Wildlife Conservation
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Lecture - 12
Habitat degradation, loss, fragmentation and displacement

[FL] Now that we know what a habitat is why it is important for our animals. Let us now have a look at why we are losing our habitats for the wild animals. So, this lecture deals with Habitat Degradation, Loss, Fragmentation and displacement.

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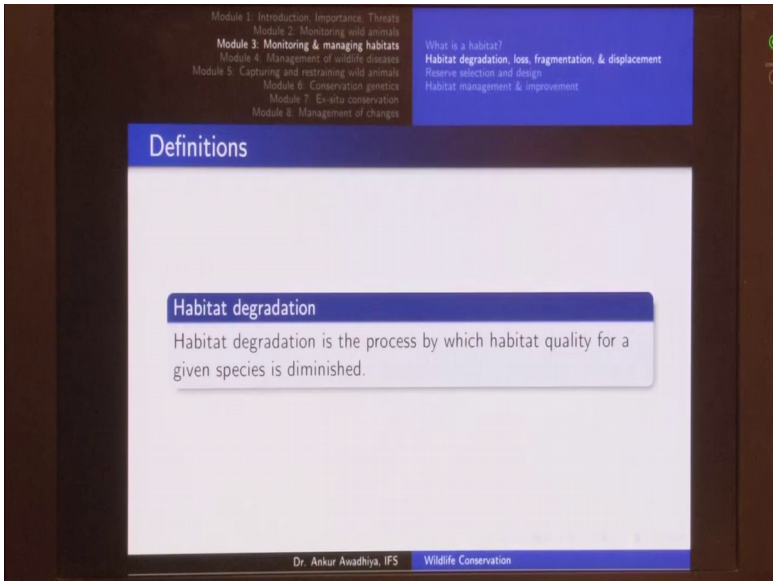

Let us begin with habitat degradation. Habitat degradation is the process by which habitat quality for a given species is diminished. So, we are talking about the quality of a habitat. So, essentially when there is habitat degradation then the habitat becomes not unsuitable for the animal, but less suitable for the animal or the particular species.

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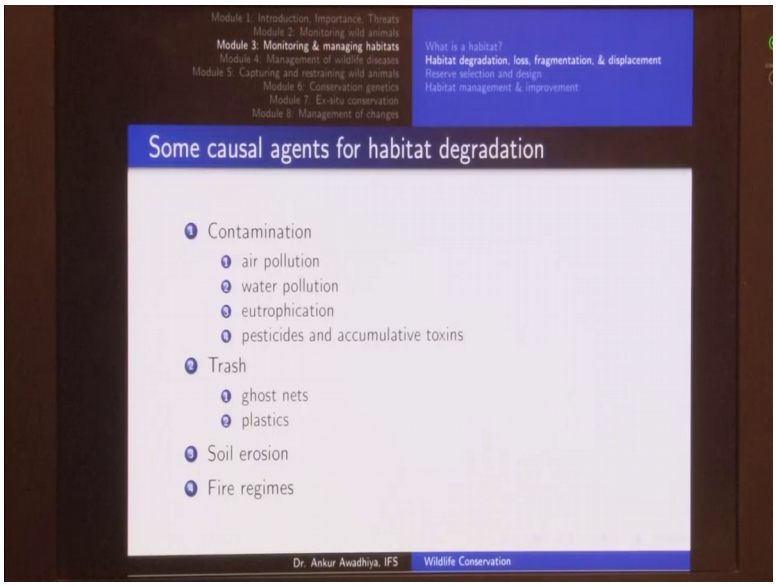

Now, some causal agents for habitat degradation include things like contamination.

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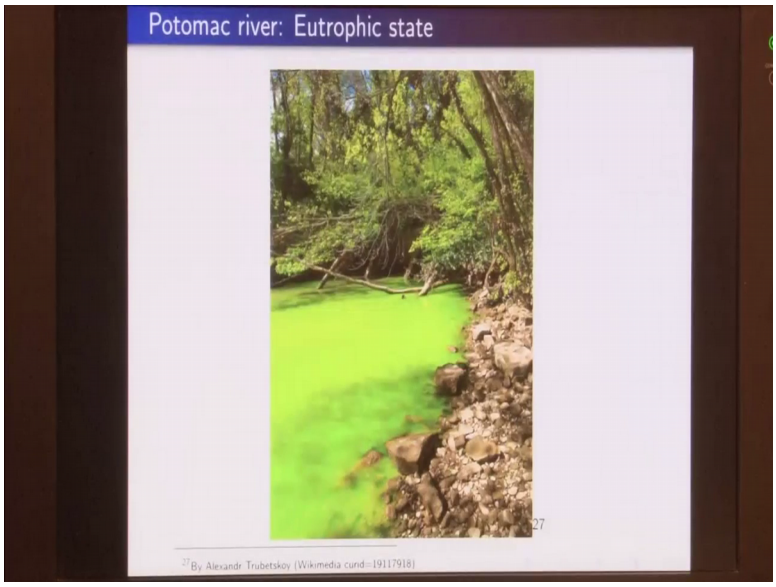

So, if there is air pollution, water pollution, even noise pollution, eutrophication, so, eutrophication is the condition in which we have an excess of fertilizers in a water body which leads to an excess amount of algal growth which we also call as algal bloom in that area. So, when there is the huge algal bloom then the surface water becomes inaccessible by most of the animals.

And then these algae die and when they go down when they drown into the water then their degradation eats up all the available oxygen that is there in the water. So, the habitat becomes less suitable for a number of species.

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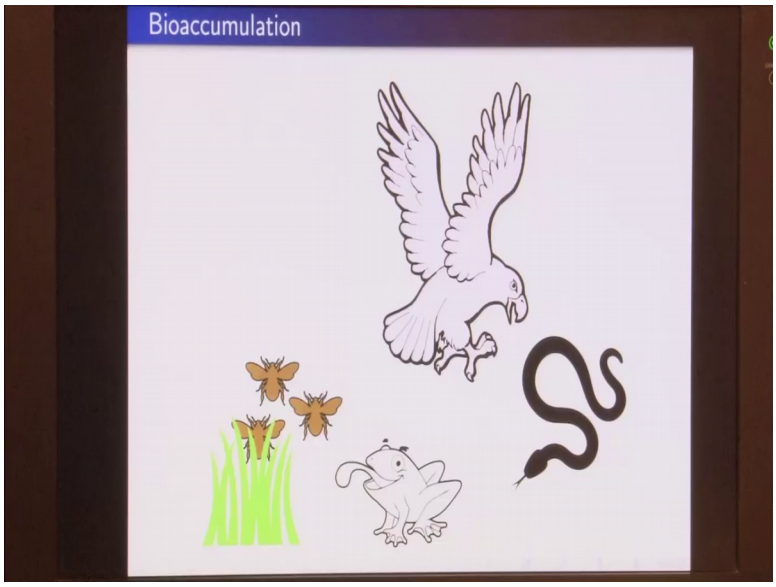

So, eutrophication and also pesticides and accumulative toxins; so, when there is a pesticide there in an ecosystem or in a habitat, so, for instance if we have these grasses and when there is some pesticide that has come into this area, probably because a nearby farm was sprayed with pesticide and then rain water brought it down here or say wind brought it down here. So, these grasses now have pesticides, but the amount of pesticide here is not very high.

So, we can have some insects that are still thriving in that area. Now, these insects would have some amount of toxins or the pesticides inside them. Now when a frog eats these insects, then say this insect had a concentration of say 1 ppm of the pesticide; 1 part per million. Now this frog in its lifetime, say it eats about 1000 insects. So because this pesticide is not thrown out of the body, it accumulates in the body mostly in the fatty tissues. So, the total amount of pesticides that is there in this frog would be greater than the concentration of pesticides that is there in these insects.

Now, similarly when these frogs are eaten up by snakes, so, a snake would be eating say 1000 frogs in its lifetime. So, in such a scenario the concentration of the pesticide in the fatty tissues of the snake would be much greater that was there in the frogs.

