Wildlife Conservation
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Lecture – 03
Economic Valuation of Biodiversity

[FL]. One question that props up again and again in the field of conservation is development or conservation. So, for instance, we might have a situation in which there is a forest, and then there are people who want to clear off this forest to make say a residential apartment. Or we can have situations in which mangrove forest on our coast are being cut to generate apartments that are sea facing, because in the market, they generally fetch a higher price.

Now, we know about biodiversity; we know that biodiversity is important. But then, if there is a proposal that has come up, that we want to replace this forest and have residential apartments or have high raised buildings. And if you say that, I we want high raised buildings; and if I go and saying no, we want forest, we are going to reach nowhere. So, there has to be an objective evaluation of which one is better, there has to be a profit and loss analysis or a cost and benefit analysis, which brings us to today's lecture of Economic Valuation of Biodiversity.

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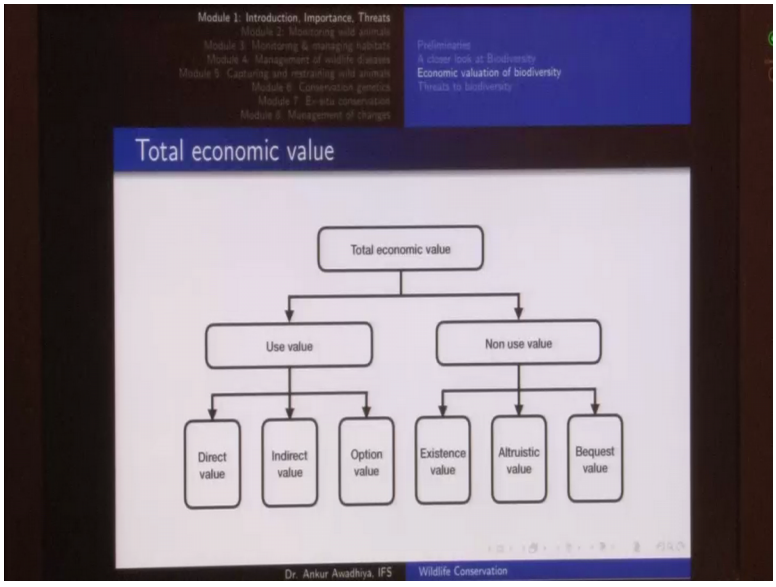

Now, to understand how we can put a rupee or a dollar value to biodiversity. Let us have a look at this chart. So, the total economic value of anything and especially things like biodiversity can be ascertained by using this chart. So, total economic value includes the use value and the non use value. Now, use value happens, when something is actively being used; non use value happens, when you are getting a value out of something, even when you are not using that resource.

Now, we will look into these in greater details. But, use value includes direct values, indirect values, and option value and nonuse value includes existence value, altruistic value, and bequest value. Now, let us look at these in greater detail.

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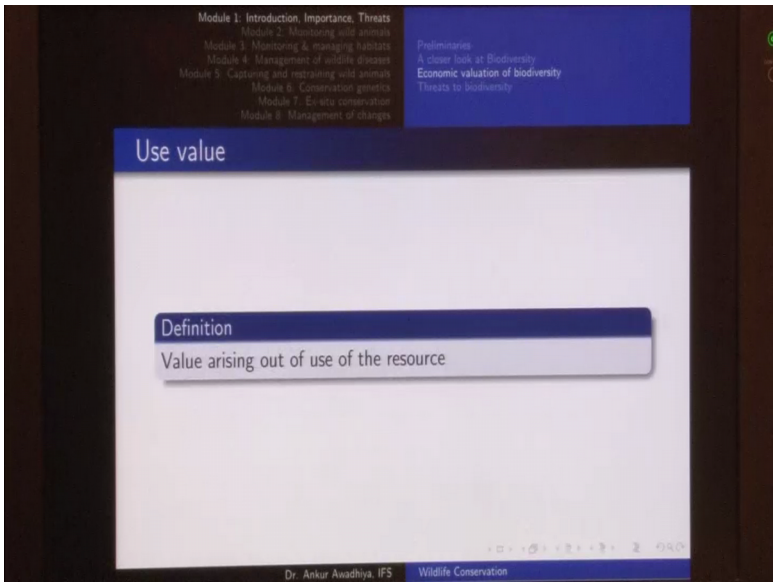

Use value is a value arising out of the use of a resource. So, for instance, you go into a forest, you cut trees, you take timber out. So, you are using the forest to get timber. So, the value of timber would count as a use value of the forest. Non use value, on the other hand is a value arising even though the resource is not being used.

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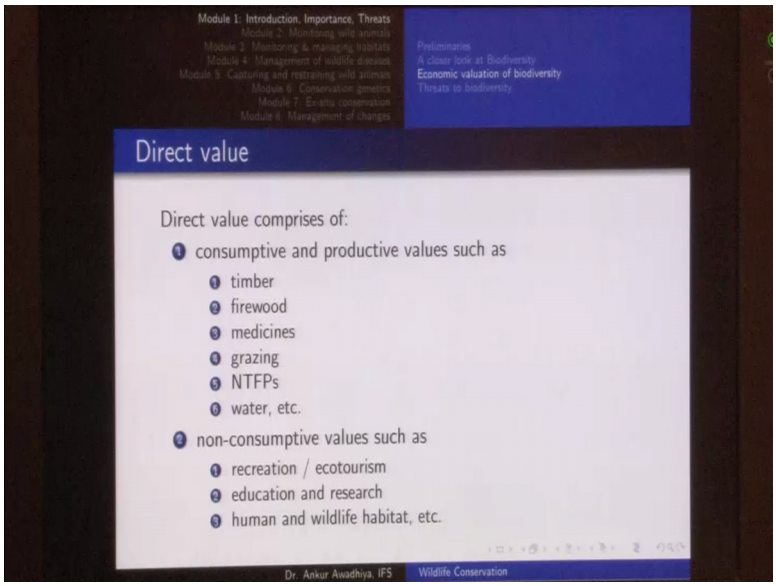

So, in the case of use value, we have direct value, indirect value, and option value. Now, direct value comprises of consumptive values or productive values and non-consumptive values. Now, how do we differentiate between a consumptive value and a non-consumptive value? A consumptive value is one that decreases, when you use the resource whereas, a non-consumptive value remains, such as even when you are using the resource.

