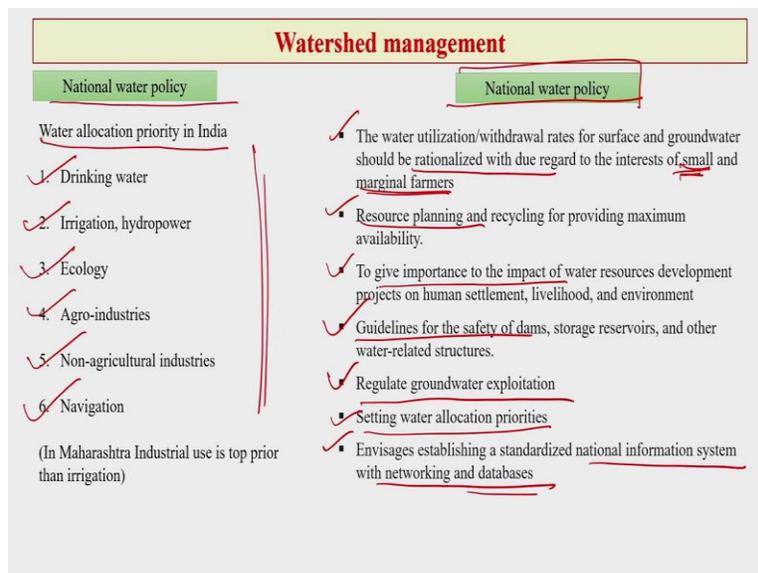


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**Week – 04**  
**Lecture - 25**  
**National Water Policy**

So, we are discussing about different water policy and then the different policies issues.

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Now, following this, we come to another larger perspective that is the National Water Policy. Now, if you see that the water allocation priority in India is largely on drinking water, irrigation, hydropower, ecology, agro-industries, non-agriculture industries and navigation. So, these are largely the areas on which the National Water Policy looked at very closely for water allocation in India.

Now, let us see that NWP the National Water Policy, the water utilization and withdrawal rates for surface as well as groundwater should be rationalized giving due regard to the interests of small and marginal farmers. So, this particular point is very important, because these group of farmers small and marginal farmers, as that they do not have much resources, neither do they have required a number of pumps to pump out the groundwater for irrigation.

So, these people need special attention and National Water Policy has rightly done so. Now, resource planning, means water resource planning and recycling for providing maximum availability of water is another aspect that NWP looked at. NWP also give enough importance to the impact of Water Resources Development projects on human settlement, livelihood and environment.

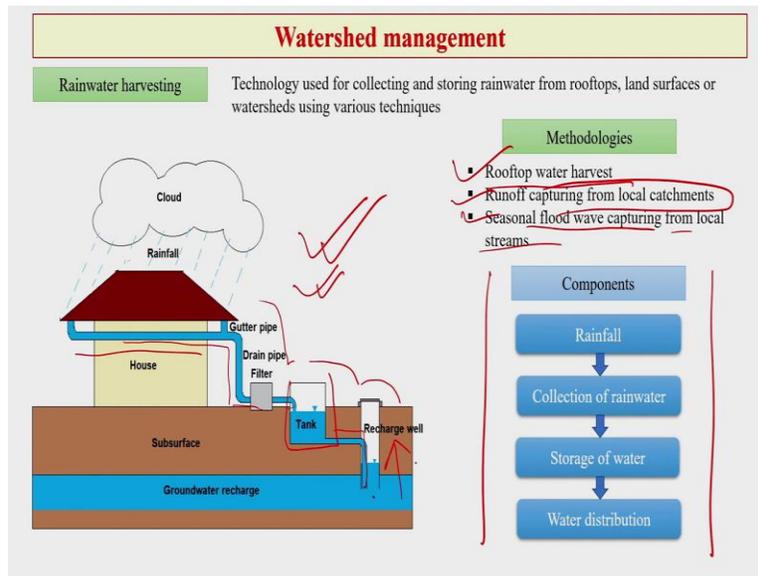
It also has given enough importance to various guidelines for the safety of dams, storage reservoirs, and other water related structures. National Water Policy also talked about the regulation with regard to groundwater exploitation, it also talks about setting water allocation priorities, it also envisages establishing a standardized national information system with networking and databases.

This is very important and at the present context, digitization of the information on various natural resource bases is very critical for efficient resource management. So, these are certain aspects, National Water Policy already has given a lot of importance. Now, often we hear about rainwater harvesting; it is needless to say that in India in many parts, especially Northeastern part a huge amount of rainfall takes place within a very small span of time, and in the southern part, and also in the western part of the country, the amount of rainfall is relatively much less.

