Conservation Economics
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Module 11
Practical issues in Economics and Conservation
Lecture 3
Valuation of natural resources

Namaste! We carry forward our discussion on the Practical Issues in Economics and Conservation. And in this lecture, we shall have a look at the valuation of Natural Resources. Now, natural resources are defined as those resources that exist without the action of humans.

What this means is that these resources are not man made resources; they exist naturally without the need for human beings such as the rainforest. Now, these resources can be threatened by human beings through over exploitation or through things such as pollution.

But for them to be maintained in a pristine state, no action from human beings is needed. So, these are the natural resources that exist without the action of humans. And natural resources can be divided into several categories. On the basis of origin, we have biotic resources and abiotic resources.

Now, bio means life. So, biotic resources are those that are coming from living matter such as timber. And we can also include things such as the wild animals under the biotic resources, or things such as the seaweeds or the corals. Now, all of these play a very important role in the maintenance of our planet earth.

Because they play a very big role in the modulation of the climatic cycles. And these resources that are living resources or derived from living things are known as biotic resources. Abiotic resources are those resources that come from nonliving matter such as iron ore. On the basis of the stage of development, natural resources are divided into potential resources, actual resources, the reserve resources and stock resources.

Potential resources are those resources that may be used in the future, for example oil that has not been drilled. So, these resources exist, but we are not using them, but we may use them in the near future or in the far future. So, these are potential resources. The resources that exist but that may be used in the future.

Actual resources are those resources that are currently being used. And generally they are used after surveying, quantification and qualification, such as timber from the forest. These are actual resources because we have done an exploration, we have done a quantification and qualification of these resources, and we are actually using those resources.

When we talk about oil that is being extracted from an oil well, that is also an actual resource. But if we know that there is oil somewhere, but we are not using it, but we can use it in the near

future whenever we require it, then we say that it will be a potential resource.
Potential versus actual depends on whether it is currently being used or it may be used in the future. Reserve resources are the part of actual resources that can be developed profitably in the future such as low concentration ores. So, when we talk about the actual resources we are actually using those resources.
But in the case of iron ore, there will be certain portions of iron ore that will be having a very high concentration of iron. And the current state of technology makes it possible to extract iron out of that iron, but there could also be certain other iron ores that are also getting extracted, but they do not have a high concentration of iron.
The current state of technology does not permit us to extract that iron ore in a profitable manner, but in the near future when the technology develops further we are going to use it. Now, these resources are actually being extracted. So, people when they are doing the mining, they will be extracting these iron ores and probably dumping it near the mine site itself.
These are known as the reserve resources because they are part of actual resources, we are actually taking them out, but we are not able to extract them profitably or use them profitably using the current technology and. We call them reserve resources that can be developed profitably in the future. We still have methods to use these resources, but they are not profitable currently.
The fourth category is stock resources. Those resources that have been surveyed, but we lack the technology to use them all together such as hydrogen for nuclear fusion. Now, we know that in the fusion reactions as happens in the stars or in our Sun, hydrogen is fused together to form helium.
Now, because we know that such a reaction exists and we have used this reaction in thermonuclear weapons, this is a resource that can also be used for the generation of electricity. If we could control nuclear fusion, we could use it in the generation of electricity, but currently we do not have the technology to do that.
Even though we know that we have plenty of hydrogen in the water in our oceans, we currently lack the technology to do this fusion reaction in a controlled manner. And so we will call them stock resources. These are resources and these resources have been surveyed. We know how much hydrogen we have, but we lack the technology to use them.
Similarly, on the basis of renewability, we have renewable resources and non-renewable resources. Renewable resources are those resources that can be replenished naturally such as sunlight. Now, what happens in the case of renewable resources is that the natural processes ensure that we will continuously get these renewable resources things such as forest.
Now, in the case of a forest, if the extraction is done in a sustainable manner, we do not do an over exploitation of the forest. What happens is that the trees will produce seeds, these seeds will fall down, they will germinate, and they will produce the next generation of trees. And so these are renewable resources that get replenished naturally.
On the other hand, we have certain non-renewable resources, those resources that either form slowly or do not form at all in the environment. So, the process is so slow that it is as good as that these resources are not being produced at all now things such as coal or petroleum. Now, it

takes millions of years to produce coal or petroleum under conditions of high temperature and pressure.

