Conservation Economics
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Module 8
Public sector and Conservation
Lecture 2
Public goods and common resources

Namaste! We carry forward our discussion on Public Sector and Conservation and in this lecture, we shall explore public goods and common resources. Let us begin with a recap. We saw that externality is the uncompensated impact of one person's actions on the well being of a bystander. Now, externality is going to be a very important factor in this lecture as well. Externality is the uncompensated impact of a person's actions on the well being of a bystander.

So, somebody is doing something, but that action is also impacting other people who have got nothing to do with that decision or that action and they are also not getting compensated for those impacts in that case we say that it is an externality, and it is of four kinds, you can have negative or positive externality.

In the case of negative externality, the bystander is negatively impacted. In the case of positive externality, the bystander is positively impacted, that is he receives a benefit. Production externality occurs when the actor is producing something such as the mining industry and consumption externality occurs when the actor is consuming something so, it is a polluting vehicle.

When you have externalities and there isn't an uncompensated impact on the bystanders, how do you deal with them? So, we have different options to compensate for the externalities. They include public sector solutions and the private sector solutions. One solution is the use of regulation.

Regulation means that the government says that dumping waste into a river is a crime. So, if anybody is dumping the waste, then he or she is going to be jailed. Now, this is one way of ensuring that the rivers do not get polluted. So, by means of laws and by means of enforcing those laws, we ensure that the rivers do not get polluted so that the bystanders are not negatively impacted. So, this is one way: regulation.

Another is corrective taxes. A tax designed to induce private decision makers to take into account the social costs that arise from a negative externality. Now, corrective taxes also go by the name of Pigouvian taxes. Now, corrective taxes or Pigouvian taxes are a tax designed to induce private decision makers to take into account the social cost that arise from a negative externality.

It means that if there is a negative; a negative externality, the government is going to put a tax on

such an action so that it becomes more expensive to do that action that is having a negative externality. That is the use of corrective taxes.

An example is corrective taxes for pollution. In this case, what is happening is that we have a price for pollution and we have a quantity of pollution and there is a demand for pollution or a demand for pollution rights.

What this curve is telling us is that there are certain industries who want to be able to pollute the environment because say there is a factory and when the factory is run, then it would give out certain amounts of a smoke or if the when the machines are running, then it would give out certain amounts of noise.

The thing here is that the person who is owning this firm or the factory wants to make this pollution because by making this pollution, he is earning something, he is earning a profit so, he requires the right to pollute the environment with sound pollution, air pollution or any form of pollution, but then the demand for for these pollution rights, this is also like any other demand for any other good in the market. So, there is also a price involved.

If you tell the factory owner that ok, you can pollute the environment if you pay 10 rupees for it every day, then probably the factory owner would say ok this is a small amount, what do I have to do with it. I will pay 10 rupees to the government and I will pollute as much as I want. But then, if the government says that ok, if you want to pollute, then for every unit of the pollutant that you are releasing, you will have to pay 50000 rupees.

Now, this person would start to think ok, am I earning enough to be able to buy this pollution permit for 50000 rupees probably not and if I am not earning enough money by running this industry and polluting the atmosphere, then probably it does not make sense for me to buy this pollution permit. His demand would reduce. If the price is too high, then probably the demand would be obliterated which means that at a very low price, the demand for pollution rights will be very large.

When price increases, the demand would reduce. Probably some people would want to reduce the amount of pollution that they are spreading by installing a pollution controlling device, but when the price increases very much, the demand will be very little. So, we are observing the law of demand that as the price increases, the quantity demanded reduces.

In this case, what the government is doing is that the government is setting up a price through this corrective tax. If this price is increased or decreased, that is what we are saying is that if the price is set at this point so, this would be the amount of, this would be the quantity of pollution that will be demanded. If the price is kept very low, then the quantity demanded will be very high.

This will be the quantity that is demanded. At this lower price, when the price is low, then greater quantity is demanded, when the price is high, then a lesser quantity is demanded. In this way, by setting a price through the corrective taxes, the government can regulate the quantity of pollution that is being spread into the environment.

