Geomorphic Processes: Landforms and Landscapes

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Lecture – 23
Fluvial Processes and Related Landforms (Part IX)

Welcome back. So, in the previous lectures mostly we discussed about the intensity the importance of the bifurcation ratio, the shape of the basin and the discharge. So, basically the discharge we had a brief discussion the beginning also can discharge is when calculated and it depends on the basically the rain water and that is that the water availability and the cross-sectional area.

So, that will give you the amount of discharge of the particular channel at particular point and this discharge is important. Because this will tell you that whether the area will be affected, during the flooding state or not. Because the channel cross section area is extremely important and one of the example which we discussed was of Coarse River from Bihar. And the reason of the migration or the shifting frequency.

Shifting of that river was because of the cross-sectional area of the channel is very less and that cross-sectional area is been reduced and during monsoon season. Where the discharge is higher and more and more amount of sediment is when poured or deposited eroded from Himalayas and deposited in the endocrine detected. So, channel cross section area reduces and because of that.

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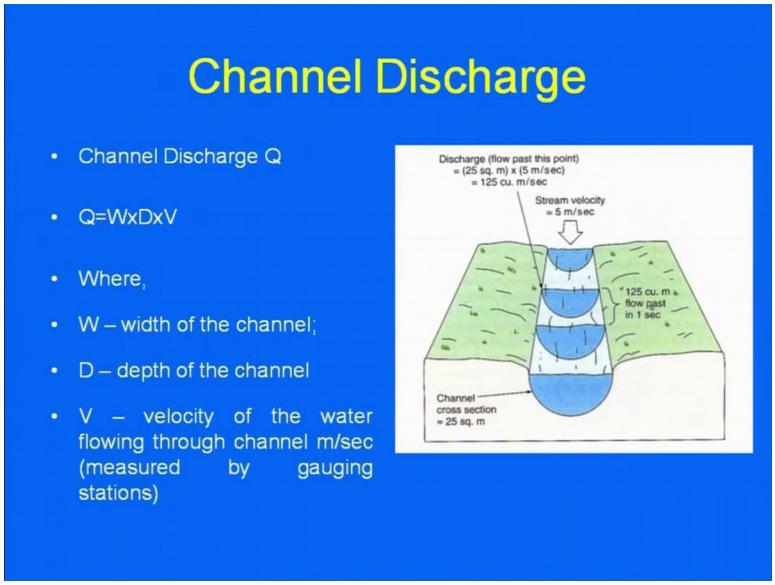

The channels are the rivers are getting into frequent flooding states. So, channel research is WDV width W is the width, D is the depth, and V is the velocity of the water flowing through the channel meter per second. So, this is measured by gauging stations now, so, if you have for example, the cross-sectional area so, for example, the channel cross sectional area is twenty-five square meters.

And you have the stream velocity is say around five meter per second. Then with this what you can have is the discharge is hundred twenty-five cubic meter per second. So, if you reduce the cross-sectional area of the channel because of the position or dumping of the bed load. Here that will affect the because the discharge for example, the rainfall in the region is constant.

Or, you remain keep that parameter constant the same rainfall, but and when you were having the cross-sectional area was large. So, easily that amount of water used to flow through the channel. But suppose this has been reduced and then your rain fall remains constant. So, you have less area which is available to siphon out that amount of water through this channel.

And what will happen is that it will spill over result into the inundation or getting into the flooding state and inundating the nearby low-lying areas. Now, this problem is have must been experienced in most of the rivers even the smaller channels are the smaller drainage basins close to the Himalayan front. Because lot of erosion is taking place in Himalaya. And that is bringing a lot of sediment load.

So, lot many forest areas have been affected because of the silting of the channels. So, the channels are filled with silt or final deposits. So, they does not have enough cross-sectional area to carry the water or the discharge which is coming from the higher uplands or watershed area which results into the flooding. So, the flooding has destroyed a lot of flora and fauna and they have affected of course.

