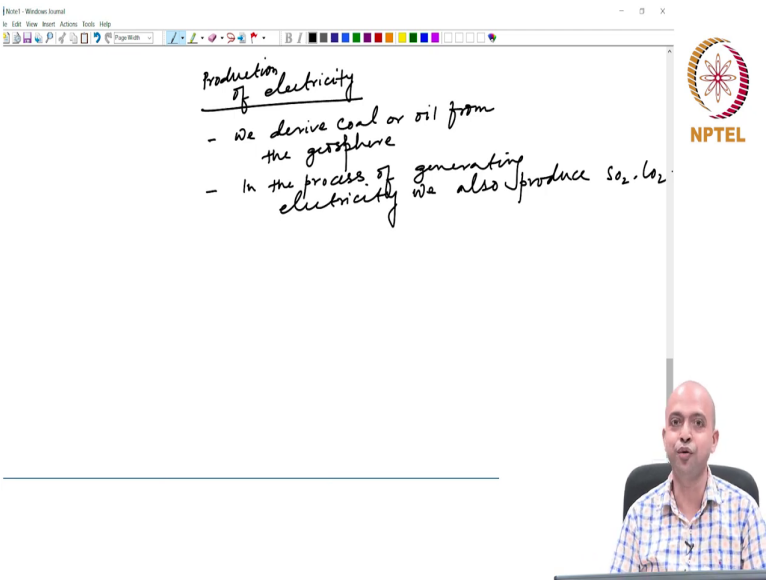
Environmental and Resource Economics
Professor Sabuj Kumar Mandal
Department of Humanities and Social Sciences
Indian Institute of Technology Madras
Introduction to Environmental Economics and Environmental Kuznets Curve Hypothesis
Part - 2

(Refer Slide Time: 00:20)

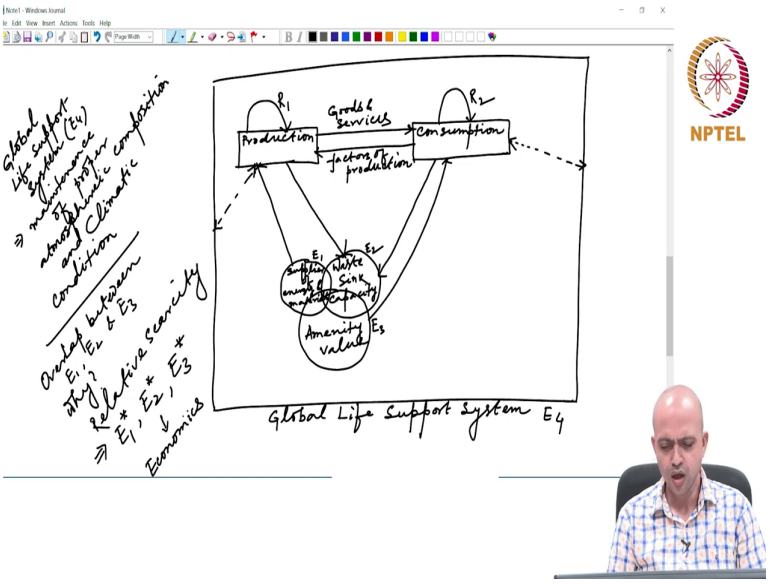


How does this happen? I will give you an example. Think about, production of electricity, an example, production of electricity. How do you produce electricity? We derive coal or oil from the geosphere. So, that means we are disturbing the environment and then we produce electricity and, in the process of generating electricity, we also produce. What do we produce from the thermal power plant? SO2, CO2 and all these things and these SO2 and CO2, they will again disturb the environment that means, the climatic condition will change.

And, when the climatic condition change then what will happen that will in turn restrict the human behavior. How? When there is a change in climatic condition, then the agricultural production, what was possible earlier will not be produced now onwards. When there is a change in the climatic condition, the living creatures which are available earlier they would not be available right now. And then, the policymakers and the government, they will intervene, they will bring regulation to restrict, to reshape, the behavior of the economic agents.

So, that means we the economic agents in the process of production and consumption, we are throwing the garbages and disturbing the environment and environment in turn is now reshaping the human behavior. How is it happening? Some part of this behavior is automatically changed, our food habit will automatically change, our production behavior will automatically change and some part of our behavior would be restricted by the imposition of regulations, the environmental regulations imposed by the government.

