Remote Sensing and GIS for Rural Development
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Week - 1
Lecture No. 02
Water security (SF) and Water security (GW) and issues

Hello everyone. Welcome to NPTEL course on Remote Sensing and GIS for Rural Development. This is week 1, lecture 2.

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The first class, we had an introduction to the course material. We looked at each and every week what will be covered. We discussed about the books that will be used and the materials. And we have introduced the personnel of this course including two TAs, Mr. Pranab and Mr. Pravin Kunde.

Also, I had mentioned that this course will have a very basic introduction to GIS and remote sensing. However, students should or by themselves learn remote sensing and GIS and multiple courses already exist in NPTEL. Please do not keep this as a limitations for this course, because understanding rural development is very key. And remote sensing and GIS is a tool for rural development.

So, in this course, you will see how we gel an issue a problem in the country with a solution providing tool like remote sensing and GIS. On this note, today, we will also look at some more introduction material for rural development to define the term rural development. And we will also look into what are the mandates by the government because, rural development

is very, very important, we have a ministry dedicated for that and that is called Ministry of Rural Development.

You can see it on the screen, the logo and the link below which gives more resources to understand what is the ministry, who is the Central Union Minister and the state level bureaucracies associated. We will find an organization chart to understand the hierarchy. But most important and also most important for this course, is the details that you can find on this website on rural development and how the ministry is ailing rural development.

Initially, as I said, India is still an agrarian nation with almost 70 percent of the population in rural areas. Everyone knows that we are one seventh the population of the world, so think about 70 percent of a billion people living in rural entities, tremendous opportunities for development to bring their lifestyles up to build the economic status up and also to handhold solutions with them, so, that they can develop by their own which is sustainable development, independent development.

So, as I said, India is still an agrarian nation, 69 percent of population and rural areas. Rural Development is key to the national growth. When I say national growth, it is not the food product alone, but a lot of GDP is being supported by rural agencies rural entities. The development in urban sectors also comes through the rural sectors.

For example, you can have a city which is Trani but the food for the city comes from rural entities. The water comes from rural entities, recharge groundwater, everything are mostly taken from rural entities. The raw material for the industries it could be chemical industries can come from rural agencies. They take sugar molasses from rural entities. Protein comes from rural agencies, so you cannot isolate a nation's growth without interlinking rural and urban. And you cannot say that engineering or technology does not require rural entities, it does.

So, rural development is key to national growth. If the percentage was less, let us say 10 percent of rural population spread, then yes, okay, we can say that okay 90 percent is an urban or Peri urban 10 percent is rural, we do not have to care much about because that can be it can be the other way around, urban centers will cater to that rural. But that is not the case. We do have countries like that. And I do have a slide to explain about how developed countries are working, we are a developing nation, where still we need to push the GDP of the rural entities to contribute more to the growth of India.

If you go to do villages, you will still see the minimum labor is very less and the annual income per household is very, very less compared to an urban center maybe 10 times less, 12 times less, or even more. So, we need to bring them also up to the healthy levels. We cannot bring same, will not be possible because cost of living is also there. But at least can we bring them up to a sustainable level is important.

So, there is a ministry for this, like you have a ministry for information technology. We have municipal communication growths, you do have a ministry for rural enterprises and rural development. So, rural development, the word does not just say land development, it does not say economic development, it should encompass everything that goes into the economic betterment of people.

Betterment not parallel income to the urban centers and this is betterment so that they live a better standard of life, they can afford to be protected against climate extremes. You do see a lot of issues in farming and farming communities, which is much much higher compared to urban communities. If there is a flood, you can stay in your high rise apartments in an urban city, you can have a lift to go up and then just stay there, but in a rural entity it still not available, you do not have high rise apartments. So, they are in the flood prone regions.

More importantly, you can work from home, you can work online, if you are an urban center but rural the livelihood is the ground. So, if a flood comes, in gets damaged and that is what is happening currently everywhere, climate change has impacted mostly the vulnerable people and vulnerable people are in the rural regions in India. So, they need to be developed. And that is where rural development the word coined also economic betterment of the people and within the economic I include resilience to climate, health, better health facilities, education, facilities, connectivity, everything comes with economic betterment.