Now, the rate of the formation is so slow that if we use up the coal and petroleum that is with us, we will no longer have any more coal or petroleum. And so resources such as these are known as non-renewable resources. They are not renewing themselves naturally, they are not replenishing themselves. And so we have to be extra careful whenever we are using these resources.

When we talk about resources, we also do an economic valuation of resources which is suppose you have a forest you may ask the question what is the value of this forest? When you do an analysis to find out the economic value of the forest meaning that ah how much is this forest worth, is it worth a few lakhs of rupees, is it worth a few crores of rupees or more?

When you do such a valuation, it is known as an economic valuation. You are putting a value to the forest and this is not a religious value or a social value, but you are putting a rupee value or a dollar value to the resource, so that is an economic valuation of resources.

We do economic valuation of resources primarily for three functions. One is to aid the cost benefit analysis when the natural resource is being diverted, for example a forest that is being diverted into mining. Now, these sorts of situations arise again and again, we have limited forests and the land over which the forests are standing can also be used for several other purposes like mining, or things like making a road, or things like even agriculture or making up residential areas or industrial areas.

Whenever we get a proposal like that, we need to do a cost benefit analysis which means that we ask the question that ok if this forest is getting diverted, and suppose we will divert it and form a mine, now when that happens what is the loss that we are incurring because once the mine has been developed, we no longer have the forest. Which is what we are seeing here is that you have a forest and the proposal is to divert it into a mine.

Now, suppose the forest is worth rupees 50 crores, and the mine is worth rupees 30 crores. Now, in such a case, once you have the mine, you no longer have the forest. So, you are giving up a thing that is worth 50 crores to get something that is worth only 30 crores. And so no rational person would say that we should be diverting such a forest. So, this cost benefit analysis is very important.

Once we know the value of the forest, in a number of cases the people who come up with the proposal to develop the mine, they would have done all sorts of computations about how much is the amount of ore that we are going to extract from it, and what is the market value of that ore.

They would even come up with things like ok how many man days of employment are we going to generate with this mine. But they will only be presenting their side of the picture, that is that the mine will develop so many days of employment and it will add so much rupees to the GDP.

But then when we look at the forest the forest in itself is also giving a number of advantages to society. It was giving a large number of things such as biodiversity benefits. It was controlling pollution; it was making the rivers flow; it was a storehouse of biodiversity.

And this biodiversity is very important whenever we get a new disease for instance because if there is a new disease, you have to look for a cure. And in a number of cases, we get cures from the secondary metabolites that are there in several plants. So, if you have the plants you can

extract the secondary metabolites and probably in a short while also make them chemically.
But then to test these chemicals we need these chemicals. And these chemicals will only be there in the plants. So, a storehouse of biodiversity is important because we may use these bio resources in the near future or in the distant future. Now, when this forest is diverted into mine, all of these things and probably a lot more are gone.
There is no longer a tourism potential in this area because people want to visit forests to watch tigers, nobody wants to go to a mine and see how the mining is done. So, the tourism potential of a forest is very large, probably this tourism potential was also providing employment. Probably it was a potential resource but it is not an actual resource which means that if the forests are beautiful if they have wild animals like tigers, then these are potential resources. Maybe we could have developed them into a tigerism. But once you take this decision to convert them into a mine, then you no longer have the forest. And once you do not have the forest, it is not no longer an actual or a potential resource from the forest point of view.
So, we need to make these computations about what is the worth of the forest and what is the worth of this mine, and only then will we be able to make a correct decision. So, economic valuation is important to aid the cost benefit analysis when the natural resource is being diverted, for example a forest being diverted into mining.
It is also important to provide evidence to aid the habitat conservation policies by highlighting the economic value that is associated with conservation, for example watershed benefits. Now, the thing here is that the forests are very important to ensure that the rivers flow.
Now, what happens in the case of forest is that suppose you have mountains and there is a river that is flowing. Now, when it is the rainy season, when it rains, now in our country we have the rains only in very few months in a year. In most parts of our country, we get rains only in the monsoon season; in certain areas we also have winter rains, but that is all.
In most cases, we will not have rain in the month of March or in the month of April. Now, what happens is whenever you have the rainfall, the water that is falling down; if there are no trees, then this water will just flow over the surface of these hills and reach into the river. And whenever it is raining, then we will have a huge amount of water in the rivers which means that we will be having a flood like situation.
And when it is not raining, then there is no water that is getting into the rivers, and so we will have a situation of drought. Now, in such a scenario, when you have consistent floods and droughts, then that river is not very useful for human beings because we are not assured whether these rivers will be flowing or not.
What happens with the case of trees is that when you have trees on these mountains, then these trees act as stoppages for the water that is coming down in the form of rain. So, the rain droplet that falls on the tree canopy will be stored in the tree canopy for some period of time. And then slowly and steadily it will come down. That is, when you stand beneath a tree after it has rained, after the rain has stopped, you will find that some amount of water is coming down trickling down.
Now, that was the water that was intercepted by the leaves and was stored in the ah canopy itself. Then slowly and steadily what happens is that this water makes its way through the surface of

