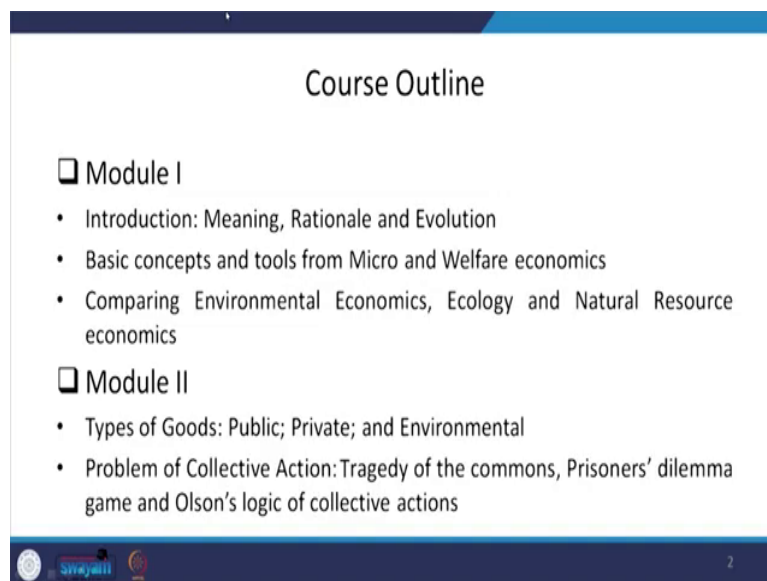


Introduction to Environmental Economics
Prof. S. P. Singh
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Lecture – 01
Meaning, Rationale and Evolution

Welcome students to this new course on Environmental Economics. This course is divided into 12 modules and we will cover 30 hours. This course has focus on three key aspects; first is theory, second is application of these theories and third is regulation and policy. So, major component of this course is related to theory and this course has 12 modules.

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The slide titled "Course Outline" lists the following content:

- ☐ Module I
 - Introduction: Meaning, Rationale and Evolution
 - Basic concepts and tools from Micro and Welfare economics
 - Comparing Environmental Economics, Ecology and Natural Resource economics
- ☐ Module II
 - Types of Goods: Public; Private; and Environmental
 - Problem of Collective Action: Tragedy of the commons, Prisoners' dilemma game and Olson's logic of collective actions

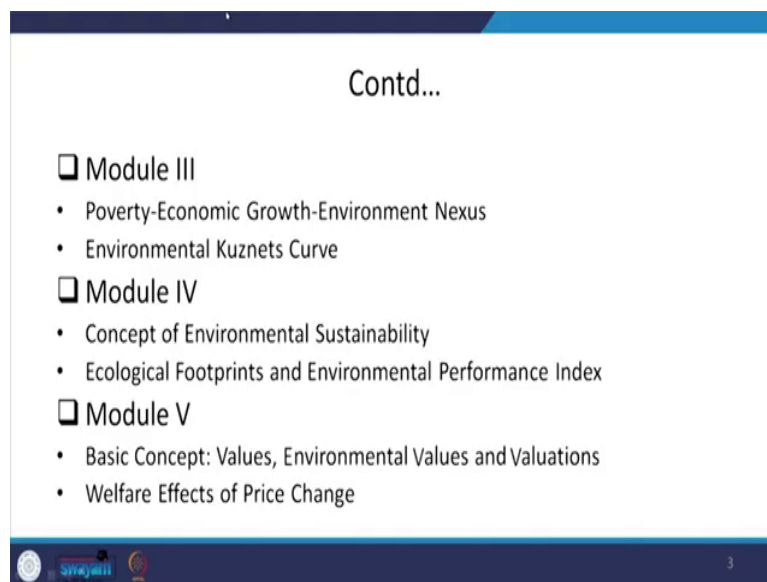
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First module is introductory and covers meaning, rationale, evolution of environmental economics. Basic concepts and tools which we will use very frequently in the coming discussions are also discussed in these modules. And, we will also compare the

environmental economics with other sub discipline of economics which are very close to environmental economics like ecology and natural resource economics.

Second modules deals with the different types of public and private goods and environmental goods, actually environmental goods are mostly non-rival and non-excludable goods. So, we will discuss in detail what are the these different kinds of goods and services related to environment. Then problem of collective actions like tragedy of commons, prison dilemma, games, Olson, logic of collective actions will also be discussed in the second module.

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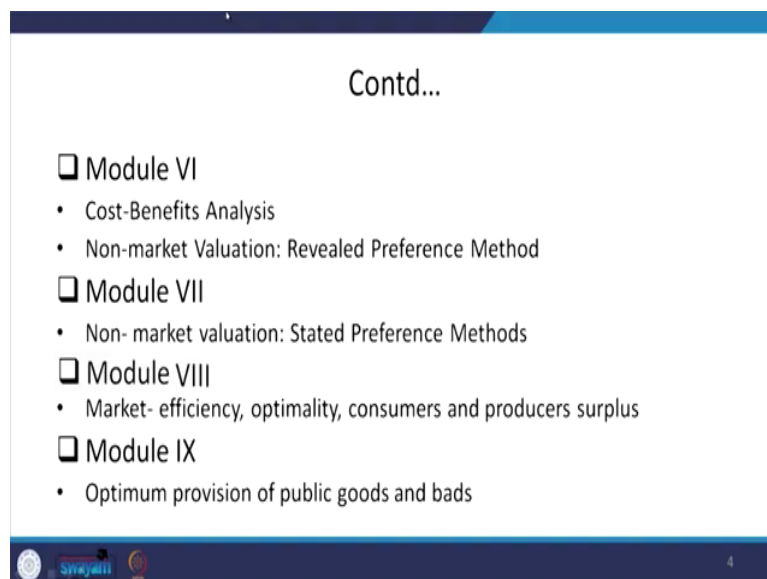
Third modules we will discuss the nexus between environment, poverty and economic growth. It will also discuss the environmental Kuznet curve and it is a very famous curve which clearly shows the you inverted U shaped relationship between economic, development and environmental protection. Initially, when the economy growth increases environmental

protection declines or environmental degradation declined. But, after a particular level of economic development then environmental condition improves.

