Laboratory Practices in Earth Sciences: Landscape Mapping

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Welcome back. So, during the last lecture this was the slide we stopped and we were talking about the Meandering Reavers. So, let us see a few more examples and associated landforms related to the meanders. So, this also part we have already discussed. So, let us move ahead. So, meandering dynamics mainly I just as I explained that if you look at the outer edge then you will find that it is deeper and the currents are more like velocities higher here.

Whereas on this side that is the inner part it will be more or less less and the depth will also be less compared to that. So, if we come look at this photograph field photograph then you will see that there is this river or the channel pattern has dynamics which keeps on migrating and it will migrate in this direction usually. Because, there is an erosive bank or the erosive nature of the channel here. So, it will migrate here and as well as it will keep depositing here.

So, it will move in this direction. So, a few more things that we were talking about are in the point bar here. So, this will be a point bar and this part will be termed as Talwaj which is the area of maximum slope and greater energy. So, the velocity in this area will be much higher and that is one of the reasons that it has an erosive nature. Now, coming to the part of the development of Oxbow lakes or we also term this as a cut off banks.

So, it is a simple mechanism here or we can say the process in fact, what we see here is that this is an erosive nature of the bank and the river is flowing in this direction here and this part is also having an erosive nature. And as I mentioned in the previous slide that this will move or migrate in this direction. So, the time will come when this channel will join this one here and this portion will be left out and that is what we call cut off channels. And these are very commonly seen if you look at the endocytic plane you will be able to see this type of cut off channels remnants. So, this is another example which shows that earlier the channel used to flow like this here and then this got connected here.

So, the next phase will be the area where you will see the connection and this will be the left out cut off bank. So, again along with the erosion and the pollution what we see here is that the portion of mostly the straight channels is what we are having. So, within the meander what we are having this is a meander here, but within that some portion you will

come across they are straight. So, what type of sediments the blue dark blue is showing the energy conditions are higher here in this case the meander the energy condition is higher here similarly here also. So, this is showing the velocity here high, medium and low.

So, mostly you will find that in the meandering part you will have this component also that is low whereas, in the straight you will have mostly the medium and this one. So, along with that what you will find is that the deposited material will vary from place to place depending on the pattern of the channel. So, here you will see mostly the coarser deposits whereas, in the case of the meander you will have mostly you will see walls. So, that is coarser will be in the area where you are having high energy conditions and finer and medium will be in the area where you are having medium to low energy conditions. So, this is a mechanism which has been explained or the process which shows that if as soon as the channels start winding up and that is your meander is getting more sinus in the sense then at this is the last stage where you will see an cut off channel which is also termed as ox pole x because it is in like shape of the ox pole and that that is the reason why it is been termed as ox pole x.

So, you just have to remember what is the process which is happening here and before what was what we were able to see. So, I will show you a couple of examples while selecting the sites for any construction. So, suppose you are having a meander here and you have been asked to put the bridge here or you need to put the bridge. So, you should not put the bridge across such areas because it will have a tendency to change the path and that is the migration and because of the processes which we have just seen. So, the creation of the ox pole x is another example which has been shown.

So, you can go through this. So, this is again the same process which we were talking about. This is the first stage then this comes nearer to each other then finally, what we see is that this is connected and this is left out which we see an ox pole x or cut off channel. So, this has also been termed as a cut off channel. Now, there is an example where we are having like we are at Kanpur and there is an excellent example of a very large meander loop which will be left out long back. So, close up if you see it is shown here.

So, this is the portion of the and research carried out on this suggests that this cut off bank which is quite large if you can see the scale here then it is quite large. So, this is not very old; it is hardly 10,000 years old. Now, coming to this is another close up of that you have you can see this cut off here and there are many other cut off I will show in the coming slides. So, this is the close up of that one here. So, earlier the channel used to flow through this path.

So, the reason here is that for example, this is then how sitting on the erosive bank of the meander this is an example from Washington. So, what happens next actually. So, this is what you will find. So, this bank and what we have been we have discussed in the beginning of this lecture that during the floods or peak floods this type of cases were observed in Uttarkashi and all that ok. And that was mainly due to the erosive nature of the channel which eroded the banks and now this house is sitting just about to collapse here ok.

