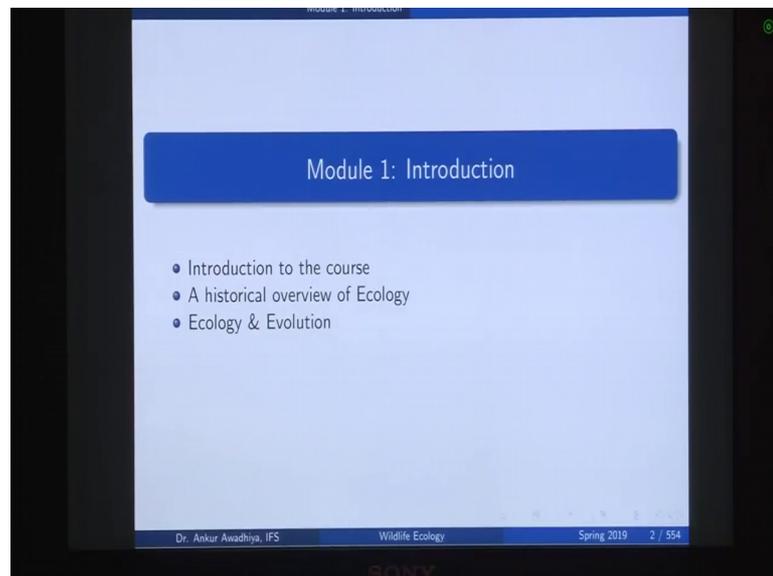


**Wildlife Ecology**  
**Dr. Ankur Awadhiya**  
**Department of Biotechnology**  
**Indian Institute of Technology, Kanpur**

**Lecture – 01**  
**Introduction to the Course**

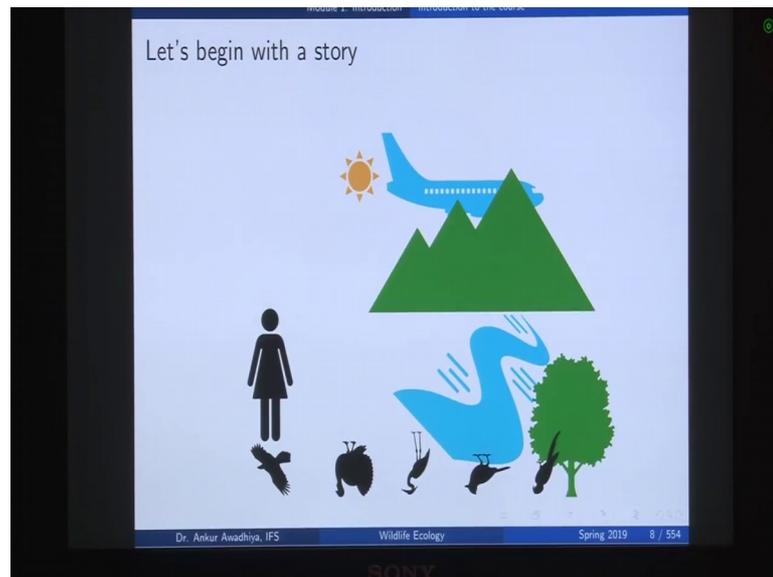
[FL] And welcome to this course on Wildlife Ecology. I am Dr Ankur Awadhiya, I am an officer in the Indian forest service of the Madya Pradesh Carter. So, this course is going to have 12 modules with 3 lectures in each module and we begin with the first module that is the Introduction to the Course.

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And this module will be having 3 lectures, first is introduction to the course, second is a historical overview of ecology and third is equality and evolution.

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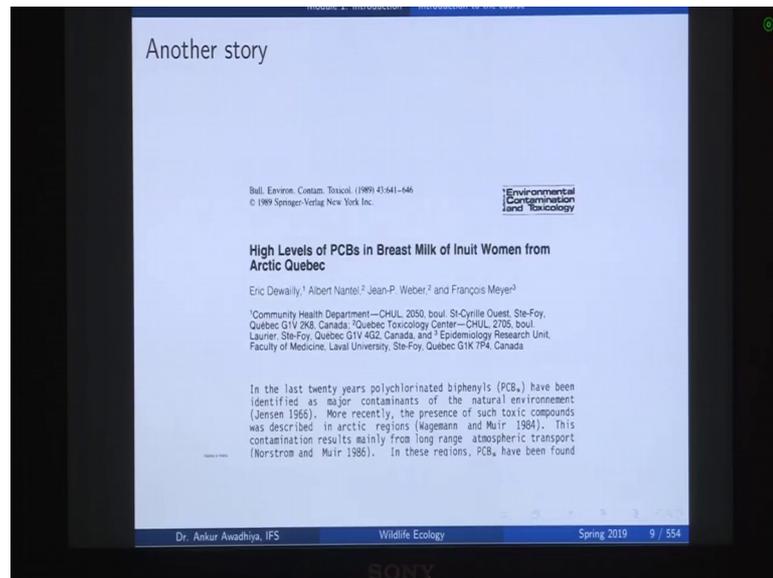
So, let us begin this course with a story. Now, this story concerns a girl who lives in a village. So, let us call this girl as miss x and she is living in a village, this village is a very beautiful village it is surrounded by some beautiful hills, it has a river that passes through it has some trees around some grassland some fields and this girl is fond of looking at nature. And she is very fond of looking at different kinds of birds that are found in this village.

So, there are some flying birds, there are some water birds, there are some ground bearing birds, there are some barricades that live on the trees and so on. But then this village also has a lot of infestation of mosquitoes and mosquitoes result in malaria which is a major issue in this village. So, one day the governments decides that let us take a plane full of insecticides to this village and spray this village with insecticides to kill off the mosquitoes. A very fine idea a number of people would say so, and mind you the chemical that is being sprayed here is an insecticide it only kills insects also the company claims.

So, the village is sprayed with insects and lo and behold the girl finds that after a short while all her beautiful birds that were there in the village die off. Now, we this story might appear hypothetical, but we are observing such instances in a number of places around the world we have seen situations in which the spray of DDT has resulted in the death of birds. Now, if you spray DDT in a very low concentration, because to kill a

mosquito you do not require a very huge amount of DDT. So, you spray this insecticide in a very low concentration and still a number of birds die and when their bodies are autopsied it is found that they have a very huge concentration of DDT that is found inside their bodies.

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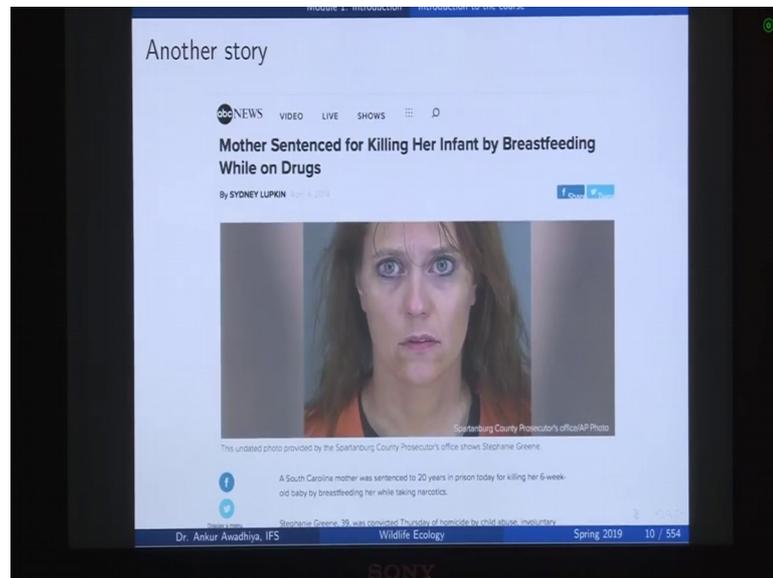


But let us look at another story. Now, this is a paper which says high levels of PCBs in breast milk of Inuit Women from Arctic Quebec. Now PCBs are polychlorinated biphenyls. Now these are chemicals that are added to a number of plastics and when Inuit women refers to women who have an Eskimo lifestyle so, Quebec is a place in Canada.

So, there are some SQM of women that are living in the arctic region of Canada and when their breast milk was analyzed it was found that it had a very high concentration of polychlorinated biphenyl. Now, the question arises that arctic is a very serene place, it is we do not go there and dump these chemicals in the arctic and still in the human population there we observe, that there is a very huge concentration of a number of chemicals, a number of which are toxic to the newborn babies. So, some people have even argued that the most toxic food that a human being can eat is the breast milk of an Eskimo woman that is living in the arctic regions.