The fall of flora and affecting the animals also. So, this is the major concern in Uttar Pradesh, an MP also at this type of phenomenon where the process is taking place which needs and quick attention.

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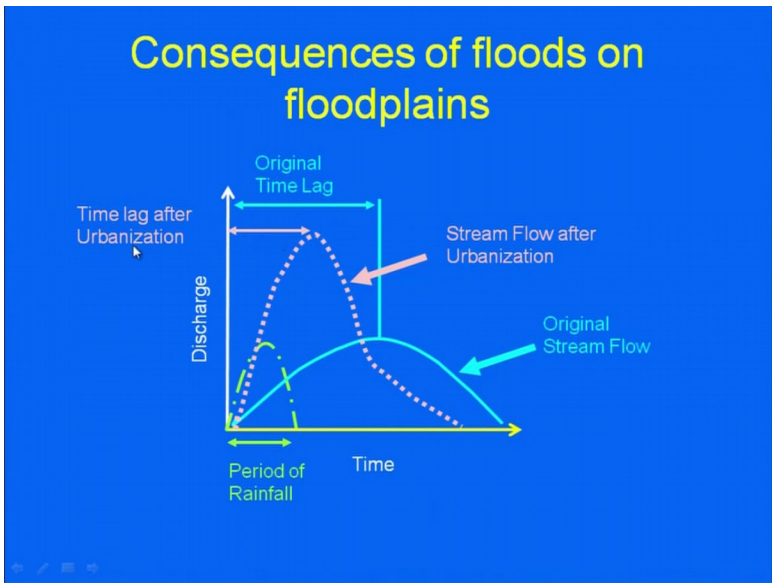

Now, consequences of floods on floodplains. So, but again, we talked if we talk about the discharge and the time lag then you will understand that if you alter one system, it is going to affect the another one. So, to some extent, the floods, which we experience in the urban areas basically are manmade and without having a proper understanding the cause of including the older parts of the channel and filling up the land and using it.

So, you are not you are and also by providing or by not providing the adequate drainage. So, this is if you take the period of rain which is constant for example we take so, this is the time when it the rainfall was experienced and then this was the original stream flow and then this pink one is comparatively the peaked one and the discharge is also very high.

Whereas, here the discharge is very low and the time which has been taken to get into this point that is the discharge maximum discharge was much higher like the time was large or

more. But here the discharge is more and the time taken is also very short. So, this is the stream flow after urbanization. So, what it explains it that before urbanization this was the timeline of the channel to come into the flooding state.

But, after the urbanization the time lag is very short and also it has increased the discharge. So, that means to some extent, what has been done was that you have occupied the area you have allowed the water to flow as early as possible. And with the more discharge resulting into the more discharge and that is because the runoff has increased the population is very less and you have occupied or constructed more concrete jungles.

So, this keen is an important aspect and we have to understand that because of a very trivial issues we have entered into the lesser time line because of urbanization.

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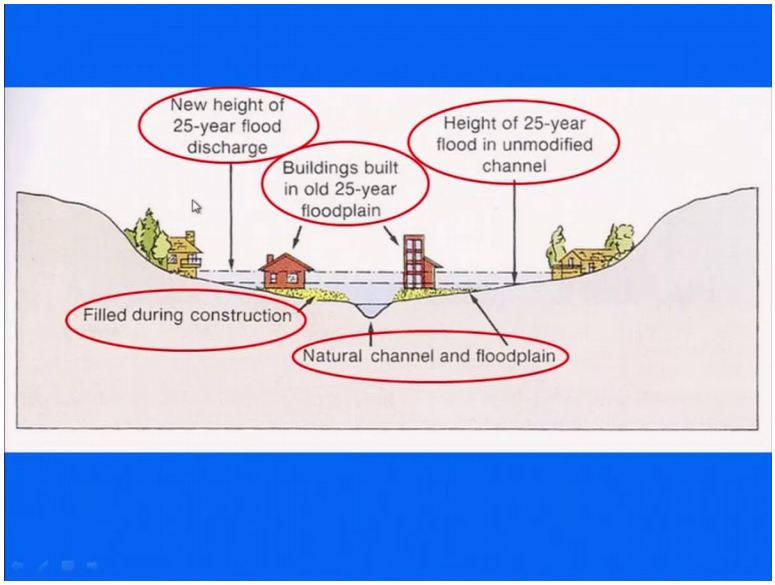

