Environmental & Resource Economics
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Optimum extraction of renewable resources and Tragedy of Commons Part - 4

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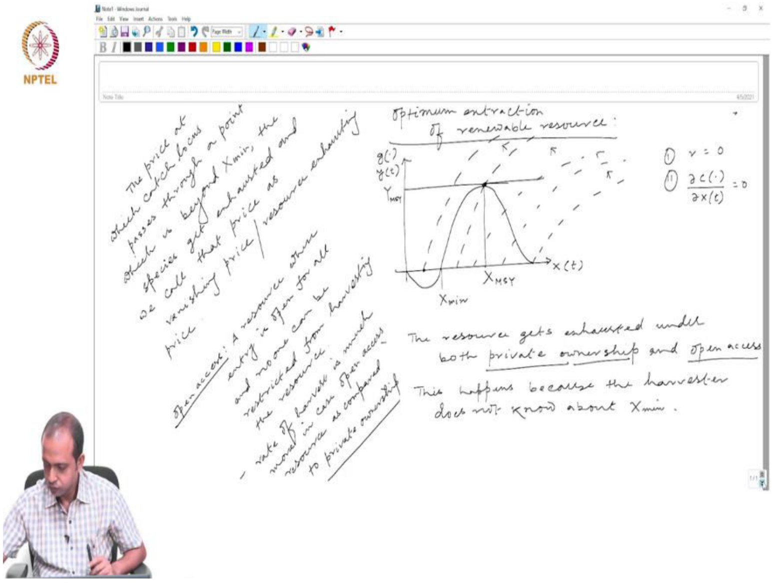

Welcome once again to our discussion on optimum extraction of renewable resources, we are discussing about optimum extraction of renewable resource. So, you are discussing optimum extraction in the context of fishery.

And in our last class we are basically discussing about what should be the economist optimum, what should be a biologists optimum and where should, when under what condition both the optimality conditions should converge to each other. That means, conditions for economists optimum to converge with that of the biologists one.

So, in terms of a diagram. Once again, if we draw the diagram let us say an x axis we are measuring stock, and here we are measuring let us say g dot that means growth, as well as extraction, and let us say, this is our, sorry, this is the growth locus. And then what we did, this is basically the point which is XMSY maximum sustainable stock corresponding to maximum sustainable yield and then this is basically the point.

So, that means, a rate of extraction corresponding to our maximum sustainable lean, we can call it why YMSY maximum sustainable yield. And then, while discussing about the two type of optimality, economist and biologist, we said that so whenever this catch locus intersects the growth lockers, we said that, that is the economist optimum because that is the steady state your growth rate is equals to rate of extraction that is what the economist want.

And in a particular case when the growth locus intersect, catch locus intersect the growth locus at its maximum then we say that economic optimum actually converges to biologist optimum, and there are two conditions that also we discussed in our previous class, that economist optimum will converge to the biological optimum under two conditions, the condition is number 1, that discount rates should be 0 there is no discount rate.

If there is no discount rate, that means, even if we maintain a stock which is actually higher than XMSY, so what will happen, that since there is no benefit from for preservation of the resource for future use, so it is better to use the resource today. So, extraction will increase, rate of extraction will increase and again the situation will come back to this point.

And second condition we discussed that stock effect on cost of its extraction del c dot del xt should be 0. And in that case also if we maintain a stock which is higher than XMSY, since there is no extra cost saving on rate of extraction because of this higher cost, so stock will immediately come down to its initial situation of XMSY.

Now, if the fish catching becomes so attractive, then what will happen? What may happen actually, this catch locus will keep on sifting outwards and it may so happen that at one point of time catch locus passes through this point which is actually less than x-mean.

So, the moment the catch locus passes through this point then the species will vanish. Then we say that, that price at which, so the price at which catch locus passes through a point, which is less than x-mean or which is beyond x-mean that species get exhausted, and we call that price as vanishing price or resource exhausting price.

Now, the resource get exhausted, the resource or the species, the resource gets exhausted under both, private ownership and public ownership also, private ownership or open-access private ownership, as well as open-access. Now, why this is so? This happens because this happens because the harvester does not know about x-mean.

So, even when it is a private ownership, we may feel that the resource is well-maintained under private ownership that is true, but still under private ownership also the resource get exhausted when the fish catching or the resource becomes so attractive for its price because the harvester does not know what does x mean. So, he will keep on, he or she will keep on increasing the rate of extraction, the catch locus will seep continuously shift upward.

And at one point of time it will pass through this point, which is beyond x-mean. This may happen under both private ownership as well as open-access. Because neither the private owner nor the other people they were aware of this x-mean level of stock. Now we have introduced one concept called open-access. What is open access actually?

Open-access is a resource where entry is open for all and no one can be restricted from harvesting the resource. And rate of harvest is much more in case of open-access resource, as compared to private ownership, that is what. Now, what we will do?

We have discussed a situation called open access, private ownership, we have discussed the context of open access. We will now compare the two situation what actually happens in case of private optimality, what happens, when the resource is open access to think about exactly the mechanism by which rate of extraction actually is much more in open access, as compared to the private ownership. Let us compare the two situation.

