Remote Sensing and GIS for Rural Development
Professor Pennan Chinnasamy
Centre for Technology Alternatives for Rural Areas
Indian Institute of Technology, Bombay
Week – 02
Lecture No – 05
Remote Sensing for Rural Development

Hello everyone, welcome to NPTEL course on Remote Sensing and GIS for rural development. This is week 2, lecture 5, this is the last lecture for week 2. Let us see what we are going to cover in today's lecture.

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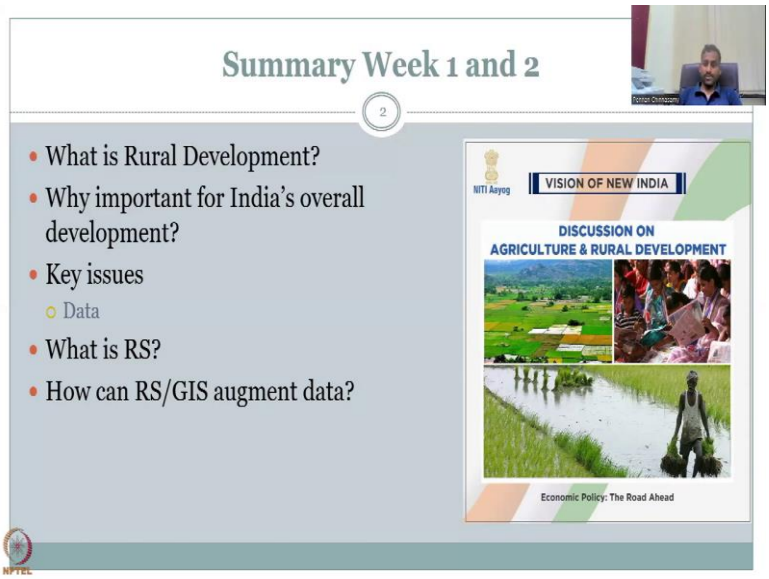

You would have noticed that I already have two other NPTEL courses, one focusing on groundwater because I am a groundwater hydrologist. I talk about groundwater hydrology and how it is very important and another course on Water Resources for Rural Regions focusing on Water Resources. In both the courses I do give some hints about remote sensing and GIS. So, that experience has given me to have a summary slide for every week.

However, the week 1 is purely introductory material, So, I may not have had a in-depth summary. So, this lecture is to summarize week 1 and week 2 and prepare you for week 3, it will also be used to link between week 1 and week 2 and the flow of the course. So, always important to reiterate. So, it is like reading a paper you start with an objective, introduction go through the results analysis and then come back to the conclusion which supports your first part of the paper, introduction, basically summarizing everything.

So, this is important to summarize what we have learned. So, please join me in today's lecture for the summary and how to do the preparations for future lectures. In the first week we looked at and define what is rural development, trust me a lot of people struggle to define this rural development. What is rural development? And we cannot give personal experiences and personal feelings about rural development.

Some may say that education is needed, some may say water is needed, and the definition of what do you mean by rural development which level to which level are you talking about rural development. So, India is a developing nation, it has to become a developed nation. So, there are matrix. So, how do you keep matrix for rural development, so these kind of questions will be asked.

The best way out for this question is follow the country specific guidelines and for India we have used the ministry of rural developments webpage. So, we have been very careful in defining from the terms, from the ministries that are putting more stakeholder and also more budgets in rural development. So, it is important to go through what the agency says the ministry, what does the ministry define as rural development, what are the sectors they have identified for rural development and we progress on that.

There may be others who would define it differently, but they are not the authority for rural development in India. So, we are taking our notes from the ministries website, if you had noticed in my reading notes and lectures I clearly indicated that we will be using a lot of government records and reports and the government records and reports come from these agencies. So, we are defining what is rural development by first even defining the agency.

