

# ECOL 481: Digital Image Processing for Environmental Applications

*eLearning Module*

*Course Teacher*

**Prof. S Jayakumar**

Dept. of Ecology & Environmental Sciences

Pondicherry University

Puducherry, India

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# 1. General Information

Course Code	:	ECOL - 481
Course Title	:	Digital Image Processing for Environmental Applications
Number of Credits	:	3.0 ECTS
Course duration	:	18 Weeks
Level	:	Postgraduate
Course Teacher	:	Prof. S. Jayakumar
Prerequisite	:	Basic understanding on Mathematics (school higher level), English language skill, computer operation (Windows/Mac).

## 2. Course description

*This course provides students an in-depth theoretical knowledge and hands-on training in satellite data handling, processing, mapping and analysis.*

### 3. Course goals

The main aim of the course is to provide students the ability to handle satellite data comfortably in different environmental applications. To make students to think and select appropriate satellite data from the freely available sources for their environmental applications. To prepare student to preprocess the satellite data, understand the errors in satellite data and get the data ready for analysis. To give training to students to handle Pan chromatic, Multispectral and Hyperspectral data. To teach students to handle the DEM from SRTM, SPOT, and other sources and to prepare digital elevation model, slope and aspect. To make understand the use of band ratioing and its applications.

## 4. Course outcome

By the end of the course, successful students will:

1. Know the sources from the where satellite data can be downloaded
2. be familiar with different types satellites, payload, bands, cell size and so on
3. be able to retrieve meta data information from each satellite data
4. know to handle different types of satellite data
5. be able to do preprocessing and make the data ready for analysis
6. know the function of geometric correction and how to perform it
7. be familiar with different types of projection, mosaicking and subsetting
8. be able to perform band ratioing and apply the same for environmental applications.

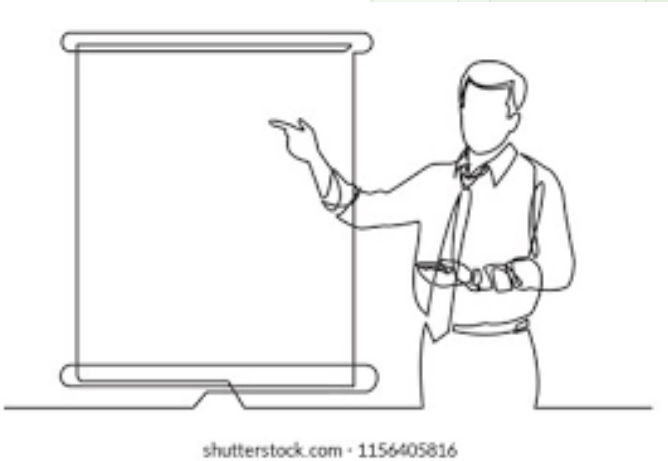
## 5. Course structure

### 5.a. Course Content

Week - 1	Introduction to Satellite data
	Satellite data download from USGS website
Week - 2	Data Import/Export, Layer stacking and FCC formation
	Metadata information
Week - 3	Pan chromatic data, multispectral data
	Hyperspectral data, elevation data
Week - 4	Raster layer information
Week - 5	Layer statistics
Week - 6	Data preparation, Geometric correction
	Projecting and reprojection
Week - 7	Mosaicing
Week - 8	Subsetting/Masking
Week - 9	Geometric correction of scanned maps
Week - 10	Spectral reflectance pattern of vegetation
Week - 11	Collection of phenological data
	Soil spectral reflectance
Week - 12	Water spectral reflectance, Urban spectral reflectance
Week - 13	Digital elevation model, spatial analysis of DEM
Week - 14	Band ratioing – RVI, DVI, NDVI
Week - 15	SAVI, SWI

## 5. Course structure

### 5.b. Mode of delivery



In-Class Lectures



On-line Lectures



Microsoft One Drive



Microsoft Teams

Students will get enrolled in Pondicherry University Learning Management System and the classes will be handled in hybrid mod



## Pondicherry University Learning Management System (<https://lms.pondiuni.edu.in/>)

The screenshot shows the LMS login page with a modal window for user authentication. The modal contains the following elements:

- Log in** header
- Username field: `jayakumar.ees@pondiuni.edu.in`
- Password field: `*****`
- Log in** button
- Link: [Forgot your username or password?](#)
- Section: **Log in using your account on:**
- Buttons: **Office365 | Tutors | Students Login** and **Office365 Login**

The background page features the **PULSE** logo and navigation menu with items like University Portal, SAMS, Office365 Apps, Courses, Site Announcements, LOGIN, and Contact Support. A sidebar on the right contains icons for home, search, and other functions.

The banner displays the **PULSE** logo and the text: **Pondicherry University Learning System - A New Initiative for Better Learning and Teaching**. Below the banner, a section titled **Integrated & Flexible Learning System** is visible.

### Integrated & Flexible Learning System

This system is based on MOODLE a well known open source Learning Management System. This provides an one stop solution for all learning and teaching activities of departments and centres in the Pondicherry University Campus. The system is fully integrated with Office365 for authentication and fully integrated to give a seamless access to both platforms. PULSE provides easy course enrolments and course tutor can enable different enrolment modes including pre-requisite. This platform provides a complete learning and teaching system for in-person, blended-online, full-online and distance mode of education.

