Rural Water Resources Management
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Week 08 - Lecture 04
Rural Water Management Issues: Data

Hello everyone, welcome to the NPTEL course on Rural Water Resource Management. This is week 8, lecture 4 as per the syllabus, we are looking at rural water resource management issues and what are the concerns that should be addressed. The ways out are also discussed in each lecture giving some examples from case studies. Let us discuss further on the role of ownerships, which we discussed in the last lecture.

We also looked at the long-term sustainability of projects for rural water resource management and then the public participatory approach where the stakeholders who are getting the benefits for example; the farmers agricultural networks, stakeholders, domestic people should take part in saving the water resources and the assets. We also looked at NGOs and how they help in establishing this connectivity between the government and the local stakeholders. What the government wants is to provide these assets. However, without proper capacity built in the local regions, it is difficult and challenging for the rural entities to manage the water. Therefore, there has been lapses and that is where NGOs play a vital role.

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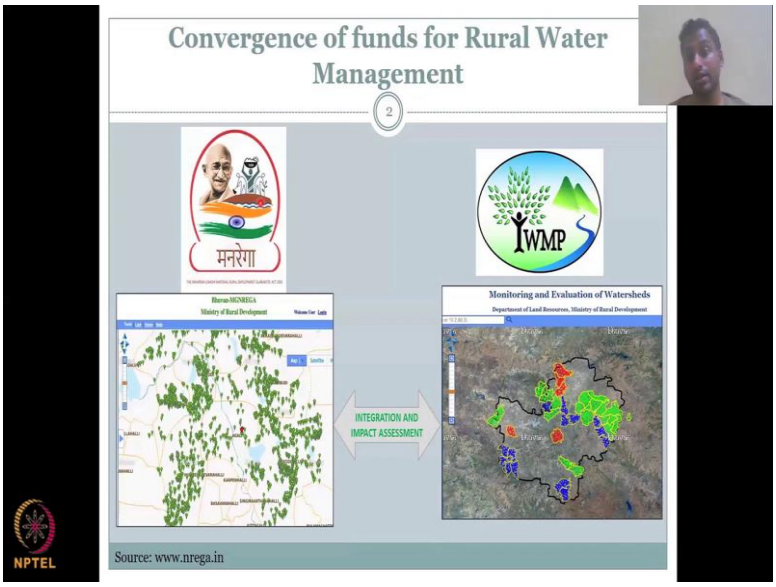

We have been looking at these the past slide now nothing comes for free. So, there is a cost involved and budgets are needed. As I mentioned in the previous slide, these the government schemes and rural schemes are there to provide the assets but the management maintenance

and monitoring but they do not have funds somewhere there has to be some give and take between the stakeholders and the government agencies.

So, that at the end the water resources are saved. So, we have on the left the MGNREGA scheme where the 100 days work is given to farmers as labor cost. And they can be used for multiple duties such as farming, nurseries, taking care of plants and local species. Tilling the lands and preparing it for the next harvest. Most importantly, working on NRMs which is the natural resource management.

And we also noticed that of the budget given to MGNREGA around 60 to 75 percent is used for the natural resource management activities. And under the natural resource management activities, most of the money is used for water resource activities. And then we have IWMP, which is the Integrated Watershed Management Plants.

There is a monitoring and evaluation on one side on your right-hand side you see the IWMP on the left hand side you see the assets created by the MGNREGA scheme on an error and especially water resources. So, these two have to be integrated. On one side you have a management plan by the government of India which is under the department of land resources Ministry of Rural Development.

Whereas on the other side you have the MGNREGA, MGNREGA where it is on focus it is to the Minister own department but it is focused on the livelihood options. So, there is different departments and now these two departments are combining together. Convergence of funds can happen So, that it can be an integration and impact assessment for both cases. For example, because you manage land and water Better you can have assets for creation of water resources. On the same hand, because of water resources, the land can change into more fertile soil with water rich conditions et cetera.