And with better economic accessibilities to funds, you have a greater social transformation, the entire rural entity will grow together and that is very, very important for rural development to happen and rural government contributes to national sustainable goals. Rural development also comes in sustainable quotes, Sustainable Development Goals.

So, how do you do a greater social transformation is by empowering the rural communities for rural development activities, and hand holding them throughout the journey. However, there are many stressors, factors that prove the development scenario down. We need to be very careful on these stressors. We need to identify how to lessen the stressors. Sometimes it is difficult to totally take it out of the system. So, the better aspect is map the stresses,

understand the stresses and from the mapping and understanding you can lessen the impact or lessen the stresses in the system.

Example, you have crops and a particular type of insect is affecting it. But the insect is driven by climate change. So, how do you suddenly take climate change picture, you cannot, but you can understand the phenomenon and through understanding you can lessen the stressor. But we do not really have a detailed map or detailed physical report of where the stresses exist and how they exist. And that is what we are going to do in this interesting non-traditional lecture.

So, the NPTEL course discusses about rural development and how can you attain rural development using remote sensing and GIS. Please differentiate that you cannot just have a map in the hand and say rural development will happen. No. So, there is a intermediate phase whereas, you have a map, you have data, the data provides solutions, the solutions provides rural development. So, it will be too long if I could add all these in the title. So, that is why we have kept it as remote sensing and GIS for rural development.

So, once we understand that, there is a lot of stresses, the next factor is who are working to lessen the stresses. We cannot expect that every time the government will identify the stressors, provide data and then tackle it. Because there is too many. The landholding size in India is very small but too many stressors, so, you have to expect at every stage the government can intervene is difficult. And that is why we need to have participation, not from the top down alone, which is the government to the people, but also the people to the government bottom up.

And this course will help you to build capacity, understand tools, remote sensing and GIS, for example, understand tools that can help you get into this participation phase. It is a very important sector, where it is not only government, it is not only public, but the public private government partnership. And through that, there is rural development.

So, on this as I said, there is an agency for rural development. It was initially started in 1974, the government realized after independence that the population is still a lot concentrated in the rural areas. And we need to acknowledge that we cannot jump into industry like different countries, we need to slowly grow industry and rural enterprises for which we need to have a statutory body to look at the development. So, this government agency for rural development was started in 1974. And there has been a lot of changes in the name and how it was called, what was the mandate.

So, what happens when a name changes is the mandates also change. For example, there could be an agency on agriculture. Agriculture could include water crops, et cetera. But there is also an agency on irrigation, dams and hydropower, et cetera. So, as the name changes, you do have a difference in the verticals or the mandates of the agency. So, for now, the agency is called Ministry of Rural Development and to understand the different mandates, where they work, how they work, I recommend you to go to the website, which is given below and read about it.

Particularly put the link to about ministry. You can read what are the mandates about the ministry, where they work, how they work. And what is important to the system. We also get different numbers like 69 percent as I mentioned here, we will get the different numbers about populations, the demographics, how many amendments the population which is educated or access to education for help.

And more importantly, as I said, the government acknowledges that this is a very, very important sector. So, there is a lot of funds that have been kept. So, this website can also give you how much funds have been kept for these schemes. What are the schemes for rural development? And how are we on track to achieve rural development?

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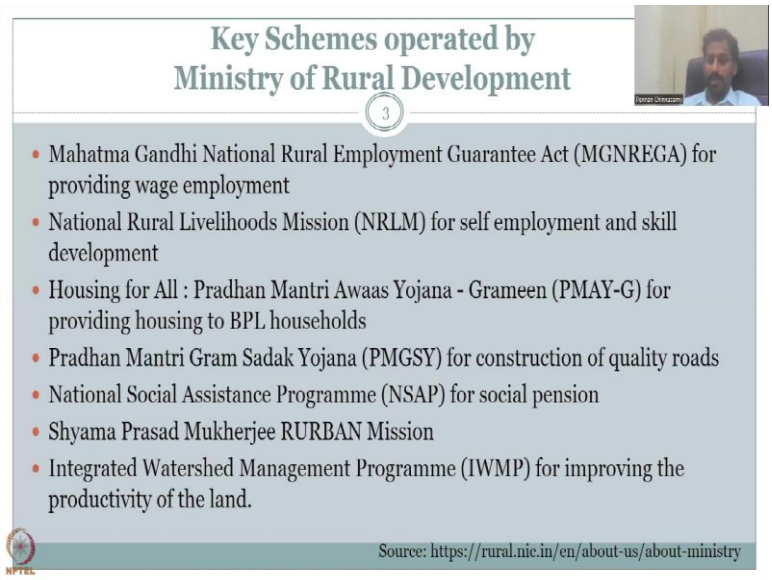