Pollution is an externality because the factory owner is earning the benefits, he is earning the profits, but the people who live in the surrounding they have to bear with this pollution and they have to pay the cost specially, the health cost, the cost of living in a polluted environment, the

cost of having to bear with all the smell.
Because this is an externality, the government may make use of this corrective tax and in this case, the government is not putting this tax to earn revenue. Now, this is the most important concept here. The government is not putting this corrective tax so that it can earn more revenue, the government is only putting this corrective tax to deter people from polluting.
This tax is only acting as a disincentive to the factory owners from polluting and similarly, the government can use these corrective taxes to control any behavior that has a negative externality. So, if the government thinks that ok, if people smoke, then the; then the people who are there in the vicinity become passive smokers and they have to bear the health cost.
So, what will the government do? The government can increase the price of cigarettes and how will the government increase the price of the cigarettes? By putting a corrective tax on cigarettes. In this case, the government is setting the price and the price is determining the quantity.
Another thing that the government can do similarly is to use corrective subsidies. In the case of corrective subsidies, the government provides money to certain activities that need to be promoted such as things like education or vaccination or health care.
When a person is vaccinating himself or herself, then they are also protecting the community from the spread of diseases. If people are more educated, then they are not just serving their own interests, but they are also serving the interest of the society by becoming more enlightened citizens.
These sorts of activities that have positive externalities, they are subsidized by the government as a solution of this externality. Another option with the government is to use things such as tradable pollution permits.
In the case of pollution permits, what happens is that the government sets the amount of pollution that can be done. In the previous case, the government was setting a price and this price was regulating the amount of pollution that will be released into the environment. In the case of tradable pollution permits, the government sets the quantity of pollution that can be spread.
In this case, what happens is that the government will give out certain permits and with each permit, a person is allowed to emit a certain amount of pollution. Let us say that there is a pollution permit and with each permit, a person can release 1 ton of carbon dioxide and the government what it is doing now is that the government is saying that ok, if you want to emit carbon dioxide from your factory, you will need a permit, but we are only going to issue 10 permits which means that a maximum of 10 tonnes of carbon dioxide can be emitted.
Now, what happens? Here as well, you have the demand curve for the pollution rights. But now, the quantity has been set and once we have the quantity, this quantity will determine the price that the people will be ready to pay for these pollution permits. Now, these pollution permits can be sold through an auction.
When these 10 pollution permits are sold through an auction, then those people who have the highest demand for these pollution rights, people who pay who who have a very high amount of value to these pollution rights, they will be buying these pollution permits at a higher price and those people who do not put a very large value or who do not want to shell out that much amount of money, they will not get the pollution permits.

The government can even go one step further by stating that let the private parties also trade these pollution permits amongst themselves. What happens in that case is suppose there are 10 firms, and the government has sold 1 tonne permit to each and suppose 1 permit is costing rupees 1 lakh. We have these 10 firms A, B, C, D, E, F, G, H, I, J so, these are the 10 firms, and they all have the permit for 1 tonne of carbon dioxide emission.

But what now happens is that this firm G, thinks that 1 tonne of permit is not enough for me probably, I would want to go for 1.5 tonnes. Now, in this case, because it has a permit with itself only to emit 1 tonne of carbon dioxide, if it emits 1.5 tonnes of carbon dioxide, it will be penalized probably, the owner might go to jail.

Now, the option with this firm G is that it will ask everybody else in the market whether anybody has an excess of the permit as compared to their requirements. Suppose firm B bought 1 tonne permit, but it is only going to need 0.8 tonnes when it is doing its production. In this case, it can sell off 0.2 tonnes that remains to this firm G.

What is the rate at which it will be selling these 0.2 tonnes? It will not be this rate, at this rate, it would have costed only 20000 rupees, but now that firm B knows that firm G desperately needs these pollution permits probably, it is going to sell them for a bit more. So, in place of 20000 rupees probably, it will be charging it say 25000 rupees.

Because G desperately needs more pollution permits, it will be ready to pay say 25000 rupees, but then, when these pollution permits are getting traded, then this will also result in certain impacts on the other firms. Probably, firm I will think that ok, I have this 1 tonne permit and I bought it for 1 lakh of rupees, but now the price has appreciated so, from 20000, it has increased to 25000 so, there is an increase of 5000 every 20000 is 25 percent increase in the price.

Now, firm I will think that ok, I have this thing that is worth 1 lakh of rupees, that is I have paid 1 lakh of rupees for it, but I can sell it off for 125000. So, let me figure out if there is a way that I can reduce the amount of pollution in my firm so that I am also left with certain excess. That is because the price has increased in the market because of free trading so, now, this firm will also try to reduce its emissions.

