Rural Water Resources Management
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Types of Surface irrigation methods
Week 06 - Lecture 03

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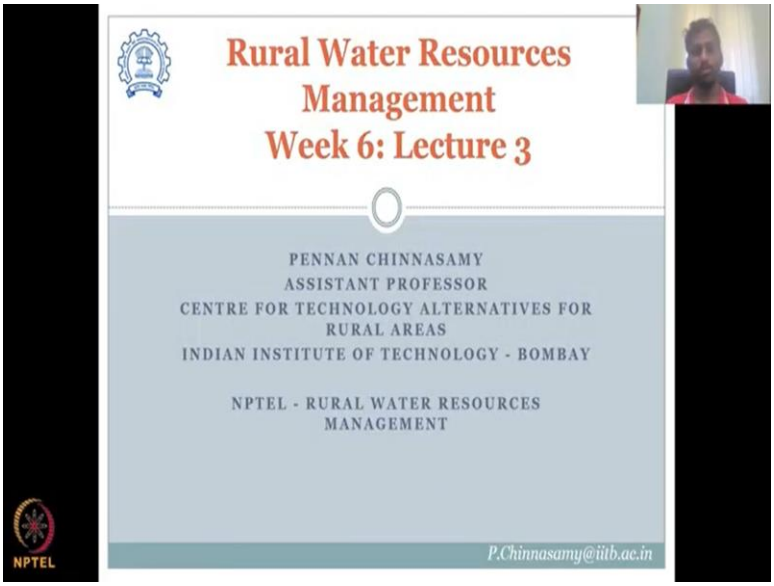

Hello, everyone welcome to rural water resource management course NPTEL, this is week 6 lecture 3. We are looking at surface water storages for rural water resource management and development.

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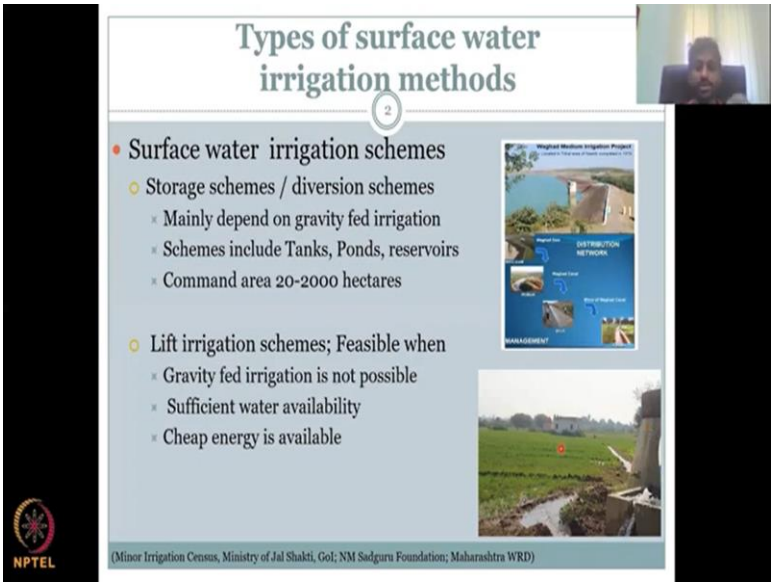

Let us look at the types of surface water irrigation methods. So, please understand before we get into this surface means above the ground and when we have groundwater under the land we use groundwater aquifers and groundwater for irrigation. In this week of lectures, we are only mostly focusing on the surface irrigation methods, from the surface water on the top. So, the water is collected and stored above the ground it could be any method and that is what we are going to look at in this lecture the types, surface water irrigation schemes are there, it is mostly run by the government as a central government if it is transboundary nature or the state governments.

The storage schemes or diversion schemes are present for example you first have to store the water and then you divert the water using gravity fed irrigation channels. So, there are channels along which you have water taken from the dam or the irrigation scheme and then supplied to different farms using gravity fed irrigation, this word is very important gravity fed. So, gravity fed means you do not have to supply energy you have water at a higher elevation when you have a gate and a channel will comes down elevation you open the gate and water flows, water flows from high potential to low potential.

So, automatically water will flow through gravity. Schemes include tanks, ponds and reservoirs, so if you look at the size it also increases as we said tank is a smaller size, pond is a bigger size and reservoirs are bigger. The command area can anywhere be from 20 to 2000 hectares, so the command area last class we saw how to demarcate it. It is the area below the water structure where the water is going to be used. You can have a large area if you have a large water stored above the dam or the tank, pond, reservoir etcetera. If it is a small water storage like a tank then 20 hectares is good.