the trunk. So, this is known as a stem flow. So, this is a stem flow. Which means that if you stand beneath a tree after it has rained and if you touch the stem of the tree, you will find that it is wet because of all that water that was collecting in the canopy.

It is now slowly trickling through the stem of the tree, and then it is reaching to the ground. Now, once this water reaches to the ground surface that is the earth surface, now what does it find? It finds the roots. So, what is happening here is that you have this tree and this tree will also be having roots, and suppose this is the ground layer.

What is happening is that first of all the water was intercepted by the canopy. So, it was stored in the leaves, that is, on the surface of the leaves. Then slowly it starts to trickle down through the surface of the stem in the process of stem flow, and then it reaches into the ground because the roots have already made a hole in the ground.

And when this water has entered into the earth what happens now is that this water suppose ah so we have this water here now this water will slowly move inside earth, and then it will come out at some point. Similarly, the water that was falling on this tree makes way and then it comes out at some point. So, it is moving inside the earth.

Now, what happens is that water takes time to move from point A to point B. When it was just falling on the surface of the earth and when it was flowing on top of the surface, then it was moving very fast. But once it is inside the ground, then it has to negotiate its way between different soil particles.

So, its speed slows down. So, what happens now is that the water that started here will probably take say 4 months to reach this point. The water that started here will probably take say 3 months. The water that started here will probably take 1 month. And so in the water that started here will probably take a very long period let us say that it takes 7 months.

What is happening through this process is that the water that is falling on the ground, it does not move very rapidly into the streams, and slow in this process the streams are not getting into a flood like situation because this water is now being retained by the canopies, the water has been retained by the soil. And these hills now act as sponges because all of this water is now inside these hills, and so they act as a sponge.

In the case of a sponge, the water is retained inside the sponge, and then it slowly moves out which is what we are observing here. And in this process the floods are avoided because all the water does not reach into the stream at the same point of time. But even more important is that because different waters take different time periods 7 months, 1 month, 2 month and so on.

At all points of time, there is some water that is entering into the rivers which means that even after the rainy season has ended even when we are not having any more rains, we will find that there is certain water that is entering into these speeds through the ground. This is known as ground flow water.

And once that happens, it would ensure that even in the dry seasons the stream will have some amount of water which means that what is now available for the drinking of humans, for drinking by animals, for irrigation purposes, for navigation purposes and so on. Now, these kinds of benefits are known as watershed benefits.

In the case of watershed benefit, we include things like ah the avoidance of flood and also

maintaining the streams in a perennial state that is all throughout the year, the streams will be having water. Now, these kinds of benefits are because we have the forest there and so we need to do habitat conservation.

Now, habitat conservation is being done by the government, it is being done by different societies, and a number of societies do this because of a religious purpose or because of a social purpose. But once we do a cost computation, once we figure out that ok if we did not have these hills, if we did not have these forests, in that case we would have an excess of water that will come in the rainy season.

Now, that excess would have caused floods. And to avoid the floods, you would have to construct a dam. What is the cost of that dam? Similarly, when you have the hills in the forest, the rivers are flowing throughout the year. Now, if we did not have that the dam would have to release the water in a consistent manner.

