Environmental Impact Assessment
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Lecture 40
EIA Methods Ecosystem Services Part I

Welcome to the course Environmental Impact Assessment. In today's lecture, we will cover ecosystem services. We will look at the methods covered in this, in the larger ambit of EIA methods. We have earlier looked into the ecosystem services. We have seen what kind of services are there.

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So, we saw different types of ecosystem services from provisioning services to regulating services, supporting services, and cultural services. We highlighted the global decline in the extent of conditions and functionality of ecosystems and their capability to provide services with potentially serious consequences to us. We also saw various drivers of change through the report.

So, in this lecture, we will develop further detailed conceptual understanding, to conceptualize better different methods used in scoping and impact assessment of ecosystem services. We will do this section in two parts. This one covers part one.

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So, accordingly, our coverage will include, we will look at the introduction to ecosystem services, we will look at various definitions and concepts, concepts covering ecosystems, natural capital, ecosystem services, we will look at ecosystem service benefits, and beneficiaries. We will look at the evaluation of ecosystem services. We will look at services demand and use, as well as we look at the service supply and access. Further, we look into the key interrelationship between ecosystem and ecosystem service supply use demand and benefits.

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Accordingly, the learning outcomes expected from you after completion of the session will be that you should be able to define and explain the concepts, all the concepts we talked about ecosystem, natural capital, and ecosystem services. Then you should be able to synthesize the key interrelationship between ecosystem, ecosystem service supply, use, demand, and benefit.

The key textbook we are following for the EIA method is Riki Therivel and Graham Wood's fourth edition book. For this section, you may read Chapter 8 on ecosystem services. As suggested by Therivel and Wood,

we see currently in the EIA process ecosystem services are not very well addressed, because of the economic market and current approach, even though natural ecosystems generate economically and socially important services for us. Even then, we do not address that.

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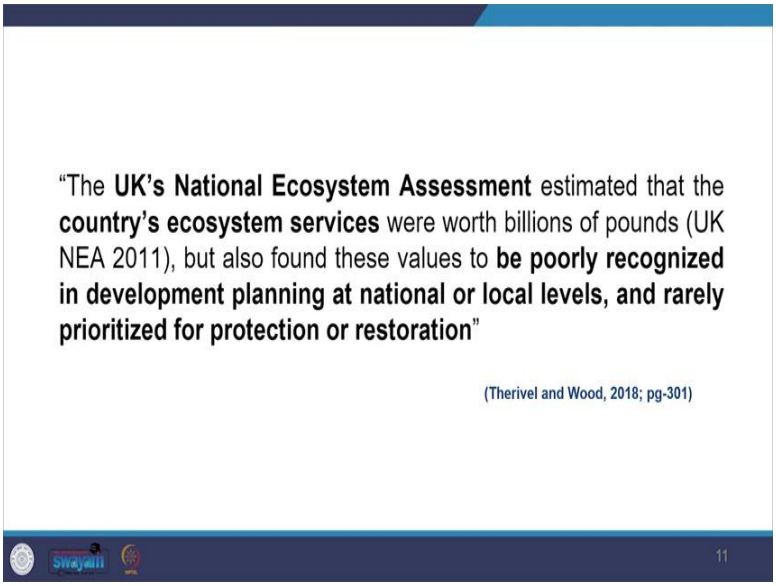

For example, as quoted in the book, we see that the UK and the United Kingdom National Ecosystem Assessment estimated that the country's ecosystem services were worth billions of pounds. However, it was also found that these values are poorly recognized in development planning at national or local levels and rarely prioritized for protection or restoration. So, we see a very weak implementation of this. Also, they suggest that the cost of ecosystem degradation is rarely taken into consideration or even addressed through mitigation, even when impacts are significant, through certain projects.

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So, for example, we can see as stated by Therivel and Wood, Tardieu's study provided minimal damage estimation of losses in the range of point 2 million pounds every year of ecosystem services because of high-speed rail project in France. As we have seen different types of services the ecosystem provides in the

current economic terms, we often do not assign value and also do not consider in trade-off list in the decision-making process.

So, there is the absence of this and you may note that ecosystem services have very intense and extensive social and economic impacts. It is difficult to measure one reason is that it is difficult to measure such benefits but are highly valued. The major difficulty is to place our ecosystem services into decision-making is that of linking changes in the ecosystem which changes our well-being.

So, it is very difficult to link that, and especially where less tangible values and benefits are involved like beauty, quality of life. So, as suggested, including ecosystem services at the beginning of the decision-making process of the project can help development planners to consider the full range of benefits and costs associated with their actions, and it would allow proper consideration of the project planning as well.

However, there have been challenges. Now, the scenario is changing as the International Finance Corporation, IFC requires ecosystem services to be addressed in assessment reports for development looking for funding, So, the funding would be done only when ecosystem services have been addressed and assessed in the report.

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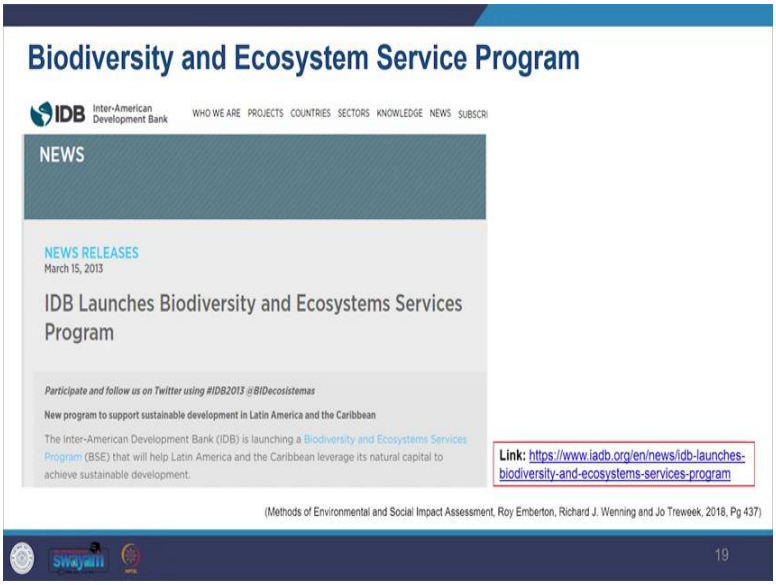

The Inter-American Development Bank also takes a strategic approach through a biodiversity and economic system program that supports countries in Latin America and the Caribbean to integrate the value of ecosystem services into key economic sectors and protect priority region ecosystems. These examples indicate that there is a growing awareness.

So, now, we are getting more sensitized. And the sense of responsibility within the business community, that the unsustainable way of drawing down natural capital, and associated decline in ecosystem services can be a material risk, So, there will be a huge risk to the successful development.

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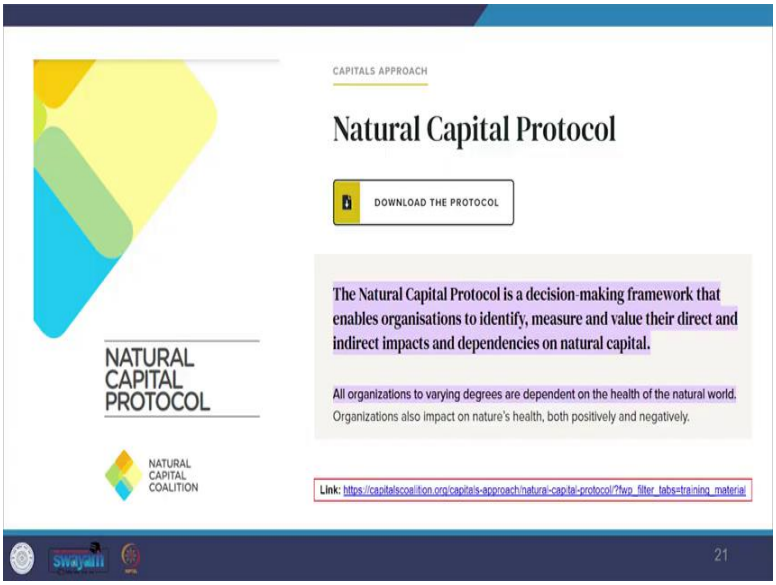

We see that numerous businesses and companies have recently agreed to our natural capital protocol for incorporating natural capital in their business planning and decision-making based on standardized principles So, there is improvement in the way we are handling it, and addressing it. Environmental Assessment is now considered an important mechanism to measure the impact of the project and to estimate the dependency on natural capital and ecosystem services. There are many guidelines available to undertake such estimations.

