Environmental Impact Assessment
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Lecture 43
EIA Methods for Coastal Ecology and Geomorphology
Part II

Welcome to the course environmental impact assessment. And today, we are going to look at methods used for coastal ecology and to assess geomorphology. So, we will look particularly at the segments of impact prediction and evaluation.

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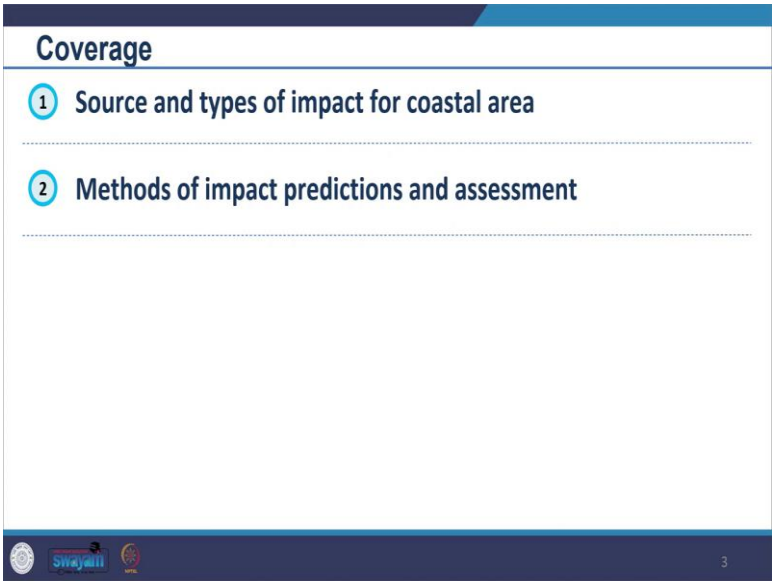

So accordingly, our coverage we will cover as we look at different sources and types of impact for use in coastal areas. And then we will look at the methods for impact prediction and assessment in this domain.

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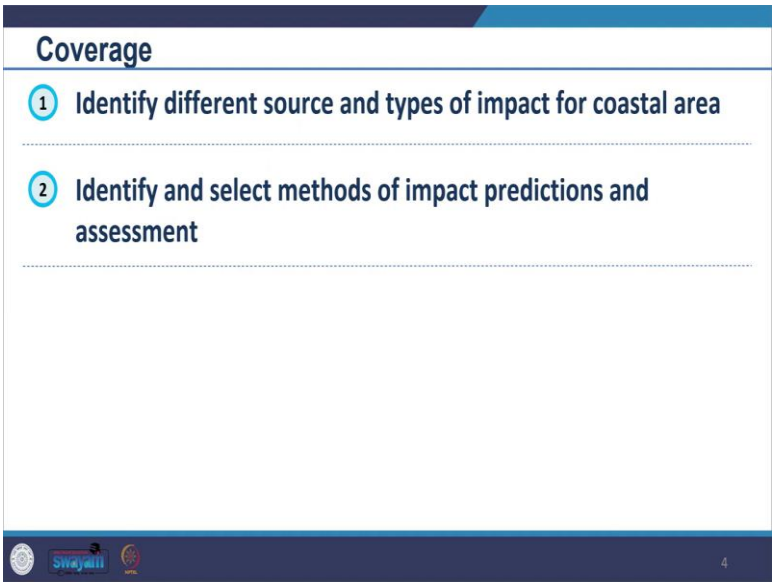

So accordingly, our learning outcomes will be that after completion of this particular session, you should be able to identify different sources and types of impacts for coastal areas. And then you should be able to identify and select methods of impact prediction and assessment. So, not going to get into too extensive

details of the methods, but we will look at what are the different methods, which are available for the domain.

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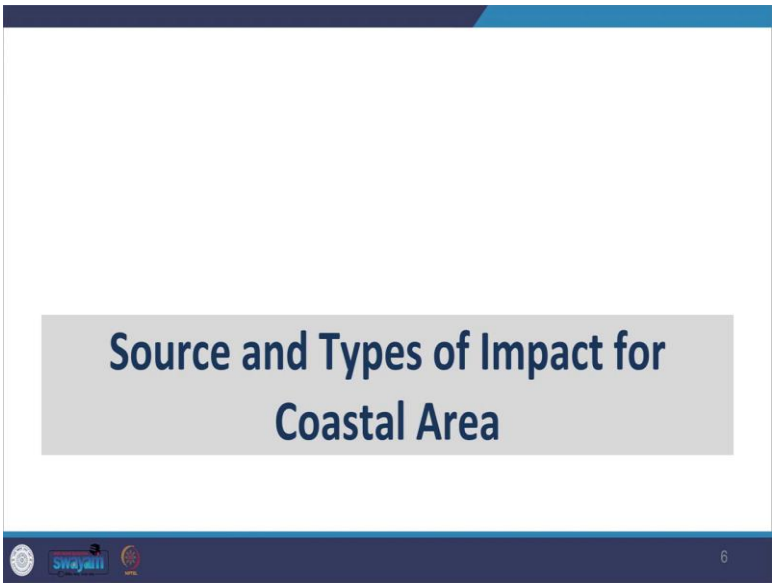

So, the key reference for this particular session, for this particular theme is chapter 7 from the course book to which we are referring, Methods of Environmental and Social Impact by Therivel and Wood, and we are also looking at the manual by Ministry of Environments. In this, we are looking at the manual which is particularly for the shipbreaking yards. So, somewhat it relates to the coastal area. So, we will be looking at that as well. And then we will, I will be also linking some of the case studies for your reference, which you can further use for detailed understanding.

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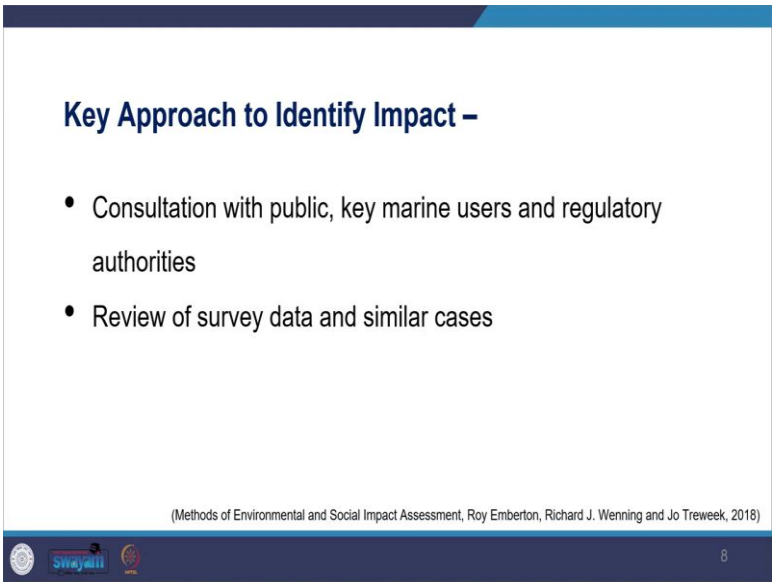

So, when we look at impact prediction, the key approach that we identify for impact is like we undertake consultation. We undertake consultation with the public, we take consultation with marine users, and the regulatory authorities. We undertake a review based on the survey data and then we also look at similar cases, and references. Along these cases where we can refer to what has happened in the previous cases and

what is likely to happen in your particular case, the project which you are for which you are preparing the impact assessment.

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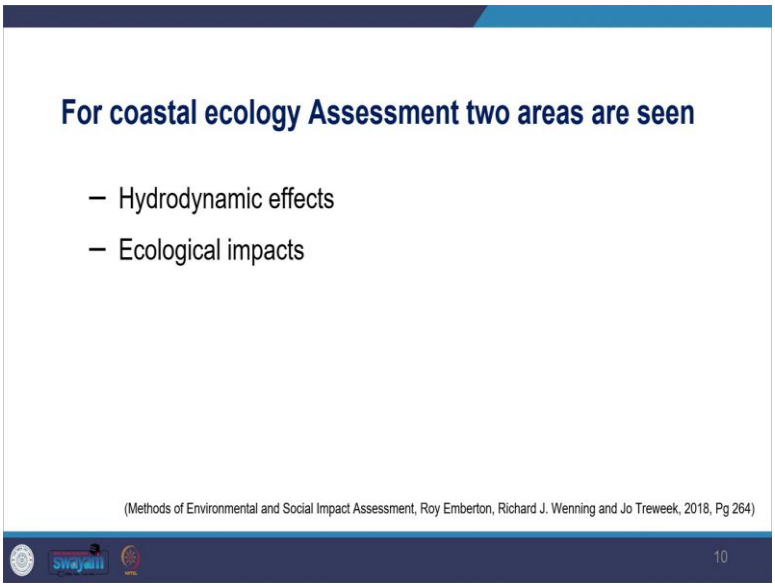

For coastal ecology, a structural approach is required, because as we have already seen in the previous session the geomorphology and the processes involved are very complex. So, we need a very structured approach. For this, as per the textbook, what we see by Therivel and Wood, it is suggested that one needs to undertake assessments separately for hydrodynamic effects. So, what kind of effects would happen to the water environment, and the other you would also look at the ecological impacts. So, what impact would have been on the ecology?