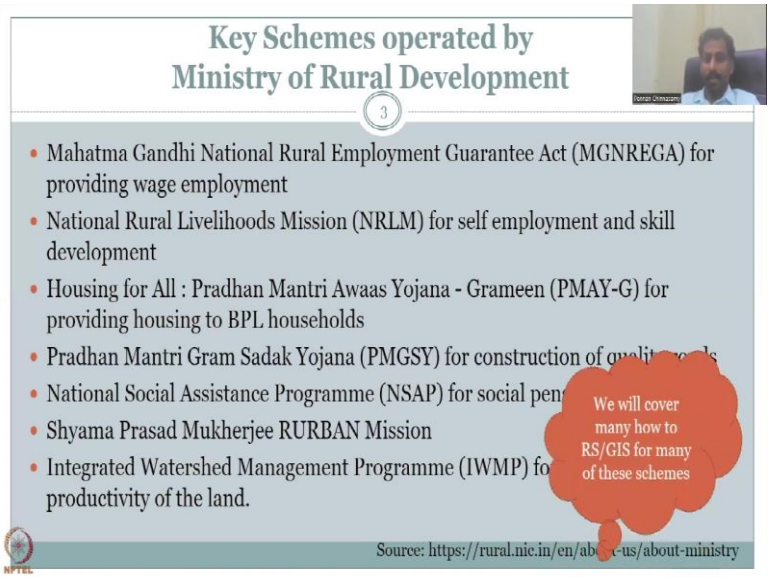

Let us see some of the schemes under the Ministry of Rural Development. A very one important scheme that a lot of people are aware about or at least know this name is the Mahatma Gandhi, National Rural Employment Guarantee Act. This was called as NREGA, MGNREGA or MNREGA. Now, it is called ng MGNREGA. So, Mahatma Gandhi National Rural Employment Guarantee Act.

So, it is an act for providing wage employment. Because there was lot of migration from rural to urban systems for money, work, labour, etcetera. They came not because they were willing to relocate because they did not have labour, they did not have labour in the villages. It could be the land was not producing as much or a climate change impact like a flood or drought hit the land. So, there was nothing growing for them to do work. So, they started to move.

However, we wanted the rural entities to look at different livelihood options, so that is one of the reasons that the government has pushed this MGNREGA Act, where they provide guaranteed income for farmers and there is a theme which uses the farmers labour or the rural people's labour for development. One is to develop water resources. One is to develop highways and road infrastructure for connectivity. There are multiple schemes under the MGNREGA.

The other one is the National Rural Livelihood Mission for self-employment and skill development. So, there are infrastructures that are created under this scheme for self-employment, how do you do cottage industries, packaging of rural produce, processing of rural produce, food processing, value addition, all these will be under the certain part and skills.

And there are a lot of industries though they do not need a degree. They need skills, hands on skills. For example, how can you assemble a scooter? You do not need to have to bring a degree for it but a skill on how they are atomics works, how the engineering works, etcetera. And that skill element will be given as a diploma using these schemes. So, that is a National Rural Livelihood Mission schemes about.

Housing for all, so, we know that rural entities have sometimes still living in mud houses and or which are being impacted by climate change extremes. So, the Pradhan Mantri Awaas Yojana - Grameen which is PMAY-G is for providing houses under the poverty line. So, BPL is below poverty line households.

So, this scheme identifies the people under the poverty line and progress them subsidies to build houses, you would have seen these houses across the villages, they look very similar in some aspects especially in Tamil Nadu, there is a state development budget which is given to fabricated houses or houses that look very similar within a budget, they have a plan. They have contractors, which is build the houses and give to the below poverty line. In this central government agency, you can also ask for funds to top it up.

Then we have a Pradhan Mantri Gram Sadak Yojana for construction of quality roads. As I said, connectivity is very important for development, especially in rural development. So, how do you connect the rural to the urban centers is through quality roads. So, this scheme Pradhan Mantri Gram Sadak Yojana looks into the construction quality roads. Then we have the national social assistance programme for social pension in rural entities.

