Remote Sensing and GIS for rural development
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Centre for Technology Alternatives for Rural Areas (CTARA)
Indian Institute of Technology, Bombay
Lecture 40
Analyzing USGS LULC data

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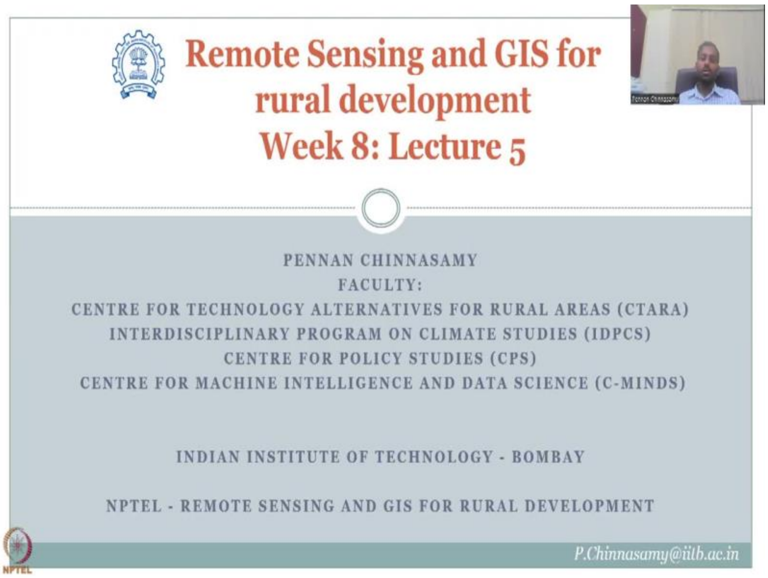

Hello everyone, welcome to the NPTEL course on Remote Sensing and GIS for Rural Development. This is week 8, lecture 5. In this week, we have been looking at land use land cover, defining what is land use and land cover, we initially start with land cover as a definition of a layer on top of the earth. And then how that land cover is used is called land use. We looked at multiple data types that can be used for understanding the land use land cover, and more importantly, the LULC change.

In today's lecture, we will look at some more data sources. Last lecture series, we also looked at data from ISRO, Bhuvan website. We spent considerable time going into each aspect in the data and the dashboard. We made created maps understood the data strengths, limitations and challenges. And now we will be looking at other data as I indicated it is good to use more Indian Space Research Organizations data ISRO's data NRSC, etc. But when it comes to application, sometimes we need the best data available.

We will be showcasing methodologies using open source systems QGIS is one where open source data is widely used. What we will do is we will look into some more data that can be used for understanding LULC globally and for India.

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So, as I explained in the last class and this lecture series, Google Earth is very very powerful tool to understand the change in land use land cover. We looked at some locations around the Ganges river in Bareilly tributaries. And we found out that the land use has changed tremendously. Land cover has also been altered where more agriculture has been ongoing and a lot of erosion and deforestation has occurred. This is just a qualitative analysis but can be updated once we have more data in the picture. So, what we will do now is since we have looked at Google Earth, let us see on the fly how the analysis is done.

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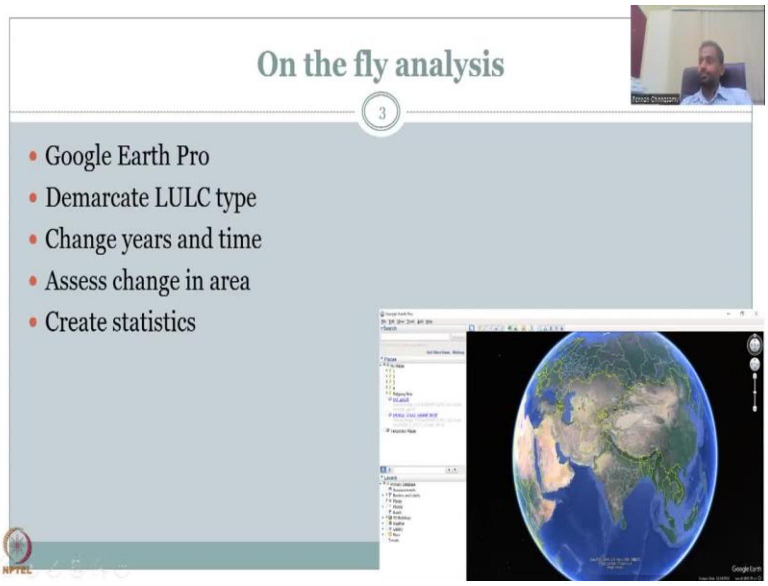

Once you open Google Earth Pro you can zoom in to a particular location of interest and then demarcate a land use land cover type. What happens here is you will be looking at the particular land use land cover type which is of interest to you and which you want to look at in terms of let us say you would like to see agriculture especially for rural development, water bodies management etc. So what happens is when you when you work on these type of systems, you have one time snap of LULC and you need to expand it to multiple time series to do an LULC change.

We will go through the steps and do a small on the fly analysis. Change years and time as I said you can drag and drop the time series and then see how the land use land cover type changes but demarcate an area, demarcate an area demarcate LULC type. Assess change in the area you can look at changes in the area because of human interventions, natural phenomena such as floods, cyclones and also earthquakes, but most of the time it will be through human interference, anthropogenic stressors.

Then what happens is you can create statistics I guess statistics can be created by using another tabular form. So, where you collect data, you put it and then you say how much the area has changed, percent change calculation everything else can be checked.

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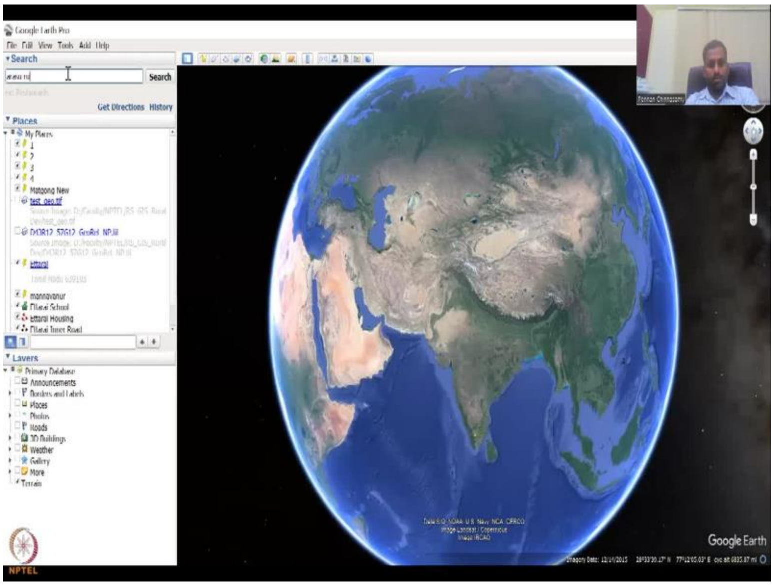

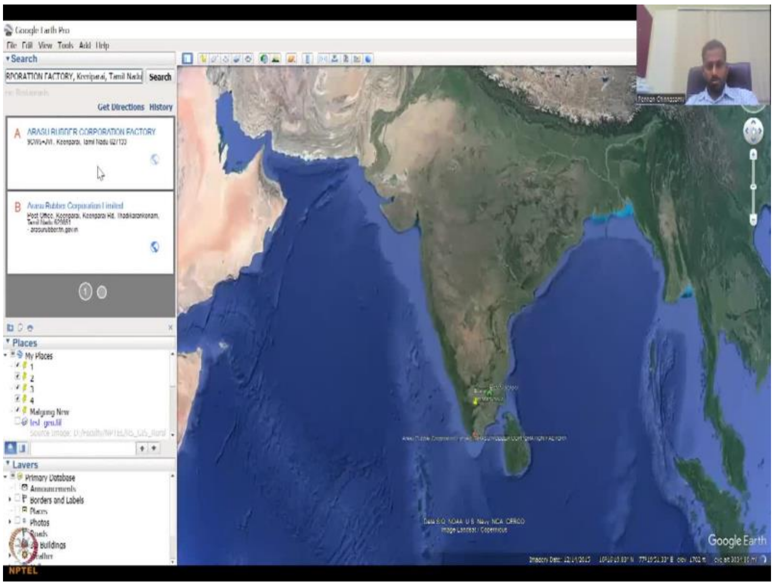
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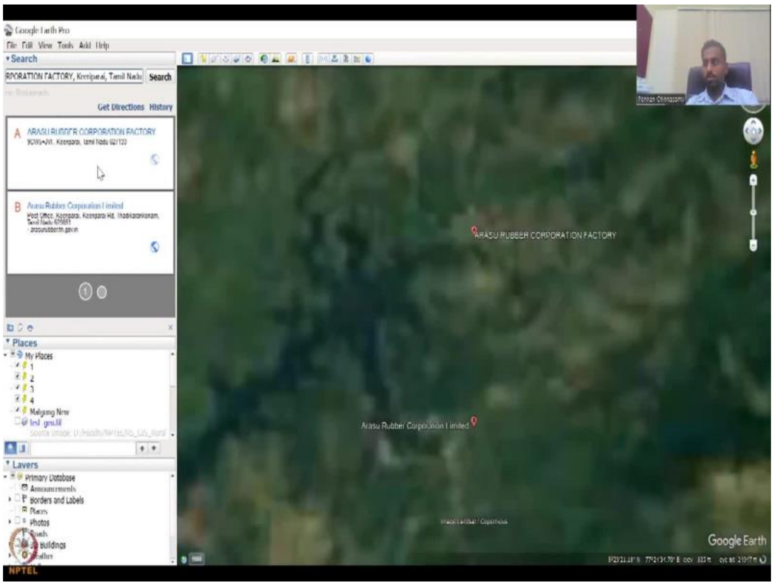
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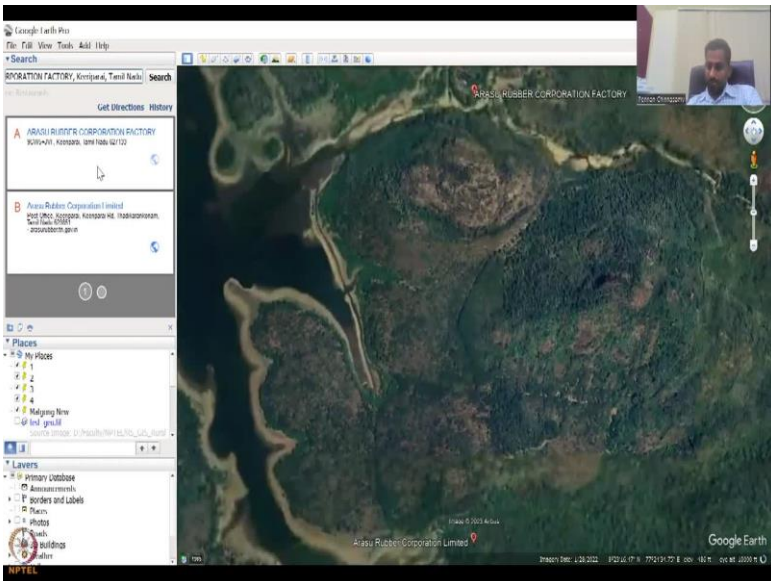
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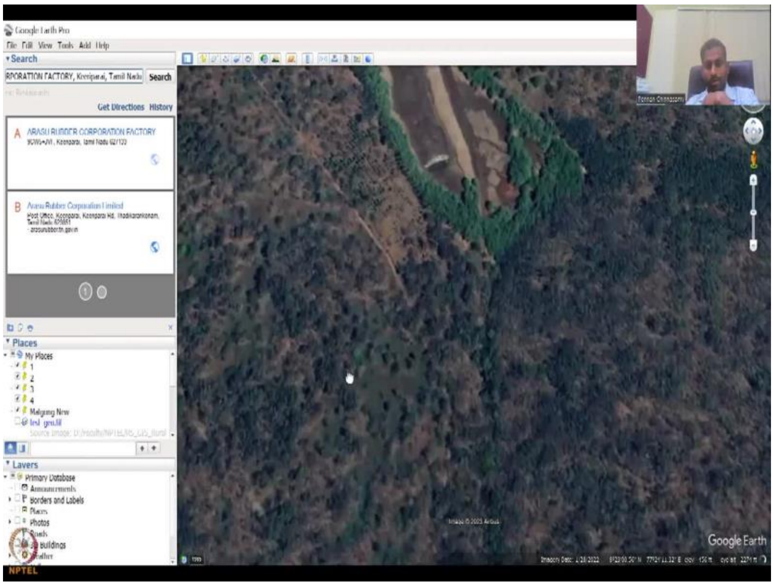
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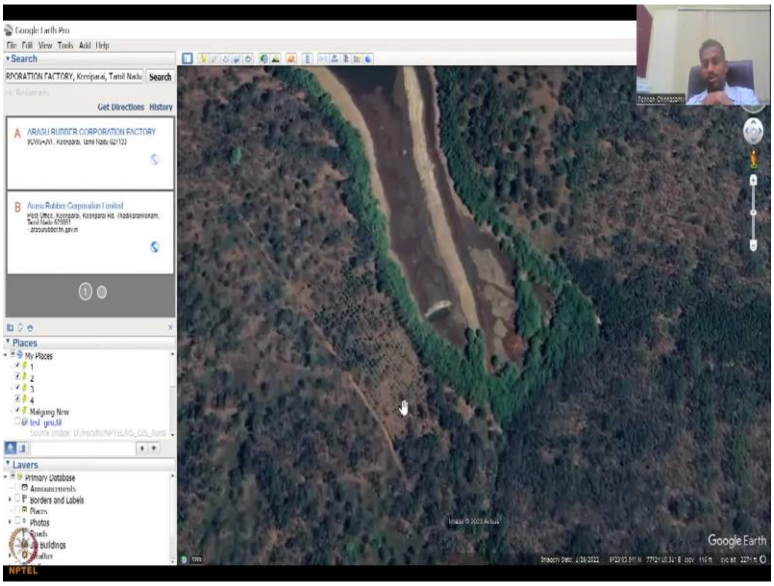
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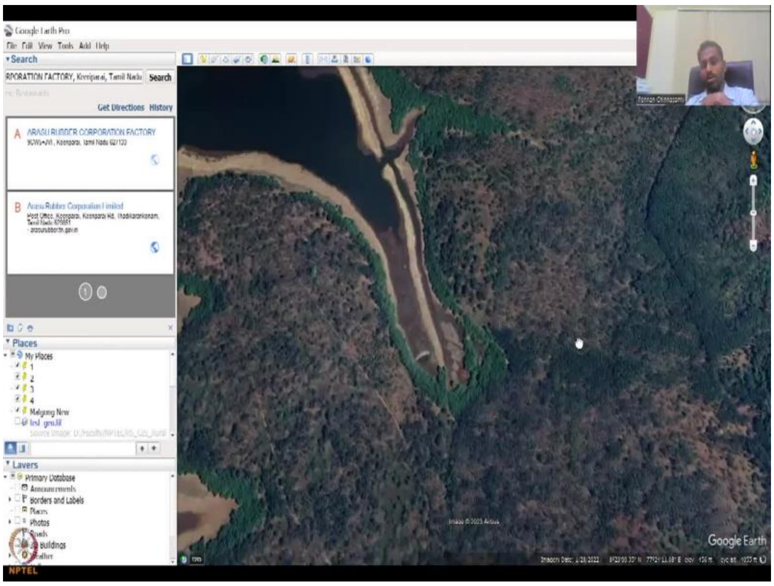
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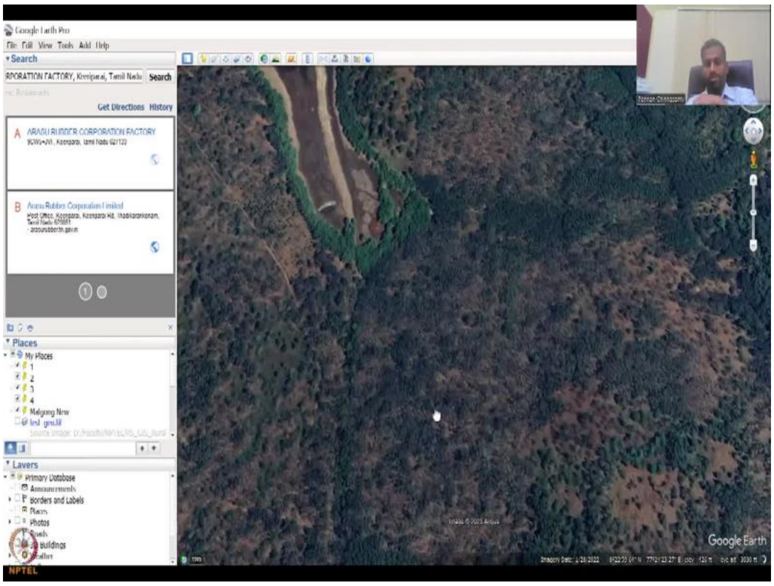

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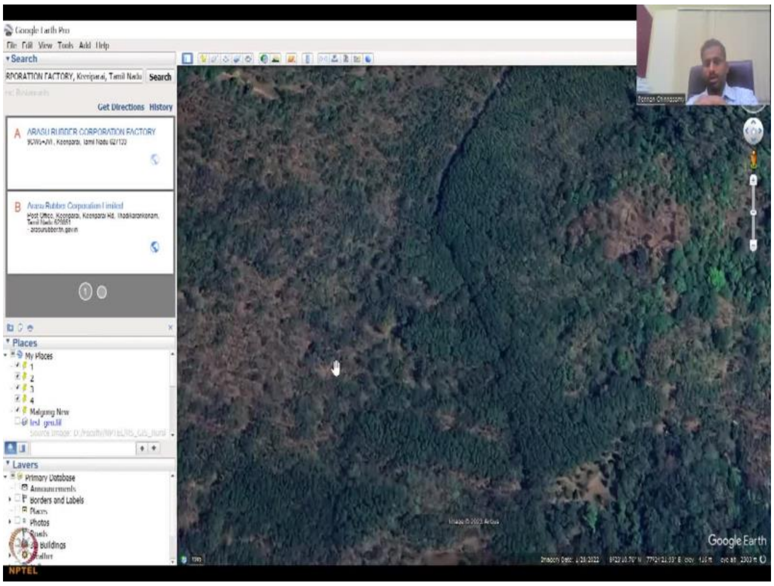

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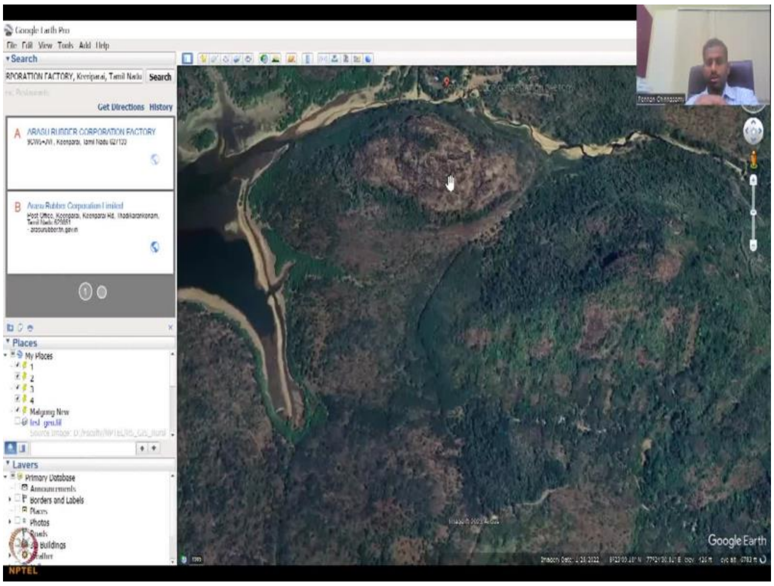