So, these two segments, you look at it differently and you look at it in a very structured manner and if you will take note, there is a difference between the terms used, you will see that hydrodynamics effects and then the other is ecological impact.

So, when we say that, there is a difference between that because any change in the hydrodynamic would not necessarily mean impact. So, there might be changes, but it would not have any kind of adverse impact on ecology, or on the environment. So, one needs to understand what kind of changes are happening that is why the term is used effect, but then, because of that, or otherwise, what kind of impact might happen on the ecology? So, one needs to understand the difference between the two.

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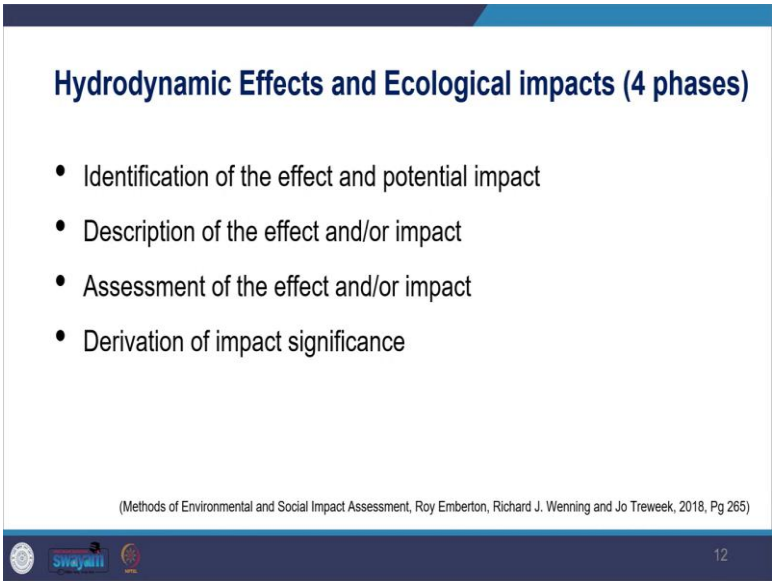

Further, when we say that it has to be taken in a structured approach when we see that one needs to identify the effects and potential impact as phase one, then one needs to describe different effects and impacts. So, we have seen that you undertake baseline assessment, then you describe it, and then you assess those effects and impacts and then you derive the impact significance. So, we are going to look at how you assess the effects or impact, and then how you derive the impact significance.

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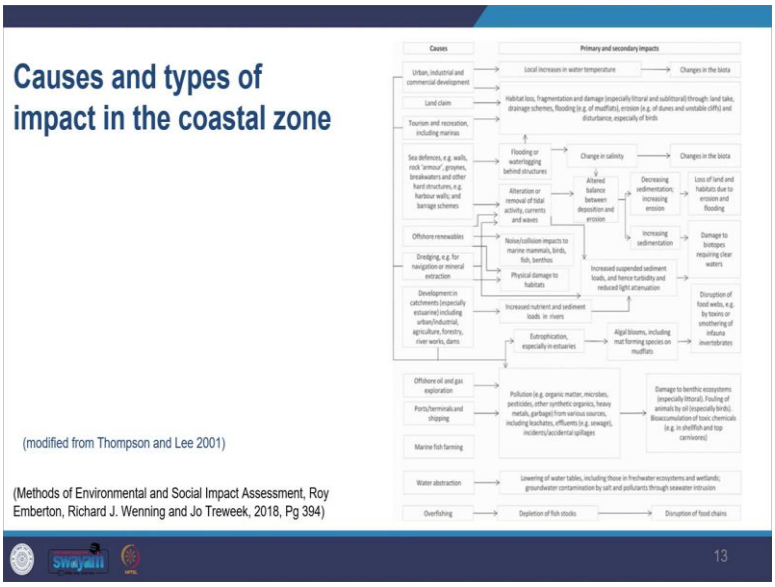

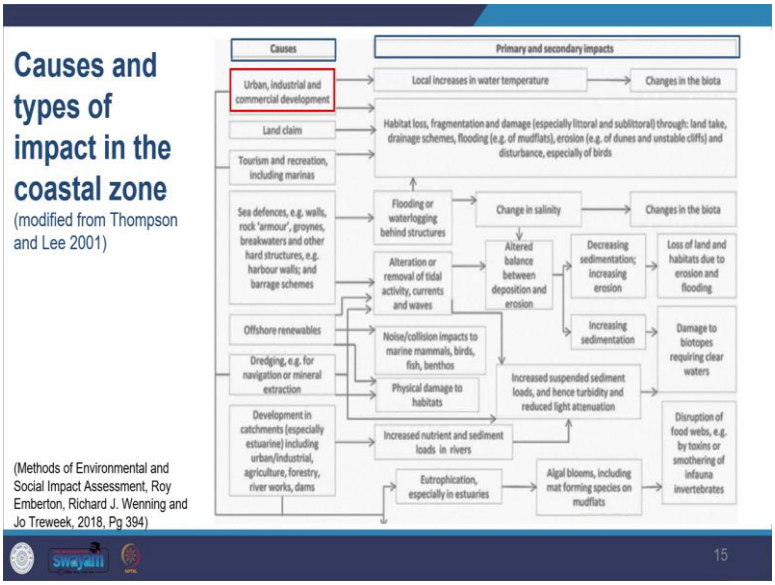

Just to quickly look at, what are the different sources of impacts in the coastal area? So, one of the major causes of what we see is the urban, industrial, or commercial development along the coastal areas. So, they are seen as causes of impact, and then the kind of impact which it has, it is like, it creates like increase in water temperature at least at the local level.

That would have a secondary impact like it would change the biota of the area, and then the same things could also change could lead to habitat loss, it could also lead to fragmentation, it could also lead to damage the littoral and sublittoral areas, which we had already seen in the previous chapter.

And this might happen because of occupying the land for certain development purposes, and then also changing the drainage pattern what kind of pattern you are developing and that might also lead to certain like blockage, or creating of the, creating a situation which might lead to flooding, or creating a situation which might lead to erosion, or create disturbances, especially for birds. So, urban, industrial, and commercial development kind of land use changes, which happens can also create these kinds of impacts.

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And then, when you look at such kind of land use change, especially when urbanization takes place, you also notice that there is an increase in the runoff including like, you might also see flash floods where very like rapid water would accumulate. So, it would lead to flash floods during the storm periods.

And then you would also see soil erosions, which would further lead to like, would have another secondary impact like suspended sediments, the load would increase and that would lead to increasing sedimentation in the estuary system. And then further that would, you would be required to remove that by dredging, and you might need to regularly maintain that for navigation purposes.

So, those kinds of impacts are also seen and then you would also see, the nutrients and toxic pollutants coming from the urban areas, again loading estuaries and the marine water. Further, you can also see bioaccumulation of toxic pollutants, bioaccumulation if you remember, we had studied bioaccumulation of toxic pollutants by coastal and marine organisms and this would also happen which would again have an impact on the organism as well as on the human health. So, it would have an impact on physiological, and ecological impact as well as impact on human health, so that can also happen.

And then, even eutrophication would happen because of the sewage affluents from the urban areas, which might impact the estuarine and nearshore coastal waters. So, that would also happen, you also have already seen eutrophication, but I will not cover that in detail here.

Further, the nutrient inputs to a certain extent, would also lead to oxygen depletion and that might also lead to dead of fish, and benthos, so that can also happen. And then also, if the proportion of nutrients also changes, that might lead to or impact the food web and also lead to an increase in the algal, and then that can also affect the bird population. So, you see this kind of range of impacts that take place.