Lift irrigation schemes are another type of surface water irrigation schemes, it is feasible when gravity fed irrigation is not possible. Let us think about it why would gravity not work you have water you store the water and then you put a pipe and why would not it work. This would not work when your command area is below the water, which is for your normal schemes but what if the water has to be supplied to a land above the dam. That is when you cannot have gravity, because gravity does not push your water from a high potential to a higher potential, so you need energy.

When there is no sufficient water availability for example on the hill slopes and then you have a dam down you have to supply energy to pump it up, so that lifting is called lift irrigation. It can

happen for domestic use which is another lift type, but we are only focusing on the agricultural water beam, so which is lift irrigation. Energy is expensive in terms of if you use electricity or diesel power, but there are other local cheap energy sources also available.

So, if you look at the pros and cons of how much water is going to be spent in lifting the water and supplying the water and how much energy is going to be spent for it and the cost that is going to be benefit for the farmers, there is always pros and cons. Sometimes we need to keep the farmers on the top also happy, so there is a subsidy given by the government to put the water up there, so that is the lift irrigation, so subsidies also work, there are cheap energies available but also subsidies work.

And these happen in mostly villages where your land is also not connected to your main channel. For example here you have the let me turn on my pointer, so here you have a dam in the, it is a medium irrigation project, because of the size and stuff. So, you have water actually stored and from here it goes into the PLWA which is the bigger channels and from there a smaller channel canal is going through. And from there it goes to the minor Waghad canal, which is your which leads to your farmers.

So, you have multiple leads from the water taken from the dam, it goes to a bigger kind of stream river like canal. And then it goes into a lined canal and then goes to a smaller canal which goes to individual farmers. Suppose the individual farmer is not near this canal what to do? Then also you have this lift irrigation wherein you have to supply energy to get water to the farmer. So, you will have to pump it to one small reservoir or small tank and from the tank it is released in a timely fashion to all other farmers.

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So, this is the very, very important difference between your canal irrigation versus lift irrigation. In your canal, you have water stored on a larger water spread area and from there multiple schemes are there to bring the water to the end farmer all through gravity. There is no pumps, it is only a gate and you open the gate or a small partition and then water flows.

So, look at this this is a big land on the top, on the hill slope or at a higher elevation where water is being collected. And from high elevation water flows to low elevation through gravity. So, it goes through the first PLWA where it is a bigger kind of a stream like a way it is just removed by the contractors to for water to flow so you can see water flowing like a small stream or river.

And then it goes to individual waghad canals and these canals actually take you to the WUA which is the water user association. And from the water users association it goes to the minor waghad canal, which is a small canals which take it to the individual farmer, every step is weighted by gravity.

Then we have this lift irrigation schemes. so in lift irrigation scheme what happens is there is water being put into the channels. So, you have this channels and water is put right next to it there is a pump house. And in the pump house there are some motors which are driven by different sources of energy and they pull the water and put it into this reservoir which you saw in the previous and supplies the water to the feed.

Now, these can be both small and large scales available small canal versus individual pumps. So, for example in the canals you can have larger canals as the main canal and then bringing it to smaller canals all it have a big irrigation scheme and only have small canals coming out because the farmers are all many there and they will just distribute the water. Same thing here you can have a big pump house for a large number of volume of farmers or you can have a small pump house or even small irrigation pumps along this canal to lift the water and put it into the land.

For example, here if you look the land is at actually at a higher elevation from the small canal how does water go into it because it flows from high to low elevation. Either you need to catch the water here and put it in or it is best but then you have to lose a lot of water due to gravity and recharge. So, here what happens is you just pump it right next to your land and put it into your land.

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Let us look at the individual cases for lift irrigation from a check dam. So, when you have a check dam, water is stored along the canal and it stopped. So, water still flows a little bit when it overflows. However, because of you stopping the water now you have enough water to pump if you just have a check dam and water is stored in the check dam and then you put small canals to take the water out sometimes it does not work, why? Because by the time you take the water, water is recharged or it flows over the check dam.

So, here is where you have a check dam and a pump house right next to the check dam so that when water stops along these check dams you can have a volume created and that volume can be pumped out for your farms nearby.