Now, how many dams would you require so that everybody gets water? What is the cost of that? Once you do these cost computations then these cost computations aid in the conservation policies, they provide support to the conservation policies. This is another importance of doing an economic valuation.

It provides evidence to aid the habitat conservation policies by highlighting the economic value associated with conservation. So, even if we did not have this economic valuation, we would still have been doing the conservation, but with the economic valuation it gets a huge amount of force.

And to evaluate the economic compensation legally required for damage to natural resources through the polluters pay principle, for example an oil spill. Now, if there is an oil spill in an area and the habitat is destroyed, then in the legal process you need to ask the person who spilled this oil the polluter to pay for the damages.

How will you ask this person how much to pay if you yourself do not know the value of your resource. Probably your forest was worth 50 crores of rupees, and the polluter is saying that ok sir I will pay you 5 lakhs of rupees. Now, will you agree or not? How do you figure out what is a good amount of compensation?

The compensation should be such that it should be sufficient to bring your forest back into the original state only then will it will it be a compensation because a compensation is being done so that the society when it has lost its resource it is able to recuperate the losses, and have the same resource back only then we will call it a compensation.

But if you do not know the value of the resource, how will you ask for compensation? What is the amount of compensation that we need? This is another reason why we do the economic valuation. Now, in economic valuation, the total economic value of a natural resource is given as the sum of its use value and the non-use value. The total economic value is use value plus non-use value.

What is the use value? Use value is a value that arises out of the use of a resource. When you are using the resource, then the value that you are generating because you are using the resource is known as the use value. But then even when you are not using a resource, even then the resource has certain values because we have seen that there are certain resources that are potential

resources.
In that case, you are not using the resource currently, they are not actual resources. So, you may use them in the future. And when we talk about those values we say that those are non-use values. Values arising even though the resource is not being used. So, the total economic value is the use value that is arising from the use of resources, and the non-use value which is arising even though the resources are not being used.
And the use value consists of the direct value, the indirect value, and the option value. So, these are the three categories of the use value. Use value is direct value plus indirect value plus option value. What are these three? Direct value comprises consumptive and productive values, and non-consumptive values. What we are saying is that direct value is consumptive value plus non-consumptive value.
Now, this is use value. We saw here that the direct value is a use value. So, these values are arising because we are using the resource. Now, we can use the resource in a consumptive manner or in a non-consumptive manner. When we say consumptive manner, we had seen in an earlier lecture that there are certain resources that are rivals in consumption, and there are certain resources that are not rivals in consumption. Here in the case of consumptive values, we are talking about those values that are rivals in consumption. And when we talk about the non-consumptive values, they are not rivals in consumption.
What are consumptive values? How do you use a forest in a way that you are consuming the forest things like timber or firewood? Now, timber and firewood are consumptive values because if I consume the timber that is I extract the timber out of the forest, then less amount of timber is available for you to extract or for anybody else to extract.
So, the total amount is limited and the more any person takes out, the less is available for everybody else. So, these are consumptive values. People are consuming their influences. Consumptive values are timber, firewood, medicines or medicinal plants. Grazing because even in the case of grazing, the forest has a fixed capacity to accommodate the animals.
So, if I bring in more animals, then for a sustainable use you can bring in less number of animals because if I also bring more animals, you also bring more animals, in that case the resource will be gone. And so when we talk about grazing it is also consumptive use because we are consuming the resources in such a manner that if I use more, then less is available for you to use.
Non-timber forest produce or NTFP, now non-timber forest produce includes things like fuel wood, or fodder, or fiber, or fruits that we are getting out of the forest. So, when we say that we are collecting things such as mango from the forest or we are collecting honey from the forest. So, these things are non-timber forest produced.
So, NTFP is non-timber forest produce. So, this is a forest produce that is not timber. So, everything that is other than timber is a non-timber forest produce. And here we include things such as honey. Now, honey is a forest produce because we normally collect honey from the hives that we find in the forest. So, this is a forest produced, but this is not timber.
Similarly, we have a large number of fibers that we collect from the forest; we have a number of medicinal plants that we collect from the forest. There are a number of aromatic compounds or aromatic oils that we collect from the forest. We also have things like mushrooms that naturally

grow in the forest, and we collect them from the forest. So, all of these things are non-timber forest produce.