So, this relationship will be discussed in detail in volume module third. Then module IV we will discuss the concept of environmental sustainability, ecological footprints and environmental performance index. Fifth module is devoted to the basic concept, values, environmental values, valuation, welfare effect of price change.

So, in this module we will study the different kinds of environmental values like option values, request values, non-use values and use values of environment. So, environment provide us different kinds of values and these values will be discussed in detail in this volume.

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- Module VI
 - Cost-Benefits Analysis
 - Non-market Valuation: Revealed Preference Method
- Module VII
 - Non- market valuation: Stated Preference Methods
- Module VIII
 - Market- efficiency, optimality, consumers and producers surplus
- Module IX
 - Optimum provision of public goods and bads

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Then next volume modules will be discussing about the cost benefit analysis and non-market valuation: revealed preference methods. So, in this topic we will study about the social cost and benefit analysis. When we have a environmental development project, it has certain cost associated which may be spread over a longer period in futures also. And, similarly the benefits of the projects also spread over a longer period. So, in this unit we will discuss the cost benefit analysis in detail. And, we will also examine the non-market valuation by using the revealed preference method.

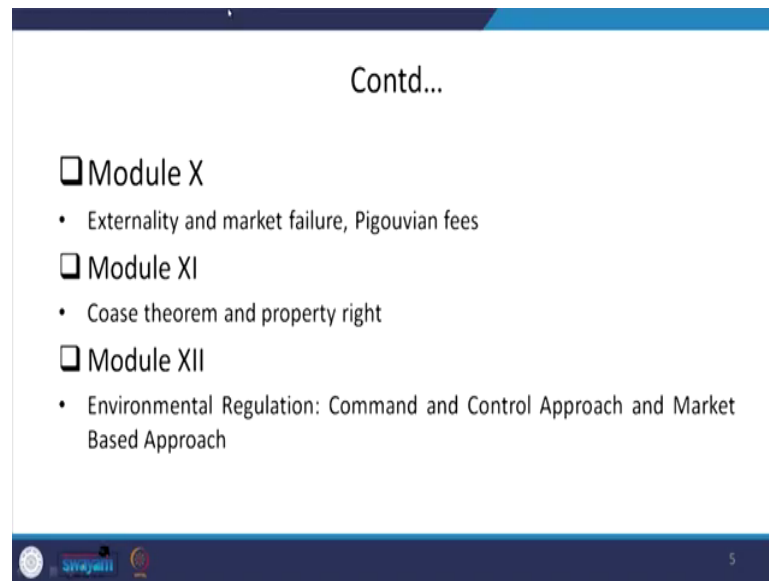
Next module is devoted to known market valuation and in this module we will use the stated preference method to estimate the value of environment. So, environmental valuation will be estimated by using the stated preference method. And, within the stated preference methods we have contingent valuation method which is very frequently used by the researcher to estimate the value of environment.

Then next volume is related to market efficiency, optimality, consumer and producer surplus. And, in this unit you will study how to achieve the efficiency and productivity of different kinds of resources, para to optimality concept will also be introduced. And, we will also try to understand what is the consumer surplus and producer surplus and how to estimate these kinds of surpluses will also be discussed. Then next module will be on optimum provision of public goods and public bads.

So, public goods and public bads both are being received by us and when ah we produce certain kinds of goods and services, we also generate bad products. So, up to what extent these bad products can be generated into the economy, will also be discussed using appropriate techniques to know the optimum level of both public goods and bad products.

Next unit is related to externality and market failures. In fact, market failure is one of the main issues related to environmental economics because most of the environmental products are non-rival and non-excludable. So, market fails to deliver these products.

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So, either market provide these goods and services less efficiently or there is no existence of market in case of these kind of good. So, externality and market failure and then how to deal with these kind of failures, can taxes be imposed to address the issue of externality; all these aspects will be discussed in this unit.

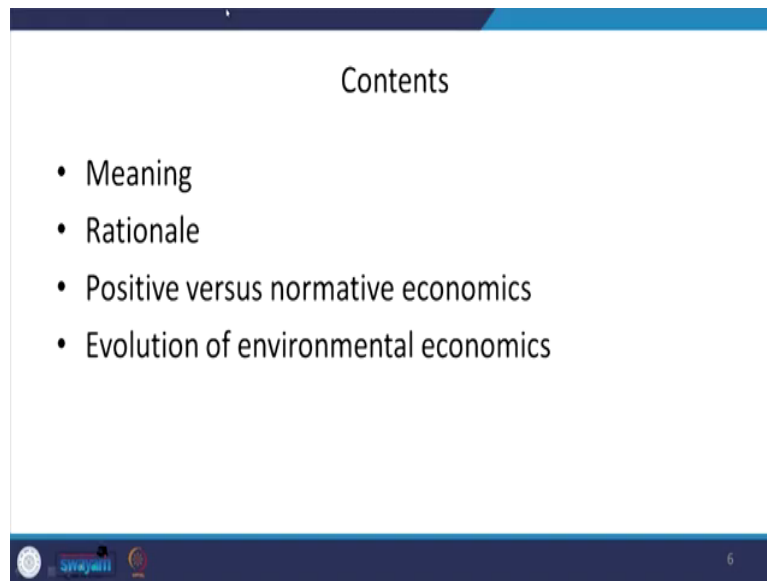
Then another important topic which we will discuss in this course is Coase theorem and Coase theorem is related to property rights. And, one of the main reasons for the market failures in case of environmental product is lack of property rights. So, how to ensure proper property rights and the Coase theorem which clearly state that, if property rights are well defined whoever is receiving the right it hardly matter, but efficient solution will occur if these rights are traded in the market.

