Geographic Information Systems
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Lecture-35
Demonstration Through GIS Software

Hello everyone! and welcome to this demonstration through these GIS softwares.

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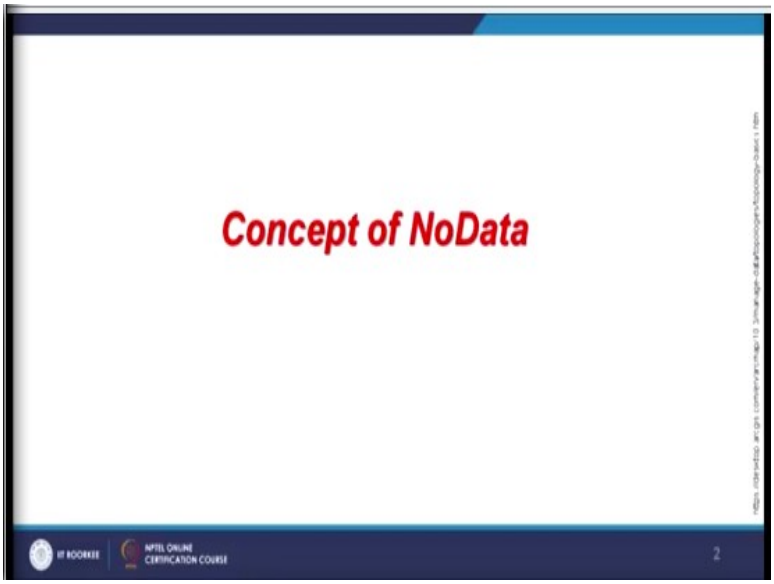

So, in this discussion or in demonstration, we will have demonstration about the concept of NoData which we have already discussed in few classes back. And we will see practically now what is the meaning of basically NoData? How it is handled by the software? And the second thing which we are going to have discussion in our demonstration about the different map projections. And I will try to use 2 softwares, how they handle this map projection.

But concept wise it is same as we have discussed in the theory part that we have to sometimes change from one projection to another. And changing vector data from one projection to another is rather easier or relatively easier as compared to the raster data. Because raster data when we project from one projection to another, there might be introduction of NoData and that too, we have to handle little carefully.

But otherwise, it is not a big problem. Most of the good softwares have already implemented different map projections and also custom design. So, if you are having required parameters about your projection and you do not have any standard menus, still you can project your data from one projection to another. And one other important thing about map projections nowadays most of the softwares also use a concept which is called on fly projection.

That means that if you are already has opened your software and having one map in the background. For example, I am having a boundary or countries map of the entire world. Now after that when I will add another theme in my project which maybe on indifferent map projection. So, my first theme is supposed in UTM, another layer I am going to add is part of India which is in polyconic projection.

So, when I will add this one, automatically the second layer will get the same projection as of the previous one or the first one. So, this kind of concept is called on fly projection or fly through projection but it has to be projected. Both themes have to be projected. Whatever the first theme, the second theme will follow the projection of the first theme. And this is what the concept of on fly projection which is very-2 useful.

And it becomes very convenient to keep adding data or different layers, themes in your map. So, good practice to always use that map or display or add in your project which you know that this is the projection, I want of all other themes. So, whenever you keep adding new layers, new themes, automatically they will adopt the map projection of the first one.

So, it is a very good help in real projects to imply this on fly. Basically, you do not have to do anything except that the first theme has to be chosen very carefully which is already projected. So, now we will see demonstration on the software. **(Video Starts: 04:09)** So, what we are seeing here is a digital elevation model which is covering entire India and neighbouring countries as well.

Now this digital elevation model as you can see here on the table of content, it is USGS topo of 1-kilometer resolution. Now someone may think that what is the use of 1-kilometer spatial

resolution digital elevation model. But through my own experience, it is very-2 useful. First of all, it is useful from the map projection point of view because it is not a very big file, I want to keep as a background.