So, for instance, in the case of consumptive values, we have timber or wood, we have firewood; we have medicines; we have grazing; we have Non Timber Forest Produce water and things like that. So, for instance, if you have a forest, and if you go out there and take the firewood out, so this is a consumptive value, because when you are when you have taken firewood out, the total number amount of firewood that remains in that forest reduces. Similarly, if you have water in a catchment area, if you have water in a pond, you go there you take this water out, so the amount of water decreases.

On the other hand, in the case of consumptive values, the values remain the same even though you are using that resource. So, for instance, in the case of recreation, tourism, ecotourism, education, research, habitat values, so even if you go there and so for instance, if one person goes into a national park, and enjoys the benefits of the national park for recreation, ecotourism or education. The value of the national park, it remains as

such, so the value does not decrease, so which is why, we call these as non-consumptive values. So, direct value includes consumptive and non-consumptive values.

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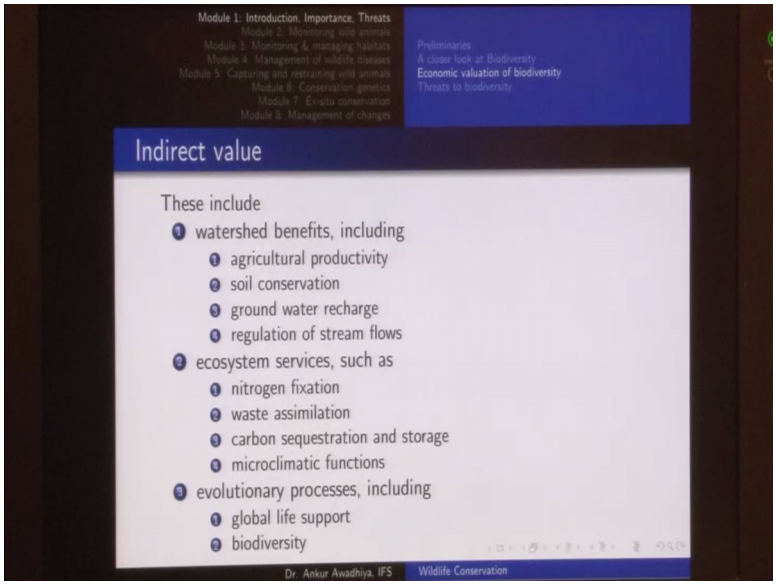

Indirect values includes things, such as watershed benefits, ecosystem services, and evolutionary processes. So, these things are going on at a larger scale. So, for instance, when we say watershed benefits, it means that in the case of forest, they act as a reservoirs of (Refer Time: 04:43) water. So, any water that falls on these hills that falls on this forest gets shift in to the water table. Now, if you have a water table that is high, you will have poor agricultural productivity, there will be less requirement to perform artificial irrigation.

Similarly, another watershed benefit is that of soil conservation, because the trees prevent the erosion of soil, they hold the soil in its place. Ground water recharge, regulation of stream flows. So, for instance, if you have a forest, then the streams that are coming out of the forest would not show a very drastic increase or decrease in the level of water. And most of them will be perennial, because the forest that have held these waters are going to slowly release it back. So, it seeps out at a constant rate. So, regulation of the stream flows.

Next, we have ecosystem services, which are the services provided by the functioning or the well functioning of the ecosystem. So, these include things like nitrogen fixation or the fixation of other nutrients, waste assimilation or waste assimilation these days is

becoming much more important because of it is also called as the sync function. And we are running out of effective syncs.

So, for instance, if you have a large water body that has a number of plants and if there is sewage that comes into it, then this sewage is treated in a biological manner and is assimilated in into these plants. So, essentially, the waste is processed in this process.

Next, we have carbon sequestration and storage, because trees hold a lot of carbon. And we also have microclimatic functions, such as regularization of temperature and regulation of humidity. Then we also have evolutionary processes including global life support and biodiversity that form a part of the indirect value.

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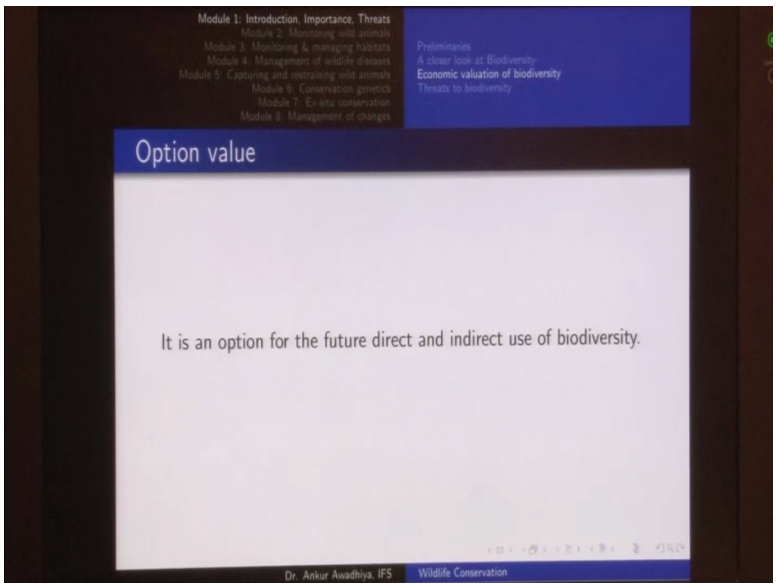

Next, we have option value. Now, option value is an option for a future direct or indirect use of biodiversity.

