Provide details of subject specific pre test questions administered to participants **(for L2 only)**

Not Applicable

17. Session details (no details required)

17.1: Kindly provide **summary** of inaugural session with photographs

The Inaugural session of the DST-NRDMS Winter Session on Geospatial Technologies was held on 17th February 2020 in the Department of Geography, University of Madras, Guindy Campus, Chennai. The occasion was graced by the presence of all the participants of the winter session along with the members from various other departments and institutes. The welcome speech was delivered by Dr. R. Jaganathan Professor and Head, Department of Geography, University of Madras who is the Coordinator for the winter session. Followed by his speech the masses were given knowledge about what they will be gaining from this session from the expert talks given by Dr. Hussain from the Department of Applied Geology, university of Madras followed by Dr. K. Kumaraswamy who is the Editor of the Indian Geographical Society. A more precise speech about latest geospatial technologies was given by Prof. N .Sivagnanam Retired Professor and Head, Department of Geography, University of Madras after which the chief guest of the occasion Dr. S.S. Ramakrishnan Professor and Director in the Institute of Remote Sensing, Anna University delivered a crisp and intellectual speech to the audience on the overall impact of Geospatial Technolgies. The session was concluded by a thank you note given by Dr. G. Bhaskaran Department of Geography, University of Madras.

17.2: Kindly provide **summary** of technical sessions conducted with photographs.

The DST-NRDMS winter school training programme was on Geo-spatial technologies. The participants, specialized in different domains, were in need of GIS and remote sensing for their field of study. So the main focus was into the understanding and applications of remote sensing and geographical information systems. The Programme was studded with special lectures from key note speakers, theoretical presentations by subject experts and intensive practical hands-on experience of geospatial technology tools. Participants were given a basic idea of geospatial science, spatial and Non-spatial data, basics of remote sensing and image pre-processing such as Introduction to image enhancements, Contrast enhancements, Band rationing, Spatial filtering Spatial Data Quality and Spatial Referencing systems. They were given an idea of different types of map making, various scales of maps & about projection systems. An introduction to basics of DEM and its application such as terrain analysis was given.

Special lectures were arranged in topics such as Applications in Urban Planning and Management, Forestry and Wildlife, applications of microwave remote sensing and a hand on experience on SNAP software was conducted. The participants completed a field visit and a mini project. The participants were divided into teams for mini project and each team presented their results.

17.3: Kindly provide **summary** of hands on session conducted with photographs

The winter school conducted QGIS, SAGA, PAST3, GeoDA and other Open Source tools for hands-on experience as part of the Programme. They were familiarized with various data acquiring sources such as USGS Earth explorer, Bhuvan, Sentinel Open Access hub. In QGIS they have done georeferencing, projection and Reprojection of vector and raster layers. Map making & the overlay sessions were conducted which helped them in their mini project and in the fieldwork repot submission. In SAGA, they were made familiar with the true color composite, false color composite, analysis of the histogram of an image. They were imparted knowledge of the difference between spatial, spectral temporal resolutions, different classification techniques of images. Derivation of indices such as NDVI, analyzing of scatter plot with other layer, basic operations such as mosaicking, sub setting ,band rationing, were familiarized. Extraction of pixel values, preparation of slope, aspect maps and terrain analysis using DEM was conducted. The participants were made familiar with the software PAST for data manipulation, univariate and multivariate statistics, time series analysis and in the spatial analysis of the data. An introduction to the Geoda software was given

17.4: Kindly provide **summary** of field session conducted with photographs.

Field work was planned for the participants to understand the importance of mapping with the help of handheld GPS. The task for every participant was to choose a locality of their interest and to map the noise pollution in that locality. The participants were given prior training in the previous day on how to use a handheld GPS through the GPS essentials mobile application. A small tour around the University of Madras, Guindy Campus was being done to make the participants understand how to use the GPS essentials mobile application. The participants were required to collect a number of points along with the Decibels of noise around that location after which they were made to import these points in QGIS and Interpolate to create a Noise Map. A final report on the work done in the field was prepared by every individual participant and submitted. Along with this a field visit was also arranged in the Regional Meteorological Centre, Chennai where a special lecture was delivered by members of the IMD and the participants were given a tour of the centre along with explanations regarding the various instruments used in the climatology and meteorology. The visit to IMD was very fruitful and helped the participants in understanding various phenomena related to their current field of work.

17.4: Kindly provide **summary** of valedictory session with photographs.

The Valedictory Session of the DST-NRDMS winter session on Geospatial Technologies was held on 8th March 2020 in the Department of Geography, University of Madras, Guindy Campus, Chennai. The valedictory function had all the participants of the winter session along with members from various other institutes and departments. The event had various speakers in the dais. The function started with an elegant welcome speech by Dr. R. Jaganathan Professor and Head, Department of Geography, University of Madras who felicitated and welcomed all the guests in the occasion. The presidential address was delivered by Prof. N. Sivagnanam Retired Professor and Head, Department of Geography, University of Madras. The Valedictory address was delivered by Dr. P. Shanmugam Professor, Department of Ocean Engineering, IIT Madras where a lot of interaction happened with the participants regarding the technical aspects of the session and about what they have grasped in particular from the 21 days. After this the certificates for the participants were given and a chance to speak on the overall impression of the session along with other non-technical aspects. The thank you note was given by Dr. S. Sanjeevi Department of Geography, University of Madras and therefore concluding the valedictory function.

18. Logistic Details

18.1 Kindly provide photographs of participant lodging.


MADRAS UNIVERSITY
GUEST HOUSE


GUEST HOUSE

18.2 Kindly provide photos of classrooms/labs where program was conducted

18.3 Any other general photos that depicts summer/winter school ambience

18.4 Group photo

ANNEXURE I

(List of Participants)

Annexure I

Sno	Name	G	Designation	Department/Centre	Institution/University	Mobile Number	Email ID
1	Amit Kumar	M	Faculty	Ramadhin College, SheikhpuraMunger University, Munger	SheikhpuraMunger University	9930808738	amitgeoiips@gmail.com
2	Anita Mary George	F	RA	Biological Oceanography Division	National Institute of Oceanography	9787211794	ageorge@nio.org
3	Ayusmita Naik	F	Ph.D. Scholar	Biodiversity And Conservation Of Natural Resources	Central University Of Odisha	8917698755	ayusmitanaik123@gmail.com
4	Chandan Kumar B	M	Faculty	Department of Geology, Central University of Kerala	Central University of Kerala	7760820636	chandankb@cukerala.ac.in
5	Geetha. S	F	Faculty	Department of Geography	Government College for Women (Autonomous),Kumbakonam	9443380302	geethaasvanth@gmail.com
6	Gokulakrishnan	M	Biologist	Tamilnadu Forest Department	Erode Forest Division	8508143239	gokulakrishnan1013@gmail.com
7	Helen Jenifer	F	Faculty	Department of Geography	Nirmala College for Women, Coimbatore	9842552449	helanrai1229@gmail.com
8	Kannan Vaithianathan	M	Biologist	Sathyamangalam Tiger Reserve	Sathyamangalam Tiger Conservation Foundation Tamil Nadu Trust	7810964541	kannan.vaithianathan@gmail.com
9	Raju N	M	Ph.D. Scholar	Department of Geography, University of Madras	University of Madras	7639346567	mazhairajugeo@gmail.com
10	Salghuna N N	F	Researcher	Lab of Spatial Informatics	International Institute of Information Technology, Hyderabad	9791810419	salghuna@gmail.com
11	Sangunathan	M	Ph.D. Scholar	Department of Applied Geology	University of Madras	9500140413	usangu@gmail.com
12	Sonawane Akash Shankar	M	Faculty	K.J.Somaiya Arts Commerce and Science College		9623092370	sonawaneakash0101@gmail.com
13	Vasanth Patil S.B	M	Ph.D. Scholar	Department of Applied Geology	VSK University PG centre Nandihalli,Sandur-583119,Bellari Dist. Karnataka	9844425299	vasanthpatil.vskub@gmail.com

ANNEXURE II

(Program Schedule with resource person)

Schedule of Programme
NRDMS-DST Sponsored 21 Days Training Programme
On Geospatial Technologies (Level 1)
(17th February,2020 – 08th March,2020)

Department of Science & Technology Govt. of India

Venue: Geographic Information Science Lab, Department of Geography, University of Madras

ANNEXURE-II

Time	Topic	Name of Resource Person
Day 01 - 17.02.2020 (Monday)		
09:00-10:00	REGISTRATION	
10:00- 11.00	**INAUGURATION** **Dr. S. S. Ramakrishnan,** Director, Institute of Remote Sensing, Anna University **Dr.N.Sivagnanam Former HOD, Department of Geography, University of Madras** **Dr. K. Kumaraswamy**, ICSSR Senior Fellow, Department of Geography, Bahrathidasan University Editor, Indian Geographical Society **Dr. Sheik Mohammad Hussain**, Chairperson, School of Earth and Atmospheric Sciences, University of Madras. **Dr.R.Jaganathan**, Coordinator of the Programme Professor and Head, Department of Geography, University of Madras.	
11.00 - 11.30	**Tea Break**	
11.30 - 12.00	Interaction with the Participants	Dr.R.Jaganathan
12.00 - 13.00	Introduction to Geoinformatics-I	Dr.K.Kumaraswamy
13.00-14.00	**Lunch**	
14.00-15.30	Introduction to Geoinformatics-II	Dr.K.Kumaraswamy
15.30-16.00	**Tea Break**	
16.00-17.30	**Lab 1:** Acquiring data (capture) (Downloading of ASTER, MODIS, Sentinel, Bhuvan ,Acquiring Toposheets from SOI, Google Earth and Census Data)	Dr. D. Surendran/ Mr. D.S.DharshanShylesh/ Mr. S. Stephen Jayaseelan
17.30-18.00	Filling in Feedback forms	
Day 02: 18.02.2020 (Tuesday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30-11.00	Geospatial Data Analysis (Marketing, etc.,)	Dr. A.Mulimani
11.00-11.30	**Tea Break**	
11.30-13.00	Map Design and Layout	Prof. N. Sivagnanam
13.00-14.00	**Lunch**	
14.00-15.30	**Lab 2:**Maps ,Images - Indexing, Searching and Labelling	Dr. D. Surendran
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 3:**Exploring QGIS	Dr. D. Surendran
17.30 - 18.00	Filling in Feedback forms	
Day 03: 19.02.2020 (Wednesday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Spatial Data and its Dimensions (Health care and etc)	Dr.B.Srinagesh
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Georeferencing and Creation of Spatial Entities	Dr. S. Sivasankar
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 4:**Colors,Symbols & Making Maps	Mr. D.S.DharshanShylesh

15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 5:** Georeferencing ,Projection & Reprojection	Mr. D.S.DharshanShylesh
17.30 - 18.00	Filling in Feedback forms	
Day 04: 20.02.2020 (Thursday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Map: Scales and Classification	Prof. N. Sivagnanam
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Map Projections	Prof. N. Sivagnanam
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 6:** Creation of base map (Point, Line, Polygon)	Mr. D.S.DharshanShylesh
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 7:** Creation of spatial data by the participants – Task	Mr. D.S.DharshanShylesh
17.30 - 18.00	Filling in Feedback Forms	
Day 05: 21.02.2020 (Friday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Data, Data Exploration and Geospatial data (PAST and GeoDa software)	Prof. N. Sivagnanam
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	**Lab 8:** Vector Analysis-Overlay (Union, Intersect)	Mr. D.S.DharshanShylesh / Ms. Jeenu John
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 9:** Vector Analysis-Overlay (Symmetrical Difference)	Mr. D.S.DharshanShylesh / Ms. Jeenu John
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 10:** Vector Analysis - Network Analysis: Shortest Path	Mr. D.S.DharshanShylesh / Ms. Jeenu John
17.30 - 18.00	Filling in Feedback Forms	
Day 06: 22.02.2020 (Saturday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	**Lab 10:** Spatial and Nonspatial Queries (Adding and Editing attributes)	Dr.D.Surendran / Ms. Jeenu John
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	**Lab 11:** Spatial and Nonspatial Queries (Join & Relates and Mapping)	Dr.D.Surendran / Ms. Jeenu John
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 12:** Spatial Data Visualization using WAP	Dr.D.Surendran / Ms. Jeenu John
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 13:** Field Data Capture in University Campus (Practical)	Dr.D.Surendran / Ms. Jeenu John
17.30 - 18.00	Filling in Feedback Forms	
Day 07: 23.02.2020 (Sunday)		
08.00 – 18.00	Feedback (Online Discussion) **Field Work:** Data Capture of Point Data and Track data, Geotagged images and mapping using WAP Filling in Feedback Forms	Prof. N. Sivagnanam / Dr. D. Surendran

Day 08: 24.02.2020 (Monday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	**Field to Lab** Mapping Analysis and Spatial Modelling	Dr. D. Surendran
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Buffer Operations (Simple, Multiple and Variable)	Dr. D. Surendran
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 14:** Remotely Sensed Data & SAGA Software	Prof. N. Sivagnanam / Mr. D.S.DharshanShylesh
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 15:** Image Visualization	Prof. N. Sivagnanam / Mr. D.S.DharshanShylesh
17.30 - 18.00	Filling in Feedback Forms	
Day 09: 25.02.2020 (Tuesday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Basics of Remote sensing	Dr. G. Bhaskaran
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Image Interpretation- Visual	Dr. G. Bhaskaran
13.00 - 14.00	**Lunch**	
14.00 - 15.30	Theory of Remote Sensing-I	Dr. P.Shanmugam
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	Theory of Remote sensing-II	Dr. P.Shanmugam
17.30 - 18.30	Filling in Feedback Forms	
Day 10: 26.02.2020 (Wednesday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Proximity Analysis: Simple, Multiple and Variable Buffers	Dr. D. Surendran
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	**Lab 16:** Examination of Image & Color composites and Ratio	S. Stephen Jayaseelan
13.00 - 14.00	**Lunch**	
14.00 - 15.30	Digital Image Processing	Dr. P.Shanmugam
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	Digital Image Processing	Dr. P.Shanmugam
17.30 - 18.00	Filling in Feedback Forms	
Day 11: 27.02.2020 (Thursday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Image Classification: Supervised and Unsupervised	Prof. N. Sivagnanam
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	**Lab17:** Image Registration, Sub setting, mosaicking & Filtering of Images	Prof. N. Sivagnanam / Ms. Jeenu John /
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 18:** Image Classification - Unsupervised classification	Prof. N. Sivagnanam
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 19:** Image Classification - Unsupervised classification	Prof. N. Sivagnanam / Mr. D.S.DharshanShylesh
17.30 - 18.00	Filling in Feedback Forms	

Day 12: 28.02.2020 (Friday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Microwave Remote Sensing	Dr. S.S Ramakrishnan
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Microwave Remote Sensing	Dr. S.S Ramakrishnan
13.00 - 14.00	**Lunch**	
14.00 - 15.30	Modelling approaches and Applications of Microwave Remote Sensing	Dr. P. Shoba
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 21:** Hands-on Training on SAR data Processing	Dr. P. Shoba
17.30 - 18.00	Filling in Feedback Forms	
Day 13: 29.02.2020 (Saturday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Geoinformatics in Urban Planning and Management	Dr.Sulochana Sekar
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Spatial Data Analysis and Modeling – Urban Heat Island	Dr.Sulochana Sekar
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 22:** Image Classification - Supervised classification	Mr. D.S.DharshanShylesh
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 23:** Image Classification - Supervised classification	Mr. D.S.DharshanShylesh
17.30 - 18.00	Filling in Feedback Forms	

Day 14: 01.03.2020 (Sunday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Change Detection Analysis	Dr. R. Jegankumar
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	**Lab 24:** Change Detection Analysis	Dr. R. Jegankumar
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 25:** Land Cover classification and change-detection analysis	Dr. D. Surendran/ Mr. N. Mankandan
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 26:** Terrain Analysis and Modelling	Dr. D. Surendran / Mr. N. Mankandan
17.30 - 18.00	Filling in Feedback Forms	
Day 15: 02.03.2020 (Monday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Geospatial Technology in Smart cities: A Case study	Mr. Narayanan Ramanathan, CDO, L&T
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	GIS based Assets Management- LBS	Mr. Narayanan Ramanathan, CDO, L&T
13.00 - 14.00	**Lunch**	
14.00 - 15.30	Remote Sensing of Weather and Climate parameters at Indian Meteorological Department (IMD)	Dr. S. Balachandran, IMD
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 27:** Remote Sensing of Weather and Climate parameters	Dr. S. Balachandran, IMD
17.30 - 18.00	Filling in Feedback Form	
Day 16: 03.03.2020 (Tuesday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Geostatistics	Prof. N. Sivagnanam
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Introduction to PostgreSQL / PostGIS & demos and Understanding Geoserver – Open layer, web services and demos	Prof. N. Sivagnanam
13.00 - 14.00	**Lunch**	
14.00 - 15.30	**Lab 28:** Working with GeoDA, PostgreSQL / PostGIS	Dr. D. Surendran
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	**Lab 28:** Working with Geoserver	Dr. D. Surendran
17.30 - 18.00	Filling in Feedback Forms	
Day 17: 04.03.2020 (Wednesday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Applications of Geospatial Technology in Health Care mapping	Dr.Sanjeevi Prasad
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Group Discussion (Team Work for preparation	Dr.R.Jaganathan/ Prof.N.Sivagnanam
13.00 - 14.00	**Lunch**	
14.00 - 15.30	Group Discussion (Team Work for preparation	Dr.R.Jaganathan/ Prof.N.Sivagnanam
15.30 - 16.00	**Tea Break**	

16.00 - 17.30	Group Discussion (Team Work for preparation of methodology flow chart for a specific case study)	Dr.R.Jaganathan/ Prof.N.Sivagnanam
17.30 - 18.00	Filling in Feedback Forms	
Day 18: 05.03.2020 (Thursday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Discussion of Minor Projects	Dr.R.Jaganathan/ Prof.N.Sivagnanam
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Discussion of Minor Projects – Identification of Research Problem	Dr.R.Jaganathan/ Prof.N.Sivagnanam
13.00 - 14.00	**Lunch**	
14.00 - 15.30	Working on Projects - Study Area, Objectives and Methodology	Dr.R.Jaganathan/ Prof.N.Sivagnanam
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	Working on projects - Study Area, Objectives and Methodology	Dr.R.Jaganathan/ Prof.N.Sivagnanam
17.30 - 18.00	Filling in Feedback Forms	
Day 19: 06.03.2020 (Friday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Working on projects – Preparation of base map and datasets	Dr.R.Jaganathan/ Prof.N.Sivagnanam
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Working on projects - Preparation of base map and datasets	Dr.R.Jaganathan/ Prof.N.Sivagnanam
13.00 - 14.00	**Lunch**	
14.00 - 15.30	Working on projects – Spatial Data Analysis	Dr.R.Jaganathan/ Prof.N.Sivagnanam
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	Working on projects - Spatial Data Analysis	Dr.R.Jaganathan/ Prof.N.Sivagnanam
17.30 - 18.00	Filling in Feedback Forms	
Day 20: 07.03.2020 (Saturday)		
09.00 - 09.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.00	Working on projects - Spatial Data Analysis	Dr.R.Jaganathan/ Prof.N.Sivagnanam
11.00 - 11.30	**Tea Break**	
11.30 - 13.00	Working on projects - Spatial Data Analysis	Dr.R.Jaganathan/ Prof.N.Sivagnanam
13.00 - 14.00	**Lunch**	
14.00 - 15.30	Working on projects – Preparation of Report	Dr.R.Jaganathan/ Prof.N.Sivagnanam
15.30 - 16.00	**Tea Break**	
16.00 - 17.30	Working on projects - Preparation of Report	Dr.R.Jaganathan/ Prof.N.Sivagnanam
17.30 - 18.00	Filling in Feedback Forms	
Day 21: 08.03.2020 (Sunday)		
09.00 – 9.30	Presentation of Feedback	Dr.R.Jaganathan
09.30 - 11.30	Project Presentation and Evaluation	Dr.R.Jaganathan/ Prof.N.Sivagnanam
11.30 - 11.45	**Tea Break**	
11.45 - 13.00	**VALEDICTORY**	

	Dr. P Shanmugam, DST Representative Professor, Dept,. of Ocean Engineering, IIT Madras **Dr. K. Kumaraswamy**, ICSSR Senior Fellow, Department of Geography, Bharathidasan University Editor, **Dr.N.Sivagnanam Former HOD, Department of Geography, University of Madras** **Dr.R.Jaganathan**, Coordinator of the Programme,Professor and Head, Department of Geography, University of Madras	
13.00 - 14.00	**Lunch**	

ANNEXURE III

(Resource Material-Cook Book)

GEOSPATIAL TECHNOLOGY

DST-NRDMS WINTER SCHOOL

USING SAGA & QGIS USER'S COOK-BOOK

FEBRAURY, 2020

DEPARTMENT OF GEOGRAPHY
UNIVERSITY OF MADRAS
GUINDY CAMPUS
CHENNAI 600-025

USING SAGA & QGIS USER'S COOK-BOOK

DST-NRDMS WINTER SCHOOL- GEOSPATIAL TECHNOLOGIES

Sponsored by

सत्यमेव जयते

Department of Science & Technology
Govt. of India

National Resources Data Management System
Department of Science and Technology
Government of India
New Delhi

Organized by

Department of Geography
University of Madras
Guindy Campus
Chennai – 600 025
Febraury - 2020

Acknowledgement

The Cook-Book is possible as a consequence of the winter school organized by the Department of Geography, University of Madras as a Training Programme for 21 days, sponsored by the **National Resources Data Management System (NRDMS), Department of Science and Technology, (DST), Government of India.**

No doubt that there are a number of user manuals, Cook-Books, Training Manuals and working papers available in the internet resources (inclusing YouTube presentations) for researchers and academicians to familiarise with the Geospatial Technology. Some of the training materials are with example data and outputs; therefore the user can practice as many times as possible to iron out the inhibitions when a person learns through the technology without a Guru. Self-learning is difficult but achievable!

This Cook-Book is an attempt to introduce another training material with necessary data for intended learners. It has got variations in understanding, learning and applications of Geospatial technology. Everyone has a method of learning and execution; in that context, the present Cook Book is an addition to the varied tricks of mastering the technology!

We, in the Department of Geography is immensely pleased to record our that's to DST-NRDMS for the support of the Programme and financial assistance. Words may fail to record our appreciation and thanks to the members of the technical team in the preparation of the Cook Book; the team includes – Research Scholars: Jeenu John and Dharshan Shylesh D.S.; the GIS analysis expertise: Dr. D.Surendran and others technical members.

R.Jaganathan
N.Sivagnanam

SOURCES AND RESOURCES

QGIS DOWNLOAD:
https://www.qgis.org/en/site/forusers/download.html
https://sourceforge.net/projects/qgis/
QGIS USER GUIDE:
https://docs.qgis.org/3.4/en/docs/user_manual/
QGIS TRAINING MANUAL:
https://docs.qgis.org/3.4/en/docs/training_manual/index.html
SAGA DOWNLOAD:
https://sourceforge.net/projects/saga-gis/
SAGA MANUALS, TUTORIALS AND GUIDES:
http://www.saga-gis.org/en/index.html
OTHER RESOURCES FOR SAGA AND QGIS:
http://dst-iget.in/index.php/tutorialdetails/1/1
http://dst-iget.in/index.php/tutorialdetails/2/2
PROJECT MANAGEMENT SOFTWARES:
Microsoft Project Management
Libreoffice: https://www.libreoffice.org/download/download/
LIBRARIES OF MANAGEMENT:
Zotero: https://www.zotero.org/download/
DOCUMENT DESIGN:
Scribbler: https://www.smart-edit.com/Writer/Details/DownloadRelease/
LYX: https://www.lyx.org/Download
EXPLORATORY TOOLS:
Statistics (Exploratory Data Analysis)
Openstat ➔https://openstat.en.softonic.com/
Past ➔https://folk.uio.no/ohammer/past/
Gretl➔https://sourceforge.net/projects/gretl/
Spatial (Exploratory Spatial Data Analysis)
Geoda ➔https://geodacenter.github.io/download.html

SAGA
System for Automated Geoscientific Analyses

PROLOGUE

The Earth is a very complicated structure with a vast diversity in its features and its behavior starting from the North Pole to the South Pole. Geomatics can be understood as a field in which the measurements of the features on earth are taken with suitable mathematical solutions towards the complications that is found on earth. It is basically the field in which data is being created for further processing and analysis. Geomatics serves as the base for various concepts such as Photogrammetry, Remote Sensing, Global Navigational Satellite System etc. For better understanding of the earth features and to analyze them it is important to create a good set of data and that can be achieved with the help of Geomatics which basically brings every feature on earth to 1D, 2D and 3D coordinates.

The field where the analysis and processing of this data is being carried out is known as Geoinformatics where the data collected is stored, processed and analyzed to gain valuable information from it which can be useful in decision making. Geoinformatics facilitates provision for storing the data in efficient Spatial Database Management Systems such as PostgresSQL, MySQL etc. The usage of efficient Programming Languages to build software that support the managing and analysis of data is the core of Geoinformatics. A number of algorithms are developed using many languages with each having its own Pros and Cons towards a reasonable output.

Geomatics and Geoinformatics are interrelated in a number of ways because the algorithms developed are heavily dependent on the way in which data is captured and the mathematical logic falling behind it. In the modern world creation of efficient spatial data is of prime importance and can be vital in many aspects that can have effect on the near future.

CONTENTS

GEOSPATIAL METHODS - AN INTRODUCTION

ACQUIRING DATA (CAPTURE)1
(DOWNLOADING OF ASTER, MODIS, SENTINEL, BHUVAN, ACQUIRING TOPOSHEET FROM SOI, GOOGLE EARTH AND CENSUS DATA)

OBJECTIVE:

- *To familiarize with acquiring of Data from Different Sources*

REMOTELY SENSED DATA

- Remote sensing is the science of acquiring information about the Earth's surface without actually being in contact with it.

- Remotely Sensed Data is captured with the help of Sensors in the satellites.

- Every object on earth reflects back some amount of light from the wide range of electromagnetic spectrum which is captured by the sensor and stored in it.

- Four major terms in regards to any satellite data will be

    - Spectral Resolution – The sensors consist of bands for each wavelength which captures the light reflected at that particular wavelength.

    - Spatial Resolution – Spatial resolution is a measure of the smallest object that can be resolved by the sensor, or the ground area imaged for the instantaneous field of view (IFOV) of the sensor. In simpler terms it is called as the Pixel Size.

    - Radiometric Resolution – Radiometric resolution refers to how much information is in a pixel and is expressed in units of bits. A single bit of information represents a binary decision of yes or no, with a mathematical value of 1 or 0.

    - Temporal Resolution - Temporal resolution is defined as the period of time needed to revisit and acquire data for the exact same location.

- Few major websites in which data can be acquired

  https://earthexplorer.usgs.gov/ - USGS Earth Explorer
  https://scihub.copernicus.eu/dhus/#/home - ESA Open Access Hub
  https://bhuvan.nrsc.gov.in/bhuvan_links.php - Bhuvan
  https://cisess.umd.edu/data-downloads/data-sets/ - Maryland Unviersity
  https://giovanni.gsfc.nasa.gov/giovanni/ - Giovanni

ASTER DATA

The ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) sensor is an imaging instrument flown on the Terra satellite which was launched in December 1999. ASTER has been designed to acquire land surface temperature, emisivity, reflectance, and elevation data and is a cooperative effort between NASA and the Japanese Ministry of Economy, Trade, and Industry (METI).These ASTER data are now available at the USGS Earth Explorer site.

MODIS

Satellite imagery from the Moderate Resolution Imaging Spectroradiometer (MODIS).MODIS provides Earth observation data in a wide spectral range, from 1999 to the present. The MODIS satellites image the Earth every one to two days, though individual products derived from MODIS data may have lower temporal resolutions. MODIS is administered by the National Aeronautics and Space Administration (NASA) and the US Geological Survey (USGS). he data have a variety of resolutions; spectral, spatial and temporal. Because the MODIS sensor is carried on both the Terra and Aqua satellites, it is generally possible to obtain images in the morning (Terra) and the afternoon (Aqua) for any particular location. Night time data are also available in the thermal range of the spectrum.

Sentinel

Sentinel-1 is the first of the Copernicus Programme satellite constellation conducted by the European Space Agency.This mission is composed of a constellation of two satellites, Sentinel-1A and Sentinel-1B, which share the same orbital plane. They carry a C-band synthetic-aperture radar instrument which provides a collection of data in all-weather, day or nightSentinel-2 is an Earth observation mission from the Copernicus Programme that systematically acquires optical imagery at high spatial resolution (10 m to 60 m) over land and coastal waters. The mission is a constellation with two twin satellites, Sentinel-2A and Sentinel-2B.

USGS EARTH EXPLORER

The United States Geological Survey (USGS, formerly simply Geological Survey) is a scientific agency of the United States government.The United States Geological Survey (USGS) Earth Explorer gives some extra capabilities: The Earth Explorer (EE) user interface is an online search, discovery, and ordering tool developed by the

United States Geological Survey (USGS). EE supports the searching of satellite, aircraft, and other remote sensing inventories through interactive and textual-based query capabilities. Registered users of EE have access to more features than guest users. The benefits of using USGS is

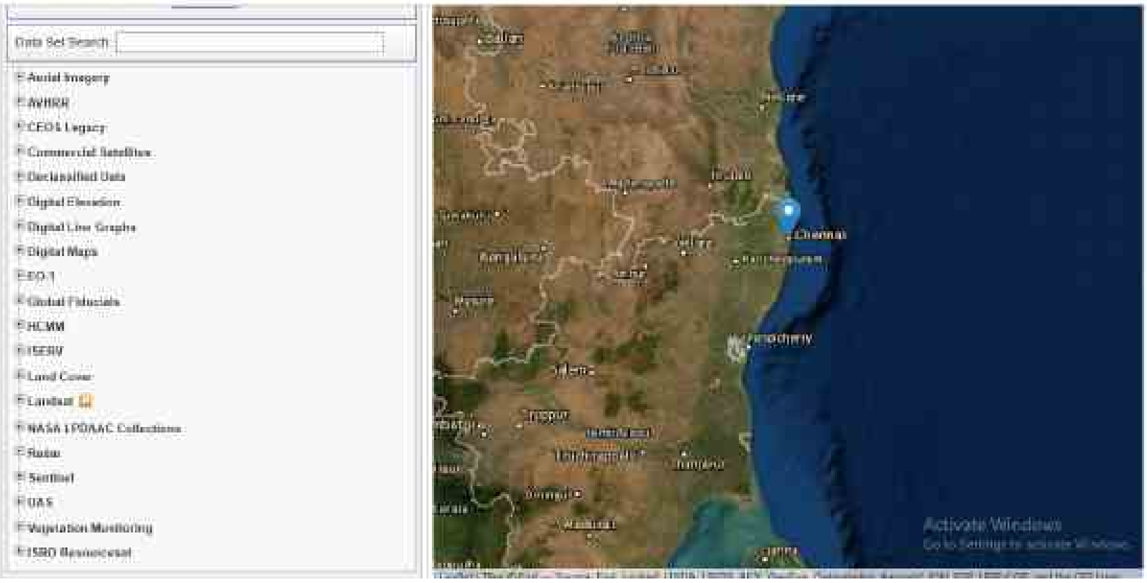
- Downloading data over chronological timelines.
- Specifying a wide range of criteria for searches.
- Choosing from a long list of satellite and aerial imagery

How to download data from USGS Earth explorer?

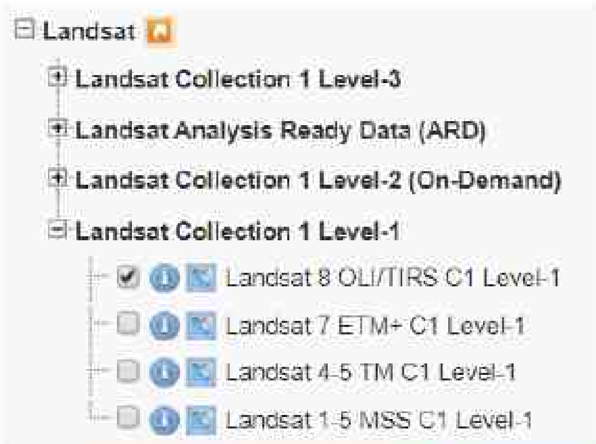
1. First, you'll have to create an account with USGS. In the top-right corner, click the Register button. You'll receive instructions to activate your account.
2. Set your area of interest in the "Search Criteria". You can use one of these options to create a region of interest:
    - Using an address to search
    - Importing a shapefile (in a zip file) or KML
    - Or you can just double-click the map to make your ROI

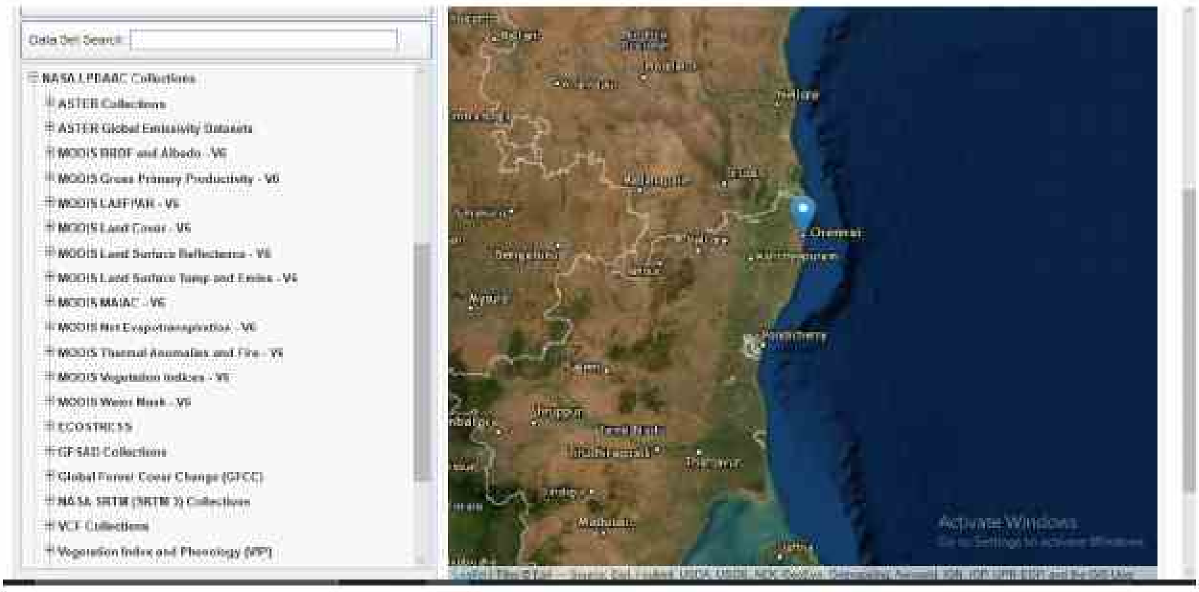
3. Select your data to download in the "Data Sets" tab

    The USGS Earth Explorer remote sensing datasets are plentiful: aerial imagery, AVHRR, commercial imagery, digital elevation, Landsat, LiDAR, MODIS, Radar and more.



4. Select the type of data from the list. If you want to select Landsat series select the Landsat .It depends on the date and time for which Landsat scene you can download. In the Landsat➔Landsat Collection1-Level 1 group, the most recent Landsat imagery is L8 OLI/TIRS and L7 ETM+.





5. If you want to download the ASTER DEM, select NASA LPDAAC collections, from which select the ASTER selections.
6. Filter your data in the "Additional Criteria" tab.
   Set the cloud cover percentage on the data sets
7. Download the required data in the "Results" tab
   - Now that you've defined the date range, type of data and additional criteria, the search results tab will populate with data sets that match your query.
   - In the result tab you select the specific imagery you want to download. But it's good to check the footprint for exactly where that scene is located. You can also preview the data, which can be good to see exactly where clouds are in the image.
   - Download the data by clicking the "Download" button. If you are going to performing analysis on the Landsat data, the Level 1 GeoTIFF data product is probably the one you're after, which will be the largest file size.

How to download sentinel data?

1. Browse the site https://sentinel.esa.int/web/sentinel/sentinel-data-access
2. First, you'll have to create an account with European Space Agency (ESA). In the top-right corner, click the Register button. You'll receive instructions to activate your account.

3. Using the navigation tool navigate to the region of interest. Draw a rectangular box around the area of interest.

4. Expand the menu bar and specify the time period, the pass(ascending/descending), which mission of sentinel to be downloaded (sentinel 1,sentinel 2 ,sentinel 3).specify the sensor and click on search button .Select the images having less cloud cover and check whether the image passes to area of interest.

How to Download Topsheet

1. Search the site soinakshe.uk.gov.in

2. Select the 'Get started' and enter the adhar card details

3. After verifying the adhar card details it will take to a page on that select search by sheet no, and enter the OSM sheet no or select 'geographical

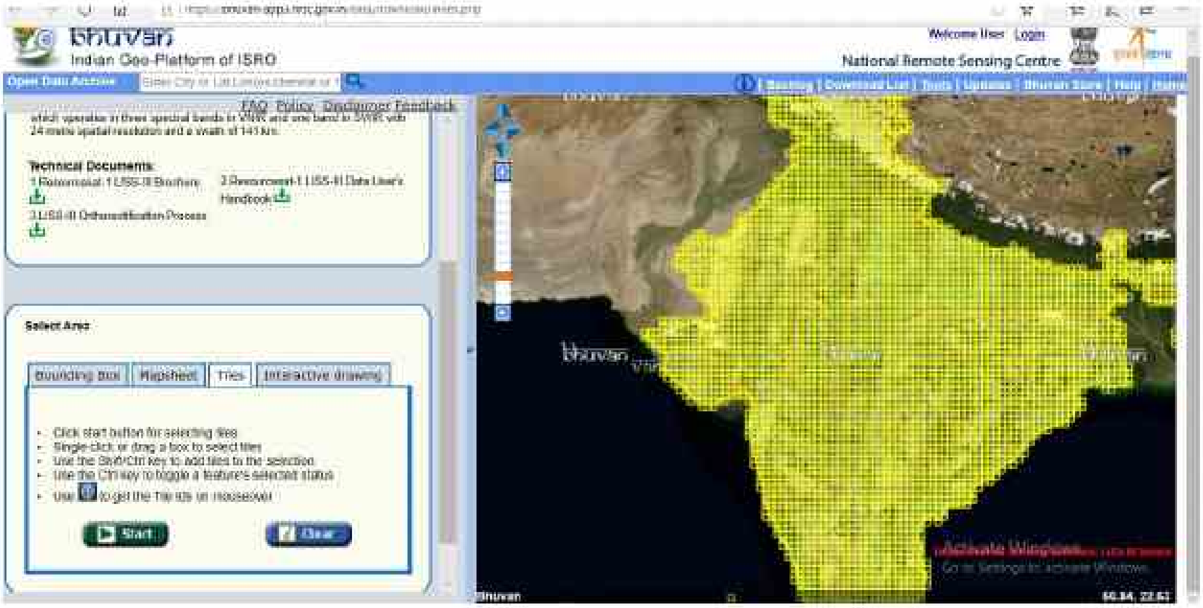
search' in which type the region .It will display the toposheet covering the region .From that select the required toposheet and click download.

How to download data from BHUVAN

1. Search Bhuvan.nrsc.gov.in

2. Select open data archive

If you want to download LISS III images, select resourcesat-I, resourcesat-III from the drop down .If you want to download DEM Select cartosat from the list.



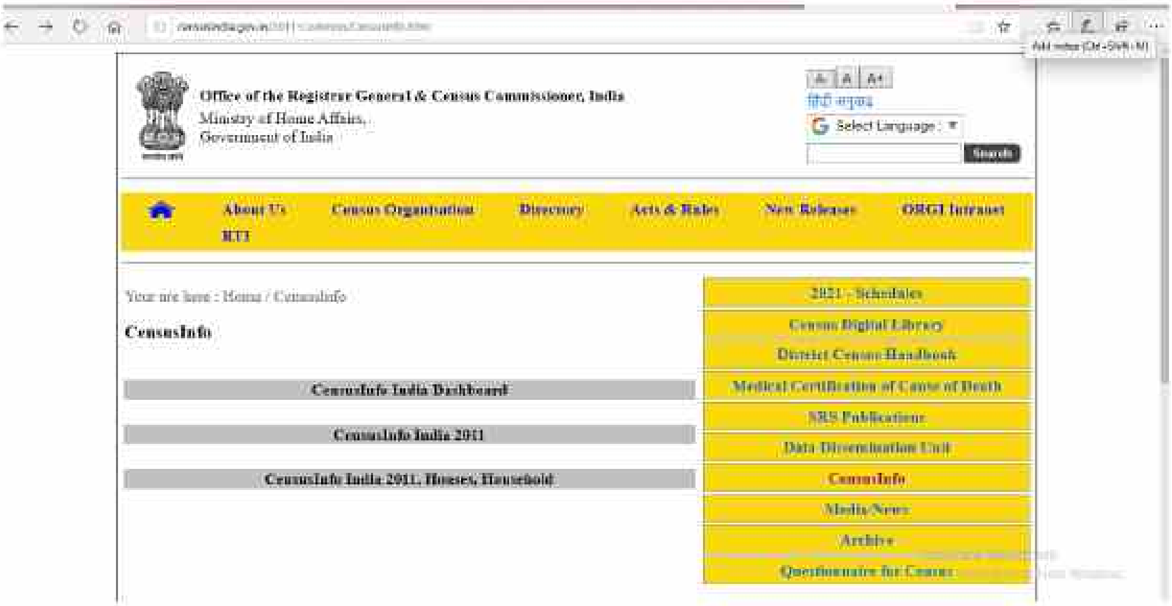
4. Select the area using either by bounding box, map sheet, tile or by interactive drawing.

5. Select tiles and click on start. Select the tile that covering the region then click the next option.

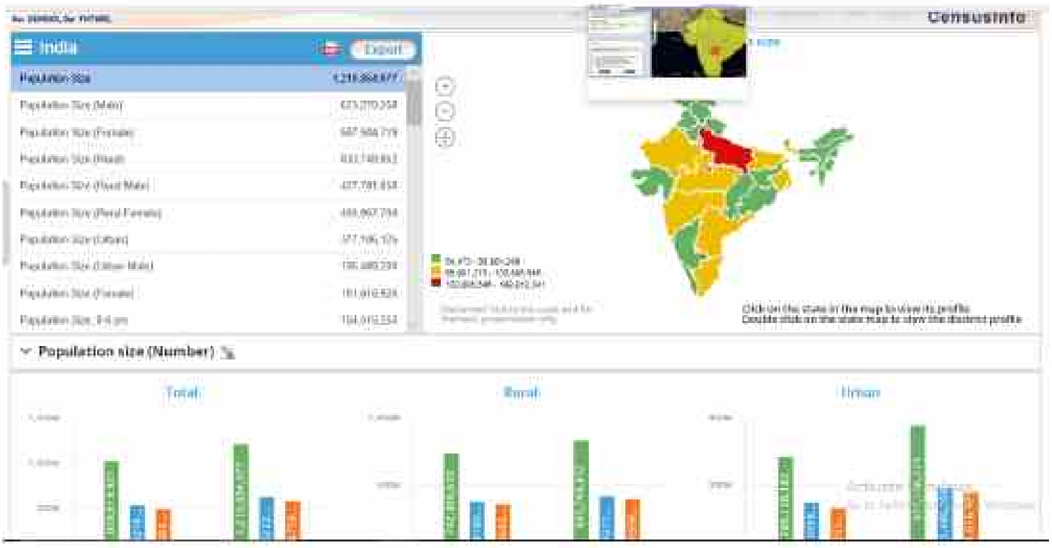
The images covering the selected tiles will be displayed, to view the image before downloading select thumbnail view, then select the required image and then click download.

How to download census data

1. Search censusindia.gov.in



2. Select the 'CensusInfo' and then select the 'CensusInfo India Dashboard'from the list



3. A page will opens up which shows the details of the population of the whole India. The map of India will be displayed on the right hand side. From the map select which state population to be displayed. From that select which district population details to be displayed.
4. Export the details as pdf.

GOOGLE EARTH

Google earth is an open source program that is mostly used by civilians to map out various locations on the surface of the earth. It can easily be downloaded and installed on the PC and usage is immediate. Google earth can be downloaded either on a mobile smartphone or on a personal computer. Google earth gives users the ability to upload their own data on the program using tools such as Keyhole ML and then manipulate the data to suit their need. Google earth offers a panoramic view of some of the landmarks and other features which gives a real-time feeling of some of the features on land.

MAPS, IMAGES -INDEXING & SEARCH

OBJECTIVE:

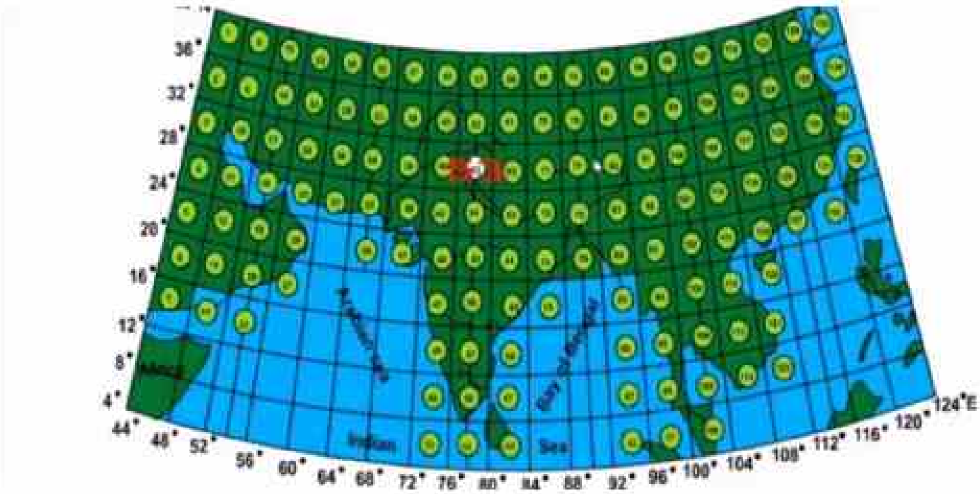
- ***To understand the map numbering***
- ***To understand the image indexing***
- ***To understand how to acquire data using smartphone***

Toposheet Numbering

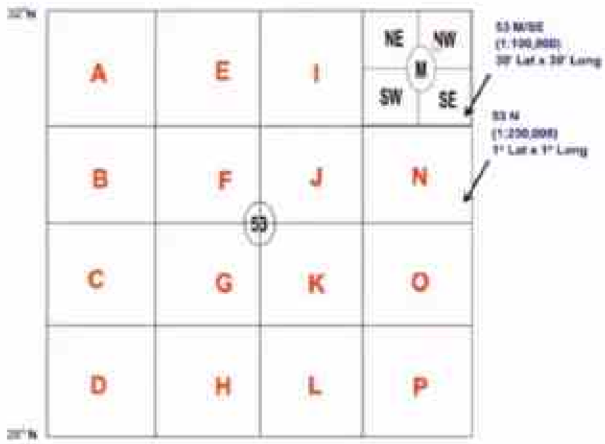
A topographic map is a type of map characterized by large-scale detail and quantitative representation of relief, usually using contour lines in modern mapping, but historically using a variety of methods. A topographic map is typically published as a map series, made up of two or more map sheets that combine to form the whole map.

India & Adjacent countries

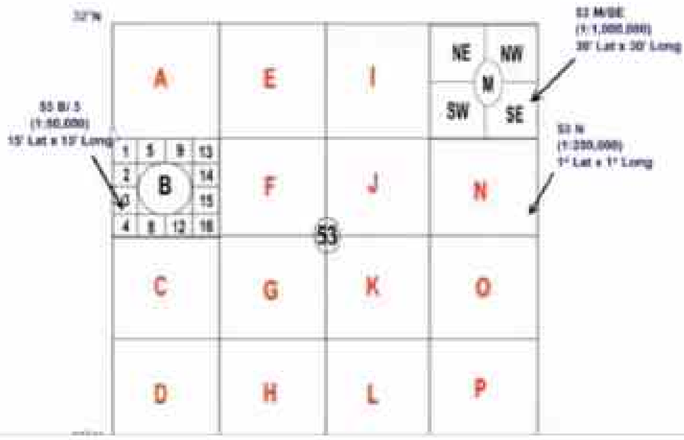
An International Series (within 4° N to 40° N Latitude and 44° E to 124° E Longitude) at the scale of 1: 1,000,000 is being considered as base map. The base map is divided into sections of 4° latitude x 4° longitude and designated from 1 (at the extreme north-west) to 136, covering only land areas and leaving any 4° square if it falls completely in the sea



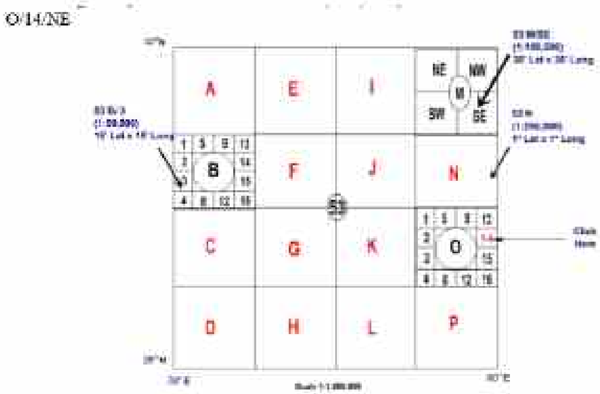
For Indian Topographic maps, each section is further divided into 16 sections (4 rows by 4 columns), each of 1° latitude x 1° longitude (1:250,000), staring from a letter A (North-West corner) and ending on P, column wise. These degree sheets are designated by a number and an alphabet such as 53



These degree sheets are further sub-divided in the following ways: Each sheet is divided into four parts (2 rows by 2 columns),, each of 30' latitude x 30' longitude (1:100,000) designating them by cardinal directions NW, NE, SW, and SE. Such sheets are identified as 53 M/SE



Degree sheets have also been divided into 16 sheets (4 rows by 4 columns), each 15' latitude x 15' longitude (1:50,000) and numbered from 1 (at the north-west corner of the particular degree sheet) to 16 column wise and are identified as 53 B/3 Each 1:50,000 scale sheet contains four (2 rows by 2 columns) 1:25,000 sheet (7' 1/2 latitude x 7' 1/2 longitude) which are numbered NW, NE, SW, and SE. Such sheets are identified as 53 O/14/NE

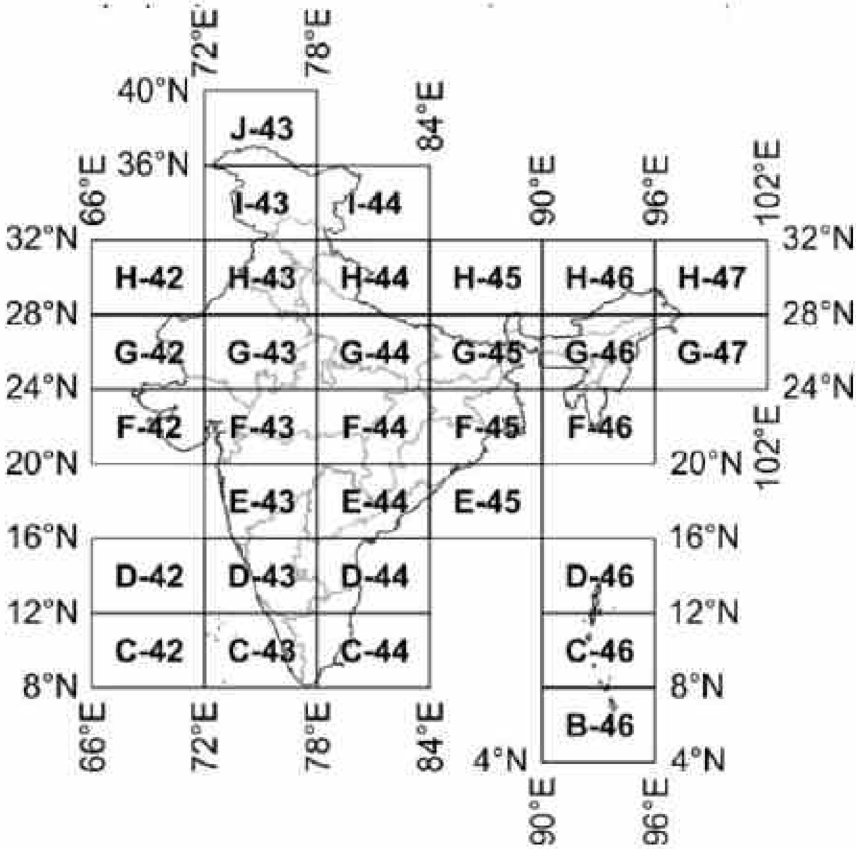


India New Series Of Indexing

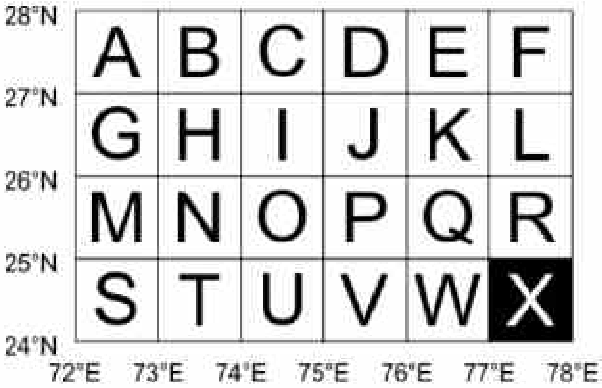
Open Series Map' have been introduced as per the National Map Policy of 2005 by Survey of India. For the same a new map numbering system has been adopted instead of the previous India and Adjacent Countries (IAC). Map numbering is of the form 'A-12A-1':

The IMW numbering system with minor modification is used upto 1°×1°/1:250,000 scale.

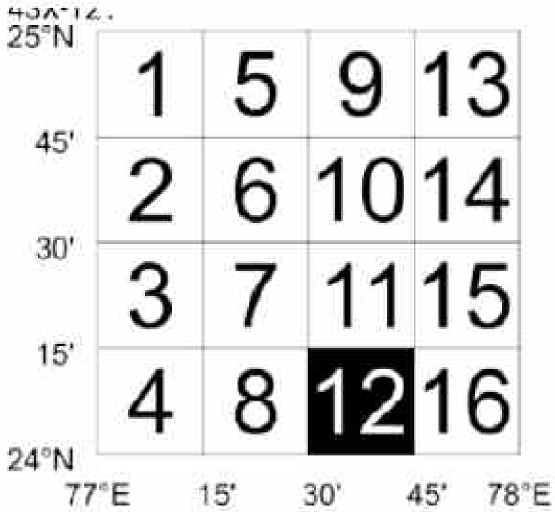
a. Since the IMW map number for India will always start with 'N' (India being in the northern hemisphere), the first letter is omitted.
b. The next alphabet and number of the IMW map number denotes the 6°×4° region of the IMW series.



Each 6°×4° rectangle is further subdivided into 24 squares of 1°×1°. Each square is indicated serially by an alphabet increasing first towards east and then towards south, starting with 'A'.



Each 1°×1° square is further divided into 16 squares of 15'×15' (15 minutes×15 minutes). Each square is indicated serially by a number increasing first towards south and then towards east, starting with '1' (similar to the system adopted in India and Adjacent Countries).



The table below shoes the scale of the map and it's aerial extent.

Scale of the map	longxlat	Aerial Extent (Km)
1:1,000,000	6^0x4^0	
1:250,000	1^0x1^0	108x108
1:50,000	15'x15'	27x27
1:25,000	7x1/2'x71/2'	13x13
1:10.000	3'x3''(City Map)	5.4x5.4
1:5,000	Village map	

1:2,000	36"x36"(Village map)	1.08x1.08
1:500	Property Map	

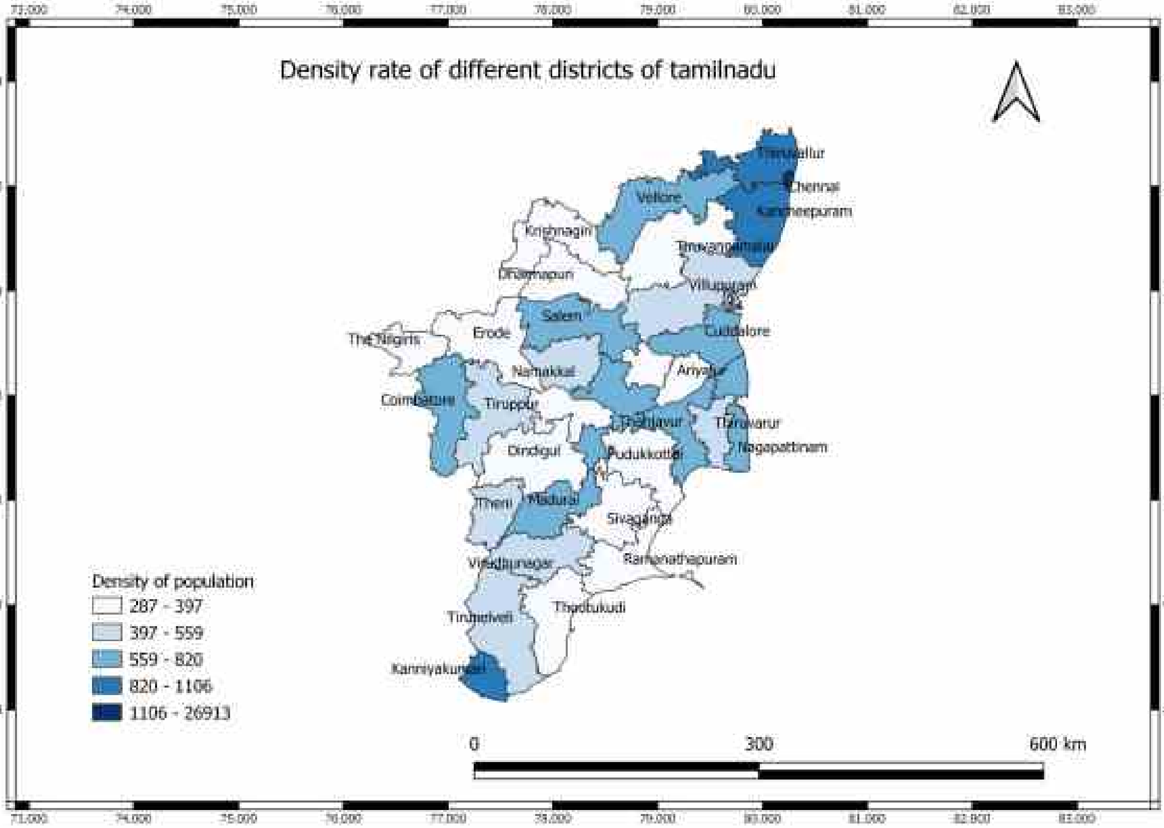
Image Indexing

When the the images are downloaded a metafile is also downloaded along with it which describes the data abouthe data .For example The download Landsat Image have the file name LC08_L1TP_143051_20190407_20190422_01_T1.tar .Here LC08 Specifies the spacecraft ID,L1TP Specifies the data type,143 is the path,51 is the row number,then the period of acquistion,01-specifies the collection number and T1 specifies the collection category.For our convenience we can rename the file ,but the nomenclature must be proper so that we can identify it later .The dates of the data must specified.

It's always good to create a document along with hyperlink to show the path ,when large number of darta is using for the study.

Acquiring data, scanning & capture by phone

The hardcopy of images can be acquired and scanned using smartphones and can be stored in different formats. The coordinates of a location can be acquired using Google maps or by using various apps.



QGIS-COOK BOOK

1. EXPLORING QGIS

OBJECTIVES:

- ***Getting familiar with QGIS interface***
- ***Installing a plugin***
- ***Adding Vector and Raster data layers to QGIS map Canvas***
- ***Familiarize important tools in QGIS***
- ***Viewing a map layer***

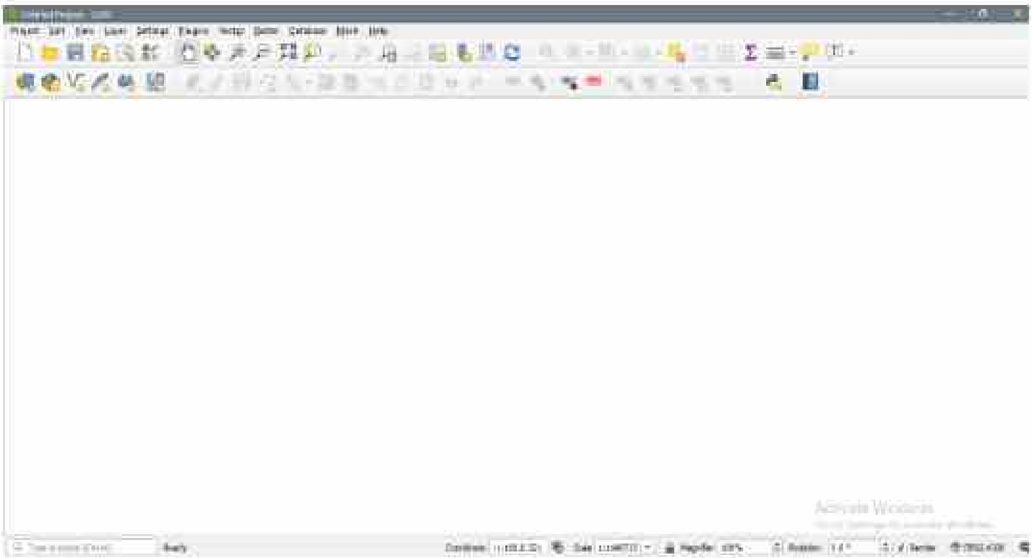
DATASETS

- tamilnadu.shp
- roadnetwork.shp
- airport.shp

Quantum GIS is a free and open source GIS application. It was a result of Source Forge project, QGIS is developed using C++ and Qt toolkit. Initially QGIS developed for displaying the GIS data, now it evolved as full GIS software package. It is published under GNU Free Documentation License as an official project of Open Source Geospatial Foundation (OSGeo). It is compatible with all the operating systems and can very well handle multiple raster, vector and databases functionalities.

- **Starting QGIS, adding data**
    - First, find the QGIS icon, shown below. The icon is often located 1) as a desktop or taskbar shortcut,

Double left click on the QGIS icon, and be patient while a start banner displays This will open the main QGIS window



- Note there are Table of Contents and Data panel, as well as various icons and menu bars.

- To add layers
    - View →Panels→Layers

- To add Libraries

  Processing→Toolbox→Libraries (If processing is not visible in the menu, go to plugins→manage and install Plugins. In that turn the processing Field on)

- To add Raster Layer
    - Layer→Add Layer→Add Raster Layer
    - A dialogue box will appear, from that select the source.

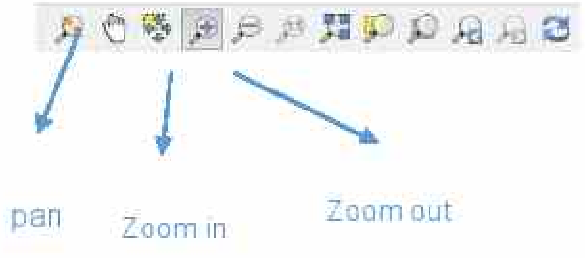
- To add Vector Layer
    - Layer→Add Layer→Add Vector Layer
    - A dialogue box will appear, from that select the source

- To add plugins

  Plugins→Manage and install Plugins→Search the required plugin →Install it

- **Panning and Zooming.**

QGIS allows you to change the magnification and area that you view in your data panel. There is a cluster of zoom buttons (see right). They are typically along the top of the main window, but because the toolbars are "dockable", the may be elsewhere.



- There is a "pan" button, a hand, that does not change the magnification, but allows you to click/drag to position data
- Left clicking on the plus **(+)** magnifying glass changes it to a "zoom in" cursor, then click on the data panel will zoom in on a point. You can also left click and hold/drag to define a zoom area.
- The minus cursor zooms out, and the "arrows in" and "arrows out" buttons, found below the magnifying glass buttons, zoom the entire pane by a fixed amount
- There is a magnifying glass with a yellow square behind that zooms to selected features (more on that later)
- One with a gray square behind that zooms to a layer selected in the table of contents.
- There are also two buttons with carets that zooms back and forth among previous zoom levels.
-

- **Some important tools in QGIS**
    - The interactive measurement tools ,
    - *Toggle Editing*

- QGIS provides several tools to select features in the map canvas

To select one or several features with the mouse, you can use one of the following tools:

- Select Features by area or single click
- Select Features by Polygon
- Select Features by Freehand
- Select Features by Radius

- **Viewing a map layer**

- Open the vector layers provided such as tamilnadu district shape file, airport and the road network. (Layer→Add Layer→Add Vector Layer).

- The vector layer can be added from a file, directory, database, Protocol: HTTPs, cloud etc.
- Right click each layer and open the attribute table of each layer and check what are the attributes present in each layer
- Select a feature from the attribute table correspondingly that feature will get selected on the interface.
- You can click twice on the field header to sort the column in descending order.

Check List

1. How to add Raster Layer
2. Which tool is used for panning
3. Which tool is used for zooming to selected features
4. How to open the attribute table
5. How to select a feature using attribute table

2.COLORS, SYMBOLS & MAKING MAPS

OBJECTIVE

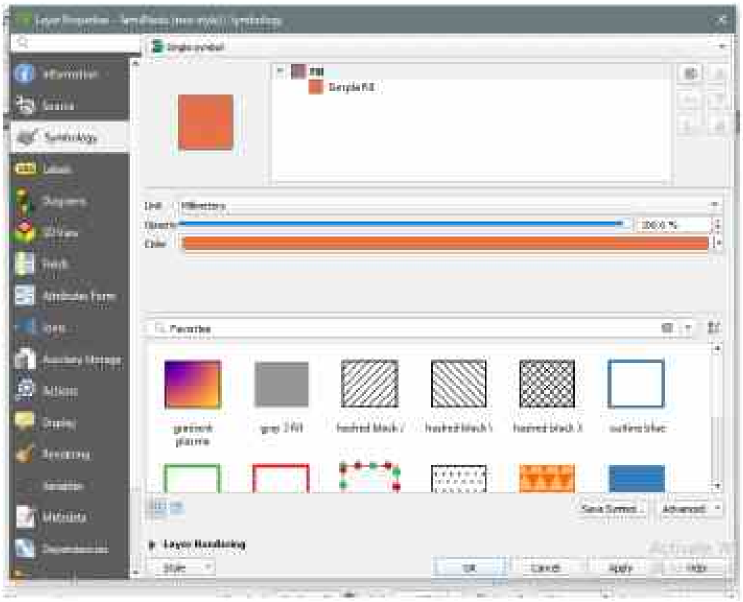
- ***To understand how to change polygon color***
- ***To understand how to change symbol of line and point features***
- ***To prepare a print ready map***

DATASETS

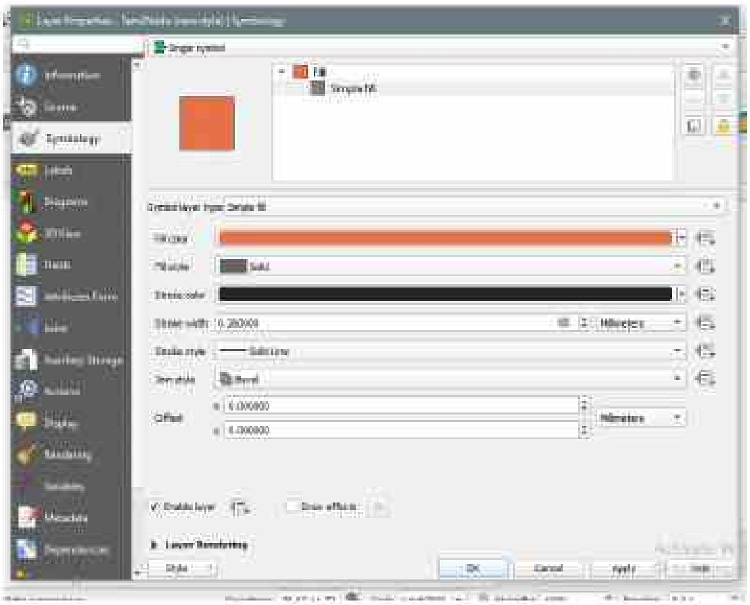
- tamilnadu.shp
- roadnetwork.shp
- point_districts.shp

How to change color of Polygon

- Add the polygon feature to the interface. In this exercise add Tamilnadu shapefile .Layer➔Add Layer➔Add vector Layer
- Right click the layer and go to properties. A layer properties dialogue box will appear



- From the dialogue box select symbology .Select the single symbol option from the drop drown located on the top right region.
- Select on fill. Choose the type of fill such as simple fill, gradient fill ...

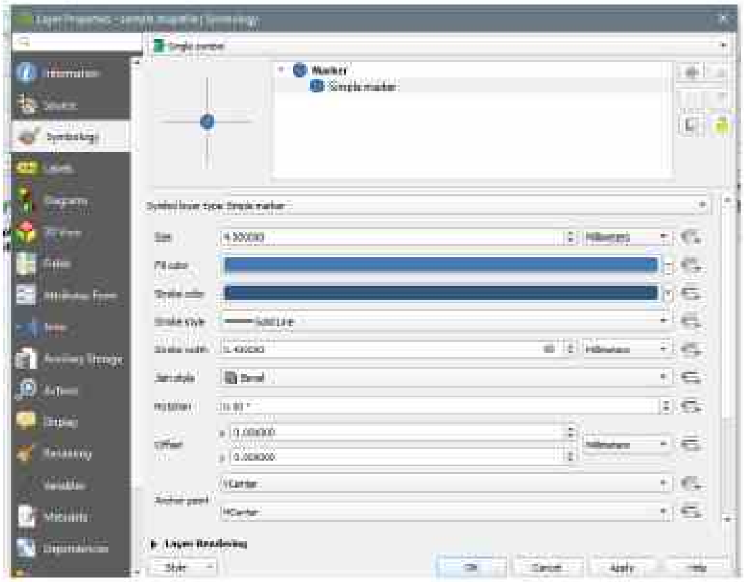


- Choose the fill color ,fill style and color of the boundary line and width by selecting the stroke color ,width and style

- Select apply and then click okay
- The polygon feature will be displayed according to the selected style
- To label the polygon feature. Right click the layer and go to properties and select single label from the drop down on the top right corner.
- Select what to be displayed under the value and adjust the style of the text
- Select apply and click okay.

To Change the Symbol of Point and Line Features

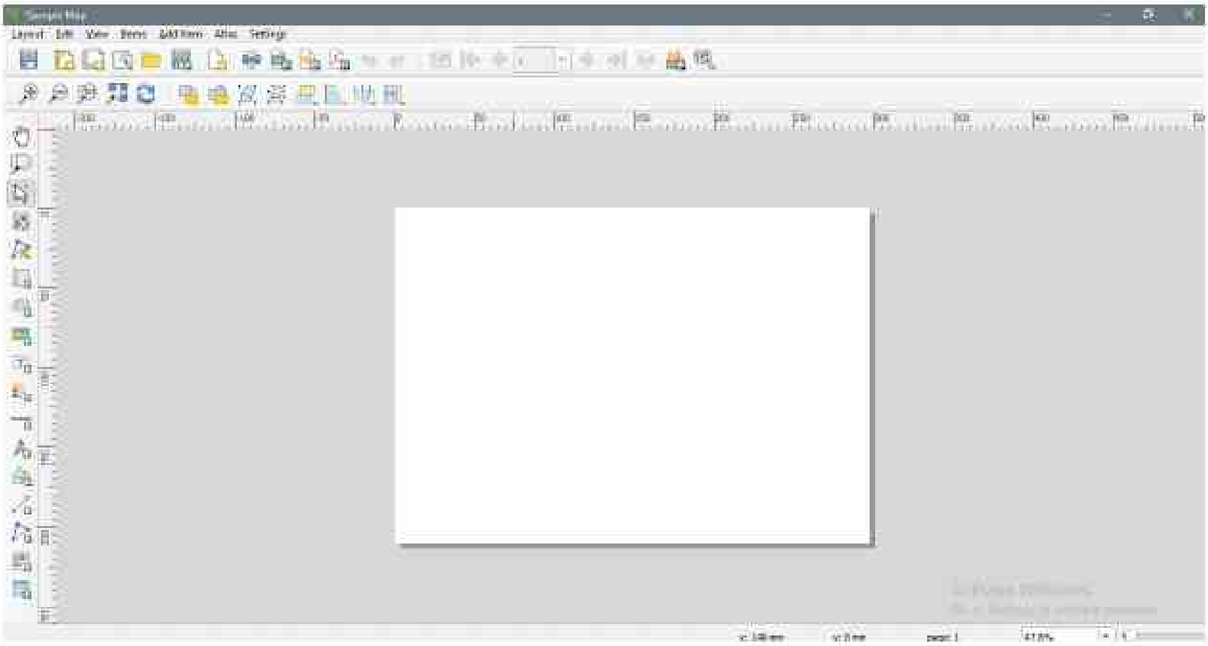
- Add the vector layers into the interface. In this add the shapefile of airport and the road network
- Right click the layer, Go to properties and select symbology from the dialogue box.
- Select the plus symbol to add new marker
- Select the symbol layer type from the drop down displayed .Based on the 'symbol layer type' a set of symbols will be displayed at the bottom. Choose the symbol according to the characteristic of the feature .For a point feature the style will be displayed as below



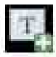
- Selct the fill color ,stroke color ,size of the symbol
- Go to apply and then click okay.
- The Point and line feature will be displayed according to the selected style on the panel

Map For Print Ready

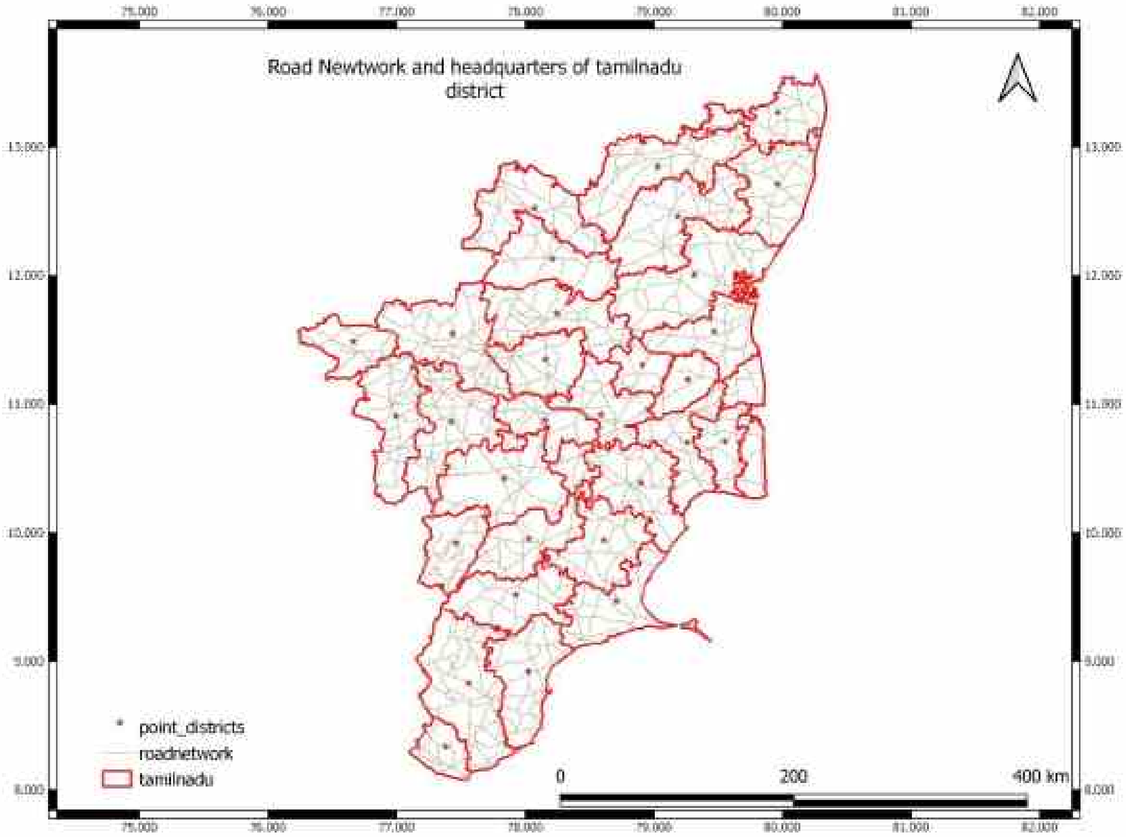
- Go to the “Project” section on the menu, and select “New Print Composer”. In the composer dialogue box, give the composition a name, and then click OK
- A new composer window will appear. To add your map , click " Add Item ", " Add Map, and then draw a box just inside the perimeter of the page



If the map is too large or too small, you can adjust the “Scale” option under “Item properties” on the right. A larger number will make the map smaller. A smaller number will make the map larger.

