Rural water Resources Management
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Lecture 51
Solving Case Studies in Rural Water Resource Management Part 1

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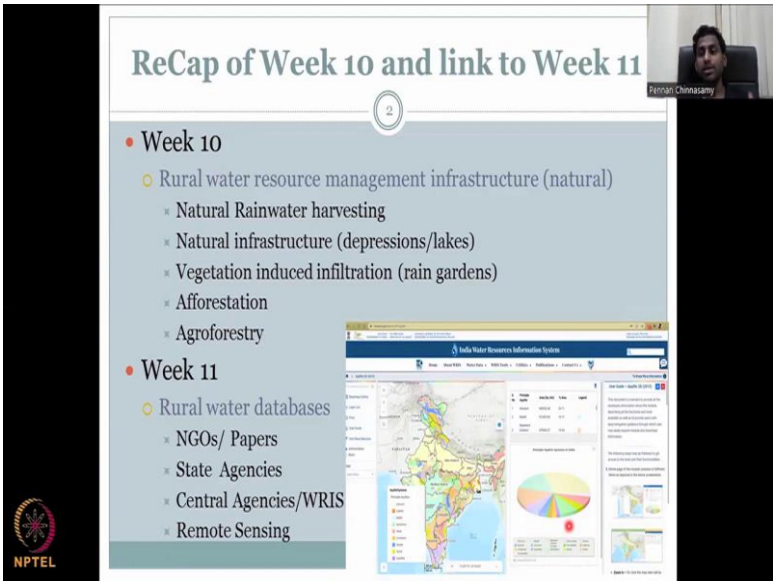

Hello everyone, welcome to the NPTEL course on Rural Water Wesource Management. This is week 11 lecture 1. The past weeks, we have been looking at how groundwater, rural water, surface water can be preserved using natural and engineered settings. Basically, in week 10 we looked at natural rainwater harvesting, wherein we capture the surface water and then slow it down using nature-based solutions.

Rainwater comes in big volume sometimes and in quick time, which means in a concentrated time, so, it is better to capture this rainfall and then slowly recharge it and slowly let it go as surface runoff. Otherwise, all the water would wash away and erode the soil and also reduce your groundwater.

Then we looked at methods to store this water using engineered solutions and nature-based solutions. In some locations, there is not much nature-based solutions you could do or the scale is too big. So, you have engineered solutions like dams, and other resources infrastructure. In week 10, we focus mostly on nature-based solutions and we looked at where naturally we can store water like in depressions, lakes, ponds, etc. We also looked at the option of using vegetation to slow down the water because your vegetation acts like a buffer or like a challenge the force from flow of water it slows down and then let water to recharge.

Also, there is some storage in the plants area which can actually help in storing water like a wetland atmosphere.

Then we looked at regions where there has been loss of biodiversity, loss of forest, plants. And then we looked at options to reintroduce forests in these locations, especially the forestation and agroforestry we looked at Miyawaki method where we brought small plants, take them in shade and then introduce them in the wild. All these require a lot of time and maintenance up to a particular point after which the system came involves.

So, with this we complete the rural water resource management lecture based on the principles, the fundamentals, the drivers, everything has been discussed. Now, we will look at the databases. So, with the understanding you have created over the 10 weeks, it is important to have data to work on. And that is where we will be focusing on week 11 and week 12.

Basically, we will be looking at where we can get the data? What are the cautious points that we have to follow while downloading these data? And what is the principal use of these data? So, Ruler Water Databases can be obtained from multiple sources. I am going to pull up a pointer to just show that NGO's collect a lot of data.

So, we will look at how NGO's collect data, why they collect data in this lecture. Papers, journal articles, like academics like me, where we write a lot of papers to show the scientific scholar at activeness and also work. You will look at where we store these data. Then, the next step is the government agencies, because NGO's or private non-government agencies.

