Groundwater Hydrology and Management
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Indian Institute of Technology, Bombay
Lecture – 4
Reservoir Storage Data

Hello everyone, welcome to NPTEL course on groundwater hydrology and management. This is week 11 lecture 4. We have been looking at data for understanding the groundwater hydrology in the past weeks. And in this week, we are looking at the other parameters that you can use in the overall groundwater storage water budget to estimate your groundwater levels and management.

So, in that note last class we looked at rainfall and how rainfall comes in and goes into your aquifers because you need water to go in way. But to understand what is the percentage of rainfall that goes in, we also need to understand how much water is stored across the basin in dams, rivers, et cetera.

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So, for that, it is very important to understand the surface water storage and river discharge data. Many agencies monitors surface water and rivers and they could be international national and state. And thus, please understand that international because these big river basins are trans boundary in nature, which means the countries are many included in one river basin.

For India, let us take the Ganges basin you will know that Ganges starts somewhere in Tibet, China flows through Nepal and then goes through India. The Brahmaputra, the other side also comes from the west like west parts of your Asian country. So, it comes along the east, for India, it is on the eastern side and it flows westward, the water flows westward goes into Bangladesh and joins the ocean and seas.

So, please understand that these boundaries exist and that is where the agencies differ for each water river and storage network. Because the water flows and then gets stored in these dams and irrigation projects. So, to understand that, it is important to first clarify the differences in who monitors these water storages. It is not one agency alone, there are multiple agencies and the data has to trickle in from all these agencies to better understand it.

So, for smaller storage structures, it is okay we do have data in India or smaller river basins or sub basins of the bigger basins. And also between states there are some non sharing water data because of the sensitivities. So, let us take a step back and reactivate. The water storage is happening in large basins and the large basins come under international category if they are transboundary nature, if the water flows through multiple countries, at least two countries.

And then they are national level the whole of India is enough to understand one particular river and its tributaries. For example, the Narmada, Kaveri, but it is also bifurcated as states. The Kaveri basin is one good example that in Karnataka, it is flowing and also in Tamil Nadu. So, the data which is housed in Karnataka part may not be given to the other states and agencies because of the sensitivity.

So, they claim it as it is sensitive data because it could lead to some misinterpretation. And so that is not released outside. We will show you how these data are when we look at the WRIS website just for water storages. So, I am going to share that screen on the WRIS page.

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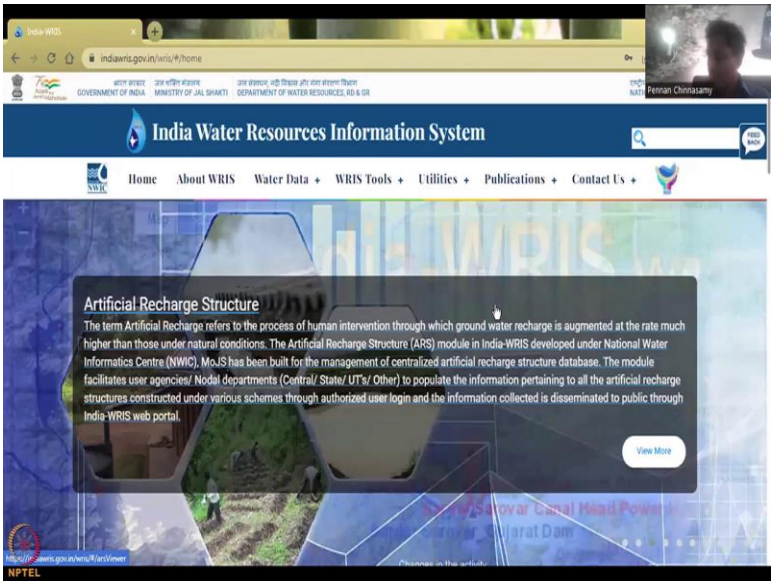

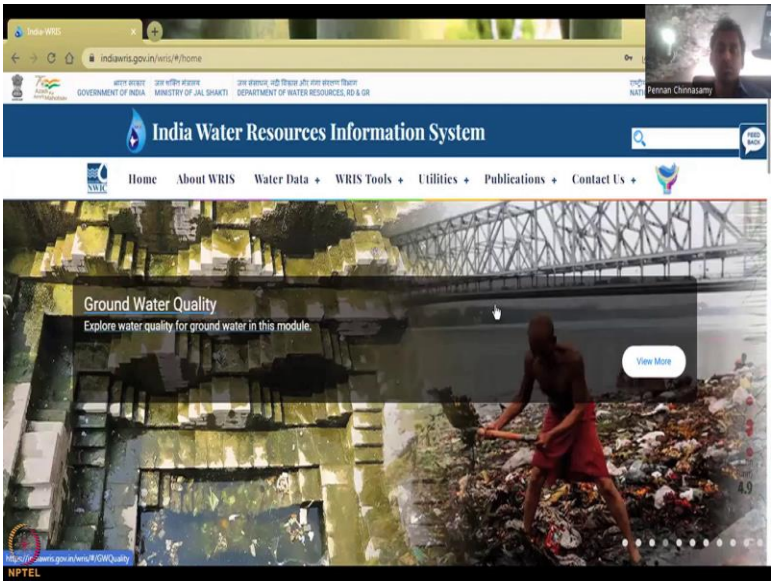

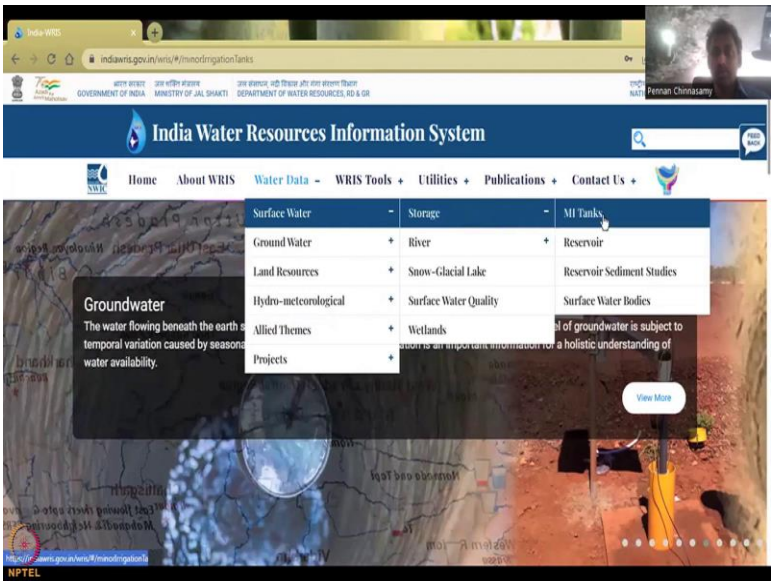

You will see that I have come to the main page. Because what else we want to look at all the water data stored in this web page and we go to surface water. So, initially for groundwater we went into exploration all these data then we will look at hydrometallurgical rainfall. We will also look at ET and soil moisture, but for today, I thought we would first look at storage. So, I will go to storage and I click at MI tanks.

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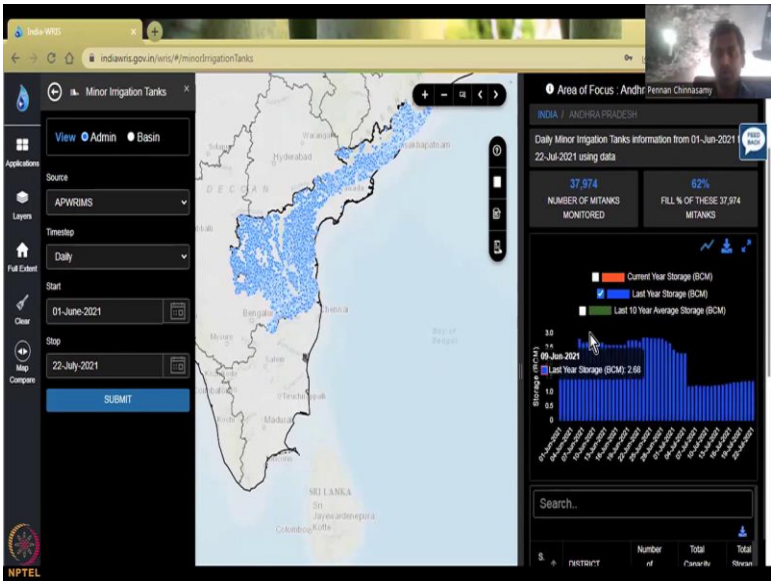