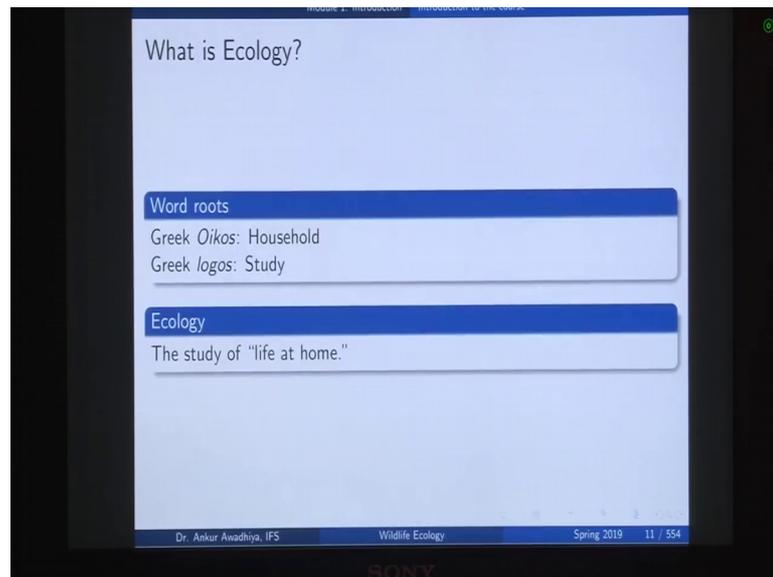
Now, how do these chemicals reach there and is it important for us? Well it is important because, if you have chemicals in the breast man invariably they are going to reach another human body.

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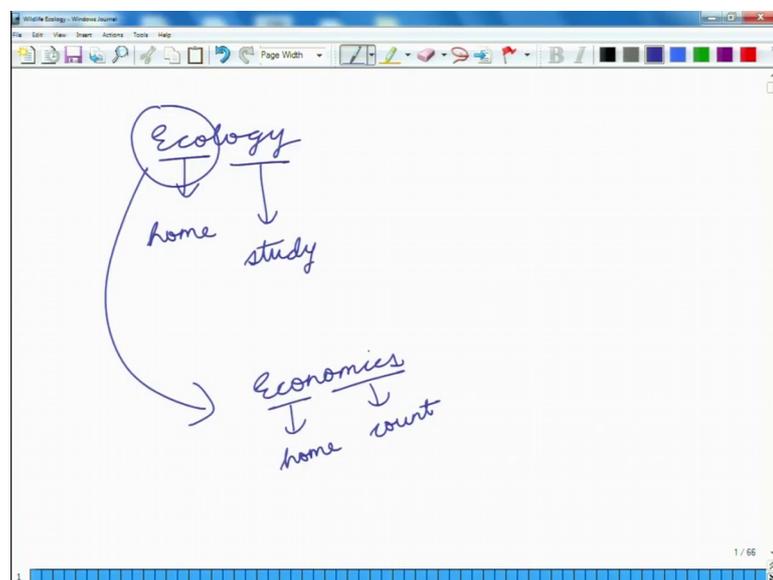
And in this case the body of a human baby. And in certain instances this may even result in very tragic consequences for instance, this was a case in which an infant was killed because it was breastfed by its mother and its and the mother of the baby was, they was on some drugs she was taking drugs and the baby died. Because the baby was getting a very high concentration of the drugs, the questions such as these are arising everywhere they are arising anywhere and everywhere on this planet.

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And ecology deals with a number of these questions. So, if you look at the word roots ecology comes from the Greek words or Oikos and logos Oikos means a household household where people live.

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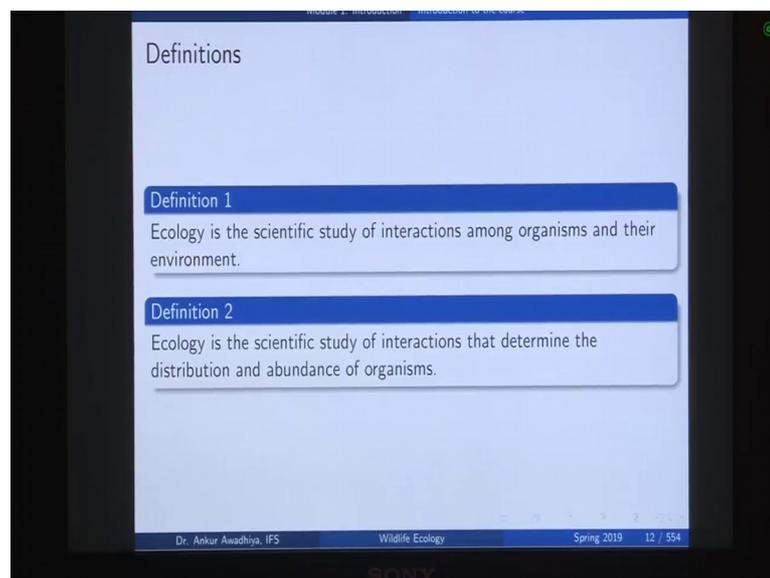


So, when we say ecology or Oikoses home and logos is study, now we can see eco as a word root also in things such as economics in which eco, or I causes home and know me is to count. Now, equality is the study of home it could be my home it could be your home it could be somebody else's home or it could be the home of other animals, it could

be the home of tiger, it could be the home of elephant it could be a marine home and so, on.

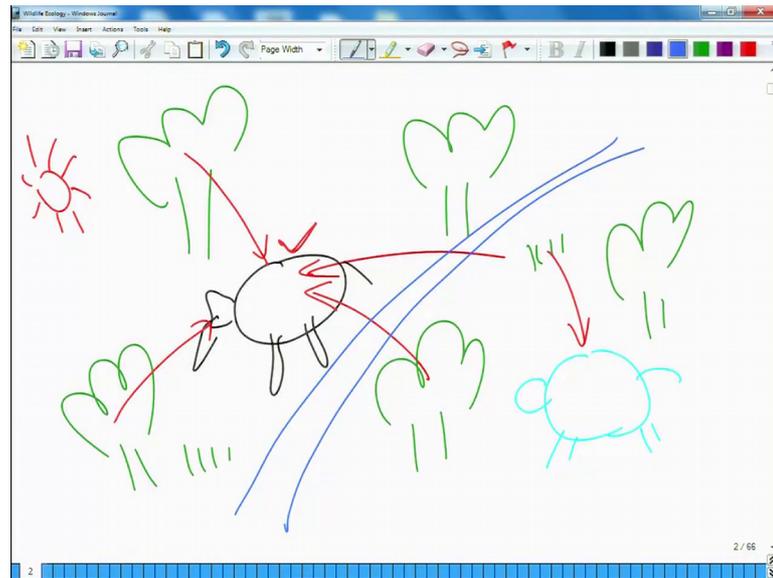
Now, because of these word roots we can have a number of different kinds of ecologies. So, for instance when we are looking at the population of humans, we can have a subject of human ecology, if you are looking at different populations we can have population ecology. If we are looking at marine environment we can have marine ecology, because the marine environment is also a home to a number of animals, we can have forest ecology or we can even have things like lattice strain ecology which is a lake ecology. So, in all of this what we are doing is we are studying the home of some organisms or some groups of organisms. So, which is why it is called ecology.

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So, ecology is the study of life at home at the home of you me or some other organism. So, if you went to define ecology, ecology can be defined as the scientific study of interactions among organisms and their environment.

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So, essentially if we have a forest and then we have some animals here in the forest. So, let us say that we have an elephant in the forest. Now, this elephant would be deriving its nutrients from these trees, or maybe from the grasses below. So, they also act as food now and when this animal is living in the forest there might also be some other animals in this forest.