So, Coase theorem will also be discussed and then in the last unit and that is also a very important units we will discuss about environmental regulations. So, there are different kinds of approaches of regulations and these approaches can be club into two main groups. One is command and control approach and other is market based approach.

So, we will discuss in detail these two approaches of environmental regulations. And, we will discuss the policy issues related to protection of environment which policy will be more effective to protect the environment whether command and control will be more effective or market based approach will be more effective; all these aspects will be discussed.

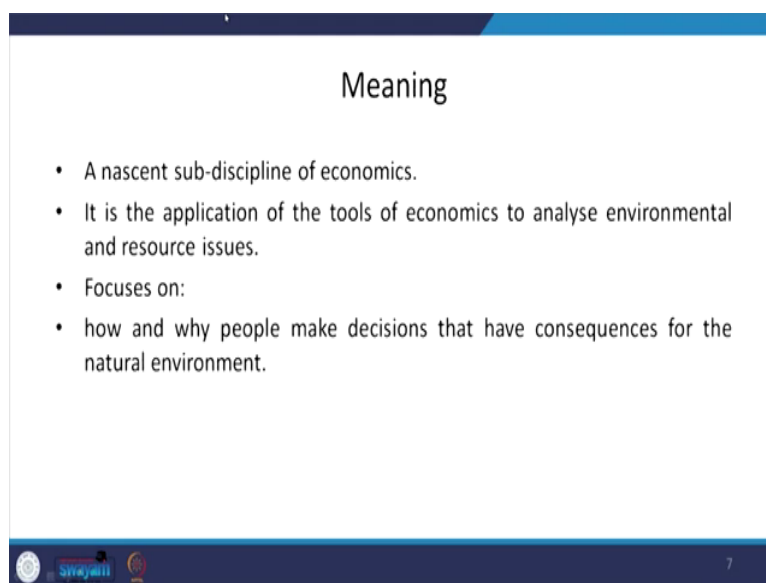
So, after just giving you a brief idea about this course let me now take the first unit and that first unit is a introductory nature. And, in this unit you will study about what is environmental economics, why should we study the environmental economics and what is positive environmental economics and what is normal to environmental economics. And, we you will also study about the evolution of environmental economics.

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How the subject evolved over a period of time.

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The slide is titled "Meaning" and contains the following bullet points:

- A nascent sub-discipline of economics.
- It is the application of the tools of economics to analyse environmental and resource issues.
- Focuses on:
- how and why people make decisions that have consequences for the natural environment.

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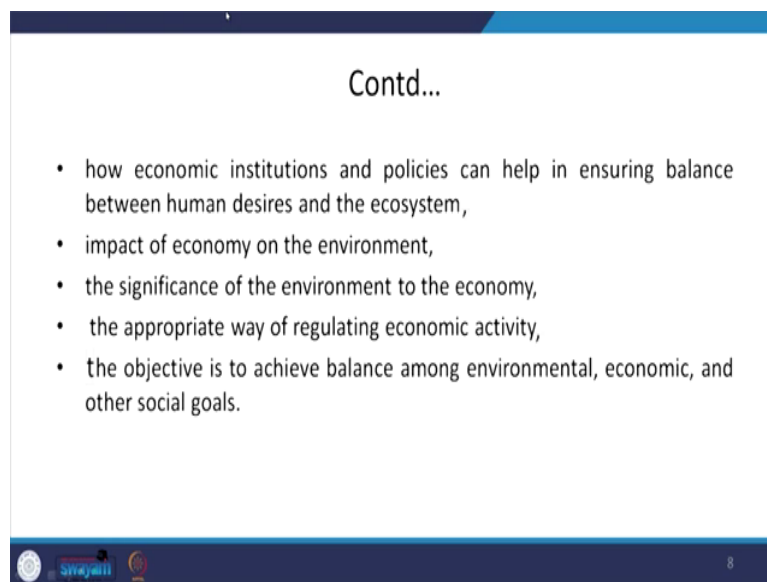
So, let me first discuss what is environmental economics. Well, before knowing the environmental economics one must know what is economics and economics studies the allocation of scarce resources among various alternatives and since our resources are limited and these limited resources have alternative uses; so, the problem of choice occurs. So, sometimes economics is called a science of making choice. And, why we need to make choice? Because, whether we have a physical resources whether we have a human resources or financial resources these resources are having limited availability.

And due to limited availability of the resources, but these resources can be put in various uses. For instance if we want to spend say 2 thousand crores of rupees to clean the river Ganga, the same resources cannot be used to set up new hospitals, new IITs etcetera. So, therefore, resources are limited and therefore, these limited resources need to be optimally

utilized. So, in economics we deal with how the resources are used and how to make choice between the alternatives.

So, its taking this subject economics, environmental economics is actually a sub discipline of economics and it is a new branch of economics. And, it is the application of tools of economics to analyze the environmental resources and we also identify certain kinds of issues which can be dealt with the use of economic tools and techniques. And, its focus is on how and why people make decisions that have consequences for natural environment.

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- how economic institutions and policies can help in ensuring balance between human desires and the ecosystem,
- impact of economy on the environment,
- the significance of the environment to the economy,
- the appropriate way of regulating economic activity,
- the objective is to achieve balance among environmental, economic, and other social goals.

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And, how economic institutions and policies can help in ensuring the balance between human desires and ecosystem. There should be a proper balance between the human needs and the environmental needs. So, ecosystem services are also studied in environmental economics

and when we put more pressure on our ecosystems then this services degrades. And therefore, there is a tradeoff between various kinds of environmental goods and conventional goods.

