Wildlife Ecology
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Lecture - 07
Positive Interactions

[FL] Today we begin with a new module which is ecological interactions.

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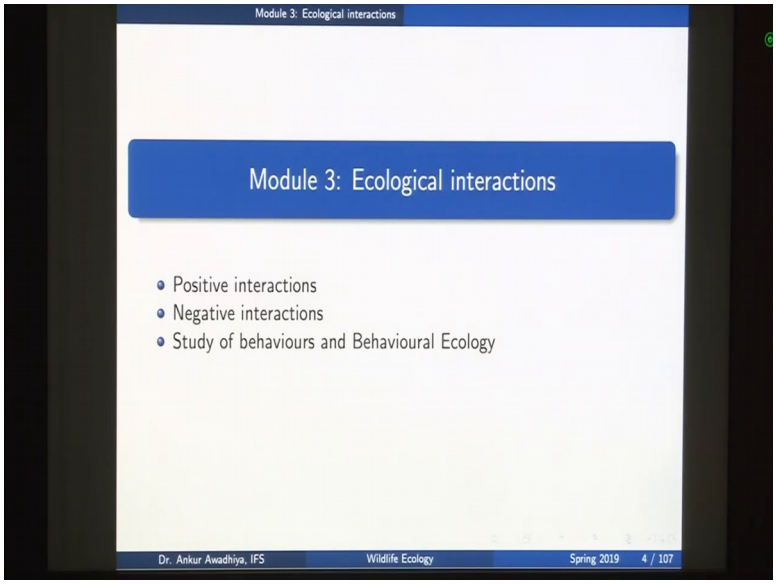

In this module, we will have three lectures the first is Positive Interactions. So, we will begin with what are ecological interactions and then move on to the positive interactions that we observe in different ecosystems. Then will have a look at negative interactions in the second lecture and the third lecture will be a study of behaviours and behavioural ecology. So, let us begin with positive interactions.

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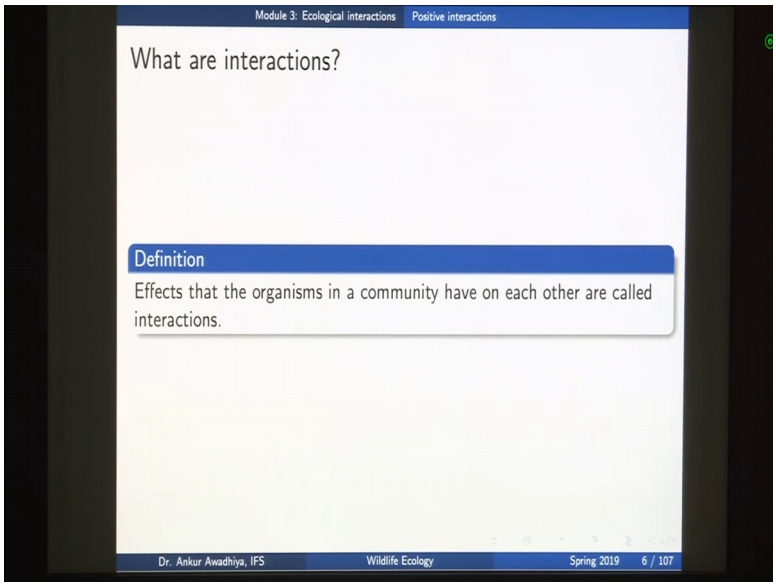

So, what are interactions? Interactions are effects or impacts that the organisms in a community have on each other. So essentially, if you see any organism that is there in the ecosystem, it will be doing something or just by its presence; it is taking up some space. And when it does so, it is putting and impact on the neighboring organisms.

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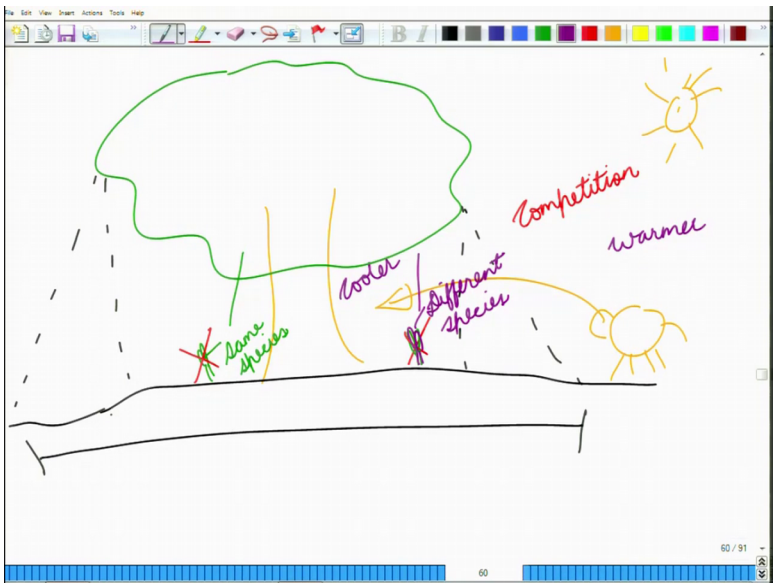

So, for instance if you have a forest and in this forest we have this tree; now just by its presence here it will be casting a shadow beneath itself and also to some degree on the sides. Now, just by its presence it is taking away all of these resources all of this space

may be a lot of water, a lot of sunshine and a lot of mineral nutrients. Because of which if there is any plant that is trying to grow up here, they will not be able to get adequate amounts of water or nutrients and then they will die out.

So, this is a process that we call as competition. So, this is a negative interaction that this tree is causing just by its mere presence, because it is casting a shadow on the surface of the ground. On the other hand this tree by the same process might also be helping somebody else. So, for instance if we have an animal and this animal cannot face the very high heat; that is there in the summer seasons, so you will find that this animal will move in the shade of this tree and so this animal will get some help out of this tree.

So, this is a positive impact that this tree is causing by its near presence here and also because it is releasing water in the process of photosynthesis, it is taking water from the ground and then it is releasing it through evapotranspiration. Now, through this process of evapotranspiration; it is also cooling the surroundings. So, these surroundings are much more cooler as compared to the warmer surroundings that are there in the vicinity. So, all of these different impacts that any organism in a community is casting on the other organisms in that community are known as ecological interactions.

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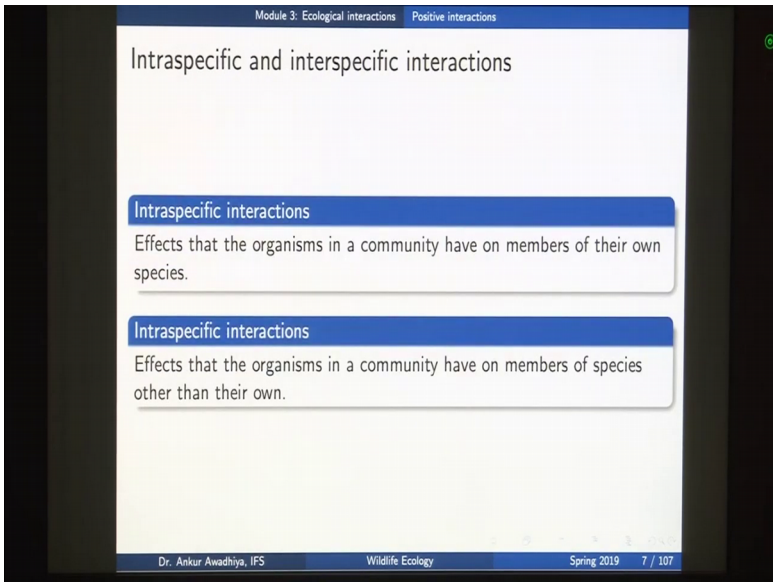

And these interactions can be divided into two parts; we have intraspecific interactions and interspecific interactions this should be interspecific; I n t e r.

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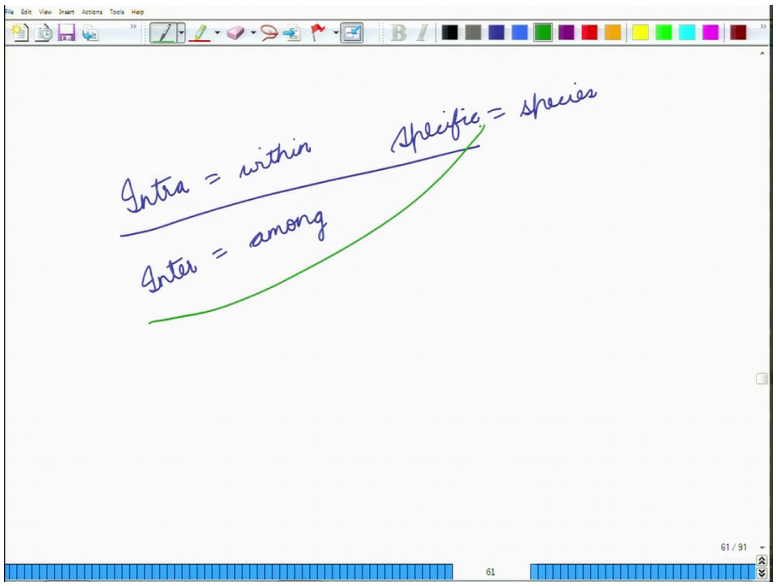

So, essentially what we mean by that is if you look at the word roots intra is within and inter is among. Now, specific is related to species; now intraspecific would mean interactions within the species. So, for instance if we consider a population of say chitals; so, any impacts that when chital is causing on another chital would come in the category of intra specific interactions.