Now, when the snakes are eaten up by a bird of prey, now this bird of prey say an eagle would also be eating up quite a number of snakes. So, the concentration of pesticides goes on increasing as we move up the food chain. So, now, at this stage the concentration of pesticides was so less that even when the insects are eating it they are able to thrive in the area. But then when we talk about this snake, this snake would probably be having such a huge concentration of pesticides that when these birds eat these snakes then they suffer from toxicity.

So, this is a process that is known as bioaccumulation. So, a number of pesticides and other toxins that accumulate in the body especially in the fatty tissues can lead to a degradation of the habitat. Another causal agent for habitat degradation is trash. So, we talked about contamination, the next thing is trash. Now, trash includes things like ghost nets and plastics. What do we mean by these?

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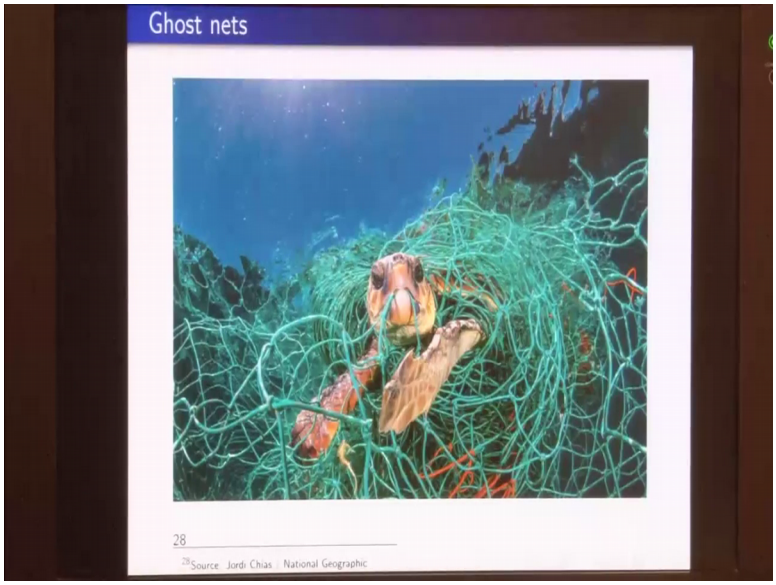

So, this is an example of a ghost net. So, what happened in this case is that there were fishermen who were using the fishing nets. Now, the fishing nets also have a definite life up to which they can be used. After a while because they are being exposed to water, they are being exposed to sunlight, they are being exposed to air then the strength of this net goes on decreasing with time.

Now, after this net has lived its much of it is working life, it could happen that when the farmer when the fisherman goes fishing then this net broke out or a part of it broke out.

And when it broke out it just goes out into the oceans and it just goes on moving in the oceans. It also happens at times that when we have severe storm in the seas then a number of nets are washed down from the boats.

Now, what does this net do? It is moving across in the oceans and it is still trapping animals. So, for instance this turtle got trapped into this net. Now what would happen? This turtle would because it is trapped here, it would not be able to gather any more food and it would not be able to move and maybe it would drown because of lack of food or maybe because of exhaustion or maybe because of because it is not able to move up and down in the water to get air. So, these things go by the name of ghost nets.

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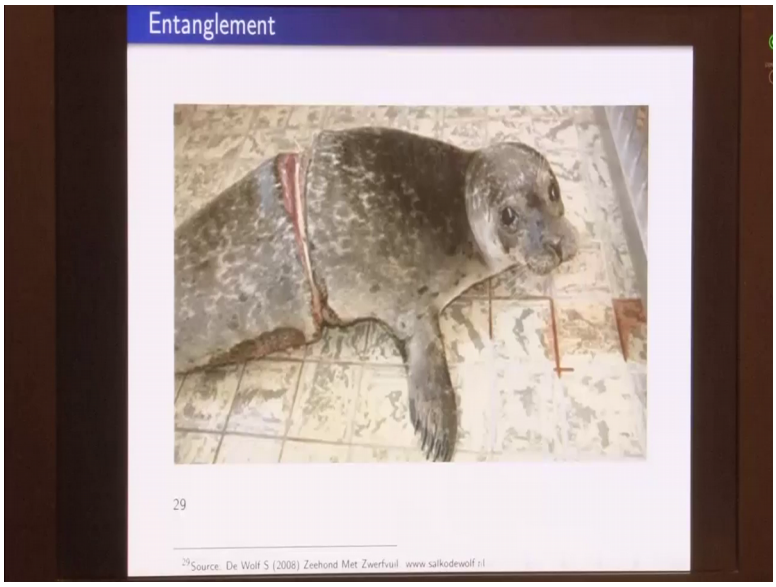

Similarly, in the case of some plastics they lead to entanglement. So, here we see a seal and in this seal there is this band of plastic that it had gotten into. This plastic got entangled with the body and later on when this seal grew in it is in size because of its normal growth then this became a hindrance and it became such a huge hindrance that it is now eating up into the flesh of the animal. So, any of these plastics when they are left outside it can pose a huge danger to the animals and are also a leading cause of habitat degradation.

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Similarly, in the case of India, here we have this picture of Nilgiri Tahr which is found near the Mudumalai Tiger Reserve. And in this picture also we can observe that we have all these bottles and different other kinds of trash that are there with the animal. Now, if this animal eats of this trash it might even lead to blocking of its elementary canal.

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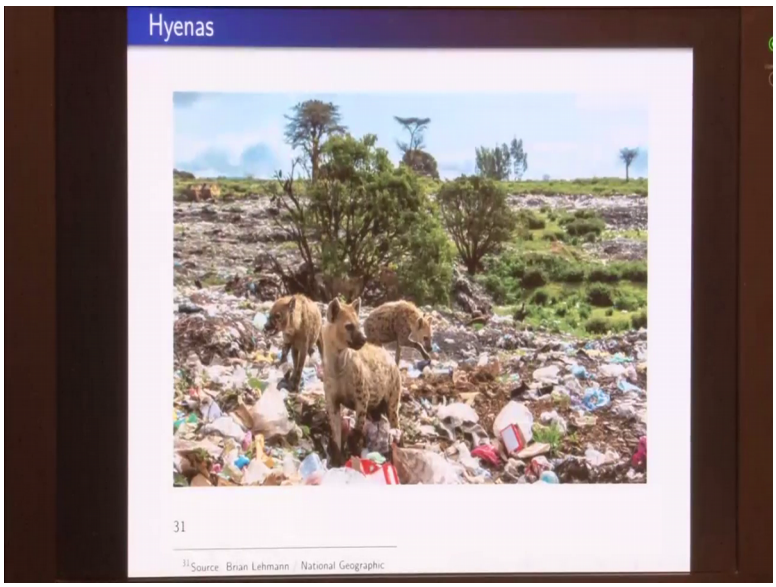

This is another picture which came in national geographic some time back. And here we see these Hyenas, now Hyenas are scavengers and they are scavenging in an area that is

all full of trash. So, during scavenging there would be eating up pieces of plastic which would then get into their intestine and might even block those.

Now, scavengers are extremely crucial for the working of any ecosystem because they are the primary ways in which nutrients which are stored up in the bodies of animals are released back into the environment so that the next generation of individuals can grow.

Now, if the scavengers die out because of the plastic then the whole ecosystem would collapse. Other things that lead to habitat degradation are things like soil erosion and fire regimes. So, if we have a heavy amount of soil erosion in some area then plants might not be able to survive any further. So, that leads to habitat degradation.

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Similarly, fire regimes; now, this is a picture from our Kanha Tiger Reserve in national park. So, in the case of a dry deciduous forest, forest fires are a natural feature. But if the rate of forest fires increases if their intensity increases or their magnitude or duration increases so, that might also be having a degrading role in the habitat. So, forest fires also become a factor of habitat degradation.