(Refer Slide Time: 03:37)



So, this example, this example illustrates, how we disturb the environment by taking all the minerals from the geosphere, production of electricity and then throwing CO2, SO2 and all other environmentally detrimental gases to the environment and that is why environment is also giving a feedback both to the production side and the consumption side.

So, this diagram explains the inter linkages between economy and environment, but one thing is not yet clear, we have understood the inter linkages, but we have not yet established, why is the environment is scarce resource?

Look at these three diagrams, these three circles once again. See the way I have drawn these three circles. They there is some kind of overlap between E1, E2 and E3. The question is why? Why is this E1, E2 and E3 they are not disjoint sets, rather they are overlapping with each other. Can you think of?

The reason why these three circles are overlapping it indicates, from the diagram itself it is very clear if you want to increase the size of E1, then automatically size of E2 and E3 will

come down if you want to increase the size of E2, then E1 and E3 will come down and if you want to increase the size of E3, then E1 and E2 will come down. Why this is happening? The idea is this, suppose you want to extract more and more resources from the environment more and more energy and materials from the environment.

That means, lot of minings are happening. What will happen? You will generate lot of dust in the process of extraction, and in the process of production also you will make a lot of garbages and those garbages you will throw to the environment and environment has a limited capacity to absorb all those garbages or do you are producing in the process of resource extraction and production of electricity and so many other things. So, that means, the moment you extract more and more resources from the environment, you are losing the waste sink capacity of the environment at the same time the amenity value.

If there are a lot of minings in the hilly regions, nowadays when you go to any hilly regions, you see a lot of minings still happening that means the nature what you were enjoying earlier, they would not be available for your enjoyment right now, because you are extracting to much of resources. So, that means if I try to increase the size of E1, E2 and E3 is coming down. Similarly, if you decide, no I will enjoy the nature, I you will not allow any more extraction. So, what will happen? Your E1 will come down and E3 will go up.

Similarly, if you want to increase E2, if you want to increase the size of E2, waste sink capacity that means you should use less resource, you should extract less resource and less production. So, E1 will come down. So, that means it says that the environment is limited in its availability, these three services are limited in nature, the moment we try to increase one the other will come down and this is called relative scarcity.

So, environment the way we think it is not an abundant factor, if the environment is an abundant factor, then there is absolutely no need of applying economic principles while dealing with the environmental issues. Actually, it is not you can understand from these overlapping three circles. We are having three, we are deriving three important services from the environment and the moment we try to increase the size of any of these services, then the other two will come down. So, this is called relative scarcity.

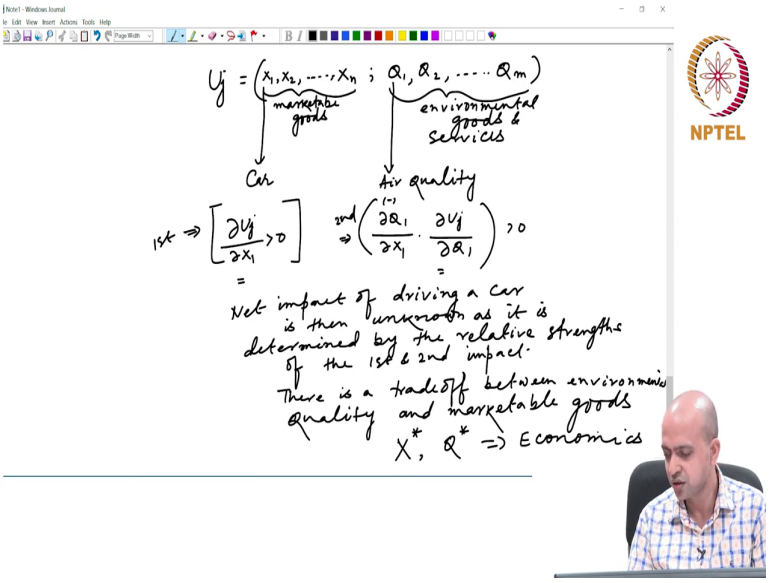
And this relative scarcity makes us thinking, what should be then the optimal size of E1 star, E2 and E3 denoted by the star. So, that means we need to have a proper size of E1, E2, E3.