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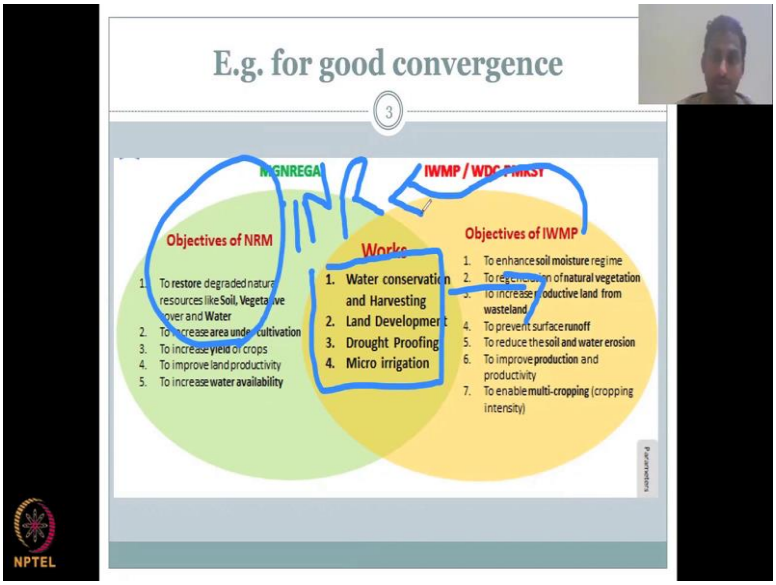

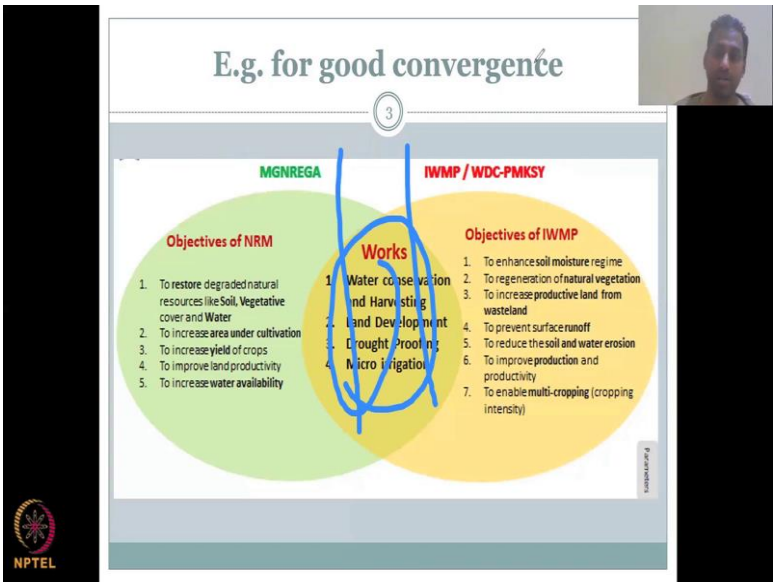

Let us look at the objectives for good governance and convergence. The left you have the MGNREGA and then on the right you have IWMP. And let us look at the objectives of each. Again, in MGNREGA. There are multiple schemes where my MGNREGA money can be used of which one vertical or one team there is natural resource management. And that has clearly given some objectives to restore degraded natural resources like soil, vegetative cover and water.

So, they want to restore degraded underline the word degraded not create new ones, but they checking where there has been degradation. For example, a forest which has started to ban and improperly managed forest or forests which has been deforested. So, all these places can

be taken under NRM for activities to restore soil vegetative cover and water. Next is to increase area under cultivation.

So, how do you increase area under cultivation like what are the key resources is water so, if you have more water, the acreage is sometimes increase more depending on the soil condition. And climate to increase yield of crops so, this is like in an acre, how much yield do you get? Is it 1 ton per hectare or 2 tons per hectare increase it.

So, when you increase what happens is the productivity of the land is saved in terms of you get more produced per acre of land and the water and nutrients are more consumed in plant growth rather than wasted in as runoff and pollution happens in rural land productivity, I have already mentioned that under area under cultivation and crop yield and increase water availability which is one of the key resources for all these activities together.