And the Shyama Prasad Mukherjee RUBRAN Mission, so there is urban, there is rural and in between you also have a rural development or conversion of rural to urban on the territory of urban, how does a rural entity co-exist and this co-exist does not fit into the urban sector nor does it fit entirely in the rural sector. So, for that there is a mission created to understand the needs and development of this segment. This is very important segment.

So, you have urban, you have rural and in between there should be a bridge and that bridge community could be rural development. And the IWMP as I said water has been acknowledged as the key resource the most important priority resource for rural entity. And for that there is an Integrated Watershed Management Programme IWMP for improving the productivity of the land, to safeguard the soil, to safeguard the fertility of the land.

There is multiple mandates under the scheme and everything comes with IWMP. You will see sometimes these schemes could also c-oexist. For example, MGNREGA labour can be put in the Pradhan Mantri Programme Sadak Yojana where you pay the rural people labour to construct to help construct the roads, roads could be constructed, just not by machines, but you also need to move some weeds and some trees and stuff if a road has been built.

So, how do you put these two together, but what you see mostly is MGNREGA and IWMP working together wherein the farmers and rural neighbours are used to construct new water resource structures in the villages or rehabilitate and maintain some water resources like lakes, ponds, check dams, those are the things which come under IWMP.

We will cover how many how to use this remote sensing and GIS for many of these things. So, all these schemes may not use remote sensing and GIS but we will focus on the schemes that have to use remote sensing and GIS for these schemes.

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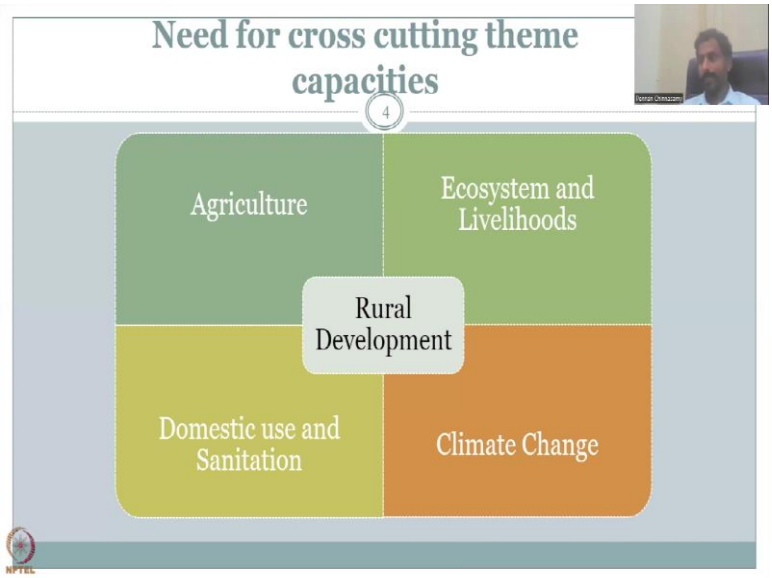