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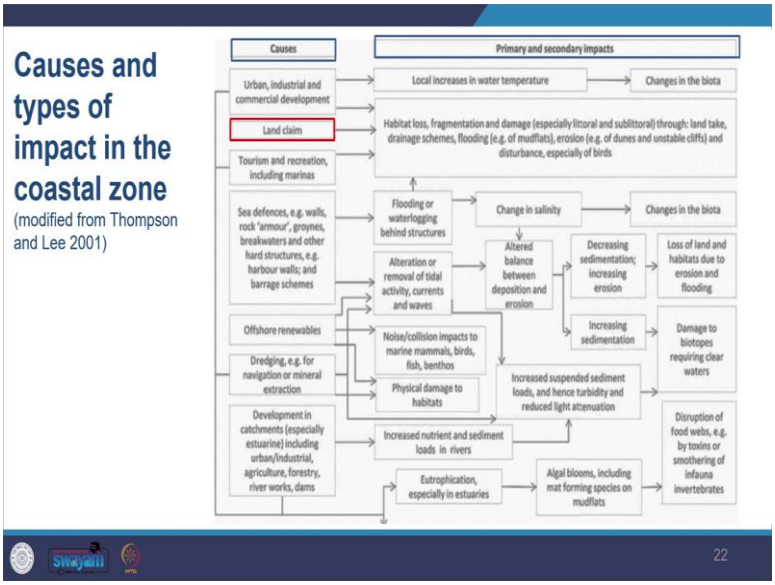

Then, whenever development takes place, we occupy land, we have a land claim. So, and then that also leads to all these kinds of changes, habitat loss, fragmentation, and so on and you would see, even the

tourism or recreational activities would also lead to habitat loss, fragmentation, and damage of the littoral and sublittoral areas.

So, when you take up the lands or you have key impacts associated with reclamation, so, when you try to do the reclamation, like you try to take more land for the development purpose, that also has key impacts. So, if you look at the direct impact including the intertidal impact you would see that there is subtidal habitat loss, and then when that kind of loss happens, that has implications on the birds, and fish feeding, and then the nursing, nursery grounds, so, how the population grows of the birds and fish also gets impacted when the reclamation happens.

And then you also see when reclamation happens, there is a change in the hydrodynamic process and then the pattern of sediment transport, how the sediment moves from one place to the other, another is also impacted and then that affects the erosion and also effects the accretion. And then you also see that there is the effect on the tidal range, what range of tidal comes there, it also affects that, and we also notice noise problem, which eventually affects fish species and marine mammals.

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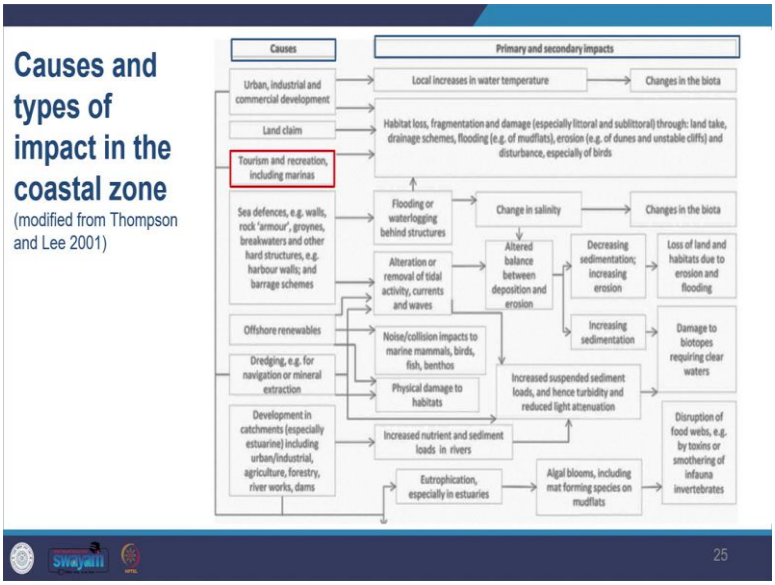

Then, looking at the problems associated the tourism and recreation, one would see that you must have traveled lot of places and coastal areas that are very popular in terms of tourist destinations. So, you would see that there is a lot of direct impact on aware visitors, more and more visitors come then it affects the sensitive ecosystem. And it also affects the dunes in particular.

So, you will see that when the vegetation over the dunes is damaged, often it is said that, to what extent it is damaged, it may be irreversible. And then, it mostly loses, the kind of ecosystem services that provides. So, if you can recollect, what kind of ecosystem services we talked about?

So, all that can it can stop, it can like deteriorate the kind of services that the area ecosystem provides. And because of a lot of infrastructure development, kind of jetties and other things, you develop there, it also

increases the disturbance kind of pressure which is created over the wildlife. Now, birds and they are especially, rely a lot on undisturbed sites for feeding purposes. So, those are disturbances that happen.

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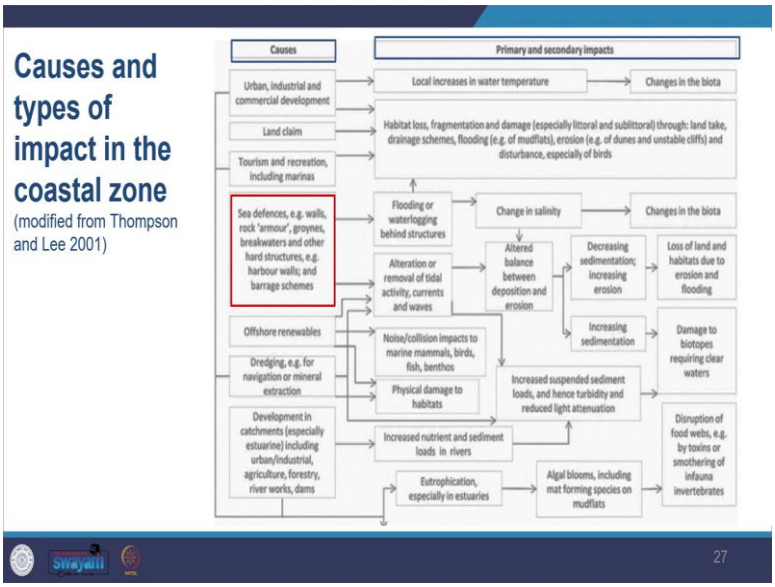

Further, we see other causes, which are like sea defenses, like at sea defenses. When we say sea defense, means there are chances of all kinds of disasters cyclones, typhoons, and things like that. So, you generally have protective walls and water breaks and other things, it can be a hard structure or you can have harbour walks, barrage schemes, and so on.

So, these also when these are built, they have primary and secondary impacts. So, they can impact flooding, or can also lead to waterlogging behind the structure. So, wherever the structure is coming from, the water that used to flow into the sea, the ocean would be blocked and it would cause flooding, and waterlogging behind the structure.

That would also lead to a change in salinity and, a change in biota again, those kinds of things can happen and then it would also lead to the removal of tidal activity. So, the activity, tidal activity which was happening without any barrier there, would now be altered or would be removed from that place.

So that would also happen, and the tidal activity currents and waves would be removed or they would be changed, because of the structure, which is built there. So that would lead to another level of deposition or erosion, and it would also lead to changes in sedimentation, and changes in nature, like increasing erosion, you might also see loss of land and habitat because of erosion and flooding. And then you might see increasing sedimentation and you might also see damage happening to biotypes, biotypes especially which require clear waters. So, in the previous class, we studied about biotypes.

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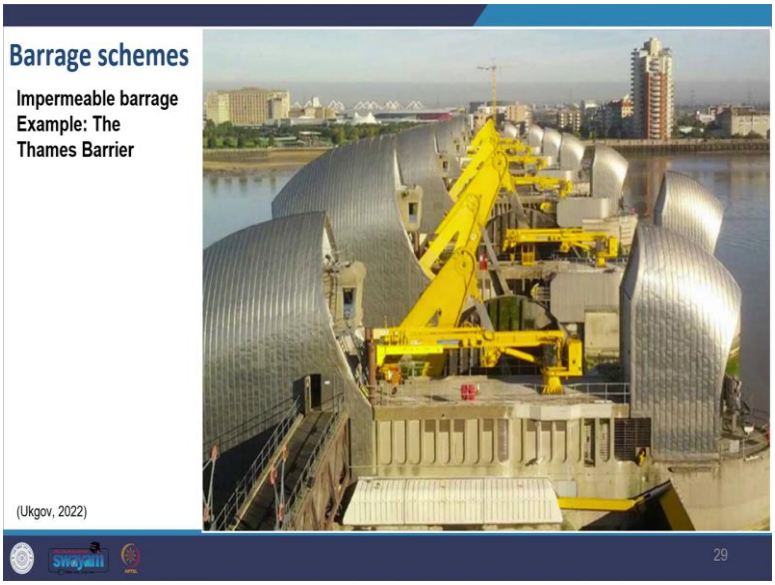

So, looking at barrage types, we see there are two basic categories of barrage, which we see one is impermeable and permeable barrage. So, one example is the Thames Barrier, which provides flood defense against high tides and tidal surges. So, they use it as per the condition and situations it allows a lot of flexibility. So, in the picture, you can see the Thames barrage, which is like controlling how the water waves come and also protects the entire city from the flood, or any kind of disaster risk, which is there. So, that is the one example.