Whereas when we talk about in inter specific interactions; it would mean interactions among different species. So, for instance if we have chital and we have sambar and if there is some interaction some impact that a chital is causing to a sambar; then we will call it as inter specific interaction.

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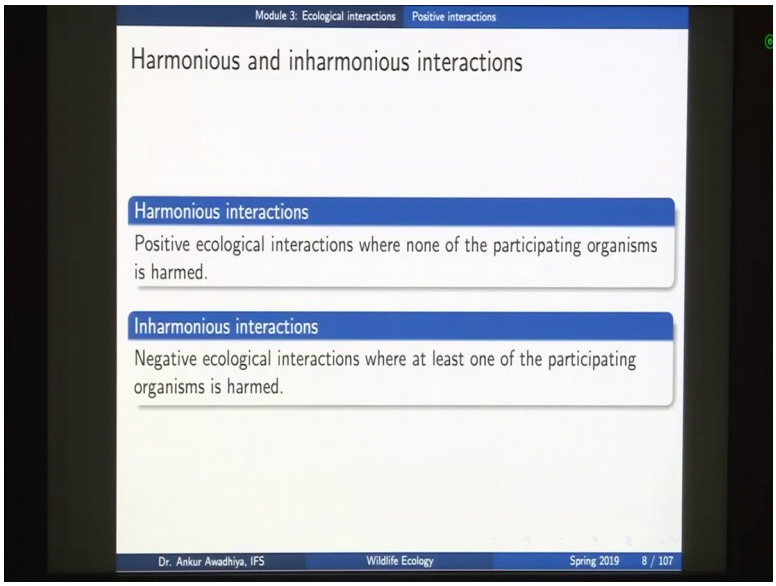

The next thing is harmonious and inharmonious interactions; now harmonious means something there in harmony or positive ecological interactions. So, how do we define a positive or harmonious ecological interaction? It is an interaction where none of the participating organisms is harmed. Whereas, in harmonious interactions or negative interactions are those interactions, where at least one of the participating organisms gets harmed.

So, even though there could be situations where none of the organisms is getting a benefit, but if none of the organism is getting a harm; we will call it a positive ecological interaction even if no none of the organisms is getting a benefit, the main principle here is the harm principle.

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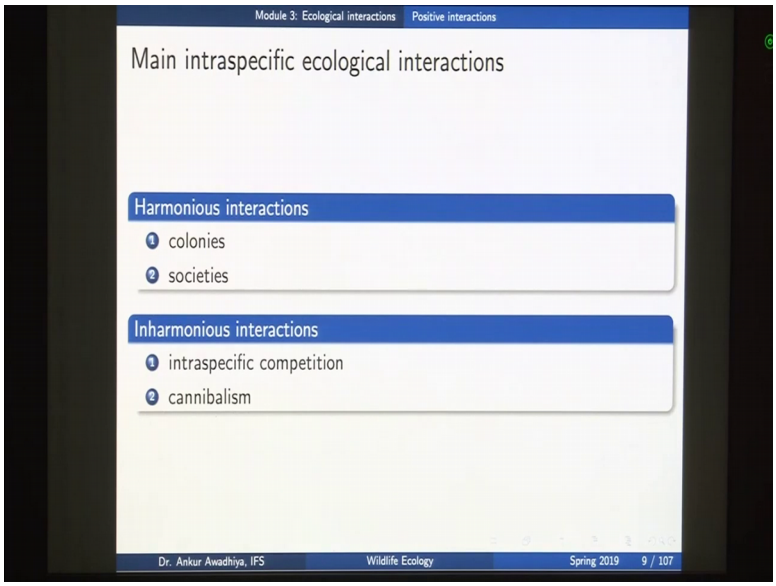

Now, if we look at different intraspecific ecological interactions; we see harmonious interactions in the form of colonies and societies that we will look in greater detail in this lecture. And there are some inharmonious interactions such as intraspecific competition and cannibalism.

Now, intraspecific is within the species; there is some competition. So, when we were looking in the previous example; so in this example if this tree, this plant and this tree belong to the same species, then the kind of competition that is happening here will be called as in intraspecific competition. So, that is an inharmonious interaction and we will look at it in greater detail in the next lecture and cannibalism where, an organism eats another organism of the same species.

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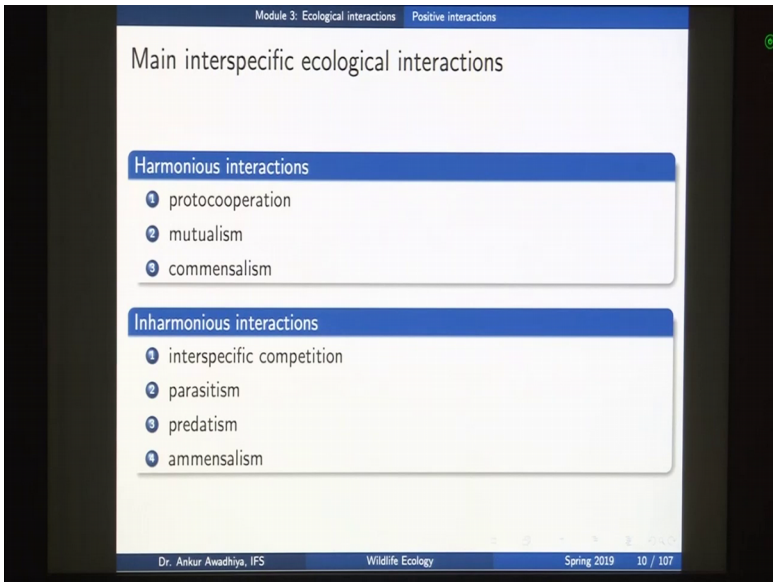

Now, these are the intraspecific interactions; what about the inter specific ecological interactions? Interspecific is between two different species. So, in this case we have harmonious interactions that is positive interactions in the form of proto cooperation, mutualism and commensalism and we will look at it and look at these in greater detail in this lecture.

And inharmonious or the negative interactions which are interspecific competition; now what do we mean by interspecific competition? In the case of our tree, if say this tree and this plant belonged to different species; then such a kind of competition that this tree is not allowing this plant of a different species to prosper to grow there; then we will call it an interspecific competition. Other examples of inharmonious interactions are parasitism which is related to the parasites that are found.

Predatism, which is related to predation or predatory behavior in which one organism eats another organism of another species; so this is known as predation. And the third one is ammensalism in which an organism is harming another organism of a different species even though it is not getting a benefit out of it.

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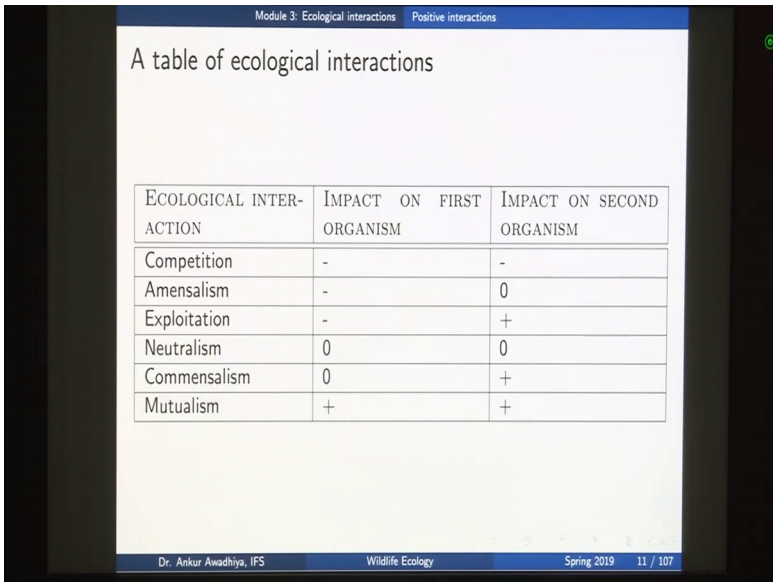

Ecological interaction	Impact on first organism	Impact on second organism
Competition	-	-
Amensalism	-	0
Exploitation	-	+
Neutralism	0	0
Commensalism	0	+
Mutualism	+	+

Now, we can summarize these interactions in the form of this table. So, we have ecological interactions impact on the first organism and impact on the second organism.