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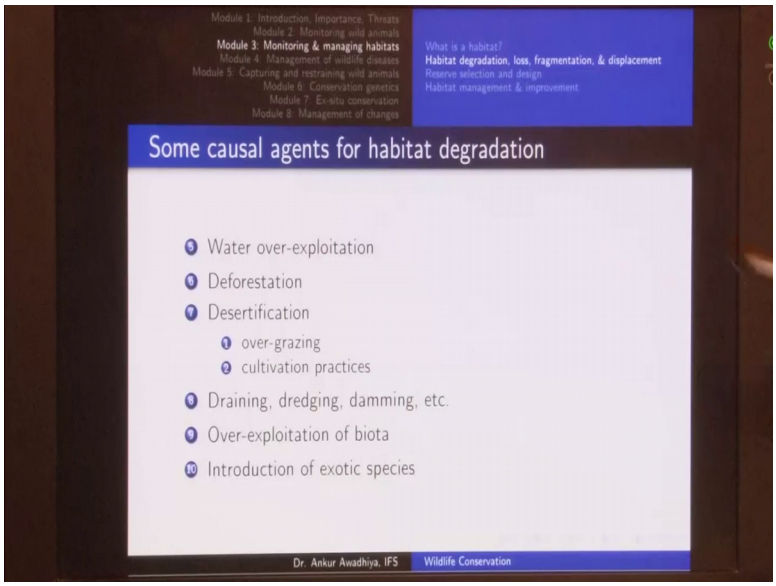

Some other causes include water over exploitation and deforestation. So, if water is not available in plenty that could be a factor that leads to have it degradation.

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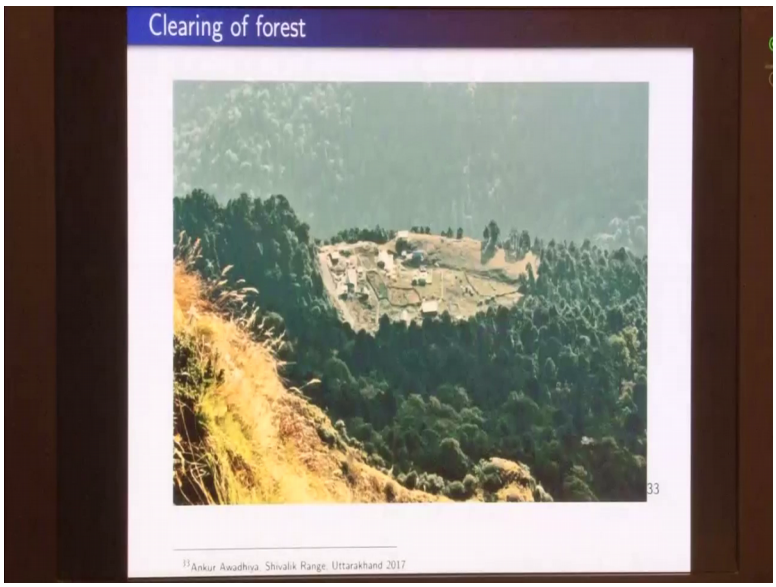

And similarly deforestation as we also saw in a previous lecture, so if there is a huge anthropogenic pressure and they are eating up all of these forests, so, the animals would not be having enough amount of forest for them to survive. Other factors include desertification. Now, desertification is a process in which we convert a forest into a

desert. And two main factors that lead to desertification are over grazing and some cultural practices.

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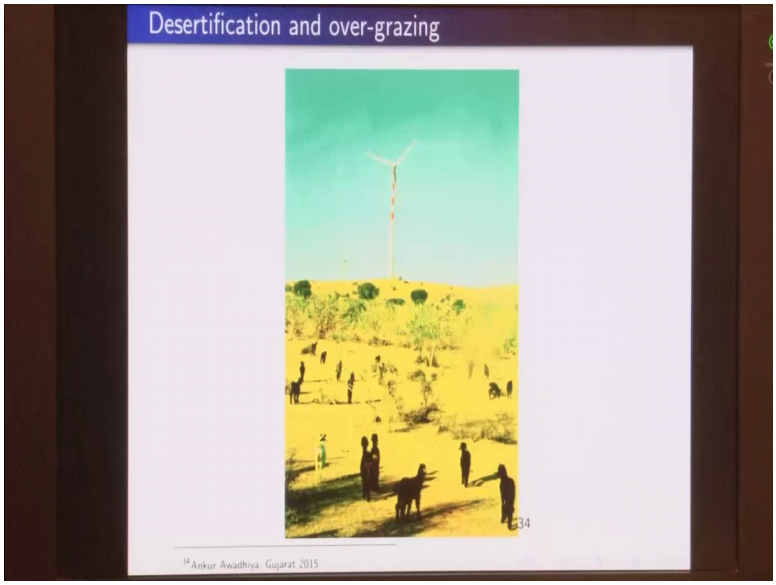

So, this is an example from our country this is a picture from Gujarat. And here we see that there are some amount of tree of shrubs that are available in this area. But then there is a huge pressure of these goats and if these goats go on eating these plants at a rate which is greater than the rate at which these plants can further grow.

So, in that situation all these plants would also be eaten away and this area would completely convert into a desert. So, desertification is caused by over grazing it is also caused by some cultural practices in the case of cultivation. So, for instance in scenarios where the water is used at a rate that is greater than the rate at which it is being replenished. So, we will be losing water from that area and that area again could convert into a desert. Other factors include draining, dredging and damming operations.

So, draining is a situation in which if we have a marsh then there could be people who would want to drain all of the water out of it to convert it into a piece of land to which is called land reclamation. And that land could be used for say construction of some houses. But then when we are draining certain habitat then the animals that were dependent on that marsh would all be gone. Similarly, dredging operations which are done in most of our streams, damming which is done on most of our rivers for accumulation of water and also for the production of electricity are also big factors for

habitat degradation. Also over exploitation of biota; so, for instance if there is a forest in which we have herbivores and we have tigers and if people hunt down all the herbivores for meat. So, this forest would not remain a suitable habitat for the tiger because it would not be having enough amounts of prey populations.

Similarly, in introduction of exotic species; so these are those species that displace out the native vegetation and in most cases these exotic species such as lantana camara in our country. So, these species are not palatable by most of the animals so when these species displace out the grass species or the fodders species. So, the animals get less amount of food and this is also a major factor for habitat degradation.

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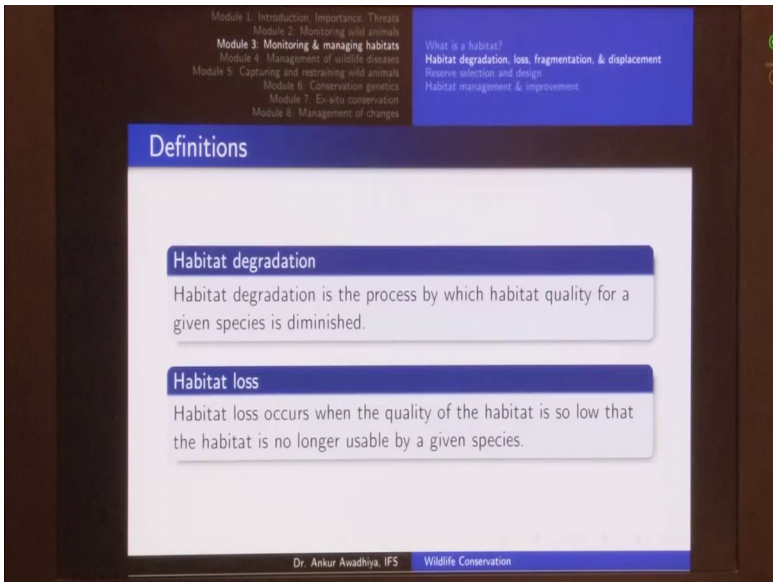

Now, after habitat degradation let us look at habitat loss. Now, habitat loss occurs when the quality of the habitat is so low that the habitat is no longer usable by a given species. So, essentially we are talking about a gradient.