What are the works they do? So, for this objective, there are a set of works that is water conservation harvesting, which is ranked really high. Because of all these objectives you see on the left 1 to 5 water is very well key. So, water conservation and harvesting. When we talk about water conservation it is by collecting the water and using it in a very sustainable fashion.

Conserving water reducing the water use and harvesting is by capturing rainfall, increasing the recharge you increase the resources that you have. Land development is changing the type of land tilling, nautile and making months those kind of things to prevent soil erosion. Drought proofing is to make your system drought ready or mitigated resilient to drought and micro irrigation goes in the water conservation where less water can be used to grow the same crops using micro irrigation techniques.

Let us look at the objectives of IWMP to enhance soil moisture regime to regeneration of natural vegetation. So, soil moisture has to increase which means water has to be available for the soil. And also, the available soil moisture should not be evaporated or transpired excessively by power plants to regenerate natural vegetation cover forest natural trees native species to increase productive land and wasteland.

So, they are very specific also about what type of land which is your wasteland they want to convert it to productive land, to produce surface runoff which means to harvest more water, produce soil and water erosion. As I said by building bonds on the side, you stop the soil

from Aerobe filter out production and productivity to enable multi cropping intensity which is increasing the cropping intensity.

So, what you see in all these is that it is almost similar to the objectives of NRM and the works are saying, So, for example, for soil moisture, reducing the runoff prevents surface runoff to reduce soil and water erosion. All of this is achieved by number one work which is water conservation, harvesting. Multi cropping micro irrigation can be used.

So, if you see the objectives might be different in number the total number, but are more or less they are related to each other in this side you have increased yield of crops and increase area to cultivation which is also coming into the multi cropping or adding more profits per acre and soil and water is both on both sides. So, the work which is needed to achieve these objectives which is kept in the center is overlapping between a NRM and IWMP.

So, the aim of this image is to show that there are a set of objectives for NRM, there is set a set of objectives for IWMP. However, the work needed to achieve objective NRM and objective IWMP can be clubbed together as one work similar works. And that is how convergence of funds are there, for example, you have funds for this one. You have INR, which is your funds.

And they could be linked to this work, which also can be used for this objective, which means you are saving money, or you can add this fund into your wager fund and then make the pool larger. Now, if you make the fund larger, then you can have more money to give it to the locals for maintenance, monitoring and managing. So, this is how one should work smartly in convergence of funds.

So, initially what has happened, these were operating differently. And MGNREGA was operating differently, they do not talk to each other. But the work was same, which was causing reproductive on both sides, same work being done repetition work, and also was not that efficient, as I said, that we want check dam done by MGNREGA now the check dam done by IWMP. If they are too close together, they are the benefit of the check dams are given.

Moving on because it is a funds. I would stop with that point. Because then you have given an example. And showed you that if you can identify smartly the work which is similar in multiple schemes, then you could easily manage both objectives in one fund, thereby either

saving the fund or increasing the funds volume by merging the funds. And this is good for sustainable management long.

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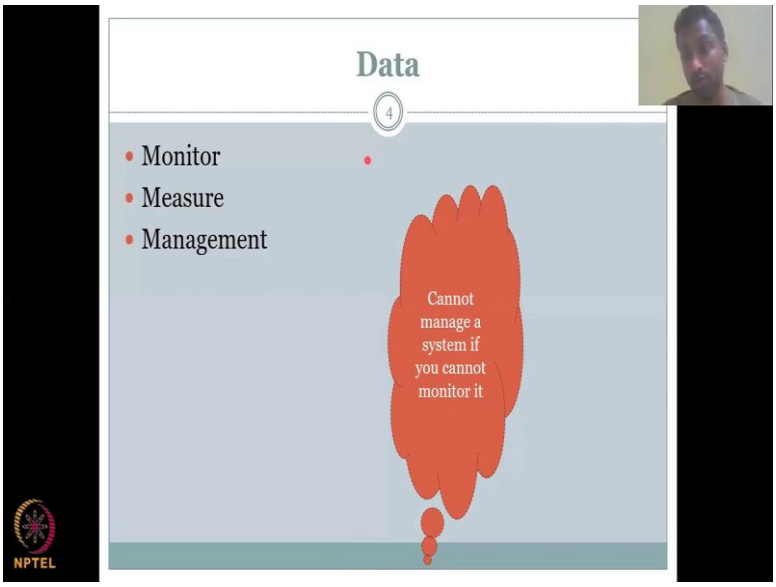