Now, in the case of competition you have a harm to both the organisms. So, here we are having two organisms that are interacting in the ecosystem; if their interaction is in the form of competition, so both the organisms are getting harmed. On the other hand, if it is ammensalism then one organism is harmed whereas, there is no impact on the second organism.

And a very classical example of ammensalism is where you have cattle that are browsing in a grassland. Now on those grasses that they are eating they are showing a predatory behavior; so they are removing the other organism in the form of exploitation. Whereas just by walking they are trampling a number of plants and when they are trampling these plants the cattle are not getting any benefit out of this behavior.

So, the impact on the cattle is 0; they are neither getting a benefit nor are they getting a harm; but just by walking on the grass when they are trampling the grass the impact on the grass is negative, so such processes are known as ammensalism. Third one is exploitation; now exploitation is where one organism gets a benefit and the second organism gets a harm. So, for example, we have predation parasitism; so most of the diseases are examples of exploitation. So, for instance if you get tapeworms; so these

tapeworms will be getting food from you and they will be harming you. So, this is an example of exploitation.

Neutralism is a situation where there is no impact on any of the organisms that are interacting. Now examples of neutralism are very limited, because in a number of situations we have not yet been able to dissect out clearly what are the impacts on the organisms. So, for instance you could say on in the first instance that two trees that are separated from each other.

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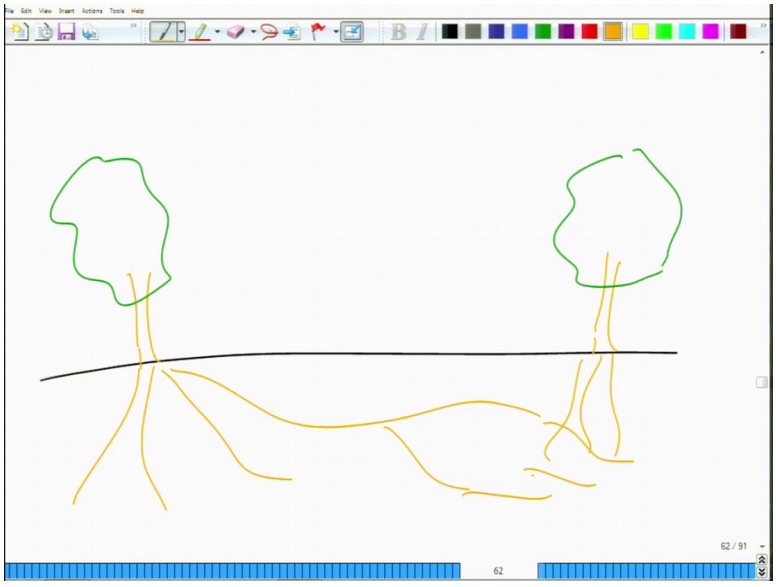

So, here we have a forest, here we have one tree and here we have another tree and this is the canopy and this is the second canopy. Now, in the first case it might occur that both of these trees are not having any impact on each other; neither a positive impact nor a negative impact because they are very much separated from each other, but then it is quite possible that the roots of the first tree are so long and so vigorously growing that they are tapping into the water source or the water that is available to the second tree. And if that situation occurs then we would say that there is one tree that is getting a benefit and another tree that is getting a harm.

So, while in the first instance; it might appear that both of these trees are in a relationship of neutralism, but it is also possible that they might be exploiting each other. So, but we call these kinds of interactions as neutralism where the impact on the first organism and the impact on the second organism are both 0. Next we have commensalism; now

commensalism is an interaction where one organism gets a benefit and there is no impact on the second organism.

Now, here also when we say no impact; it might be a minimal impact, it might be an impact that we are yet to discover; however, if more or less if we see that there is a very minimal impact or no impact on the first organism; we will say that it is a relationship of commensalism. So, here one organism is getting a benefit and the second organism is not getting any benefit or any harm.

Now, a good example could be, if you are walking on the countryside and you watch a buffalo and on top of that buffalo there is a crow that is getting a hitchhike. So, now, this crow is getting a benefit because it is not expending any energy; it is just using the buffalo as a means of transport. And there is no impact on the buffalo because a buffalo is say around 400 kg organism. So, it does not make much difference if say 2, 3, 4 kg crow is sitting on top of it.

However, there might be some negative, some negative impacts because even though it is a very minimal weight, but still this buffalo has to explain a bit more of energy. But then we can classify such interactions in the name of commensalism because the impact on buffalo is minimal, it is very close to 0 and finally, we have the interaction called as mutualism.

Now, mutualism is a relation where both the organisms are getting benefitted. So, to sum up here we have 6 different kinds of ecological interactions, competition, amensalism, exploitation, neutralism, commensalism and mutualism.

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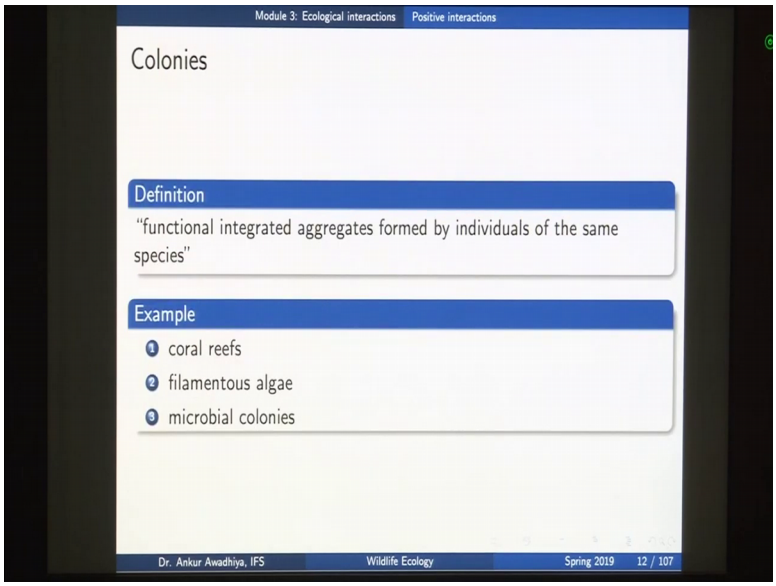

So, when we are talking about intra specific that is belonging to the same species, harmonious interactions we said that we have the examples of colonies and societies. Now colonies are defined as functional integrated aggregates formed by individuals of the same species. So, they are functional integrated aggregates that are formed by individuals of the same species. And good examples in this case are coral reefs, filamentous algae and microbial colonies. Now what do we mean by functional integrated aggregates?

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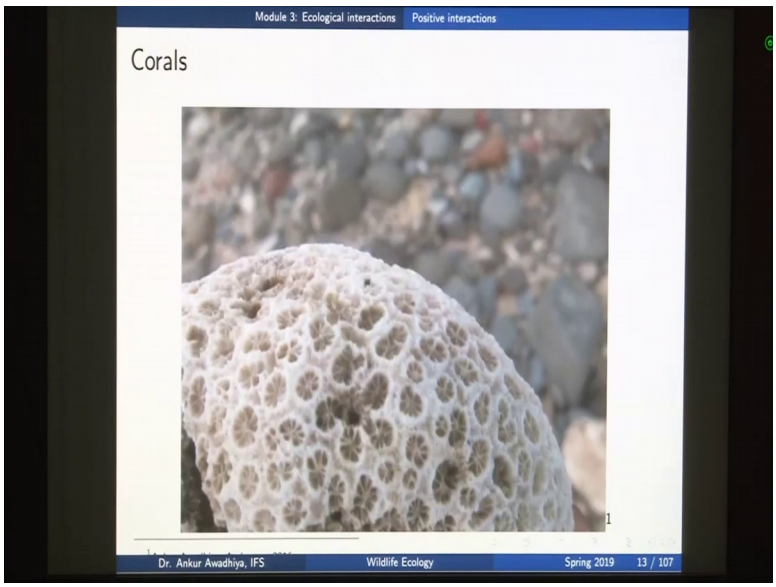

So, let us have a look at a piece of coral reef. Now this is how a coral reef would look like. So, this is a small portion out of it and then here we are observing that you have this huge rock like structure and it appears that this is just one piece of rock, this is just one organism. Whereas, actually we have a number of different organisms of the same species that have colonized it together and they have formed an integrated aggregate; so this is an example of a colony.