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Another example, if you look at the impermeable barrage is Cardiff Bay Barrage. So, it is said that the Thames Barrage is said to be having a lesser environmental impact since it is very flexible. On the other hand, Cardiff Bay Barrage is to a certain extent criticized for its environmental impact.

So, it has led to the exclusion of tides and also the exclusion of tides especially for the immunity purpose like water sports and for the consistent view, waterfront development, and so on. The impact of this has been there has been a loss of marine habitats, a loss of mud flats, and also a loss impact on marine coastal flora

and fauna. So, in the picture, you can see the Cardiff Bay Barrage here you can see how the entire area is divided.

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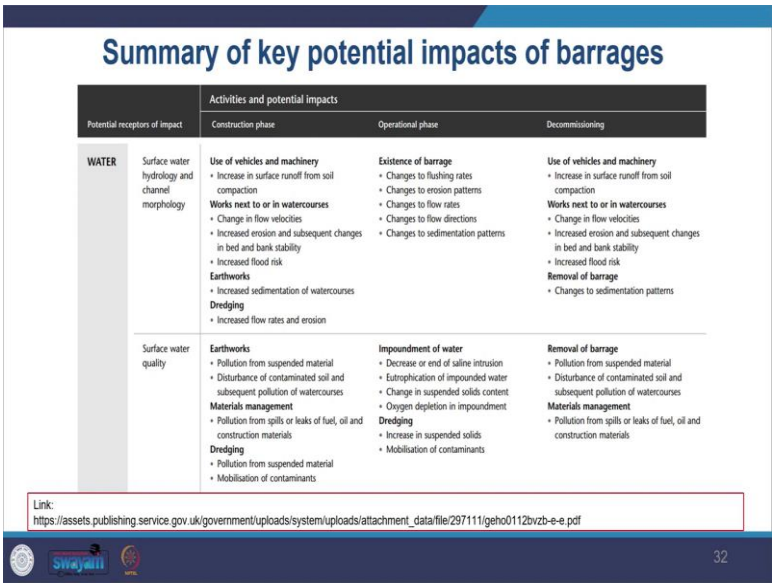

And another document, which we see here from the UK Government is like, which helps you to look at the key potential impacts of barrage. So, here I have given you the link, from where you can download this document. So, you can see how impacts of barrage are there, like in the domain of water, surface water hydrologic and channel morphology, surface water quality, and then how it, how different phase of the project like the construction phase, the operation phase, the decommissioning phase, has impact on the water environment.

So, you can see how during the construction phase, you can use vehicles and machinery, they can impact the increase in the surface runoff from the soil compaction, and then you can see the change in flow velocity, increased erosion, and subsequent changes, the increased flood risk and so on.

So, you can see here how it is, it is also giving you like, how you can use it at the, to identify the different impact that you can see what impact will happen on lands like you have landscape soil geology, and during the construction phase, what can happen, you can have the creation of new landform, you can have visual impact, then you would also see erosion, and exposure of the soil and then you would see the removal of rock by excavation work.

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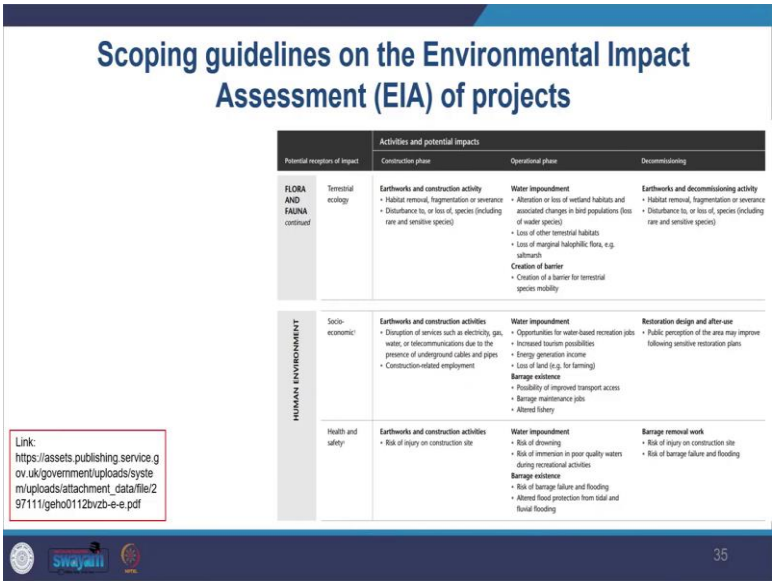

Likewise, you see all these in the operational and decommissioning phase as well, you see the flora and fauna, and then how they affect the human environment. So, this a linked way from where you can download the documents, I have given it to you.

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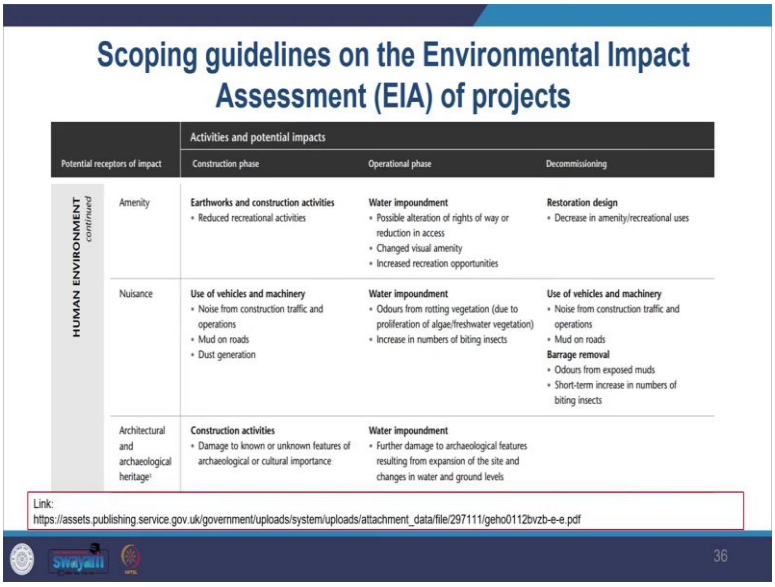

And when you look at the permeable barrage, that normally seems like it works on the tidal power to generate electricity. So, usually, they change the sedimentation pattern and reduce the tidal activity upstream so they reduce that activity so they change the tidal activity, and it has the potential to also increase the chances of eutrophication.

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You can also see here in the Rance estuary in France, also you can see how there are studies which tell what kind of changes have happened. Then you can also look at the Sihwa Lake tidal power station, which is one of the largest built on the west coast of South Korea, you can see in the image, how extensive a large-scale project it is. So, you would also find those things and how they affect the environment there.

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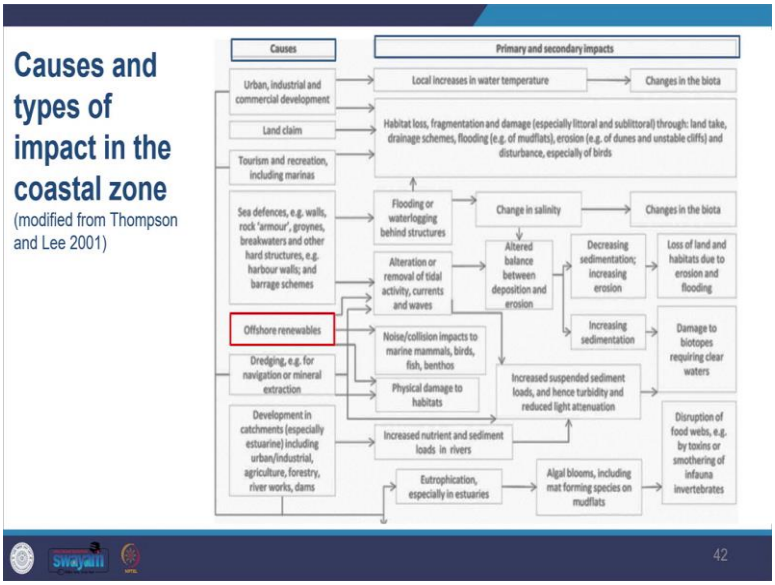