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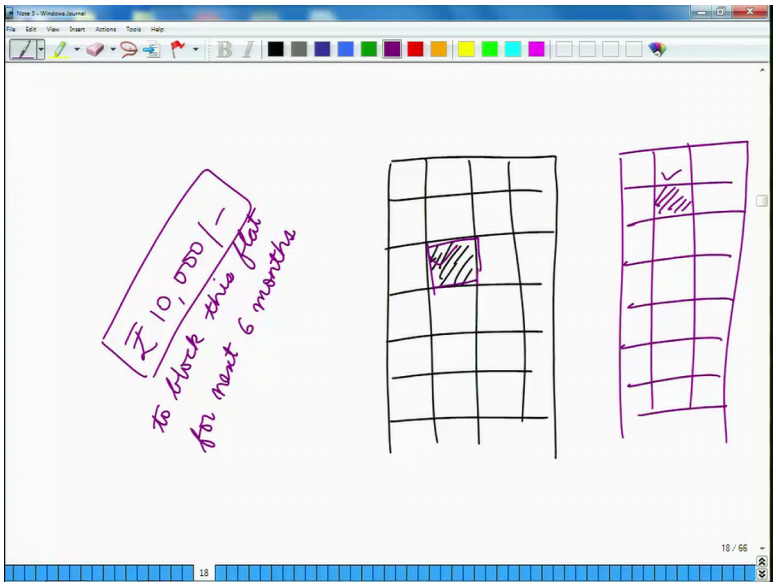

Now, to give an example, suppose we have a large sized a high rise building that has a number of apartments. Now, suppose I like this apartment and I would want to purchase it, but I am not very certain, whether I should purchase it right away or whether I should purchase it in a nearby apartment that also has a number of flats, and basically I like this flat here. So, I am not certain today, whether I should go for this flat or whether I should go for this flat.

So, I can go to the builder and I can say that please do not sell this flat, for the next 6 months, because I have not yet made up my mind, but I am going to make up my mind in the next 6 months, whether I am going to get this flat or whether I am going to go for the second flat. Now, the builder would say that, but if I keep this flat for you and if somebody else comes, then I would want to sell it to the second person to the second buyer, because why should I keep my inventory, there when I have a buyer and I can sell my flat to that person.

So, in that case, I would come up with the proposal, I would tell the builder let I would give you a sum of rupees 10,000 to block this flat for next 6 months. So, basically I am giving this amount to the builder, even though I am not getting a flat, because I am paying this amount to have an option of on this flat. So, in due of being paid with 10,000 rupees, even if another buyer comes to the developer, he is not going to sell this flat to

the other buyer for the next 6 months. At the end of 6 months, even if I do not purchase this flat from this developer, he is not going to return with this amount of money back.

Now, so this thing is known as, option value. Now, in the case of forest and other avenues of biodiversity, if we say that we are going to harvest this forest, we are going to cut down all these trees, and we are going to use these resources now, versus whether we should use it sometime in the future.

For in for example, there are a number of medicinal plants in the forest, now I do not currently have the technology or the (Refer Time: 09:22) to search for these medicinal plants and to use them. So, what I could do is that, I could just leave this forest as such, and may be in the next 20 or 30 years, when we have developed our technology use these resources. So, the option value of the forest is the value that is given to the forest, just for keeping it as such for any future use.

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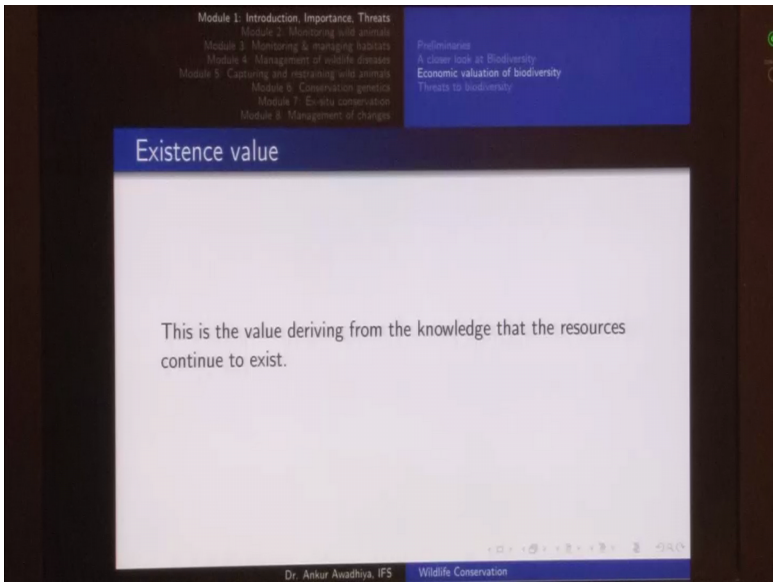

Next, we have existence value. Now, existence value is the value deriving from the knowledge that the resources continue to exist. Now, a good example of existence value could be say Taj Mahal or Qutub Minar in our country. Now, there is Taj Mahal, I am sitting here in Kanpur, I am not going to Taj Mahal, but it gives me a pleasure to know that Taj Mahal still exist in our country. I feel proud of the fact that we have this monument, this beautiful looking building in our country.

So, existence value is the value deriving from the knowledge that the resource is continuing to exist. So, just this fact that this resource is continuing to exist is giving me some amount of pleasure, it is giving me some amount of value. So, this is also another value that can be quantified.

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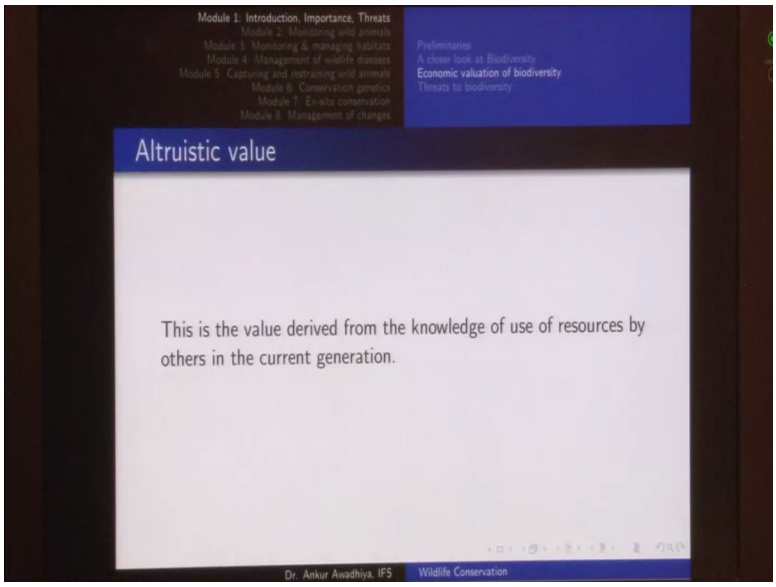

Next is altruistic value. Altruistic value is the value derived from the knowledge of use of resources by others in the current generation. Now, to give an example, let us consider the city of Mumbai, now I am not residing in the city of Mumbai, but I know that there is a marine drive there, which people can walk on in the evenings and enjoy the sea.