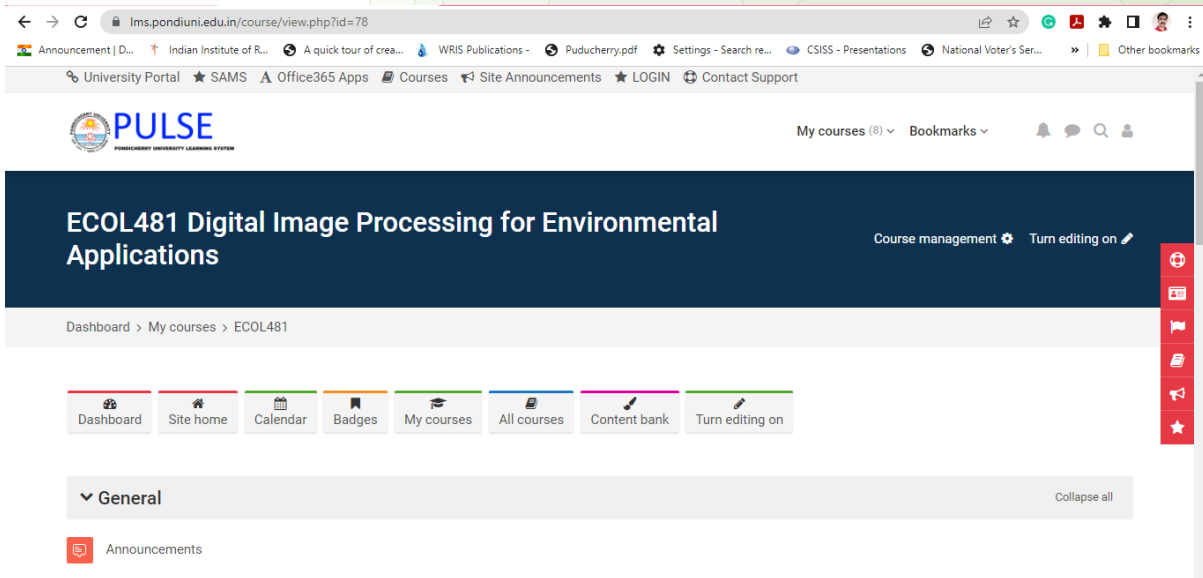
**Features...**

**Office365 Deep Integration**

**Turnitin Plagiarism Similarity Check**

**Competency Based Activities**

**User Reports and Customization**



Dashboard > My courses > ECOL481

**ECOL481 Digital Image Processing for Environmental Applications**

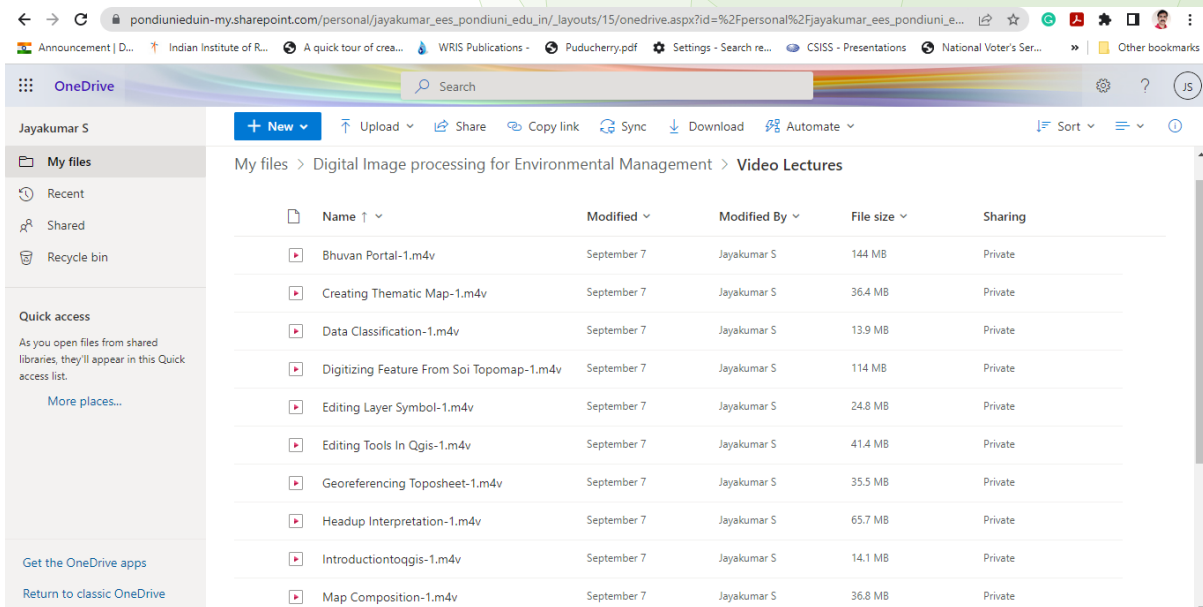
Course management + Turn editing on ✎

Dashboard Site home Calendar Badges My courses All courses Content bank Turn editing on