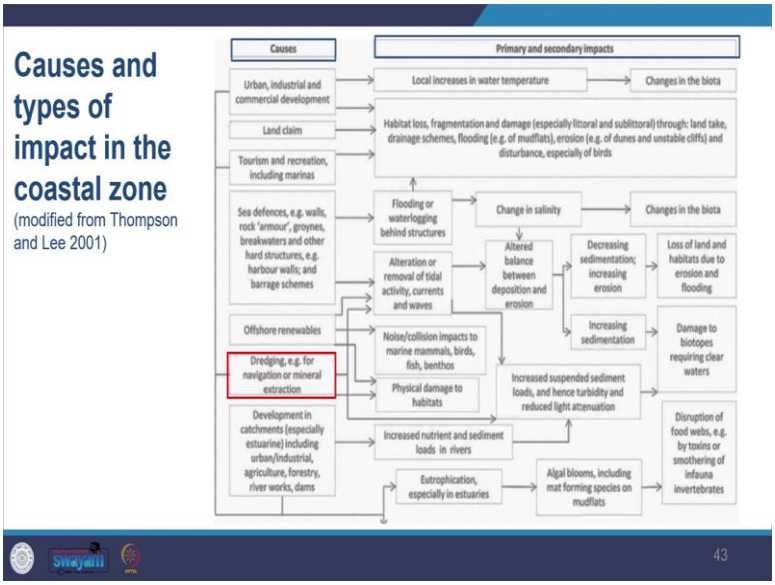

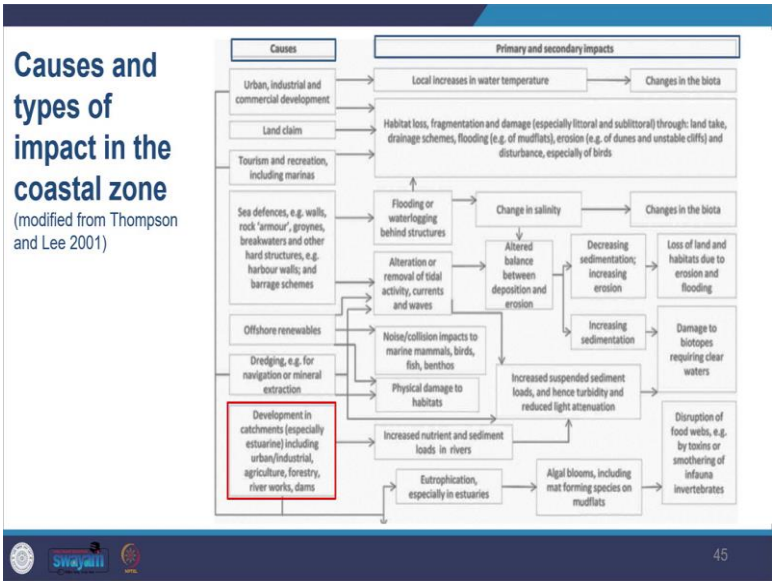

So, the other causes range of projects include offshore renewables, that you, like you have dredging. So, that also has a lot of impacts, also that also you see the alteration or removal of the tidal activity, currents, and waves, it also leads to an altered balance between the deposition and erosion, you would see decreasing

sedimentation, increasing erosion, loss of land and habitat, and increasing sedimentation, then you would also find noise pollution, impacts to marine mammals, birds, fish, and benthos.

So, you see that and then like because of the development of the catchment areas also like especially in the estuaries with due to these development activities including like taking care of the urban, industrial, agriculture, forestry, any construction work like dams, check dams and so on. So, that also leads to an increase in the nutrition and sedimentation load, and then the chances of eutrophication also increase it also increases the chances of disruption of the food webs.

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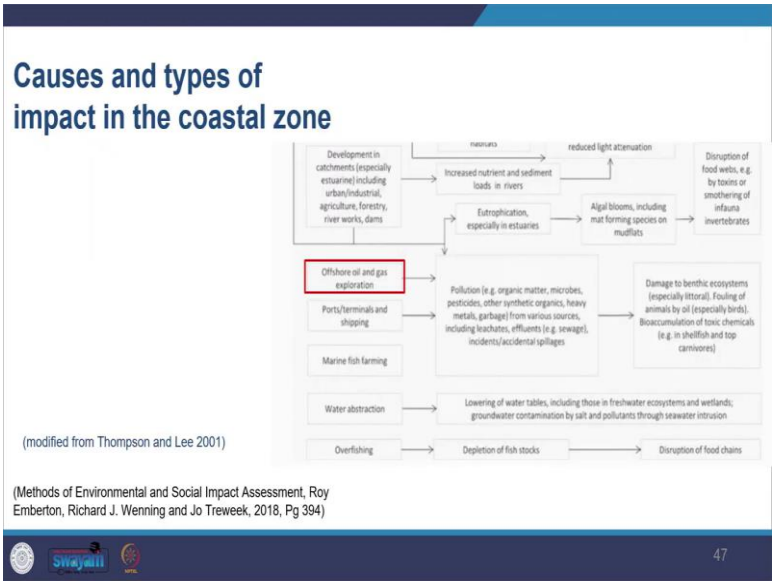

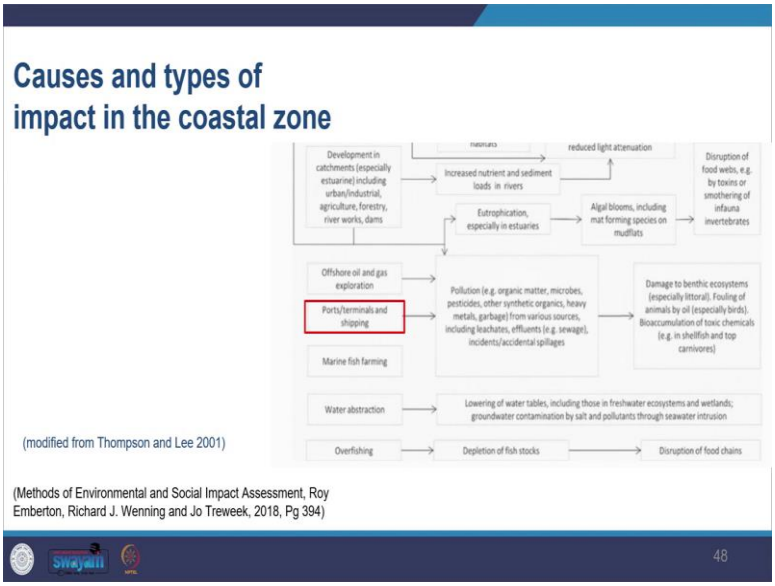

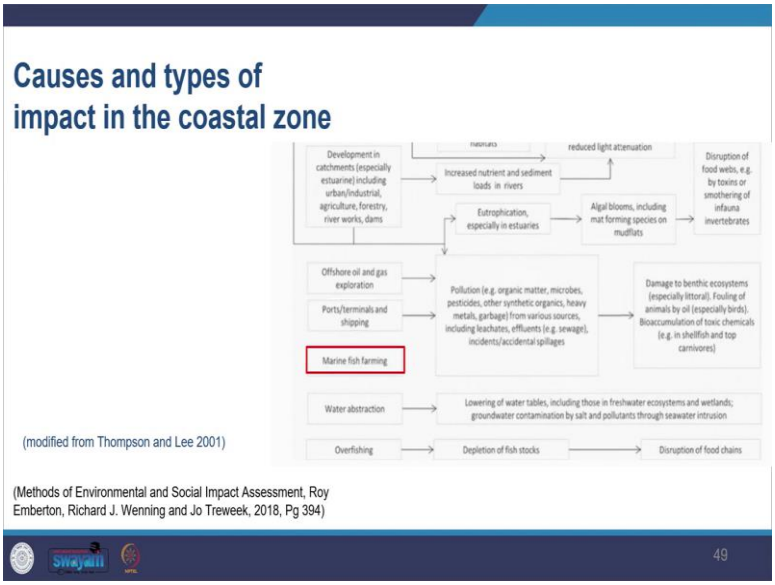

So, likewise, you also see that another important area is offshore oil and gas exploration. Ports terminals and shipping, marine fish farming So, you see these activities so, they also lead like you saw how oil and gas exploration is happening. So, that also has a direct impact on pollution like you have organic matter microbes pesticides, and other things getting into the water.

And because of the kind of activity happening and also like you have affluence which is which are going into the water, and then there can be also incidences or accidents which can happen with the oils and other things, and which is said to be one of the greatest threat to the ecology. So, it could damage the benthic ecosystem and it could also, it could lead to loss of life and loss of wildlife, animal life, and bird life in the coastal areas. And then you also see by accumulation of toxics because of these projects.