Now example, what we were talking about in a couple of slides about the land forms and the floodplains or the terraces. So, if you are moving on the higher grounds, higher ground are the older floodplains are this one here, and usually, we low to get into the areas closer to the channel. So, what it shows here is that you have the valley and the natural the channel and floodplain what you see here.

So, filled during construction work. So, what usually we do is and most of the cities. Even in India, what you find is that the reclaimed areas, so, areas are been filled. So, that means the floodplains are then fill the artificially and that land or the area has been used for

construction. So, this is the natural channel and the floodplain and adjusted floodplain. So, height of twenty-five years flood in unmodified channel.

So, this is the of course, the valley the portion of the so, this is present of channel that, but, during the flooding state, it will of course, occupy the active floodplain as I was showing in one of the satellite photo also. So, active floodplain should be avoided for residential areas or for industrial areas. So, height of twenty-five years flood in unmodified channel is marked here this one.

But, of course, as we have most of us have decided to stay in the floodplain areas because it is flat more fertile and then less work to be done for cleaning the region. So, it is artificially also failed for the construction of houses. So, building built in old twenty-five years floodplain. What has they it has affected that new height has been keen in twenty-five years and discharge.

So, discharge is so, high it is much higher as compared of the flood as compared to this one. So, this used to have come up to here, but after filling for the construction and occupying the area. Now, this is the height of the floods or new height. So, this is what is happening in most of the urbanized centres that because of occupying the floodplains, you have increased the height of the flood discharge.

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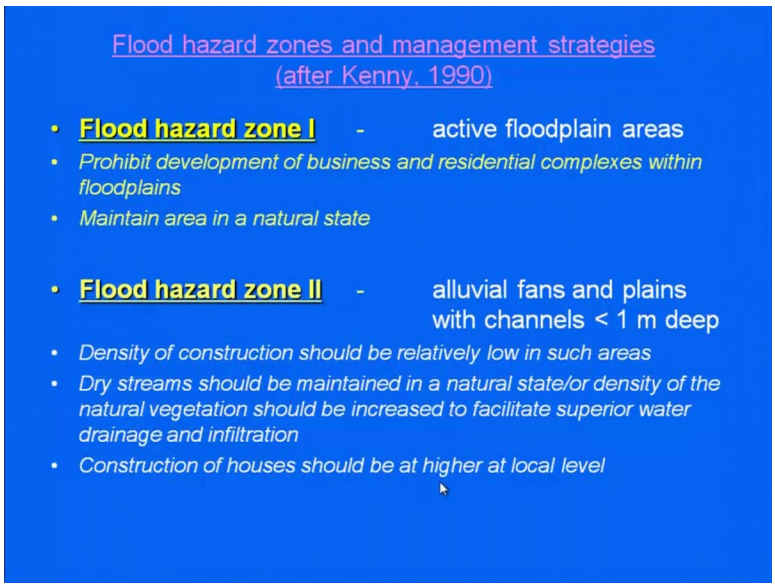

Flood Hazard zones and management strategies mainly not it says that flood hazard zone one at active floodplains prohibits for business and residential complexes within flood maintain

the area and natural state flood hazard zone to we have also seen the land forms there is alluvial fans and planes with the channel depth less than one meter. So, again the density of the construction should be relatively low.

In such regions dry stream should be maintained in a natural state or the density of the natural vegetation should be increased. To facilitate superior water drainage and infiltration because the timber the vegetation will also help infiltration. So, the infiltration is higher mine on the surface and the runoff will be less and that will result into the less discharge and the channels.

So, construction of houses should be at higher levels. So, this is what we are talking about the construction should be had on higher terraces or the abandoned older floodplains.