General Collapse all

Announcements

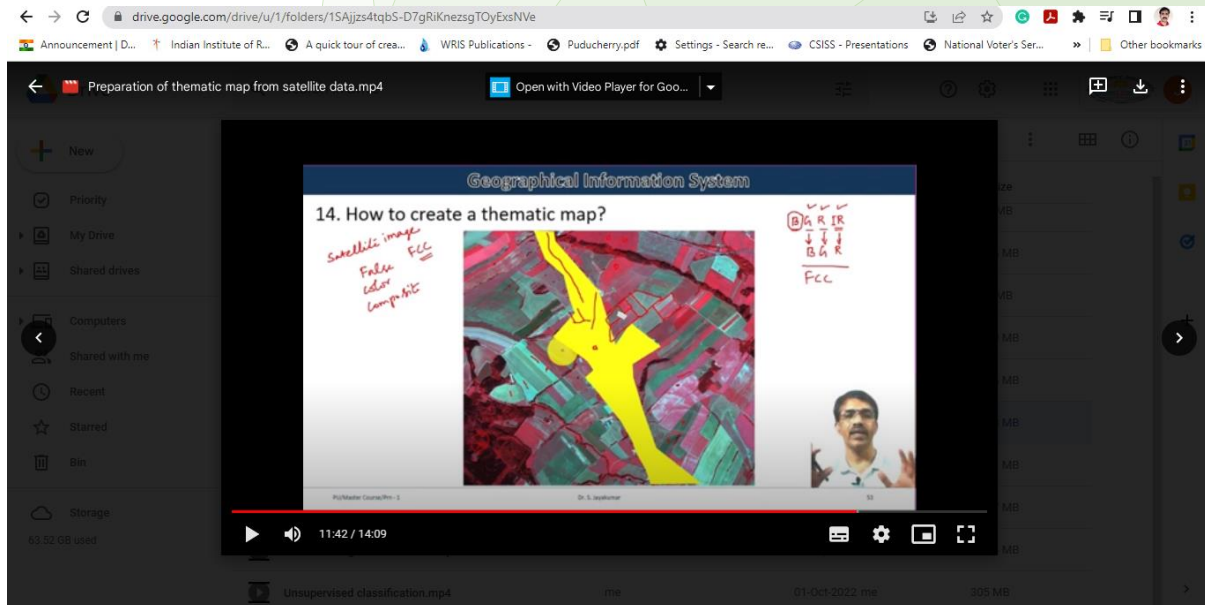
## Video Lectures linked to PULSE



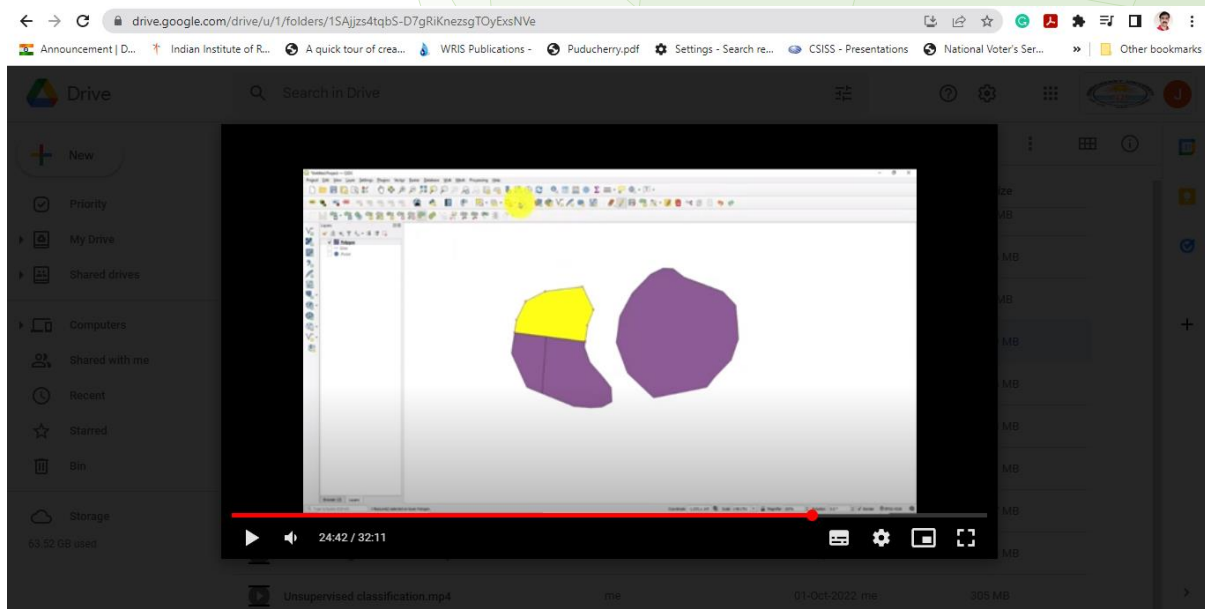
My files > Digital Image processing for Environmental Management > Video Lectures

Name	Modified	Modified By	File size	Sharing
Bhuvan Portal-1.m4v	September 7	Jayakumar S	144 MB	Private
Creating Thematic Map-1.m4v	September 7	Jayakumar S	36.4 MB	Private
Data Classification-1.m4v	September 7	Jayakumar S	13.9 MB	Private
Digitizing Feature From Soi Topomap-1.m4v	September 7	Jayakumar S	114 MB	Private
Editing Layer Symbol-1.m4v	September 7	Jayakumar S	24.8 MB	Private
Editing Tools In Qgis-1.m4v	September 7	Jayakumar S	41.4 MB	Private
Georeferencing Toposheet-1.m4v	September 7	Jayakumar S	35.5 MB	Private
Headup Interpretation-1.m4v	September 7	Jayakumar S	65.7 MB	Private
Introductiontoqgis-1.m4v	September 7	Jayakumar S	14.1 MB	Private
Map Composition-1.m4v	September 7	Jayakumar S	36.8 MB	Private

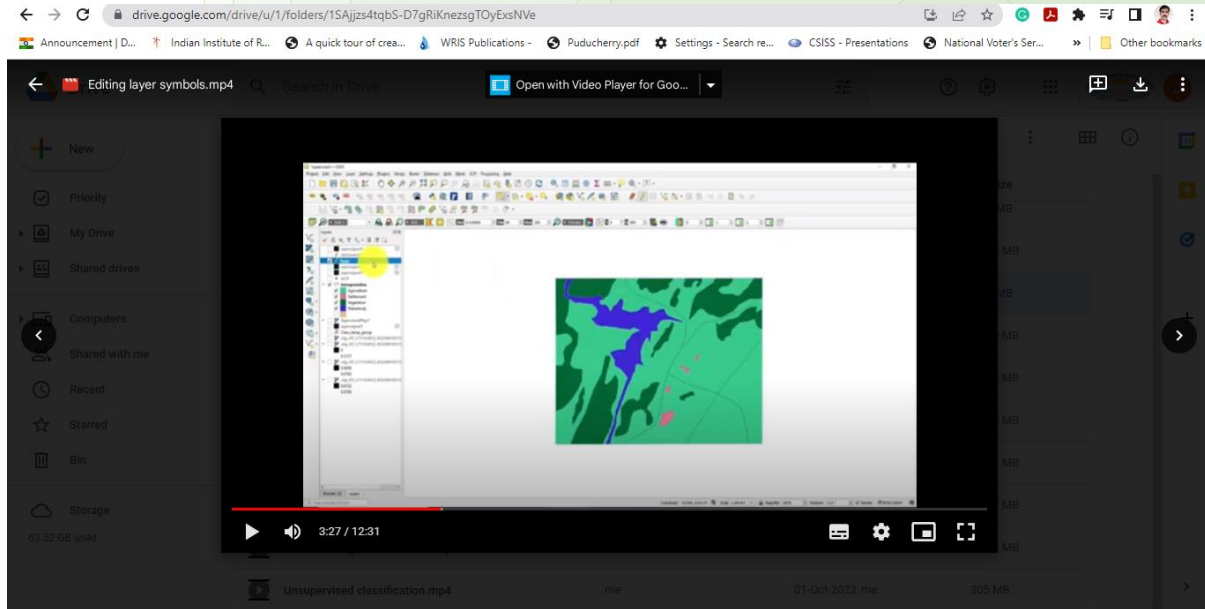
## Glimpse of Video Lectures: Preparation of thematic map