We also looked at cases why it is important for India's overall development, I will go through it again in this lecture with some statistics. The key issues for rural development and or to improve rural development is data. Data on the schemes, data on the need for the schemes, and data on the beneficiaries the cause, the budget, everything. It is big budgets that come into this development scenario. So, it is important to understand these issues.

When we talk about data, we have to look at alternators for data observation data and it has to be cost effective high spatial and compound resolution and so we identified remote sensing. Remote sensing has been proved to be very useful in different parts of the globe and even in India for urban cities, for rural it has been less studied. So, for that we are introducing the concept remote sensing here.

So, this course itself is a very unique course because you would see remote sensing for glaciers urban, flood, different courses on remote sensing for crops but as rural development it is not there and that is why we have kept this course. How can remote sensing and GIS augment data, we looked at multiple methods through which remote sensing can address the issues that is mentioned earlier, the data issues.

So, we will be careful in seeing how to use the remote sensing in GIS always augment data not overtake or replace data because government has a set of data which is very very carefully taken there are some issues that we have mentioned as temporal, spatial, some data issues we have however it is still a government record.

So, you cannot bring remote sensing and take the government record out you have to merge them, work together and make a augmented product, it can be called as data value addition, it can be taught defined as augmenting data, updating data et cetera. So, these all are also mentioned in the vision of New India by NITI Aayog, where there is a lot of discussion on agriculture and rural development.

Agriculture is still the most important or the majority livelihood for rural regions and for agriculture water is more important. So, you see how it is tied together, it will jump to water without putting these in front. So, rural areas need to develop and rural areas focus on agriculture and livelihood options agriculture is driven by water and soil fertility.

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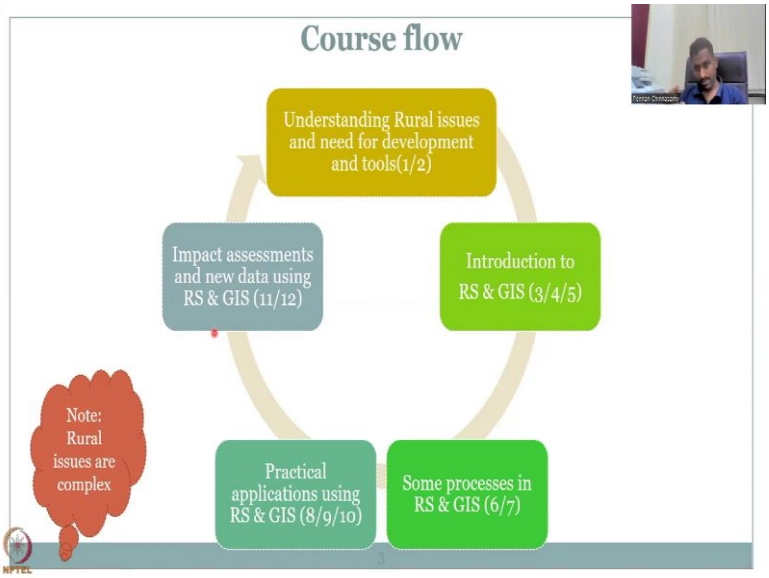

Let us look at the course flow. So, as I mentioned the title of this course how it was done. We also want to let you all understand the course flow, so that you can do some preparations

before. I have seen the material that we are going to cover asked in lot of aptitude test, civil service exams, bank exams et cetera. So, I hope these kind of lectures will help you also prepare for those kind of aspects. Very specifically, it does lie in civil, earth, remote sensing those kind of platforms and also subjects.

Let us look at the course flow, in weeks 1 and 2, we will understand rural issues that are stagnating rural development. And we will look at the need for tools that can improve the development scenario. One of the tools that we already started with is remote sensing and GIS. Since, we already proposed it in the title and we supported our argument with week 1 and week 2 understanding we go to week 3, 4 and 5, where we introduce the remote sensing and GIS tools.