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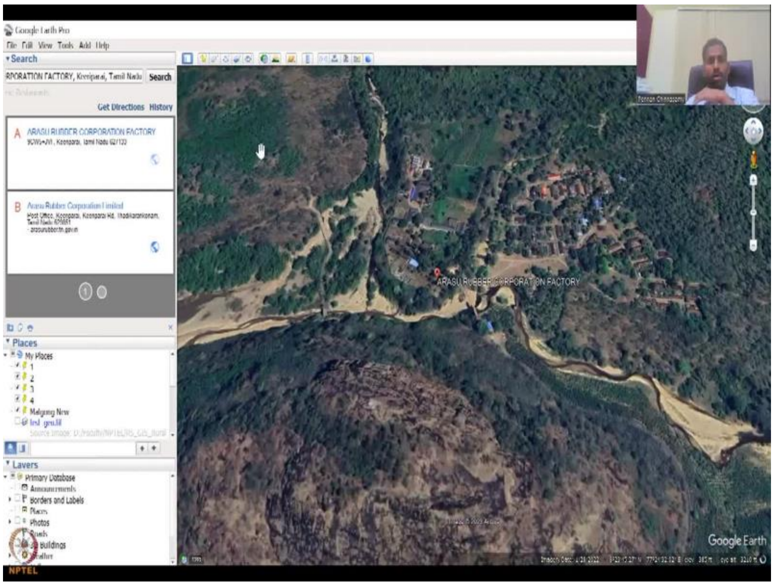
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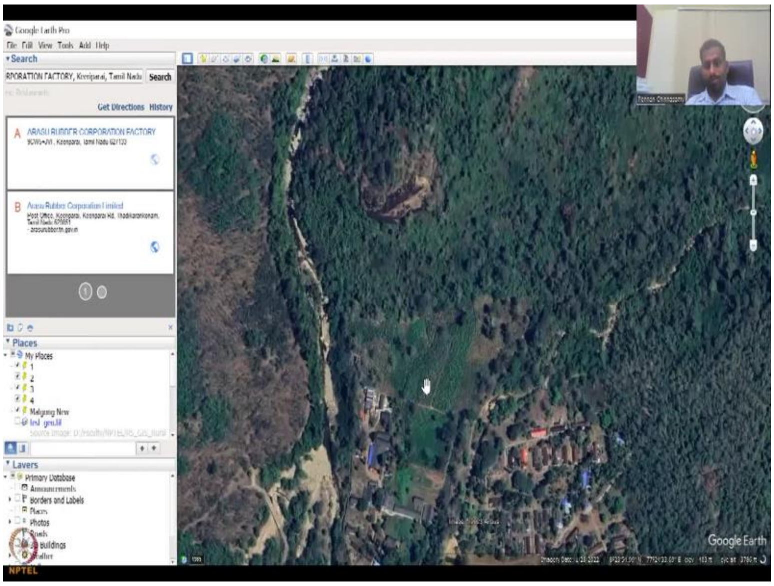
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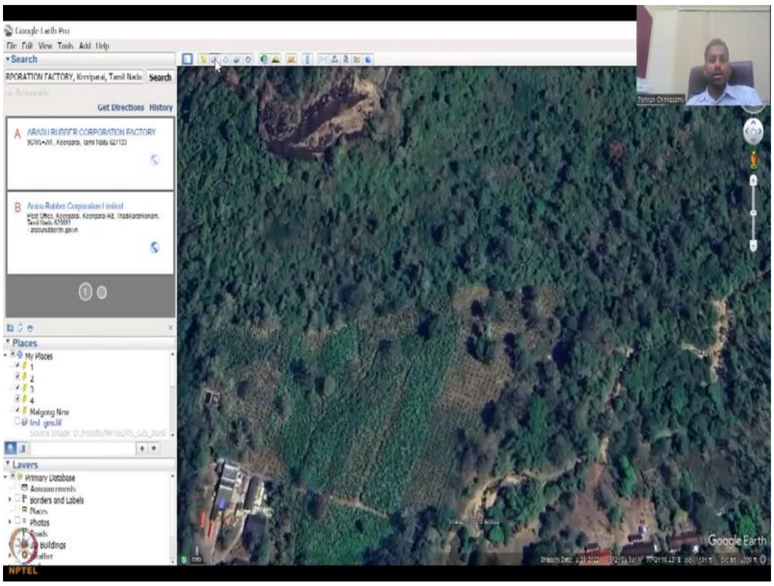
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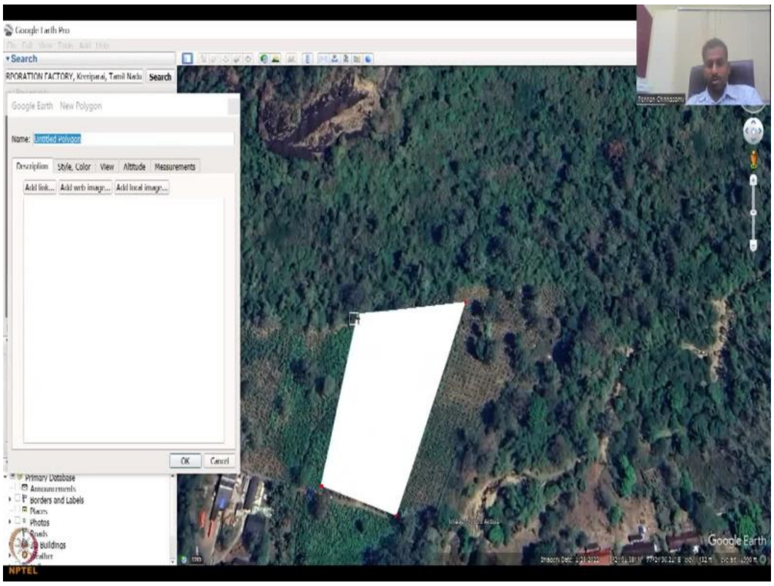
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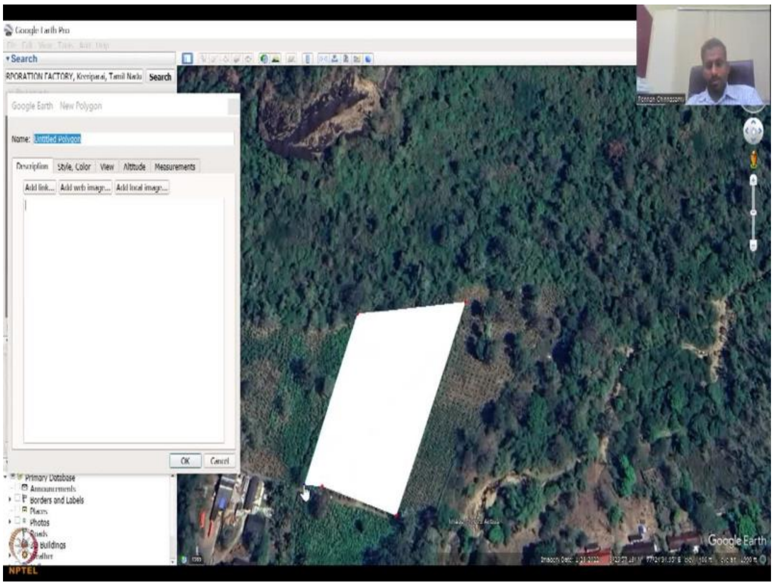
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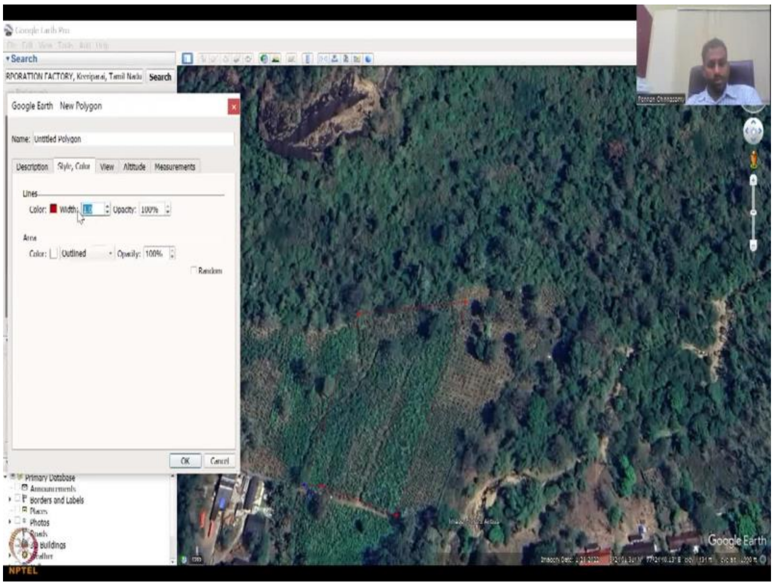
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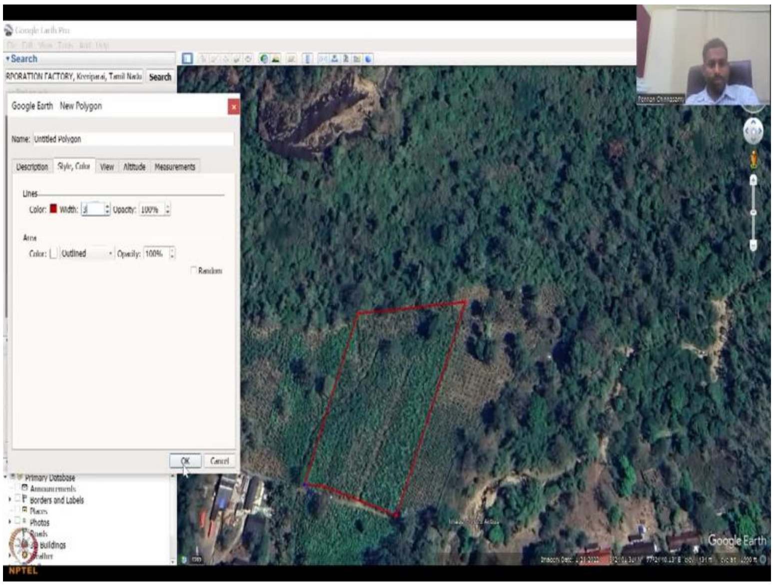
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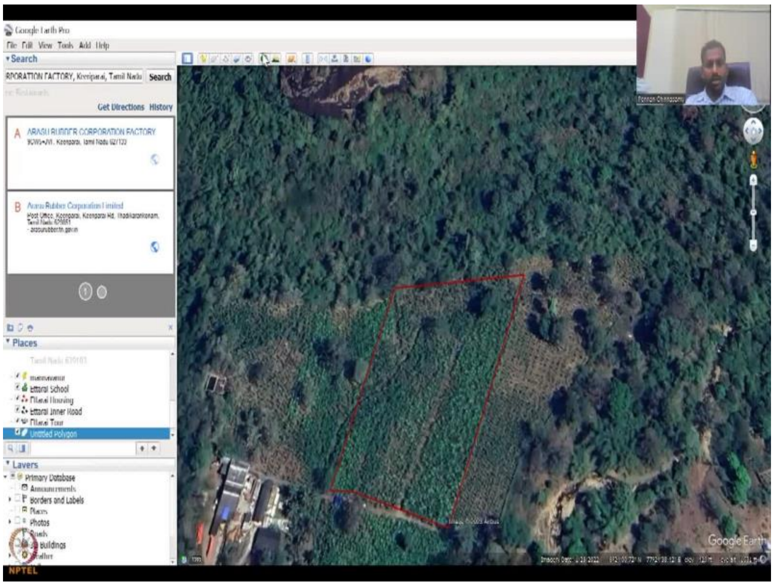
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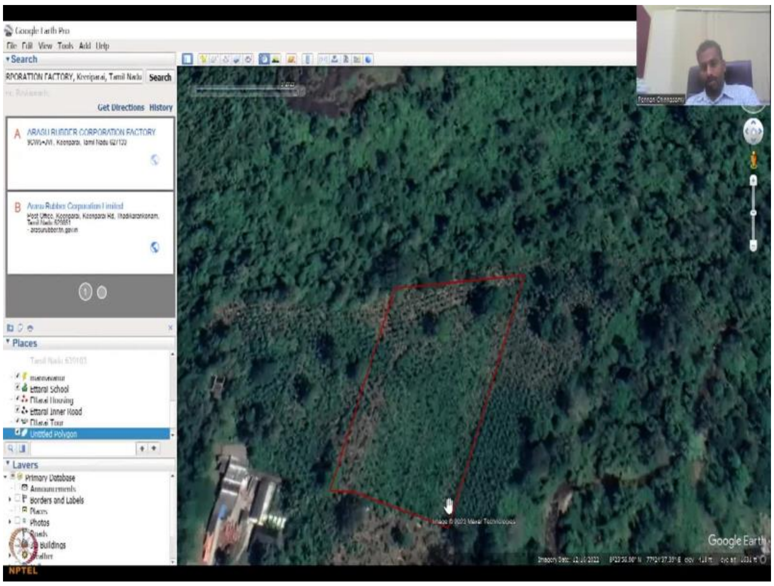
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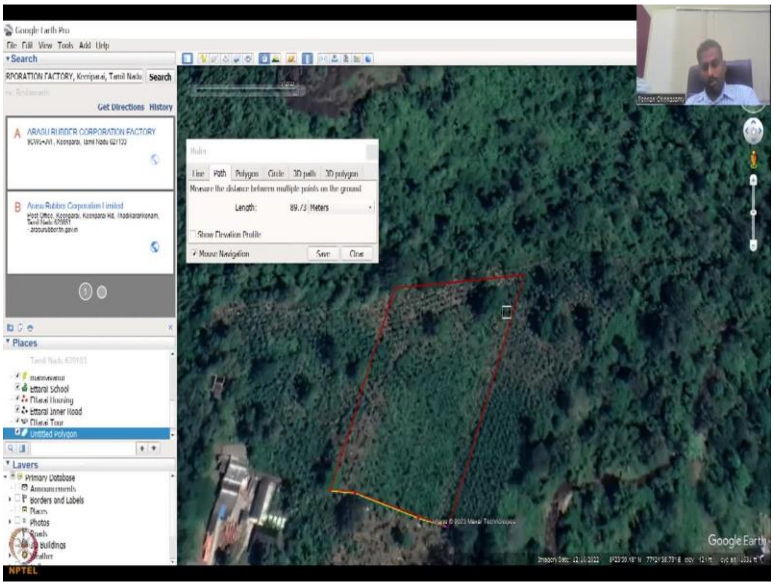
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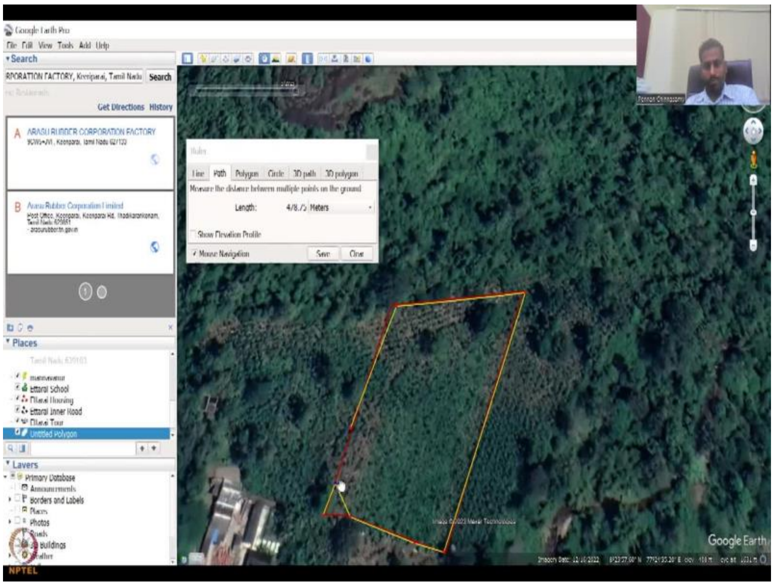
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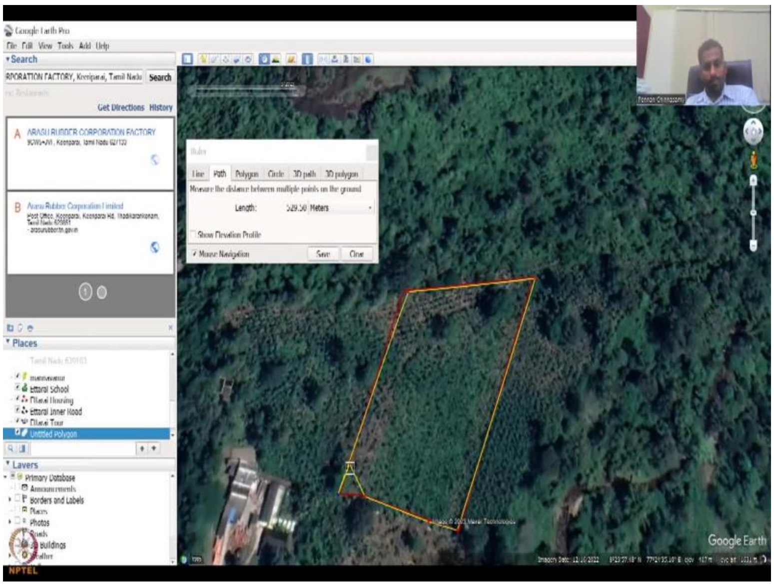
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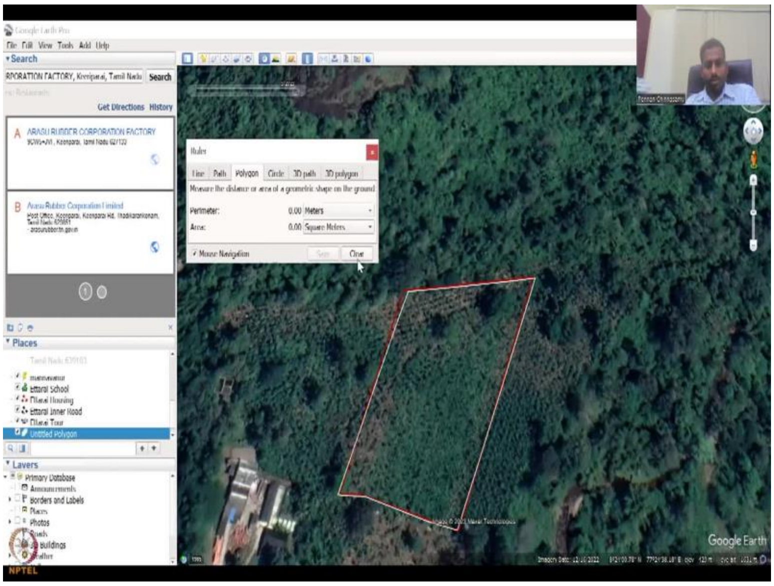
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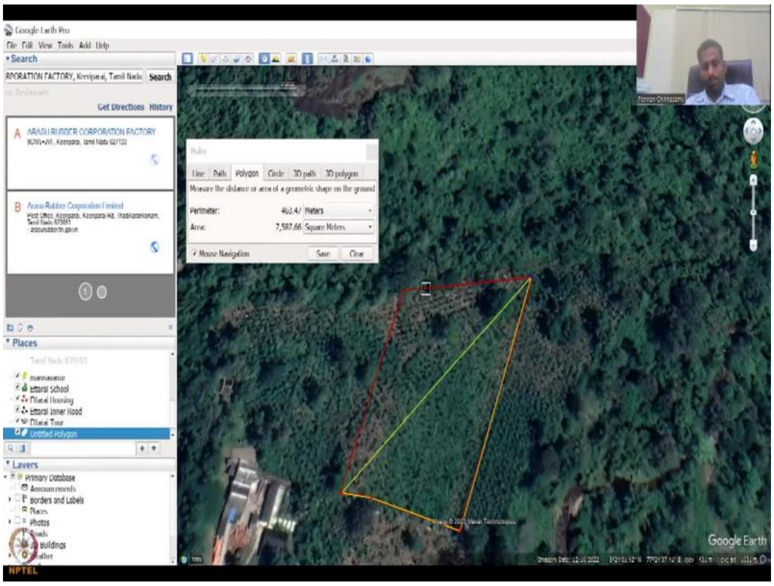
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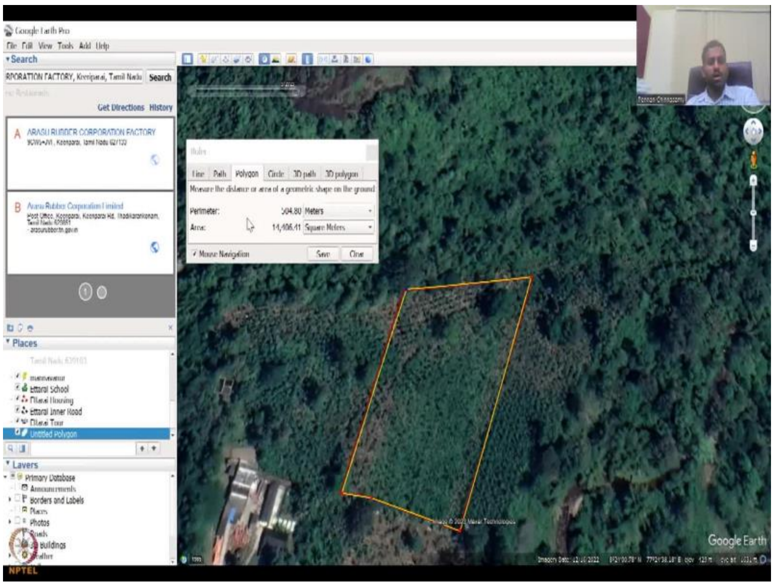
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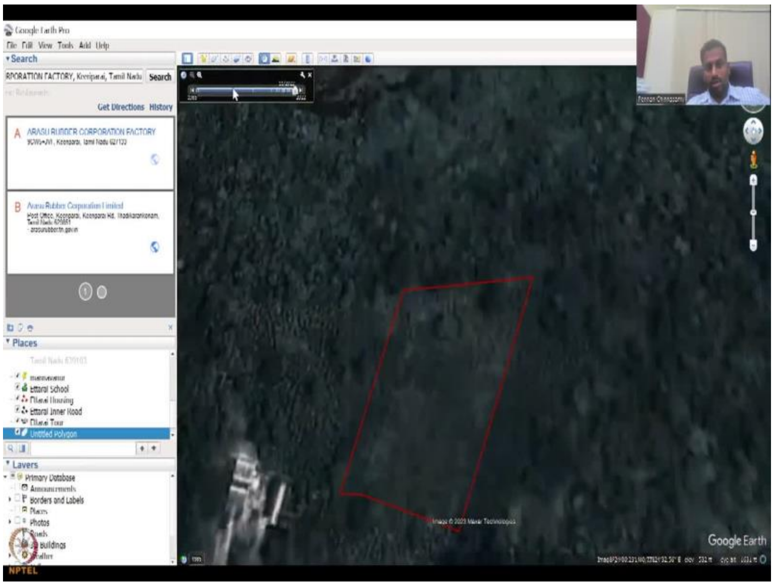
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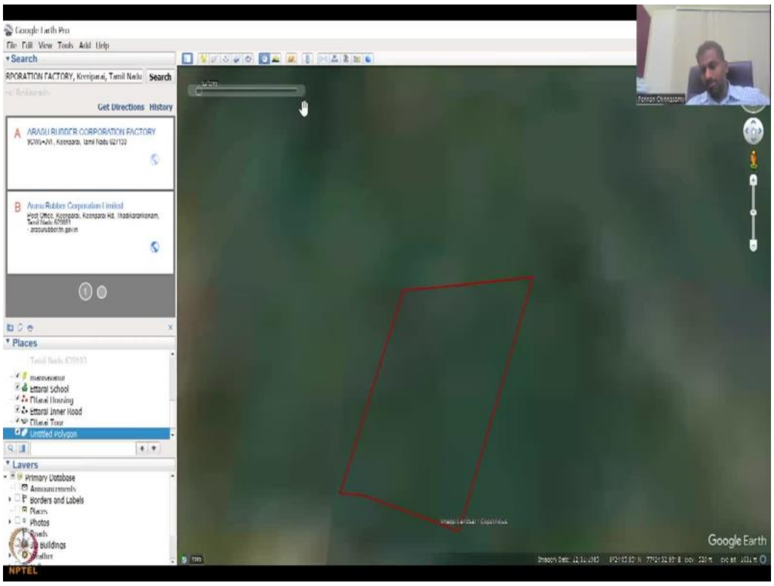
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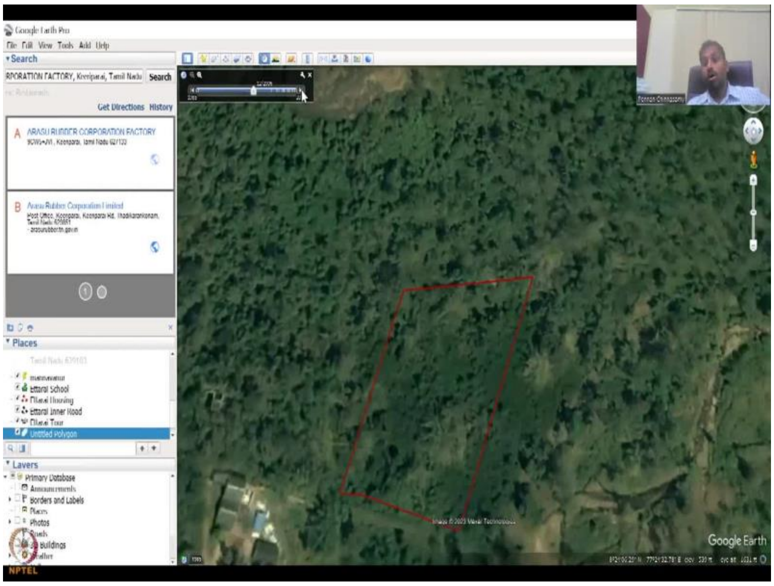
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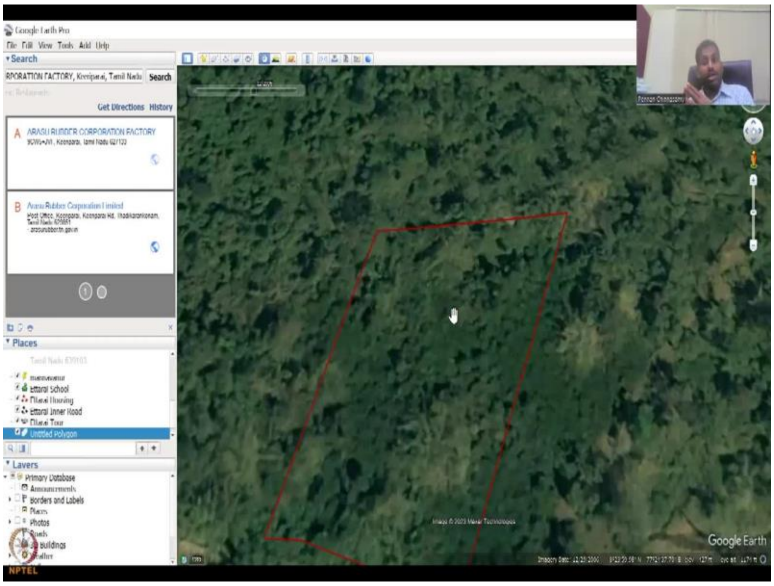
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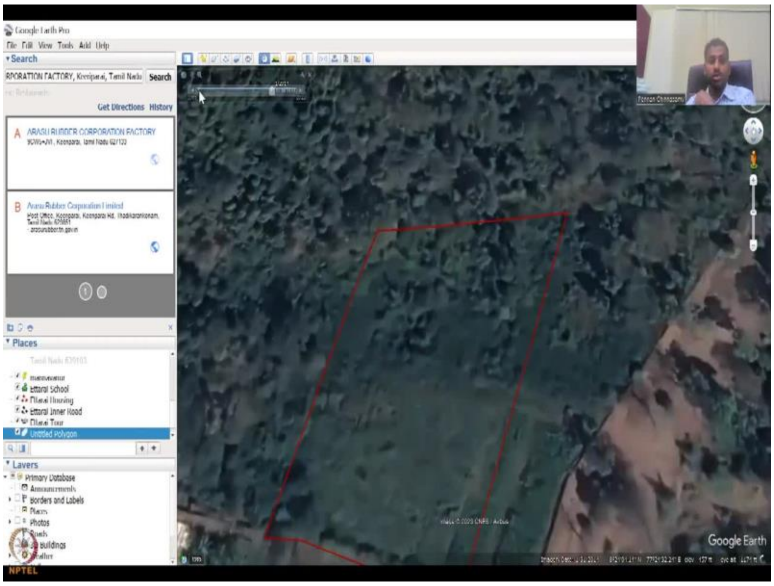
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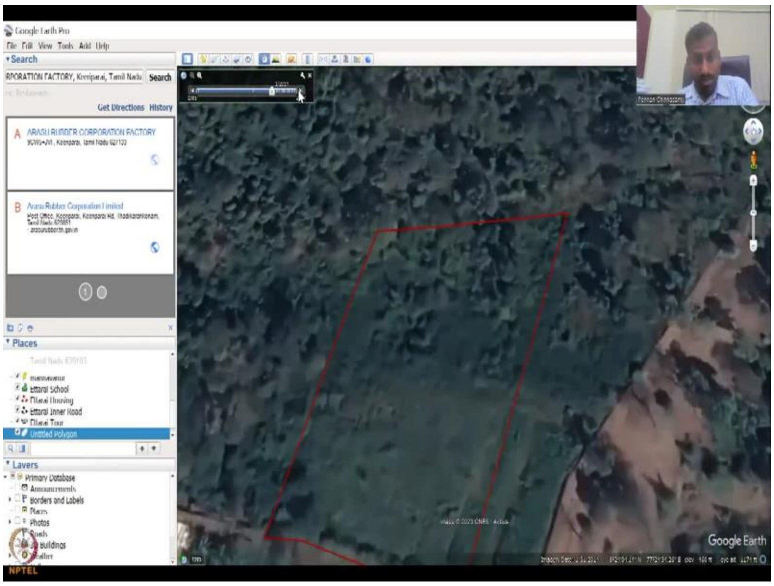
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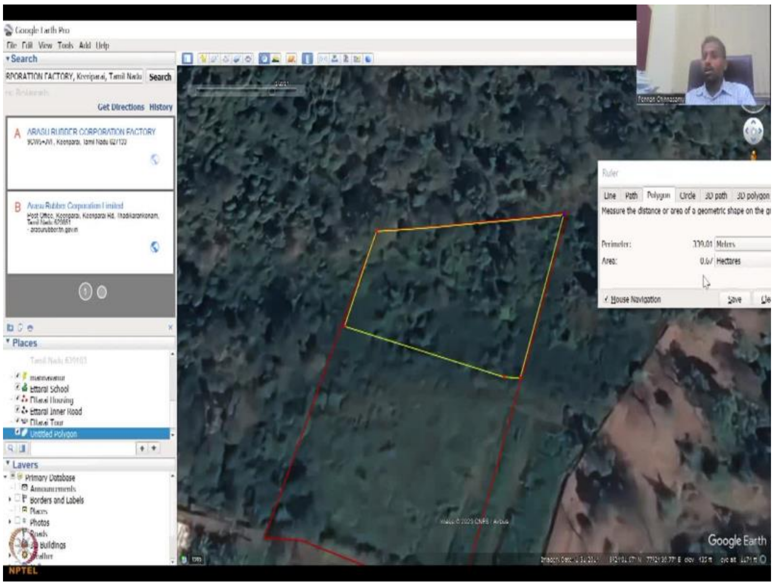

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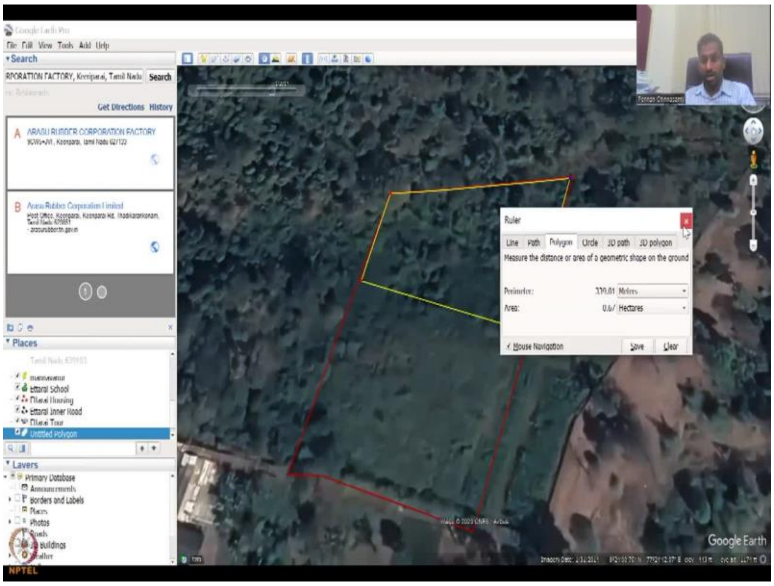

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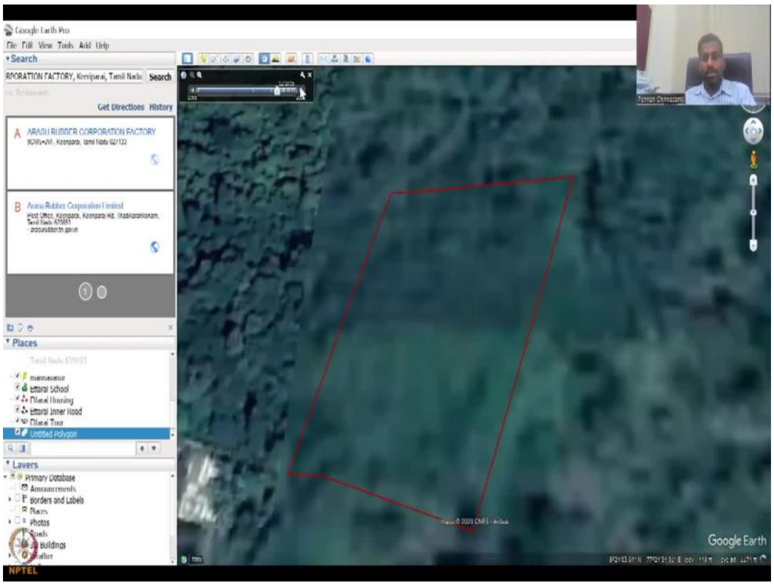