And these are all consumptive values of the forest because if I consume more of the honey, if I extract the honey, then less honey is available for anybody else to extract. Water, water is another consumptive value that we derive from the forest. Non-consumptive values include things like recreation or ecotourism.

Now, in the case of recreation or ecotourism it is a non-rival in consumption which means that if I go to the forest and if I watch a tiger I feel happy about it. Now, here I am using the forest to see a tiger. So, this is a used value. And I am directly using the forest.

So, this is a direct value. But when I see the tiger then it does not reduce the value of the tiger. So, when you see this tiger then the quantity or the quality of the tiger has not gone down because I have seen it before. So, this is a non-conservative use. So, things such as recreational purposes.

If I go to a forest and I find that this forest is very beautiful and I enjoy the surroundings, I enjoy the peace and tranquility in the forest that I am seeing. And when you come to this forest later on then if I have not used the forest in a way that if I have not littered into the forest.

If I have not spread waste into the forest then there is no change in the value; and when you go to the forest later on, you will also enjoy the forest. So, things like ecotourism or recreation are non-consumptive values. Similarly, we have education and research. So, if I go to the forest, and if I do a research project about how tigers regulate the population of deer. I do this research. Now, when I do this research, I am just going into the forest and counting how many tigers are there, how many deer are there, when they hunt, how they hunt and so on. Now, in this process I am neither reducing the quantity of tiger or deer nor am I reducing the quantity of tiger or deer.

Now, later on suppose you come up with another research proposal that how does tiger regulate the growth of say some birds in the forest. So, while I have used the forest to do my research work, it has not reduced the quality or quantity of the forest for you to use it as a research area. So, this is again a non-consumptive use of the forest.

Similarly, human and wildlife habitat. If I am using the forest as a wildlife habitat or if I am using the forest as a human habitat, so if there is say ah a rest house in the forest I go into the forest and I use that rest house because it has a very beautiful surroundings.

Later on if you go into the forest, you stay in the rest house then it does not matter whether I have stayed before or not as long as I am using it sustainably and I am not destroying it. So, these things are known as the non-consumptive values that we derive from the forest.

And direct value is the sum of consumptive values and the non-consumptive values, because in both of these whether we are talking about consumptive usage or non-consumptive usage we are using the forest directly. There are also indirect values that we derive from the forest. Indirect value means that we are still using the forest, but the values that we are deriving out of it are indirectly.

We are not directly deriving these values. So, this includes things like watershed benefits including agricultural productivity, soil conservation, groundwater recharge, regulation of stream flows. We have seen before that the watershed benefits that the forest provides lead to protection

of soil, they lead to availability of water throughout the year.
But when somebody gets an enhanced income because of the presence of soil and because of the presence of water throughout the year, this person will not say that I am getting this value or this amount of money because of these forests because they are not directly using it. It does not come to their mind that they are directly getting these values, but they are still getting these values indirectly.
It includes things like ecosystem services: nitrogen fixation, waste assimilation, carbon sequestration and storage, microclimatic function, now all of these things are also indirect values that people are deriving because of the presence of forest the climate is kept much more moderate.
The global climate or global warming is kept under check. Now, the benefits of these things will be derived by everybody, but they will not say that oh ah this year I am I did not get a drought situation because of this forest. It just does not come to mind, but it is still a value that people are deriving indirectly.
Or things like evolutionary processes such as global life support and biodiversity. Now, when we talk about the organisms that we have on earth and we are deriving values from different organisms, these organisms also require a place to live. When we talk about polar bears.
When we talk about tigers, when we talk about leopards, leopards require a place to live. Now, we derive a benefit out of seeing a tiger, but then the forests are the areas that provide it with the habitat the forest are the areas which ah which provided an opportunity for a tiger to evolve into what it is today. So, these are also benefits that people derive indirectly.
So, these are the indirect values. And we also have the option value. It is an option for the future direct and indirect use of biodiversity. Now, what is an option? Suppose, there is a forest and we have got two options. One is that we can go into the forest. We can cut all the trees and extract the timber out. Now that is one way of using this forest.
But you may also say that no this forest has certain biodiversity and I might use it in the future. So, I am not currently using it, but I might use it in the future. So, let us keep it as a forest. Now, this value that you derive for a future use is an option value. You can make a correlation by saying that suppose there is a house.
And you want to purchase this house. Now, you can buy this house for, say rupees 60 lakhs, but there is also another house that you think that ok this is also a good house I might purchase this house again. So, we are not sure whether you will buy this house and suppose this house is worth 65 lakhs, and this house is 60 lakhs.
Now, you are not certain which house to buy, probably you will ask a few of your friends, you will ask a few of your family members, you will do a bit more research, you will do a bit more feel with it, to make up your mind which house to buy.
But then when you are in this process the seller of the house might say that ok sir you are taking so much time, so let me sell this house to somebody else because there are so many people who want to buy this house. Now, the thing is you have not decided which house to buy, but you are sure that you are going to buy a house.
What you can do is you can tell these sellers that ok I want you to keep this house for me for say