- To add title ,In the menu, select " Add item", and " Add Title of the map
- Click on this button: 
- Click on the page, above the map, and a label will appear at the top of the map.
- Resize it and place it in the top centre of the page. It can be resized and moved in the same way that you resized and moved the map.
- To add North arrow, "Add item" and select " Add North Arrow
- To add Scale bar Select " Add item "and Select "add Scale bar"
    - Set the scale bar units and Style of the scale bar.
- To add legend to the map Select Add legend from add item menu
- Draw a box where you want the legend to appear. By default, all layers on the map will appear as legend items.

- To remove a legend item, uncheck the "Auto update" checkbox to the right, and then select and manually remove the layers you don't want in your legend using the minus button.
- To change the name of a legend item as it shows up in the legend, click the legend item itself, and then change the title of the legend in the item properties
- To add Grid, Choose the grid option in item properties
    - Add grid by clicking on + option .Then Click on the modify grid option
- Select option on the grid type
- Change the CRS to WGS 1984 by clicking Change
- Choose the interval
- Set the units of X and Y
- Choose the frame style
- If the coordinates to be displayed then tick draw coordinates icon
- Export the map
    - The map can be exported as image or pdf
    - From the layout➔Choose export as image .It will be exported on the desired location



CHECK LIST

1. How to change the symbology of polygon into gradient Fill
2. How to change the size in symbology of point feature
3. How to display the latitude and Longitude values in the map Layout

3.GEOREFERENCING, PROJECTION & REPROJECTION

OBJECTIVE:

- ***To georeference a toposheet by using graticule intersections in a known coordinate system and datum***
- ***To get familiar with the projecting and reprojecting of the data sets by using Quantum GIS***
- ***To get familiar with symbology types while preparing maps***

DATASETS

- Toposheet
- tamilnadu.shp

Georeferencing

Georeferencing is a process of establishing a mathematical relationship between the images Coordinate system and the real world spatial coordinate system. This mathematical relationship can be assigned by any one of the transformation settings, viz. Polynomial order 1, 2 or 3, Linear, Projective and Thin Plate Spline etc. Polynomial order 2 is the most widely used transformation in Georeferencing

- **Step: 1 Scan the map**

The first task you will have to do is to scan your map. If your map is too big, then you can scan it in different parts but keep in mind that you will have to repeat pre-processing and georeferencing tasks for each part.

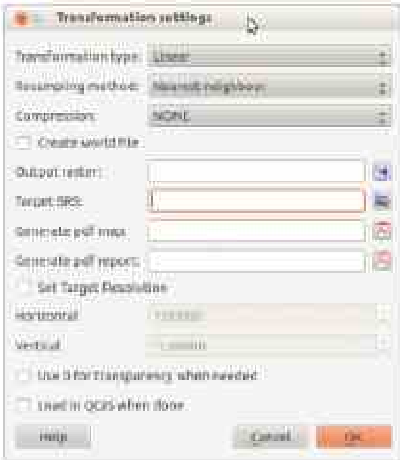
- **Step: 2 Import the map into QGIS**
  - Layer➔Add layer➔Add raster layer
- **Step 3 Preparational steps**

  You will use the georeferencing plugin from QGIS, the plugin is already installed in QGIS. Activate the plugin using the plugin manager .The plugin is named **Georeferencer GDAL**

  - Click now on *plugins* ➔ *georeferencer*.
  - In the new window you need to open your scanned image by clicking on *Open Raster* and choose your desired map.

Zoom to the lower left corner and mark a spot of longitudes and latitudes. Then read the corresponding values at the edge of the map and insert these values as "new values of x and y. Please make sure that you're working diagonally. In our example it would be: lower left, upper right, upper left, lower right. This will minimize problems according to the visibility of the map during georeferencing it.

- **Step 4 – processing it**
  - After you have marked the four points, click on the green arrow *Start Georeferencing*. A new window will open.



- The *transformation type* in our example is "linear" which means that we will only need to define 3 points to get a georeferenced image but it doesn't mean you will certainly get a good one.
- The *Resampling method* specifies how the transformed pixels (the transformation could make a square pixel into a cone or a trapeze but it needs to be square in the target image to be stored as a raster...). If you choose nearest neighbour you will not change the color code of a pixel. But in fact we are not interested in the correct color code but in a good representation of our map in our GIS-project.
- *Compression* should be none. So an image file and the values in it will not be distorted in any way.
- Define your target images name and location in the *Output raster* field.
- As the Target SRS you need to choose your defined target coordinate system.
- Generate a PDF report if you like.
- Load the georeferenced layer in QGIS

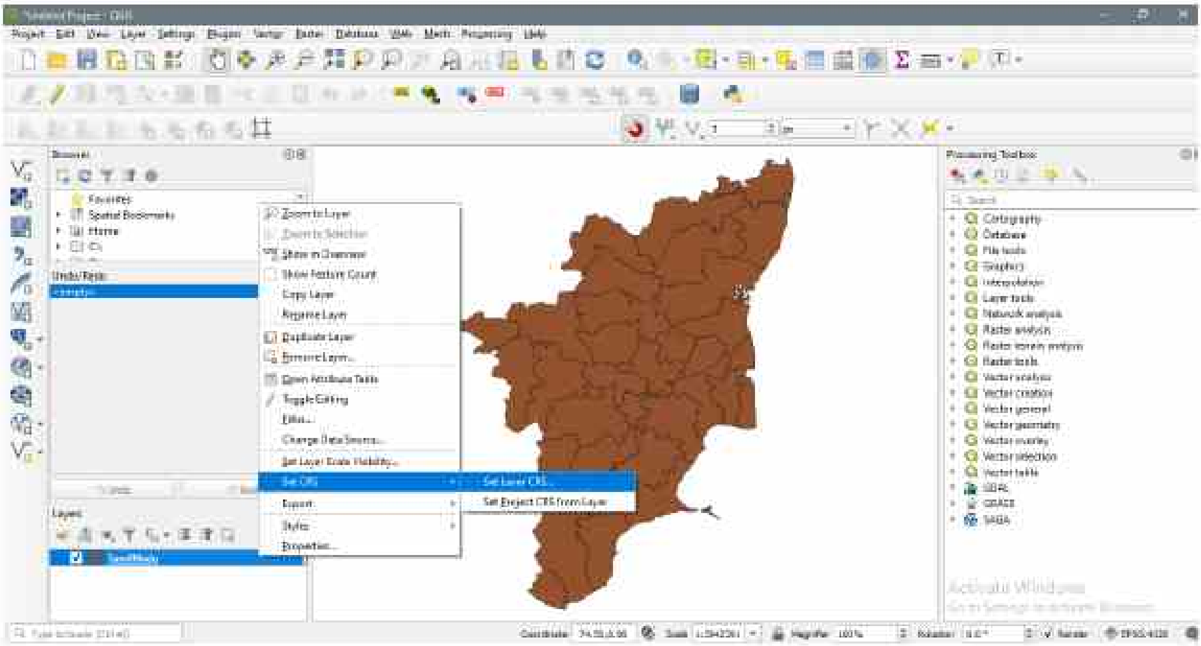
PROJECTION

A mathematical surface of oblate spheroid best fitting the irregular surface of the earth is considered as a frame of reference for measuring locations on the surface of earth and is called as Datum. If the spheroid is best fitting a particular area, then it is called as Local Datum and if it is best fitting the entire globe then it is called as Global Datum. For example Everest ellipsoid is the best fit to India and its adjacent countries but not to the entire world, similarly WGS 84 ellipsoid is the best fit to the entire world but not exactly to India. Generally Geographic Coordinate Systems (GCS) are associated with these datum, the measuring units are angular in nature. To overcome this difficulty of representing a three dimensional curved surface on a piece of paper we use a method called as map projection a projection is never accurate. Choosing the right projection is very important for successful GIS projects

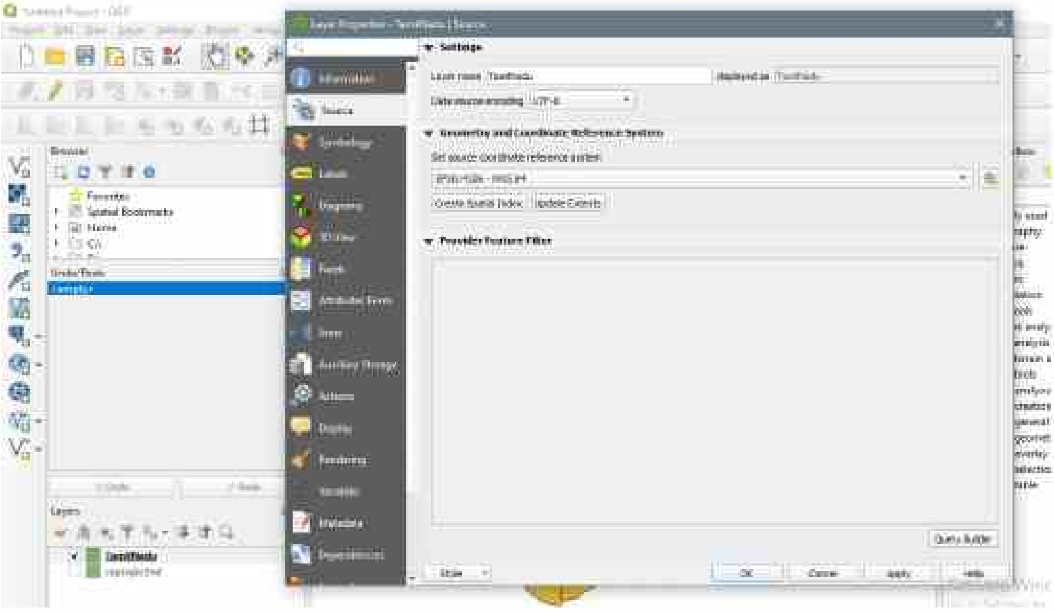
STEPS:

- Open the raster layer of georeferenced toposheet of last tutorial in the map canvas via, Layer ➔ Add Vector Layer➔or else directly click on add vector layer icon from the toolbar, browse and select the georeferenced raster layer in tutorial data (View➔Toolbar➔Manage Layer toolbar

- Now Right-Click on the shapefile opened➔ Set CRS ➔Set Layer CRS, Set WGS84 EPSG:4326 from 'coordinate reference systems of the world' section



Or right click the shape file➔properties➔Source➔Set the coordinate system under Geometry and coordinate reference system.



If we use CRS of the first layer for setting the CRS for projects, then the map canvas CRS will be that of the added layer.

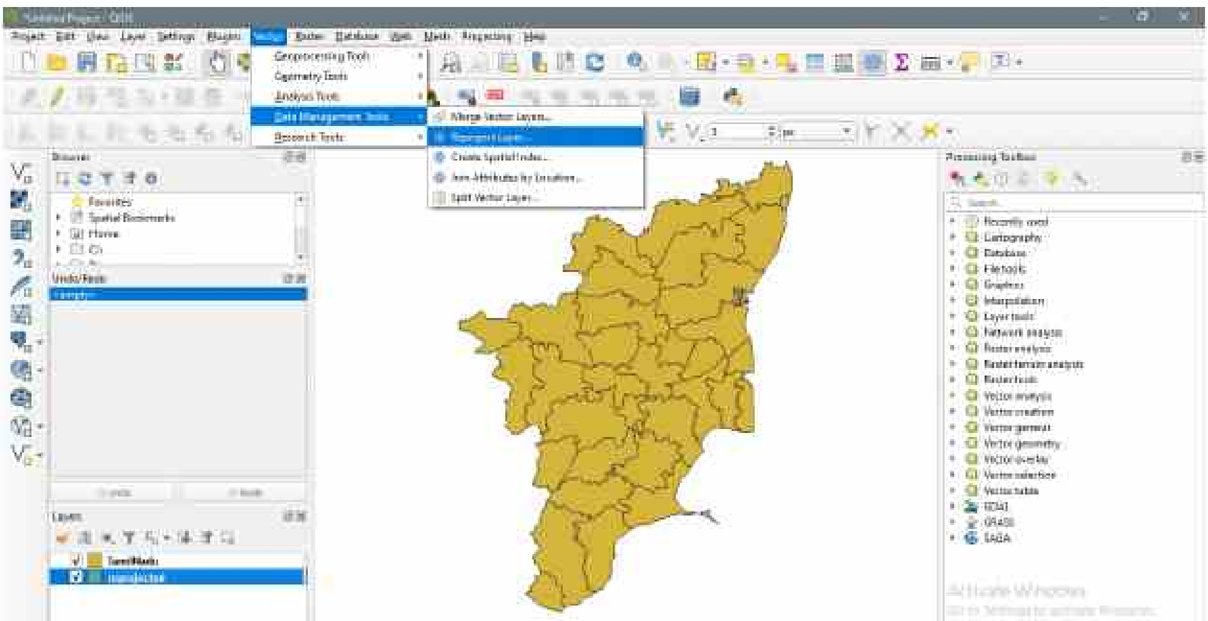
TRANSFORMATIONS

Reprojection of vector layers from Geographic to the projected system is often required for

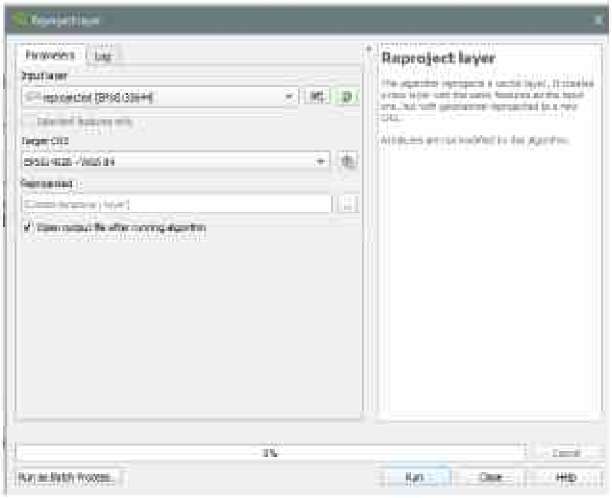
Various geoprocessing analyses

Steps:

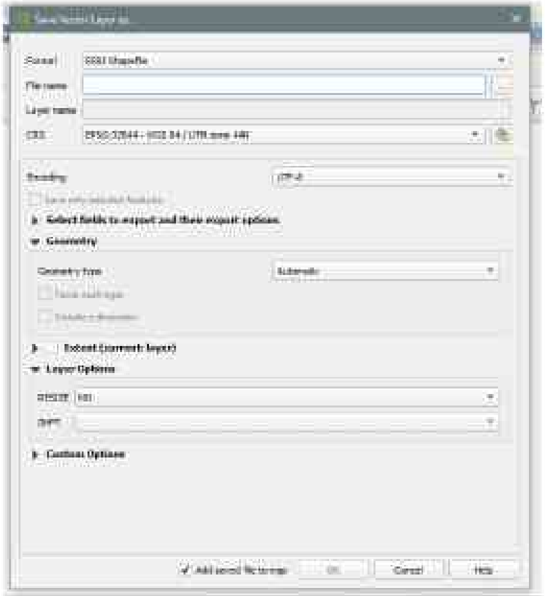
- For Reprojection go to the menu bar choose Vector➔Data management tools➔reproject layer



- A dialog box of reproject layer will open .In that choose the CRS to which the layer to be projected and click run. After 100 % completion click close.



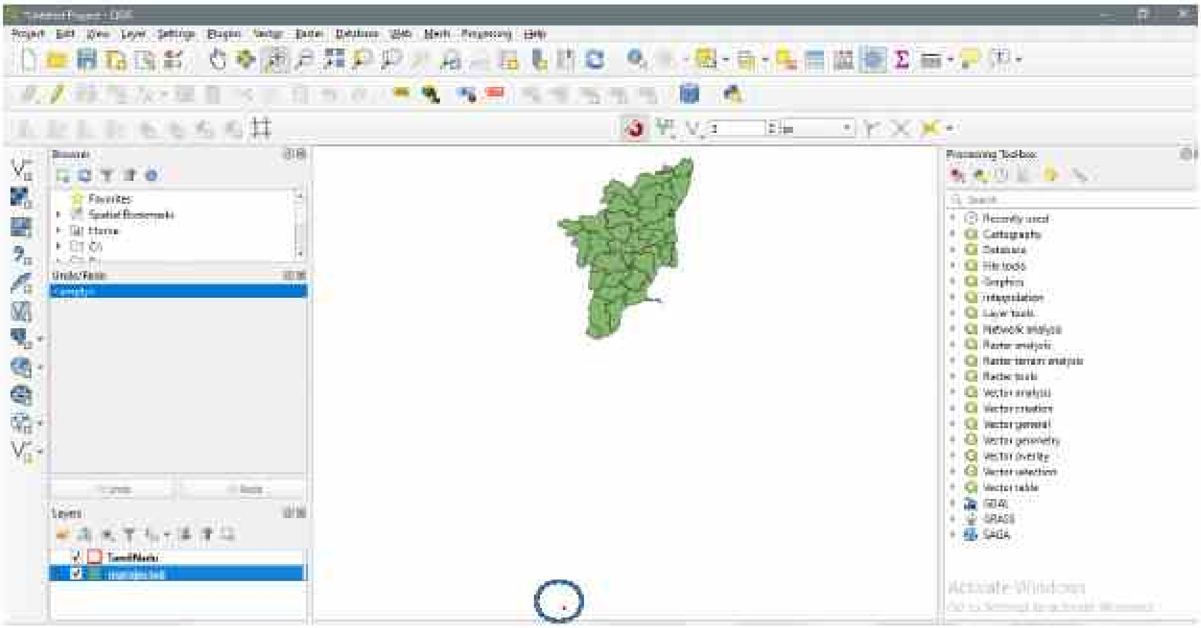
- The reprojected layer will appear in the layer panel. Save the reprojected shape file by right clicking the reprojected shapefile ➔Export➔Save feature as



- In that on the format select ESRI shape file and give the name and choose at the corresponding location.

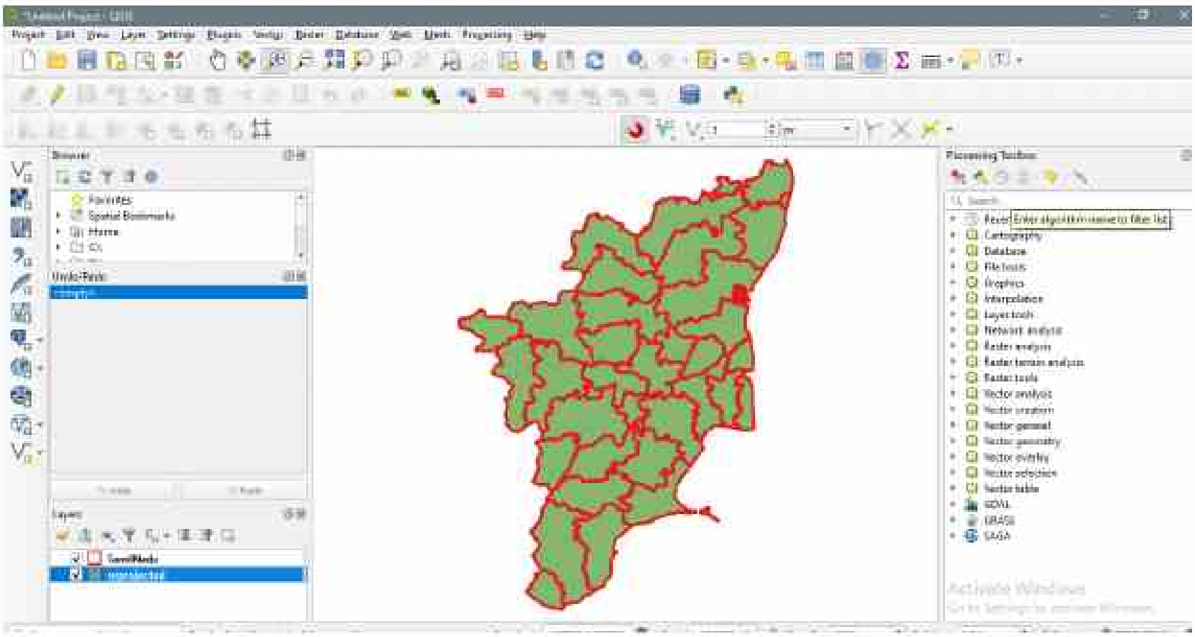
Use of 'On the Fly' Option

Open a new Qgis window, add the projected and reprojected layer into it . After adding the layers click on 'Zoom Full' tool. The result will be look like as shown below. You can use 'Zoom in' tool to get better idea.



You can notice the two files opening at two different locations in the workspace inspite of they belonging to the same area "Tamilnadu District". Because it belongs to two coordinate system. By disabling the on the fly both layers will overlap each other

It can be done by project➔properties➔Clear the tick in the "no projection" opened in the Project properties dialog box. You can see that both layers is overlapping each other



SYMBOLOGY TYPES

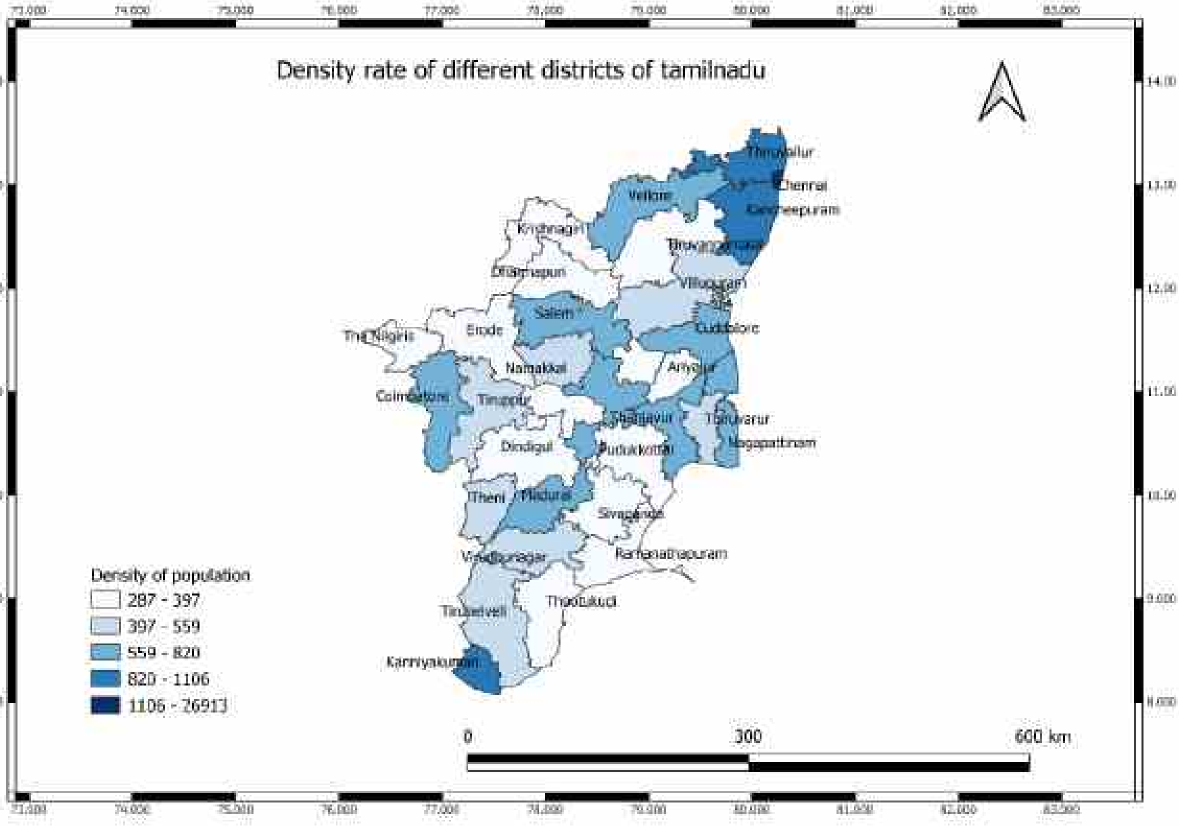
Symbology is the application of graphic symbols-varied by color, size, and other properties –to represent geographic features on the map. The symbology of a layer is its visual appearance on the map .The basic strength of GIS over other ways of representing data with spatial aspects is that a dynamic visual representation of the data .Different types of Maps can be prepared .One of them is Cholropleth Map

Choropleth maps

A map which uses differences in shading, coloring, or the placing of symbols within predefined areas to indicate the average values of a particular quantity in those areas .Apply colors to polygons in order to demonstrate variations in the values that we want to convey in our stories.

- Add the vector file to the interface by layer➔Add Layer➔Add vector Layer
- In this exercise the shapefile of Tamilnadu districts is taken .It will be added to the interface.
- Right click the layer and select the properties
- From the layer properties dialogue box select labels. From the drop down select single labels
- And change the text font, size, style and color and click ok.
- Again right click the layer and select properties, from the dialogue box .Select the "Symbology". The arrow to the right of "No symbol" produces a drop-down menu.
- Select the "Graduated" option. Now we have to decide which value to display. Click on the arrow to the far right of the space next to the "value" label to obtain the drop-down menu. Select "density". Select the color ramp and choose the shade of color.
- You'll notice that QGIS defaults to 5 "Classes", which divide the values into five equal parts. You can change the class.
- For our demonstration map, we will use the five equal classes. Select the type of mode. There are 5 types of modes available .Equal Count, Equal Interval, Logarithmic scale, Natural Breaks, Pretty Breaks, and Standard Deviation. Select the type of interval and click Classify. You can get rid of the decimal places by double-clicking on the values to produce a small dialogue box. Select the "Apply" and then "OK" tabs.

- A legend appears on the menu to the left, and map is color coded with the darker colors representing areas with the higher density.
- Now export this Cholropleth map in a map layout form



CHECK LIST

1. How will you reproject a layer
2. How will you choose your classification interval

4.CREATION OF BASE MAP

OBJECTIVE:

- ***To digitize (Vectorization) a toposheet using Quantum GIS***

DATASETS

- Toposheet

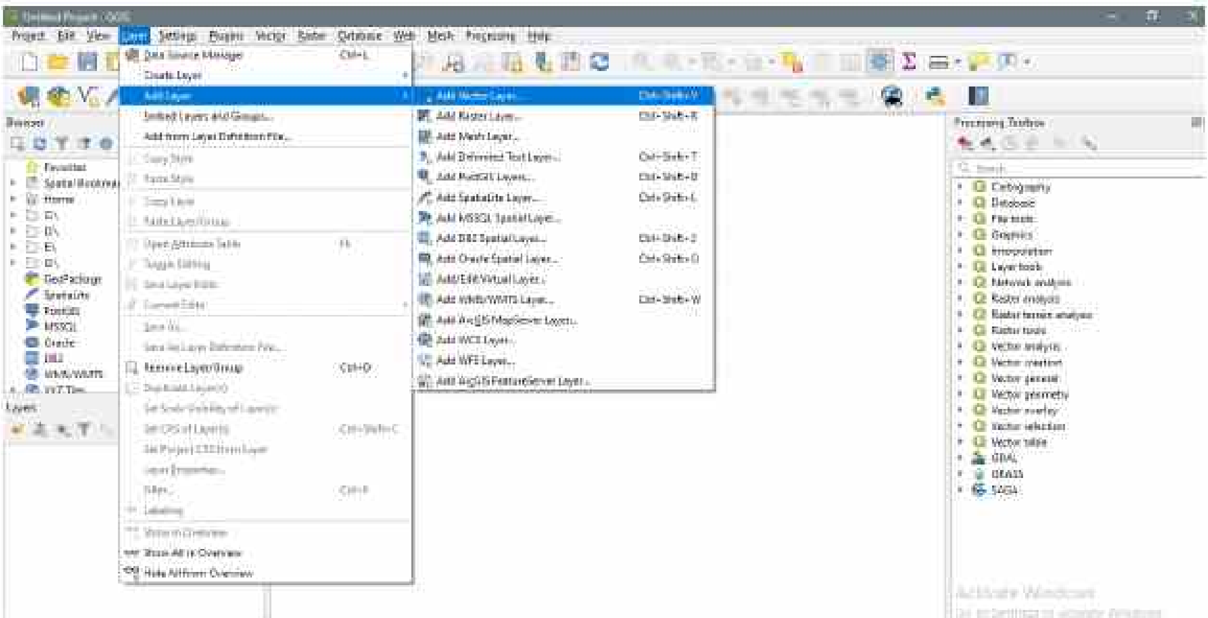
With the help of digitization we can create different set of layers Viz. Rivers, roads, schools, ward boundaries and building blocks from a single map; this process is known as Vectorization. Vector data is easy to edit, update and is more accurate as compared to raster data. Vector data is more efficient for GIS analysis. Due to these reasons Vectorization is the first step in many GIS projects.

Vector data is mainly of three types –

- Point: It consists of single points having (X, Y) coordinates, for example lamp posts, bus stops and postbox positions etc.
- Line: It consists a series of (X, Y) coordinates in a sequence (from start node to end node with a number of vertices joining these two nodes). For example roads, power lines, ward boundaries and contours etc.
- Polygon: It is a series of (X, Y) coordinates in a sequence closing a figure where first and last points are the same. For example lakes, building blocks, village blocks, ward areas and forests etc.

STEPS

- Open the raster layer of georeferenced toposheet of last tutorial in the map canvas via, Layer ➔ Add Layer➔Add Raster Layer or else directly click on add raster layer icon from the toolbar, browse and select the georeferenced raster layer in tutorial data (View➔Toolbar➔Manage Layer toolbar

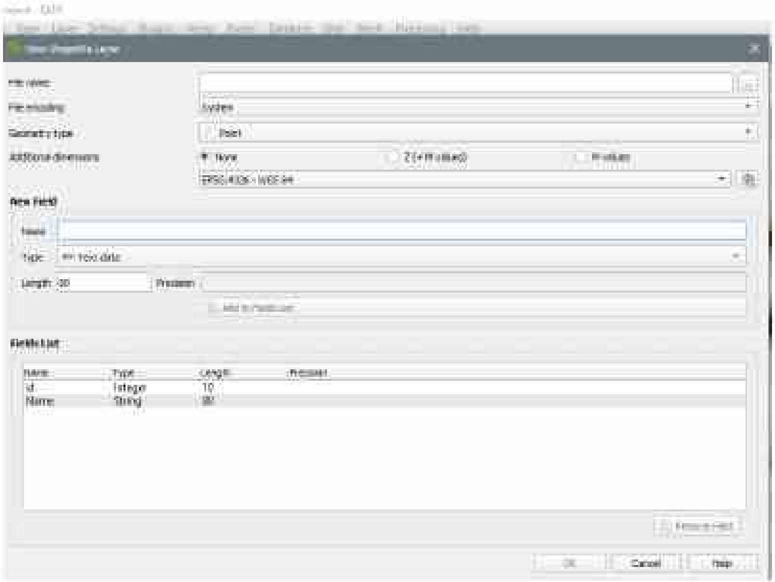


Creation of the shape file

Point Layer creation

- To create new point layer, go to main menu bar in QGIS interface and select Layer ➔Create layer➔New Shape file Layer.
- Now the 'New vector Layer' window will popup. Select Type➔Point as we are Interested in creating a point layer.
- Specify CRS same as original layer, i.e., as 'EPSG:4326 - WGS 84'. To do this click on Specify CRS ➔ Select the 'WGS 84' under Coordinate reference system of the world ➔Click on OK

We can add the required attributes to the vector layer we have created .If we want to add the name, type, area, width … as attributes we can do it by specifying the field and type of the variable (like text, whole number, decimal number and date) .Click on 'Add to attribute List' and the attribute will be added to the list. Now add the attributes details shown in the below figure



Note: If you want to remove the added attribute from the list, select the attribute you want to delete and click on 'Remove attribute' in 'New Vector Layer' window.

- Once the required attributes are added, click on 'OK'.

To start digitization

- Enable the editing mode of the corresponding vector layer. Right click on point shape file that is created and click on 'Toggle Editing'

- You will notice a pencil symbol on left side of the layer name. This tells you that the layer is ready for editing. Zoom into the toposheet where details present to be digitized.
- Click on Add feature icon from digitizing toolbar.

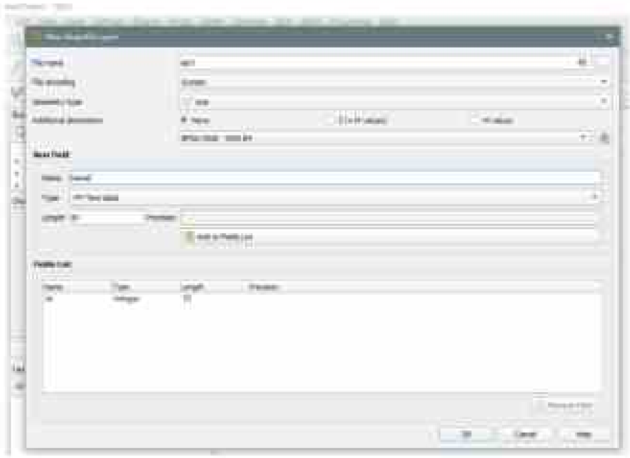
Place the pointer at the center of the feature of interest and click .You will be presented with an 'Attributes' window. Fill the required attribute information like 'id', 'Name' (those fields that have created earlier). The point will be created with the specified attributes at the specified location.

- Now open the attribute table of point shape file by right clicking on the layer and selecting 'Open Attribute Table'. If you want to change any details, then simply select the attribute by double click and edit it.
- Click on 'Save Layer Edits' icon in 'Digitizing' tool bar, to save the edits. After saving click once again on the toggle button to stop editing. This will save the point layer along with its attributes.

To create line features

- To create line layer, go to Layer➔ Create layer➔ New Shapefile Layer.

The 'New vector Layer' window will open up. Select 'Type' as 'Line' as we are interested in creating Line layer of roads and Specify CRS as 'EPSG: 4326 – WGS 84'.Add required attributes.



The layer is created and will be listed in Map legend. Right click on layer, click on 'Toggle Editing.

- Zoom into the toposheet where roads are seen. Click on 'Add feature' icon from 'Digitizing' toolbar. Now trace cursor along the middle of the road by using left mouse button to insert

Vertices when you think the road changes its profile, this means you have to insert more vertices while digitizing bends to get smooth curve. When you reach a junction or at the end of the road click on the right mouse button to stop.

- Now 'Attributes' window will open, fill in the appropriate attributes. For example Once you are done with digitizing one road, try and digitize the road network by using the snapping the tool which is very effective and reduces errors like Overshoot and Undershoot. It helps to find out location of one feature in relation to other feature by use of the snapping tool it is possible to get an accurate intersection of roads.

Once you finish digitizing all roads in the toposheet save the edits and stop editing by

- Clicking on 'Toggle editing' button. Now the road network along with its attributes will be saved.

Polygon Layer creation:

Polygon is basically used to demarcate areas such as administrative parcels, forests, build-up

Areas and water bodies etc.

- To create Polygon layer, go to Layer➔ Create layer➔ New Shape file Layer. The 'New vector Layer' window will open up.
- Select Type ➔Polygon➔and Specify CRS as EPSG: 4326 – WGS 84
- Add required attributes for example 'Name' and click 'OK'. 'Save as' window will open up, save the file at appropriate location,
- . The layer will be created and listed under Map Legend. Right click on layer and click on 'Toggle Editing'.
- Zoom into the toposheet where polygon features are located.
- Click on 'Add feature' icon from digitizing toolbar. Make sure that the snapping option for layer is also enabled.

- Start digitizing the polygons by using left mouse button to insert vertices and right mouse button to finish. Once you finish digitizing all reserve areas, save edits and de-select the 'Toggle editing' button.

CHECK LIST

1. How to add the attribute 'name' to the polygon feature
2. How to digitize the road network
3. How to start and stop editing

5.VECTOR ANALYSIS-OVERLAY

OBJECTIVE:

- ***To get familiar with overlay operations such as Union, Intersection, and Symmetric Difference is familiarized***

DATASETS

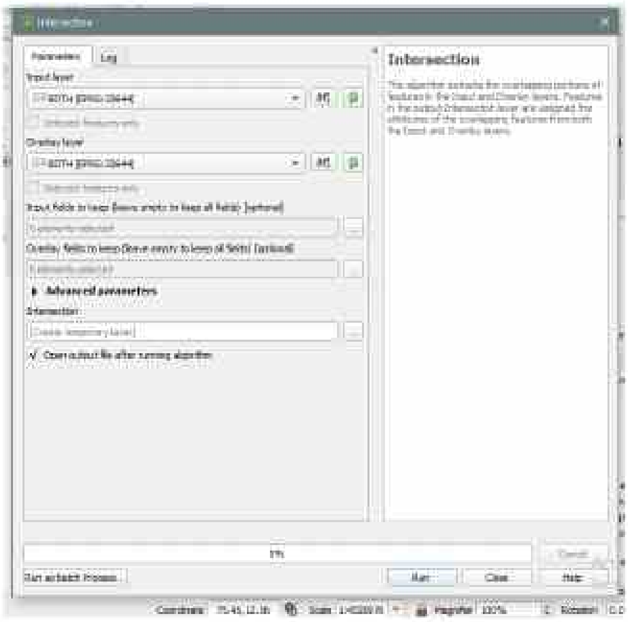
- districts.shp
- Chennai.shp
- Kancheepuram.shp

Overlay

Overlay is the primary way to combine information from two separate themes. Overlays are most common for polygonal data and perform geometric intersection which results in a new layer with the combined attributes of both initial layers .The other operations are symmetric difference and the union. In the symmetric difference the area that is common to both the polygon features will be deducted. In union both the polygons get combined to a single feature.

Intersect

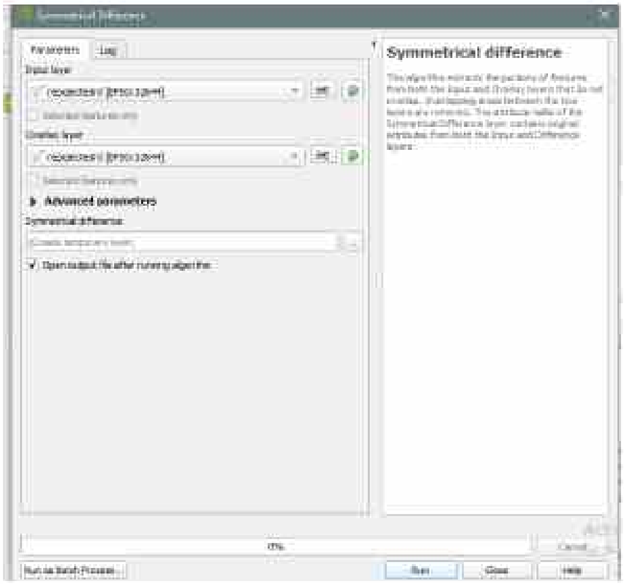
- Add both polygons to the QGIS interface, Layer➔Add Layer➔Add vector Layer. The polygons must have an overlapping area
- Go to vector from the menu, Vector➔Geoprocessing➔Intersect



- A dialogue box of intersection will appear in that add the input layer, add the overlay layer the layer which have overlapping area. Then click Run
- The intersection polygon will appear in the interface. You can see that the area which is common to both the polygon will come as an output.

Symmetrical difference

- Add both polygons to the interface
- Go to Vector➔Geoprocessing➔Symmetric Difference



- A dialogue box of symmetric difference will appear. Select the input and the overlay layer and click run
- A layer named symmetric difference will appear on the panel ,in which the intersected portion gets removed and other portion remains

Union

- Add both polygons to the interface
- Go to Vector➔Geoprocessing➔Union
- Add the input and overlay layer and click run
- The layer named union will be displayed on the panel

To verify intersect +symmetric difference=union

<u>CHECK LIST</u>

1. How to check the ‘union’ using intersect and symmetric difference

6.VECTOR ANALYSIS-NETWORK ANALYSIS

OBJECTIVE:

- ***To get familiarise with network analysis***

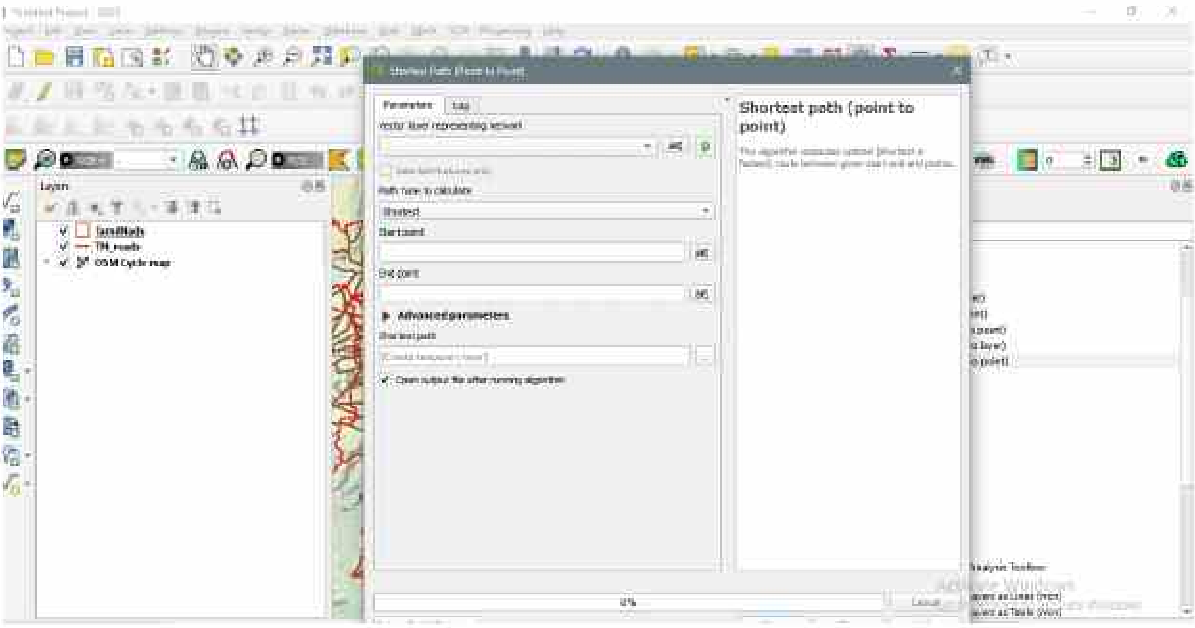
DATASETS

- tamilnadu.shp
- roadnetwork.shp

Dijkstra's algorithm (or **Dijkstra's Shortest Path First algorithm**, **SPF algorithm**) is an algorithm for finding the shortest paths between nodes in a graph, It can also be used for finding the shortest paths from a single node to a single destination node by stopping the algorithm once the shortest path to the destination node has been determined. Using the network analysis tool the shortest distance between two nodes can be finded out.

Steps:

- Add the road network of Tamilnadu district to the QGIS interface.
- Add the OSM layer to the interface by Web➔Quick Map services➔OSM
- Switch on the OSM Layer
- Go to Processing➔Toolbox➔Network Analyst➔ Shortest Path (Point to Point).



- A dialogue box of shortest path point to point will be displayed , select the vector layer representing network
- Specify the start point and end point and click run
- A layer called shortest path will added to the panel
- Right click the layer and check the attribute table
- To add the length Switch on the toggle editor and click on the field calculator, type the name of the field, it's type and length
- Select the $length and click ok

- The length of the shortest path will be displayed

CHECKLIST

1. How will you find the shortest path between two nodes
2. How to add the attribute 'length' of the shortest path

7.SPATIAL AND NONSPATIAL QUERIES

OBJECTIVE:

- ***To get familiar with constructing spatial and Nonspatial queries in Quantum GIS.***

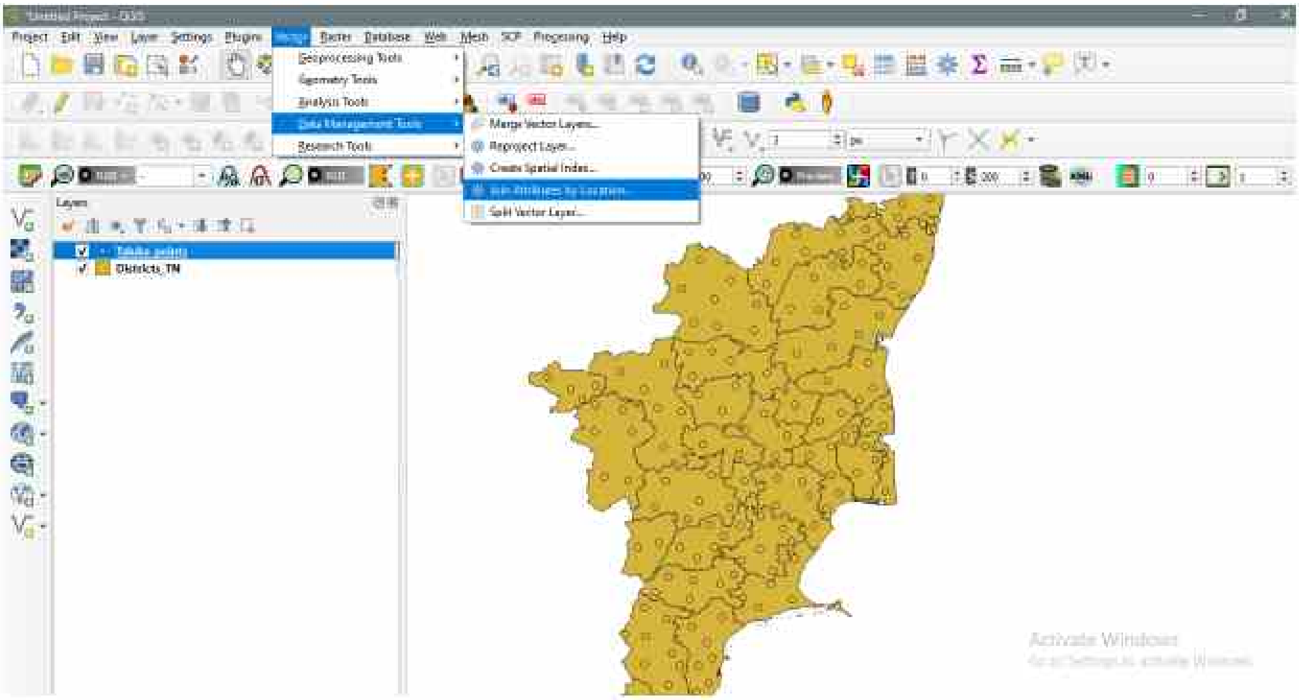
DATASETS

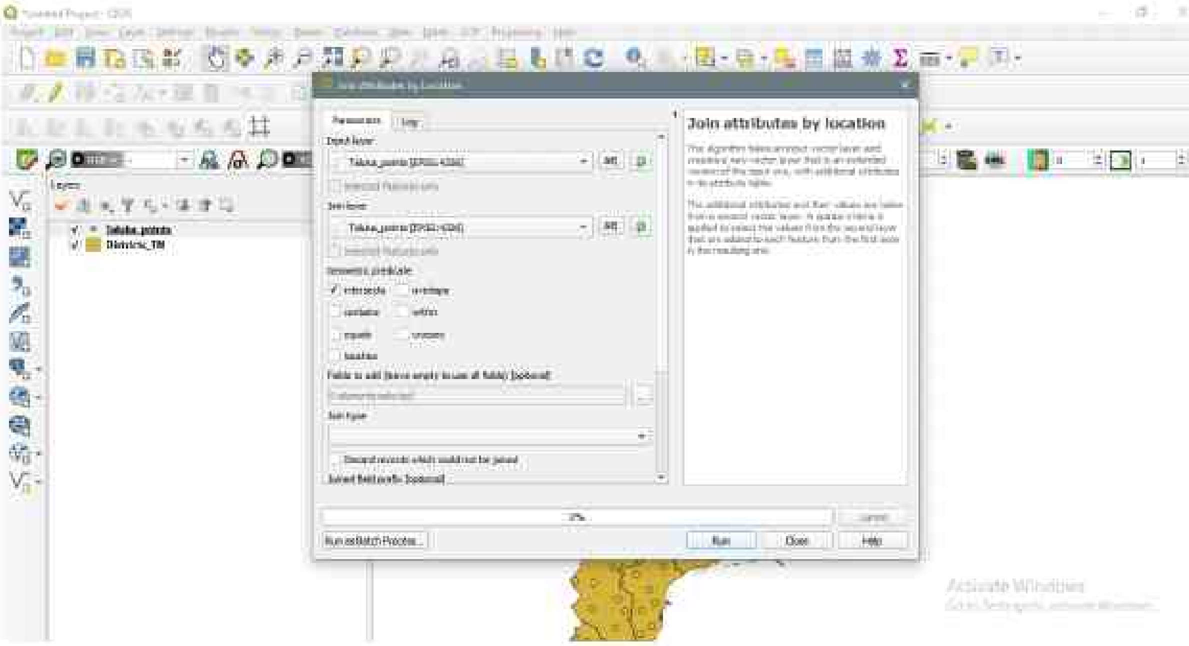
- tamilnadu.shp
- taluk.shp

Query in GIS is a logical expression that selects and displays only the features or the attributes satisfying the criteria defined by the user. This is a very useful tool for exploring the information and spatial patterns in the given data-sets. Queries are generally of two types 'attribute query' and 'spatial query'. Attribute query is also known as 'aspatial query' purely depends up on the attribute information associated with geographical data-set. It uses relational operators and Boolean logic to get the desired results from the attributes of the data-sets. Spatial query selects geographical features based on location and spatial relationships. It uses spatial logic or spatial relationships among the datasets such as adjacency, intersect, within etc.

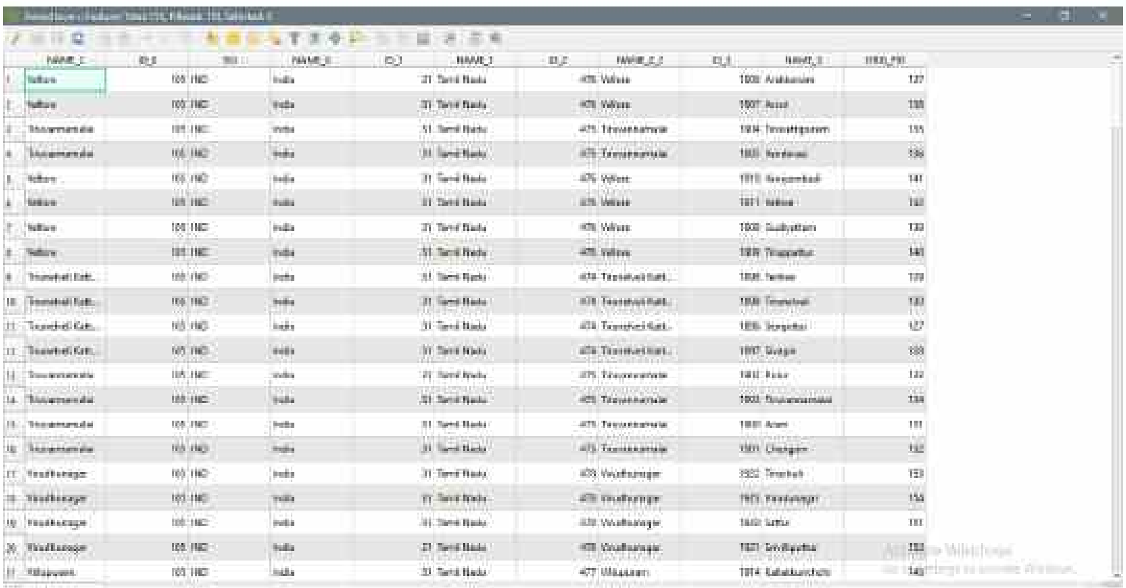
SPATIAL QUERY

- Open the vector layer in the map canvas via, Layer ➔ Add vector Layer➔or else directly click on add vector layer icon from the toolbar, browse and select the georeferenced raster layer in tutorial data (View➔Toolbar➔Manage Layer toolbar)
- Add both vector layer provided in the tutorial
- Right click the shapefile and check the attribute details in each shapefile
- Go to Vector ➔ Data Management Tools ➔Join attributes by location.





- Specify the input layer and joint layer. The input layer is the one we want to add the attributes to.The Join vector layer will be the taluk point's layer. We want to know what all taluk is "contains" in a district .Select contains from Geometric procedure.
- Select the type of joint and click run.
- The new joined layer have features from taluk.shp. Right-click on the layer and select Open Attribute Table.

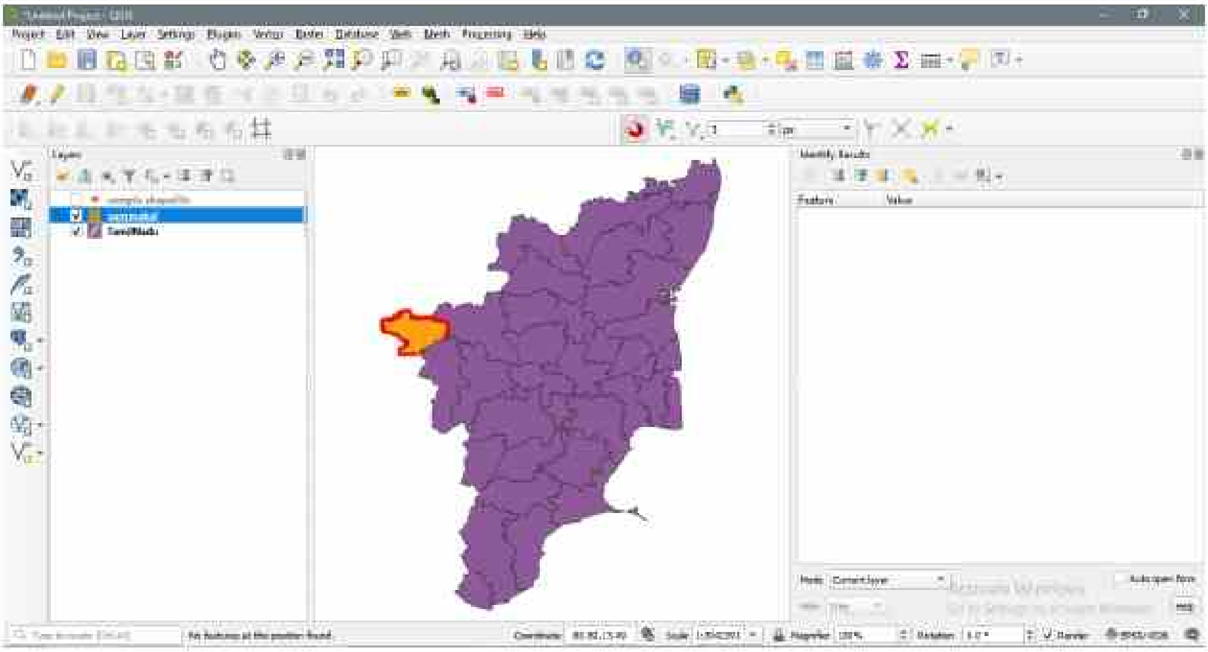


- Save the joined layer by right clicking the layer→export→save feature as .Save the feature at desired location,

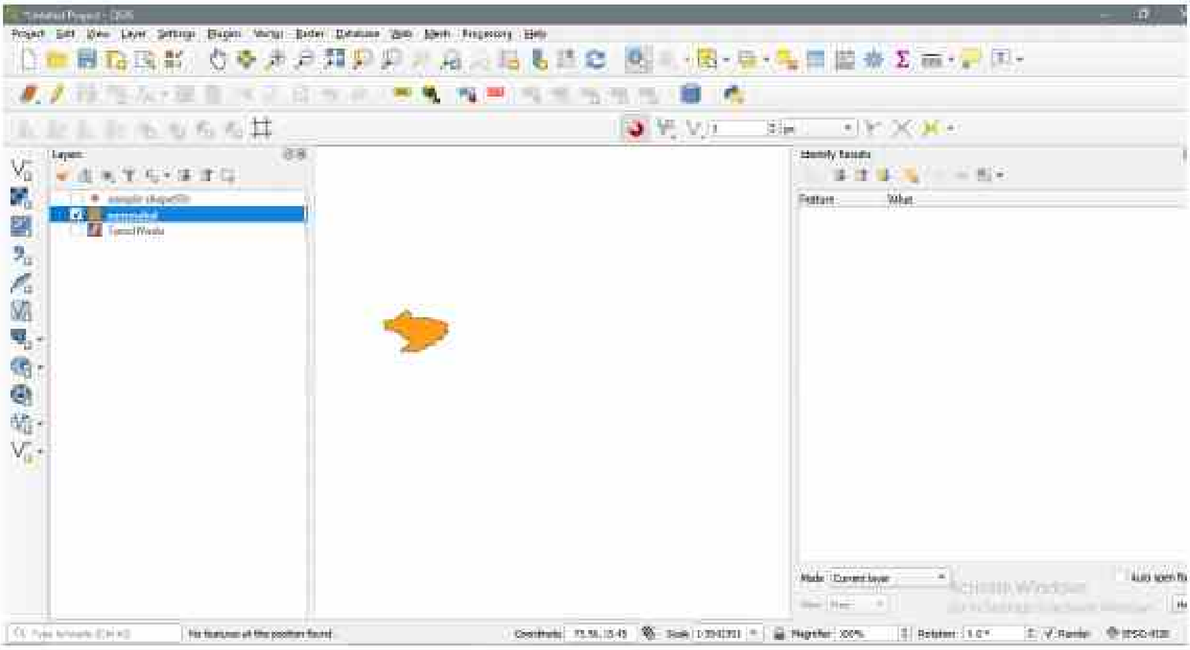
ASPATIAL QUERY

- First, we open Quantum GIS
- Add the vector layers of Tamilnadu by clicking on the 'Add Vector' or from the Menu bar (Layer →Add Layer→Add Vector Layer)

Query no 1: From the given data-sets, which districts have least density of population



- Open the Attribute table of 'tamilnadu.shp' (Right click on the layer → Open Attribute Table).
- Search for the "Density" column in the attribute table
- A triangle is seen next to title name. Triangle pointing upward indicates that the data in the column is in 'Ascending order' and vice-versa.
- Arrange the data in ascending order for 'Density'. So the first entry will have minimum population, which we are looking for.
- Next step is to see this area spatially. Click on the row you clicked, the area is selected and highlighted in the map canvas.
- To create a new shape file of the selected area, right click on layer name i.e. 'tamilnadu.shp' under 'Layers' and click on 'Save Selection As'. You will be directed to 'Save vector layer as' window. Select desired name and location using 'Browse
- Click on 'Save' and 'OK' to finish.



Query no: 2 find out the areas having "population density" above 500

- Open the Attribute table of 'tamilnadu.shp'. Click on 'select features using expression' from the menu. This window contains different functions and list of fields.

  Function help window is to the top right, different operators in the centre and a space to build the required query under 'Expression'

- Select the condition density greater than 500. (Density>500).

  Select these areas to highlight it on the map. As discussed earlier we can export these selected areas as separate vector layer to create a map

<u>CHECK LIST</u>

1. How will you combine attributes in the taluk.shp to the district.shp
2. Find out the areas having population density>1000

8.GEOSTATISTICAL OPERATIONS –POINT PATTERN ANALYSIS

OBJECTIVE:

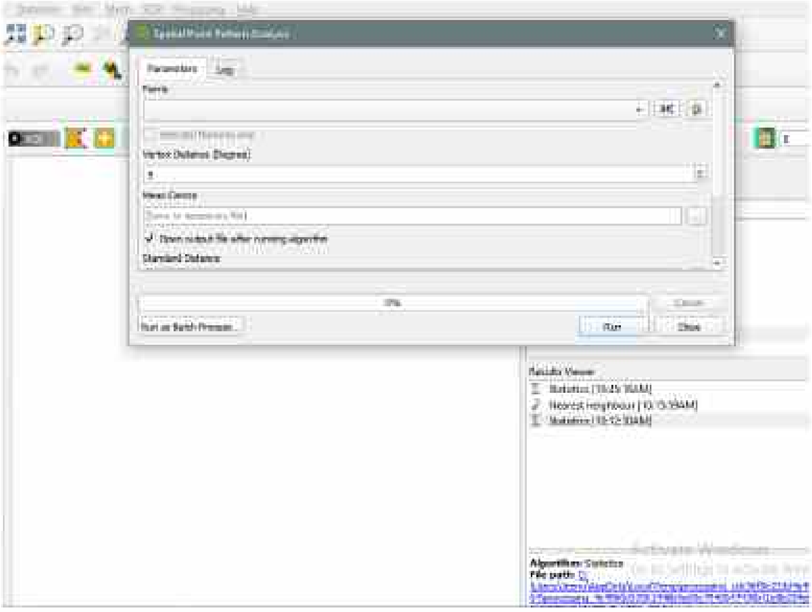
- ***To get familiarize with point pattern analysis***

DATA SET

- moisture.shp

A very basic form of point pattern analysis involves summary statistics such as the **mean centre**, **standard distance**. Mean centre is the computed average x and y coordinate. Standard distance is the measure of the variance between the average distances of the features to the mean centre.

1. Go to Processing➔Tool box➔Saga➔Geostatistics➔Spatial Point Pattern Analysis



2. A dialog box will appear .Select the point value ,the vertex distance and click run
3. The layers such as Bounding box, Standard Distance & Mean Centre will be displayed on the panel
4. Right click each layer and check the attribute table.

CHECK LIST

1. How will you compute the mean centre of a set of point data

9.GEOSTATISTICAL-INTERPOLATION BASIC SUMMERY

OBJECTIVE:

- ***To familiarize geostatistical operations such as interpolation***
- ***To familiarize* Basic statistics**

DATASETS

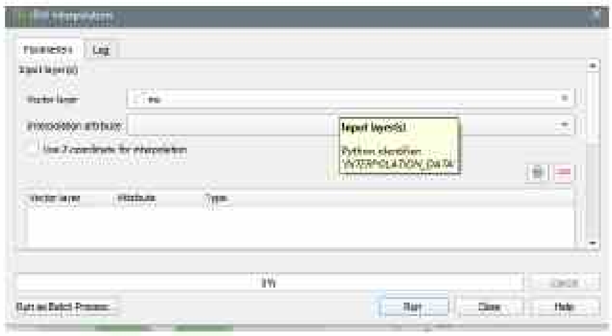
- moisture.csv

Geostatistics is a class of statistics used to analyse and predict the values associated with spatial or spatiotemporal phenomena. It incorporates the spatial coordinates for the analysis. One of the analysis is interpolation. The purpose of interpolation is to create a continuous surface from point or line data. Different types of interpolation is there such as Inverse Distance weighting (IDW), Natural Neighbour Inverse distance Weighted (NNIDW), Spline and kringing.

IDW Interpolation

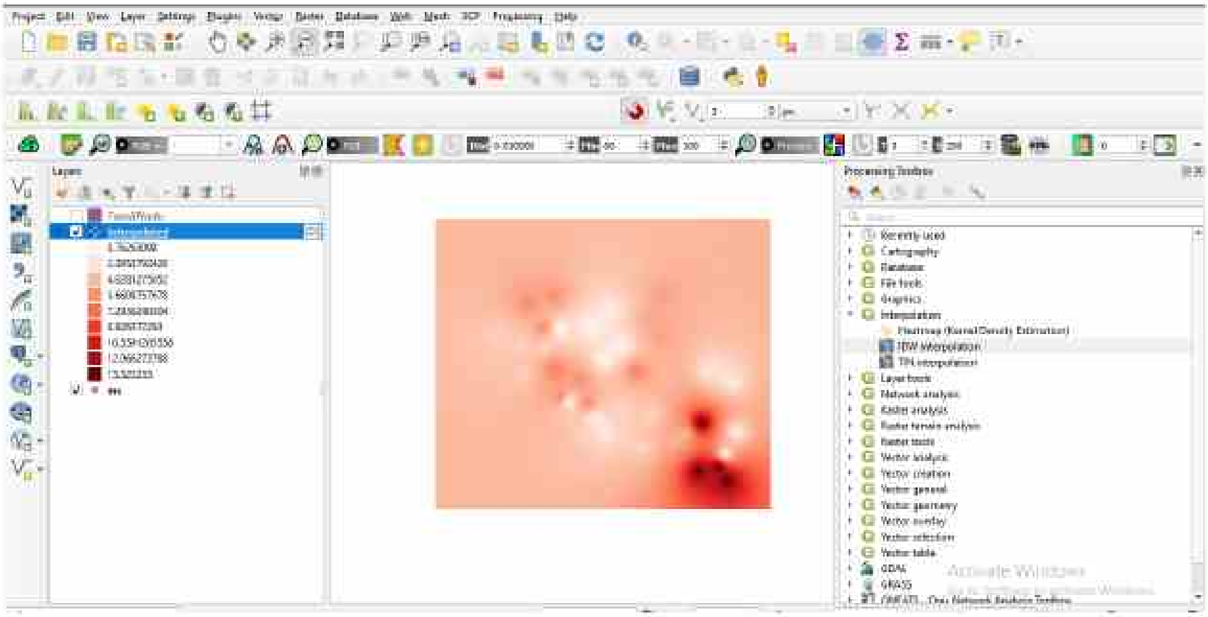
The Inverse Distance Weighting interpolation assumes that each input point has a local influence that diminishes with distance. It weights the points closer to the processing cell greater than those further away. A specified number of points, or all points within a specified radius can be used to determine the output value of each location. Use of this method assumes the variable being mapped decreases in influence with distance from its sampled location.

- Add the csv file into the interface and convert the csv file into a shapefile by opening Layer➔Add Layer➔Add Delimited text Layer.
- Select the geometry type as point type and then input x and y values and set the coordinate system
- The csv file will be converted into shape file and will be displayed on the panel. This is a temporary layer
- Right click the layer and export it to the desired location.
- Go to Tool➔Processing➔Interpolation➔IDW Interpolation
- A dialog box of IDW interpolation will appear



- Select the vector layer to be interpolated and choose which attribute to interpolate

- Click the add button ,the vector layer and the attribute we choose is displayed there
- Select the extent on the canvas and set the number of rows and columns and click ok.
- The interpolated layer will displayed on the panel ,check the lowest and highest value
- Right click the layer and go to properties and choose symbology ,From the render type choose single band pseudocolor and select the style and click ok
- Right click the layer and export the interpolated layer to the desired location.



Basic statistics

Basic statistics are a set of values calculated from a dataset; known as, the mean, the mode, the median and standard deviation, and are exactly what their name suggests, the most basic statistics. They form the basis of statistics and are some of the most valuable to calculate. Often used as tools for the organization on larger datasets.

- Go to vector→Analysis→Basic statistics for field
- Select the input layer
- Choose the field whose values to be computed
- Click run
- Check on the result viewer a file will display showing the statistical components.

Analyzed field: Mc

Count: 38

Unique values: 26

NULL (missing) values: 0

Minimum value: 0.74

Maximum value: 13.34

Range: 12.6

Sum: 171.79999999999995

Mean value: 4.521052631578946

Median value: 3.125

Standard deviation: 3.515852001807142

Coefficient of Variation: 0.7776610345613237

Minority (rarest occurring value): 0.74

Majority (most frequently occurring value): 1.92

First quartile: 1.92

Third quartile: 6.02

CHECK LIST

- How will you create a moisture map when point data is given
- Calculate the statistics of the field density in the tamilnadu.shp

10.FIELD TO LAB (IMPORTING FIELD DATA IN QGIS)

OBJECTIVE:

- ***To download the waypoints collected from the hand held GPS in the field and conversion into *shp file format***

DATASETS

- GPX Points from the field

This tutorial aims to describe the steps involved in downloading waypoints collected from the hand held GPS and conversion into the *shp file format. The Waypoints can be collected using smart phone .Some of the apps are mentioned in the table below.

Name of the App	Source
GPS Essentials	**Playstore**
GPS Test	**Playstore**
GPX Viewer	**Playstore**

STEPS

- Connect GPS to the computer and import the waypoints into the system. GPX is a standard format when saving data from a hand held GPS
- QGIS can load GPX files as layer. Open QGIS and add vector layer. Select file type GPs eXchange format .Locate required folder and file name then open. GPX data contains GPS waypoints opens as layer
- To select multiple data types, hold the CTRL key as data types are selected. Layers will be displayed
- You can change the appearance by right clicking layer and selecting properties
- QGIS will not allow editing of the GPX layer. Editing is only permitted on shapefile layers. To edit the GPX layer convert that to a shape file. Right Click that layer and choose export, from that select "Save As" and then save it as shape file at corresponding location.