That means we cannot say that we will only enjoy the environment, we will not derive any resource from the environment, minerals or resources from the environment. We have to extract resource, we have to use the waste sink capacity of the environment also at the same time, we must enjoy the amenity value. That means there should be a proper size of E1, E2 E3, which are denoted by E1 star, E2 star and E3 star.

So, environmental services needs to be optimally allocated for different purposes and who will ensure this is E1 star, E2 star and E3 star, that is the job of economics. So, this would be ensured by economics, Is this clear? Now, we have understood. Yes, environment is a scarce resource, we need to optimally decide its services and then economics will play an important role here. As we all know, the only role the economics play is optimal allocation of resources, efficient allocation of resources, so, that we derive the maximum satisfaction or utility.

So, from this diagram, two things are clear, this diagram explains the inter linkages between the economy between economy and the environment. This diagram also makes us understand, environment is a scarce resource and that is why economics has a role in deciding environmental issues.

(Refer Slide Time: 11:54)



We will try to understand the scarcity of resources with a simple mathematical formulation also. What we will do? Let us understand that, this is the utility of a jth individual like you, me or any other individual can be called as jth individual and this jth individual's utility depends on a vector of marketable goods which are denoted by X1, X2 then dot dot dot Xn

these are called marketable goods. And then this jth person utility also depends on Q1, Q2, Qm. These are called environmental goods and services.

Now, you can think of marketable goods like let us say shirt, then this computer, then the vehicle you drive, so on and so forth. These are all marketable goods. And what is environmental goods and services maybe air quality, water quality, so on and so forth.

Now, for our satisfaction, we need both the goods, you cannot say that I will take only X1 only X and I will not take any of this Q, then you cannot survive because without a minimum level of environmental cleanliness environmental quality, we cannot survive here. Similarly, if you say I will enjoy only the clean environment, there also you cannot survive, oxygen is not enough for your survival. We all need food, shelter, clothes computer all these things.

Now, from this utility function, let us say that we are thinking about this X1 which is a car, that you drive and let us say that this is Q1, which is air quality. Now, when we drive the car, what happens to our utility? If the jth individual drives a car, what will happen to jth's individually utility Uj, obviously, that is positive, we will all enjoy driving a car.

So, that means I can say del Uj, del X1 is positive, if we drive more car, then we will enjoy a lot of utilities, but if you enjoy your driving, then automatically you will disturb the air quality that means you will disturb the environment. What will happen to this? So, you will first disturb the environment. And then, if you disturb the environment in turn that will give an indirect impact on the utility also that means del Uj, del Q is also there.

So, what is the sign of this. See, this is this is positive, sorry this is negative and this is also in turn it will negative some kind of negative impact it will give. So, that means, this you can think of negative kind of thing if you drive car that will result in deterioration of the environmental quality and that in turn will reduce the utility.

So, that means, there are two effects, this is the first effect and this is the second one and what is the net impact of driving a car then, net impact of driving a car is ambiguous, net impact, so this is the 1st component, this is the 2nd component.

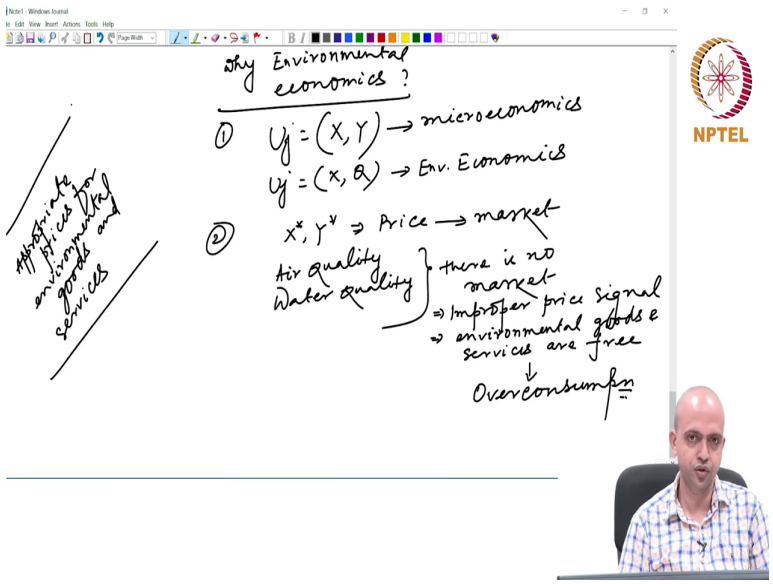
So, net impact of driving a car is then unknown as it is determined by the relative strengths of the 1st and 2nd impact. So, net impact is unknown, but one thing is clear, even from this

simple mathematical formulation, that if we want to enjoy more and more marketable goods, then we need to sacrifice environmental quality.