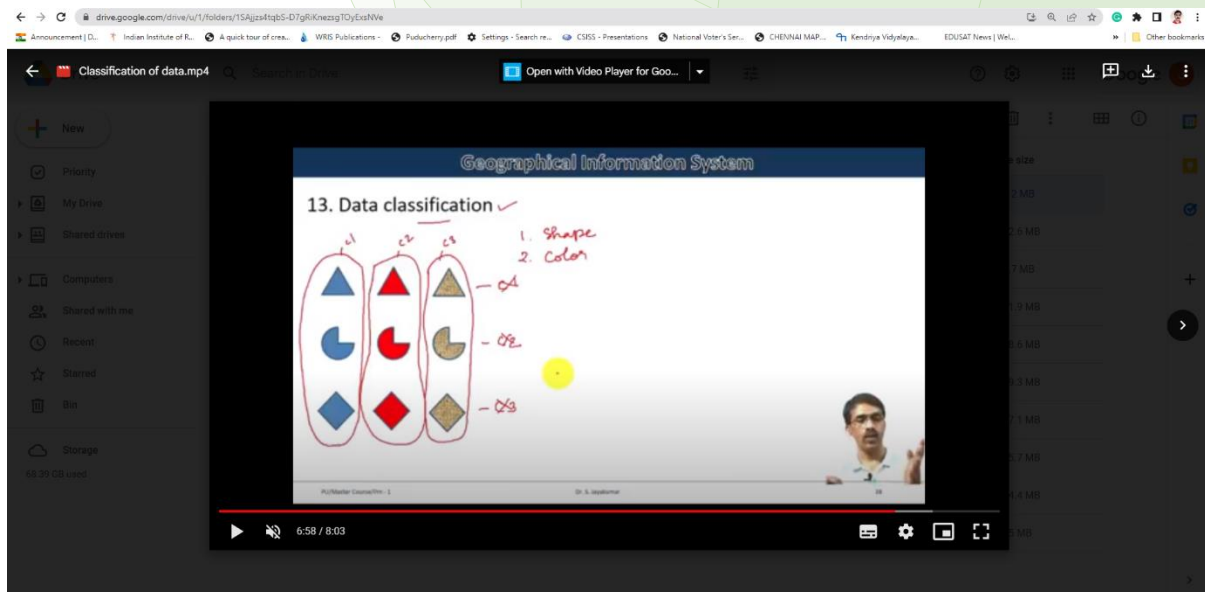
## Editing layers in QGIS



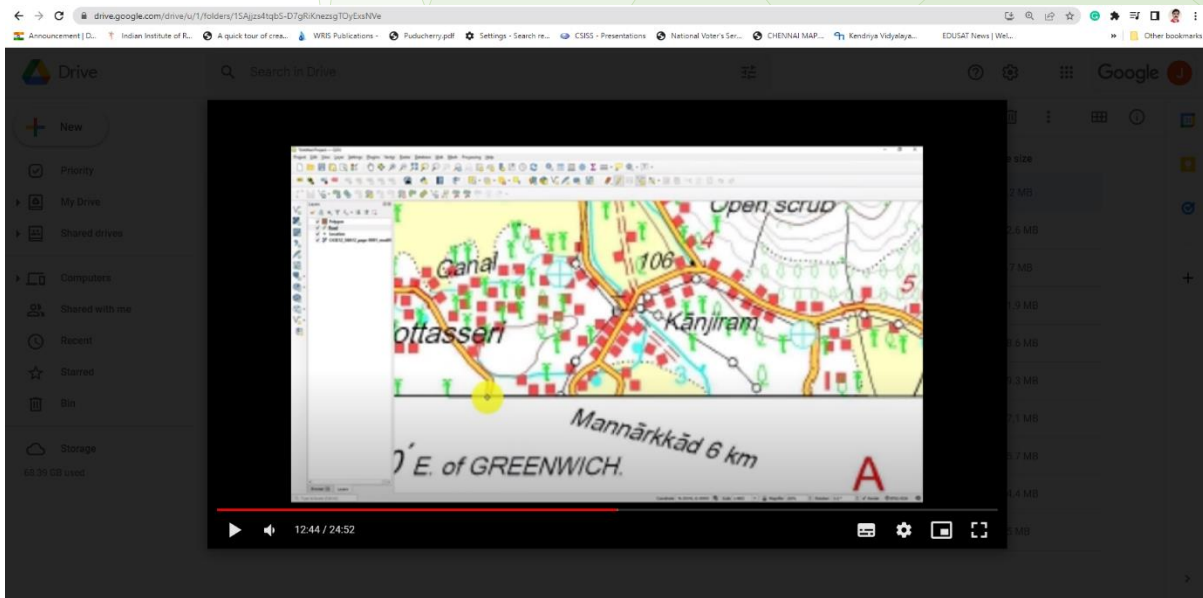
### Editing symbology in QGIS



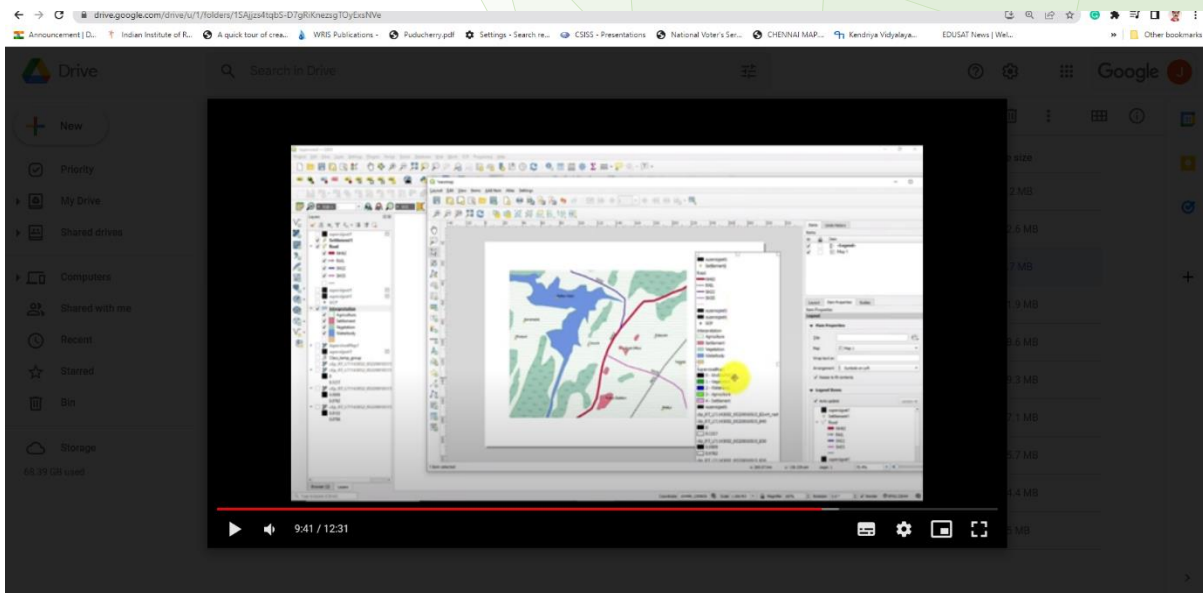