And whenever I want to use, I can use it or just keep as a background and because it is satisfying my projection requirements. Otherwise, it is also very useful for some other purpose whenever I want to show anything of say, India. So, if I am working over India, I can definitely keep this type of 1-kilometer resolution. And if I want to go for a higher spatial resolution digital elevation model like here which is a 30-meter ASTER based digital elevation model.

No problem! This is what you are seeing a 30-meter spatial resolution digital elevation model. But before that what we will do? I will zoom a part and then will show you what is the basically difference between these different spatial resolutions. As you see that now this is what it is being displayed as 1-kilometer spatial resolution and this is called USGS topo. It is very famous; you can also download for your area of interest.

And if you are working for India then one tile would be sufficient for downloading and covering the entire India. Now here individual cells are representing 1 square kilometer of the area like here. And if I zoom it, I can get the exact elevation value for my this one also. So, only thing I have to choose little carefully that only the visible layer and then next time when I click, I get the value which is 2371.

This is a stretch value so you keep ignoring the stretch value. The pixel value is the real elevation value which is what is useful. You also might be knowing this will also come in future discussion but since we are having demonstrations, so I will briefly touch a this USGS topo. This USGS topo global digital elevation model has been developed implying 250000 survey topo sheets of various countries. And the contours from these 250000 scale topo sheets have been digitized and employing interpolation techniques, a global surface has been created at 1-kilometer resolution.

So, maybe like 10-15 years back, when we did not have any other global digital elevation model then we used to imply this USGS topo 1-kilometer resolution digital elevation model very extensively. Now since we are having digital elevation models available at 90-meter like SRTM, no issue. We can very well download for our area of interest or 30-meter or even nowadays you can get a 12-meter. For India, you can get this Cartosat based digital elevation model of even up to 5-meter resolution.

But there are only few tiles for India, it is available. One other important thing that one has to really remember is when we say a high spatial resolution or low spatial resolution. So, relatively here we can call this USGS topo relatively is low spatial resolution digital elevation model. But there is the advantage of relatively low spatial resolution because only one tile because this has been developed in form of tiles.

So, you need not to download the entire global tile, you can just download the tile of your area of interest like I have done for India. But being a relatively lower spatial resolution, it is covering the large area, not only India but even surrounding countries. So, in that way, it is very-2 good if my application requires to cover entire India and surroundings but if I want a higher spatial resolution DEM like the one which I mentioned here about the ASTER one then it covers a very small area of India

And a small-2 tiles would be there depending on whether they are 5-degree tiles or 1-degree tiles. You can definitely check if I put my cursor on the corner and read at the bottom; longitude, it is 78 degree and this is again, so this is 1 degree tile. Same I can check for latitude that if I keep here, this is as say 30 and this would be 31.

Also, if you read the name of the file which I have downloaded, also clearly it tells us that what is the extent of this tile. It says that north 30 that means latitude wise, it is represent starting this corner one; this bottom left coordinate is a north 30 that is latitude and E; E for that is longitude of eastern hemisphere. So, E078 that means the 78. So, this is always addressed to the bottom left corner.

Similarly, here also what it says for India if I again zoom it this one but I find that here just to check the longitude, I have to because here the lower part is mixing with the background. So, here it is 60 and then it should be 40 or here this is 40. So likewise, these tiles are address as per their latitude, longitude extent. So, very well you can very easily know which one is the degree tile, which one is a 5-degree tile or which is a much more wider tile line this one.

Now what we are going to do? We will now focus mainly on this ASTER one and before I go for this NoData thing which is for this demonstration is specifically. First, I would like to tell that it is always easy or it is always possible to create a subset of your data set, whether it is a vector data or a raster data. What we are going to see here if I want the digital elevation model of this ASTER DEM of only this red polygon.

That is my say water-shade or my area of interest or a district, does not matter. And I do not want to keep any other thing except digital elevation model for my area. So, it is possible to imply a tool and you can always search also here that you can just type like extract a raster or clip and then extract Y polygon. So, when you choose an appropriate option which are there, you get immediately a clipped part like this one.