the next two months. By the end of these two months, I will make up my mind. Can you please keep this house and not sell it to anybody. The seller would say sir why should I do that because as soon as I get a buyer, I will sell this house.

So, you tell these sellers that ok, I am going to pay you 20000 rupees. And I am paying you to these 20000 rupees so that you do not sell these houses in the next 2 months that is what you are doing is that you are paying rupees 20000 for this house, and you are paying a rupees 20000 for this house just to keep it like that for the next 2 months till you are able to make up your mind.

Now, this amount that you have paid 20000 here and 20000 there is an amount so that you retain your option. You are paying this amount, so that these houses are not sold before you make up your mind, and you retain an option on both the houses. This is an option value.

Similarly, when we say that there is a forest and we are not extracting this forest, we are not taking out all the resources because we might use it in the future. Now, we do not know when we are going to use it or whether we are going to use it, but we still want to maintain an option in the forest.

Then later on should we decide that we are going to use this forest for say um getting a particular drug then this forest should remain. Now, this is a value that we derived from the forest just by keeping it as such. So, this kind of a value that you derive is an option value, an option for the future direct and indirect use of biodiversity.

So, these are the three different use values: direct values, indirect values, and option values. Similarly, we have the non-use values: value that is arising even though the resource is not being used. And here we have existence value, altruistic value and bequest value. So, these are three non-use values. What are these?

The first is existence value: this is the value deriving from the knowledge that the resources continue to exist. What we are saying here is that we know that there are polar bears, and a lot of us would have probably seen polar bears on the television. Now, suppose one day you get to know that all the polar bears have become extinct, how will you feel about that? Probably a lot of us will feel very bad that polar bears are now extinct.

But now if you think about it, you are not using a polar bear, you are not using a thing like the pandas, you are not using the whales that are there in the ocean, but even then if these animals become extinct you will feel bad that you now no longer have these animals on the planet. Now, you have lost the chance to ever watch these animals, or your children and your grandchildren have lost the chance to ever see these animals.

When we say that we feel bad, the other thing is that when the resources continue to exist we do not feel that bad or we feel good. We feel good that yes on this planet we still have polar bears.

Even though we are not going to the arctic regions and watching the polar bears, still we feel good that yes we have the animals. Probably someday we might go and watch these polar bears, probably we will never go and watch these polar bears, but still we feel good that yes the polar bears continue to exist.

Now, when we talk about these values these are the existence values. This is a value that we derive from the knowledge that the resources continue to exist. So, if there is a forest and you get to know that the forest is burnt that is ah every year we get to know that there are huge forest