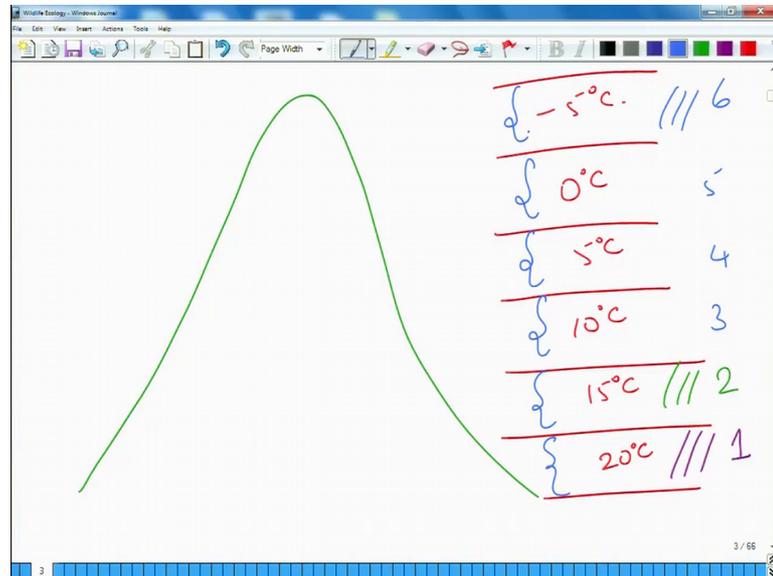
So, let us have so here we have say another animal let us say that this animal is a sambar. And this sambar also eats this grass. So, we could have competition between both of these animals so, this animal our elephant is interacting with the trees it is interacting with the sambar, it is interacting with the number of other organisms and it is also interacting and it is also dependent on the environment that is here.

So, for instance it would depend on the amount of sunlight that is there, if it is very hot or if it is very cool, then probably this animal might not be able to live in that area, probably this animal might have to migrate from this area or for instance, if we have a river that is passing through this area and if this river dries out. So, this animal is now not getting enough water so, it might have to move out. So, ecology is the study of all of these. So, ecology is the scientific study of interactions among organisms and their environment.

So, in this in the system we have the organisms, we have the environment and we are studying all of these interactions. Another definition could be that the ecology is the

scientific study of interactions that determine the distribution and abundance of organisms. So, what we are looking here is the distribution of animals or organisms and the abundance of organism now to take another example.

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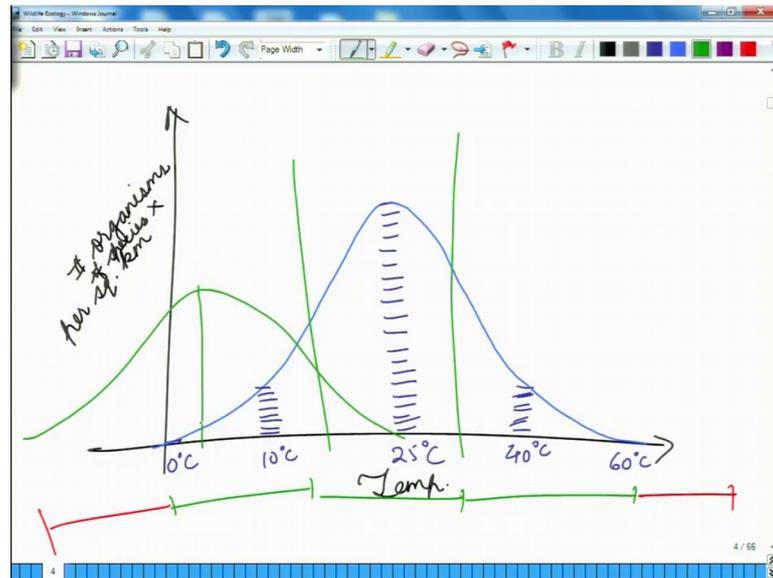


Suppose we have this mountain and in this mountain at this level, we have an average temperature of say around 20 degree Celsius and as we move up the temperature reduces.

So, in this region we have around 15 10 5 0 and this area has an average temperature of minus 5 degree Celsius. Now, the organisms that are found in this zone let us call it zone 1, will be very different from the organisms that are found in zone 2 and extremely different from the organisms that are found in let us say this is 3 4 5 6 so in zone 6. Now, if you look at the definition again we call it is the scientific study of the interactions that determine the distribution and abundance of organisms.

Now, what will be asking here in the case of ecology is what organisms are found in this zone what organisms are found in this zone and so on. And if they are different why are they different is it because of the temperature is it, because of wind is it because of less amount of sunshine that this region gets or is it, because of less amount of moisture or differences in moisture that are there in different areas. So, what are these factors that are determining the distribution of these organisms. And secondly, what are the factors that are determining the abundance of these organisms.

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Now, when we say abundance what we are referring to is that if we take any of these parameters so, let us say temperature. And we look at the number of organisms per square kilometer number of organisms of  $p \times x$  per square kilometer. Now, what we will observe is that there would be a set of temperature in which these organisms find it very easy or very congenial to survive. So, for instance in the case of us human beings if our surrounding temperature is say around 25 degree Celsius, we will feel extremely comfortable. So, this is the most comfortable zone.

But then if we increase this temperature so, this was say 25 degree Celsius now let us increase it to say 40 degree Celsius. Now at 40 degree Celsius a number of us might not be able to feel very comfortable. So, there would be some people who would find it comfortable, but there would be a very huge chunk of people who would find it relatively uncomfortable. So, little less number of organisms would be found in this region or let us increase the average temperature to say 60 degree Celsius and probably 1 or even 0 of us human beings would be found in that region in that temperature range.

Now, similarly if we reduce the temperature to say 10 degree Celsius, you would find that less number of people are able to do to find this temperature to be congenial. If you reduce it to even less to say 0 degree Celsius probably very few of us would be able to live there. So, we can now draw a curve that is something like this. Now, this curve is telling us the abundance of human beings that would be founded at different

temperatures. So, there is this zone we are arbitrarily defining a dividing this curve into 3 regions.

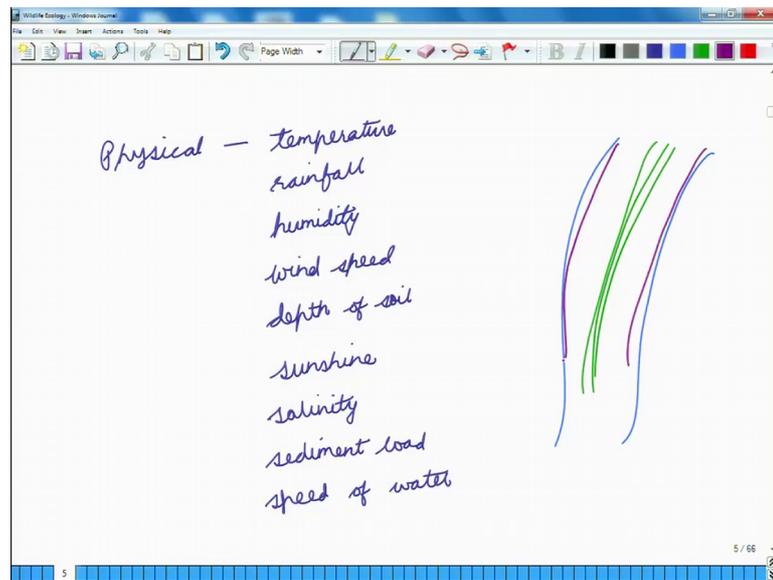
So, in this zone we will have less number of animals in this zone we will be having more number of animals, in this zone will be having less number of animals and in these zones will probably be having 0 number of animals. Now, similarly for every organism so for elephant there would be a certain range of temperature in which it will find congenial to survive for the case of tigers, there would be a very different range of temperatures for polar bears it will be a very different zone. So, in the case of polar bears we could even have a situation in which we have a maximum somewhere here.

So, polar bears would probably prefer to live somewhere say around 1 or 2 degrees average temperature or maybe even lesser. Now, when we look at ecology what we are asking is the interactions that are determining the distribution and abundance of organisms. So, distribution what are the areas in which these organisms are able to live and abundance what is their number. Now, these are physical factors, but we could also have a number of biological factors. So, for instance in a forest in which you have ample number of prey animals.

So, if you have a forest in which you have a substantial population of cheetah or sambar you would find tigers that are living in that area, but if you have another forest in which we have very less number of cheetahs and sambars, then probably tigers will not survive in that area, because they are not getting enough food. So, you can even have a number of biological factors or for instance.

If you have a forest in which you have a very huge density of tigers then probably leopards will not be able to live in that area, because they cannot compete with tigers. So, leopards would be found in an area where you do not have a very substantial number of tigers. So, you can have little factors that determine distribution and abundance or you can have biological factors that determine the distribution and abundance.