So, this belongs to this water-shade which earlier we have formed or it is there. So likewise, it is very easy to clip for that area or extract for that area without any problem. These tools are available in all good softwares. So, this is the first step in that sense about for the NoData. Now, what you are seeing here is arbitrary boundary of a digital elevation model whereas I have been always telling that the overall shape of a raster can only be either a square or rectangular.

Of course, shape of the cell or unit of raster is always square but overall say can only have either rectangular or square but here I am seeing in arbitrary form which is only for the display purpose. So, if I go in the properties of this one then I would find that the concept of NoData is being utilized here or being implied here that is what I have discussed also.

And here the NoData is given as no colours would be displayed; display no data is nothing and therefore it is mixing with the background. For time being if I change the colour and I say okay,

display as yellow colour then it will display. So, the true shape of my overall raster of this clipped water-shade or subset of my ASTER DEM tile is this much which is including the yellow areas.

But since I have instructed to the system that do not display as any colour; no colour and then say apply. Now the colour is mixing with the background. I know that the background colour is white so I can also choose white colour and then it still there will not be any changes. So, it is always better to use no colour and say apply. So, whatever the background colour does not matter, your water-shade or your area of interest will be displayed with arbitrary boundary but the system knows as a 2-dimensional matrix and that can have either rectangular or a square shape.

So, this is very-2 important for NoData. Other things if you want, you can definitely handle but whenever you make a extraction or clip of your data, that will be always displayed by default, this particular software will assign the NoData as without any colour. So, it makes our life much easier to do such kind of things very easier. So, this is what is the NoData is doing. Now, another advantage of NoData is that whenever I am using NoData and it is declared to the system then that value is not considered in any of my calculation.

So that is another very good part of NoData concept that for any calculation even for statistics, NoData values are not considered at all. That is why you are not seeing the NoData value here. The elevation values are between 573 meters to 2895 meters whereas NoData values are generally given in default by -4 times 9 or 5 times 9. That means this kind of value will not exist on the surface of the earth. The deepest part of the surface of the earth is 11 kilometers and highest part on the surface of the earth is 8848 meters.

So, if my NoData value is either lower than 11 kilometer or higher than 8848 and if I declare as a NoData value then system would know very easily. So, this is the technique which is employed for NoData and it makes our display much more realistic rather than always displaying the area of my data with a different colour. So, here if I use a colour then it does not look very nice.

But if suits your requirements, you can definitely display your values without any problem. I have earlier also mentioned this hill shade so just very briefly, I will also discuss this hill shade part also. But this hill shade discussion would not be complete once we discuss the theory part. And after theory, again we will come and how to generate hill shade, what are the precautions or options we have to take, that I will discuss later.

But related with the NoData, I would like to discuss this hill shade. So here again, this is a SRTM 90-meter of Himachal Pradesh digital elevation model. Again, there is an arbitrary boundary and the background is or the NoData value is having black colour which we can check also here. See NoData as a black colour, again if I choose no colour, it will disappear. And it looks now much more realistic and good also.

Rest of the areas are mixing with the ground that means in the NoData value. So, whenever you encounter such problems, try to handle these things through NoData. And as I have already told you that once the NoData has been declared, that value is never used in any kind of calculation or estimation or statistics. So, that value is always ignored by the software. And here what you are seeing a hill shade which has been derived using digital elevation model and that hill shade has been shown here as a coloured one, not an issue.

Now sometimes we find some other requirements so I will just show you a very simple way of achieving these things by implying the same data differently. So, first I add a file, the one which I showed in the theory part also, very common file which I have been using this one is a digital elevation model. Hill shade has been derived from this digital elevation model which I will also add in this view.