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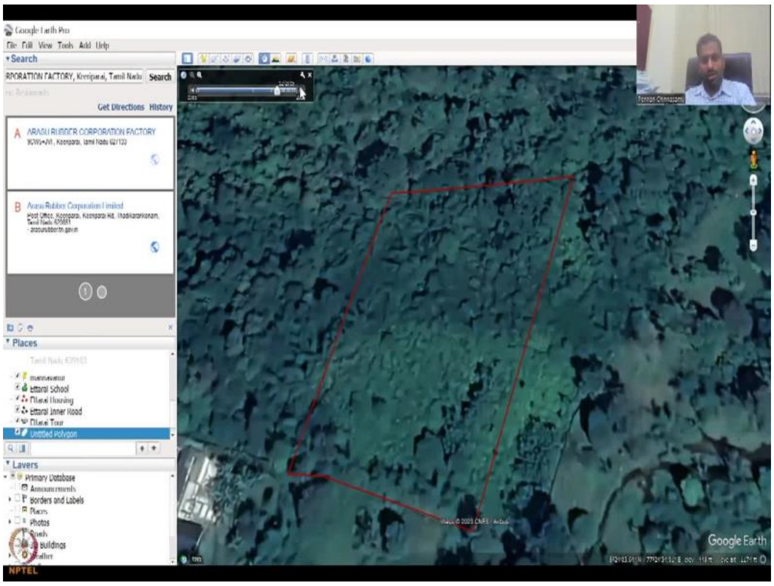
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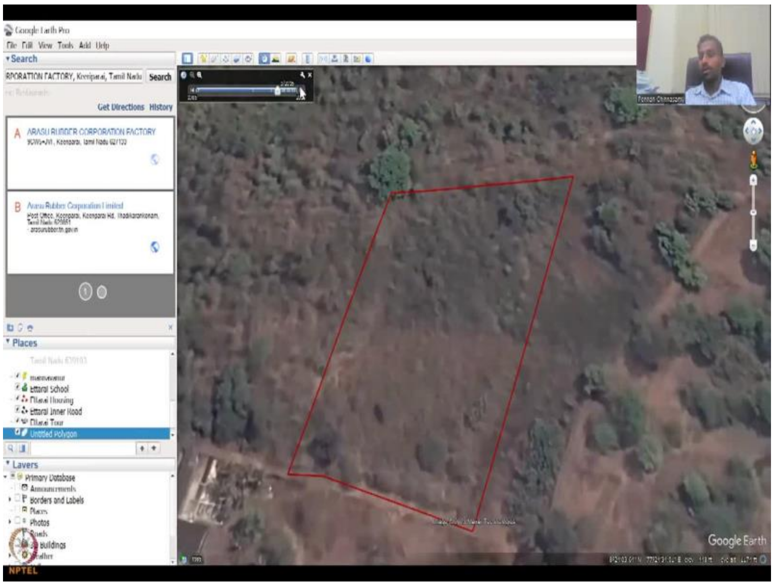
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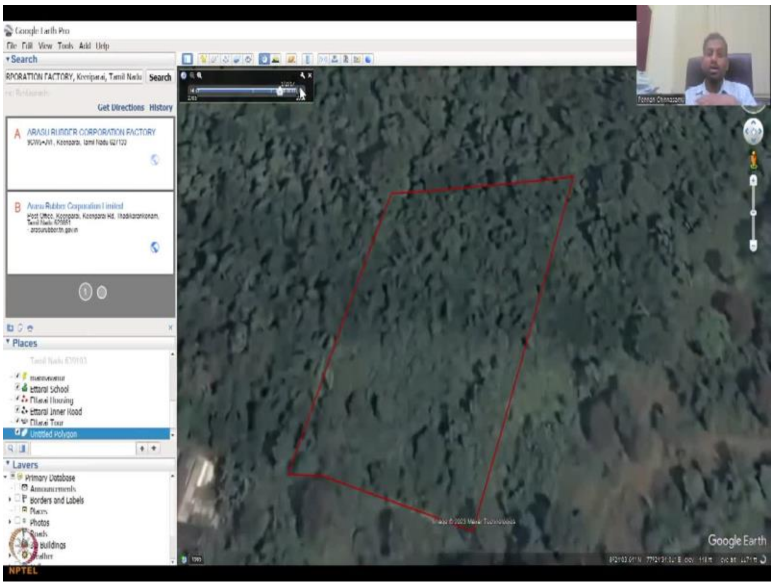
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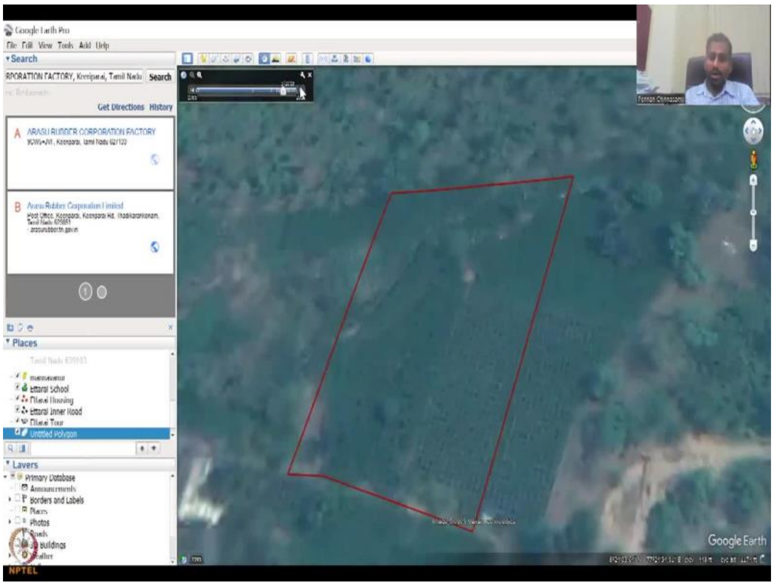
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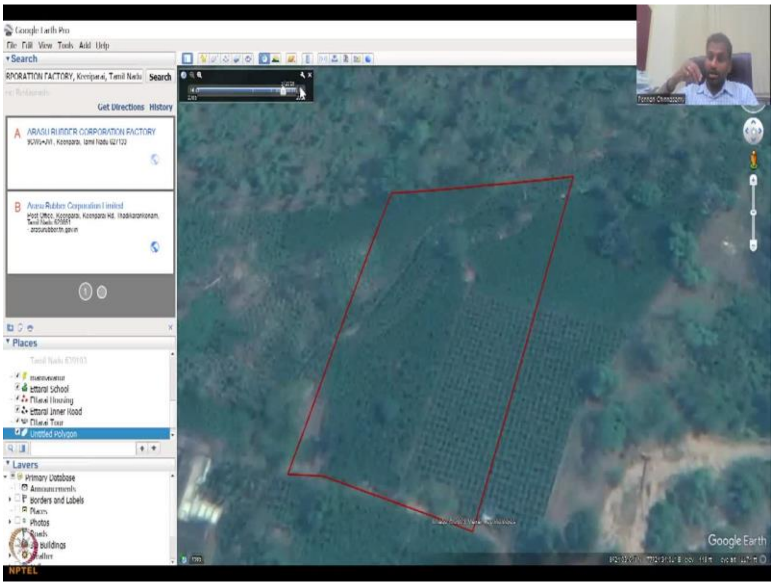
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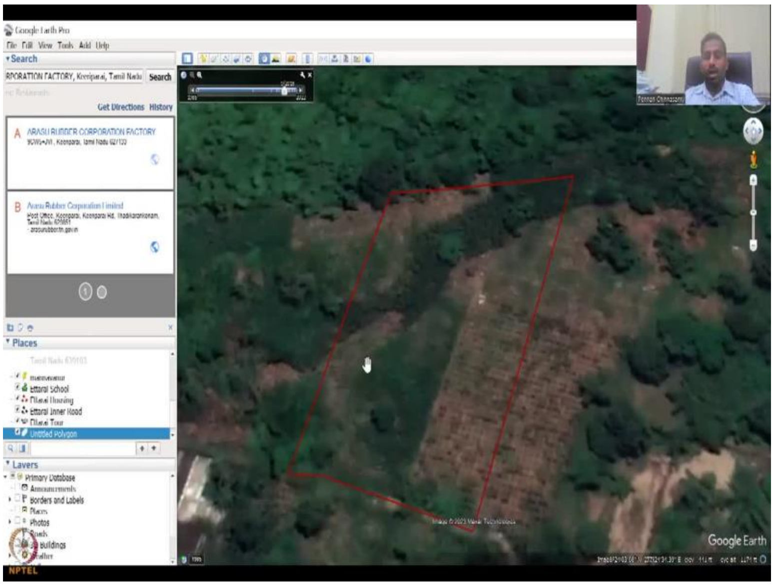
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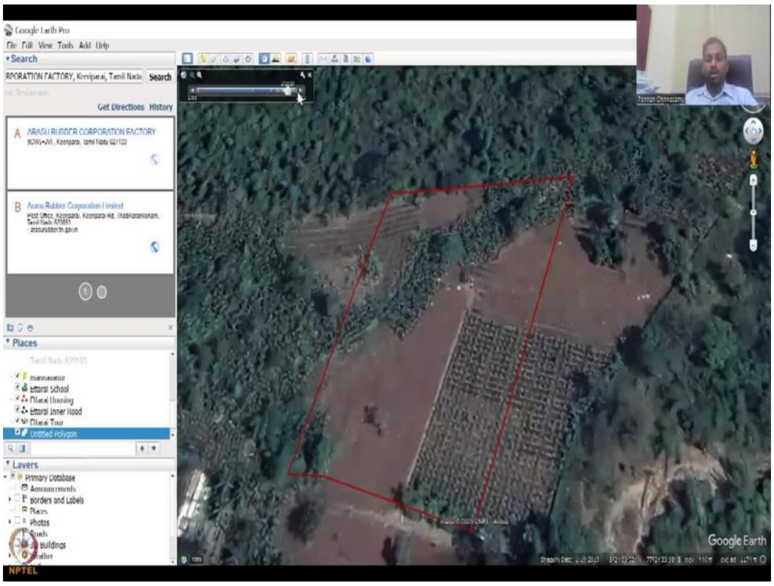
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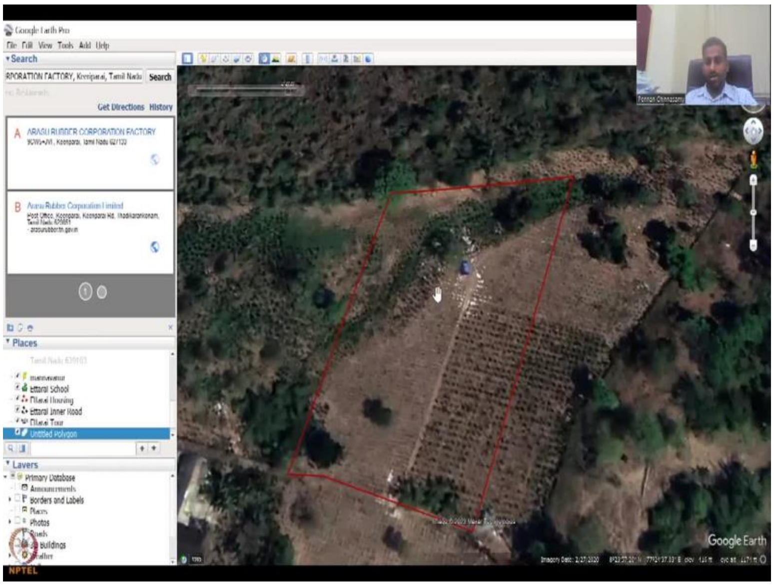
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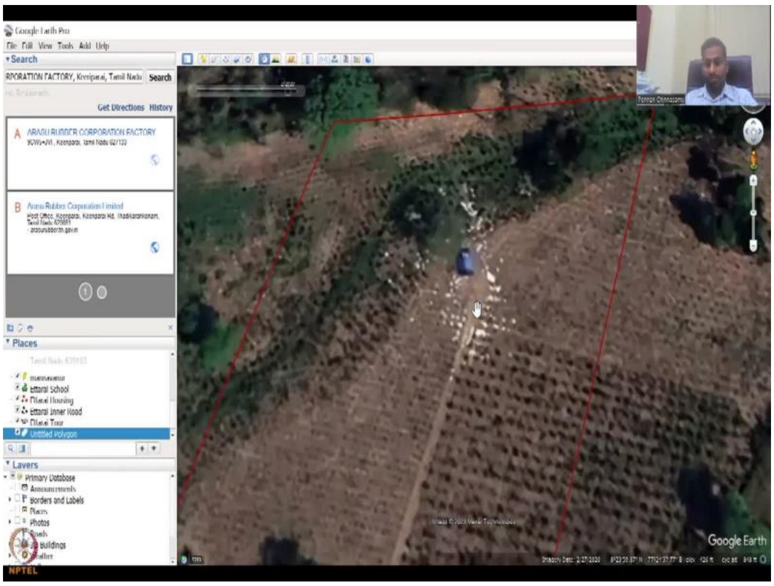
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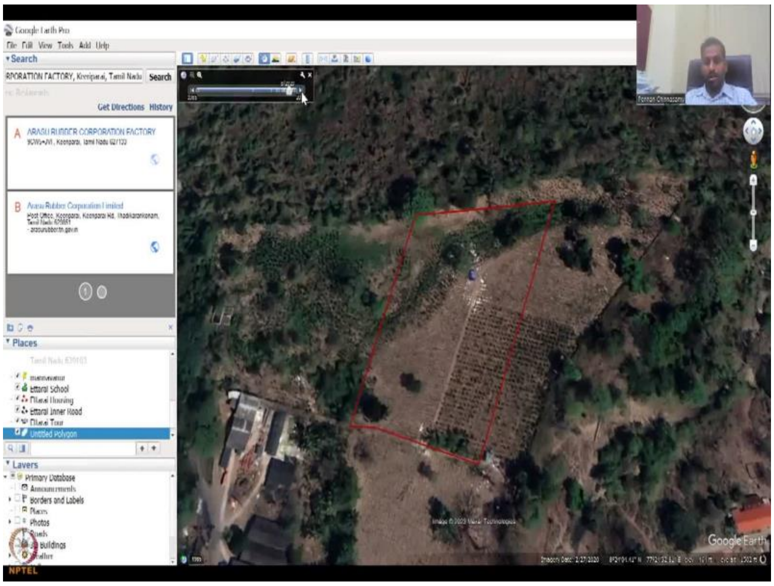
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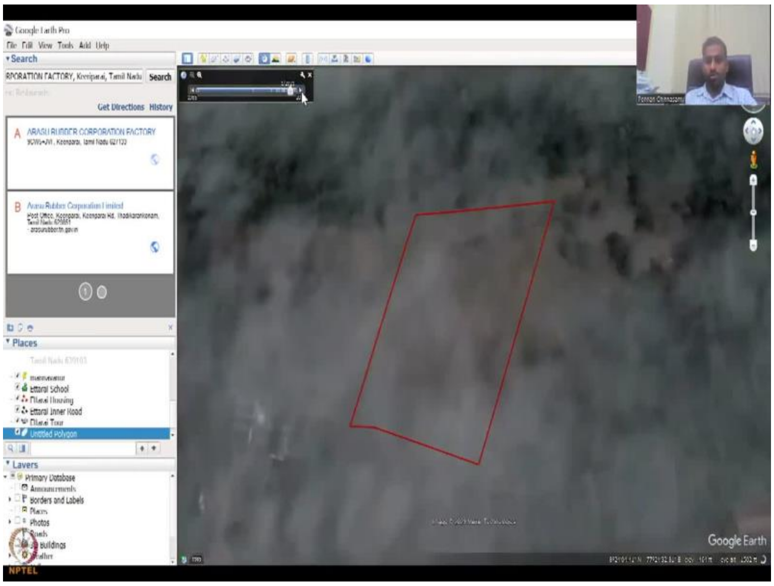
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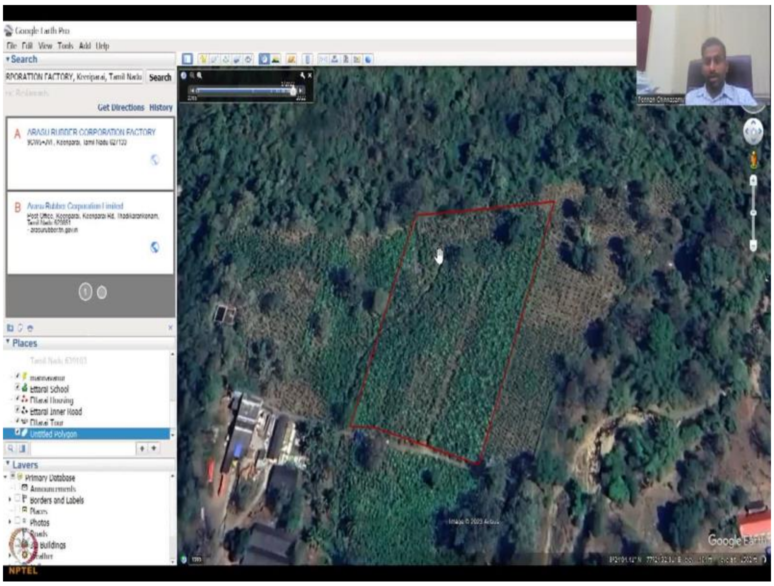
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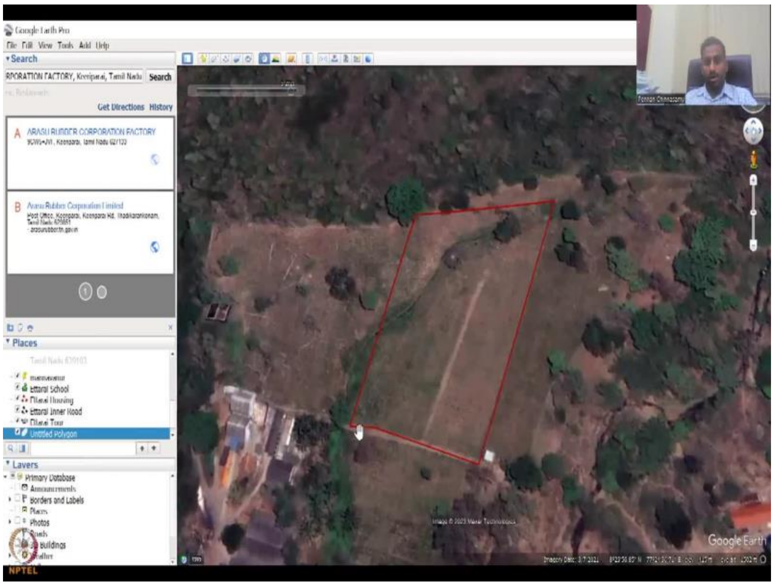
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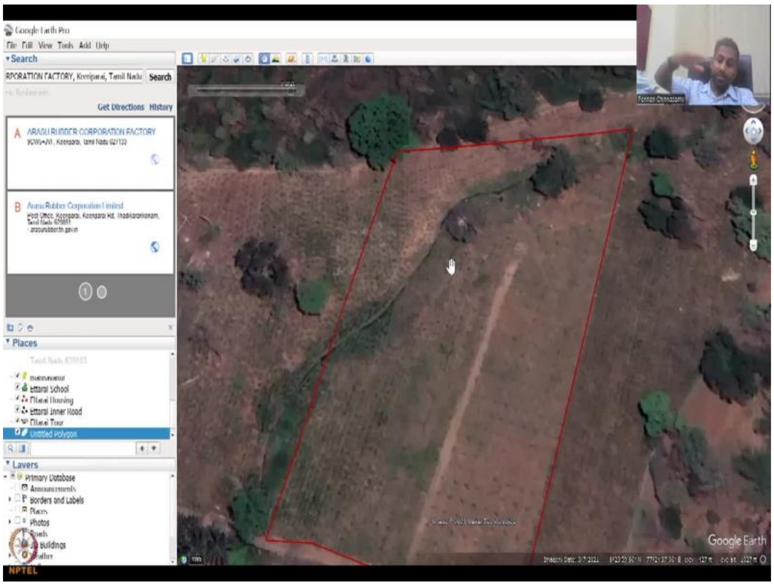
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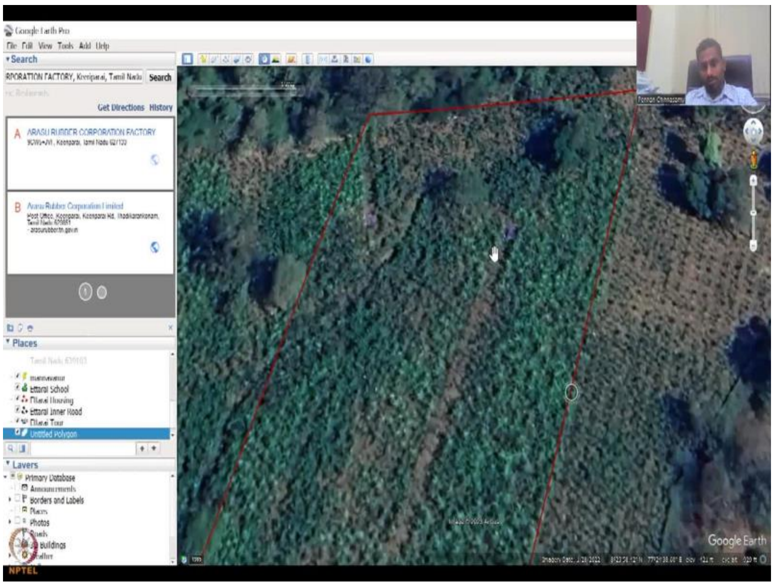
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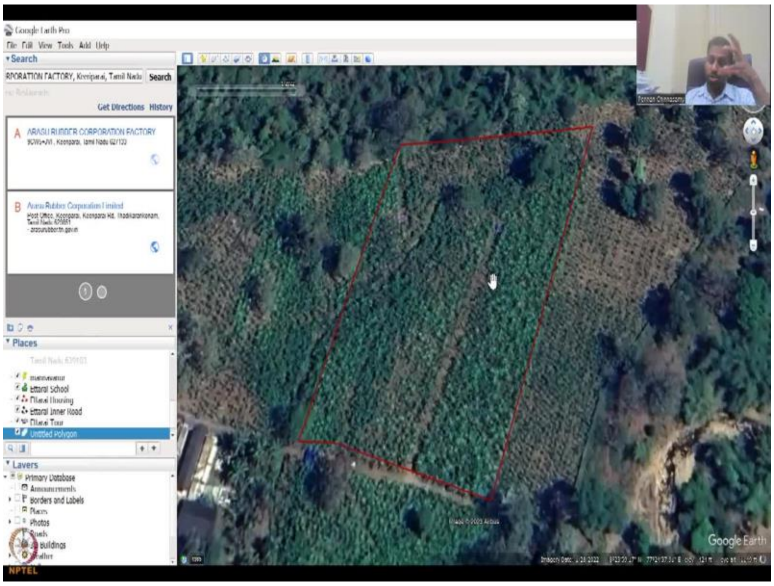
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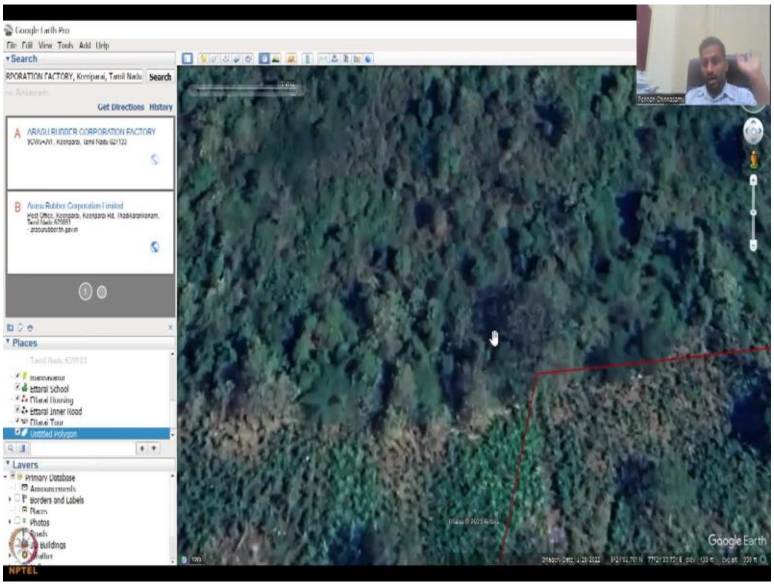
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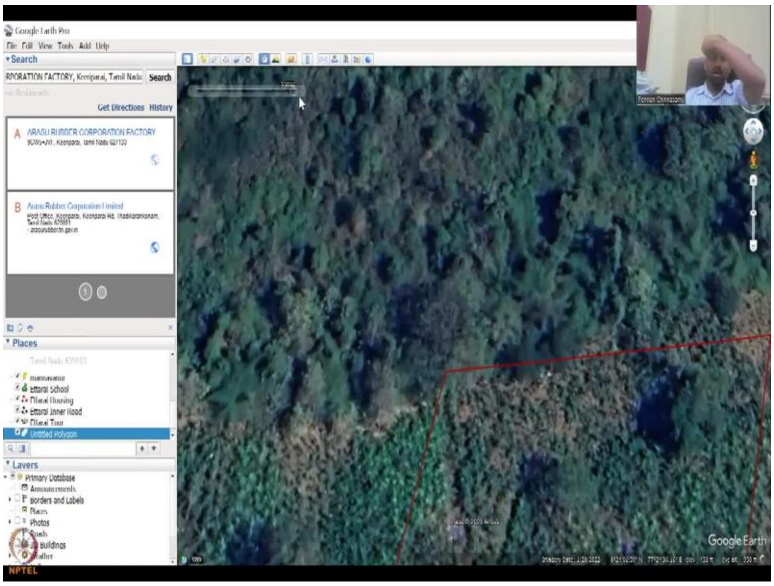
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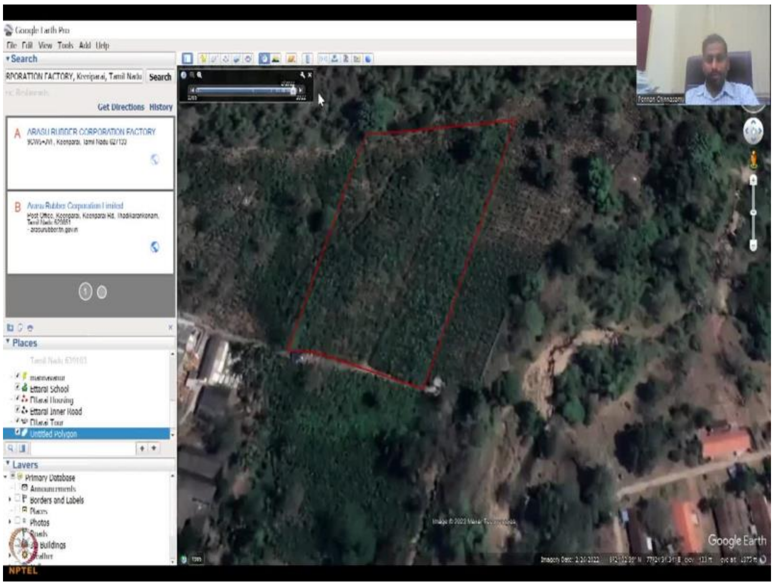

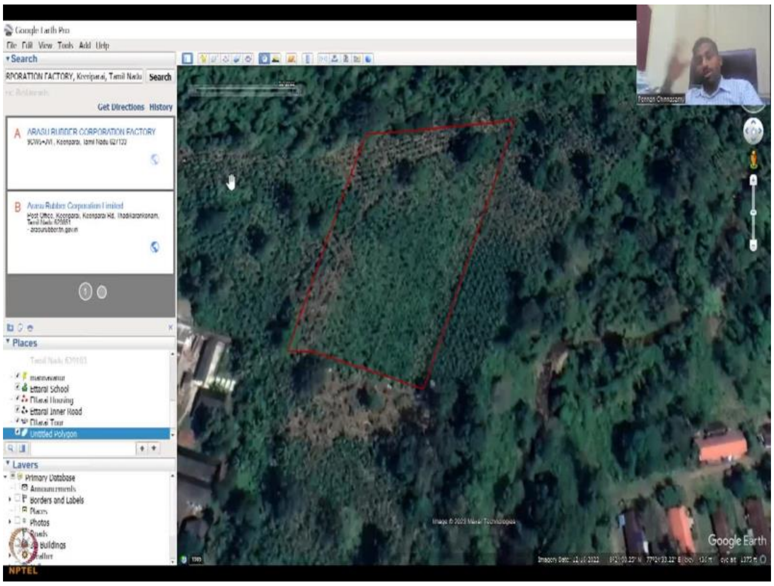

So, let us do a small exercise of this in Google Earth Pro. So, I am going to share the Google screen so, we can look at let us look at a plantation across, this is a longer Western Ghats and this is a government plantation that plants rubber. So, initially the land use land cover would have been a forest because it is on the Western Ghats boundary but then slowly development has happened and development has happened in terms of converting that into rubber trees. So, as I said we can zoom in to a particular area.

So, you can see here these lines, rows etc. clearly indicate that these are not natural because natural trees do not grow in rows and columns it just randomly grows and then you understand that these row column plantation is a clear plantation I just reset the tilt so you can see that this is a corporation, the factory and these could be the trees. Here we have all the plantations happening and as I said let us demarcate an area at least over the last 50 years let us see what has happened and then style and color you can make it opaque so you now have a red line of interest area of interest. As I said, let us click on the time analysis.

So now you know we can estimate the area here by running some calculations along this you can say that my path, just retrace this but just get the approximate area. Again, since it is an area change, you can quickly do this assessment so you have the perimeter as 500 meters, and then polygon, we can see how that becomes. And then we will do an area, so area is around 500 meters perimeter area is around 14,000 square meters hectares let us say 1.44 hectares. This is the land we are going to look at.

So 1.44 hectares, you take a note. And then now we will go back in time, as I said, let us now clearly say that this is a plantation, rubber plantation. And the earliest you can go is 1985, which may not be clear enough because of the resolution, but it is fine you can go to 2006, 2006 you do not see plantations. It is a pure forest, a conservation forest conservation area. If you do not see and why I could say that very dominantly is the growth of the tree and the coloring is different. In a plantation, it will be the same why? Because they plant on the same days.

So the colors of the leaves and the height will be the same because you are watering you are taking care of the trees together. It is not like you plant one and then after one year you plant another tree, and then you can slowly see that this land is being clear. So initially it was forest. So let us take data note as in 2006, it was forest 100 percent. So 1.44 hectares was forest now we say 30 percent is forest 70 percent. So it is qualitative I am saying but you can also measure how will you measure? You do another plot go back to polygon and say that of the 144 hectares this is not so 0.67 hectares.

So, almost 50 percent 40 percent is not into… is the remaining forests. So, all this is not a forest now. So, we will have to remove it. So, now the percent change is starting to happen. And then you go on to the next year, random year, you have some more forests, some more clearings, some more plantations, still no forest 2016. So, there is a forest cover increase, forest cover loss, natural phenomena is happening. And then you see boom, these plantations, you can see that every row and column is planted.

So, this is where a forest which could have given some livelihood options to rural development has been taken and converted to a plantation. However, this also gives occupation and livelihood but what I am trying to say here is you need to look at it from an angle of quantifying it on land use land cover. Again here you have a lot of these land that has been covered cleared and then only some forest has been kept. So 10 percent, 20 percent now slowly, you will see that every every part of the land is going to be used for the plantation.

So, most of it is used for plantations, there is a house that comes up or a factory to process these rubber and then some cloud cover you cannot use and then more and more. So, the area gets increased can you see here. So, in 2021 you will see that the entire area is increasing and you see as I said the row cultivation is there the height of the plant is the same throughout and then you have this same growth, same growth and now the leaf color the leaf shape is the same which means it is a uniform homogeneous forest and that does not happen you can see here this is not homogeneous, you can see there is dark trees, draft leaves, light leaves, and then here you have all the same color and shape.

Here the shapes are different the crown is different. So those are clear demarcations of different land use land cover. So this is good you take as I said now, this is 100 percent plantation. So initially it was 100 percent forests now it is 100 percent plantation and this is how you could document change.

Now let us move on you have the statistics so it is good for your class or research project. Let us move on to the presentation. So, this is the on the fly analysis, you take an area you quickly put a polygon you quickly put an area estimate and that is all is needed area change estimate for one particular LULC so here the dominant particular LULC we found is forest which has been converted to a rubber plantation.

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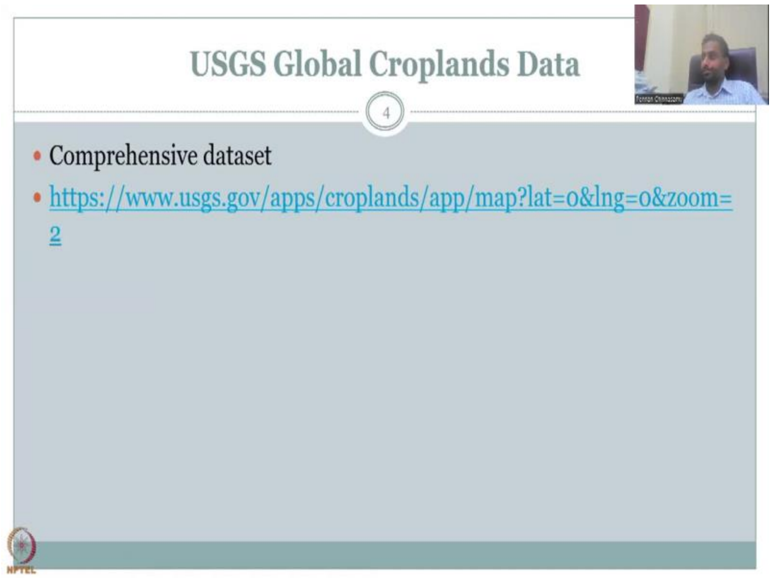

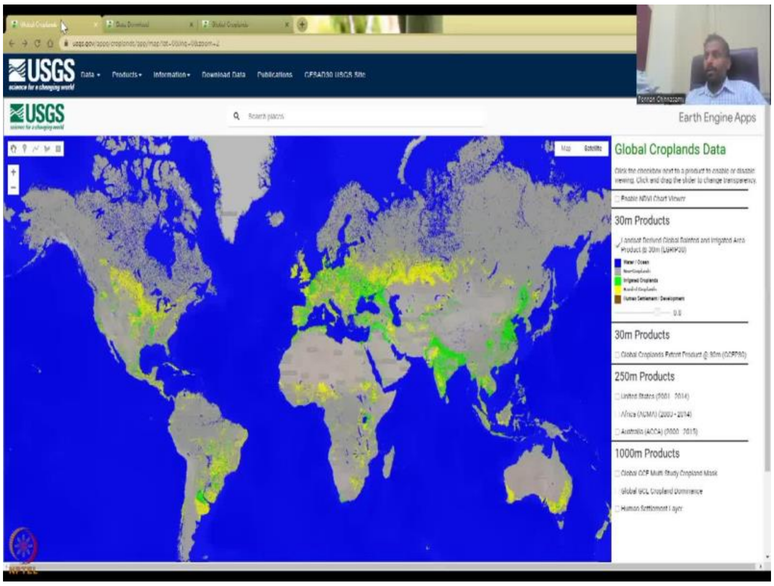

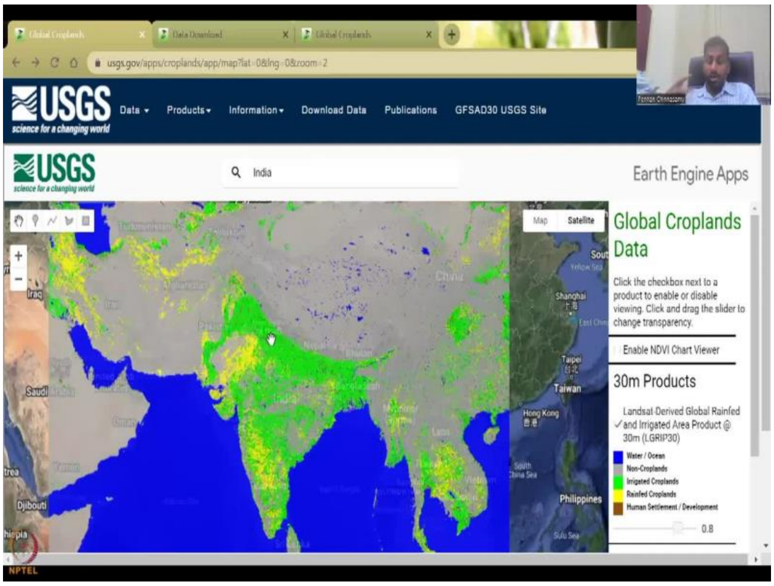
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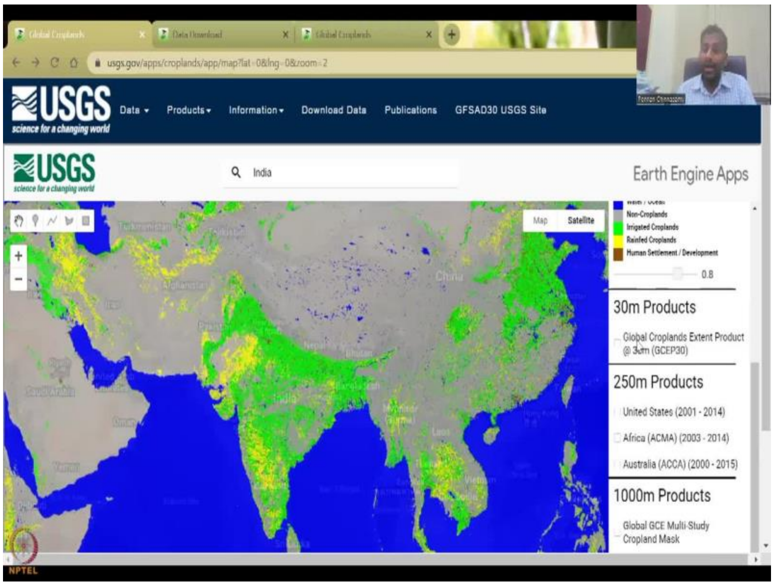
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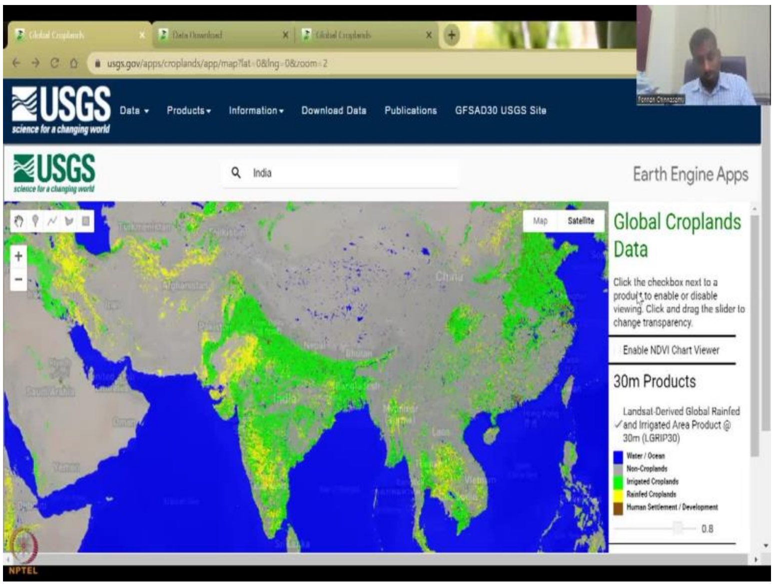
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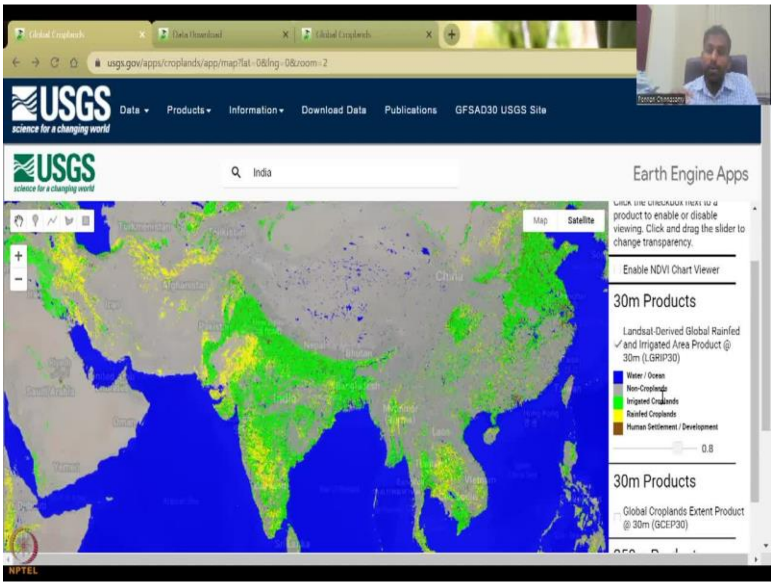

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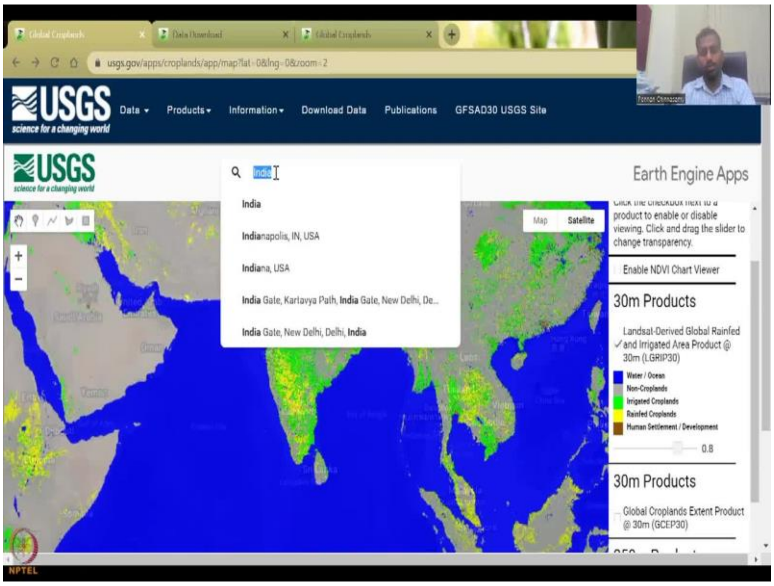

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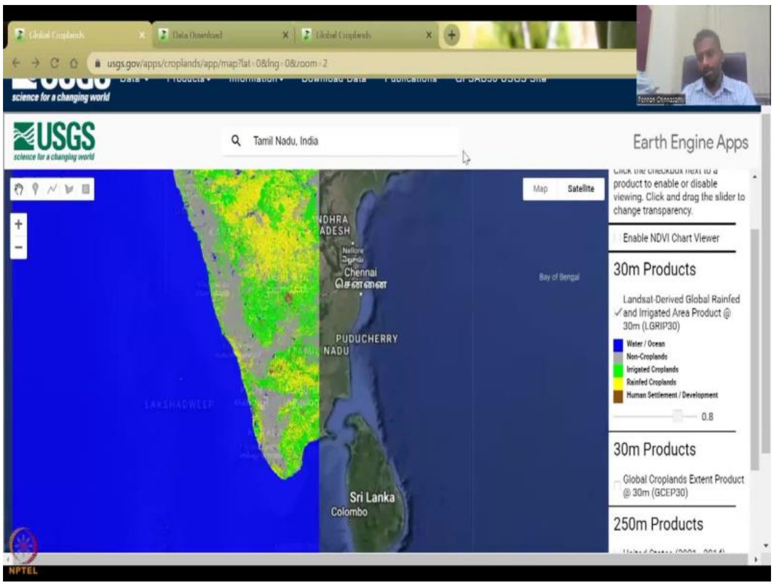