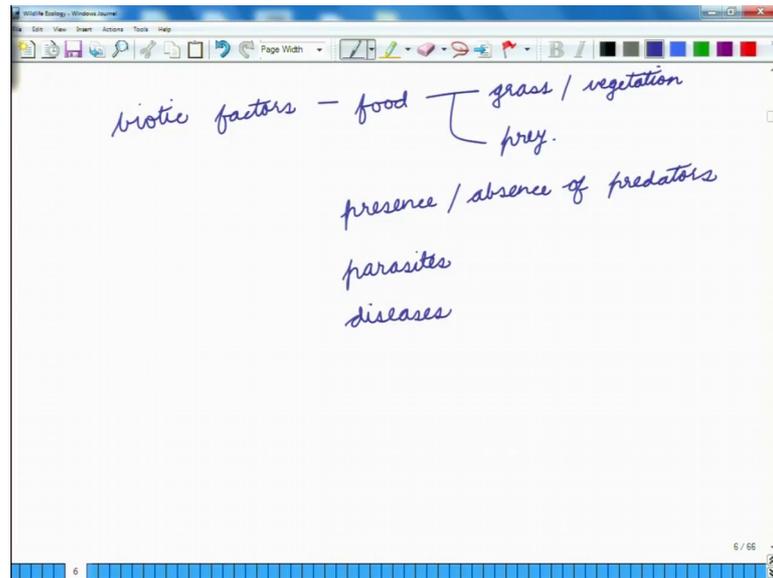
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Now, let us recount some of the physical factors, now physical could be things like temperature or say rainfall, or humidity, or wind speed, or the depth of soil that is found in that area or the amount of sunshine that the area gets, or in the case of marine environments we could even have things like the amount of salinity, that is there in a particular segment of water or things such as the amount of sediment load that is there in the water or in the case of rivers we could even have things such as the speed of water.

So, for instance in the case of a river the central region that has greater speeds would be used by certain organisms and the surrounding regions that have lesser speeds would be utilized by some other organisms. So, these are all different physical factors that would determine the distribution and abundance of different organisms and ecology would ask the question, what are these interactions that are driving the abundance and distribution of these animals. Now, let us look at some biological factors or the biotic factors.

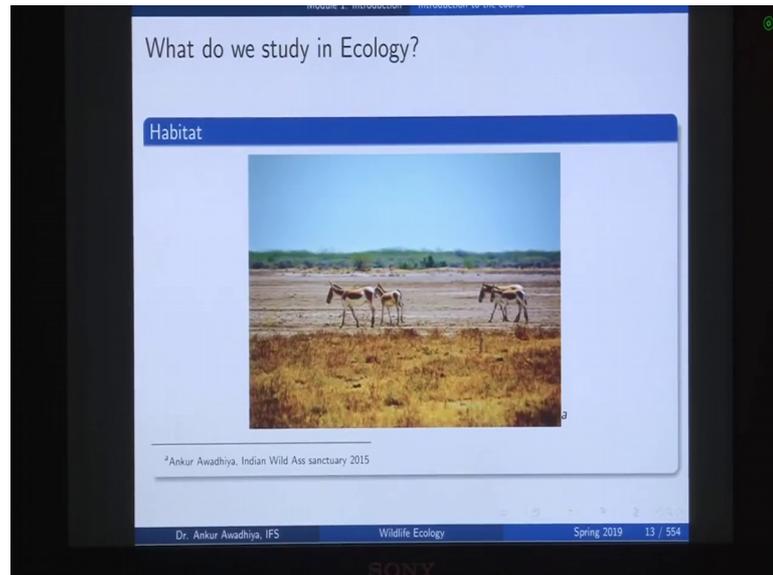
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Now, biotic factors could include things such as food. So, this food could include things like the amount of grass or vegetation that, you have or the amount of prey that, you have in this area it would also be another biotic factor that would determine distribution and abundance would be the presence or absence of predators in the area. So, if an area is having a very huge population of tigers, then probably cheetah sambar would not prefer to live in that area, because they will get eaten if they live there or you can have things such as parasites or you can have things like diseases.

So, a number of these factors play a role in determining the abundance and distribution of the annuals and ecology is the scientific study of all these different factors and their interactions that are determining the distribution and abundance of organisms. So, what do we actually study in ecology. So, this was the theoretical basis, but what do we actually look at in ecology well.

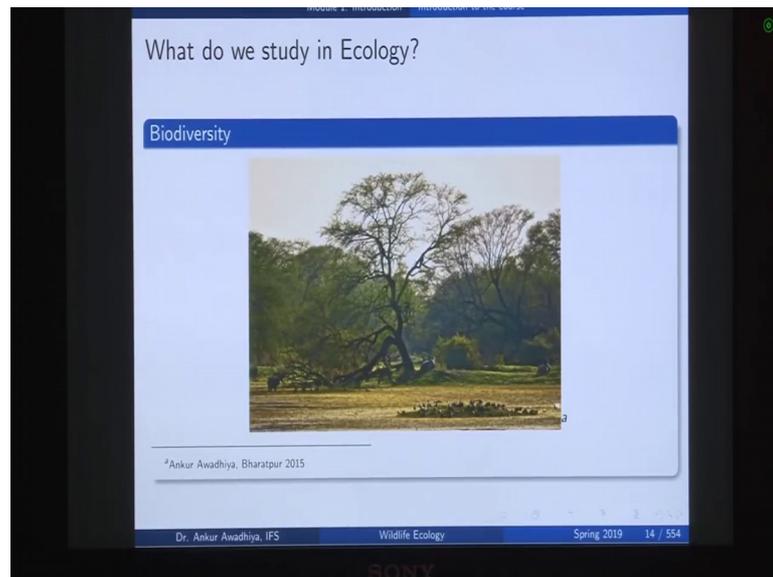
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We look at habitats habitat is the home of an animal the national home, or the abode of the animal. So, for instance this is the Indian wild ass and this lives in these sorts of habitats. So, we have this Indian wireless sanctuary in Gujarat and as you can see this is a very plain topography area it hardly has any vegetation in most of the ideas, there are some hills that have slight amount of vegetation, then this is a very dry area it has a lot of saline soil.

So, ecology would go out and study what are the kinds of habitats that are there in different areas and how are these different habitats determining whether this organism is able to survive in that area or not. So, for instance we find Indian violence only there, we do not find it in say west Bengal, because the habitats that are provided or that are available in West Bengal are very different from the habitats that of labeling Gujarat. And similarly we have the royal Bengal tiger that is found in West Bengal, but it is not found in Gujarat. So, ecology would go and ask the question what are the different kinds of habitats that the organisms get in different areas.

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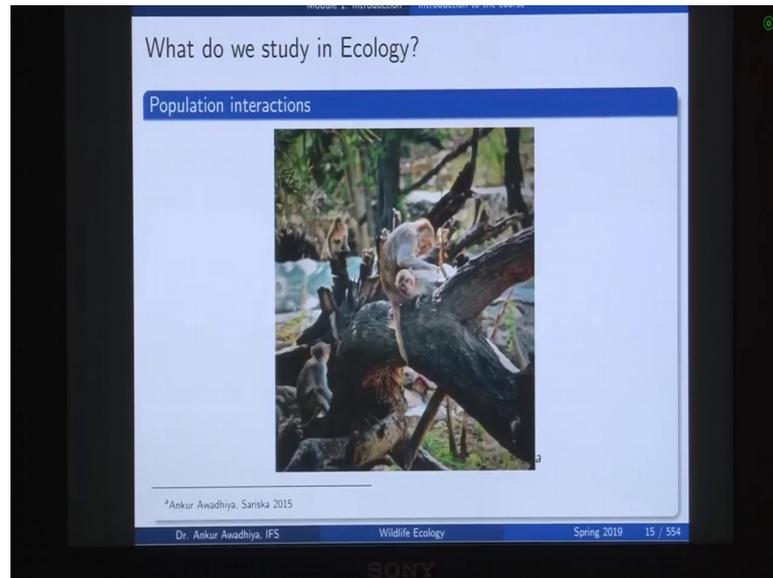


Then it would go out and ask what is the amount of biodiversity we have so, for instance in the previous image, we saw that we have this Indian wild ass and there are hardly any other animals that are seen here and also the kinds of grasses that we have all the kinds of vegetation that we have here is very different from say something that will find in Bharathpur.