Now, even though I am not utilizing this resources right know, but I know that somebody else in my current generation is using this resource. So, this is also another value that we call as altruistic value. Altruistic value, because this is not a grid value, this is not something that is coming to me, but it is coming to somebody else in my current generation. So, this is also a value that is there in the biodiversity.

So, for instance, I might not get a chance to visit the Kaziranga national park, but I know that some other people of my generation are visiting Kaziranga national park because of which they are getting knowledge about conservation because of which they are getting exposure of about animals, and which would make them more inclined towards the cause of conservation. So, essentially when they are utilizing this resource, this is helping me, because this ah this knowledge or this exposure is going to get into the public opinion.

So, this knowledge, so this value that is derived out of somebody else from my generation using a resource is called an altruistic value.

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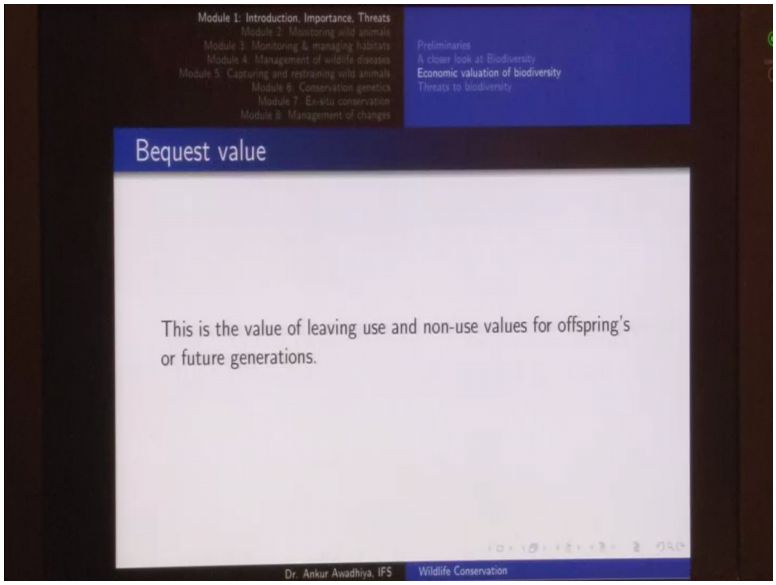

Next, we have bequest value. Now, bequest value is the value of leaving use and non-use values for the offspring's or the future generations. So, for example, even if I am not using a resource, and if I say that I am leaving this resource for my children or for my grandchildren, then it becomes a bequest value. So, we can say that we have all these different kinds of values; we have use values, we have non-use values, direct values, indirect values, altruistic value, option value, bequest value. But then, how do we put a rupee or a dollar tag on all of these values combined. So, this brings us to the methods of valuation.

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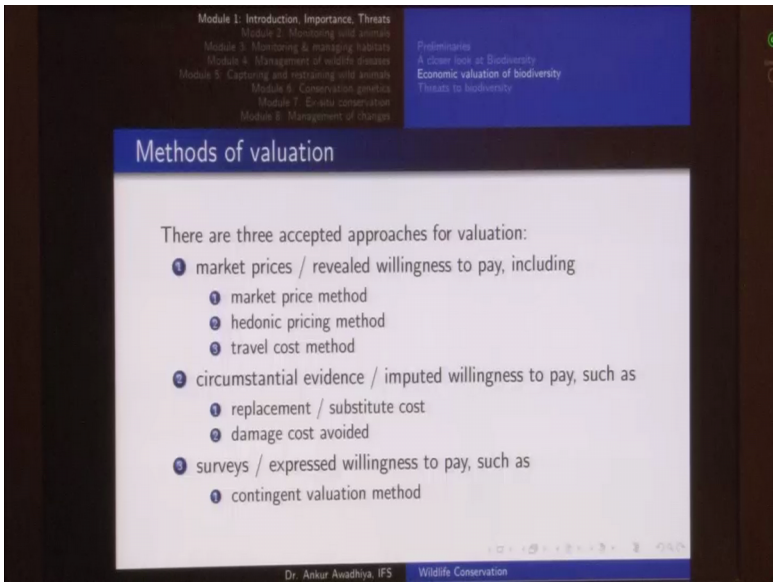

So, there are three accepted approaches for valuation of biodiversity of valuation of forest and other natural resources. So, let us look at these one by one.

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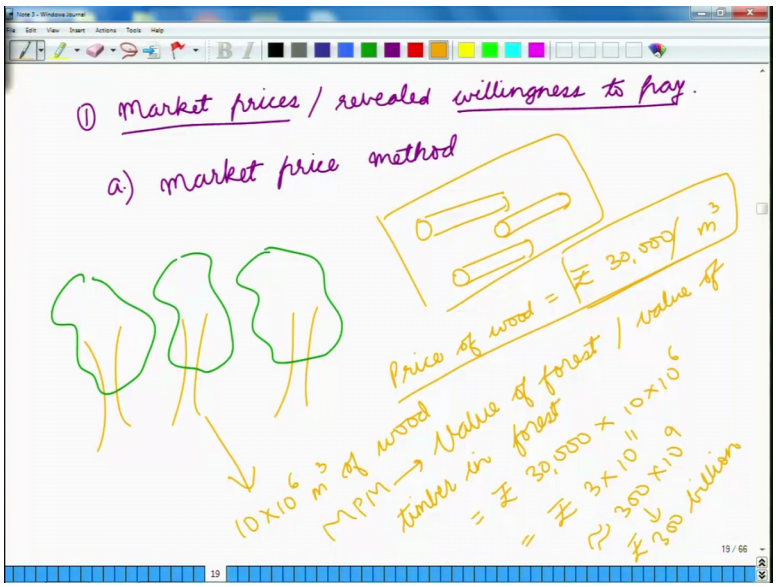

So, the first method is called market prices; also known as the revealed willingness to pay now. Why would somebody want to pays for something? Somebody would want to pay some amount in rupees or dollars to something, because he or she is deriving some value out of it.