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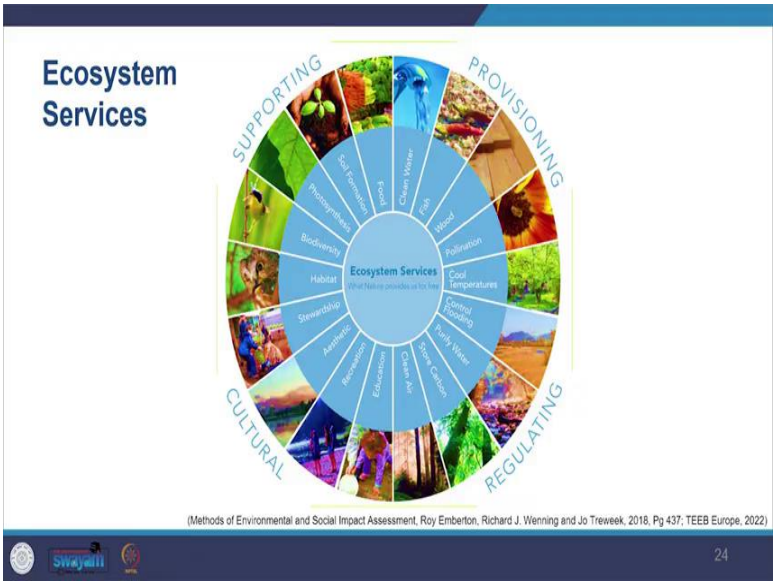

Ecosystem services are multi-dimensional concepts. There are a lot of things which are involved. They depend on many aspects, and therefore, assessing impacts and reliance on them requires a comprehensive perspective of environmental and social changes. To undertake this, we need to understand all the dimensions of it. So, that is why it is very complex. This assessment requires the synthesis of many segmental assessments, which are done in the assessment process.

However, it has been emphasized by many that ecosystem assessment should be undertaken systematically, as it indicates material risk and impacts. So, it is important, it is been emphasized a lot and already these

have not been addressed substantially in the past. So, this makes it even more costlier for us to rectify or correct. So, this process allows us to capture the unanticipated costs and benefits of the project more comprehensively than a standard EIA.

So, when we do this, we consider it comprehensively in totality, and we can identify stakeholders who might otherwise be missed in the usual process that we take. Now, we look at definitions and concepts that are important to decide the approaches and methods used for assessing impact through quantitative and qualitative approaches. There is also a prevailing view that the ecosystem service perspective should be used as a complementing study then replacing the existing assessment approach.

So, the existing assessment approach starts addressing the ecosystem service assessment. So, rather than replacing it, it is suggested to complement the existing study. It also requires a collaborative mindset. So, when one has to do this, one needs a collaborative mindset to integrate things, it also needs active engagement between specialists.

Since it deals with multi-dimensional, it further needs in-depth understanding and it needs to integrate different approaches. And integration will provide a better perspective to locate our interventions in the line of sustainable development.

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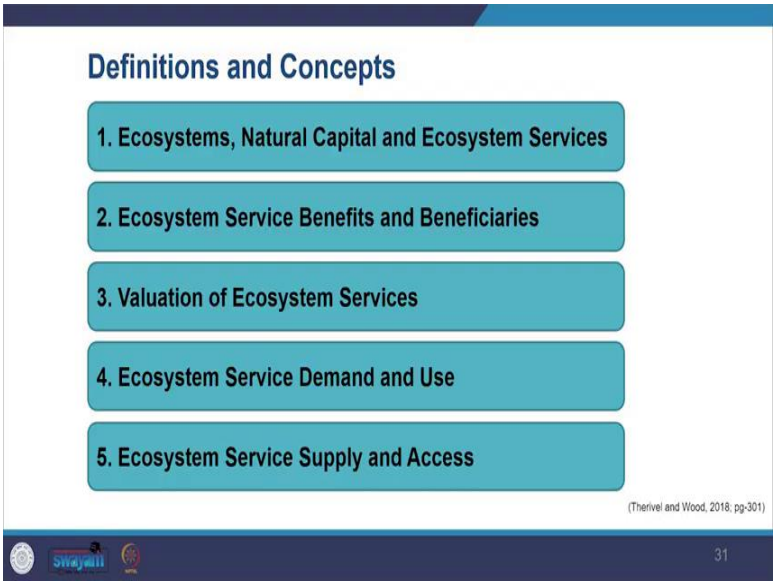

Therefore, we will look at the following definitions and concepts. The ecosystem natural capital, ecosystem services, benefits, beneficiaries, and ecosystem service valuation, we will look at the service demand and use, and we will look at the service supply and access.

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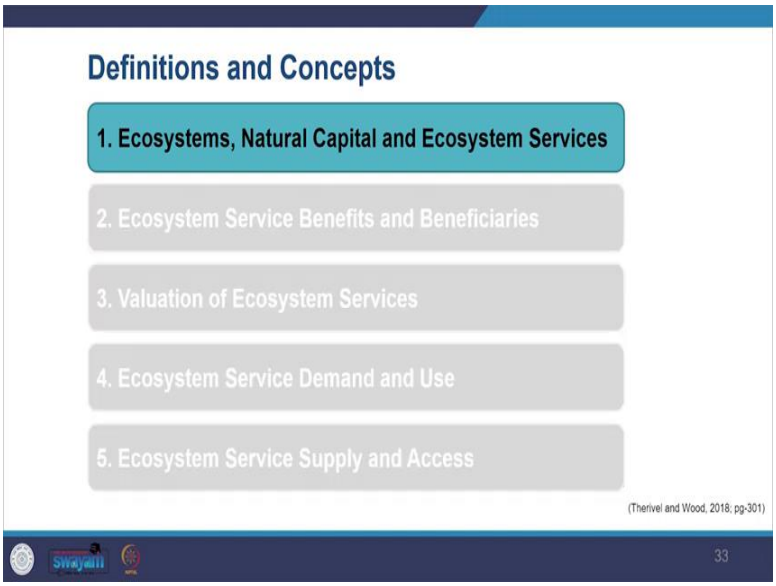

Looking at ecosystems, natural capital, and ecosystem services. In particular, it is important to differentiate clearly between ecosystem service supply, demand, use, and benefit as these have to be described or quantified to predict the impact in the process. So, you need to know these very distinctly So, that you can quantify or you can describe it in the process.