In this case, the government is not forcing this firm to reduce the emissions, but what is happening is that because of the market mechanism and looking at everyone's self-interest, now in this case, the firm I is not thinking that if I am releasing pollution, then it is harming the environment or it is creating an externality to the people in the surroundings no, they are only looking at their own self-interest and in this case, firm I is thinking that if I can reduce my amount of emission, then probably I can sell my permit at a premium.

Probably it will also try to cut down its pollution and so, in place of say emitting 1 tonne of carbon dioxide probably, it is able to; it is able to bring it down to 0.9 tonnes and in that case, it can sell the remaining 0.1 tonnes to the firm G. So, what is happening in this case is that the government is not putting a price to the pollution as it was doing earlier.

Earlier the government was setting the price through means of taxation. In this case, the government is just saying that ok, this is the amount that we are going to permit and whoever has a higher requirement, whoever values the right to pollute more is going to pay more and if there is still a shortfall.

We can even permit the players to trade amongst themselves, the government only needs to enforce the rules to see to it that nobody is able to pollute without a permit and the market mechanism will take care of everything else. Now, in this case, we have a solution to the problem of externality. The government wanted to reduce the externality in the form of pollution and this is one way of doing it.

The government may go even a step further. The government may say that ok, this year we permitted 10 permits, but next year we are going to permit only 9 so, when there is a gradual reduction in the number of permits that will be issued, then slowly and steadily, those firms that are in a better position to cut down their pollution, they will take hold of this opportunity and cut down their pollution.

In this case, not every firm is cutting down its pollution because there could be certain firms such as a cement firm that has little options to cut down on the amount of carbon dioxide that it releases because during the production of cement, calcium carbonate has to be heated and that will release carbon dioxide.

There is a limit to which it can bring down its carbon dioxide emissions, but at least those firms, say a firm that is working in the energy sector, may at least bring a few of its coal-based power plants down and probably shift to solar energy or wind energy.

So, those firms that are in a better position to cut down on pollution will do so and they will trade these pollution permits with those firms that are not that good at reducing their pollution and slowly and steadily, the government can control the amount of pollution. So, this is another way in which the externality can be regulated.

Other solutions are the private sector solutions. Moral codes and social sanctions: social boycott of those who are doing pollution. So, in this case, the government is not needed, but what is happening is that the society is boycotting these firms that are doing pollution and probably the society is encouraging those people who are cutting down the pollution, showing an exemplary way of cutting down pollution.

Another option is charities, giving money to those organizations with positive externalities. Schools and colleges and research institutions. This is another way in which the government is not needed, but if people in a society find that research institutions are good for the society because they are going to increase efficiency, they are going to lead to better health care, better education.

In that case they can themselves provide a certain amount of money to these institutions. Integration of businesses such as orchard and apiculture together to reap maximum benefits, contracts and bargaining. So, these are all different solutions to externalities.

And here we also looked at the Coase theorem. The proposition that if private parties can bargain without cost over the allocation of resources, then they can solve the problem of externalities on their own. Now, this is something that we have seen before, but the important thing in the Coase theorem is that it does not matter who has the upper hand whatever be the situation, the private parties can come to a solution to the externalities, and they are able to bargain without cost.

Let us look at the case of a steel plant that is polluting the river and this pollution is reducing the fish catch. Now, here again for the Coase theorem to work properly we need to have property

rights and we need to have a government that can help in the enforcement of property rights. We will look at two cases.

The 1st case is that the river belongs to the fishermen. The government has given the right of the river to the fishermen. So, they exert a right on clean water, and they threaten to close the steel plant. Now, in this case the fishermen go to the steel plant owner and say that ok, this river belongs to us, you cannot pollute this river, if you do this, we are going to enforce our property rights and we are going to shut you down.

Now, in this case, when both these parties can bargain together, the steel plant owner can tell these fishermen that ok, your catch is getting reduced because I am spreading this pollution, but then, there has to be some rupee value or dollar value to the amount of cash that does not go down.

What he is saying is that suppose earlier, you were earning 20000 rupees because of your fishing operations, but because of my pollution, now, you are earning only 10000 rupees and because you are earning 10000 less so, you are telling me that you are going to close the plant, but I have a better solution. So, the steel owner says that let me pay you 11000 rupees and you let my plant to work as before.

In this case, the the plant owner is at a profit because probably, he is manufacturing a steel that is worth lakhs of rupees and he only has to pay 11000 rupees and the fishermen are also at a benefit because earlier, they were earning 20000 rupees, now they will be earning 10000 rupees from fishing and getting 11000 rupees as compensation. In this way, through bargaining, both these parties can come to a solution that can benefit both of them.