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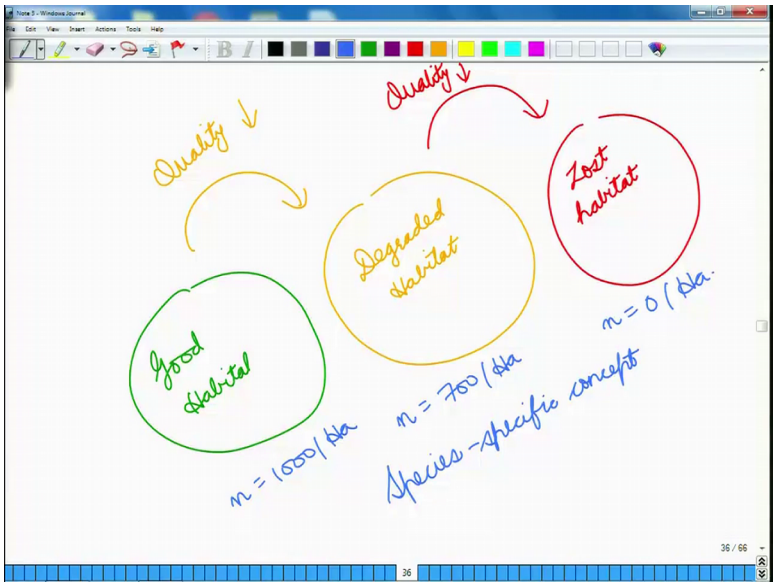

So, if we have a good habitat, now if there is some amount of degradation in quality. So, the quality reduces and it becomes a degraded habitat. Then after a while if the quality further reduces, then it might even become lost habitat. Now, in the case of a good habitat suppose we have number of animals is equal to 1000 per hectare. In the case of degraded habitat we would observe a less number of animals. So say we have 700 animals per hectare. In the case of a lost habitat we would be having an even lesser number of animals or maybe even no animal per hectare.

Now, again as in the case of habitat this loss or degradation of habitat is a species specific concept, so this is a species specific concept. So, essentially if this area was a good habitat s o we did not have any of the weed species, weed species or exotic species such as our lantana camara. So, a good habitat is for tigers maybe or a good habitat for our herbivores could be a very bad habitat for our exotic species or weed species.

In the case of degraded habitats are an amount or the number or the density of the weed species has increased. In the case of a lost habitat, we only have weed species in this area we do not have any palatable species. So, it is a lost habitat for our herbivores, but it could be again be considered as a very good habitat for the weeds. But then it is a question of management; whether we want our herbivores, whether we want our native populations, or whether we want those species that are not being used by any of the animal or most of the animals.

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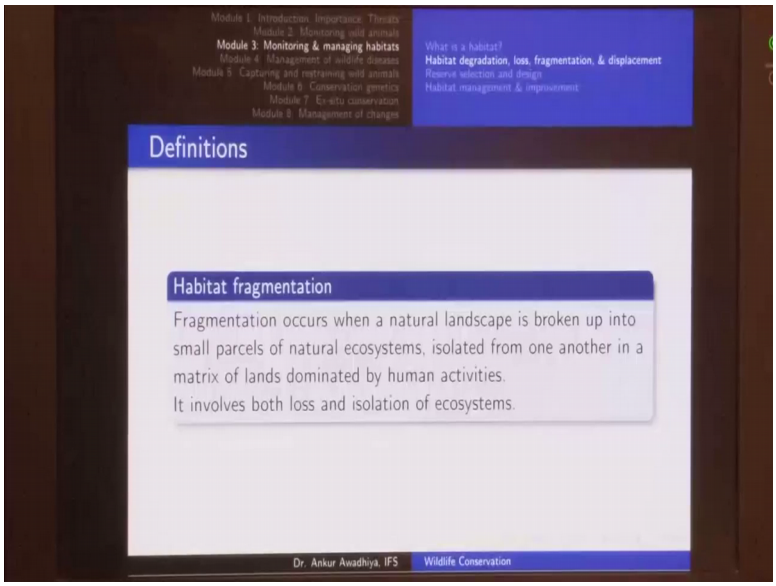

Now, another concept here is Habitat fragmentation. Fragmentation occurs when a natural landscape is broken up into small parcels of natural ecosystems, isolated from one another in a matrix of lands dominated by human activities. It involves both loss and isolation of ecosystems. So, what we are referring to here is this.

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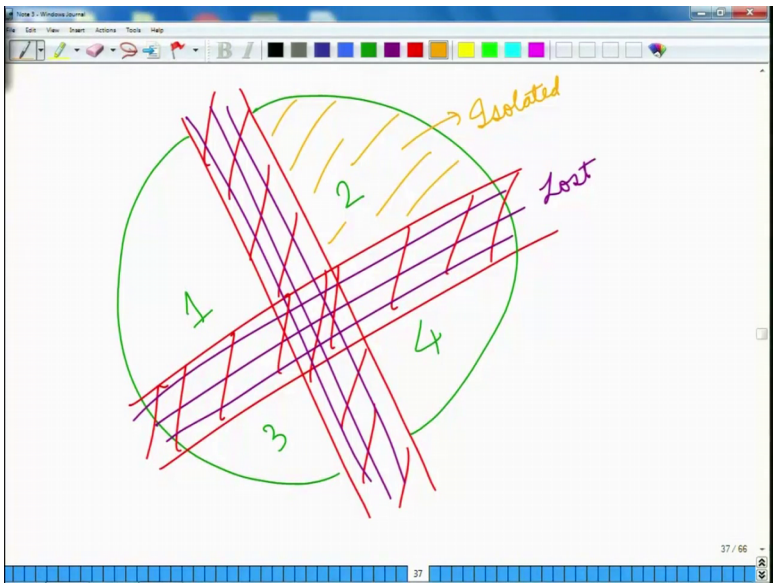

Earlier we had a large forest then later on we divided this forest into two parts. So, now it looks like this. So, this forest is now converted into two fragments; fragments number 1 and fragment number 2. Then later on if we have some other infrastructure development

that goes on, so this area is again lost for our wild animals. And so now, we have four fragments, 1, 2, 3 and 4. So, essentially a large forest has now been converted into very small fragments, so this is the process that is known as habitat fragmentation.

It involves loss of ecosystems and also isolation of ecosystems. So, basically this area that earlier was a forest is now lost, so these areas have been lost. And this area let us call it represented in yellow. So, this area which was earlier a part of a connected ecosystem is now an isolated system. So, why isolated because animals are not able to reach this area from say 1 or 3 or 4. So it has become isolated from all the other patches.

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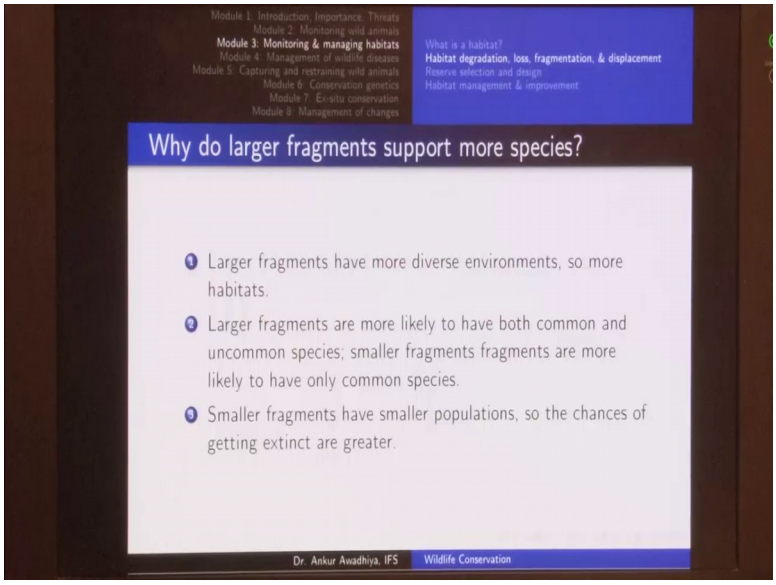

Now, why should this thing bother us, why are large fragments good for our species? So, large fragments support more number of species because they have more diverse environments and so more number of habitats. So, essentially if you have a large sized forest you might be having some areas that have hills, you might be having some areas that have grassland, some areas that are marshy, some areas that have a river. So, when you have a large fragment you have a diversity of habitats.