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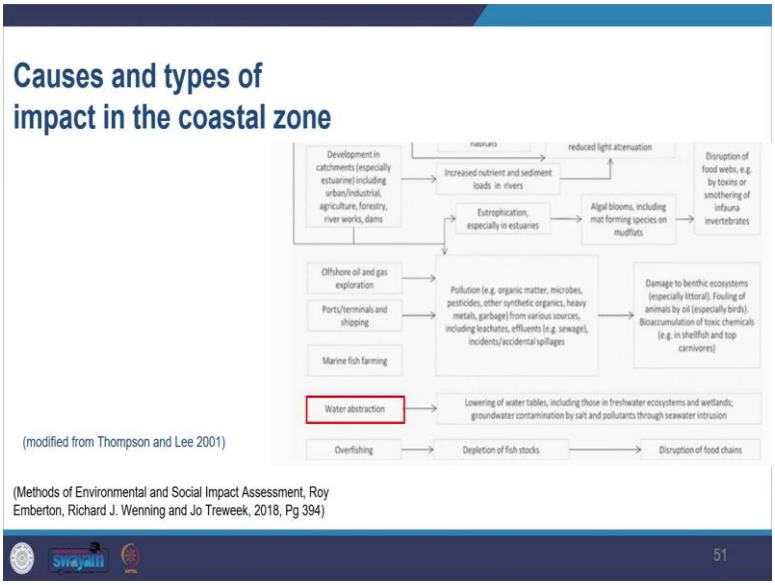

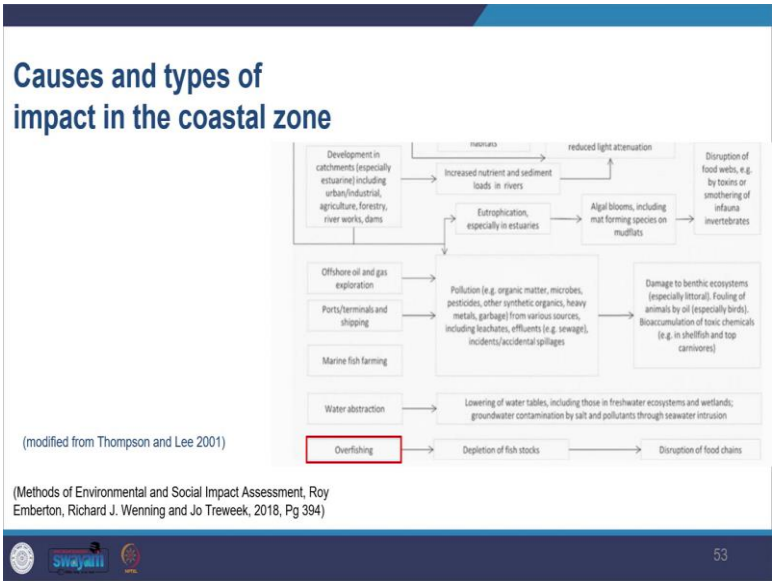

And then the other cause of what we see is the water abstraction. So, when water is abstracted, it leads to a lowering of the water table, including those in the freshwater ecosystems and wetlands. Groundwater contamination by salt and pollutants through seawater intrusion. And then you will also notice some of the causes are overfishing as you have seen in all industries, we talked about in the environmental status time. And then that also leads to depletion of fish stock and disruption of the food chain.

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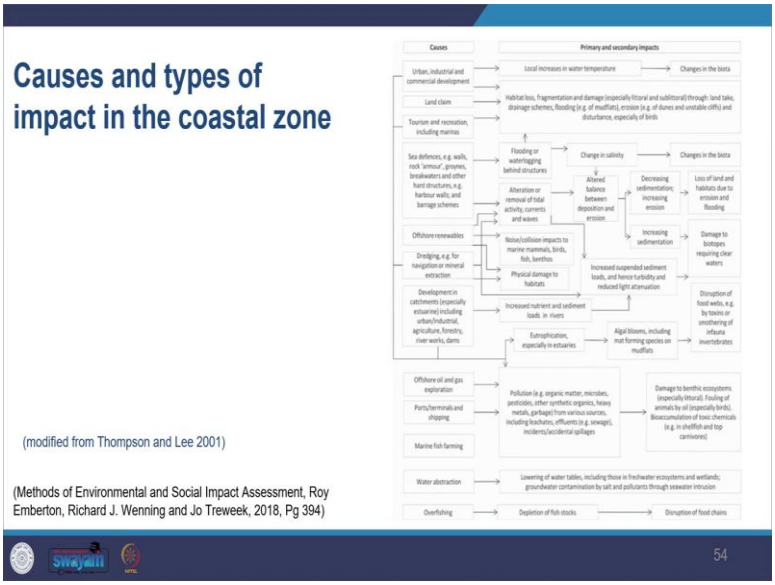

So, these are different kinds of impacts, which you see from different sources. And then you might also hear about another term which is like, coastal squeeze. So, there is also another problem with whenever the defenses or any kind of structures are built across the coastline, so when we say coastal squeeze, it is the loss of intertidal habitats, due to the rising sea levels, and where defenses limit the ability of the frontage to roll back.

So, because you are putting the defense whatever water which comes and goes back, it is being stopped. So, that leads to a loss of intertidal habitat, which puts freshwater habitats at risk and then risk which is like developed behind the sea walls.

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So, here have put a link to a video where you can see this coastal squeeze mechanism, and you will try to understand how, and what is the problem. And how it happens? So, I have given this link and the suggested read and watch.

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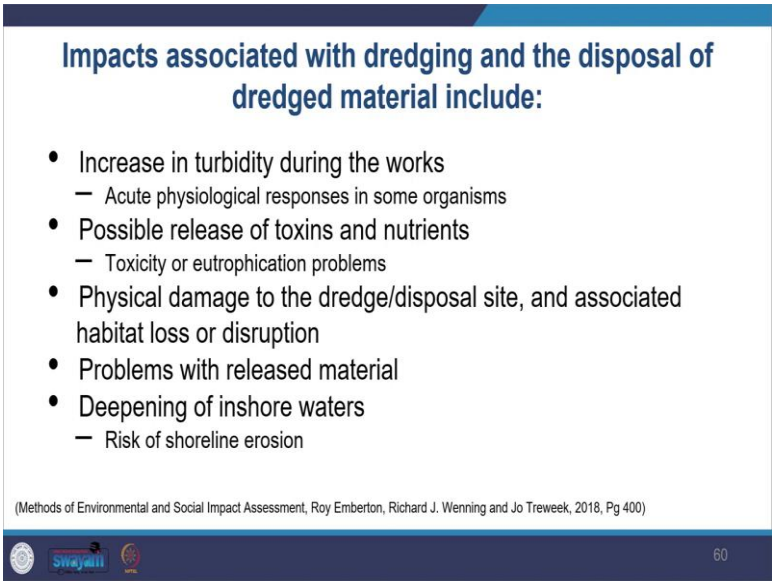

So, looking at dredging, dredging is like really one of the areas, which has like has impact, and then dredging is done for many, many purposes like you have, whenever you are extending the harbor, you are creating the new ports, or you are creating navigation channel, or you are just maintaining those channels. So, for that purpose, the dredging, for many of those purposes, dredging is required.

So, when dredging is done, it has several impacts, when you look at those impacts, you will see that it has it increases the turbidity during the works, which may reduce as less light goes, and if less light goes it would affect the production and the visibility in the water. And then that would also lead to changes in physiological responses for some of the organisms.

And then you also see that there might be the release of toxins and nutrients and then there can be physical damage, damage also and there can be also problems with the material which are released after the dredging. And by the act of dredging itself, you might deepen the inshore waters and then you might create very sharp slopes, which might make waves to break through the structure and then you are exposing the area for making it more vulnerable to a risk.

Further, we see that climate change can also impact all the processes. So, we have been seeing how climate change what are the impacts of it. So that can also change the impact, it can also impact all the processes that we are seeing.

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So, we would also notice that because of the wind farm, there is impact and it influences the geomorphology, it influences the ecological structure, and it can influence wind farm can influence all of these at the different phases of its life. So, usually, when sees that there are shorter disturbances of the seabed during the construction of the wind farm.

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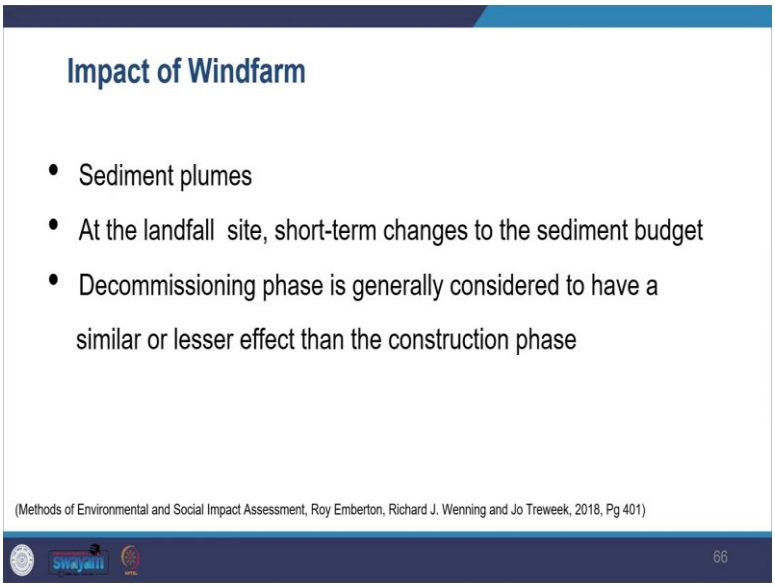

And then it might also create sediment plumes. At the landfill site construction activities may result in short-term changes in the sediment budget also. So, you may note the term sediment budget, how it works, and how much it keeps on adding on. And so, any kind of development can reduce or hamper these processes. Decommissioning can also influence but just consider that this decommissioning is like really the least threatening in terms of impact. So, we see that wind farms have a major impact at the construction stage.