So, it is important in both the places to restore, to harvest the water. In one case, we see that more than required amount of rainfall is taking place within a very short span of time and those waters are actually getting away from the system. We are not able to somehow hold that water in certain designated places so that when there is no rain, that water can be utilized.

Whereas in other condition like in western part of India, some part of northern India and southern India, where rainfall is very less. So, there whatever amount of rainfall is taking place that has to be harvested.

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Rainwater harvesting, rooftop water harvesting has become now one of the ways that people can actually harvest the rainwater. So, rainwater harvesting, as you see from this picture, that rain whenever it comes, we can actually collect and harvest them in various manner. We can also recharge our well, we can recharge our groundwater.

So, rooftop water harvest has also become a norm in some parts of the world and as well as some parts of our country where if you build a house or flat roof water harvesting is almost must. Runoff capturing for the local catchment area is another aspect where we actually lagging behind many other countries.

So, we really need to utilize some proper technology suitable technologies to capture the runoff loss which we are getting. That water if you somehow can reduce the runoff or stop it getting lost from the system will not only could preserve or conserve some water, but also can actually avoid losing the important minerals and top soils of any particular location. Seasonal flood wave capturing from local streams is another aspect that helps in rainwater harvesting.

So, how you can do it, I mean, it is pretty simple; you need to actually collect rainwater, store it and then you can go for distribution. There are various ways this particular diagram is one of the potential ways that we can actually harvest the rainwater whichever is falling on the rooftop of our houses. We can use a pipe and through a filter if we pass it, we can stay to a store in the tank, from there we can also pass it on to the groundwater for recharging groundwater and recharge

well. So, see there are already some existing knowledge and we need to actually apply that for the betterment of water resource management.

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**Watershed management**

**Water harvesting benefits**

- ✓ Provides good quality of freshwater
- ✓ Improves groundwater quality after groundwater recharge
- ✓ Decreases the groundwater pumping cost
- ✓ Self-sufficient water supply for drinking, irrigation, and domestic purposes
- ✓ Rooftop rainwater harvesting can be adopted by individuals as the system is easy and less expensive in construction, operation, and maintenance
- ✓ Reduction in soil erosion, sediment yield
- ✓ Saltwater intrusion prevention in the coastal aquifers due to the maintenance of balance between fresh and saline water by means of groundwater recharge
- ✓ Hilly terrains natural undulation helps in the creation of water harvesting structures naturally
- ✓ In islands rainwater harvesting provides necessary freshwater for anthropogenic use as the freshwater aquifers are the limited extent
- ✓ Desert areas water harvesting provide the essential source of water for livelihood

Now, what are the benefits that we could actually achieve if we go for water harvesting? Many. There are many fold of benefits, you not only get good quality of fresh water, it also improves the groundwater quality, I just, in a previous slide I have explained that it could recharge the groundwater, it decreases the groundwater pumping cost because it requires some source of energy, electricity.

Self-sufficient water supply for drinking, irrigation and domestic purposes is another benefit that you can achieve. Rooftop rainwater harvesting can be adopted by individuals as I just said that in some parts of our country, rooftop harvesting has become a norm if you go for a building, a flat or a house. It is easy, it is less expensive in construction and also it is, operational cost is also relatively less.

Reduction of soil erosion and sediment yield; that is another benefit that we can get out of water harvesting. Saltwater intrusion prevention in the coastal aquifers due to maintenance of balance between fresh and saline water is another aspect which because of groundwater recharge we can actually take care of that particular issue.

Hilly terrains sometime also have its own problem, but if we go for water harvesting the hilly terrains' naturally undulated topography, it helps in the creation of water harvesting structures

almost naturally. So, that also we can somehow utilize for water harvesting utilizing that natural topography of hilly terrains.

In case of islands, again, rainwater harvesting would provide necessary fresh water for anthropogenic use; means for the use of human being as freshwater aquifer are almost getting very limited day by day. Desert areas water harvesting definitely would provide the essential source of water for livelihood. Remember that if we can harvest water and if we can conserve the water, then at least one extra season of vegetables or grains we can grow.

So, one dry season, if you can provide with the reserved water, then definitely the income of the farmers can be almost doubled, otherwise, because you see he will be keeping his land almost empty because of lack of rain or lack of water, so that is one straightaway benefit that if you have preserved your water during whatever rain that you have got, so that will help during the dry season to take one extra crop. That means extra income.