Now, because different species utilize different habitats a large diversity of habitats also mean that you have a large diversity of species. Secondly, large fragments are more likely to have both common and uncommon species, whereas smaller fragments are more likely to have only the common species. So, here we are saying that we have when we have a larger size fragment then again because of a diversity of species we might be

because of a diversity of habitats we might be having situations in which we have those species that are found very rarely, whereas, in the case of a smaller fragment, we will have no more of the common species.

Next, smaller fragments have smaller populations, so the chances of getting extinct are greater. So, when we have a large size population and if there is any calamity, if there is a forest fire, if there is a disease then there is a good chance that at least some animals are left out from this calamity. And so the population would be able to grow itself back again. But in situations when we have a very small sized fragment and we have say only 10 or 15 individuals that are there in that area in if there is any calamity then all of these animals die out and so we have lost that population.

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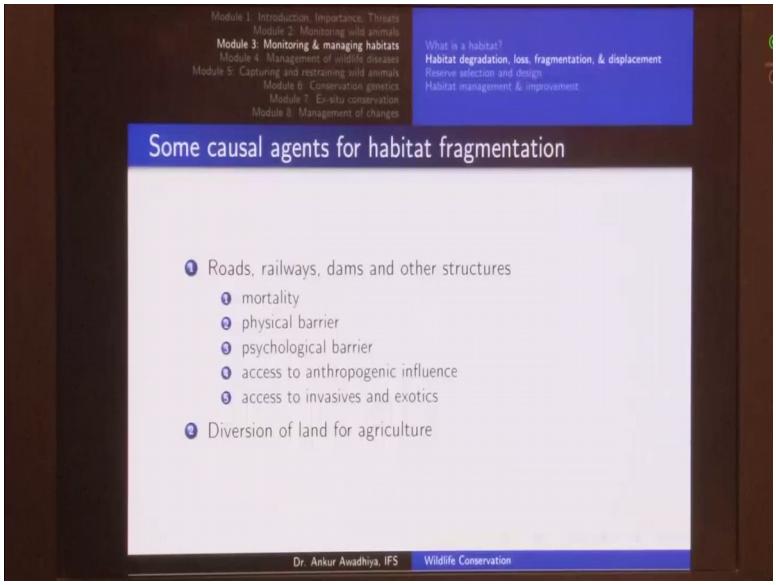

So, what causes habitat fragmentation? So, most of these factors are human made. So we have things like roads, railways, dams and other structures. Now, when we have a road when we have a railway we would observe quite a number of animals that die out of accidents with the automobiles. So, there is a huge mortality of animals in these areas and also these structures act as physical and psychological barriers. Because an animal is not used to seeing these huge vehicles that applying at fast speeds.

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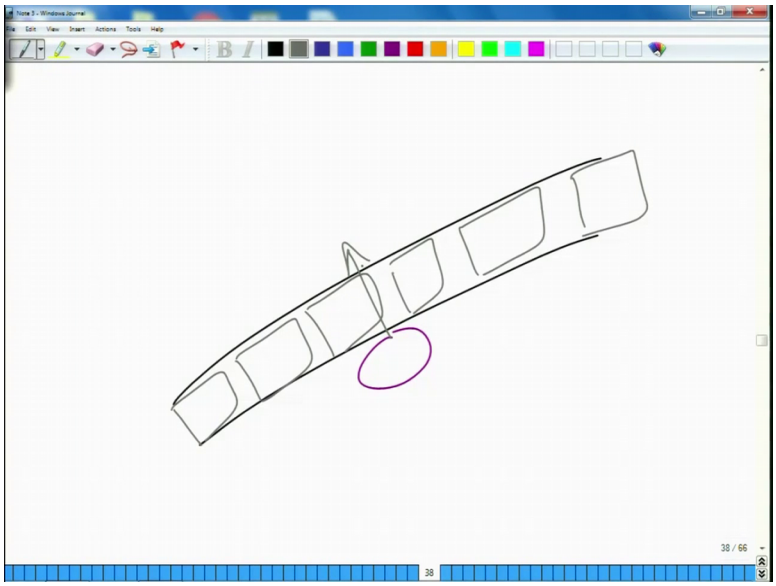

So, when it comes to a road so what we have observed is that if you have a road somewhere you will have an animal that comes very close to the road. And then this animal observes that you have one vehicle followed by another vehicle followed by another vehicle and so on this road. So, this array of vehicles looks like a wall of vehicles in front of the in the eyes of the animal.

And when it sees this wall of vehicles in front of it is not able to cross to the other side. So, essentially a road becomes a very major factor for fragmentation of the habitat. Similarly with the railways so it not only leads to mortality, but it also becomes a physical and a psychological barrier. Then these structures also become habitat fragmentation agents because they provide access to anthropogenic influences.

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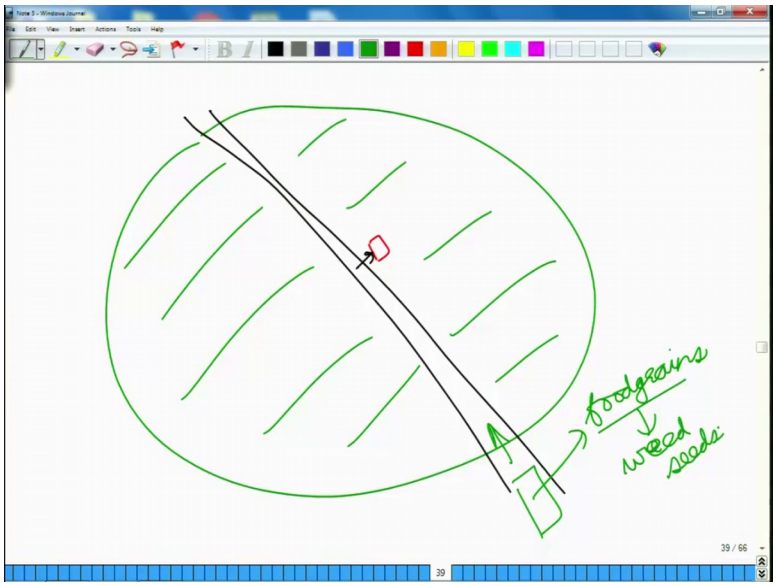

So, essentially if you have a large sized forest then probably there would be a very few number of people who would want to go and settle in this area or would want to go and do farming in this area. But now when you have a road then road has provided access inside the forest and so we would find people who come and settle in this area do farming or do animal husbandry so it provides access to anthropogenic influence. And it also provides access to invasives and exotics, why? Because earlier coming back to the screen so earlier all this area was full of native species. But now when you have your road, you will have trucks moving in which are carrying say food grains.

Now, food grains are those species that have been modulated by humans. So, that they are much more hardier than the species that are present in the forest. Now, along with the food grains we would also be having some weed seeds. Now, if these seeds get into the forest because they are able to outcompete the native species they become invasive species and exotic species in the natural ecosystem. So, this is another way in which the roads railways act as agents for habitat fragmentation. Similarly things like dams so if there is a big dams somewhere the animal would not be able to cross it just because of its sheer size of water that is present there. Next, we have diversion of land for agricultural purposes.