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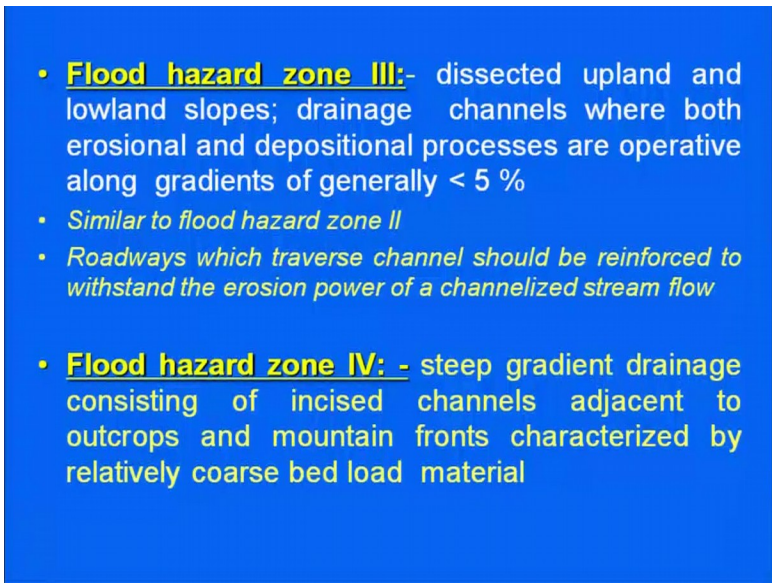

Then zone three these are basically the dissected uplands and the lowland slopes drainage channels where both erosion and depositional processes are operative along the gradient of channel generally less than five percent similar to the So, similar norms should be adopted has adopted for zone two. So, roadways, which Travers channels should be reinforced withstand to withstand the erosion power of channelized stream flow.

So, mostly because you cannot avoid some places. You cannot avoid or realign your road construction and you are probably crossing suppose a meandering river then you will have to make sure that you make it like embankments or maybe the it should be the channel should be reinforced so avoid the erosion and channelize the flow. Flood zone four are basically the

areas of with steep gradients consisting of insights channel adjacent to the outcrop of mountain fronts characterized by relatively course bed load.

So, these are the areas where mostly we are talking about the illegal fan areas and all that. So, this again, close to the front or Piedmont areas or pediments because these are the areas which will be existent to the mountain fronts and those areas to be avoided for any construction.

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Now, restoration of the banks and the rocks this is mainly most common the scene in most of the areas this is how you can do it. So, the erosional part the outer part is the erosional parts. For example, if you take the cross section of channel cross section DD, DD dash, then this is the deepest part and the outer part of the channel flow, there is the point bar here. And so, most of the pole or the higher velocity will be seen on this side and to stop the erosion.

This is what has been seen that it is been blind by rocks, rock fragments and the rock blocks and finally, what you see is a very beautiful outline of the channel here and restore channels. So, this is the restoration has been done or reinforcement has been done. So that to erode the to stop the erosion and allow the water to flow through and through quickly. So, most of the cities.

If you have or if you are constructing the road across this, then this type of construction or the safety norms will help and stop the erosion.

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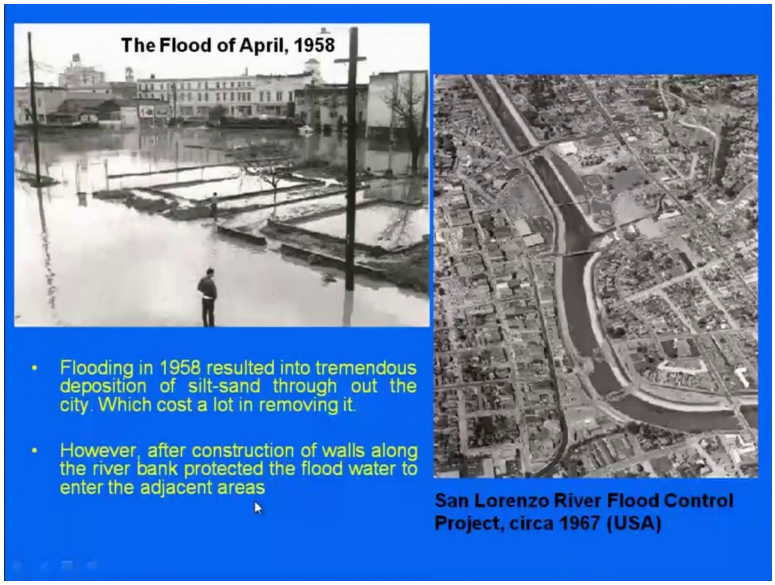