fires and so many millions of ah acres of forest are getting burnt.
Whenever we see such a news, we feel bad; or the other way around this if this forest had continued to remain as it is they would have been good. So, the value that we derived just because the forest continues to exist is the existence value. So, this is a non-use value because we are not using this resource.
Another is altruistic value, the value derived from the knowledge of use of resources by others in the current generation. So, when we find that there are rhinoceros in the Kaziranga National Park and because there are rhinoceros in the Kaziranga National Park so many tourists visit Kaziranga National Park.
And because they visit, people in the surroundings get employment. Now, who are these people? These are our own country people, they are our own brothers and sisters, they are the citizens of the same country. Now, these people are there in the same generation as we are.
And we feel good that ok because of the rhinoceros there are certain people in our country who are getting employment. So, we feel good that yes even though I am not getting a value out of these rhinoceros directly because the tourist is not paying me, but at least there is somebody in my country who is getting employment because of the rhinoceros.
Now, this value that we'll derive because we are getting the knowledge of the use of resources by others in the current generation. Now, in this case we are not talking about our children, we are not talking about our grandchildren, we are seeing that yes today there is somebody in our country who is getting employment because of rhinoceros.
Now this kind of value that we derive because we are feeling good that there is somebody who is getting employment - this is known as an altruistic value. Now, this is a non-use value because we are not using those rhinoceros, but we still feel good that yes there are certain people in our country who are getting employment for using these resources. So, this is an altruistic value.
And when we leave these values for our offsprings or future generations then we will say that we are having a bequest value. So, the bequest value is when you ask the question, ``Ok, today if I am generating a waste, today if I am polluting the environment, what am I giving for my children and for my grandchildren?''
Everybody wants to leave the world in a better place for their children and their grandchildren than they are currently living in. And when we have this kind of a thought when we say that ok we are leaving these forests for our children and our grandchildren.
We are ensuring that we still have tigers so that our children and our grandchildren can watch tigers. When we have such kinds of thoughts then the value that we derive because we have tigers for our children and our grandchildren is known as a bequest value. So, this is another non-use value.
Now given that we have so many values we can now talk about the methods of valuation. How do we put a rupee value or a dollar value to all of these different values? There are three accepted approaches for valuation of the natural resources. The first one is known as market prices or the revealed willingness to pay.
In the case of market prices, we have three main methods. One is the market price method, the hedonic pricing method, and the travel cost method. The market price method asks the question

that ok if we use these different values what is the market price for each of these? That is when we talk about the market price method for a forest we will say that this forest has timber.
Now, if we extract all of this timber, what is the amount of money that we will get by selling this timber? So, let us say that the amount that we will get is 30 crores of rupees. This forest also has water. Now, if we extract all of this water and we try to sell it off, what is the amount that we will get?
Suppose, we will get 10 crores of rupees. In this forest we have a number of animals such as fishes. Now, if we extract all the fishes what is the total value that we will get when we sell it in the market? Suppose, we can sell it off for 25 crores. And similarly we can make a list of all the other birds that we are getting from the forest.
And what we are asking is if we extracted all of these out and if you sold it in the market what is the price that we will get. Suppose everything else is going to give you 15 crores. Then the market price method would say that the total value of the forest in crores is 25 plus 15 is 40, 50, 60, 70, 80.
So, this forest is worth 80 crores of rupees. This is the market price method. You make a list of water and things that are there in the forest, find out their current market prices, add them together, so that is the market price method. Another is hedonic pricing method, hedonism is the value of feeling good and the feel good factor.
Now, the thing is, suppose there is a tower. And this tower has different flats. And on one side of the tower, you have a forest; on another side of the tower, you have a road. So, here you have a road. And on this road, there are vehicles that are flying, and there is a huge amount of noise that we get and it does not look good.
But if you look at the forest, it looks good, it is a beautiful forest. Now, when that happens and when the flats are put up for sale, suppose we have these two flats A and B. Now, the person who gets flat A will get to see the road, and the person who buys flat B will get to see a forest.
And typically what we observe is that the flat BB is sold at a premium because it gives a very good view. So, it is very similar to having a sea facing view. So, sea facing plots or flats cost much more than a non-sea facing flat. And similarly here a forest-facing flat will cost much more than a non-forest facing flat.
Now, the hedonic pricing method asks this question that people are paying this premium because they are deriving a benefit in the form of happiness in seeing this beautiful forest. And so if we did a computation of the prices of all of these and the prices of all of these, the difference is because these portions are towards the forest.
The difference in prices between both of these will give us a certain amount of value that is coming from these forests. So, that is the hedonic pricing method. Another is the travel cost method. Now, the travel cost method is based on the idea that people put a value on things. And if the price is less than the value that they are putting only then will people be purchasing that particular item.
That is if I put a value to this pen of 50 rupees, and if I am getting it for 30 rupees, I will buy this pen. But if I am getting this pen for 100 rupees, I will probably not buy this pen. So, the amount that I am paying can give a very good idea about the minimum value that I am putting to this

thing. That is if I am paying 30 rupees for this pen, then that would mean that the value is greater than or equal to 30 rupees only then I am paying for it.

