Natural Resources Management (NRM)
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Week – 04
Lecture - 24
Watershed management: Flood control

Next is flood control. And we discussed quite a lot about that how actually we can restrict the soil erosion and along with that, how we can actually conserve water and recharge also the groundwater. But in case of flood also within a watershed area, it is important to actually also see how we can deal with floods.

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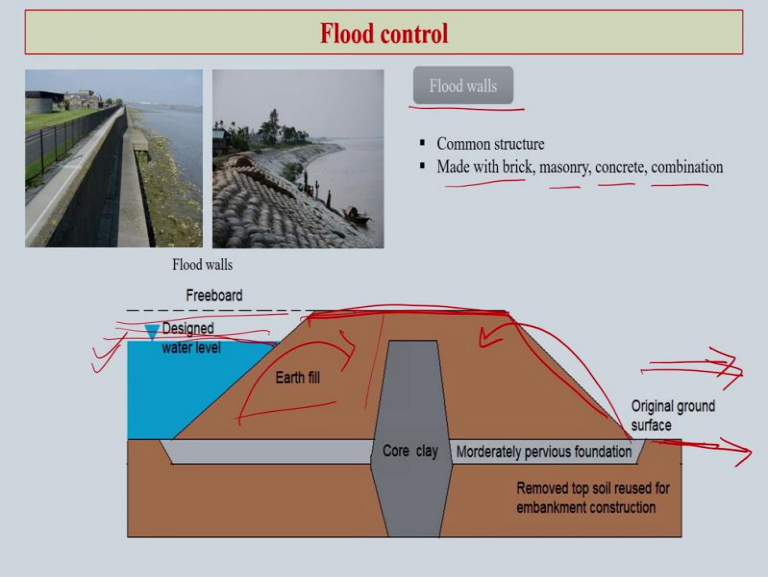

Now, there are various ways that flood can be managed; one is flood walls, which is one of the most common way common structure that we see in and around us, normally made with brick, masonry, concrete or combination of all those things, even some time sand bags are also being used.

How it is actually basically done is that you have kind of a suppose that water level up to this range, and then you try to have first earth filling and then make the height of this earth filling in such a way that it can also take care of the original ground surface. The original ground surface

is basically the surface area, which has the topsoil, where actually majority of the agricultural purposes or agricultural practices will be carried out.

The removed topsoil, what is being done here that it is reused for the embankment construction. So, you do not allow the topsoil to go away, you bring it back and do the filling with that soil which otherwise could have lost from the system. So, this kind of earth filling also quite common and this is done to avoid flood or impact of flood severely on the other side, where habitation and also agricultural practices are going on. But of course, we know that beyond a certain point, this kind of structure also may not work.

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Sandbag, this you have seen many places; stone riprap also are being used along the side of the river, then gabion walls also are here used if you anticipate that your water level could actually rise with the rainy season; then concrete and brick walls are often used and these are seen largely in the developed countries and sometime also you can see it in some coastal regions of India in a different format.

Concrete and blockwork these are also visible in many parts of our countries along this sea coast, concrete bagwork is another option that people these days use quite a lot. So, we have these kinds of options available with us to reduce the impact of flood on the ecosystem.

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One step ahead if we want to go with the technology options, we have coir rolls also, which can be used as you see here, the coirs that you get that can be made roll and then you can across the slope pack it so that if in case of rising of water, it can actually get soaked there in this coir and then it actually also allows to the soil to get the appropriate amount of moisture. So, this helps in both ways.

Aqua dams is not that much common in our countries. Open stone asphalt, also we may not see very frequently in our country. There are measures like boulders; this is common in many places of our country as well. Wave return sea walls, these you will see in marine drive area; so wherever there is tide comes so the water actually hit these walls. So, this somehow protects the civilians and also the inland agricultural purposes or any other human related activities.

Concrete revetment; this also reduces the flow of water as well as the soil loss from the particular affected area. So, the flood water if it comes suddenly then the flow of water can be reduced quite significantly by concrete revetment. Combination of wave return walls and boulders; this is not again very common in our country, but is an another potential techniques can be used across the coastal line.

All these flood control measures are also useful for riverbank erosion control. So, this is why actually I am sharing all the options that in across the world people use. So, it is kind of a basket

of options that I am trying to share with you. Given situation and opportunities, some of these options can also be utilized as I said that for riverbank erosion.

But wave return sea walls and boulders, these two are used for coastal watershed mainly and to reduce the sea tide erosion control. So, we have actually a lot of technological options with us to also to reduce the impact of flood, but we may not be able to totally stop it, but the effect can certainly be reduced if proper measures are taken.