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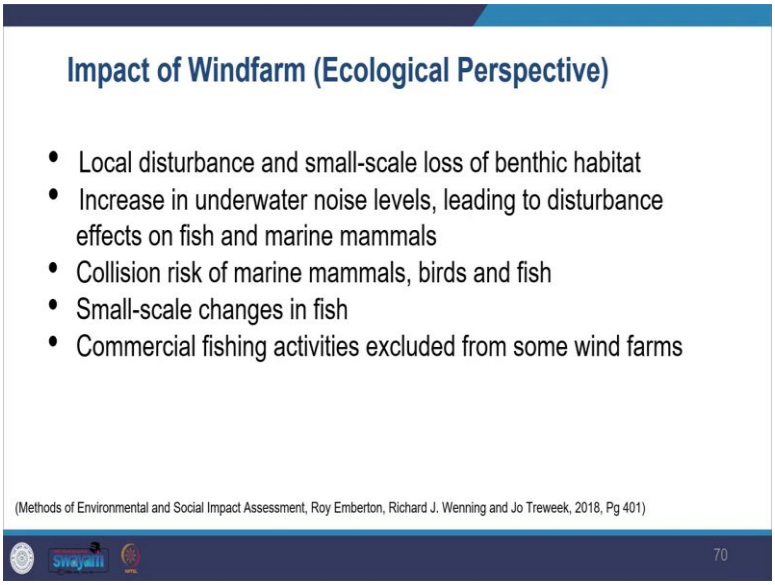

And especially from the ecological point of perspective and especially because of the local disturbances which would cause and then also the piling work also can create noise, underground noise, so, which we if you remember, we had seen it in the very first week of our lecture, and then there can be chances of collision, there can be changes in the fish population. And then, it is also suggested that fish, commercial fish activity also has lots of impact.

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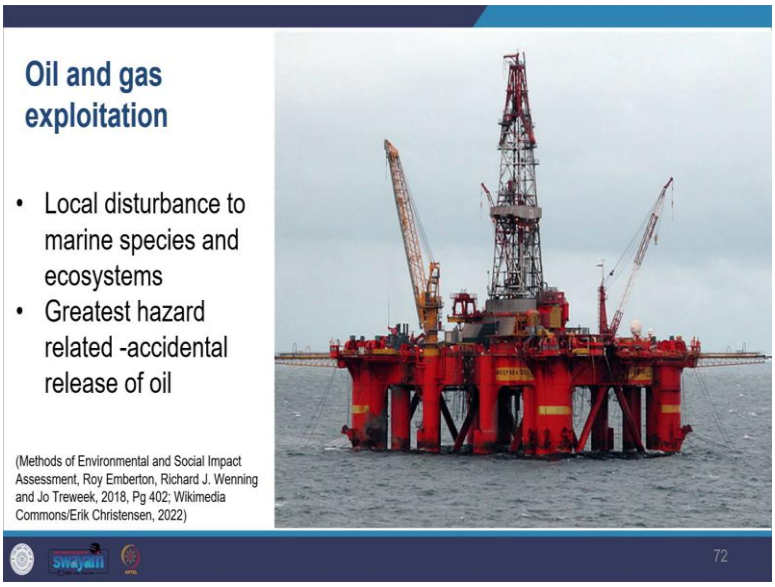

Now, looking at oil and gas exploration, so that if you look at that, what nature of work happens, oil and gas exploration. So, where you lay pipelines, you have the construction of offshores, rigs, and onshore terminals, and then when the function is done, it is like decommissioning also. So, that also causes local disturbances to the marine species and ecosystem, the biggest hazard that is seen, is the accidental release from the oil and gas exploration.

So, the transport of oil by ocean-going like tankers ship and all that you see is said to be the most evident pollution which can happen and that mostly and it can happen because of the accident till spill it. So, we had also seen historically how we started taking care of it. And then you also see ballast water and biofuels also have significant risks with shipping, that problem also is there.

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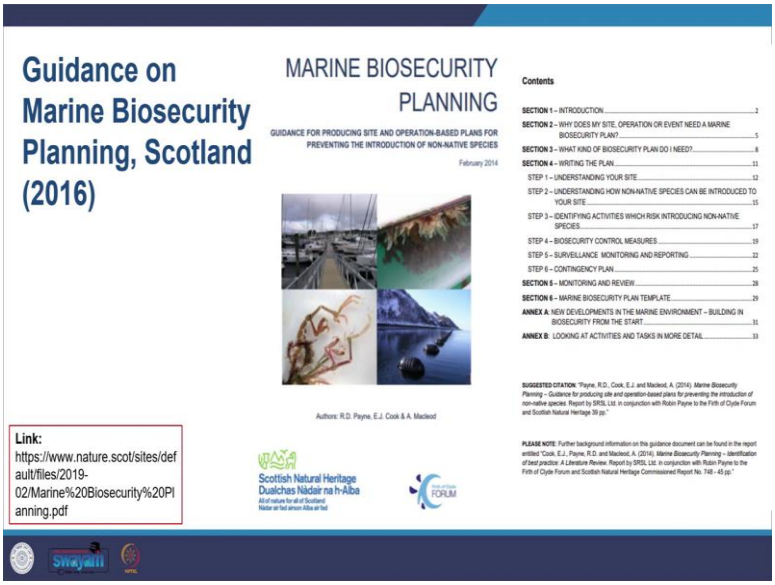

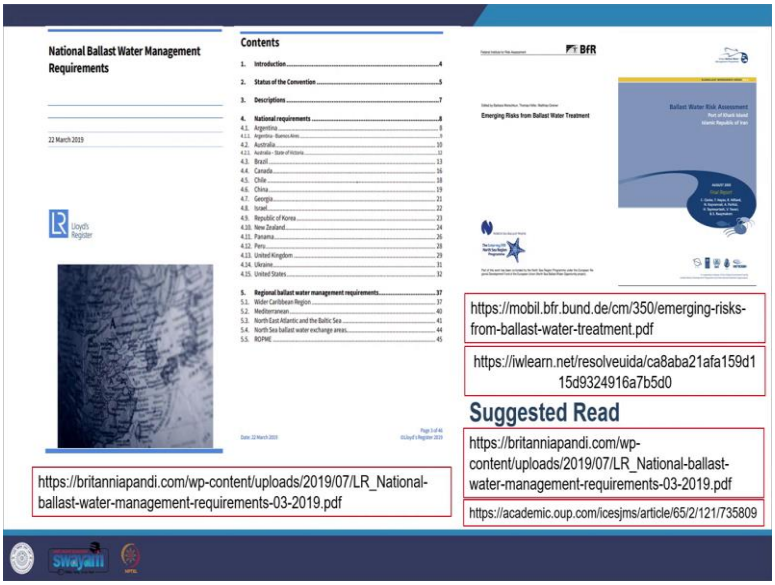

And then you would find guidance in this area where you have convention and recent marine. Biosecurity planning guidelines, so you can see I have given you the link, from where you can look at the guidelines which are provided on how you can do all kinds of identification and assessment. And then you would also find the national ballast water management requirements. So, here again, you can see this.

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And then the other cause is marine farming, and in India particularly, it is important in the Kerala area and the tide is used to help harvest shrimps and like there are 75 percent of the farm shrimp is produced in Asia, and, China, and Thailand on all these eastern areas. So, that is also caused a lot of that also has impact. So, we saw a range of impacts, when we studied environmental status.

So, marine farms, have a high potential to lower the water quality. So, it can impact the water quality, because of the cages which are created and one relies on chemicals and pest control and so on a lot of medication which happens. So, there is water quality going down, and then you can have pollution of water columns and then you can also see sea bed pollution.

And then this has also been noticed that parasitic lice can be parasites also and then there have been cases where fishes Salmon fishes have died because of the increase in lice and other things. And then water extraction also you can see has an impact. Water abstraction leads, saline water intrusion, and saline water intrusion. Intrusion can have other kinds of impacts.

So, you can have, it can lead to pollution in the seawater then you can also have it can also affect the biota of marine, maritime fresh or the brackish water habitats then you can also have like cumulative impact where abstraction as well as infrastructure, they can also cause lots of other things, and one notable thing is the sinking of the land to the sea level which also we had studied before. So, all these can lead to that.