CHECK LIST

1. How will you create shapefile from GPX points

<u>11.MAPPING AND VISUALIZATION USING GOOGLE EARTH</u>

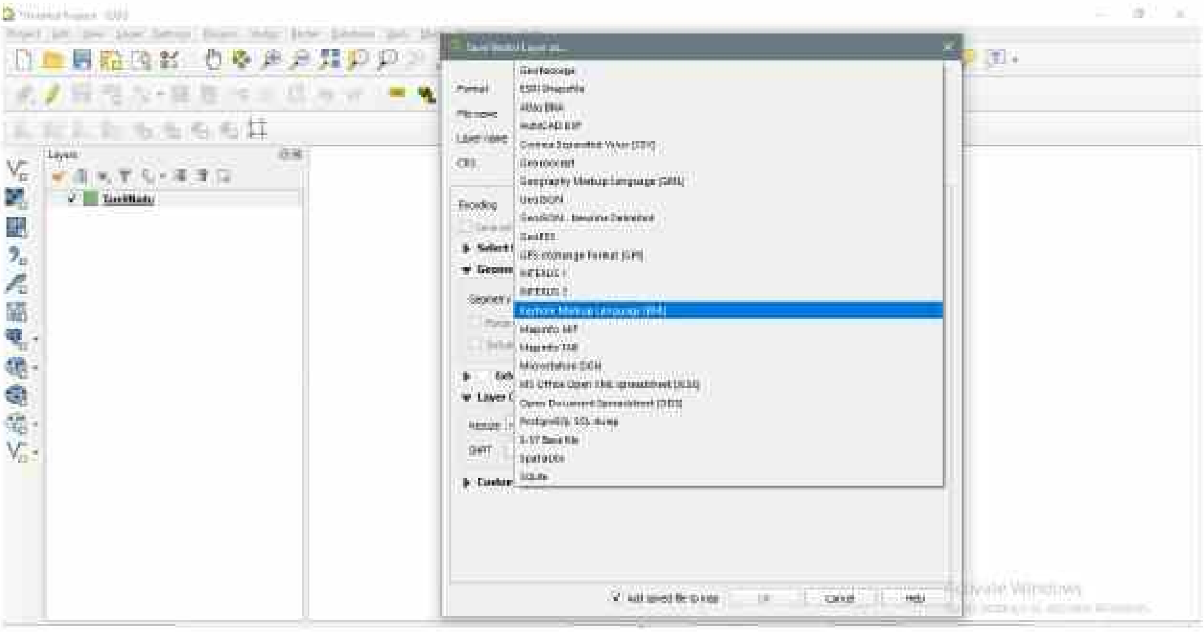
<u>OBJECTIVE:</u>

- ***The objective of this tutorial is to introduce you to Google Earth and Open street maps using Quantum GIS***

Google earth and Open Street Map (OSM) are important free sources of spatial data. It is very easy to mark the boundaries and digitize the spatial features of interest on Google Earth but digitizing in Google Earth doesn't solve our purpose every time. We need to export this data into some GIS software to create more comprehensive datasets that can be used for analysis and preparing maps Before proceeding further ensure your computer is connected to Internet

Exercise 1: Exporting shapefile to Kml format and Opening in Google Earth

- Add the vector layer 'tamilnadu.shp'.(Layer➔ Add layer➔Add vector layer).Right click the layer and 'Save As' .
- In the 'Save As' popup window change the format from 'ESRI Shapefile' to 'Keyhole Markup Language[KML] and tab navigate to the desired destination folder and give an appropriate name

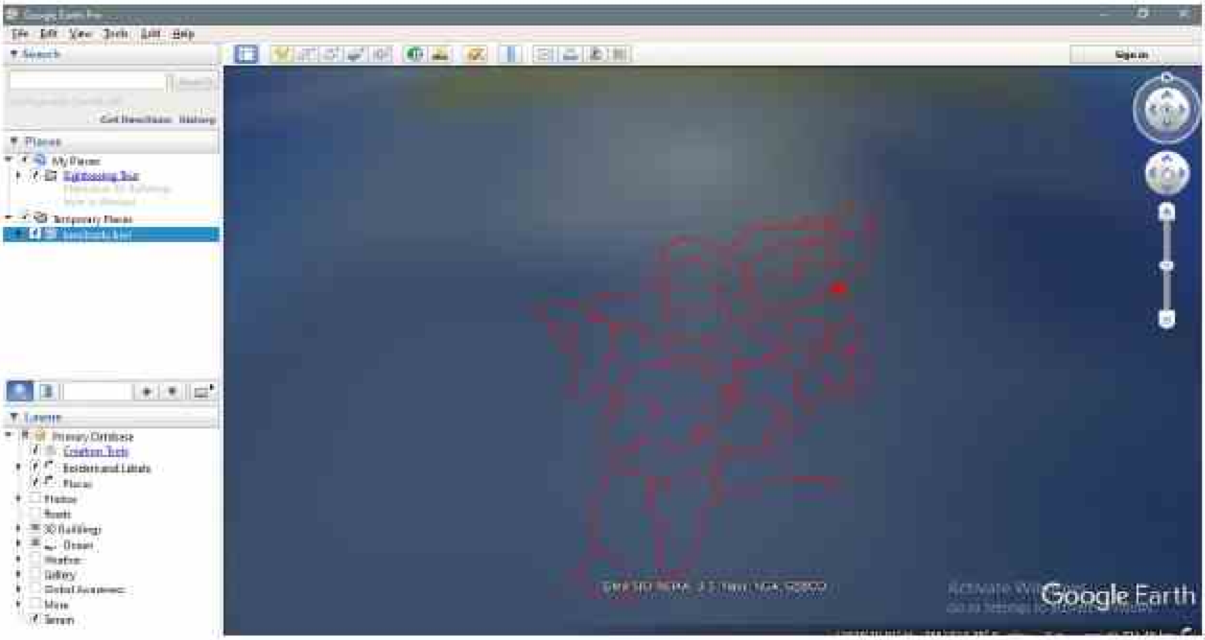


Make sure that CRS is 'WGS 84', if not select the 'WGS 84' as CRS. Now click on OK' to save the file in kml format and 'OK' in prompt window.

- The Layer opens up in Google Earth. This layer demarcates the boundary of Tamilnadu. In the following figure the red color polygon represent the area of interest

In this way you can convert any supporting format file to KML format by using Quantum GIS.

Note: Every time while converting into kml file make sure that the target CRS is set as WGS84



Exercise 2: Digitizing in Google Earth.

In this exercise we will digitize polygon features

- Go to the 'Places' section in Google Earth 'Right-click' on 'My Places' and 'Add' 'Folder' in the popup window name the folder and click OK'. This will add a new folder under the 'My Places'
- Now select the folder under places. We will use (polygon) for digitizing.
- Click on the 'Add Polygon' button located under menu bar now you will notice the 'New Polygon' popup window on screen, give the 'Name' of the polygon.
- Click on 'Style, Color' under 'Lines' change 'Color' to any desired color by click on ' Color box' .Select the desired color from the palette and click on 'OK'.
- Select 'Width' as required for example: 'Color' to yellow and 'Width' as '2'. Select 'Outlined' under 'Area' section. Now start digitizing the polygon by using left mouse button to place vertices, once you completed with the digitizing click on 'OK' in New Polygon window. You can use the same procedure to digitize the rest of the area.
- Now we will save the digitized polygons to 'KML' via Right-click on the folder contain digitized polygons and select 'Save Place As' .Now navigate to the

desired destination folder and give a proper name, and save as type as 'Kml (*kml)' click on 'Save' in the popup window

- Importing Kml file to shapefile by using QGIS

In this exercise we will import the digitized Kml in above exercise to shapefile by using QGIS.

- Now add the digitized kml file by using 'Add Vector layer' refer While browsing through the folders make sure that the file types set to '*.kml'.
- After adding the kml file to QGIS map canvas, 'Right-click' on the kml layer
- To convert this layer into shape file format click on 'Save As'. In the 'Save As' popup window, change the format from 'Keyhole Mark-up Language[KML]' to 'ESRI Shapefile' and browse for desired destination folder and name it as click on 'OK' to convert it into shapefile

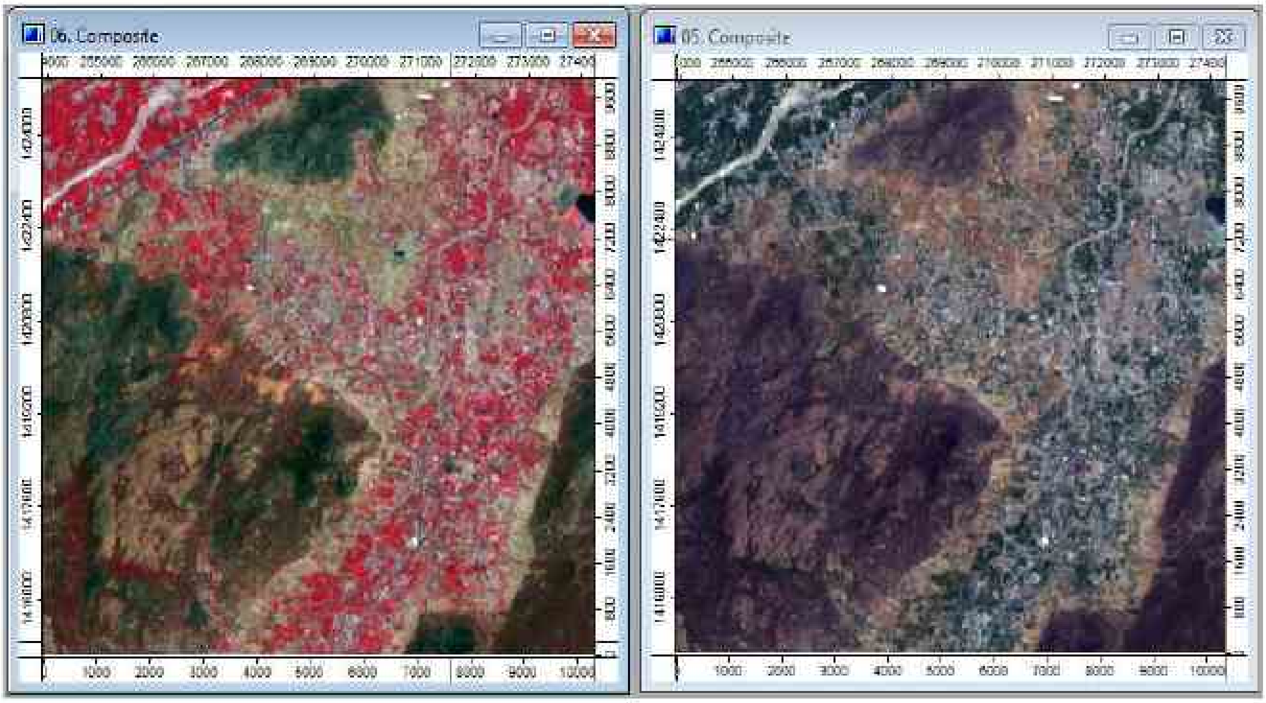
Exercise 4: Installing Open Layer Plugin/Quick map services

This plugin helps to add the Google, OSM , as base maps to the QGIS Map canvas. These layers can be used for visualization and as well as base map for digitization.

- Change the layer style of 'tamilnadu.shp' from 'Simple fill' to 'Outline'. To do this double click on the layer to open the properties. Click on 'Style' tab to change the style.
- Then select symbol layer type as 'Outline: Single Line'.
- Change the colour of the boundary to your desired color by clicking color palette. Once you finish up with editing click 'OK'
- Go to 'Plugins' in menu bar and click on 'Manage and Install Plugins'. Select 'Open Layers Plugin' /Quick map services (new version). Click on 'Install Plugin' button. It will install the plugin in to QGIS
- After installation of 'Open Layer Plugin' Click on 'OK' in popup window click on 'Close' in QGIS Python Plugin Installer window.
- Now add the OSM Standard by using 'Open Layer Plugin' from web Menu bar

<u>CHECK LIST</u>

1. How will you convert a kml file into shapefile



SAGA THE WORK BOOK

1.EXPLORING SAGA SOFTWARE

OBJECTIVES:

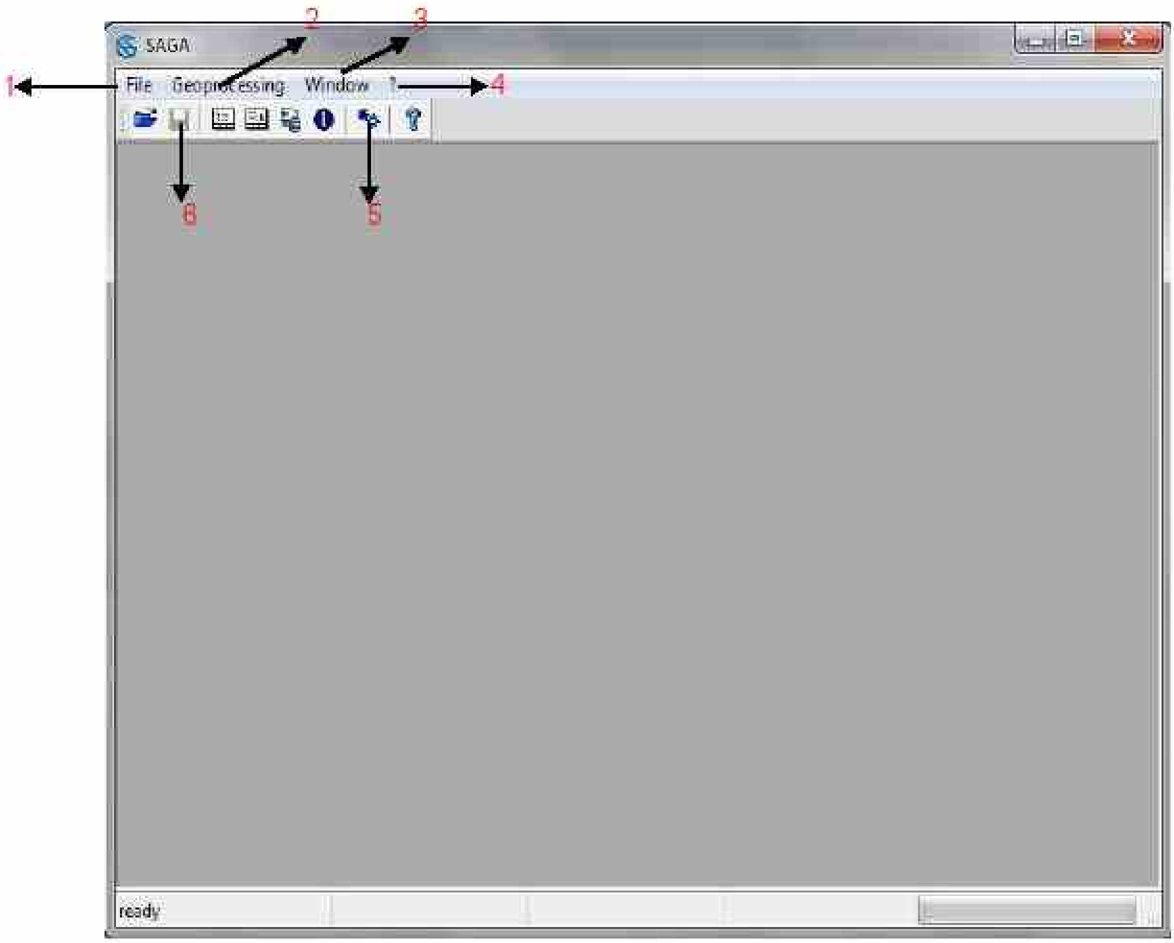
- ***Understanding the user interface of SAGA***
- ***Adding raster and vector data***
- ***Exploring the various tools in SAGA***

DATASETS:

- Landsat_8_Band_5.tif
- GC_Chennai.shp

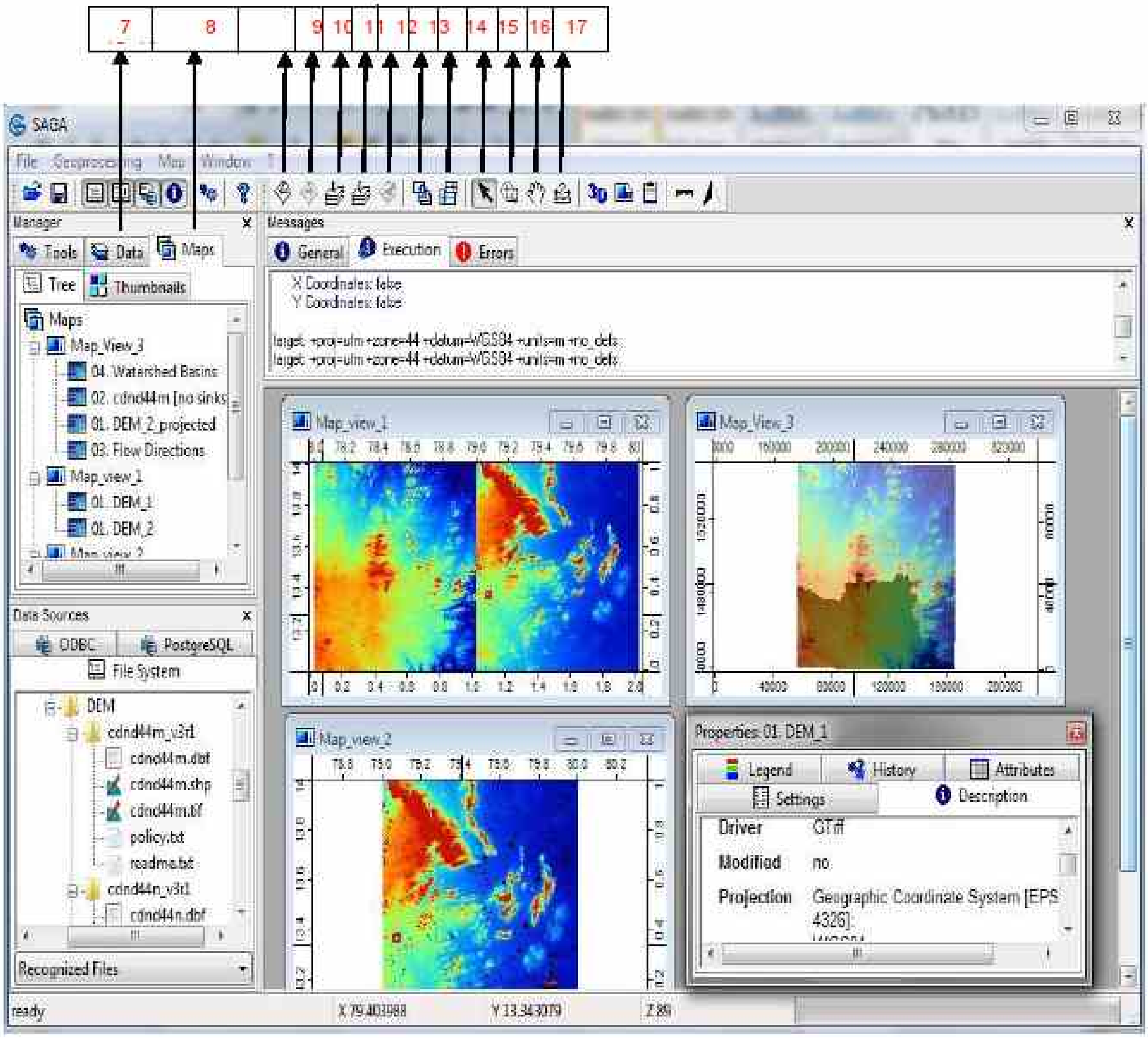
- What is SAGA?

  SAGA - System for Automated Geo-scientific Analyses – is a Geographic Information System (GIS) software with immense capabilities for geo-data processing and analysis. SAGA is programmed in the object oriented C++ language. Functions are organised as modules in framework independent Module Libraries and can be accessed via SAGA's Graphical User Interface (GUI) or various scripting environments (shell scripts, Python, R).
- Open the Saga Application.
- The basic interface of SAGA is shown in the image below.



1	To **load files** such as shapefiles, images, point clouds, TIN etc.
2	Geoprocessing consists of tools that are used for various raster and vector operations
3	Window option can be used to switch on the four major **panels/windows** that the SAGA interface uses • Manager window – Helps in managing all the **Tools, Maps, Data** that is being added into the Application • Object Properties window – It helps in visualizing the Legend, Description, Attributes, History and also **Settings can be done** for **both the Map and the Layer.** • Data Source window – It displays the **Source of the data** when a layer is selected. • Messages window – Displays the log messages.
4	Help options
5	Search and Run tool which can be used to search a particular tool by name/description and Run
6	Save option

- Try to add some Raster and Vector Layers into SAGA by clicking on
- File ➔ Open ➔ Choose the Raster/Vector file
- For Raster ➔ Landsat_8_Band_5.tif
- For Vector ➔ GC_Chennai.shp
- Try to switch on all the four major windows from the windows option.
- Windows ➔ Choose all the four windows
- After completing the above operations we will be able to see a more **occupied** view of SAGA as shown below.



<table>
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The Data Tab in the Manager Window displays the data that is being added.
After a set of raster or vector data is added click on the Data Tab in the Manager window.
<u>Raster Layers</u> are generally represented in the Grid systems.

When you add a Raster layer with a Unique - Cell size, No of Rows and Columns, Extent it forms a new grid system and if another raster layer is added with the same cell size, rows and columns, extent it falls into the same grid system.
If the new raster layer that is added does not have the same parameters as the previous layer it forms a new grid system.

</td>
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</table>

	• In the case of ***<u>Vector Layers</u>*** when you add a vector layer it falls into **Point, line or Polygon system/shapes.**

8	• The **Map tab** in the Manager window opens the data in a Map view for visualization and interaction with the data using the various tools available.
	• Once data is added go to the Data tab → Right Click the Layer → Add to Map (A dialog box opens) → Click New.
	• Now go to another layer and Right Click and Click Add to Map.
	• Now the same dialog box appears with two options
	    o Previous map view you added the layer
	    o New map view
	
	(Note: Many types of data can be viewed in the same Map view)

9	Zoom to Previous Extent
10	Zoom to Next Extent
11	Zoom to Full Extent
12	Zoom to Active Layer
13	Zoom to Selection
14	Synchronize Map Extents
15	Cross Hairs
16	Action tool – Displays the pixel values in the **Attribute Tab** found in the Object properties window
17	Zoom

18	Pan
19	Measure Distance

CHECKLIST:

1. What are the different windows in SAGA
2. How is raster and vector data represented in SAGA
3. How to Zoom In and Zoom Out
4. Difference between Layer and Map

2.IMAGE VISUALIZATION

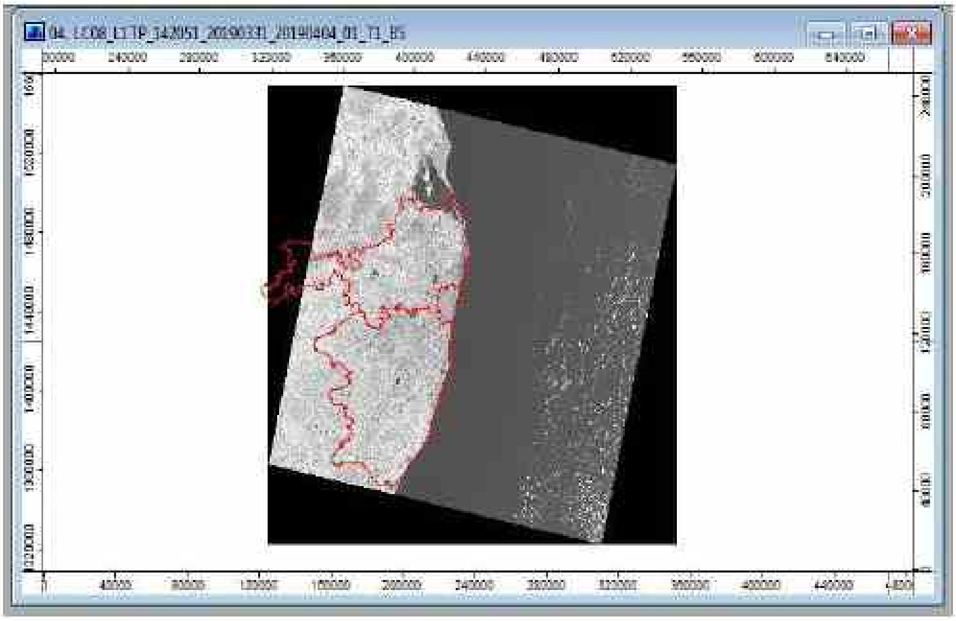
OBJECTIVES:

- ***Exploring the pixel values of the Image***
- ***Symbology of the Image***
- ***Using the Action tool to examine the pixel values***

DATASETS:

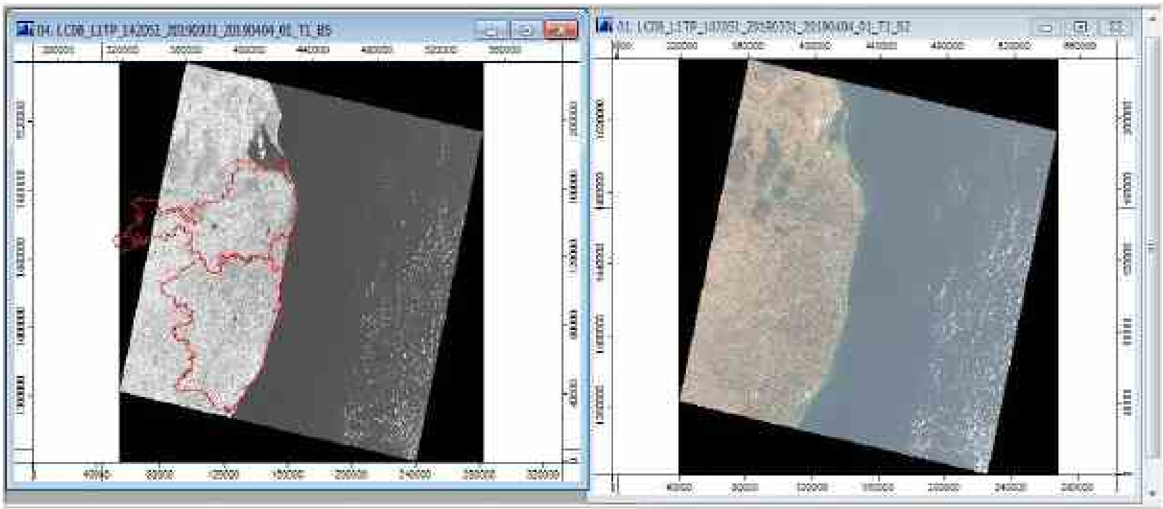
- Landsat_8_Band_5.tif
- Landsat_8_RGB.tif
- GC_Chennai.shp

- Open the SAGA application and Add the Landsat_8_Band_5 data from the folder.
- Open the Image in a Map view and open the object properties window
- Also Add the GC_Chennai.shp boundary polygon shape and open it in the same map view.



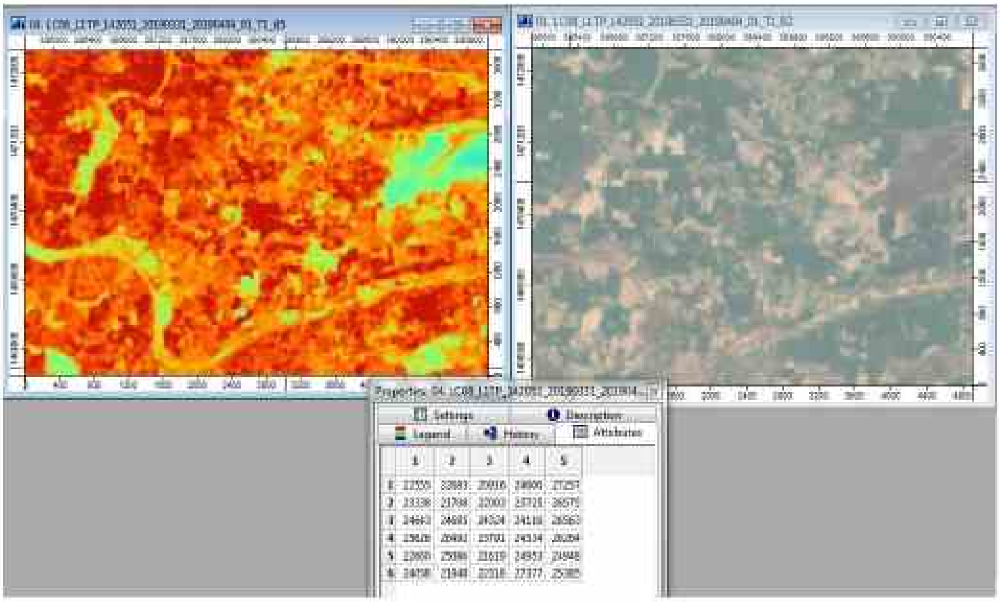
- In the Object properties window ➔ General Section ➔ Click on Show Cell Values
- Then use the cursor to zoom into the Image and the pixel values will be displayed.

- This being "Band 5" of the Landsat – 8 satellite it represents the Near Infrared Band (NIR) which is usually used to detect vegetation because of its high reflectance towards the NIR wavelength.
- Zoom in and also try changing the Symbology of the Image from the object properties window ➔ Colors Section ➔Type.
- Add the Landsat_8_RGB.tif file from the folder and open it in the Map view.
- Now arrange the Map windows in horizontal or vertical alignments.
- Select both the maps and Click on the **Synchronize Map extents** button.

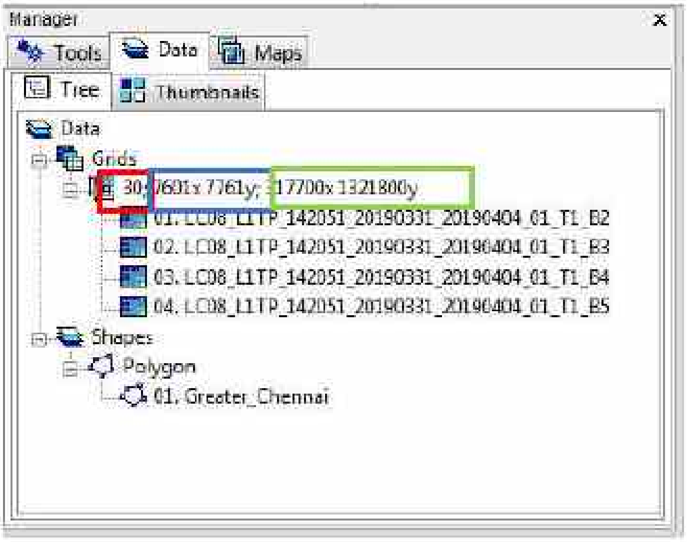


- Once the map views are synchronized zoom in to a particular feature in the RGB view and the NIR band view will also zoom into the same extent.

- In this case to understand the high reflectance of NIR from vegetation, zoom into a highly dense vegetation area in the RGB view and check the Value of the pixel in the NIR view.
- Similarly try zooming into a less dense/ no vegetation region and examine the value of the pixel in the NIR view.
- Another way to examine pixel values is to use the Action tool from the toolbar.
- You can use the action tool to examine the pixel values by clicking on it or drawing a box around it. Then open the object properties window → attributes. The pixel values will be displayed.



- Once any data is added in the window, based on the type of data it gets categorize into a ***grid system(for raster) or a shape system(for vector).***
- In the Data Manager Window once a polygon or raster layer is added we will be able to see the raster data falling into a grid system and vector data falling into a shape system.



- Cell Size
- Number of Rows and Columns
- Extent information of the Image

<u>CHECKLIST:</u>

1. How to examine the pixel value using Action Tool
2. Based on what grid system is defined
3. If the pixel value is higher in NIR band what does it signify

3,EXAMINATION OF IMAGE

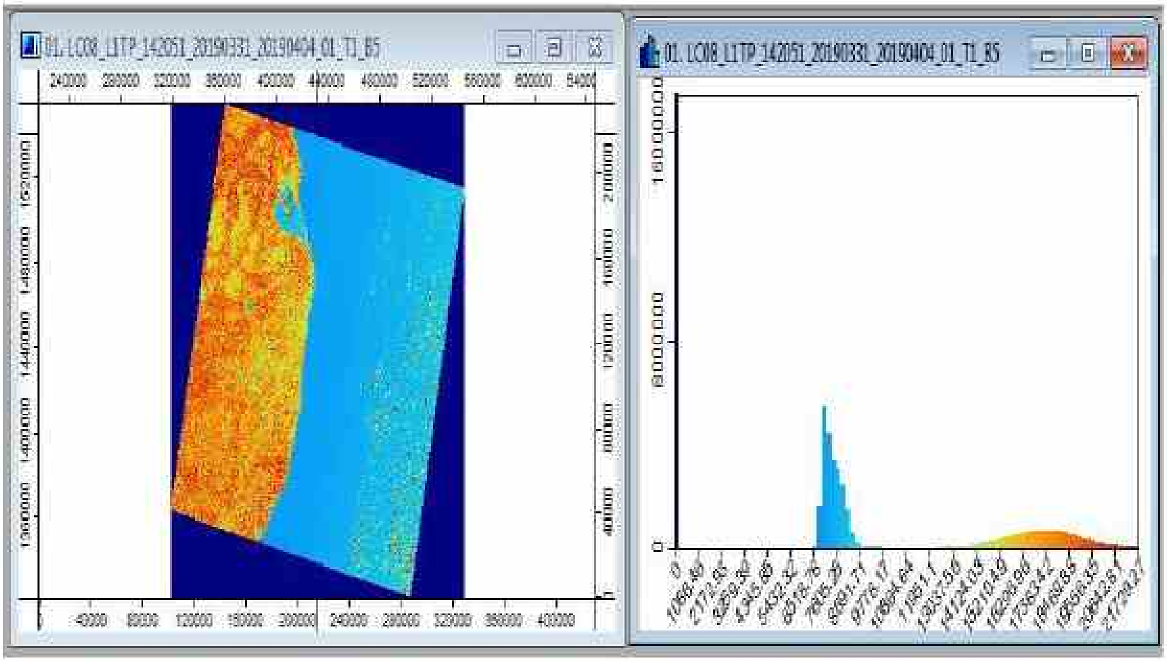
OBJECTIVES:

- ***Understanding the Image histogram***
- ***Understanding the use of Scatter plot***
- ***Converting Digital Numbers to Reflectance values***

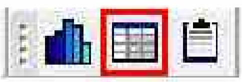
DATASETS:

- Landsat_8_Band_5.tif
- Landsat_8_Band_4.tif

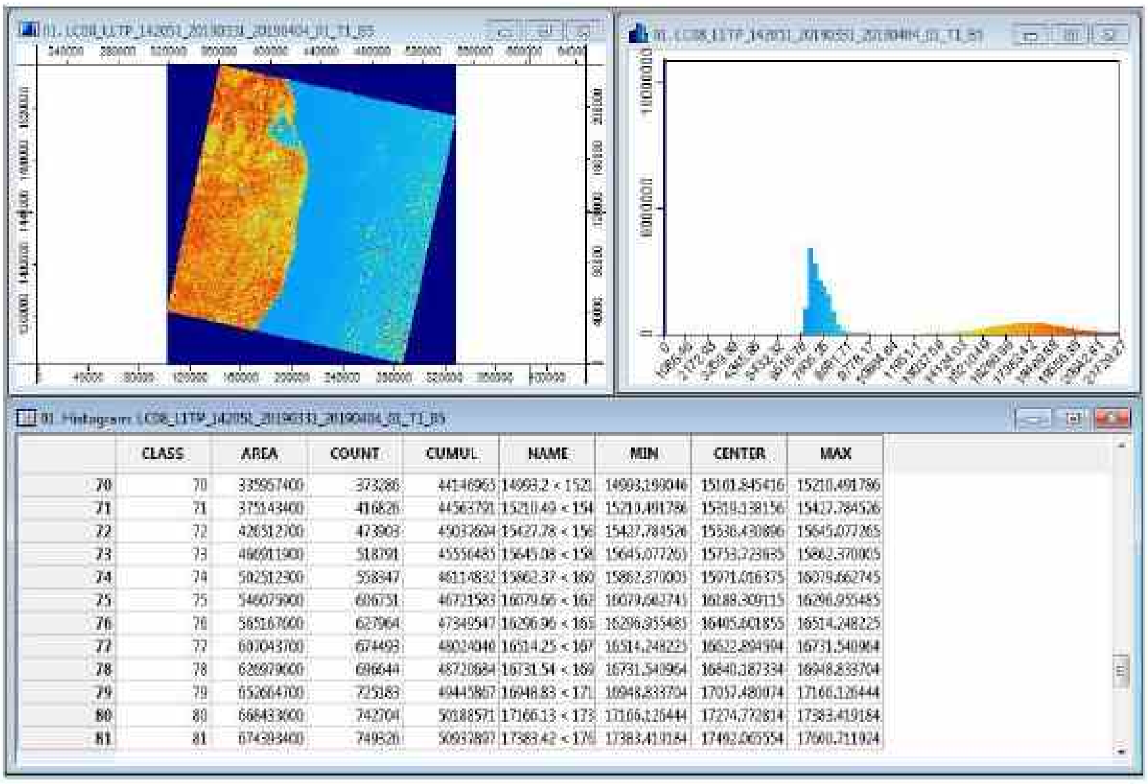
- Open the SAGA Application and add the Landsat_8_Band_5 data from the folder.
- A histogram basically helps in understanding the frequency. The Image histogram plots the frequency of pixels for each pixel value/tonal value.
- To open a histogram: Right click the data in data manager window ➔ Histogram



- In this histogram the x axis consist of the pixel value range and the y axis consist the count of the pixels.
- So for every value in the **range of pixel values** the number of pixels is plotted.
- This so called range of pixels is defined by the **Radiometric Resolution** of the Image.
- Now this histogram can be converted into a Table and viewed
- To convert the histogram into Table Click on the histogram from the viewer
- On top in the toolbar three options as shown below will appear

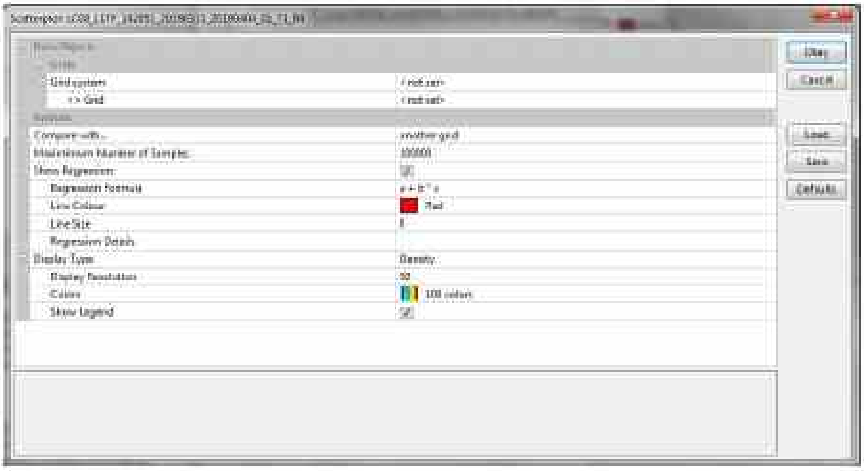


- The first option is for cumulative histogram where the whole range of values is cumulated into 100 classes and the number of pixels for those values is plotted
- The second option inside the redbox is to **Convert to Table**
- The table created will be a cumulative table.

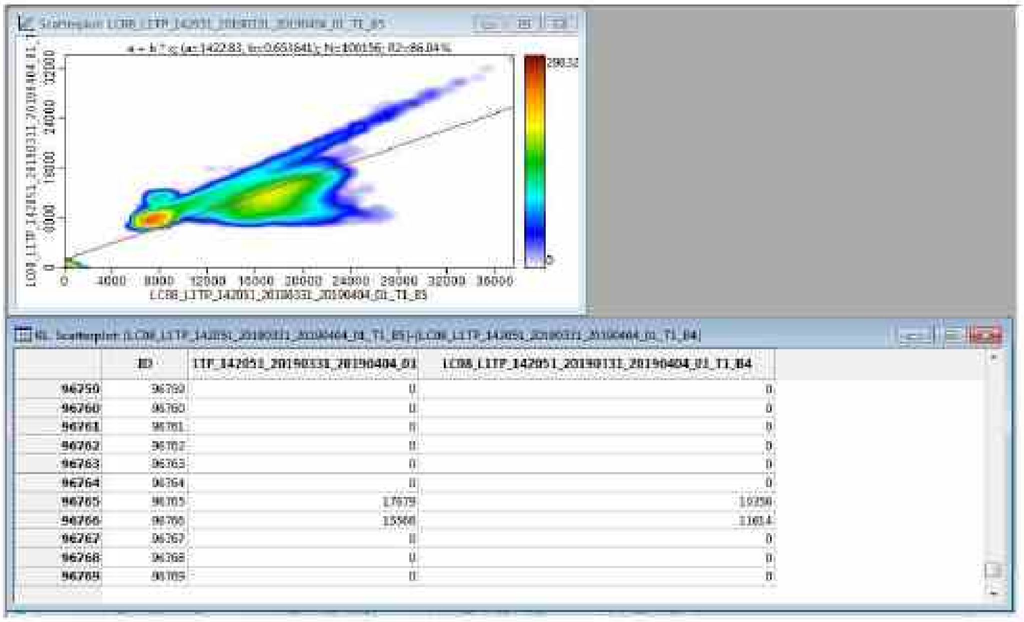


	CLASS	AREA	COUNT	CUMUL	NAME	MIN	CENTER	MAX
70	70	335957400	373286	44146965	14993.2 < 1521	14993.199046	15101.845416	15210.491786
71	71	375143400	416826	44563791	15210.49 < 154	15210.491786	15319.138156	15427.784526
72	72	426512700	473903	45037694	15427.78 < 156	15427.784526	15536.430896	15645.077265
73	73	466911900	518791	45556485	15645.08 < 158	15645.077265	15753.723635	15862.370005
74	74	502512300	558347	46114832	15862.37 < 160	15862.370005	15971.016375	16079.662745
75	75	546075900	606751	46721583	16079.66 < 162	16079.662745	16188.309115	16296.955485
76	76	565167600	627964	47349547	16296.96 < 165	16296.955485	16405.601855	16514.248225
77	77	607043700	674493	48024040	16514.25 < 167	16514.248225	16622.894594	16731.540964
78	78	626979600	696644	48720684	16731.54 < 169	16731.540964	16840.187334	16948.833704
79	79	652664700	725183	49445867	16948.83 < 171	16948.833704	17057.480074	17166.126444
80	80	668433600	742704	50188571	17166.13 < 173	17166.126444	17274.772814	17383.419184
81	81	674393400	749326	50937897	17383.42 < 176	17383.419184	17492.065554	17600.711924

- Now one way to enhance the quality of the Image is to adjust the histogram.
- To adjust the histogram using SAGA open the object properties window ➔Colors section ➔Histogram Section➔Adjustment
- Try using various adjustment techniques and visualize the changes happening in the histogram and the Image.
- The next operation will be to use a scatter plot and compare two bands – "Band 5" and "Band 4"
- Add the Landsat_8_Band_4 data and open it in a new map view.
- A scatter plot is generally created to compare the pixel values of two images.
- To open the scatter plot : Right click the Image with which the comparison is to be made ➔Scatterplot



- Choose the Grid system and Grid of the other Image which is to be compared and click Okay.
- The x and y axis will have the pixel values of the respective images.
- The regression equation along with the R^2 value is also displayed.
- Now this scatterplot can be converted into a table as it was done for the histogram.
- Click on the scatterplot in the viewer and Convert to Table.



- Next we will see how information is stored inside a pixel and what information is stored in it.
- ***Radiometric resolution*** refers to how much information is in a pixel and is expressed in units of bits. A single bit of information represents a binary decision of yes or no, with a mathematical value of 1 or 0.

- In case of latest remote sensing images the radiometric resolution is found to be 8 bit – 0 to 255 values, 10 bit – 0 to 1024 values, 16 bit – 0 to 65536 values.
- Information is stored in each pixel based on the radiometric resolution and pixel values that we visualize are called the **Digital number (DN value)**

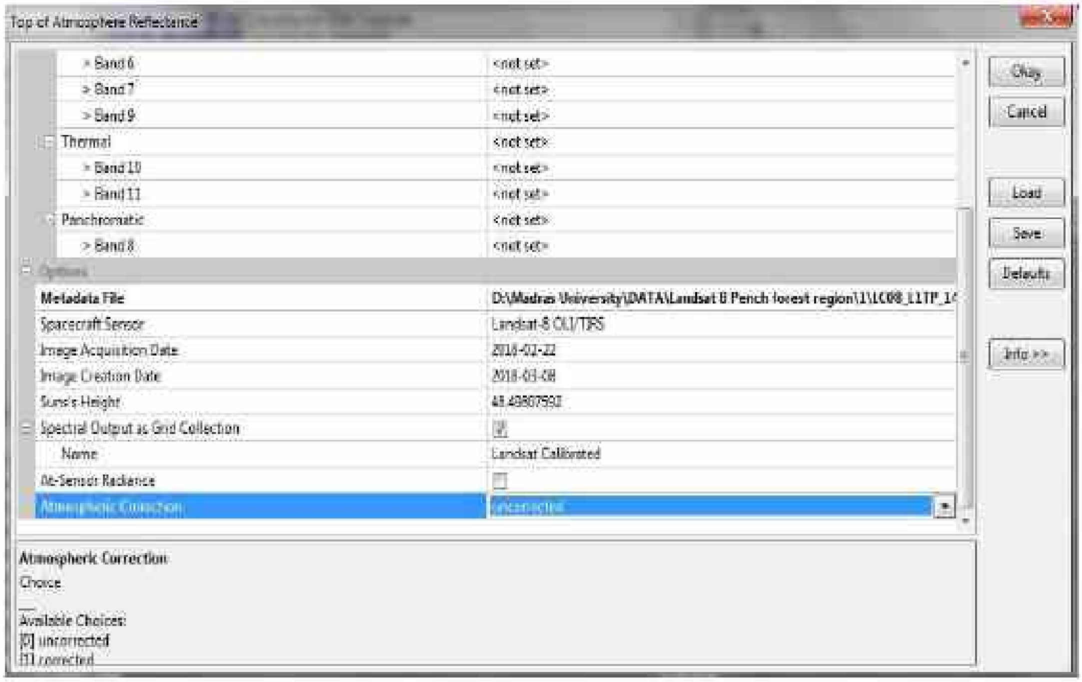
- ***Digital number*** in remote sensing systems is a variable assigned to a pixel, usually in the form of a binary integer in the range of 0–255 (i.e. a byte) or more than that. The range of energies examined in a remote sensing system is broken into 256 bins. A single pixel may have several digital number variables corresponding to different bands recorded.

- For certain processing we require the original reflectance value of the pixel rather than its digital number. In that case we must convert the DN values to the ***Reflectance*** values and it requires the Metadata file of the dataset which is found when downloading the dataset.

- ***Reflectance is the ratio between the amount of light reflected from an object to the amount of light striking the object.***

- SAGA has a specific tool for converting the DN values of Landsat imagery to reflectance values.

- Geoprocessing ➔Imagery ➔Landsat ➔ Top of Atmosphere Reflectance



- Input the Bands for which the reflectance value is required and Input the Metadata file and click Okay.

CHECKLIST:

1. How to open the histogram of an image
2. How to convert it to a table
3. How is the AREA field calculated in the table
4. How to compare the pixel values of two Images
5. What is the difference between Reflectance and Digital Number

4.COLOR COMPOSITES, VARIOUS RATIOS…

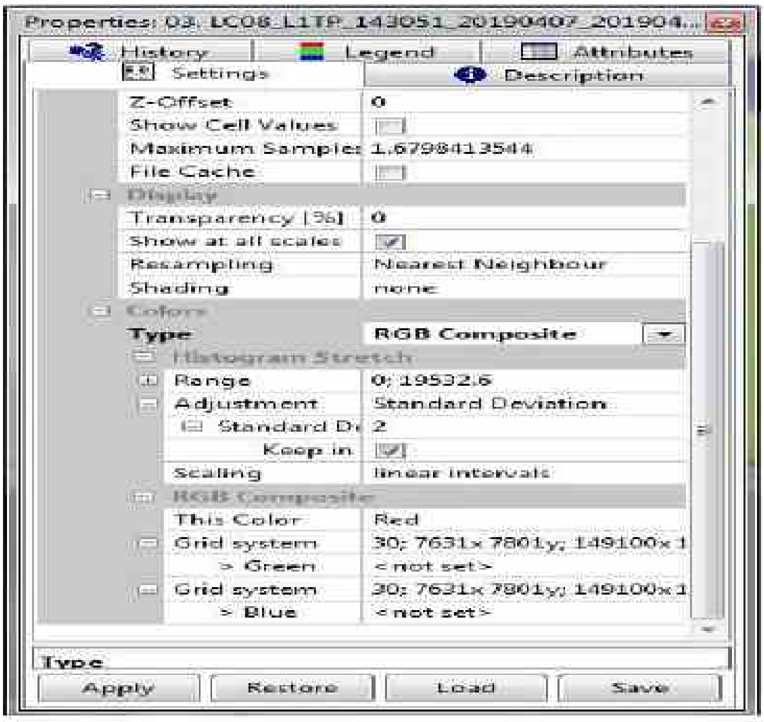
OBJECTIVES:

- ***To create a True color composite image***
- ***To create a False color composite image(FCC)***
- ***To create a NDVI Image.***

DATASETS:

- Landsat_8_Band_2.tif
- Landsat_8_Band_3.tif
- Landsat_8_Band_4.tif
- Landsat_8_Band_5.tif

- Open the SAGA application and add the Landsat_8_Band_ 2, Landsat_8_Band_ 3, Landsat_8_Band_ 4, Landsat_8_Band_ 5 Images.
- For better interpretation of the image it is important to build True color composites and False color composites.
- True color composites are nothing but the True color which is visible to the eye. This type of composites are achieved by combining the **R**ed, **G**reen and **B**lue bands and can also be called as a RGB composite.
- False color composites are created when we need to interpret from the invisible spectrum.
- First to build a RGB composite open the layers in the map view and choose " band 4"and open the Object properties window
- Setting ➔Colors section ➔ Type ➔RGB Composite



- In this panel the layers forming the RGB must be added according to the color.
- The currently chosen Layer is the Red band and hence This Color option ➔ Red ,Green option ➔Band 3 and Blue option ➔ Band 2

- Once the bands are set click Okay and view the Band 4 image in the map view. It will be created as a RGB composite

- Use the Histogram option to enhance the RGB image by adjusting the histogram until a perfect RGB composite is obtained.

- Object properties window ➔ Colors section ➔ Histogram Stretch ➔Adjustments ➔Linear, Manual, Percentile, Standard Deviation.

- Try altering **all the options** for ***all the three bands individually*** and their **respective values** to obtain the right combination.

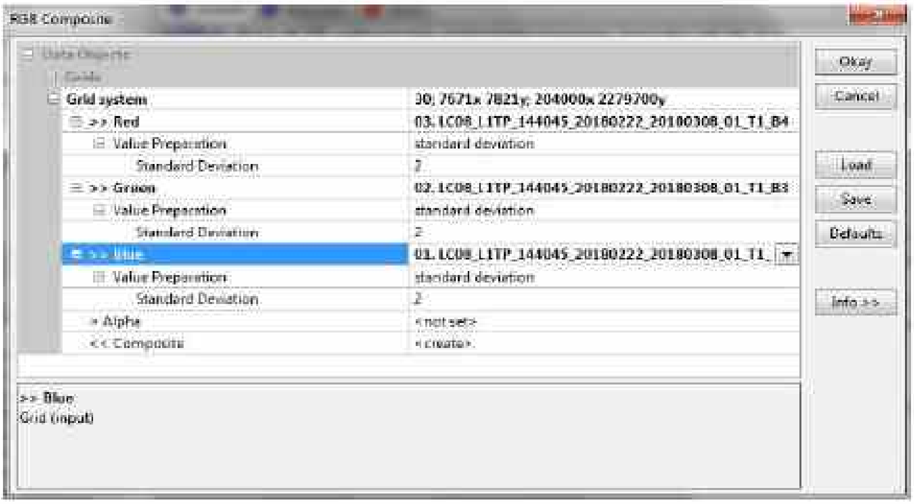
- Note the parameters for the perfect RGB composite.

- *This is a way in which by trial and error the perfect enhancement can be done before executing the tools.*

- Next we will see how to create a separate RGB layer using the three bands provided here using the parameters noted down from the previous step

- The RGB composite tool helps in building that type of a Layer.

- Geoprocessing ➔Visualization ➔Grid ➔RGB composite



- In this case the Band 4(Red) is assigned to the red color, Band 3(Green) is assigned to Green color and the Band 2(Blue) is assigned to the blue color.

- This combination of bands is called a Natural/True/RGB color composite which generally represents the true color of the features which is visible to the eyes.
- Click on Okay and the tool is executed and the output is added to the data manager window. Open the output in the Map view and visualize/interpret the image.
- Once this output is created Export it into a TIF Format and save it.
- To export the Image: Geoprocessing ➔ File ➔ Grid➔ Export ➔ Export Image.
- In the same way we will try to create a False color composite with the "NIR band – band 5", "Red band – band 4" and "Green band – band 3".
- Create an FCC image using the object properties of the band 5 image and then note down the parameters for a good quality FCC image.
- Choose band 5 ➔ "This color ➔ Red", "Green color ➔ Band 4", "Blue color ➔ Band 3".
- Similarly create a False color composite (FCC) using the RGB composite tool ➔ Band 5(NIR) is assigned to Red color, Band 4(Red) is assigned to the Green color and Band 3(Green) is assigned to the Blue color.
- Click Okay and execute the tool after which the output can be viewed in the Map view and saved as a TIF format file.
- ***(Note: The reason for creating an FCC image using the NIR band is because vegetation reflects more in NIR spectrum)***
- A comparison of the True color (Right) and False color (Left) Image is shown below

- The next exercise that will be done is related to band ratio/indices.

- Indices and band ratios are the most common form of spectral enhancement where selected bands are chosen and few numerical operations are done on them to obtain information.

- We will try to work with the NDVI which is the most commonly used Index to identify vegetation.

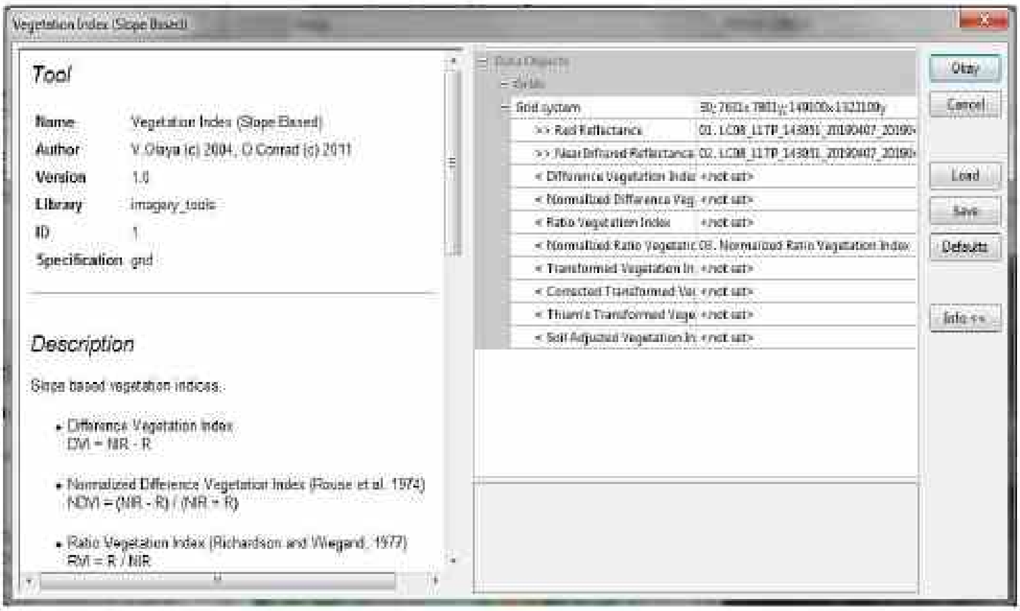
- NDVI stands for Normalized Difference Vegetation Index.

- To create an NDVI image we require "band 5 – NIR" and "band 4 – Red"

- The formula to create NDVI is [illegible]

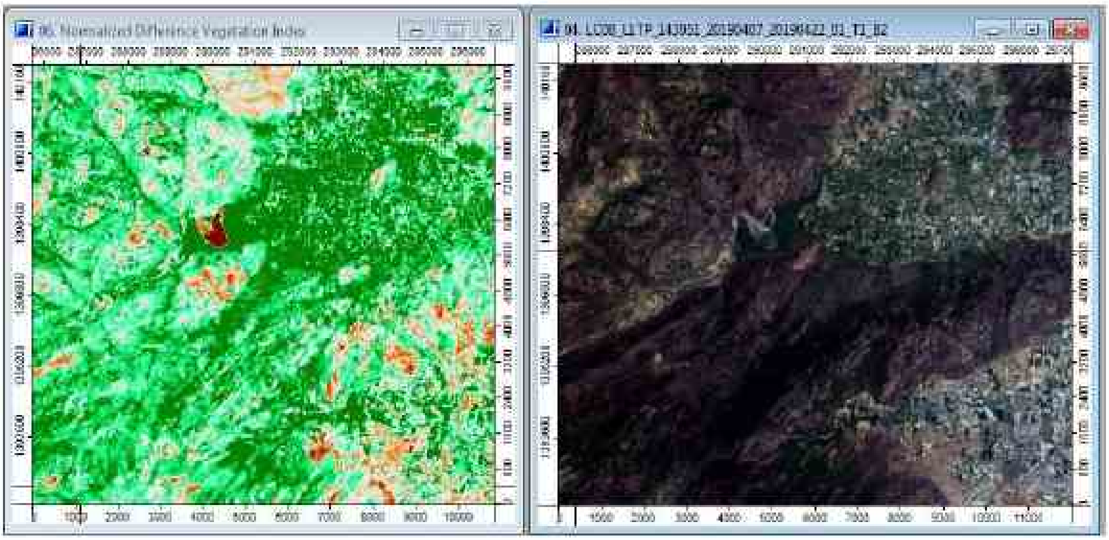
- Add the bands required to calculate the NDVI.

- To calculate NDVI: Geoprocessing ➔Imagery ➔ Vegetation Indices ➔Vegetation Index(Slope based)



- In this window set the Red reflectance band, Near Infrared Reflectance Band and select <create> for Normalized Difference Vegetation Index.

- A comparison of the NDVI and the RGB composite is given below



CHECKLIST:

1. How will you create a RGB Image without using the RGB composite tool
2. How to set the parameters in RGB composite tool
3. Difference between FCC and RGB
4. Can you create a NDVI image using Sentinel-2 data and If yes How??

5.IMAGE REGISTRATION

OBJECTIVES:

- ***To register a Google Earth Image using Landsat_8 Image***

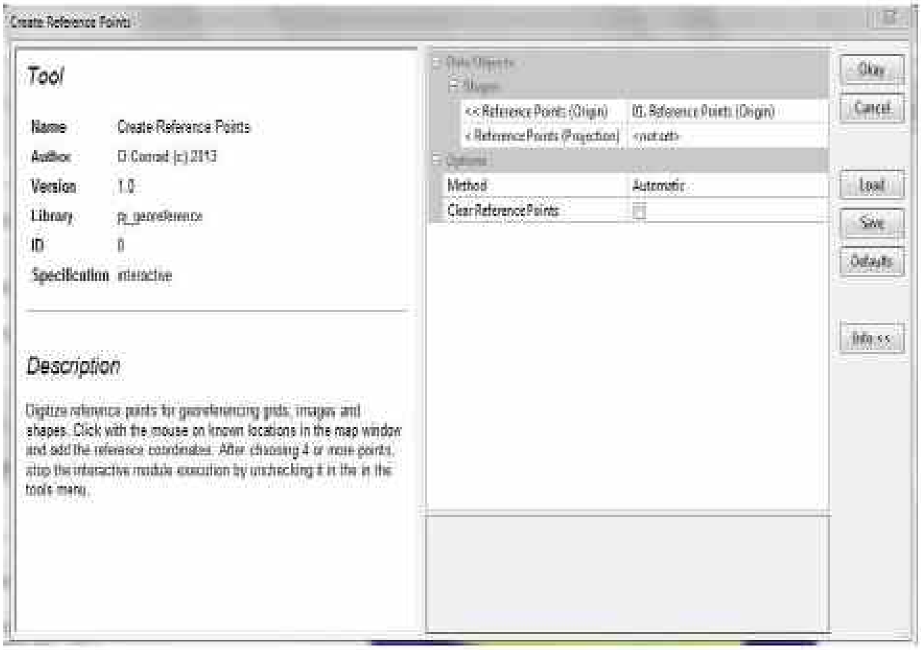
DATASETS:

- Landsat_8_Band_5.tif
- Boundary.shp
- GE_Image.jpg

- Image registration is the technique in which an image is geographically referenced with the help of ground control points obtained from the field or from other satellite data.
- Open the SAGA application and add the following data:
    - Landsat_8_Band_5.tif and the Boundary.shp
    - GE_Image.jpg

- The image shown above is the image that we will try to Geo reference using SAGA.
- There are two steps that must be followed to rectify an image using SAGA

- **<u>Step 1:</u>**
    - To set reference points on the four corners of the image.
    - Geoprocessing ➔ Projection ➔ Georeferencing ➔ Create Reference Points [interactive]



- Set the Reference points (Origin) as <create>

- Set the Reference points (Projection) as <not set>

- Choose the Method as Automatic

- A new point layer with the name Reference points (Origin) is created.

- Start marking the ***corners of the polygon which is visible in the Image*** by editing the Reference point (Origin) Layer and update the coordinate information by taking it from the boundary shapefile.

- The attribute table of the reference point layer is shown below

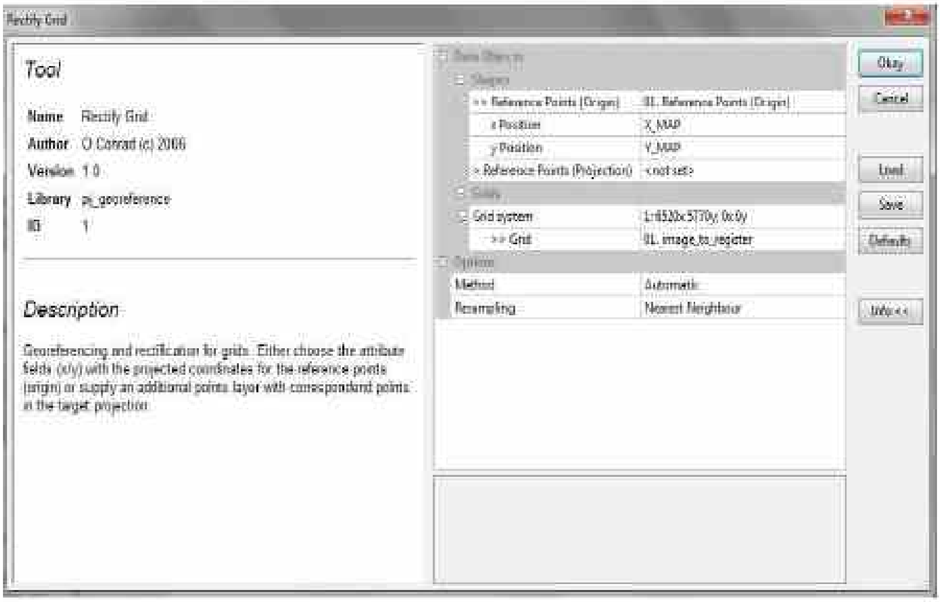
	X_SRC	Y_SRC	X_MAP	Y_MAP	RESID
1	538.757439	5583.929997	266251.4265	2399998.989	0
2	5887.780478	5620.078833	307031.9764	2400007.8665	0
3	6223.220839	159.94629	307031.9764	2360024.05	0
4	315.460801	105.857548	266250.9209	2360021.2345	0

- X, Y SRC – The coordinates in the image to be rectified

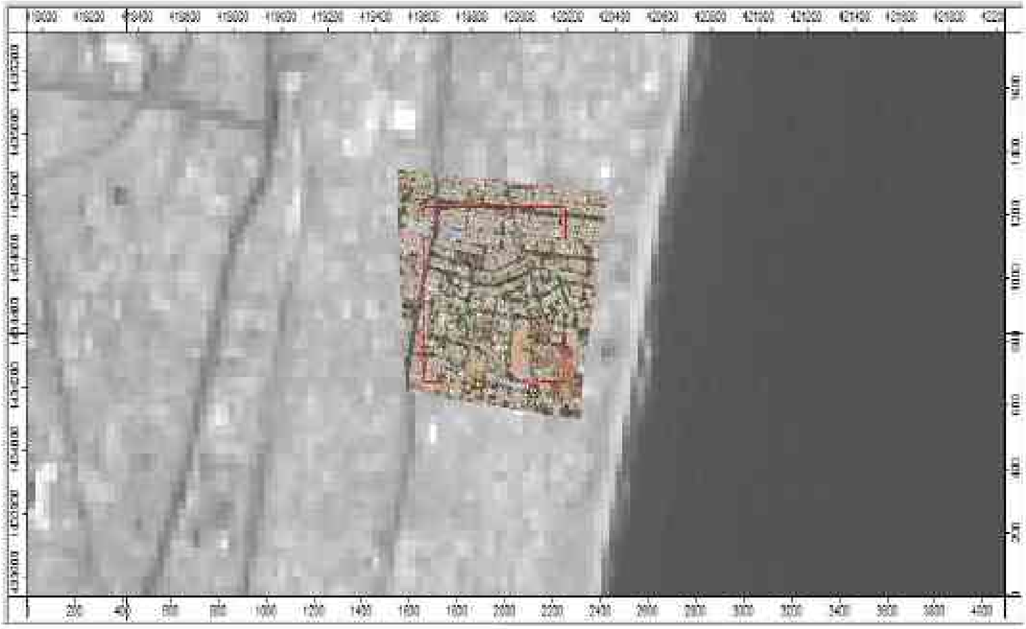
- X, Y MAP – The target coordinates used to rectify the image

- Once a reference layer is created we will move to step 2

- **Step 2:**
  - To rectify the image : Geoprocessing ➔ Projection ➔Georeferencing ➔Rectify Grid



  - Select the Reference points Layer
  - Choose X_MAP for the x position and Y_MAP for the y position.
  - Choose the Grid system and the Grid which is to be rectified
  - Choose appropriate resampling methods.
  - Once we rectify the output is as shown below



CHECKLIST:

1. Which tool should be used to do Georeferencing
2. What is X_SRC, Y_SRC, X_MAP and Y_MAP
3. Difference between Rectify and Georeferencing

6.SUB-SETTING,MOSAICKING AND FILTERING IMAGES

OBJECTIVES:

- ***To mosaic two satellite Images***
- ***Clipping the Images***
- ***Filtering of Satellite Image***

DATASETS:

- Landsat_8_stacked_1.tif
- Landsat_8_stacked_2.tif
- GC_Chennai.shp
- Landsat_8_Band_8.tif

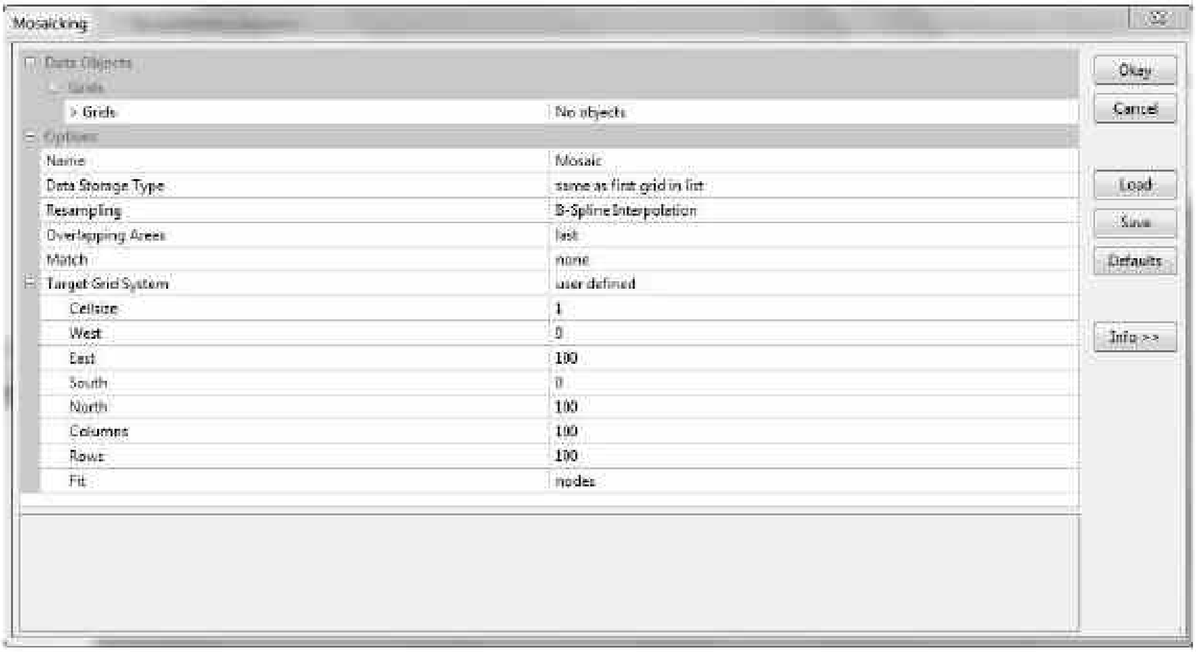
- Sub – Setting/clipping: It cuts a portion of a raster dataset based on the users required study area.

- Mosaicking: It helps in combining two or more raster datasets

- Filtering: A technique by which the pixel values of the image are altered with the help of a moving window with certain conditions assigned to it.

- Open the two Landsat_8_stacked_1.tif and Landsat_8_stacked_2.tif files navigating to the given folder and add them into SAGA and open it in the Map view

- Now to do the Mosaicking of two RGB composites : click on Geoprocessing ➔Grid➔Grid Systems ➔ Mosaicking.

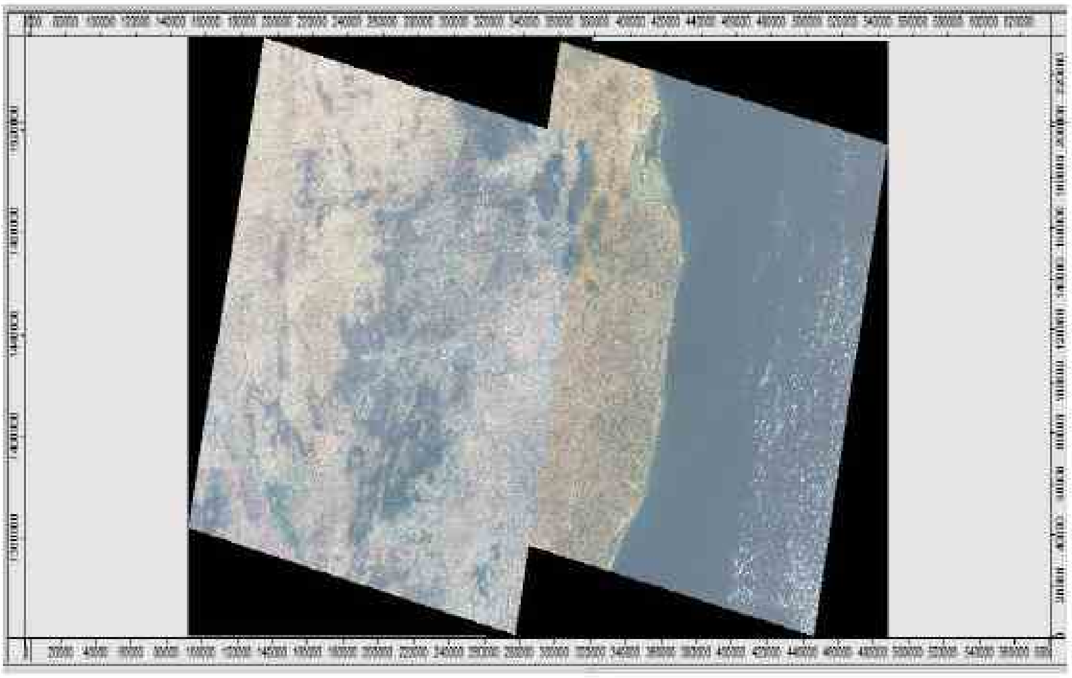


- Enter the Grids which are to be mosaicked.

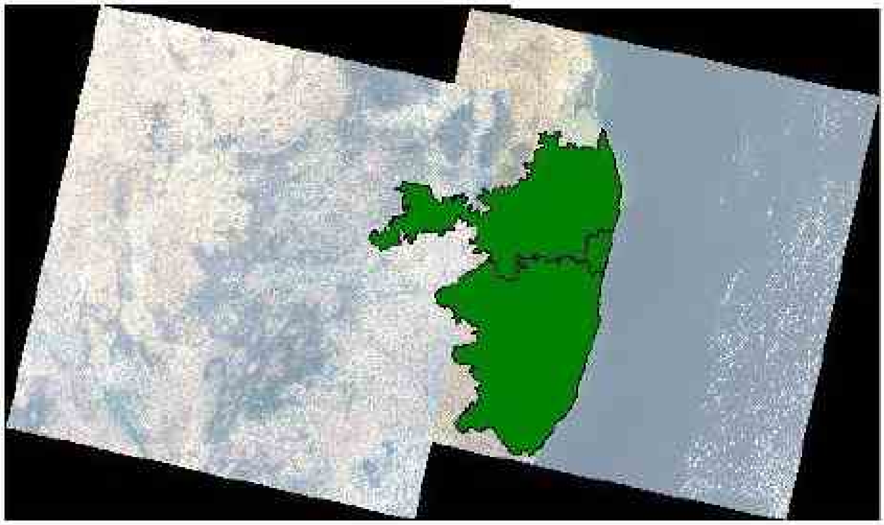
- Name of the new output that is generated

- Data Storage type – The radiometric resolution for storing the Pixel values. Eg: 8 bit floating value.

- Resampling – Pixel values are assigned to each cell after mosaicking based on the Algorithms provided here. Choose the appropriate technique.
- Overlapping Areas – The allocation of pixel values in the overlapping portions of the datasets. Few operations such as Mean, Minimum, Maximum, First, Last are given.
- Match – Histogram for the output is matched with the overlapping areas or first input grid or regression is done.
- After setting the required parameters run the tool and add the output to a new Map view.
- The output of the mosaic is shown in the below image:

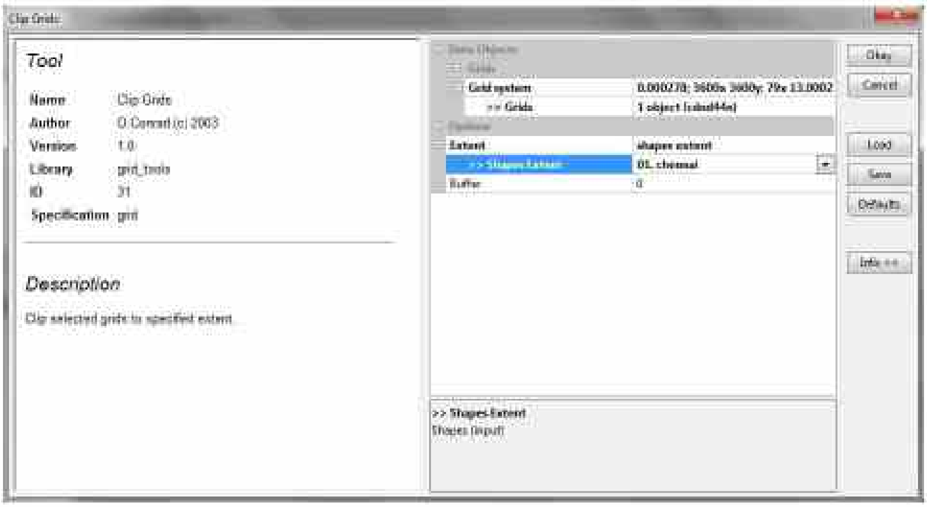


- Add the GC_Chennai.shp from the folder to the same map view where the mosaic is opened.