Then when you go to the government agencies, there are two major types, your state agencies and the central agencies. The state agencies have their own budgets, small scale budgets compared to the central government and they work on the state's need. They work very focused solely on the state water resources and under the state water resources, rural water resources is key.

Then we go to central agencies where we have thematic agencies, for example, we have climate change and forestry, we have water resources, Jagjivan mission, all these different agencies within the government, how they collect data, where do they store it? And how can you access it? Then we will also be looking at remote sensing platform, because some of the data bases I have mentioned may not be able to capture the entire spatial and temporal resolution.

Spatial means, across India, every single district can you collect data is a question or even every single block. Also, some of these data are not collected daily, whereas your remote sensing can at least give you weekly estimates. So, in this lecture series, we are not going to pick one and say this is the best, because it depends on your location, and where you want to do your research for the time period, also the research question.

For example, if I am looking at groundwater for rural areas, the observation record is only once every four months. So, can I augment it? Can I add remote sensing data is the key. Then we look at central water agencies where remote sensing is also a part for example, ISRO, is a central agency, government agency. And it has a lot of remote sensing products, which the government agencies are using.

So, it is not one data is better than the other, how can we use them together, I will discuss in this and the week after this lecture, which is the last week. So, we are almost coming to the end of the rural water resource management course. And I would like to focus on the principles that we discussed in class are enough to at least create the basic understanding and start managing the water resources. To have hands on experience, we are looking at these datasets.

So, let us get into today's lecture on the first aspect, which is your NGO and paper-based data. I will also while completing this lecture; I will also go into the WRIS database and show exactly where these data are stored, so that you can easily retrieve the data. For example, here I am showing the groundwater aquifer type data across India.

And you could see that all this data can be downloaded and used for your water resource assessment. In fact, there are places in this region where some of the groundwater structures that we discussed the natural recharge structures, the engineered structures cannot work. So, we need to understand these potentials, which the groundwater board has done and put it on these websites. I would say WRIS is a more centralized location of your data and I will be happy to explain most important datasets and let you learn in due course, how to use these datasets.

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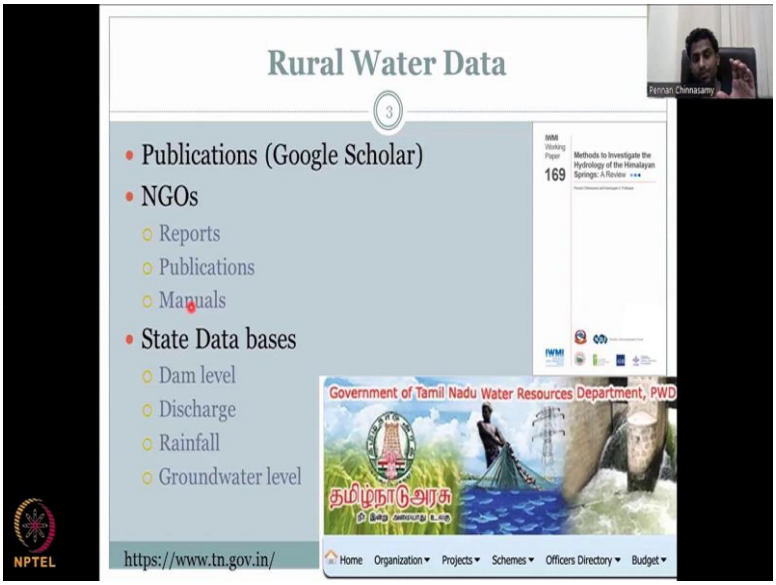

So, without further ado, the first ruler water data resources we will be looking at is Publications. So, Publications are written by scientific scholars, and students, and who are active in research. Most of these are found in the Google Scholar. So, basically, while googling your data that you need, you can go to Google Scholar, Google Scholar is part of Google, which focuses only on papers, journal articles, for example, you have Google Books, you have Google Scholar, both our scientific knowledge products are kept. Let us say for example, if you want to go from one location to another location, you use Google Maps. So, how will you use Google Maps, because it has a separate vertical under the Google umbrella only for maps. Similarly, you have a one vertical for scientific publications, and that is called Google Scholar.