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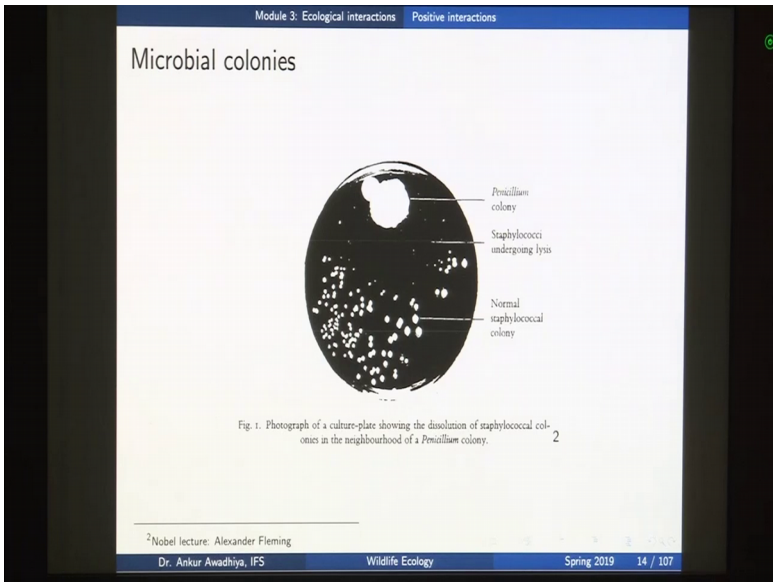

Another example of colony is microbial colonies; so for instance in this petri dish and this is an image from the Nobel lecture of Alexander Fleming, who discovered penicillin; the first antibiotic.

So, here we are seeing penicillium colony; so this is a colony that is made by a fungus and here we are having normal staphylococcal colonies; so all of these are different colonies. Now, if you look at any one of these colonies will see that this is one structure; you will not be able to differentiate different bacteria that are inside this structure. But then all of these bacteria have come from one single bacterium through the process of through the process of multiplication.

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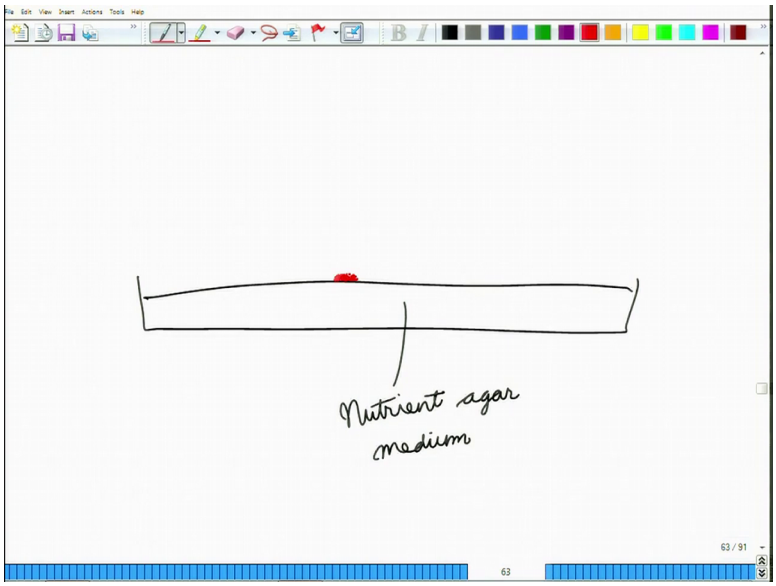

So, what is happening here is that on the surface of the petridish and here you have a nutrient agar medium. So, in this case you had a single bacterium that came here and then it multiplied and so it became from 1; it became say a million bacteria, but all of these bacteria are together.

So, when you look at this structure; you will not be able to see different bacteria from each other; so we will call this a colony of the bacteria. So, here we are having colonies of staphylococcus which are bacteria and here we have colonies of fungus, which is the penicillium and because penicillium is releasing penicillin; so it is able to kill the bacteria. So, this is how penicillin was discovered. So, intraspecific positive or harmonious interactions are colonies.

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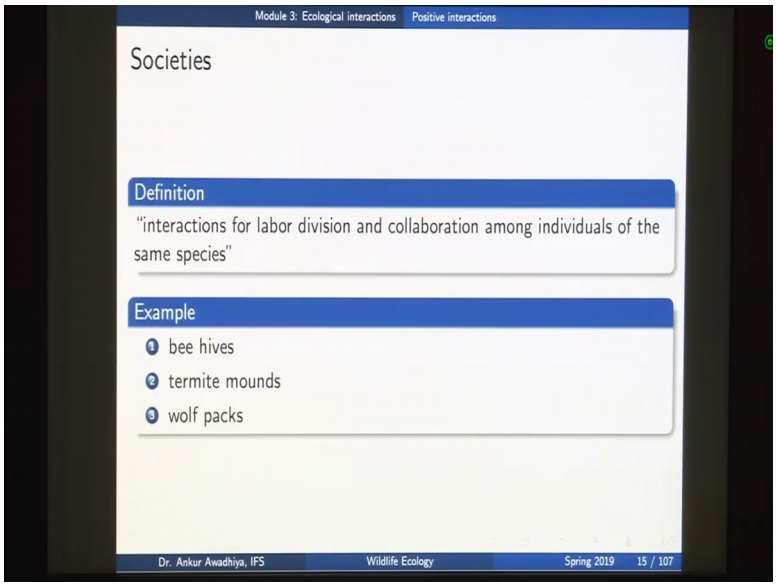

And the second one is societies; now what is the society? Interactions for labor division and collaboration among individuals of the same species; so, these are interactions that are for division of labor. So, for instance when we look at a colony a society of bee in the form of a bee hive; so we will be having a queen bee inside, we will be having a number of drones and a number of worker bees. Now in that case there is a strict division of labor; so in the case of the queen bee her role or her labor is to is to give rise to a number of eggs, it is to lay eggs. The role of drones is to fertilize the queen and the role of the workers is to go out for foraging to get food from outside, to defend the nest, to build up the nest, to take eggs and when these eggs hatch to feed the larvae and so on.

So, there is a strict division of labor; so, these are also interactions for labor division and collaboration. Now why is this collaboration essential? Because if we just consider a group of worker bees, they will not be able to reproduce; so they do not have this ability. Whereas, the queen bee that has the ability to reproduce that queen bee is not able to defend itself. So, only by coming together they are able to pass on their genes; so this is an example of collaboration. So, these are interactions for labor division and collaboration among individuals of the same species. So, examples are bee hives, termite mounds and wolf packs.

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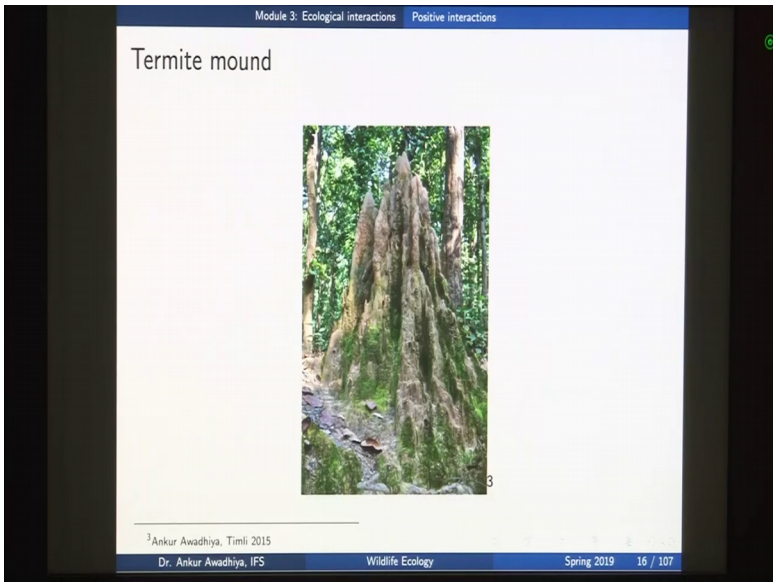

So, even in the case of a termite mound; you will also have termites that are serving different purposes.

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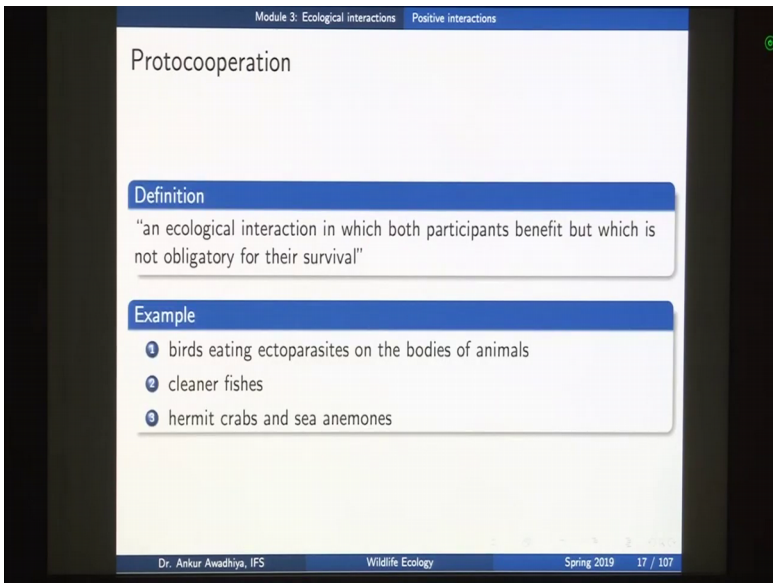

Now, when we look at interspecific harmonious interactions; so interspecific is between two different species two or more different species; harmonious interactions because these are positive interactions they are not harming anybody.