And, in environmental economics we also deals with certain kind of tradeoffs; if we are focusing more on creating the conventional goods then less resources will be available for protecting the environment. So, there is a trade off and this trade off is also examined in environmental economics and we also study in environmental economics the impact of economy on environment. So, when economy growth increases, when employment growth increases, when overall economy is increasing how this increase in economy is having some impact on environment.

For instance: if our GDP growth rate is increasing that will put more pressure on fossil fuels because demand for energy will increase. And, when demand for energy is increasing then the demand for fossil fuels will increase and it will generate more pollution in the economy. So, bad products in the economy will also increase and that will put more pressure on the carrying capacity of environment. So, in environmental economics we also study the significance of environment to the economy and sometimes it is called that environment development is must, but environment is first.

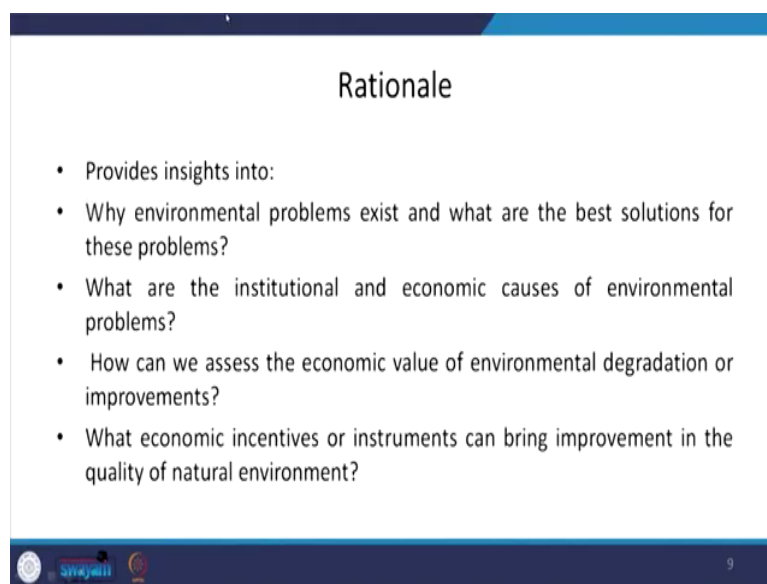
So, we have to study the relationship between environment and development in environmental economics. For instance we needs the development activities, we need our development, but development also lead to environmental degradation. So, therefore, my view is that environment is first although development maybe must. So, taking these two things in to account, in environmental economics we deals with how to make a proper balance between environmental needs and the human needs for various conventional goods and services.

Environmental economics also deals with how to regulate the different kinds of economic activities. The objective here is to achieve the balance among environmental economic and other social goals. Let me now discuss why should we study environmental economics or what is the rationale of studying environmental economics.

And, to know this we should know the relationship between environment and economy and environment provide us various kinds of goods and services. And, when we give more emphasis on economic activities, then these services also have some pressure and these services also degraded.

So, why environmental problem exists and what are the best solution for these problems must be examined and for that environmental economics should be studied. What are the institutional and economic causes of environmental problem? We can understand this by understanding the subject.

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Rationale

- Provides insights into:
- Why environmental problems exist and what are the best solutions for these problems?
- What are the institutional and economic causes of environmental problems?
- How can we assess the economic value of environmental degradation or improvements?
- What economic incentives or instruments can bring improvement in the quality of natural environment?

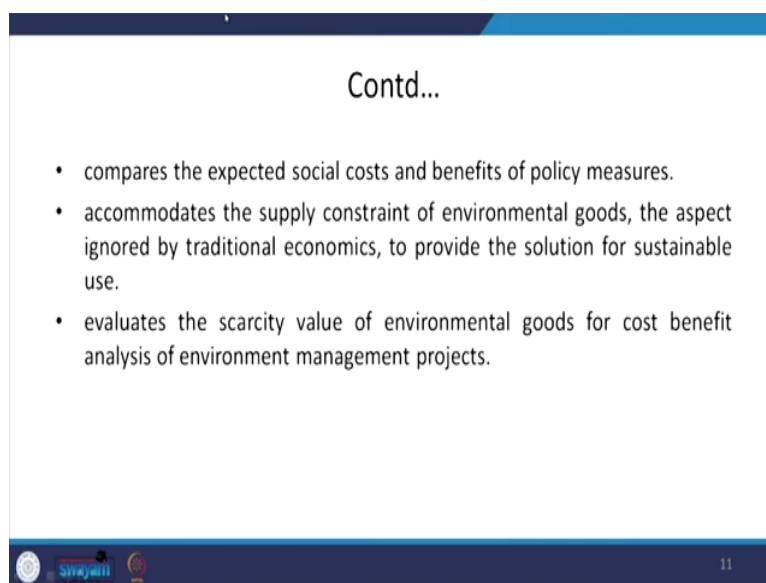
How can we assess the economic values of environmental degradation or improvements? That can be examined by having understanding of the environmental economy. So, environmental economics must be studied to know all these aspects. What economic

incentives or instruments can bring improvement in the quality of environmental resources or natural environment? That is also necessary and for that we must understand the environmental economics. Environmental economic determines the most reasonable trade off among various set of environmental goods, we will discuss this trade off in detail later on.

So, there are a lot of tradeoff between various kinds of goods and services and environmental economics is studied these kinds of trade off. Environmental economics also provide the solution for environmental problem through application of market based models. So, as I in the beginning told you that we have the two kinds of approaches to deal with the environmental issue. One is command and control kind of approach where we have certain kinds of regulation like State Pollution Control Board regulate the environment through appropriate policy actions.

Similarly, we have the market based approach that can be used to solve the environmental problem. So, how to use the different kinds of approaches to solve the environmental issues are also examined in environmental economics. Environmental economics also provide solid foundation for most of the policy measures to address the environmental problems. For example, should emission be stopped by regulating or through taxes are also studied and it also compared the expected social costs and benefit of the policy measures.