Another option is when the river belongs to the steel plant. Now, in this case, the fishermen are concerned about the reduced catch so, what is happening is that the fishermen, they find that their catch has gone down by 10000 rupees and because the steel plant owner is also owning the river, he can pollute as much as he wants. So, now, what these people will do is that they will tell the steel plant owner that we are going to pay you something.

What they will say is that we are going to pay you say 5000 rupees to install pollution control equipment. What the fishermen are doing in this case is that the plant owner because he owns the fish and he is in no mood to pay for the cost of installation of the device, what the fishermen would do is that they will install the device for the plant owner and in this case, the machine is going to bring down the pollution.

What is happening here is that they can either install the equipment or they can pay to the steel plant owner and say that ok, you please reduce the amount of pollution that you are causing, and we are going to pay you for that. So, you give us this service of reducing pollution and we are going to pay you for the service.

What we are observing here is that whether the river belongs to the fishermen or whether it belongs to the steel plant owner, in both the cases, the parties can bargain amongst each other and come up with a solution, that is the beauty of the Coase theorem. Whether the property belongs to any one party, the both the parties if they are able to bargain without cost over the allocation of resources, they can solve the problem of externalities on their own.

Essentially, what we are saying here in the case of externalities is that markets are usually a good

way to organize economic activity because as we have observed people can do trading of pollution permits, people will go with Coase theorem and solve the problem of externalities, but if that does not happen another option is that governments can sometimes improve the market outcomes as in the case of corrective taxes.

Other kinds of goods are public goods and common resources. Let us look at this case: The village that Shyam lives in is surrounded by grasslands. The grassland can support 200 cattle. Each person in the village has a right to graze his or her cattle in these grasslands which means that there is no private property as far as grasslands are concerned, any person can take their cattle to the grasslands for grazing.

The village has 20 people, each of them have 10 cattle which means that the total number of cattle is 200 and the grassland can support 200 cattle. So, basically the grassland can support 200 cattle and there are already 200 cattle in the village and Shyam is thinking of buying one more cow. What is his cost in benefit given that the grassland is already supporting the maximum number of cattle and will he buy?

Essentially, there is a grassland, and the grassland can support 200 cattle, there are already 200 cattle, and we have one person in this village who is thinking of buying one more cattle. Now, in economics we consider that people are rational thinkers. Now, if Shyam is a rational thinker, what would he think? He would think that ok, if I get one more cattle, then the total number of cattle will be 201, but the grassland can only support 200 cattle.

Now, the grassland is not an entity that will only permit 200 cattle to get inside and will leave out one cattle, but what will happen is that each of these 201 cattle will be eating a little less. In this case, suppose one cattle can give 10 liters of milk. Now, every cattle because they are getting less amount of feed so, every cattle will be giving out less amount of milk.

Let us say that every cattle in place of giving 10 liters of milk will give 9.8 liters of milk, but then the one cow that I am going to bring that is also going to give me 9.8 liters of milk. What it means is that earlier, Shyam had 10 cows and each of them was giving 10 liters so, in total it is 100 liters of milk that he is getting.

With one more cattle, he will be having 11 cattle and each of them will be giving 9.8 liters of milk. What is the total amount of milk that will be produced for Shyam? It will be 107.8 liters. Now, the thing here is if Shyam only kept 10 cattle, he was getting 100 liters of milk.

But when Shyam gets the 11th cattle, he is now getting 107.8 liters of milk which means that his production has increased by 7.8 liters and the cost of having this cattle is being borne by all the other people because they will be getting a slightly less amount of milk.

Now, this kind of a resource is known as a common resource. So, this is a common property, there is no private uh property rights in this grassland and a common thing with common property is that people tend to over utilize them and remember that this sort of a thinking is coming from a rational decision-making process, it is not that Shyam is irrational.

Even though Shyam knows that 200 cattle is the maximum that can be supported, he would still want to have one more because it is in his own benefit. Now, in this case, we are not talking about an externality because it is having a negative impact on everybody else that is fine, but what we are talking about is what is the impact on the resource?

Now, when Shyam gets this extra cattle, he also knows that it is possible that because of overgrazing, the grassland itself will be destroyed, but then, the destruction of grassland will take some time so, it will be a long-term process and in the long-term, we are all dead.