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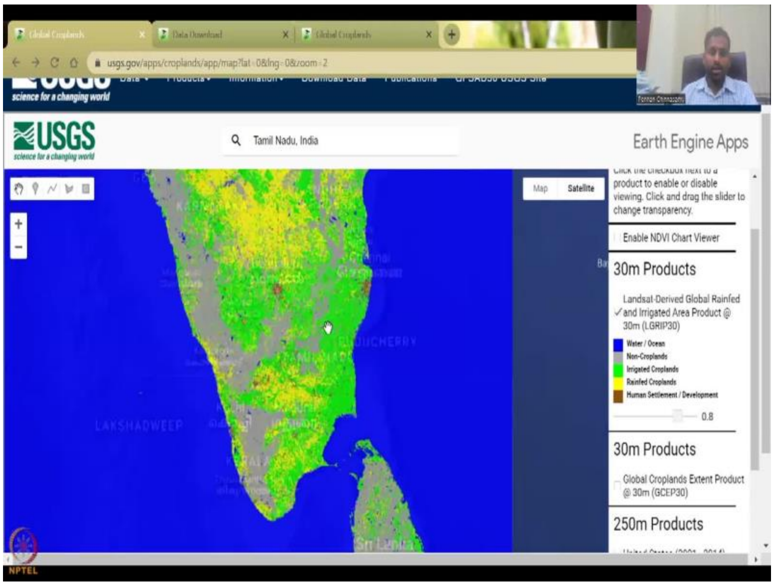
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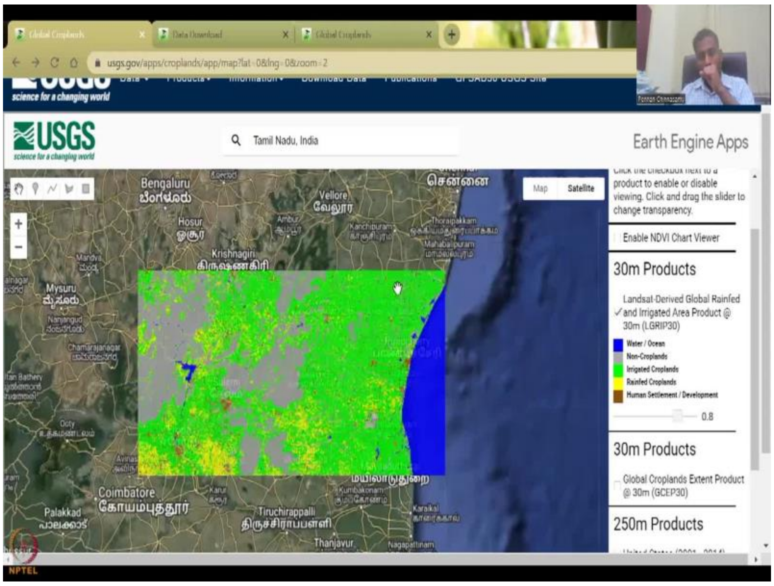
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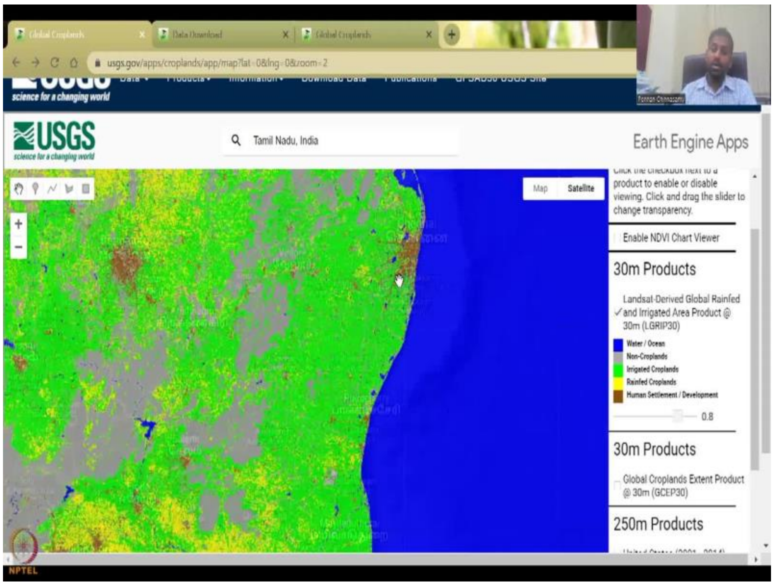
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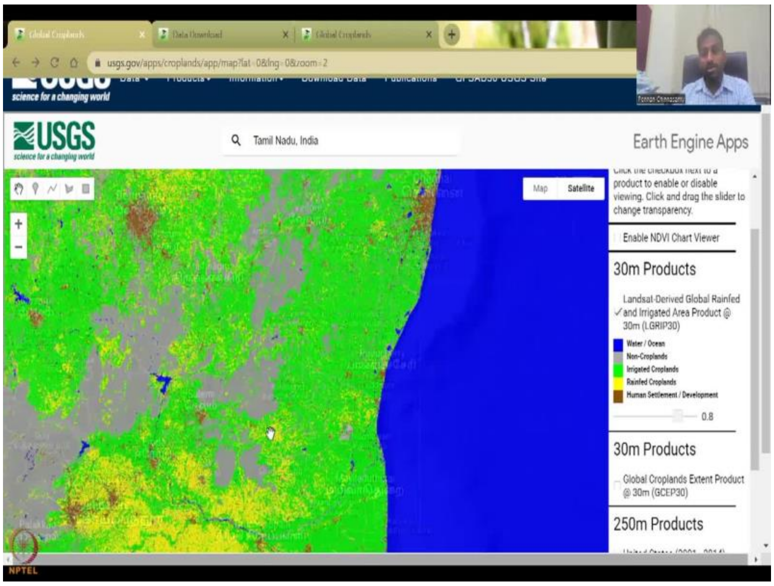
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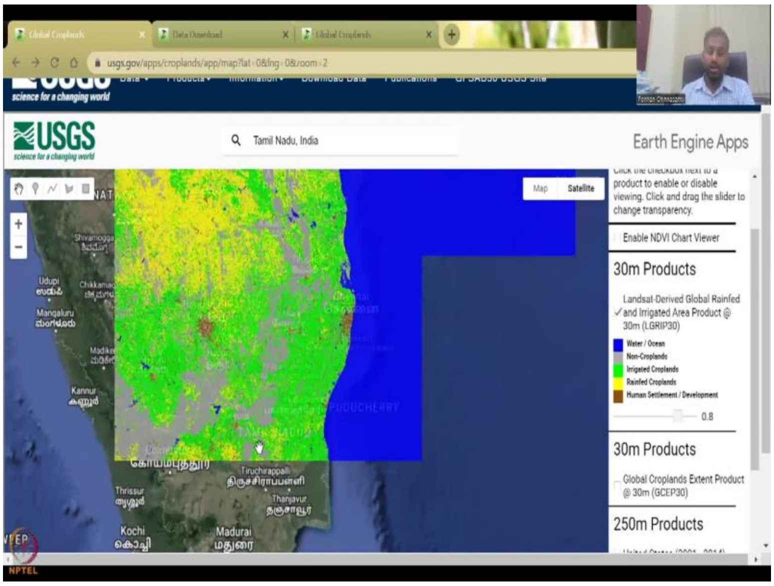
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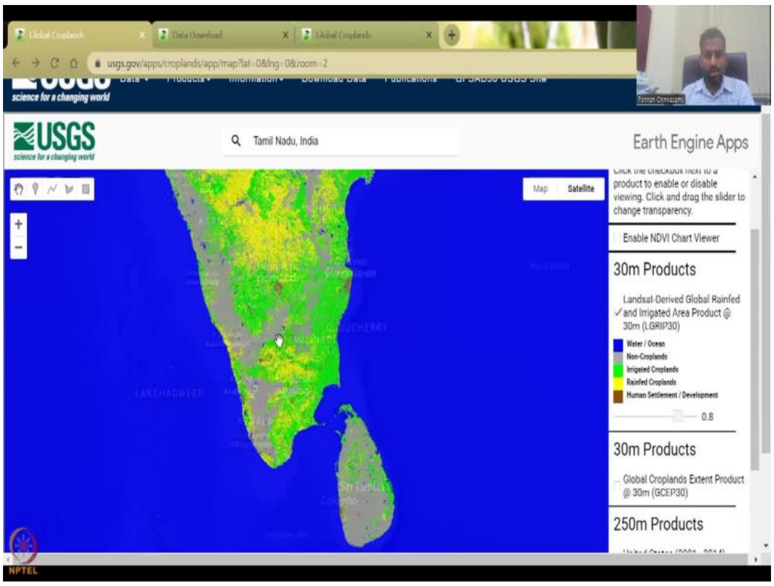
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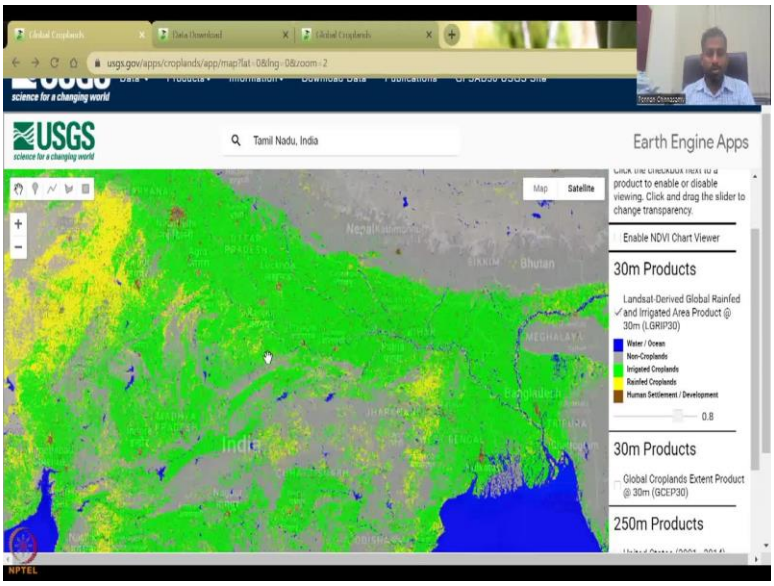
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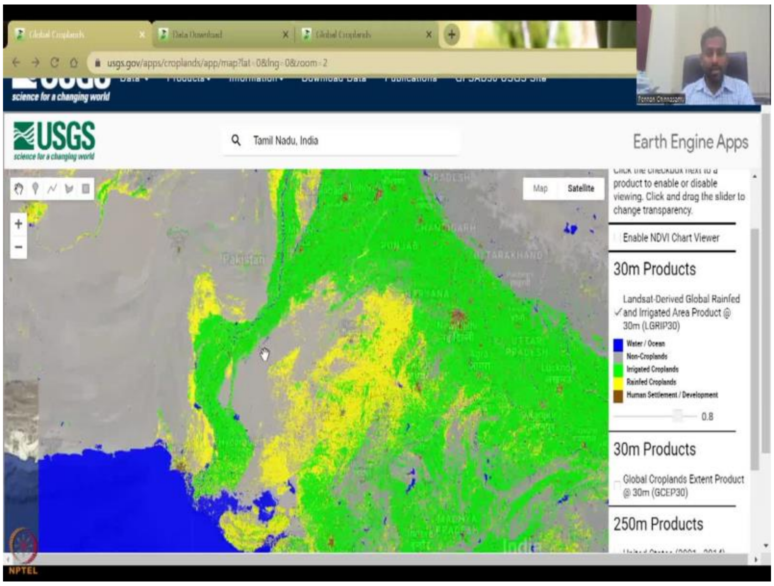
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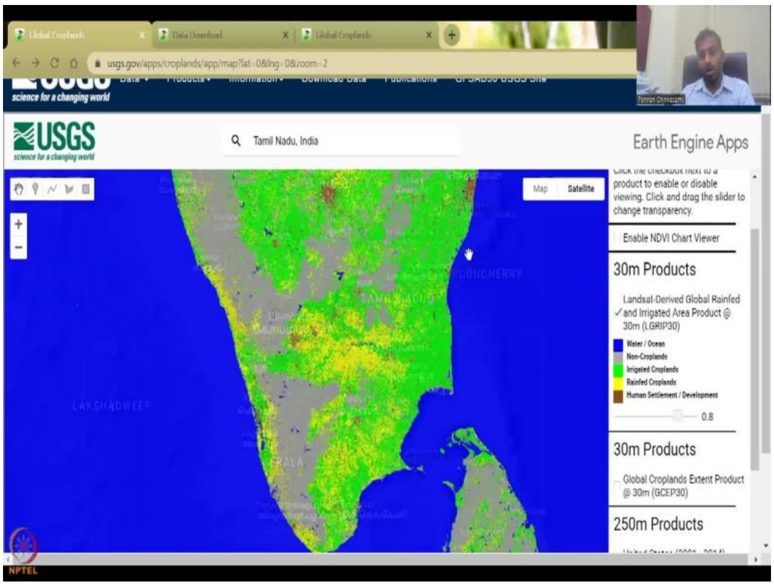
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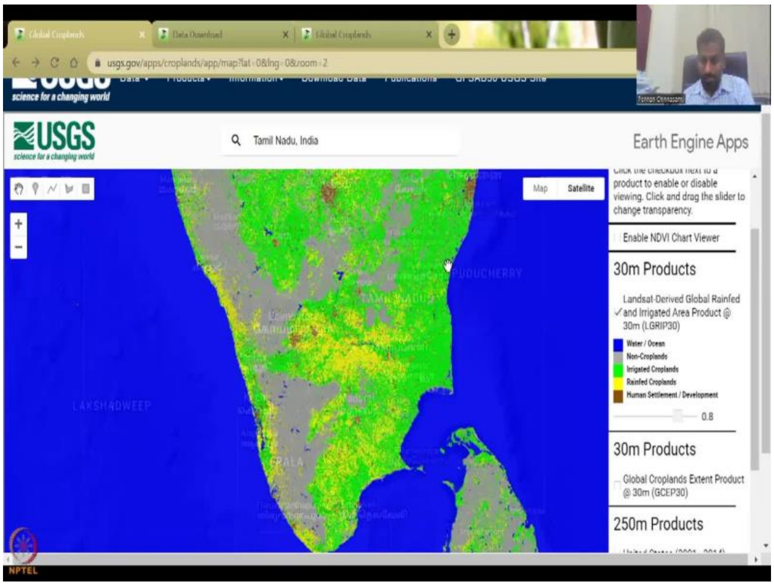

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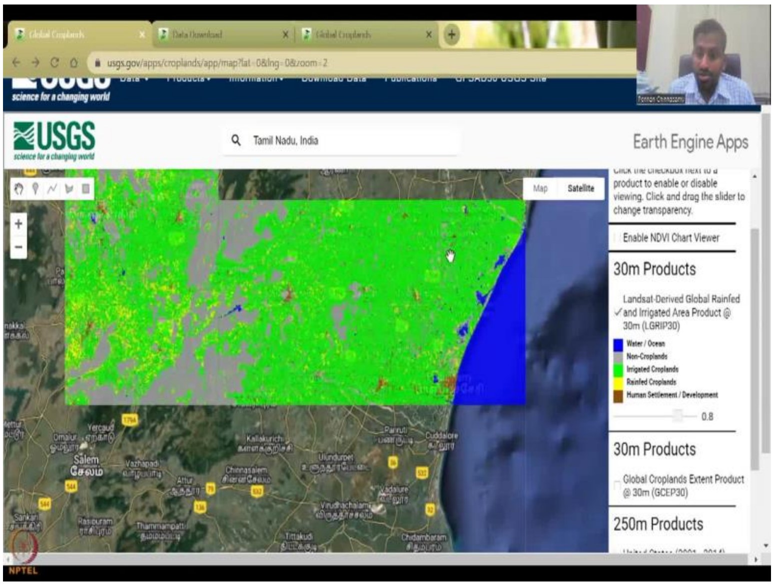

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30m Products
Landsat-Derived Global Rainfed and Irrigated Area Product @ 30m (LGRIP30)
Water / Ocean
Non-Croplands
Irrigated Croplands
Rainfed Croplands
Human Settlement / Development
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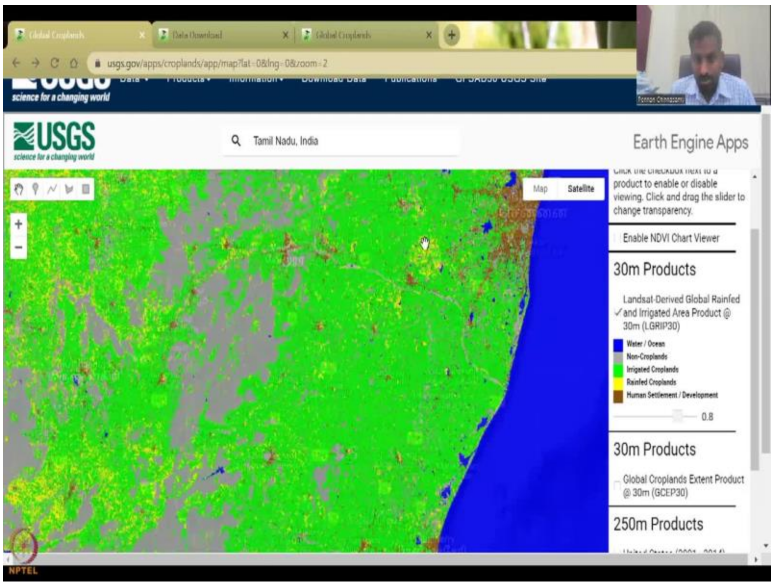

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Water / Ocean
Non-Croplands
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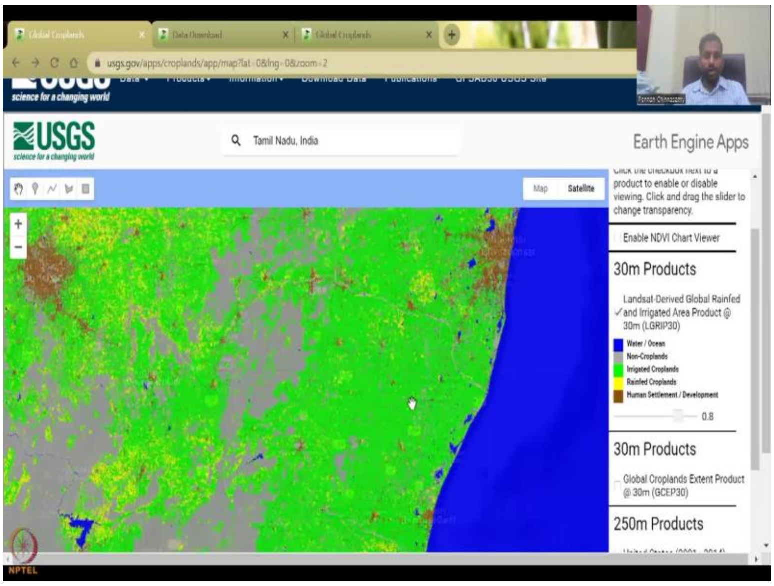
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Water / Ocean
Non-Croplands
Irrigated Croplands
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Human Settlement / Development
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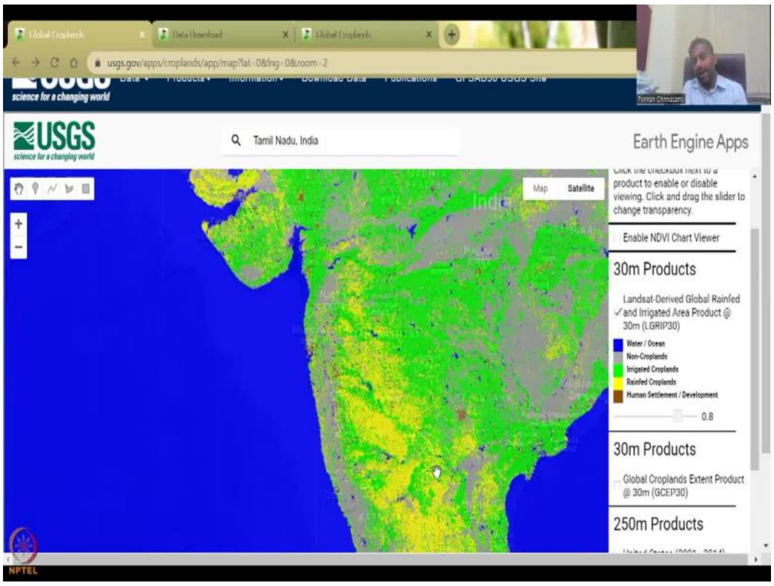
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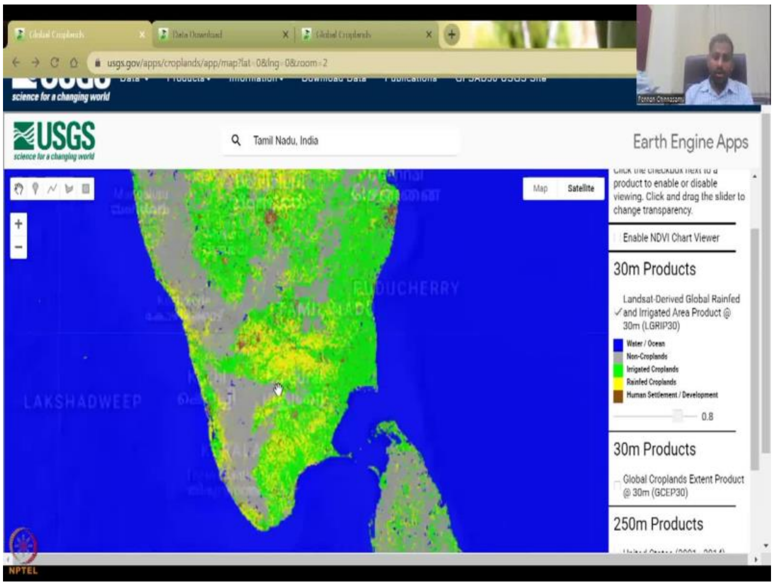
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Non-Croplands
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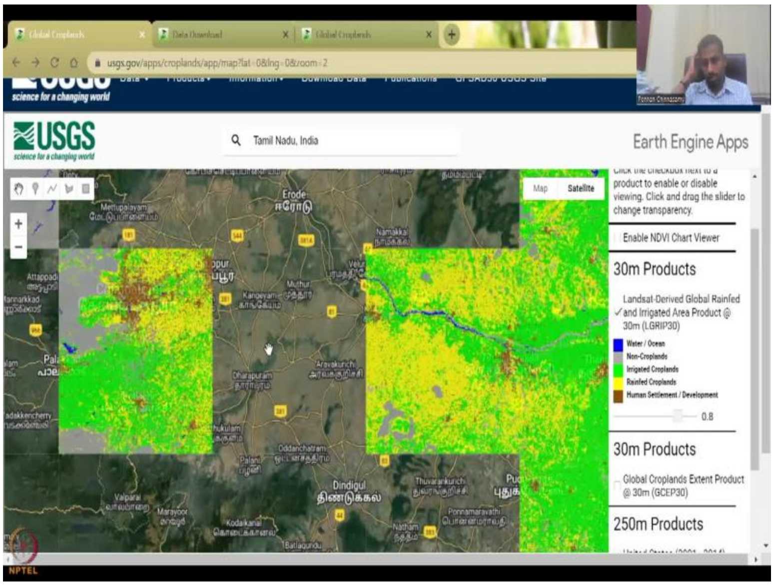
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Non-Croplands
Irrigated Croplands
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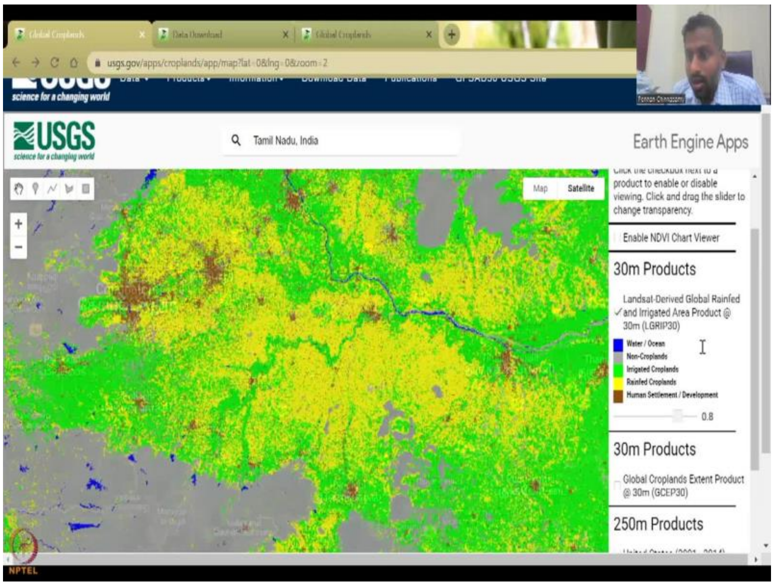
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Non-Croplands
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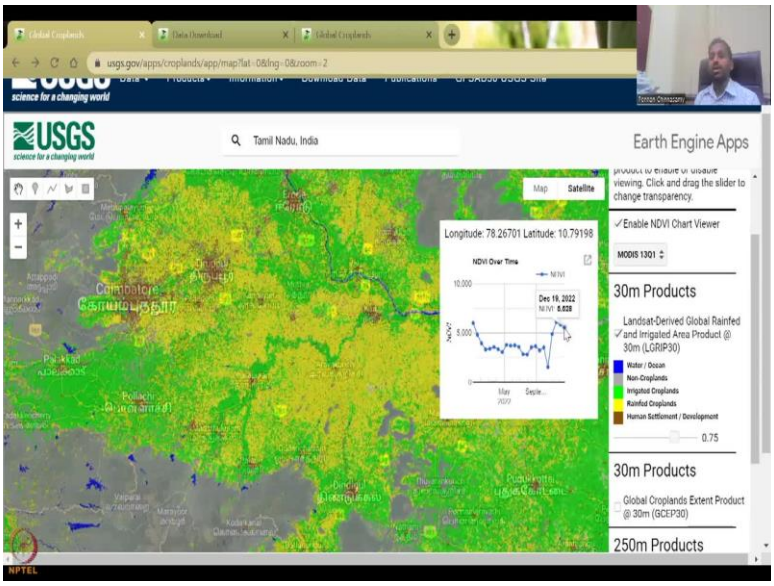
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NDVI Over Time
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Dec 19, 2022
May 2022
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Water / Ocean
Non-Croplands
Irrigated Croplands
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250m Products
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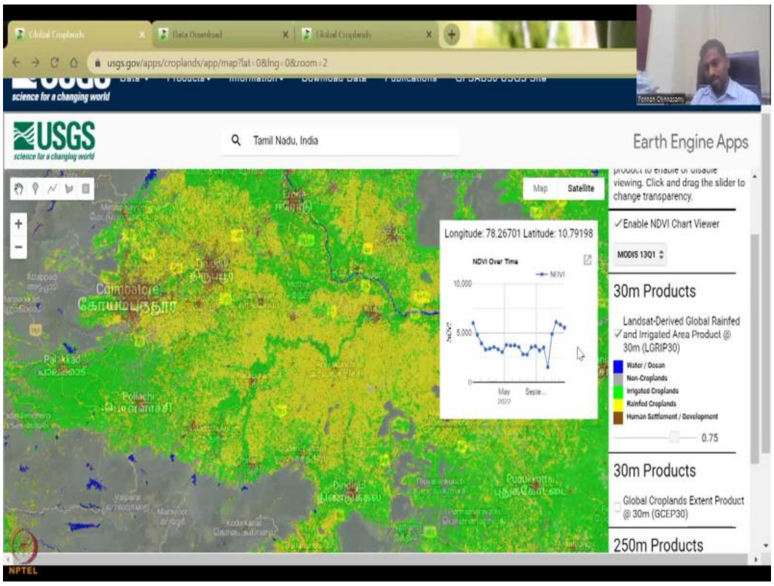
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Water / Ocean
Non-Croplands
Irrigated Croplands
Rainfed Croplands
Human Settlement / Development
0.75
30m Products
Global Croplands Extent Product @ 30m (GCEP30)
250m Products
Coimbatore
NPTEL


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NDVI Over Time
NDVI
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6,000
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2,000
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April 2022
June 2022
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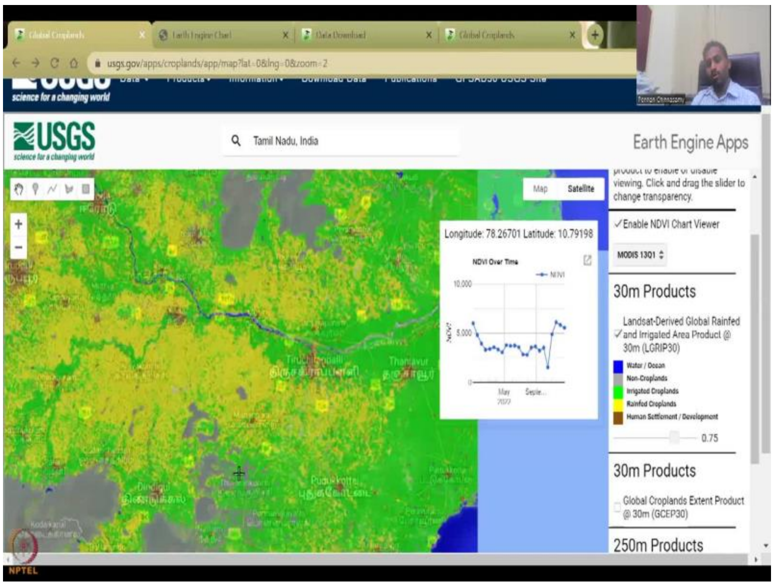
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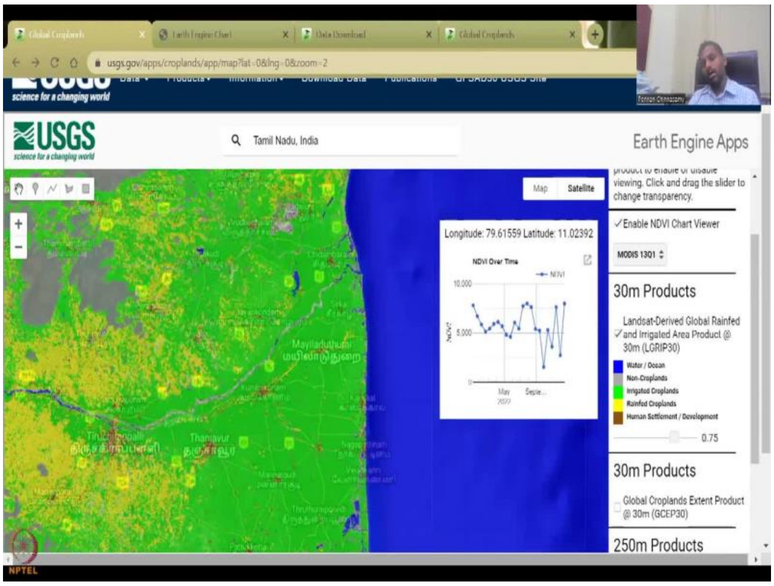
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NDVI Over Time
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Water / Ocean
Non-Croplands
Irrigated Croplands
Rainfed Croplands
Human Settlement / Development
0.75
30m Products
Global Croplands Extent Product @ 30m (GCEP30)
250m Products
Thanjavur
Mayiladuthurai