So, earlier they had in this area of the river bank ok, but now this is completely eroded this portion is completely gone ok. So, that's what you see here. So, these are the areas of concern where we need to be very careful. Now, this one of the example which I always discuss with my students that if you are having like if you are given this area and then you have been asked to put in bridge of course, there is a bridge which is connecting here. There is a road here which connects the and goes through Hamirpur. This is a small town and it moves further ahead ok.

Now, what will happen in future if you consider what we have discussed now ok. So, this is a close up here and as we have been discussing in previous couple of slides that this portion is having an. So, this is an outer portion of the channel and it has an erosive nature and it also tends to migrate ok or you can say shift. So, shifting will be in this direction. So, the time will come that this channel will keep on migrating here and will join this one ok.

So, this will be left out. Now, the only point is that in that case there was again no need for this bridge over here ok because this will disconnect this channel ok. So, if given an example to interpret then you can give your suggestions that what will happen in such cases ok. So, this is the close up of that ok that is Hamirpur. So, probably this town is in danger. We can say ok because it will definitely keep eroding and this channel cannot fight nature . It will keep moving here this side ok.

So, another one is your braided streams which have like multiple channels connecting further downstream with the main channel. So, braided streams are the positional channels divided into a series of braids separated by your islands, that is your braided braid braid bars or you can say braided islands ok. So, braided channels form the conditions where stream energy is high and the channel gradient is steep. So, these are the main points: the energy is high, gradient is steeper then sediment supply is high here ok with coarse or bed load supplied from the hill slope and tributaries and bank material is erodible allowing the channel to shift sideways. So, these will be not very deep channels mainly, but you will see that these channels have a tendency to migrate ok.

So, this is another issue with the braided channels. Another similar to braided channel which we term this as an anastomosing channel ok. So, anastomosing channels have a set of distributaries that branch and rejoin again very much similar to the braided one. It mimics the braided channels, but braided channels are single channels from where the flow is diverted around the obstacle that is an obstacle like you are having a bar here. So, the braided channel will flow like this and it will have a single channel.

So, for example, the channel is coming from here then this will bifurcate like this and if you are having another bar here then it will go like that ok. So, this is not typical of braided channels, but this will have multiple channels ok and it will as I said that it will mimic it is very much similar to what we call not the same, but similar to your braided channels ok. So, anastomosing channels are a set of interconnected channels separated by bedrock and stable alluvium. Alluvium is basically the loose material ok. So, this again has a tendency to migrate very in the white areas ok.

So, this is again an issue with the anastomosing channels. So, if you know the pattern of channels you have identified and then you have to give your suggestions for the best size selections then you need to understand the different patterns of the reverse that is a channel pattern ok. So, this is an example of the braid bar. Now, as I said, if you look into the gangetic plain this is a corona satellite photograph of the gangetic plain. So, what you see here is multiple things ok.

So, one we see here is the main channel which is the present day stream or or the channel and then few we can see here the cutoffs ok. So, these are the cutoff channels here and there are few here also ok on this side. So, and this whole area so, because we as we have learnt and discussed in the beginning of the lecture that the reflectance or the objects we can differentiate based on the reflections what we are getting back ok. So, we can save this because this is a panchromatic image. So, we see the variation of the gray tone here ok.

So, what you see here is that let us look at further in detail. So, this is your main channel that is your active channel and this is your older meander and this boundary which is marked between the darker one and the lighter one in the gray shade is your active floodplain ok. So, as we were talking about, this channel pattern has a tendency to migrate or shift. So, within this active channel we should not allow any construction also because this area will have a tendency to occupy or we can say reoccupy the same as its own channel also. Mostly this is common when we look at the alluvial fan areas which will be discussed very soon, but this also channels have the tendency to do that.

The darker parts what you see here are the older alluvials or we can say the older floodplains are ok. Even in the coming slides we will talk about and this will be a little bit

higher as compared to this one ok. So, if you put a cross section here then what you will come across is something like this ok. So, if I put it on, So, this will be your active channel, this is your active channel and these are older floodplains ok.

So, as I said that you can look at any Google image you will be able to see these features ok. You can see here also you have an older meander which has been sitting and as we talked about this one and this one here. Now, river and river related landforms in if as we have discussed as one is that in the beginning we were talking about the levees also. So, naturally the levees will be like as I have discussed in the beginning also that it will be slightly having a slope towards the that is away from the main channel ok. So, it will have a slope on this side.