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- compares the expected social costs and benefits of policy measures.
- accommodates the supply constraint of environmental goods, the aspect ignored by traditional economics, to provide the solution for sustainable use.
- evaluates the scarcity value of environmental goods for cost benefit analysis of environment management projects.

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So, we had different kinds of policy measures and we can examine these policy measures in terms of how much the social cost they are having and how much the benefit the society are achieving by taking these kind of actions. It accommodate the supply constraints on environmental goods, the aspect ignored by traditional economics to provide the solution for sustainable use. Environmental economics also evaluate the scarcity value of environmental goods for cost benefit analysis of environmental management project.

In brief I can say that the study environmental economics is needed to understand number 1, optimization of pollution and environmental degradation. We know some pollution is inevitable, if we want to achieve 0 pollution then we have to stop various kinds of activities.

So, pollution is the byproduct of good product; when we are producing good product, bad product will also be generated. So, the issue here is how to optimize pollution. So,

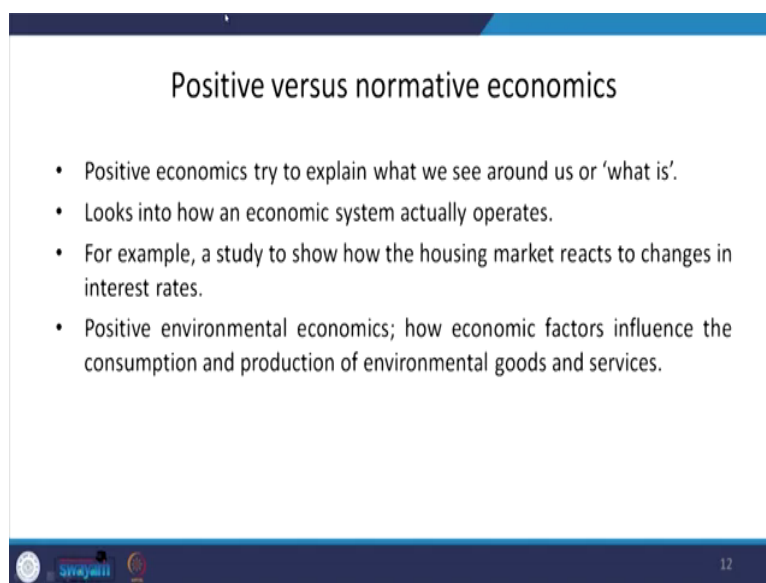
optimization of pollution is studied environmental economics and for that efficiency, productivity all these aspects will be discussed in detail.

Second is human needs or greeds. So, we must be knowing the clear cut difference between human needs and greeds. As Gandhiji rightly mentioned that nature can provide or fulfill the needs of everybody, but cannot fulfill the greeds of anybody. So, we should also understand what are our needs and what are our greeds in context of environmental economics. And, third important aspect why should we study environmental economics is intergenerational equity. If we are planting our resources today, then these resources would not be available for the future generation.

So, we have to establish equity between the current generation and the future generation. And, for that basic understanding of environmental economics is very very necessary, then another important issue is problem of scarcity. In the very beginning I told you that the resources at our disposal are scarce. So, scarcity of resources also is an important issue and these scarce resources have competing use. So, therefore, we have to know how to use optimally these limited resources; trade off we already discussed.

So, environmental economics deals with the different kinds of tradeoff, there is a tradeoff between conventional goods and environmental goods. If we are for example, using more water from the river for irrigation purposes less water will be available for maintaining the ecological flow in the river. So, these there is a trade off between these two kinds of products, environmental products or services and conventional goods and services.

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The slide is titled "Positive versus normative economics" and contains a bulleted list of four points. The slide has a blue header and footer. The footer includes a logo on the left and the number "12" on the right.

Positive versus normative economics

- Positive economics try to explain what we see around us or 'what is'.
- Looks into how an economic system actually operates.
- For example, a study to show how the housing market reacts to changes in interest rates.
- Positive environmental economics; how economic factors influence the consumption and production of environmental goods and services.

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And, another important aspect which you will study in environmental economics is environmental demand and this is a major contribution of environmental economics. So, how to drive the environmental goods demand and you know that environmental goods are non-rival, non-excludable and they are outside the market. So, can we develop a market demand or can we develop a demand for environmental goods? Those goods which are outside the market is a major challenge and environmental economics deals with such kind of challenges.

So, how to develop and demand for environmental goods which cannot be traded in the market because of nature of these products, then policy response to solve the environmental problem. So, we should also study environmental economics to know how the different kinds of policies can have the impact on different indicators of environmental protection. And, finally you can also study environmental economics to understand the social cost and benefits

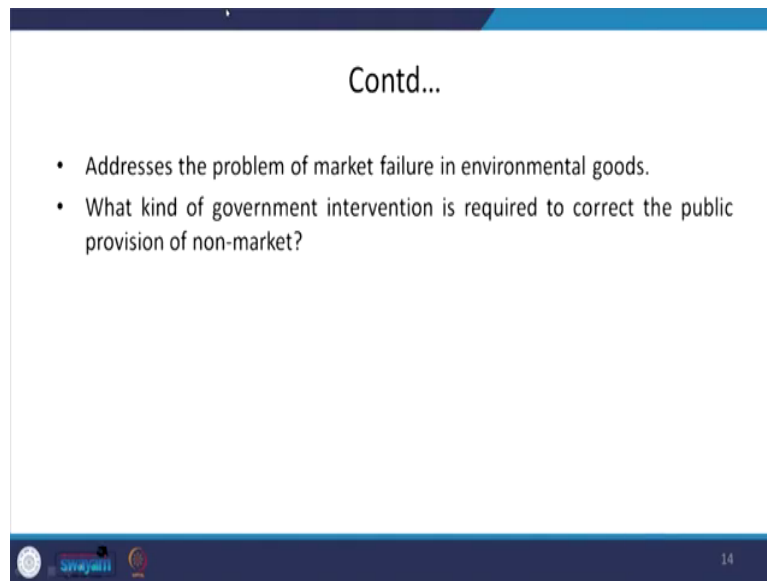
of various development projects. When we start when it development project their benefits may be received by one section of society, cost may be borne by another section of society; sometimes cost may be borne by the future, by the current generation; benefits may go to the future generation. So, therefore, social cost and benefit analysis of these kind of various development projects can be examined in environmental economics. So, therefore, environmental economics is very useful subject to know the interface between economy and environment.