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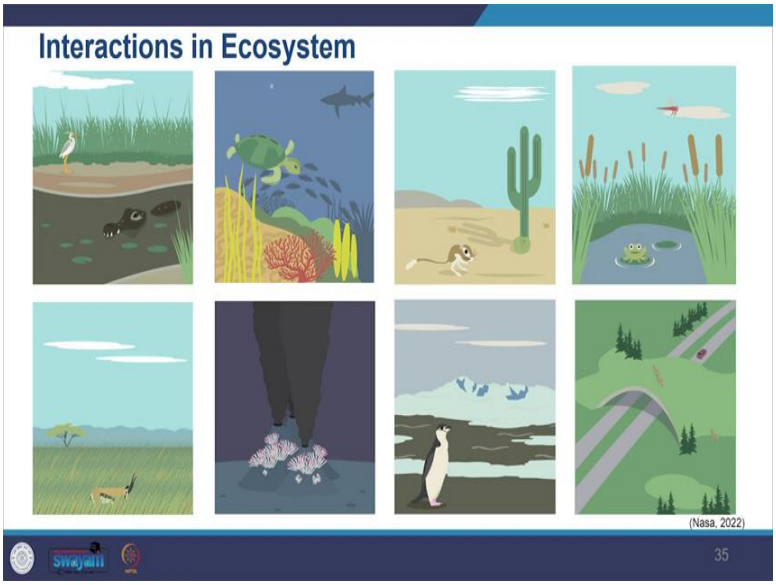

An ecosystem is said to be a dynamic complex of plants, animal, and microorganism communities and their nonliving environment interacting as a functional unit. Here in the image, you can see a range of interactions in the ecosystem. Ecosystems are sometimes referred to as natural capital, which reflects the economic semantics of capital stock and flows.

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Natural capital is the natural assets, the stock of living and nonliving environmental resources, which are potentially available to generate value So, we can derive value out of it. So, those are called natural capital. Ecosystem services are the flow of benefits that the stock provides. So, what we can extract is the ecosystem services. They are multiple beneficial goods and services taken by us from ecosystems. These services are numerous and considerable.

So, there are a number of them, they are required for our health and survival and our economic activities and enjoyment of life. So, we draw a lot of services from the ecosystem. Ecosystem services are the direct and indirect contributions made by the ecosystems for our well-being and also for projects,

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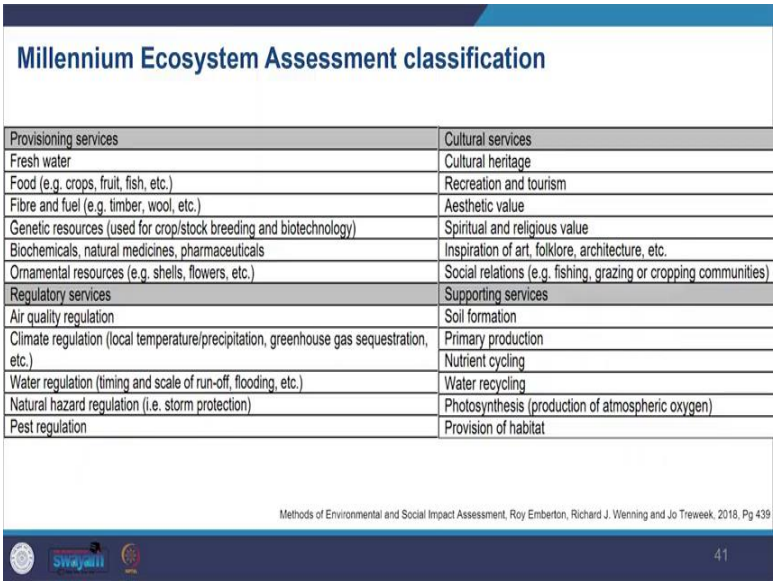

We see general four classifications as per the Millennium Ecosystem Assessment classification of ecosystem services. First, we see provisioning services such as food, freshwater and So, on, then we see regulating services, services that contribute to our well-being from the control of natural processes such as air quality, control, climate regulation, protection from natural hazards and So, on.

We see cultural services such as recreational, spiritual values, and aesthetic enjoyment, and then we see supporting services which are the natural processes needed to maintain the other services such as primary production or nutrients and water cycles. So, you can see the Millennium Ecosystem Assessment classification of ecosystem services. It is important to understand their role in maintaining our well-being and to understand how they will be affected by a proposed project in a cumulative manner.

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Further, we will see two more terminologies in this that are the final services and the intermediate services. So, the financial services are the ecosystem services that directly benefit our wellbeing, So, they are direct, we draw it directly, for example, livestock farming, which provides us direct income through meat or milk. And it is very easy to identify specific beneficiaries connected with final services.

However, intermediate services are the indirect support we receive or derive such as hay production, which indirectly helps in supporting livestock production. So, we take that and use it in an intermediary and then eventually it comes to us, So, they are intermediate services. It is difficult to identify the end users particularly where multiple ecosystem services have multiple beneficiaries and the chain is very complex, the supply chain is very complex. However, even if it is complex, it is a very important aspect to be covered under assessment.

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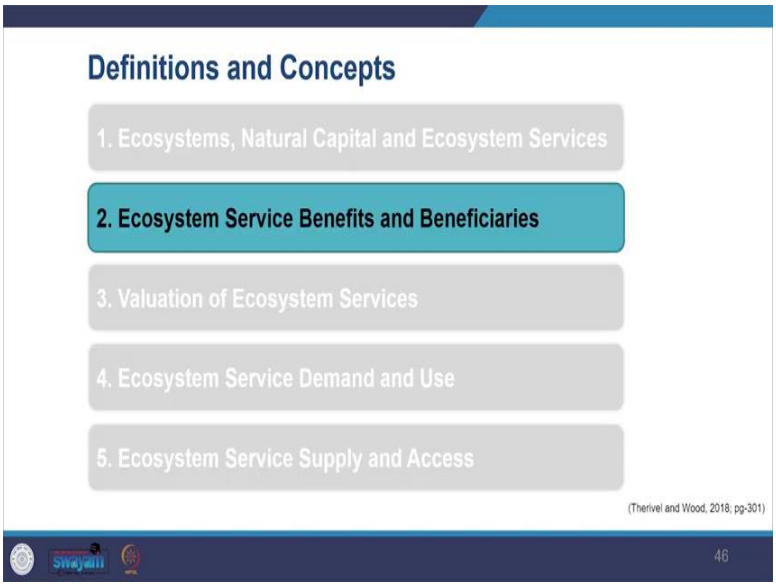

Now, we will look at what are the ecosystem services benefits. And how do we identify beneficiaries? Ecosystem services benefit is the gain we get from the use of ecosystem services regularly and in totality. So, that is the ecosystem service benefits, So, something which we use. Beneficiaries are the people who get the benefit from ecosystem services. So, that is how we differentiate between the two.

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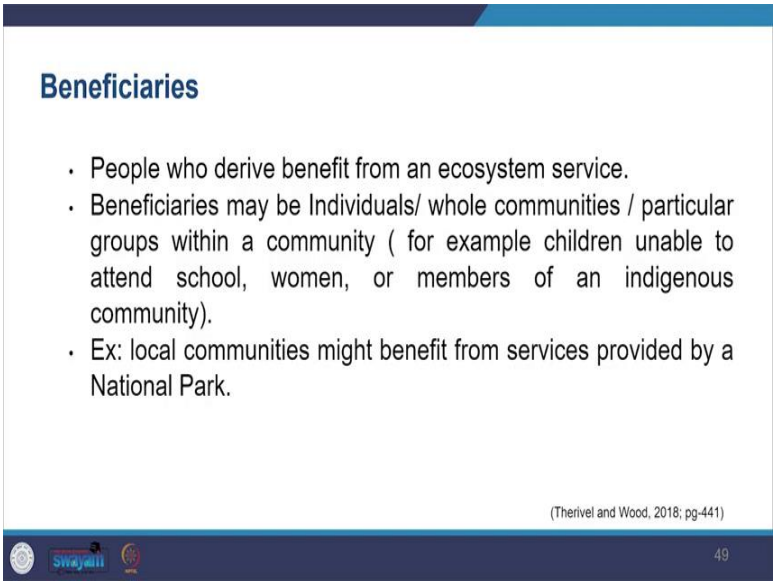

Beneficiaries may be individuals, a whole community, an entire community, or a particular group, within the community, for example, children unable to attend schools, women, members of the indigenous community, and so, on. So, you see the wide range of beneficiaries here. This is the main purpose of the ecosystem services assessment to identify who is using which services and this has to be done in the context of before the development takes place.