So, for instance if I think that this pen is say worth 20 rupees, so why would somebody want to pay something for something. Now, let us take the example of this pen. If I think that this pen is worth 20 rupees, and if there is a seller that is selling it to me for 15 rupees, so I would think that this thing has a value of 20 rupees, I am getting it for 15 rupees. So, essentially I am at a profit of 5 rupees. So, in that situation, I am going to pay for this resource.

On the other hand, if I if in my eyes the value of this pen is 20 rupees, and the seller is charging 50 rupees for it, so in that case, I would say well the price is much more than the value, so I am not going to buy it. So, when somebody pays some amount for something, then we can get an indication of the value that they are putting on that resource.

So, in the case of the market price methods or the reveal willingness to pay, the first method goes by the name of the market price method itself. Now, what do we do in the market price method? If you have a forest and this forest when it is cut down, can be converted into logs of wood.

Now, we can use the current market prices for per unit of wood. So, for instance if we say that the price of wood is say 30,000 rupees per cubic meter per meter cuboid. So, if we know that this is the price of wood, then we also know that this is the minimum value that the customers are putting on the wood.

So, if we know this value and if we know that this forest has for instance 10 million 10 into 10 to the power 6 cubic meters of wood, then market price method would put the value of forest or the value of timber in the forest as 30,000 into 10 million. So, this is rupees 3 into 10 to the power 11 or we can also put it as 300 into 10 to the power 9 or 300 billion rupees. Now, in the market price method, this is the price of one thing that we are getting out of the forest. We could also use something else.

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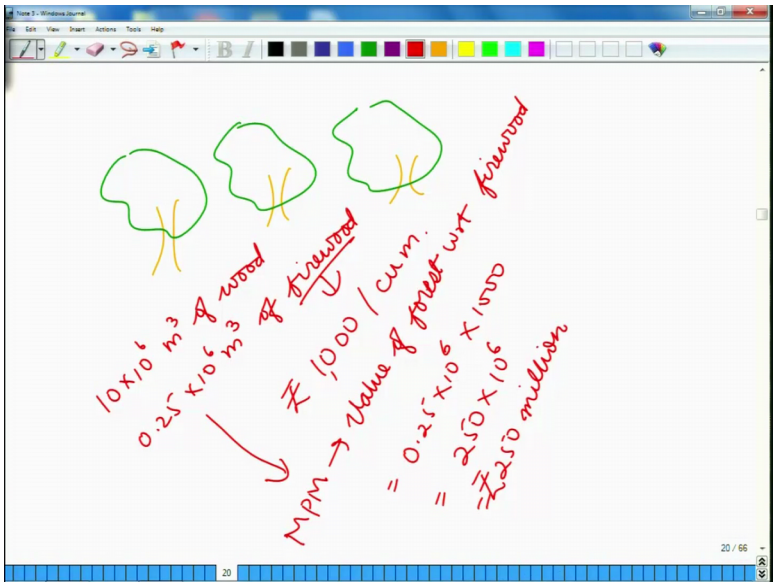

So, for instance, we have this forest, and when we preformed all these timber operations, so apart from getting this value of 10 million cubic meters of wood. I also get as residual amount; say 0.25 million cubic meters of firewood, which comprises of the small branches or the dried out portions of the tree. So, then I can go to the market figure out the price of a firewood.

So, for instance, if I say that the price of firewood is say 1,000 rupees per cubic meter, so in that case, the market price method would say that the value of forest with respect to firewood is given by 0.25 into 10 to the power 6 into 1,000 is 250 into 10 to the power 6 is 250 million rupees.

So, similarly we can go and look at each and every resource that is being provided by the forest, which is there in the market. So, if it is there in the market, we now the value of that product, we know the value of that resource, then we multiply that with the total amount of resource that is present in our forest to get a valuation of the forest. So, this thing goes by the name of the market price method.

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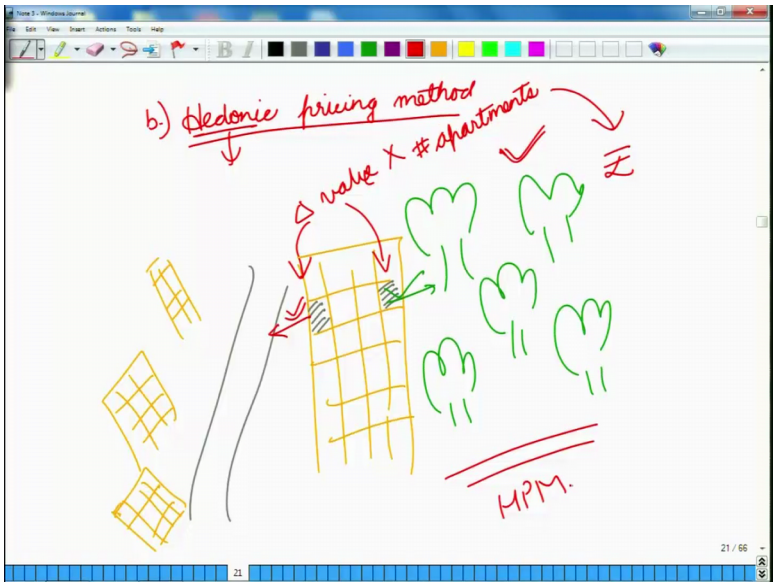

Now, the second method goes by the name of hedonic pricing method. Now, hedonism is a term that represents the amount of pleasure or the amount of joy that I am getting out of something.

Now, to give an example, suppose there is suppose there is a high raised building with a number of flats. On one side of the building, you have forest, on other side of the building you have a road and other high raised buildings. Now, if a person goes to buy a flat in this building, then the price of flat on the forest side would typically be greater than the than the price of a flat on the road side. Why, because a person who takes the forest side flat gets a view of the forest, which a person gets pleasure out of.

