Photogeology in Terrain Evaluation (Part -2)
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Lecture – 02
Introduction to Natural Hazards (Types of Hazard)

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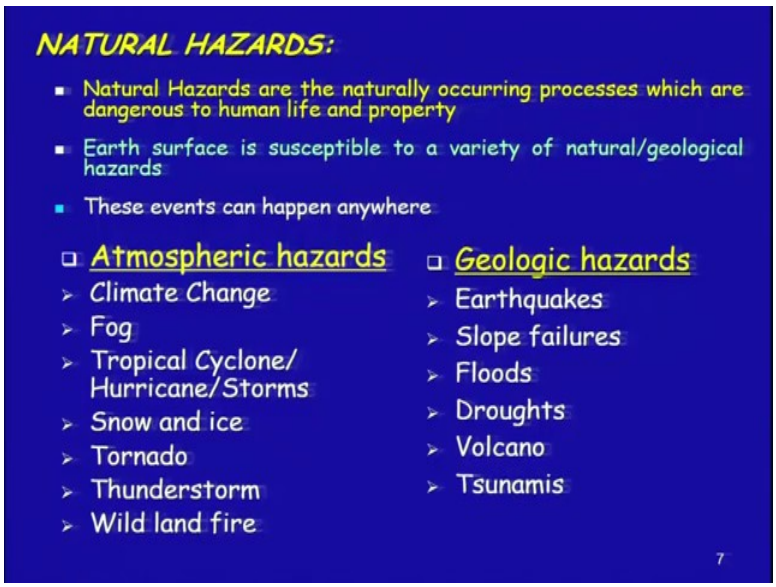

Welcome back. So, Natural Hazard; if we take as a definition are the naturally occurring processes which are dangerous to human life and property. And the earth surface is susceptible to a variety of natural or geological hazards. Few of them I was talking about that wildfire or maybe you can say side effect, liquefaction, landslides, floods, the earthquakes. So, they are the earth surface is susceptible to such events. Now this event can happen anywhere which are because of either atmospheric hazard or we can say geological hazards ok.

So, atmospheric climate change people have been talking about the climate change and all that, but there are some groups still believe that there is no such climate change which has been driven or triggered by the interference of humans. So, that is what we call human impact.

So, there are debates, but most of us believe that there is a tremendous rise in carbon dioxide and the earth is warming up and because of that then what is what we call the greenhouse effect and all that and that is creating the extreme events. But there are other

theories also which takes you back millions year; we millions of year back which talks about the climate change.

So, I usually ask this question to myself and then I discuss with my students also. There whether at that point of time humans existed or not, then why do not the climate change occurred at that time. Because now we keep on telling that because of the human interference we are putting more of carbon dioxide in atmosphere. So, we are having more of such events.

But whether in the past when such climate change took place which we call glacial periods and interglacial periods. So, glacial periods were colder or the cold period and the interglacial were hotter, why that happened in the past when there were no humans? So, whether this effect which we are talking about is real or not? This is a debatable question.

So, I will not get into the detail of this, but of course, with whatever most of us are expecting, but there are there will be more extreme events and what we have accepted. Like there is a climate change, there are regions where we have problems with fog, in winters or smog, we have tropical cyclones, one ends another has been forecasted and couple of them we have been forecasted which had in landfall in south India along the Indian eastern coast. We have snow and ice avalanches tornado, thunderstorms, wildfire etcetera.

Just take this all which are listed here atmospheric as well as geological hazards which are listed here like earthquakes, slope failures with landslides floods. Drought we had in the past, but recently we are not having volcanic eruptions just not leave. Our country moves little bit far. You will find that there were lot many volcanic eruptions which took place in recent past in last 5 to 6 years, then we had tsunamis. Now here I can give you the example that we like in fog; the Delhi government. They issued a memorandum that you will not run many cars on road.

So, they came up with a formula of even and odd numbers of the registration numbers so that to reduce the number of cars plying on that particular day. Whether that was effective in the question remains. So, mostly in the indo-gangetic plain side, we have the problems or the issues of fog during winters.

Tropical cyclones as I was talking about the Gaja, then we had in the past which was your Oda cyclone which was devastating again and in 1990's, there was a major event of cyclone in Orissa which what which affected the Orissa. Wildfire as I have told that example from Uttarakhand. Earthquakes if you come to this side of that is geological hazards in India, we had earthquakes right from starting from 1999 magnitude was not so high 6.6 or 6.5.

But if you come down to 2000 that is 21st century, we had 2001 Bhuj earthquakes, 7.6 magnitude we had, 2005 Muzaffarabad earthquake close to the India and Pakistan border again 7.6 ok. We had 2004 Andaman-Sumatra earthquake which was again the magnitude was large or we can say mega earthquake of magnitude 9.2 which also triggered the tsunami. And then we had recent one in Nepal that is Gorkha earthquake 2015 magnitude; again was 7.8.

Slope failures are associated with earthquakes because ground shaking as well as floods or maybe if you are having heavy rains, then that will result in to slope failures. And if you are having cloud burst sudden pouring out of the water on the earth surface can also result in to a major landslide or a land slip or slope failures. And as I was talking about floods, we always experience flood in the indo-gangetic plain areas as well as we had flood in south India and recent was Kerala flood.