So, from week 1 to we go to 3, 4, 5 where we introduced Remote Sensing and GIS. In weeks 1 and 2 you would have only known about the issues where data can help and why data is not available. For example, I gave the river networks and I said suddenly the river can change the direction but the map will tell the previous river direction. So, what is needed to update the map and to update the map we need better data, which comes from these kind of platforms.

So, that will be covered in 3, 4, 5 some very important introduction material will be covered but please note this is not a full remote sensing in GIS course it is an application course. So, please add your understanding of remote sensing in GIS from other NPTEL and open source courses.

So, 3, 4, 5 we will develop key concepts of Remote Sensing and GIS. There are multiple tools and tools are always updated in Remote Sensing and GIS of those tools the key tools will be specifically explained in week 6, 7. This will be more like a tutorial that I will be going through, on the screen you will see I how I use the tool, how the data is created, how the analysis is done, we will try our best to finish within 30 minutes.

Because your lecture is 30 minutes, otherwise it will be broken as 2 sessions 30 minute 1, 30 minute 2, part 1 part 2. So, some processes in Remote Sensing and GIS will be explained in weeks 6 and 7. Moving on we will also use a practical case for example I said mapping of a lake, I will show you in weeks 8, 9, 10. How to map a lake, how to quickly find the area of the lake in the last 15 years, and then document, if the lake area has been shortened due to encroachment or any other issue, and how it is affecting the rural development.

So, we start with a practical case of first mapping a lake mapping the area of the lake for the perimeter and then over time how has the perimeter changed. Suppose the lake has diminished by 60 percent then we will go in a zoomed out assessment to look at where are the regions that are affecting the lake or why is the lake depleting, for example encroachment, for example people putting landfills into the lake, land reclaimed from the lake. So, which means they basically construct into a lake.

Remember Singapore has extended into the waters by reclaiming land, it is a big process that occurs. We do not know if it is sustainable, because a lot of flora fauna ecosystem should have been destroyed, but it still exists a lot of around the world people countries do reclaim mapping, so if the land is this much and then there is sea or an ocean, let us say sea, they will extend the land by bringing, land materials from different parts, rocks, sand et cetera et cetera and then putting and then building it on top of it.

The concerns are the waters are different regions and is it sustainable. So, those kind of things we will look at in mapping. Luckily, India does not have that issue our neighboring countries have not tried to take up our coastal regions in terms of land reclamation but mapping helps because satellites can always look at those regions and then we can map. In fact, while I am talking this there has been a satellite recently launched by Indian government and the first images of Gujarat have already been shared. We will talk more about the satellite, what it was capturing and how.

Since the government has understood that satellites are very very important for monitoring and evaluation more and more satellites are in the pipeline to be launched. So, after we get practical experiences in the weeks 8 to 10, 8 9 and 10 specifically then we go to impact assessment and new data using Remote Sensing and GIS in weeks 11 and 12. Apparent we will take a particular scheme, for example MGNREGA, IWMP, the housing scheme by the government, the rural electrification schemes, Jal Jeevan mission for water, any scheme we will take and do a small assessment.

The idea is if I am doing example for Trichy in Tamil Nadu Tiruchirappalli. So, I can take the district boundary and do the MGNREGA impact on Tiruchirappalli district, another person can come and do it for a district in Kashmir or in Rajasthan, the steps are the same because the data is for full of Indian.

So, how do you do these steps in different methods to come to the same theme will be covered in these sections 11 to 12 and we finish the course. But I would like you to continue

this process of understanding rural issues by going through the circle again. So, once you have finished identifying a rural issue let us say encroachmentization and you map new encroachments, then go back again and do more GIS analysis, and then get better better maps, which can be used for your research, which can be used by the government officials et cetera.

The only thing that is very very important is rural issues are very complex, complex in nature because it is not from one theme one focus or one discipline, it is multi-disciplinary, it is interdisciplinary, and intra-disciplinary. So, some people call it transdisciplinary also. So, my point is please try to look at rural issues very carefully except it is a complex issue and somewhere we do need to take holistic measurements and remote sensing helps for that.