On the other hand, somebody who is taking this flat would be seeing only the roads, vehicles, they would be getting quite a lot of noise, may be even some amount of smoke and dust and there is nothing beautiful to look around. So, we have seen that typically forest view apartments or even sea view apartments sea facing apartments or even things like hill facing apartments, of valley facing apartments, typically get a premium pricing as compared to their other counter parts, which are not exposed to these natural resources.

So, a value of the forest (Refer Time: 20:49) also be discerned by getting the difference of the value between a forest facing apartment and a non-forest facing apartment. And multiplying that with the number of apartments that have a forest site view, and that will

give me a rupee value that is a hedonic price that people are willing to pay or they are already ready to pay to get this pleasure out of the forest. So, this thing goes by the name of the hedonic pricing method.

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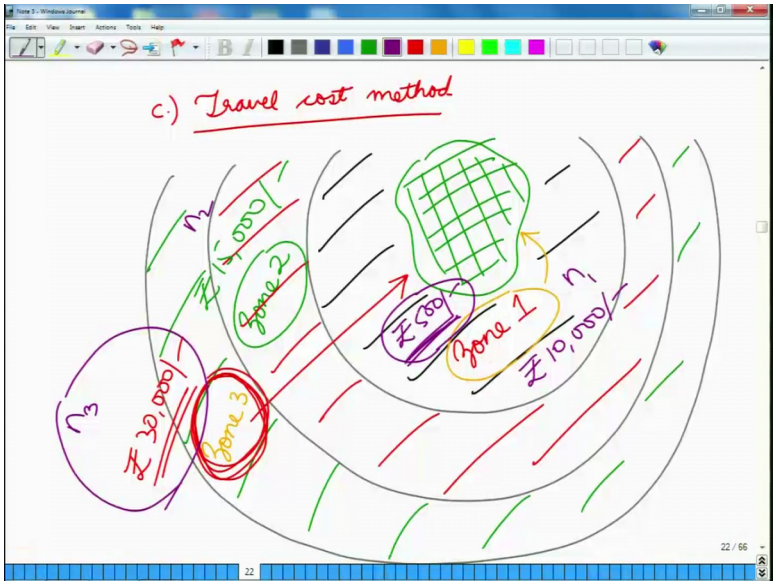

Next is the travel cost method. Now, in the travel cost method, let us take an example that we have a national park, and then we have people, who are coming to this national park from different distances in the country and maybe even abroad.

Now, typically a person who is coming from this zone, let us call it zone 1. He or she will typically be paying a lesser price for getting into the park, then somebody in the second zone. So, let us call it the zone 2. We would again be paying a lesser price as compared to somebody, who is coming from another zone; let us call it the zone 3, because zone 1 is closer to the national park, so the transportation costs are less.

And it is also quite possible that people who are residing nearby might come into the national park, enjoy the scenic beauty, enjoy the animals, and then come out without having to spend a single rupee on getting accommodation, because they are living nearby.

On the other hand, people who are leaving far off from this area, would have to pay much more transportation cost and would also have to spend quite a lot of money on getting accommodation, on getting local food and things like that. So, because a person

who is coming from zone 3, and suppose this person is paying say 30,000 rupees for one trip to the national park.

So, in that case, we can say that this person puts the value of the national park as at least 30,000 rupees. Because, only if the value of the national park in the eyes of this person is greater than 30,000 rupees, would this person be ready to pay 30,000 rupees to get to this national park. Because, after all he or she needs to derive a value he or she needs to derive a profit out of any transaction, in the case of economics. So, in this case, we would say that the minimum price of this national park in the eyes of people, who are coming from zone 3, is 30,000 rupees.

Similarly, if we say that in the case of zone 2, people spend say 15,000 rupees, and in the case of zone 1, people spend say 10,000 rupees including all the cost. Now, what we can do is we can make an inventory of the number of people, who are coming from zone 3, let us call it n 3; the number of people, who are coming from zone 2; and the number of people, who are coming from zone 1. Now, what we can do is we can multiply these numbers with the amount that these people are paying, to get an estimate of the value of this national park in the eyes of these people.

Otherwise, another way of getting to the same equation is to see how much amount is a person willing to pay. So, for instance, the entry ticket of this national park is say 500 rupees per person; if this value increased to say 1,000 rupees, how many people would be there, who would be able to or willing to pay 1,000 rupees. So, we can derive an equation from all of this data of the number of people, who are visiting and the amount of money that they are spending. To see how to estimate how much is the amount that these people would be willing to pay, to get into this national park, if the entry fees is enhanced.

Now, if we just play with the entry fees and just on a computer simulation, we can make an estimate of the amount that people are willing to pay just to get inside this national park, whether from any of these areas, which can also be another estimate of the national park in the eyes of these people.

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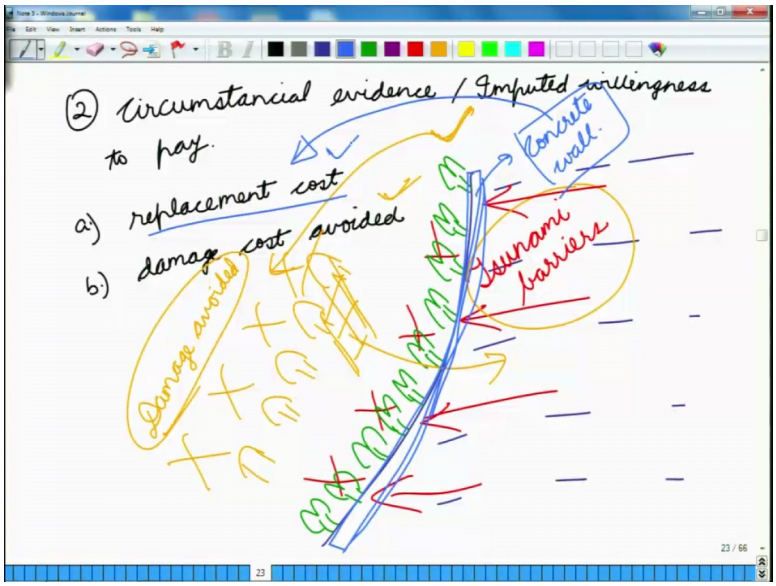

Now, another way in which we do an economic valuation is called the circumstantial evidence or which is also called the imputed willingness to pay. And here, we have two methods; one is called the replacement cost, and the second is called the damage cost avoided.