So, before development, you need to access it, you need to assess it. So, your work will be to identify the people who will face significant changes in the benefits when the project comes up. So, whenever your

development project comes up, who are the people who will face these changes? You will be required to identify beneficiaries at very different spatial scales.

For example, local communities might benefit from services provided by a national park, but So, may international visitors or even people who have never visited the park, but derive benefits from the knowledge that they learn from that place that exists to conserve endangered species. So, there can be a wide range of users at different scales, you can see that here.

You have to know the changes that will happen in the capacity of an ecosystem to supply services, any change in the capacity will have very different obligations for beneficiaries. So, whenever the capacity, whenever the capacity will change, it is going to impact the beneficiaries, it will depend on how much they have been reliant on our service. Also it will depend on their ability to access or use alternative services.

So, if they are solely dependent on that particular service, then it is going to hamper them or the impact would be much higher on them. Therefore, the impact assessment you make needs to be quite precise, and consider how different beneficiaries might be affected by the same changes in an ecosystem. So, this may require information on levels or frequency of use by different beneficiaries, So, you may have to collect those data as well.

One of the main challenges in the assessment is to develop defensible methods for detecting key dependencies. So, you should be able to support logically, support the methods you are using for identifying these beneficiaries, and also detect key dependencies. So, the usage of your method has to be justified properly, So, that has to be checked by you.

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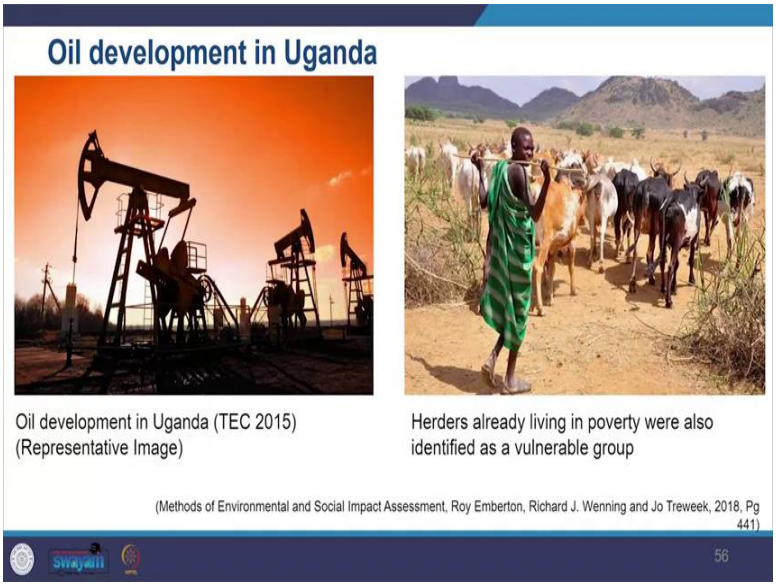

For example, an ecosystem services review for oil development in Uganda revealed high levels of dependency of hired cattle herders on livestock production from open-access grazing. And ecosystem service dependents that did not emerge as being particularly significant in socio-baseline surveys carried out for the EIA purpose. So, how you do it may have a different result altogether.

The proposed development was expected to catalyze, proposed development was expected to catalyze increased levels of land enclosure and settled agriculture, with potential benefits in terms of reducing pressure on forests from existing livestock grazing regimes and boosting local food production. However, an integrated approach through ecosystem services revealed a specific and significant risk from the land enclosure to hired herders.

So, a lot of things can be revealed in the process. This group is particularly vulnerable because they do not own, depend absolutely on unemployment for income and food, and have highly restricted alternatives. Mitigation recommendations therefore included efforts to improve land use zoning So, that open-access grazing could persist at a substantial, sustainable level.

The herd is all greedy living in poverty and was also identified as a vulnerable group, potentially requiring targeted innovation in the future to accommodate changing agricultural practices. You may also reflect that even the projects are also the beneficiaries of ecosystem services themselves. The proponent's project may fail if they do not recognize their reliance on ecosystem services.

Many of the projects are needed like they need a sustainable supply of ecosystem services for their activities. For example, the project might need a regular supply of cooling water for a lake ecosystem, which they might not miss identifying because they are going to run their setup on that. But they may miss understanding the reliability of the water supply in the future so, they might miss how it is going to be available in the long run.

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For example, if you are assessing hydropower on the river system supplying the lake, you need to consider the quantity of water availability, you need to see the land management around the lake, or poor land management might affect the availability of water in the lake. Therefore, for the new project, you need to consider the exact and correct assessment of the impact on ecosystem services and dependency on ecosystem services.

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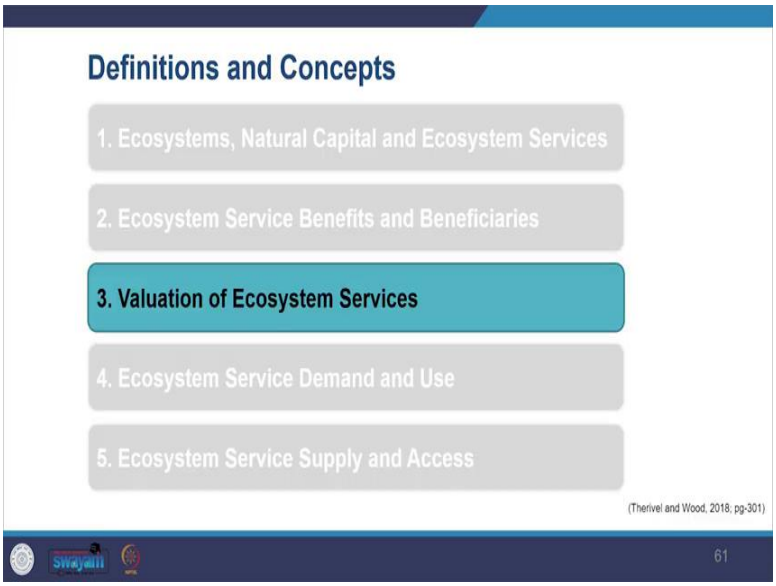

Now, looking at a valuation of ecosystem services, So, this is another important part, which you need to take care of. Even though most of us take benefit, and profit from ecosystem services, you can think about many benefits that you get but do not pay for them. So, we do not pay for all the services we enjoy or use or need, and therefore many ecosystem services have no market price. However, these services have value. So, it is valuable for us.

We derive utility from their actual or potential use and also value them for reasons not connected with the use or non-use values. We get economic benefits from ecosystem services as support in income generation, our well-being, and protection. So, there is a lot of value to it, though we do not put a market price on it.

When we adopt an economic evaluation technique to put a value to it, then we try to bring out choices for changes in ecosystem impacts in terms of money, and monetary value we put that. It is not necessary to use economic valuation techniques to describe or quantify benefits from ecosystem services. That is not required. But there are some advantages of it in certain cases when we put a value it is very easy to identify and compare the choices you have.

So, when you have identified the changes in the well-being and evaluated its significance, you can compare the cost and benefits of the development alternatives or you can prioritize which services to consider at the scoping stage. So, you will also know where to prioritize when you are scoping were choosing areas for further study.