Moving on, the other issue that we have is the data issue. The standard data is needed for monitoring data is needed for measuring how much let us just keep water. Let us take groundwater for example. So, I need to know the change in groundwater. So, I need to monitor I need to know the exact value of how much my aquifers are in water for which I need to measure and there are pumping.

So, I need to measure the pumping also how much they pump and dependent on that I need to set up management plants. So, the point is all this is tied to data. If you do not have data, primary or secondary data to assess the water levels and provide scientific justifications to the management plan, it will be very difficult. In other words, you cannot manage a system if you cannot monitor it.

So, people say that I am going to manage groundwater, how do you manage it without monitoring it is the question is how can I know how much it may come? How much is okay for pumping. So, they give all these regulations. However, they do not work unless there is a almost unlimited supply of water, which is not the case almost everywhere water resources have been hit hard. They have been unsustainably used, most places did not have poor data to monitor and measure.

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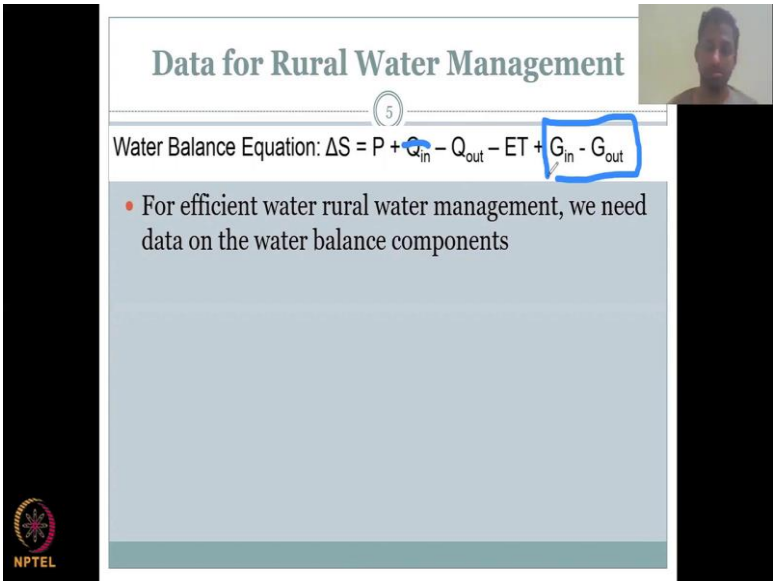

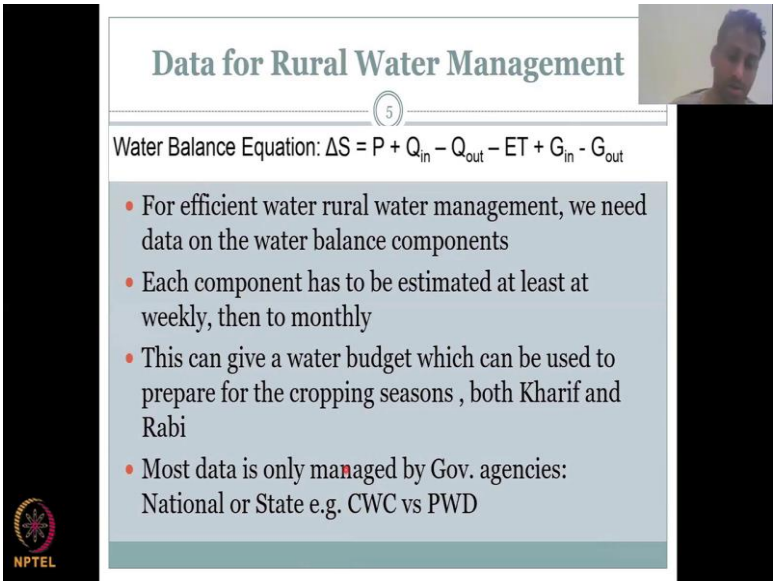

So, for rural water management is very important. Let us look at the water balances quickly to show that which parameters are very, very important. As I said you cannot monitor everything if you do not have money. But that is not a justification to say I do not have money. I am not going to monitor it. But I will be managing the water. So, you need at least one a couple of these parameters to monitor; so, that you can manage properly.