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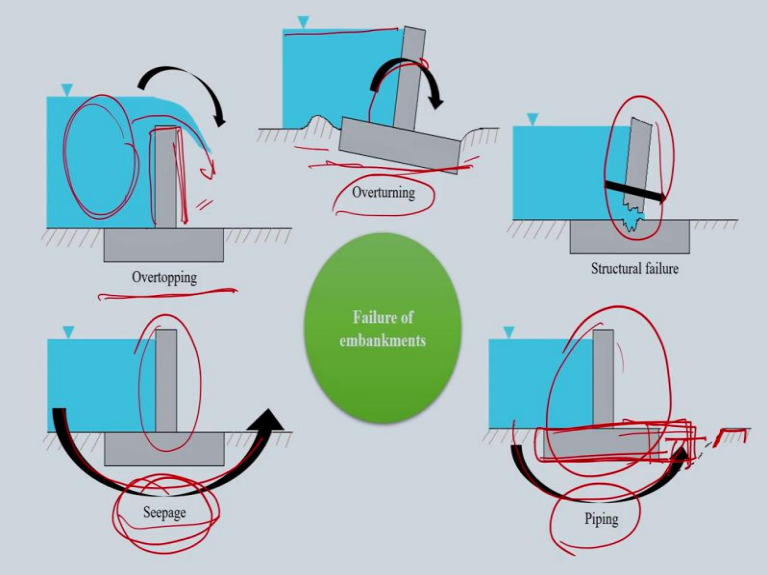

Now, why we listen quite often that embankments have failed to do its job, if the embankment has done with all right technology, why then it fails? Now, there are various reasons for that, some of those reasons I would like to discuss here, one is that overtopping. As you see that the embankment has been made, but the water, amount of water coming into the system is so high, the volume is so high that even when you have built this embankment, you actually anticipate.

Certain amount of assumptions are involved that how much water actually even in maximum rainy season could come up. But if your that assumption also is fail or means it crosses beyond even that limit, then certainly the water will flow above your embankment. And this kind of situation is actually rare, but this can happen. And in that case, your embankment actually fails to do its job.

Second case is overturning; what happened is that sometime because of certain movement in the soil or along with that, the again amount of water if sudden flow of water increases heavily, then

there is a chance that your embankment structure can be overturned and this kind of situation we often see in many cases in and around us. So, that is another point that we should keep in mind while establishing this kind of embankment, that overturning of embankment can also takes place.

Structural failure, that is purely technological engineering failure, which can certainly be avoided, if not 100 percent, but at least engineering wise technically, this can be easily rectified. So, as you see here, that there is a crack in the embankment structure, but as I said, this can be avoided to a large extent.

Seepage is another issue that actually takes place very silently. And often, when we establish this kind of structure, we need to actually look into this aspect that seepage can also take place. So, due to seepage, sometime our embankment structure also fails to do the job in appropriate manner.

Piping, is another problem that sometimes your embankment actually fails and that sometimes happens for two reasons; one could be that it is not properly established, the ground verification was not done appropriately, because if you see that you have kept a huge amount of gap from your sidewall support system, then there is a chance that water may actually cross your foundation of embankment and then can weaken this embankment structure. So, these are a few potential failures of embankment that sometime construct.

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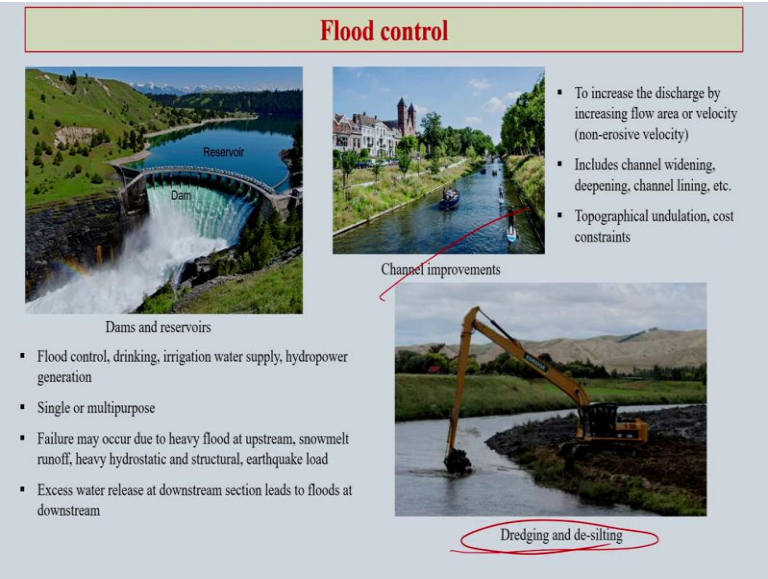

So, there are various other options also for flood control. These are reservoirs, dam, channel improvements, dredging and de-silting all of those things are very common and I am sure that all of you are quite well aware of.