So, in this case the first example is that of protocooperation. Now protocooperation is defined as an ecological interaction in which both participants benefit, but which is not

obligatory for their survival. Now in the case of protocorporation you have two entities both of them are interacting and they are interacting in a way that they are mutually getting benefited; the first party also gets a benefit the second party also gets a benefit.

However, even though they are getting this benefit they are not reciting together for a very long time because this is not compulsory for their survival. When we say obligatory, obligatory means compulsory; so, this is not compulsory for their survival; so they might even go away from each other. So, a good example is birds eating ectoparasites on the bodies of animals.

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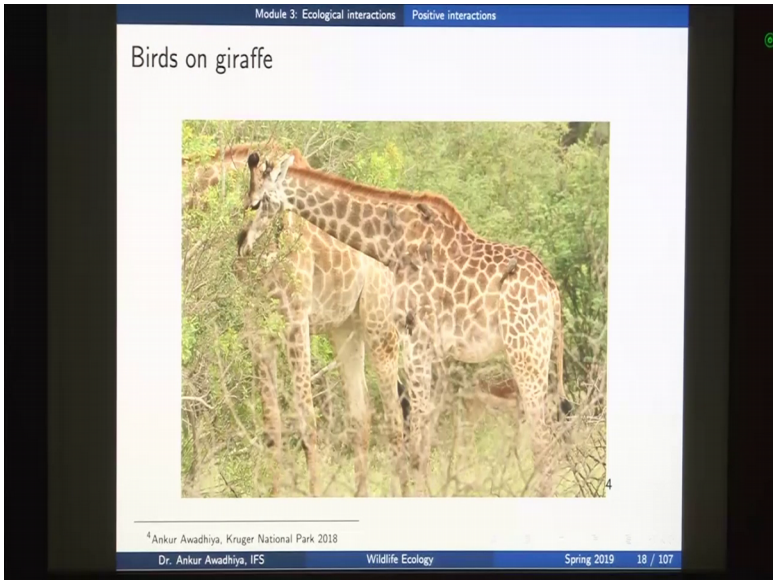

So, a good example is as these ox birds that are there on the surface of the giraffe. So, we went to Kruger National Park and there we saw this giraffe and on the body of this giraffe, you can observe that there is a bird here about here a bird here, a bird here, a bird here here. So, there are so many birds that are sitting on the body of this giraffe.

Now, what are these birds doing? These birds are eating the insects and the parasites that are on this skin of this giraffe. Now why are they eating these insects and parasites? Because these insects are in parasites are serving as food for these birds. So, with this interaction by coming close to the giraffe and by sitting on the skin of the giraffe and eating away all these insects and parasites; these birds are getting a benefit, they are getting food out of it. And this is a very easy source of food; Why?

Because if these birds went out into the ground. So, it will be a very much difficult to see these insects and to eat them; whereas, on the surface of this giraffe it is very easy to see these insects. Now, so there is benefit to the first party; now what is the benefit to the second party? What is the benefit to the giraffe? Why is this giraffe allowing these birds to come to its body, sit over it and do their job, get their food? Well this is because the giraffe is also getting a benefit out of it because the skin of the giraffe is getting cleaned in this manner.

So, these birds are removing the insects and the parasites that would remain on the body of this giraffe. However, even though both of these parties are interacting together and both of these are getting a benefit; even then this is not obligatory for the survival of either the birds or the giraffe. So, even if there are no birds around; this giraffe will live and even if there are no giraffes around; these birds would live because they would switch to some other source of food; so which is why we call this interaction proto corporation. So, in this both the parties are getting a benefit; however, this benefit is not obligatory for the survival of any of these.

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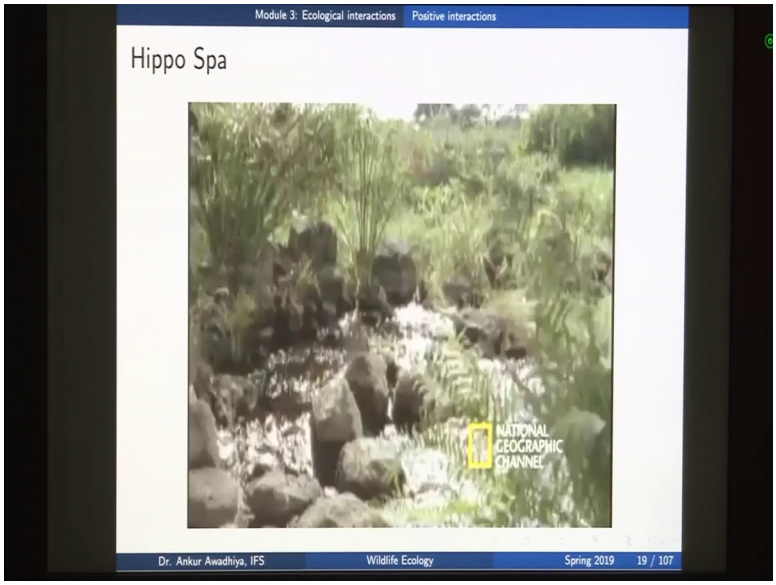

Another example is cleaner fishes; so we will look at a small video to see what cleaner fishes are. So, this is an example of what we call as a hippo spa; so this was featured in the National Geographic some time back.

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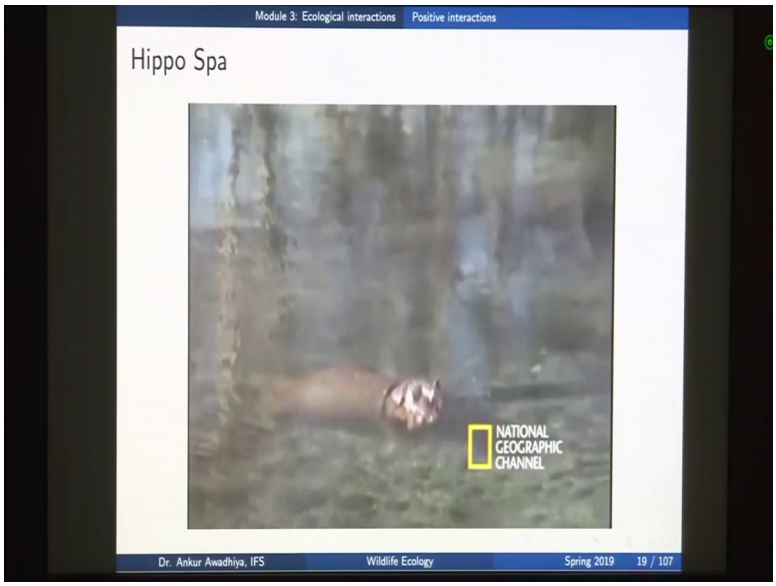

So, here we have a hippopotamus and that is lying in a river.

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And; similar to the case of the giraffe where we had so many birds that were eating its, eating the insects and parasites on its surface, here we have a number of fishes that are known as cleaner fishes; that are cleaning the body of this animal, the hippopotamus.

Now in this process, this hippopotamus is getting a benefit because its body is getting cleaned up. So, it will have less number of diseases whereas, at the same time the fishes are also getting a benefit because the dead skin cells of the hippopotamus are serving as

food for these fishes. And not only do these fishes clean the outer skin they also clean the mouth of the animal.

So, for instance we normally do a brushing of our teeth, but in the case of these animals; they do not have a toothbrush. So, this is an alternative arrangement that nature has provided to them. So, once they open up their mouth; these fishes will even get to the inside of the mouth and clean it.

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Now yeah so now this animal is opening its mouth and the fishes will clean the insides as well. Now in such an interaction it is essential that these fishes should not be harmed by the animal, because if these fishes think that this is a predatory animal; so they will not be coming there and cleaning its body or its mouth. And similarly the hippopotamus should not also be getting any sort of harm through this process.

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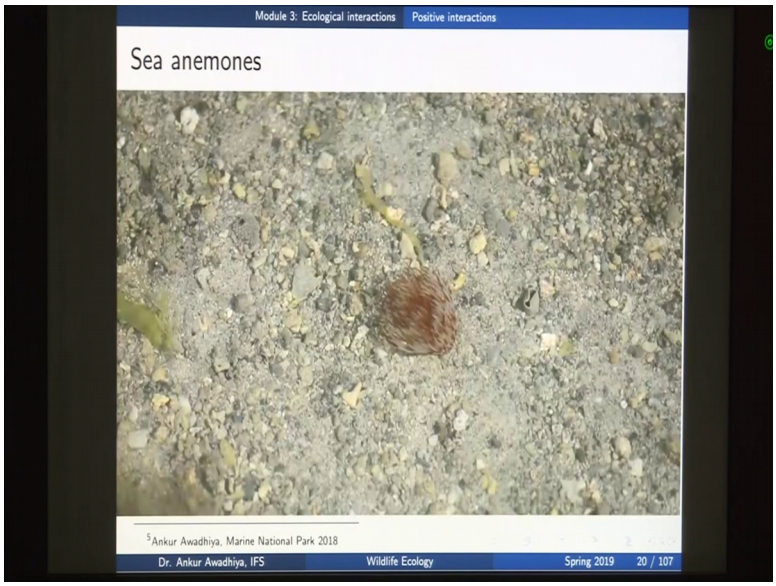

Another example is that of hermit crabs and sea anemones.