Here, you can take a lot of paper, which has data, for example, I will spend one more minute on this Google Scholar. I am showing you a report that as common Google Scholar and what you could do is you could get into these resources and collect the data. I will also explain how you collect the data, how you cite it? So, what do NGOs do? NGOs, write also reports and publications and research manuals.

These may not be accessed in Google Scholar; you should use only the Google to find it. Why is because most of the papers that are put in the Google Scholar database is peer review, which means it goes through a scientific process, where the papers content, and the data, the results is checked by a couple of scientists, or researchers or academics, they should give a thumbs up saying this paper is good, then it comes into publication domain and then it goes to Google Scholar.

So, you first write a paper, you send it to a review process, the reviewers give comments that is the peer review. And then once the paper is accepted, it goes to the publisher. After the publishing is done, it goes to Google Scholar. So, that is what Publications are. However, NGOs do not have to go through that route, because this process is time consuming, and they know that their data is good. It is a very localized data, and not much science, but applications of science principles and data. So, for that, they would keep NGOs, reports, publication manuals in open domain, and publications, the research publications, paper publications sometimes require money to publish.

So, since NGOs work on a very short budget, and it is not a profit-making company, or industry, so they would publish in open domain, which is Google also. So, I will go through some of the reports and how they are doing it. In this week lecture, I will also look at first state databases, because databases are huge. And they have a lot of data that is collected and maintained rigorously in their work domain.

So, think about a massive server, a massive server can stay in the central, for example, the capital, Delhi, and then have data for all the regions across India. However, the state can also have their own servers, and from the state server, the state data can be housed and shared with public. So, we will look at how the state databases are run, what are the data that they collect, and how you can access it?

So, before we move on to the state databases, and an example, I would like to show one example of an NGO report. So, here is one report and inside the report, what you would find is a lot of government archived data, and they collect data. So, similar, the publications, I mentioned, where the scientific community writes proposals and collects data. The NGO's also do the same method of writing proposals and collects data.

They analyze it using the own team, scientific team, and they put it in these websites or in these books. These books are kind of open source. It is not a hard copy, for example, it is stored in as a PDF in the database, which can be shared with everyone. So, there are a lot of databases, ResearchGate is one database, with a lot of papers, you can access and publications. Google Scholar, as I said, has all these publications.

Then they write reports, annual reports, for example, every year what have they done in terms of securing funds, and for the funding agency, like for example, you have Melinda Gates Foundation, which is giving money for a rural water resource management work, the NGO's take the money, they work on the field, and then they collect data, put it into the database,

and reports and publish it. It may not go into a scientific publication, but still it can go into a good report like this.

Then you have the manuals, which they use for training and also building capacity. See NGO's do a lot of extension work, which means they connect people, they talk to people and they train them to manage the water resources. So, for training, they collect data, they analyze data and they reproduce data. So, all these work in the manuals, tutorials that they make, and they publish it.

Then the state databases as I said, they the lot of database is created for each state and some of the data on dam level for example, you have the irrigation projects, which is we covered in lecture 9, week 9, we looked at engineered data, engineered infrastructures and we saw how dams help. So, now we need to know the levels so that we know how much discharge is left, how much water comes in what goes out of the system? So, to create all these water budgets, the database is created at state level and dam level discharge rainfall, groundwater level is collected, this is at a state level.