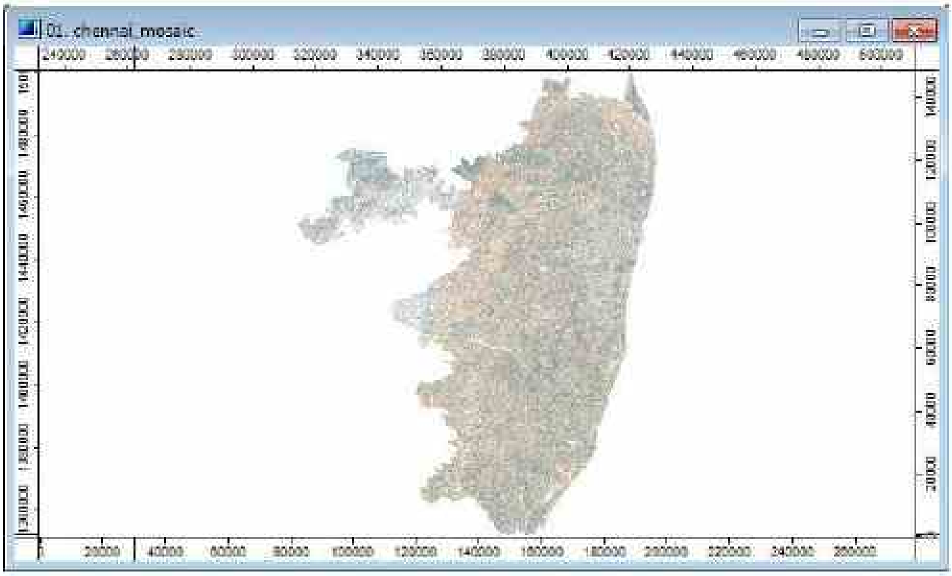


- The next operation is the clipping of this mosaicked raster in accordance with the shapefile.

- To perform the clipping, go to Geoprocessing ➔Grid➔Grid Systems ➔Clip Grids.



- Choose the Grid which is to be clipped and set the Extent as polygon.
- Choose the Greater Chennai Shapefile in the polygon option.
- Set a Buffer if Required.
- Execute the Tool and add the output data to a new Map View.



- Export the clipped output as a **TIFF file** and save it.

- When a single band is being interpreted especially the panchromatic band which is a high resolution image, few filtering techniques can be used to highlight sharp edges, smoothening the image and etc.

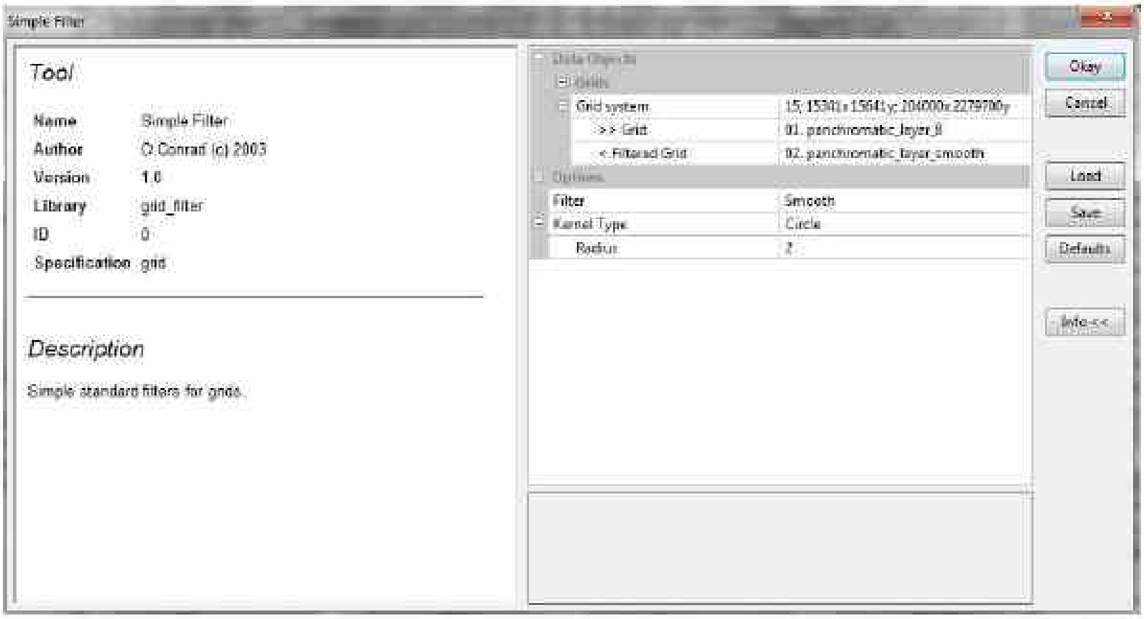
- Open the Landsat_8_Band_8.tif file

- ***Band – 8: Panchromatic band***

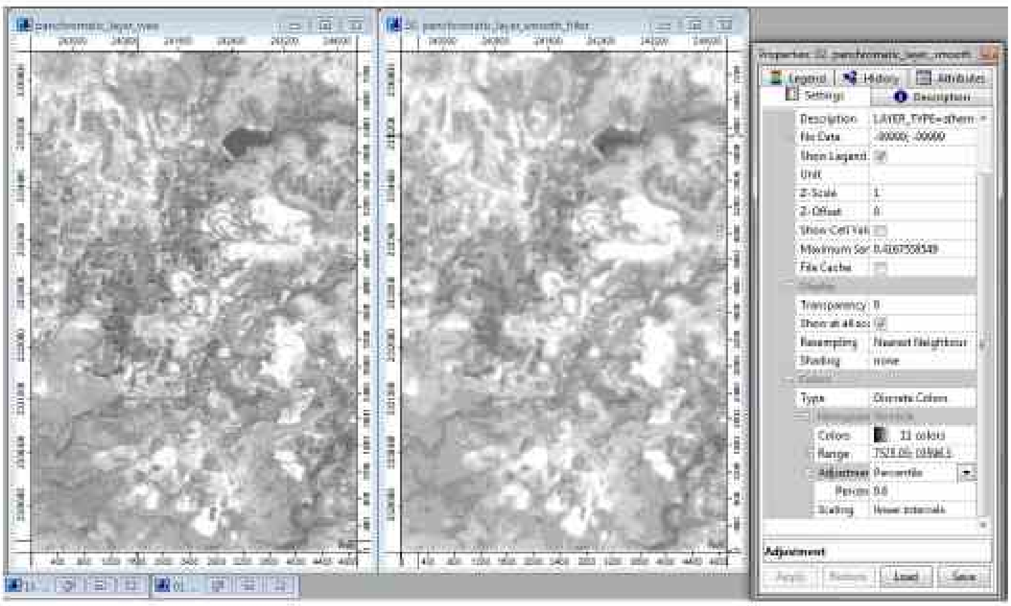
- Open the panchromatic layer in the map view and apply a suitable histogram stretch to the layer

- There are many types of Filter provided for various reasons. The filters discussed here are simple filters which perform operations such as smoothening of image, sharpening of image and edge detection

- For running a simple filter : Geoprocessing → Grid → Filter → Simple Filter

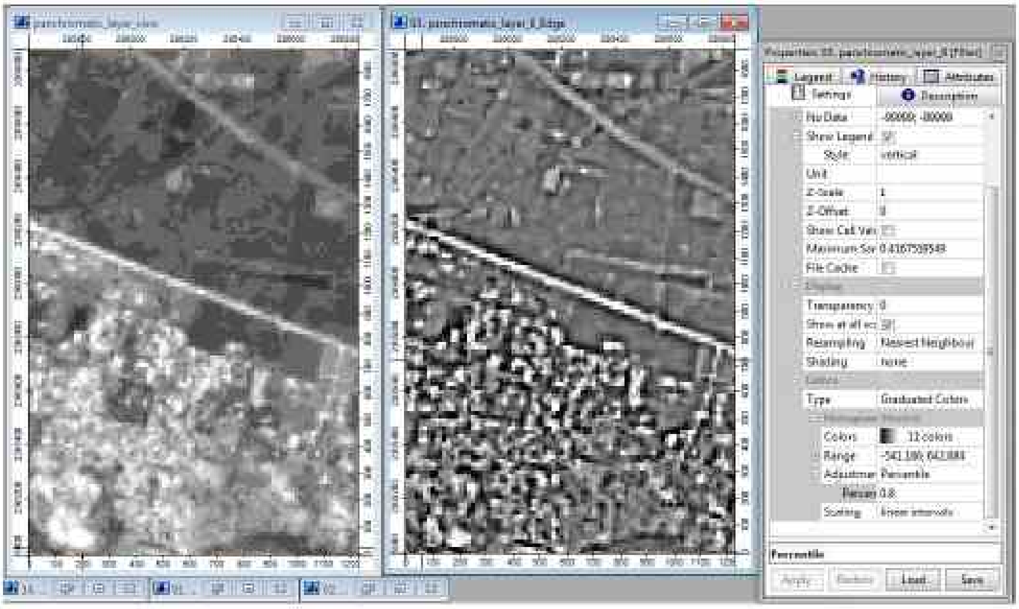


- Choose the grid system and the Layer/Grid
- In the Filtered Grid option ➔ <Create>
- For the type of Filtering: Filter ➔ Smooth, Sharpen and Edge
- For the type of Kernel: Kernel type ➔ Circle and Square
- A comparison between the original panchromatic layer and the smoothened panchromatic layer is shown below



* Smoothening of image is done when there is more noise in the image. It removes the noise by averaging the pixel values inside the chosen kernel and brings it to a lower value compared to the initial image.

* An example of the Edge detection is given below



* The road feature in the right side image is much clearer and precise after applying the edge filter to the initial left side image.

* **Task: Try applying the Sharpen filter and compare the outputs.**

<u>CHECKLIST:</u>

1. How will you Mosaic two Images
2. How will you clip a raster image
3. Why is filtering of Images done
4. Which is better for Interpretation – Filtered Image or RGB composite.

7.UNSUPERVISED CLASSIFICATION

OBJECTIVES:

- ***To do Unsupervised Classification of the Image***
- ***To Reclassify the classified Pixels***

DATASETS:

- Landsat_8_stacked.tif

- Image classification is a process in which pixels of similar spectral values are grouped into separate classes based on their spectral and spatial properties.

- Two major types of classification is discussed in the tutorial

    - **Unsupervised – Does not require sample data input for classification.**

    - **Supervised – Requires a sample data input for classification.**

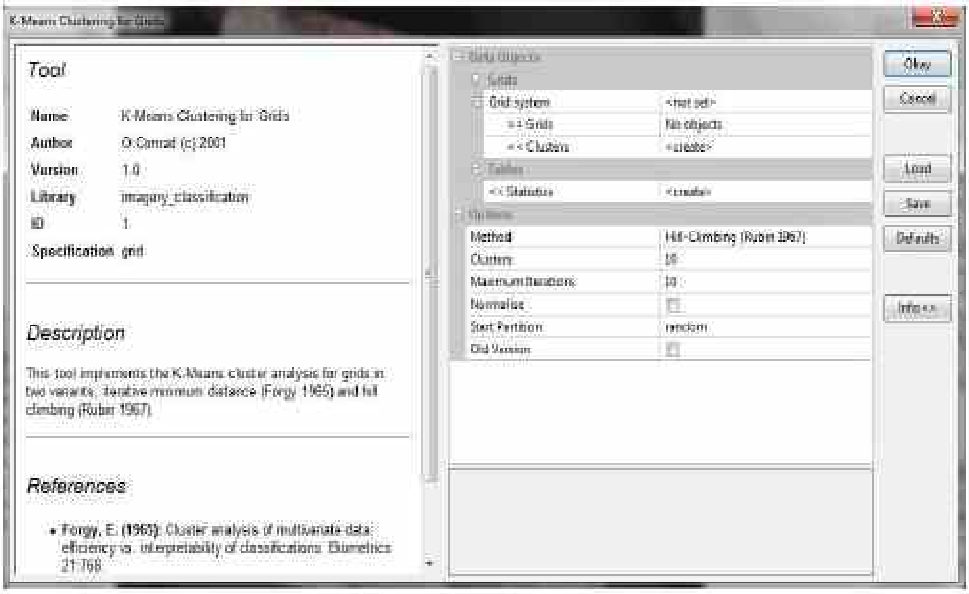
UNSUPERVISED CLASSIFICATION

- Unsupervised classification is a technique in which a training dataset is *NOT* required for the classification of the Images. The algorithm identifies the pixels of similar spectral values and based on the number of classes required by the user it classifies the Image.

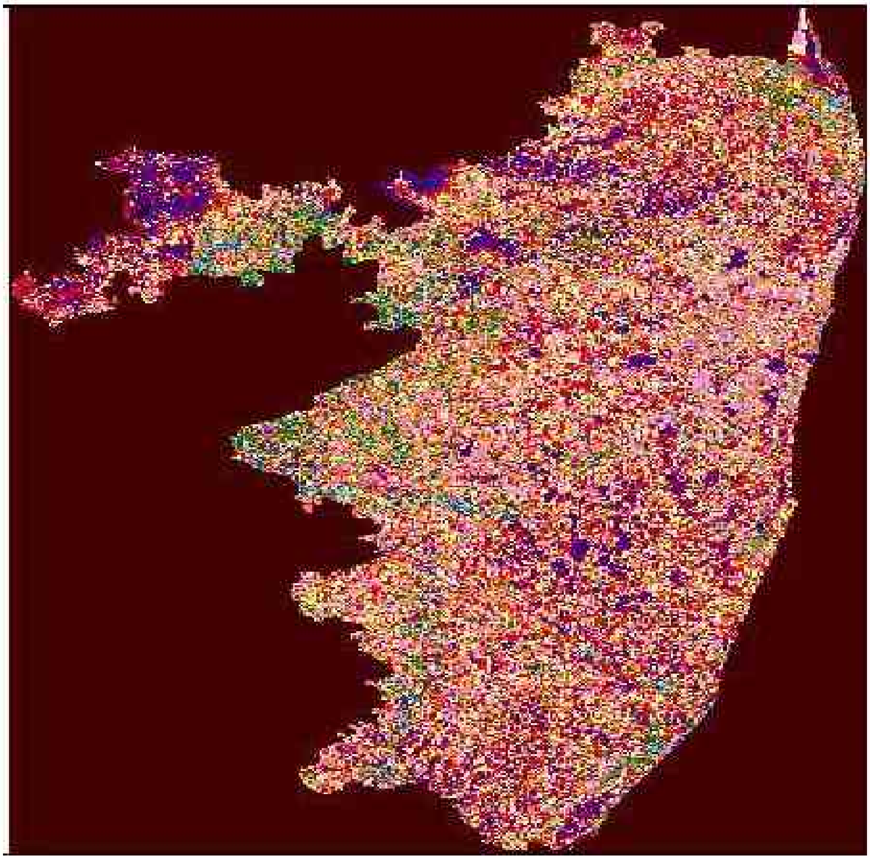
- Add the Landsat_8_staced.tif file from the folder and open it in the map view.

There are two major types clustering K-means & ISODATA. The K-means algorithm allows the cluster centers to shift in order to optimize a performance index. The ISODATA algorithm is essentially a refinement of the K-Means algorithm. The specific refinements are: Clusters that have too few members are discarded, Clusters that have too many members are split into two new cluster groups, Clusters that are too large (too disperse) are split into two new cluster groups, If two cluster centers are too close together they are merged.ISODATA is considered self-organizing because it requires little user input.

- Now to do the unsupervised classification: Geoprocessing ➔Imagery ➔ Classification ➔ Unsupervised ➔K-means Clustering for Grids



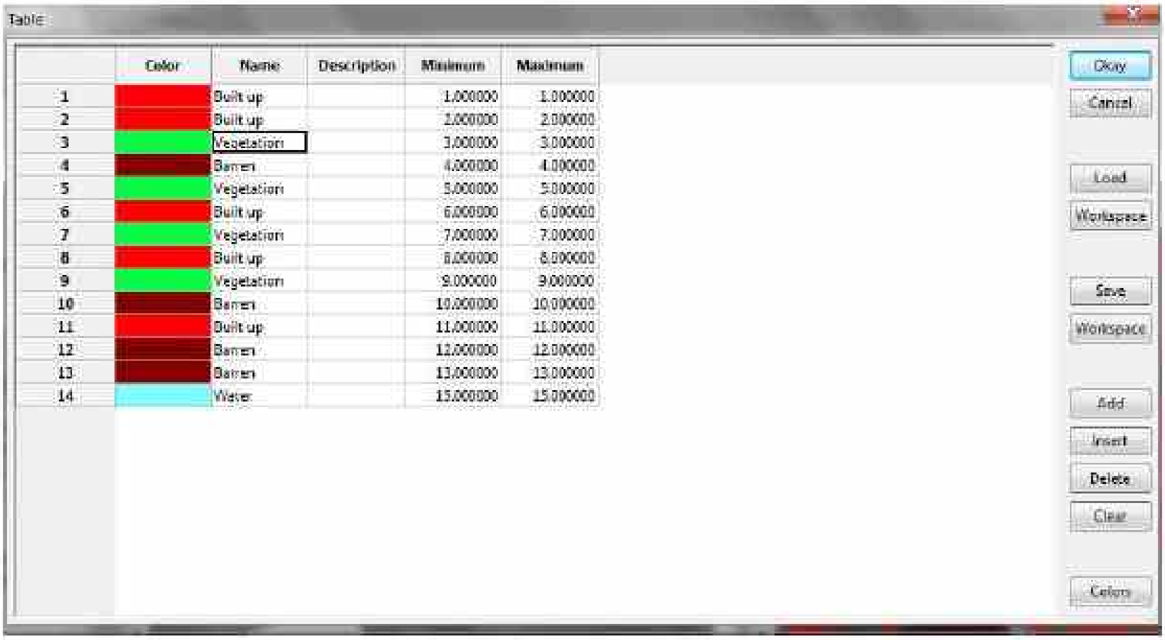
- Input the appropriate Grid system and Grid.
- Cluster ➔ <create>.
- Select the <create> option if Statistics Table is required
- Choose the appropriate method ➔ Iterative Minimum Distance, Hill Climbing, Combined
- Choose the **number of clusters required** and choose the number of Iterations required.



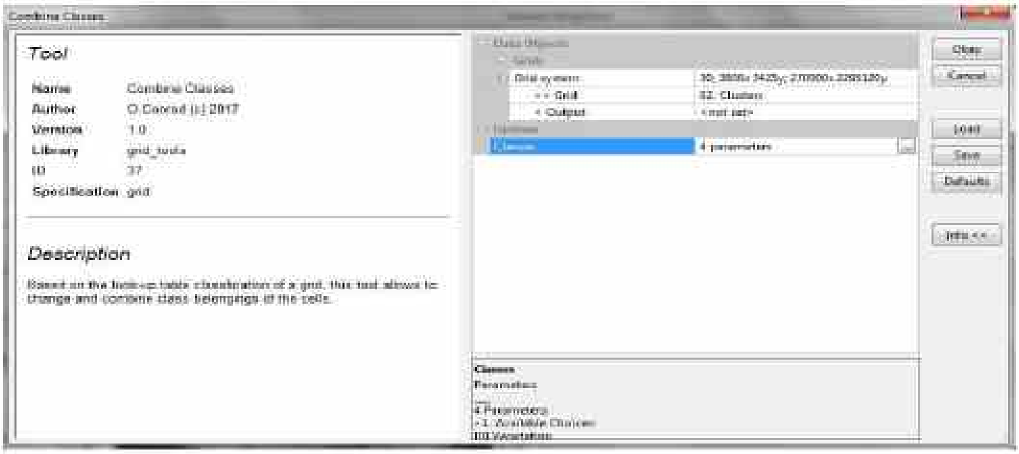
- After the output is created go to the object properties window and check the Table provided under the colors section.

- The table created will have five columns which are
    - Color
    - Name
    - Description
    - Minimum
    - Maximum
- The next step is to identify what land use each cluster is representing by ***interpreting the classified image*** with the help of satellite Images, Google earth, etc.

- Once the land use is identified update it in the ***name*** column of the table. One type of land use might have two or more classes/clusters also.



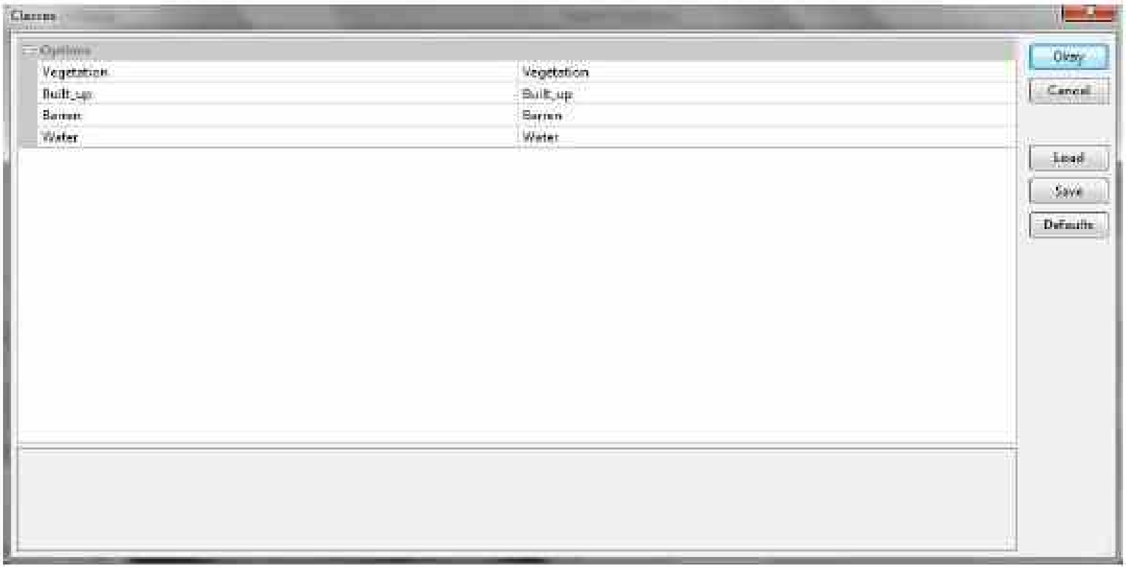
- Now the final step will be to reclassify the raster image
- To do the reclassification : Geoprocessing ➔Grid ➔Values➔Combine classes



- Enter the Grid system and the Grid and specify <create> in the Output option

- In the options section go to classes and click on the icon provided at the right side

- A dialog box as shown below opens up



- Choose the classes which will combine together with a particular class and update it carefully.

- The final output after reclassification is displayed below

	Color	Name	Description	Minimum	Maximum
1		Built_up		1.000000	1.000000
2		Vegetation		3.000000	3.000000
3		Barren		4.000000	4.000000
4		Water		15.000000	15.000000

CHECKLIST:

1. Why do we classify an Image
2. How is the classification of Image done without training sets
3. Why and How do we Reclassify

8.SUPERVISED CLASSIFICATION

OBJECTIVES:

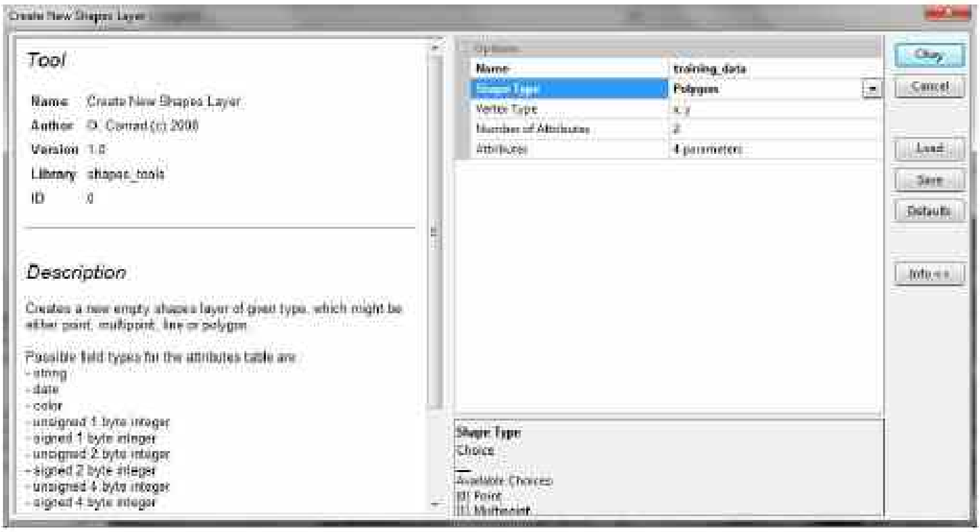
- ***To create a training dataset***
- ***To do a supervised Classification***

DATASETS:

- Landsat_8_stacked.tif

Supervised classification requires a user to define 'training sites' of known land cover type. Pixels are then grouped into classes based on the spectral data from the training site pixels.

- Open the SAGA application.
- Add the Landsat_8_stacked.tif file and open it in the Map view
- Adjust the histogram parameters if required.
- The **first step** in supervised classification will be to **create training datasets**.
- Create a new polygon shape layer.
- Geoprocessing ➔Shapes ➔Construction ➔Create New Shapes Layer
- Create a polygon layer which will be used to collect the training datasets.
- Name the polygon layer as ***"training_data"***
- Add the training_data layer in the map view and start editing.



- To start editing: Right Click the training_data layer ➔ Edit ➔ Add Shape ➔Click on the Action button ➔Start editing.

- To stop editing and save changes :Right click to complete the sketch ➔Right click on the layer from manager tab ➔ Edit Selection ➔ Yes

- Zoom into a particular landuse/landcover for which there is proper evidence, and draw a polygon where you can find the same group of pixels representing that LULC.

- Make sure that your polygon must not contain pixels of other LULC classes.

- Name the polygon according to its identified LULC.

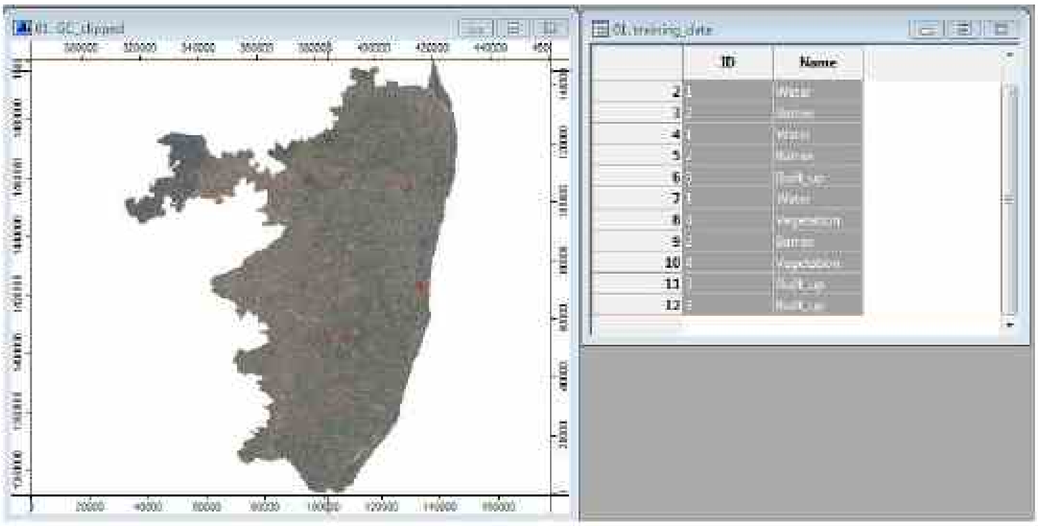
- An example of the above process is shown below:

- Similarly try to identify the different land use land covers and create polygons small polygons around those pixels

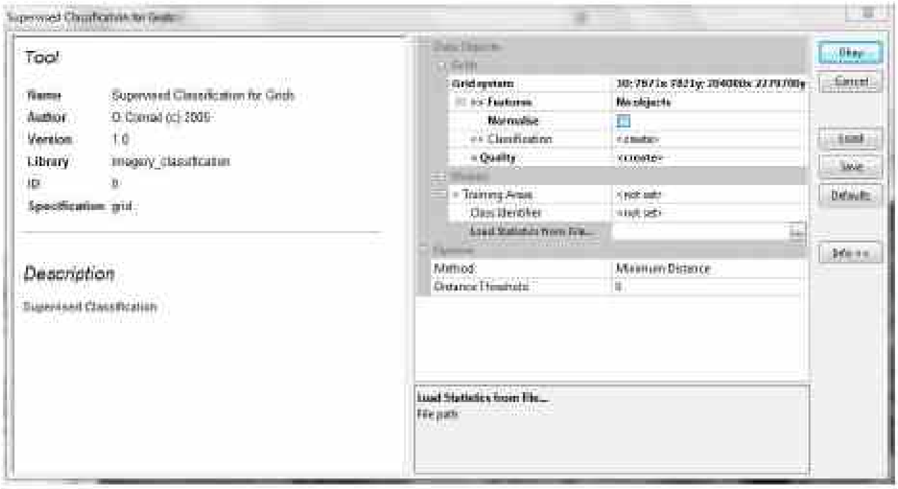
- When the training data is collected the number of samples for a particular LULC must me more which means more number of polygons must be created.

- Once you create sufficient number of polygons they must be **merged into one polygon for each class of LULC**. To **merge polygons** select the polygons by pressing CTRL and then Right Click ➔Merge Selection.

- The final training dataset table and locations are shown in the below image

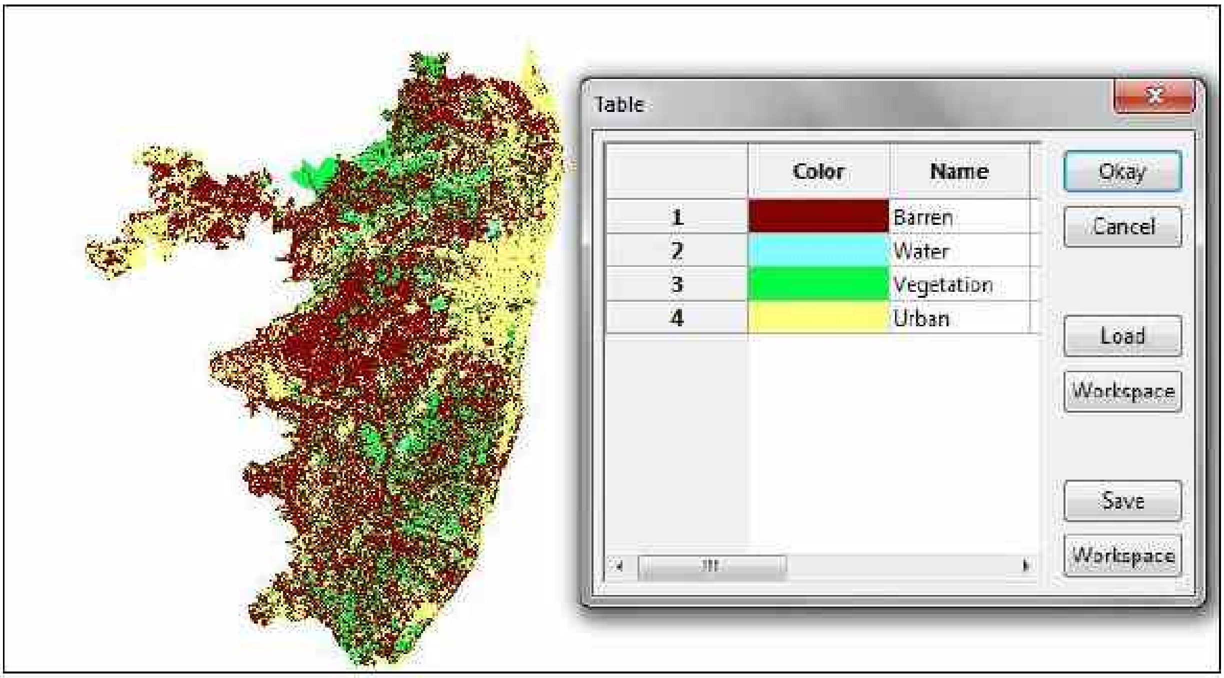


- The **second step** is to do the **Supervised Classification**
- Geoprocessing ➔ Imagery ➔ Classification ➔ Supervised Classification
- A window as shown below opens up



- Enter the Grid system and choose the Grid for which classification is to be done.
- For the classifications option ➔ <create>
- Training Areas ➔ Input the training_data layer
- Class Identifier ➔ Choose the field which represents the classes

- Choose the appropriate method for classification and run the tool



CHECKLIST:

1. Why do we require training sets and How to create training sets
2. Can we use these training sets for other Images
3. How to do a supervised classification
4. Can we classify High, Medium, Low vegetation regions using supervised classification technique

10.IMAGE AS PRINT READY MAP

OBJECTIVES:

- ***To prepare a print ready map***

DATASETS:

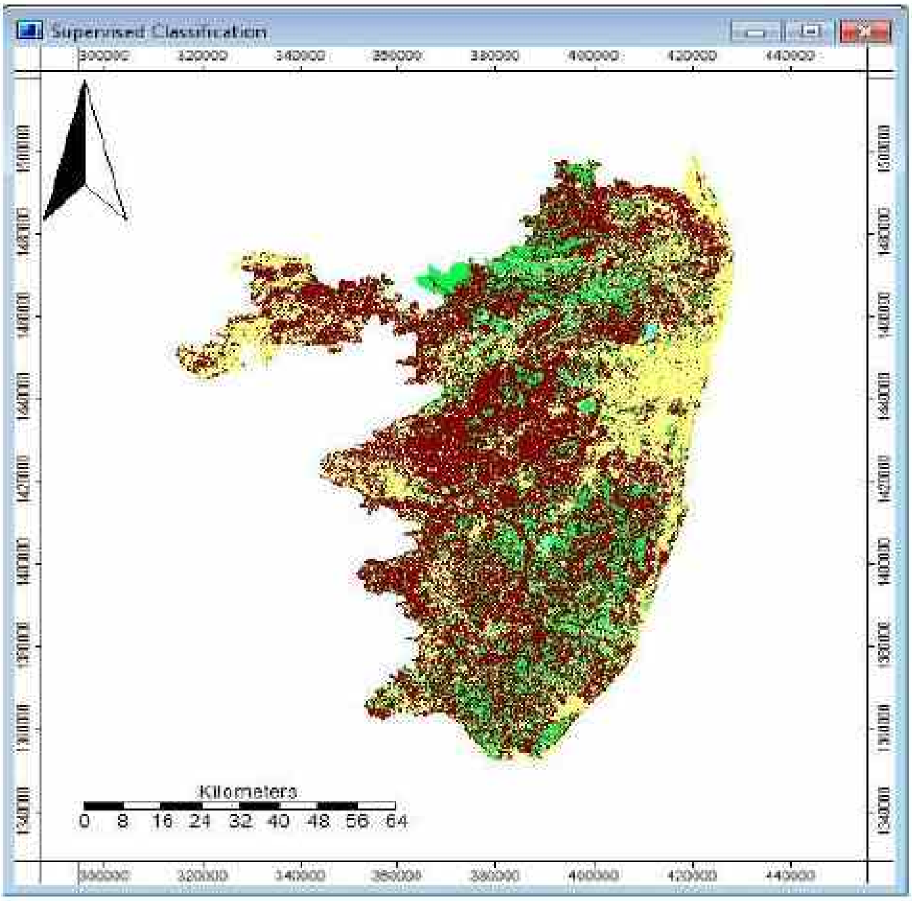
- Supervised Classification Output from previous tutorial

- Add the layers for which you want to create print ready maps to the Map view.

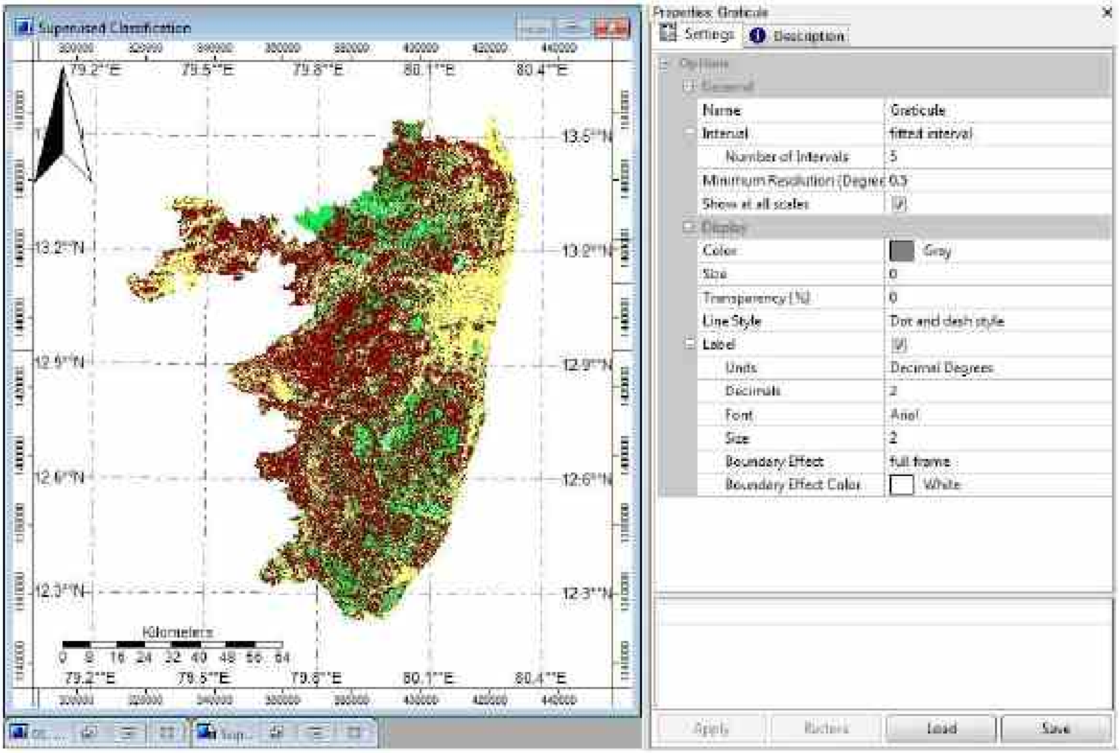
- Now click on the Map and go to the object properties window.

- In the object properties window for Map view ➔Settings ➔General Section ➔ Select North Arrow and Scale Bar options.

- The north arrow and the scale bar will be displayed in the Map view



- To add a graticule/grid to the Map: Click on the Map option from the top toolbar ➔ Add Graticule
- A graticule/grid system is added to the map and also to the data manager window for which changes can be made through object properties window ➔Settings.



- Now to open the Map in a print layout go to the toolbar on top and click on this  icon or Click on the Map option from the top toolbar ➔ Show print Layout.

- Then the print Layout opens with all the added elements into it.

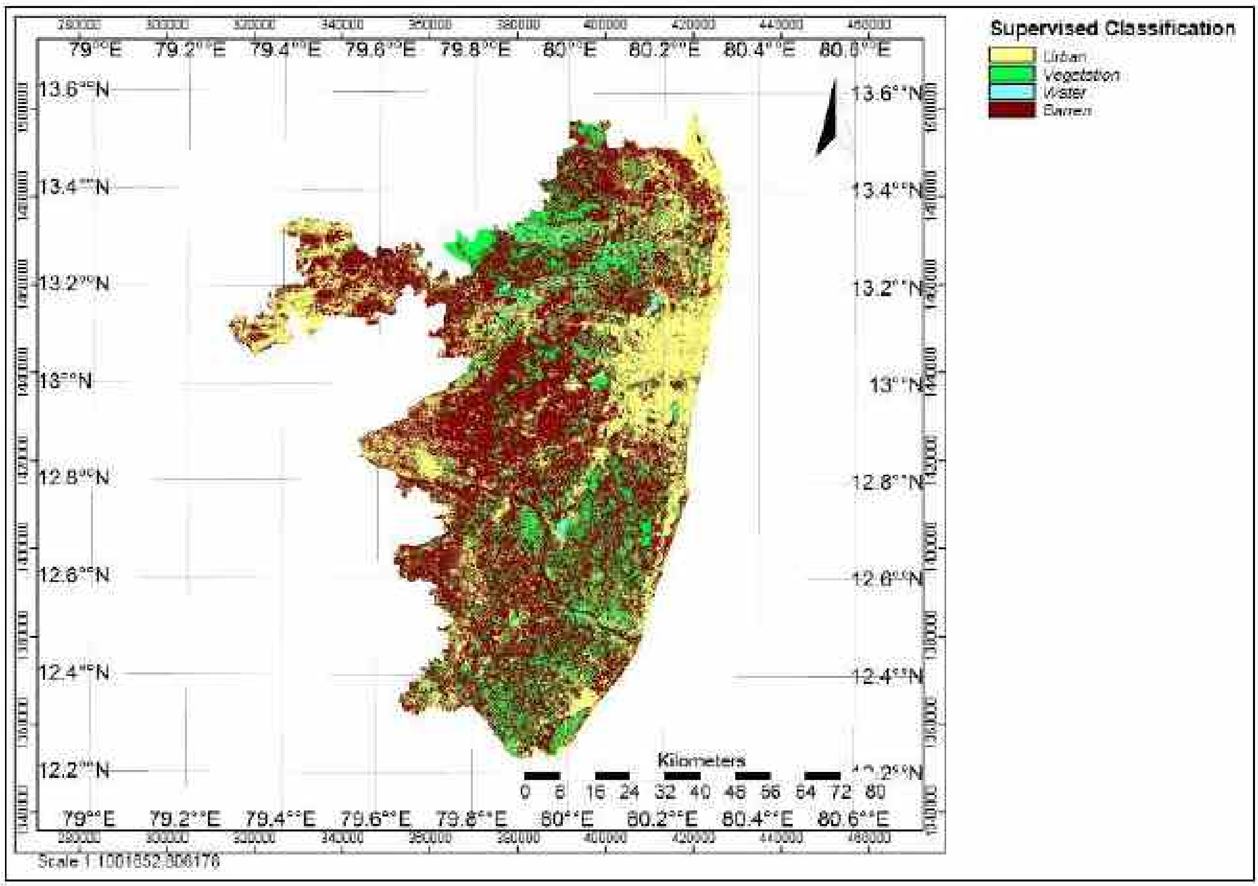
- Next Click on the Map view ➔ Object properties window ➔ Print Layout Section ➔Select Legend

- If you want to add a representative fraction scale Click on Scale.

- Options are also provided to add and remove the Frame.

- All the other options with regards to position of North Arrow, Scale bar and graticules can be adjusted from the object properties of the map view.

- Once all the options are set then click on the Layout window and click on Layout from the top toolbar ➔Print Preview to view the output Layout which is ready for printing.



A sample of the print preview is shown in the above Image

CHECKLIST:

1. How can we add gaticules
2. How can we add the North Arrow and place it in the Right side of the Map
3. How to adjust the size of the scale bar.

11.USING DEM DATA

OBJECTIVES:

- ***Adding a Digital Elevation Model data to the map (Raster Data)***
- ***Changing the Projection***
- ***Filling the sinks in the DEM***
- ***Visualizing it in 3D***

DATASETS:

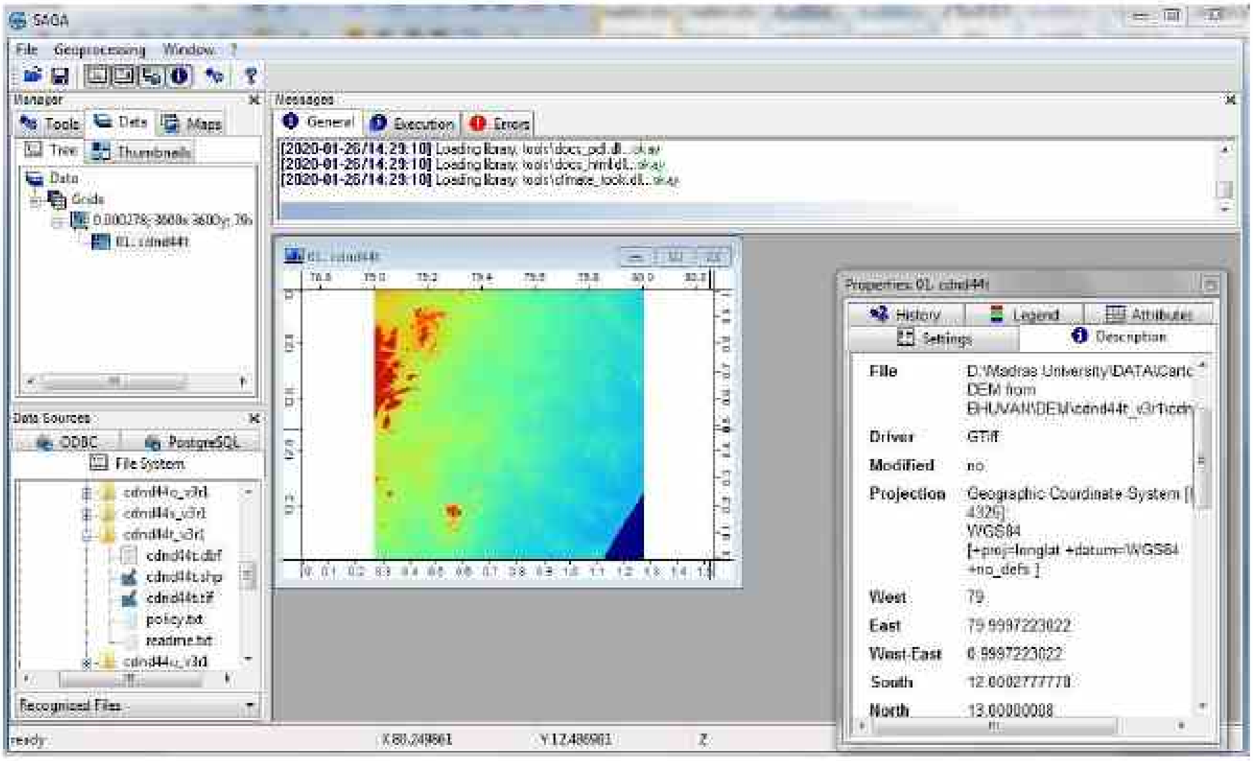
- DEM.tif

- Open the SAGA application.

- Click on File ➔Open ➔Add a DEM

- Open the data in the Map View

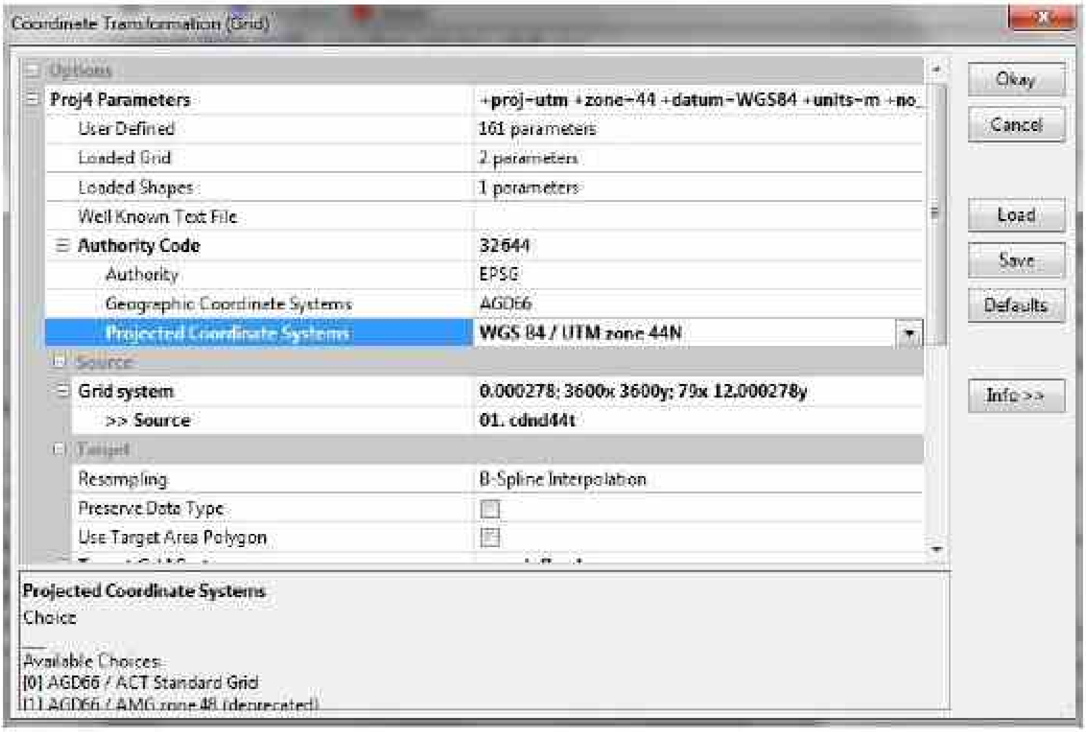
- Open the object properties ➔Click on the Settings Tab ➔ Colors ➔ Try changing the symbology of the layer



- Next to change the projection click Geoprocessing➔Projection ➔Coordinate Transformation(Grid)
- The parameters required for the projection can be set using this tool and execute to obtain a projected dataset.

- A UTM projection system was selected with zone 44N (Chennai).

- The projected data is added to a new map view.

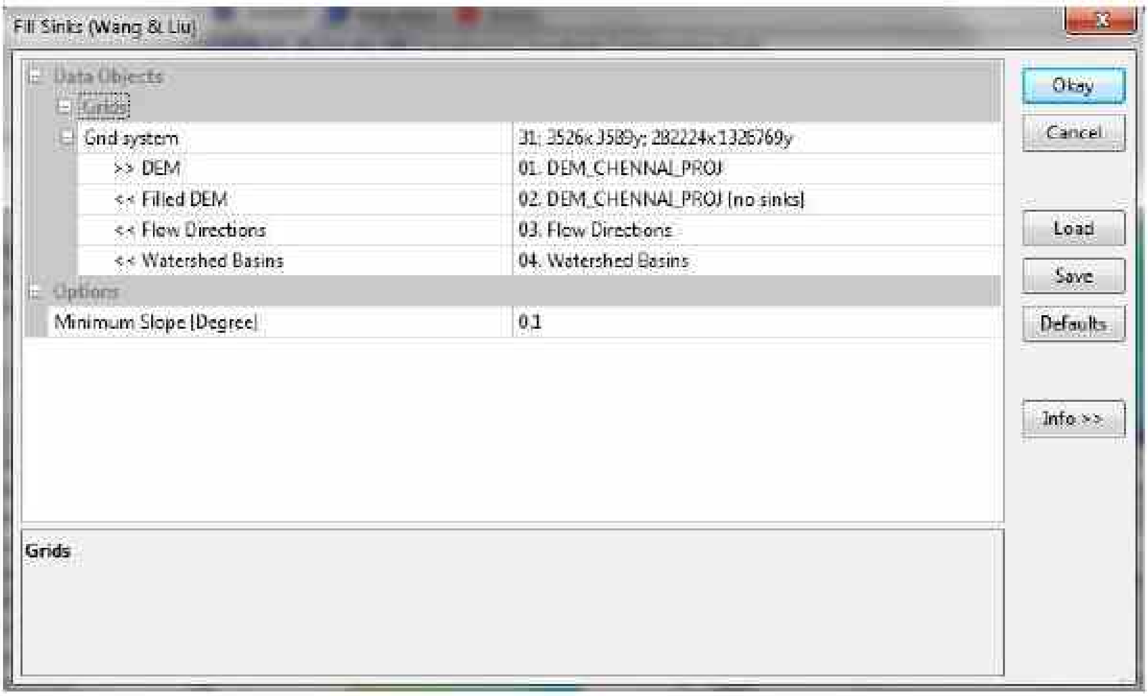


- The next task is filling the sinks in a DEM, which is done to remove the erroneous depressions and peaks so that a smooth surface is obtained for processing.

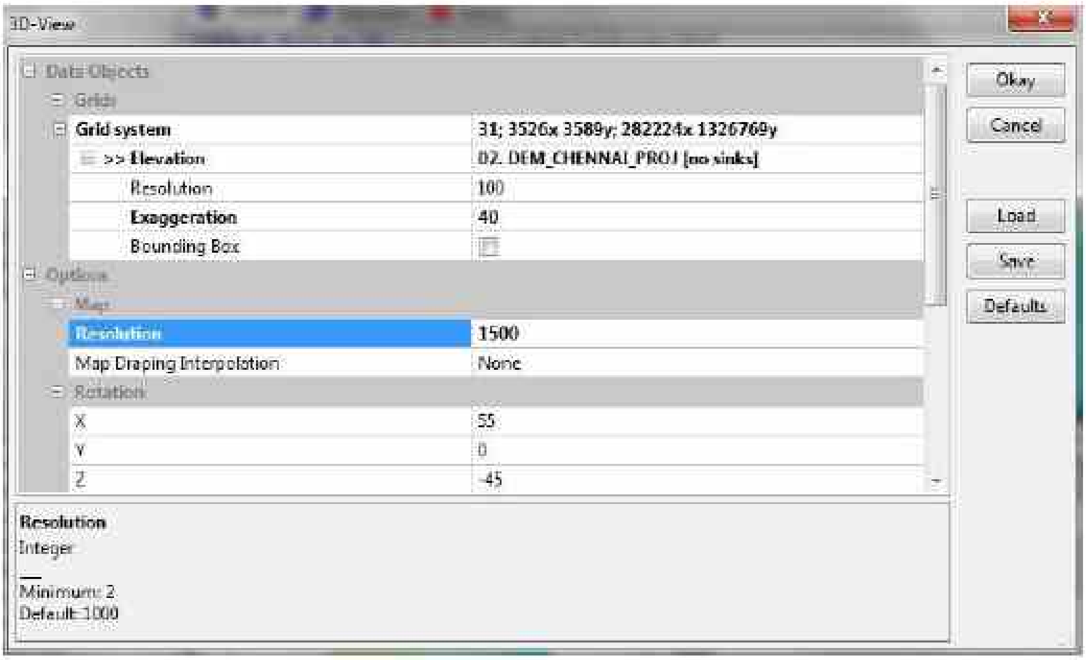
- Geoprocessing ➔Terrain Analysis ➔Preprocessing ➔Fill Sinks(Wang Liu)

- Enter the appropriate Grid system and the DEM data and run the tool.

- Three outputs are obtained after the execution of this tool
  - ➢ DEM[no sinks]
  - ➢ Flow direction raster
  - ➢ Watershed basin raster

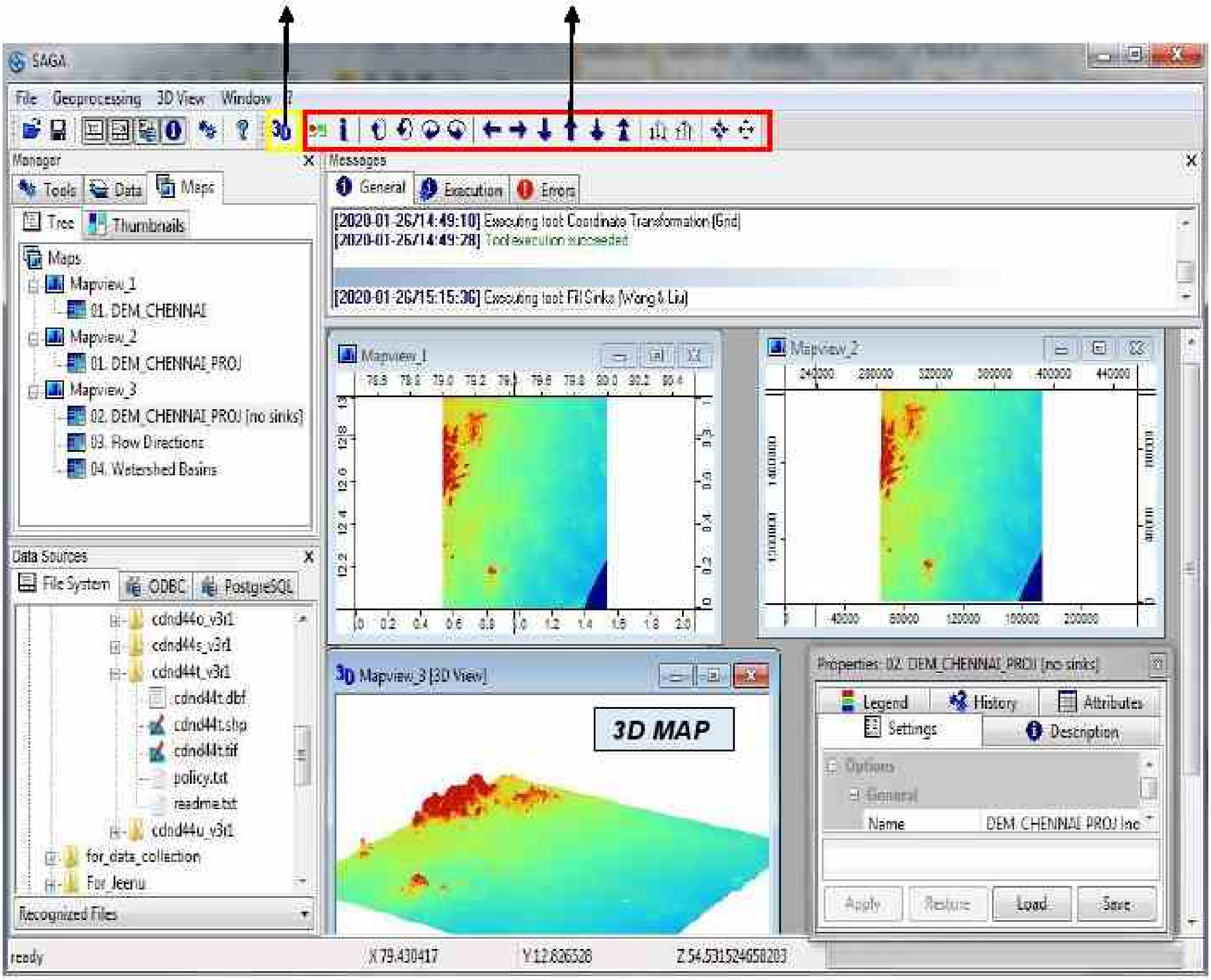


- Now the final task is to visualize this DEM data in the 3D view
- Click on the 3D button found in the toolbar.
- A window as shown below pops out



- Set the Grid system for 3D display, layer for elevation, the resolution and the exaggeration of the values and click Okay.
- A 3D Mapview is opened with a set of 3D tools to visualize the data

3D button which pops out the window	3D Toolset for visualization



CHECKLIST:

1. What does the pixel value of a DEM signify
2. Why do we fill sinks in DEM and How
3. How will you view the DEM in 3D

12.TERRAIN ANALYSIS

OBJECTIVES:

- ***To generate Slope and Aspect from DEM***
- ***To extract drainage network from DEM***

DATASETS:

- DEM.tif

- Open the SAGA Application and add the DEM.tif file from the folder.

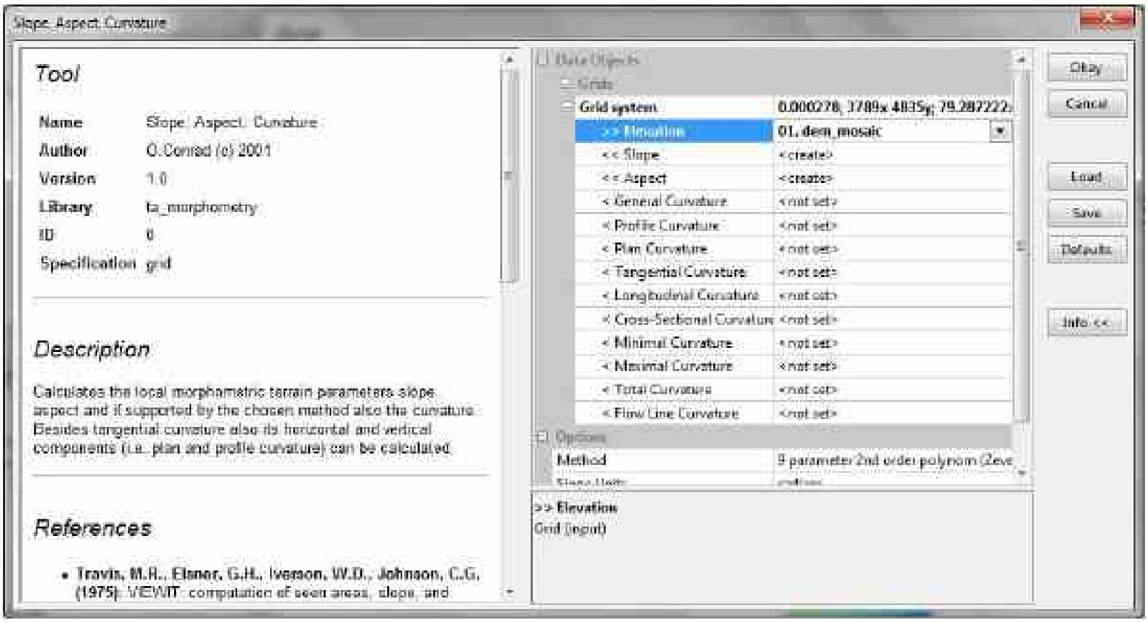
- The first analysis that will be done is the Slope and Aspect analysis. Slope and aspect are basic terrain analysis that gives an idea about the terrain in which a study is done.

- Slope is basically Rise (Height) / Run (Length) and every pixel in the output represents the degree of slope.

- Aspect is nothing but the direction of the slope.

- ***(Note: The DEM data must be reprojected to WGS 84 UTM 44N projection)***

- To do the Slope and Aspect Analysis: Geoprocessing ➔ Terrain Analysis ➔ Morphometry ➔ Slope, Aspect, Curvature

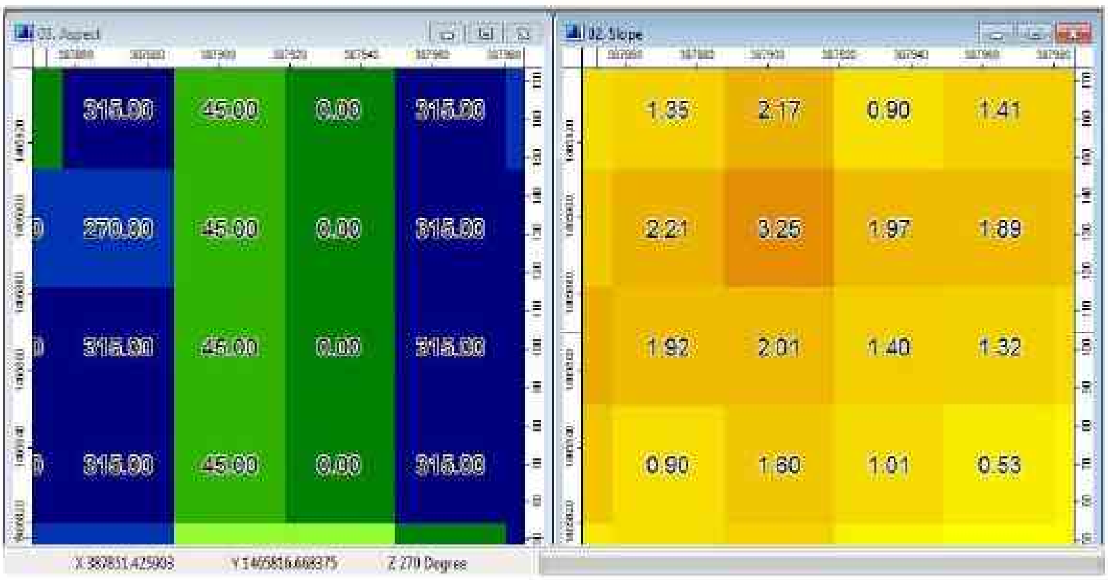


- Choose the Grid system and choose the Greater Chennai DEM for Elevation.
  - Slope ➔ <create>
  - Aspect ➔ <create>
  - Remaining options need not be set

- In the options section of the tool
  - Method ➔ Maximum Slope (Try other options also)
  - Slope Units ➔Degree
  - Aspect Units ➔ Degree

- After setting the options execute the tool and add both the outputs to the Map view
- Synchronize both the Map views and start examining the pixel values.
- The pixel values for the slope layer will have a range between 0 and 90 representing the degree of slope. Higher the pixel value higher is the slope.

- The pixel values of the aspect layer will have a range between 0 to 360 where
  - 0 – 90 ➔East, North-East, North
  - 90 – 180 ➔North, North-West, West
  - 180 – 270 ➔ West, South-West, South
  - 270 – 360 ➔South, South-East,East
- These values represent the direction of the sloping surface as mentioned earlier.

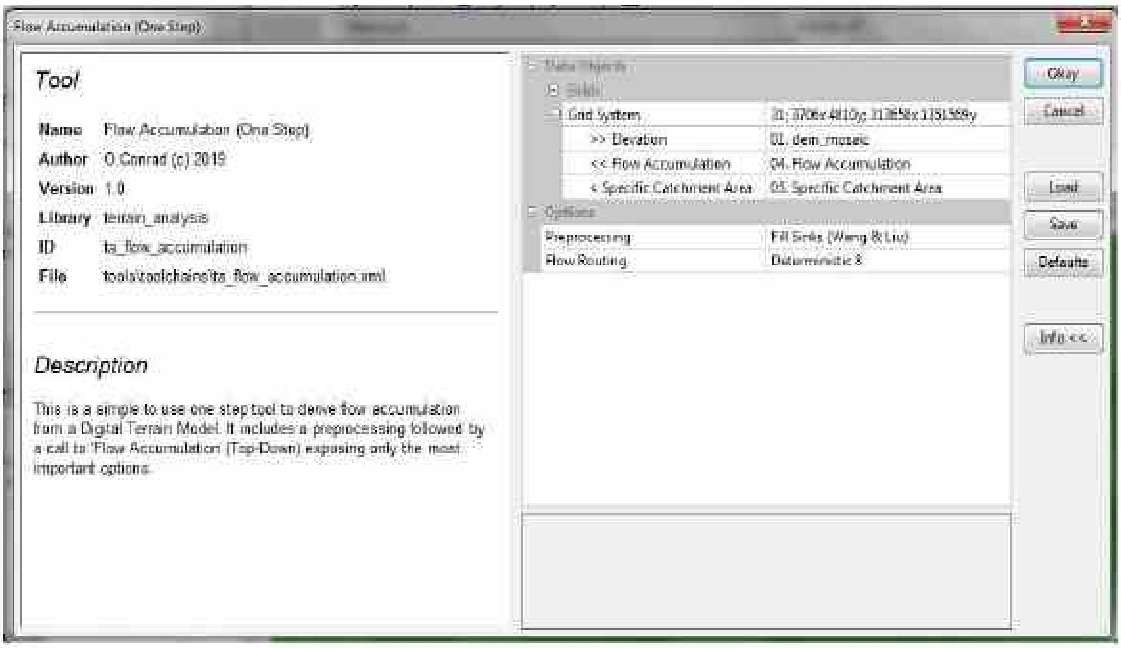


- The slope and aspect are very helpful in decision making and used in many Multi criteria analysis and site suitability projects

- Next operation is to derive a drainage pattern from the given DEM data.

- Drainage pattern is a very important data in sub-catchment delineation and hydrological rainfall – runoff processes

- To generate the Drainage from the DEM : Geoprocessing ➔ Terrain Analysis ➔Hydrology ➔Flow Accumulation ➔ Flow Accumulation (One step)



- Set the appropriate grid system.

- Set the DEM data for the elevation

- Flow Accumulation ➔ <create>

- Specific Catchment Area ➔ <not set>

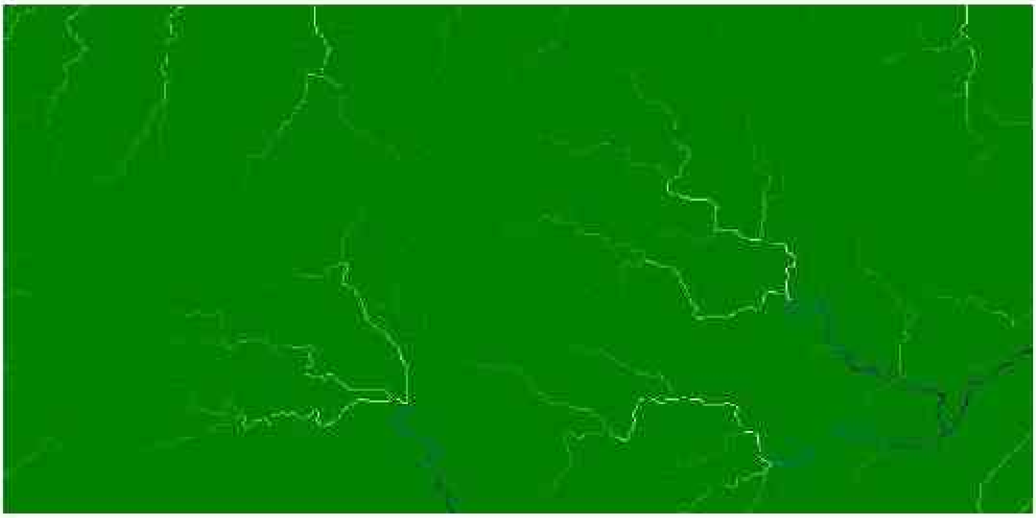
- In the options section
  - Preprocessing ➔ Fill Sinks
  - Flow Routing ➔ Deterministic 8.

- Execute the tool after all the options are set and add the Flow accumulation output to the Map view.

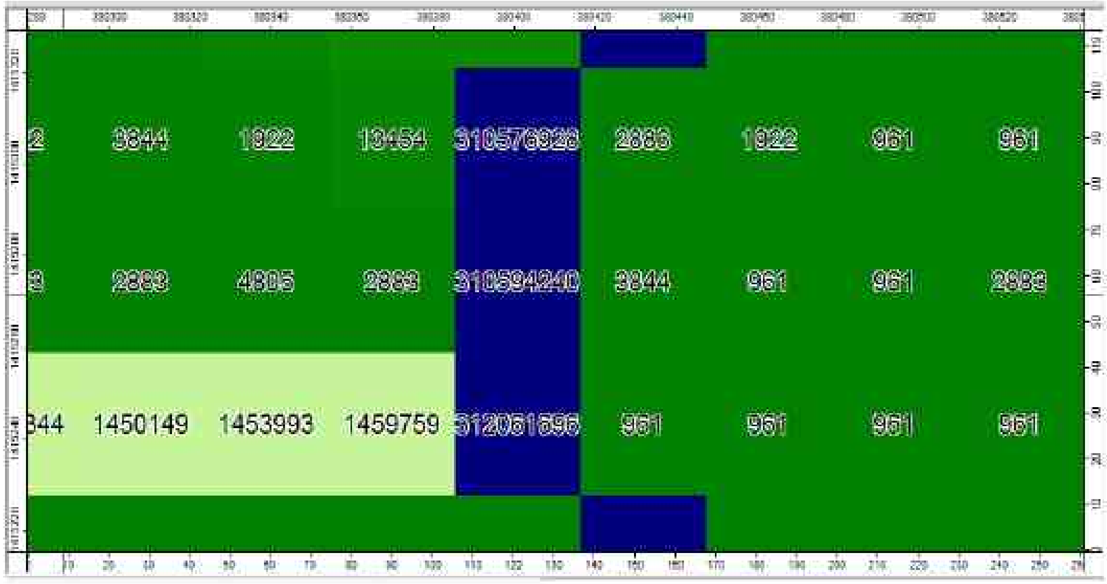
- Zoom into a particular patch of the output

- Select the Flow accumulation data and open the object properties window ➔ Colors section ➔ Histogram Stretch. In this option change the adjustment methods and scaling factor until a clear and strong drainage pattern is obtained.

- The Flow accumulation Tool helps in identifying the cells contributing to a cell at downstream by the help of direction and starts accumulating into it.



- Let us look into the pixel values of the output that we have obtained.



- The pixel values of the drainage network are found to be exponentially higher than the other cell values. This is because of the flow accumulation tool.

- A threshold value can be set and pixels having value above that can be extracted separately to form the drainage network.