Tsunamis; if they are associated with that thankfully that volcanic eruptions and drought are not experienced in the recent time, but of course, we have experience in the past ok. So, you have lot many hazards and you cannot say that we are we can get rid of any one of this. Again, which is the important point is that this all hazards can occur anywhere, but few of them are of course, a very particularly where it is going to occur the location the area whether they are favorable to have such hazards or not. That we will when we are discussing and talking about more in the course, you will understand that part.

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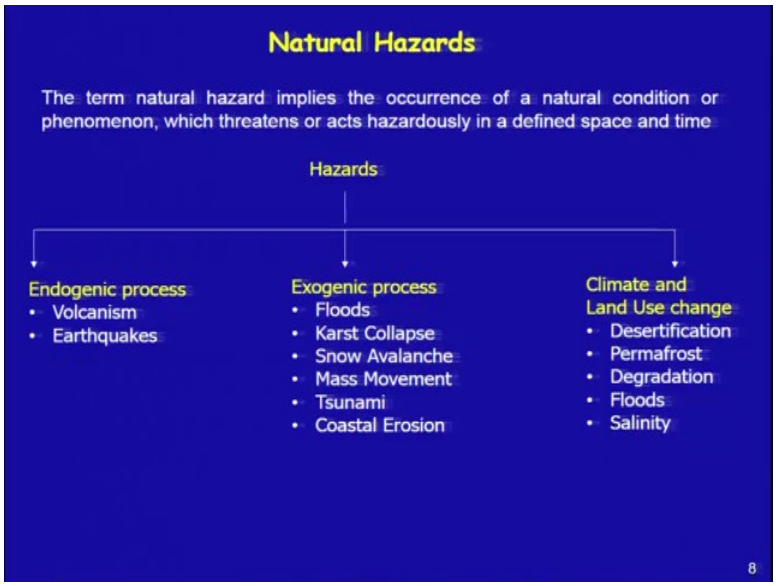

So, the term natural hazard implies the occurrence of a natural conditions or phenomena, which threatens or act hazardously in a defined space and time. So, how much area is going to be affected and what will be the time frame? So, if we know roughly also thus of course, the space you can fix up.

Now we have the technology and then science has advanced. In fact, certain stage that we can use very high-resolution satellite data and then we can come up with the maps. We can even simulate the floods knowing that, what is the topography of the area, what is the water shade of the area, how much area is related to a particular drainage basin. We can also talk about that how much cusec water is going to be to come in particular reservoir; if there is heavy rain in the watershed area.

Now, there the role comes of whether the downstream area for example, has not experienced any rain or a very less rainfall could get into the flooding state or not. So, if the dam is there and the reservoir is full of water, whether the water should be released slowly or the water should be released instantaneously which will definitely result into the floods in the low-lying areas or we can see in the downstream area of that particular watershed.

So, that you can you can talk about and we can do that exercise using remote sensing and all that. In this course, we will try to do the one exercise where the attempt was being made by my students to simulate tsunami. Now what are the parameters which we have

been used we will talk at that time. So, he will be delivering one lab assignment or maybe you can make in deliberate talks a small talk where he can talk about that how we did everything and what was the effect which we have found on the east coast; whether it was similar to 2004, what was the effect on the area, which are adjoining in the ocean if we changed the source of this mega earthquakes.

So, the point here is that, are we going to have and more devastating event that is tsunami in future? More area will get affected because of the flooding that is the coastal flooding we say either it is tsunami or because of the storms you can simulate that part, but in this course, we are going to talk about the tsunami part and we found very interesting results out of that. So, as soon as we have changed the source from Sumatra to Andaman, then the effect of that event which we would say that we are sure about that it will occur in future, the effect was quite devastating that is in terms of the water levels. Because when tsunami comes you have the water flooding and you have the ocean water coming on this on the coastal areas.

So, further if you classify these hazards, we have endogenic processes which we talk about volcanism. Earthquakes, exogenic processes. We talk about on the surface floods, karst collapsing that is the related to this term is related to the limestone terrain. So, you have if you are sitting on the limestone terrain, you may experience collapse or subsidence.

Snow avalanches mass movement land slips or the landslide, then tsunamis coastal erosion ok, then climate and land use changes which had desertification, permafrost degradation and floods again. So, we can in total we can classify this hazard in three that is endogenic processes, exogenic processes and climate that is again a part of the exogenic processes. And of course, the salinity increasing salinity that is also in part of a hazard.