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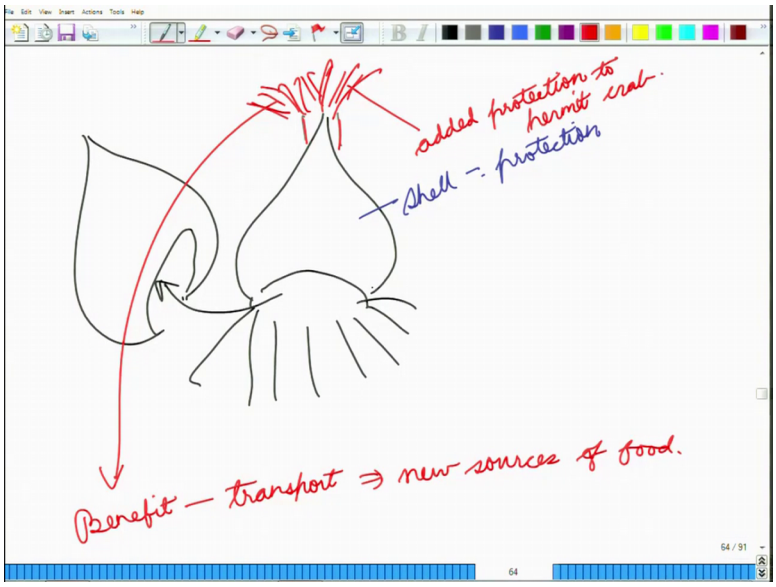

Now, hermit crab is a crab that has a soft shell on the top. So, ; so let us say that this is a crab and if you have a crab in a water body, there are a number of predators that can come and eat up this crab.

Now what the hermit crab does is that because it has a soft shell; it will make use of any molluscum shell. So, any c p or any quarry shell that is available. So, it will just take up any of these shells that are vacated until you get inside. So, essentially when it goes

inside; it will have this larger shell on top of it and then it will use it as a means of protection. On the other hand, we have these organisms; so this is something that we observed in the Marine National Park in Gujarat. So, here we have seawater and here we have this animal and this animal is known as sea anemone.

Now, this is how it will look; so it is a very beautiful looking animal and this is a predator animal, but as soon as you touch it; it will get inside. Now what this animal does is that it also has a number of stinging cells on its body and this animal can even prey upon some smaller fishes. Now when this hermit crab has this the shell on top; it can it is using this shell for protection. Now it can get an even better protection if it could go to a sea anemone and maybe take off this small portion and then stick it on top of its own shell. So, in that case we will have a situation where you have sea anemone on the top and you have all these tentacles that are around.

Now, how does this help; when you have these tentacles which have stinging cells, so a number of fishes will be extremely vary of coming close to the hermit crab. So this anemone is providing an added protection to the hermit crab. And at the same time as we observed here in the; so, as we observed here in this video this animal is a cecil animal. So, it remains attached only at one place.

So, if it is found here and only when some features come near it will it be able to predate upon those fishes, but then if it has a has a connection to the top shell of this hermit crab. So, this anemone will also get a benefit of transport which would mean new sources of food. So, in this process both of these organisms are getting benefit out of each other and so this is also an example of protocoorporation.

Now why is this protocooperation? Because you can have hermit crabs that live without a sea anemone on their top and you also have sea anemones that live without a hermit crab. So, this sort of a relationship is not essential for their survival, but in this relationship both the organisms are getting a benefit.

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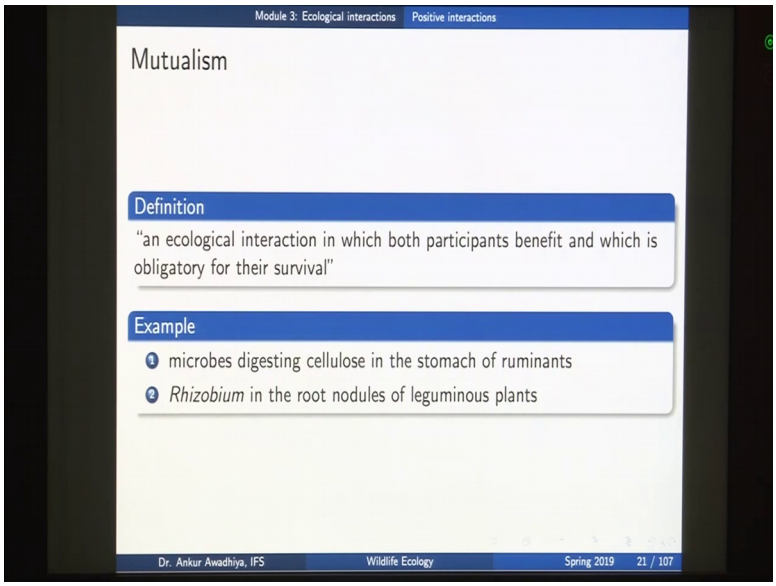

Now, another example now or another kind of relationship is known as mutualism. Now mutualism is an ecological interaction in which both participants benefit and which is obligatory for their survival. So, the only difference here is that both the participants are getting a benefit, but this is also compulsory for their survival. And examples are microbes that digest cellulose in the stomachs of ruminants and the bacterium rhizobium in the root nodules of legumes plants.

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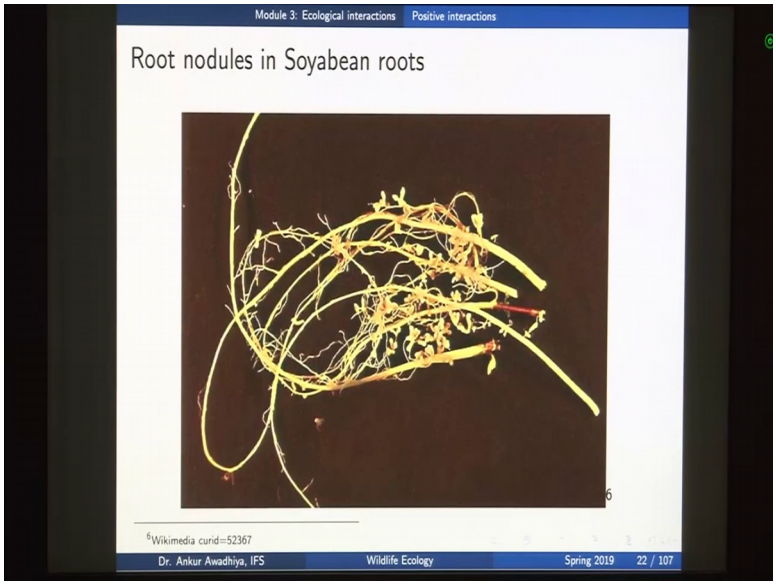

Now, how does this relationship work? Now if we look at the root nodules of legumes plants such as soya beans. So, this is the root of soya bean and here we will find that it has a number of module like structures.

So, nodules are these small protrusions that have come up on the surface. Now these nodules harbor bacteria of the rhizobium species. Now, these rhizobium bacteria get a benefit of shelter and food from the plant. So, when they are here in these nodules; they are getting protected and at the same time they are getting a free an easy source of food through the plant and these bacteria are able to fix nitrogen that is found in the air.

So, they convert nitrogen into nitrites and nitrates so that it becomes amenable for absorption by the plant. If you just have nitrogen the plants are not able to absorb it through their roots, but if you convert them into inorganic minerals like nitrates on nitrates. So, in that situation the roots are able to absorb the nitrogen in the form of nitrates and nitrates. So, these bacteria which are found in the legumes; they are benefiting the plants by providing them with nitrogen which is essential for their growth.

So, if you have a plant and you do not give it nitrogen this plant would die. Now the presence of these bacteria permits this plant to survive even on those soils that do not have a heavy amount of nitrogen in them. And these plants are permitting these bacteria to survive in those areas, where survival otherwise would have been impossible. So, in this case both the organisms the plant as well as that the bacteria are getting benefit out of each other and this benefit is so essential for their survival that it is obligatory. So, they cannot live without each other; which is why we call these as mutualism.