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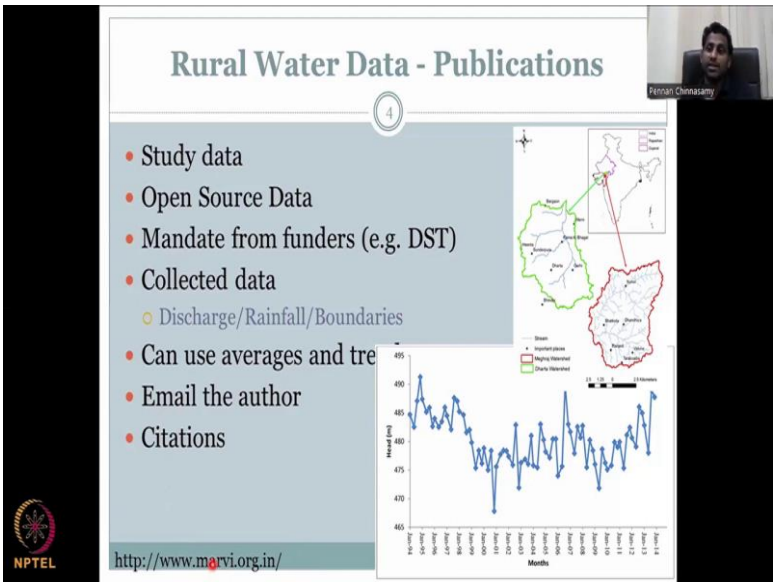

And they also do a lot of dissemination. So, let us look at focusing on the publications first. So, each one I will go in detail, what can you get from publications? Please be careful on assessing a lot of content in the paper, see, the paper is not going to give you all the data you need, you will have to search for the data that you need.

For example, the study data can be found as written inside the lines for example, they will say the hydraulic conductivity of the aquifer is 10 meters per second, so that 10 value is the data

you need for your groundwater assessment. In other words, they could say that, for example, this region in Darta watershed, they could say that the annual rainfall is 655 millimetres, see that number is because they put rain gauges; they collected rainfall in the village. So, this was done by the Marvi team, who a lot of NGOs, so they collect the data, and they write as a publication.

So, in the publication, you have this data as rainfall for Darta is 655 millimeters. This data you may not get readily in government records or the state records because maybe they are not monitoring at that particular village. However, this study has done it. So, what I am trying to tell is search for publications, put the village name, put rainfall in Google Scholar, you may get some hits and use that hit to collect or make data. So, this is kind of your data mining and getting into more data, labels here, and data mining is a term where you go and mine, dig and take out data. So, from the paper, you should have that, time and expertise to collect data from a paper.

Sometimes publications also give you a link to the data for example, nature publications, hype and publications. They always have a link or a database linked to the paper, because they want people to use it, all these are open source data. It is not a data which is stored in the government agencies because it is not funded by them. But the people who fund the paper or the study, they would like to see the data for public use, which is open source data.

So, you could go to these links, the paper links, click the data and use it. For example, this paper Marvi, you could go into the funders webpage, which is ACIR and you can take the data and use it for your studies and understanding, etc. Also, some agencies put a mandate saying that the data has to be shared to public. For example, if I am writing a DST project, which is Department of Science and Technology Government of India, they will say sometimes, please make the data available for public.

So, how do you do it? Is you create these data as as as an Excel sheet or database and link it into the paper, you can give it a Google account, Google Drive account or symptom server which is from your university for example IIT Bombay I can put it in a cloud and then give the data. So, the point here is those information are put inside the publication. So, you need to go in and collect the data from the papers.

So, please skim through the paper, at the end it will say acknowledgement and also supplement data or data in appendix. So, then you can go back and then do can take the data out. Also, they will have data in between the lines as I told you, for example, they will say

rainfall is 655 millimeters and they will also put it as a table in the table, you have data, you can take out the data, but very sure, you should always acknowledge it, I will come to that point.

So, you can collect data like discharge rainfall, most importantly, the boundaries, the boundary of this watershed is not available online, you cannot get it online. So, you could actually get it from the paper or email the author, every paper will have the details of the author in the paper which is called corresponding author.

So, look for the word corresponding author, you can email them and get the data. So, then you could use that data to create these maps by yourself, which is the watershed is very important aspect in rural water management I said, and then you could collect all the rainfall data, other data that is inside the paper, you could also write to the authors asking them about these datasets.