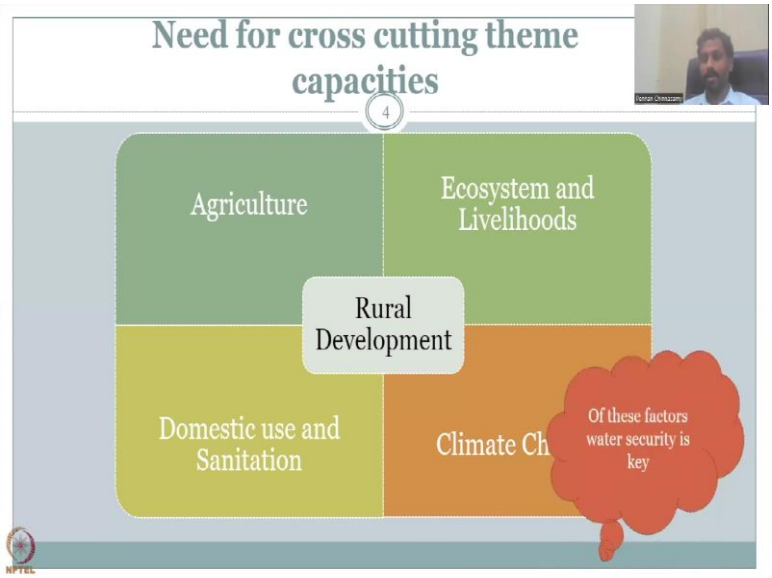

There is also need for cross cutting theme capacities. So, let us look at rural development as a whole. There is agriculture. There is always food production. There is always when I say agriculture, it does also include your other livelihood, such as aquaculture, cattle, et cetera, et cetera. Because it is not only for food, but that segment let us keep it as a green segment for all the agriculture related activities. And then there is also ecosystem and livelihood which is the forest, the lakes, the rivers that have to be kept, so that livelihood options are life.

For example, if you have a healthy river, you have healthy fish. Aquaculture is where you have separate systems for water and a fish but you also have your rivers and oceans and your lakes and ponds that have fish which are tied to the ecosystem. Ecosystem is the interaction between life and abiotic sectors like rocks, sand, land, etcetera and the trees and how do they co-exist. So, you have to keep that intact for rural development.

Then you have domestic use and sanitation which is the people the rural peoples need, they need water for drinking, they need water for bathing evolution and sanitation. So, how do you improve that for room? How do you improve agriculture? How do you improve the ecosystem and livelihoods for rural development? And most importantly nowadays is how do you lessen climate change impacts to safeguard rural development?

Because when a flood comes your rural land is gone, how do they have livelihood, how do they have food, how do they have agriculture. So, now there is a need for cross cutting themes for one rural development. You have to have agriculture, you have to also account for climate change impacts and understand how much domestic need is there. So, if you give water for agriculture and livelihoods, but will not take care of domestic needs, how will they survive.

So that is encompassing all of it and cross cutting themes are there for rural development, of these factors water security is key as I said, we need to understand we need to acknowledge that water security is key and it does include a lot of sectors across, for example, water is needed for agriculture, water is needed for livelihoods, water is needed for domestic use and sanitation and climate change impacts water.

So, one example is water as I said, but there are other sectors also for example, there is power. Power is needed for agriculture, pumping, processing the food, livelihoods is needed for processing the food etcetera you need power. For domestic use in sanitation, you need to clean the water, you need power and during extreme climate change, you need to need power to sustain your livelihoods. So, there are multiple sectors.

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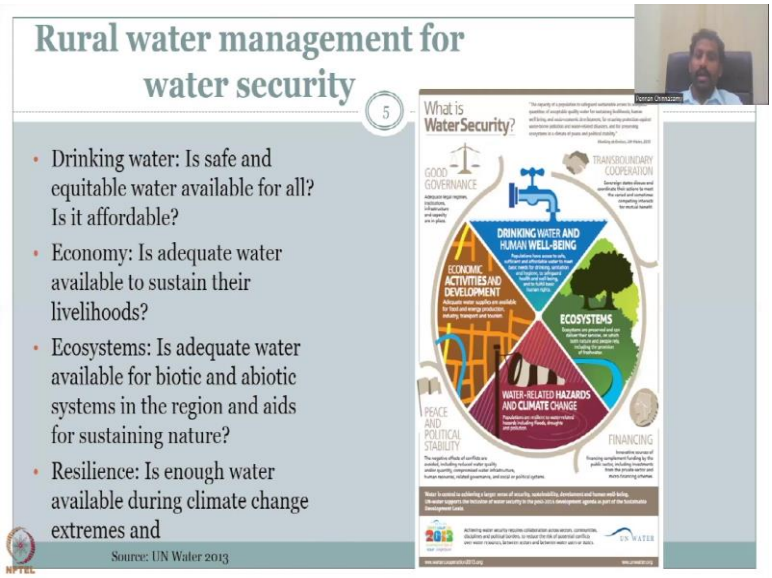