Now, Bharathpur is a bird sanctuary and in this area will find a number of birds will find and this area is regularly inundated with water. So, in this area we will be having a number of water birds will be having ground dwelling birds will be having a number of birds that live on these trees though even the vegetation in this area will be very different, because this area has ample amount of water.

So, the kinds of trees that will live here will be very different from what we are finding there in Gujarat. So, the next question that ecology would try to study is the level of biodiversity that, we have what are the different kinds of species that are found in each area what is their abundance and distribution. So, for instance if we look at this area do we have say 1000 birds of this species and say only 10 birds of some other species or do we have equal number of birds of all of these different species. So, that is also another topic that is studied in ecology.

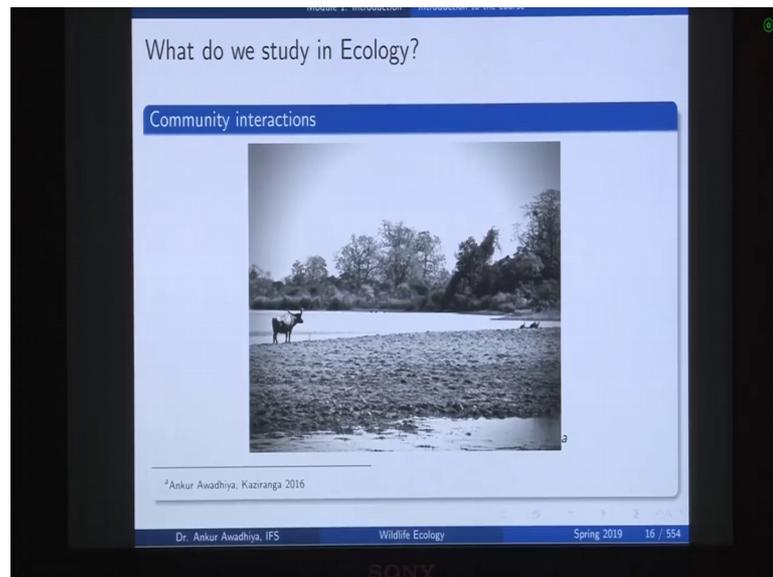
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Next we look at population interactions. Now, population is a group of animals that are living together and they belong to the same species. So, for instance in this image we can see a troop of macaques so, we have these macaques. And if you look at these two animals this animal is grooming this second animal. So, what are the kinds of population interactions how do they behave together why do they behave in this manner? So, for instance what is the profit or loss or the gain or loss that is being provided to this animal by grooming this animal, because in the first instance it might seem that this is an act of altruism this animal is only grooming this animal and not getting anything in return.

Now, such a system might not work in practice. So, in any case this animal should give something back to this animal that was grooming it. So, how do these interactions work in these populations how is this animal able to give back to the first animal are the kinds of things that will study in ecology.

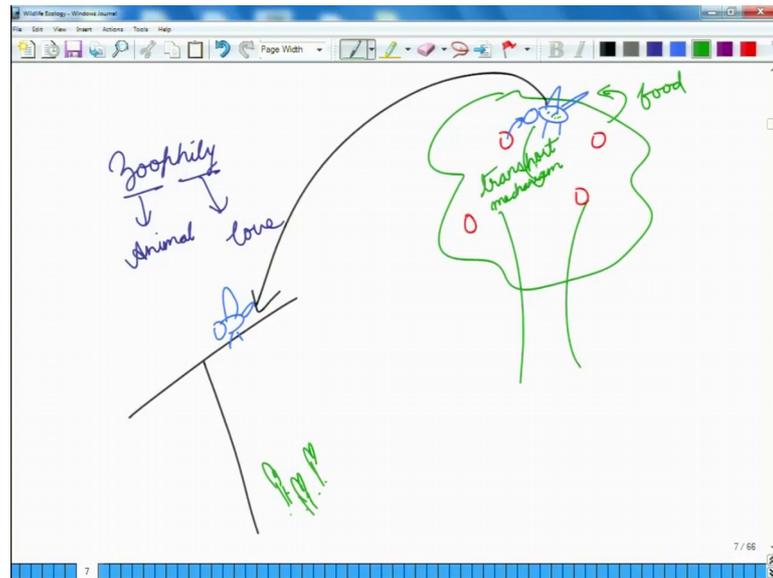
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Next we look at community interactions now community is a group of organisms that belong to different species and they are living together. So, for instance in this image this is from Kaziranga, we can see we have a buffalo we have some scavengers in the form of vultures and then we have a number of different trees here different species.

Now, community interaction means what are the kinds of interactions that are being held between say this buffalo and the scavengers or between the busting between the buffalo and the trees and so on. So, for instance in a number of trees we have a phenomena that is known as zoophile now zoo Phillies.

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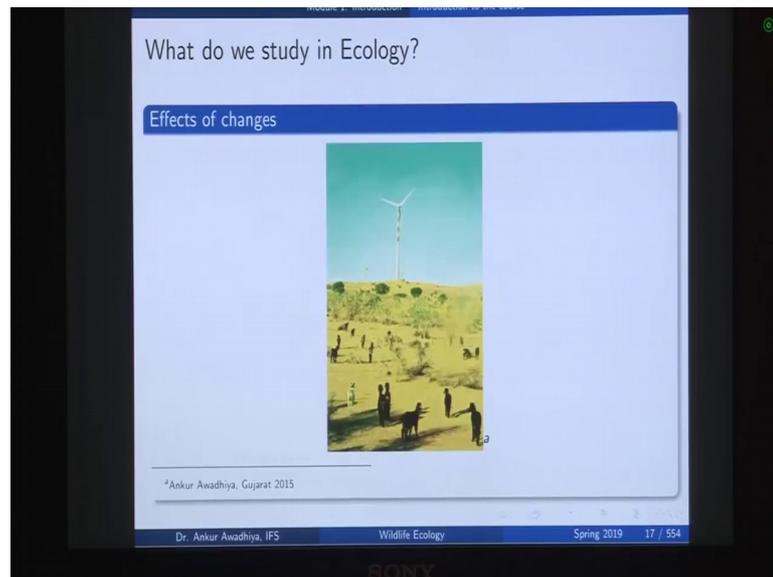
Who is animal and Philly is love now zoo pilly is a situation in which you see have a tree and this tree bears fruits and then these fruits are eaten up by a bird and, when this bird eats up this fruit it gets nutrients, but at the same time the seeds also get inside the bird.

So, now the seeds of the tree are inside this bird and then this bird moves to say some other location. So, let us say there is an electricity line and this bird, then goes there and then this bird defecates these seeds out here and when it difficult you have all these seeds that have fallen onto the ground and then after a while after the next rains, we will have some small plants of this tree that grow up in this area.

So, in this case this tree is using the bird as a vehicle to transport its feeds. So, zoo is animal soap it is using this animal which is the bird to transport its seeds. So, again in this case we can see that there is a one to one interaction or a give and take relationship between both of these organisms. The tree is giving food to the bird and the bird is giving a transport mechanism to the tree.

So, here we have organisms that belong to two different species and they are interacting in a way that is mutually beneficial to both of these. Now, similarly in this situation if we have the buffalo is it helping the trees, or is it harming the trees or some other vegetation. Similarly if you look at these vultures are they helping the system or they are or are they harming the system and how are they doing that. So, these are the kinds of interactions that we observe in a community and this is also a topic of study in ecology.