So, now I am having one is a hill shade. This is elevation; flat, only it is grayscale. No other values are there. Minimum value is 94.7, maximum is 3070 for this entire area. Whereas this hill shade is being represented as 0 value and 25 because it is an 8-bit image but it is giving you the feeling of the terrain. Now this one, we can call as a digital terrain model and this one, we can call as a digital elevation model.

But believe me, this terrain model or hill shade has been derived using that simple digital elevation model. That means this one has been used and one very popular derivative that hill shade or shaded relief model has been derived, this. Now the one which I wanted to show a very simple way of bringing both together and making a very useful product for further use in our plotting or our analysis.

That what do you do, you keep this elevation grid higher in the priority then hill shade; that means hill shade in the background and this elevation model or DEM on the top. And here, I will change this ramp or colour palette into a more attractive colour something like this and apply. So, now what is happening that instead of grey shade, now I have colours. Now further thing which I will do here that in my display, I will make this the colour digital elevation model 50% transparent.

And see what happens as soon as I press apply button. See that the background in which I have a hill shade in grey is now, both layers are displayed together; the top one 50% transparent, the bottom one is fully opaque then this is the product which I get which is a very-2 useful for several kinds of plotting. It is not only giving the colours but also giving the feeling of the terrain or it is terrain surface in that sense or we also call as a relief map.

So, very easily without any involving any classification or other thing, you can create a shaded relief model or hill shade from a simple digital elevation model and display top of or first elevation file and then that hill shade file and give colours to the elevation file or DEM and also 50% transparency. And once you do it, you get this kind of product. Now we will be also discussing about the map projection.

So, let me also show that one, 2 more map projection. Here what I am having? I am having 2 files or 2 layers, one is just countries in no projection or in geographic projection and the values are appearing here in degree decimal. And as you can see that the shape of Antarctica is completely distorted whereas the countries in the center are ok. But as if you go on the higher

latitudes or near the north pole as like in a south pole, the country's boundaries are completely distorted here also.

So, now this is about how to change this projection to another projection that we can do. Another layer which I am also having in my view is in these UTM zones of different countries. So, if I zoom over say India, there is some missing about the boundary of this India in the northern part because of some international dispute so that we can ignore here. This is not the true boundary of India in the northern part but many international maps are showing wrongly.

So, just ignore that part but if I want to check what is my zone at this part. So immediately, I can know the zone that visible layers and when I press here, I know the zones as well. Now, what I am going to do? I will project this one using different projections. So, what you can do that you say data frame properties in this particular software. And then you can choose a different map projection. A whole list of map projections is available, starting from geographic to our custom designed also. And various projections are there as discussed in theory class that each country is having their own projection system.

So, if I say projected coordinate system and I want to display say polar projection. Now within polar projections, there are many-2 so say I want for north or this north pole or I would go for south pole projections. And these are the details which are being used by changing from this projection to another. And once I press, just see what happens to the maps. How it is changes to the chosen projection which is south pole stereographic projection, see.

So, now the world is being shown and see this is now a true shape of Antarctica. So, when I am seeing from the bottom means from the southern pole upward having a stereographic projection for south pole, this is what the true shape of Antarctica. Whereas in the earlier, that was absolutely completely different representation of your Antarctica. Similar if I go and say for Asia and here, I can go and change say for example Indian projections. And these are the details. If you are having further information, you can definitely change it or you choose this one.

So, as soon as I will apply, you will see things will change and they have come like. So, see the shape of Antarctica, completely gone bad whereas the shape of other countries is now ok. So, it depends on where that particular country or your area of interest is there. Further I also said that if you want to do some measurements then the best thing is first to project to UTM. And let me do for India. Say if I choose a UTM projection for India, say 46. There are different zones which I wanted to show you earlier.

No problem, here we will see. So, if I choose this 46-zone, 46N; N stands for northern hemisphere, apply it. Now roughly India is in the center, rest are going here and there. And this is zone 47, if I go for 48 then there will be some again changes like this or I can also go for 44. Indian 44 is not there but anyway. And also, you see here that this is of course transverse mercator projection.