So, everybody is doing short-term thinking and so, Shyam will get one more cattle and we will have a similar thought process with every person in the village so, every person would want to have one more cattle, but when that happens, the overall common resource gets destroyed.

Another kind of resource can be understood with this example. The society that Ram lives in has decided to go for beautification and is collecting funds for it. In this process, the walkways will be cleaned and paved, and on both sides, trees will be planted. The contribution to this fund is voluntary. Will Ram pay to the fund or not because whether Ram pays to the fund or not, he will benefit from the beautified surroundings. Now, the question is will he pay?

Because the thing is when the society is beautified, Ram is going to have all the benefits of that whether he pays or not because once the society has been beautified, once the pavements have been cleared, once you have these trees, then Ram is also going to enjoy the benefits, there is no way that the society can say that Ram is not allowed to use this benefit, the society cannot say that ok, Ram you did not pay so, you should not walk in the shade of these trees and you should not be using the pavements, the society cannot do that.

Now, in that case, it is in the interest of Ram if you look at a short-term rational decision-making process. Ram will think that ok, I should not pay because whether I pay or not, I am getting the benefits so, why should I pay. But when that happens and this; this sort of rational thinking will be there in the minds of everybody. Every person who lives in the society will have a similar thought process because this fund is voluntary so, why should I pay.

But when that happens, when nobody pays for the fund, then probably the society will not be beautified and so, Ram and everybody else in the society will continue to live in a dirty looking surroundings without these trees, without clean pavements, but it is being done through a rational decision-making process and things such as these are known as public goods.

And these sorts of things, the public goods and the common resources are at the heart of lacking efforts to save the environment and over utilization of natural resources because when we talk about Ram living in this society, it is very similar to saving the environment.

So, the thing is if we conserve the tigers, if we conserve our forest, we are all going to reap out the benefits. Everybody is going to have the benefits of biodiversity, but when it comes to payment, nobody wants to pay for these.

People want to have more number of roads, people want to have more electricity, but then people also want more biodiversity, people also want to have tigers, people also want to have tourism in their country, but they do not want to pay for that because the thing is if you do not pay for electricity, you do not get electricity, it is something that you can be excluded from, but the benefits of biodiversity cannot be excluded.

If somebody pays or not, they are going to get the benefits of biodiversity. So, it is a public resource, it is a public good and similarly, when we talk about polluting the environment so, everybody knows that the environment can only tolerate a fixed level of pollution and if we cross this threshold, then it is to the detriment of everybody, but still people go on polluting why?

Because the environment, air, and water are all public, these are all common resources.
Even though the quality goes down, the quality goes down for everybody so, everybody will suffer. If everybody is going to suffer, but I am going to gain from it, why should I not pollute is the sort of thought process that goes on in the minds of people. Which is why public goods and common resources are very important topics when we talk about conservation economics. These are cases where completely rational thinking destroys the environment.
And we have observed a number of such cases such as things like the Minamata disaster in which Chisso corporation just dumped untreated mercury containing toxic waste into the seas. Now, it is not that the people from the Kiso corporation did not know that mercury is bad for the environment, the thing is if we pollute the seas, then the cost will be paid by everybody, but the benefits will be gained only by us. So, why not pollute? That is the sort of thought process that goes on.
The smog of London. Everybody knows that if we are using fuel to heat the homes and we are using those fuels that are releasing pollution, that will lead to negative consequences, but the thing is negative consequences will be borne by everybody. But if I am using this fuel to heat my home, even though it is giving out a huge amount of pollution, but then, I am getting the heat so, I am gaining the benefit, but everybody is paying the cost so, why should I not gain the benefit?
A rational decision-making in these cases destroys the environment. Things like the release of toxic uh gases like dioxin, the dumping of waste into the Love canal, the Bhopal gas tragedy, these are all questions of conservation and rational thinking lies at the heart of them. What are these common resources, what are the public goods? Essentially, we can divide goods into four different categories depending on whether or not they are excludable and whether or not they are rivals in consumption.
Excludability is the property of a good whereby a person can be prevented from using it. So, when we say that a good is excludable, it means that one person can say that no, you cannot use this good, this good is mine or this good is ours and we will not permit you to use this good. So, you as a person can be excluded from using it.
A very good example is your home. If an outsider whom you do not know wants to enter your home, you will just say no, we are not going to permit you inside. So, your house is an excludable good, you can exclude people from getting inside. Private societies are excludable goods, you can exclude people from getting inside.
Your personal resources are excludable goods because you can always say that the pen that you have, you are not going to others; you are not going to permit others to use your pen, you can exclude them from using the resource that is the pen that is in your hands. The other criterion is rivalry in consumption. The property of a good whereby one person's use diminishes other for people's use.
When we say rivalry in consumption it means that if I consume the good, then you have less amount or less quality of that good available for consumption. A good example again is things such as forest. So, if I cut down a tree, then that and I take the timber away, then that timber is not available for your reuse. So, it is a rival in consumption. If I use more, you get less. If you use more, I get less. That is rivalry in consumption.