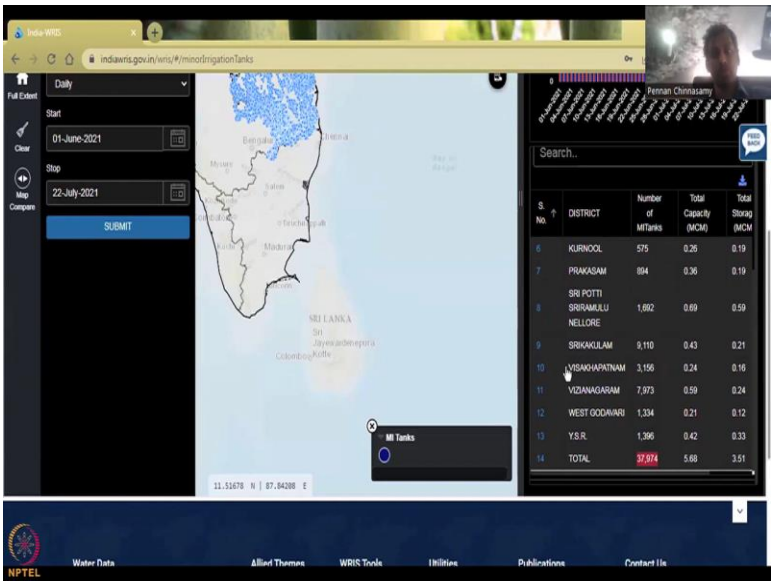
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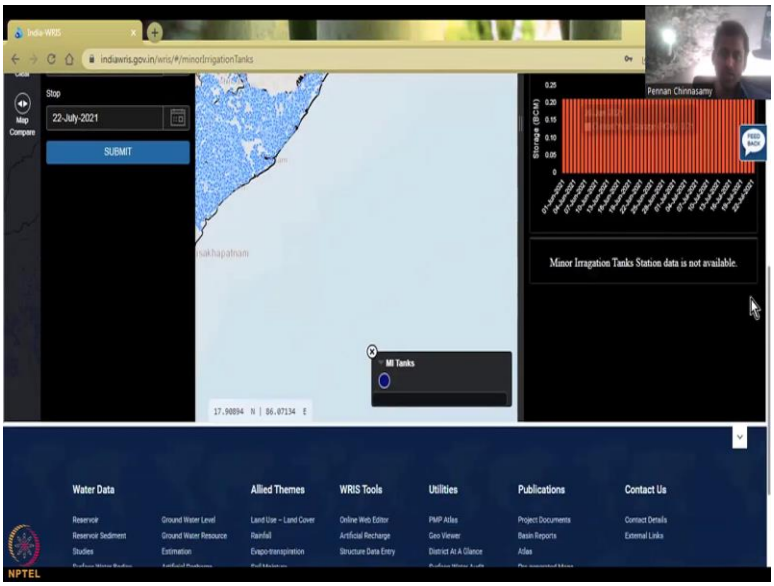
6 KURNOOL 575 0.26 0.19
7 PRAKASAM 804 0.36 0.19
8 SRI POTTI SRIRAMULU NELLORE 1,692 0.69 0.59
9 SRIKAKULAM 9,110 0.43 0.21
10 VISAKHAPATNAM 3,156 0.24 0.16
11 VIZIANAGARAM 7,973 0.59 0.24
12 WEST GODAVARI 1,334 0.21 0.12
13 Y.S.R. 1,396 0.42 0.33
14 TOTAL 37,974 5.68 3.51
MI Tanks
11.51678 N | 87.04208 E
NPTEL
Water Data
Allied Themes
WRIS Tools
Utilities
Publications
Contact Us


India-WRIS
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Map Compare
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Storage (BCM)
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MI Tanks
17.90894 N | 86.07134 E
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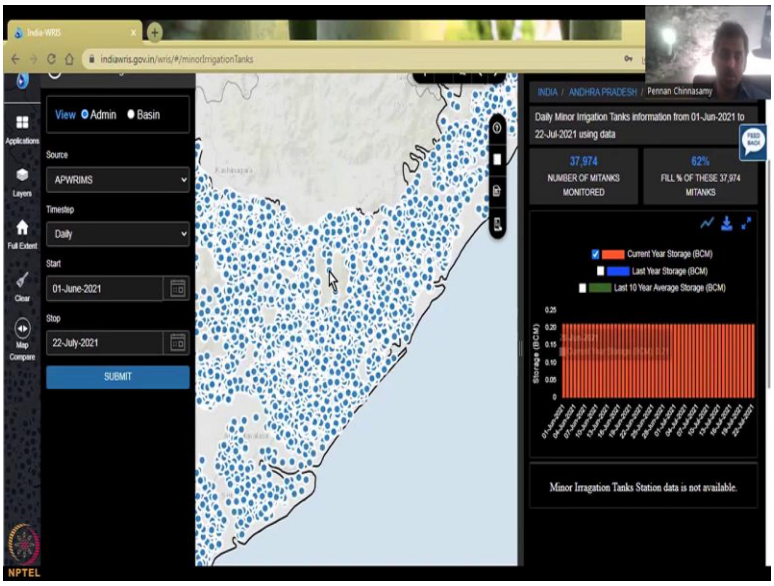
Reservoir
Reservoir Sediment
Studies
Ground Water Level
Ground Water Resource
Estimation
Land Use – Land Cover
Rainfall
Evapo-transpiration
Online Web Editor
Artificial Recharge
Structure Data Entry
PMP Atlas
Geo Viewer
District At A Glance
Project Documents
Basin Reports
Atlas
Contact Details
External Links



So, what is MI tanks? These are the minor irrigation tanks. So, we understood that when water is stored in these irrigation tanks, water is then released into the land by through channels and canal areas and that canal areas also recharge groundwater. What you see here is only one state in India has put their data on this website and that is the Andhra Pradesh data. So, it is clearly saying as soon as I open the web page, automatically it goes to Andhra Pradesh.

It says India, Andhra Pradesh, I did not select a particular state but because only that data exists, it is going there. And it says around 37,000 or 38,000 minor irrigation tanks are there from one June 2021 to 22 July 2021. And their storage levels are given at a daily step. And you would see that you have the current year, the last year, and the last 10 years. You could click it to see how the data populates. So see, the last 10 years the data shows that it is not fulling that much.

Dam levels are not increasing that much. Whereas the year last year has been a good productive year for the storage. But the current year, the current data what we view seeing has the highest. Current means this one the 1st June to 22nd July. And if you come down all the how many are there, you can see all these. All these tanks data is given as a district. So, each district has 517. For example, the number of tanks are again, and all of them are two 37974.

So, in due course of time, I would expect that all states will put the data here where you have the location of the tanks. And you can also click and go into that. So, let us say seek three curriculum district. The district boundary comes up, because of the location of the minor tanks, it does take some time to see the district. But what is important is all the total storages are given. If you see

closely, sometimes the total storage numbers are same, because these are built on a particular size and dimension.

So, all these minor irrigation tanks are built, and it gives you the data on the storage. It also says 62 percent full on these average tanks. So, for example, all the tanks are taken, their water levels are taken as per their storing capacity. And their percentage is calculated as an average. It says minor tanks data is not available. That is fine. But we can also click on a particular location and a particular time to see the data.

And I would not be surprised if the data does not show up readily. Because again, this is the only state that has at least put all this location data on the WIRS website. So, there it is populated. Let me try one data.