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NDVI Over Time
NDVI
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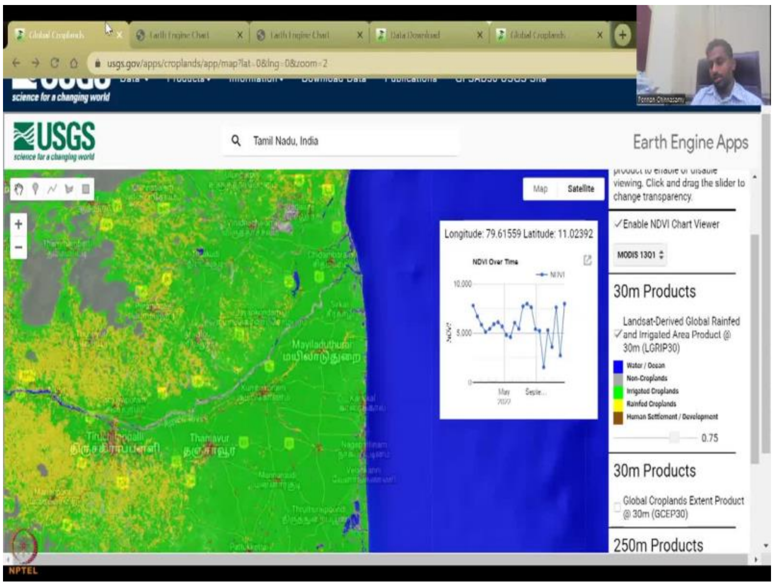
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Water / Ocean
Non-Croplands
Irrigated Croplands
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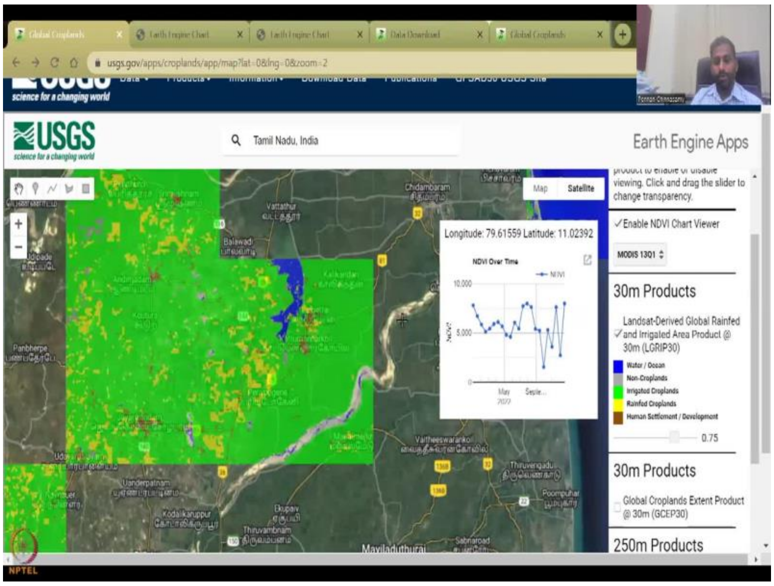
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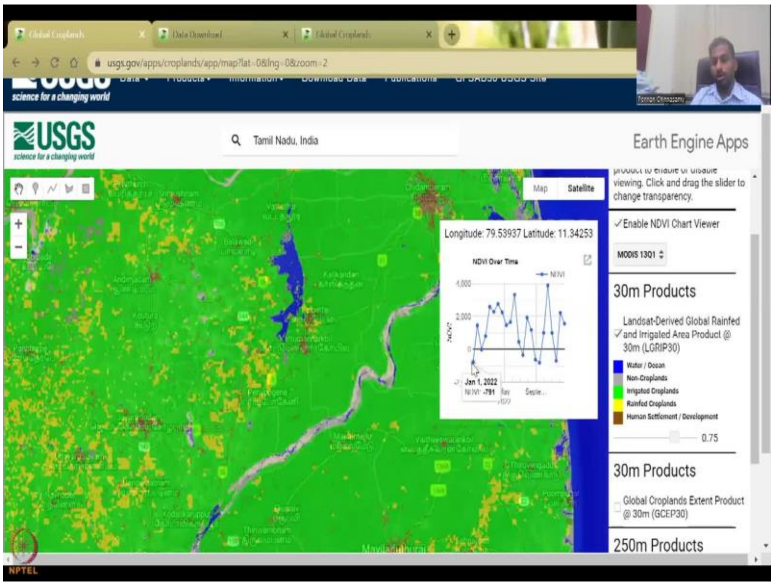
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Jan 1, 2022
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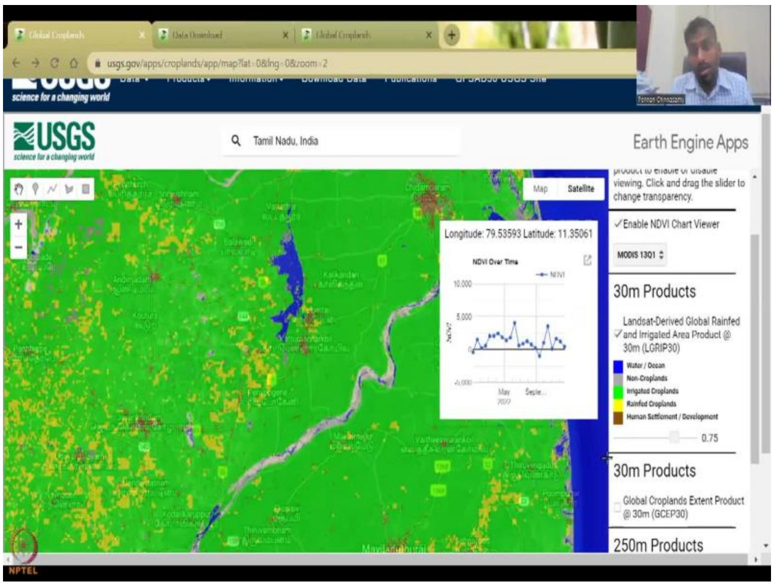
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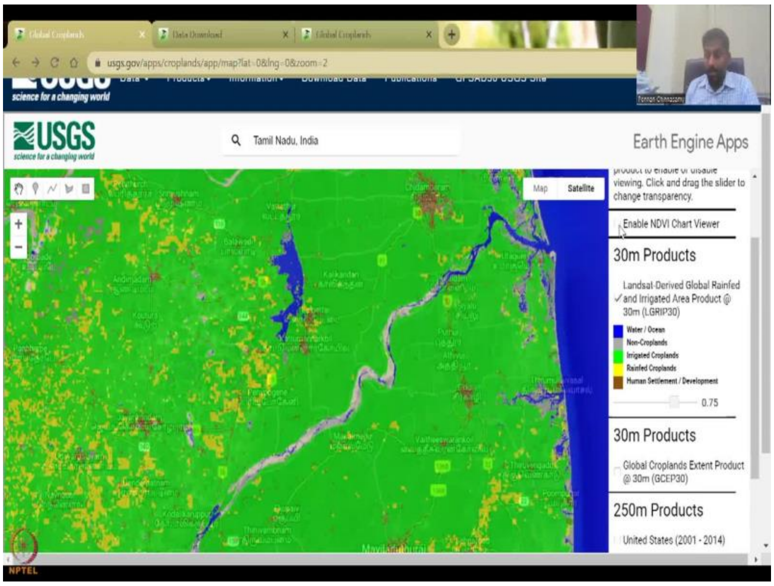

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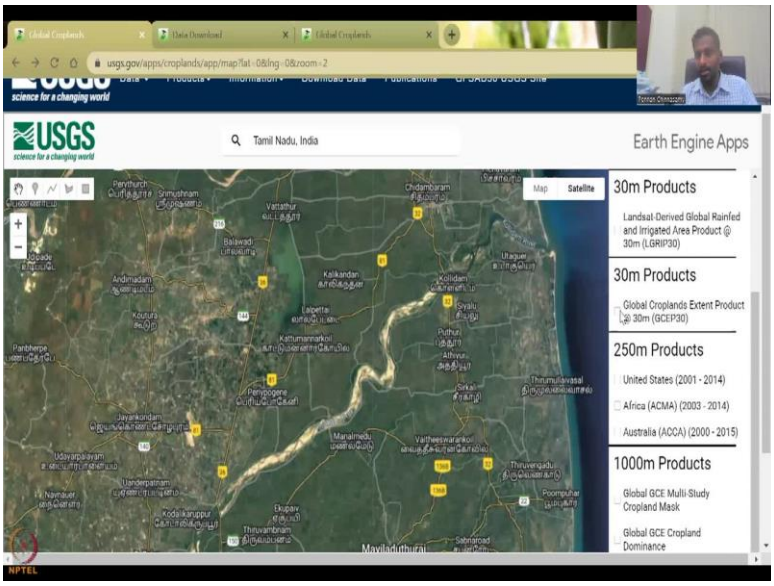

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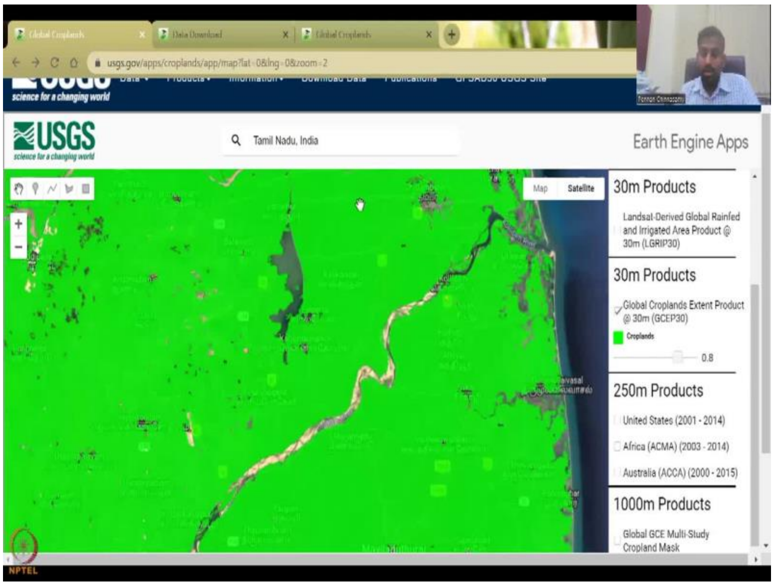

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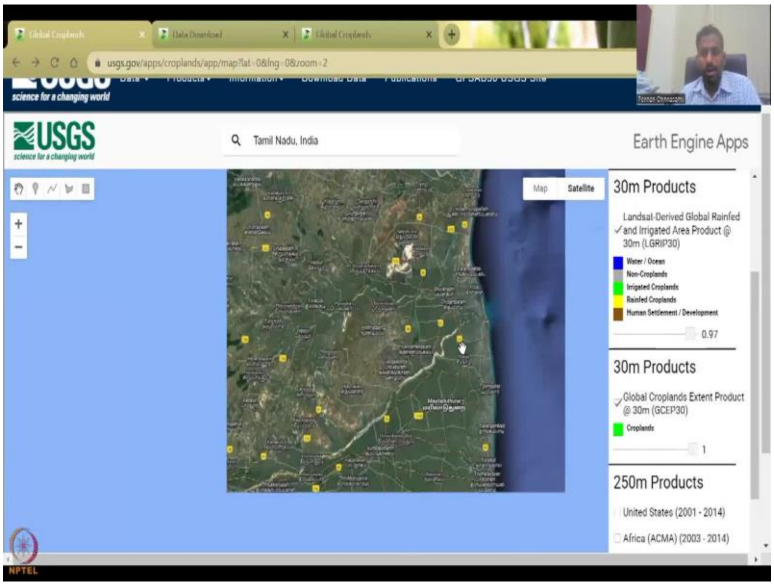
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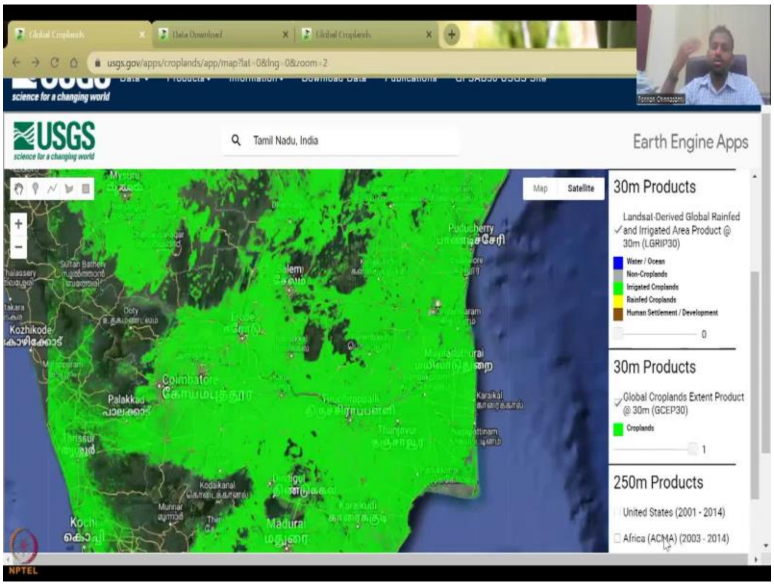
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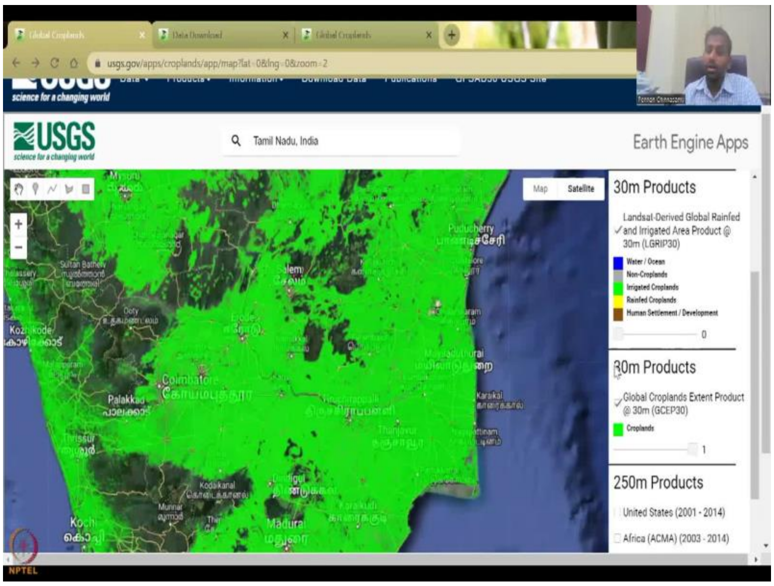
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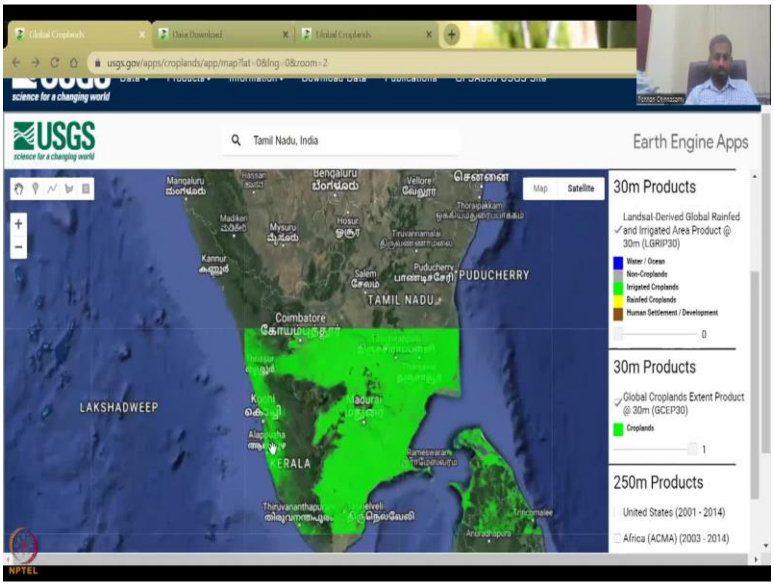
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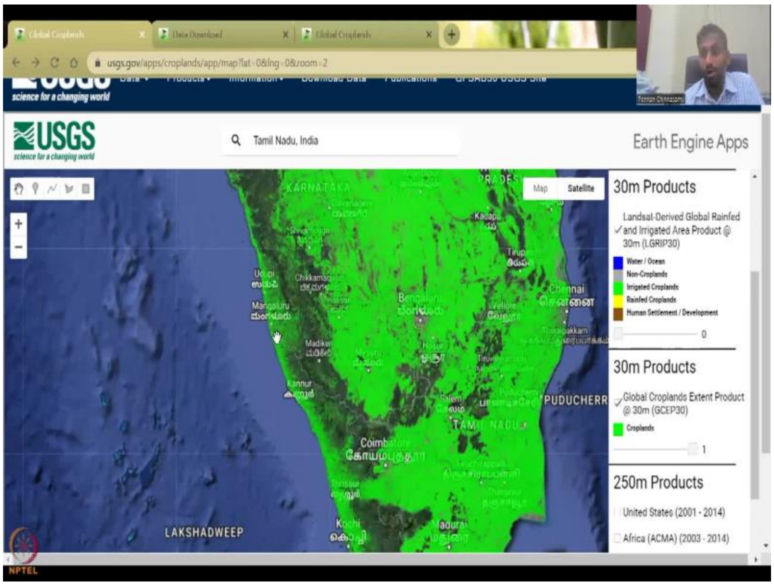
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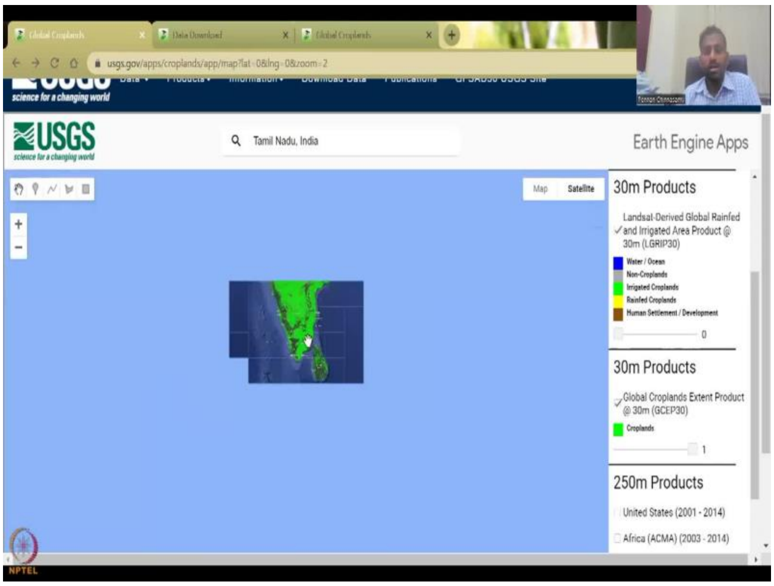
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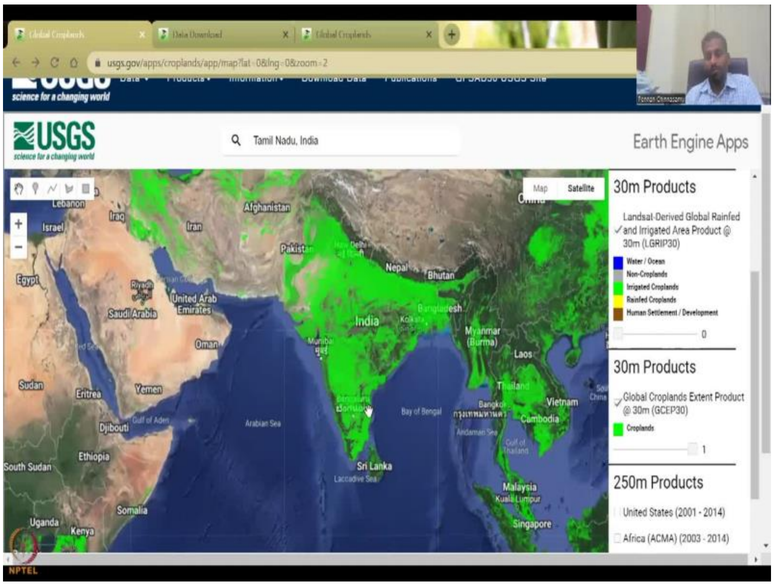

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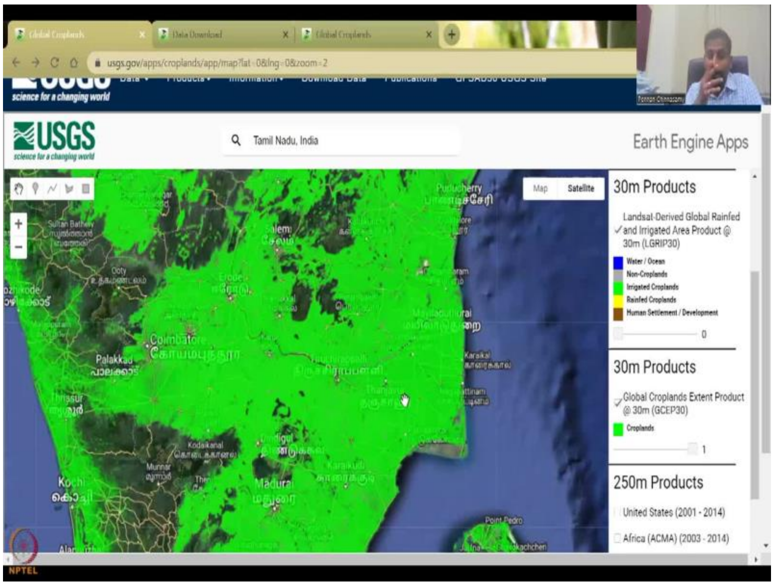

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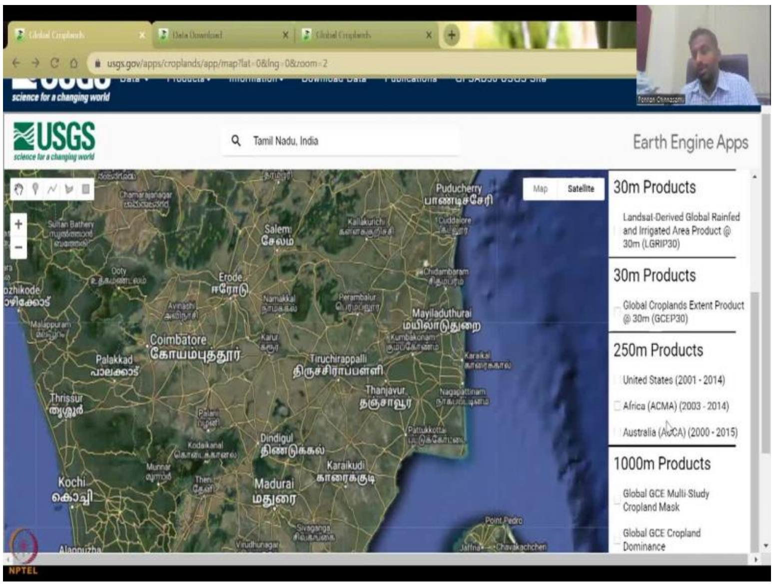

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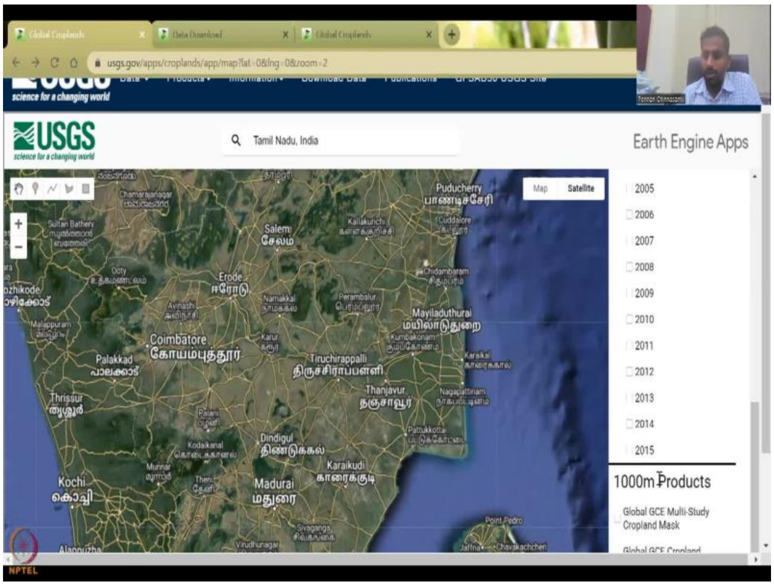
Global GCE Cropland Dominance



Now we will look at a USGS global crop land data which is very, very comprehensive dataset. I will click this and we will open the new slide. So what happens is now you have when I click that link, this will open up it is a Google Earth Engine supported dashboard. So here you can say search places let us say India and zooms down to India beautiful. You can pick a particular region.

You can do these maps just basically as your Google Earth Engine map or Google Earth Pro map, but here they have added data, which is global cropland data, and some products, you can see all the products here on the right hand side panel, these are the very very new ones very high resolution products 30 meter resolutions. And these are different because it is not just giving you a cropland or not like the ones we saw in Bhuvan agriculture or not barren or not, this is going to give you a irrigated area product. Why is this very important is irrigation means application of water.

So, there is two major types of farming, one is the kharif farming which is based on the monsoon water. So, which means rainfall happens the water comes to the field plants grow you do not apply energy, time, money to supply water. So, all these are saved for the farmer. However, after the monsoon season, which lasts mostly 4 months, there is still need of water, there is some reminiscence water or soil moisture residue, maybe 1 or 2 months, let us say 5 to 6 months you have good water supply already in the soil.

Not much irrigation is needed, but for cash crops and crops that grow using a lot of water even during the rainfall, it is not enough. And thanks to climate change and other factors, this is a growing issue in rural regions. So, what do we do is we need to support the plan using other resources of water canal irrigation, groundwater irrigation, tube well irrigation and then you also have lift irrigation, multiple types of irrigations where you take water from a water resource body surface water, groundwater, and then you apply it to the field. So, there is a source procurement, transportation, application, pumping, energy costs all, so a lot of costs involved.

So, to understand the profit, the net profit in an agricultural area, it is very important to understand the irrigated non-irrigated crop types. So, here what you could see is the land use it is kind of a land use land cover map, but all the major things are kept and more diversified for example, water ocean is kept non crop lands which is barren. So, if you look at the Bhuvan’s classification, you will have barren, wasteland, wetland all those stuff forest, etc. Here none of this comes because it is focusing on only the crop area, non crop area and there is some human settlement development.

So, let us go to Tamil Nadu. It is a global map, so, you can go anywhere in terms of the coverage and you can see that it is kind of a land use land cover map for Chennai, Chennai has a lot of urbanization. So, you can see that urban systems have grown, but more importantly it is also highly intensive agricultural state you can see that a lot of agriculture is happening less compared to the other regions.

So here Kerala you will see less almost entire Tamil Nadu is covered with agriculture and then same as that in along the Western Ghats not much same as that in Maharashtra and Karnataka and some split. In Odisha, Chhattisgarh less areas then going up north you have less areas in Rajasthan which is blank. The hilly regions also are very less same in the Northeastern regions.

So, coming back in the Tamil Nadu region, you could see that there is a lot of off the right hand side, Southern right hand side you see a lot of irrigation happening and these irrigation are happening along the coastal regions along the regions where the major cities are present like Chennai, Puducherry etc. So, how is this sustainable is the question because all these water bodies are facing high water stress groundwater resources are facing stress because of these irrigations then you have the Rainfed croplands.

Sometimes you have Rainfed overlapping the irrigated area which means you have an area where rainfall crops are used. But then after the rainfall it still is being used for irrigation. Let us say rice, rice could be used as a kharif crop where a lot of rainfall is taken up for growing.

Then after the harvest is done the same land can be used for irrigated crops like legumes like soybeans, groundnuts, vegetables like carrot, onions, potatoes, all these things can be grown in this area.

So you have the major two types irrigated cropland and rain croplands. So for India, you could see that the central regions are mostly rain fed. And that is the concern also, because if there is a big climate change, impact like droughts and floods, there is no much water available for agriculture. So there is a need for building climate change resilient crops. Whereas here you see some in the western side, some regions are rain fed like Coimbatore and stuff, but they get more rainfall also because of some rainfall coming from the Western Ghats and stuff.

So this is your rain fall irrigated areas in yellow, and then your irrigated crop lands in green and then this slider will give you a opacity. So same thing if you want to reduce the opacity to see the background and show how this crop is working, you can play with the slider. So most important is in this you have a readymade Google Earth Engine plugged in with NDVI. So let us say I click this enable NDVI and I am going to click this map here, it is going to generate a graph of the current scenario May 22, September 2022, and this is December, until December the NDVI value is available. The left hand side the units may be scale, for now, you could say that is it increasing or decreasing along the baseline.

So the baseline is this, you can ask if the data is increasing or decreasing, I am just going to make it big. And you could see that NDVI value goes down from February 22 to December 22, little bit down and then goes up almost above the level in February. So Jan, Feb, there is a good winter rainfall, maybe in that region and so there is crops picking up. So but you can also go to this area and say these are all irrigated areas, let us click on a map and then you have very high NDVI as compared to the previous one.

So, from here to 0 to 7, whereas here to 0 to 8 and most of the values are in the peak, you have an August rainfall capturing high NDVI values, NDVI when it is high, it is higher vegetation is happening when it is low or minus 1 it is less vegetation and minus 1 refers to water. So, you could see that here there is not much differences because there is a 2 rainfall seasons one in December, one in August, and so there is a good application of irrigation water.

We will also click on the water body just for sake and as I said it goes below minus because negative is for water bodies, and you could see that the chart generates by itself. So, this is how the system works here, you could just want to so, they use modest data to calculate the NDVI the NDVI is a indicator of vegetation cover, if the value is positive and high it ranges normally from minus 1 to plus 1 the range in this particular dashboard is off a little bit or maybe they scaled it which is fine, but normal range is minus 1 to plus 1 whereas minus 1 relates to water bodies and barren land is from minus 1 to 0. So, the negative values are mostly for barren land and other aspects. Whereas the positives are green cover.

So, as the crop is healthy and growing, it attains full growth and goes to plus 1 value of NDVI. So that both of them we can see. So these this is one product Landsat derived a rainfed and irrigated product at 30 meter resolution. So all these are each pixel is 30 meters. Let us take it out and then we will go to the next one which is global crop lands extent product at 30 meter resolution.

So basically, this is getting populated. This is total crop lands, in the initial one it is cropland plus water body plus barren. So, you can see that some overlap is happening, what I am going to do is I am going to reduce this cover obesity, so that we can also see this guy and you can play up and down with this to see that all these same spots are done. So basically, cropland is together, it is merging the irrigated cropland and the Rainfed cropland just to show an image of where is the majority cropland happening.

So, the layer on the top always has a higher precedence. So, for example, if I keep it high, you can see the yellow marks and the brown marks coming, which is not part of the cropland down. So cropland is only crops, but for some reason, it is also picking up the Western Ghats, which is not cropland. So, this is these are things that they did it uniformly but they should understand that Western Ghats is not a cropland it is forest it is a conservation forestation.

So there are data which is good because this is done for global so you can see that globally it has been done and you see it beautifully populate for the entire Indian region. But then when you zoom in, you got to be careful about using it widely. So I am going to remove these two products. Now you have these 250 meters product which is bigger in resolution let us do Australia, and then you have multiple years.