Now, to give an example, let us consider another facet of biodiversity. We have sea's on one side, and we have mangrove trees that are growing on this sea shore; now mangrove trees provide a number of benefits. So, for instance, they help raise the young fishes to their maturity, which increases their cost or they or the market price. At the same time, they also protect the residence who are leaving inside from any tsunami that could come from the seaside. So, essentially they act as tsunami barriers.

Now, if there is a proposal that we should get rid of all these mangroves, so that we can have a high raised building on this side, and it would benefit from getting a seaside view of the seas. Then what are our alternatives. So, there are two things that could happen; one is that (Refer Time: 27:47) we have removed all of these mangroves, we do not have any other amount of protection.

So, that in that case, if there is any tsunami that comes into this area, all of these houses will be destroyed. And they would be a huge amount of damage; not only to this houses, but also to people, also to vehicles, also to farm lands and other things, because salty water will come into all of these places.

So, if we can make an estimate of this damage that is happening, and we say that just because of these mangroves we are able to avoid this damage then we can say that the value of these mangroves is at least equal to the damage that is avoided just by their presence, which goes by the name of the damage cost avoided method.

On the other hand, if we say that no, we do not want the mangroves and at the same time, we do not want this damage. So, another thing that can be put up is some sort of a Tsunami barrier in the form of a concreate wall. So, here we have a concrete wall. Now, this concreate wall has to be so high, that in the case of any tsunami, it is able to protect the hinterlands from the tsunami.

In that case, we can do a cost computation of making this concrete wall. And the cost of this concrete wall would go by the name of replacement cost. So, in the case of these mangroves, they are providing value that is at least equal to the cost of creating this concrete wall, which is a replacement for these mangroves. So, this method goes by the name of the replacement cost method.

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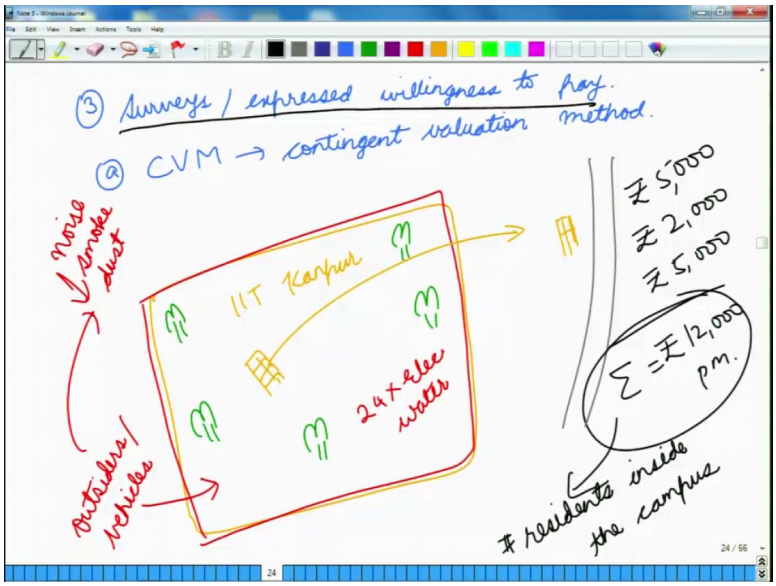

The third way in which we do an evaluation of biodiversity is through service, which also goes by the name of expressed willingness to pay. And an example here is the contingent valuation method.

Now, to give an example, here we are residing inside the IIT Kanpur campus, now this campus has a number of trees, then it has a good level of security all around, then we have 24 hours electricity and water, then this campus has a very low visitation rate from outsides. So, there are very less number of outsiders or very less number of vehicles inside, which also means that there is very less amount of noise, vey less amount of smoke, very less amount of dust in the campus and suppose, there is a person, who is residing in one of the apartments inside the campus.

Now, if this person were to asked to move outside of the campus to some other apartment, where there is a road nearby, where you do not have any trees, where you have heavy vehicular traffic, quite a lot of smoke, quite a lot of noise.

Now, if you ask this person to move outside of the campus, then he or she is going to protest may be even (Refer Time: 31:39) that I am getting so many facilities, when I am residing inside the campus. But outside the campus there will be so many things involved. I would also have to come from outside to inside, so there will also be a transportation cost.

So, now we can come to a constant benefit analysis. So, for instance, we could say so, you have to come from outside to inside, let me give you 5,000 rupees per month, for your convenience charges. The person would say that is fine, but then I also have to live in a surrounding that has quite a lot of smoke. So, I would ask that person ok; so, how much is the level of compensation that you want for that. Suppose, this person says ok, I will take 2,000 rupees more. Then this person might say ok, but I may not getting electricity 24 hours. So, what is the level of compensation that you want for that? This person says ok, I want 5,000 rupees more.

So, what we do is we make a tabulation that this person requires 5,000 rupees for travel, to rupees 2,000 for to compensate for smoke, rupees 5,000 to compensate for electricity so on and so forth, and then we make a sum. So, in this case, we would say that a sum of 12,000 rupees per month is what, the person would want extra just to live outside of this campus. So, we are not asking this person to live very far off, but just outside of this campus, he would require 12,000 rupees more.

Now, multiply this figure with a number of residents inside the campus. So, in this case, what we have ask is we have done a survey in which people have expressed the amount of compensation that they want to move outside of the campus.