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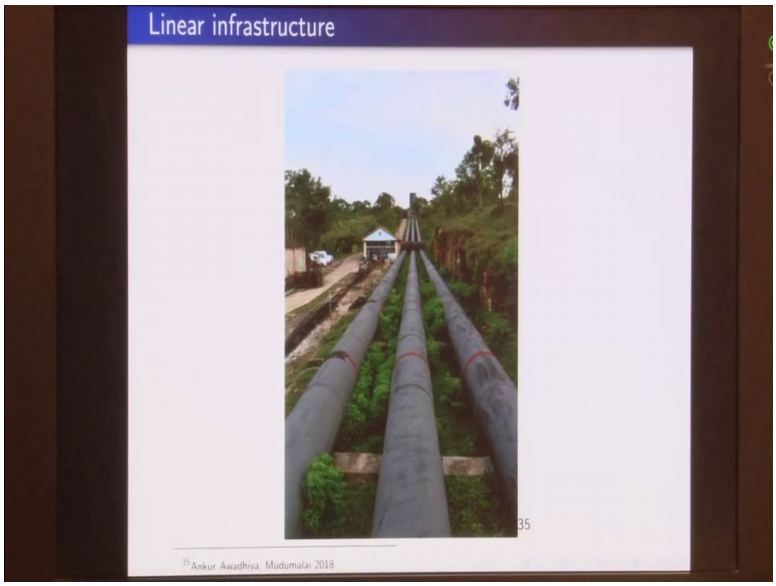

Now, this is an image from Mudumalai, here we have these pipelines that carry water and the height of these pipelines above the ground is more than my own height. So, there are very few number of animals that would be able to cross these barrier to reach to the other side. So, it becomes so these structures that also go by the name of linear infrastructure. Because essentially if they are in a straight line so from here to there it is a straight line, but these linear infrastructures become very potent agents of habitat fragmentation.

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Similarly, dams now in this case earlier when this dam was not there all these areas were connected. And an animal was able to move from here to this side very easily. Now, it sees this huge body of water and so if it has to go to the other side it will have to come down the slope swim across and then get to the other side. And there are very few number of animals who would be able to do that. So, let us now look at the process of habitat fragmentation and loss.

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So, consider this forest. So, this is an original forest it is all full of trees. Now, fragmentation occurs in a number of steps. The first step is dissection so once you have made these roads you have dissected these areas into these smaller patches. Now in the beginning people might argue that when you consider area wise the area of these roads is very less as compared to the complete forest. So, this is one way in which these projects get the accent of the administrators, but here it is important to note that this is just a slippery slope in which we would have a huge habitat loss. So, once this area has been dissected by the roads the next step is that of perforation.

Now, because these roads have now provided access to the insights of the forest, so we might have some people who just settle out somewhere here; just because they have an axis here and it is not completely possible to man or monitor each and every small patch of forest. So, in this huge big size forest so if there is a small patch that in which people have started living it is very difficult to detect them in the beginning. Now, these people

might start agriculture in these areas or might start having some cattle in these areas. So, we might be having some larger settlements and some smaller settlements and this stage goes by the name of perforation.

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Now, this is a picture again from Mudumalai in which we can see so many animals that are now there in the forest areas. So, after perforation the next step is fragmentation. So, what is happened now is that these settlements have grown in size. So, we had a small settlement here, we have we have we had a small settlement here. But now because we have a road here so this these settlements have also grown and these settlement is also grown and they have now ties to each other. So, this whole area has become a contiguous patch of human influence. Similarly with this settlement and these settlement, so both of these have not connected together. So, once these areas have connected together they are leading to fragmentation of the habitat.

Because earlier this was a contiguous habitat, now if an animal has to move from this point to this point it has to go through this human dominated area. And as we know from our newspaper reporting's quite a lot. That if we have say an elephant that goes from here to here then invariably it would lead to some amount of destruction in the villages. And so the so the administration would want to keep it into the forest. So, not only does this human habitation become a source of fragmentation it becomes a very potent barrier

or because these humans would also want to drive the animals back into the forest when they had been using these routes.

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Now, one example of fragmentation is this so in this case we had these forests and we also had forests in the other side animals would be able to cross from this side to this side. But now because of because all these areas have been converted into tea plantations so now, the animals cannot move from this forest to the forest on this side, so this has now become a fragmented habitat. Now after fragmentation the next step is attrition. Now, in the case of attrition what happens is that all these smaller patches of forest that were there they are now becoming even more smaller. Why? Because we already have these settlements here.

So, now it becomes a responsibility or a liability of the government to provide these people with the basic infrastructure. Now basic infrastructure would mean provisioning of electricity, provisioning of water, provisioning of schools, provisioning of dispensaries, and so on. So, when we have all these electricity poles out here and when we have things like hospitals and dispensaries it then leads to the next level of growth of the human settlements.

So, then people might even say that this is a very good place why not have a small industry here or say why not have a small resort here. So, once these things grow the next thing is for feeding all of these people you require much more land. So, much more

of area of the forest would be diverted or maybe even just encroached upon to have more of the fields to have more of the animals to provide milk to have more of the grasslands. So, in this process the forest fragments that were remaining are being push into even smaller sizes and this goes by the name of attrition.

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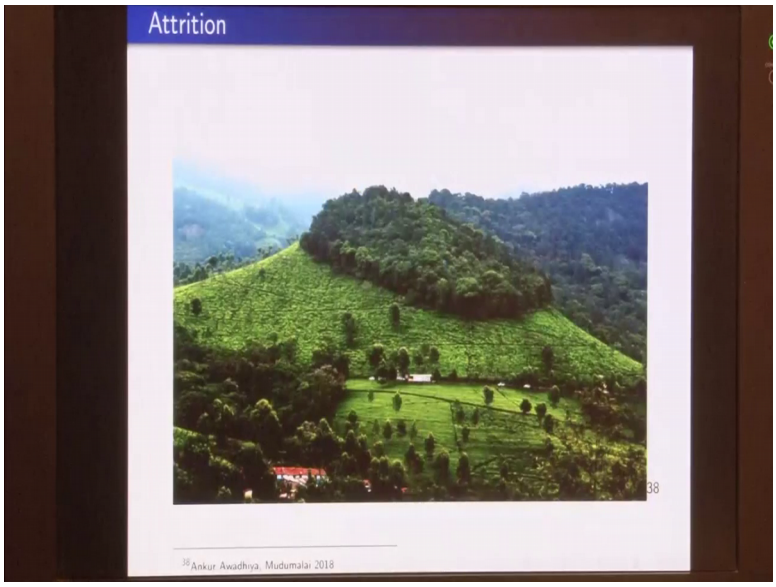

Now, a good example can be seen here so in this case this hill that was earlier a complete forest is now being eaten away from all sides. And so now what we see on the top is just a small patch of forest. And because people are eating in away into these forests from all sides so in a very short while this small patch will also go away so this is attrition.

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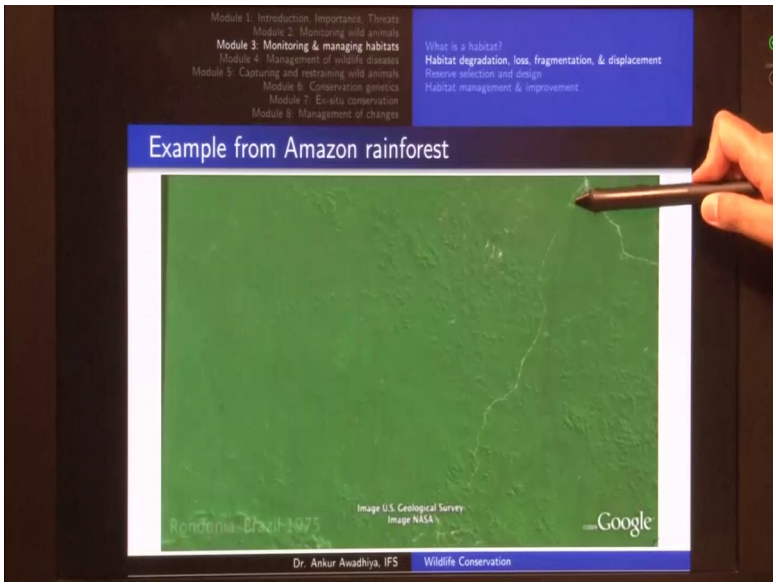

Now, one good example that we see from the Amazon rainforest is this. So, here we can observe that this is a small road that was built in the year 1975 around that time.