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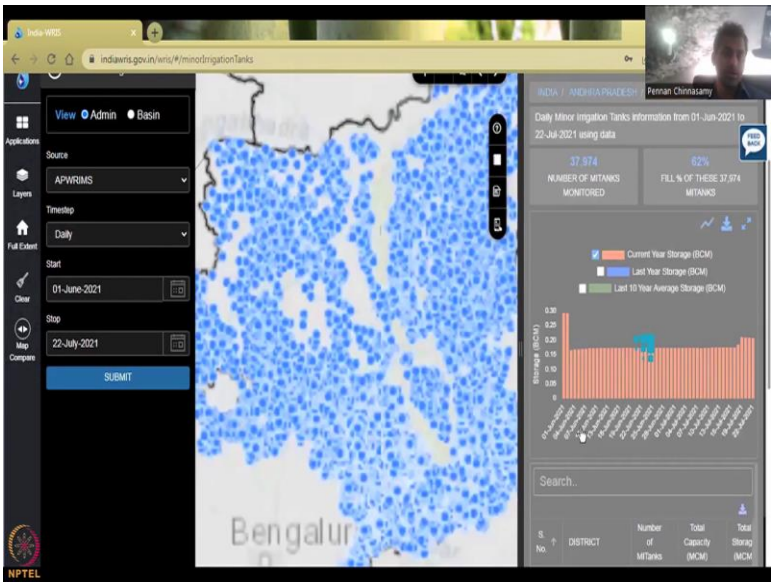
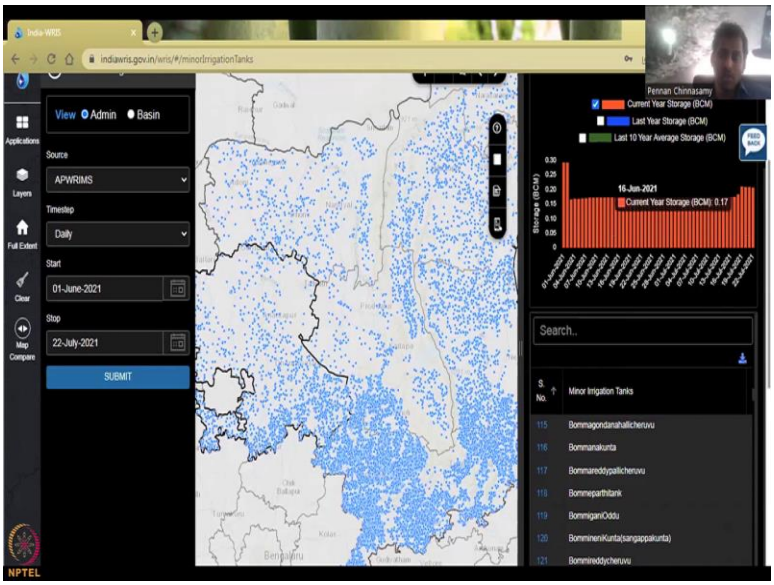
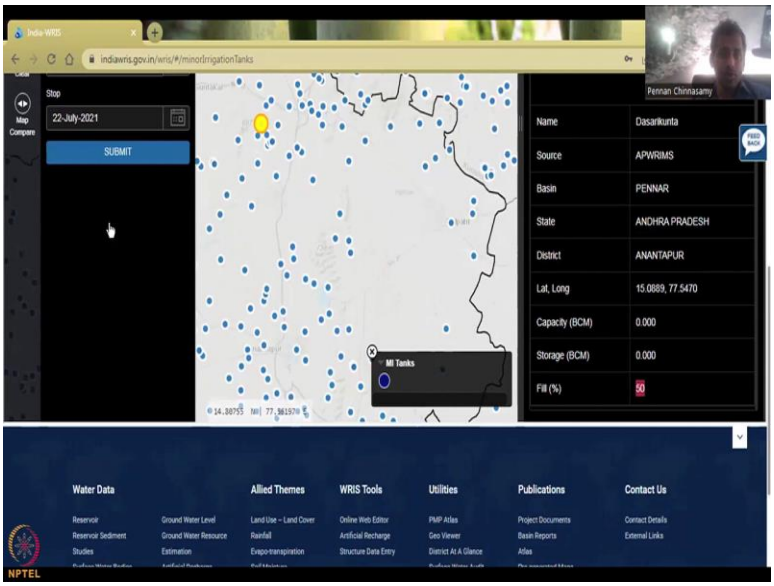



India-WRIS
indiawris.gov.in/wris/#/minorIrrigationTanks
Pennan Chinnasamy
View Admin Basin
Source
APWRIMS
Timestep
Daily
Start
01-June-2021
Stop
22-July-2021
SUBMIT
Current Year Storage (BCM)
Last Year Storage (BCM)
Last 10 Year Average Storage (BCM)
16-Jun-2021
Current Year Storage (BCM): 0.17
Storage (BCM)
Search..
S. No.
Minor Irrigation Tanks
115 Bommagondanahallicheruvu
116 Bommanakunta
117 Bommareddypallicheruvu
118 Bomneparthitank
119 BommiganiOddu
120 BommineniKunta(sangappakunta)
121 Bommireddycheruvu
NPTEL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Stop
22-July-2021
SUBMIT
MI Tanks
Name Dasarikunta
Source APWRIMS
Basin PENNAR
State ANDHRA PRADESH
District ANANTAPUR
Lat, Long 15.0889, 77.5470
Capacity (BCM) 0.000
Storage (BCM) 0.000
Fill (%) 50
Water Data
Reservoir
Reservoir Sediment
Studies
Ground Water Level
Ground Water Resource
Estimation
Allied Themes
Land Use – Land Cover
Rainfall
Evapo-transpiration
WRIS Tools
Online Web Editor
Artificial Recharge
Structure Data Entry
Utilities
PMP Atlas
Geo Viewer
District At A Glance
Publications
Project Documents
Basin Reports
Atlas
Contact Us
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External Links
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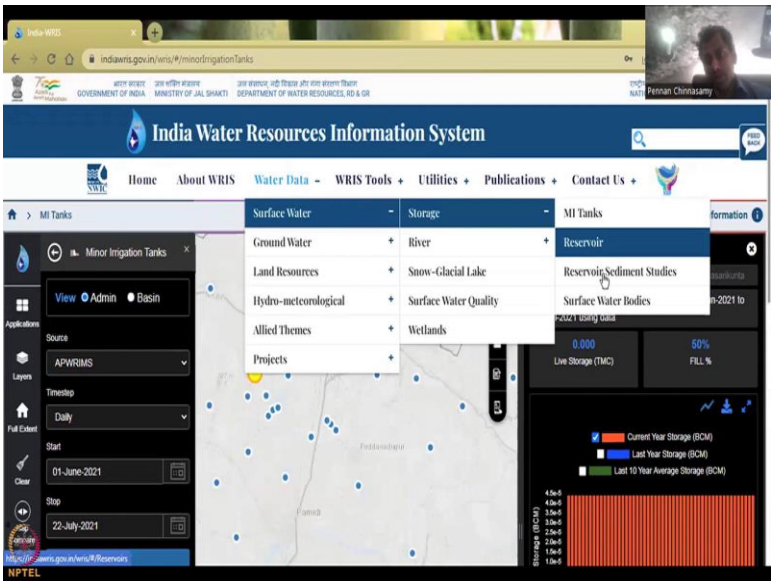

So, let us go back to Andhra Pradesh. Let us go back to the first Anantapur district. Yes, so there is a district comes up and I hope this is Anantapur district and all the minor irrigation tanks are put maybe because even once it takes too much time to load, then please understand that there might be some issues in the network speed also. And you can come here the tanks have come.

You could see the tanks, you could click on one tank and then see the values of these individual tank values. Right now what you see is the district tank value, I mean you can also download this data for viewing later. See, you have here the data for this tank. The data includes the Dasarikunta is the name of the tank where it flows., it flows in the Pennar river Andhra Pradesh, Anantapur district, the location lat long of the minor irrigation tank.

The capacity storage is 00, or this could be an error because the 50 percent fill is there. So, this is a good data for understanding that if rainfall is happening, not all water can flow and recharge your groundwater because some water is also stored in these tanks. You can also change the date and see other time zones but we will pass this and then go to the storage reservoirs. Before we go to reservoirs, I would like to talk about the reservoirs sediment studies.

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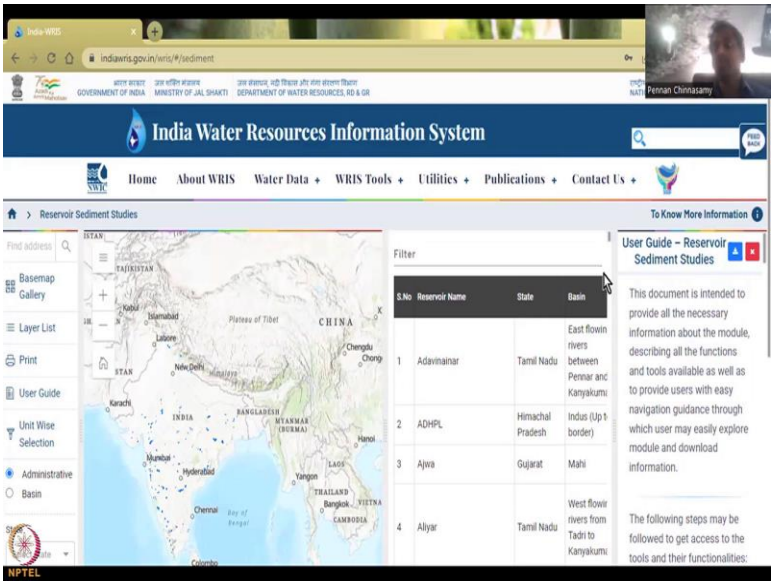