- ***Task: Try to extract a drainage network by defining a threshold value from the flow accumulation output. (Clue: Reclassify)***

<u>CHECKLIST:</u>

1. Difference between slope and aspect and how it is generated
2. What does the pixel values of an Aspect output signify
3. How will you extract a drainage network

Sl.No	SATELLITE NAME	SWATH WIDTH	SPECTRAL RESOLUTION			SPATIAL RESOLUTION (m)	RADIOMETRIC RESOLUTION
			Name	Band Number	Spectral Range(µm)		
1	**LANDSAT - 8 OLI/TIRS** **OLI - Operational Land Imager** **TIRS - Thermal Infrared Sensor**	185 KM	Coastal/Aerosol	1	0.433 to 0.453	30	12 bit(16)
			Visible Blue	2	0.450 to 0.515	30	
			Visible Green	3	0.525 to 0.600	30	
			Visible red	4	0.630 to 0.680	30	
			Near-infrared	5	0.845 to 0.885	30	
			Short wavelength infrared	6	1.56 to 1.66	30	
			Short wavelength infrared	7	2.10 to 2.30	30	
			Panchromatic	8	0.50 to 0.68	15	
			Cirrus	9	1.36 to 1.38	30	
			Thermal	10	10.6 to 11.19	100	
			Thermal	11	11.5 to 12.5	100	

2	**LANDSAT - 7 ETM+ ETM+ - Enhanced Thematic Mapper Plus**	185 KM	Blue	1	0.45-0.52	30	8 bit
			Green	2	0.52-0.60	30	
			Red	3	0.63-0.69	30	
			NIR	4	0.77-0.90	30	
			SWIR 1	5	1.55-1.75	30	
			Thermal	6	10.40-12.50	60	
			SWIR 2	7	2.09-2.35	30	
			Panchromatic	8	0.52-0.90	15	
3	**Resourcesat-1 / Resourcesat-2: LISS-3 Linear Imaging Self Scanning Sensor**	140 KM	Green	1	0.52 – 0.59	23.5	7 bit/10 bit
			Red	2	0.62 – 0.68	23.5	
			NIR	3	0.77 – 0.86	23.5	
			SWIR	4	1.55 – 1.70	23.5	
4	**Resourcesat-1 / Resourcesat-2: LISS-4 Linear Imaging Self Scanning Sensor MX MODE**	23KM/70 KM	Green	1	0.52 – 0.59	5.8	10 bit
			Red	2	0.62 – 0.68	5.8	
			NIR	3	0.77 – 0.86	5.8	
	MONO MODE	70 KM	Panchromatic	1	0.62 – 0.68	5.8	
5	**Sentinel -1**	Strip Map Mode-80Km	C Band Synthetic Aperture Radar		3.75-7..5 cm	5X5	10 bit
		Interferometric wide swath-250km				5X20	

		Extra wide swath mode - 400 km	C Band Synthetic Aperture Radar			25X100	
		Wave mode400km				50X20	
6	**Sentinel 2**	290 Km	Coastal aerosol	1	21 nm	60	12 bit
			Blue	2	66 nm	10	
			Green	3	36 nm	10	
			Red	4	31 nm	10	
			Vegetation red edge	5	15 nm	20	
			Vegetation red edge	6	15 nm	20	
			Vegetation red edge	7	20 nm	20	
			NIR	8	106 nm	10	
			Narrow NIR	9	21 nm	20	
			Water vapour	10	20 nm	60	
			SWIR – Cirrus	11	31 nm	60	
			SWIR	12	91 nm	20	
			SWIR	13	175 nm	20	

7	**IRS 1C/1D PAN**	70KM	Panchromatic	1	0.5-0.75	5	6 bit (PAN)/ 7 bit(LISS 3 & WiFS)
	IRS 1C/1D LISS-3	141KM	Green	1	0.52-0.59	23	
			Red	2	0.62-0.68	23	
			NIR	3	0.77-0.86	23	
			SWIR	4	1.55-1.70	70	
	IRS 1C/1D WiFS (Wide Field Sensor)	810KM	Red	1	0.62-0.68	188	
			NIR	2	0.77-0.86	188	

SATELLITE DATA SPECIFICATIONS

ANNEXURE IV
(Field Work Mannual)

DST-NRDMS Winter School

February, 2020

Department of Geography
University of Madras
Guindy Campus, Chennai - 600025

सत्यमेव जयते
Department of Science & Technology
Govt. of India

Smartphone as Field Probe WAP for Spatial Data Visualization and Mapping

Contents

Introduction:

Field data collection is always a challenge for the investigator. Beyond field survey of using questionnaire / schedule, the investigator has to carry field equipments to capture locational information (usually GPS) and other field measuring devices. The questionnaire / schedule based problems require a number of paper prints; after field work compiling data from paper for digital format is yet one more work.

Now the reality is to explore **Smartphone** with their various apps to replace the paper prints (Questionnaire / Schedule Survey) and survey equipment's at the same time for the quick appraisal of the field investigation

Exploration of WAP!

for

Point Data Capture

Track Capture

Geotagging Field data

Intent

It is proposed to undertake field work / survey, exploring the applications of **Smartphone** for generation of spatial data with various apps by the following

1. a. Point data capture at selected locations, b. Tagging the same with field photos and attribute tables
2. Assess the noise levels at the field
3. Conduct a tracking experiment to capture line / area data

4. Assess the various local climatic parameters of the area at 2 / 4 hour interval.

Technical requirements for field work:

1. WAP i.e. Smartphone capable of field data collection with sufficient RAM and storage support (Storage can be external with OTG supported Thumb Drive)
2. Mobile Apps
    a. WideNoise Plus
    b. GPS Essentials or GPS Test
    c. Windy (Meteorology)

Optional mobile apps

d. Otter app (Speech capture and converter)
e. Spreadsheet (WPS office)

Digital Analysis Support (Lab)

- Collected data shall be integrated in QGIS environment for mapping and Analysis.
- QGIS available either Desktop or Network

The Approach:

The field work is composed of **FOUR** tasks and the compilation, analysis and reporting as the **FIFTH** task carried out in the lab.

Let there be Project Management Schedule adopted...

Initiation:

Get the knowledge of the proposal, smartphone apps for the data collection and their limitations.

Planning:

Install the apps; familiarize with the operations

Execution:

Data collection in all the four tasks

Review and documentation:

Transfer of Data; QGIS application; Mapping; Reporting

Closing:

The report with all the facts documented and closed

LAB- FIELD-LAB

Preparation of Base map:

Step 1: Open QGIS 3.10 A Coruna (latest Version)

Step 2: Add ***OpenLayers*** Plug-in from Manage and Install the Plugin "**Open Layers Plugin**"

Step 3: Open the Plugin and Add Google Satellite Image for Base map Creation for your study area.

Step 4: Create a shapefile *(Polygon)* and digitize the Study Area *(University Campus)*

Step 5: Based on the size of the study area decide suitable sample locations for collecting data (Noise etc)

Step 6: Prepare a layout of the study area and get started with the field gadgets and equipment's.

Android Mobile

GPS Essentials

WideNoise Plus
L3S Kassel / Würzburg

TASK - 1

Lab-Field-Lab: Noise Pollution Mapping

GPS Essentials
mictale.com

Aim:

To Collect Noise samples in the field using Wireless Application Protocol (WAP) and convert the non-spatial data into spatial data for geostatistical analysis.

Procedures:

Step 1: Install WideNoise Plus and **GPS Essentials** App from google Play Store / iOS

Step 2: At the survey location open the **WideNoise Plus** app and Measure the Noise level (in decibels)

Step 3: Simultaneously open the **GPS essentials** at the field location. Go to settings and ensure the following options 1. Datum (World Geodetic System 1984), 2. Position Format (Degrees, Minutes, Seconds), 3. Units (Meters, Kilometers).

Step 4: Select "**Satellites**" and hold the mobile stable to ensure more than 10 satellites visible and minimum 6 satellites used for fixing the position.

Step 5: Click on **"Waypoints** → *Press* **Add"** enter the values obtained from the **WIDE NOISE** App from the particular point and complete the process until the survey is completed.

Step 6: Export the collected sample values from GPS essentials to respective email address as KML/KMZ file.

TASK 2

Lab-Field- Lab – Tracking Data

Introduction

A GPS tracking is normally carried by a moving person or animal or Vehicle which uses the Global Positioning System (GPS) to track the movements and determine the travelled location.

Aim:

To Create and Visualize track data collected using WAP device from the field.

Procedures:

Step 1: open the **GPS essentials** at the field location. Select "Satellites" and hold the mobile stable to ensure more than 10 satellites visible and minimum 6 satellites used for fixing the position.

Step 2: Click on "**Tracks**", Give a name to the track and press **"Start"** and move along the surveying area.

Step 3: After completing the survey export the tracts from GPS essentials to respective email address as KML/KMZ/GPX file format.

TASK 3

Lab-Field-Lab: Point Data Capture and Geotagging Photos

Geotagging is the process of adding geographical coordinates to various digital media such photographs, videos, Stores, SMS messages and so on. A geotagged photograph is generally a photograph with a geographical location and by geotagging.

Aim

To capture the geographic objects (trees, buildings, religious places, monuments etc.,) and geotag the photographs with attribute data.

Procedure

Step 1: open the **GPS essentials** at the field location. Select "Satellites" and hold the mobile stable to ensure more than 10 satellites visible and minimum 6 satellites used for fixing the position.

Step 2: Click on **"Waypoints →** *Press* **Add"** and mark the geographic objects in the particular location and add the details in the description column.

Step 3: Simultaneously, click on "**Camera**" in **GPS Essentials** App and take the photograph of the geographic objects **or** Open the Mobile camera, Go to Settings and enable the "**Location Access**" and start to take photographs of the geographic objects**.**

Step 4: Complete the survey with minimum 30 sample points.

TASK - 4

Lab-Field-Lab: Windy (Meteorology)

Aim

To Monitor / map the local climatic parameters of the area for every 2/4 hours

Procedure

Step 1: Install Windy App, familiarize with the datasets.

Step 2: Create a table of parameters at time interval using your WPS.

TASK - 5

Lab-Field-Lab: Return to Lab

Integrate all the four tasks into a report

Let the MISSION CLOSED

****

ANNEXURE V

(Mini Projects)

Mineral resource mapping using Remote Sensing (RS) and Geographical Information System (GIS)

Chandan Kumar Boraiaha, Amit Kumar, Akash Sonawane, Vasanth Patil

March 8, 2020

Details of Team Members

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We thank Dr. Jagannathan, Co-ordinator of DST-NRDMS Winter School program on Geospatial Technology, and Head of the Department of Geography, University of Madras for providing the opportunity and infrastructural facilities to carry out this research work.

We are grateful to Prof. (Dr.) Sivagnanam for his thoughtful guidance throughout the Winter-School and especially, during the project execution.

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Mr. Manikandan is thanked for his wonderful hospitality.

Introduction

Mineral exploration is a complex process(**author?**) [4]. The complexities of mineral exploration can be solved by using remote sensing techniques in the early stages of mineral exploration for the reconnaissance of target areas with the goal of continuing exploratory operations. One of the most recognizable uses with remote sensing is mineral exploration and the identification of various geological structures, faults, lineaments, litho units, alterations, indicator, and tracer minerals (**author?**) [6] [1] [3] [2]. The factors mentioned play important roles for recognizing mineralization in the region of interest. Therefore, the identification of these factors saves time and cost as well as giving a more precise result (**author?**) [7].

Because of its synoptic view which is advantageous in detecting promising mineralized zones in less time and at a low cost, optical remote sensing technology plays a significant role in the reconnaissance survey stage of mineral exploration. Currently, in India the optical remote sensing technology is not very well developed to be applied in densely covered vegetation areas. The most important, and probably the only, reason being the remotely sensed optical image typically expresses reflectance spectra of vegetation, not rocks and soils below it. One way to overcome this problem is by discriminating featured spectral patterns of vegetation anomalies caused by the mineralization.

Although plant growth is a complex process and the underlying physiology has not been entirely understood, plants take up nutrients from the substrate, including metals in soils. The absorption of metals causes changes in photosynthetic activity and chlorophyll contents.Therefore, reflectance spectra in the visible to near-infrared (VNIR) region (350-1400 nm) and numerous Vegetation Indices (VIs) using this region have been marked to detect metal-induced vegetation stress. However, the stress tends to appear more clearly at longer wavelengths, i.e., shortwave-infrared (SWIR) region (1400-2400 nm) by the interference of water absorption in leaves. Hede et al (**author?**) [5] took advantage of this feature and developed a new VI using reflectance in the VNIR and SWIR regions which has been proved highly sensitive to vegetation stress and effectively captures mineralization hidden by vegetation.

In this study we have attempted to test the above hypothesis of Hede et al.(**author?**) [5] on one of the most prominent iron ore reserve of India, i.e., Sandur Iron-ore Deposits (SID) which falls in the reserve forest area, by applying VIGS (Vegetation Index in Green and Shortwave Infrared) to multi-temporal satellite image data.

Problem Statement

Objectives

1. To map iron ore rich regions of Sandur greenstone belt.

Methodology flow chart

Sentinel-2 images will be downloaded from the website of Earth Resources Observation and Science (EROS) Center, USGS (http://earth-explorer.usgs.gov/). The images will be pre-processed for converting radiance values to reflectance values before using them for the VI analyses. Each band of Sentinel-2 image downloaded was divided by 10000 using grid-calculator option in SAGA GIS 7.1 software available at Department of Geography, University of Madras. Detailed methodology followed in executing this project is illustrated in Fig.1.

Reflectance at each pixel will be derived from the preprocessed Landsat images and will be used to calculate two images for VIs, VIGS and NDVI. VIGS is formulated as:

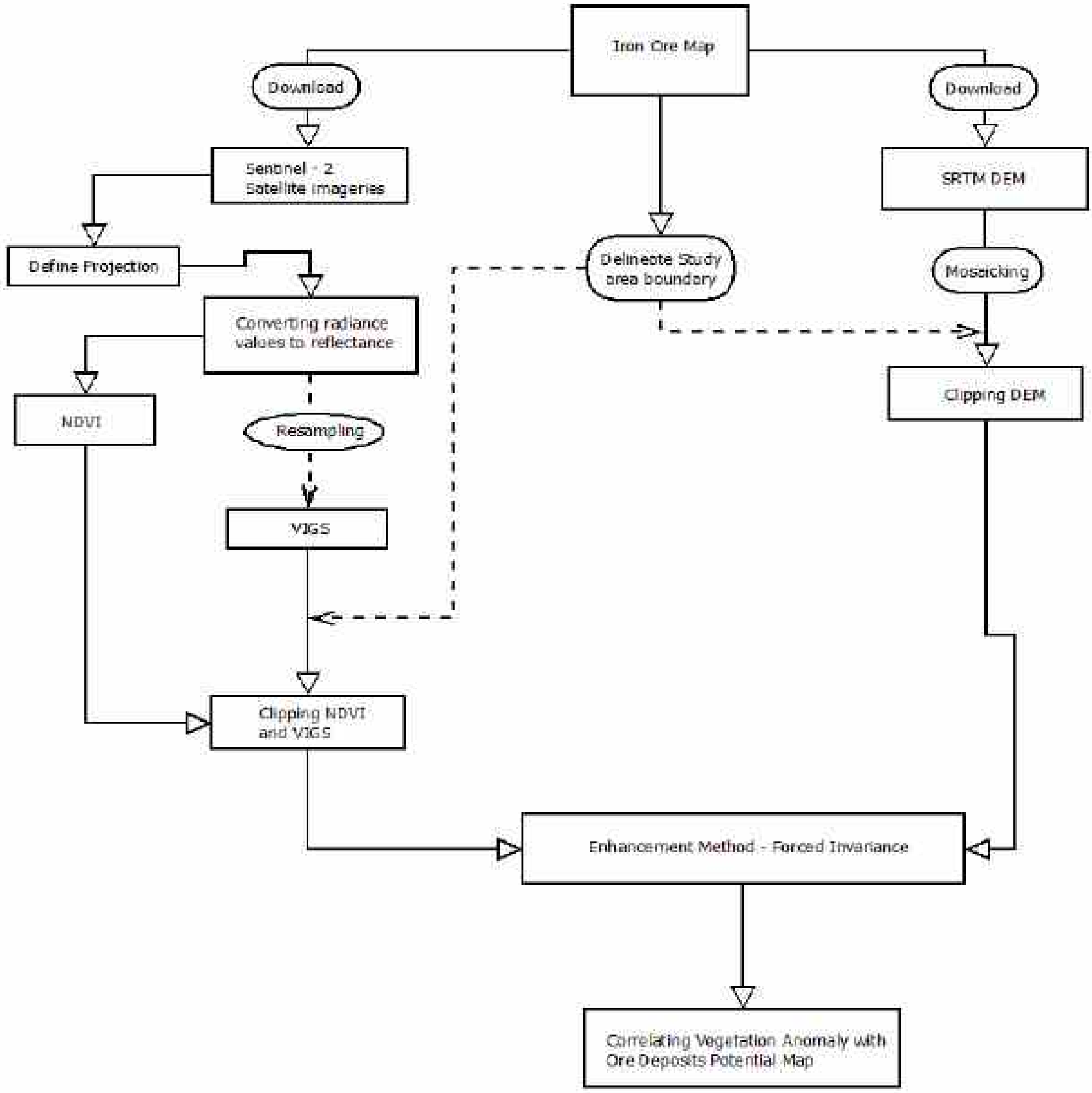

Figure 1: UML diagram illustrating the methodology adopted in this study

$$VIGS = w_1\left(\frac{G-R}{G+R}\right) + w_2\left(\frac{N-R}{N+R}\right) + w_3\left(\frac{N-S1}{N+S1}\right) + w_4\left(\frac{N-S_2}{N+S_2}\right) \quad (1)$$

where G, R, N, S1, and S2 denote the surface reflectance in the visible green and red, near-infrared, and two shortwave-infrared wavelengths, respectively. For a Landsat ETM1 image, G, R, N, S1, and S2 correspond to the reflectance at bands 2, 3, 4, 5, and 7, respectively. The w1, w2, w3, and w4 are weights for each term and a combination of w1 = 1.0, w2 = 0.5, w3 = 1.5, and w4 = 1.5 was employed in this study based on results of Hede et al., 2015. Equation of NDVI is:

$$NDVI = \frac{N-R}{N+R} \quad (2)$$

Data sets

The data set and open source softwares used in this study are:

1. Sentinel-2 image.
2. SRTM DEM
3. SAGA GIS 7.1 software
4. QGIS Software
5. LYX
6. Dia

Results

Discussions

Remote sensing has proved effective in delineating the mineralized zones in thick vegetation covered areas. In the present study various image processing techniques described above are applied on Sentinel-2 image in order to identify the stressed vegetation where the stressing is due to anomalous mineral concentration rather than non-availability of water. Healthy vegetation is masked from the scene. This is achieved by applying forced invariance enhancement method. Supervised classification method was adopted to delineate the mineralized zones along with water bodies, mining pits, vegetation areas and settlements.

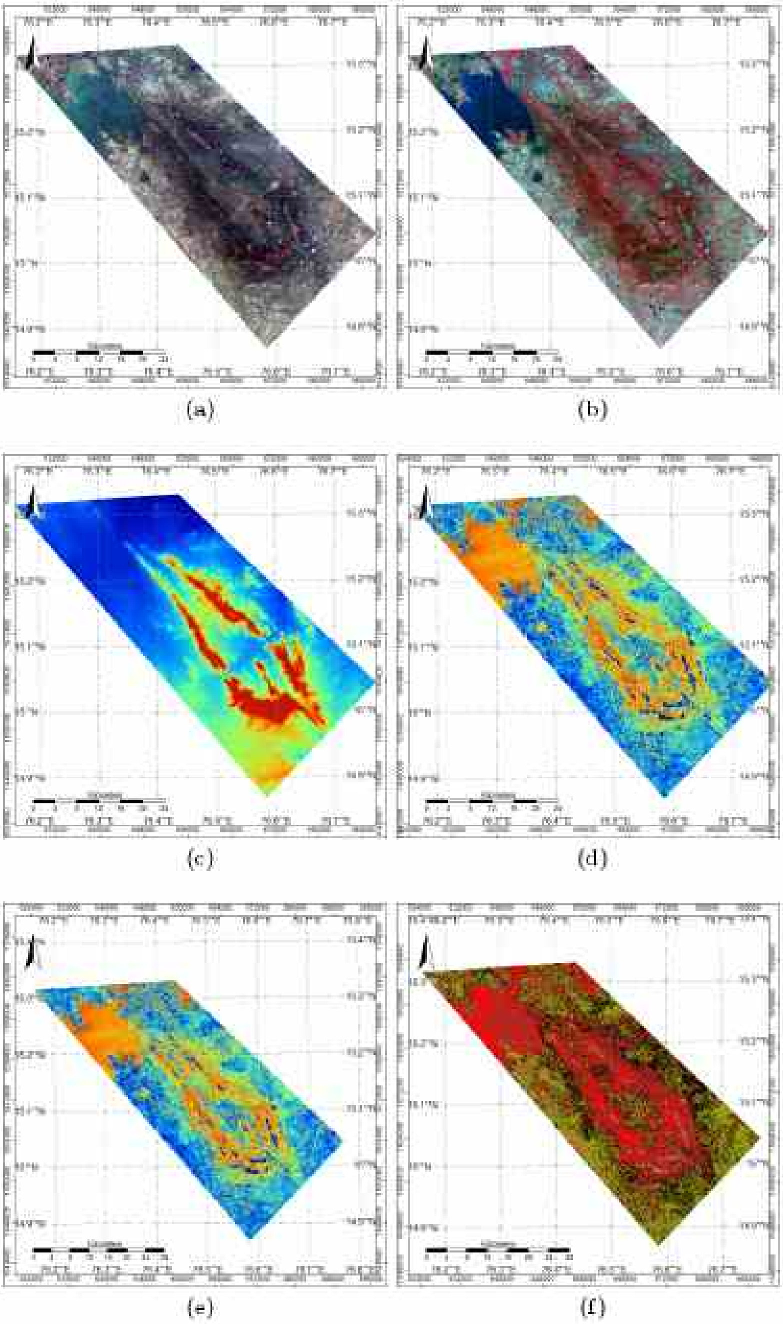

Figure 2: Various images of the study area.

Conclusions

The remote sensing and GIS techniques can be effectively used in targeting the locations for reconnaisance survey. It is a cost effective method and saves a good amount of time and energy. Lyx word processing software is extremely felsible and user friendly which can be used to design the mannuscript according to different journal requirements. Dia software helps in desiging and generating beautiful UML diagrams to better convey the scientifc ideas.

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GEOSPATIAL MAPPING AND ASSESSMENT : IMPACT OF URBANISATION ON ELEPHANT MIGRATION AND ITS CONFLICTS WITH HUMANS.

DST – NRDMS Winter School on Geospatial Technologies

17.02.2020 TO 08.03.2020

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CONTENTS

GEOSPATIAL MAPPING AND ASSESSMENT:
IMPACT OF URBANIZATION ON ELEPHANT MIGRATION AND ITS CONFLICT WITH HUMAN

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Abstract

Dalma wildlife sanctuary located near Jamshedpur city in Jharkhand State of India is known for its elephant habitat. The Dalma elephants migrate between the forested area located in the border of Jharkhand, West Bengal, Odisha as per food and water availability, and climatic conditions. Urbanization and increase in the population led elephants to migrate from their habitat. The present study is carried out in Dalma wildlife sanctuary and surroundings to understand the migration pattern, recent migration systems, land use land cover change for the period 2001 and 2019. Also, the study identifies potential conflict spot and works on human loss and injuries.

Keywords: Urbanization, population, migration, land use and land cover.

1. INTRODUCTION

Increasing human population and associated development have led to degradation of natural resources, and hence impacting the food and shelter availability to the dependent wildlife in those natural systems. Elephant is one such wild life which is highly affected by human development because elephants are landscape animals and they require vast area to move around, and huge amount of food to survive. Human developments have encroached the corridor regions of these elephants and hence forcing the animal to enter the human populated area. This leads to conflict which results in loss of life on both the sides. As per the recent Synchronised elephant population estimation in India (MOEFCC, 2017), the total number of elephants in India is 27312 encompassing 4 regional distribution (South: 11960, North-East: 10139, North-West:2085, East-Central: 3128). The number of lives lost due to elephant-human conflict is highest in the east-central region where 100s of lives are lost on both the sides (human & elephant), every year. Considering increased human developments in this region, the comings years may see even more rise in the elephant-human conflict. In this regard the human-elephant conflict analysis was carried out using geo-spatial technology in Dalma Sanctuary of Jharkhand state in India.

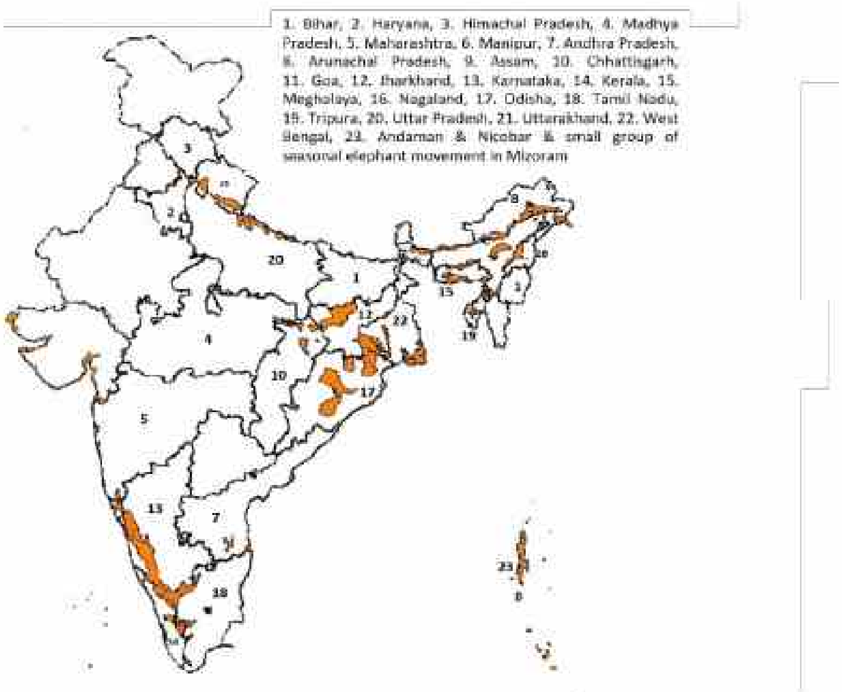


Figure 1: Elephant Distribution in India (orange color) (Source: MOEFCC, 2017)

In Jharkhand state, at least 2 – 3 human-elephant related conflict per month is very common. The Jharkhand state is rich in forest cover and 29.61 % of its total geographical area is covered with forest. The total number of elephants in Jharkhand is 679 (MOEFCC, 2017). Out of these, more than 150 elephants are in Dalma Wildlife Sanctuary (Jharkhand forest Department, Census 2011 - 2012) which is the second most elephant habitat zone in Jharkhand. It is natural for elephants that during monsoon and winter season they come down form hilly area and migrate towards warmer regions of south Bengal and Odisha, and in this process, they get attracted towards the paddy fields in nearby villages which naturally results in conflict.

2. RESEARCH REASON

Jharkhand (lit. "Bushland" or the land of forest) is a state in eastern India, carved out of the southern part of Bihar on 15 November 2000. After the partition the state has increased their population with tremendous change in the urban areas and their extensions.

From the news channel ANI telecasted on March 3 2017, it stated that the elephants change their primary path because of the climatic conditions, dry water ponds and degradation of forest cultivation. It also referred about the secondary path of certain herb that interfere into the extension urban area. Also, few supporting articles are shown in figure 2

Due to such episode's human are much disturbed/injured and there are loss of life and property (Table 1). Even after much urbanization and census qualified population is existing, still there are not many facilities and considered as under developing state of India.

Urbanization to elephant migration to human interaction and conflicts with elephant can be mapped and assessed using Remote Sensing and GIS.

RESEARCH QUESTIONS

1. What is the change in the urban extent after the partition of Jharkhand from Bihar?
2. Why only Khunti region is targeted by elephants?
3. Is it food or water that makes elephant reach the urban area?
4. Why are elephants migrating from their primary track?

hindustantimes

Elephant goes on the rampage, kills three in village near Ranchi

Vikas Kumar, officer-incharge, Lapung police station, said that Sushma Toppo (30) along with her six-year-old son were on their way to attend nature's call when the solitary elephant attacked them.

Jharkhand: Wild elephants on rampage, villagers seek refuge in government middle school; Pathalgarhi movement acting as a deterrent

RANCHI: Eight families of a village in Khunti's Arki block in Jharkhand have sought refuge in a government middle school in an adjacent hamlet after a herd of wild elephants, drawn by the scent of Hariya (rice-beer), went on a rampage and razed their kuccha houses late on Saturday night.

United News of India
India's Multi Lingual News Agency

Posted at: Feb 9 2020 5:56PM | Time: 16:26 Hrs(IST)

Elephants destroy 10 homes in Khunti

Khunti, Feb 9 (UNI) A group of elephants created havoc in Sasangbeda village under Arki Police Station area of this district during which they destroyed a total of ten homes and also ate away the foodgrains which were kept inside.
Locals said that late last night the tuskers entered into the village and destroyed the homes. Somehow the people managed to run away and save their lives. A team of the forest department today reached at the village and looked into the incident.
The disaster management department has made arrangements in the school. People said that a group of 15 elephants is moving in the area which Saturday night entered into the village and created havoc.

Figure 2: Newspaper articles about the human and elephant conflict.

3. AIM AND OBJECTIVE

The aim of the study is to assess the impact of urbanization on elephant migration and its influence in human health using geospatial techniques. The following objectives will be carried out to complete the above aim.

1. To map the urban growth in and around of Ranchi – Capital city of Jharkhand. To know the land use and land cover status during the time of partition (2001) and the current scenario (2019).
2. To delineate the elephant tracks and their migration path from their host (Dalma Wildlife Sanctuary) to their food and water.
3. To identifies potential conflict spot and analyses human loss and injuries due to elephants.

4. STUDY AREA

Jharkhand state having 28 districts was formed in the year 2000 out of Bihar State, and its total geographical area is 78,714 sq. km having total population of 32,966,238 (census, 2011). Our study area is Dalma wildlife sanctuary and its environs from two districts East (Purba) Singhbhum and Saraikela Kharsawan districts. Also, it includes a part of Ranchi and West (Paschim) Singhbhum districts (Figure 2). This wildlife sanctuary is situated in the north (around ~10kms away) from the steel city Jamshedpur which total area is 193.22 sq. km (Sambath, 2014). The core area of this forest is 35 sq. km. and buffer area 158.22 sq. km. Dalma wildlife sanctuary is famous for its natural beauty is surrounded by Dalma hill, which is ~928 meters above from mean sea level. 10 to 15% of this forest is a plane land, summer temperature varies between 22°c to 38°c, and annual rainfall is around 1400 mm. The geomorphological characteristics of this land are undulating terrain of hill rocks, plateaus and open field. The main water source of this region is the river Subarnarekha. The type of the forest is dry deciduous. This forest is suitable for elephants and wild dog, mouse deer, Indian giant squirrel, python, pangolin, eagle and various type of insects and birds because of availability of water in sufficient scale.

5. DATA USED

Toposheets (1:250,000), Landsat 7 ETM+ and Landsat 8 satellite images (30-meter spatial resolution) and SRTM will be used. The spatial database about transportation network and water bodies in the study area was created from toposheets. Forest area and settlements were extracted from Google earth. Elevation and slope map were calculated with the help of SRTM DEM data.

The data of last few years on human- elephant conflict was collected from Jharkhand Forest Wildlife Department. Elephant migration route and elephant mortality data were also gathered from forest office.

The injured and death count of Khunti district is given by the District collectors office in collaboration with Jharkhand forest wildlife department.

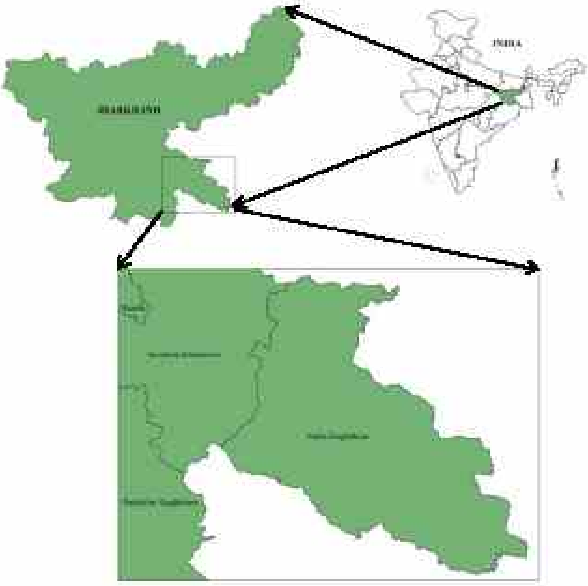


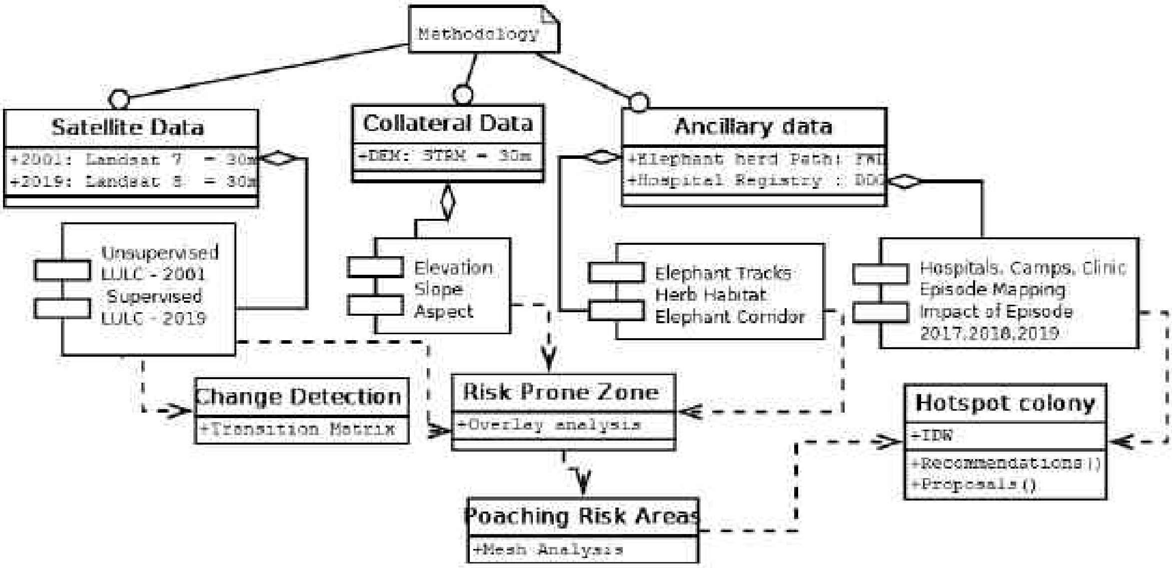
Figure 2: Location of Study Area.

SL No	Number	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-2019	2019-Jan 2020
1	Tuskers killed by poachers	-	1	-	2	-	-	-	-	-	-
2	Elephants killed by poisoning	-	1	-	-	-	-	-	-	-	-
3	Elephant killed by accidental electrocution	1	1	3	1	-	-	-	-	-	-
4	Elephant killed by deliberate electrocution	-	-	-	-	-	-	-	-	-	-
5	Elephants killed by train accidents	-	1	1	1	-	-	-	-	-	-
6	Elephants dying by contagious diseases**	-	-	-	3	-	-	-	-	-	-
7	Elephant declared rouge under Sec 11 and killed	-	-	-	-	-	-	-	-	-	-
8	Elephant declared rouge under Sec 11 and captured	-	-	-	-	-	-	-	-	-	-
9	Elephant captured under Sec 12	-	-	-	-	-	-	-	-	-	-
10	Elephant dying of other unnatural reasons	2	1	-	3	-	-	-	-	-	-
11	Elephant dying of natural reasons	10	4	4	-	1					
12	Elephant dying of unknown reasons	-	-	-	-	-	-	-	-	4	-
13	No. of persons killed by elephants	69	62	60	56	10	9	12	50	26	3
14	Amount Paid (in Rs. Lakh) on account of ex-gratia for human deaths	52.62	67.32	91.17	109.28	10	9.5	10	110.63	38.74	3.75
15	Amount Paid (in Rs. Lakh) for crop damage etc as compensation	74.94	131.89	120.19	275.61	29.76	59.16	39.6	52.62	305.78	4.5

Source: Jharkhand forest wildlife department.

Table 1: Human-Elephant Conflict data around Dalma wildlife sanctuary in Jharkhand (Year 2009 - 2020)

6. METHODOLOGY



Elephant Habitat Suitability Analysis:

On the basis of many previous researches works, we tried to model the potential suitable habitat locations for Elephants. The basic parameters such as food and shelter (in terms of forest cover, water body), Disturbances parameters such as distance from roads and human settlement, accessibility parameters such as elevation and slope have been mapped and their contribution towards elephant suitability was modelled.

Adult male elephant requires 212 liters water for drinking, especially during the peak of summer heat. Elephants also like to wallow in the water and, in consideration of these factors along with the elephant's daily range of movement, areas with water sources were deemed very suitable. Elephants eat around 150kg of Vegetation daily. Settlement is one of the most influential factors as the farther locations from settlement helps to avoid the conflict area in mapping the suitable locations. High elevation is not suitable for elephant. Indian elephants generally comfortably migrate up to the 300 meters. All the input data layers were aggregated considering their importance as weightage.

Potential Conflict spot Identification

Land use and land cover maps of two time periods (2001 and 2019) were prepared using Landsat images and the change was analysed. Using elephant route data obtained from the forest department we have prepared a 5 km and 10 km buffer zones. The we did an overlay analysis using change detection map, elephant route map and elephant attack points data to understand and detect the potential conflict spots.

Table 2: Weighted of variables and their associated attributes

Variables	Final weightage
Forest and Settlement Suitability	0.5
Elevation Suitability	0.1
Slope Suitability	0.1
Water bodies Suitability	0.2
Transportation Network Suitability	0.1

7. Results and Discussion

Since our study is mainly focused towards Dalma wildlife sanctuary we did not look into the migration and conflict issues within West Bengal and Odisha states. Figure 3 reveals elephant sighting area, water holes etc. of Dalma wildlife sanctuary area and conflict locations of Dalma elephants as observed from the forest field survey report.

Every year in winter season Dalma elephants migrate to West Bengal and Odisha and they return back in Dalma in summer. According to the census report of wild animals in Dalma, the time of migration of elephants is not constant across years. In the Table-3 one can see the vital migration time of Dalma elephants over the past few years. Dalma elephants migrates continuously in different groups to the west Bengal and Orissa at different phases. The different migration routes of elephants in Dalma shown in Figure 3.

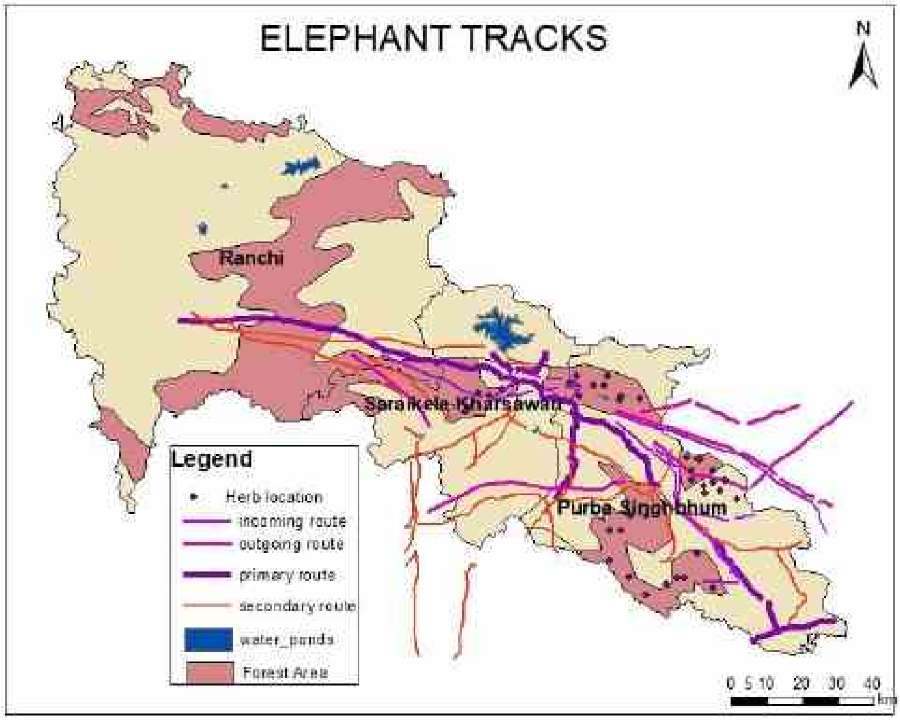


Figure 3 Tracks of the animal

Habitats Suitability

By analysing 6 geo-environmental variables as mentioned in the method section, we have modelled the suitable areas which are classified into 3 groups such as not suitable, , moderately suitable, suitable. Suitable areas are mainly spread over those areas where all variables are optimal. The suitable areas should have forest and water bodies, far away from transportation network and settlement along with low elevation and slope.

Land Use Land Cover Change Analysis

In order to show the changes in our study are over last 25 years, Land use Land cover prepared from satellite images have been divided into following six classes: built up, water bodies, agriculture land, wet land, waste land, forest. Human settlement and industrial areas have been included in built up class. Agriculture class includes plantation and cropland.

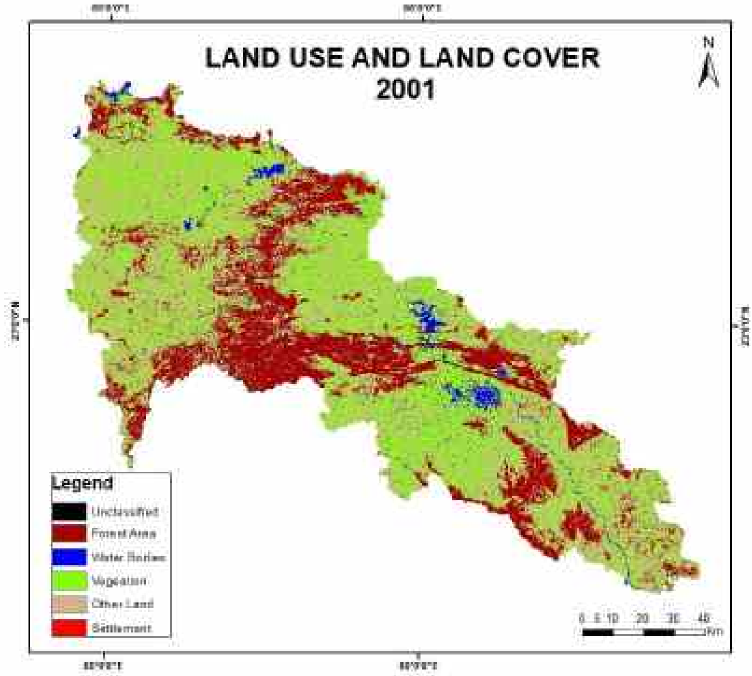


Figure 4: Land Use and Land Cover map in 2001

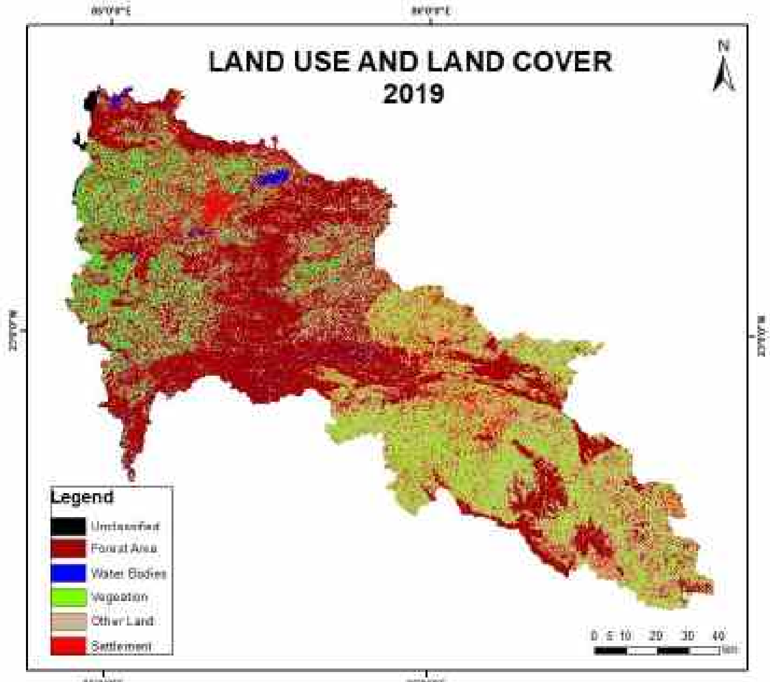
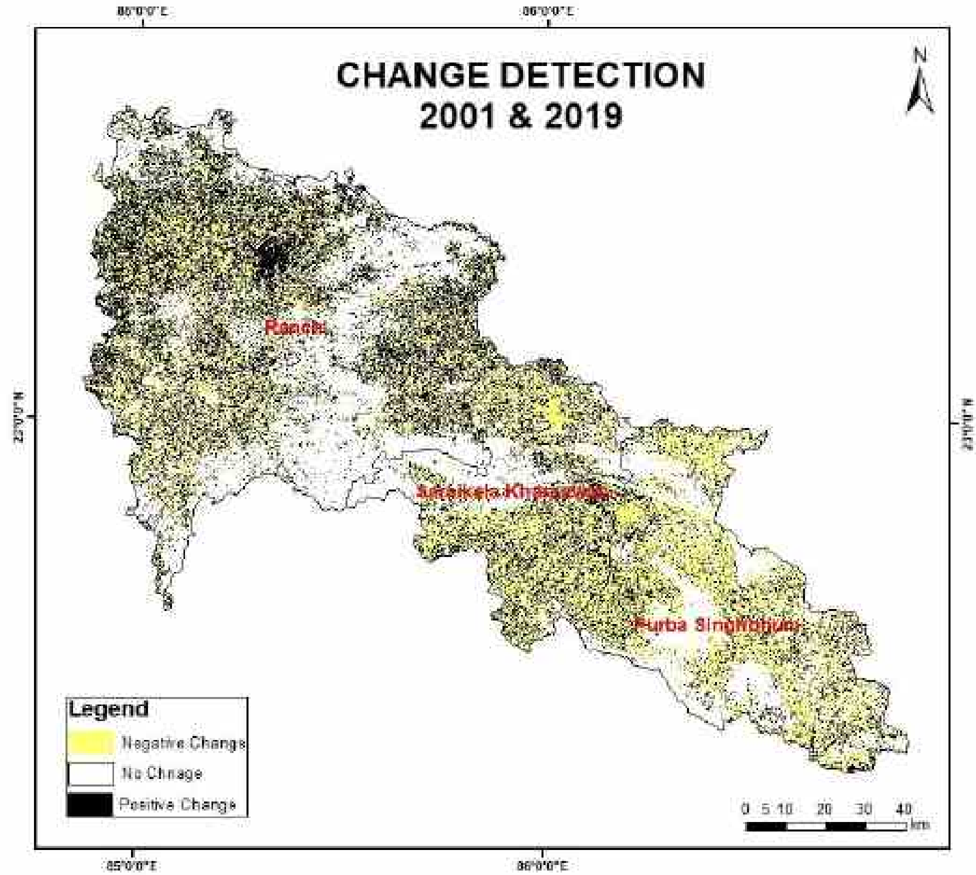


Figure 5: Land Use and Land Cover map in 2014



CLASS_NAME	Forest	Water	Vegetation	Other Land	Settlement	Area
Forest	3377.07	0.00	0.00	0.00	0.00	3377.07
water	0.00	160.97	0.00	137.57	0.00	298.54
vegetation	0.00	0.00	1815.21	739.18	1224.38	3778.78
Other land	0.00	0.00	0.00	2021.04	0.00	2021.04
Settlements	0.00	0.00	0.00	503.32	378.16	881.48
Total Area	3377.07	160.97	1815.21	3401.10	1602.54	10356.90

Table 2: Change Detection

It is observed from the overlay analysis (Figure 7) that maximum human elephant conflict locations are within 10 kilometers buffer area. This establishes the fact that the main reason for increase in human elephant conflict is expansion of human settlement nearer to forested area, and also the conversion of forest land into agriculture and human settlements. Some potential conflict spot are identified inside the forest area which reveals that human activities are also increasing inside the forest area. A clear degradation and fragmentation in the forest area can be seen from the LULC maps

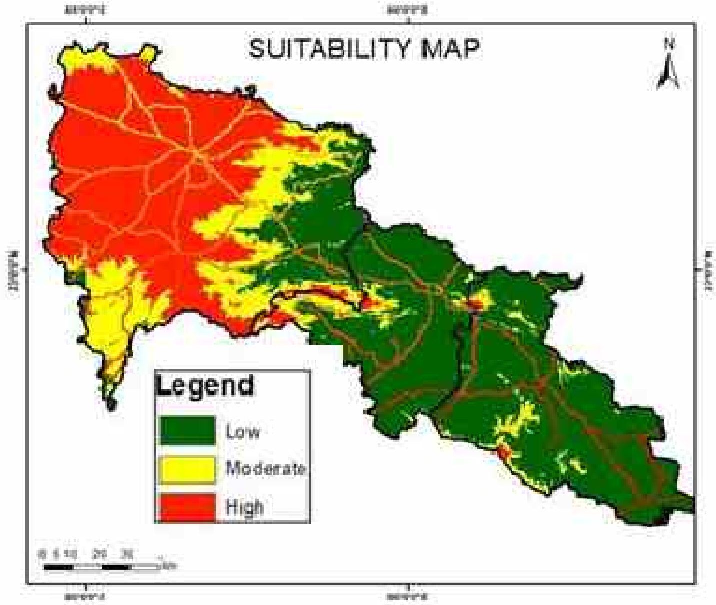


Figure 7: Potential conflict area

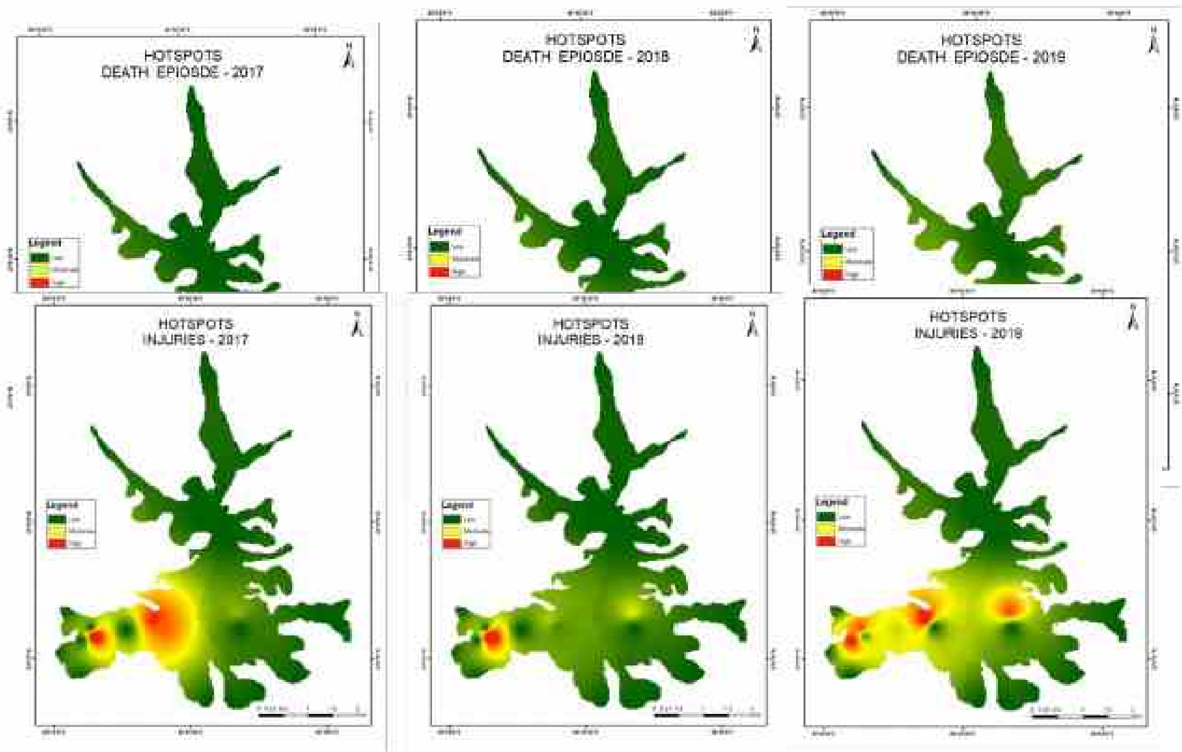


Figure 8: Hotspot region

Based on the data collected on the episodes IDW was performed to know the prominent conflict zones. Further the study can be extended by adding more parameters and field ground truth.

8. CONCLUSION

The identification of potential suitable area and overlay based conflict area demarcation from this study would help the planners and researchers. Combination of GIS, remote sensing and field survey data has helped us visualize and understand the human-elephant conflict scenario in a better manner. Using geospatial model we have divided the Dalma wildlife sanctuary and surroundings into five levels of suitability which will help to plan future corridor area for wild life movement between the forests. Present elephant population has a deep relation with forest area, water sources and their migration route which is getting disturbed by increasing human built up. To avoid future conflict government may develop a holistic model where relation between human and elephant may not disturb each other through a better management plans of elephant and its corridor.

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Checkdam site selection in Karaipottanar sub-basin of Cauvery basin, in Tamil Nadu

17 February to 08 March 2020

DST – NRDMS WINTER SCHOOL

Geospatial Technology
Department of Geography
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1.0. INTRODUCTION

Checkdams are ideal entities for management of rainwater in arid and rainfed regions. Checkdams play a vital role where the rainfall is not sufficient for agriculture and domestic use. They are also important for mitigation of the impact of natural disasters for achieving sustainable development in the region (Ibrahim-Bathis and Ahmed 2014). The Advisory Committee on Hill Areas (Planning Commission), government of India has stressed on various problems faced by hill areas such as soil erosion, deforestation, water, energy, fodder, agriculture, communication, transport, rugged terrain, landslides, floods etc. The significant factors for the planning and management of a watershed are its physiography, drainage, geomorphology, soil, land use/land cover and available water resources (Ratnam et al. 2005). The selection of best sites for water harvesting schemes must be based on certain criteria that take into consideration the socio-economic (distance to agricultural field, road and settlements) and the physical characteristics (terrain slope, soil types, and land use) of the checkdams (Anupma and Vikrant 2012). Geo-Spatial science (Remote sensing and GIS) provide useful tools that allow efficient integration of all the spatial characteristics of checkdams to present excellent mapping solution to various resource problems in a cost-effective and time saving manner (Rolland and Rangarajan 2012, Al-Adamat, 2010, Singh *et al.*, 2009 and Padmavathy *et al.*, 1993).

In a place like Nammakkal district in Tamil Nadu state, where the land has hills, forests and Cauvery basin and depends only on rainfall for agriculture and domestic use, checkdams are a boon to support the livelihood of people and livestock. To prove the utility of remote sensing and GIS on hydrogeology a minor project was planned as part of the DST- NRDMS Winter School organized by the Department of Geography, University of Madras, Chennai. The project is based on the visual interpretation using satellite and collateral data.

Study area

The area chosen for this study is Karaipottanar sub-basin where the major part is located at southeastern region in Namakkal district and smaller part in Northwest of Trichy district. The basin lies between 10°56' and 11°23'N latitudes and 78°06' and 78°28'E longitudes and its covers an area of 1116 km^2 (Fig. 1). Karaipottanar sub-basin has hills and forest with undulated terrain that flows into the tributary of Cauvery basin which originates from the number of small isolated hillocks of Kollimalai hills. The hills are located in the eastern and northern parts of the area, whereas southern and central parts of the area are low-lying with a few isolated patches.

Industry

Traditional sectors like textiles and handlooms are predominant in the district. The Salem Central Co-operative Sugar mill at Mohanur and Paper Mill are large scale industries in the basin while steel, manufacturing units, chemical and agro based industries are in the form of medium scale. Small scale industries are also widespread in Namakkal district. The major industrial sectors are animal and poultry feed units, sago factories, rice mills, oil mills and agro units. Other significant industries are the manufacturing units of rig vehicles and their accessories (DHDR 2017).

Lithology

The study area is mostly underlain by the Archaean crystalline and metamorphic complex. The geology of the area is complicated due to recurring tectonic and magmatic activities occurred during pre-Cambrian period. Gneisses are the oldest rocks in basin. It is present widely in plains. The Gneisses are highly weathered up to 30 m at places and are intruded by Ultramafic and basic rocks. Charnockites are coarse grained and their color is bluish dark to grey. They are the second largest rock type present in the area. They are massive and less weathered than the gneisses. Iron ore deposits associated with quartz felspathic gneiss and garnetiferous quartz gneisses are present in some areas. These rocks are highly folded and less weathered (Vignesh et al. 2015). There is a poor deposit of alluvium (Sand and silt) along the course of the Cauvery, as it runs mostly on high land and rocky floor. The lithology of the study area is shown in Fig.5.

Plains of the Namakkal district widely consists of oldest rocks in all the four taluks. The general direction of foliation varies from east west to east-north-east-west southwest with a high magnitude dip towards north or southeast.

2.0. PROBLEM STATEMENT

Major part of the water because of the elevation and slope of the area runs off to the Cauvery basin. Currently majority of the area is unirrigated and there are few efforts to store the rain water. If the rain water is harvested it will help in growing crops more than once in a year. Thus, an attempt has been made to select suitable checkdam sites for storing the rain water.

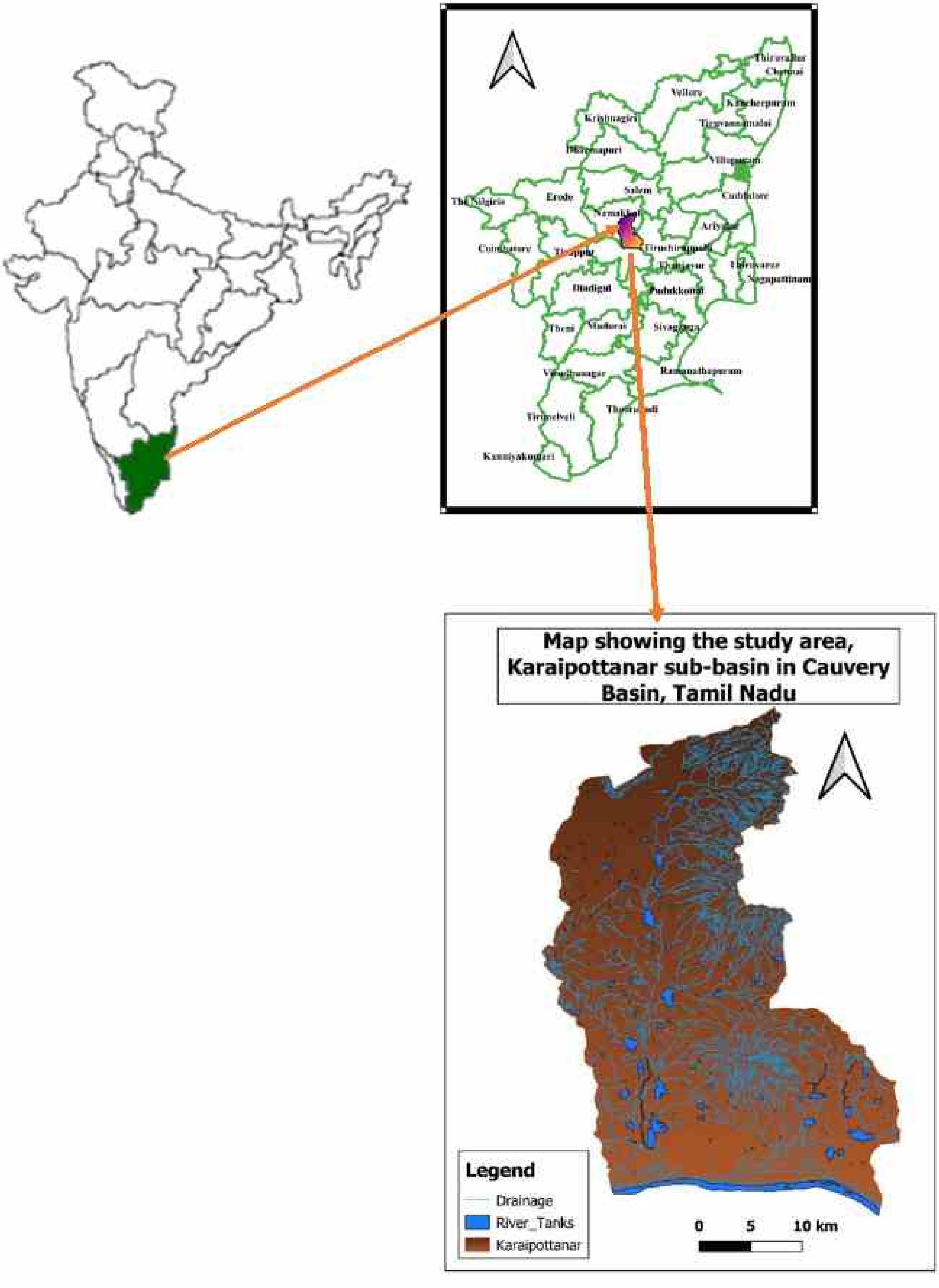


Figure 1: Location map of Karaipottanar sub-basin

3.0. OBJECTIVES

To select suitable checkdam sites in Karaipottanar sub-basin

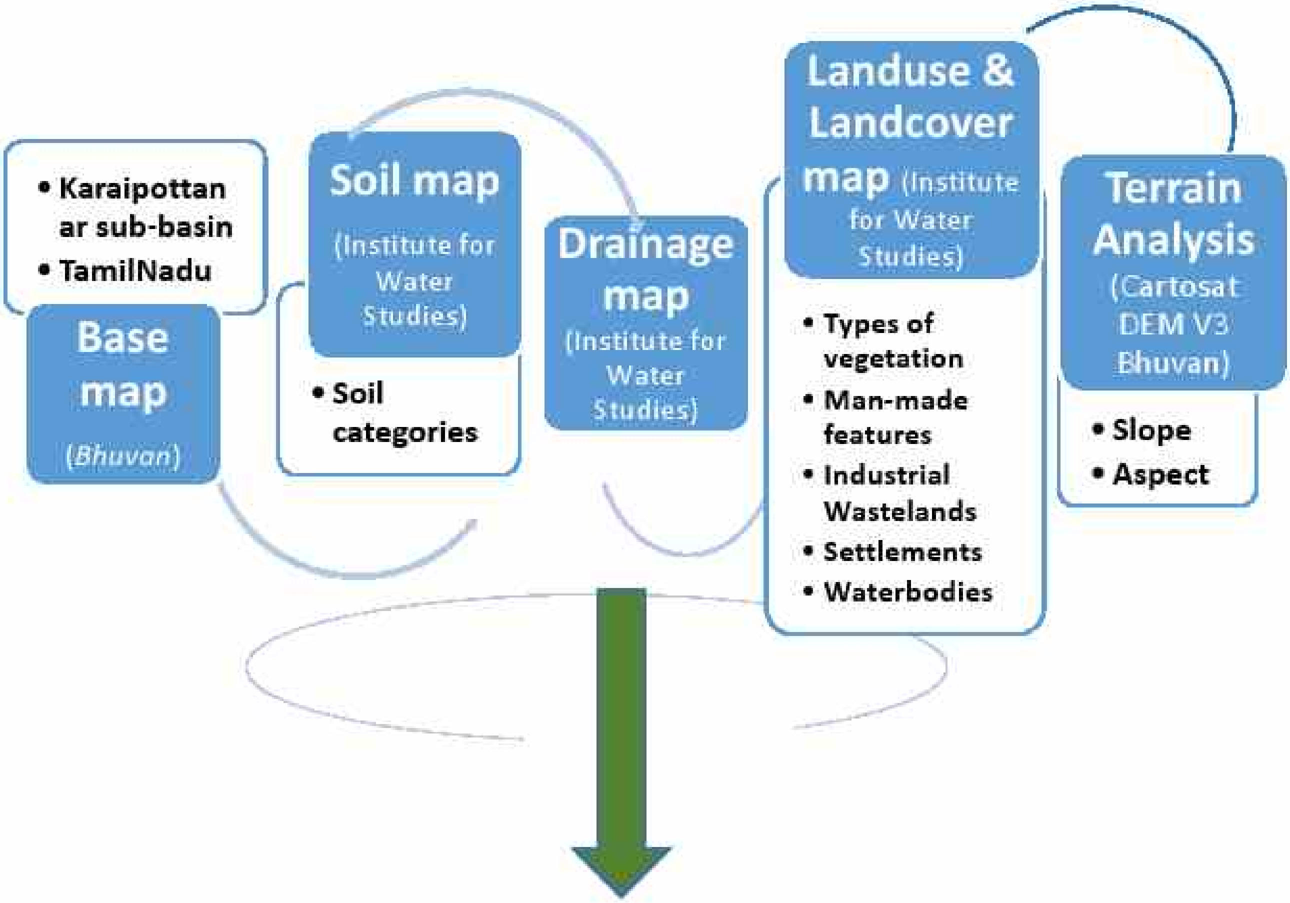
4.0. METHODOLOGY FlOW CHART

Major Criteria for check dam site selection

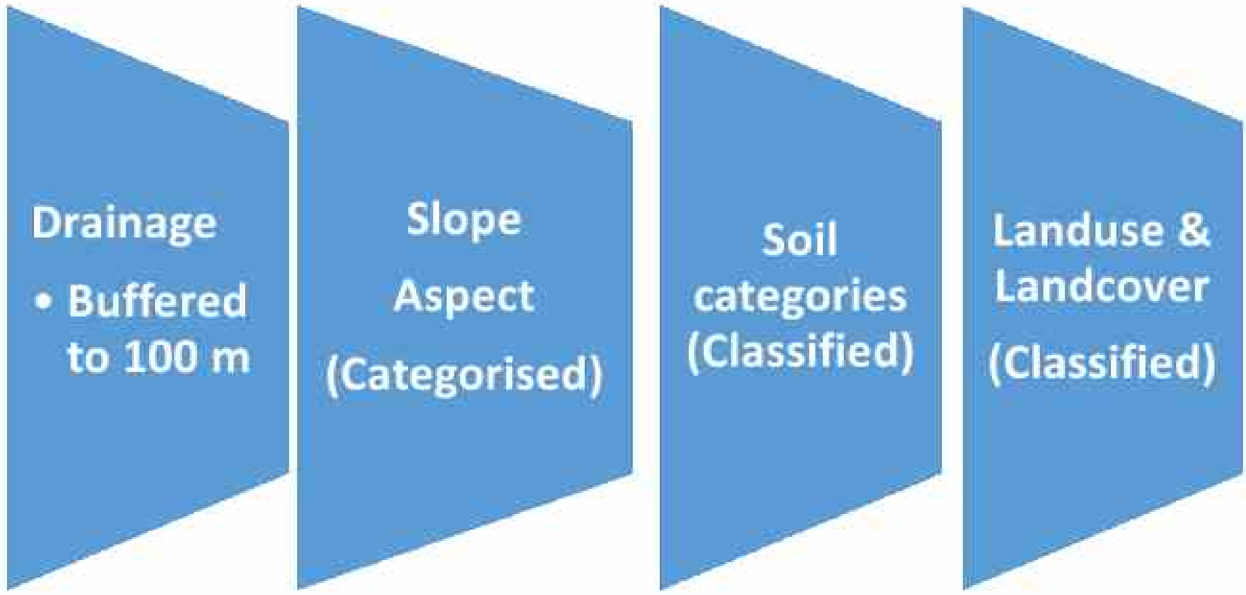
- Soil downstream of the bund should not be prone to water logging
- Land for downstream of checkdam should have irrigable land
- Drainage should be a slope

Additional secondary data on rainfall and population were considered for checkdam site selection.

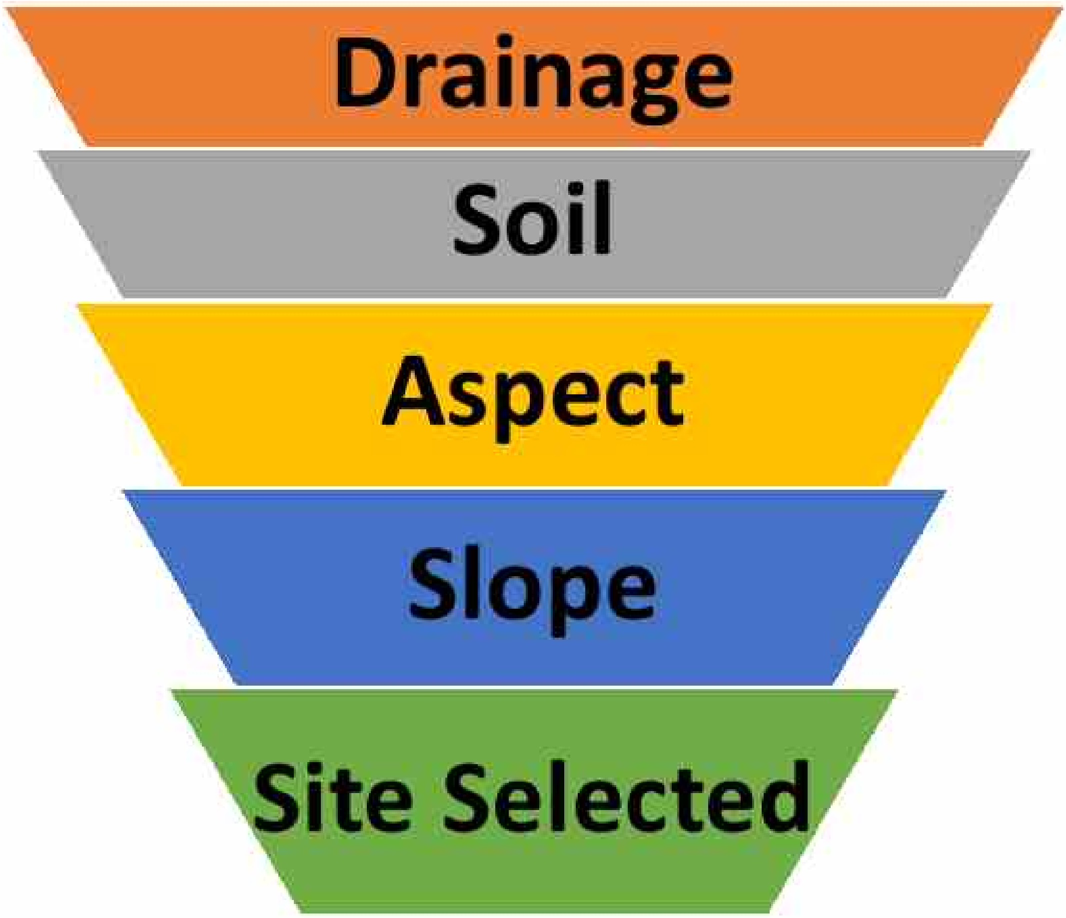
- Rainfall in Karaipottanar sub-basin should be less than 1000 mm/annum
- Population in the district should be considerably moderate



Overlay



Order of thematic layer overlay for site selection



The soil pattern and geomorphology of Karaipottanar sub-basin was classified followed by analysis of land-use and land-cover map. Also, rainfall and population data was collected. The selected streams (drainage map) was buffered with a distance of 100 m along both the sides and superimposed over contour and slope map. Contours which are very close to the stream, and forming a closed valley were selected. Such areas were checked for suitable slope - along the valley slope class upto 2 and across the valley more steeper slope, slope class greater than 2. (This was done keeping in view that if check dam is constructed, the water spread will be less and depth will be more so that evaporation will be less). Based on the above exercise few sites were identified and possible water spread in each tank if constructed were drawn taking the closest contour~into consideration. Using raster calculator the soil, drainage, sloe and aspect maps (after assigning suitable weightages based on checkdam preference) were superimposed and the best five sites suitable for checkdam construction was done. The land which is having 0-8% of slope and can get the water by natural flow itself has been given the value of 2 and the area which is having steep slope has been given the least value.

5.0. DATASETS

The following datasets generated (pertaining to Karaipottanar sub-basin in Namakkal district) were added in QGIS, integrated/analysed for selecting suitable checkdam sites.

- Rainfall (Secondary data)
- Population (Census 2011)
- Soil (Institute for Water Studies)
- Drainage (Institute for Water Studies)
- Landuse and Landcover (Institute for Water Studies)

6.0. RESULTS

Rainfall

Rainfall is the major source of water for Namakkal and Trichy districts in Tamil Nadu State. The basin is characterized by a sub-tropical climate with moderate temperature. The weather is pleasant from November to February and hot in April to June. The district receives rain during both southwest and northeast monsoons. However, the northeast monsoon contributes the maximum rainfall to the district. There are three rain gauge stations located in the basin is in Erumapatti, Namakkal and Senthamangalam. The average rainfall in Nammakkal from 2004 to 2019 was 622.83 mm (Fig 2) where northeast monsoon brings the maximum amount of rain in Namakkal district (Fig 3).

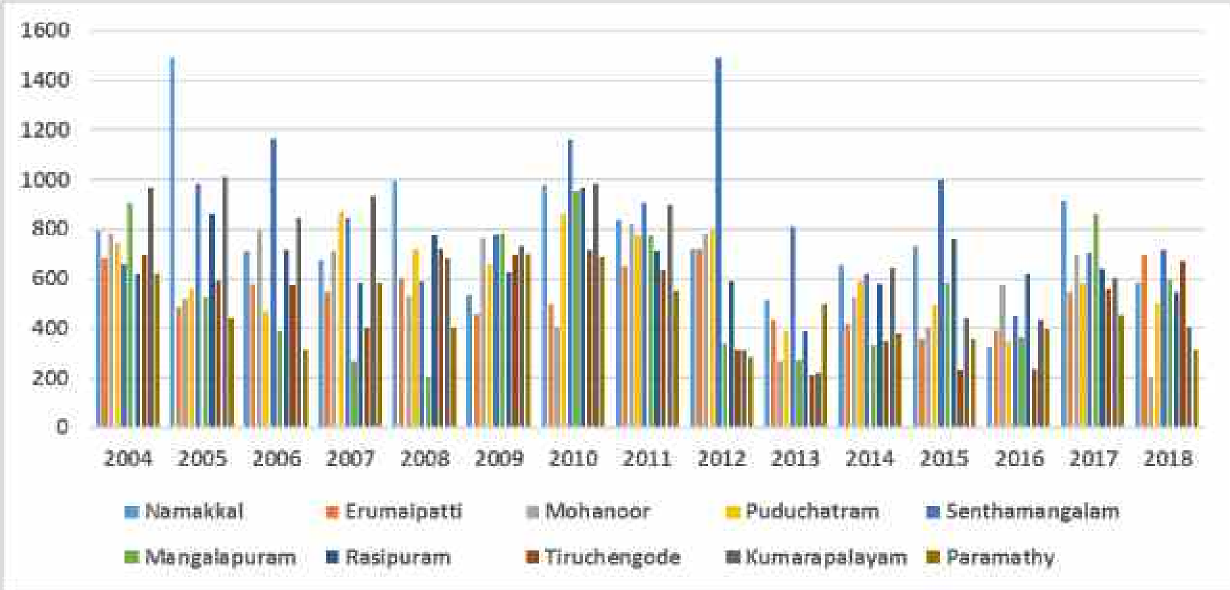


Figure 2: Average Annual rainfall (mm) from 2004-2018 in Namakkal District

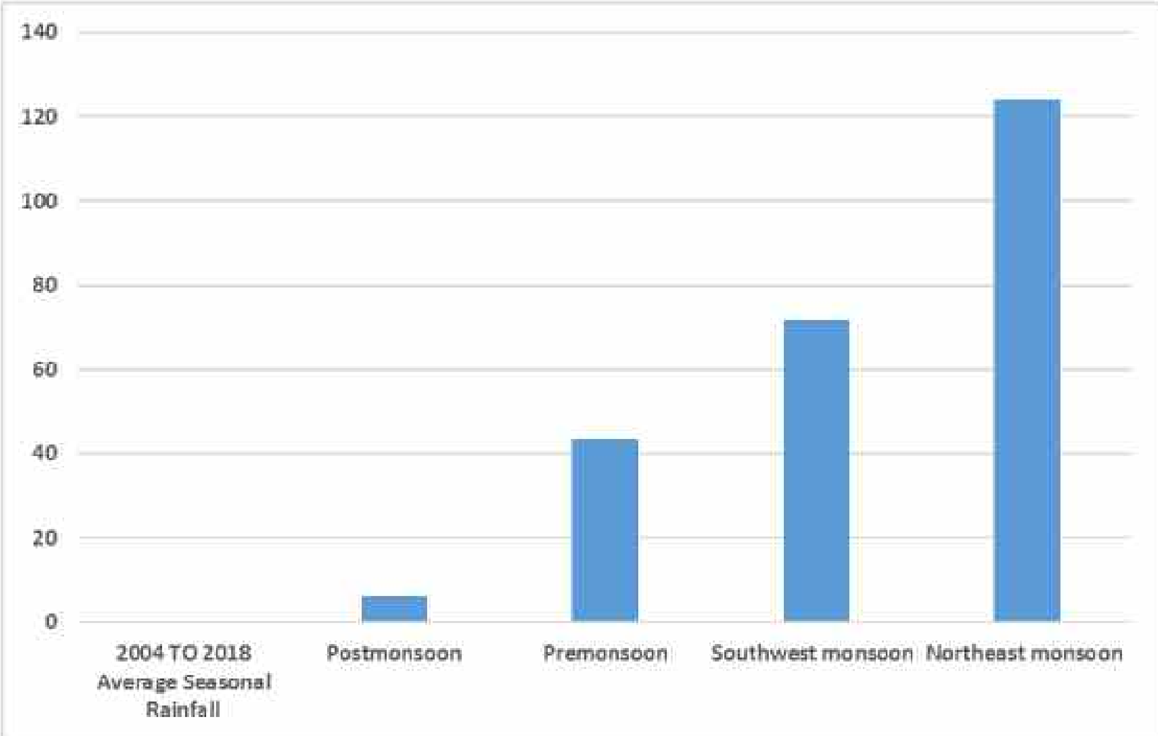


Figure 3: 2004 to 2018 Seasonal average rainfall (average) in Namakkal District

Population

The initial provisional data released by census India 2011, shows that density of Namakkal district for 2011 is 505 people per sq. km. In 2001, Namakkal district density was at 439 people per sq. km.