Now, let me tell you that environmental economics can be classified into two branches. One is positive environmental economics and other than normal to environmental economics. In economics also we study these two branches of economics: one is positive environmental economics. Positive environmental economics deals with what is and most of the physical sciences, I can say all physical sciences are positive sciences, where we study what is. We explore the fact, we interpret the fact that is all, we do not add anything from our side.

So, one part of the environmental economics is positive economics, where we study what is for example, why our rivers are polluted, why is our environment polluted. So, to get the answer of such kind of questions you have to study environmental positive economics. And, the environmental positive economics is predictive in nature, while another branch of environmental economics is normative economics and normative economics deals with what ought to be or what should be and that is prescriptive in nature.

So, and both side of economics, both branches of economics are very very useful because welfare part of the environmental economics deals with the normative economics. While, positive economics includes all theories etcetera like how to optimize pollution that is a part of positive environmental economics. And, how to formulate or what kind of different policies should we formulate to improve the welfare of society, how to improve the environmental conditions through appropriate policy. So, this part is largely comes from normative economics. So, these are the two important branches of environmental economics: positive economics and normative economics.

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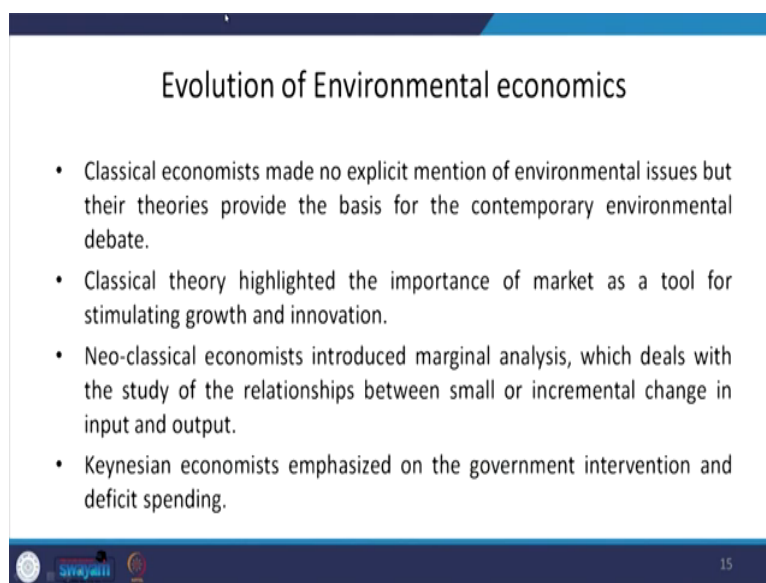
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- Addresses the problem of market failure in environmental goods.
- What kind of government intervention is required to correct the public provision of non-market?

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Then we also this normative economics also addresses the problem of market failure in environmental goods. Market failure is one of the major issues in environmental economics. Sometimes market; sometimes market does not exist, sometimes market fails to deliver the goods efficiently. And therefore, what kind of government intervention is required to correct the market failure or what kind of policies are required to create the enabling environment under which market can work in case of environmental goods. Then next point is how this subject is evolved over a period of time, evolution of environmental economics.

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The slide is titled "Evolution of Environmental economics" and contains a bulleted list of four points. The slide has a blue header and footer. The footer includes a logo on the left and the number "15" on the right.

Evolution of Environmental economics

- Classical economists made no explicit mention of environmental issues but their theories provide the basis for the contemporary environmental debate.
- Classical theory highlighted the importance of market as a tool for stimulating growth and innovation.
- Neo-classical economists introduced marginal analysis, which deals with the study of the relationships between small or incremental change in input and output.
- Keynesian economists emphasized on the government intervention and deficit spending.

We can cite some of the works of earlier economist, classical economist. Even Ricardo gave the theory of rent and that rent theory also gives some insight that agriculture is subject to diminishing marginal return because, when we exploit more and more our soil then productivity of soil decline.

So, these earlier classical economist although have not made explicit mention of environmental issues, but their theories provide the basis for the contemporary environmental debate. Another important topic which is or theory is developed by the new classical economist and that is the marginal principle.

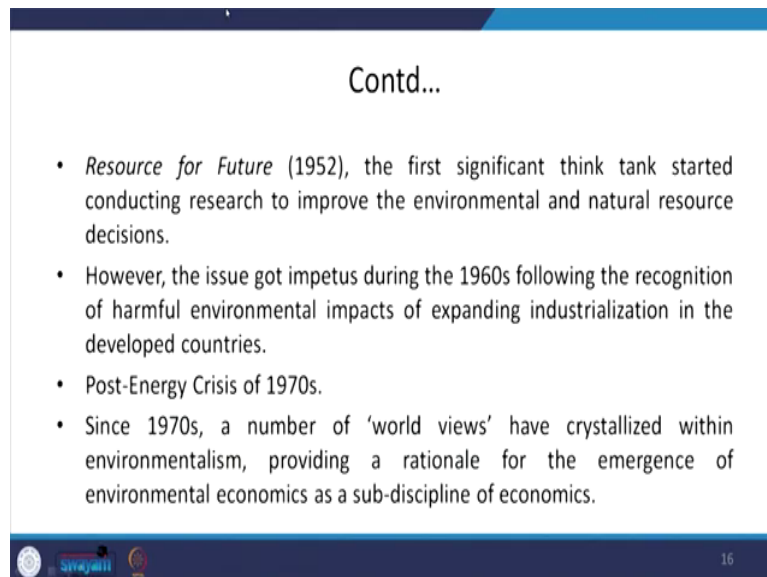
So, marginal principle is developed by the classical and neoclassical economics Marshall etcetera. And, this new class classical concept of marginal list is very very useful to study the

optimum use of resources or we can know how to achieve equilibrium by taking these concept of marginal cost and marginal revenue or marginal benefit or marginal cost etcetera.