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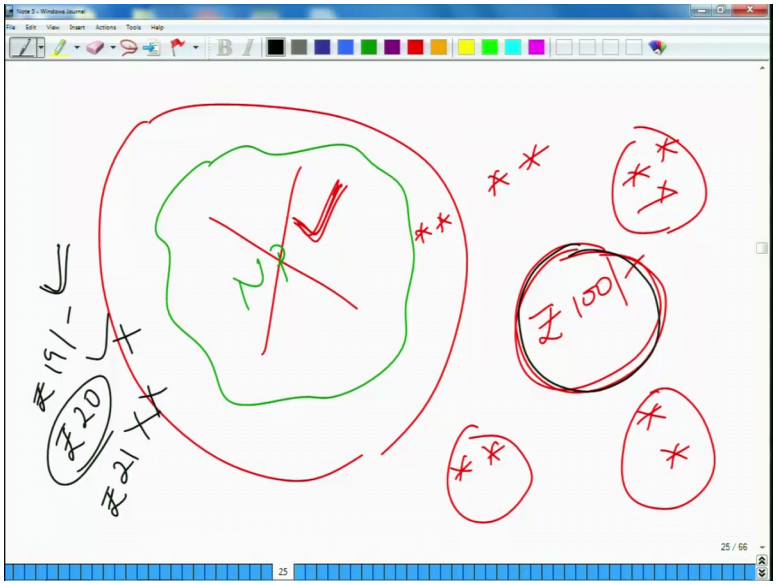

Similarly, we can have another situation. So, this was an urban setting, but suppose there is a national park. Now, you go to people, who are leaving outside or maybe even far off an another metro, and now you give them a situation, that this is a national park that is supposed to be destroyed, so how would you feel about it. Most of the people would say ok, we would not like if this national park is lost, because everybody has some sort of value that they put on a national park.

Now, you ask these people if you want this national park to be saved, and let us say that the government is going to put up a taxation, so how much is the amount of taxation that you would be willing to pay. If the government says ok, everybody has to pay 10 rupees, and if everybody gives us 10 rupees, then we are going to keep this national park as it is, we are not going to destroy a this national park. So, this 10 rupee is for you? The person might say yeah, 10 rupees is fine.

What about 20 rupees? What about 50 rupees? What about 100 rupees? Now, this person might say no, 100 rupees is the bit too much; this is not the level of taxation that I can afford to keep this national park in its place. So, in that case, we have 100 hundred

rupees margin that we say is the maximum amount that this person is willing to pay, to keep this national park as it is. So, this is an expressed willingness to pay by this person.

Now, we can repeat this sort of a survey with other people, people who are leaving in the surroundings, people who are leaving a bit faraway, people who are leaving very faraway, people who are leaving in an another metro, may be even people who are leaving in another country because, if you ask somebody from the US or say some body in Canada, if they wanted to have Kaziranga, and if they have even learnt about Kaziranga. If they know about Kaziranga, they might say yes, if Kaziranga is there, it is good for the earth.

So, in that case, we can ask all of these people or say different samples of these people, what is the amount of money that they are willing to pay to keep this resource. Now, as economist, we know that the amount of value that you would be willing to pay for something is less than the valuation that you keep for that resource.

So, again coming back to the example of the pen if I think that this pen is worth 20 rupees, I will not pay 50 rupees for it, but I will pay 15 rupees; 16; 17; 18; 19; even 20 rupees. So, 20 rupees will be the cut off, 19 is something that I would always pay, 21 is something that I would never pay, because my valuation is only 20 rupees.

So, if my valuation is rupees 20, and if somebody says that by paying 19 rupees, I can have this thing, I would definite pay. If somebody says that I need to pay 21 rupees, I would never pay for this. But, 20 rupees yes, I would I might pay or I might not pay.

So, in the eyes of the person, when somebody is paying 100 rupees, it means that the national park is worth at least 100 rupees, in the eyes of that person. And this is something that we have gotten just out of a survey. So, this is an expressed willingness to pay, because the person themselves are saying that this is the amount that they are ready to pay just to have this resource.

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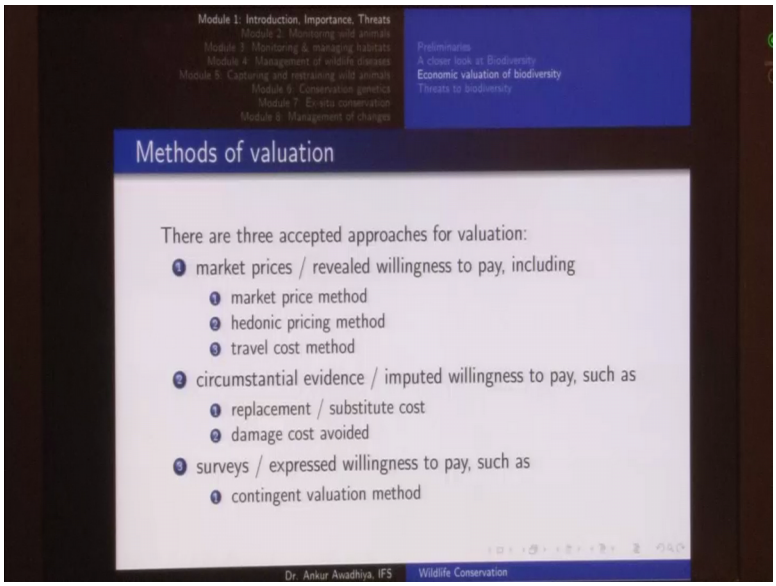

So, surveys or expressed willingness to pay, so one example is this contingent valuation. Why is this contingent valuation, because this is a hypothetical situation, nobody is removing that national park, we are just putting it as a scenario. So that people can think about it so, contingent valuation method is also another method of valuation.

Now, we have so many different methods of valuation, but then depending on the on the situation, depending on the amount of time and the amount of funds that, we have we may choose one or the other method.

So, for instance, if there is a forest that is only being utilized to produce timber, then we can just go for a market price method and we can very quickly come up with the sum that yeah, this forest has at least this value. And suppose, if the alternative that has been suggested is less than this value, there is no need to go for any more detailed analysis of the situation. But, in certain situations, especially when we when we want to put up figures at the national or the international level, we need to go through a number of these different valuation methods, so as to get the best figure that we can suggest as the value of something.

So, in this lecture, we saw what are the values that? We derive out of biodiversity, direct, indirect, altruistic, bequest so on. And how we can put a dollar price or a rupee price, on the value of this biodiversity, so that is all for today.

Thank you for your attention. [FL]