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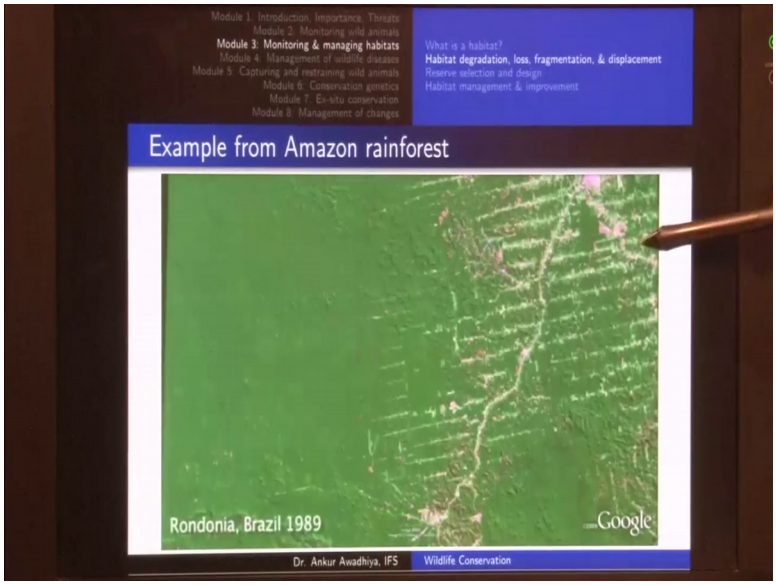

So, now this is an image from 1989 so these green areas are forests.

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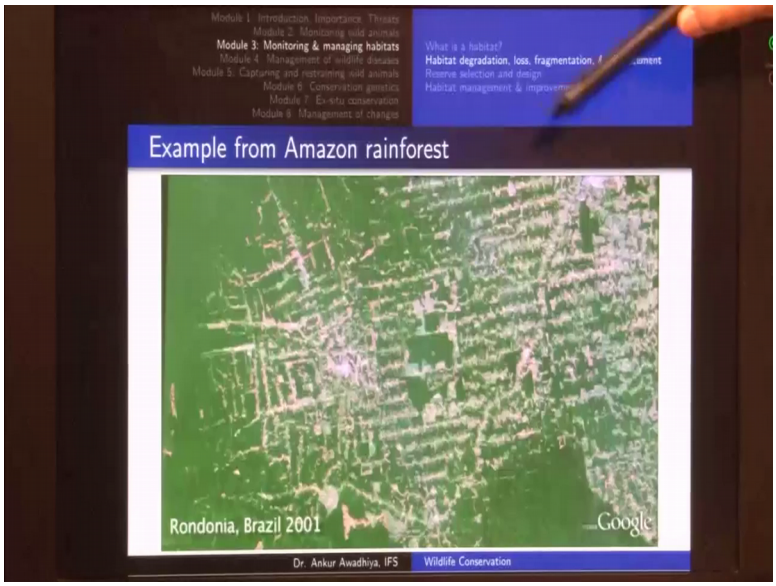

And all these areas are now being eaten away by people for logging purposes and also for conversion of these areas into Hamlin's and also into grazing grounds.

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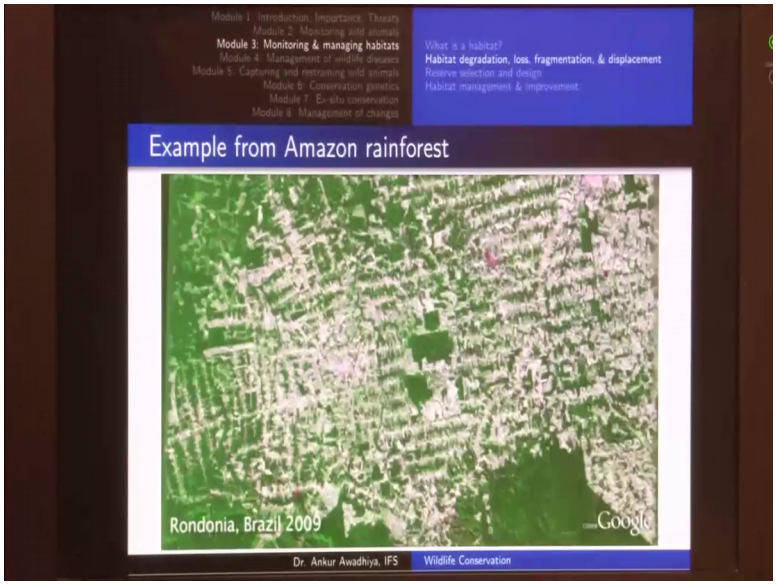

So, in a very short period of time, so 1975 to 2009, just 35 years and all of these forests are not gone.

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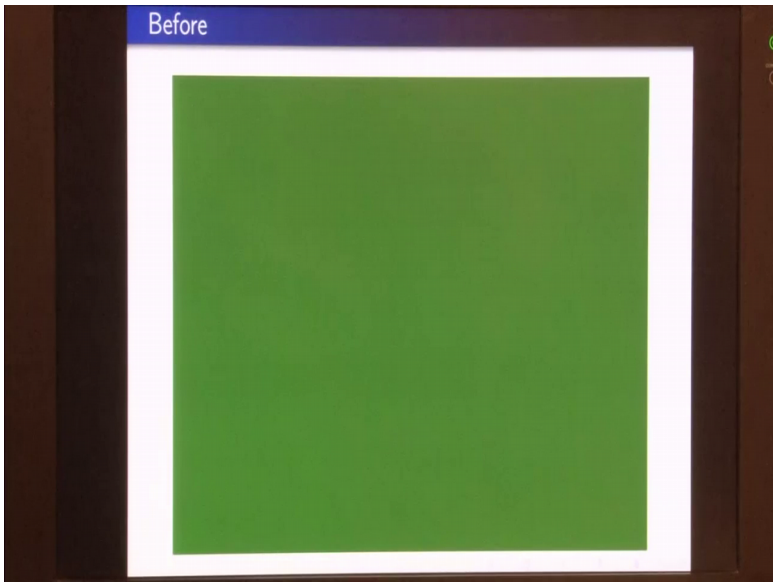

So, this is something that we see in most of our areas. Earlier we have a big patch of contiguous forest which is represented here in green.

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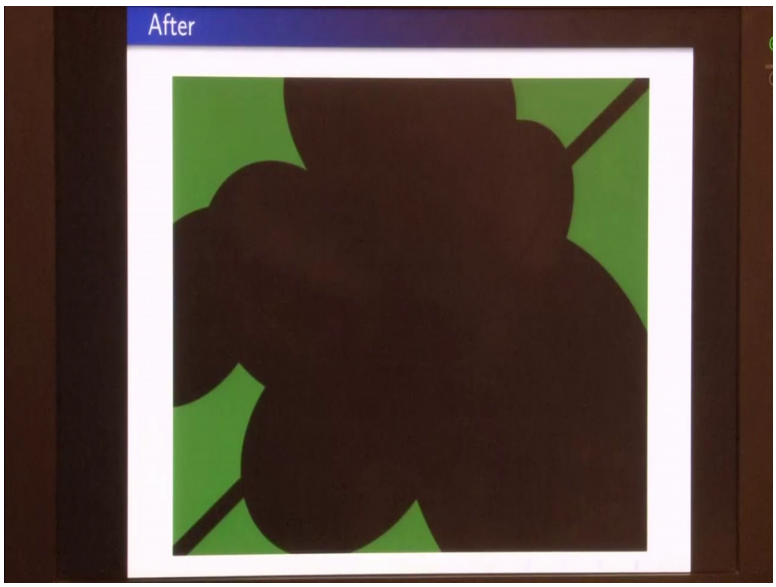

And in a short while we have converted it through the providing of the roads into very smaller patches atrophied patches which are not connected anymore. So, any animals that are here so not only does this small patch have a very less diversity of habitat. So, a very less number of species that are found here a very little species richness.

But at the same time any animal that is found here would not be able to come to this side without crossing the whole of the human dominated landscape. So, this becomes a way in which we are losing of habitats. Now this again is an example of an extremely fragmented habitat.