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**Soil erosion measures**

**River bank erosion**

- More velocity of streamflow
- Greater amount of runoff due to LULC, climate change
- Decrease in flood plain zone due to increment of built-up areas by construction



**Sediment yield**

- By USLE
- By using hydrologic models with GIS interfaces like Soil Water Assessment Tool (SWAT) Water Erosion Prediction Project (WEPP)

I have been now mentioning in the last couple of minutes or also few slides back that soil erosion through water, through wind is one of the major issues that we confront today. So, if we want to protect our topsoil, and then avoid losing our soil productivity, and thus brand production or total yield, we need to somehow manage our soil. We need to protect our soil from erosions.

Now, one of the major reasons of soil erosion is that the velocity of water along the slope, so, the stream flow. So, great amount of runoff takes place due to steep slope as well as not having some

kind of hurdles or some kind of restriction to the continuous flow of water across the slope. We can have various types of measures to reduce the pace of the water flow across the slope, we will talk about those techniques, and how we can do that.

So, riverbank erosion is one of the major issues that in many parts of our country, even in Brahmaputra River Basin are one of the major issues. So, there are a lot of reasons for that, why this thing is happening, but instead of pondering too much on the reasons of this problem, I think that we need to find out some solutions.

And to reduce the riverbank erosion, it can actually help also the sustainable management of the water resources as well as fish, aquatic life and other associated organisms. Sediment yield is another issue that we need to take care of by utilizing different kinds of hydrologic models with GIS interfaces like SWAT, WEPP, people are actually analyzing the extent of sediment yield and also are trying to find out that what could be the potential way to reduce the sediment yield.

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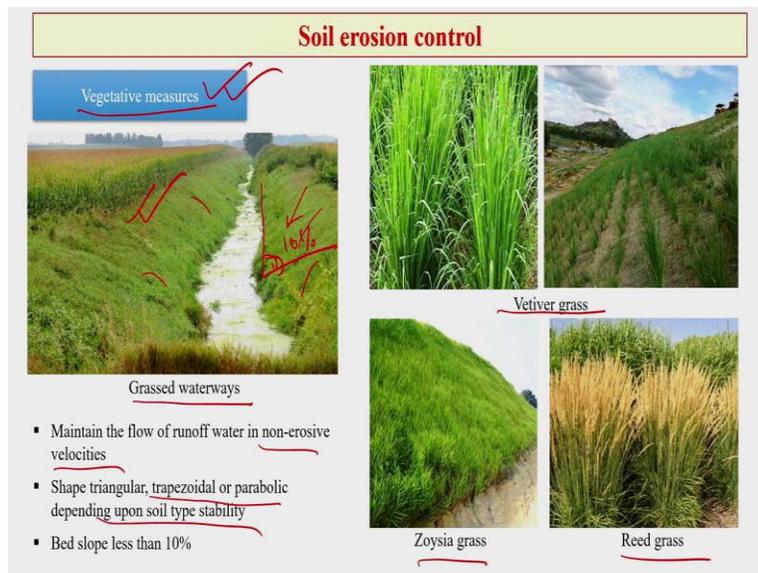
So, there are some practical techniques that we have with us, which can be utilized for soil erosion control and some of them just mentioned or share with you. Sediment traps, so as you see in this picture, that this is a sediment trap, the water is actually flowing, and the sediment will be trapped, and that will be stopped from going out of the system, because, if you can trap that sediment that will also enrich that particular area, the nutrient and other constituents of that sediment will not go along with water out of the system.

So, there are various type of sediment traps that you can see. So, here one is a very common which probably many of you might be seeing in university or institution campuses, when you go through the road on the side of the road, you will find these kind of sediment traps are there. So, as you see in this particular figure, that this is a kind of inlet through which the water is trying to come in inside the dykes and then when it flows above this particular inlet, then the water will come and it will get deposited here and this is called the deposited basins.

Now, once the water along with other constituents are here, then an open check dam has been created, the water will flow come from here, then some of the deposits will remain here and next step there is another counter check dam has been created. So, some parts of the constituent which come through this particular outlet, so, those again constituents will get for the second time get deposited here.

So, in a sense, what we are trying to do is that step wise kind of trapping of sediments so that we can actually somehow reduce the loss of sediment from the system to go out of the system. So, this is important for various reasons.

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And soil erosion can also be regulated, at least if not can be totally avoided by vegetative measures. Now, this kind of pictures is very common in any Indian villages, we call it grassed waterways. So, here what happened is that, when you put this kind of grass cover on the sideline of the waterways, the chances of soil loss actually is almost minimum. It also at the same time

maintains the flow of runoff water in almost in a non-erosive velocity, relatively slow steady velocity.