So, you can use averages and trends that they talk about in the data for example, they would say the average rainfall is 655 millimeters per year and the 20-year trend shows that there is a slight increase in rainfall of 10 millimeters per year. So, what you could say 20 years, every year, you have a 10 millimeter increase or is it after 20 years a 10 millimeter increase, you can you can get this information from the paper.

So, that for your area, if there is a 20 millimeter increase per year, and there is a 10 year difference, you can easily calculate how much rainfall has increased in your region. So, you can kind of extrapolate or take the data from the previous data. Email the author, as I said, you can write to authors, I have a lot of requests from my papers to say, can you please share the data, most of the authors share the data for example, I share the data.

However, if I am working on the paper again, and I need to save the data until I write my papers, I will not give it. So, that is one caveat. So, if the author says sorry, I cannot give it please understand, they may be writing a paper, or it means sensitive data, two things. The last thing is, they will be happy to share the data and work with you on these water budgets. So, you can also ask them if they can work with you.

Most importantly, from publications, please cite them, citations is mandatory because they have put some time, collected the data and put it on a publication. All they would like to see is if you are collecting data without asking the author, if you are collecting from the papers,

then you have to give them credit. Let us see, for example, this is the watershed that does groundwater level.

And you could see from Jan 94 to Jan, 14, the data has been collected. So, what you should do is you should tell that okay, in Jan 2002, I have this groundwater level, I take that water level, and I can understand that the water level is declining, and then it is stabilized. See all these trends you can make from here, you can easily say that, and then 2002 was around 478. It is average you can take just from the figure.

So, this is how I am saying you could take the data or create an understanding about the water from publications. If you are going to use it in your thesis, in your work, in your publication or report, please cite them, you have to give citations. You can Google and see what the citation and how to cite. Basically, you have to write the author's name in your report. For example, if you are using this work, you will say Marvi you have to cite, and maybe you can put the whole website saying that thanks to Marvi, marvi dot ORG dot in, for the paper which had the data and that data you have used in your research.

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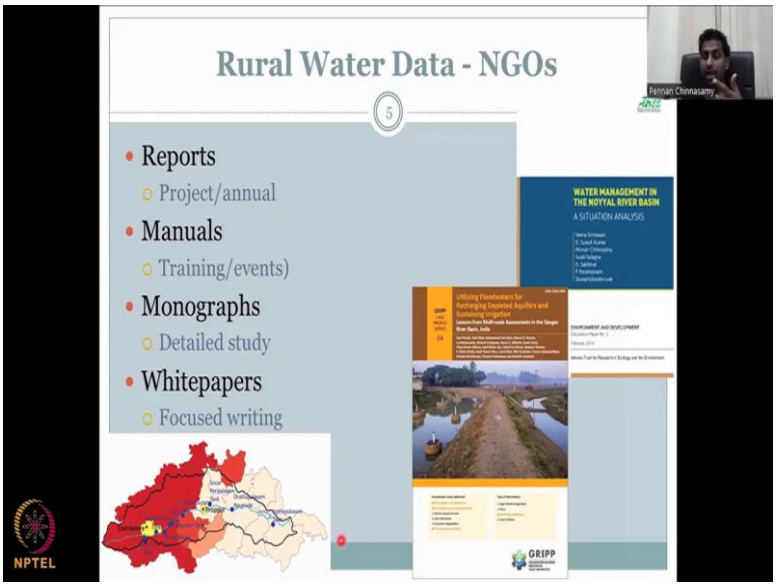