So, the NM Sadguru foundation has done very good work in the Dahod region it is a NGO. And 10 new community lift irrigation schemes were installed in 2014-15. So, if you look at it the word community is important because it does not work for one individual person this pump house and the management cannot work for one person, why? Because you are trying to monopolize the water if you use it only for one person. It is a community it is a communal source which means the water is coming it can be used by everyone but they do not have money so instead of individual pumps the farmers combine as one community and that is how this NGO works they help them form communities.

And they set this pump house the low cost and then extract the water and divert it to individual farms. So, here you are one farmer cannot do it by alone because the pump cost is really

expensive, however if you have a community of farmers who are willing to share the water in a communal way then this scheme really works.

And NM Sadguru foundation has done miracles in creating this lift irrigation scheme and pulling people out of poverty, because slowly these farmers have seen profit and they would able to repay also these maintenance and management costs which is huge when it comes to individual farming.

So, as I said this foundation has worked really well it is an NGO the link has been given in the bottom you could go and check it how they work and you could see that. For example they have the channel coming here and then there is a land which is right here and then the water is around here. So, how do you get water here that is a point and what they did is they actually built this lift irrigation schemes, so that they could pump the water up to the land and this land is now irrigated.

So, this land which was not seeing any vegetation for the last hundred years, because of them having this lift irrigation scheme and also the check dam which is blocking the water here little bit to have some water storage volume it is working now. So, it is a very good case studies and we will see some case studies in this new course and we move on.

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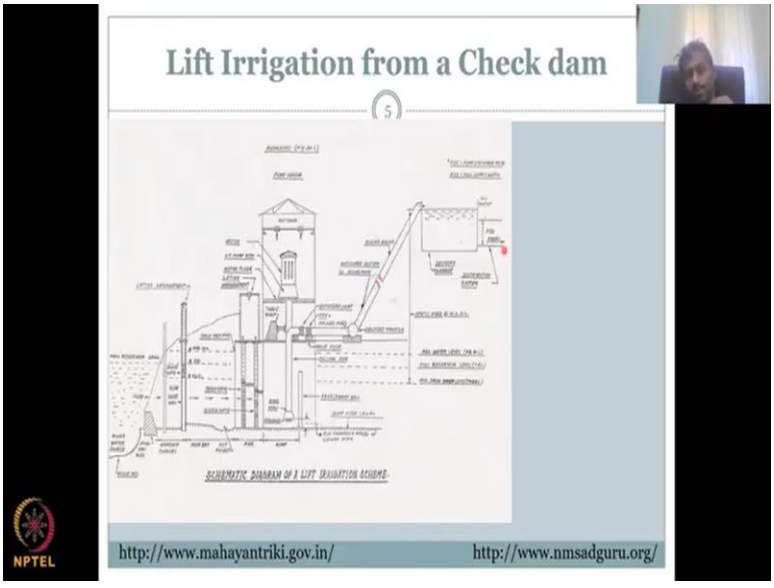

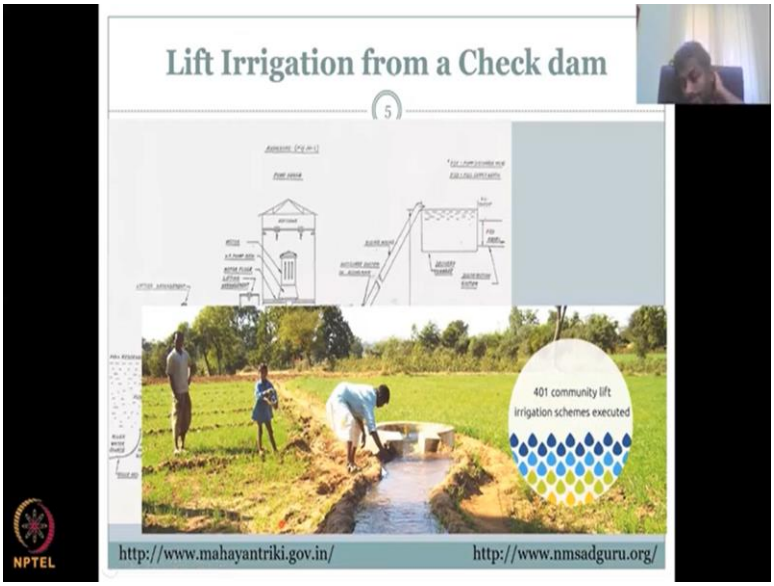

Let us see how a government lift irrigation scheme works, this is the from the Maharashtra government. What you could see is the water is being kept in the reservoir you first dam the water and you keep the water in the reservoir you build a water level. Once you build the water level there is a pump house a big pump house which can pump water up to higher elevations and put it into a storage tank.