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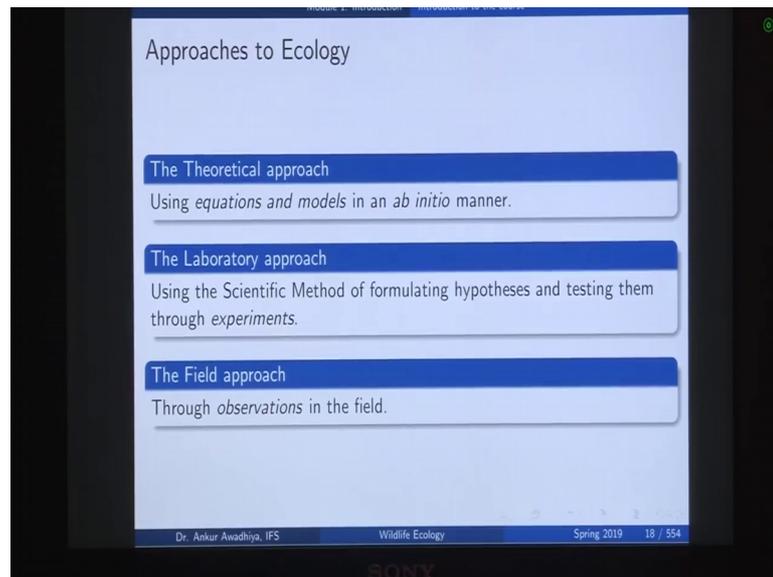
Now, ecology also looks at the impacts or the effects of different changes that are happening on our earth. So, for instance this is an amazing game from Gujarat and here we can observe a number of goats and as you can observe here, we have these sand dunes and we also have a very scanty vegetation.

Now, if you have vegetation somewhere so, the roots of the plants are able to bind the soil or are able to bind the sand in this region. Now, if you have goats and if you have a large number of goats that are going there and eating away these plants what will happen in a short while is that these after these plants get removed the sand will be able to move freely.

Because it is now unbound and so, you will have a situation in which the amount of erosion would increase in the system, or for instance earlier this area was having some vegetation and so, we had a situation in which this area is it a semi arid area. But once you have removed all of these plants and you do not have any further seeds that remain in this area, this area will become completely barren it will become a complete desert.

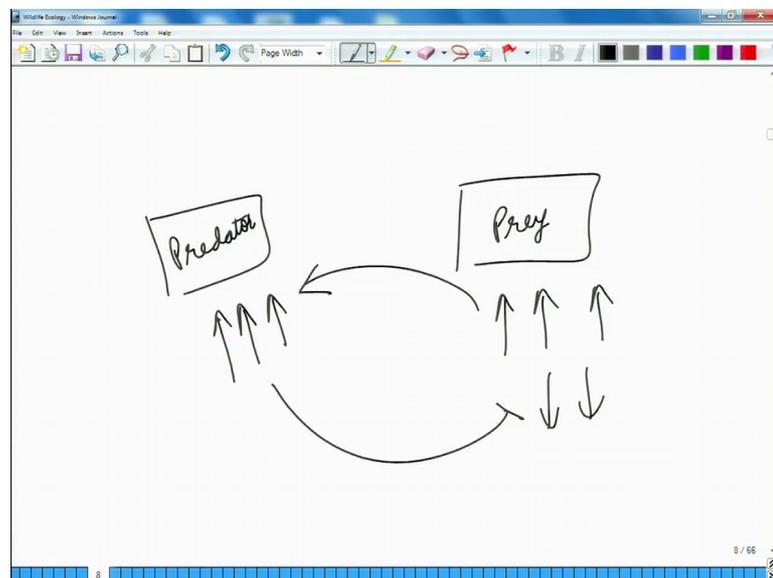
So, things such as these things such as desertification that have been brought about by some human activities are also topics that we study in ecology. So, effects of changes so, these are some topics that we study in ecology, but how do we study these.

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So, there are three approaches to ecology the first is called the theoretical approach, now in the theoretical approach we use equations and models in an evolution manner to understand what is going on in the system.

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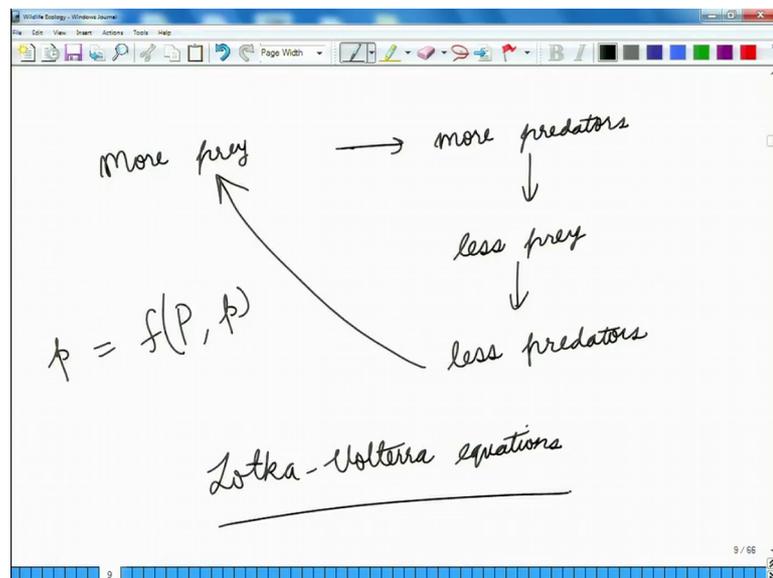


So, for instance to give an example you have say a predator and you have a prey population. Now, if the number of prey increases then we will observe that the number of predators would also increase, because they are getting more amount of food and

because they are getting more amount of food they will be able to devote more resources to reproduction.

So, an increase in the prey population would increase the predator population, but then if you have more number of predators, because of this increase that would provide a negative feedback. So, a negative feedback to the prey population because now because you have more number of predators. So, these predators would be preying upon the prey population and would reduce their numbers. So, this would reduce it down now if this number reduces, if the number of prey animals reduces that would again go back and reduce the population of the predators and when that number reduces that would again give a feedback that would increase the prey population.

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So, to put it in other words if you have more prey that would give you more predators. Now, if you have more predators that will result in which a number of prey animals are eaten up which would result in less prey. Now, if you have less prey so, you will have less amount of food that is available to the predators. So, that would result in less number of predators, because less number of prey population is able to support a lesser number of predator population.

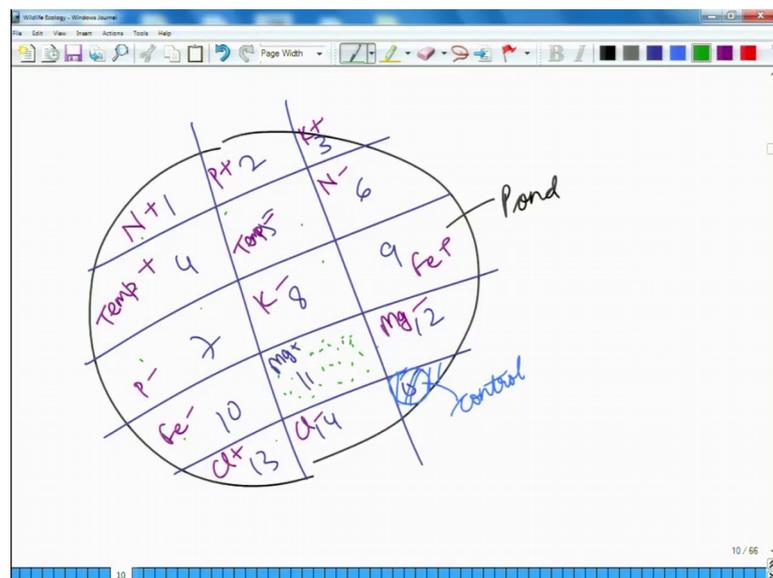
Now, if you have less number of predators the prey would be able to increase. So, then we would be having more number of prey, now this is something that we can understand intuitively. Now, if you go to the theoretical approach. So, theoretical

approach would begin with such a framework and would then go on and define different equations and different models through which we can understand the system.

So, for instance if you have a population that is represented by small p and predator population that is represented by capital P. So, the our theoretical approach would ask that, if you have this prey population it would be a function of the predator population and the existing prey population and what would be the equation through which we can model this system and we will have an example so this system is governed by what we call is the load curve Volterra equations and we will have a greater look at this system in more detail in one of the later lectures.

Now, the second approach to ecology is a laboratory approach. So, laboratory approach uses the scientific method of formulating hypotheses and testing them through experiments.

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So, to give an example suppose we have this area and so, suppose this is a pond. And in this pond we are having very less amount of algae. Now the question that we could ask here is, what are the factors that are limiting the algae population in this pond. So, again we are looking at the abundance and distribution of an organism in this case this organism is algae. And now we are asking the question, what are the limiting factors in this pond because of which the population is less. So, what we can do in this case is that we can divide this pond into different regions so, we can set up curtains. And once we

have set up these curtains we have these different regions 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15.