### Satellite data classification



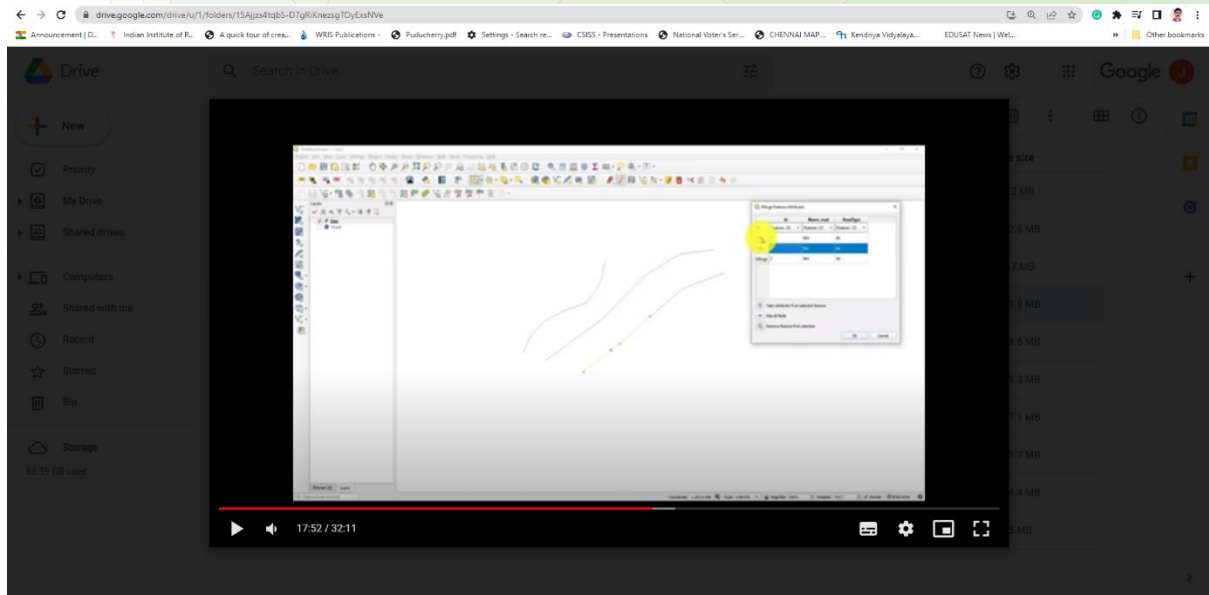
## Digitizing features from topo map



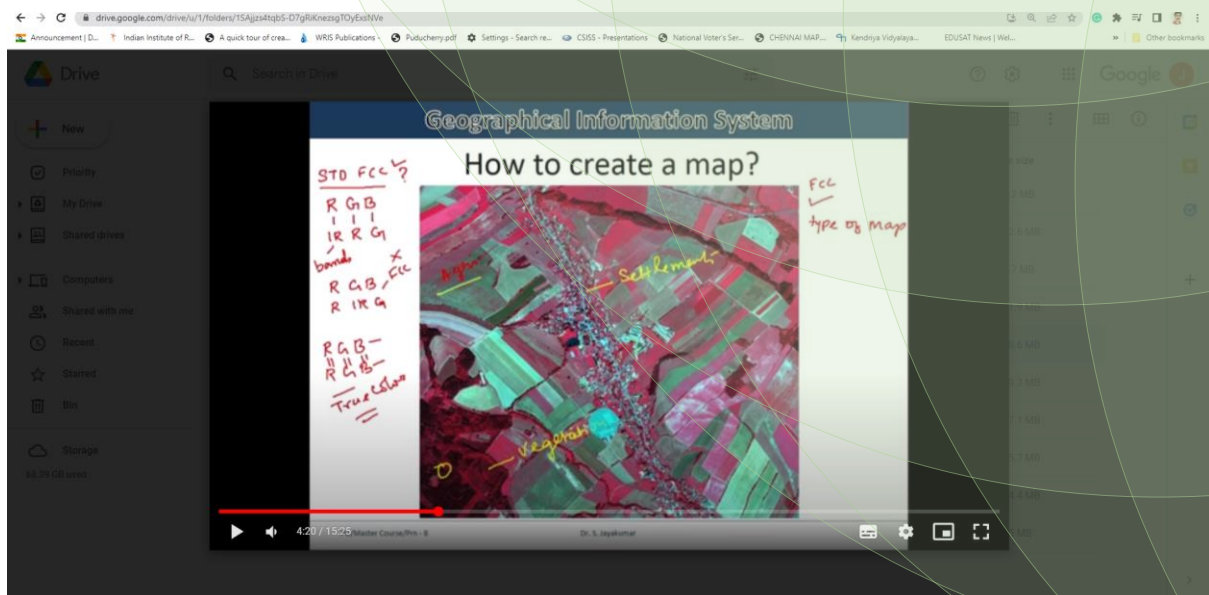
## Map composing in QGIS



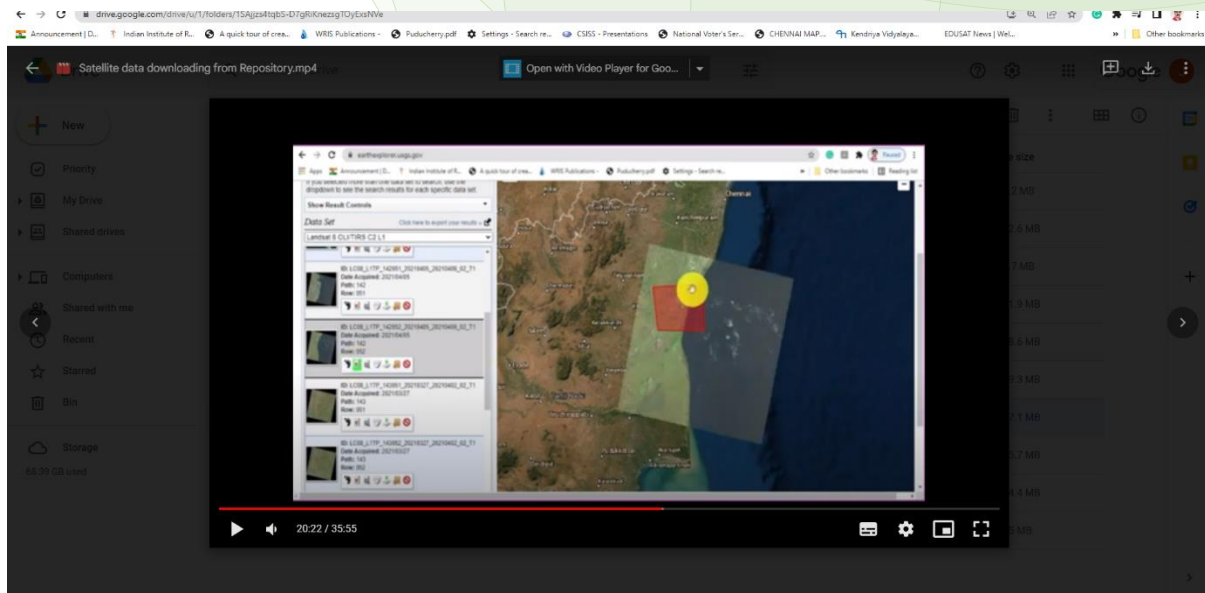