There are many methods developed for preference evaluation methods, including market and nonmarket economic valuation, as well as nonmonetary methods. You can see that it can be used to estimate values for ecosystem services. You may, however, face the challenges of how to apply them and how to obtain the data needed for them to be reliable and effective So, that challenges might be there.

There is still a challenge for experienced practitioners so, it is still limited, and the time and resources to obtain reliable data and results is also a big challenge, particularly when new data is required to be collected.

Qualitative indicators of ecosystem services may be useful and fast in the absence of data. So, you need not necessarily go for quantitative indicators you can also go for qualitative indicators for your assessment purpose.

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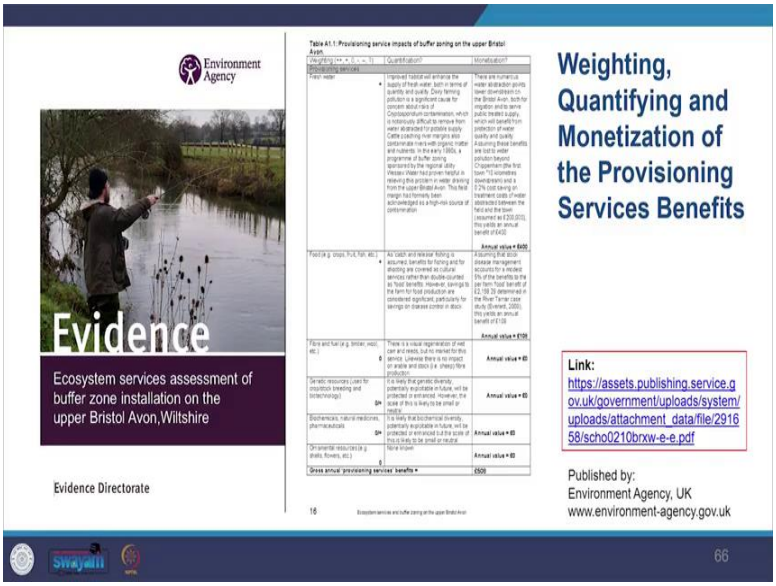

You may see the example here of weighting, quantifying, and monetization done of the provisioning services benefits from the environment agency of the government of the UK. The report outlines the background methods findings and learnings following an assessment of changes in ecosystem services stemming from like in this project, the installation of a buffer zone in the range of 330 meters of one of the banks of the upper Bristol Avon catchment in North Wiltshire.

So, this is the assessment report actual government report that we are looking at. So, you can see here, how they have been monetizing, waiting and identifying and monetizing, giving value to that. So, you can look at the bottom row, how the value is assigned to the ecosystem services.

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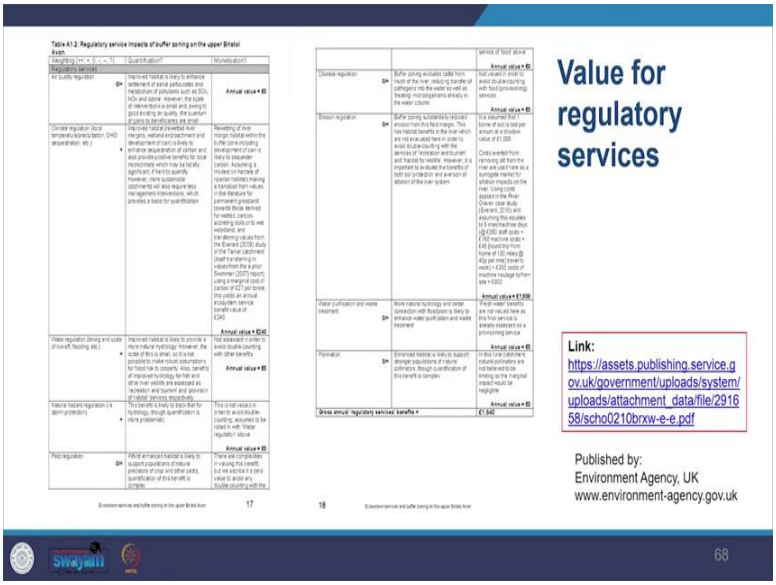

Likewise, you can see how they have estimated the value of regulatory services. You can see again the value at the bottom here for the services translated in terms of numbers.

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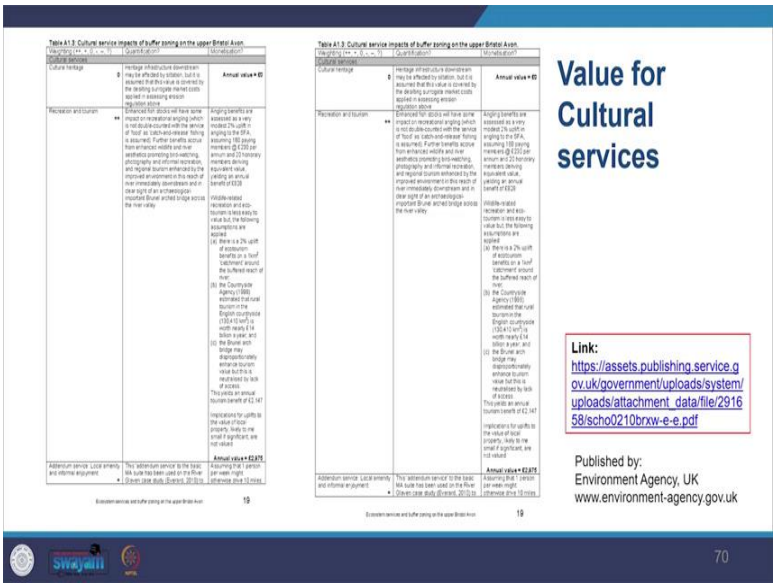

Likewise, you can see how they have estimated the value of cultural services. Again here you can see from the snip from the report, that the report has been attached for you along with the references given you can see this case study.

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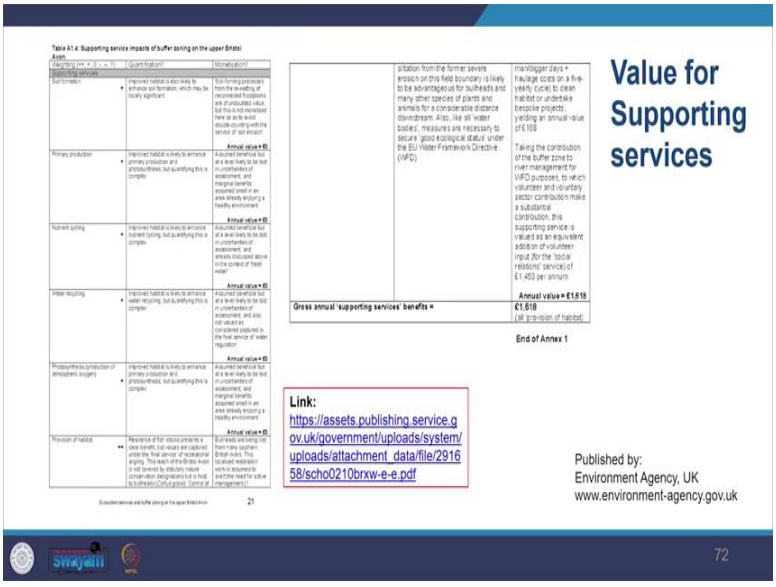

Likewise, you can see how they have estimated the value of supporting services. So, see how the evaluation is done and how the judgment has been made.