So, all the schematics is given I would not get into the individual schematics, however you could see that the water is stored and from the water a pump is put to the pump house. And multiple segments are there to push the water up and also some mechanics are given so that the water does not come down to gravity and water fills up. Once water is filled up there is a feeder canal from which it goes to the distribution system and each and every farmer now gets the water.

So, there are many schemes it can be either a big tank and from the tank the water feeder goes to these smaller channels and from there it is the automatic gravity effect. So, once you get it to this part where water is going to be pumped from the reservoir to a massive storage. And from the massive storage to an individual farm location and from there the farm location water can be shared between farmers, so that is what is happening here the water is being brought up to from the tank to the outlet point and from the outlet point water can be shared.

Also note that sometimes if you do not have this there would be a tank a tank which can be smaller in size than a storage or just a pipe network this pump can be pushing water into the pipe network. And along the pipe network the farmers can extract the water and use it for their farms.

Because it is a communal source there is also meters here so that people understand how much water they use and they share it more responsibly.

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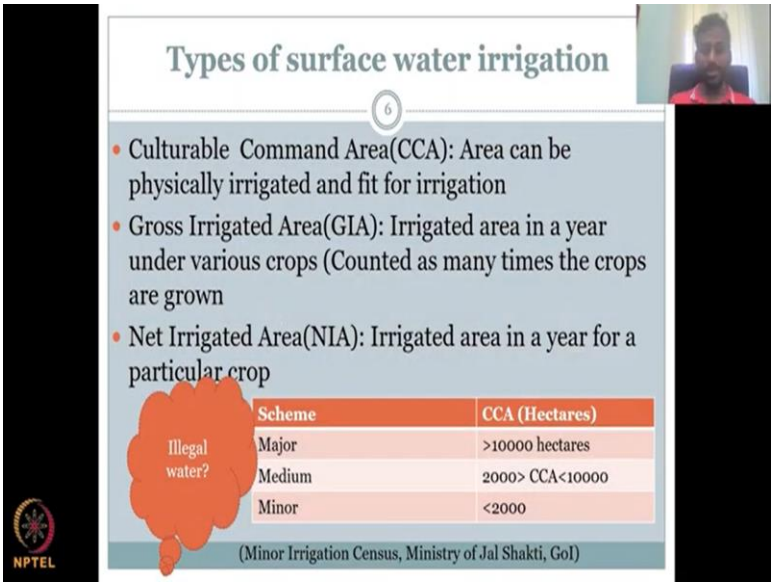

Let us look at the other types of surface water irrigation and more importantly the terminologies involved. You have the cultural command area which is called the CCA, which is basically the area that can be physically irrigated and fit for irrigation. So, culturable command area is below the dam or the water irrigation scheme and that is where you can send the water and the land has to be good for irrigation. You cannot just put water there and say there is no irrigation happening. So, a lot of survey will be done before all these structures are built because it is very expensive and they have to see how much is of the command area is culturable.

Then we have the gross irrigated area GIA, which is the irrigated area in a year under various crops of inside the command area. You will have an area which is irrigated and the grass is the addition of all the irrigated area for multiple crops. For example one area is a 100 acres and if the 100 acres is grown one time it is one hundred acres. However, you harvest it and then you count it again another 100 acres you know within a year. So, this actually gets back on how much water is used however the net irrigated area is only for one particular crop.

So, then we will say net irrigated area for example paddy price and that is the irrigated area only for one particular crop. So, in this schemes also the wording I used previously is it major minor schemes it is not only of the water that is stored in these big dams or reservoirs also it is the how

much CCA is there. So, a major dam or a major irrigation scheme is labeled for a scheme where the CCA is more than 10000 hectares, a medium is from 2000 to 10000 hectares whereas the miner are less than 2000.

So, this is how you could see how a major dam like the Saurashtra region has and the Narmada and then how a medium dam like the Vaga that is shown from Maharashtra differ. It is basically, how much area is there which is culturable and that area should have enough water to store.

On all these schemes, there is issues of illegal water use. You can have a culturable command area or a crossed irrigated area however there could be some farmers or some people who want to extract the water without giving due credit to the government as taxes or in numbers. If you do not give the numbers then the farmers who are downstream who are actually legally using the water will not get water.

Because the dam control person would say I have this area this is the gross irrigated area I am going to release the water. However, if the water is being consumed by other illegal aspects, then there is a loss. We will come back and look at the illegal water we discuss the communities and how water can be saved.