This is an example from US San Lorenzo, river flood, this is before the city got affected in 1958 by floods and this what you see the photograph is in 1967 after the flood control project was operated and the channel was channelized constructing the channel of bath way. So, this helped in protecting the surrounding areas.

So, this is very important. So, after construction of walls along the riverbank, protected the floodwaters to enter the adjace adjacent areas.

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Now, this is the photograph from Tokyo. So, you can see that in one of the channel of the major river is flowing across the Tokyo cities Tokyo is one of the best city in the world. So, you can see the residential areas are sitting very close by but the channelized river has helped them not getting affected during the floods.

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Now, this is the condition of Ganga River near Kanpur.

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And flooding state. So, mostly what is happening is that this is the high ground which you see the older floodplain, but the low lying area adjacent to that most of the areas are been occupied and most of the years when whenever the rivers are such rivers are in flooding state, we need to or there is an rescue of this people staying in the low lying areas and then and most of the areas we need to evacuate.

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Then there is an example of the channelized flow which has been done in Gujarat this is an example of Sabarmati river at Ahmedabad, where the whole area has been purified and constructing the walls on either side as I was showing in from US example from US and this has helped for protecting the city of which is developed on either bank of the Sabarmati river.

So, this photograph is at the time of the construction and this whole area has been used for recreation, they have parks and then then several like Chow patty, what you see in Bombay.

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This has been used. So, this is after the construction, this whole area is what they called the riverfront.

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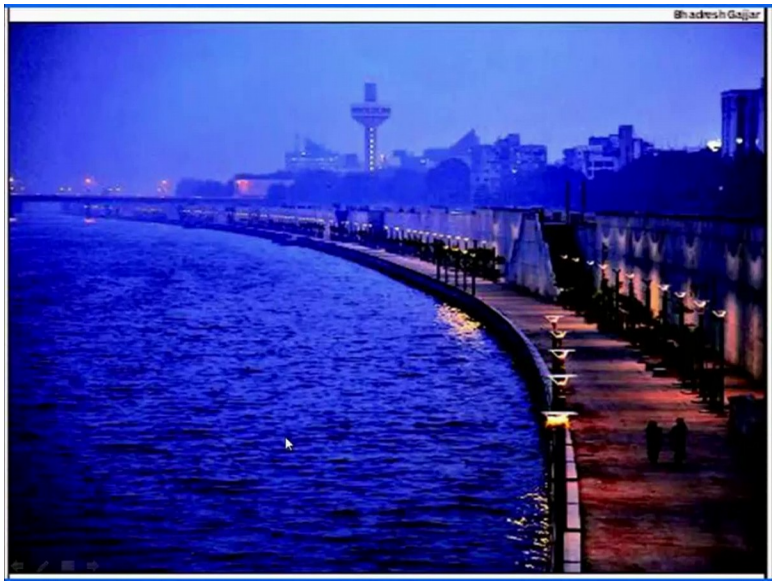

And this it looks like this. So, this is the pathway which has been constructed by default pedestrians and then you climb up you have this sand fill here. So, at least during the even the during the flooding state, the water will not cross this wall. So, it helps in flood controls and siphon out the water as early as possible.