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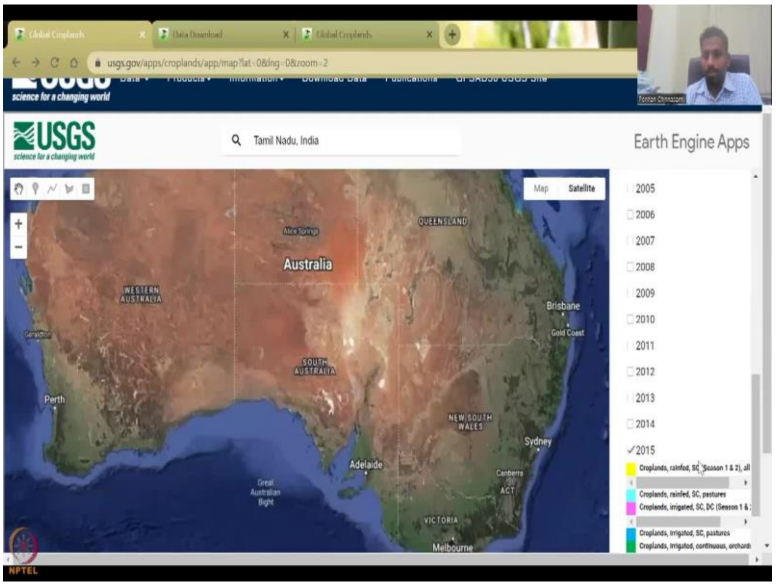

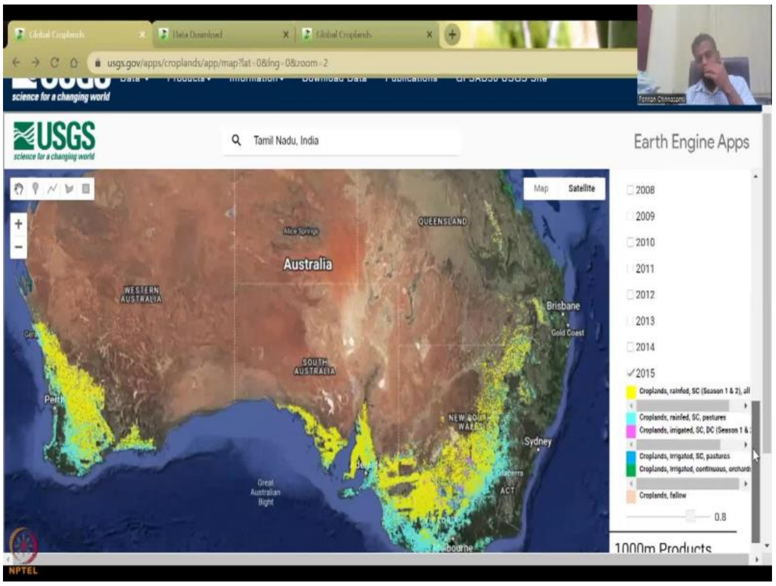

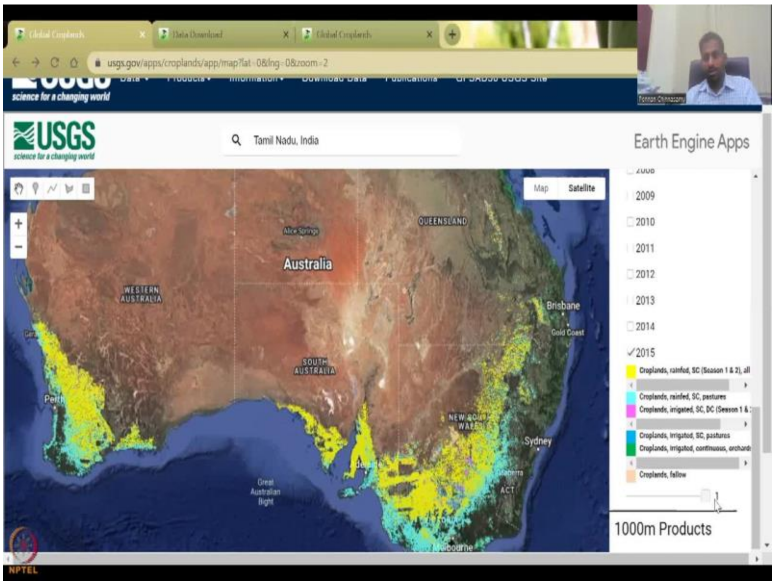

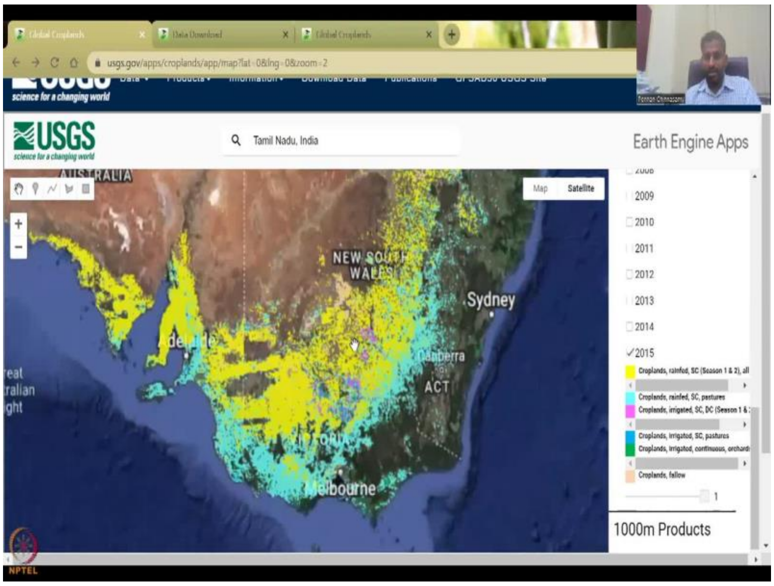
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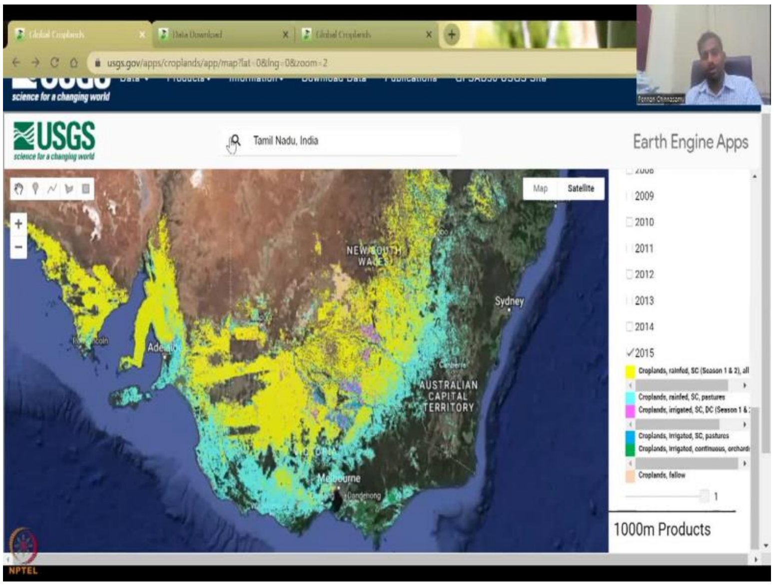
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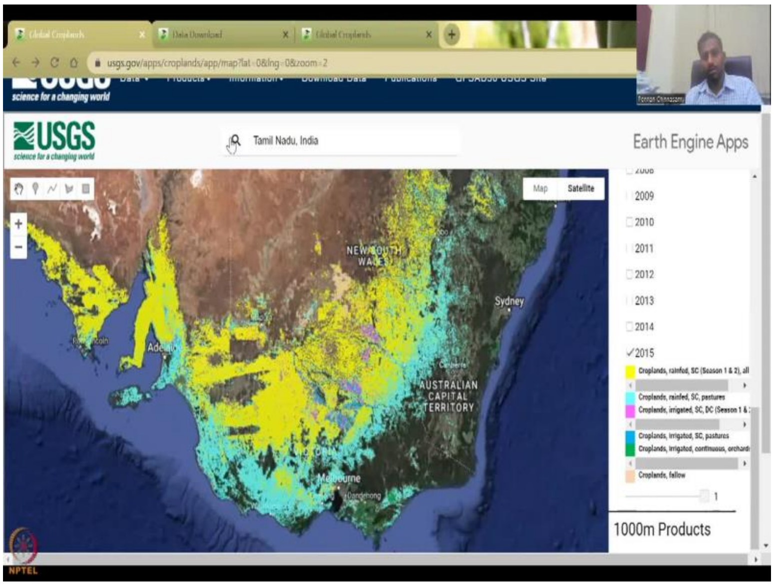
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Let us do 2015 and what they are going to do is they are going to show Australia's land use land cover. Cropland rainfed season one, season two, and then cropland fallow all these are there. So, you could see that there is tremendous fallow land in Australia, the central region is very, very dry. And that is one of the reasons they are high importers of food crops, food produce.

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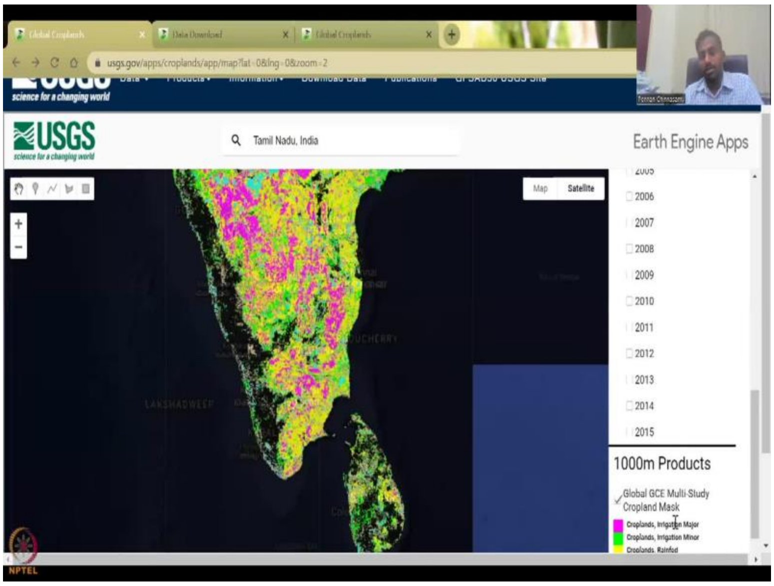

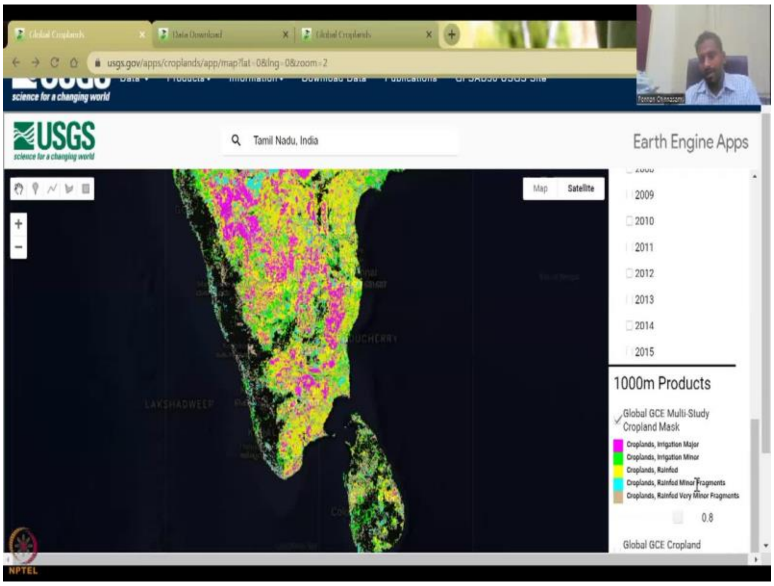

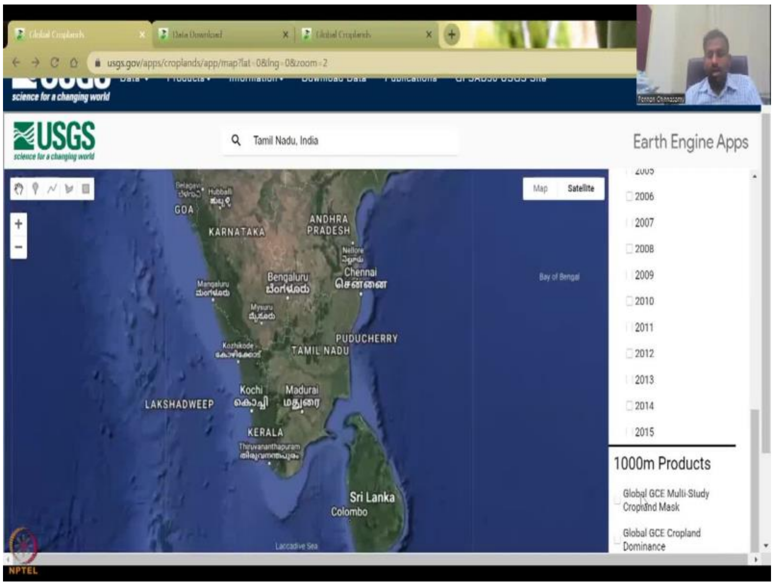
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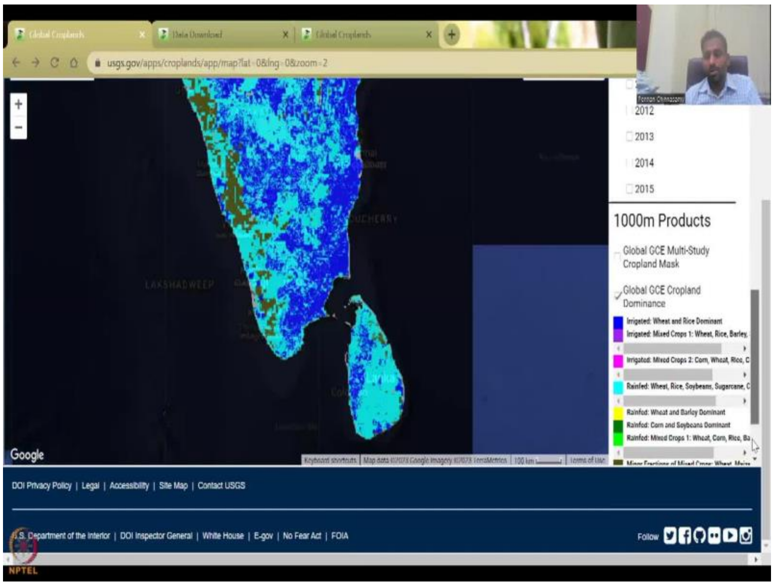
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Rainfed: Wheat and Barley Dominant
Rainfed: Corn and Soybeans Dominant
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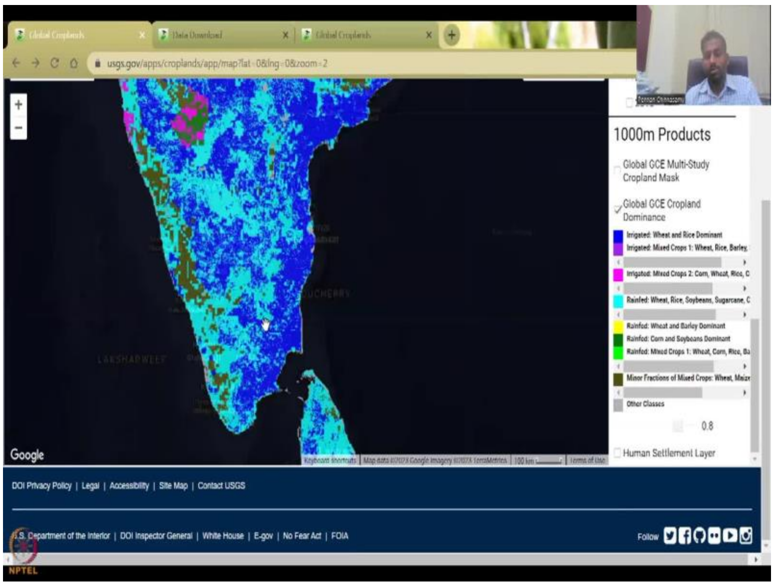
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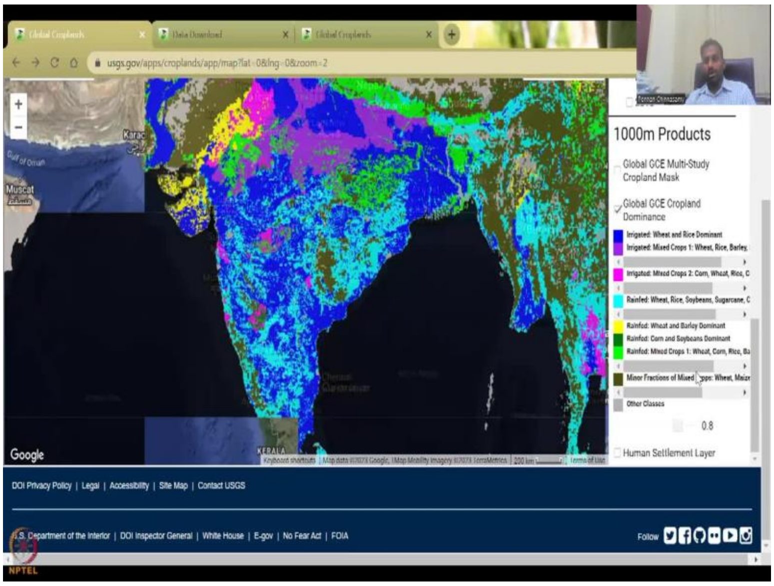
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Irrigated: Mixed Crops 2: Corn, Wheat, Rice, C
Rainfed: Wheat, Rice, Soybeans, Sugarcane, C
Rainfed: Wheat and Barley Dominant
Rainfed: Corn and Soybeans Dominant
Rainfed: Mixed Crops 1: Wheat, Corn, Rice, Ba
Minor Fractions of Mixed Crops: Wheat, Maize
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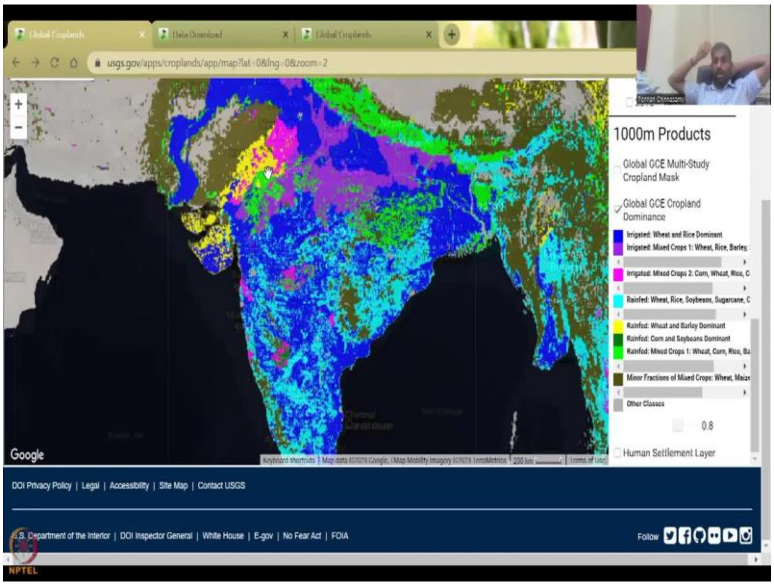
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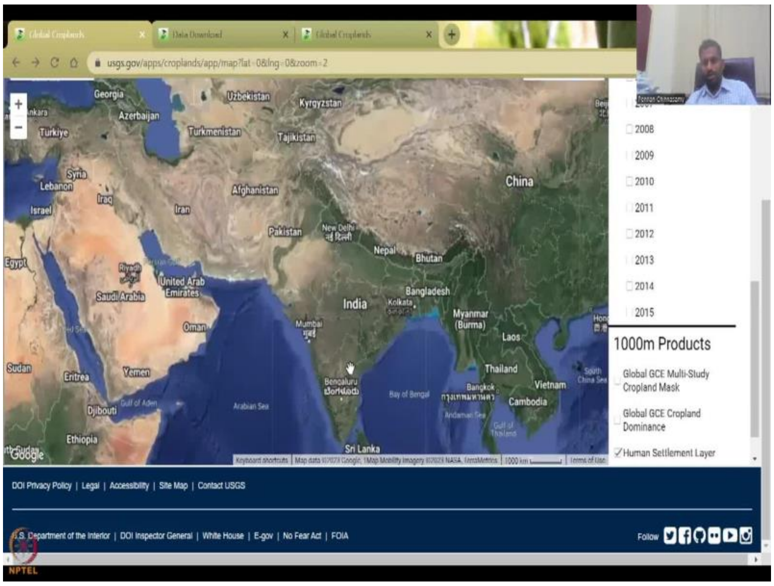
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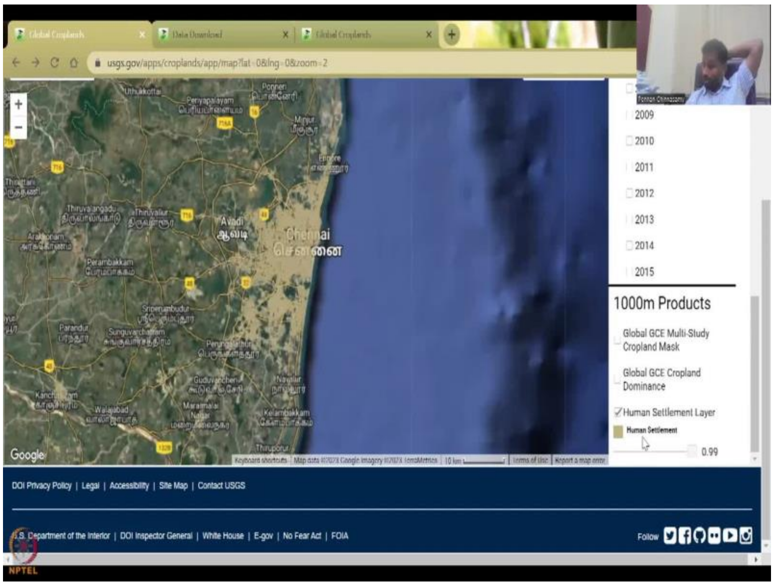
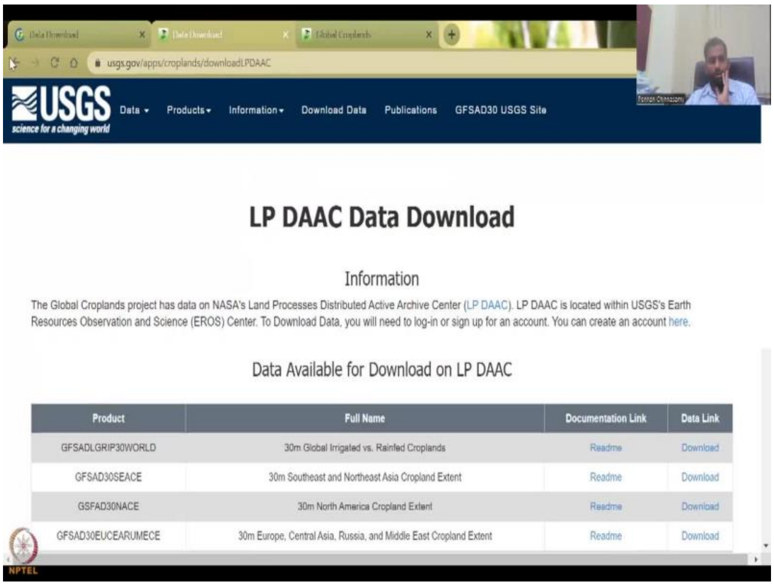




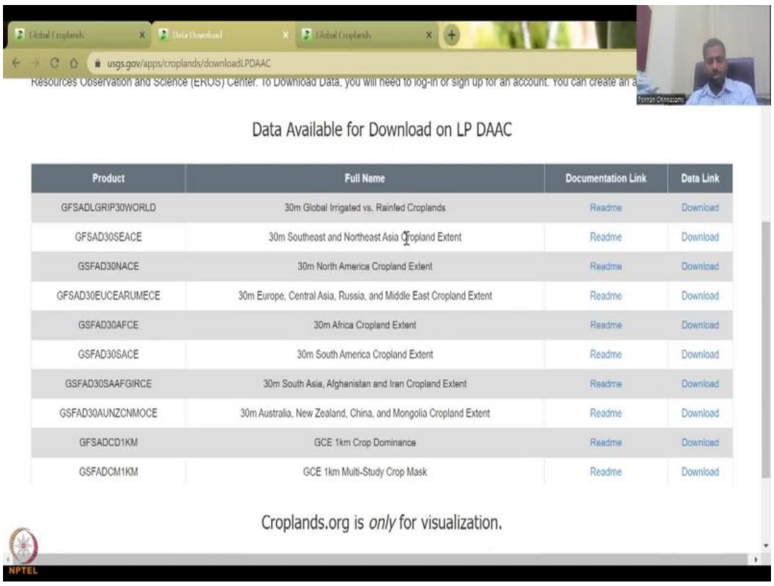
LP DAAC Data Download

Information

The Global Croplands project has data on NASA's Land Processes Distributed Active Archive Center (LP DAAC). LP DAAC is located within USGS's Earth Resources Observation and Science (EROS) Center. To Download Data, you will need to log-in or sign up for an account. You can create an account here.

Data Available for Download on LP DAAC

Product	Full Name	Documentation Link	Data Link
GFSADLGRIP30WORLD	30m Global Irrigated vs. Rainfed Croplands	Readme	Download
GFSAD30SEACE	30m Southeast and Northeast Asia Cropland Extent	Readme	Download
GSFAD30NACE	30m North America Cropland Extent	Readme	Download
GFSAD30EUCEARUMECE	30m Europe, Central Asia, Russia, and Middle East Cropland Extent	Readme	Download



Data Available for Download on LP DAAC

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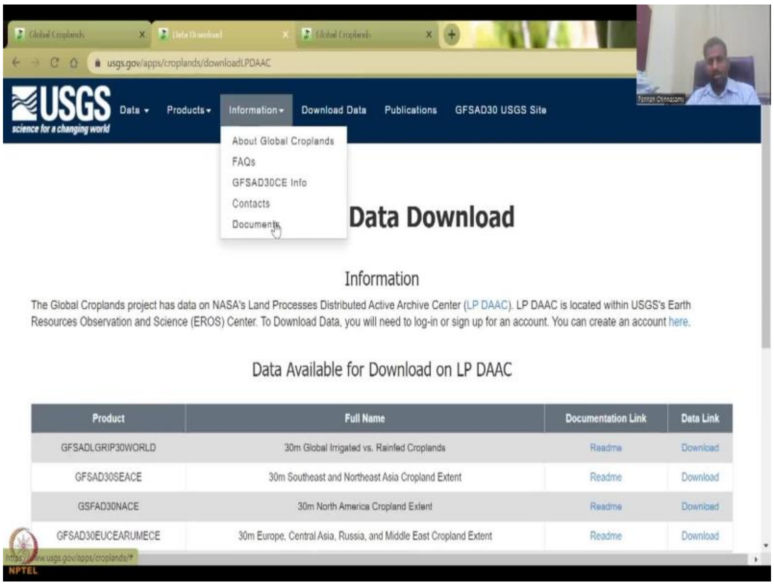
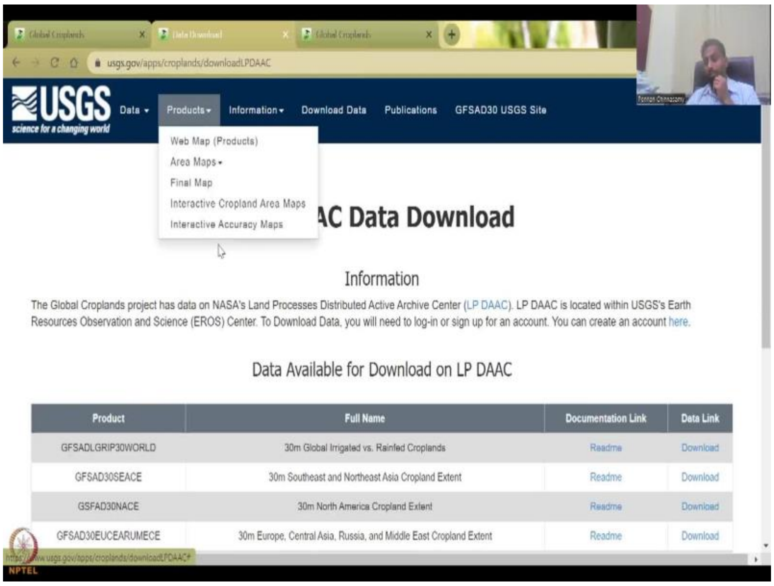
GFSADLGRIP30WORLD	30m Global Irrigated vs. Rainfed Croplands	Readme	Download
GFSAD30SEACE	30m Southeast and Northeast Asia Cropland Extent	Readme	Download
GSFAD30NACE	30m North America Cropland Extent	Readme	Download
GFSAD30EUCEARUMECE	30m Europe, Central Asia, Russia, and Middle East Cropland Extent	Readme	Download
GSFAD30AFCE	30m Africa Cropland Extent	Readme	Download
GSFAD30SACE	30m South America Cropland Extent	Readme	Download
GSFAD30SAAFGIRCE	30m South Asia, Afghanistan and Iran Cropland Extent	Readme	Download
GSFAD30AUNZCNMOCE	30m Australia, New Zealand, China, and Mongolia Cropland Extent	Readme	Download
GFSADCD1KM	GCE 1km Crop Dominance	Readme	Download
GSFADCM1KM	GCE 1km Multi-Study Crop Mask	Readme	Download

Croplands.org is *only* for visualization.





So let us take this off also then we have 1000 meter products or 1000 meter products we have the global GCE multi study cropland mask, and then it is basically 1000 meter product of land use land cover, minor fragments, very minor fragments, irrigated minor, irrigated major, different schemes of irrigation. And then you have the global GCE dominance, which is the wheat mix crops and other things. And you can see that we have mostly in the southern region, a lot of rice, so, wheat and rice dominant regions are dark blue, light blue or rain fed wheat, rice soybeans.

So these are the 2 colors that come in the south, you can now look at where it becomes yellow. So yellow is wheat, and barley dominenet, so there is not much rice. So India is beautifully divided in terms of food and major staple more rice in the south south, whereas wheat is had more in the northern regions so chapatties rotis are consumed more in the northern part whereas rice, idly, chawal, or is taken up in the southern regions.

And one more layer which is very important is the human settlement layer. I have clicked it but it does not populate anything yet because maybe the data has not been plugged in which can wait for some more time. You see it picks up, in Chennai, it picks up slightly, you could see that the brown colors picking up these are the human settlements for 2015, all these are 2015 which is similar to the Bhuvan's data product of 2015 we will do a hands on course on doing a very very current land use land cover classification in week 9 first lecture.

So before we finish, I also wanted to show case the other dashboard datasets that are available. So these kind of dashboards come up often. So how do you know what is the protocol? What is the data source, etc you can click download data, it will open this page, which I have already opened for you, let it go through. So once you hit the data download page, it will give you information about the download data, the 30 meters, this is a 30 minute resolution, irrigated versus rain crops, etc, etc.

So which one you want to download, you can just download at a global scale for the year 2015. But this is highly, highly validated, I will show you how it has been validated. And then it is only for visualization, etc, etc. So this this part, Croplands.dot org is for visualization. So you have all this data that can be downloaded and mapped into a GIS for further analysis and experimentation. Then you also have the information you can click and know about what are the datasets, contacts and documents, different map that have been already made. So let us say web map products.