Namakkal district sprawls over 3,420 square kilometers of area. The population density of Tamil Nadu state is shown in Fig. 4.

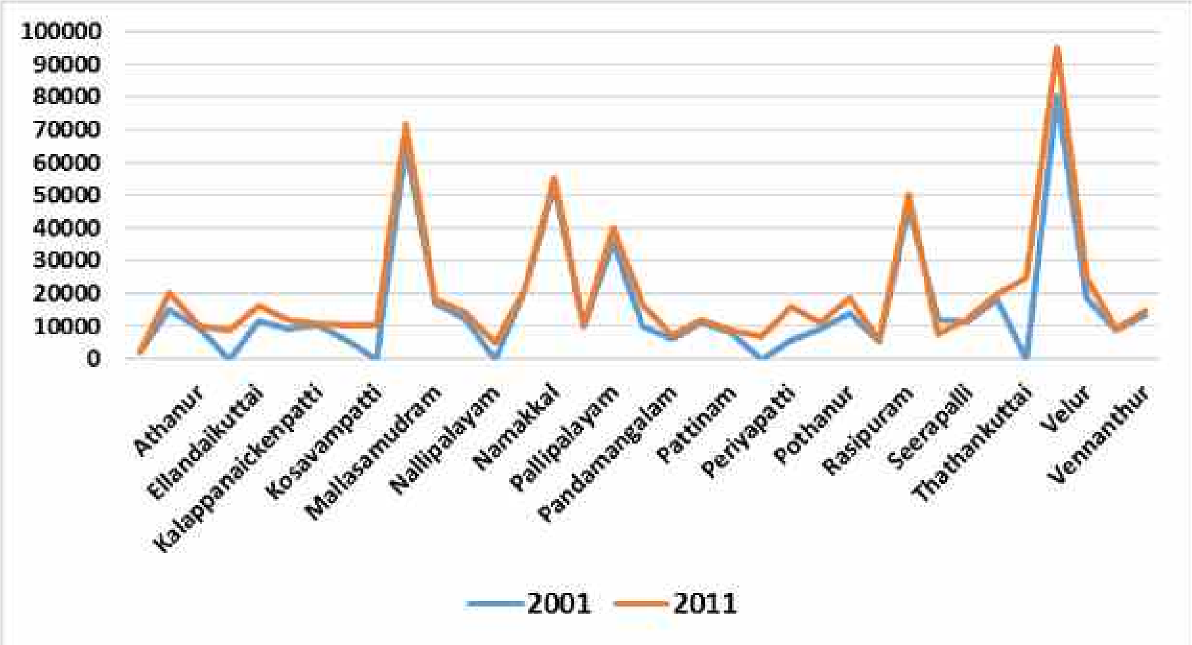


Figure 4: Population density selected taluks in TamilNadu state

Soil

The soil of Karaipottanar sub-basin can be broadly classified into clay, clayey silt, clayey loam, loamy sand, sandy clay, sandy clayey loam, sandy loam and silty clay. Sandy clay loam is observed in the river flood plain and sandy clay occurred in the foothills of hills in the basin. Area with low altitude in the sub-basin consist of clayey loam which spreads in the centre and northwest portion of the sub-basin. Loamy sand is seen in patchy areas in most of the sub-basin. The different classifications of the sand are shown in Fig. 5.

For the checkdam site selection, we selected both sandy (Sand) and Loamy sand areas following (Bathis & Ahmed, 2014).

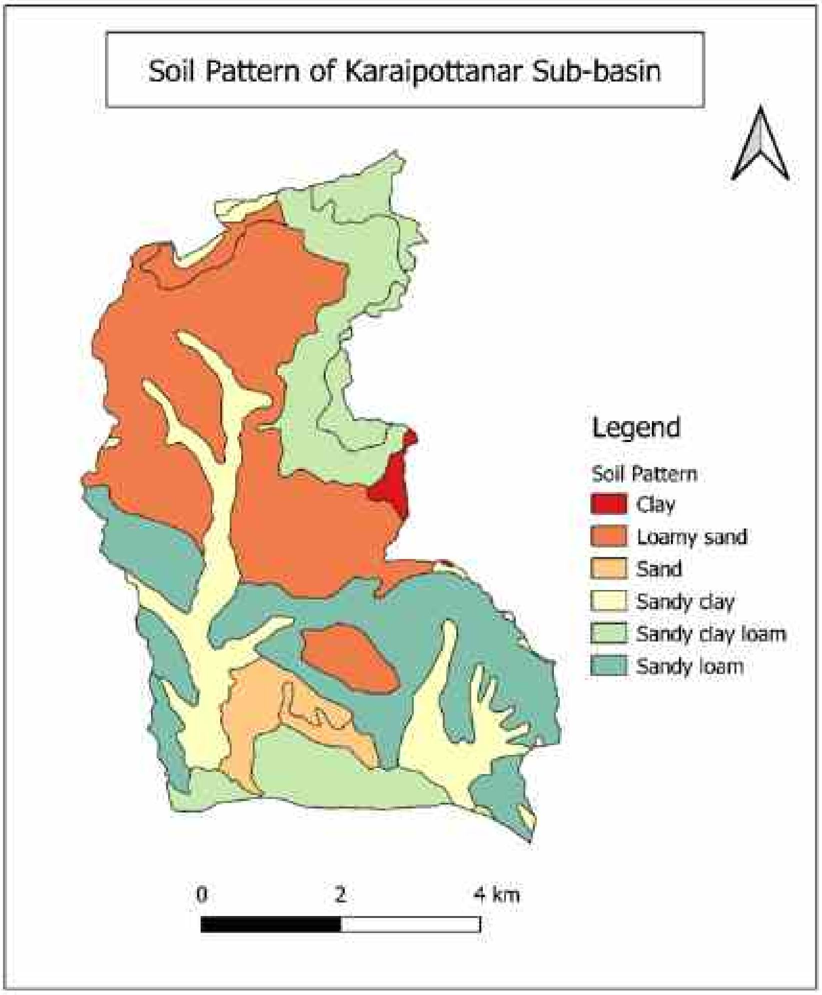


Figure 5 showing the distribution of different kinds of sand in Karaipottanar sub-basin

Drainage

Cauvery river is perennial in nature and flows through the southern boundary of the Karaipottanar sub-basin. Drainage density is defined as the closeness of spacing of channels. It is a measure of the total length of the stream segment of all order per unit area. The drainage pattern of Karaipottanar sub-basin is shown in Fig 6.

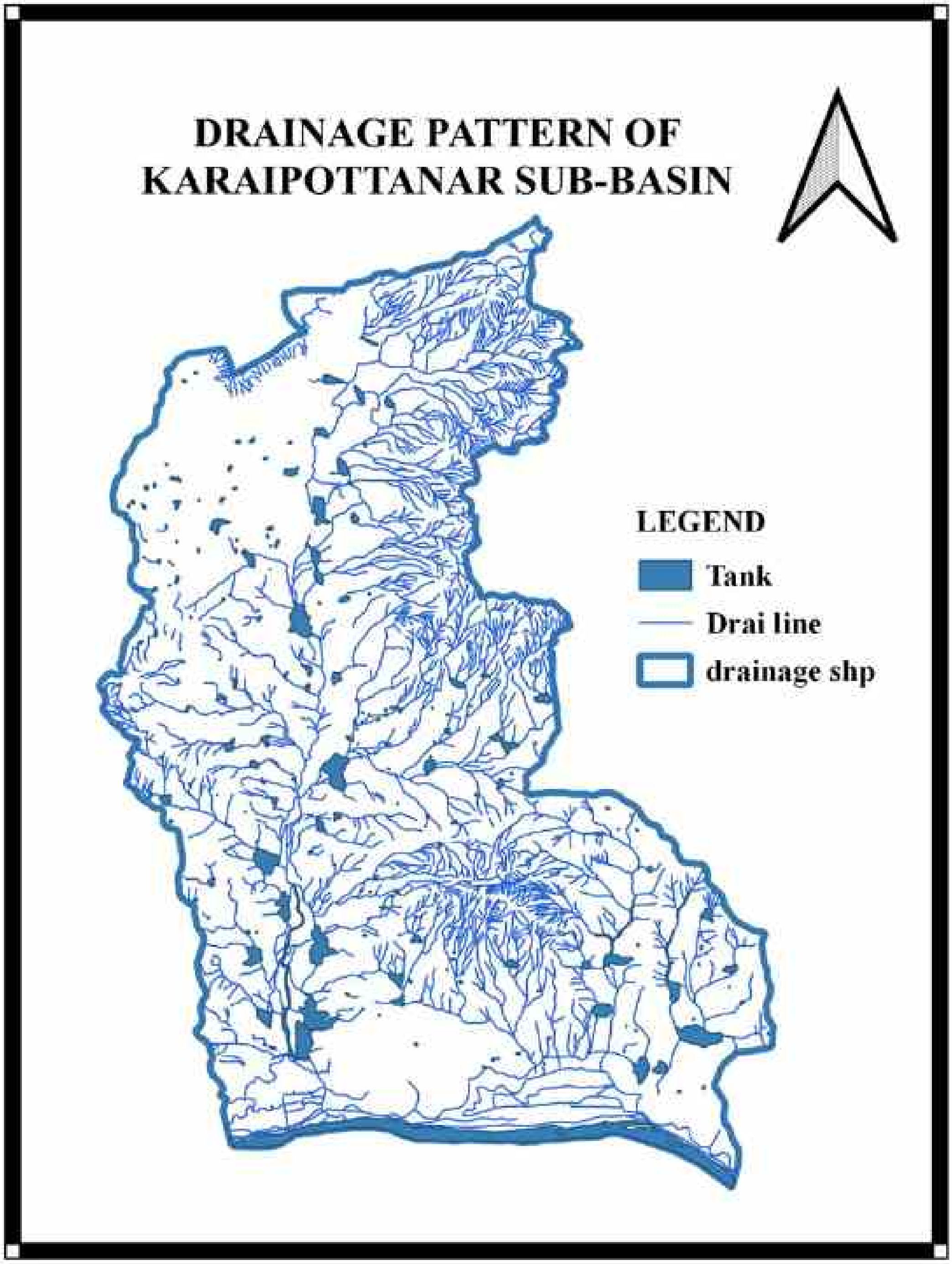


Figure 6: Drainage pattern of Karaipottanar sub-basin

Land use/ Land cover

The various categories of landuse and landcover details are classified and shown in Fig 7. From the land use/ land cover map it is observed that major areas are crop land, dense forest (base of the Kolli hills) and other plantations. Settlements are concentrated in few pockets from northwest to southeast pattern. Built-up areas are of towns and indusiries. Forest land comprises of scrub forest, ever green and semi ever green forest, and other forest. Waste land is being categoriesd as barrren rocky, fallow land, gullied/ravenous land, land with scrub, land without scrub and some degraded forest land. Water body in the area spread along the slope where reservoir and tanks can be built.

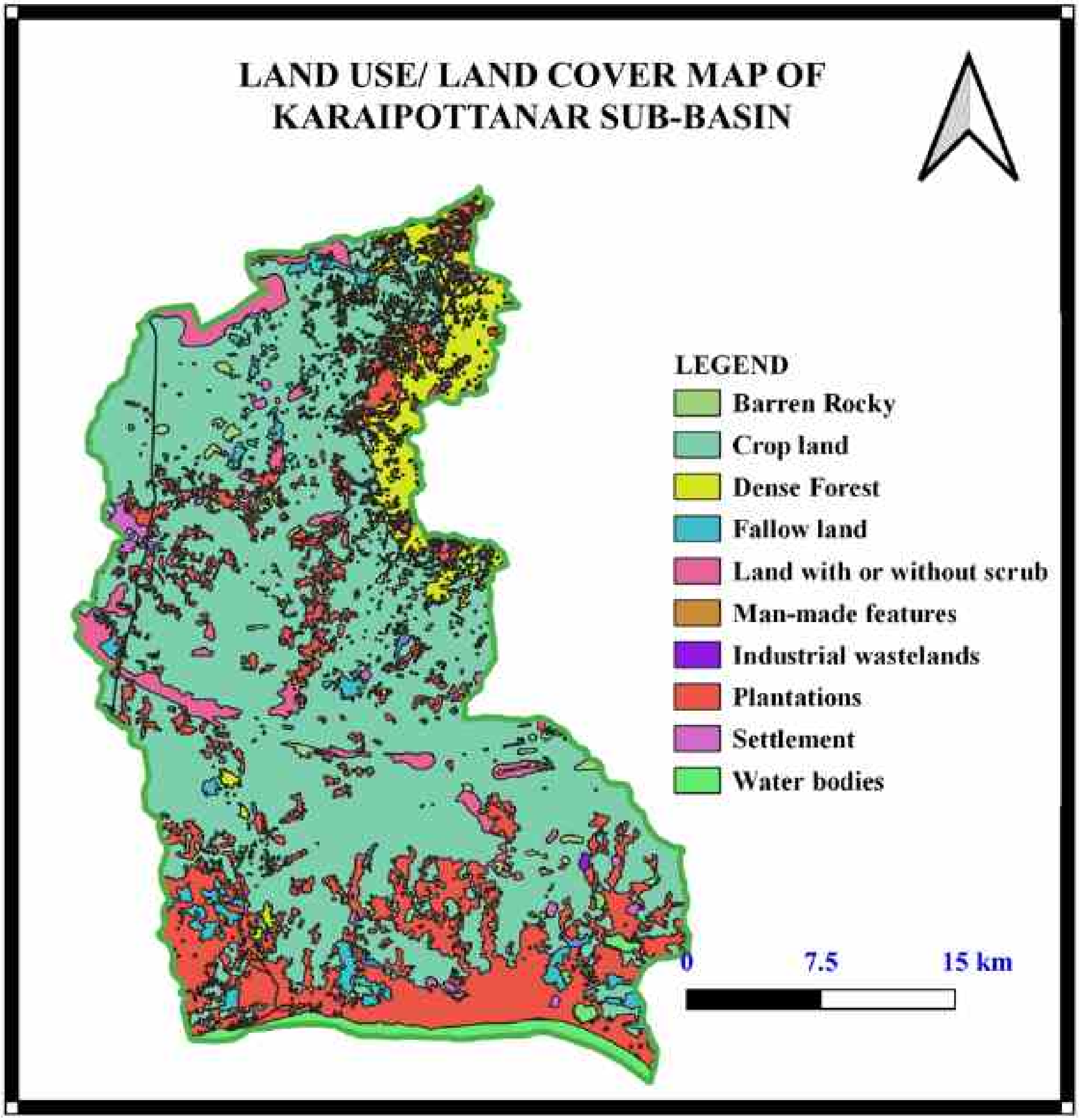


Figure 7: Drainage pattern of Karaipottanar sub-basin

Suitable site selection

The slope and aspect of the sub-basin was analysed after rasterizing the shapefiles and resampling the same. The slope was classified to 0-64 degrees while the aspect was noted from 0-360 degrees (Fig 8 and 9).

Figure 8 showing the slope gradients of Karaipottanar sub-basin

Using the raster calculater the following has been assigned for soil, slope, drainage and elevation to arrive at a selection of suitable sites for checkdams which is shown in Fig 10.

- **Soil** – A (A1 & A2) – (Sandy and Loamy Sand)
- **Slope** – B
- **Drainage** – C (2 = flow & 1 = null)
- **Elevation** – D

The formula adapted is: A ∩ B ∩ C ∩ D

- (**A1=2 U A2=3**) ∩ (**B<2**) ∩ (**C=2**) ∩ (**D < 50**)

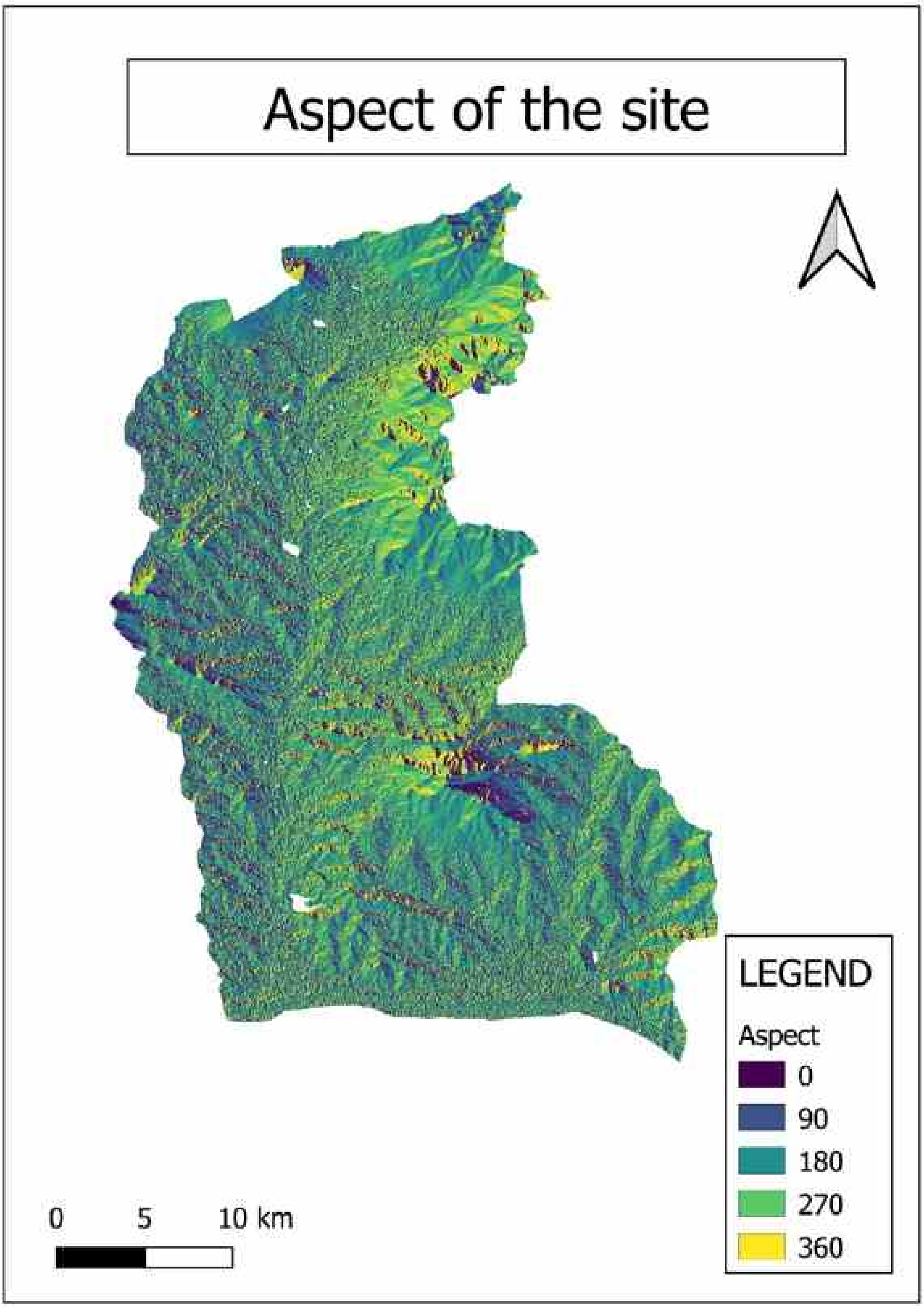


Figure 9 showing the aspect gradients of Karaipottanar sub-basin

Figure 10: Suitable sites for checkdams identified (yellow patches) in Karaipottanar sub-basin

Based on the overlay of soil, different drainage patterns, slope and aspect five suitable sites for checkdams were selected (Fig 11).

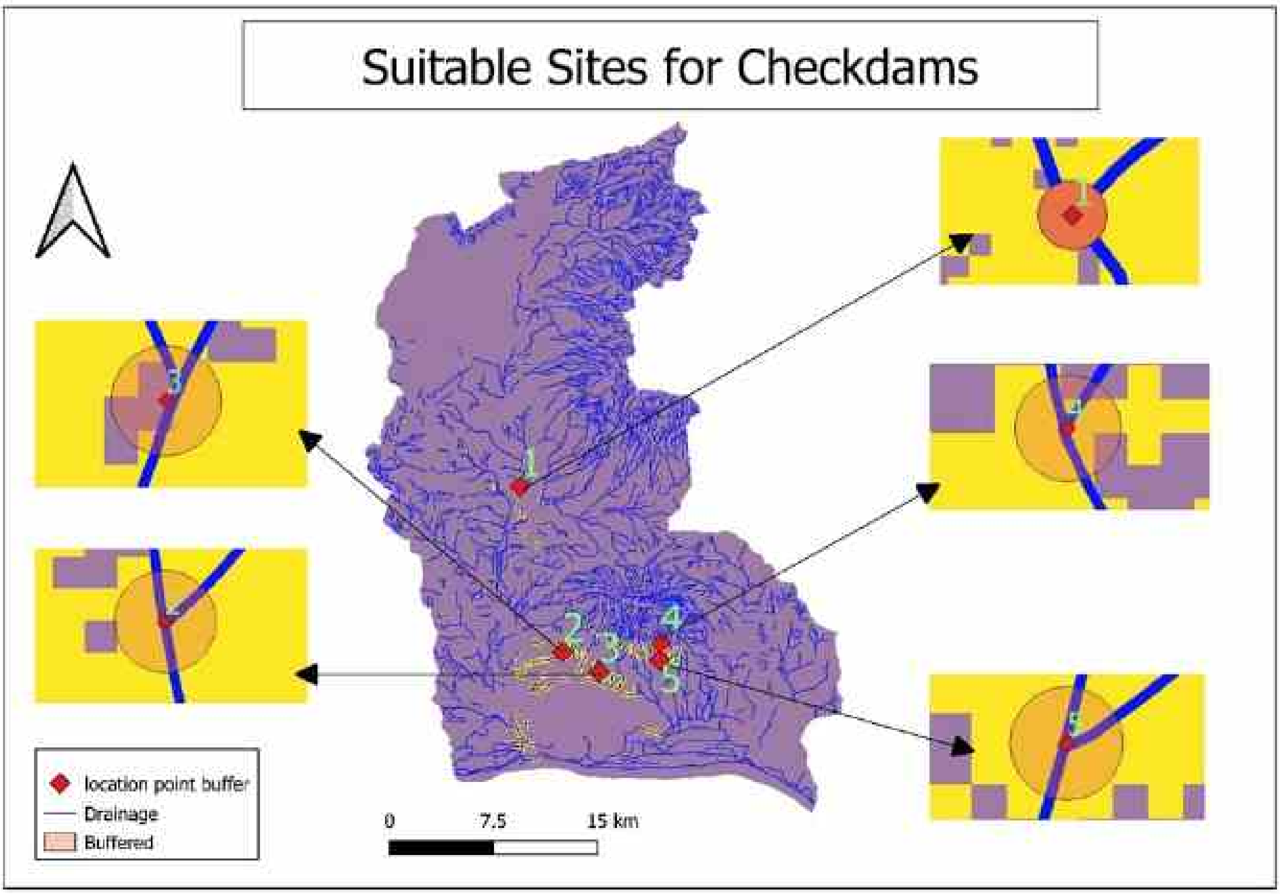


Figure 11: Suitable sites for checkdams identified (red points) in each buffered zones of drainage flow meets at Karaipottanar sub-basin

7.0. DISCUSSION

The various thematic layers of soil, drainge, landuse and landcover were presented alogn with the slope and aspect of the locations. Since, Karaipottanar sub-basine is a pristine site where no such checkdams were constructed, this study calls for more importance and serving the public. The selected check dam would be effectively used for storage of water in the monsoon season when the discharge decreases. This also suggest an effective site for construction of low-cost dam to arrest mud flows. These suggested sites would be useful in conserving water during the monsoon season and the villages nearby to the survey locations will be highly beneficial. In addition, for further analysis, the incorporation of landuse and landcover will also be suggested in order to ensure the land availability incluidng soil stability for construction. This study also suggests the suitable checkdam sites, but the technology may be applied for selection of sites for bigger dams as well.

8.0. CONCLUSION

The present study has shown that geo-spatial approach of integrating GIS and remote sensing are useful tools for integrating various information / thematic layers and select suitable sites for checkdam construction in arid or rainfed regions like Karaipottanar sub-basin in Namakkal district. Moreover, the above advanced technologies will be cost-effective and reduce the time and extent of the area to be investigated. However follow-up through thorough field investigation before implementation is a must in any selected location. Since, landuse and landcover has several crops and vegetation types to be considered, a detailed approach on the same has to be initiated before finalizing the checkdam sites. As it was observed that siltation is the major problem which hindered the storage of water, proper care has to be taken to avoid the siltation while constructing the checkdams.

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ANNEXURE VI

(Assessment)

a. Practical Exam
b. MCQ

DEPARTMENT OF GEOGRAPHY
SCHOOL OF EARTH AND ATMOSPHERIC SCIENCES
UNIVERSITY OF MADRAS
DST-NRDMS WINTER SCHOOL
Practical-Geospatial Technology

Date : 07-03-2020 Time : 11.00 – 2.00 pm
Duration : 3 hours Max. : 30 Marks

Answer the following Questions (6 X 5 =30)
All questions Carry equal marks

INSTRUCTIONS

GENERAL

- *Create a folder in your name on the desktop. All the data and results should be in this folder.*
- *The data for the practical exam is to be copied from the "DST Winter school Practical exam" folder from the Z drive. The time allowed to copy the data is 20 mins after which the common drive will be disabled.*
- *Verify the files in your desktop after copying it.*

DATA

- Question 1: *Data – Toposheet 66C_4*
- Question 2: *Data - Tamilnadu.shp*
- Question 3: *Data - taluka.shp, tamilnadu.shp, airport.shp*
- Question 4: *Data - Landsat -8 Bands 2,3,4,5*
- Question 5: *Data - Landsat -8 Bands 2,3,4,5 & Kancheepuram.shp*
- *Question 6: DEM Data*

OPTIONAL

- All the results shall be documented in a file using documentation software of your choice

1. Complete the following tasks ***(QuesNo.1 Data)***
   a) Georeference the given Toposheet
   b) Project it into UTM 44N.
   c) Digitize the Cholavaram Tank / Large Tank
   d) Calculate the area of the water body

2. Create a population density map of Tamilnadu with appropriate class interval from the Data; only population attribute is in the table. Add area attribute using field calculator ***(QuesNo.2 Data)***

3. Identify the taluk which fall under the following airport buffer of 250 KM & represent it in a map. ***(QuesNo.3 Data)***

4. Perform the following for the data given below ***(QuesNo.4 Data)***
Task 1: Create natural color composite and ration images of Blue/NIR & Green/NIR
Task 2: Create a NDVI
Task 3: What is the significance of the above images?

5. Jeenu is going to Kancheepuram by today 2:00 PM. she requires a map to understand the land cover in Kancheepuram. With the data provided above create a four class land cover map to help her. ***(QuesNo.5 Data)***

6. Using the DEM generate Slope and Aspect Map. What is your understanding the difference between slope and Aspect? ***(QuesNo.6 Data)***

Name:

DEPARTMENT OF GEOGRAPHY
School of Earth and Atmospheric Sciences
University of Madras, Chennai-600025

DST-NRDMS WINTERSCHOOL

Multiple Choice questions (20X 1=20)

1. Remote sensing survey techniques make use of the properties of ………………………………………emitted, reflected or diffracted by sensed object
a) Electric Waves
b) Sound waves
c) Electromagnetic waves
d) Wind waves

2. The NDVI is calculated by ……………………………
a) NDVI = (NIR + Green)/(NIR - Green)
b) NDVI = (SWIR − Red)/(SWIR + Red)
c) NDVI = (NIR − Red)/(NIR + Red)
d) NDVI = (NIR − Red)/(SWIR + Red)

3. The reflected energy from surface is stored as______________ in a SRTM image
a) Reflectance
b) Radiance
c) Digital Number
d) Digital Elevation

4. The Band 8 of SENTINAL 2A is
a) Red
b) Near Infrared
c) Green
d) Short wave Infrared

5. Which one of the following operation is used to stitch two or more images?
a) Clipping
b) Mosaicking
c) Sub setting
d) Mapping

6. ___________ Remote sensing system uses its own energy spectrum
a) Microwave and Optical
b) Active
c) Microwave
d) Option b & c

7. Which one of the following sentences are wrong?
    A. Supervised classification does not require training data
    B. Unsupervised classification does not require training data
    C. Cannot define the number of classes required in supervised classification

a) A
b) B
c) A & B
d) A & C

8. Which one of the following band combination will form a true color composite in Landsat 5

a) Blue, Green, Red
b) NIR, Green, Red
c) Green, NIR, Blue
d) Red, Blue, SWIR

9. Microwave remote sensing is based on

a) Reflectance
b) Emissivity
c) Energy scatter
d) Energy Absorption

10. Spatial resolution represents

a) Number of pixels
b) Number of bands
c) Ground representation
d) Storage capacity

11. The revisit period of a satellite is

a) Spatial resolution
b) Radiometric resolution
c) Spectral resolution
d) Temporal resolution

12. Slope is measured in terms of

a) Degrees
b) Elevation
c) Distance
d) None of the above

13. GIS deals with which kind of data

a) Numeric data
b) Binary data
c) Spatial data
d) Complex data

14. Which one of the following is a large scale map

e) 1:250000
f) 1:50000
g) 1:10000
h) 1:2000

15. Which of the following is true for Spatial Interpolation

a) Kriging
b) IDW
c) Natural Neighbour
d) All of the above

16. Which of the following is Indian Based Navigation System

a) GNSS
b) GPS
c) IRNSS
d) GLONASS

17. Which of the following represents map merging operation

a) Union
b) Intersection
c) Identity
d) Clipping

18. If the maximum pixel value of the image cannot exceed 255, what is the radiometric resolution?

a) 1 bit
b) 1 byte
c) 8 byte
d) 7 bit

19. Which software tool is used for text formatting for publication?

a) Word
b) Spread sheet
c) Lyx
d) PAST

20. Urban Heat Island is related to

a) Development
b) Excess pollution
c) Residential density
d) Absence of water bodies

ANNEXURE VII

(Field Work Report of the Participants)

Annexure -7

NRDMS-DST - Winter School on GEOSPATIAL TECHNOLOGIES

NRDMS-DST, Government of India, New Delhi Sponsored

21 days Winter School on Geospatial Technologies

(17th February, 2020 – 08th March, 2020)

PARTICIPANTS FIELD WORK REPORT

सत्यमेव जयते

Department of Science & Technology
Govt. of India

Organized by

Department of Geography
University of Madras
Guindy Campus, Guindy
Chennai – 600 025

SAMRTPHONE BASED FIELD ANALYSIS AND SPATIAL DATA VISUALIZATION AND MAPPING OF ADYAR IN CHENNAI DISTRICT. (SUNDAY TASK)

Sangunathan, U

Department of Geology, University of Madras, Chennai

Introduction

Smart phones with a GPS essential app when turned on can collect satellite details such as latitude, longitude, altitude, noise and track details. We were given a task to prepare a Geographical Information System (GIS) map with assigned tasks of noise, track and weather details. The points collected can be saved for offline use (though there is a limit to the size of the map that can be saved at once). This will help to verify the location in the field.

The collected data can be saved to after collecting the field coordinates. The data will be then converted to KML files to plot them on Google Earth. While using this method, the sensitivity (accuracy) of GPS point capture would depend upon the quality of the device, the better it is, less variable the captured data will be. This way, it will be least costly when using Google Maps. If you are on budget, you can invest more and purchase GIS software for mapping.

Objectives

1. To collect noise samples using wireless application protocol (WAP) and convert the non-spatial data for geostatistical analysis.
2. To create and visualize track data collected using WAP device from the field.
3. To capture the geographic objects (trees, buildings, religious places, monuments etc.,) and geotag the photographs with attribute data.
4. To monitor/map the local climatic parameters of the area.

Study area

Smartphone based filed work has been carried out in Adyar of Chennai district. It is a large neighbourhood in south Chennai (formerly Madras), Tamil Nadu, India. It is covered by lat long of 80.235 to 80.280 East and 12.990 to 13.015 North and it is located on the southern banks of the Adyar River. It is bounded by the Buckingham Canal to the west, Tiruvanmiyur to the south, and Besant Nagar to the east. Adyar is one of the costliest areas in Chennai with property values four times the value of similar sized properties in the northern part of Chennai.

Methodology

Task 1: Noise Pollution Mapping

Steps involved for the task 1 is that, installation of GPS Essentials app and WideNoise Plus from google play store. Measure the Noise level at different locations in study area by using WideNoise Plus app. That has been exported as KML file and sent to the email of mine.

Task 2: Tracking Data

This involves tracking the way of sample collection by using GPS essential app and send to the respective email to be downloaded in QGIS.

Task3: Point data capture and geotagging photos

This task consist of capture the location photos where the noise samples collected and that photos should be sent to email for further process.

Task 4: Collection of atmospheric data from Windy app.

This task is started with installation of Windy app and measures the required atmospheric parameters in one hour interval of time. The data will be tabulated and plotted as a graph and GIS maps.

Task 5: Processing these data with QGIS in Lab

Result

Spatial distribution of Noise level shows near Adyar depot which due to high traffic condition and the lowest values presented in interior of Besant Nagar where the area is undisturbed from noise of traffic and other hassles on road. The collected noise level data was given in **Table 1** and illustrated in **Fig 1.** The track was started from Besant Nagar to Madras University Gate-I Guindy and this was over laid on spatial diagram of Noise level diagram **(Fig 1)**. The geotagged images were collected from the study area and shown in Fig 2. Data collected by Windy app (Humidity, Temperature, NO_2, Aresol and O_2) was tabulated in Table 2 and changing trend of values was shown in **Fig 3**. All the work in this project has been carried out with the support of QGIS and Smartphone Apps such as Windy and GPS Essentials.

Table 1 Noise Level Data of around Adyar in Chennai district.

Sample No.	Lacation name	Noise level
1	UNOM Gate 1, Guindy	81
2	UNOM Gate 2, Guindy	82
3	UNOM Boys Hostel	66
4	UNOM Power Station	71
5	Velankkani Church	80
6	Elliot Beach (Chai King)	78
7	Elliot Beach (Dwaraka Building)	85
8	Elliot Beach (Police Booth)	81
9	Elliot Beach (Near Thalapakkatti Biriyani)	81
10	32 Cross Street	85
11	OMHS	76
12	Tennis Court	76
13	Asian Hospital	80
14	Spencer daily	81
15	Vannandurai	79
16	Pillayar Koil	80
17	Ramar koil	81
18	Krishanmurthy Foundation	71
19	Theosofical Society	81
20	Ponniyamman Koil Street	81
21	Adyar signal	80
22	Gandhi nagar signal	83
23	Madhya Kailash Temple	81
24	Cancer Institute	82

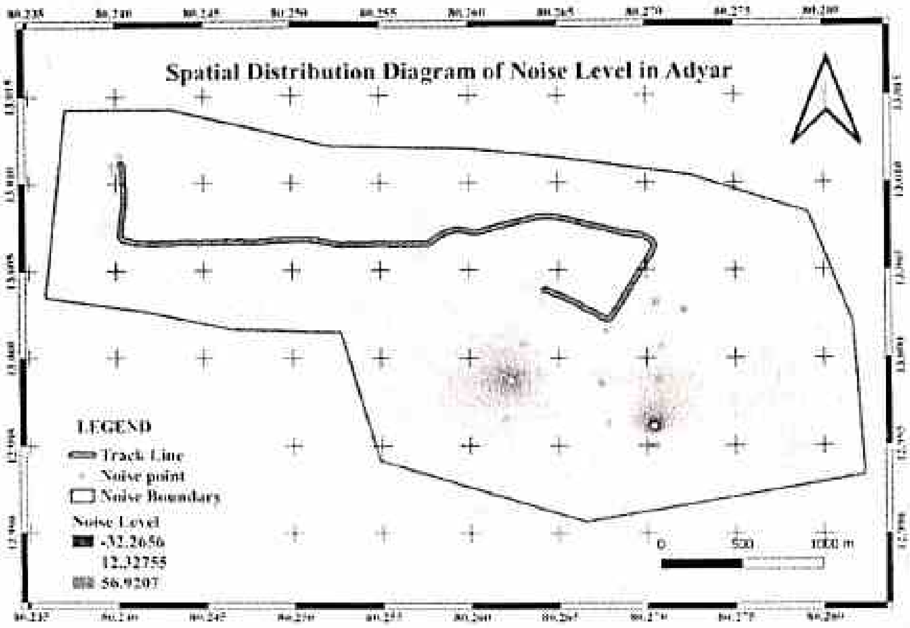


Figure 1: Spatial distribution of Noise level and Tracking data of Adyar, Chennai

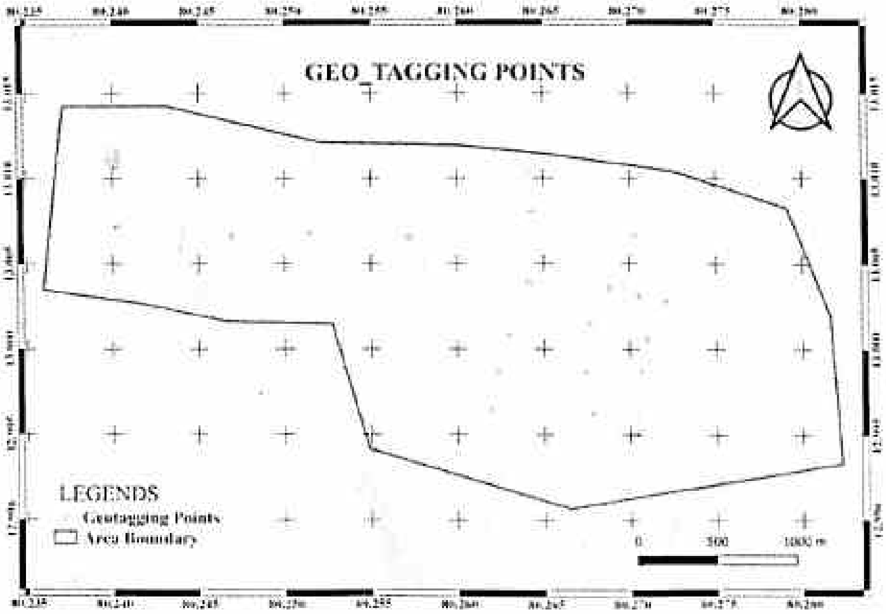


Figure 2 Geotagged locations (yellow points) of the study area in southern Chennai

Table 2 Windy data for required atmospheric parameters

S.No.	Place	Lat	Long	Time_T	Temp. (C^0)	Humidity (%)	AQ_NO_2 (μg/m3)	AQ_Aero	AQ_ O_2
1	Elliot Beach	12.996179	80.270323	10	29	54	8.48	0.407	263
2	Elliot Beach	12.996179	80.270323	11	28	54	4.88	0.407	269
3	Elliot Beach	12.996179	80.270323	12	25	53	3.33	0.406	269
4	Elliot Beach	12.996179	80.270323	13	24	51	3.33	0.401	269
5	Elliot Beach	12.996179	80.270323	14	24	51	2.84	0.358	269
6	Elliot Beach	12.996179	80.270323	15	23	52	2.13	0.345	269
7	Elliot Beach	12.996179	80.270323	16	23	58	2.13	0.331	269
8	Elliot Beach	12.996179	80.270323	17	23	67	2.13	0.315	269
9	Elliot Beach	12.996179	80.270323	18	23	70	4.56	0.3	269
10	Elliot Beach	12.996179	80.270323	19	26	74	6.41	0.277	269
11	Elliot Beach	12.996179	80.270323	20	26	78	7.12	0.277	269
12	Elliot Beach	12.996179	80.270323	21	27	83	9.84	2.61	269
13	Elliot Beach	12.996179	80.270323	22	28	84	16.18	0.257	269
14	Elliot Beach	12.996179	80.270323	23	30	84	16.18	0.244	269
15	Elliot Beach	12.996179	80.270323	24	30	86	17.56	0.244	269
16	Elliot Beach	12.996179	80.270323	1	30	86	19.97	0.244	269
17	Elliot Beach	12.996179	80.270323	2	27	90	19.97	0.244	269
18	Elliot Beach	12.996179	80.270323	3	27	91	19.97	0.244	260
19	Elliot Beach	12.996179	80.270323	4	27	92	19.97	0.236	263
20	Elliot Beach	12.996179	80.270323	5	27	91	19.97	0.22	263
21	Elliot Beach	12.996179	80.270323	6	26	80	18.21	0.22	263
22	Elliot Beach	12.996179	80.270323	7	26	79	7.58	0.2	263
23	Elliot Beach	12.996179	80.270323	8	26	78	5.64	0.18	263
24	Elliot Beach	12.996179	80.270323	9	26	78	3.5	0.18	263

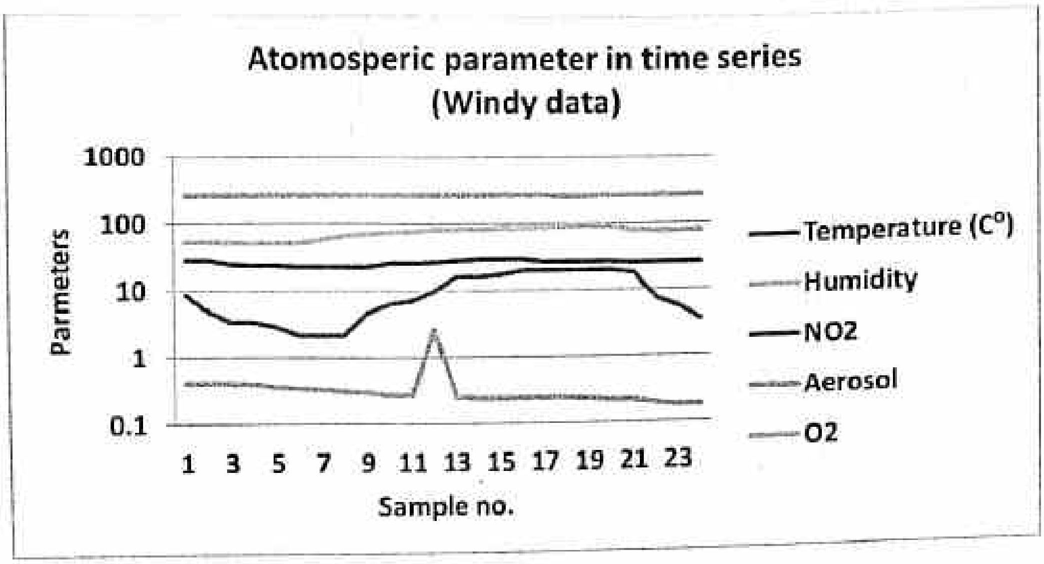


Figure 3: Windy data in time series.

CHANDAN KUMAR.

Sunday Tasks

Introduction

The first Sunday of the twenty-one days DST-NRDMS Winter School Program was designed to be a productive and fun day. Four different tasks were assigned to the participants. The tasks were aimed at collecting data using free mobile apps (mainly android).

Objectives

The Sunday tasks had following objectives:

1. To collect noise samples using wireless application protocol (WAP) and convert the non-spatial data for geostatistical analysis.
2. To create and visualize track data collected using WAP device from the field.
3. To capture the geographic objects (trees, buildings, religious places, monuments etc.,) and geotag the photographs with attribute data.
4. To monitor/map the local climatic parameters of the area.

Methodology

The noise samples were picked up along the ECR Road from Marina Beach, Chennai to Mahabalipuram. The noise samples were detected in the field using *Widenoise* android app and the data were added into *GPS essentials* app. Similarly, the track data was collected from Besant Nagar Chennai to University of Madras, Guindy Campus using *GPS essentials* android app. The photos of interesting features were taken using *GPS essentials*. The climatic parameters were collected using *Windy* android app.

Results

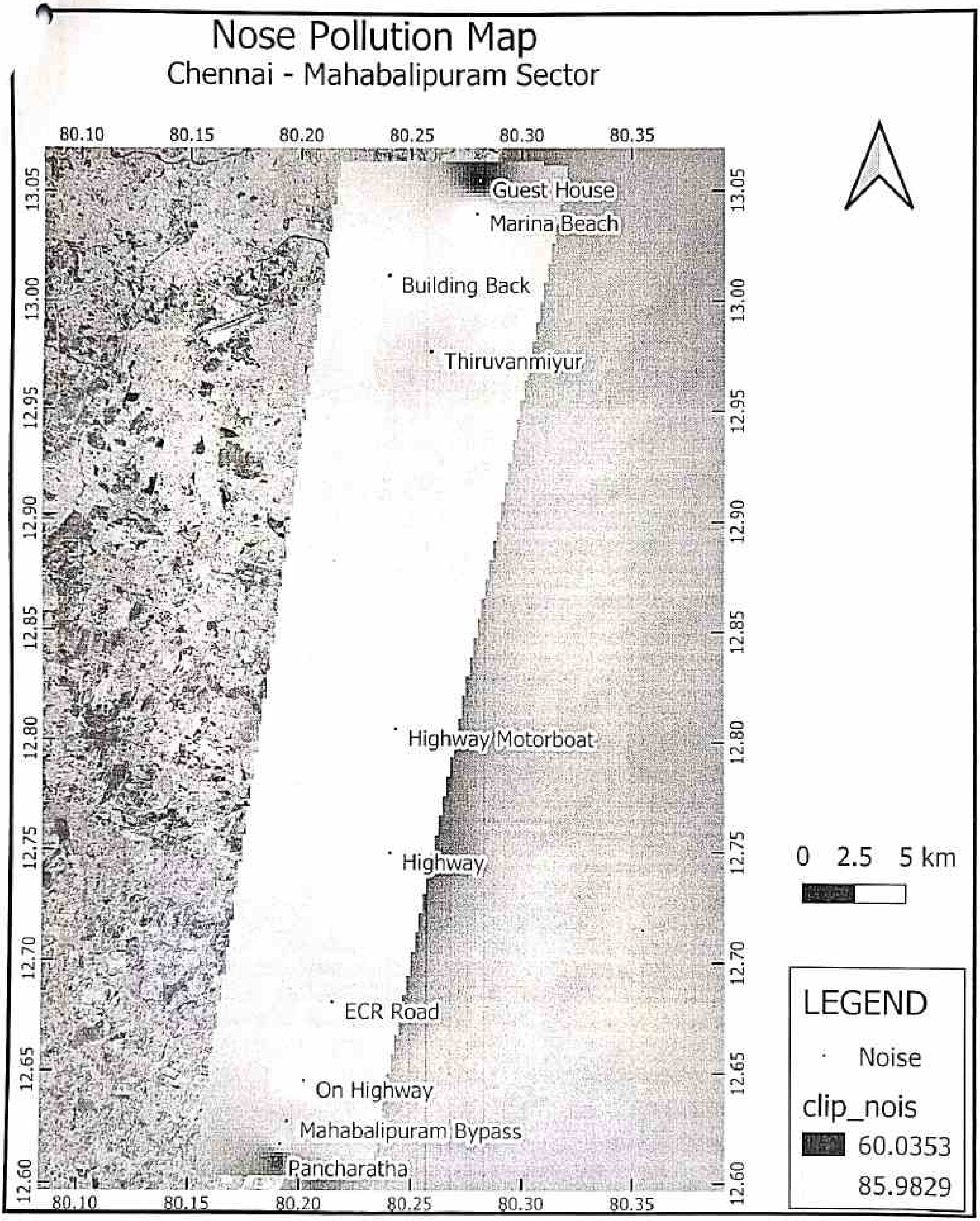
The data obtained in the field were imported into QGIS 3.10 software in the Geoinformatics lab of Department of Geography, University of Madras. The IDWS interpolation technique was applied to visualize the distribution of noise and humidity samples. The track data and geotagged photographs was overlaid on google image using QGIS. The final maps prepared are given as separate pdf attachments. The noise and humidity data used are given in Table 1 and 2 below.

Table 1: Noise samples along ECR (Chennai to Mahabalipuram)

Location	Noise (db)
Front Gate	73
Building Back	83
Outside Gate	82
Marina Beach	86
ECR Road	74
Mahabalipuram Bypass	71
Rock Garden	74
Pancharatha	61
On Highway	77
Highway	83
Highway Motorboat	80
Thiruvanmiyur	73
Guest House	60

Table 2: Temperature (T), humidity (H) and wind speed (WS) samples along ECR (Chennai to Mahabalipuram)

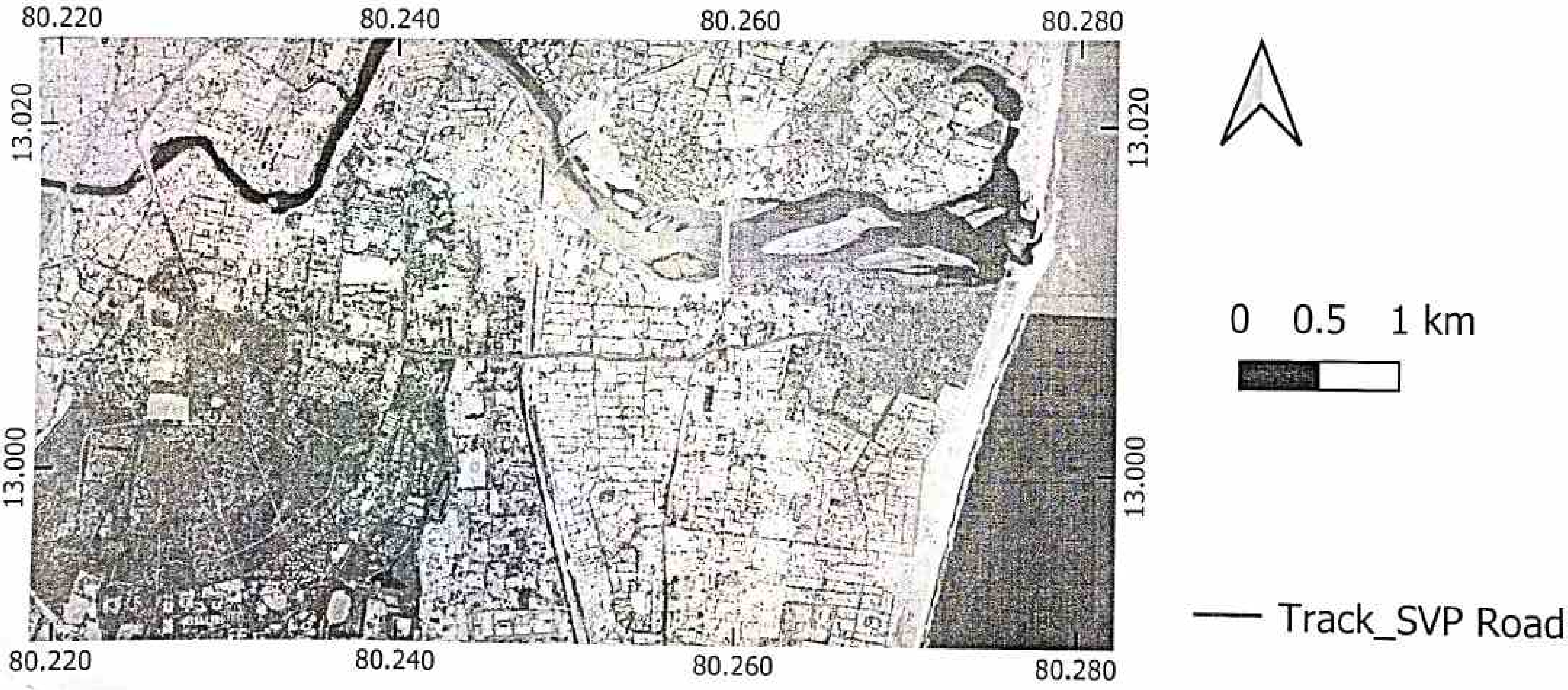
Place	**Long**	**Lat**	**T (°C)**	**H (%)**	**WS (km/H)**
Pondy	79.8401	11.9714	24	75	16
Pondy	79.8401	11.9714	24	70	16
Pondy	79.8401	11.9714	24	79	16
Uni Guesthouse	80.281	13.054	26	76	8
Santhome Church	80.278	13.052	27	73	9
Uni Guesthouse	80.281	13.054	27	76	9
Ice house	80.273	13.053	28	77	9
Villivakam	80.207	13.105	29	77	7
Kumaraswamy nager	80.202	13.121	29	78	8
Anna Nagar	80.212	13.089	27	77	8
Solinganallur	80.221	12.896	27	78	7
City centre	80.274	13.043	27	74	9
Lifestyle Entrance	80.276	13.052	27	75	10
INOX	80.264	13.059	26	75	5
Uni Guesthouse	80.282	13.054	26	76	8
Uni Guesthouse	80.282	13.054	26	76	7


Nose Pollution Map
Chennai - Mahabalipuram Sector
80.10
80.15
80.20
80.25
80.30
80.35
13.05
13.00
12.95
12.90
12.85
12.80
12.75
12.70
12.65
12.60
Guest House
Marina Beach
Building Back
Thiruvanmiyur
Highway Motorboat
Highway
ECR Road
On Highway
Mahabalipuram Bypass
Pancharatha
0 2.5 5 km
LEGEND
Noise
clip_nois
60.0353
85.9829

Task 2

Tracking Data

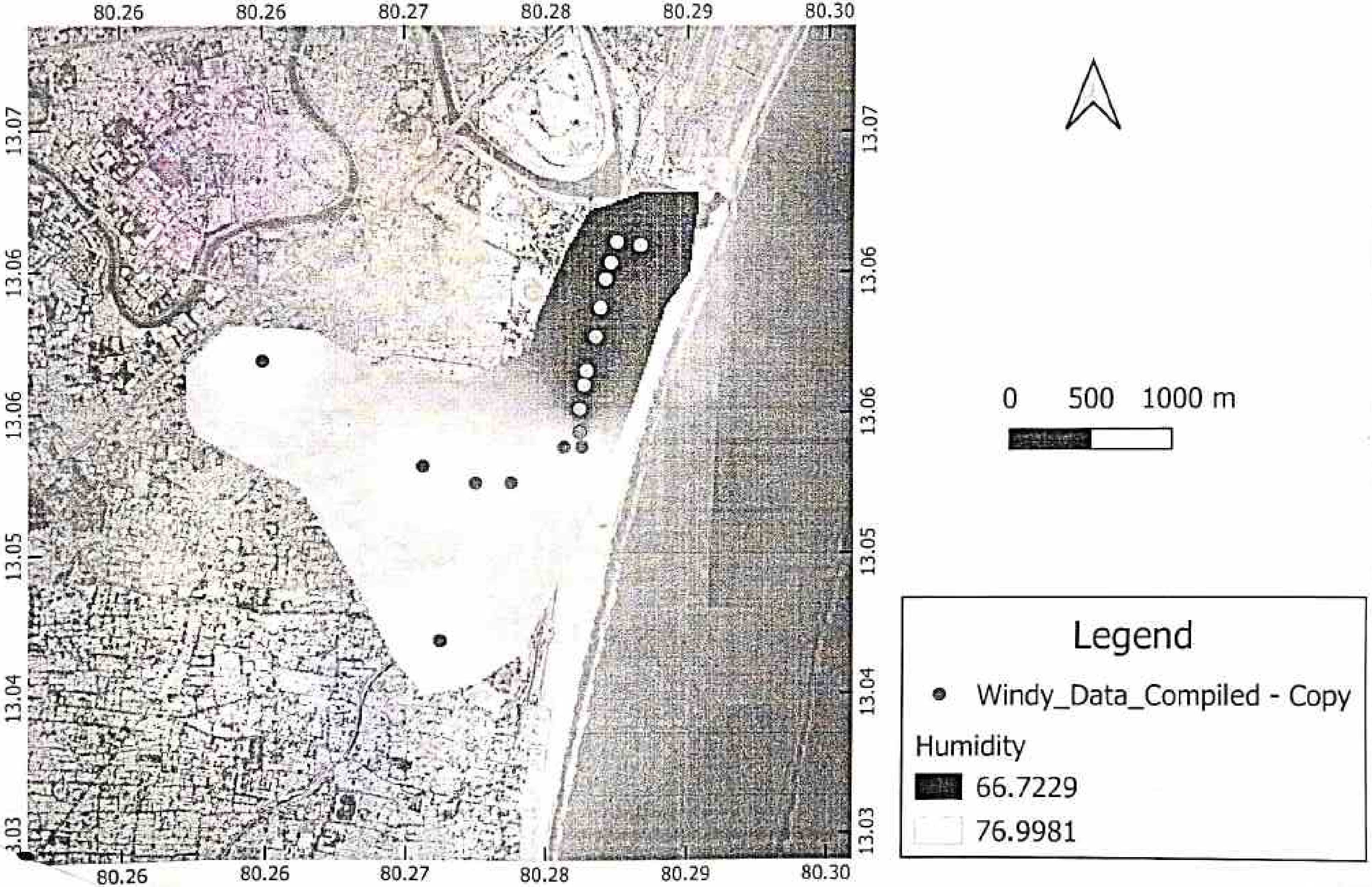
Along SVP Road, Chennai



Task - 4

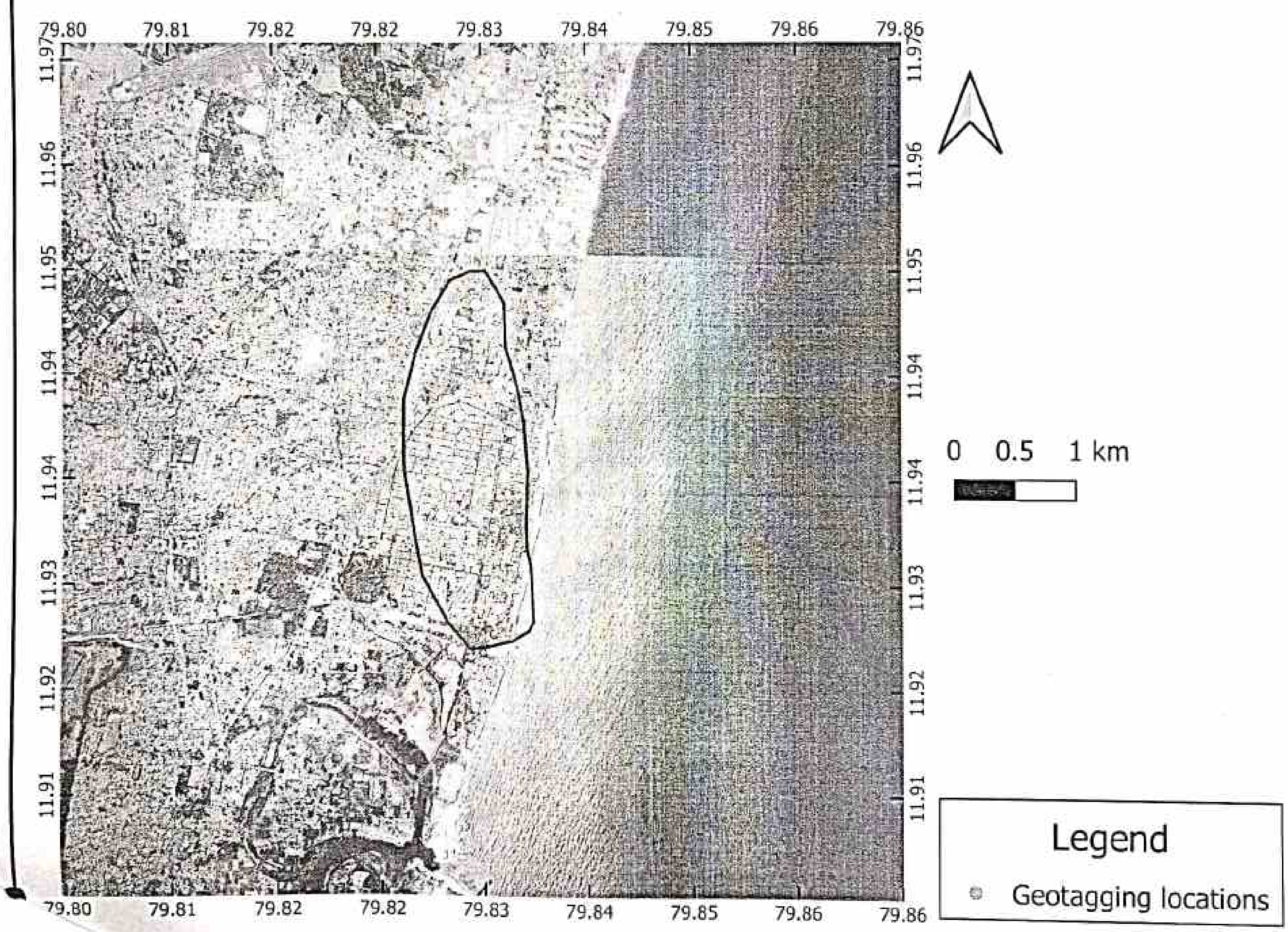
Windy (humidity)

Chennai City



Task 3

Geotagging



NOISE POLLUTION MAPPING

Raju. P

Introduction

Noise pollution is a one of environmental pollution which cause health problems for people and wildlife. It could be measured and planned accordingly to reduce noise pollution. In terms of plan to reduce noise, it needs the data spatially were the higher and lower level of noise. According to WHO, if noise level is more than 70 db is effects more the risk of myocardial infarction. The Noise pollution data were collected by using GPS essential mobile android app with spatial reference which helps to know variation of noise in different location. Noise data measured in db and location saved in decimal. Data were incorporated with QGIS by converting those collected datasets in KML using Google Earth Pro.

Aim

To analyse noise pollution in Tharamani, Chennai.

Objectives

1. Point capture
2. Track capture

Methodology

Noise data collection done by GPS essential mobile android app in the field. Data were converted in google earth for easy to import that files with GIS software. Using QGIS interpolation techniques used to understand spatial variation of noise level and visualised layout with proper map elements.

Analysis and discussion

Task – 1 Noise pollution mapping

The noise collected in stretch from The University hostel to nearest state highway road in Tharamani was ranged from 57.04 db to 80.97 db. The observation shows that the minimum level recorded in the area of inner place of hostel. The maximum recorded in the area of nearby state highway due to vehicles. There was not much variation is shows that higher in higway area lower in the area of hostel and other residential place. So, to reduce the noise level could be done if trees were planted along the road side.

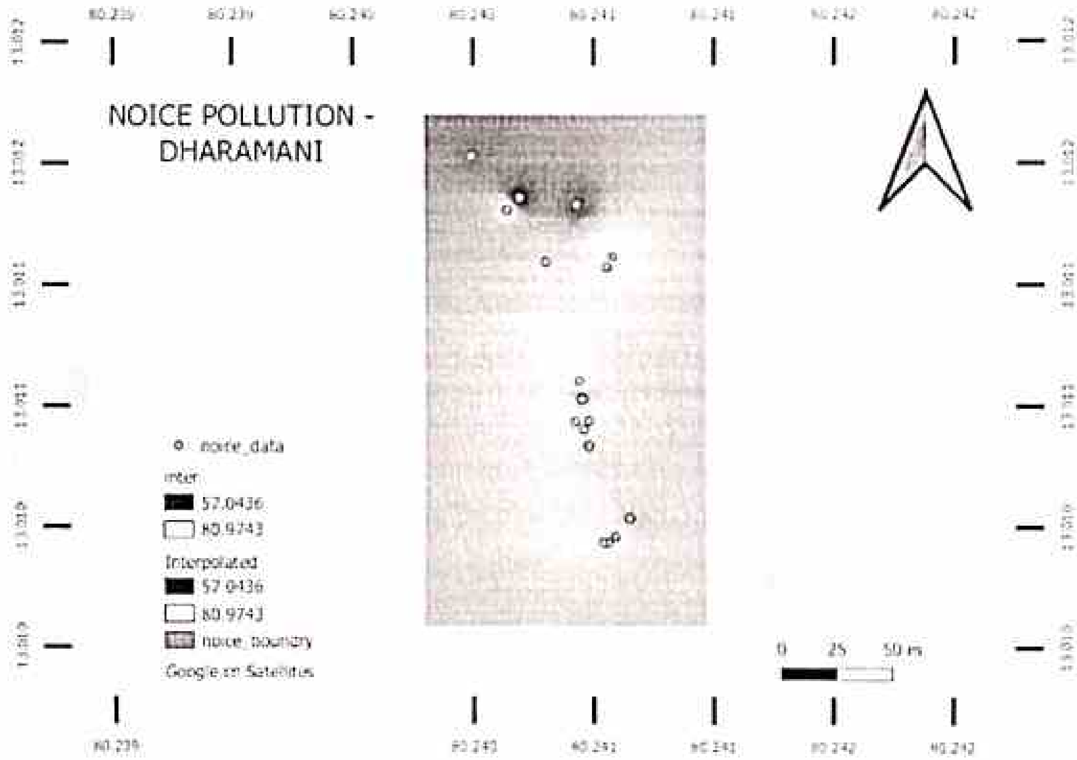


Fig.1. Noise level mapping in Tharamani

Task -2 Tracking with GPS

Tracking of data by using GPS Essential recorded track by following area of noise pollution data. The same stretch was used for tacking data collection from the hostel play ground of Tharamany campus in Madras and analysed map below the tracking analysis using Q-GIS.

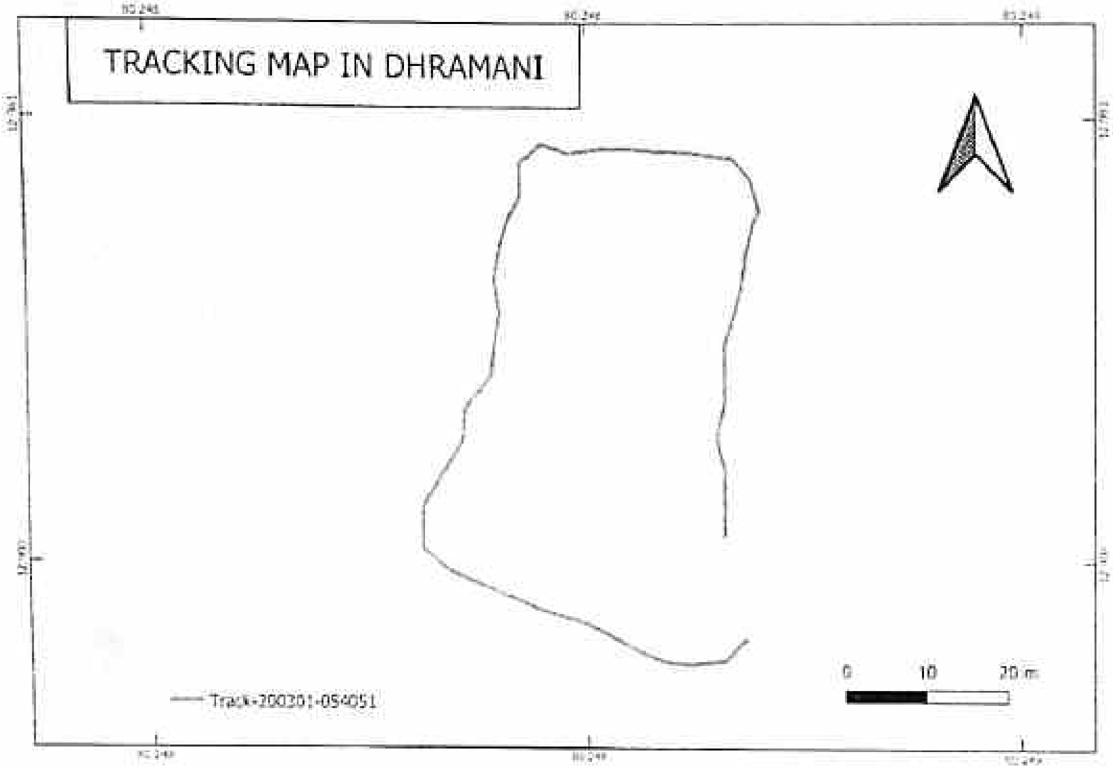


Fig.2. Tracking map in Tharamanai

Conclusion

Track map were successfully mapped with using QGIS software from collected datasets.

REPORT ON THE USE OF VARIOUS GPS APPS AND ITS INTEGRATION IN QGIS.

AIM OF THE TASK -

(1) To collect Noise samples in the fieldusing WAP and convert non spatial data into spatial data for geostatistical analysis.

(2) To create and visualize track data collected using WAP device from the field.

(3) To point capture images and Geotagg the photos.

(4) To map the local climatic parameters of the area for every 2/4 hours.

STUDY AREA –

The sites chosen were mostly around the Guest house of University of Madras, Marina Campus and few locations were taken in the Guindy Campus of University of Madras.

METHODOLOGY –

Apps like GPS Essentials, Wide Noise, and Windy App were installed from the google play store.

GPS Essentials- Navigate, manage waypoints, tracks, routes, can build own dashboard from 45 widgets.

Wide Noise – Measures sound samples in decibels.

Windy App – This app helps in determining weather forecast at each interval of 2/4 hrs.

GPS Essentials were checked for the satellite visibility. Standing at a point the wide noise app (noise samples in dB) coordinates and other details were documented in the Essentials.

The GPS Essentials was also used for capturing the track.

The windy app was used as well to take the readings of the humidity of various places of Chennai. The readings were noted down.

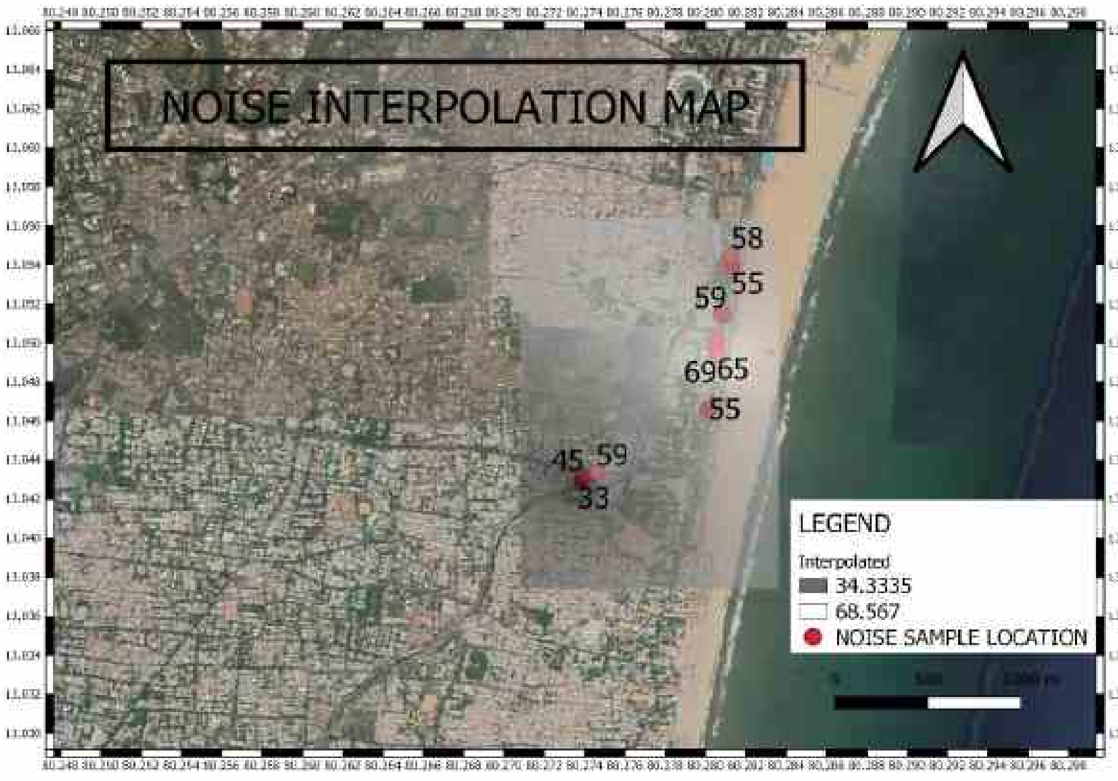
Coming to the lab all the four of the task was integrated in the QGIS 3.10 using various options available. Interpolation was carried out in the noise sample study for better understanding.