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I would like to rephrase and reassess the importance of this course by speaking about the rural development again. India is still an agrarian Nation, excuse me, with approximately 70 percent of population in rural areas, 69 percent to be more specific. And while technologies as you could see there is one person plowing the field using bull carts and another person using tractors and small tractors, still technology has not been taken down to the rural areas evenly, there are a lot of issues and it is complex, lot of governments, leaders have understood that rural development is key to National growth, we cannot grow just cities living rural regions behind.

Think about your body if you are working out and exercising you want the entire body to grow evenly, if one hand grows and the other hand is very weak, it is not good for your body.

Same thing, the nation is one unit, we need to look at all population with the same lens and everyone has to develop, more important sustainably.

Rural development is important for economic betterment of people. We need to understand this more carefully in terms of economics also. Development does not just mean you are growing more crops you have water access et cetera, but is it converting to a profit for the farmers. Green Revolution has increased the crop production in India, however the farmers still are not getting the due credit or due profit which requires more social transformation.

Many stressors exist it is a complex system, just water is not enough for agricultural productivity, just soil fertility is not enough, there are multiple multiple other things and that is why the ministry has been created with multiple sub themes.

Increase participation is needed, the government can monitor but it also needs monitoring from us, the public who are using the food from our farmers and this course can give you some aspects on how to create these kind of data. Government agency for rural development has been started, currently it is called the Ministry of Rural Development, however it is started 1974 in different names and has become Ministry of rural development in 1999.

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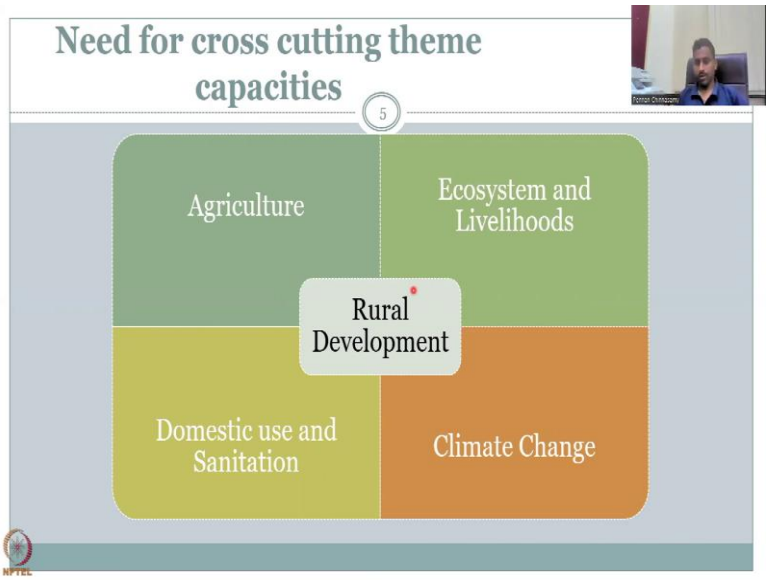

Why the names have changed because of the mandate and the mandate has to reflect in the name. Because rural development is multidisciplinary and complex it needs cross-cutting theme capacities. People who are well versed in agriculture needs to talk about rural development same as ecosystem and livelihoods, domestic use and climate change. If we leave the people behind and just focus on agriculture, then rural development will not happen.

Same way, if we ignore climate change and think that water is enough for agriculture and domestic use we will get caught. So, all of this the major things I have captured here is important for rural development.