So, in order to protect this area in particular artificial levees are also constructed ok. So that the flood waters do not enter these areas and these areas will be used for construction and all that or maybe for agricultural purposes. So, you can if there are examples where artificial levees have been put. So, considering that this level will be the maximum flow depth here, it can go up to this also, but this will not cross this ok. So, protecting the surrounding floodplain areas you will see that.

So, this is the area in this sketch. It shows that the river is flowing in this area where you have the active channel and during the flood events this whole area will be affected. But if you are putting the levees that are landscape after the construction of levees what you can do is that you have channelized the flow. And another term which has been commonly used for this is your river training. So, the river has been trained to flow through this path only ok and then you can use this for. So, this is what we are looking at is that if you take the cross section then you will find that this is something like this ok.

So, this part is elevated here. So, the channel of the river has been trained to flow through this artificially and the flow has been channelized through this. So, this can be used for construction and for agricultural purposes. So, when there is a low flow you can say then this portion also will be used for agricultural purposes. So, on the river side you will find that most of the during the winter and summer before the rainfall and before the channel is getting into the flooding state these areas are being used for agricultural purposes. So, what we are expecting from you is that when you are given some exercise to map the geomorphic features you can talk about all this ok.

So, the advantage of natural levees is another example: unless and until it is breached then this area will get flooded, but mostly you will see that these areas have been protected. So, you can see now the clear cut profile of the cross section profile of the artificial levees which is being constructed and which shows that the channel has been trained to flow

through this pathway. Another landform which is common in the fluvial regime is the alluvial fan and the and the final destination where the river goes and meets that is the ocean then you will have seen the delta ok. So, we will see these two examples quickly. So, mostly why the alluvial fans are formed again when a stream flows through a steep slope.

So, we are talking about the uplands here steep slopes. So, if you say that this is the profile here and then these are the hills ok. So, when this stream is flowing through a steep slope and suddenly it enters into the. So, in this area it will remain confined ok. So, we can say that the flow is confined in the upland whereas, in the plane areas that are alluvial plains the flow will be unconfined.

So, basically I will explain here. So, you are having a slope here. So, in this portion like in the uplands it will be confined, but here it is getting unconfined ok. And again there is a sudden change in the gradient. So, that is what we will see here. So, one is that the flowing through the steep slope steep valleys in the upland areas the bowels suddenly go to a nearly flat.

So, for example, if you consider this as an Himalaya and this is an Indo Indo-Gangetic plains, ok. So, you will find this very clear demarcated geomorphic landforms along the foothills ok. So, it is entering into the flat area that is your alluvial plane. It experiences a decrease in slope. So, there is a sudden decrease in the slope here ok, a corresponding drop in the velocity and a decrease in its ability to carry the sediments.

So, the carrying capacity also reduces. So, carrying capacity also decreases here as a result the stream deposits its load in a fan-like shape because it is getting unconfined. So, it will just deposit or unload the material and this fan shape is the reason because the material which is loose material has been termed as alluvium. So, when we say we call this an alluvial fan. So, that is how this term has been given to this landform. So, these are the examples as I said that you will be able to see this commonly at the foothills of mostly hilly terrain where you are having the confined streams coming from the steeper slope and this is the gradient drops here.

So, it will become unconfined and the deposition will be. So, it will have multiple channels here again. So, this is an example from the foothills of Himalaya where you are having the sub area or we can say this shivaliks shivalik hills and this is the area from Chandigarh where you are having the major fan deposit. So, there is a fan which has been deposited over here. Now, issues with the alluvial fan is that if you are have to select the sites and all that and if the the channel is active and have the capability to deposit the fan again because there are a gradational phases which we have we have come across in the

studies in many locations that the the fan a gradation are seen in the multiple sequences.

So, the area close to this will be of high hazard and in the middle part it will be moderate hazard and the lower hazard as you move away from the fan. The reason here is that you will have the coarser deposits here and as you move. So, this will be medium in size and this will be finer. So, as you move from the proximal end to distal end this is your proximal part that is exactly we can say this one is proximal and this will be your distal part ok. So, if you move from proximal to distal then you will find there is a change in the grain size from coarse to finer and that is why the hazard has been marked here that close to the proximal part you will have higher hazard ok.

So, we will stop here and continue in the next lecture. Thank you so much.