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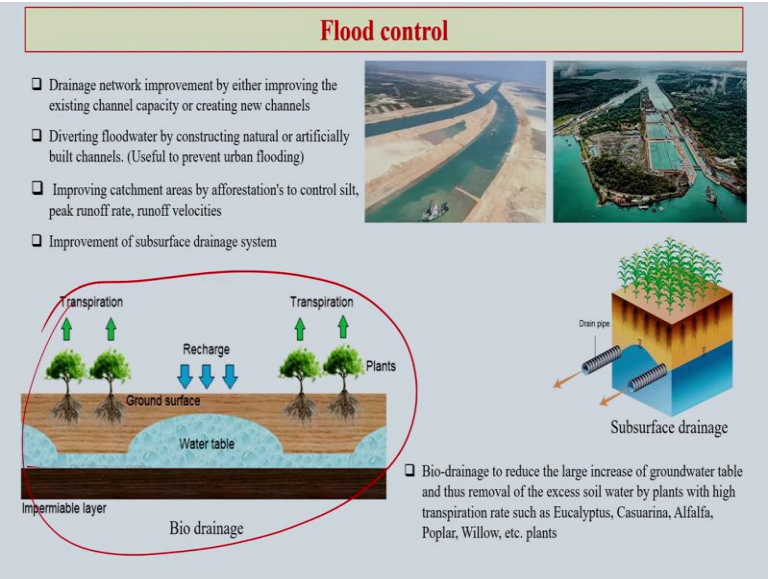

Then comes these days biomitigation is coming heavily and that how actually you can utilize different kinds of plant species and also how you can actually create a bio drainage system so that the drainage network can work in an appropriate manner. You can do it either improving the existing channel capacity or creating new channels.

This can also be done by diverting the flood water by constructing natural or artificially built channels. We can also do it improving the catchment areas through afforestation to control the seal the peak runoff and also the velocities of the water. Improvement of subsurface drainage system is also critical for flood control measures.

As you see in this picture that you try to adjust through different kinds of plantations, the drainage system can be improved with the help of suitable plant species grown in and around the water table that through ground surface the recharge of groundwater in a very regulated manner can take place, when we use proper plantation or proper plant species in an area.

Some of the species as you know like vetiver works very good not only for soil strengthening soil structure improvement, but also it has its own inputs into the soil for improving its quality.

So, it not only reduces flow of water, soil erosion, but also provides some inputs into the soil and also enhances the microbial activity dynamics in the soil.

So, in a sense that a plant species if it is properly choosing, it not only reduces the impact of flood, it not only reduces the soil loss, but at the same time it can also provide some other ancillary benefits. Bio drainage also reduces the large increase of groundwater table and thus it can help in removing the excess soil water by plants with high transpiration rate.

So, such as sometimes you will see eucalyptus, casuarina, alfalfa, poplar, willow, these kinds of plants are often used, but this kind of technology also has to be done with proper investigation on the ground level. As I said that choosing of appropriate plants for particular area is critical, because every plant cannot be or should not be used in any area without the ground verification.

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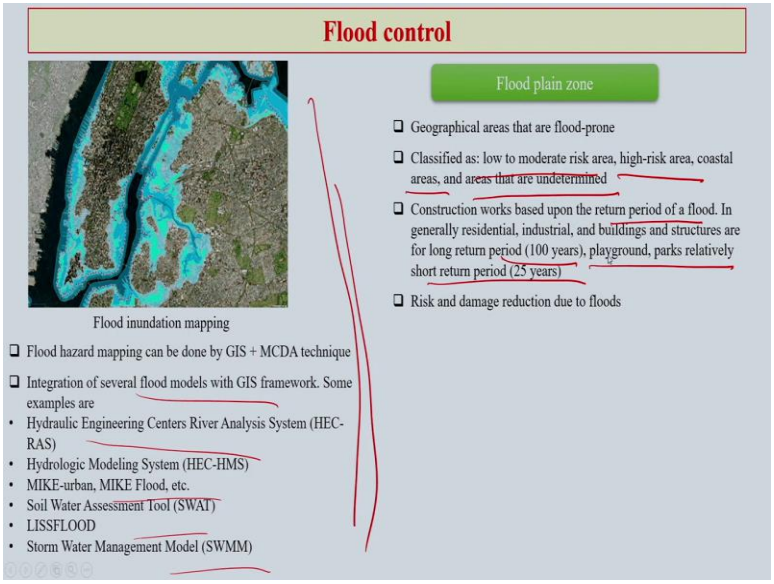

Now, continuing with flood control, flood plain zone; I know is very important, and flood inundation mapping through GIS and remote sensing these days help us to actually identify the exact area which is actually is affected. And then various kinds of engineering technologies can be used for development, further improvement of flood affected area. Mostly that the flood affected areas or flood prone areas classified as low to moderate risk area and then high-risk area, coastal areas and areas that are undermined.

Now, one thing is that construction work in these areas are based upon the return period of the flood that when it could return again. In general, you will find that residential, industrial and

buildings and structures are for long return period about 100 years, playground and parks relatively short-term period roughly around 25 years. So, these are the points that we should also keep in mind.

Now, risk can damage reduction due to floods is also another point aspect that under floodplain zone program one has to keep in in mind. So, as we see that there are various technological options are available also for flood management, like our erosion management.