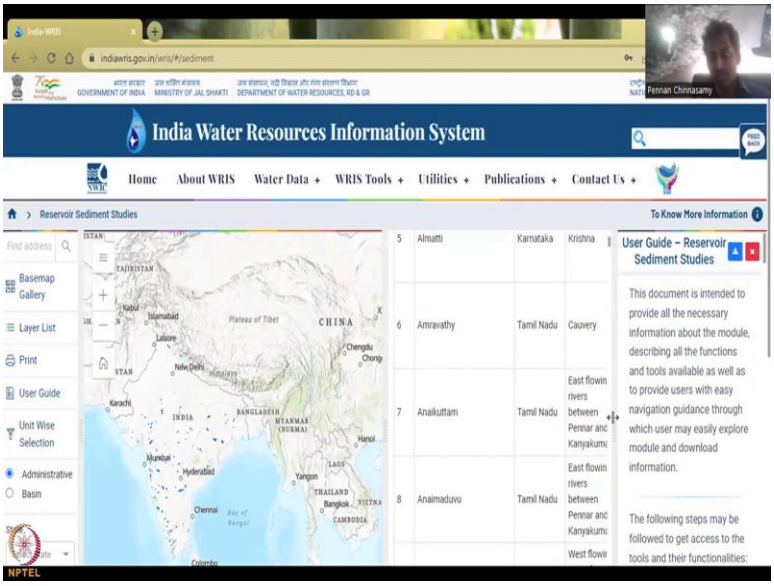

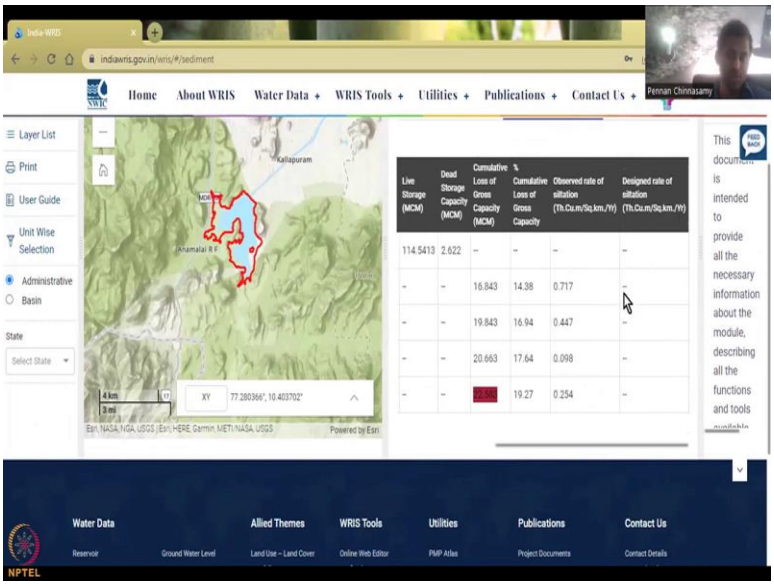

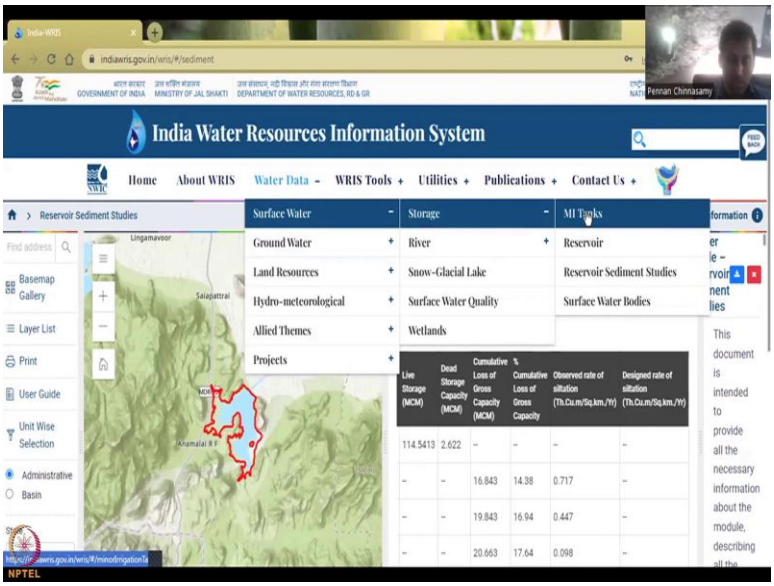

See, when there is sediment in the reservoir then the recharge potential is also affected. Because water on top of the water column or the water stored in these dams and irrigation structures are less. So, once that water is less your recharge is also going to be less. You might create the head the potential water level can be created and water can be pushed down. However, there is some lack in the recharge.

So, you have to be careful about that part how much water is recharging into the aquifer. So, here we have reports of the sediment analysis done. For example, I could just move this to the side and then you can see here Amravati. So, I am just going to click it for Tamil Nadu Kaveri basin,

what you will see is it will populate the data that has been taken as a survey for this water body. And this water body is mapped first.

And then you could see the number of years the survey has been done. The last one was done 10 years ago at least in 2013. By the state government agency, the total storage was assessed committed loss of gross capacity. So, how much is lost is assessed and then the sedimentation rate and other things are assessed.

So, this is important to use the budgets wisely to create these structures as a groundwater recharge structures, remove the sediments use the sediment in another fashion so that more water can recharge. Still only less amount of data is in this website. So, hopefully it will be getting populated, please use it. However, see I do acknowledge that there are some issues in this website in terms of time, space and resolution.

Our, this is one of the best data sources available for water resources assessment, especially groundwater resources. So, you could be patient and write to them or go to the state agency and ask for more data in person. And then I am going to go to the reservoir.

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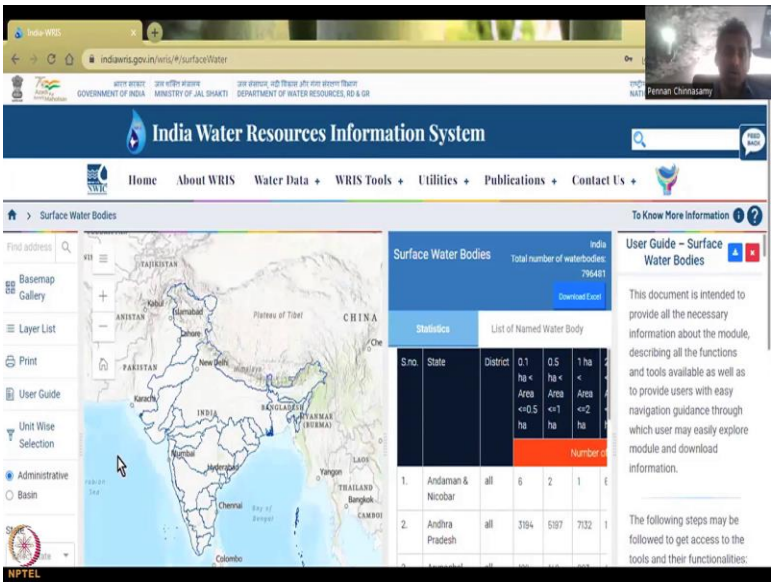

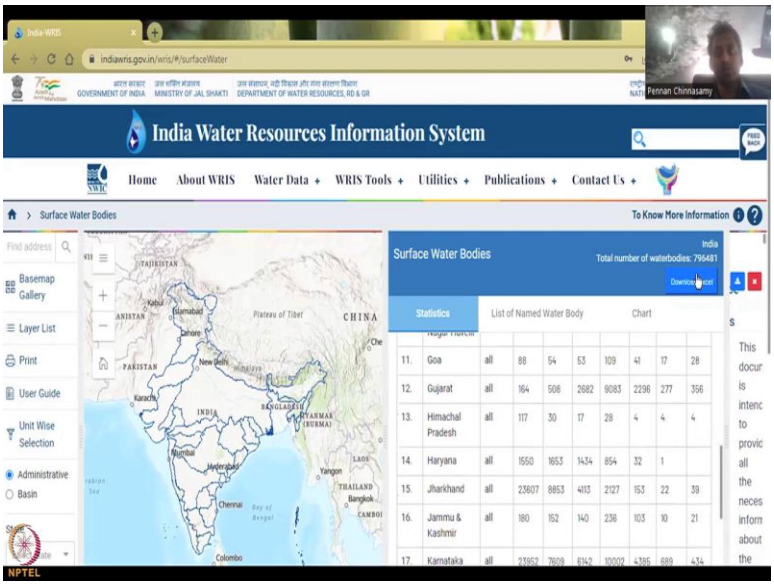

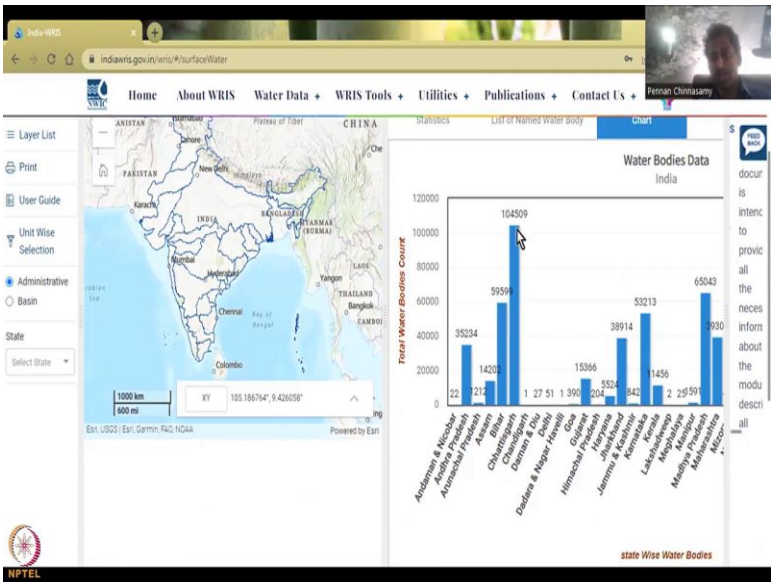

Surface water bodies would just include your lakes, ponds locations and the number of water bodies as classes. So, is it greater than one hectare, lesser that one hectare how many in a particular state. It is basically a location specific data. Let us take the state for example. I am just going to make this smaller so that we can see the location number of water bodies as per the area.