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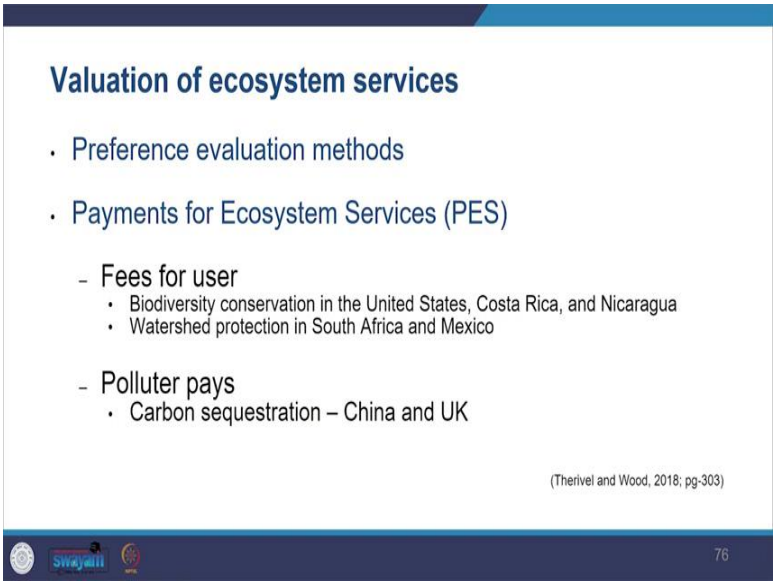

You may also note PES which is payments for ecosystem services. These are a mechanism for people who manage ecosystems to benefit from generating ecosystem services. So, they are encouraged to provide the services that are used for enjoyment by others. You may think about government conservation agencies, private or community landholders, or not NGOs implementing ticketing systems and a lot of services for the tracking and other enjoyment which you take in all the natural spaces.

PES payments for ecosystem services schemes are market-like mechanisms. So, they are a market-like mechanism that allows ecosystem services to be valued and traded. So, you can put a value and you can exchange that service. So, PES can also be a proxy for the cost of damaged users such as a polluter pays principle, So, not only for the enjoyment, but also when you are damaging causing damage, you have to pay a value for that.

So, people who damage the environment must compensate for the damage. Carbon markets are an example of this, allowing users to buy and sell carbon emissions rights in a cap and trade system. PES schemes exist for carbon control in China and the United Kingdom, watershed protection, and South Africa and Mexico and we can see biodiversity conservation in the United States, Costa Rica, and Nicaragua. PES is therefore considered to be a very effective mechanism for investing in and delivering mitigation or for offsetting the impacts.

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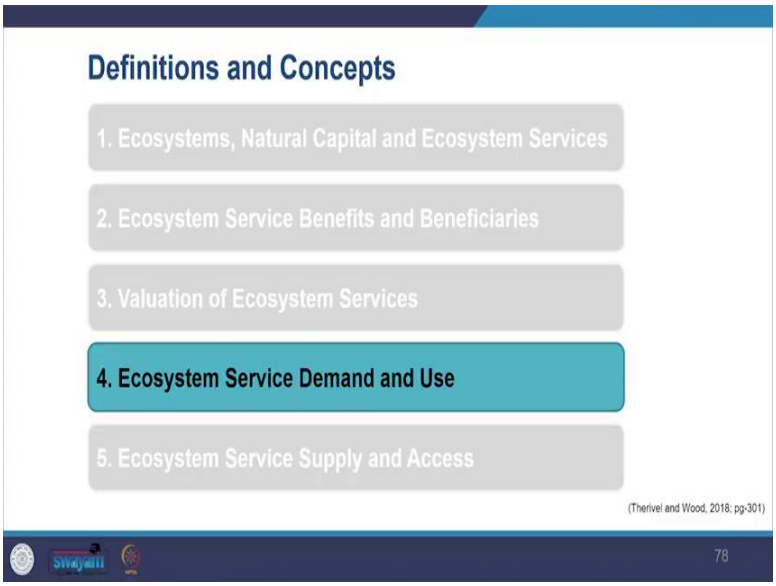

Now, looking at the ecosystem service demand and use concepts, So, we are going to look at what is demand and what is used concept.

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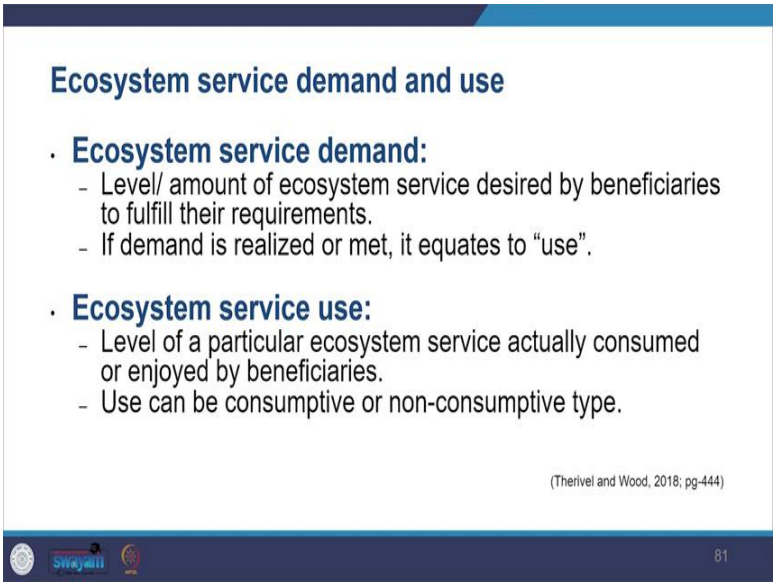

Ecosystem service demand is the level or amount of ecosystem services desired by beneficiaries, you or me, or the community in the context to fulfill their requirements. So, how much do we need, if the demand is realized or met it equates to use. So, whatever we can take it is equated to use. Ecosystem service use is the level of a particular ecosystem service consumed or enjoyed by beneficiaries.

So, whatever we can consume, the use can be of a consumption nature, such as agriculture, crops, food, and water, what we consume, So, it can be consumption native or can also be of non-consumption nature such as recreational or spiritual procession of landscape, wildlife, and So, on. So, the concept of use is particularly important in the assessment process as a means for linking ecosystems.

So, how it has been used? So, we need to understand because we will be able to connect it with the benefits of the user side. So, once we know the user will be able to connect it. It is also important to assess the sustainability of use in the baseline without the project, how in the future would be, and with the project.

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We will see the term now, use-shed. We are looking at the term use-shed, it is the area people use for getting a particular ecosystem services. So, what is the rain, what is the use-shed from where people get people get those services, for example, the firewood area from where villages collect firewood or the extent of that area? Another example is the river catchment from where people get the drinking water.

So, that would be the use-shed. While you are assessing the use-shed you may be conscious of the chances that the proposed project may change the supply and use of the ecosystem and also change the use-shed itself. So, not only it would change the supply or the services, but it might also change the use-shed itself the profile of it by maybe by the designing of new roads or the change in the rate which is brought about by the new technology by the development there.

So, the development of a paved road through a forest. For example, we can see here in conjunction with increased economic opportunity and the ability to purchase vehicles could expand the use-shed from a few kilometers around the village to hundreds of kilometers. So, the use-shed can also increase because of the increase in the demand, use-sheds for nonuse values can be very large, and for services such as climate amelioration might be global.