If we need to enjoy more and more environmental quality, we need to sacrifice marketable goods. That means there is a need to determine, how much car we will drive and how much environmental cleanliness we will enjoy. So, that means there is a tradeoff between environmental quality and production of this marketable goods.

If you recall, that is also another principle that we learn from our Principles of Economics. That means there is a tradeoff between environmental quality and marketable goods. So, once again not we need to derive, the optimal quantity of X and Q and who will determine that economics.

(Refer Slide Time: 20:25)



So, we have established the role of economics in dealing with environmental issues, but then the question is, we have already studied microeconomics, macroeconomics. Why environmental economics then? Why environmental economics? We have already studied economics and if at all economics principles are required to understand and to deal with environmental issues, we already know that why there is a separate branch called environmental economics.

Now, to understand that, if you recall in our microeconomics, what we used to do, our utility function, jth individuals utility function, utility was a function of only X and Y, two goods, where X and Y were both marketable goods. In microeconomics, we have never dealt with

any utility function. So, this is the microeconomics. But, when your utility function is X and Q, marketable goods and environmental quality, that becomes an extension of microeconomics, which is environmental economics, this is the first thing.

Secondly, in microeconomics, how we have decided this optimality of X star and Y star through price and who decides this price, by the market. So, market will decide, if you recall from our Principles of Economics, market will decide, what to produce, how much to produce, who will buy those, all those things market decides by a single most powerful instrument, which is the price but when you talk about environmental quality, air quality water quality, there is no market. Is there any market for air quality? Is there any market for water quality? No, such market does not exist.

And, when market does not exist, what happens? The price what we think of, what we think about this environmental goods and services they are improper. So, that means, improper price signal, we tend to think environmental goods and services as free goods and services. Improper price signaling induces us thinking environmental goods and services are free. So, when we think they are free, obviously, there would be a tendency of overconsumption.

And this overconsumption, only leads to environmental degradation. So, that means the problem starts here. There is no direct market for environmental goods and services. That is why the price signaling is improper. We think that environmental goods and services are free good, we tend to over consume them and that is the reason for environmental degradation. So, to deal with these issues that means what we need to do, we need to get a proper price signaling, we need to estimate, we need to determine appropriate prices for environmental goods and services.

And so far in our microeconomics literature, we have not learned when there is no market how to estimate the prices of those goods and services. This environmental economics will help us understand how to determine the appropriate prices for environmental goods and services to deal with the environmental degradation. So, these are the two reasons.

Environmental economics is an extension of microeconomics, the traditional neoclassical economics of utility maximization and the extension is here. So far, we assume utility is a function of only marketable goods X and Y, but now onwards, we will think that utility is a function of marketable goods as well as environmental quality.

And secondly, since there is no direct market for environmental goods and services, environmental economics literature that we are going to discuss in this course, that will help us understand how to determine and estimate appropriate prices for these goods and services, so that we get a proper price signaling and once the price signal is proper, then we can solve the problem of environmental degradation.

So this, whatever we have discussed so far, this is the, this is our 1st module, where we have discussed the importance and justification of studying environmental economics, by understanding the marriage between economics and environment by understanding the inter linkages between the economy and the environment.

And in our next class, we are going to discuss about what are the other modules that means, I will try to give you an overview an outline of the entire syllabus of this course, Environmental and Resource Economics. So, with this, we are closing our discussion today and we will meet again once again tomorrow.

Please read this before we come back to our next session. Please watch this video. And think about this. Tomorrow, I will be discussing about the remaining portion of our syllabus and I will also let you know the reference that means the text as well as the references for that we are going to use for this entire course. So, this is going to be an interesting course. I hope you will enjoy this course. But only thing what I require from your side is immediate reading and watching these videos. With this we are closing our discussion. Thank you very much.