Then later on Keynesian economist emphasized on the government intervention and deficit financing. So, the role of the government is strongly advocated by Keynes, we you know that Keynes wrote a famous book *General Theory of Employment Interest and Money* in 1936.

And, he gave the concept of effective demand and in order to maintain the effective demand he strongly advocated the role of government. So, role of government means that government has to prepare certain kinds of policies to deal with the different kinds of issues. So, policy intervention in economy is also very very important topic and now environmental regulations or environmental policies, they are being used to deal with certain kinds of environmental issues.

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- *Resource for Future* (1952), the first significant think tank started conducting research to improve the environmental and natural resource decisions.
- However, the issue got impetus during the 1960s following the recognition of harmful environmental impacts of expanding industrialization in the developed countries.
- Post-Energy Crisis of 1970s.
- Since 1970s, a number of 'world views' have crystallized within environmentalism, providing a rationale for the emergence of environmental economics as a sub-discipline of economics.

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But, up to 1950s environmental economics was not a prominent subject, it got prominence especially after 1970. Especially, you can say when industrialization generally lot of pollution then economist, social scientists, biologists they started thinking about the adverse conscious of economic development on environment. And, they start writing on various environmental issues and especially energy crisis that is started in 1973.

So, post energy crisis this subject become more and more relevant and since 1970s a number of world view have crystallized within the environmental, environmental is providing a rationale for emergence of environmental economics as a sub discipline of economics. And, in this case there are three world views regarding the evolution of environmental economics. First is a market and technology driven growth process.

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Major Landmarks

- **1961:** WWF is created at Morges, Switzerland
- **1968:** UNESCO Biosphere Conference
- **1970:** Earth Day April 21
- **1972:** the Stockholm conference on Human Environment created formal international awareness of the need for maintaining the quality and integrity of the environment
- **1972:** *The Limits to Growth:* The Club of Rome, a group of leaders and thinkers from 40 countries, issues this report written by Donella and Dennis Meadows.

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Many economist like Julian Simon, they strongly advocate that the technology and economic growth can lead to environmental protection and they have given their own arguments. For example, if prices of petrol increases in the market then the cost of production will go up.

So, then the company will think of developing the alternatives and they spend lot of money on R and D, research and development. And, new form of energy maybe evolved like today you know this solar energy; solar energy is continuously becoming more or more cheaper than even another sources of energy and that is the result of research and development.

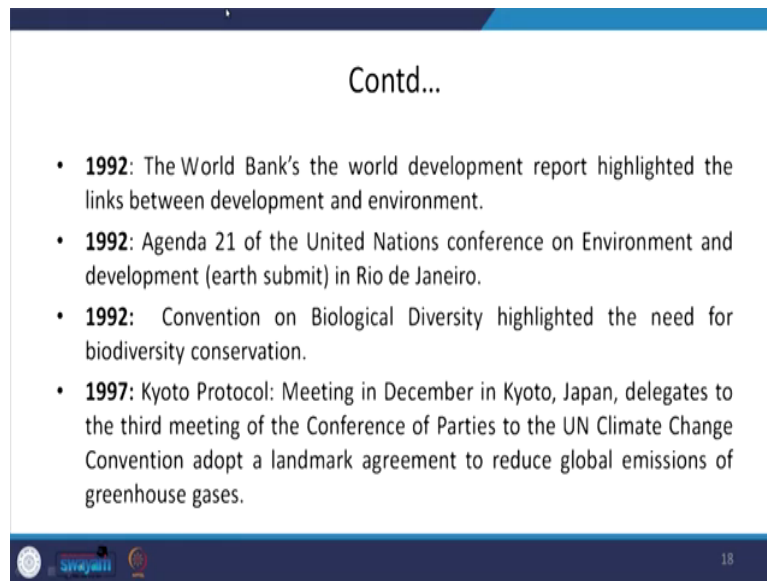
So, technology and market driven growth process may lead to environmental protection, this is one group. Second group is those who always strongly advocate limit the growth that the growth in the world economy is creating environmental degradation and they believe in limiting the growth they are called eco preservationist.

And third is which is having middle path, they always believe in sustainable development. So, self sustaining development or sustained development and this concept came into existence in 1987 in our common feature. And, most of the economist are now strongly believing that we should focus on achieving the sustainable development.

The development that meets the need of the current generation without adversely affecting the needs of future generation. Major landmark in the development of environmental economics number 1 is 1961. WWF was created, then in 1968 UNESCO Biosphere Conference was held, in 1970 Earth Day was celebrated. And, now every years on April 21st Earth Day is celebrated.

Then in 1972, the Stockholm conference on Human Environment created a formal international awareness of the needs for maintaining the quality and integrated of environment. Then in the same year in 1972, The Limit to Growth: The Club of Rome, a group of leaders and thinkers from 40 countries, issues this report written by Donella and Meadow.