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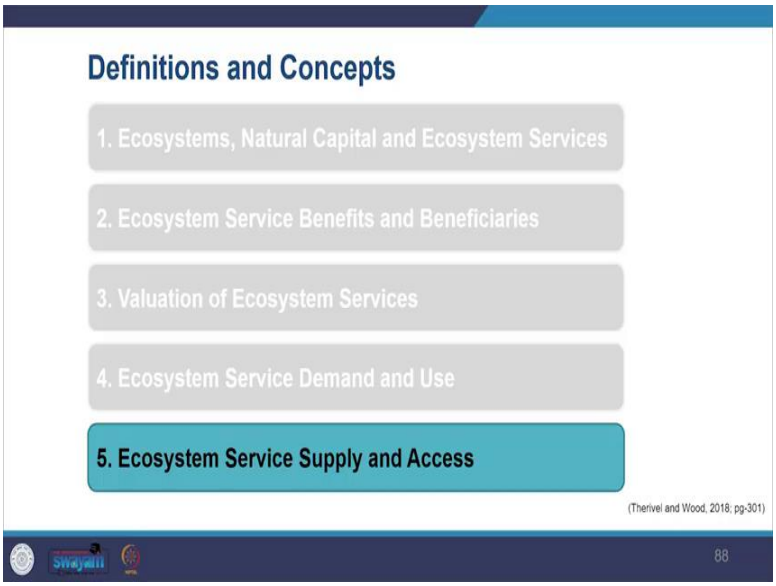

Now, we will look at the ecosystem service supply and access concept.

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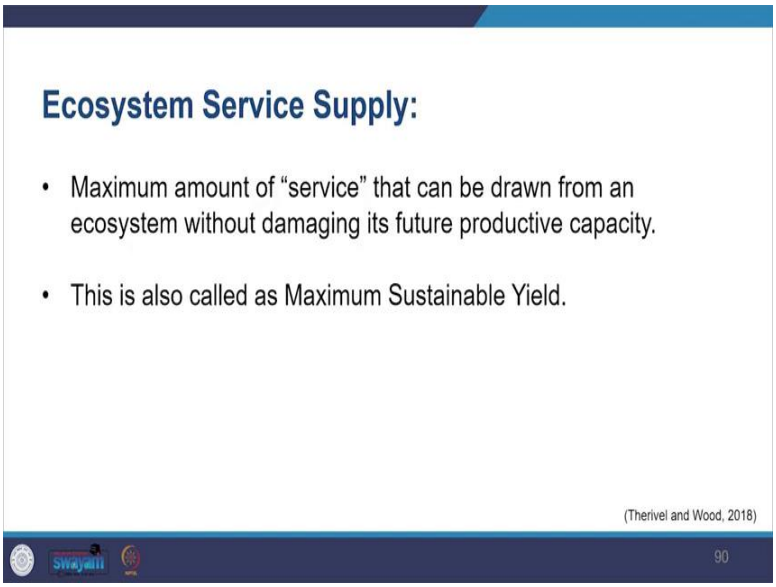

Ecosystem service supply is the maximum amount of service that can be drawn from an ecosystem without damaging its future productive capacity. For example, how much fish we can catch from the source without reducing the produce, how much timber we can take from a forest without affecting its capacity to produce timber at the same level in the future. This is also called maximum sustainable yield. So, what is the maximum capacity which does not alter its rate?

So, that is the maximum sustainable yield or the maximum amount of service which we are looking at. There can be a significant long-term impact on the people who derive the services if use exceeds supply. So, if we take more than the supply, then there will be a long-term impact on the beneficiaries, and the users of it.

While assessing, you may check if the benefits will be affected within a project timeframe. So, you need to see that within the project timeframe, there will be a difference in the impact. This usually depends on how close the services are to their sustainability threshold. So, you need to check those figures.

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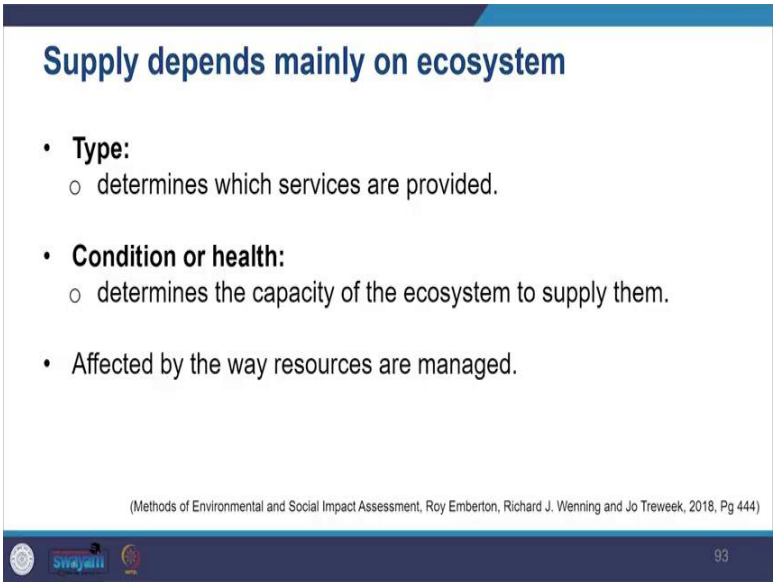

You may also know that supply depends mainly on ecosystem type, and condition or health. So, what type of ecosystem is there? What is the condition and health of that ecosystem? It will also depend on that. Ecosystem type helps to know which services are provided. Whereas, ecosystem conditions help us to know the capacity of an ecosystem to supply them. The supply can be affected by the way resources are managed, depending on that it can be negative or positive. So, how does this manage it can be both negative or positive?

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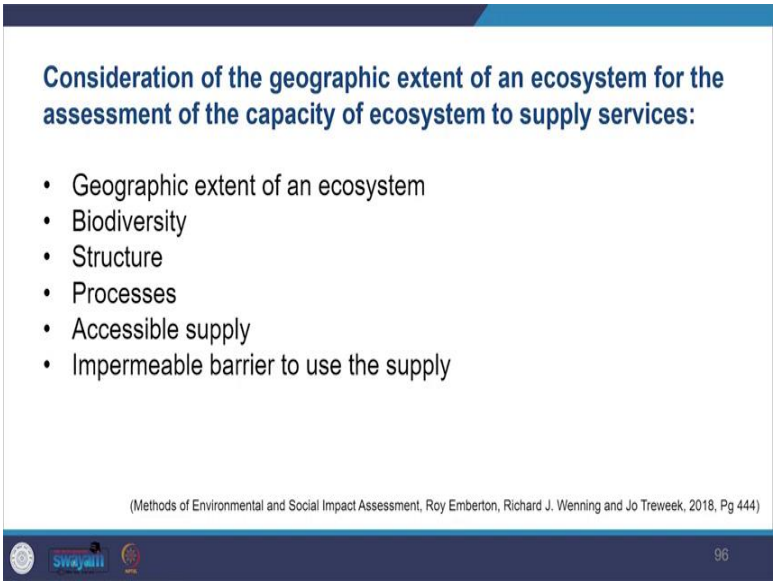

While assessing the condition of the ecosystem or estimating the capacity of an ecosystem to supply services, you need to consider the geographic extent of an ecosystem. So, you need to see what is the spread, its biodiversity, what kind of diversity is there the structure, and then the processes involved. Because they

can also affect the quantity and quality of services, the ecosystem supplies, So, you need to check all these things.

Further you need to find out whether ecosystem service is accessible or not. So, this is another important aspect, accessibility to ecosystem services. Is the beneficiary able to use an ecosystem service and enjoy the benefits? This is called accessible supply. This applies especially to the provisioning services, food, wood, and freshwater and may not apply to the other types.

So, accessible, you have to see whether those ecosystem services are accessible or not. You may be conscious that the proposed development may not affect the supply of provisioning services, but might block the access. So, nothing is happening to the services but beneficiaries are not able to access it anymore. So, you are blocking the access by the development activities. For example, by creating a very busy road that prevents people from harvesting firewood anymore from the other side.