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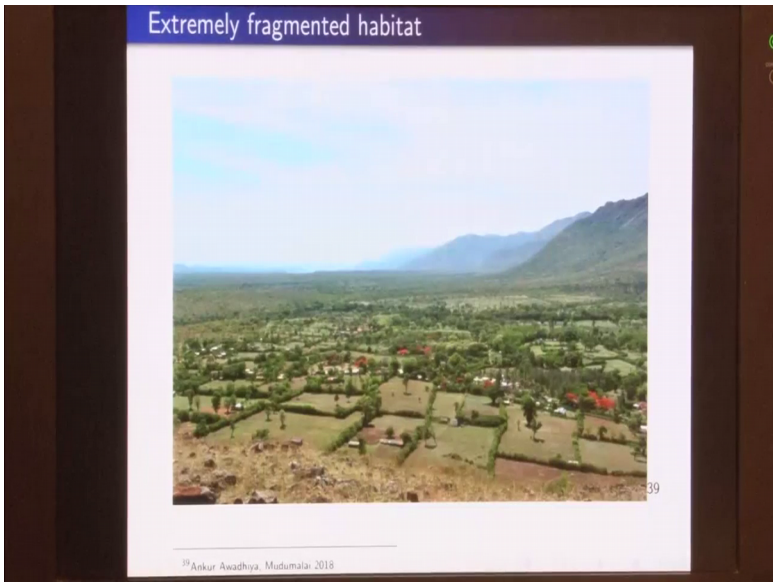

So, here we have these hills in which we had the forest and all of these areas have been taken away for the construction of houses, for construction of resorts, and also for some level of agricultural activities. So, now all of these forests that are remaining so any animal that wants to go from this side to this side would not be able to go through without going through all of this human nominated landscape

Now, wild animals by their nature are extremely shy of humans. So, they prefer not to come in contact with humans which they see as a species that is extremely threatening to them. So, once we have these human influences the habitat automatically gets fragmented also because of the psychological reasons.

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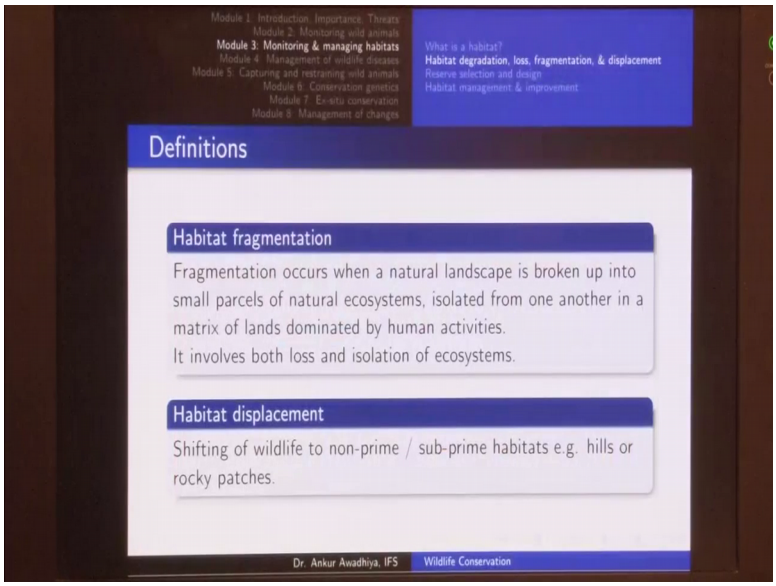

Now, along with habitat fragmentation we also observe habitat displacement. Now habitat displacement is the shifting of wildlife to nonprime or subprime habitats such as hills or rocky patches.

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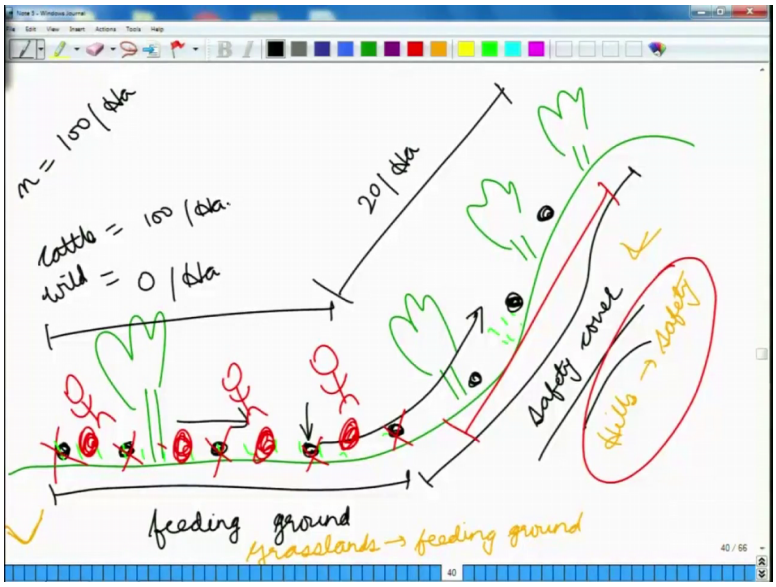

Now, what happens in these cases is that earlier we had an area in which we had a hill and we had this grassland. So, these areas have grasses and then in the case of the hills we would have small bit of grasses and then some more of trees, this area also maybe had some more trees. Now in such a scenario we would find wild animals everywhere.

So, let us represent them by black dots. So, we have wild animals that are using all these areas. Especially, so because if you think like a wild animal this area provides a feeding ground and this area provides a safety cover.

So, essentially if this animal were to be chased by a predator from this side it would run into the hills. And in that case the in most of the scenarios the predator might not be able to run at that faster pace into these hills and. So, the animal would use the hills as a safety cover for their survival. But in this case it is important to note that the feeding grounds are for feeding and the hills are for the safety. So, let us write it here, so we have grasslands are feeding grounds and hills are for safety.

Now, when we have an anthropogenic influence; so let us say that we have now these cattle here. Now, the cattle do not need the hills because we have human beings for their protection, they would come with sticks, they might even come with guns and they would be able to chase away any of the wild predators. So, now when we have human influence here, when human beings have come into this area along with their cattle these animals would go away, the wild animals would then slowly go away.

Because they are shy of human beings, but then what is the space left for them. The only space left for them is the space that the humans are not using which is the hills. Now, the hills do not provide enough amount of nutrition because they do not have the grazing ground they were only being used as safety grounds but because now we have dominant human intervention in the grassland. So, the animals have nowhere else to go so they are moving into a subprime habitat. Now what would happen after a while is that we would conduct a census of the animals and then we would say that in the case of health we saw some animals. And say earlier we had number of wild animals as 100 per hectare.

Now, we would say that in the hills we saw animals at the rate of 20 per hectare. And in the grassland we did not have any of the wild animals, so wild animals is 0 per hectare, but cattle is say 100 per hectare. Now, what is happening in the scenario is that now people would come and say that there is absolutely no way in which the humans are impacting the wildlife. Because people would say that these grasslands have humans and the wildlife lives on the hills. However, it is important to note here that when the humans were not there then the wild animals are also there in the grasslands. And the grasslands were the only source through which they were getting their nutrition, hills were only a

safety covered they did not provide any nutrition. Now, that we have this huge human influence in the grassland. So, the animals have moved into the hills, but the hills are not a prime habitat they are a subprime habitat they are not the optimum habitat.

So, we can observe this scenario here as well so in the case of coming back to this image, when we have all these human habitations here now if you do any census you would find that all the animals are found in the hills. And so people would say that there is no way that these resorts are causing any harm to the animals. Whereas, in reality what these resorts have done is that they are not only fragmented this habitat. But they have also displaced these animals from the prime habitat which was grassland to the subprime habitat. And this is something that we known as habitat displacement.

So, in today's class we looked at the loss of habitat, the degradation of habitat, the fragmentation of habitat, and also the displacement of wild animals from a prime habitat to a subprime habitat because of the anthropogenic influences. We also observed how a very small step such as making of a of a road which may be a very thin road through the forest areas is gradually builds up into different stages such as perforation and fragmentation and attrition, which ultimately results in the in the creation of very small patches of forests; that are completely isolated from each other which then becomes a very potent cause of the loss of habitat for our wild animals so that is all for today.

Thank you, for your attention. [FL]