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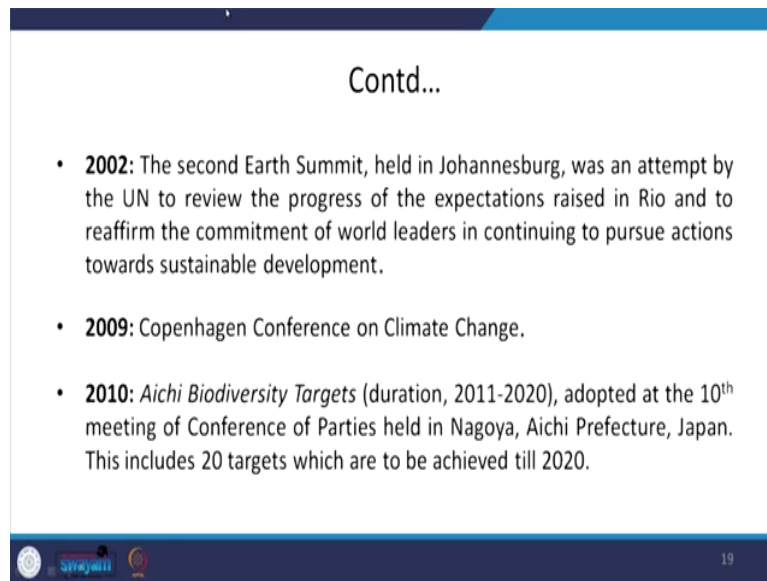
- **1992:** The World Bank's the world development report highlighted the links between development and environment.
- **1992:** Agenda 21 of the United Nations conference on Environment and development (earth summit) in Rio de Janeiro.
- **1992:** Convention on Biological Diversity highlighted the need for biodiversity conservation.
- **1997:** Kyoto Protocol: Meeting in December in Kyoto, Japan, delegates to the third meeting of the Conference of Parties to the UN Climate Change Convention adopt a landmark agreement to reduce global emissions of greenhouse gases.

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So, this is also the important landmark towards the development of environmental economics. Then in 1992 World Bank first time in its world development report focuses the relationship between economic development and environment. So, the focus of this report was on the relationship between economic development and environment. In the same year 1992 Agenda 21 of the United Nations conference on Environment and development that is also called earth summit in Rio de Janeiro was also held.

Same year Convention on Biological Diversity also highlighted the need for biodiversity conservation. In 1997 Kyoto Protocol, now you all know this is a famous protocol and it develops a new mechanism for protecting the environment. So now, carbon credit and clean development mechanics; so, different kinds of mechanisms were developed after the Kyoto protocol.

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The slide is titled "Contd..." and contains a bulleted list of three international environmental conferences. The first bullet point describes the 2002 Earth Summit in Johannesburg, the second describes the 2009 Copenhagen Conference on Climate Change, and the third describes the 2010 Aichi Biodiversity Targets. The slide also features a footer with logos for the University of Jyväskylä and the number 19.

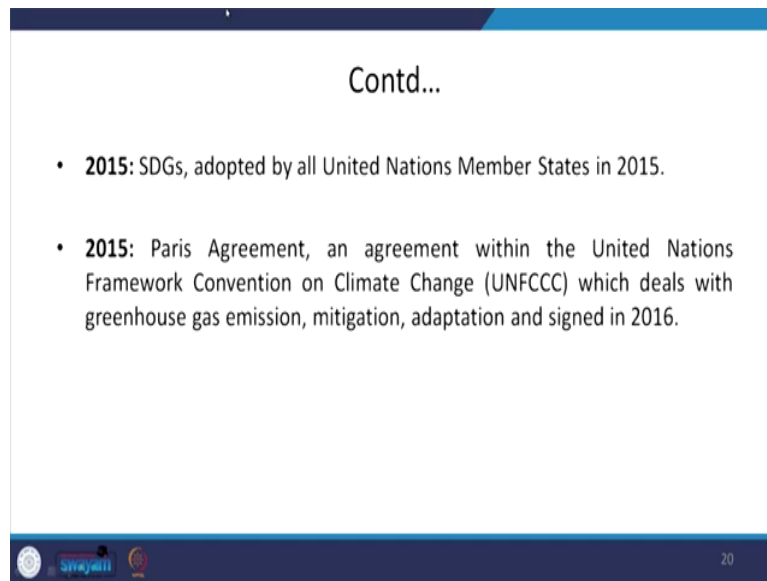
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- **2002:** The second Earth Summit, held in Johannesburg, was an attempt by the UN to review the progress of the expectations raised in Rio and to reaffirm the commitment of world leaders in continuing to pursue actions towards sustainable development.
- **2009:** Copenhagen Conference on Climate Change.
- **2010:** *Aichi Biodiversity Targets* (duration, 2011-2020), adopted at the 10th meeting of Conference of Parties held in Nagoya, Aichi Prefecture, Japan. This includes 20 targets which are to be achieved till 2020.

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Then in 2002 another Earth Summit was held in Johannesburg and it also focuses on protecting the environment and raising the various concerns including the global warming, climate change and how to achieve the sustainable development. In 2009 Copenhagen Conference on Climate Change was held. And, 2010 Aichi Biodiversity Target was set up for the next one decade starting from 2011 to 2020.

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- **2015:** SDGs, adopted by all United Nations Member States in 2015.
- **2015:** Paris Agreement, an agreement within the United Nations Framework Convention on Climate Change (UNFCCC) which deals with greenhouse gas emission, mitigation, adaptation and signed in 2016.

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And finally, you can say 2015 is sustain a development goals adopted by the United Nations Member Countries and the target is to achieve this goal by 2030. And, in 2015 Paris Agreement, an agreement which within the United Nations Framework Convention on Climate Change which deals with greenhouse gases emission, mitigation, adoption were also signed. So, these are the major landmark towards the development of environmental economics.

Let me take a couple of minutes to summarize what I have discussed in this lecture. In this lecture I had discussed what is environmental economics, what is economics and I also discussed the rationale for environmental economics. Why should we study environmental economics, they are tradeoff between environmental economics and conventional goods. We

have to also maintain intergenerational equity and for that you must study the environmental economics. And finally, I also discussed the evolution of environmental economics.

Thank you very much.