So, you have to consider the supply and access need when you identify impacts on ecosystem services supply, you may note the concept of supply sheds. So, another term we are looking at is supply shed which is related to accessibility. This supply shed is the area people need access to for an ecosystem service to be sustainable in terms of the level of benefits they need or depend on. For example, in the area of woodlands, people would need to obtain a sufficient sustainable amount of firewood.

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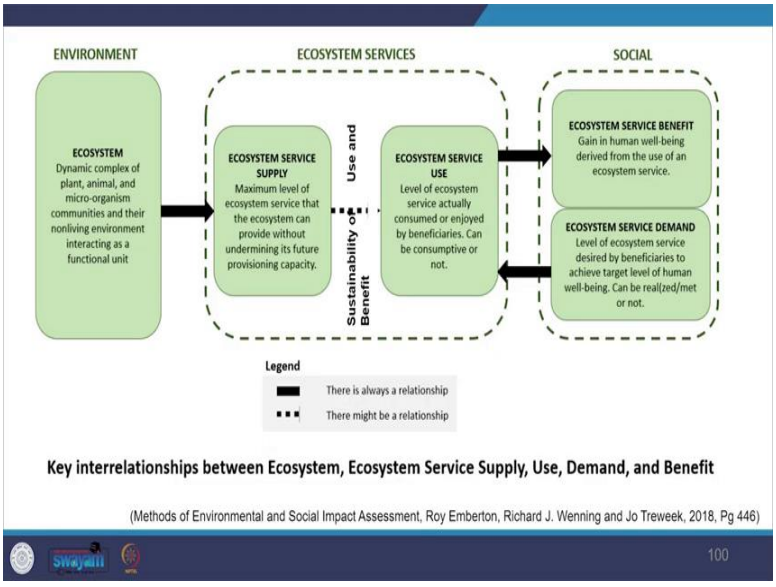

So, the figure here illustrates how ecosystem services interface between the biophysical environment ecosystem and human well-being which is the social, highlighting the requirements for assessments through different specialist dimensions in the EIA process in the assessment process. The figure shows key interrelationships between ecosystem and ecosystem service supply, use, demand, and benefits.

As you know, our ecosystem involves a dynamic and complex interaction among plant animals and microorganisms, communities, and their nonliving environment which act as a functional unit. This biophysical environment has always been associated with ecosystem services. We have already studied the

concept of ecosystem services supply and ecosystem service use and this diagram also reflects that there might be a relationship between them.

The levels of ecosystem service depend on the sustainability of use and benefits. From the use of ecosystem services gains in human well-being are derived. Ecosystem service demand which is desired by beneficiaries to achieve a target level of human well-being can in turn be realized or met from ecosystem service.

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So, summarizing what we covered today. So, we looked at the overview of ecosystem services, we looked at the definitions and concepts of various terms, which we might need for the assessment purpose while using different methods. So, we looked at ecosystems, natural capital ecosystem services, we looked at the benefits, beneficiaries, what are the terminologies for valuations, and ecosystem service demand and use, we looked at the service supply and access, as well as we looked at the key interrelationship between ecosystem, ecosystem service supply use, demand, and benefits. So, that is all for today.

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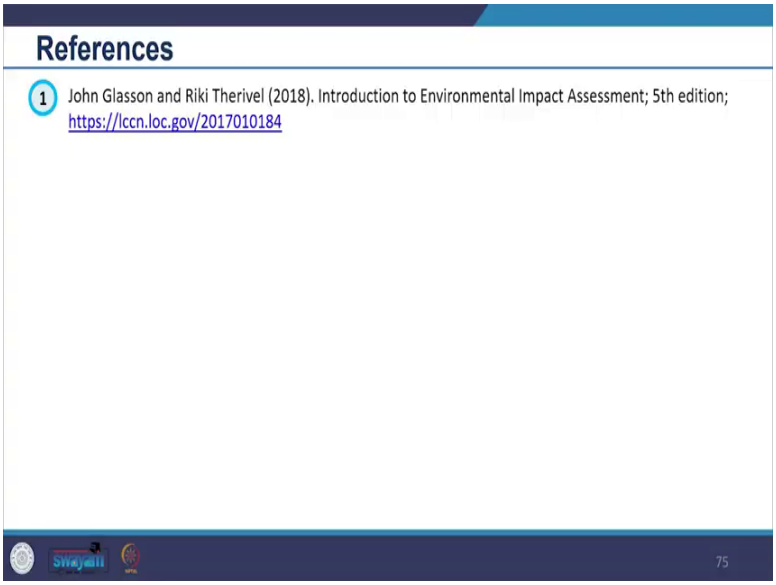

This was our key reference for this particular session.

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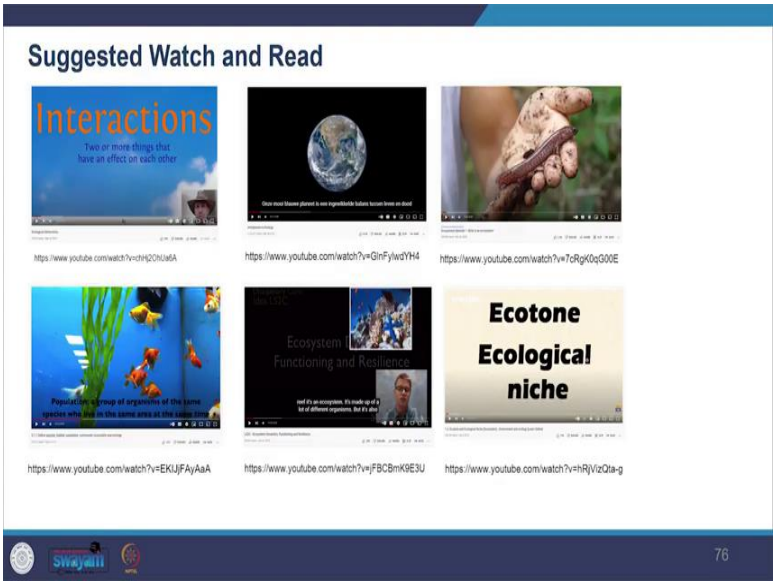

And there are certain suggested watch and read for you, if you want to learn more explore more from this.

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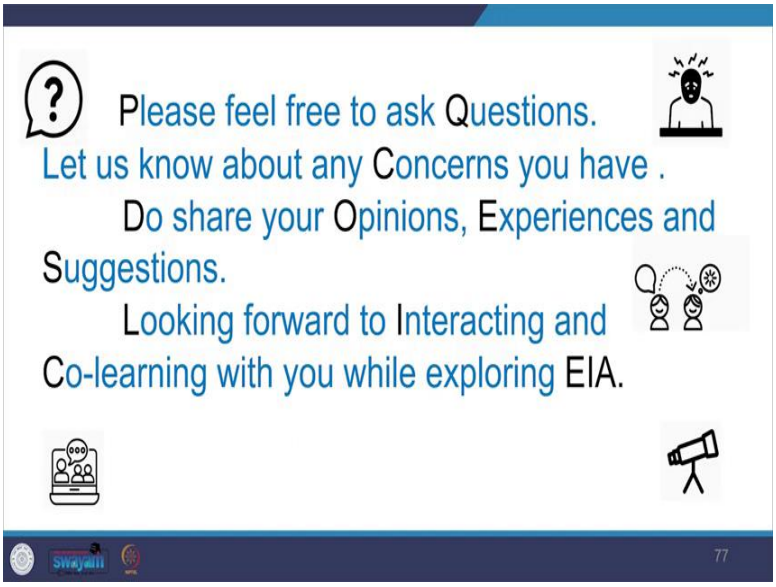

So, please feel free to ask questions. Let us know about any concerns you have to share your opinions, experiences, and suggestions. Looking forward to interacting and co-learning with you while exploring EIA. Thank you.