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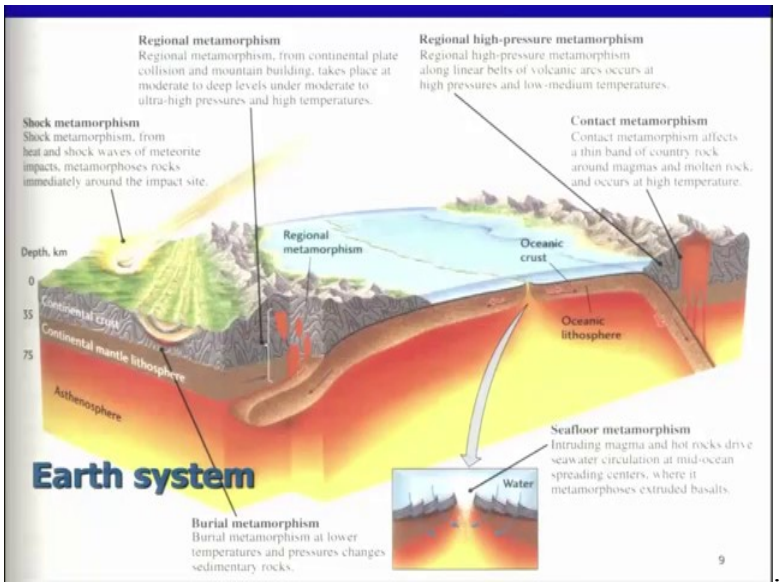

Now, coming to this we will definitely get into more detail when we talk about the endogenic process, the internal processes. Now, this diagram it shows because we are going to talk about the system. Warth as a system, whether it is an open system or it is an isolated system or it is an closed system. So, here what we see is these are what we call the tectonic plates; one plate is subducting or going down below the another one the plate or the portion of the earth crust which is climbing up or riding over the that this one will crumple down because of the lot of friction and the resistance between the two plates. But one will keep going because as we know this will also we will talk in one of the lectures, but we have the Indian plate which is not a stationary and we have dozens of plates across the globe which moves with different velocity. And the Indian plate is moving in north east direction towards Tibet or we can say towards China or we can say the Indian plate and the plate which is overriding the Indian plate is the Eurasian plate. It is moving towards it with the velocity of 40 to 50 millimeter per year.

So, this also we will talk what is the implication of this movement. So, what do you see here the crumpling in geology, we say these are folded folds. So, if you have read somewhere we say folded Himalayan Mountains or half folded Himalayan ranges. So, these are because of the overriding plate getting crumpled or deformed which will result also into the one plate is moving down, it goes down and melt result into the volcanic eruptions here because the magma is coming on the surface. Then we have the extra-

terrestrial material which is coming up and resulting into the impact on the earth's surface that is meteorites.

And similarly, the other processes which are taking place that is geological processes, but this is this part I am not going to discuss here where we are talking about metamorphism and then high-pressure metamorphism, contact metamorphosis. This we are not going to talk here some of the portion is I am already covered in one of the course, you can refer there, but of course, this is the process which will go on because this will result in to the changeover of the rocks or the material. So, you are having this loose material or I would say that the first the lava is coming on the surface, it will get eroded because of the different agents like water, wind and glacial and the sediments will be formed smaller particles or the cluster of the rocks or sand. Then you will have sedimentary rocks, then sedimentary rocks and the igneous rocks or the volcanic rocks which will be taken down to the earth's interior. By this process that is the plate is going down, it will melt again and it will come back. So, this is the complete cycle what we call the tectonic cycle and rock cycle.

So, we have plate movements and we have geothermal energy. So, these are part of the internal processes. So, here we also learn about that whether this plate movements have benefited the overall development of the humans or not. This is another important part yes of course, if we take the example of Indian subcontinent, then I would say that the plate motion has given us monsoons. Plate motion has given as monsoon, plate motion has given as rivers mighty rivers, plate motion has given us fertile land and of course, the other part is the scenic view. So, we have advantages, but at the same time the disadvantage is the hazard part.

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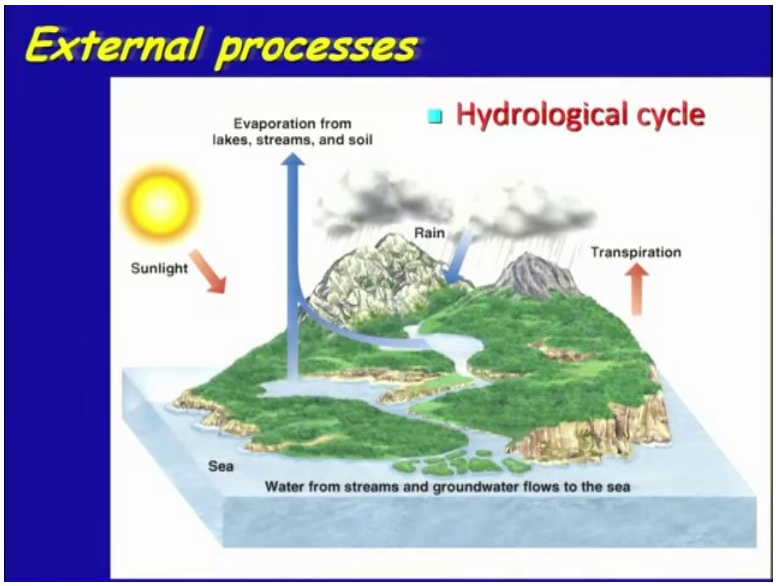

So, I will stop here and we will continue in the next lecture.

Thank you so much.