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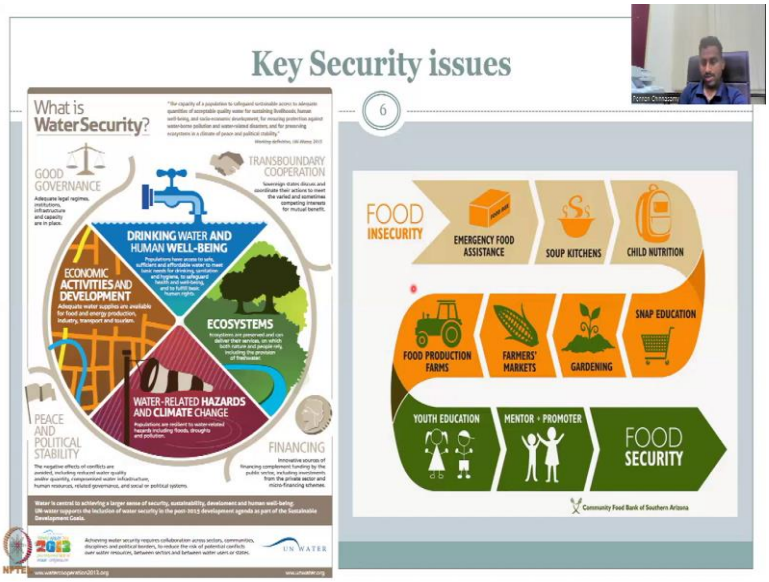

There are many security issues for rural development and for the nation. So, when I say some security issues are there for rural entities, it will definitely reflect on the entire community of the nation because rural supports urban systems. All these security issues the major major ones are water security and food security. Still most of the cities get water from rural regions through tankers and et cetera.

What does water security mean is there good water and enough water for drinking in human well-being. Well-being is sanitation, ablution, bathing et cetera. And then is there enough water for our ecosystem forest, rivers, aquatic life, insects, birds, every everything because all this is tied back to the agriculture. You need birds for dispersing seeds, you need animals to control the pest. So, everything is tied together. So, if you just focus on drinking water and human well-being and take all the water from forest it will backfire.

So, that is what this even water report clearly mentions and are there water related hazards and accounted for during climate change and mitigation adaptation plans developed. For example, if the coastal regions are flooding do we have the infrastructure to relocate them during these extremes. And the final thing which is also important is, is there enough water for holistic economic activities and development which takes together your agriculture, livelihood, aquaculture those kind of aspects.

So, water security is key, this can be broadly for urban and rural systems but if you look very closely it is mostly for rural systems which support urban systems, then film security food is mostly grown in at least in our country most of the food is only grown in rural regions some vertical farming, some urban farming is there, but it is not enough. The population is still high and our rural economies have to provide it.

So, is there enough food for emergency remember we did have four issues scarcity issues, ration issues before the 1960s and the Green Revolution has tremendously pulled us out of this issue, now we need to make sure it is sustainable. Child Nutrition is very important, are we feeding the correct food, the nutritious food for children, who are the next leaders future leaders of the country, are the capacities being built for farmers, youth education addressed and food security achieved.

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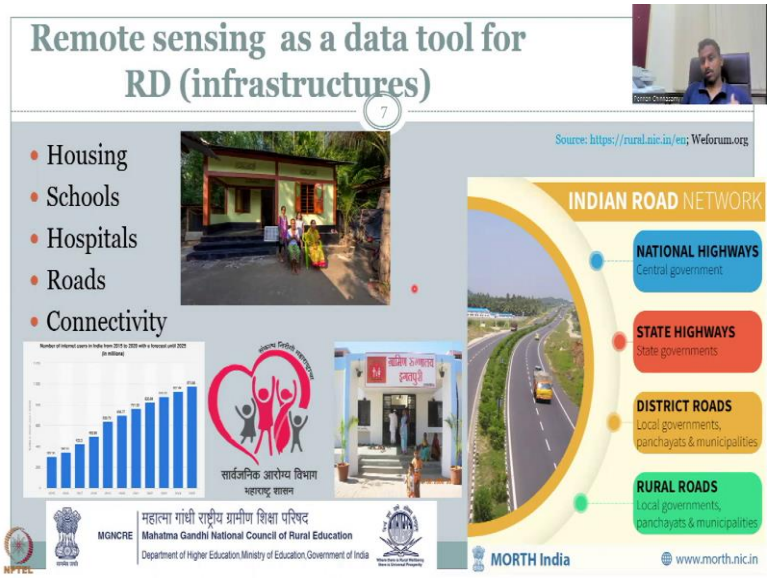