And you would have easting, northing or false easting northing and central meridian is 93 and there might be some change in a scale also. So, it is very-2 easy nowadays it has become to change your data from one theme or one projection to another without any problem. You can change to any projection whichever you want. Like suppose for northern hemisphere, WGS 84. Again, I can choose the zone say 44 as I was looking for India, alright, apply.

And this is what now, India is in the center. Sometimes I want to show the true shape and size of India only, rest I do not bother in some projects or in some work. Then I can choose that particular zone and automatically that will come in the center and rest may be distorted. As you can see what happens to the Antarctica, Australia or South Africa or in northern hemisphere. Rest have gone except for India; it is a correct representation likewise.

So, if I zoom, I get the correct representation. This is how you can project both datasets, vector and raster from one projection to another without much problem. The problem only with raster data that whenever you project from one projection to another, it would create a NoData value also. So, once it has created, not a big issue. You can assign NoData value as no colour and just remember whenever use encounter NoData value, assign no colour.

So, it will mix with the background, you won't see, everything would be alright. After geo-referencing also of raster data, it would create NoData. So, the best solution is assigned no colour and that way, it will mix with the background and it would look more realistic and nicer as well for presenting them either through PPT or some other like printing or other things. So, it is always better to handle these things.

That is why I have discussed or demonstrated these 2 things together. Because whenever you do or change from one projection to another, you are going to create NoData and whenever you do that geo referencing and other things. So, NoData and map projections in some way, they are links. And choices of map projection nowadays are enormous. And custom design projection systems can also be used for as per your requirement. You can modify any existing projections as well.

And some favorite, you can create like this one. This is GCS and WGS is world geodetic spheroid 1984 projection. Geographic coordinate system; GCS stands for that. If I apply that perfectly and now, I am getting values in degree decimals. So, this is what from where I really started our discussion. So, with this, I ended this demonstration with the advice or request that please spend some time not only practicing about NoData, getting feeling of NoData, how to handle NoData but also try to do map projections.

If you want like these layers or files for on your system, very easily you can find on the net. Just type the world countries boundary download. And probably first or second link will take you to that one. And then try to project this theme using different projections; there will not be any problem. The same way, I can also do it in ArcView as well. Though it's an older software but does not matter. The same data I can take. See this is the file which I was having. Now here also, when I go for these view properties then I can change the projection.

Currently, it is showing my mapping units are degree decimal and my distance units are miles, does not matter. I can convert into say kilometers also. And for projection, currently it is saying no projection because it is a geographic coordinate or GCS system. So, I can change the projection. Here in this software, you may not get those numbers of projections as in ArcGIS.

But the other part here, if you are having your own data to create your own projection; custom design projection then you can do it here very, very easily.

Only it requires the reference latitude, central meridian, 2 standard parallels and false easting and northing. So, these 6 parameters are required. You can choose whichever you want like a Lambert conformal conic or which is closer to our earlier Lambert polyconic projection. You can use spheroid and then you require these parallels. Currently, I do not have these values with me. So, whatever the default, it is displaying. I will choose and let us see what happens? So, when I apply, I may not get anything on display, does not matter.

So, sometimes there might be some problems. You have to really try with different map projections. And hopefully, these will work. In the standard parallels, probably the parameters which we have chosen were not correct. And like if I go for Mercator projection and these are the values which are being taken. Projection of the world, I can say projection of the hemisphere or I can say UTM. So, if I go UTM, here I can choose India, the 44 roughly comes in the center of India. And that from zone point of view and I say ok and ok. **(Video Ends: 37:36)**

And now I get a UTM projection 44 there. And of course, my latitude longitude values here in the top right corner are in meters because these are in easting, northings and they are in meters. This is how the system will automatically change from one projection to another. Now see what happens to the orientation of Australia or Antarctica; completely distorted but India is in quite good shape and size. So, if shape is good, of course it is going to be the correct size as well. So, with this, I end this demonstration. Thank you very much.