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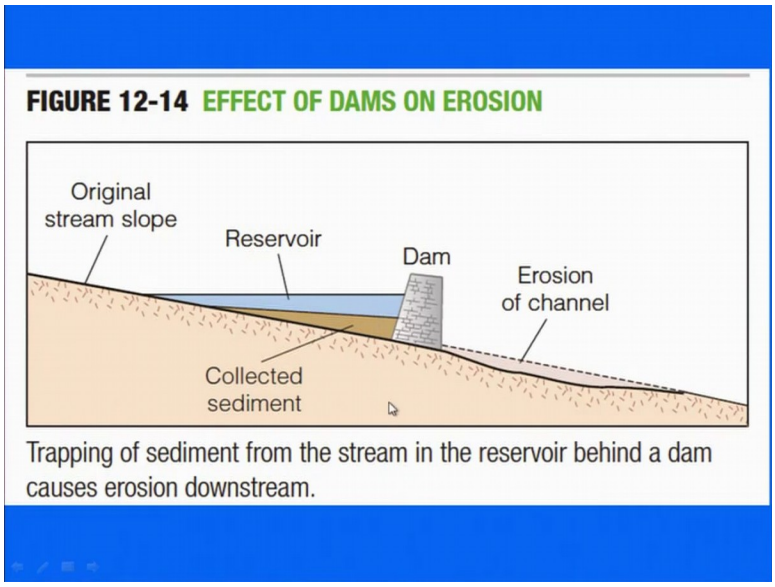

So, some measures can also be taken or the flood controls can be done by consumption of smaller dams or the urban dams are the barriers across the channel and stop the water in the region.

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Progressive failure of Teton Dam, eastern Idaho, June 5, 1976: **A.** *At 11:20 a.m., muddy water pours through the right abutment of the dam.* **B.** *At 11:55 a.m., the right abutment begins to collapse and a large volume of muddy water pours through the dam.* **C.** *and* **D.** *Just after noon, the dam fails and the reservoir floods through it.*

Now, this is the breach of the urban Nam, which has been,

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A. A barge and crane add coarse rock to shore up a levee protecting a town. **B.** Breach of a major levee on the Sacramento River, California, rapidly flooded surrounding farmlands and towns in January 1997.

Shown here. And this example that shows that if you construct even the natural artificial levees because of the breaching of or the breaking up of the levees can dissolve into the flooding in adjacent state. So, this has been shown there, so the edge of the river and then flooding land forms because of the breach of the levees.

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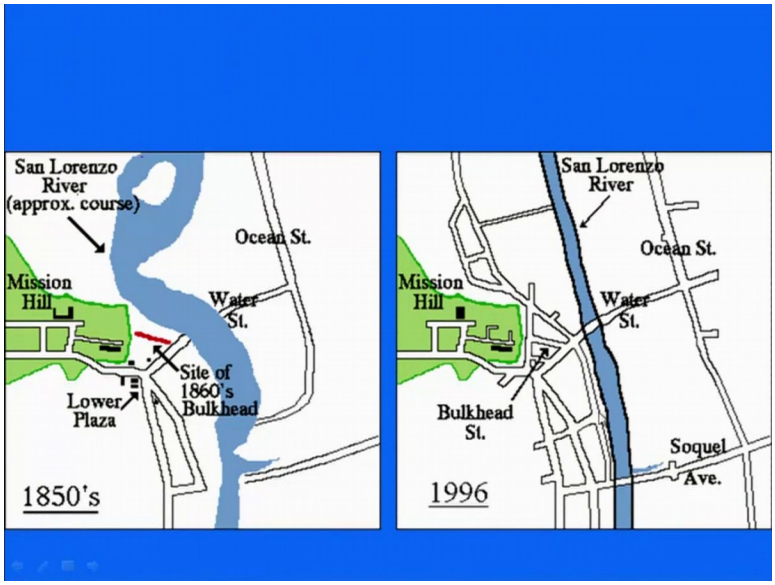

So again, there is an example which has been shown but before the channel was channelized, a construction how it looks like an after that this the same river, San Lorenzo how from US. So, I will stop here and we will continue in the next lecture with new topic on Tectonic Jamo Floor. Thank you so much.