For each of the task a map lay out was made in order to study the parameters and site well.

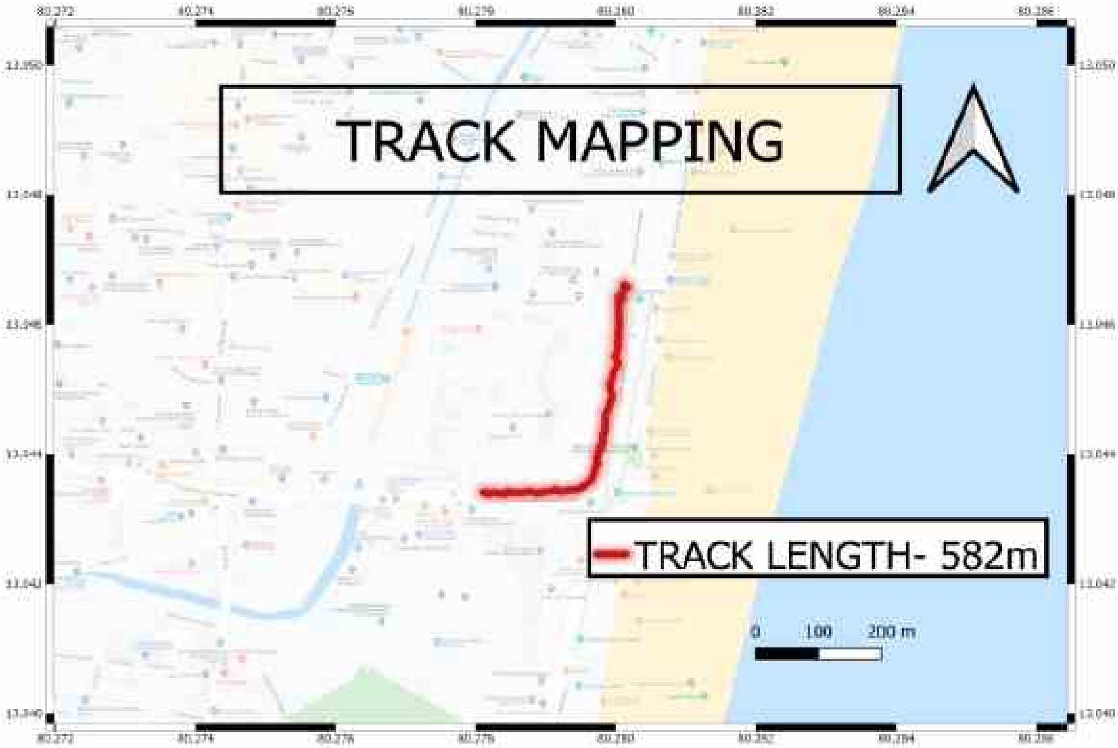
RESULT AND DISCUSSION-

In this paper we take into account the noise samples taken in the periphery of University of madras, Marina Campus, Guest house of University. The datas were integrated and interpolated in QGIS 3.10 software for noise mapping. **Interpolation** is a commonly used GIS technique to create continuous surface from discrete points. Spatial interpolation is the process in which we use points with known values to estimate values at other unknown points. In our mapping spatial interpolation can predict the noise samples even when only few areas were sampled by using known noise samples. As shown in the Map below (Map - 1) it depicts that the area that are white in colour are the regions that are noisy (69dB, 65dB) are the higher noise levels as compared to the darker one that lies below the interpolation area (45dB,33dB) are the lower noise level in decibels). Basically the areas with higher decibels value are the market areas since it has a lot crowd and that of the lower decibels are the University of Madras Campus as its an Educational Institution.

In the second task as well the track was taken from a point starting near the City centre in Chennai up to around 582m (Map - 2).The track pathway were integrated in the QGIS and was drawn out as a map layout as depicted below.



Map - 1



Map - 2

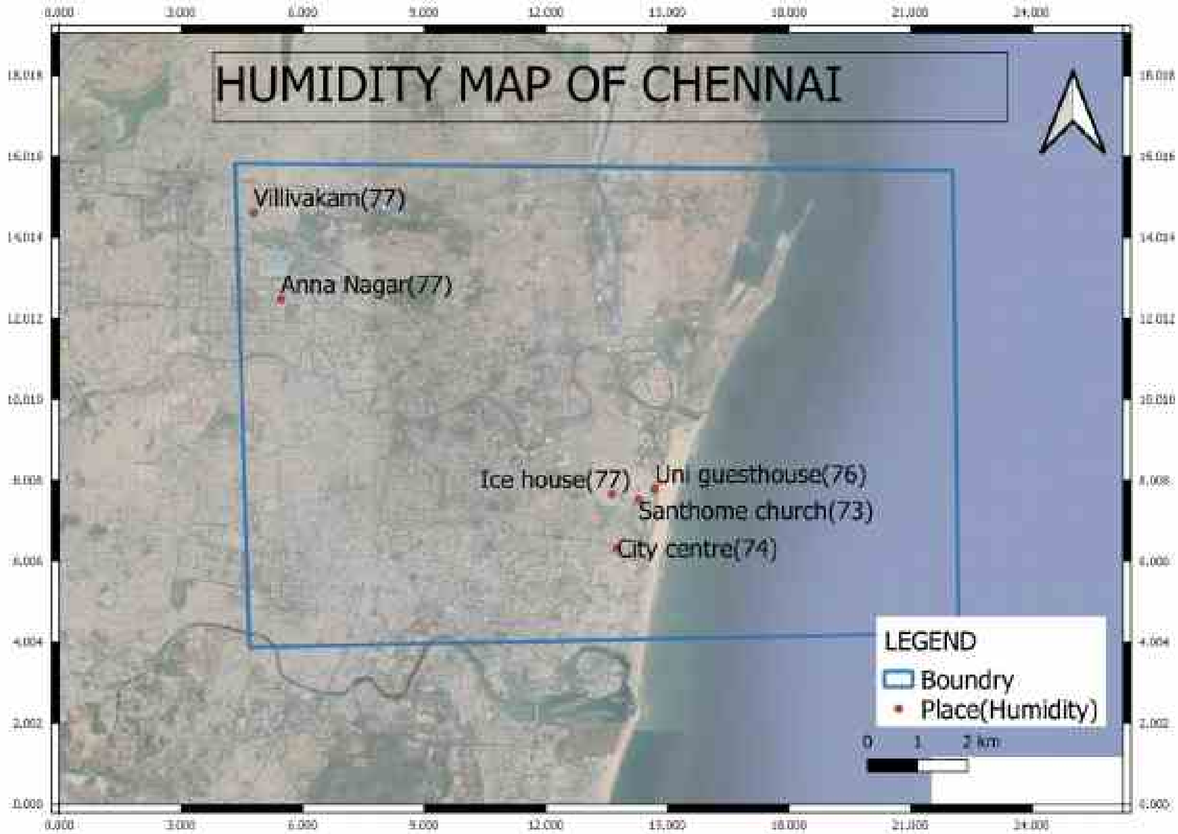
In the third task few photos like signature landmarks, trees were taken and were geotagged in QGIS as shown below by the map layout (Map - 3).

Map – 3

In the fourth task we took five places around Chennai and recorder their humidity and plotted them in map as well. The tabulation 1 is shown below. The University of Madras guest house (Uni guest house) shows the higher humidity percentage of 76% that may be contributed due to the presence of sea beach and that of the Santhome church the lowest among them that is 74%.It means air is filled 78% of its capacity to hold water(moisture). 24% capacity is still left after which the evaporation would stop. This in turn makes the region uncomfortable for humans.

Place	Latitude	Longitude	Humidity (%)
Uni guesthouse	13.054	80.281	76
City centre	13.043	80.274	74
Santhome Church	13.052	80.278	73
Anna Nagar	13.089	80.212	77
Villivakam	13.105	80.207	77
Ice house	13.053	80.273	77

Table – 1



Map - 4

<u>CONCLUSION</u> –

Through the various apps used along with QGIS 3.10 helped to learn a lot about Mapping. The information collected by this field study helped to know lot about the mapping elements that are to be used while drawing maps.

2020

Winter School on Geospatial Technologies

University of Madras, Chennai

Geospatial Analysis of Noise Level and climatic Elements in Chennai

Dr. Amit Kumar

24 February 2020

Introduction

Environmental pollution such as air, water, hazardous waste and noise pollution has always been a global concern affecting both the public's health and the planet's fragile ecosystems. The concentration of environmental pollution is significantly increasing and causing serious threat to the quality of the environment. Management of environmental pollution is a challenge. Although there are many management techniques, the problem of environmental pollution still remains the same. One of the serious issues of environmental pollution is noise. Noise pollution in large urban areas is regarded as a growing problem of communities.

Currently, noise pollution in urban environment is one of the serious issues of concern in major cities of world. There are various factors that contribute to increase of noise levels in urban areas. One of the factors is the increase in urban population, which contributes to high traffic volume combined with increased intensity. In most urban areas, the corridors are developed in a close proximity where people live and work, which led to limited space and thus increase the number of high rise buildings. This type of settlement created a dense environment in urban areas, thus increasing the traffic volume. Numerous countries have implemented new technologies to control noise pollution in urban areas. For example, low noise generating engines, changes in quality of tyres, changes in road material.

GIS For Noise Mapping

GIS provides the central database management environment and noise data can be imported into a GIS. The phenomena of noise involve spatial distribution and dynamic process that fits into GIS environment. New mapping approaches supported by a GIS can be combined with spatial data analysis and mathematical modeling that further improves the quality of noise maps. Noise maps provide spatial presentation of acoustic situation. Noise maps build in GIS can be used for analysis and management process. GIS provides good visualization tools of noise propagation and assist in building a spatial decision support system that can be used for decision making process. Noise effect can be determined in GIS by combining noise levels with the location of people living in the area and their sensibility to noise (Kluijver de Henket al., 2003). Measurement of noise in the field is difficult because of various factors, such as, variation in traffic flow, speed, type and variation in weather conditions. Noise maps found to be very helpful for assessment of noise effect.

Changes in extreme weather and climate events have significant impacts and are among the most serious challenges to society in coping with a changing climate. The relationship between climate and the hydrologic regime of the oceans exhibits a different character. While the regime of ocean currents depends substantially on wind, radiation, and thermal conditions at the surface of the oceans, the heat transfer by currents in its turn represents an important climate-forming factor. In the regions of warm and cold marine currents, climatic conditions are sharply different. In some cases, these changes extend over great distances. Climate is greatly affected by the warming and cooling of the upper layers of ocean water. The change in heat content of this water called forth by changes in the meteorological regime itself produces a great influence on atmospheric processes.

Data: Data for the present study was collected on 24 February 2020 through the mobile app.

GPS ESSENTIALS

We have gone through mobile app GPS essential and collected information regarding way point, tracking data and air pollution.

Create Way Point

1. Creating way points 1.From the main menu, select Waypoints. 2. Select the Add tool to create the waypoint. 3.It will start recording 1st waypoint. Change the attributes of the waypoint (Wide Noise Plus) and then press Back to get back to the list.

Geotagged Photo

1. From the main menu, select Camera. 2. Take a picture of desired area for geotagging. 3. The photo taken will serve as a waypoint and automatically be saved on the Portable Maps and Google Maps.

WIDENOISE PLUS

We have collected the data about noise level through Windy noise Plus mobile app.

1.Similarly, this app is also installed 2.Click "Take Noise Sample" and then note the reading in dbA and note down in the description of GPS essentials.

WINDY

The study also has gather information about climatic elements like , temperature, humidity, cloud visibility through Windy mobile app.

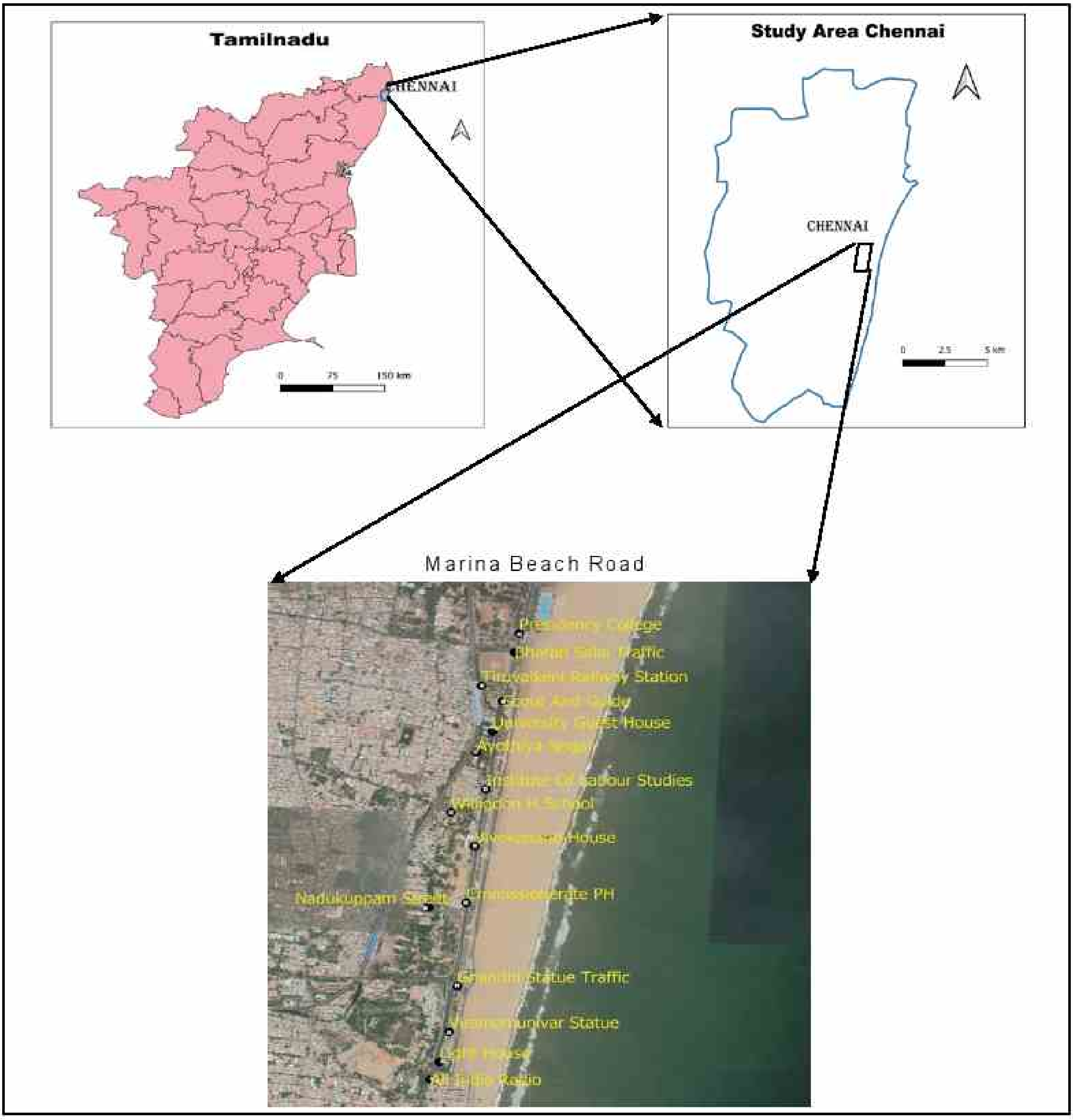
Methodology

The study carried out analysis through QGIS and used Interpolation technique for noise pollution. Moreover, we have done mapping of tracking map, geotagged map by QGIS. Further, the study has done trend analysis of climatic elements like temperature, humidity, wind and air pollution.

Study Area Chennai

Chennai is situated between 3°5'16.22"N, and 80°16'42.49"E. It is located on the south–eastern coast of India in the north–eastern part of Tamil Nadu on a flat coastal plain known as the Eastern Coastal Plains. Its average elevation is around 6.7 meters (22 ft), and its highest point is 60 m (200 ft). Chennai has a dry-summer tropical wet and dry climate (Köppen climate classification: As). The city lies on the thermal equator and is also on the coast, which prevents extreme variation in seasonal temperature. The average temperature is 28.C and average humidity is 70 %. As of 2018, the city had a green cover of 14.9 percent, against the World Health Organization recommendation of 9 square meters of green cover per capita in cities. The city had a built-up area of 71 percent. Water bodies cover an estimated 6 percent of the total area, and at least 8 percent of the area has classified as open space.

Figure:1, The Study Area



Results:

Noise Pollution Mapping

The noise level at the Study area was ranged from 66 db to 80 db. The observation suggests that the minimum level recorded was at the memorial Ayothiya Nagar and Thirvaleken Railway Station. Since this area was 200 meter inside the marina beach road.. The maximum recorded was traffic voice that crossed near to Bharti Salai Traffic point and Vivekanad Traffic Point.There was not much variation recorded in the noise level along the stretch. The noise pollution recorded and analysed using mobile App is given below (Fig 2)

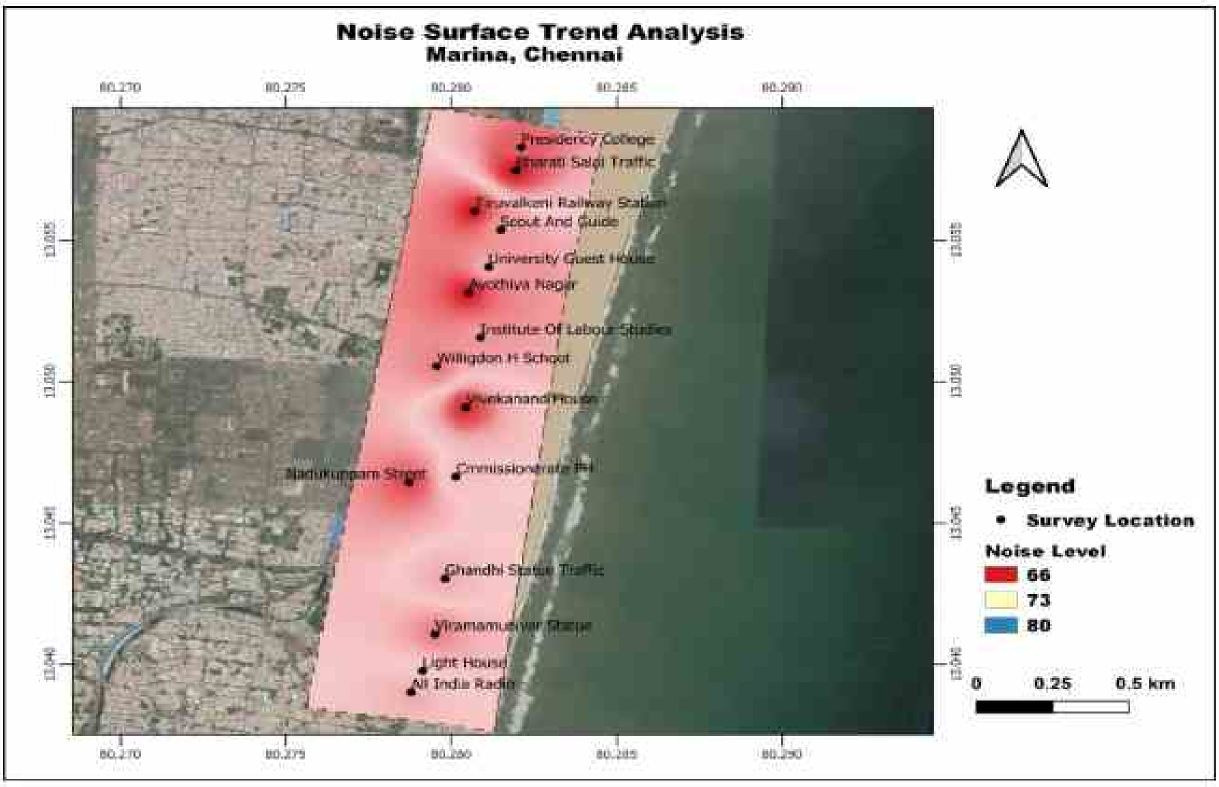


Figure: 2, Interpolation Map of Noise Level

Tracking Data and Map

The stretch was used for tracking studies from the All India Radio Station to Presidency College Gate and total tracking points are fifteen. Tracking distance has covered is 2.5 km through pedestrian walk. The analyses map below itself shows the tracking analysis using Q-GIS.

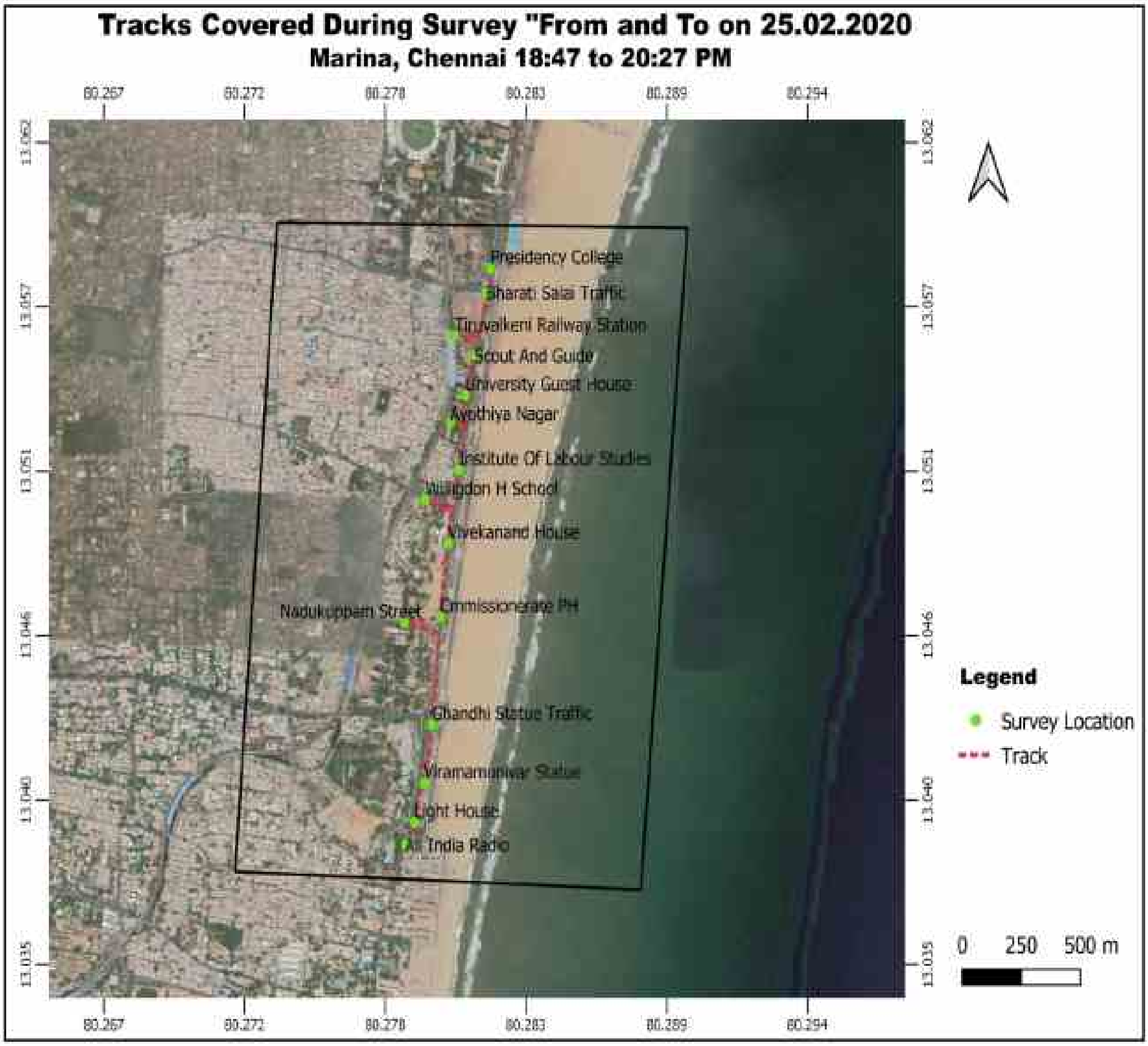


Figure: 3, Map of Tracking Survey Location

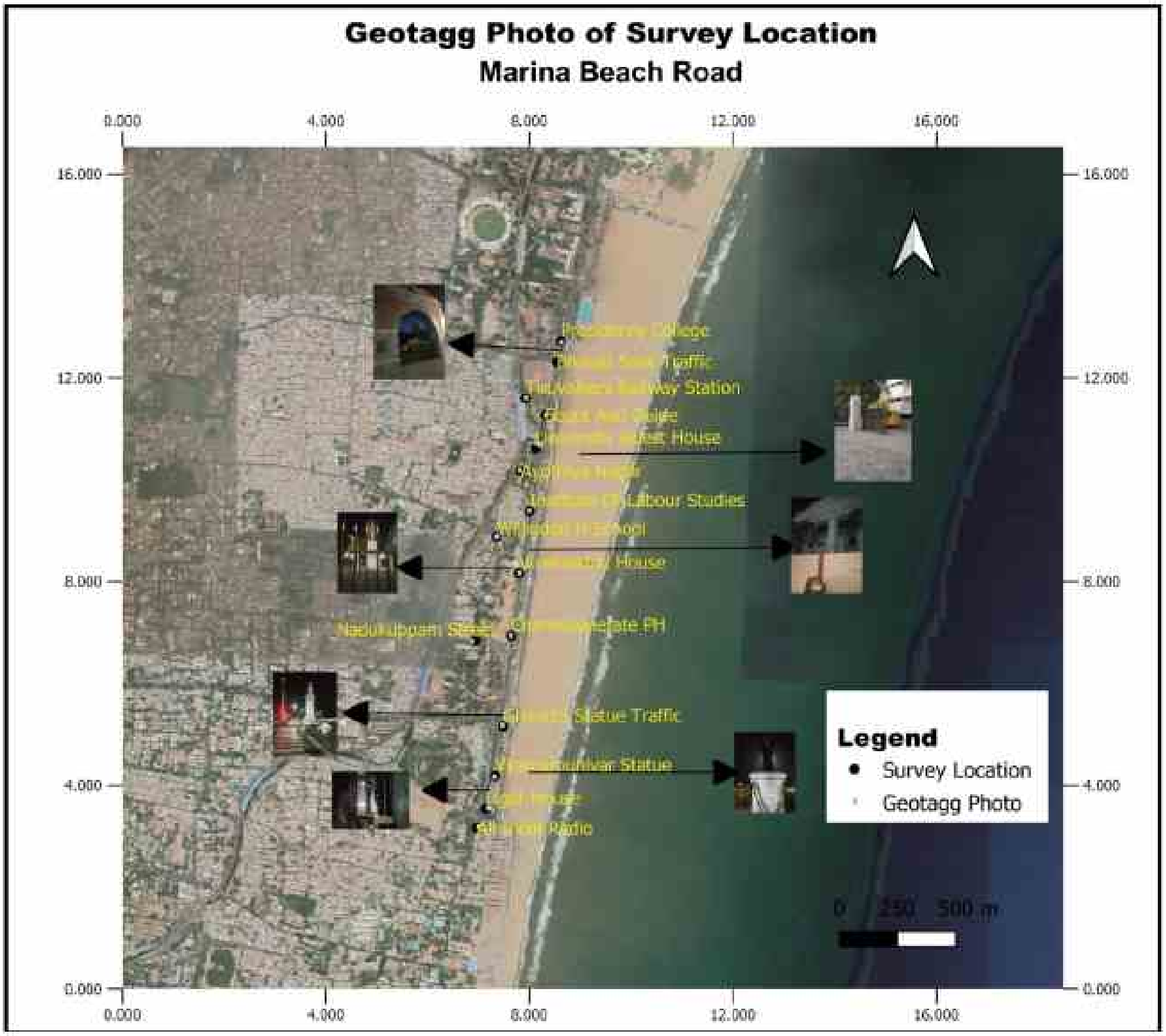


Figure: 4, Geotagged Photo of Survey Location

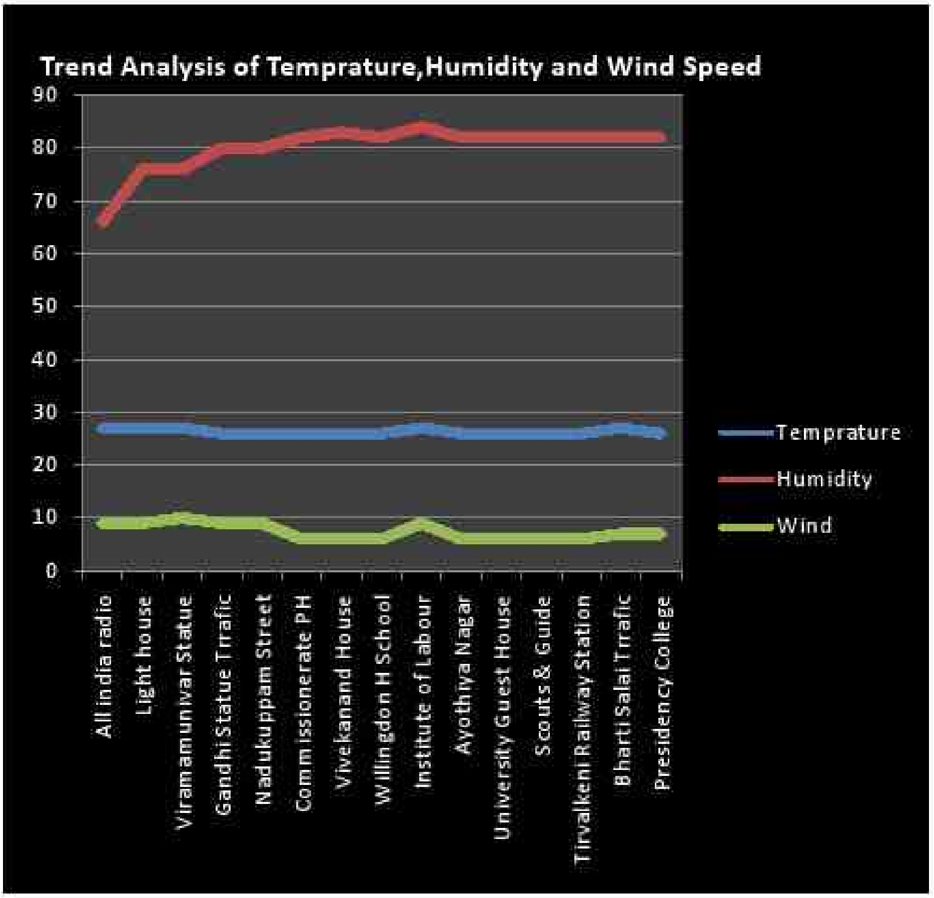


Figure: 5, Trend Analysis of Climatic Elements

Trend Analysis of Climatic Elements

Figure 5 shows that trend analysis of climatic elements. Result found that little variation humidity and wind speed. Humidity range was 66 % to 83% and win speed range was 6 knot nautical to 10 knot. Surprisingly, the study didn't find variation in temperature.

Discussion

The study is limited with a single day (Monday) from 6:30 pm to 8:30 pm. Overall, the study find that no much variation in noise pollution pattern. Moreover, same pattern found for humidity and wind speed. Temperature is totally smooth finding. However, Such type of find due to taken strait area and short time duration.

GIS APPLICATIONS FOR ANALYSIS OF NOISE POLLUTION LEVEL IN PONDICHERRY, INDIA

Abstract

Noise comprises those sounds occurring around us that are not part of the environment under consideration. Noise is also a type of pollution and impacts on our health and wellness. The prevalence of noise is increasing in magnitude and severity because of growing population and urbanization. Noise pollution leads to many chronic and socially significant impacts. This study analyses the level of noise at different points in Pondicherry – one of the highest tourist places all over year. As per Indian standards the desirable noise pollution in daytime is 56 dbA. Noise levels were measured with open source app (GPS Essentials, WideNoise Plus) at 23 points within study area in and around of Pondicherry from 10 am to 8.00 pm on Sunday. The preliminary results show higher noise levels near the Sunday market area after 4.00pm and due to traffic congestion MG road, watch tower circle also were high with the noise levels all over the day and the evening. Also, the study tries to interpret the link between the noise and air pollution. Air pollution and noise pollution have a negative impact on all of society but some groups are more affected than others. Entire part of India is affected with this logic as lower socioeconomic status is generally associated with poorer health, and both air and noise pollution contribute to a wide range of other factors influencing human health.

Keywords: Noise, GPS Essentials, WideNoise, tourist, population and urbanization

INTRODUCTION

The word "noise" is derived from the Latin word "nausea," which means seasickness or a sensation of discomfort. Noise comprises sounds occurring that are not part of the environment under consideration. It is also a type of pollution and impacts on our health and wellness and the ability to do productive work. Sources of noise pollution include industries, traffic and vehicles, construction and domestic appliances. The effects of noise are both direct and indirect; they affect the health and make our living environment miserable.

Noise contamination is an undesirable or hostile sound that irrationally interfere into our day by day exercises. It has numerous sources, the majority of which are related with urban improvement like street, air, rail transport, modern noise, neighbourhood and recreational commotion. Various components add to issues of high noise levels, including expanding populace and expanding commotion levels in a vehicle. The familiarity with ecological commotion has expanded and there is a higher desire for region, state and neighbourhood government to diminish commotion levels in India. Although noise a critical natural issue, usually hard to evaluate related expenses. Expulsion of weight horns from all vehicles. regulatory experts, nearby bodies, and princely individuals. Noise Pollution - Agarwal The Noise lately has developed as one of the critical poisons of condition. Indeed, it needs the enactment to control and there are some focal and state authorisations which specifically or in a roundabout way identify with the issue of commotion be that as it may, there is no particular enactment in India as in some different nations to address the developing difficulties of noise contamination on national level. Another issue of noise contamination rose as of late in India is a result of the unpredictable utilisation of amplifiers. Its aimless use from religious spots and in execution of religious functions and talks now and again makes it so troublesome for the general population to make the most of their fundamental flexibilities with all human respect. Distinctive individuals have diverse profundities of rest and they can change in accordance with night-time sounds. No question in India, institutions for natural security exist, yet the gravity of the issue of commotion contamination has not yet been acknowledged by the Government. Noise Pollution and Control Strategy - S. P. Singal. The issue of noise contamination has officially crossed the risk point and commotion like exhaust cloud, is debilitating as a moderate operator of death. It is elusive, even in country regions, wherever where the main sound is those delivered by nature. People are the normal receptors of noise contamination. In spite of the fact that it is anything but difficult to demonstrate that over the top noise could bring about the loss of hearing in people, it is hard to show to what degree the impacts of commotion can win on people. Noise can deliver genuine physical and mental weight on individuals. Effect of commotion relies on the sound's pitch, its recurrence, time example and length of introduction. Noise has both sound-related and non-sound-related impacts relying on the force and the term of the commotion level. It influences rest, hearing and correspondence, mental and physical wellbeing.

Various measures have been taken and standards evolved by the U.S. Environmental Protection Agency and Indian standards IS: 4954-1968, limiting the noise levels for different types of areas. In order to legally enforce control on noise levels, the Government of India has notified the Noise Pollution (Regulation and Control) Rules 2000, under the Environment (Protection) Act, 1986. Under these rules, ambient air quality standards with respect to noise have been specified for different types of areas. For residential areas, the day time noise should not exceed 55 dB(A) Leq as per these rules. Universities, colleges, schools, libraries, national laboratories and hospitals come under Silent Zone.

Transport sources, such as road traffic, are responsible for both noise exposure and air pollution there has also been an interest in understanding the relative contribution of noise exposure and air pollution to health. Recent studies have strengthened the evidence base for noise and health, beyond effects on noise annoyance and sleep, to providing evidence of convincing health impacts in terms of hypertension, risk of ischaemic heart disease and mortality

The main aim of the study is to delineate the noise in the Pondicherry city. Using the google open apps the noise is recorded (in decibels) with their respective geo- location. The noise was recorded on Sunday which is considered as the peak day of Pondicherry. The study further aims to visually interpret the area affected using proximity analysis on the basis of their surface trend analysis. Parallelly, the study uses the air pollution data for comparison with respect to noise status. As secondary data the temperature, humidity and ozone layer depletion are considered.

STATUTORY CONTROL OF NOISE POLLUTION:

1. **Criminal Procedure Code and Noise Control**. - Provisions under the Sec. 133 of the Criminal Procedure Code, 1973 the Magistrate has the ability to make contingent request requiring the individual causing irritation including that of commotion to evacuate such aggravation.

2. **Factories Act Reduction of Noise and Oil of Machinery**: The Factories Act does not contain a particular arrangement for commotion control. Be that as it may, under the http://cpcb.nic.in/PollutionControlLaw.pdf third Schedule Sections 89 and 90 of the Act, noise incited hearing misfortune, is specified as notifiable illness. Likewise, under the Model Rules, limits for noise introduction for work zone territory have been recommended.
3. **Motor Vehicle Act:** Arrangement Relation to utilisation of horn and change of Engine: - In Motor vehicle Act rules in regards to utilise horns and any alteration in motor are made.
4. **Noise Pollution Control Rule 2000 under Environment Protection Act 1996 :** Encourage for better direction for commotion contamination There are The Noise Pollution (Regulation and Control) Rules, 2000 with a specific end goal to check the developing issue of noise contamination the administration of India has sanctioned the noise contamination decides 2000 that incorporates the accompanying principle arrangements:- *The state government may classifications the territories in the modern or business or private

STUDY AREA

Pondicherry district is located on the Coramandal coast between 11^0 52' 56" and 11^0 59' 53" of north latitude and between 79^0 45' 00" and 79^0 52' 43" of east longitude. It is limited on the east by the Bay of Bengal and on the other three sides by the Cuddalore district of Tamil Nadu State. The layout of Pondicherry district above which is enclave within Tamil Nadu presents a peculiar picture of territorial jurisdiction perhaps the only one of its kind in the world. The district headquarters is located at Pondicherry. The physiographic map of the district presents more or less a flat land.

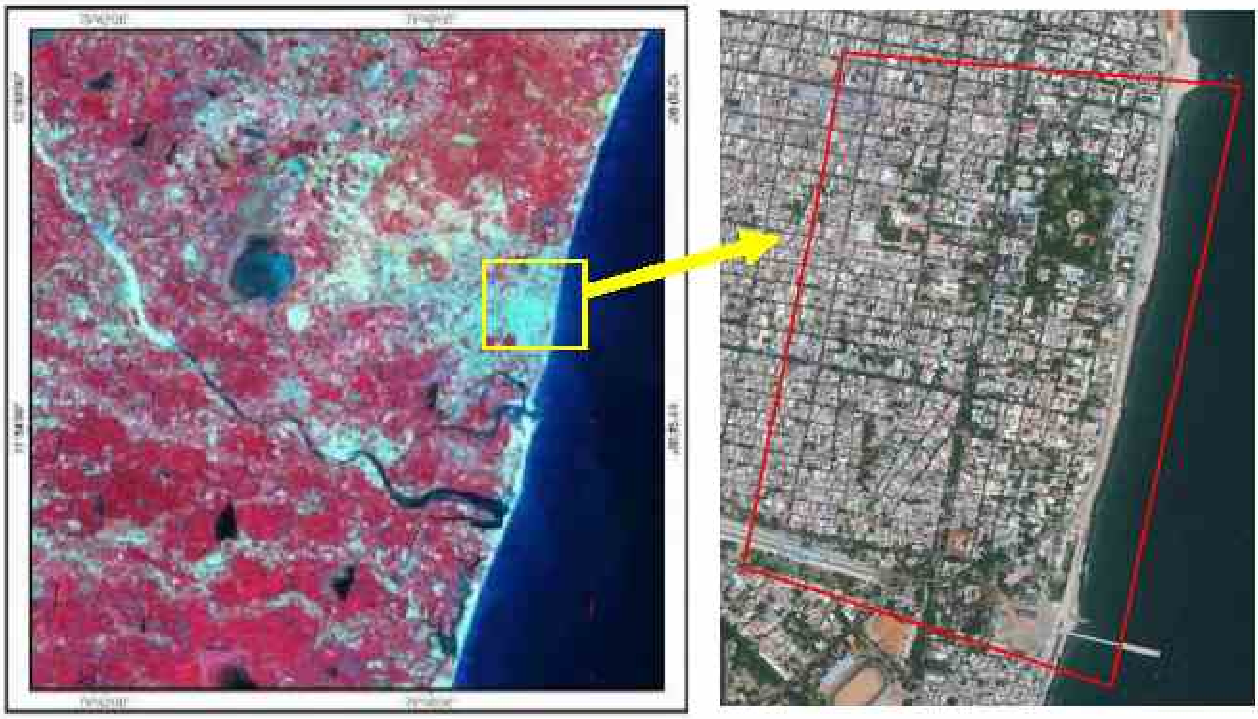


Figure 1: The study area

There are no hills or forests in this district. The main soil types met with in this district are red ferrallitic black clayey and coastal alluvial. Pondicherry attracts a large percentage of tourists visiting India due which there is much medium of noise production based upon various reasons.

To represent the overall study area, FCC (321) of IRS 1C LISS III digital data of 2005 is used. The study was restricted to the bounding box which was overlaid on google satellite maps for the current scenario. The study is completely used google satellite images for visual assumptions and analysis. Also to support the study, air pollution data is used so that the risk assessment will assessed in a better way.

GOOGLE OPEN APPS USED

GPS ESSENTIALS

The most complete GPS tool available for navigation, manage waypoints, tracks, routes. This shows navigation values such as: Accuracy, Altitude, Speed, Battery, Bearing, Climb, Course, Date, Declination, Distance, ETA, Latitude, Longitude, Max Speed, Min Speed, Actual Speed, True Speed, Sunrise, Sunset, Moonset, Moonrise, Moon Phase, Target, Time, TTG, Turn. Its supports Google Maps, MapQuest, OpenStreetMap.

WIDENOISE PLUS

There are various kind of pollution that often get on the first page of newspapers. Yet, noise pollution is rarely cited. WideNoise will help to understand the soundscape around.

WINDY.COM - WEATHER RADAR, SATELLITE AND FORECAST

Windy (also known as Windyty) is a tool for weather forecast visualization. This fast, intuitive, detailed and most accurate weather app is trusted by professional pilots, paragliders, skydivers, kiters, surfers, boaters, fishermen, storm chasers and weather geeks, and even by governments, army staffs and rescue teams. Windy provides you with the most up-to-date weather forecast around. The uniqueness of Windy lies in the fact that it brings better quality information, powerful, smooth and fluid presentation than the other weather apps' pro-features with no adds in between the usage of the app. Global ECMWF and GFS, plus local NEMS, AROME and ICON (for Europe) and NAM (for the USA) are Windy weather forecasting models

Global satellite composite is created from NOAA, EUMETSAT, and Himawari. The image frequency is 5-15 minutes based on area. Doppler radar covers large parts of Europe, America, Asia, and Australia.

METHODOLOGY

INSTALLATION OF GPS ESSENTIALS

1. Tap the "Google Play Store" app icon on Android device's home screen to open the Android Market.
2. Use the search bar at the top to search for "GPS Essentials".

3. Tap the GPS Essentials icon and select "Install". (Before using the GPS Essentials Application, make sure the GPS in your Android phone is enabled.)

ACQUIRING SATELLITES

Before a GPS receiver emits a location (also called a GPS fix), it must receive signals from at least four satellites. The lower the satellite is above the horizon, the longer its signals travel through the atmosphere so satellites high above the horizon usually have better signals. To check the satellites in study area:

1. From the main menu, select Satellites.
2. If there are at least four satellites used in the fix, then you may start using the GPS Essentials features.

CREATING TRACKS

1. From the main menu, select Tracks.
2. Tap on Start from the toolbar. It will create a new track and start recording. Wait some seconds until GPS fix is available.

CREATING WAYPOINTS

1. From the main menu, select Waypoints.
2. Select the Add tool to create the waypoint.
3. It will start recording 1st waypoint. Change the attributes of the waypoint (WideNoise Plus) and then press Back to get back to the list.
4. Similarly, the other waypoints are recorded in which the description is the noise data which are collected from the other app (WideNoise Plus).

WIDENOISE PLUS

1. Similarly, this app is also installed.
2. Click "Take Noise Sample" and then note the reading in dbA and note down in the description of GPS essentials.

GEOTAGGING PHOTOS

1. From the main menu, select Camera.
2. Take a picture of desired area for geotagging.
3. The photo taken will serve as a waypoint and automatically be saved on the Portable Maps and Google Maps page.2
4. The data (picture location and the photo file name) will also be logged on the Waypoints page.

EXPORTING/SAVING WAYPOINTS

1. From the main menu, select Waypoints. It will show the list of waypoints you recorded.
2. To export all the waypoints, select Export from the Options button. If want to export a single waypoint, select the desired waypoint, click the Options button and select Export.
3. The dropdown box will let you select what type of file you want your data to be exported. For now, click KML (Google Earth).
4. In Similar way, Tracks are also recorded.

WINDY.COM

1. The app is user friendly and the values for the needed parameters is recorded and noted in spreadsheets for future use.

ANALYSIS AND RESULTS

The waypoints are collected from the GPS Essentials with the Noise data from WideNoise Plus that are exported in kml and then converted into shapefile for further analysis. The survey points (waypoints) are recorded in such a way that the data apparently covers the study area. Inverse distance weighted analysis is performed to know the noise trend analysis in the study area. Since Sunday is considered to be the busiest day of Pondicherry the survey is initiated on 23.02.2020 between 10 am to 10 pm (Figure 2). From Figure 3, it is illustrated that the station part of study area is always noisy because of trains and the crowed of people. The complete MG road is always noisy as the Sunday market is placed in those streets from 4.00pm. The end of the street there are fast food shops were there are too much crowd and due to congestion, they are more noise produced in the peak hours. Also, during survey it was found that few religious customs were carried out in the beach due to which there were lot of drums and taval played decreasing the peace of the nearby people. Generally, beach is considered to have a large public Collison but still the noise is considered to be bearable other than the port side.

Figure 2 Tracks for collected the survey locations

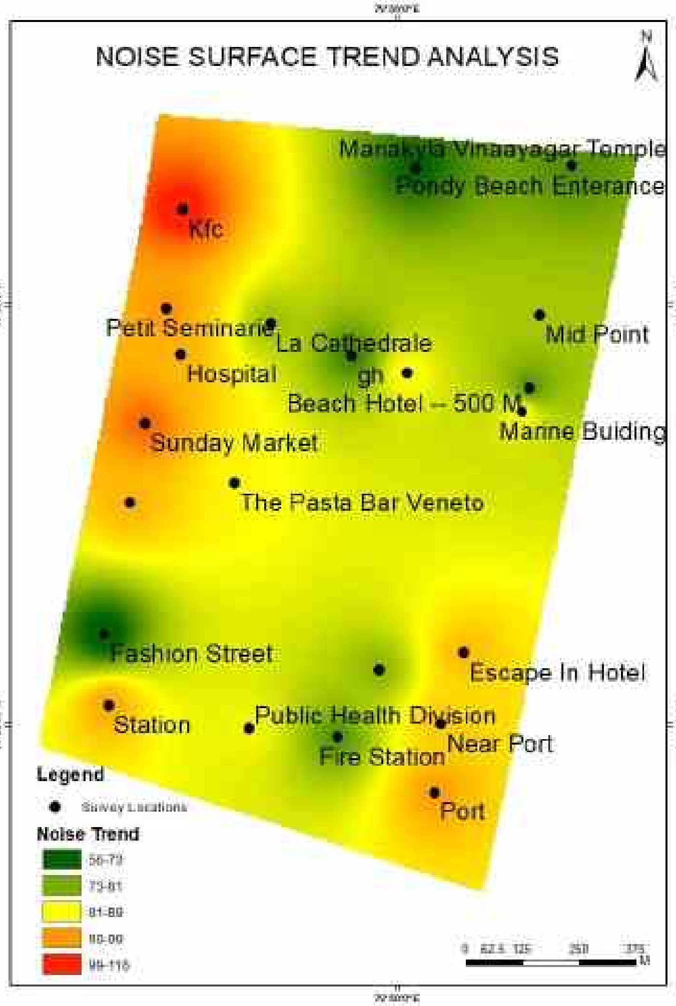


Figure 3: Noise Trend Analysis using IDW

Figure 3 indicate that the red region has high produced noise due to multiple reasons mentioned above. The study also claims to find the highly effected noisy region in and around the noise occurrence. Simple proximity analysis is performed to find the affected area around the high noise occurrence area. The 3D view of the interpolated map is performed on the surface analysis for interpreting the noise trend in a better manner. (Only visualisation purpose)

Figure 4: Highly affected zones

It is very important to know the zones where these noises are considered as a disturbance and further reteamed to be a health issue due to high sound. The area considered has a combination of residentially area and also a tourist spot. Normally 56 decibels are considered as a nominal noise that can be tolerated in the residential area where as for tourist spot its 90 decibels. But currently the study ranges till 118 decibels which may affect the nearby surroundings due to the epicentre of noise.

In figure 4, the 100m buffer denoted as highly affected region and 50m with moderately affected region which can be a risk in future. The roads shown in the figure 3 is not the track followed collected of the data. It is delineated for knowing the proximity between the public and the noise via transportation.

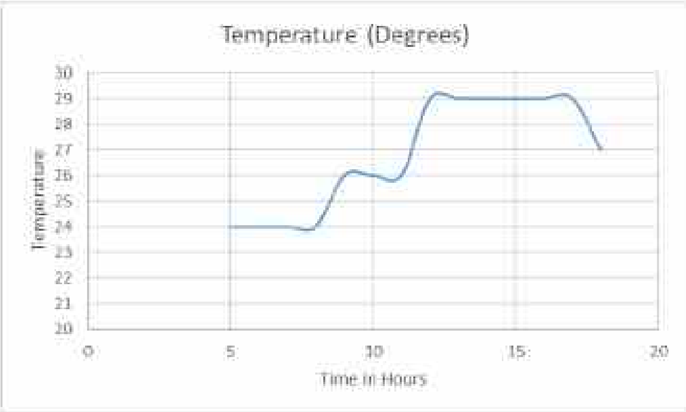
Figure 5 Noise zone demarcation

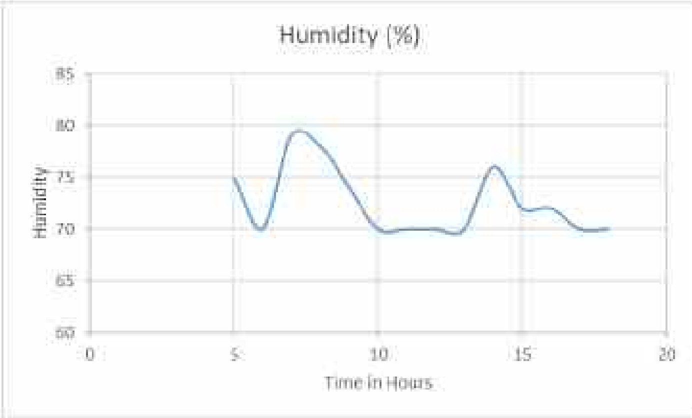
The figure 5 shows noise zonation of the area were there were moderately to highly noise area. The fact is the places near KFC are always crowed and traffic congestion is more through the week. This affects more than 25 houses near the spot (epicentre of noise) daily which is really harmful for the ear drums and other health issues like heart attacks etc. The beach region noise is not a static noise (doesn't occur always). During the survey, noise was recorded based on religious custom (instrument played) near beach. Where figure 6 is Sunday market which is the static and every Sunday, scene of Pondicherry is same. It is very difficult for the people to survive in such region with much noise.

Figure 6: Static epicentre of noise

Linearly people place their stalls (yellow line) and the noise from the vehicle, sellers, buyers etc make the place a huge epicentre for noise. Near by is the residential area where more than 50 house comes under the proximity hazard zone.

Since air pollution and noise pollution are linked together due the vehicles and other human activities, air pollution data was considered as a secondary data for analysis. The study area is small so the survey was not collected for all the points but on a point since there will not be any change in any parameters with respect to spatial area.





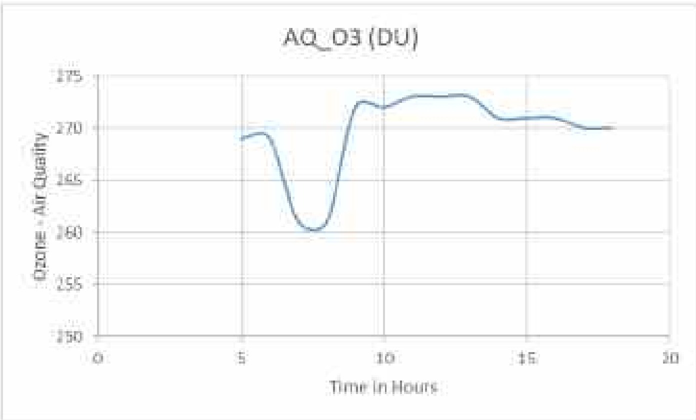


Figure 7: Secondary data– Air pollution data

It is quite evident that during 8.00 am to 12.00 pm the temperature and humidity is increasing gradually as it's a coastal plain. This means mostly in coastal region, morning hours have gradual change other than 2.00pm to 4.00pm. Whereas there is much fluctuation in ozone air quality which is perfect example that Pondicherry is at risk on the basis of air quality. If ozone is affected, then the scale is much questionable with respect to land and areas in the study area

DISCUSSIONS AND CONCLUSIONS

The study is limited with a single day (Sunday) from 10 to 10 of the clocks. The study should have examined hour based on more days so that accuracy of the analysis would have been high. The photos taken in the field are geo tagged so further reference. Overall the study claims that most of the places in Pondicherry is highly noisy area where people can be affected and health issue may occur due to over production of noise in daily basis. The recommendations cannot be derived based on a day survey.

FIELD TO LAB REPORT ON SMARTPHONE AS FIELD PROBE WAP FOR SPATIAL DATA VISUALIZATION AND MAPPING

by

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Submitted to

DST-NRDMS Winter School

Geospatial Technology

Department of Geography

University of Madras

Chennai – 600 025

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Introduction

Field data collection is always a challenge to anyone in any walks of research. Most of the researchers produce ambiguous reports albeit of undertaking excellent field survey data. The major hurdle every investigator face is the handling and use of Global Positioning System (GPS) and other measuring devices.

As a part of the field data collection, the Winter School in Geospatial Technologies Level-1 Workshop (17 February to 08 March 2019) organized by the DST-National Resources Data Management System (NRDMS), Government of India, New Delhi and Department of Geography, University of Madras, Guindy Campus, Chennai designed a project on Sunday 23 February 2020 for all the 13 participants.

The exploration of Wireless Application Protocol (WAP) through Smartphone with their various apps to replace the printed forms of questionnaire, scheduled survey and other survey equipments' at the same time for the quick appraisal of the field investigation is the aim of this exercise.

At the end of the project, Geographic Information System (GIS) maps was planned to be prepared and presented independently.

Aim of the study

To undertake the following four tasks through a Lab-Field-Lab data collection, mapping, analysis and interpretation through the exploration of WAP for point data capture, track capture and geotagging field data.

Task 1: Noise Pollution Mapping
Task 2: Tracking Data
Task 3: Point Data Capture and Geotagging Photos, and
Task 4: Wind (Meteorology).

Locations and Methodology

The location in northern Chennai starting from University of Madras, Guindy Campus through University of Madras, Marina Campus Guesthouse to varied random locations in Villivakam, Anna

Nagar, Sollinganallur, City Centre and Express Avenue Malls and back to University of Madras, Marina Campus Guesthouse, Chennai was selected as survey points.

Instruments used

Smartphone OnePluse A6000 Android Version 10.

The following apps were downloaded using Google Playstore.

1. WideNoise Plus
2. GPS Essentials
3. Windy.com
4. Otter app
5. Spreadsheet (WPS Office)

The methodology is to undertake a field survey to all the above locations and generate the spatial data using the smartphone apps. The point data captured was tagged at the particular location, with GPS points and photos. The data was then updated in the WPS Excel sheet. Similarly, noise level was captured using WideNoise App and the Meteorology details using Windy App. The Otter App is to record voice which can transfer the details and photos can also be taken with GPS coordinates.

Criteria assessed

i) Noise Level
ii) Air Quality
iii) Wind
iv) Temperature
v) Clouds
vi) Humidity
vii) Tracking points

The points were extracted into **QGIS Desktop 3.10.2 version software** and the four assigned tasks were described in the results section.

Results

The following four tasks were performed using the smartphone apps and the results were obtained following the steps as explained accordingly.

Task 1: Lab-Field-Lab: Noise Pollution Mapping:

Aim: To collect Noise samples in the field using WAP and convert the non-spatial data into spatial data for geostatistical analysis.

Method: The Smartphone app WideNoise Plus and GPS Essentials was installed through Google Play store. At the above 14 survey locations, WideNoise Plus app was used to measure the noise level which was recorded in the GPS Essentials app simultaneously by setting the datum (World Geodetic System 1984), Position format in decimels and units in kilometres. About 14 points were collected using the satellite points. Then the waypoints were added and the noise levels were noted in the GPS Essentials app.

Results: The noise levels at the various above mentioned locations showed a range of 58 to 89 decibels (db) which was given in Table 1. The lowest range 58 db was noticed in Kumaraswamy Nagar, Villivaakam while the highest was noticed in Sollinganallur (89 db). The interpolated 3D map is presented in Fig.1.

Table 1: Diurnal data points on noise levels at different locations in Chennai on 22 Feb 2020

Location	Lat	Long	Noise (db)
Uni Guesthouse	13.054	80.281	68
Santhome Church	13.052	80.278	89
Uni Guesthouse	13.054	80.281	77
Ice house, Marina	13.053	80.273	88
Villivaakkam	13.105	80.207	78
Kumaraswamy nager	13.121	80.202	58
Anna Nagar	13.089	80.212	82
Solinganallur	12.896	80.221	89
City centre	13.043	80.274	78
Lifestyle Entrance	13.052	80.276	86
INOX, Express Avenue (EA)	13.059	80.264	80
Uni Guesthouse	13.054	80.282	71
Uni Guesthouse	13.054	80.282	80

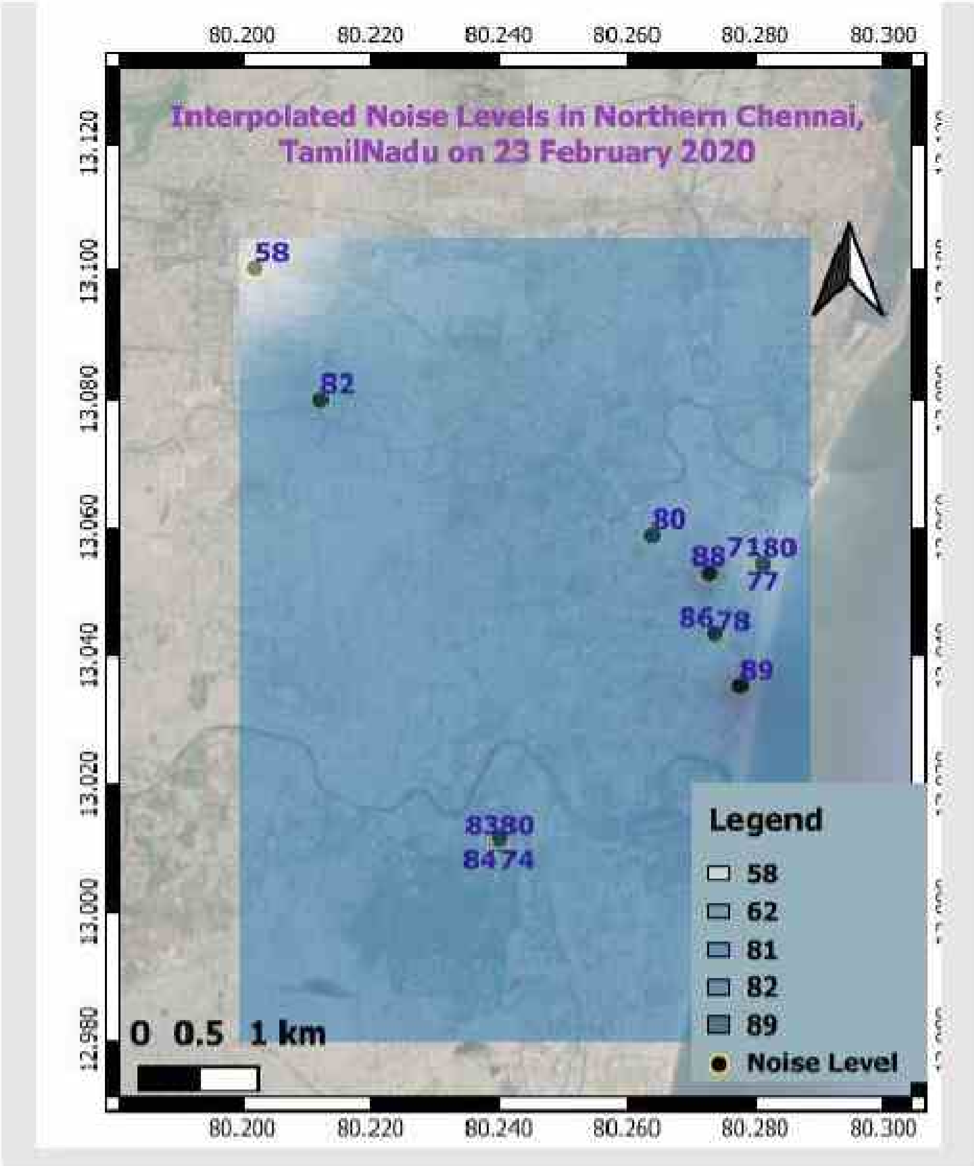

Figure 1 showing GIS map of the interpolated noise levels in northern Chennai

Task 2: Lab-Field-Lab: Tracking Data

Aim: To create and visualize the track data collected using WAP device from the above survey locations.

Method: The GPS essentials app was used to track the points from the University of Madras guesthouse to marina beach and back. The tracks were automatically noted in the GPS Essentials app by giving the 'Start' and end by 'Stop' options. The tracking points were transferred to the computer and the html file was converted to shapefile for QGIS display with track label.

Results: The tracking data was taken at the University of Madras, Guindy Campus and the same is presented in Fig. 2.

Figure 2: GIS map of the tracking path in Marina Beach, northern Chennai

Task 3: Lab-Field-Lab: Point Data Capture and Geotagging Photos

Aim: To capture the geographic objects like people, shops, sunrise, boats and beach in marina beach, Thiruvallular statue line, Chennai.

Method: The GPS Essentials app was used to locate the satellite positions and waypoints were added to mark the beach location. In each interesting point, the camera was simultaneously operated to take photos. The photos were transferred to email which was then uploaded in QGIS and Geotagged with a google satellite imagery as a base map as shown in Fig. 3.

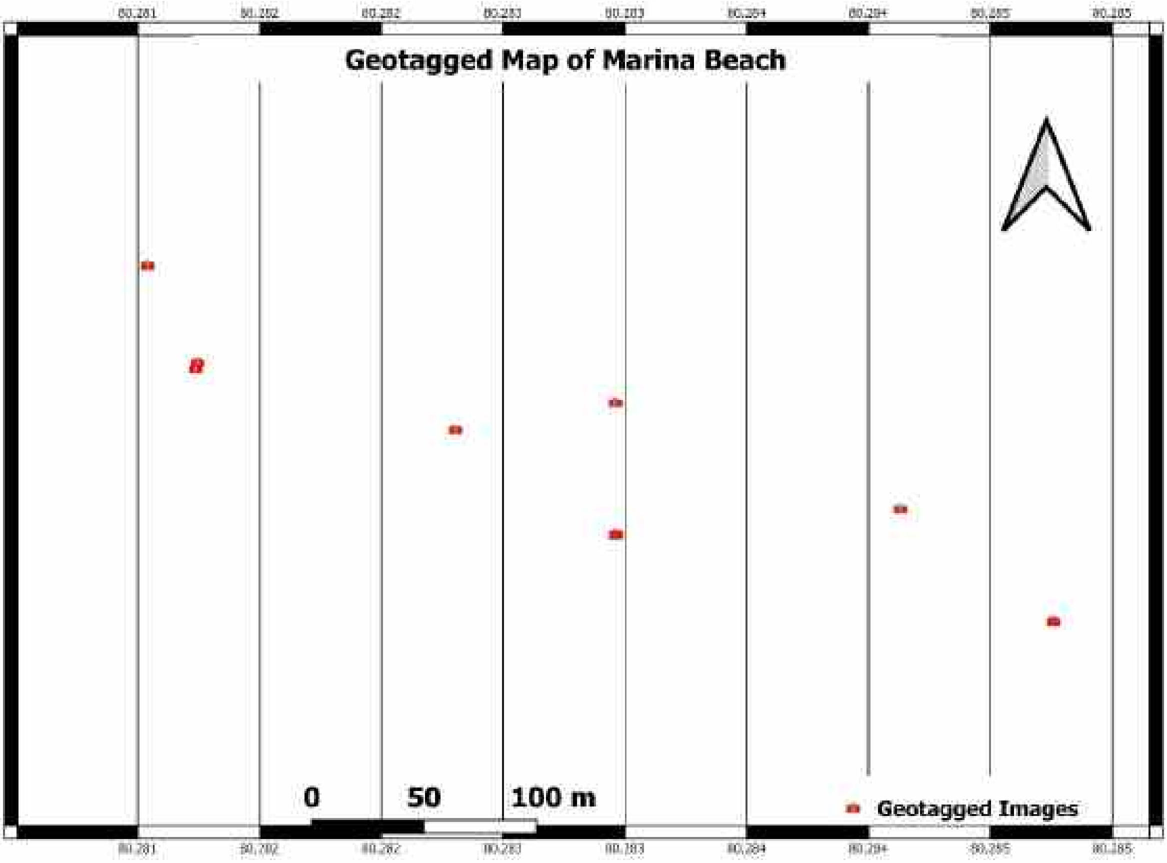

Figure 3: GIS map of the geotagged photos taken at Marina Beach, northern Chennai

Task 4: Lab-Field-Lab: Wind (Meteorology):

Aim: To monitor and map the local climatic parameters of the 14 locations of north Chennai.

Method: Using Windy.com app, data on temperature, wind, air (NO_2), humidity and clouds were recorded which was then transferred instantly to the spreadsheet using WPS Office app. The excel sheet data was saved as .csv files and added as 'delimited layer'. Further converted to shapefile and interpolated using geoprocessing tools.

Results: The results of the collected data on temperature (°C), humidity (%), wind (knots), air (µg/l) and clouds (%) collected from different locations on 23 February 2020.

The temperature (26-27 °C), humidity (%) and cloud (%) data showed only moderate variations in all the locations. However, the air quality showed a lower value of 2.12 µg/l in Kumaraswamy nagar, Villivaakam while the highest (19.85 µg/l) was recorded in Ice house, parallel to marina beach, Chennai. The raster histogram graph of air quality data was shown in Fig. 4. The interpolated air quality data was plotted in QGIS (Fig. 5).

The wind data showed a variation of 5 to 10 knots with the highest near the marine beach (10 kt) while low in Kumaraswamy nagar, Villivaakam. The windy data collected for the above parameters were given in Table 2 along with the latitude, longitude and time (24 hr format). The interpolated wind map was shown in Fig. 6.

Table 2: Data points on temperature (°C), humidity (%), wind (knots), air (μg/l) and clouds (%) collected from different locations on 23 February 2020

Location	Lat	Long	Temp (°C)	Humidity (%)	Wind (knots)	AQ_NO^2 (μg/l)	Clouds (%)	Time (24 Hr format)
Uni Guesthouse	13.054	80.281	26	76	8	16.87	26	21
Santhome Church	13.052	80.278	27	73	9	19.31	29	6
Uni Guesthouse	13.054	80.281	27	76	9	19.31	33	7
Ice house	13.053	80.273	28	77	9	19.85	30	10
Villivakam	13.105	80.207	29	77	7	3.33	30	11
Kumaraswamy nagar	13.121	80.202	29	78	8	2.12	32	13
Anna Nagar	13.089	80.212	27	77	8	2.49	29	16
Solinganallur	12.896	80.221	27	78	7	2.43	27	18
City centre	13.043	80.274	27	74	9	2.45	24	19
Lifestyle Entrance	13.052	80.276	27	75	10	4.81	24	19
INOX, EA	13.059	80.264	26	75	5	9.47	31	20
Uni Guesthouse	13.054	80.282	26	76	8	15.42	25	21
Uni Guesthouse	13.054	80.282	26	76	7	16.27	41	8

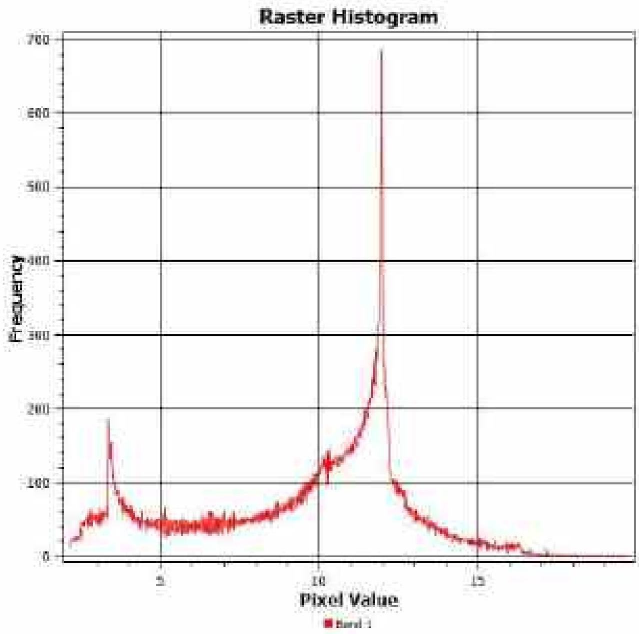

Figure 4: Air quality graph showing the fluctuation of lower and higher values in few locations

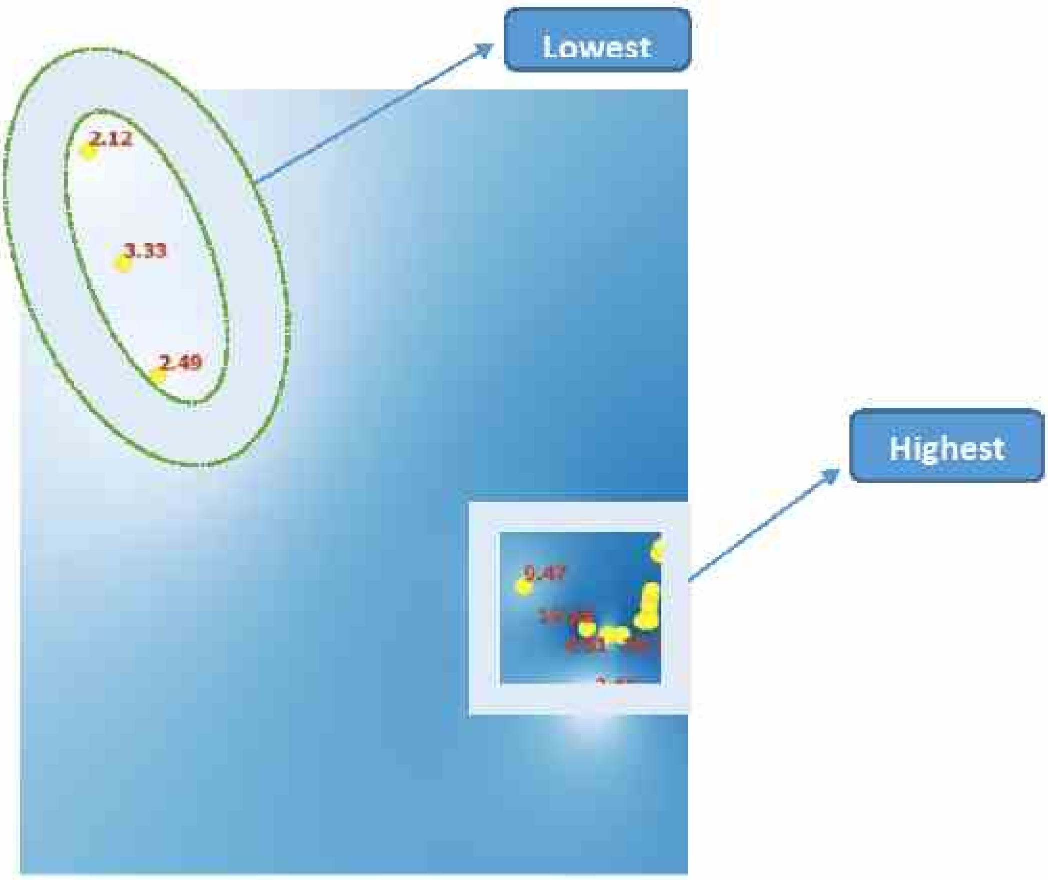

Figure 5: Interpolated air quality map of northern Chennai showing the locations as yellow points and values in red.