And using these two criteria, we have four different categories. The first one is private goods. Goods that are both excludable and are rival in consumption. Clothes, cake, ice-cream, congested toll roads. So, if I have a cake and if I eat up this cake, then less of this cake is available for you to eat.

So, it is a rival in consumption. The more I eat, the less is; the less remains for you, but it is also excludable. I can say that this is my cake, I am not going to allow you to eat it. So, it is excludable. Goods that are both excludable and rivals in consumption are known as private goods.

Another example is congested toll roads. Because the road is congested it means that if one more vehicle gets inside, if I take my vehicle inside this road, then it becomes a rival in consumption because you have less of the road available for use. So, essentially, if I get into this road, your speed also reduces. The more I use this road, the less it is available for others and so, it is a rival in consumption.

But at the same time, it is also excludable because it is a toll road which means that we can say that we are not going to permit other people to use this road, if they do not pay for getting inside. So, it can be excluded. We can raise the price of getting inside too high so that people effectively cannot use the road at all. So, it can be excluded. So, congested toll roads are also private goods.

The second category is club goods. Club goods are those goods that are excludable, but they are not rivals in consumption. Things such as cable TV. Now, in the case of a cable TV, it is not a rival in consumption because if I have cable TV in my house and you have cable TV in your house and if I am using the cable TV, it does not stop you from using the cable TV, it does not reduce the quality that you are getting in your home, it does not reduce the number of channels that you get in your house.

So, this is not a rival in consumption. But it is excludable because the service provider can always say that if you do not pay so much amount to me, I am not going to give you the subscription. So, it is excludable, but it is not a rival in consumption. Things such as mobile subscriptions. Here again, if I have a mobile, you have a mobile, then both of us can use the mobile, but it can be excluded. So, people who do not pay the charges will not get the mobile subscription.

Fire protection: if my house is protected, it does not reduce the quality of protection of your house. If there is a fire and if we have a fire service, then you are also going to benefit I am also going to benefit so, it is not a rivalry consumption, but it is excludable because if a private company provides this service so, the company can always say ok, those people who pay for the subscription are going to get the fire services others are not going to get it.

Things such as uncongested toll roads. Now, here, it is a toll road which means that it is excludable. So, people can say that; that those people who are not paying the tolls will not be permitted so, it is excludable, but at the same time, it is not a rival in consumption because it is uncongested.

So, there are so few vehicles on this road at present that if a few more vehicles get inside that is not going to make any difference in the quality of usage by the people who are already inside. So, these sorts of goods are known as club goods.

Another category is common resources. Goods that are rival in consumption, but not excludable. Things such as fish in the lake. Now, fish in the lake is a rival in consumption because if I take out more of the fish, if I do more fishing, then less fishes available for you.

So, it is a rival in consumption, but it is not excludable in most cases because people have free access to the lake. So, until and unless there is an authority that puts up a fencing all around this lake, it is not excludable, but it is a rival in consumption.

Things such as clean air, it is a rival in consumption because if I use the clean air and I pollute it in the process of using, then you will not get that amount of or that quality of clean air, but it is not excludable because one person cannot say that ok, this is my air, you are not; you are not permitted to use this air, it is there for everybody or congested non-toll roads.

Now, because this road is non-toll so everybody can use it, it cannot be excluded, but because it is already congested, the more people that get inside this road, that are using this road, the lesser the quality remains for the other people to use it. So, these are common resources.

Now, the issue with the common resources is the issue of the tragedy of the commons. A situation in which a shared resource where individual users, acting independently according to their own self-interest, behave contrary to the common good of all users by depleting or spoiling the shared resource through their collective action. It is a situation in which there is a shared-resource system.

So, the resource is shared which means that mean many number of people can use it and in in this tragedy of commons, there are these individual users who are acting independently according to their own self-interest and they are also doing a rational thinking, but in doing this rational thinking and in acting in their own self-interest, they act in a matter that is contrary to the common good of all the users.