So, as per the area has given, let us say in Andhra Pradesh, we do have all districts across all districts, this is the total number of water bodies per class. And you will have the total at the end you can also download this used as a chart, which does take some time to make. So, as per the chart you can see number of water bodies count. So, you can see that Chattisgarh has one of the highest number of water bodies.

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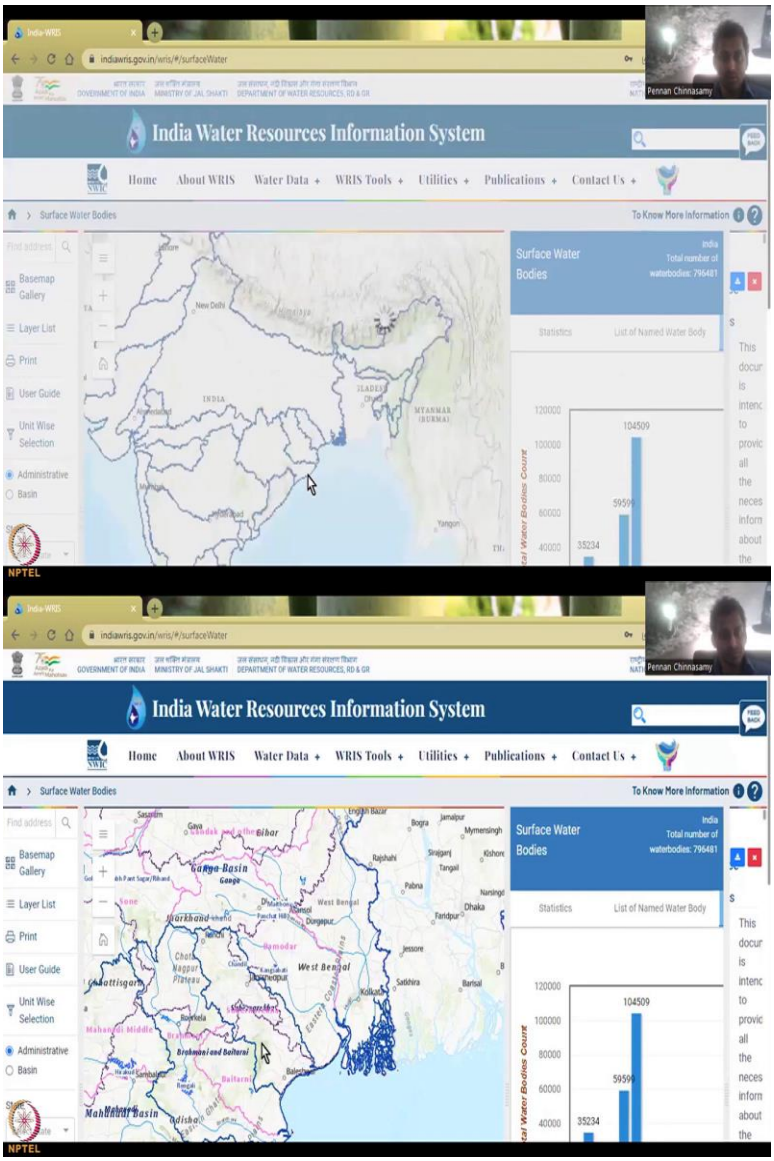

I am just going to make this small so that you can see the whole graph. So, it is the highest followed by West Bengal. So, these are small but they have the highest number of water bodies. And if you could go into the data, you could see what is that water body? What size is the water body? Those kinds you can see. And it does get slowly populated because of the number of data points that is there.

And we did see Chattisgarh in West Bengal having a lot of, so I am just going to go there. And it is still updating, the data on these websites. So, there you go, you see all these small small when you zoom in, you can see the small small water bodies popping up. And that is what constitutes your data while making these models.

Per district, so it is not as friendly as the other websites tab, like here they are, these tabs it is not as friendly because they are still populating the data and hopefully, they will get all this data into the main web page.

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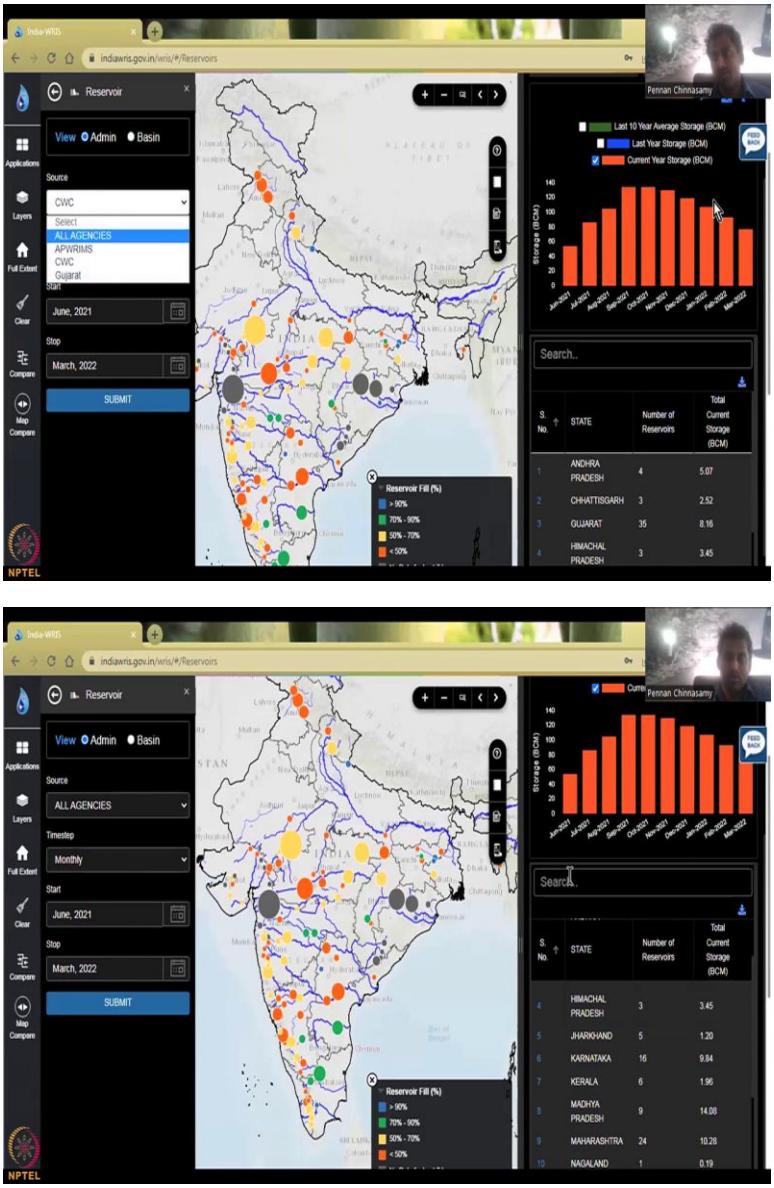