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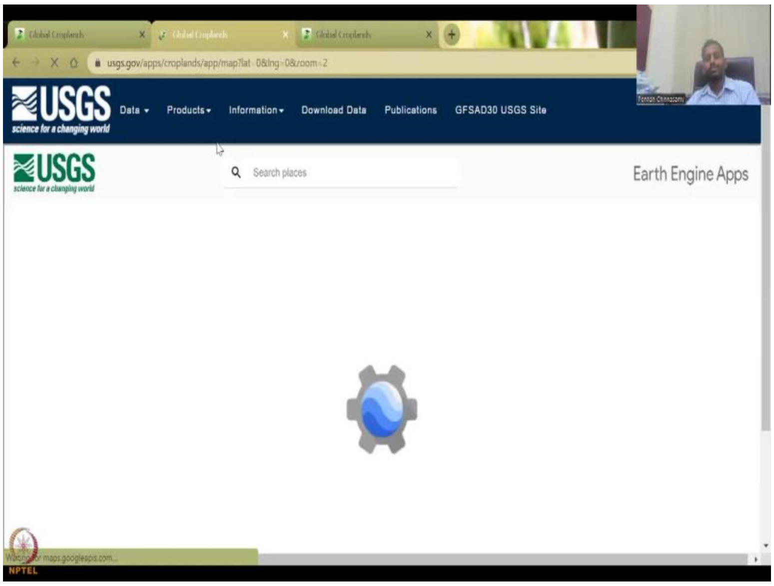

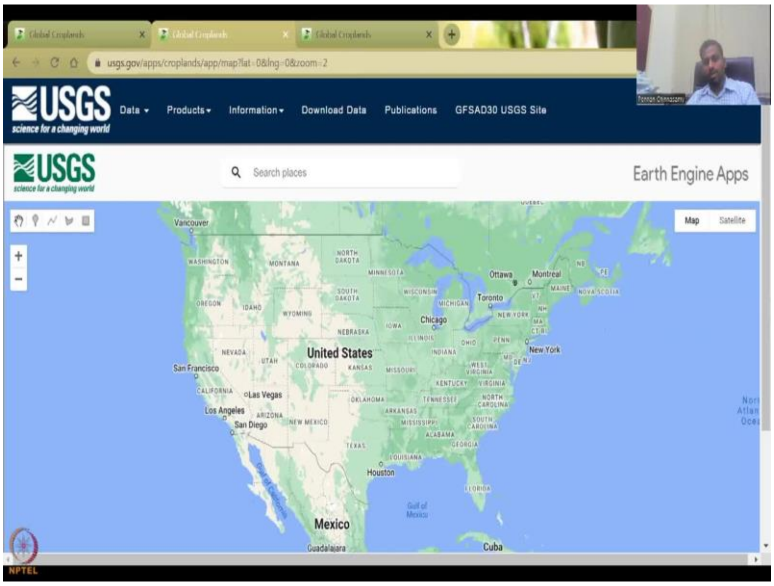

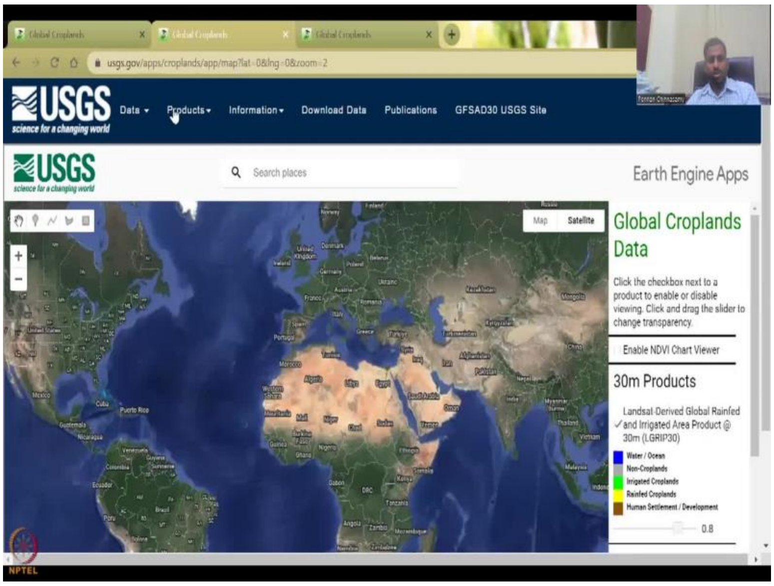

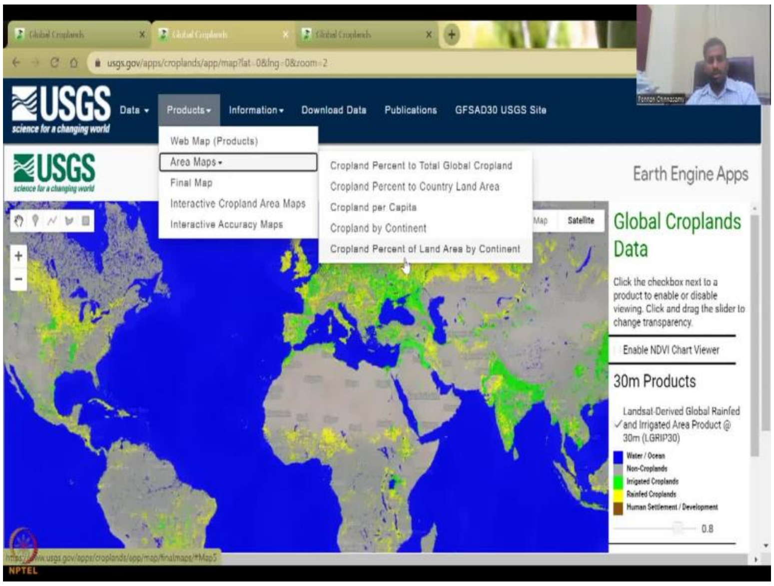
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Interactive Cropland Area Maps
Interactive Accuracy Maps
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Earth Engine Apps
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Landsat-Derived Global Rainfed and Irrigated Area Product @ 30m (LGRIP30)
Water / Ocean
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Rainfed Croplands
Human Settlement / Development
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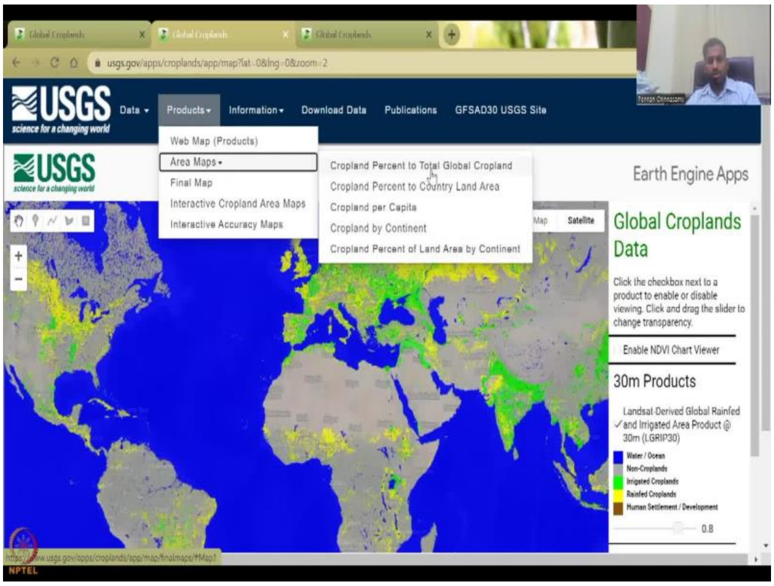
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Cropland per Capita
Cropland by Continent
Cropland Percent of Land Area by Continent
Earth Engine Apps
Satellite
Global Croplands Data
Click the checkbox next to a product to enable or disable viewing. Click and drag the slider to change transparency.
Enable NDVI Chart Viewer
30m Products
Landsat-Derived Global Rainfed and Irrigated Area Product @ 30m (LGRIP30)
Water / Ocean
Non-Croplands
Irrigated Croplands
Rainfed Croplands
Human Settlement / Development
0.8
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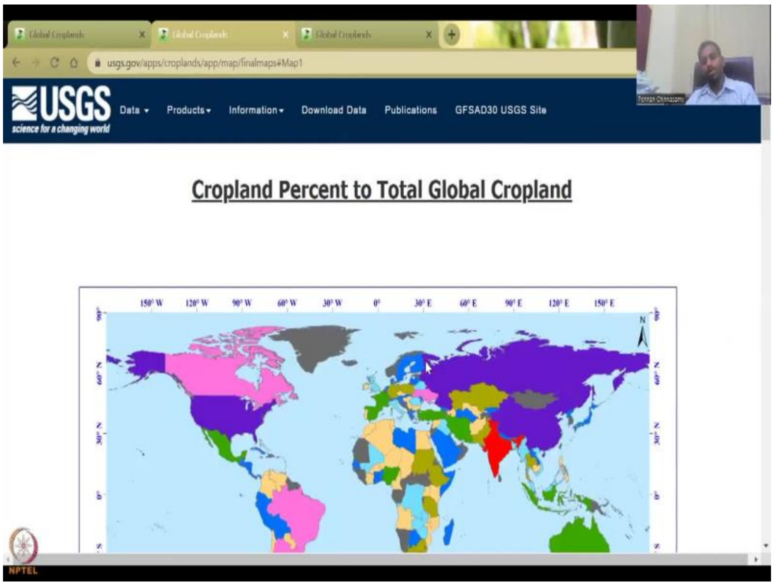
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Cropland Percent to Total Global Cropland
150° W
120° W
90° W
60° W
30° W
0°
30° E
60° E
90° E
120° E
150° E
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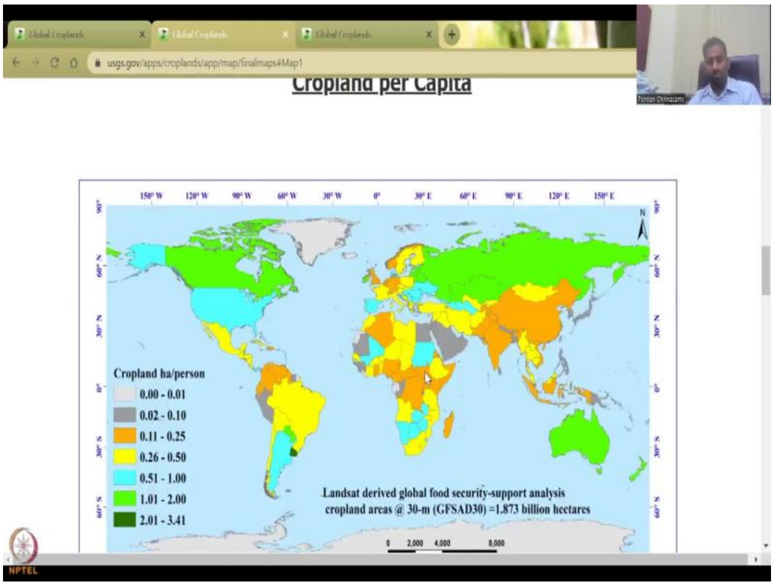
NPTEL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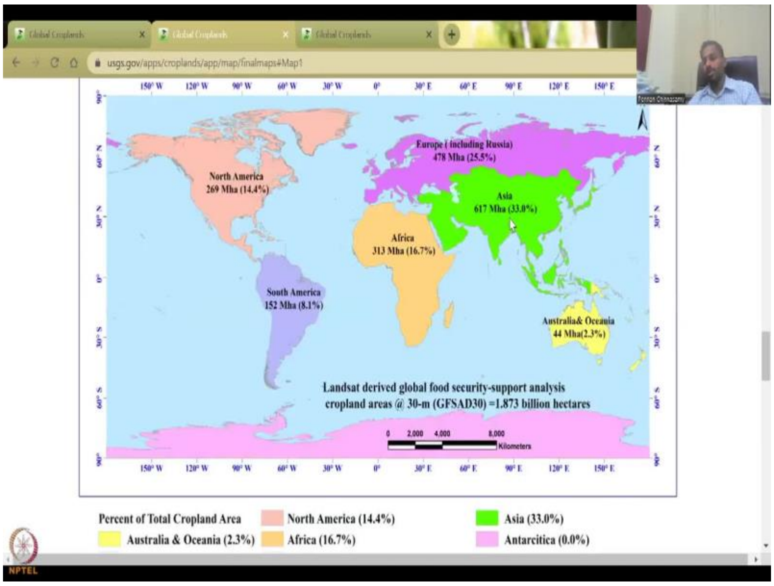
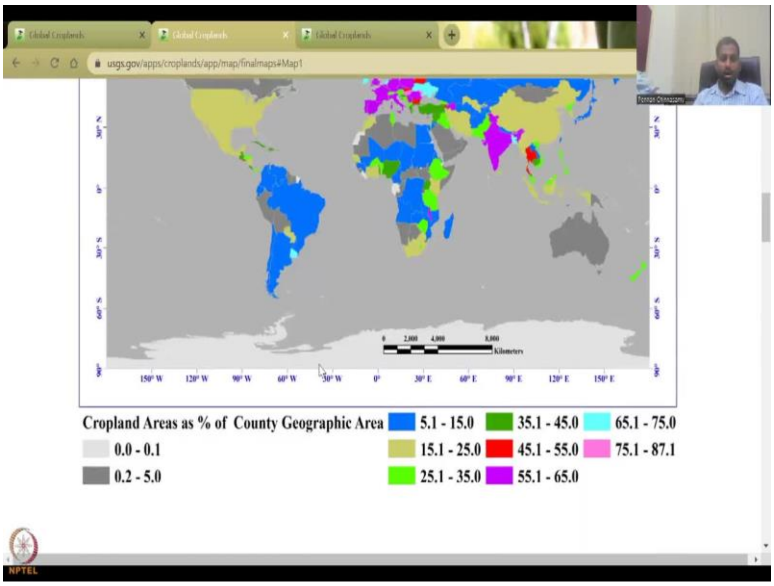
Cropland per Capita
Cropland ha/person
0.00 - 0.01
0.02 - 0.10
0.11 - 0.25
0.26 - 0.50
0.51 - 1.00
1.01 - 2.00
2.01 - 3.41
Landsat derived global food security-support analysis
cropland areas @ 30-m (GFSAD30) =1.873 billion hectares
NPTEL


usgs.gov/apps/croplands/app/map/finalmaps#Map1
Europe (including Russia)
478 Mha (25.5%)
North America
269 Mha (14.4%)
Asia
617 Mha (33.0%)
Africa
313 Mha (16.7%)
South America
152 Mha (8.1%)
Australia& Oceania
44 Mha(2.3%)
Landsat derived global food security-support analysis
cropland areas @ 30-m (GFSAD30) =1.873 billion hectares
Kilometers
Percent of Total Cropland Area
North America (14.4%)
Asia (33.0%)
Australia & Oceania (2.3%)
Africa (16.7%)
Antarcitica (0.0%)
NPTEL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Kilometers
Cropland Areas as % of County Geographic Area
5.1 - 15.0
35.1 - 45.0
65.1 - 75.0
0.0 - 0.1
15.1 - 25.0
45.1 - 55.0
75.1 - 87.1
0.2 - 5.0
25.1 - 35.0
55.1 - 65.0
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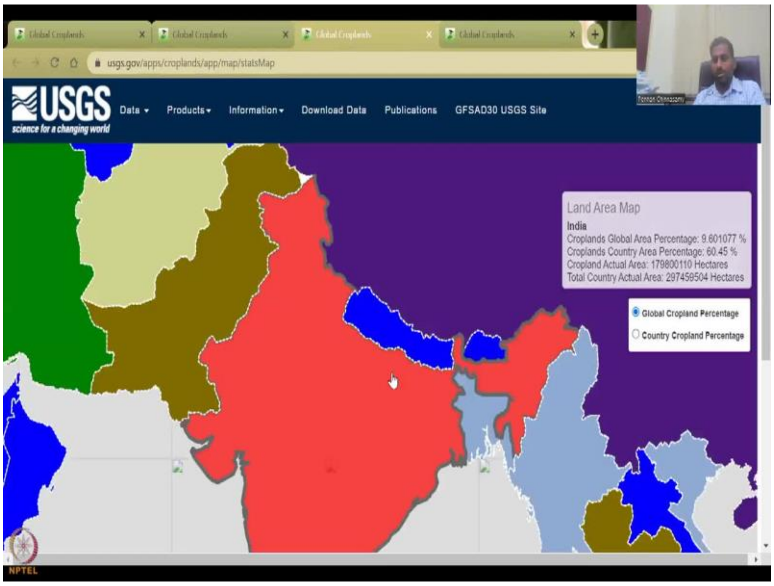

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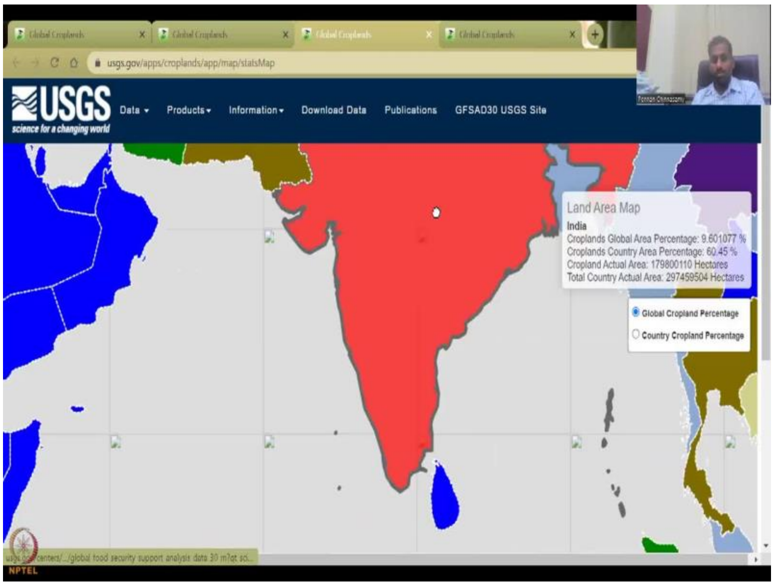
Land Area Map
India
Croplands Global Area Percentage: 9.601077 %
Croplands Country Area Percentage: 60.45 %
Cropland Actual Area: 179800110 Hectares
Total Country Actual Area: 297459504 Hectares
Global Cropland Percentage
Country Cropland Percentage
NPTEL



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Global Cropland Percentage
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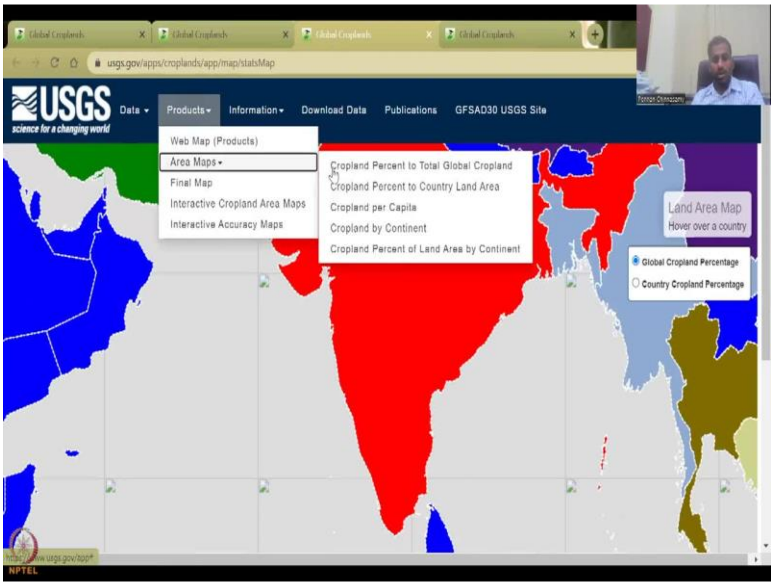
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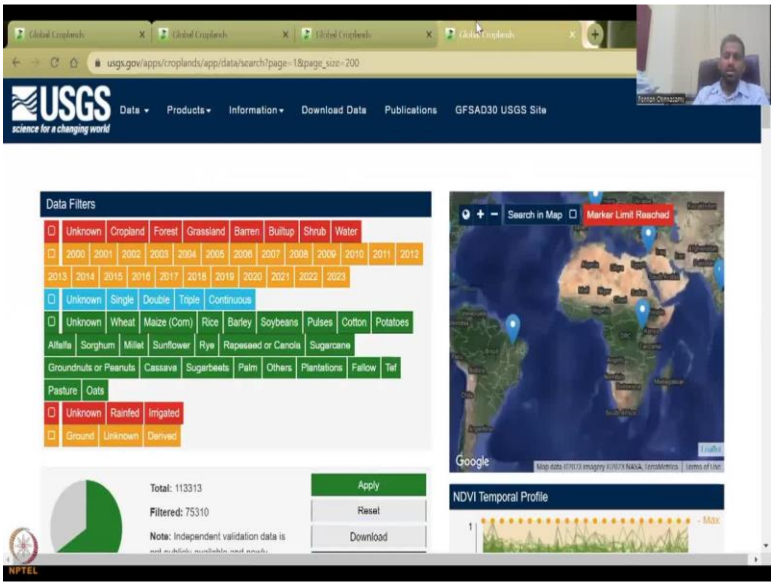
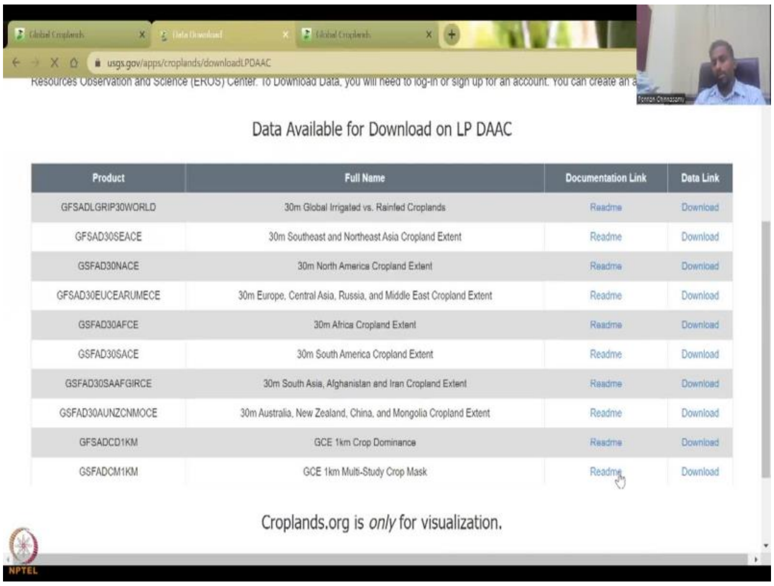
So this is a Google Earth Engine that we already used, and then the left hand side will populate. So this is the initial dashboard. And then you can also look at area maps, percentage, total cropland, so these are maps that have been made for different regions. And then some numbers are there for 2015 year.

So it gives you a crop land by continent how much acreage or 52 million hectares 8.1 percent of the global. So you could see that Asia, pan Asia has the highest contribution to agriculture crop lands 33 percent, as one third, almost one third of the planet derives its food from Asia, Asian regions, whereas the next highest would be in the European continent 25.5 percent and Russia and then you have China also contributing to the Asian parts.

These are maps that have been made already, how would I get there, we just went to data products and then maps at the cropland percent, final maps are there, interactive cropland maps are also there, where you could interact in terms of what areas you want, you want to have a percentage, so I can click the percentage it says what is the percentage 96, 9.6 percent of the total land area percentage, but again, the boundary should be very carefully used. So since this is the USGS website, they use different boundaries maybe but one thing which could be of uses if you go to the products and then say area maps, and then cropland percentage, you can see that the boundaries have been updated.

(Refer Slide Time: 32:57)





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GFSADLGRIP30WORLD	30m Global Irrigated vs. Rainfed Croplands	Readme	Download
GFSAD30SEACE	30m Southeast and Northeast Asia Cropland Extent	Readme	Download
GSFAD30NACE	30m North America Cropland Extent	Readme	Download
GFSAD30EUCEARUMECE	30m Europe, Central Asia, Russia, and Middle East Cropland Extent	Readme	Download
GSFAD30AFCE	30m Africa Cropland Extent	Readme	Download
GSFAD30SACE	30m South America Cropland Extent	Readme	Download
GSFAD30SAAFGIRCE	30m South Asia, Afghanistan and Iran Cropland Extent	Readme	Download
GSFAD30AUNZCNMOCE	30m Australia, New Zealand, China, and Mongolia Cropland Extent	Readme	Download
GFSADCD1KM	GCE 1km Crop Dominance	Readme	Download
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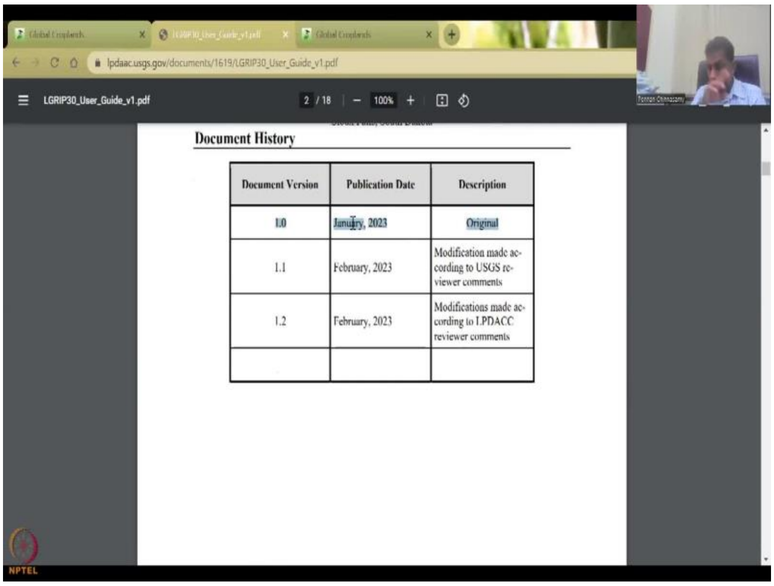
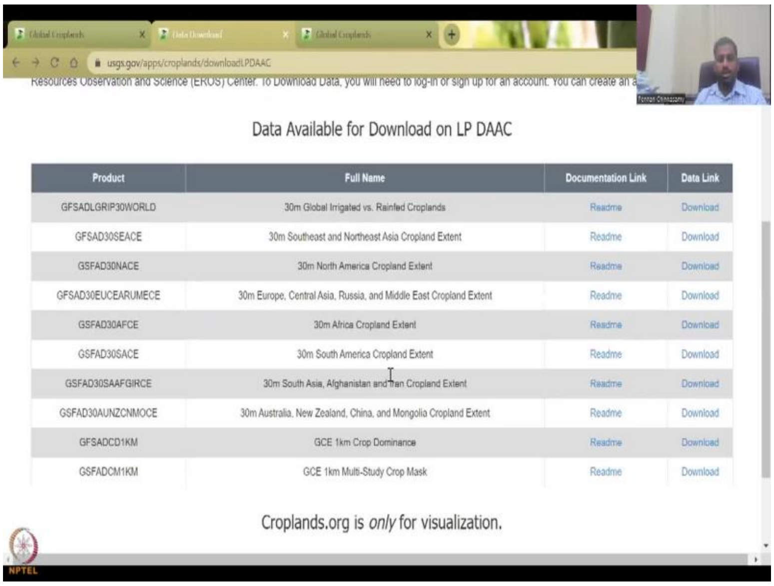