So, by acting in their self-interest, they act against the interest of all the people, of all the users by depleting or spoiling the shared resources through their collective action. Good examples are overfishing and overgrazing. In the case of overfishing, all the individual users or any individual user while acting in his own self-interest would think that I should have more and more fish, I do not care whether these fish are being removed in a sustainable manner or not.

The only thing that I care about is how much profit can I make, how many fish can I take out, but when everybody does this, then the whole resource gets depleted, but in this case, everybody is acting in their self-interest, everybody is doing the rational thinking, but still the resource gets depleted. This is the tragedy of the commons.

And we have looked at this example that everybody in this village would want to have one extra cow, but when everybody is acting in their own self-interest, through rational thinking, acting independently they destroy the whole of the resource. So, this is a tragedy of the commons.

Now, there are certain solutions to the tragedy of commons. Things such as social arrangements. Now, in the case of the tragedy of commons, we said that individual users are acting independently.

Now, if we remove this term independently by putting in a social arrangement, now in this case, the social arrangement could say that ok everybody only gets 10 minutes to fish. Now, when you have such a social arrangement, then it is not possible for people to take out all the fish or for

people to do all the grazing.

Basically what it says is that we have a grassland and in this village, we have 20 people all with 10 cattle and every person gets 10 minutes for their cattle to graze. Now, in this social arrangement what happens? If Shyam gets 11 cattle and he is only getting 10 minutes for these cattle to graze so, what is happening is that in those 10 minutes because the cattle can only graze in a certain portion in this area so, his cattle will be getting less amount of fodder, but other people's cattle will be getting sufficient amount of fodder.

In such a social arrangement, we can ensure that people are acting in the benefit of the common resources as well. So, things can be regulated. Everybody getting 10 minutes for fishing with a specific size of net is again another social arrangement through which we can solve this problem or things like privatization.

In privatization, we can make this farmland a private resource. When it becomes a private resource, it becomes excludable and it becomes a rival in consumption. Now, it is already a rival in consumption, but by putting the clause of excludability, we can say that ok, if people have to bring in cattle inside, then for each cattle they will have to pay say 20 rupees. So, the people who are bringing in more cattle will have to pay more, this is another arrangement.

Or government regulation such as the UN convention on the laws of the sea. So, we can have regulation by the government as well about how these resources have to be managed. A very good example is the management of forests in our country. The supreme court says that a forest will be managed only according to a working plan and in the working plan.

The government makes a regulation about how many trees can be cut so that the extraction of timber happens in a sustainable manner, government regulation is a way to solve the problem of tragedy of commons. Another thing is internalizing the externalities such as tax on petrol which means that if because clean air is a common resource so, if the petrol is taxed higher so, in that case, the externalities are getting internalized.

The more one person is polluting by using a less fuel-efficient vehicle, the more they will have to pay. So, these are all different solutions to the tragedy of commons. Similarly, we have public goods. Goods that are neither excludable nor rival in consumption. So, you cannot prevent anybody from using this resource and these resources are not rivals in consumption which means that if one person uses this resource, then it does not reduce the quantity or quality of the resource or used by other people.

Good examples are things such as warning sirens. Now, if there is a siren that is blaring because a tsunami is nearby, then we cannot say that people who did not pay for this siren are not going to be permitted to hear it or if one person hears it, it does not reduce the quantity or quality of this resource for use by others because if one person is warned and other another person also hears it, he will be we warned equally well.

Or things like national defense. Now, if the nation is defended, everybody is defended, you cannot exclude somebody. It is not a rival in consumption because as citizens of the same country, if my nation is defended, then it does not reduce the quality of defense of you or your nation because we both belong to the same nation.

So, national defense is a public good. Scenic view, if a view is beautiful, then we cannot prevent