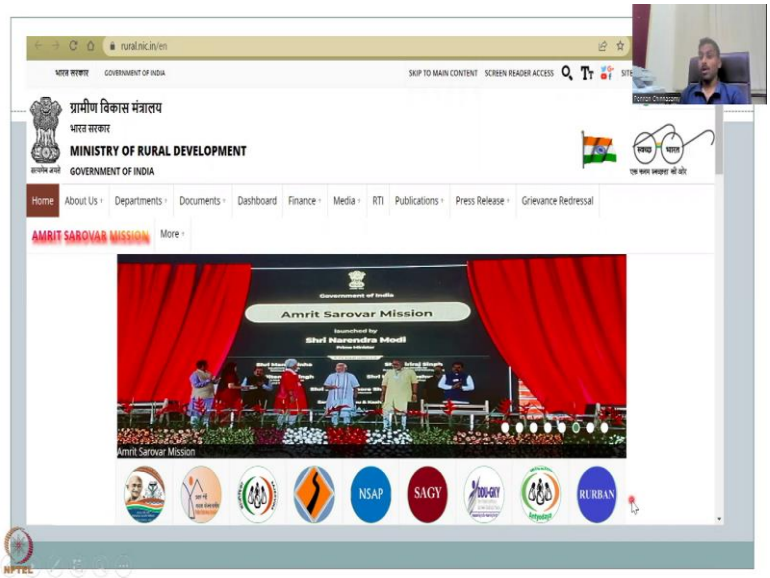

We also looked at where remote sensing can be used as a data tool along with water and food security we also looked at rural development infrastructures, such as housing, schools, hospitals, roads, and connectivity. Why roads differ from connectivity is here it is mostly the internet connectivity, mobile network connectivity. And there are multiple schemes that the government is working on in addressing all of this, which I have captured in the next slide.

If you look at this slide that we discussed, we clearly mentioned where the government focuses on under the minister of rural development. You could see all the different schemes that are given below which tie back to this slide housing, schools, hospitals, roads, and connectivity.

One other thing that is highly connected for rural development is the labor market, which is given by the MGNREGA scheme. What we plan on my research plans to do more is, yes MGNREGA gives 100 days employment guarantee for rural population. How can it be used for water and food security, building roads is a different department but at least water and food security can be clubbed with the MGNREGA program.

So, when you look at these programs in isolation, make sure that you understand that each program has its own mandate, however there is cross cutting teams also. So, MGNREGA work can also slip into the road work D2 DDU GKY or RURBAN work and most importantly to the IWMP the water management programs.

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So, to achieve this, the ministry has set up many schemes, however there are separate ministries also that are related to rural development. And we did have a look at these various ministries, starting from Ministry of rural development that we saw in the previous slide, there is Ministry of Health and Family Welfare for the entire nation with more focus or very interesting and specific focus on rural entities.

Because in cities even the government invest or not population have the bandwidth and economic power to take private medical facilities. Let us say for example vaccination, in IITs we did bring vaccination and it was given to everyone at a cost, outside the government was doing free services also. So, there are two choices you can go to private, you can go to government schemes.

In rural it is only government schemes you do not expect a private hospital to come and provide these kind of life-saving vaccinations. So, that is where I said this Ministry of Health and Family Welfare has a big focus on rural. So, there is some overlaps some synergies that can be built. Ministry of Housing and Urban Affairs, yes it is housing and within the housing you can have rural also. Ministry of Home affairs, Minister of Personal and Public Grievances, Ministry of Environment Forest and Climate Change, this is very very focused to rural.