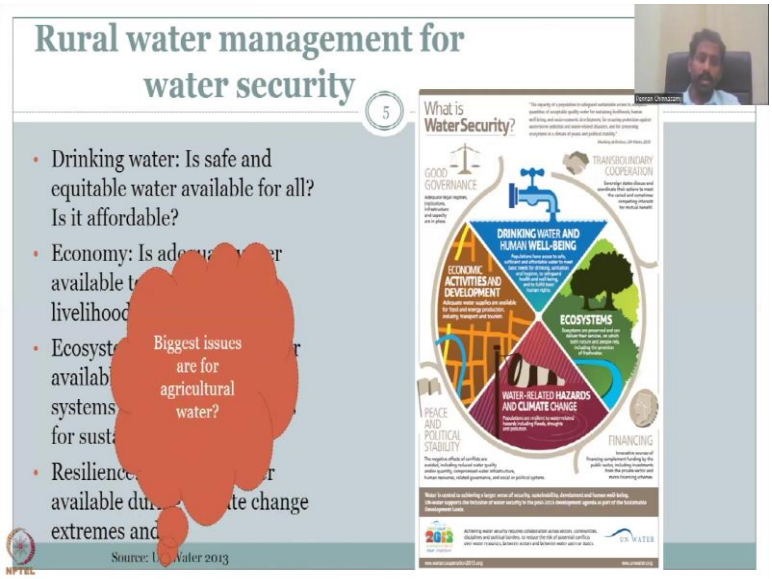

Let us look at a small example a rural water management scenario, what is water security and the human agency has clearly differentiated the word with other systems. It says drinking water and human well-being as I said domestic use, we need to have enough water for domestic use, we need to have enough to sustain the population in rural entities. Also we need enough water to sustain the ecosystem which is the trees, the rocks, the soil, you need to have enough water and that is what is kept as ecosystem services.

Water related hazards and climate change which we have to understand, we have to protect water during the climate change, so, there could be a pollution, there could be a scenario where too much heat all your water is evaporating, et cetera. And economic activities and development requires water as I said the economic activity could be fish or cattle which requires lot of water.

So, there should be good governance as per UN water it says that you need to have good governance for managing water, you need to have transformed co-operations between states between countries, between districts to share water there should be good financing to protect water resources and peace and political stability.

On the left, it has defined as drinking water is safe and equitable water available for all and is it affordable. So, a bottled water you find in the cities, is it is that affordable for a public in rural entities? It is not. You still find a rural entities people would purify the water, filter the water and then drink or put it in containers, pots and then drink. You do not see people buying just bottled water, use and throw. This is like your refill but the other water you use it, which is really harmful for the environment, single use plastic.

Is it affordable is key and the next is economy is adequate water available for sustaining the livelihood as I said it could be your cattle or aqua fish or it could also be something related to rural entities like washing food value addition, garments making, so you need a lot of water for washing time, is there is it in a sustainable way. Ecosystems is adequate water available for biotic which is your trees, your grass, your birds, animals, abiotic system is a soil in regions and aids for sustaining nature, is nature kept and is nature protected.

Resilience is, is enough water when during climate change extremes which includes floods and droughts. So, this is what UN water has discussed. And as you could see, all of this is very, very important for rural development. You need people to drink good water, you need economic activity to be around so that they have rural development, economic development.

They live very close to nature compared to urban cities. So, there is a lot of trees, birds, animals that need water. And more importantly, they are more vulnerable to climate change.

So, biggest issues are for agriculture and water, I hope we all agree that we see that a lot of water has been tapped and there is biggest issues for agriculture.

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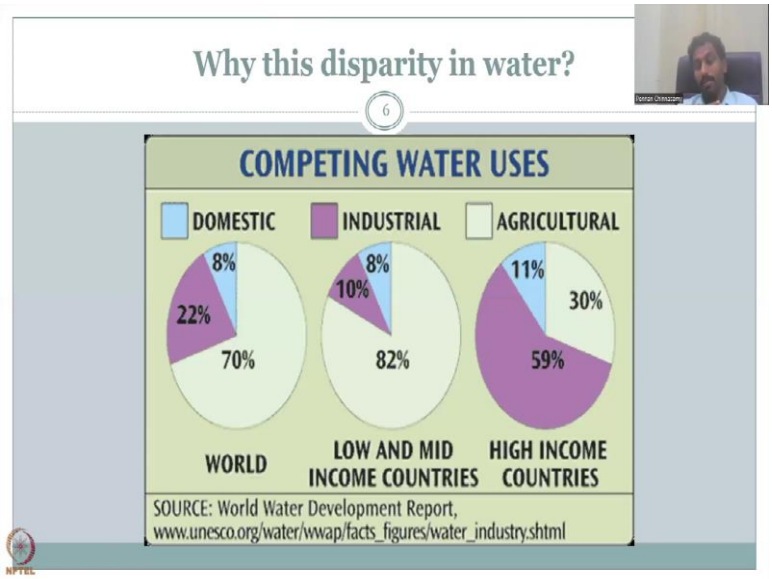