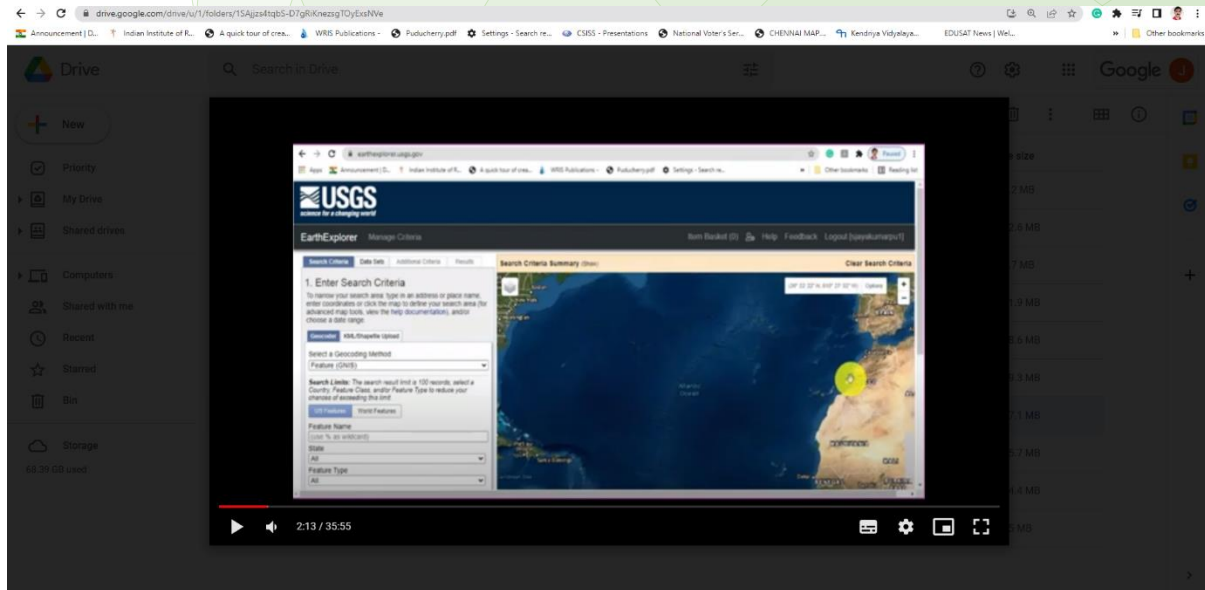
## Editing tools in QGIS



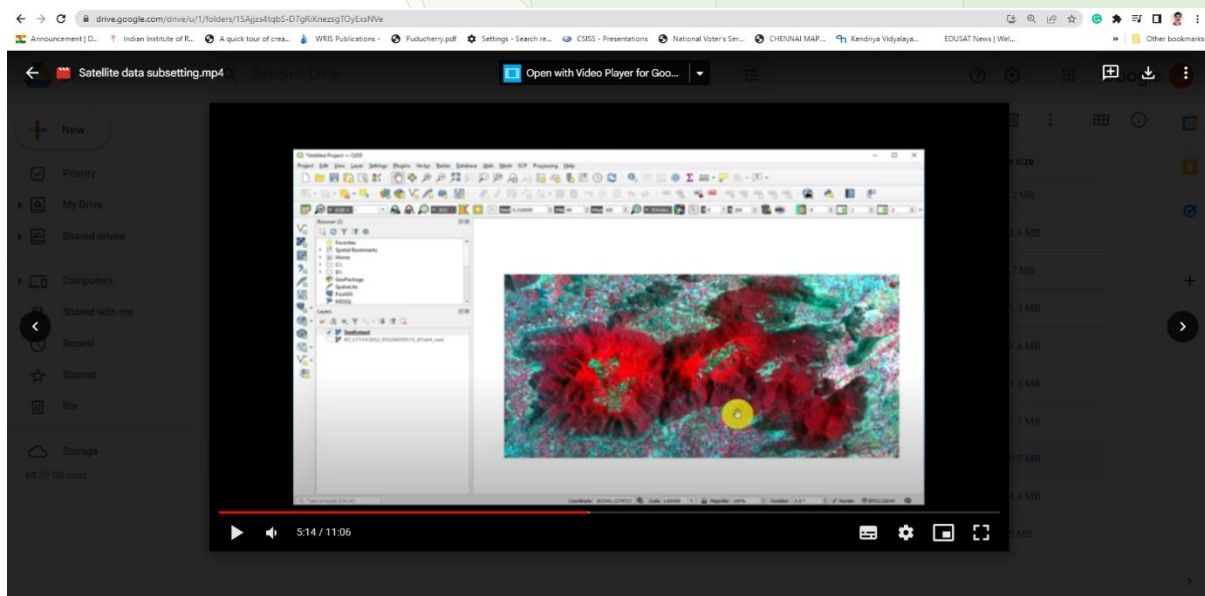
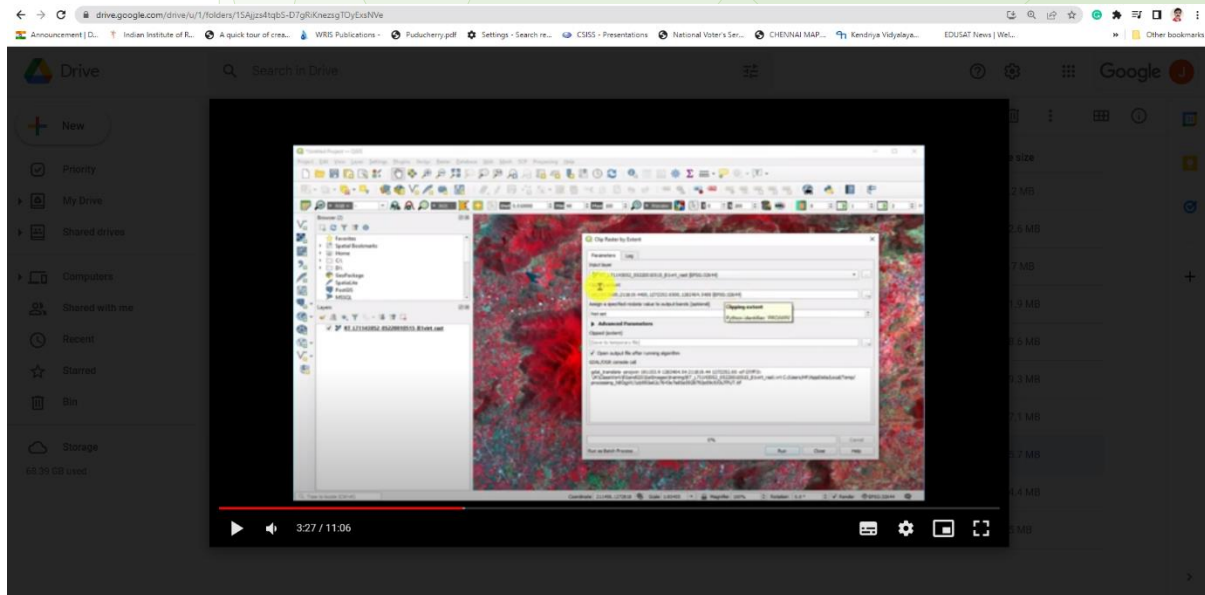
## Head-up interpretation