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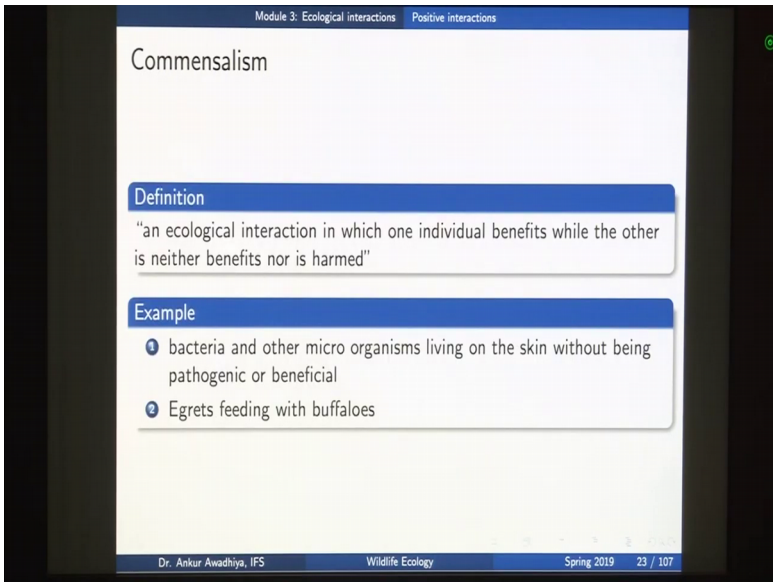

Now, another sort of interaction goes by the name of commensalism. Now commensalism is an ecological interaction in which one individual benefits, while the other is neither benefited nor is harmed.

So, here also we have two different organisms; this is an inter specific interaction and it is a harmonious interaction, it is a positive interaction nobody gets a harm. However, there is only one individual that gets a benefit, the other individual does not get any benefit. Now example are bacteria and other microorganisms that live on the skin without being pathogenic or beneficial. So, for instance if you look at the surface of your hand; if you took a sterile cotton swab and if you moved it across on your hands.

And if you put it into an (Refer Time: 31:25) film, you will find that there are a number of bacteria that grow on the surface. Now these bacteria are not harming us and neither are they providing us any benefit, but then why are these bacteria lying on the surface? Because they are getting food out of us because, if there are a are any dead cells; they will act as food for the bacteria. If we give out any oily secretions that would act as food for the bacteria; so the bacteria are getting a benefit whereas, we are not getting any benefit out of it. At the same time we are not getting any harm because of these bacteria because these bacteria are non pathogenic bacteria, they are not causing any diseases to us. So, it does not matter to us whether they remain there or not we are neither getting a benefit nor are we getting a harm.

So, such kinds of interactions in which you have a situation where one organism gets a benefit; while the other organism neither gets a benefit nor is harmed is known as commensalism. Now, another good example of commensalism is egrets that feed with buffalos.

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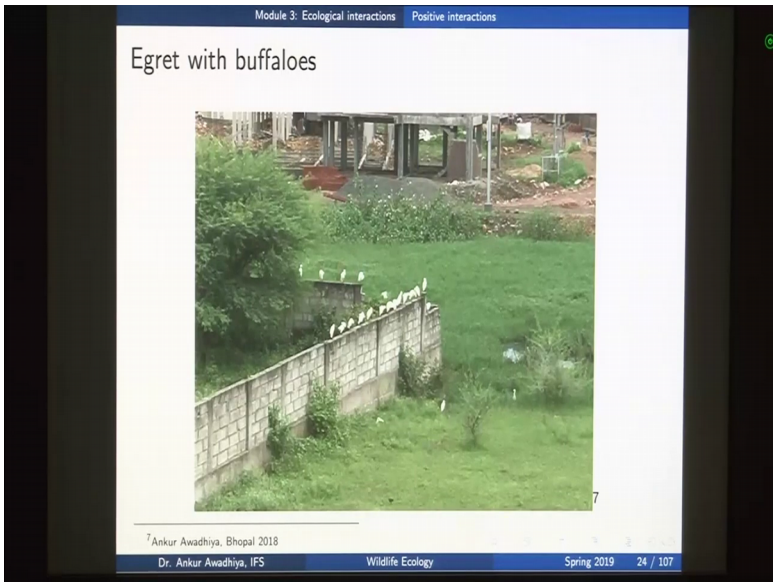

So, here we have a very interesting example. So, when I was looking out of my building; I saw this wall which was being constructed. So, this is an area in Bhopal that is getting constructed and here we have this wall and there are a number of a egrets. Now egrets are small birds and these are insectivores birds; so they feed on insects. And where do they get these insects from? Well they will find them in the soil.

So, you have these grasses here and these grasses will also be harboring a number of insects. So, there might be some locals there might be some grasshoppers and a number of other caterpillars and so on. Now you have a plentiful supply of food in the form of insects that are found in these grasses and you have the predator in the form of these egrets.

Now these egrets came to this wall very early in the morning say around 7 o'clock or even say 6.30. And they would just come here and they would keep on waiting; they would not do anything else. So, we used to wonder what they are doing there, because you have a bird that is hungry, you have insects that are available, why is this bird not getting down and eating the insects? And we used to see this every day.

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Now, one day when it was a weekend and I was there at home. So, I observed that close to around 10.30 or 11; we used to have some buffaloes that came up to these grounds. And immediately when these buffaloes came here the egrets came down and started feeding on the grass. Now what is happening here? If, you consider yourself to be an egret and you see this grass around. So, this grass would be having a number of insects, but then how do you get to that insect?

So, you come down and you find that there is an insect that is behind a leaf. So, insects are also very adapted camouflaging themselves. So, they will not show themselves off most of these insects will also be green in color and when you are around; when an egret is around these insects would hardly move. So, in that case it becomes very difficult for the egret to catch hold of an insect or to put it in terms of energetics; the cost of a getting an insect is much greater than the benefit that you will get out of eating that insect.

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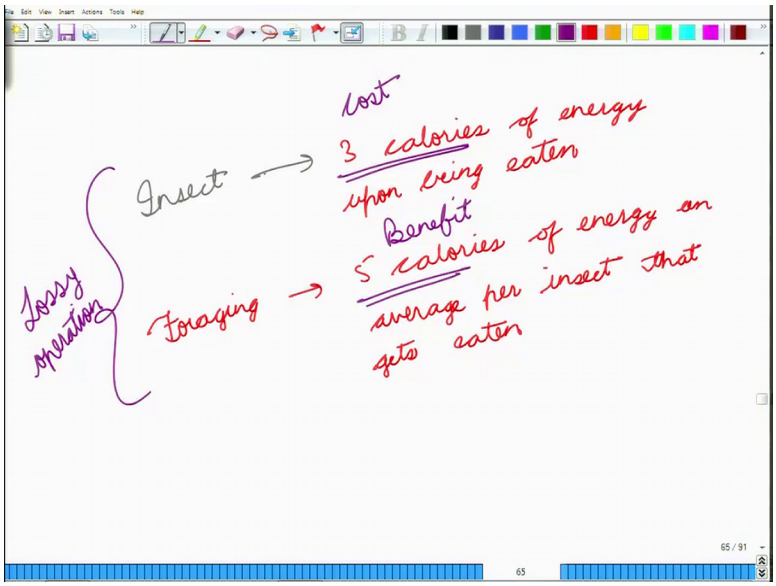

So, essentially if you have an insect and if that insect say gives you let us say 3 calories of energy upon being eaten. Now, if you do not have a buffalo around you go down and you do the foraging and you spend say 5 calories of energy on average per insect that gets eaten.

So, what we are seeing here is; if you have the birds if this bird gets down. So, basically this bird would be living somewhere else. So, it came to this wall early in the morning; so it has expended some amount of energy to come to this area, that is rich in insects that is rich in food; so, that has expended some amount of energy. Now if this bird comes down here and when it comes down here it would start searching for insects and these insects because they are camouflaged. So, this bird will have to spend time; it will have to spend energy to catch these insects. Now, on an average if you say that looking for insects because it is because it is energy intensive.

Suppose on an average you are spending 5 calories of energy per insect that you are able to catch; so, that is the cost of the operation. Now what is the benefit that you are getting out of it? You have those small caterpillars or you have these grasshoppers and you are eating those and on an average 1 insect will give you 3 calories of energy.

So, on an average we would find that this would become a lossy operation because the cost; the cost of getting the insect is much greater than the benefit that you will get out of eating that insect. So, the bird does not want to spend its energy, it does not want to get

into a game that is lossy for it. So, this bird will not get down; it will just keep on sitting there. So, it will sit here it will not get down.

Another thing that adds to the cost is a cost of predation. So, for instance if you have this ground you might also see some (Refer Time: 38:09) dogs some street dogs that can come here, and when these dogs come they would want to eat the birds. So, they might chase the word or they might even try to attack the birds; when that happens the bird will again have to fly. Now flying again will entail some more amount of energetic cost; so, this bird does nothing it just sits there.

Now say around 10.30, 11 o' clock when the buffaloes come the situation changes. How does it change? Well one because when you have these buffaloes around you will also have the [FL] that comes or the milkman that comes along with these buffaloes and he chases away the dogs. So, one these birds are now free from the danger of being predated. Now at the same time; when these buffaloes are grazing on the grass when they are moving around. So, when they are when they are moving these grass blades will also be moved. When that happens a number of insects would just jump out; now why this that happen?