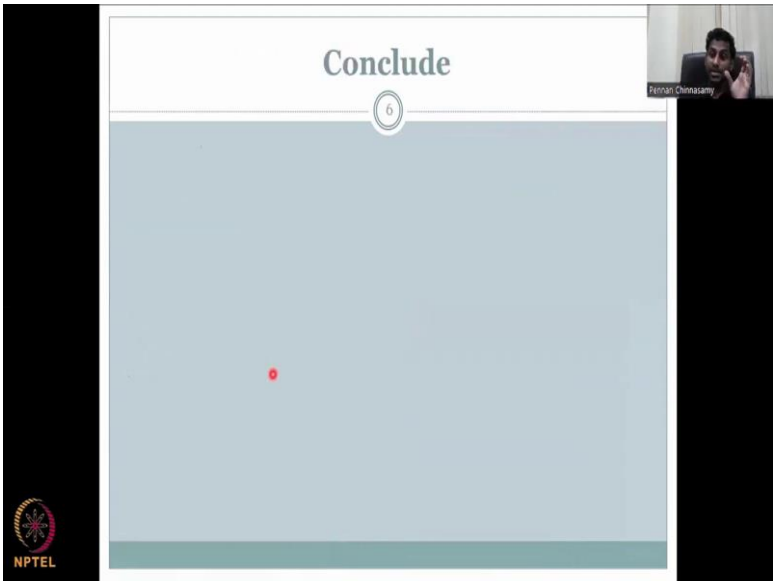

Then I will go to Rural Water Data from NGOs. This is very similar to the publications but these are books and papers that you can find not in Google Scholar, but in other just a very simple Google search or in the agency's web page like you here IWMI, here ATREE, you can go there and collect the data. So, what do they have is project reports.

As I said, every project will have a report in an NGO, let us take this example, water management in the Noyyal basin, a situation analysis, I was part of this study. And what we did is we collected a lot of data from the government. So, inside that you see a lot of curves, trends, and graph from the government data. And physically, I collected a lot of data for groundwater, dam, tank levels etc. Those data are also mapped inside the paper.

So, you could ask the Atree office to share the data if they are willing, or you could take from the graph, you could understand the trends and write it in your report. So, that is where you have project reports, which have the data and your annual reports from NGOs, which they submit annually to the government or to the funding agency will have all these data as a supplement.

Mostly NGO data are available because they would like people to use it, unlike academics, because academics, papers, they write a lot and they have to save the data until the papers are published. Whereas these type of NGOs', they promote more data sharing, and they actually give you the data on request. Then they have lots of training events. For example, in IMWI they do a lot of groundwater trainings, surface water training, and for the training, they give some data and also take you to the field and collect data. All these data are stored in the database web page, you can click and access it.

Then there are monographs and white papers from the NGOs which are mostly focused detailed study reports or white papers, which is focused writing of a particular issue. So, monographs will have a lot of data about a study area. So, here we say Noyyal River Basin, if the lot of data is collected for that basin, then monographs are established, mono is single and graphs. So, it is a more studies and data from a particular region, whereas a white paper is focusing on a particular issue. So, here is where you could see that the rural water data can be mined from papers and NGO's and can be used in your research.

For example, in this book for the Ganges water basin, they had conducted study on transmissivity, hydraulic conductivity, and specific yield for the region. Sometimes that data is not available readily for the public. However, the data is here, you can go and take the data and use it in your models.

Also, the layers, how many layers of the aquifer are given in these reports, you could take it and use it. They have done conceptual models, and hydrological model setup, which you can use to understand the water budget and make water management better. So, this is how you could use report data. I am giving one more example here where you can see groundwater depletion and location of the tanks, you can see here there is a very Pallipalayam tank, and then there is an Orathupalayam reservoir, all these things can be mapped into the GIS layer.

And that layer is inside this book, which is the water management and the Noyyal River Basin, it talks about how the water travels from the Velliangiri Hills through the villages and cities and then goes out. Throughout the lot of data as I said, we collected I collected groundwater data tank data and it is in the book, you could refer the book to study about that region.

Similarly, there are other reports for various regions nationally and internationally that you could collect for your work. I hope I clarified how you could mine data using Google, using the books, using the publications. Please do not say that there is not enough data that may be the case, but you can also write to these people as email and get the data for your work. So, with this, I would conclude today's lecture. I will see you in the next lecture where we discuss more on databases at state level. Thank you.