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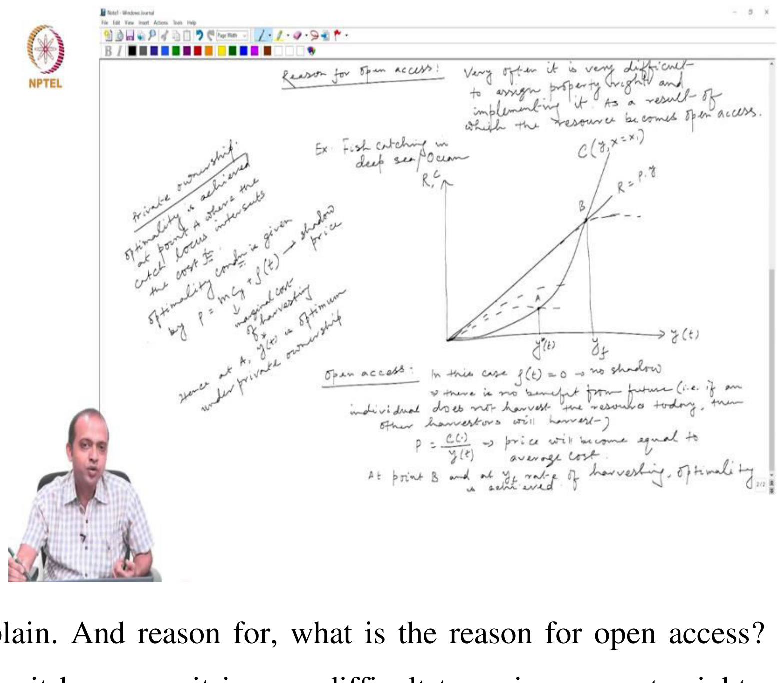

So, we will explain. And reason for, what is the reason for open access? Reason for open access very often it becomes, it is very difficult to assign property right and implementing these and implementing it, as a result of which the resource become open access. For example, fish catching in deep sea in the context of deep sea and ocean it is really very difficult to assign property right.

Who is assigned with the property right to catch fish in deep sea and deep ocean. So, that is called open access resource. So, basically, if we draw a simple diagram to understand the situation. Let us say that, in the y axis we are measuring rate of extraction yt and in the x axis, this is yt, and in the y axis we are measuring revenue, as well as cost.

This is let us say, the revenue curve, this is the revenue curve which is equals to p into y, price multiplied by the rate of extraction. Then we also have a catch locus, this is catch locus, which is given by y, and a particular stock let us say x equals to x1. I will make it a little flat, sorry. So, in case of private ownership, let us say this is the point, first we discussed about private ownership.

Optimality this is point A, optimality is achieved at point A where you have actually this is the cost curve and you are having let us say this is catch locus and this is let us say yt star achieve at A where the catch locus intersects the cost function. So, basically, if you recall, this is the point, the catch lockers is nothing but several optimality point where the first order condition is satisfied.

Now, in case of private ownership, sorry, in case of open access, sorry, here the condition is and the optimality condition is given by p equals to mc marginal cost of extraction plus rho t, where rho t is the shadow price. This is the mc marginal cost of harvesting and this is a shadow price. Hence at A yt star basically indicates is optimum, under private owners.

Now what happens in case of open access? In this case rho t actually equals to 0 rho t becomes 0. Why rho t becomes 0? That means, there is no benefit from future. That means, if i an individual does not harvest the resource today then other harvesters will harvest it. So, why rho t is basically, what is the meaning of rho t equals to 0?

rho t is basically the shadow price. That means, in case of single ownership when I use a resource today there is some kind of opportunity cost because the resource would not be available for future. If I do not use it today, the resource will be there for me for tomorrow's use, no one else will come to extract that, that is why, in case of private ownership it makes sense to preserve the resource for tomorrow, as a result of which we impose some kind of positive rho t value.

But when the more resource is open access, then there is no benefit from future, there is no benefit from preserving the resource because if I preserve it, if I do not extract the resource today, there is no guarantee that resource would be available for me tomorrow, because some other harvesters will definitely come and they will harvest it.

That means, each individual will try to maximize its harvest as much as possible at present period itself, that is the meaning of rho t equals to 0. So, no shadow price, which means, no shadow price in this case of open access. And in that case price would become only c dot divided by yt. That means, average cost will be equals to the price, price would become equal to average cost. So, in case of private ownership p equals to mc plus rho t.

The moment rho t equals to 0 in the context of open access resource price is no longer equals to marginal cost. Why this is so? Because we you think this situation as a perfectly competitive market, what happens in the short run, price equals to marginal cost of production. But in marginal cost pricing there would be a positive profit. So, other firms will enter into the market, and then they will take the price drive to average cost. That is why in the long run equilibrium p equals to mc equals to LAC long run average cost curve.

Some kind of similar analogy. You can apply similar type of analogy here also. When there is private ownership, price equals to marginal cost of extraction plus rho t. The moment we make an open access rho t becomes 0, price becomes equals to only average cost, price becomes average cost. And in that average cost pricing the equilibrium actually happens here in this point where c is equals to cost equals to revenue.

Same type of situation in the context of perfectly competitive market. Because there is lot of entry in the market, cost of production increases. And here also when there are a lot of entry in that resources cost of extraction increases, as a result of which equilibrium happens at a point where c equals to revenue, cost equals revenue, just the break even, there is no positive profit. So, some kind of catch locus will pass through this point.

So, this is the point where the optimality achieved here at B in case of open access resource and this is called yf optimum rate of extraction in the context of open access resource. So, at point B and at yf rate of harvesting optimality is achieved. So, that means, what we see that rate of extraction is much more in case of open access resource. Why this is happening? Because too many entry makes it more costly for the extraction, cost of extraction increases. So, to break even obviously, the harvester has to harvest more.

There is no benefit from preservation. As a result of which catch locus will shift upward and make the optimality point at a level where cost is actually equals to the revenue. It is just the breakeven point for the harvester.