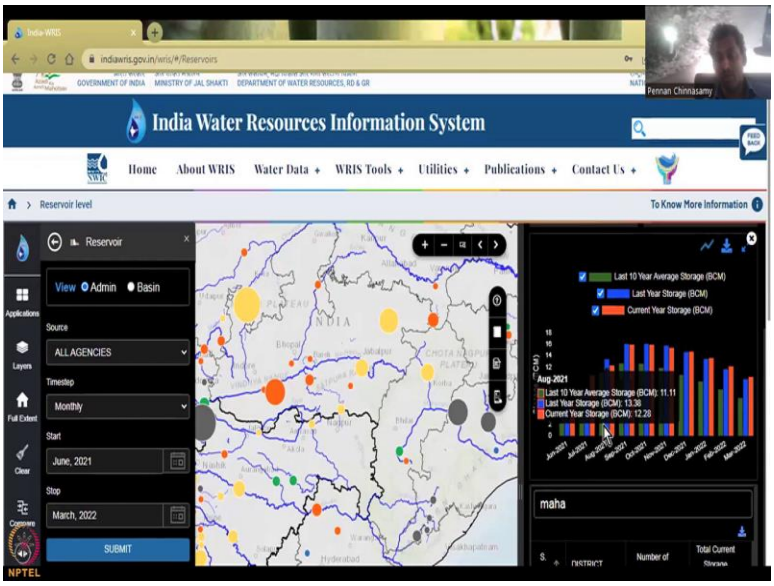

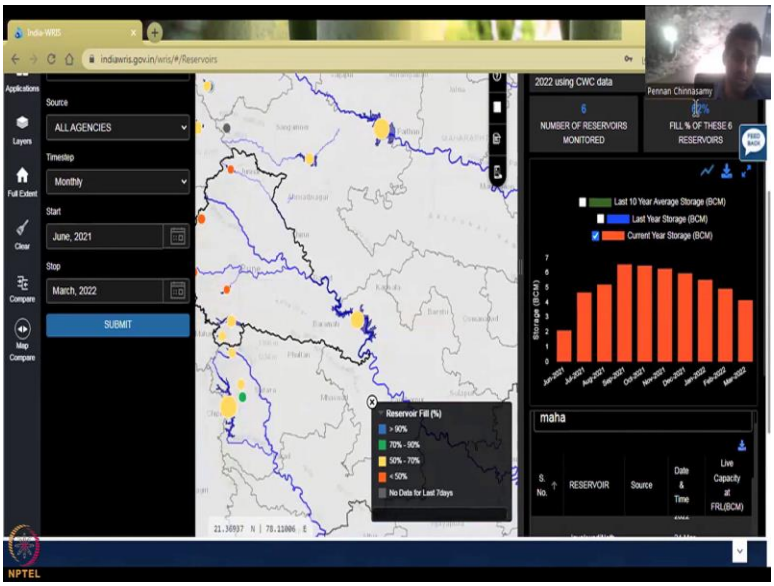

Now we are going to go to the reservoir data. All I did is water data, and then go to surface water and then reservoir. Sorry, go to water data surface, water storage and reservoir. This comes up, so what you see here is the same default date comes up from first Jan June to 30 March 2022. We are having around 138 reservoirs of which 46 percent are, is a full capacity. And because right now also we are in the nearing the summer period, so there is some water use.

So, here if you have CWC alone, then this is the number of reservoirs monitor, but I want to use all agencies so that we also see the state owned agencies. Still, the number is the same, which means all the agencies have been incorporated and then we are going to look at Maharashtra for

examples. So, how do you pick Maharashtra? Same the way the data has been arranged, so come down and select Maharashtra, wherein you can select or even type. Let us type it as Maharashtra.

So, number of large reservoir are 24 in number. When I zoom in to the state it goes directly to the map goes directly to the state. We have 24, so think about it 138 for all of India, of which 24 are present only in Maharashtra. Similarly, for the last 10 years data, you have the last year storage data and the current year storage data which has been mapped here for the date. So, always does agree that you have good data for reservoir storage at a daily interval.

And underneath you can also see the districts and where the districts are high with the groundwater storage and also the tank storage systems. I am going to click Pune, because Pune has a lot of reservoirs, at least 6 in Pune. And it is highly full compared to the overall average, overall 48 and 42 percentage is respectively and just in Pune you see 62 percent. So, the district has been zoomed in when I clicked Pune. And the reservoir name is here.

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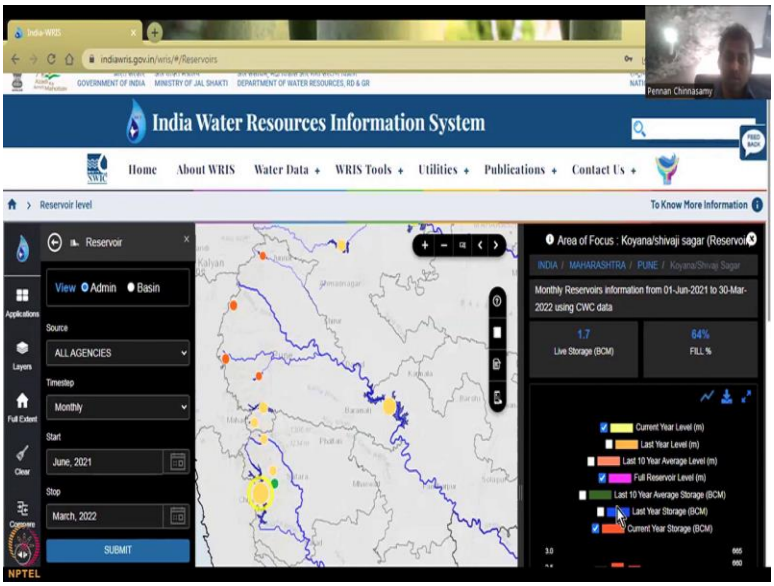

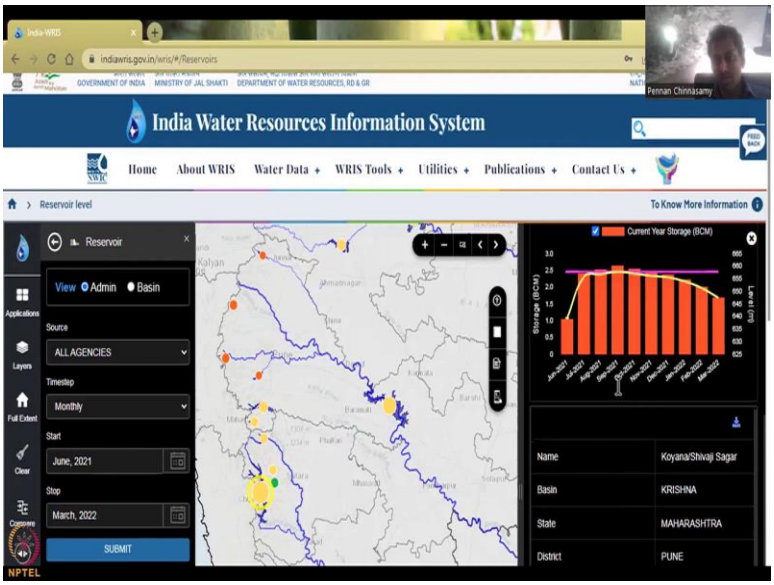
India-WRIS
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GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES, RD & GR
Pennan Chinnasamy
India Water Resources Information System
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Publications
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Reservoir level
To Know More Information
Reservoir
View
Admin
Basin
Source
ALL AGENCIES
Timestep
Monthly
Start
June, 2021
Stop
March, 2022
SUBMIT
Current Year Storage (BCM)
Storage (BCM)
Level (m)
Name
Koyana/Shivaji Sagar
Basin
KRISHNA
State
MAHARASHTRA
District
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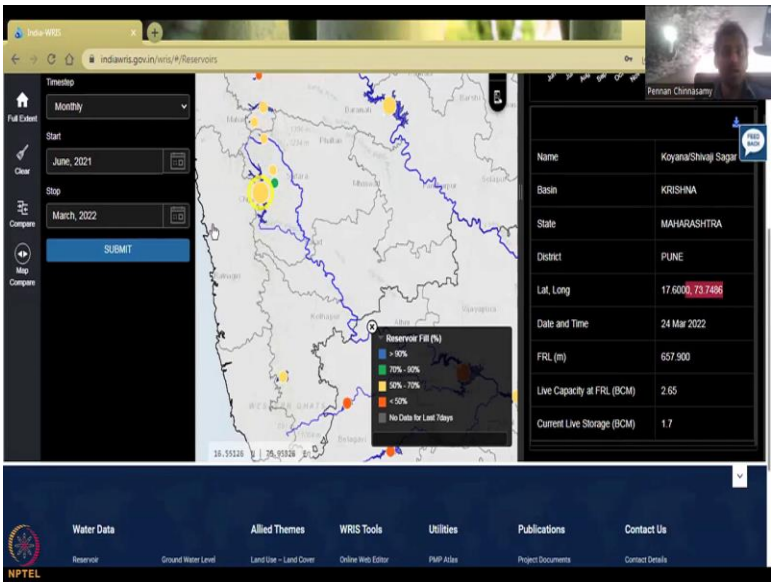
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indiawris.gov.in/wris/#/Reservoirs
Pennan Chinnasamy
Timestep
Monthly
Start
June, 2021
Stop
March, 2022
SUBMIT
Full Extent
Clear
Compare
Map Compare
Reservoir Fill (%)
> 90%
70% - 90%
50% - 70%
< 50%
No Data for Last 7days
Name
Koyana/Shivaji Sagar
Basin
KRISHNA
State
MAHARASHTRA
District
PUNE
Lat, Long
17.6000, 73.7486
Date and Time
24 Mar 2022
FRL (m)
657.900
Live Capacity at FRL (BCM)
2.65
Current Live Storage (BCM)
1.7
Water Data
Reservoir
Ground Water Level
Allied Themes
Land Use – Land Cover
WRIS Tools
Online Web Editor
Utilities
PMP Atlas
Publications
Project Documents
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Contact Details
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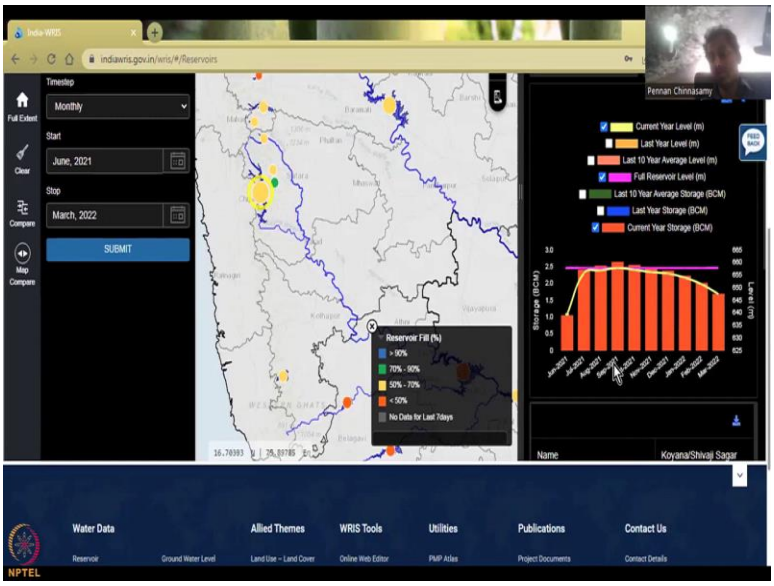