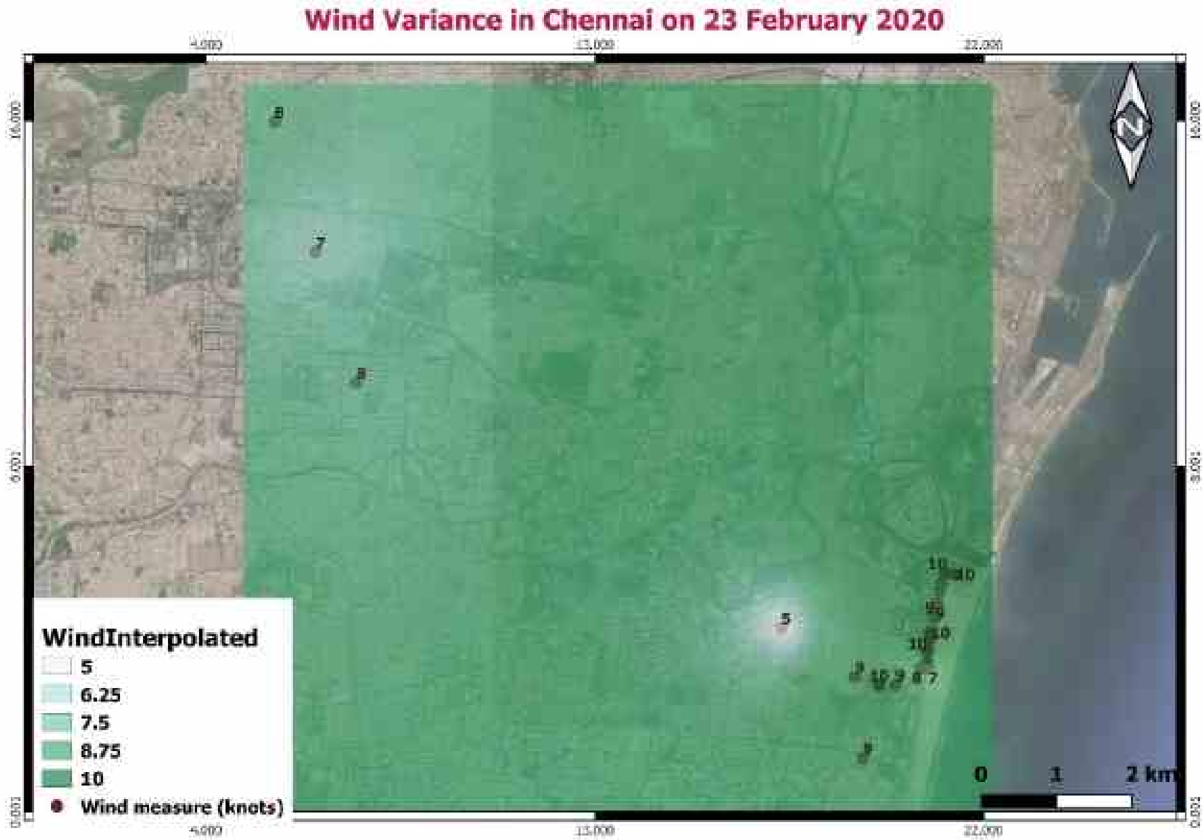

Figure 6: Interpolated wind data (knots) from the northern Chennai locations.

Discussion and Conclusion

The four tasks of collecting noise levels, track details, geotagging photos and windy data was done using the smartphone apps. This indeed replaced the traditional and time consuming task of using sophisticated equipments like altimeter, digital thermometer, humidity meter and infrared thermometer. Also, writing on paper and pen was replaced using just a smartphone. The points were taken at ease instantly using the smartphone apps. The Otter app was not used as it was not that user-friendly as the other used apps.

The data processing of integrating all points in QGIS was also easily mapped. However, some of the technical difficulties was faced in choosing the focussed points in interpolated boundary and presenting accordingly. Moreover, the preparation in print layout consumed time in getting the correct grid points. Otherwise, this project taught the collection of data points from the field and preparing maps independently.

GIS APPLICATIONS FOR ANALYSIS OF NOISE POLLUTION LEVEL IN CHENNAI (MARINA BEACH COAST) INDIA

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Abstract

The prevalence of noise is increasing in magnitude and severity because of growing population and urbanization. Noise pollution leads to many chronic and socially significant impacts. This study analyses the level of noise at different points in Chennai (near marina beach) – Noise comprises those sounds occurring around us that are not part of the environment under consideration. Noise is also a type of pollution and impacts on our health and wellness. As per Indian standards the desirable noise pollution in daytime is 56 db. A Noise levels were measured with open source app (GPS Essentials, Wide Noise Plus) at 16 points within study area in and around of Chennai (marina beach coast) from 2.30 pm to 5.20 pm on Sunday.

Keywords: Noise pollution, GPS Essentials, population and urbanization, Wide Noise,

Introduction:

Field data collection is always challenge to investigator Beyond field survey of using Questionnaire scheduled the investigator has to carry field equipment to capture locational information (usually GPS) and other field measuring devise. The questionnaire scheduled problem require a number of paper prints after field work complaining data from paper for digital format is yet one more work. The word "noise" is derived from the Latin word "nausea," which means seasickness or a sensation of discomfort. Noise comprises sounds occurring that are not part of the environment under consideration. It is also a type of pollution and impacts on our health and wellness and the ability to do productive work. Sources of noise pollution include industries, traffic and vehicles, construction and domestic appliances. The effects of noise are both direct and indirect; they affect the health and make our living environment miserable.
Now the reality is to explore smartphone with their various apps to replace the paper prints. and survey equipment at the same time for quick appraisal of the field investigation.

Objectives of The Study:

It is proposed to undertake field work / survey exploring the application of smartphone
For generation of spatial data with various app by the following

1. A point data captured at selected location tagging the same with field photo and attribute table.
2. Assess the noise level at the field.
3. Conduct a tracking experiment to capture line / area data.
4. Assess the various local climatic parameters of the area at 2 / 4-hour interval.

Study area

The present study area is present a costal line near marina beach in Chennai district is located coast between 13.069859°N to 80.284665°E and 13.037530°N to 80.278175° E. (Madras university guest house to River) It is limited on the east by the Bay of Bengal in Tamil Nadu State. The layout of Chennai district above which is enclave within Tamil Nadu presents a peculiar picture of territorial jurisdiction perhaps the only one of its kind in the world.

Figure 1: The study area

(Source: Google Earth Image)

Data Base and Methodology: -

The present study is based on the various apps which is inbuilt in smart phone. WAP that is smartphone capable of field data collection with sufficient RAM and storage support (Storage can be external with OTG support Thumb Drive)

Mobile Apps.

Wide noise plus:- There are various kind of pollution that often get on the first page of newspapers. Yet, noise pollution is rarely cited. Wide Noise will help to understand the soundscape around.

GPS Essentials :- The most complete GPS tool available for navigation, manage waypoints, tracks, routes. This shows navigation values such as: Accuracy, Altitude, Speed, Battery, Bearing, Climb, Course, Date, Declination, Distance, ETA, Latitude, Longitude, Max Speed, Min Speed, Actual Speed, True Speed, Sunrise, Sunset, Moonset, Moonrise, Moon Phase, Target, Time, TTG, Turn. Its supports Google Maps, MapQuest, OpenStreetMap

Windy (Meteorology):- Windy app is a tool for weather forecast visualization. This fast, intuitive, detailed and most accurate weather app is trusted by professional pilots, paragliders, skydivers, kiters, surfers, boaters, fishermen, storm chasers and weather geeks, and even by governments, army staffs and rescue teams. Windy provides you with the most up-to-date weather forecast around.

How to collect the data?

GPS Essentials

1.From the main menu, select Satellites.

2.If there are at least four satellites used in the fix, then you may start using the GPS Essentials features.

Creating way points

1.From the main menu, select Waypoints.

2.Select the Add tool to create the waypoint.

3.It will start recording 1st waypoint. Change the attributes of the waypoint (Wide

Noise Plus) and then press Back to get back to the list.
4.Similarly, the other waypoints are recorded in which the description is the noise data which are collected from the other app (Wide Noise Plus)

Wide noise Plus
1.Similarly, this app is also installed
2.Click "Take Noise Sample" and then note the reading in dbA and note down in the description of GPS essentials.

Geotagging Photo
1.From the main menu, select Camera.
2.Take a picture of desired area for geotagging.
3.The photo taken will serve as a waypoint and automatically be saved on the Portable Maps and Google Maps.

Collection of samples From Madras University Guest house, 3M Car area to River

Place	Lat	Long	Temp	Humidity	Noise	Wind	Clouds
University Guest House	13.0542	80.2806	27	50	68	8	29.3
University gate	13.054	80.2812	27	51	72	6	28.3
Slum cultural Board	13.0514	80.2808	27	51	72	6	30.3
Swami vivekanand house	13.0481	80.2805	27	52	75	6	29.3
police Head Quarter	13.045	80.2801	27	53	85	7	28.3
Mahatma gandi Sta	13.0437	80.2799	27	54	79	8	29.3
Marina Police Station	13.0403	80.279	28	55	77	8	29.3
3M Care Care	13.0376	80.2781	27	55	74	8	29.3
Bharatscourt road	13.056	80.2816	27	54	72	8	28.3
Bharti salai	13.0574	80.2819	27	51	70	7	29.3
Residency college	13.0583	80.2821	27	53	53	8	26.3
Central Arch	13.0603	80.2825	27	56	68	8	29.3
Pwd Department	13.0638	80.2832	27	57	65	7	29.3
Madras University Main building	13.0656	80.2836	27	58	82	8	26.3
River	13.0695	80.2846	27	61	78	7	29.3

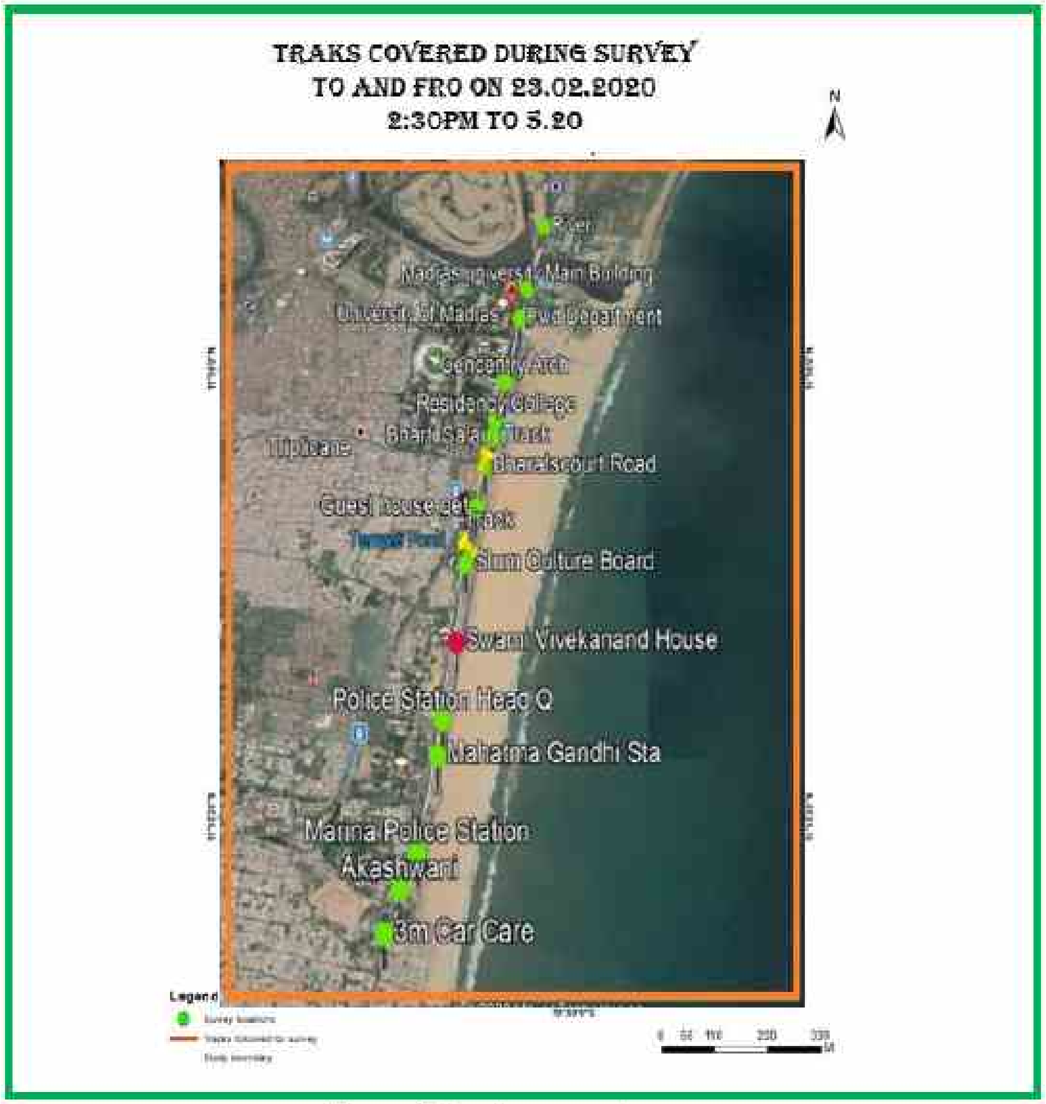


Figure 2 Track covered area

The above figure shows the track covered area of a costal line near marina beach in Chennai district is located coast between 13.069859°N to 80.284665°E and 13.037530°N to 80.278175° E. (Madras university guest house to River).

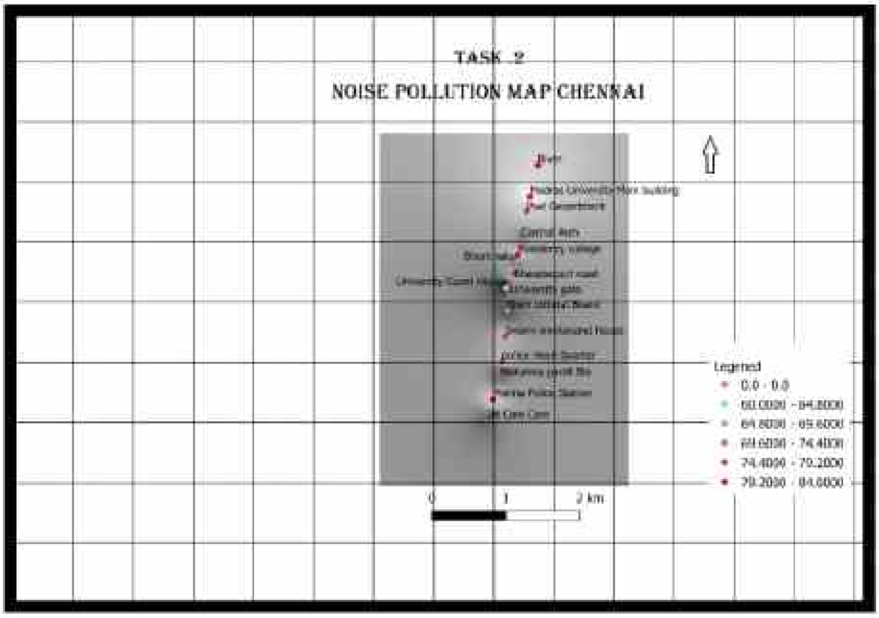


Figure 3: Noise Trend Analysis IDW

The above map indicate that the White Bright region has high produced noise (Near Madras university main building and Marina Beach police station) due to multiple reasons mentioned above. The study also claims to find the highly effected noisy region in and around the noise occurrence. In above figure two buffer zone is highly noise polluted and the overall other region is moderately polluted due to tortes place like a marina beach so the most of people visited this beach thus the air pollution and noise pollution are linked together due the vehicles and other human activities, air pollution data was considered as a secondary data for analysis. The study area is linear and small so the survey was not collected for all the points but on a point since there will not be any change in any parameters with respect to spatial area.

ANALYSIS AND RESULTS

The waypoints are collected from the GPS Essentials with the Noise data from Wide Noise Plus that are exported in kml and then converted into shapefile for further analysis. The survey points (waypoints) are recorded in such a way that the data apparently covers the study area. Inverse distance weighted analysis is performed to know the noise trend analysis in the study area.

Since Sunday is considered to be the busiest day of Chennai the survey is initiated on 23.02.2020 between 2:30pm to 5pm and it is always noisy because of Busses and the crowed of people. The complete Marina beach Road road is always noisy as the Sunday. The end of the street there are fast food shops were there are too much crowd and due to congestion, they are more noise produced in the peak hours.

GEO TAGGING PHOTO:

With the help of GPS ESSENSIAL collected a photo where I collected a Noise, Humidity, Temperature, Cloud, and Wind samples and after that with the help QGIS I tagged all the photo in that particular location which is given in below figure:4.

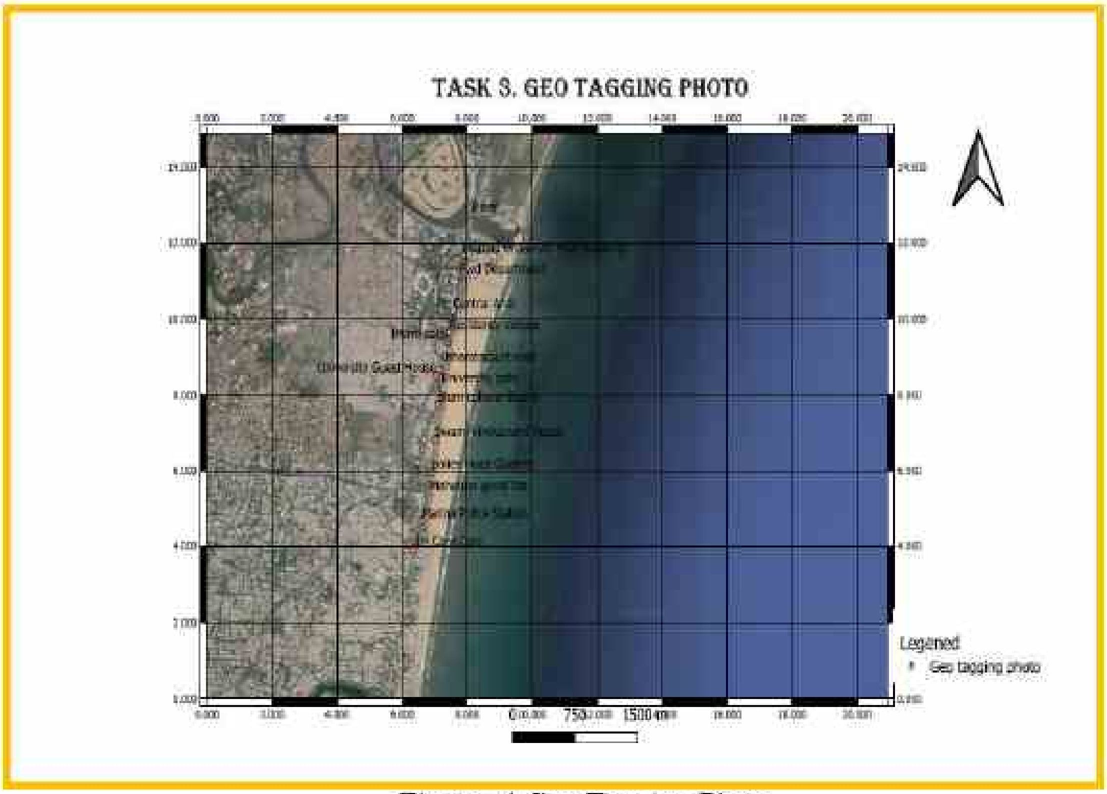


Figure. 4 Geo Tagging Photo

In given below figure:5 we see the Humidity in particular location. In this given image the Humidity is Higher in River area and it decrease towards the slum cultural board and after that Its slidely increase towards the 3M car care. In the river area the Humidity is higher due to release the higher Temperature in evening time thus the humidity is higher in river area.

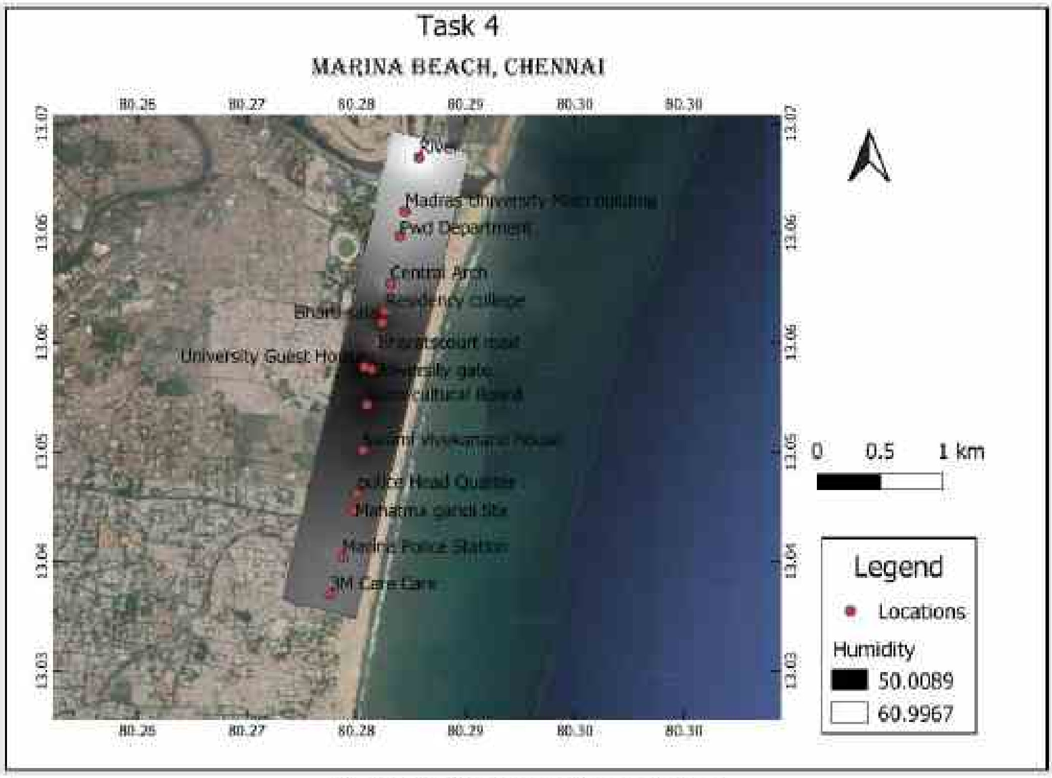
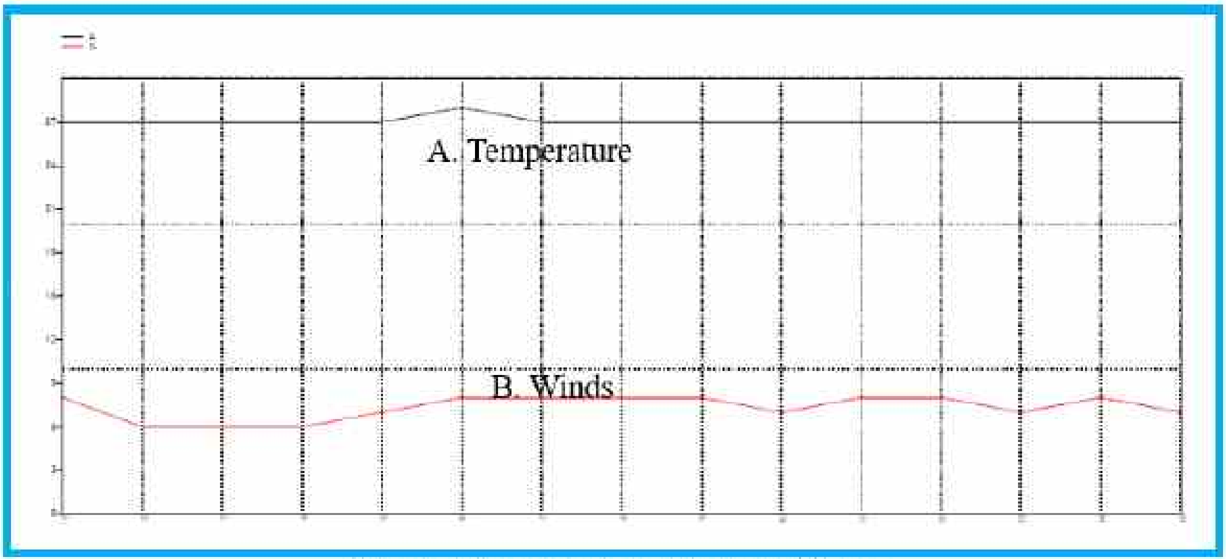
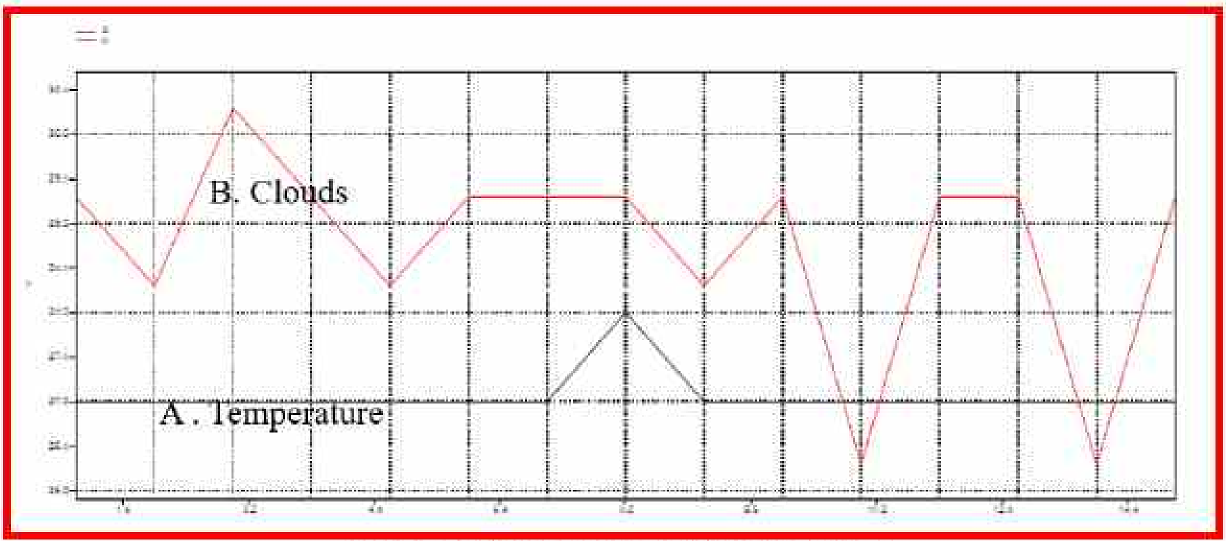


Figure:5 Humidity Variability



Graph :1 Temperature and Wind Relation



Graph: 2 Temperature and Cloud Relation

In the given above graph :1 shows the Distribution of Temperature and Wind. Generally, the wind blows High pressure to low pressure (low pressure where the temperature is higher- and High-pressure belt is where the temperature is lower) in day time the temperature is always higher in land part thus the low pressure observes in land part so the wind moves from sea towards the land. According to the rules where the temperature is higher Evaporation also higher and thus clouds formation process also higher in the ocean but this study area is very less so we can't clearly perform up to the satisfaction level. But this kind of Graph are use full in day today life for distribution of Temperature, Humidity, wind, cloud and their relationship.

****

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SHORT STUDY ON SPATIAL DATA VISUALIZATION AND MAPPING USING SMART PHONE

A case study

Gokulakrishnan T

23February2020

SHORT STUDY ON SPATIAL DATA VISUALIZATION AND MAPPING USING SMART PHONE

Submitted by

Gokulakrishnan T

Introduction

Field data collection in any discipline is a tedious process for the person engaged on the ground related realities. In the past decades field data collection using questionnaire and other materials and means made the work complex in gathering, compiling the data and training the individuals involved in these processes which pushes the expenses at very high. In the recent days due to the technology revolution and its application made us user friendly to record field data using smart phone. There by reducing cost, time and field expenses to some extent are really an excellent approach particularly for the researchers and government establishments that require field-based data collection for management purposes. Therefore, using the Smart Phone this attempt was made from Lab to Field and from Field to Lab.

Aim

Learning the Apps using the Smartphone as a device – Point Data Capture, Track Capture and Geotagging Field Data

Objective

1. Point Data Capture
2. Track capture
3. Geotagging Field data

Methodology

As part of this Study, the Study area extends from the Madras University Guest House to Nepiar Bridge along the seashore. Mobile Apps are used to collect the different kinds of data viz., Noise Pollution Mapping, Tracking data, Point data Capture and Retagging Photos.

Lab to Field

Smart Phone and the freely available mobile Apps such as WideNoise Plus, GPS Essentials, Windy (Meteorology) are installed from the Google play store to collect the field data.

Field to Lab

The collected data and supplementary information gathered were brought and analysed using Quantum-GIS Software.

Analysis & Discussion

Task 1. Noise Pollution Mapping

The noise level at the Study area was ranged from 66 db to 80 db. The observation suggests that the minimum level recorded was due to points taken at the memorial located along the stretch. The maximum recorded was due to an ambulance that crossed near to the memorial. There was not much variation recorded in the noise level along the stretch. The noise pollution recorded and analysed using mobile App is given below (Fig 1)

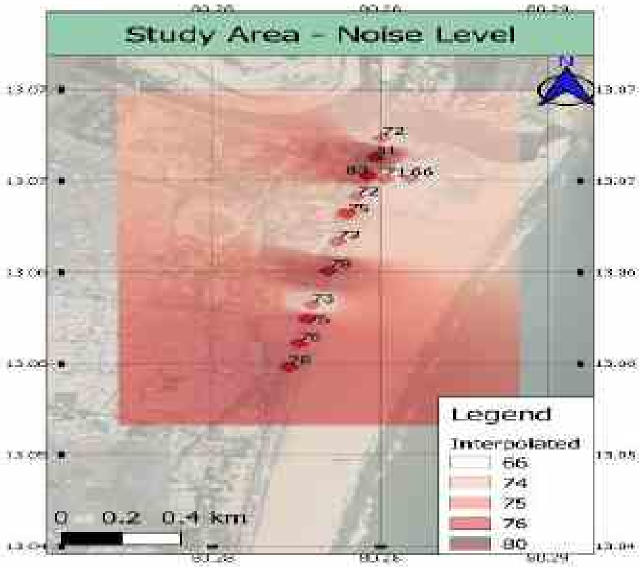


Fig. 1. Noise level mapping along the University Guest House to Napier Bridge

Task 2. Tracking Data

The same stretch was used for tracking studies from the Guest House to Napier Bridge. The analysed map below itself shows the tracking analysis using Q-GIS.

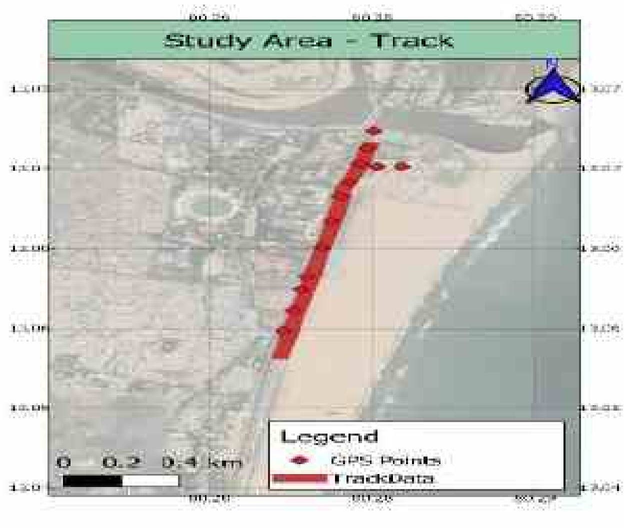


Fig 2. Track data mapping along the Guest House to Napier Bridge

Task 3. Point Data Capture and Geotagging Photos

Similar to the above two tasks the point data capture and geotagging of photos was done. Along the stretch the major landmark buildings were photographed, later those were geotagged with its respective locations.

Fig 3. Mapping point data capture and geotagging of photographs

Task 4. Windy (Meteorology)

Along the stretch the wind speed was recorded and analysed using the mobile app. The minimum wind speed recorded along the stretch was 8.8 km/h and the maximum was 9.7 km/h.

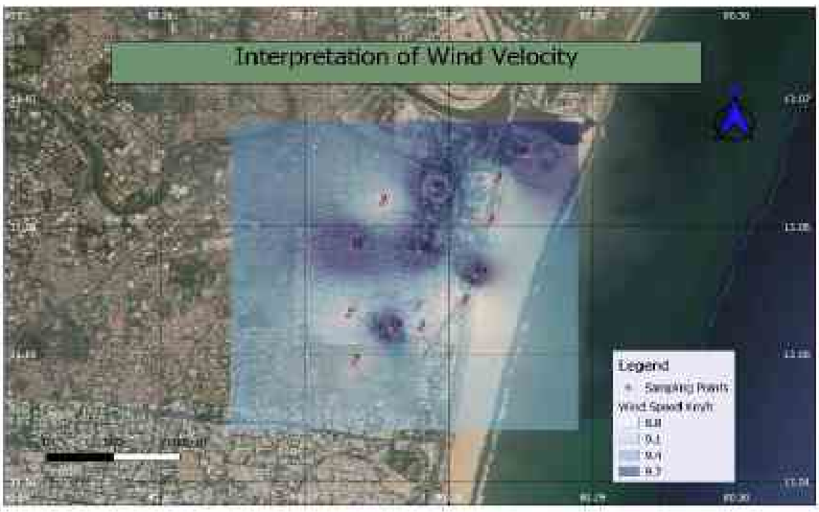


Fig. 4. Wind speed analysis using Q-GIS

Summary

At the Study area the Noise level ranges between 66 dB to 82 dB and the wind velocity ranges between 8.8 to 9.7 km/h. According to the Health department the Noise level above the 85dB are more harmful. In this case the study area is prone to harmful level of noise and it has a pleasant calm wind velocity.

Visualization and Mapping Based on Spatial Data

Introduction:

Field data collection is challenging one for the investigator. Mostly all the project used to depend on secondary data, at the same time it is easy to collect the primary data using smart phones. Through the smart phones it is easy to explore the data's by installing the apps.Noise pollution and Weather forecast are the important phenomenon that is of major concern in both developing and developed countries. Noise Pollution is one of the real issues in this current scenario which should be control. Noise Pollution has been observed by using GPS Essential and Wide noise+. GPS (Global Positioning System) is one of the significant tools to track the movements and to determine the travelled location. It can give the correct position with latitude and longitude and friendly handy tools for the users.Climate is the single most important one to man.Climate also directly affects vegetation, soil, water resources, and drainage, etc…Climate is a critical factor in the lives and livelihoods of the people and socioeconomic development as a whole. Weather forecast is very important one to study about the Climatic Change of that local site. So to collect like this Parameters Windy app is used. These apps are helps the investigator to collect the primary data of that particular field.

Aim and Objective:

- To collect noise samples in the field using Wireless Application Protocol (WAP) and convert the non-spatial data into spatial data for geostatistical analysis.It examines the spatial variation of noise pollution.
- To create and visualize track data collected using WAP device from the field.
- To capture the geographic objects (trees, buildings, monuments etc…) and geotag the photographs with attribute data.
- To monitor the local climatic parameters like humidity, etc…

Data and Methodology:

This study is based on Primary data. **GPS Essential** and **Wide noise+** apps were used to collect the sample value of noise pollution. **Windy** has been used to monitor the weather phenomena of that particular day. These data was imported in app Quantum GIS desktop (3.10.2). QGIS has been used to create the map of Interpolation and the windy map of Chennai City. First and foremost noise pollution data was imported in QGIS and created .shapefile for that data and using IDW Interpolation the maps were created in the 3Dmodel. This field work is composed of noise pollution, tracks, geotagging photos and climatic parameters of that day. These data's were compiled, analyzed and reported in the lab.

Study Area:

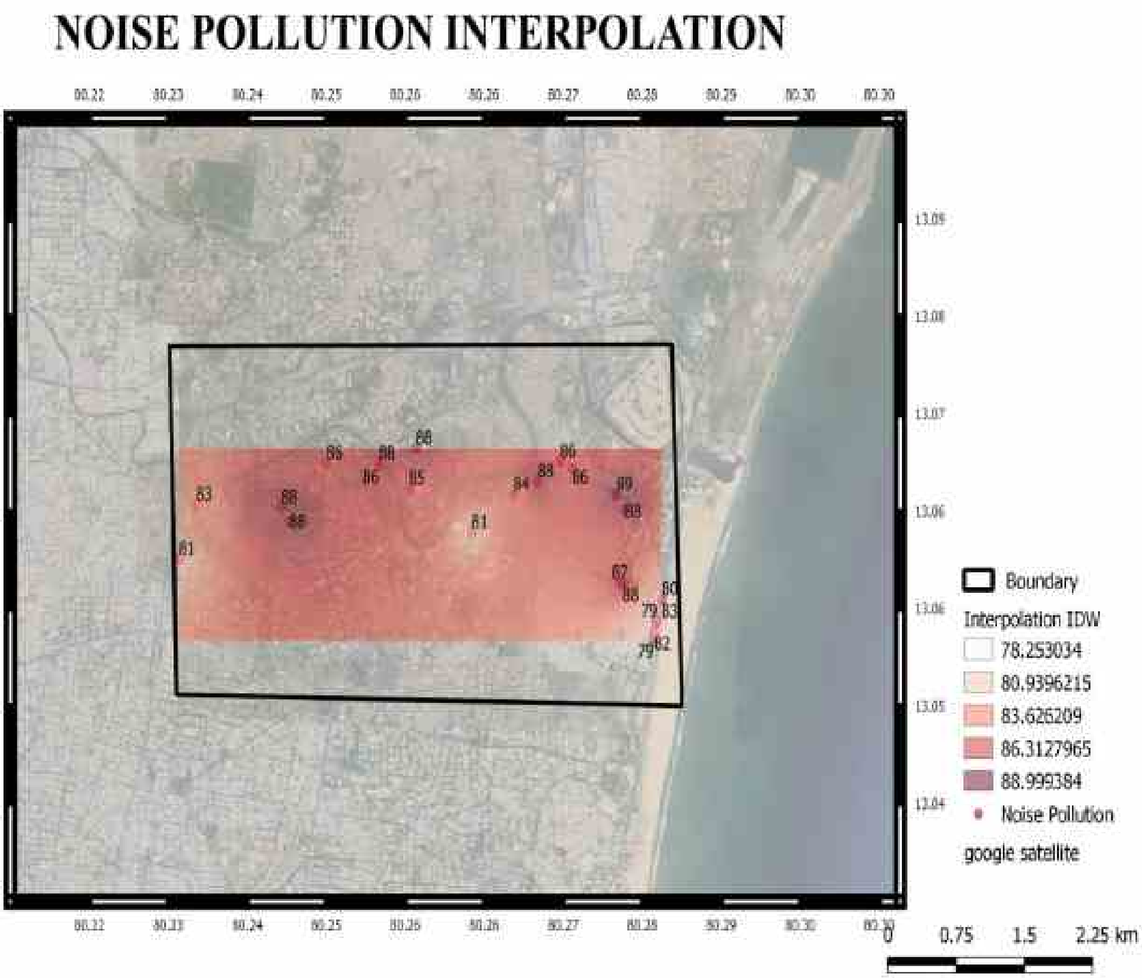
Chennai is the headquarters of Tamil Nadu in India. Tamil Nadu is one of the 28 states of India, situated on the southeastern coast of the country. In this city, Noise pollution data has been covered the area from Marina guest House to Loyola College. Other places are surrounding of the Marina Guest House, etc… in Chennai.

Analysis:

Noise Pollution:

PLACE	NOISE POLLUTION IN DECIBAL
Marina Guest House	78
Bharat Scouts and Guides	79
Kannagi statue	83
Kannagi statue Bus stand	80
Bharathi Salai	88
Near Madras Cricket Club	88
Mount Road	81
Near Madras Metro Auto Drivers	85
College Road	86
Sterling Road	88
Wheat craft Road	88
Loyola Hostel	81
College Road	86
Near State Bank	88
Casa Major Road	88
Bonny Salai	84
Near Croma	88
Walajah Salai	86
Medical College	89
Near Subway	81
Near the Temple	79
In front of the University Hostel	82
Outside of the Marina Guest House	79

Table: 1. Data for Noise Pollution



99

Figure1. Noise Pollution Map

Any unpleasant sound makes noise pollution. These noise pollutions are common in urbanized cities like Chennai city. This noise pollution data was collected and the variation was visualized in the map. Through this observation the maximum value 89 db has been observed near Government Medical College and the minimum value 79 db has been observed near Marina Guest House. This value ranges from 79 – 89 db. 81 db was observed in the Loyola College Hostel and on the Mount Road. Noise beyond a particular level or decibel tends to become a health and environmental hazard. So noise pollution should be control.

Track:

This particular track has been started from Nelson Manickam Road to Bharathi Salai Bus stand in Chennai. With the help of GPS Essential these track has been explored. This particular track has been covered the distance of almost 7.23 km.

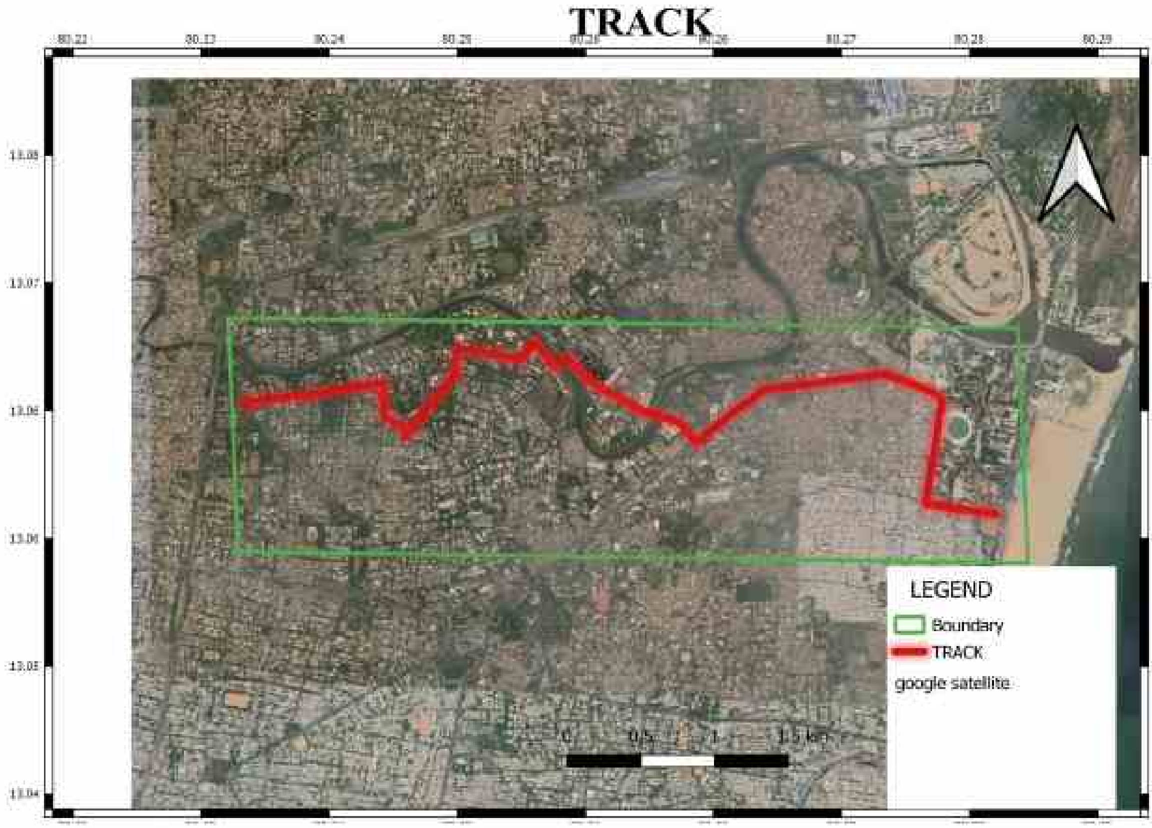


Figure: 2. Track Map

Geotagging Photos:

These photos were snapped by GPS Essential camera. By using this app one can understand where that particular photo has been taken. Using Google Satellite, it can give the exact locality with the coordinates and one can visualize the image. Images like trees, building, bus has been taken in the Marina Guest House, and it's all shown in the given map.

GEOTAGGING PHOTOS

Figure: 3.Map of Geotagging Photos

Windy (Meteorology):

On 23.02.2020 the local parameters of Humidity data has been observed by Windy app. The maximum humidity 77% has been observed over Ice House at 8 pm and the minimum value of 73% was found near Lifestyle Entrance at 2 pm. In the University Guest House humidity level was around 76% in the evening.

PLACE	HUMIDITY	TIME
Santhom Church	76%	6am
City Centre	74%	8am
INOX	75%	10am
Lifestyle Entrance	73%	12pm
University Guest House	76%	4pm
University Guest House	76%	6pm
Ice House	77%	8pm

Table: 2. Data for Humidity

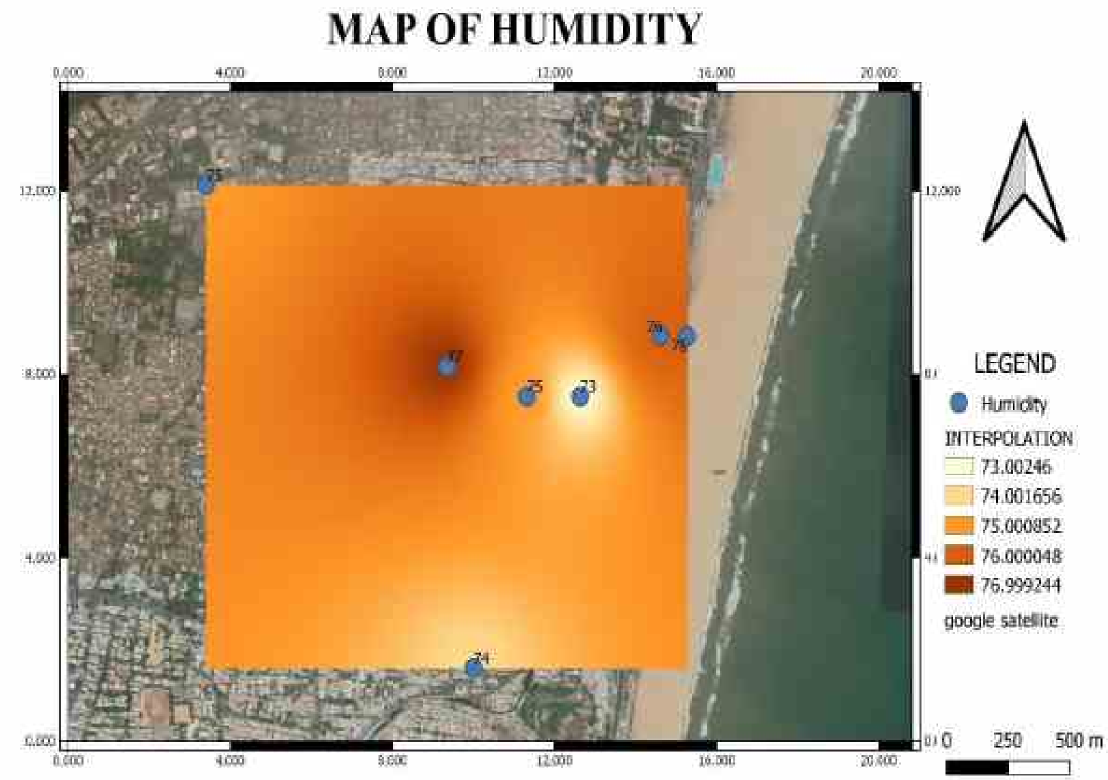


Figure: 3.Map of Humidity in Chenneai.

Summary and conclusion:

The present study demonstrates the monitoring, visualizing and mapping of the spatial data. Smart Phones are very essential one to collect primary data. These Primary data's are directly collected from the field. So they were reliable, accurate and time consuming one.One can collect these data in the field itself by using these apps.Investigators are supposed to install this these apps in the Smartphone's to collect primary data. After collecting, these data's were imported in computer to create map. Through this one can understand that QGIS software and Google Earths are helps us to create the map as well as to visualize the map.

SHORT STUDY REPORT ON SPATIAL DATA VISUALIZATION AND MAPPING USING SMART PHONE

Submitted by

Kannan Vaithianathan

(2019UOMDOGL101330)

Introduction

Field data collection in any discipline is a tedious process for the person engaged on the ground related realities. In the past decades field data collection using questionnaire and other materials and means made the work complex in gathering, compiling the data and training the individuals involved in these processes which pushes the expenses at very high. In the recent days due to the technology revolution and its application made us user friendly to record field data using smart phone. There by reducing cost, time and field expenses to some extent is really an excellent approach particularly for the researchers and government establishments that requires field-based data collection for management purposes. Therefore, using the Smart Phone this attempt was made from Lab to Field and from Field to Lab that is learned from DST-NRDMS Geospatial Winter School organised by Department of Geography, University of Madras, Chennai.

Aim

Learning the Apps using the Smart Phone as a device – Point Data Capture, Track Capture and Geotagging Field Data

Objective

1. Point Data Capture
2. Track capture
3. Geotagging Field data

Methodology

As part of this assignment I took the start location from the Madras University Guest House and walked towards North up to Nepiar Bridge along the seashore. During the walk I used the Mobile Apps to record Noise Pollution Mapping, Tracking data, Point data Capture and Geotagging Photos.

Lab to Field

Teachers have taught us how to use Smart Phone and the freely available mobile Apps from the Google play store such as WideNoise Plus, GPS Essentials, Windy (Meteorology) in collecting field data.

Field to Lab

The collected data and supplementary information gathered were brought back from field to lab and analysed using Q-GIS.

Analysis & Discussion

Task 1. Noise Pollution Mapping

The noise level at the stretch from University Guest House to Nepiar Bridge was ranged from 66 db to 80 db. The observation suggests that the minimum level recorded was due to points taken at the memorial located along the stretch. The maximum recorded was due to an ambulance that crossed near to the memorial. There was not much variation recorded in the noise level along the stretch. The noise pollution recorded and analysed using mobile App is given below (Fig 1)

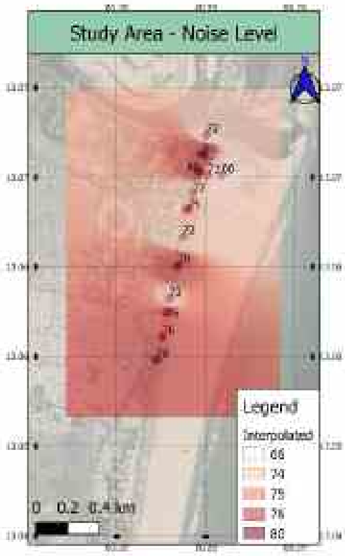


Fig. 1. Noise level mapping along the University Guest House to Napier Bridge

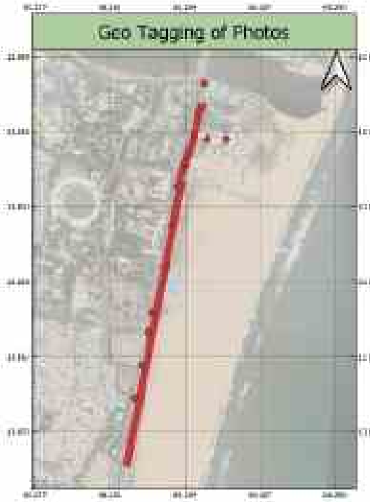
Task 2. Tracking Data

The same stretch was used for tracking studies from the Guest House to Napier Bridge. The analysed map below itself show the tracking analysis using Q-GIS.

Fig 2. Track data mapping along the Guest House to Napier Bridge

Task 3. Point Data Capture and Geotagging Photos

Similar to the above two tasks the point data capture and geotagging of photos was done. Along the stretch the major landmark buildings were photographed, later those were geotagged. Though I am successful in geotagging the photographs I am unable to show them in the mapping analysis, which need to be practiced.



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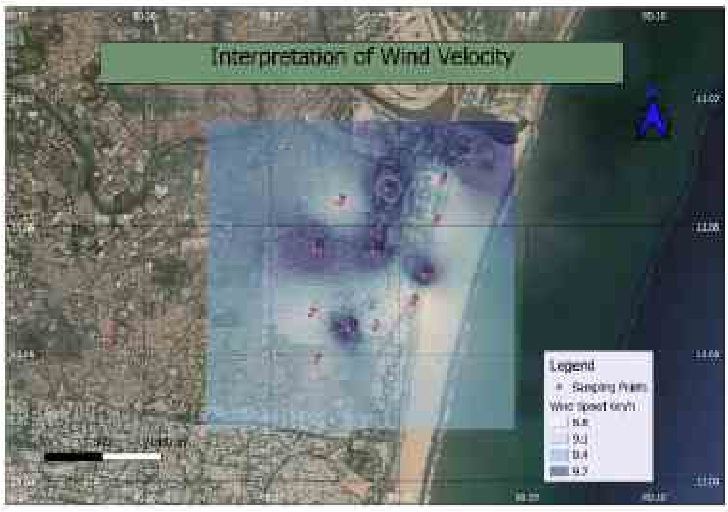


Fig. 4. Wind speed analysis using Q-GIS

Summary

As I am from different background the technology and training provided by the DST-NRDMS Winter School organising team is an excellent learning experience for me and will be integrated in my field studies particularly in the area of Biodiversity and Protected Area Management.

ANALYSIS OF NOISE POLLUTION IN THIRUNAGESWARAM TOWN, KUMBAKONAM TALUK

1. INTRODUCTION

Noise pollution is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms. According to the World Health Organization, sound levels less than 70 dB are not damaging to living organisms, regardless of how long or consistent the exposure is.

The loudness of sound is commonly expressed in decibel (dB). Permitted noise level of different locations shown in Table1.

S.no	Type of area	Day time	Night time
1.	Industrial area	70	70
2.	Commercial area	65	55
3.	Residential area	55	45
4.	Silence zone	50	40

2. STUDY AREA

Thirunageswaram is a Panchayat town in Thanjavur district in the Indian state of Tamil Nadu. Thirunageswaram located inbetween the10.9637° N Latitude and 79.4315° E longitude.Thirunageswaram is located 6 km east of Kumbakonam. It is the suburban region of business city of Kumbakonam.

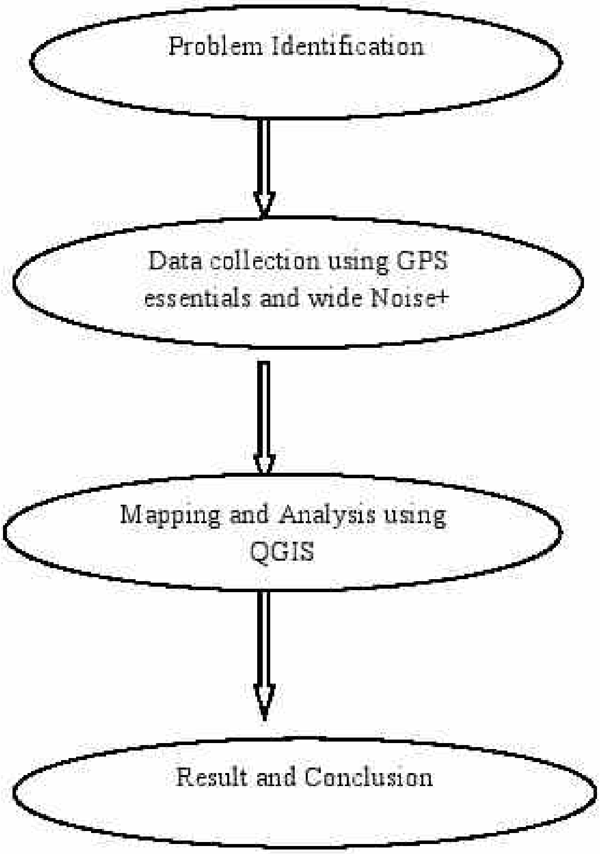
3. AIM

The Main objective of this study is to develop a road traffic noise pollution model for the study area.

4. OBJECTIVES

- To collect the noise data on different locations using GPS essentials and Wide noise+ app.
- To prepare the noise maps using QGis and calculate noise levels at each observation point.
- To draw interpolation using IDW interpolation techniques for Noise mapping.

5. METHODOLOGY



6. USING APPS

1. GPS essentials
2. Wide Noise+
3. Windy
4. QGIS.

6.1. GLOBAL POSITIONING SYSTEM

Global Posting System Data Collection Various methods use for the collecting high-accuracy GPS data and it depends on several factors like the objective of the survey preferred precision, equipment availability and field logistics. Each point contains attribute data like topographical coordinates, location, date and time of data collection, a major source of noise, noise indices, maximum logged noise level, minimum logged noise level and an average noise level.

6.2. INTERPOLATION

Surface Interpolation Technique by using IDW The interpolation is a technique to envisage the cell value at a position that deficit the point. It can work on the principle of the special auto reformation or spatial dependency, that measure the relationship between nearby and distant object item. The interpolation technique of the ground surface can define all specimens to calculate every output in form of the grid cell values and this cell value can be found out by inverse distance weighted (IDW) interpolation method using a linearly weighted grouping of the sample points. The function of inverse distance is a weighted. The inverse distance weighted can control the impact of known points, the interpolate values and their distance from the output point. IDW can provide precise weighted interpolate surface grid value and structure.

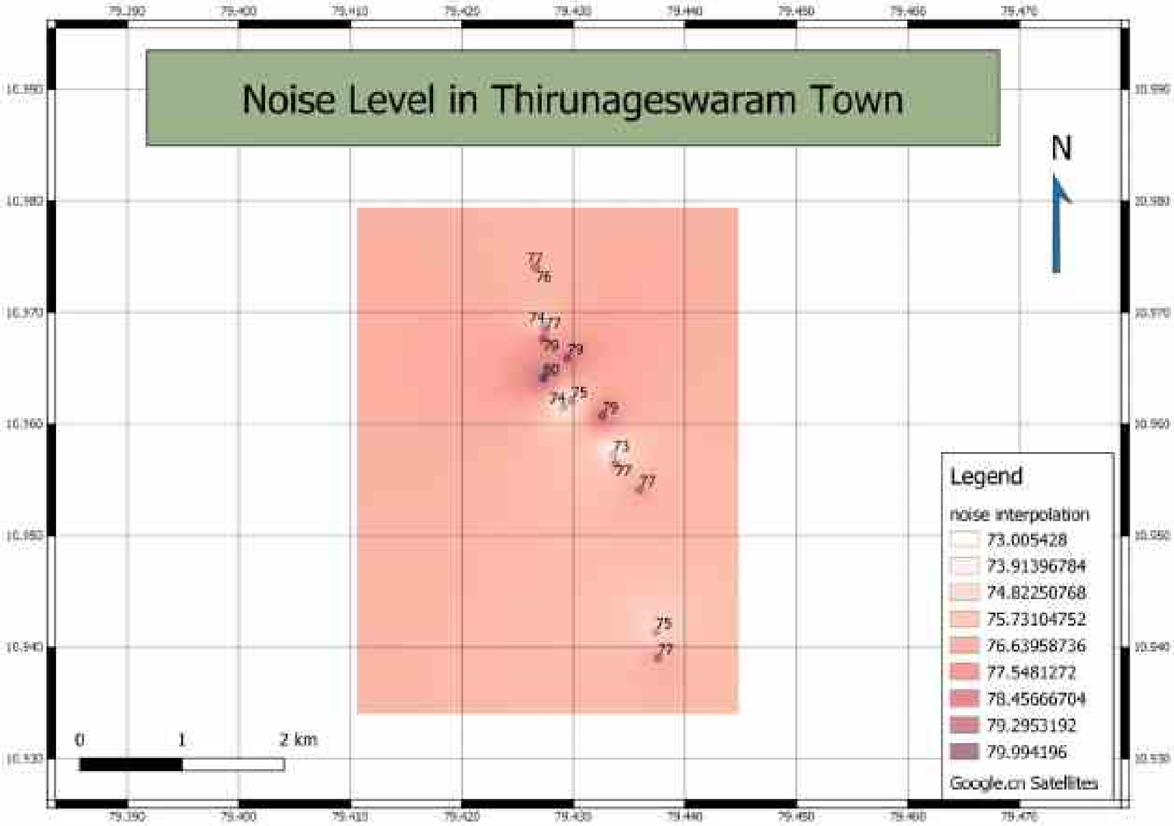
7. LOCATION MAP

Fig.1. Location of Thirunageswaram Town

8. WAY POINTS

Fig. 2. Way points

9. **NOISE INTERPOLATION**



The noise levels recorded in and around Thirunageswaram, Kumbakonam(Taluk), Tamilnadu, presented in Figure3. It is observed that the noise level is maximum during evening peak hour between 5:00pm and 7:00pm. Noise level is gradually increasing from Evening 5:00pm to 6:00pm and then reaching evening peak from 6:00pm to 7:00pm. The noise level is higher on far noise is decreasing from 8:00pm onwards. It is also observed that the noise level is decreasing towards buildings from the source. The side than that of near side and the reason for this is the return trip to home is more.

S.No	Area	Noise level in (db)	Activity
1.	Big Bazaar	79	Commercial Region
2.	Market	79	Commercial Region
3.	Ayyavadi Bridge	73	Settlement Region
4.	Pillar kovil Street	80	Commercial Region
5.	VVL church	73	Settlement Region

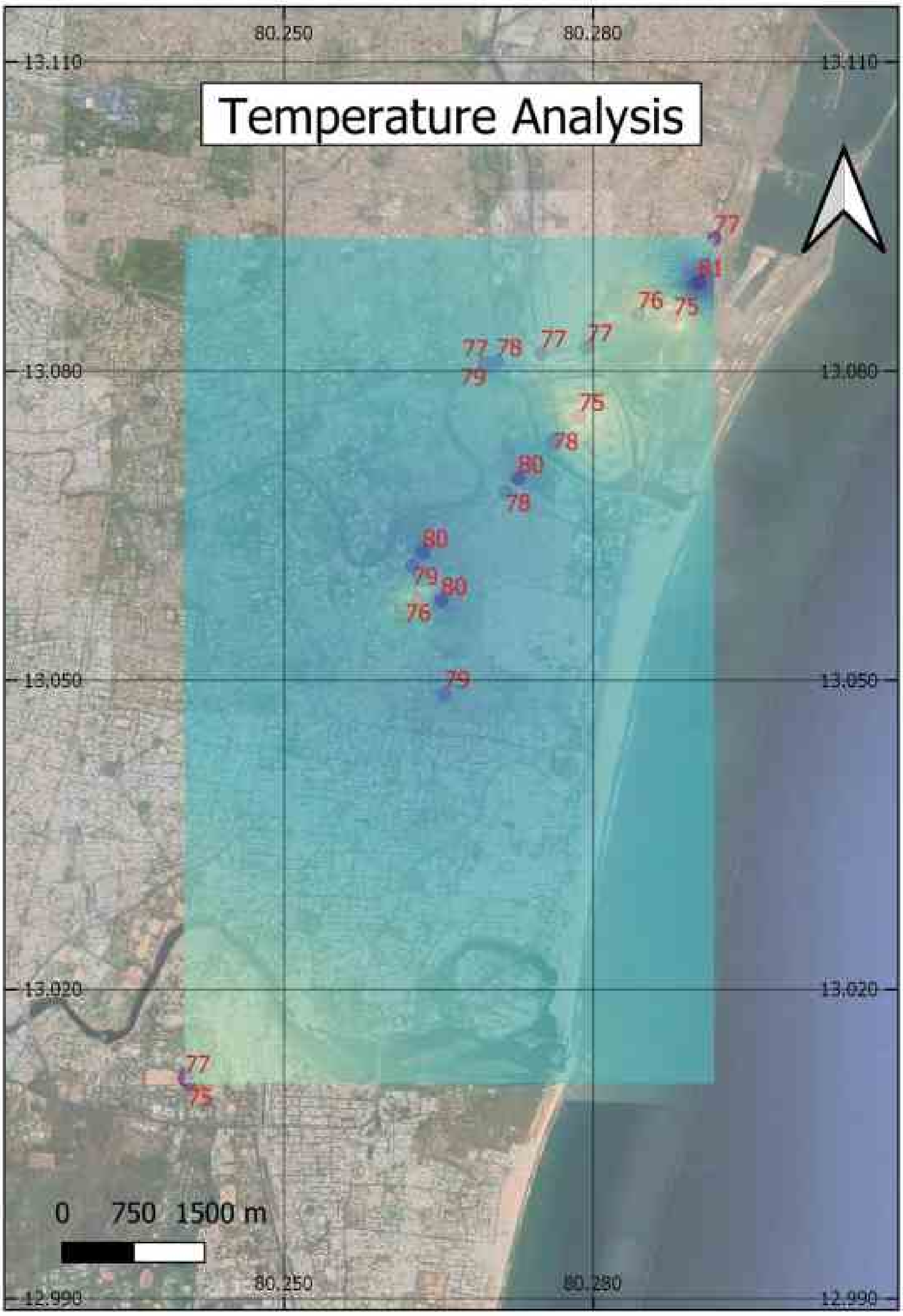
From the above table the lowest level is 73. Because the settlement areas are located near the busiest roads, near railway tracks and Industrial regions. The highest noise level is recorded in Pillar Kovil Street. It is the main road to connect all directions.

S.No	Area	Noise level in (db)	Activity
1.	Big Bazaar	79	Commercial Region
2.	Market	79	Commercial Region
3.	Ayyavadi Bridge	73	Settlement Region
4.	Pillar kovil Street	80	Commercial Region
5.	VVL church	73	Settlement Region

10. CONCLUSION

Noise pollution is not only causing environmental but it also gives a negative impact on human health as if the hearing loss, hypertension, ischemic heart disease, annoyance, and sleep disturbance. . Noise control or mitigation is a technique of reducing unwanted sound emissions. There are various techniques of noise control or mitigation as if sounds insulation, sound absorption, vibration damping, and vibration isolation. Thirunageswaram is the major town for nearby villages. Uppiliyappan temple, Raghu temples are situated near the town. Thirunageswaram had a major vegetable market for neighboring villages. It connecting the near by villages. It is a industrial region. So the noise level is recorded maximum.

TEMPERATURE ANALYSIS



Temperature Analysis
80.250
80.280
13.110
13.080
13.050
13.020
12.990
77
81
76
75
77
78
77
77
79
75
78
80
78
80
79
80
76
79
77
75
0 750 1500 m

Noise Pollution Mapping by GIS Techniques and Wireless Application Protocol(WAP).

Vasanth patil S.B

Introduction:

Noise pollution is also known as sound pollution. Sound pollution mainly caused by machines, transport, and propagation systems. Noise is measured in Decibel (dB), The average noise level of 97.60 dB obtained exceeded the WHO value of 50 dB allowed for residential areas. Noise pollution affects both health and behaviour. Unwanted sound (noise) can damage physiological health. Noise pollution can cause hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances and other harmful and disturbing effects. The main aim of the study is to analyse noise pollution spatially in the Marina beach area using the google open apps with their respective geo- location.

Aim:

- To generate spatial map of Noise pollution of Chennai Marina beach road.

Objective:

- To collect the Noise samples in the field by using WAP (Wireless Application Protocol) and covert the non-spatial data into spatial data.

Mobile apps used:
- GPS ESSENTIALS
- WIDENOISE +
- WINDY(Meteorology)

Methodology:

Task-1: Noise pollution Mapping:

- Collected the Noise samples in the field using Wireless Application Protocol (WPS) and covert the non-spatial data into spatial data for geostatistical analysis.

Task-2: Tracking data:

- Created and visualized the track data using WAP device from field and worked in the QGIS Software.

Task-3: Point Data capture and Geotagging Photos:

- Captured the geographic objects and geotag the photographs with attribute data by using GPS Essential App.

Methodology:

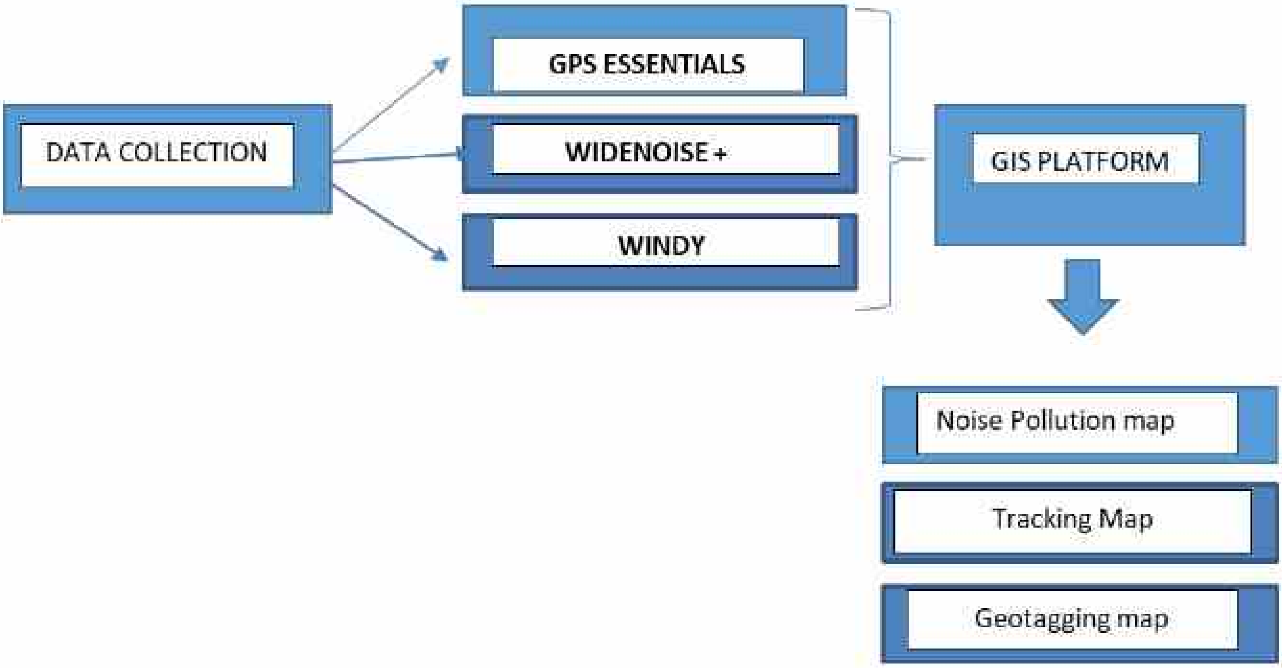


Fig 1-Flow chart of methods used

Result and discussion:

The fallowing results maps are generated

Task-1: Noise pollution map:

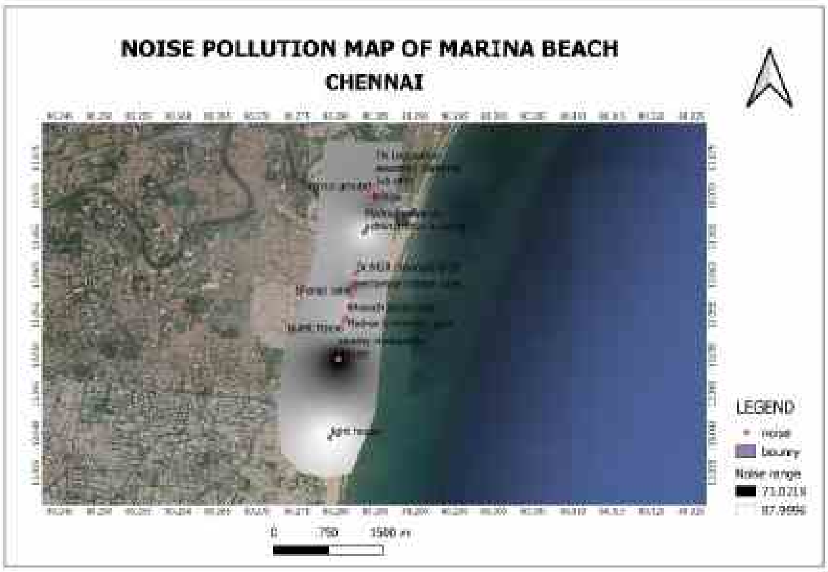


Fig 2- Noise pollution map of Marina beach,Chennai.

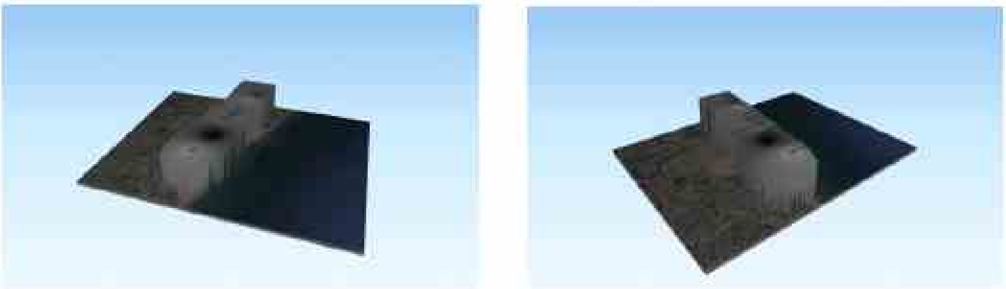


Fig:3-3D models of noise pollution

Task-2: Tracking data:

Fig:2-Tracking map of Marina Beach,Chennai

Task-3: Point Data capture and Geotagging Photos:

Fig:4-Geotagging map of Marina beach, Chennai

Place	Lat	Long	Temperature	Humidity	Wind	noise
Madras University gate	13.0546	80.2813	28	60	6	78
Bharath scout road	13.056	80.2816	28	60	6	83
Bharati salai	13.0574	80.2819	29	58	6	83
Precidency college gate	13.0582	80.282	28	65	8	73
Dr.MGR cenenary arch	13.0603	80.2825	28	64	6	81
Madras university adminstrative building	13.0655	80.2836	27	64	6	86
Bridge	13.0695	80.2845	28	64	6	73
TN Legislative assembly Diamond Jublee.arch	13.0713	80.2849	27	64	6	78
circus ground	13.0706	80.2834	29	63	6	77
guest house	13.0542	80.2809	27	62	8	83
swamy vivekanada house	13.0494	80.2803	28	64	8	63
light house	13.0395	80.2792	28	64	8	88

Table 1: Data collected from Field using Mobile apps

Conclusion:

From the above result we estimated that high noise pollution area is light house because of high traffic and low noise is present in presidencial college gate and near bridge,Humidity is very low in Madras university guest house and high in presidency college gate and other places have moderate humidity.