Document Version	Publication Date	Description
1.0	January, 2023	Original
1.1	February, 2023	Modification made according to USGS reviewer comments
1.2	February, 2023	Modifications made according to LPDACC reviewer comments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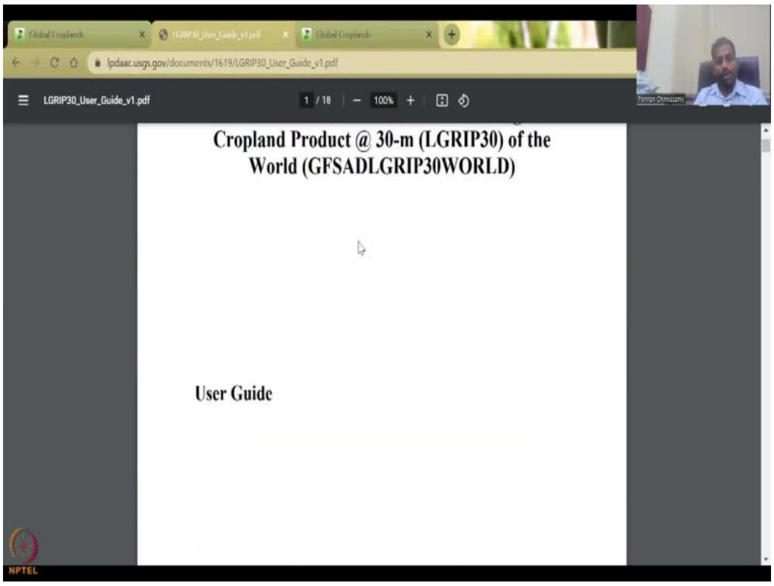
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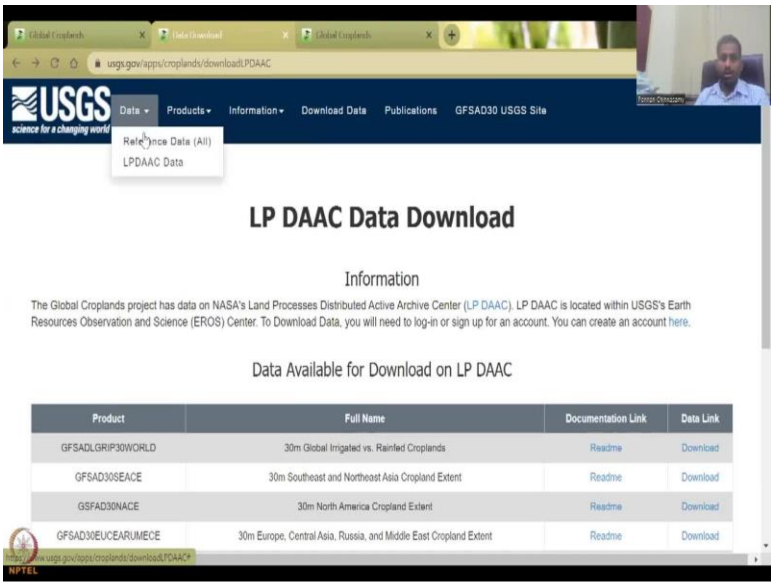
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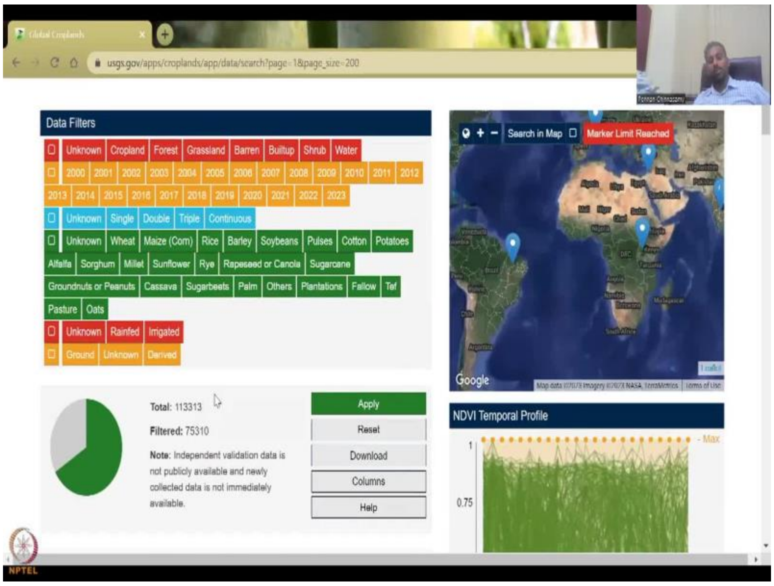
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Alfalfa Sorghum Millet Sunflower Rye Rapeseed or Canola Sugarcane
Groundnuts or Peanuts Cassava Sugarbeets Palm Others Plantations Fallow Tef
Pasture Oats
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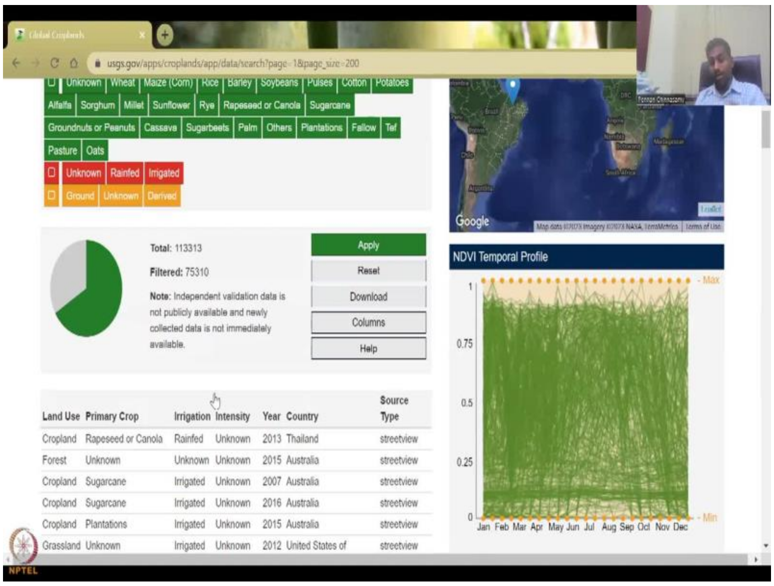
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Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Land Use Primary Crop Irrigation Intensity Year Country Source Type
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Forest Unknown Unknown Unknown 2015 Australia streetview
Cropland Sugarcane Irrigated Unknown 2007 Australia streetview
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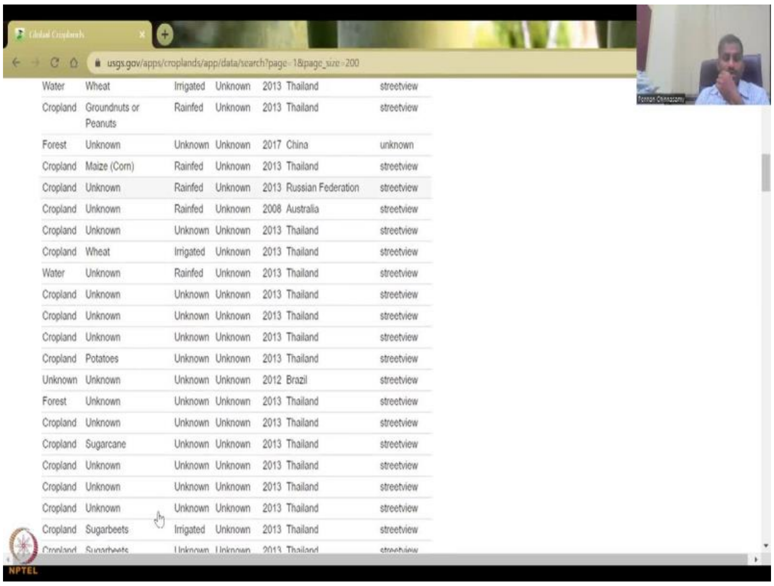
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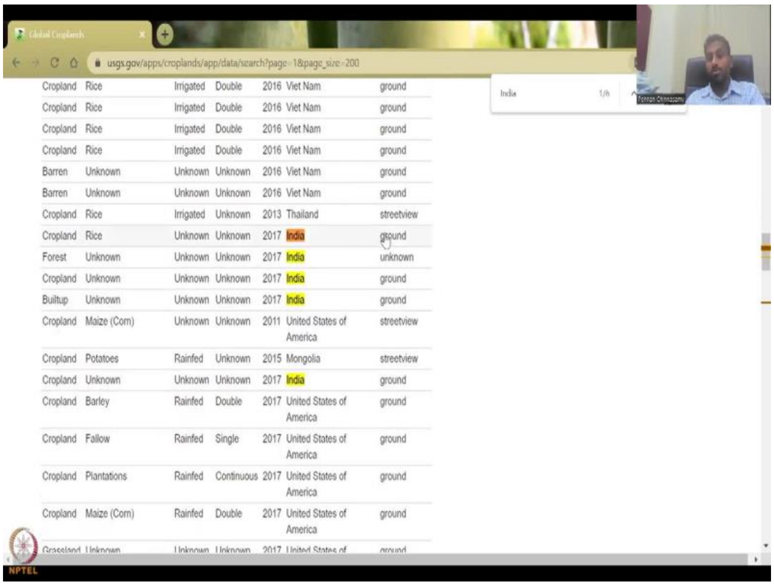
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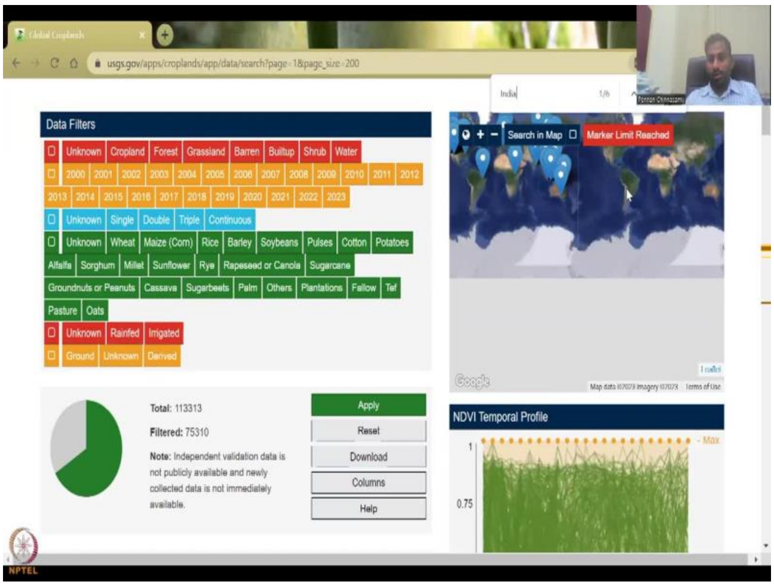
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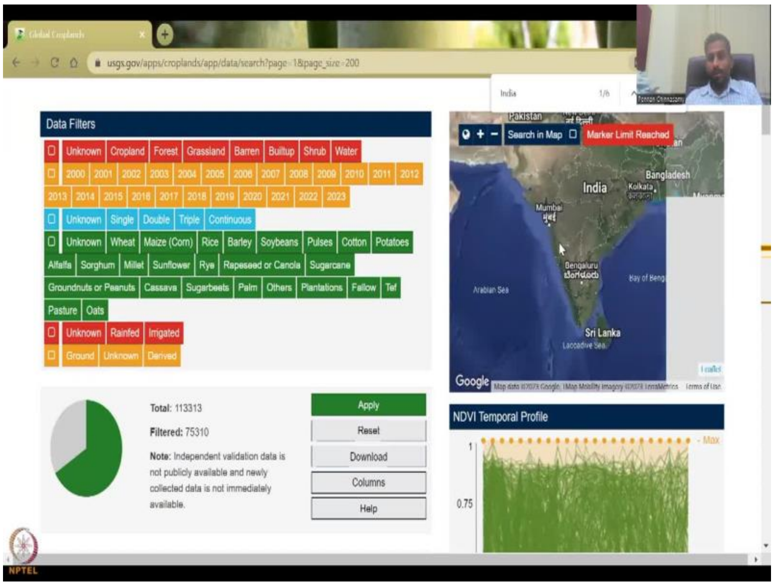
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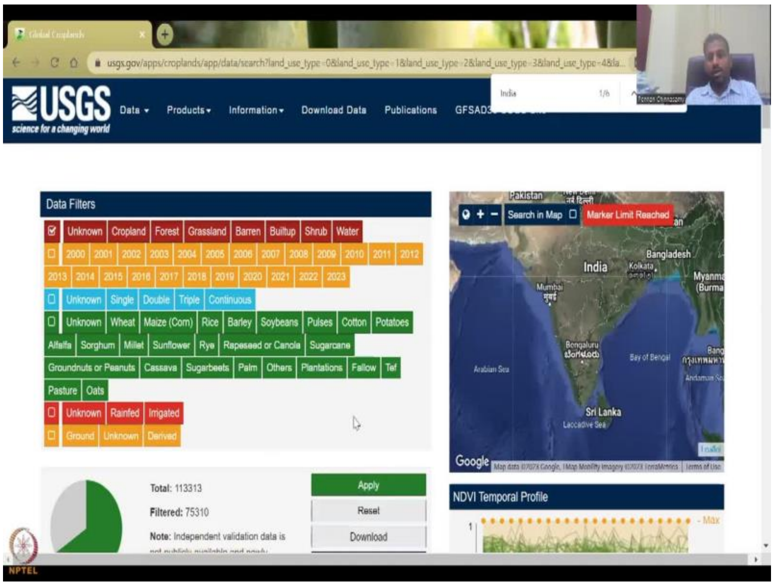
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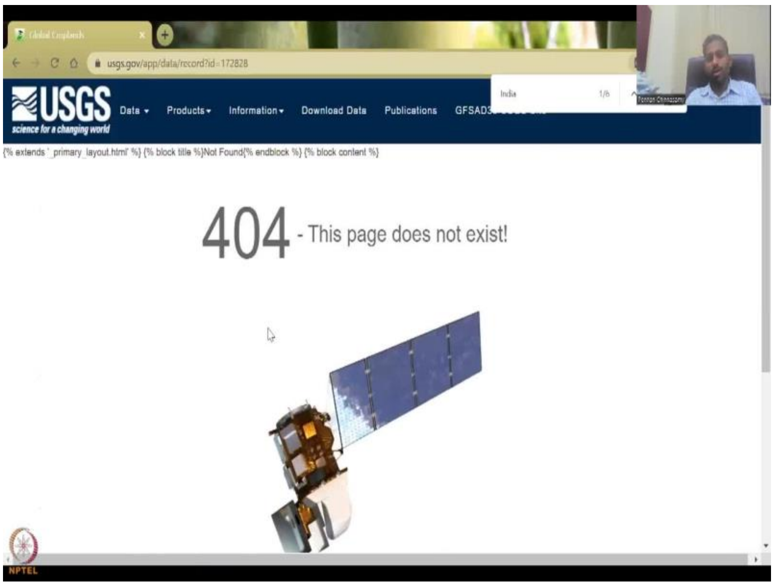
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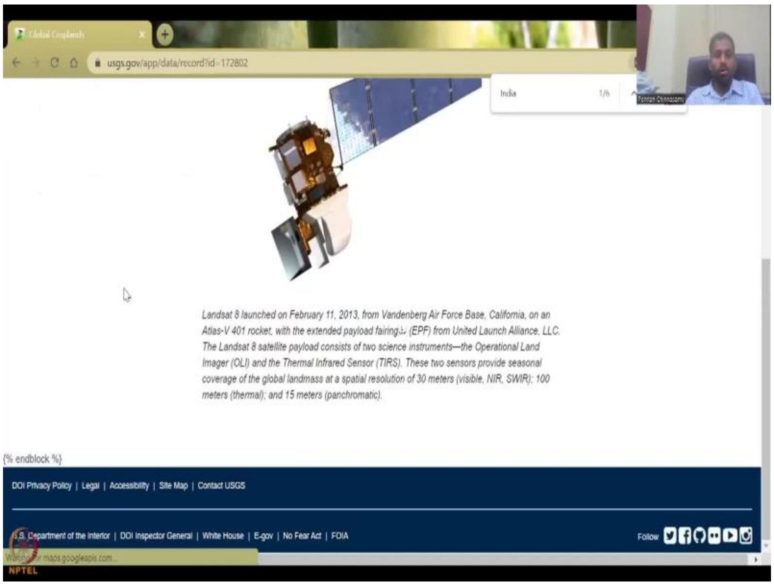
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Landsat 8 launched on February 11, 2013, from Vandenberg Air Force Base, California, on an Atlas-V 401 rocket, with the extended payload fairing (EPF) from United Launch Alliance, LLC. The Landsat 8 satellite payload consists of two science instruments—the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS). These two sensors provide seasonal coverage of the global landmass at a spatial resolution of 30 meters (visible, NIR, SWIR); 100 meters (thermal); and 15 meters (panchromatic).
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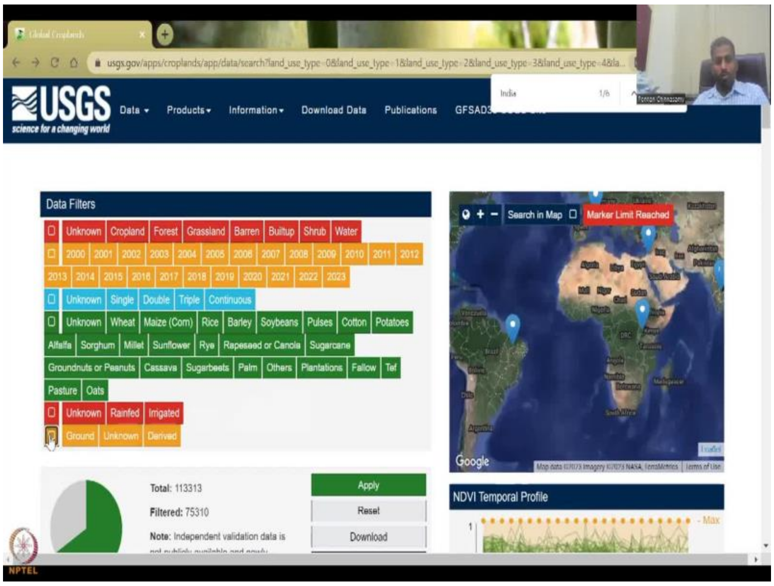
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Unknown Cropland Forest Grassland Barren Builtup Shrub Water
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023
Unknown Single Double Triple Continuous
Unknown Wheat Maize (Corn) Rice Barley Soybeans Pulses Cotton Potatoes
Alfalfa Sorghum Millet Sunflower Rye Rapeseed or Canola Sugarcane
Groundnuts or Peanuts Cassava Sugarbeets Palm Others Plantations Fallow Tef
Pasture Oats
Unknown Rainfed Irrigated
Ground Unknown Derived
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Marker Limit Reached
Google
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Filtered: 75310
Note: Independent validation data is
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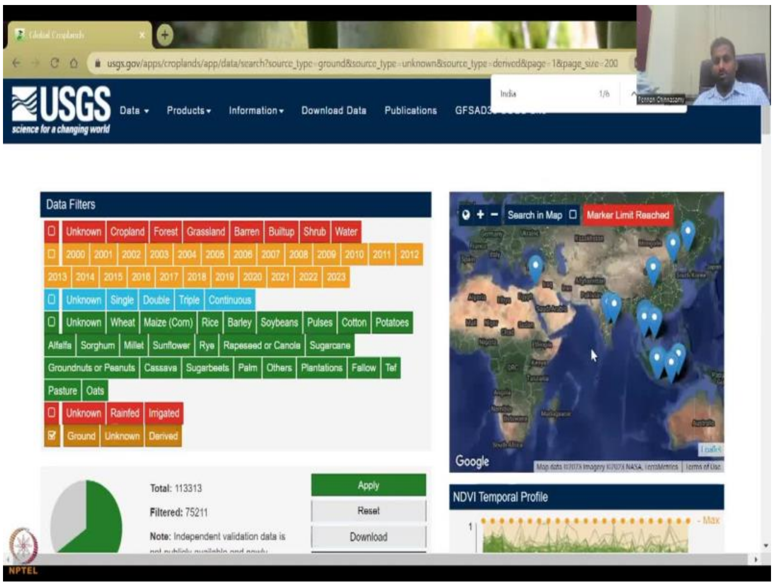
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Ground Unknown Derived
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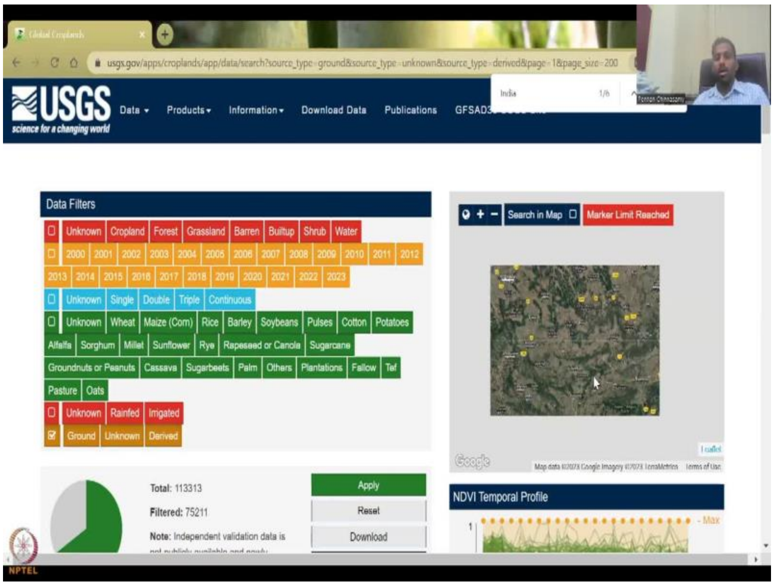

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Pasture Oats
Unknown Rainfed Irrigated
Ground Unknown Derived
Search in Map
Marker Limit Reached
Total: 113313
Filtered: 75211
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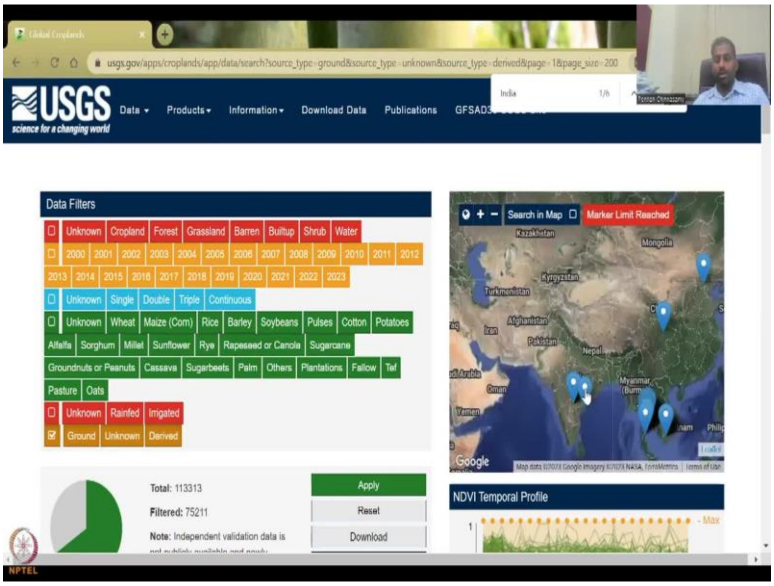

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Unknown Rainfed Irrigated
Ground Unknown Derived
Search in Map
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Kazakhstan
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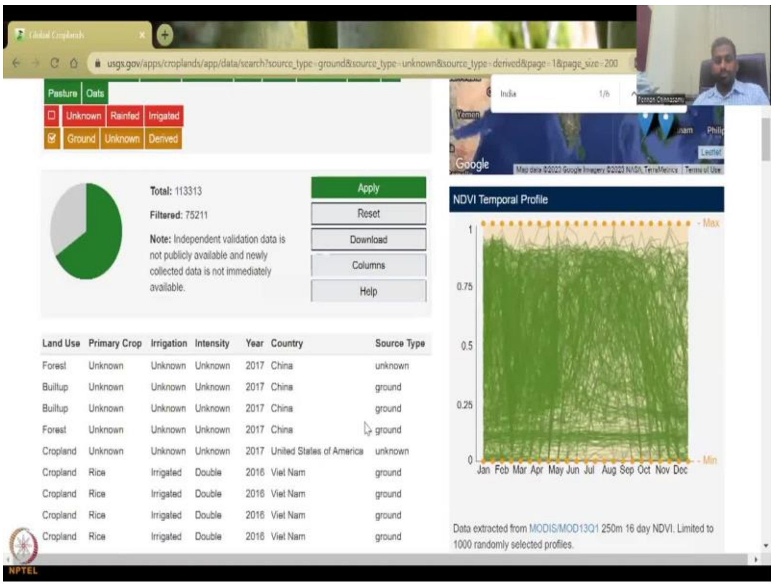

usgs.gov/apps/croplands/app/data/search?source_type=ground&source_type=unknown&source_type=derived&page=1&page_size=200
Pasture Oats
Unknown Rainfed Irrigated
Ground Unknown Derived
Total: 113313
Filtered: 75211
Note: Independent validation data is not publicly available and newly collected data is not immediately available.
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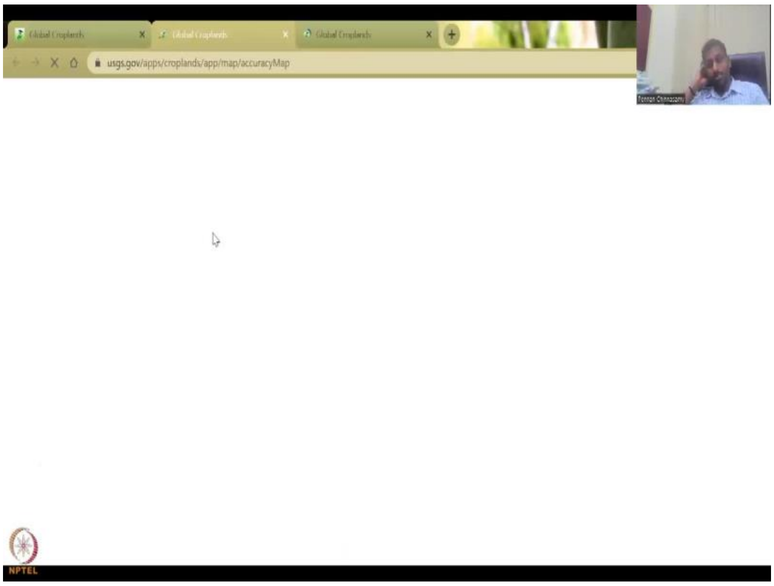
Columns
Help
NDVI Temporal Profile
Max
Min
1
0.75
0.5
0.25
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Land Use | Primary Crop | Irrigation | Intensity | Year | Country | Source Type
Forest | Unknown | Unknown | Unknown | 2017 | China | unknown
Builtup | Unknown | Unknown | Unknown | 2017 | China | ground
Builtup | Unknown | Unknown | Unknown | 2017 | China | ground
Forest | Unknown | Unknown | Unknown | 2017 | China | ground
Cropland | Unknown | Unknown | Unknown | 2017 | United States of America | unknown
Cropland | Rice | Irrigated | Double | 2016 | Viet Nam | ground
Cropland | Rice | Irrigated | Double | 2016 | Viet Nam | ground
Cropland | Rice | Irrigated | Double | 2016 | Viet Nam | ground
Cropland | Rice | Irrigated | Double | 2016 | Viet Nam | ground
Data extracted from MODIS/MOD13Q1 250m 16 day NDVI. Limited to 1000 randomly selected profiles.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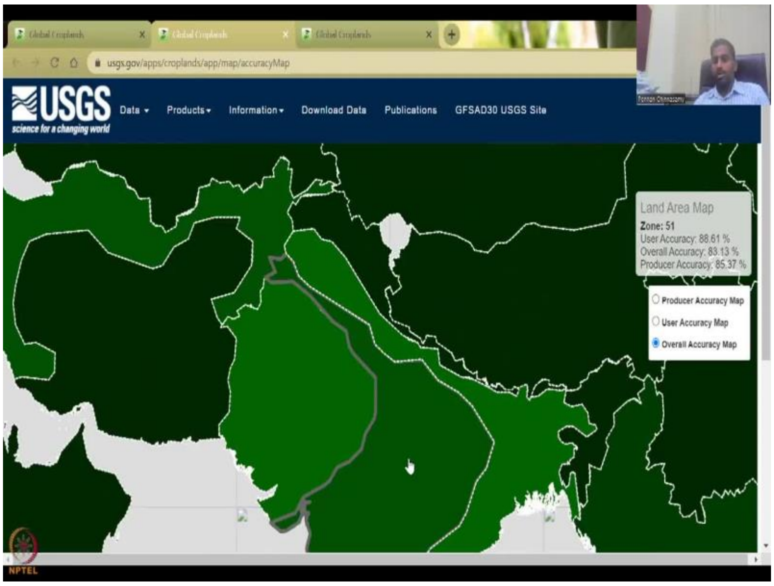
Land Area Map
Zone: 51
User Accuracy: 88.61 %
Overall Accuracy: 83.13 %
Producer Accuracy: 85.37 %
Producer Accuracy Map
User Accuracy Map
Overall Accuracy Map
NPTEL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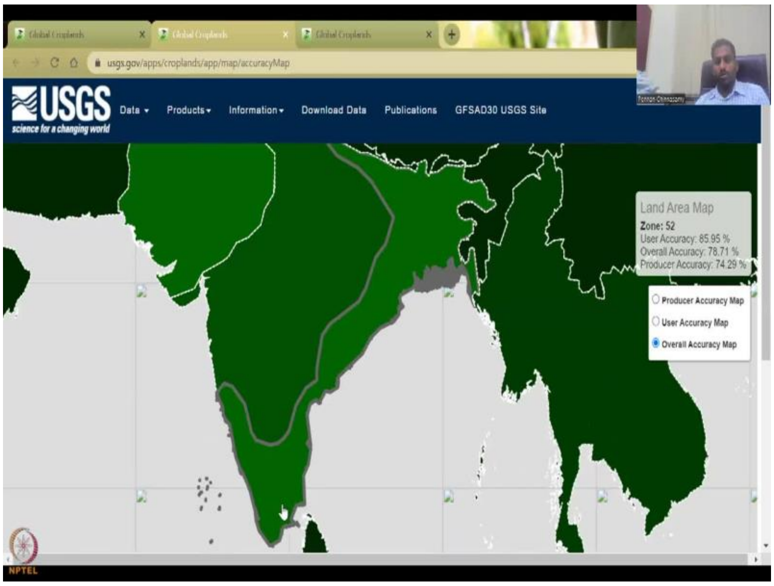
User Accuracy Map
Overall Accuracy Map
NPTEL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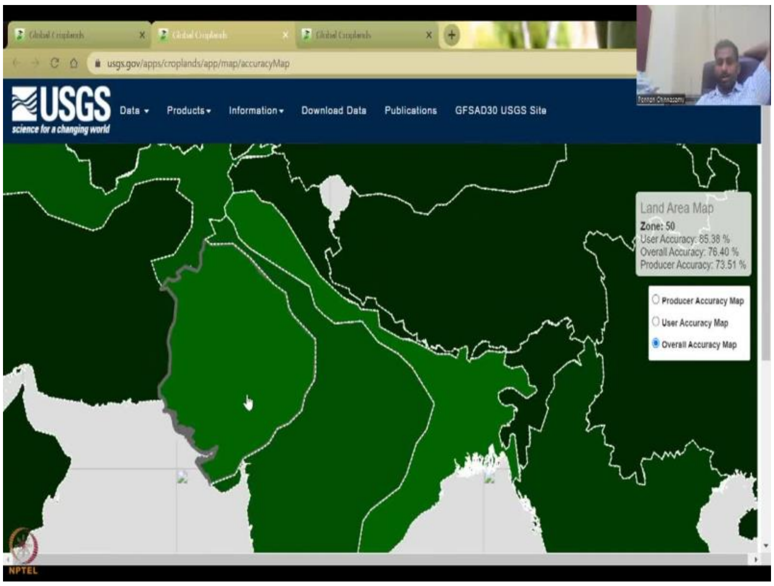
Land Area Map
Zone: 52
User Accuracy: 85.95 %
Overall Accuracy: 78.71 %
Producer Accuracy: 74.29 %
Producer Accuracy Map
User Accuracy Map
Overall Accuracy Map
NPTEL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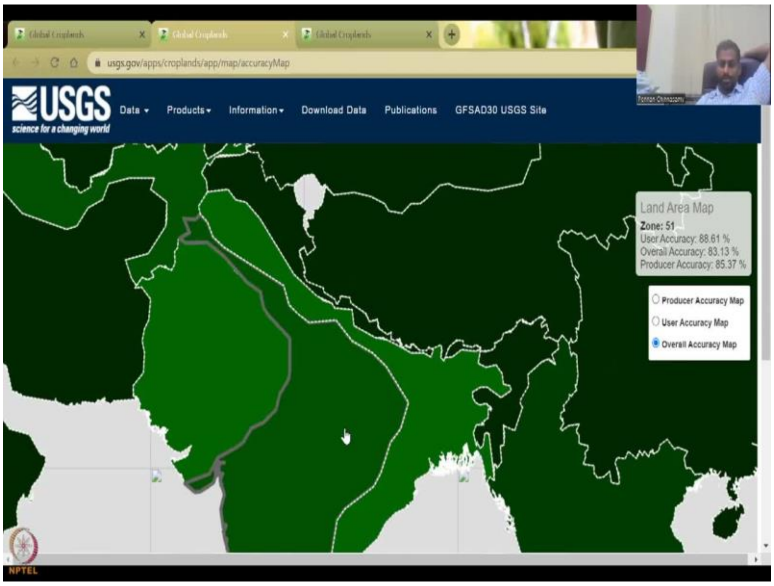
Land Area Map
Zone: 50
User Accuracy: 85.38 %
Overall Accuracy: 76.40 %
Producer Accuracy: 73.51 %
Producer Accuracy Map
User Accuracy Map
Overall Accuracy Map
NPTEL



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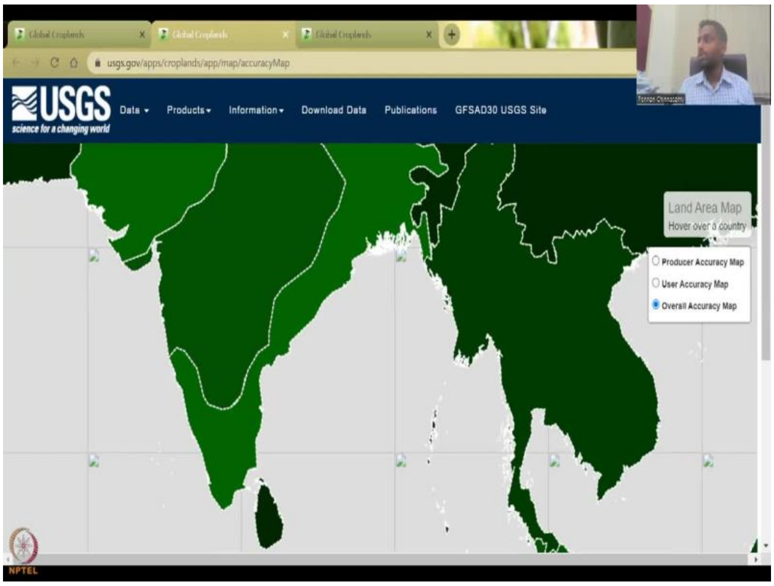

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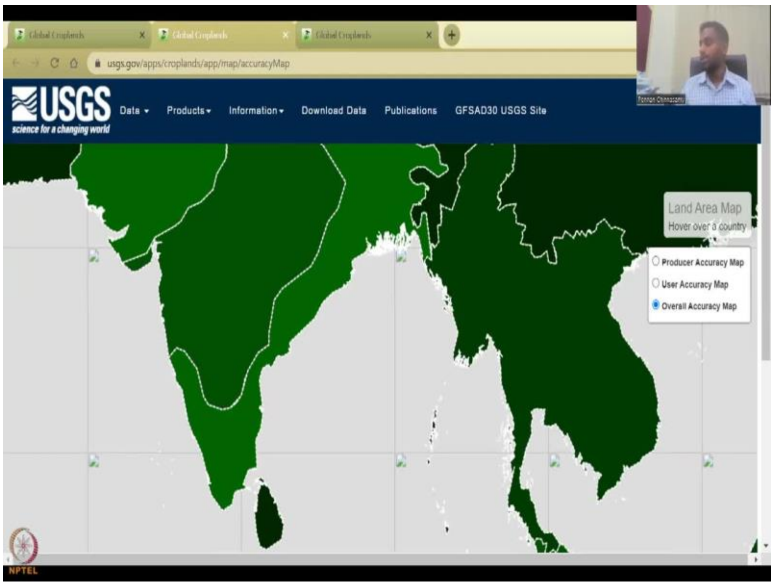

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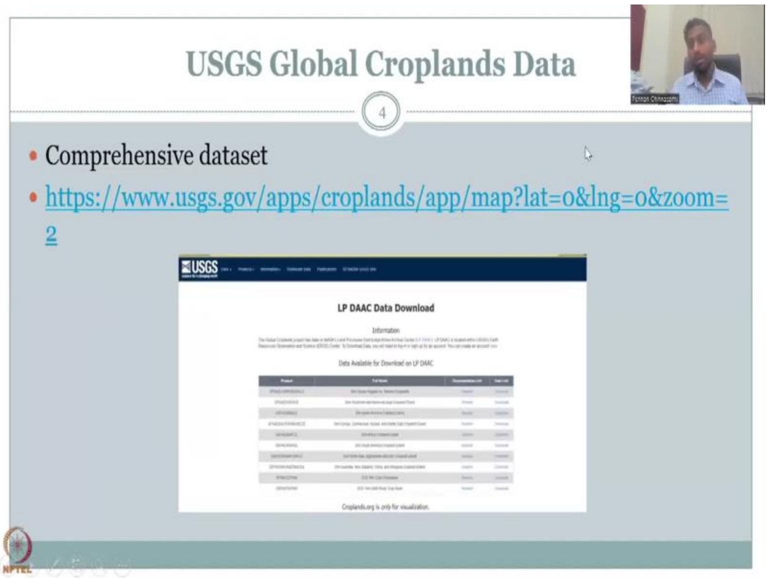

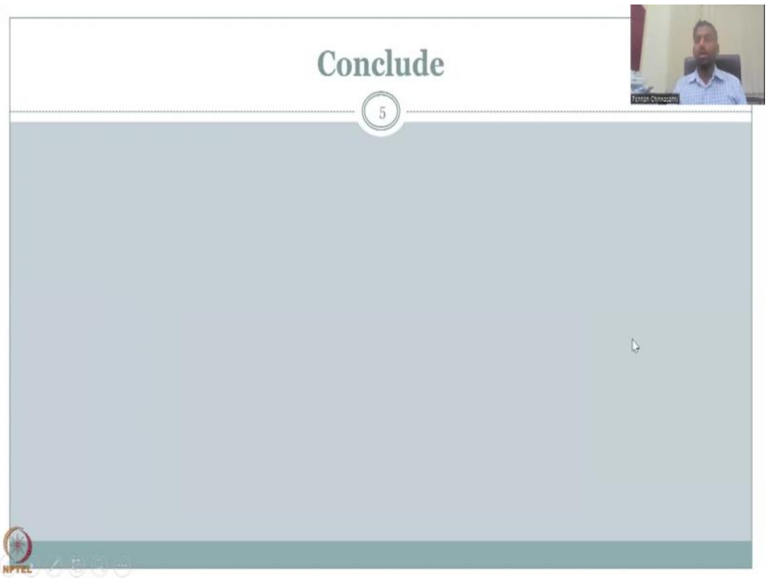

There are some updations needed about these maps. Then the other interesting part is the information you can see other documents contact me download data, etc. with the download data, we saw the links to be knowing about the data, the metadata, for example, read me and it talks about the data user guide about the data. So very, very recent see how it when it was released, it was recently in January 2023. So just 2 months ago, this data has been come up and it has been widely used now.

So this is the part where you went into data download and then address the things. In the data, you can also look at the reference data, which is very, very important, what is the reference data? So these are the ground points, which I always asked you to collect from the ground, you collect points, and then you supply to the coloring scheme so that the color green reflects a turf, or a tree or a plant can be demarcated. So green is green for our eyes. But on the computer panel it may look different.

So here you can see that there is a lot of these datasets have been taken from different different sources, source type, street view, they have taken and made these maps. So for example, cropland, rapeseed or canola, an area a green color has been marked. And it has been marked during the rainfed season of 2030 using street view and for Thailand area, so that was used for Thailand’s color coding, etc.

Let us Google and find where India was used. You could see that India very less data was used. Ground data is where you go to the ground and collect data. So crop land rice, rice data for India, the color of the crop was taken by ground estimates in 2017. You could ask me why 2017 was used for 2013. It took time for them to make these datasets. And if the crop type does not change between 2015 and 2017 you can still use the crop identity.

So here they use rice and then they use forest unknown, they do not have any source, maybe it is a map from a government or a literature review. And then they have ground data for cropland and built up. And then street views use ground data for cropland is also used. So India now and there, there is good forest cover from ground data. And then so 6 data sets have been used within a database.

So I think this is good for understanding how it is been done, you could see that these are the data points that were used for demarcating where the area is you can show that where the cropland data filters and then this will filter out saying only cropland and forest and you say apply, it will apply to the points. It will also give you sometimes the points where the data was taken, let us say India, again. I am clicking on the link, it does not open. But normally it does open the link to the dataset. So maybe they will update it, but I have showed you how these datasets does work.

So you can definitely use these, let us click just unknown location of United States it still does not work. And this data set may be used in the future. So do not ask me why it does not work now, when it started, maybe it worked. But then as I said, they do go through issues of data and other issues, take it out. If your ground truth data, you can apply reset and then look at where the data was collected. So for example, this data you can click and see if it gives some validation calibration for your models, because they have already went and taken the data and then these are the Indian parts.

So with this a good exercise we will be following up soon on the formation of land use land cover using satellite data, you can also do an accuracy map to see where which regions are more accurate. So, you can see that producer accuracy map user accuracy map overall accuracy map, you can see that India is okay this region is having an accuracy of 85 percent or 83 percent overall accuracy. Zones, by zones they have created because by zone they collected data and map the data.

So, this is now 88 percent along the western regions whereas, this is around 92.4 percent overall accuracy 78 percent 83 percent. So, as you move your mouse you can see that how the accuracy percentages change. With this I will stop here I will go back to my initial slide and then conclude the presentation with the need for mapping and data using multiple sources whatever is the best please use it and so, I will conclude here and meet you in the week 9, Thank you.