So, let me click the Koyana Shivaji Sagar Dam, it is live storage is 1.7, the current storage is 1.7 billion cubic meters, which is approximately 64 percent of the total capacity. Normally, they do not go about 70 to 80 because at that point, they have to worry about the safety of the dam and also the downstream communities so that they can release water and not flood them.

So, yeah, the last year data last 10 years data, and then the rainfall, the last 10 year average storage, storage current storage. So, the level is also given in the bottom. So, you have the storage on your left axis, and then your right axis has the level in meters. So, about this level, it does not go up because the full reservoir capacity level is given at around 6, let us say 655, 657.9 is the total reservoir capacity.

Again it is a, it is a default June to March I will also change it to show you one, one water period and how the data goes up for the same Shivaji we will do. So, it gives you more details the name of the dam Koyana Koyana or Sivaji sagar sometimes these dams have two or three names based on the Britishers period, the current period et cetera. And it gives you the basin in which these dam is placed, the state Maharashtra, district et cetera, the lat long which is important.

See, now, it has actually zoomed in and has selected for us the water dam and then when was the date last date the data was captured 24th March which is 7 days before. And we have the full reservoir level is 657.900. So, this is the full level as we were talking about the pink line, above the pink line the water need not be stored. So, slowly the water is released.

Actually, while the water level comes up to that point slowly water is going to be released because they cannot release it at once all the water. So slowly, they will have to release it so that people are not getting affected. So, the line capacity is around 2.65 billion cubic meters. In current storage capacity is 1.7 of the total. So, for example 2.67 billion cubic meters is the total volume of the dam of which the current storage current storage is 1.7.

So, there is still some percentages as well 60 percentages. So, we do have some percentage, what I am going to do is I am going to click on the date go to Jan 2021 December.

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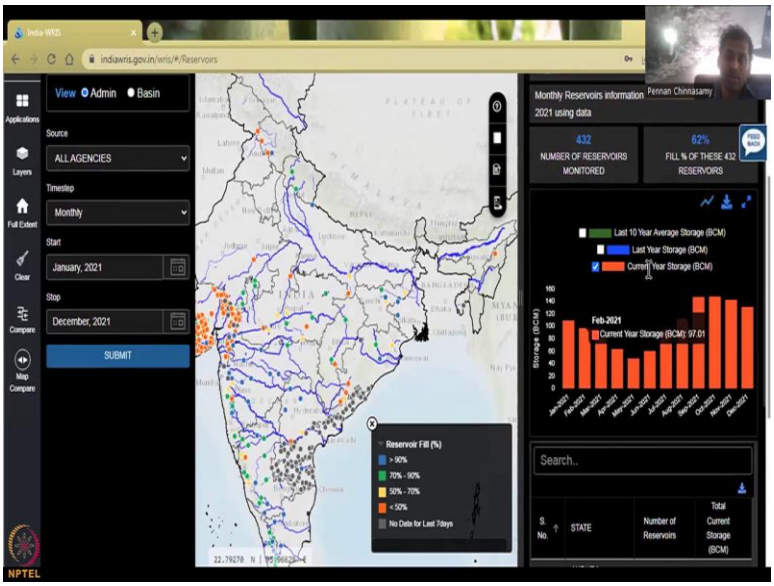

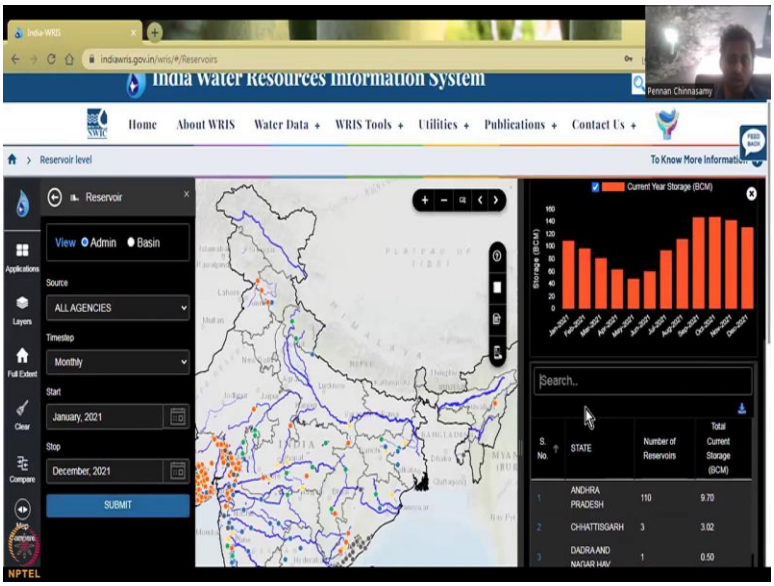

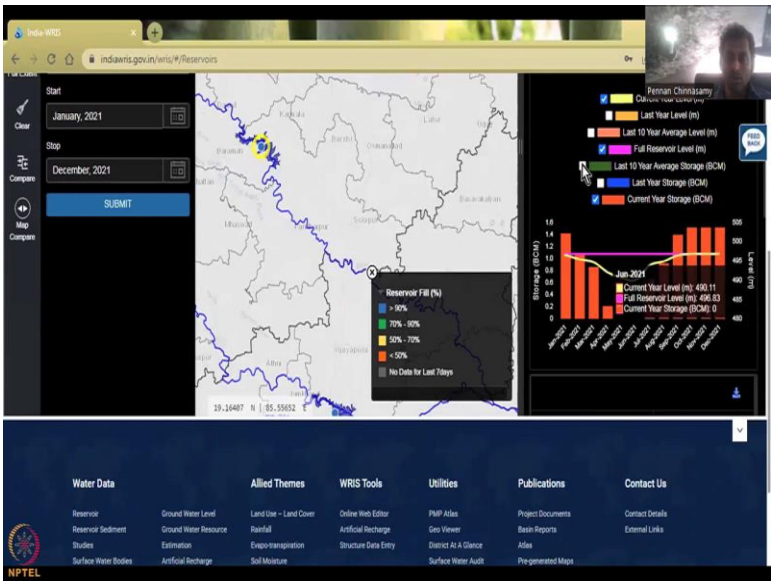

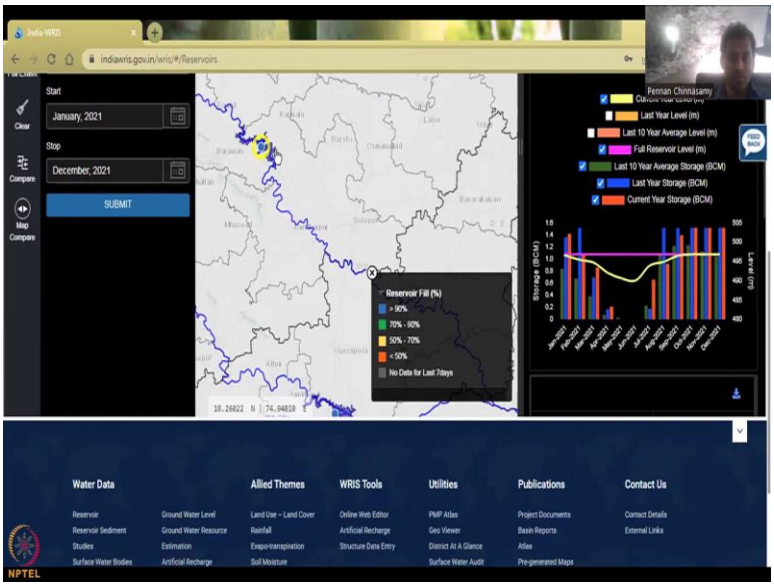

See when you take a full water year with the rainfall, you understand how the rainfall is generating this runoff and how much runoff goes into the groundwater aquifer. So, you can see here the level of the dam is high, goes down and then go starts picking it up again and very high.