The shape is largely triangular and trapezoidal or parabolic depending upon the soil type stability. Bed slope is most of the cases is less than 10 percent. So, these are some vegetative measures. And vetiver grass actually in this aspect could be a very, very important agent to reduce the soil erosion to restore the soil quality and to also make the soil steady.

So, vetiver grass can be also used as a biological mitigation for soil erosion, soil loss. Zoysia grass is also sometimes used and reed grasses are also sometimes used for stopping or regulating or reducing the erosion of soil. So, these are all vegetative measures, which can be utilized to control soil erosion in any watershed.

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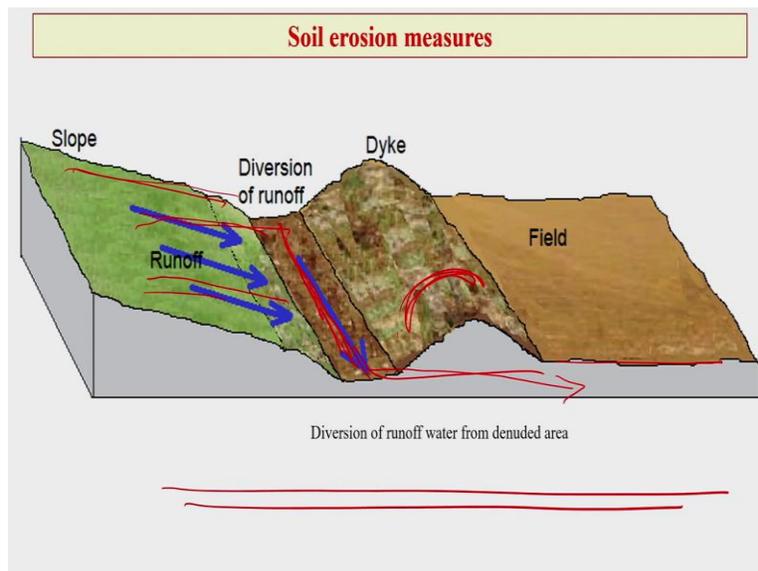
Now, let us see the some other also techniques. Now, land grading and land levelling is another approach which often is used in many places. Then comes another popular technology is mulching; mulching can be of various types plastic mulching, which you see here, but you can also mulch your soil we leaf liters, which actually cover the soil at the same time over a period of time can be the source of organic matter under microbial degradation.

Obviously, this is the easiest way of reducing soil erosion. Reforestation and tree plantation, then retaining of existing vegetation, you know that sometimes it happens that we try to go for

reforestation and tree plantation in one side, but on the other side, we continue chopping down the trees.

So, retaining of existing vegetation itself could be one way of reducing soil or soil erosion. Roadside gutters, this is a very kind of common picture in any kind of highway that you can see. So, the roadside gutters, something with vegetative cover on the side, sometime also help reducing the soil loss, unwanted soil loss from some part of the area or particular site.

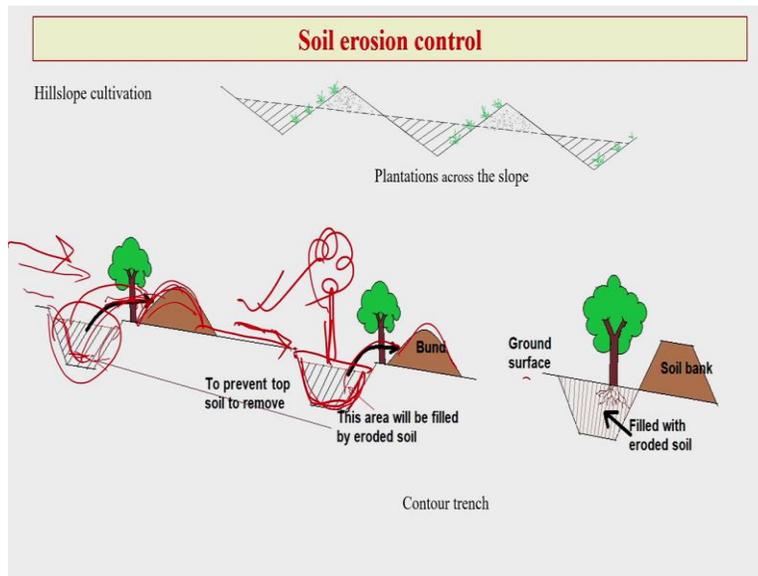
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Now, soil erosion, there are different measures already I have discussed some of them. So, if you see that in a particular watershed, this is suppose a watershed where you have on the left hand side that kind of a hilly terrain, where slope is relatively higher and runoff is taking place, then you have a kind of a dyke system here and in between this you have a kind of channel type of formation through which the water which is coming through the slope can be actually channelized to the direction that you want.