## Satellite data downloading from repository

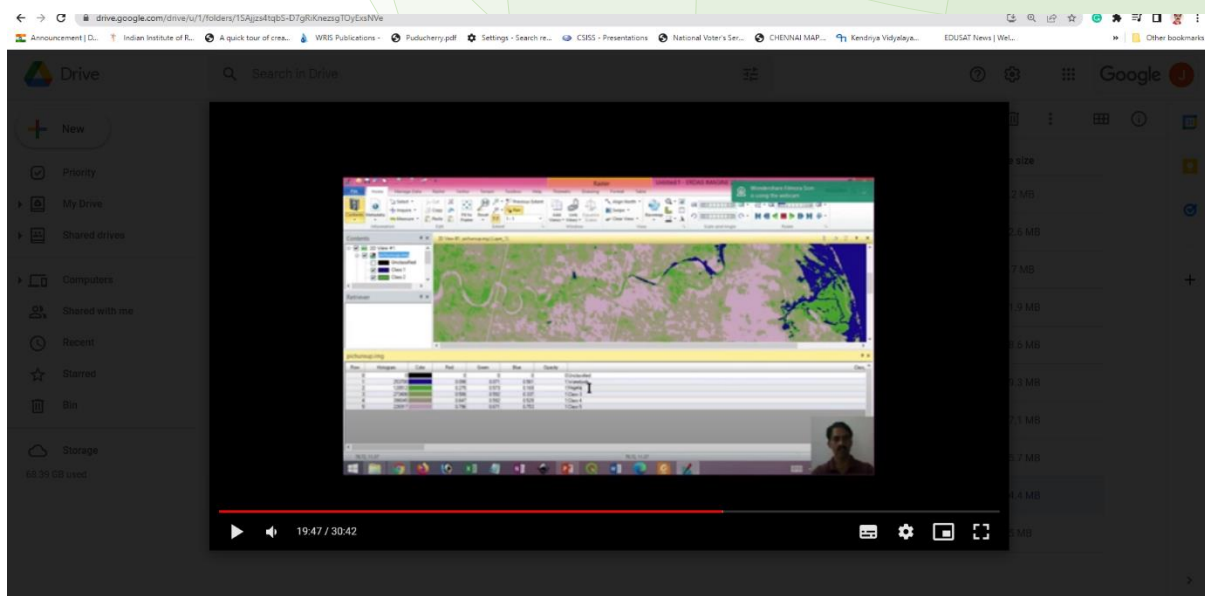
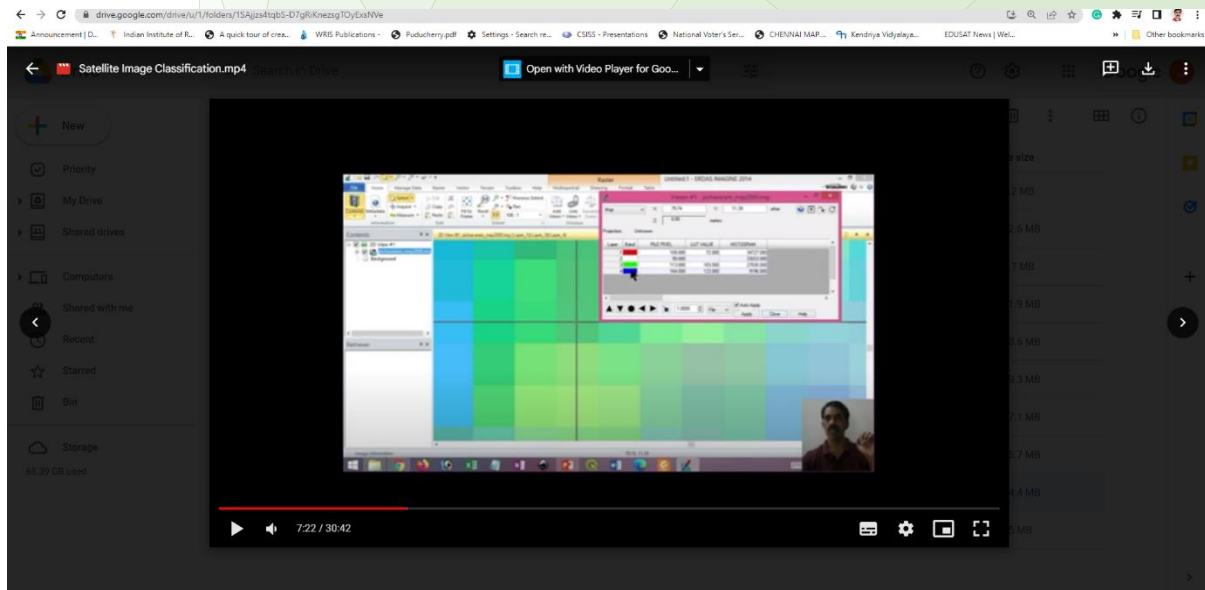