So, the this picking up happens after the summer period in June because until May, June, or your groundwater levels, the storage water levels are declining and after June when the picks up the monsoons pick up then you have more water. It has gone back to India level again let me go back to my analysis state of Maharashtra. I click Maharashtra, this will be much faster than the rainfall data that we looked in the previous class because there is less data points.

So, now you could see that this system has been preserved how the water comes low during the pre monsoon period which is the summer and then during the monsoon it rises and then peaks. We have all these districts and as I said we will go to Satara district and the dam we want to see is the Bhima Ujjani Reservoir. So, here you could see 0 which means there is no water all the water has been exhausted.

So, when the summer starts and the pre monsoon conditions are there, all the water is gone and they release the water. So, if you look at 10 years average and last year average the storage during these months have been 0, which means all the water has been dried up and then after the monsoon comes the water has been captured. So, the 90 percent capacity et cetera has been established.

So, this is the reservoir you can see the blue volume represented as a 2D surface and you have all the other information needed for understanding how the live storage is and can you put more water in it. So, 1.52 is the live storage and it is 100 percent full in terms of your final data output in this period. Because December time normally the water rainfall stops in September, October and all the rainfall runoff slowly comes in and your base flow comes in.

This is where it is important to groundwater because groundwater flow discharging goes into these reservoirs and gets stored. So, for example, if the reservoir level is rising, even though there is no rainfall, then please understand that it is the after effects of the rainfall, most importantly the water goes into groundwater and then comes back to the reservoir.

So, with this I think we have showed how to select one particular reservoir and all the data that is associated with the reservoir. You can also look at the data agency, the data range and monthly, daily et cetera. I am just going to click daily to see if it works you will have to double check the year when to do 2020 December 31.

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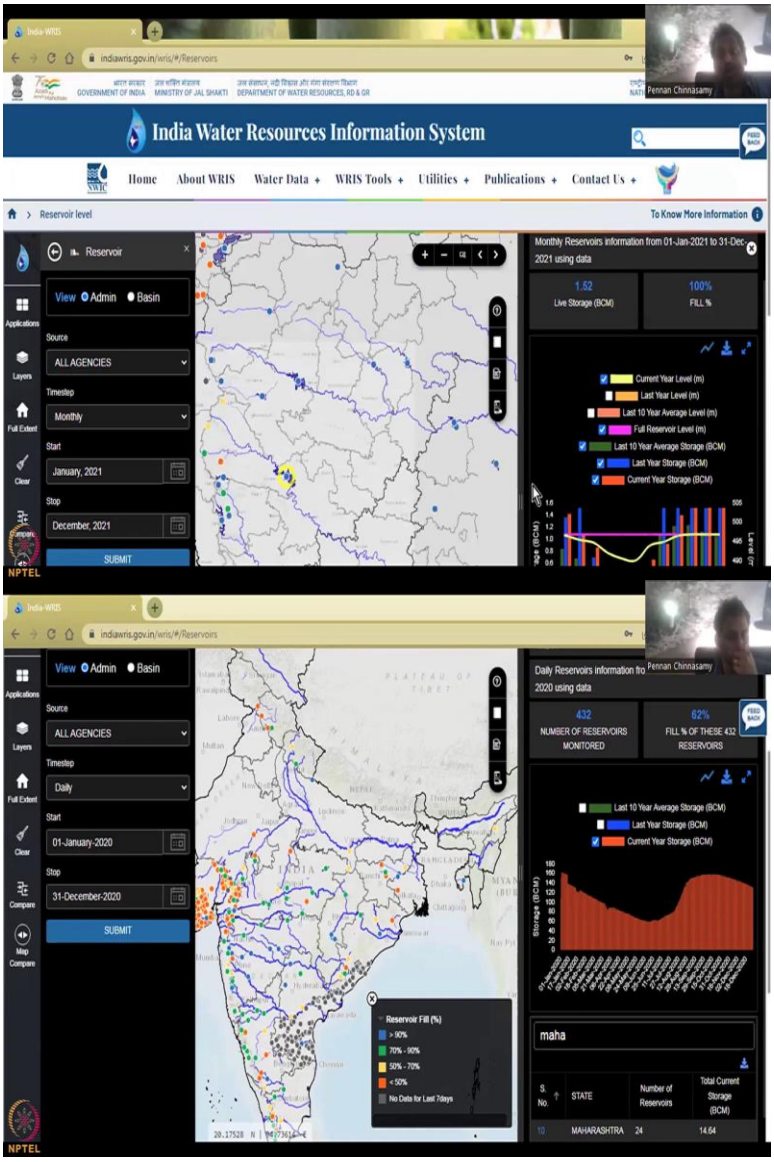

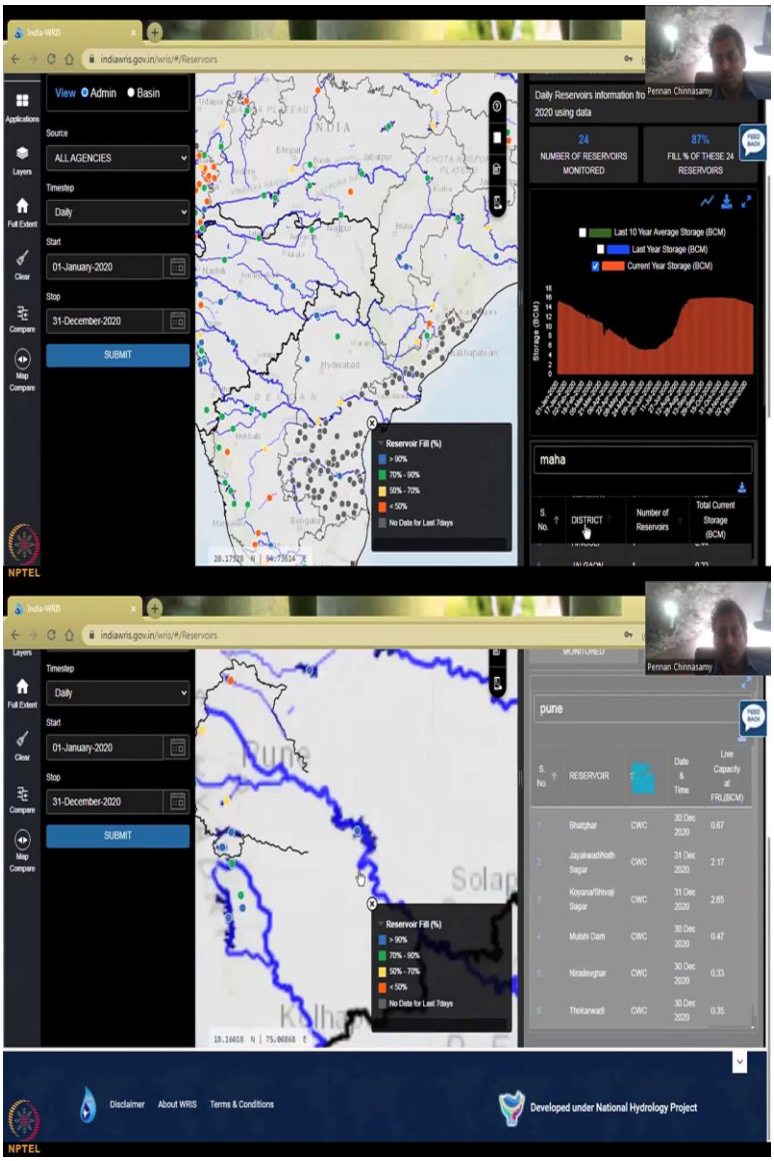

So, that is one full year I have selected and the data populates and if it is blue, it means it is full of water that is above 90 percent. Again for some reason it has to go back to the full India site. I am just going to quickly run through the Bhima reservoir because it is daily it does take some time we will see that see how much data points it has. Number of reservoirs, I am going to just go to Maharashtra again, click Maharashtra and then I am going to click Pune. There are 6 reservoirs the data is showing up, you could see the blue color coming up with that Pune.

I am just going to click the reservoir to see what is the name and what is the data. So, you have clicked Maharashtra we were looking at the Bhima so let us look at the Bhima again. So, the more data has come up. It is in Satara district then the data can be downloaded, all the data for

that particular daily thing can be downloaded. Sometimes there is a peak, you need to show if there is no rainfall, there is no peak that can happen.

So, these are the data cleaning that you would have to do eventually removing these peaks and outlets. So, locations are given the life capacity full capacity, when was the date and time the data was recorded. With this I conclude the surface storage structures for the groundwater assessment. We will see you in the next class. Thank you.