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As you know that these schemes are there for a long time some were started before the British period like for example the Kalani in Tamil Nadu. It was before the British built by the kings and then many were built during the British period and then we have post-independence water structures.

It is not possible for always the government to come and monitor and manage this because of the locations and the timely interventions that are needed. And for that there is an impetus a very important a push to get the community manage the water better. In other words also sometimes as I said in the last point there is illegal water use and to bring the government to catch these are not going to be possible because these are local villages.

So, you can also be monitoring this water use and efficiency using a community approach where the farmers would be not indulging in the illegal activities because they know each other. So let us see how our communities can come together and are coming together the recent times to manage these water sources.

Water acquisition in particular cleaning of channels and desilting of water bodies the check dams etcetera are much needed. For example you have a check dam and water is coming through water comes through a velocity and with that velocity it picks up sediments along the sides and other air areas and brings the sediments along. Once you stop the water you stop it and the velocity is zero just water stagnating the particles will fall down the sediment particles will fall down. Now,

if you do not remove this sediment what happens is your check dam is now full of sediment and the water will go on top of the earth's sediments and check dam.

So, there is no water stored so the check time is not going to be usable. So there is periodic maintenance and use of these water bodies for which you can have communities of farmers or locals villagers who use it for domestic use also. And they can come together and maintain the water bodies in a regular interval. That is what you are seeing on the top corner this image because sometimes there is a push so NGOS help. So, this is like the Dhan foundation is helping these people to come together and manage the water.

Also the Mandriga money which is a big budget for given for keeping farmers in the villages, by the 100 days work scheme. And that 100 days work scheme can be used for this kind of labor work the farmers who during the lean period during the summer period when there is no much farming activities. The farmers can be given the MGNREGA money to help in desilting these structures. It helps in both ways both the government is also satisfied and also the farmers know how much water is coming and how to protect it better.

Water allocation and distribution this is a very important part, as I said the water comes in the dam and from the dam channel big channel small channel and then WUA and then to the farmer. Now, how the monitoring can happen at the top level is very difficult for the water secretaries to see how the water is being distributed.

However, if you have a community at the WUA and at the farm level then the farmers can talk to each other and then distribute the water equitably and I say equitably it is almost equal share. And that is where the NM Sadguru foundation has worked well saying that I will build you these lift irrigation schemes however you will have to combine together and use the water amicably.

And that is where this is there, so what allocation distribution if the government official says maybe they know they not follow it. However if the community of farmers say there is much acceptance of this. So, release of water based on availability not on demand I can have the interest to grow sugarcane, however the water is not enough to grow sugarcane because if I grow sugarcane other farmers may not even have water for millets which is very less water consumption compared to sugarcane maybe one third of rice.

So, here is where you take a cautious decision of all farmers together and you say this is the water. Let us say 100 cubic meters we have let us divide it among 10 farmers at 10 cubic meters per head rather than saying no here sugar can let him get 90 and all the remaining 10 will get one one, no that is not correct. So, that decisions are taken by this community. Designated persons for different jobs example Neerkatti, Neergandi all these are traditional terms used for people to monitor these channels monitor the sediment levels and also monitor the distribution.

Decision making process a participatory decision making not a single person led. So, if you see here the women are also brought into the group to make these decisions, because they also want to know how much water is available based on that how much domestic livestock etcetera they can have. It is a participatory decision making not a single person decision making. Enforcement of rules and punishment of violators, so here is where I said the top authorities in the dam and irrigation network cannot come down and arrest people there is no police which can come into villages and arrest people just because they are stealing water it is very hard to accept it.

So, it is more acceptable, if the violators are punished by these communities. So, enforcement of rules, rules are first set as a combined decision and then they put down these rules for the farmers during these sessions, so sluice operation by village water man Neerkatti. So, where the gates is open and closed not by individuals but by a person who is designated from the community to do it. And penalties for defaulters for example the Neerkatti would say I am opening the gate you will get water for 8 hours if the defaulter is just using more water let us say 9 hours then he or she is taking water from the other farmer.

So, these kind of penalties offer defaulters can be taken by the Neerkaati or the waterman village watermen and those are nominated by the community farmers. So, if I say 10 farmers are there in a village all 10 would nominate one person to take care of the water and that is nomination by vote and everything, so it is not like one person stays every time. So, this is how a community network can actually solve the issues of farm water use etcetera.