people from seeing it and if one person has seen a beautiful place, then it does not reduce the quality or the beauty of that place to be seen by other people.
Fundamental research, fighting poverty, uncongested toll roads now, uncongested non-toll roads. Now, these are all goods that are neither excludable nor rivals in consumption. In the case of uncongested non-toll roads because there is no toll so, there is no restriction so, it is not excludable and because it is uncongested so, there are less number of vehicles that are applying and so, if a few more vehicles get inside, it is not going to reduce the quality. So, these kinds of goods are known as public goods.
Now, in the case of public goods, we have the free rider problem. Free rider is a person who receives the benefit of the good but avoids paying for it. So, this is a person who receives the benefit. Why does he receive the benefit? Because this public good is non-excludable, but in this case, he avoids paying for it. So, he is getting the benefits without paying the cost. So, he is a free rider, and a good example is this example of Ram who is not paying for the beautification of his society but is gaining all the benefits of it.
Now, there are a number of solutions to the free rider problem. One is public sector provisioning of public goods. So, in this solution, what happens is that the public sector or the government provides the public goods. So, when we talk about things such as national defense, then it is the government's rule to provide for this good. When we talk about uncongested non-toll roads, roads that are joining the villages that are in very distant areas, they are provided for by the government and the government gets money through taxation. So, in this way, this problem can be solved to quite an extent.
Or social norms sanctions, in this case, if we have a resource such as a warning siren. Now, in this case, the social norms and the sanctions may say that everybody should pay for the warning sirens to be installed and if a person does not pay for the; for the warning sirens, then probably this person will be ostracized. So, social norms and sanctions can help solve the free rider problem.
Also, if they find a person who is doing uh free riding, then there can also be a social boycott. So, in this way, the social norms and sanctions can be used, or the use of voluntary organizations such as the Red Cross. Now, this is similar to the government providing these services or we can have contracts or we can have a private sector that is providing the goods at a cost such as lighthouses charging nearby ports.
Now, in this case, what happened was that the lighthouses used to provide direction and used to give a signal to the boats or the ships that there is a port nearby. Now, if there was a ship that was not paying for the running of the lighthouses, then in that case, the ship cannot be excluded from seeing the light and also this uh, but is non-rival in consumption. But then, if this happens, if nobody wants to pay for the running of the lighthouses, then there will be no lighthouses.
In this case, the solution was that the lighthouses started to charge the nearby port. So, they used to say that ok, if ships come to your port, then in that case, there will be business going on in that port. If you do not pay us, we are going to switch the lighthouse off. Once that happens, the ships will not know that there is a port here and they will just bypass your port and they will go to another port.

And in this way, the private sector so, in this case, the lighthouses were being built and run by the private sector, but the private sector started charging and they used to charge in such a manner that they used to get the fund or integration of the potential free riders. A builder who is constructing a complete colony will not worry about free riders using these street lights since all the land where the land where the light is falling is his.

So, streetlights are also public goods because you cannot exclude people from using them and they are non-rival in consumption, but if nobody pays for the streetlights, then what will happen? There will be no streetlights.

So, either the government can provide for the streetlights or the builder can provide for the streetlights and when the builder provides for the streetlights, then there is no issue of free riders because the land that is being lighted also belongs to the builder. So, in this case, the integration of potential free riders can solve the problem.

In certain situations, the free rider problem is very easily solved through private provisioning such as when some individuals care more than others because of their higher income or stronger taste for public goods. So, a rich person may pay for getting his surroundings clean, irrespective of whether poor people in the surroundings pay for it or not.

In this case, the public good will be made available by the rich person for the use of everybody because he cares so much about his clean surroundings that he does not care about whether others are paying for it or not. This is one case. Another is the case of altruistic activities. When individuals value the benefits and cost to others in making their consumption choices.

Example is when people trust others. If there is a person who trusts everyone or if there is a society where everybody trusts everybody so, in that case, the free rider problem will not be there because of the trust, because of an ingrained social value, the free rider problem will get solved by itself.

Or the warm glow model, a model of the public goods provision in which individuals care both about the total amount of the public good and their particular contributions such as getting publicity by doing social work. Now, in this case, the public good is being made available through social work because people feel good about doing the social work. So, these are three cases where the private provisioning or free rider problem can be done.

Now, there is one issue when we say that the public sector can provision for the; for the public goods, one is that they can be crowding over which means that as the government provides more of a public good, the private sector will provide less, and this will lead to a contraction of the private sector. Now, if you want a free-market economy, if we want a capitalist sort of a system, in that case, crowding out will become a serious problem.

But then, the solution is to contract out. An approach by which the government retains the responsibility for providing a good or service but hires private sector firms to actually provide the good or the service such as government hiring private firms for cleaning of localities and paying them through the tax revenues.

In this case, the private sector will be working because they are actually doing the cleaning operation, but because the government is acting as an intermediary by paying them through the tax revenues so, in this case, the free rider problem gets solved automatically because the

government ensures that these private sector firms get money for doing the work. So, this is an option.

In summary, we have these four kinds of goods determined by whether they are excludable or not and whether they are rivals in consumption or not.

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