Efficient water rural management we need data on the water balance components which is given on the top. As I said, if you do not have all the data, you could at least get away with a very crude estimation of water or storage of water del S but for example, you do not know the precipitation. I do not know the rainfall, which is one of the most important input to the system, how are you going to estimate all the other parameters, thereby estimating del S.

Del S is what you want to understand how much water do I have stored in my village and how can that stored water be used for domestic agriculture industry ecosystem services. So, please understand that there are priorities for data and some data as I said, you can get out with it. For example, if there is no revenue coming in to take you in, is not there, but you all can be there.

And if it is assumed that the groundwater pumping is boiling the water from outside the basin, which means groundwater in is equal to groundwater out, the levels do not fluctuate that much, you can say that this goes to 0. So, depending on your field conditions and understanding of the hydrology, some of these parameters can be lost or not monitored. However, you cannot get away with 0 monitoring.

For efficient water management, each component has to be estimated at least at weekly, when to monthly, be very careful about this. Each component has to be estimated at least weekly, if possible, and then monthly at least. So, for example, groundwater is monitored once in for months by 4 to 3 months. So, by central groundwater board, in most regions, you get it at 3 months, otherwise it is quarterly, every quarter you get your groundwater levels.

This can help a water budget which can be used to prepare for a cropping season but Kharif and Rabi. Nowadays, because of the climate change scenarios so Rabi and Kharif interact too much the seasons and all your Kharif season is taking Rabi's water which is your dam irrigation water or groundwater. So, it is very important to understand how these changes using data so, that you can manage it more to prepare be prepared for better management.

Most data is only managed by government agencies this is a concern. And some of it is not kept in the open domain big issues in… Security and the sensitive data. So, it is not all data that you can get. Most data is with your national agencies followed by a state for example CWC versus PWD, CWC is a Central Water Commission which is PWD would be your public water department or public works department depending on where you are in India.

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So, the challenge in data what is the challenges and issues for rural resources management, I will take a leaf out of this book which is written by me and do you in 2019 from World Bank case study what we did is we were supposed to do a climate change assessment for all the South Asian countries SAWI is the project SAWI South Asian Water Initiative. And what happened is instead of giving us giving them recommendations on climate change and stuff, we have to give them recommendations on data.

The data are so bad that we cannot make tangible outcomes. So, lack of good quality data quantity observation data is very very important issue understanding current and future scenarios understanding geophysical processes is also very weak. So, once your data is less you cannot understand the current what is happening the current scenario, how much pumping is what are they growing et cetera. Then how are you going to assess the future water demands take out.

Same if we do not have data you do not understand what are the drivers that are affecting your water balance. Lack of cooperation between agencies because the CWC may not talk to PWD, Central Board Water Board may not give data to other resources. So, those kinds of things happen a lot across Asian countries. So, there are lack of cooperation or lack of sharing between agencies, between countries when it comes to transboundary like the Ganga's basin.

The Ganga runs not only in India but in multiple countries and to manage the Ganga water, it is needed to have all these data from different countries including Nepal, then you have interstate issues, water issues are still relevant between the states. And so, it is very important to have good data to showcase that why these issues are happening and how to resolve it in an

amicable way. Lack of capacity warning systems models resident prototypes all occur because there is lack of data, you cannot build a warning system flood warning system if the data is weak, the models and resilient prototypes all will not be efficient. So, data is important.