So, when we talk about the travel cost method, it asks the question that if there is a forest let us say there is the Kanha tiger reserve. And people are coming to Kanha tiger reserve from different areas. So, let us say that there is a person who is coming from Delhi, there is a person who is coming from Mumbai.

Now, the person who is coming to this forest is spending money on transportation, this person is spending money for entry fees, this person is spending money for ah paying for the accommodation and food at higher prices than what he would he or she would have paid at home. Now, if a person from Delhi is spending say 30000 rupees to come to this forest; a person from Mumbai is spending say 40000 rupees to come to this forest.

So, the person from Delhi is putting the value of at least 30000 rupees because of which he is spending this amount the person from Mumbai is spending is putting a value of at least 40000 rupees. And so in the case of the travel cost method, we make a list of the people who are coming to the forest, and we make a computation of how much they have spent.

When we add them up together, then it gives us an idea of the value that these people have come to the forest, so that is the travel cost method. Another approach is the circumstantial evidence or the imputed willingness to pay such as a replacement or substitute cost or damage cost avoided. Now, in this case what we are asking is suppose there is a sea and we have a mangrove forest near the shore.

Now, if there is a tsunami, then all these areas will get inundated with water. And there will be a loss of life, there will be a loss of property. Now, when we talk about the damage avoided. We are asking the question that if our ah mangrove forest were not here, because mangrove forests protect against the impacts of the tsunami they act as barriers to the water that is coming in.

Now, if we have the mangrove forest, then they are protecting the inland areas. If it did not have these forests, then there would be damage that would be caused to the inland areas. What is that damage? And when we do a computation of what would be the damage caused if we did not have this natural resource.

And we put that value to this that this forest is giving us a protection that is worth 1000 crores of rupees then that is a damage cost avoided method of valuation. On the other hand, we could ask another question: if in place of having this forest we removed all the trees and if we constructed a wall along the shore.

Now, this wall would also protect us against the tsunami. But the construction of this wall will cost us money. So, what is the cost of construction? What is the cost of maintenance? So, that is the cost that we would have to spend to have the same level of protection if the mangrove forest was not there.

When we ask that question we are asking about the replacement or the substitute cost, how much does it cost for the replacement of the natural product or the natural resource? If we did not have the forest, we would have to construct structures to prevent soil erosion, how much would those structures cost?

If we did not have the forest, we would not have clean water. And we would have to start a plant

to clean the water. What would be the cost of constructing and running that plant, so that is the cost of the replacement. So, this is also a method of valuation of the natural resource. And a third method of valuation is surveys or expressed willingness to pay such as the contingent valuation method.

In this case you ask people the question that ok, there is this forest and you give them a hypothetical situation that the government has decided that this forest should be cut down. But if the ah and the government is cutting down this forest to sell off this land, but if we pay to the government in the form of a tax, then probably the government will not cut down this forest. What is the maximum amount that you are willing to pay?

Now, the people who are deriving value from the forest will put up a certain amount ok, I am ready to pay 20 rupees or I am ready to pay 1000 rupees, or I am ready to pay 10,000 rupees. So, depending on the amount of value that they are putting to the forest, they will come up with a certain figure.

Now, this is a completely hypothetical situation, but we are getting an indication of the amount of value that people are putting into the forest by the amount of money that they are expressing that they will be willing to pay for the continued existence of the forest. So, that is known as a contingent valuation method through service or express willingness to pay.

Now, different methods of valuation are used for different areas. And we can choose between these different methods depending on the situation that they are addressing. So, in this lecture, we had a look at the total economic value. Total economic value is use value plus non-use value. Use value is direct value plus indirect value plus option value; non-use value is existence plus altruistic plus bequest value.

These are all different values that we derive from the forest. And we can make a computation of their rupee values or their dollar values by using different methods of valuation. And this is used so that we get an idea of the resource that we are protecting.

We get an idea of how much it will cost somebody if this resource is to be diverted, we get an idea of computing the damages, and it also helps us in reinforcing our policies for conservation. So, in this case, economics is a very good tool to aid conservation because it helps us make choices in a rational manner.

That is all for today. Thank you for your attention. Jai Hind!