Then the last one is mobilizing of funds. The fund is collected by these Neerkatti or village watermen based on how much water is used and that water fees or the payment for the services can be used for buying utensils and other networks to clean and maintain these dams. For example the walls of the dam need lining concrete where is the money going to come from if

they are going to request the government it will come in a very slow wave by when migration would have happened.

So, these farmer communities would put a small rate on the use of the service or the water and everyone chips in money and the pool is built and all these networks where they need to do some management or new pumps etcetera can be done.

And penalty can be also taken as a fine so the defaulters will be more liable because there is no arrests for this there is no I am going to say no water for you cannot say that, so the best thing is to put a fine on it. Because the profit is what they want the farmer the defaulter take the profit out and put a fine, so that they would not do it again. And that money is now being put into infrastructure cost. So, it is a very good scheme where the communities themselves manage and monitor the water. But let us get back to a classic example of a illegal water. So, now I have seen how communities can take part.

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Let us go through this slide the last slide for today on how water lifting illegally is being done. So, for example this is the main river channel and there is or the canal from the big dam for irrigation and then there is a pump house which monitors the water pumps the water into the branch canal and from there it goes to the village service areas. Distribution this is a major distribution channel, minor distribution channel and then some more miners, so all these villages

are getting water because of this. Now, this is the scheme the government did and hoped that all farmers would take part amicably and do it but what actually happens.

And this is the case from Gujarat is that there is illegal pumping multiple pumping, so instead of taking water from here into this area for agriculture what they do is they put pumps on these individual pumps on these networks and then they started pumping. So, because you pump from there the main branch channel water would go down and they would not participate in funding this maintenance and distribution network. Because they have their money and they said no I do not want to give you money I will put my own pump and take the water that has to be avoided, because the water is common not one man's property.

So, then it does not stop here even during the distribution channel even during the miners channel there are unauthorized irrigators who would just put pumps and then pump the water and use it for them not caring about the downstream communities. For example if these farmers are taking water then the end farmers like for example all these farmers illegally taking water then the farmer at this end will never get the water. Because they are pumping and using it lavishly more than what they should. However, in this scheme every single plot of land is calculated and said this is how much water is going to come this is how much you will get.

So, those calculations will go wrong, because of this illegal distributed pumpers. So, it is very important that water access is given by the government, but it has to be done legally and if people because they have money or loan and put these pumps the whole system will collapse. Now, all the system would collapse because there is no money to maintain this pump, the pump would go defunct and the water would just go and only these farmers are getting the water. So, please understand that illegal issues are there and this is a classic case study from Gujarat, please go to this paper if you want more information.

And these have to be avoided and this can be avoided by having a community participation, because the community participated Neergandi the village waterman would walk along this channel to see anyone pumping and fines are put. Also, these people would not be allowed to get other benefits like, Ration, election, village festivals etcetera. So, nowadays they are very careful on using this water amicably and not stealing water. So, there are many other issues but because of time we will stop here and we will look at these issues in the future directions class also when we do some case studies.

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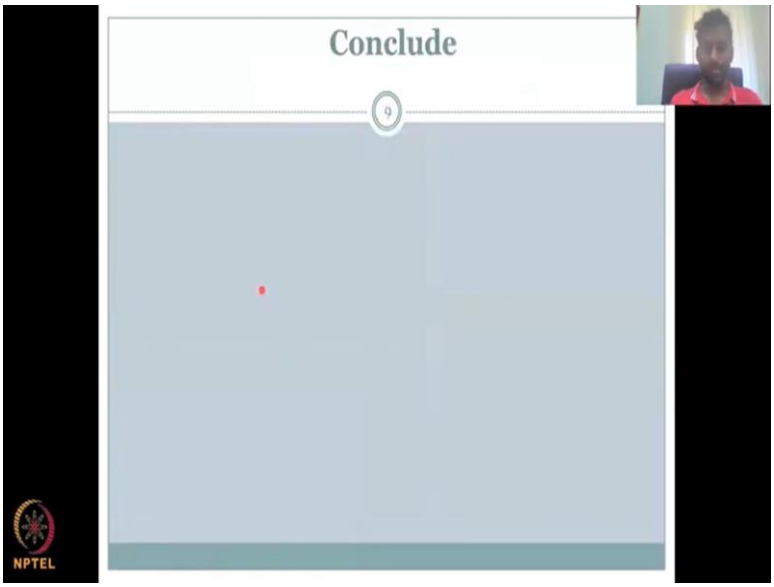

With this, I will conclude thank you.