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Let us look at the data issues and I have told you what are the concerns in data sharing data transboundary natures but let us look at specific issues in data as a quantitative number. Data errors there are a lot of gaps in the data which means there is a gap warning system and then data is coming every for example as a weekly. Suddenly, there are gaps and the gaps which means no data recorded the gap could be due to instrumentation errors, which mean the instrument is just a machine or a battery ran out the power and solar power.

So, it stopped it is very important to understand the instrumentation errors maintain and manage these instruments in regular intervals to get correct water levels. Then you have data collection errors, the person who was collecting the data downloaded the data may not have it at the time. So, it overlaps or the data is lost. Then once the data is taken from your instrument, let us say this is the rain gauge instrument the green color you see you collect the data and instrument is working and the data is there.

So, you collected the data perfectly. But what are the errors that will come? Data entry errors. So, for example you are taking a digital format from your rainfall gauge and why you convert it into a dashboard or a website or a report that will be typo errors, duplication errors is saying 10 millimeters 3 millimeters and 5 millimeters you say 10 10 5 which means you are

duplicating the numbers rather than say 10 and 3 you say 10 and 10 entry errors between stations the number of the station might have been changed all this occurs.

These are from studies across the world it is not only in India. So, please understand that these are the very very important basic issues in data which should be at can be data representativeness is a big issue where you place the instrument for example, you could see monitoring well placed outside an agricultural field. If it is placed outside agriculture field, especially in a hardrock aquifer, then the connectivity is very less.

Which means what happens in the agricultural pumping will not affect the groundwater level in the monitoring world. So, you may be not monitoring the actual scenario but you are monitoring something else. It has instrumentation error, which I said earlier, your calibration and validation should be done, your maintenance should be done. And if not, there is error issues in the top I said suddenly the instrument does not work. So, there is a data gap.

In the bottom last point, I am saying instrumentation, instrumentation errors as it reads… And for which you need to do calibration and validation often. So, especially calibration of your instruments. You need to check okay is it measuring the exact volume it was a 10 millimeters is it recording 10 millimeters, it may be recording 15 millimeters. So, those errors happen in instruments.

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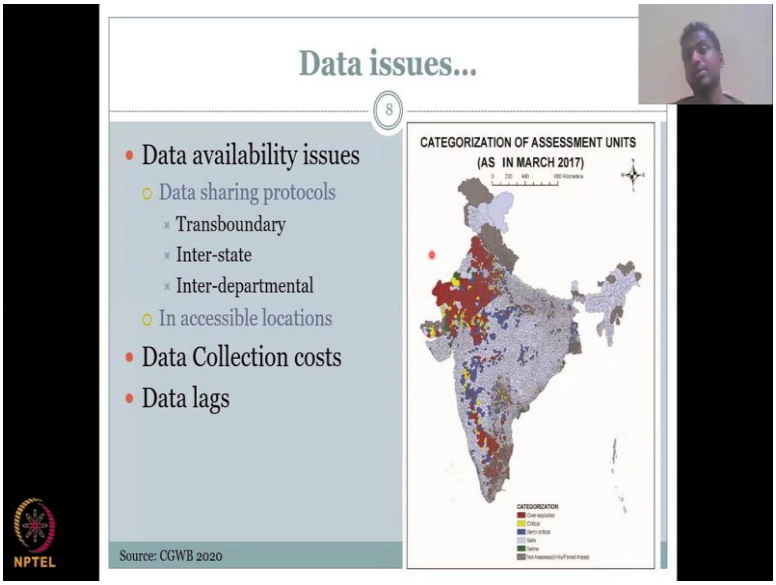

Data issues continued data availability issues are there. So, first I talked about the nature of data and challenge of data then I went into the data issues. Now, I am going to talk about the data availability issues. Data sharing protocols are absent between transboundary interstate

and interdepartmental. So, there is no quick and easy seamless flow of data. It is a lot of paperwork, a lot of accounting needed to get the data.

Which actually delays the work and people may not want to do all this try (())(24:58) say I do not want the data in accessible locations are in some regions, the data is available in the instrument, but not readily available for the public data collection costs are very high, this instrument also is very high. So, I will add a statement that data collection slash instrumentation is very high and that is why some people may not afford some agencies may not afford data collection and they start modeling and assumptions for data.