This is the plane field. So, if this water which is coming from the slope can be channelized and put wherever actually we need water for irrigation or for growing plants and crops, we can actually divert that particular runoff water for some other uses.

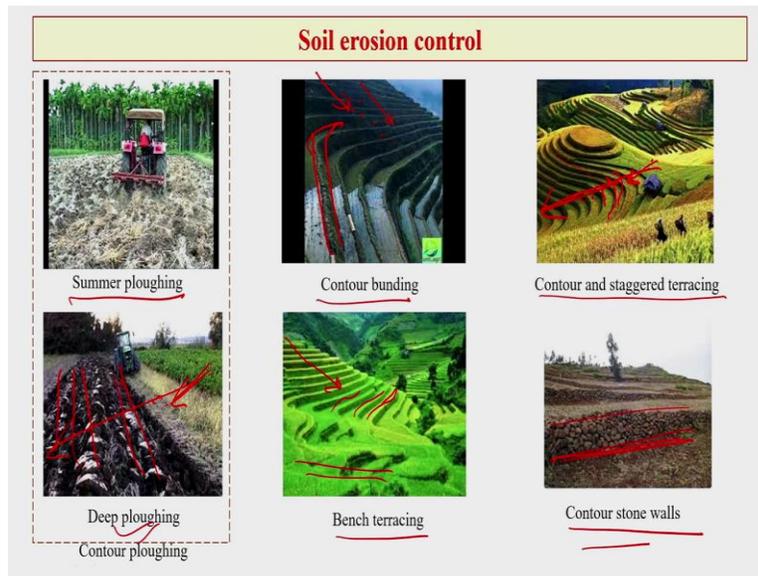
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Hill slope cultivation, see, there is another very nice way that often visible in the hilly terrain is that you dig along the slope in one place and take out the soil and deposit on the top. So, what happens is that you continue doing that along the slope, what it does, if your slope is in this direction, along with water or wind the soil will come. First it will get somehow try to get deposited here in this ditch that you have made and then even after that, if it tries to go then it gets somehow get registered by this heap of soil that you have put taking out of this ditch.

So, again if from here any soil tries to go off along the slope then what happened is that before it goes away from this particular point, it will come here and get deposited by those eroded soil from the upper area and then once it is filled up, then you can again put a plant here and you can grow it there. So, this is the way that you can create a trench and then grow a plant and the soil which comes out from the trench it can be used as a bund. So, this is some kind of trenching system which is often used in the hilly region and it found a very effective for reducing soil erosion.

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Apart from that there are certain technologies which often are used utilizing machines, like summer plowing is one option that many a times we do it for reducing the erosion. And this summer plowing actually helps to reduce the free flowing of topsoil along the water or wind from the particular field site.

Contour bunding is another very popular one, it is across the contour as you see here, that this kind of bonding it goes. So, if water from top tries to come up definitely in every contour bund it get resisted and definitely the speed of its flow will get reduced significantly and thus the erosion will be also less.

Contour and staggered terracing is another very nice way of doing it, you see it in Philippines and some parts of other country in Southeast Asia. So, this contour and staggered terracing also helps because if they are not here, then water will simply just flow and take over the topsoil. Because of these staggered terrace water get resisted, the flow of water get resisted and also deposition of sediment takes place.

Deep plowing or contour plowing is another way of reducing soil erosion, because here the wind or water coming from this side will definitely get resisted when you go for deep plowing and contour plowing. So, it will not have a free flow from out of the system, the soil will be stopped to go out of the system or at least the speed of the wind and the water will be reduced significantly.

Bench terracing is another way, it looks like a bench as you will see here. So, this also is kind of if the water flows from the top, definitely the speed of water will get significantly reduced, and so, the soil loss.

Contour stone wall, very common and very popular you will see in many parts of our country, including eastern part of our country, southern part of our country and even Madhya Pradesh, I have seen this kind of contour stone walls that people try to do. So, this is a very economic way utilizing the resources available there in the particular location. One can go for contour stone wall which can reduce again the speed of flow of water and thus it reduce the amount of soil loss reduce the soil erosion in the system.