## Satellite data subsetting

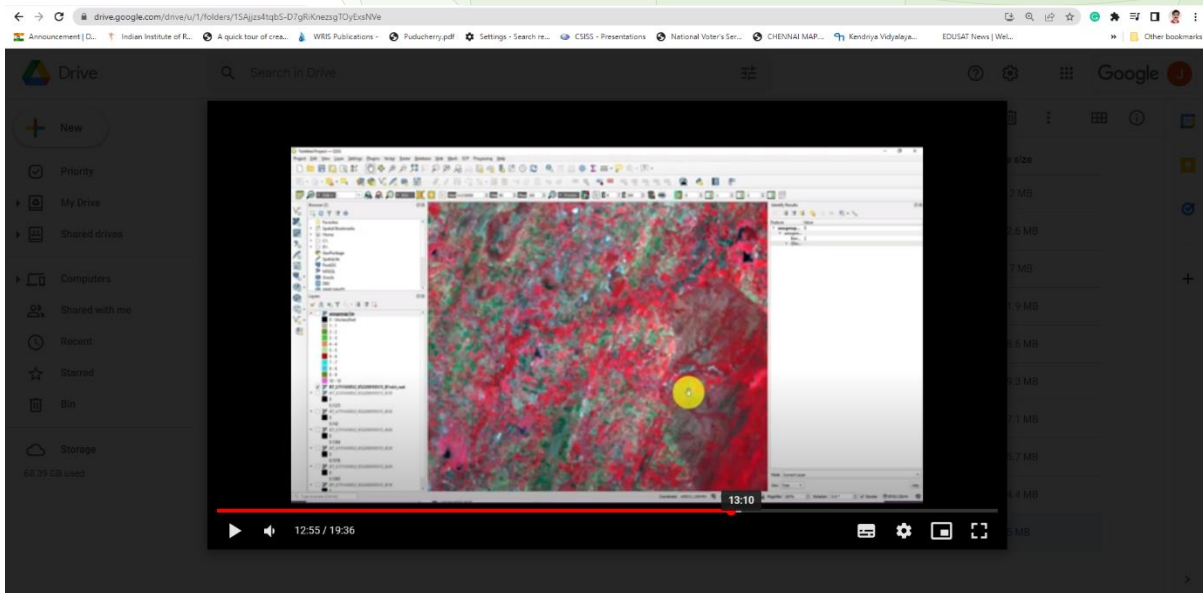
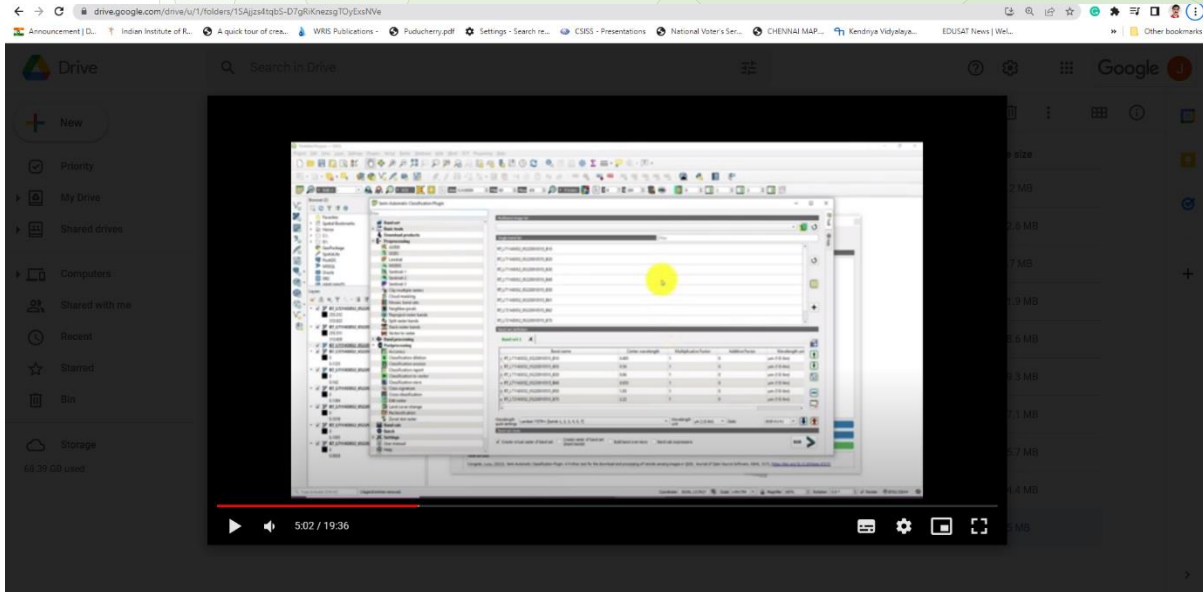




## Satellite Image classification



## Unsupervised classification



## 5. Course structure

### 5.c. In-class discussion

Understanding the satellites architecture, sensor characteristics, bands, pixel size, satellites from different countries, Optical, thermal and microwave satellites

### 5.d. In-class assignments & field assignment

Understanding False color composites, various band combinations, field check, ground truth data collection, preparation of interpretation elements for different categories

### 5.e. Reading and discussion of assigned papers for seminars

Understanding the application of different types of satellite data in various environmental applications, analysis used, results interpretation, data integration and environmental planning

### 5.f. Group project presentation

Ability to make presentation, effective communication, critical interpretation of data, response to audience

## 6. Course Assessment

Type of assessment	Percentage of Marks
In-class discussion	5
Assignment	5
Seminars	10
Group projects	10
Internal assessment test (MCQ types)	10
Final assessment	60
<b>Total</b>	<b>100</b>

## 7. References

- 1 Jensen, JR, 2013. Remote Sensing of the Environment: An Earth Resource Perspective –, 2<sup>nd</sup> Edition, Prentice Hall.
- 2 Lillesand, T, and Kiefer, RW. 2008. Remote Sensing and Image Interpretation Sixty Edition, John Wiley & Sons, Inc,
- 3 ERDAS IMAGINE Field Guide, Erdas Inc., USA, 2017.
- 4 ERDAS IMAGINE User Guide, ErdasInc, USA, 2017.