Because Environment and Forest are mostly along the rural entities and Climate Change affects these rural entities mostly. Let us say Mumbai floods, if Mumbai floods the people living in the low-lying areas house water may enter, most of them are living in flats and if you go to the flats you will see stills. So, the bottom floor is only cars, cars get inundated but

people still go up in the lift and stairs and they are safe, whereas in rural areas the house is washed away mud houses.

So, that is where climate change as I am saying is more focused. In addition climate change affects crops which is the livelihood. So, when there is a flood you can still work on your laptop in a city, you can still take classes but a farmer when a flood comes entire crop is lost, when a drought comes entire crop is lost. So, this ministry has a lot of focus on rural development.

And finally, yes the minister of Agriculture and Farmers Welfare very very focused on agriculture whereas the minister of rural development has agriculture water multiple multiple schemes. So, this reassesses or reiterates my point that the government is very focused on rural development, it has one just for Ministry of Rural Development, but multiple Ministries that also cater to rural development.

Multiple schemes exist that is what we mentioned and we saw, and the government wants feedback on how these schemes work, and how can they improve it. However, there are data issues which limit or may limit the efficiency. Let us say the school example I gave in the last lecture, the government has built schools in Japan, however it is an excess. So, now the efficiency of the school is compromised, would you run a school for just two students, if is it easier for them to arrange a bus to bring the student to one centrally located school.

The cost of a bus is definitely cheaper than running a school or placing the new school in between the villages. So, that all villages commute less time to come to the school. So, these kind of things are needed to improve the efficiency. And that is what we will cover in this course.

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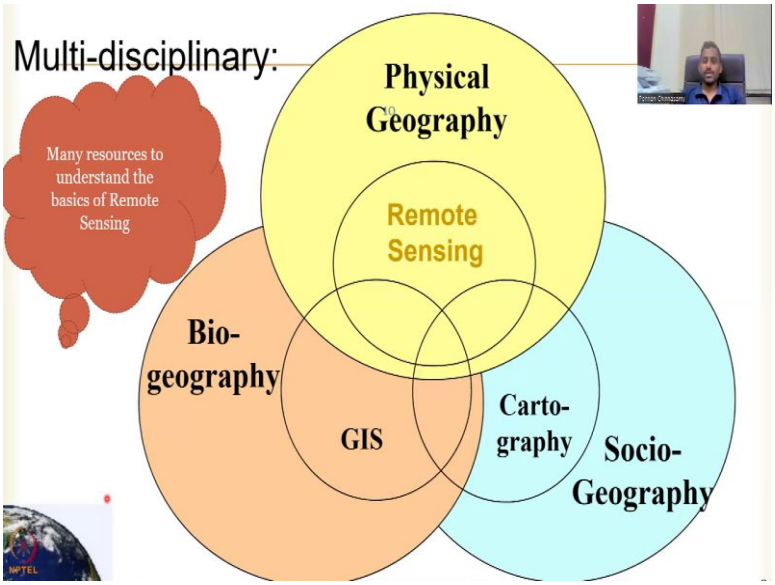

We saw that data is an issue and for the data issues we looked at remote sensing where remote sensing is a very multidisciplinary approach. Remote Sensing and GIS are used in biography, physical geography, social geography, and there is a lot of overlaps. So, that is why we always use remote sensing and GIS together, cartography is the science of making maps, it could be made digitally then becomes GIS or on papers and maps like you find wall maps hanging, so that is totally done through surveys and stuff. So, we will focus on the Remote Sensing and GIS.

Many resources to understand basics of remote sensing are there, I have clearly mentioned that this course will not be able to fully introduce Remote Sensing in GIS, because these two are separate courses by themselves, here it will be applied for rural development. I have given you links on how to learn these softwares and also GIS, please go through it, we will go through three weeks of basic introduction again. Because I will introduce some topics that are very focused for rural development. So, you can take my introduction again, but there are multiple full NPTEL courses on Remote Sensing and GIS, which I have given links and there is always new courses coming out. With this I would like to conclude week 1 and week 2, I will see you in week 3. Thank you.