Now, once we have set up these curtains water cannot move from one of these areas to the, to another area so, all of these zones have now, become different from each other. Now, what we can do is that see we have a hypothesis that we have a less population of algae here, because there is less amount of nitrogen that is available to the plants. So, in that case what we will do is that, in this area will add nitrogen maybe there is another hypothesis that this could be because of less amount of phosphorous that we have in this area. So, in another area we will add phosphorus in another area we will add potassium and so on.

So, we can formulate n number of hypotheses and then we can perform this experiment we can alter all of these different factors maybe you could even have a factor of temperature. So, probably temperature is very less and so, your plants are not able to grow here. So, probably in this area we will put up a heater and we will heat up this water or probably temperature is too high.

So, in another area we could reduce the temperature or in the case of these nutrients, you could have a sector in which we reduce nitrogen we reduce phosphorus we reduce potassium in some other areas we add iron in some other areas we reduce iron. So, we can perform n number of experiments and in all of these experiments, we will keep certain areas as controls. So, control is a sector in which we are not doing anything.

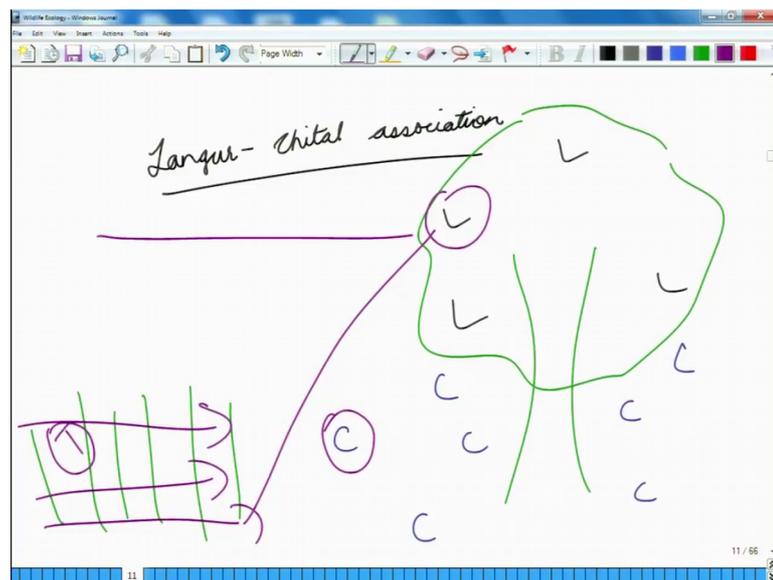
So, this is how our system was without doing any of the interventions. So, in this approach what we will do is we will formulate hypotheses that, we can have these n number of reasons, because of which we are having less number of or less population of algae and in these waters, we could have a deficiency of certain nutrients we could have in excess of some nutrients, that are becoming toxic to these plants or maybe we could have less temperature, higher temperature, less amount of sunshine more amount of sunshine we can formulate a number of hypotheses. And then within perform experiments to check all of these. So, we can alter all of these different variables and then we can check them with the controls.

So, probably it turns out that in this experiment see there was an area in which magnesium was added magnesium was reduced or say chloride was added or fluoride

was reduced and so on. So, probably it turns up that in all of these different areas nothing changes, but in the area with magnesium, we can more number of plants that are that have come up. So, once this happens we will be able to tell that we have a less population of LG in this pond, because of a deficiency of magnesium. So, this would be a laboratory approach. So, we are using the scientific method of formulating hypotheses. So, the first step is to formulate hypothesis what are the things that could be playing a role in, it in having a reduced population.

And then we can test them out using experiments. So, we look at the theoretical approach in the laboratory approach the third approach is the field approach. So, field approaches through observations in the field. Now a very good example of the field approach is what we refer to as the Langur Chital association.

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Now, this association between these two species was figured out in car now. So, what people observed was that, if you have a big tree and in this tree you have some Langur population that is a true (Refer Time: 35:27) that are there on the streets you will also find a number of Chitals that would come below this tree.

So, what are the factors that are resulting in this particular distribution of animals that wherever you get Langur on trees you find kittles coming there. So, what people did was they just sat and they observed what are these Langurs goes doing to the Chitals. So, they observed that if you are a languor and you are on top of a tree you have a very good

vantage location to observe the surroundings. So, if you have a tiger that comes up here and if you have these tall grass lengths so, you have these grasses that are there. So, a cheetah will not be able to observe the tiger, but a longer route will be able to observe the tiger and whenever this animal observes that either it starts giving out false alarm calls. So, that other Langurs are also aware that there is a predator nearby.

Now, when this happens then, and you have a cheetah that is also nearby. So, cheetah also hears the alarm. So, even though your Chital was not able to see a tiger, because it was there on the ground it was not poaching high up on the tree, if it is close to the longest it can make use of that information. So, that is one benefit that is provided by the lung goes through the Chitals. Secondly, whenever the lung hoods are eating the leaves of the tree they tend to be a bit destructive feeders. So, what they will do is, they will pluck up a leaf then eat a bit of it and they will throw the rest of the leaves down. Now especially in seasons, where you have scanty vegetation or you have less number of green grass status of leaf.

So, say in the summer season you will have this area that has all the dry grasses, now dry grasses are mostly unpalatable, because they have a very high amount of silica content if Chital is going to eat over or dry grass it is going to injure its mouth. So, it requires green vegetation. Now, when it is when it comes to the bottom of this tree a Langurs that will be plucking a leaf eating its part and throwing the rest of the part down.

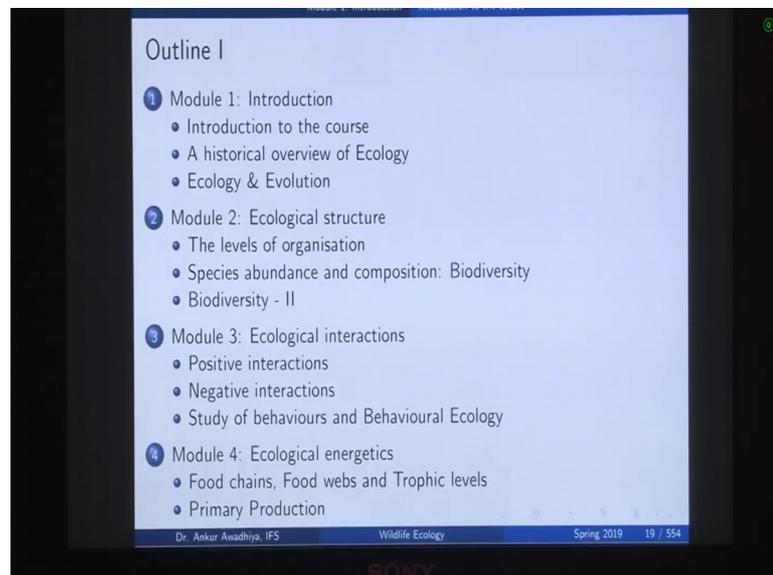
So, Chital will automatically get access to this food resource. So, this Chital it is unable to climb up a tree and it is unable to get those leaves by itself, but by coming in close contact with the lung roots by just coming where the Langurs boots are eating and it can eat now all the leaves that are falling from the trees.

So, this is a kind of observation that can only be made in the field. Now, similarly why does Langurs (Refer Time: 38:18) Chitals when it is there because a langur is getting a viewpoint from here it is not getting a viewpoint from here Chitals also have a very good sense of smell so, probably if you have a tiger here and a Langur was not able to see this tiger and the wind was blowing in this direction. So, Chital was able to get a sense. So, when Chital a sense of this predator nearby it will also give out an alarm call it would run away and that would alert the Langurs. So, essentially this kind of an association in

which you have two different organisms that are interacting with each other or a community interaction can also be study studied using the field approach in the field approach, we use observations in the field.

So, these are three approaches to equality and in the rest of the course we will make use of all of these three different approaches to understand why an organism is somewhere why an organism is not from somewhere else and what we can do to help these organisms or to conserve these organisms. So, these are the three approaches to ecology the theoretical approach the laboratory approach and the field approach.