It alikes are present instead of reading the data instantaneously, you get the data after 1 year or 2 years. What is the use of such data? For example, I say groundwater data, if I am getting the map of groundwater data 1 year after the recording, then what is the use? Am I going to make a plan for groundwater development? Am I going to reduce my water consumption after seeing another year of data?

No, it is kind of usable in a very less less fashion readily available data is very important. For example, this map which was done in 2017 was released in 2019. So, the data was collected for 2017 evasion for December also. So, nice you would have assumed to get it by 20, you know, 18 first 2 months. But no, it takes sometimes a year or a half, which actually surpasses the need of the government's mandate to monitor the data.

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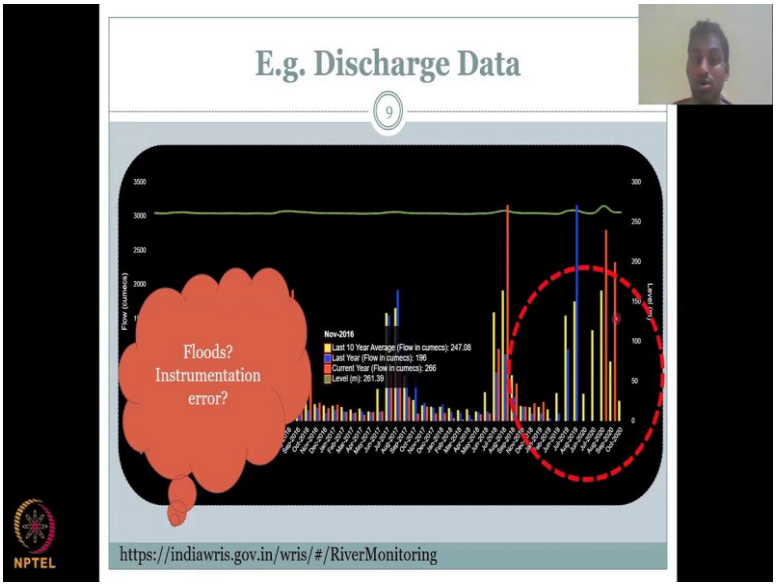

So, it is very, very important to get the data without data lags. Last data issue, I will show you is an example of a data error this is the discharge data for a station in India, the government

website just to showcase the error not to pinpoint the error, but how can error come in the data. So, you see here, you have the last 10-year flow in yellow last year flow in blue, the current year in red, and the level in green curve which you do not see at all…

It does not fluctuate much it is of the secondary… Whereas the primary y axis is flow in the x axis… You have the data. So, what do you see here is the data gap is there here the red bar is missing, which is the current year flow is missing. And then you have also the last year's flow missing in this location, all you have is the last 10 years for location this flow which may not be that important, it could be important to understand the long-term variability, but what is important about how it was last year and this year.

So, even 2 years if you do not have data that means something is not right in that location which needs to be checked. So, could it be a flood is a question instrumentation error, because a big flood can come and then push the instrument out of place or wash away an instrument thereby, there is no data when the data collector goes and collects data. So, all these have to be monitored regularly.

So, that the data if not available, quickly, a new instrument has to be put and then re calibrated. So, that is how the data should be recalibrated and the new location has to be found. So, that the continuity of the gauging location is continued because the instrument can be gone nothing can be done right. If the big flood comes and washes away your instrument, which could be approximately here to here because it is the rainfall season June August, the peak monsoon seasons.

But the point is, we cannot just afford to say okay, washed away. We do not care about that location. We do need the data for which we need to go back and then set up the instrumentation. What do you see here is the red has been there until Jan Feb and then slowly the instrument was not there and suddenly the instrument comes up in September along the peak monsoon backs but the September is pretty high compared to your other months and or other September which is also pretty high. So, somewhere there is a change or a new location is being placed wherein the instrument has to be updated to the current condition. This concludes today's lecture. I will see you in the next lecture to wrap up week 8.