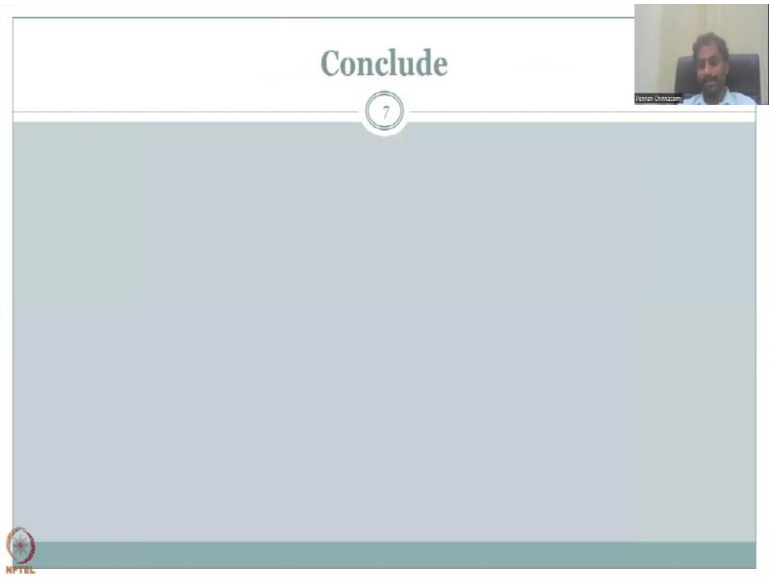

So, as I promised, I would like to show you how it is different in water resources between countries. So, we are popular should have nearly 1 billion and out of which we do have 70 percent living in rural areas. Let us see how that compares when they use water in different countries. So, in a world average, 70 percent of water is used in agriculture.

The first diagram, 8 percent is used for domestic use and 22 percent is for industry, this is the world average. In low middle income countries and developing economies including India,

you see that 82 percent is used for agriculture, 10 percent for industries and 8 percent for domestic So, we are on the world average, which means the world is domestic population is getting 8 percent, we are also getting 80 percent. We are fine, but we are limiting our industrial use and putting more water in agriculture.

Let us look at high income countries. And this includes the western countries European countries, you can see that 60 percent of the water is used for industries, 30 percent is used for agriculture, whereas 11 percent is domestic. So, definitely they have better live standards, they have better living conditions, because they have more water for their personal use. So, domestic consumption is high, it is not very high compared to 8 percent. But still there is good water and enough water available.

The most concern is this industrial demand. See industry products is valued high compared to an agricultural product. A car is much, much more expensive than a rice bag. We will take even a lorry of rice, it is not as expensive as a car that has been produced. So, you could see how smart these high income countries are, what they do, they put more water in industry. And that industrial produce is sold across the world for really high cost. For example, mobile phones, mobile phones were initially made it across the world and then we were buying it.

So, but the water, if our farmers are using for agriculture say rice and stuff, when they export it is not the same. So, 1 liter of water has high economic value when it is spent for industry compared for food. A great example I can give is grapes. You can water grape plant and then take it, pluck it and eat it as a grape table grape, we say this is a fruit. But when there is an industry that processes the grapes, puts it in barrels and then puts it in a bottle as wine, the price almost goes 10 times. So, that is industry and this is agriculture and food.

So, there is big disparity in water. And the concern part is the low and middle income countries are still kept as the food providers and they consume lot of water, they do not have enough water to even lift their living standards, whereas the high income and developed countries continue to buy fruit from these underdeveloped countries and put more water in the industry.

So, this is where you see the 8 percent and 11 percent difference, because they do not have high agriculture demands, there are very less agricultural demands, the rural population is very less. They have more population industries in cities. So, coming back to us for our development, we need to develop water resources and we do need to develop water in the

rural entities, so that we can develop rural economies. With this, I will stop today's lecture. We will see in the next lecture. Thank you.