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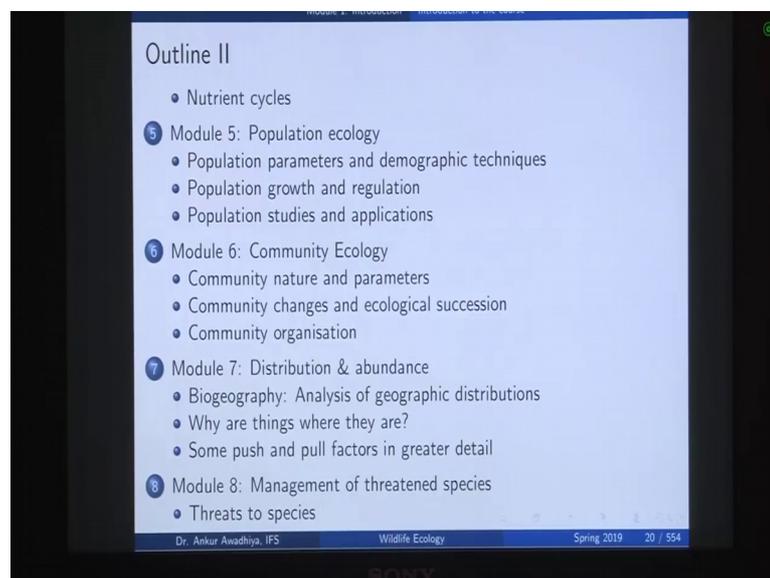
So, in this course we will be having so, let us now have a look at the outline of the course. So, we will be having 12 modules in this course the first module is introduction introduction to the course a historical overview of ecology which will tell us who did what to make the field of ecology what are the contributions of different people different scientists who made ecology the field that exists today.

Next we will have a look at ecology and evolution does ecology drive evolution and if yes how does it do that, the second module will be about ecological structure. So, in structure we will have a look at the levels of organization. So, when we say a population of animals or a community of different organisms, what is an ecosystem and things like that. So, we look at different levels of organization and how this organization helps the

system to survive next we will have a look at which is abundance and distribution or biodiversity and we will look at it in greater detail in the third lecture.

The third module is ecological interactions. So, we will have a look at positive interactions and negative interactions and the study of behaviors and behavioral ecology. The fourth module is ecological energetics. So, in this module we will have a look at food chains food webs and trophic levels and we will also understand how and why are the birds dying because of the insecticides, we will have a look at primary production.

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So, primary production is how plants make food out of sunlight and we will also have nutrient cycles say carbon cycle nitrogen cycle and so on. The fifth module is population ecology now population is a group of animals that belong to the same species. So, say a group of cheetah or a group of sambar that is a population.

Now, if we want to study a population we will have to define a number of population parameters. So, what is the number of organisms that are there, what is their sex ratio how many offsprings are born to each mother and so on. We will also have a look at different demographic techniques to get an idea of these population parameters.

Next we will have a look at population growth and regulation. So, for instance say we wanted to conserve tigers how does this tiger population grow, why is it not that we put tigers into a forest and the in this population shoots up what are the factors that regulate

its growth and what are the factors that may even lead to its decline are things that we will understand in this lecture.

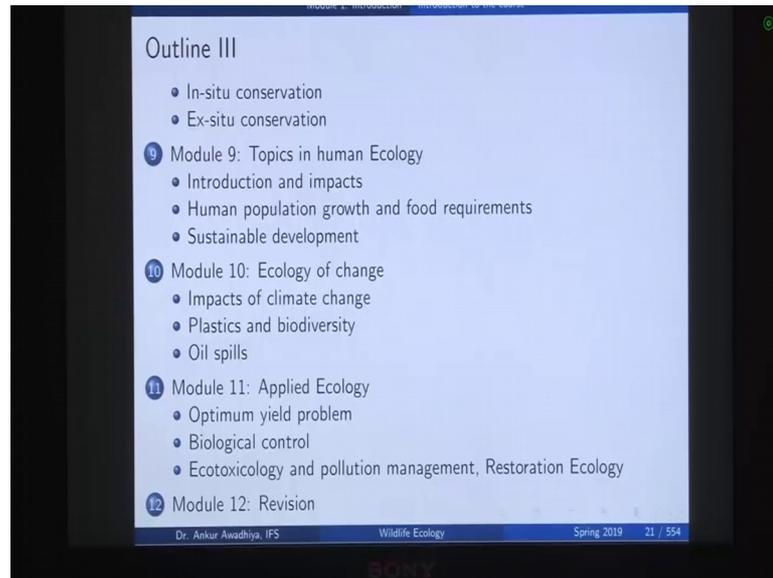
Next population studies and their application so, this is more of an applied topic the sixth module is about community ecology community nature and parameters changes and ecological succession. So, succession is a process in which the ecology changes or the ecosystem changes from one state to another state. So, for instance if you have say a piece of barren rock. So, on this rock after a while we might observe that some algae grow up and when you have some algae on these rocks.

So, after a while they would start degrading this rock converting it into soil. Once you have the soil there then you might have some other organisms that come in say you have grasses that come into this rock rocky region, once you have these grasses they will degrade the rocks even further and make way to say small plants followed by some trees.

So, this is the process of ecological succession. So, in the process of ecological succession every species makes way for the next species till you reach a climax. So, we will have a look at ecological succession and also community organization now the seventh module is about distribution and abundance.

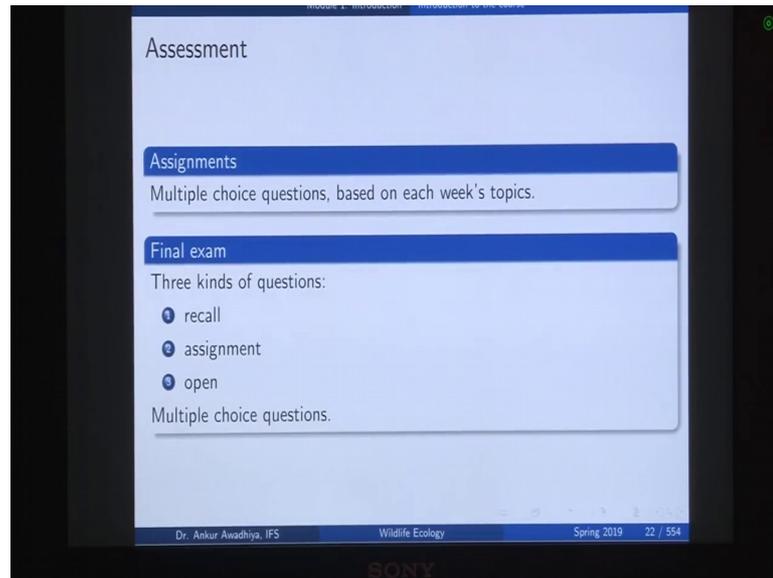
So, we have biogeography that is the analysis of geographic distributions next we have fire things where they are what are the factors that regulate this distribution and abundance and we will have a look at some push and pull factors in greater detail the eighth module is management of threatened species. So, what are the different kinds of threats, that we have two different species? So, there are a number of species that we are trying to conserve we have tigers we have elephants and so on.

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So, what are the threats that are being faced by these species and what can we do to reduce the impacts of these threats to be divided into incident three to conservation and xe to conservation the 9th module is topics in human ecology. So, we will have an introductory session followed by human population growth and food requirements and sustainable development the 10th module is ecology of change. So, we will have impacts of climate change impacts of plastics, specially on biodiversity and impacts of oil spills the 11th module is applied ecology. So, we have the optimum yield problem biological control and ecotoxicology and pollution management and restoration ecology and then we will devote a week to revision of all the topics that we have covered so far.

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Now, in this course we will have a continuous assessment. So, the assessment will be in the form of assignments and in the form of a final exam. Assignments will comprise multiple choice questions which will be based on the weeks topics and in the final exam will be having three kinds of questions. So, we will be having final exam in two different sorts a morning cotton and evening sort and we will be having three different kinds of questions will have recall questions.

So, recall questions are those questions in which you have to give an answer based on recall from the lectures, then we will have some questions that will come from the assignments maybe slightly modified, but more or less based on the assignment and third will be open type questions that will test your or your wider understanding of the whole topic.

And the final exam will also comprised of multiple choice questions. Now, the final exam will be computer based and will not require you to write any rain the answers. So, in this lecture we had a look at what ecology is what are the different kinds of topics that we study in ecology what is habitat what are the kinds of interactions that we have what is a population what is the community and so on. We also had had a look at three different approaches to ecology we have theoretical approach, we have a laboratory based approach and we have the field approach and we make use of all of these approaches as we move forward in this lecture.

So, thank you for your attention. [FL]