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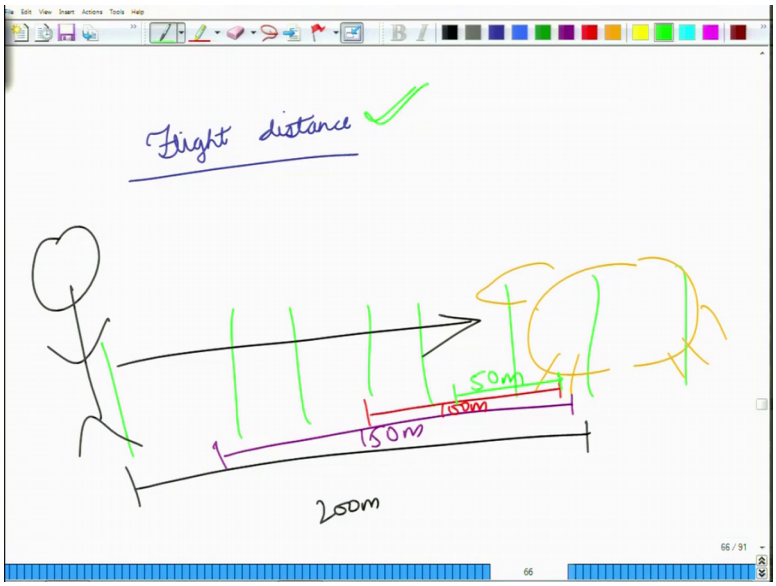

Now, in ethology; so ethology is the science of behavior of organisms we have a concept of flight distance. Now what is the flight distance?

Suppose you have a grassland and suppose you have an animal say a chital that is standing here. Now you are here and you go towards the chital; now you are say at a distance of around say 200 meters. Now at 200 meters this chital feels that it is extremely safe. So, you will not be able to just jump and grab this chital because you are very far apart. Now you move closer; so now, you say you are 150 meters away from the chital.

Now this chital is getting more and more alarmed because it is getting this sense that you are getting close to it, but still you are 150 meters away; so it does not have to worry about you. Next you come even closer, so now you are 100 meters away. So, now this chital is extremely anxious, but still it waits because if it saw you and started running; so it is also expending its energy.

So, it always has to make this decision whether I should run away or whether I should continue to eat these grasses. Because this chital is here in the grasses because it is eating the grass; it is getting food from the grasses, now if it runs away it will not be able to get this food. So, it has to make this decision whether it should run or whether it should continue feeding. So, you came as close as 100 meters and this chital is still feeding and then you come as close as say 50 meters. Now when you come as close as 50 meters; now this chital thinks that you are so close that now if anything happens; you can jump and you can grab this chital. So, what will this chital do? It will stop feeding and it will start running away in the other direction.

Now, this phenomena of flight distance is observed in a number of organisms. So, we see it in a number of wild animals, but we also see it in the case of the insects. So, when the animal is moving; so the insect might also feel that it will get trampled upon under the hooves of the buffaloes. So, when this buffalo moves this insect out of its; sheer fright it will start moving.

So, it might jump and as soon as this insect jumps; so you have this egret nearby and this egret will grab this and eat it. So, in the first instance when the buffalos were not around; this egret had to be very of the dogs and also it had to do a searching for the insects by itself; manually by expending its own energy. But when the buffalos are around the buffalo does all the work for the egret and the egret is getting benefit out of it. Now why does the buffalo permit the egret to be around?

That is the second question; now in place of the egret suppose it was something like a tiger. So, would the buffalo allow a tiger to come so nearby? The answer is no; why? Because the buffalo also feels that tiger might harm the buffalo, but an egret is not going to harm the buffalo; so, its fine with the buffalo. At times you will also observe that this egret will come on top of the body of the buffalo and will hitchhike for some distance; the buffalo does not find that as well.

So, in this example what we are observing is that we have two organisms that are interacting one is the egret, the second is the buffalo. One organism is getting a benefit out of this interaction; the egret is getting the benefit. So, you will always observe that the egret comes close to the buffalo, the buffalo will never go close to the egret because the buffalo is not getting any benefit out of it. But at the same time the buffalo is also not getting any harm out of this interaction. So, such an interaction where you have two different organisms in the community; one gets a benefit, the second neither gets the benefit nor gets the harm goes by the name of commensalism.

So, this is a commensal relationship between both of these. So, in today's lecture what we observed is that we have a number of ecological interactions. So, we have a number of species that are there together; these species will interact with each other, they will have some impact on each other, they will have some effects on each other. Now these effects could be voluntary effects; where an animal is doing something or these could be involuntary effects just because of the presence of that organism or the animals that is there. And these impacts can be positive on other organisms or they can be negative on the other organisms; if these are positive interactions we call them harmonious interactions.

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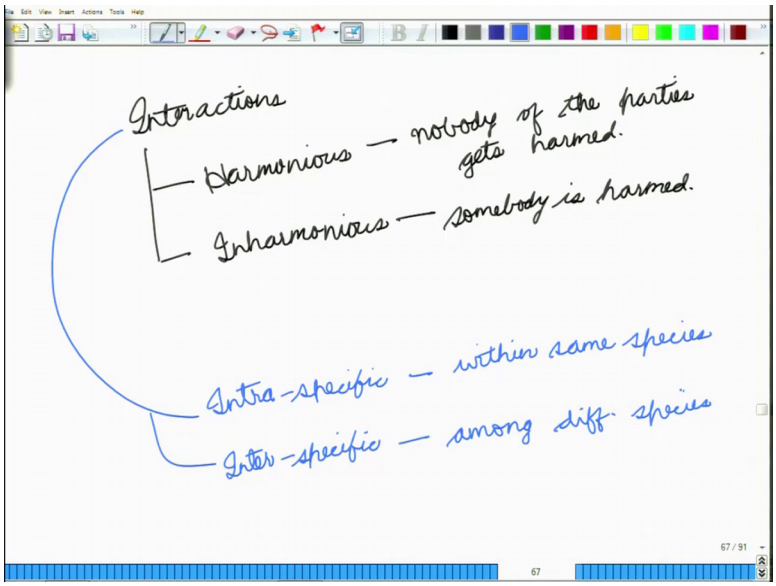

So, what are the key terms that we have in this lecture? We have interactions and these interactions can be harmonious or they can be inharmonious. Inharmonious is somebody is harmed and here somebody is one of the two organisms that are interacting with each other. In the case of harmonious interaction, you have nobody or let us say nobody of the parties gets harmed; so, that is one sort of a classification.

Another classification is whether these interactions are intra specific or whether they are inter specific. Now intra specific is within same species and inter-specific is among different species. So, for instance in this image; if we have an interaction between this egret and this egret, that is an intra specific interaction or between this buffalo and this buffalo this is an intra specific competition an intra specific interaction. So, for instance they might be competing against each other.

If this buffalo eats up most of the grass, the second buffalo might not be able to get enough amount of grass. Or for instance if this buffalo is trying to bate with say this buffalo and this buffalo is also trying to bate with this buffalo; so, both of these buffaloes are competing against each other. So, these are examples of intraspecific interactions, but when we consider the interaction between the egret and the buffalo; we have an inter specific interaction.

Then we looked at some harmonious interactions that were intra specific and some harmonious interactions that were in inter specific. So, in the case of intra specific

interactions we looked at colonies and we loved great societies. Now colonies good examples are colonies of corals or say colonies of bacteria or microbes that are there on the other plate.

Now in the case of colonies the organisms are so close together that they behave as a single unit. Whereas, in the case of societies you have different organisms that are living together, there is a division of labor and then they are helping each other; a very good example is a society of honeybees; so, where you have the queen bee, the worker bees, and the drone bees. Now in the case of inter specific interactions we saw a number of examples. So, some examples are commensalism, mutualism then we had protocoorperation.

So, now in the case of protocooperation you had both the organisms that were getting a benefit, but this is not obligatory for their survival; they can live even otherwise. So, you had this example of giraffe and the birds. So, the giraffe is providing food to the birds the birds are removing insects from the giraffe and so both are helping each other, but they can remain away from each other.

In the case of mutualism, again you have a situation where both the parties are helping each other, but this is obligatory for their survival. You have rhizobium in the root nodules of legumes plants; if you remove the rhizobium, the plant would die. If you remove the plant the rhizobium would die, and both are helping each other because the rhizobium is providing nitrogen as a nutrient to the plants and the plants are providing shelter and food to the rhizobium. So, both are getting benefit out of it and if you remove this interaction both the parties would die off. So, that was the second harmonious interaction and the third one was commensalism that we just looked at.

So, we will continue this lecture with the negative interactions in the next lecture; so that is all for today.

Thank you for your attention [FL].