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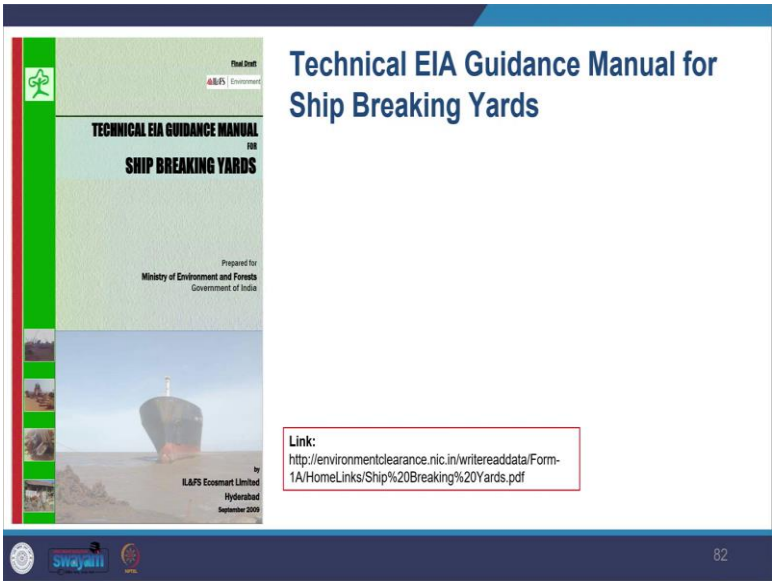

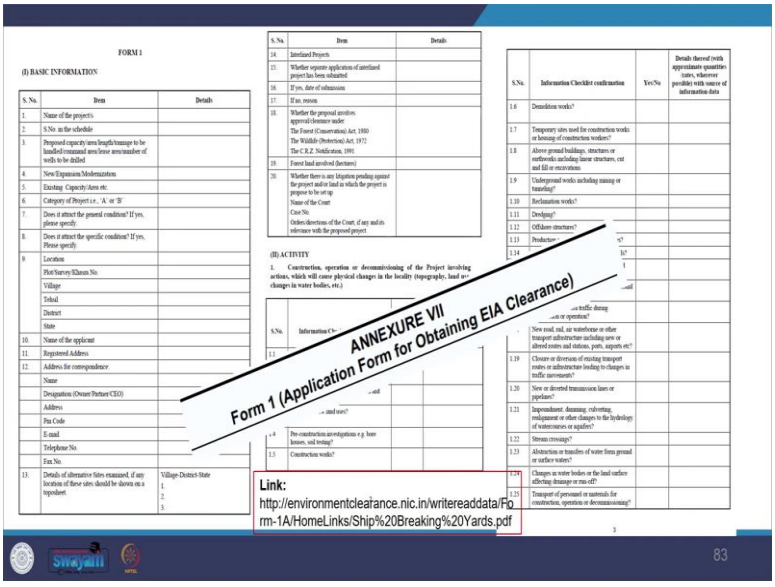

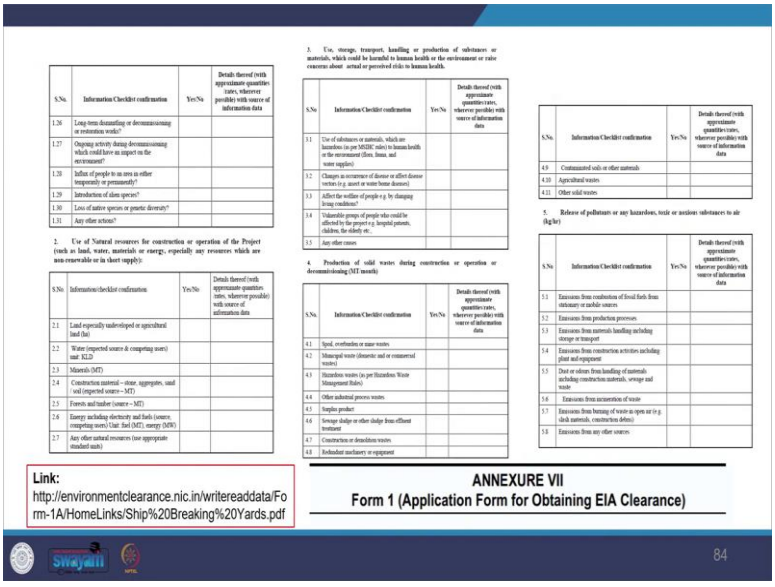

So, this manual by ILFS by the Ministry of Environment and Forests government of India. So, if you will see that you undertake all this information like the basic information about the project, and based you can see number 1, number 2, you would see all the kinds of natures of activity which goes and it provides you with information checklists confirmation.

Then you see what kind of natural resources are used for the construction of the operation of the project use of storage transport, handling of production, production of solid waste during construction of operational, decommissioning, and then the release of pollutants, any hazardous toxic or noxious substance to air.

Then you can see the generation of noise and vibration and emission of light and heat, you can see the risk of contamination of land or water from the release of pollutants into the ground into servers, then the risk of accidents factors which should be considered. So, you can consider such as consequential development, because of one development other developments would happen. So, cumulative impact, so you can see the lead to the development of supporting facilities all the ancillary facilities which might come, and then if you look at the choice of methods for prediction of impact, you would it also provides you that.

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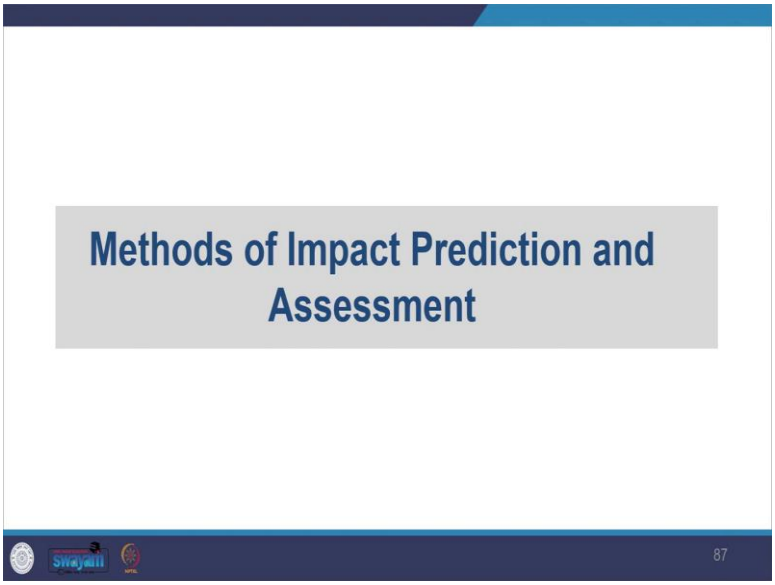

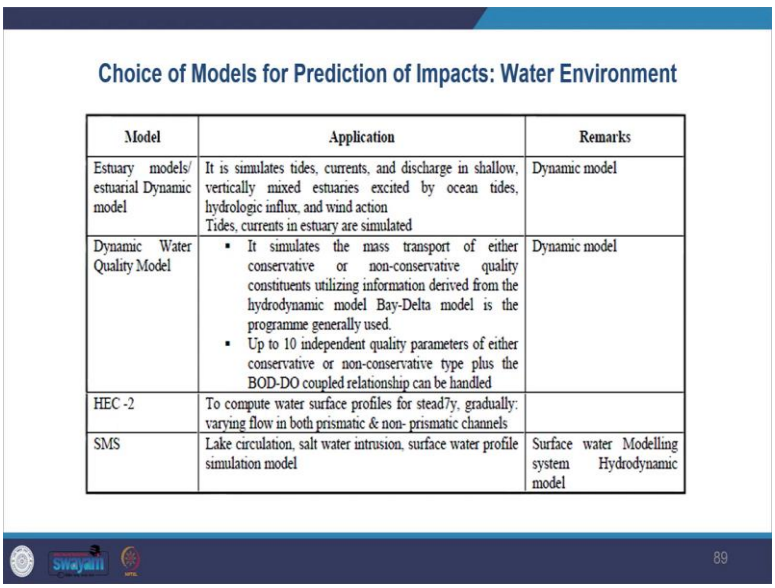

So, you have for the water environment you see estuary models and estuarial dynamic models. So, we have seen this briefly within a water environment also. So, dynamic water quality models, so you can see this, I will be sharing this document with you, and HEC-2, and SMS all these give you modeling choices like what model you wish, you can create to do the assessment.

So, looking at the methods of impact prediction and assessments, you see that the choice of methods for the prediction of impact on the water environment has been provided by the manual. So, you can look at the estuary models, and then the dynamic water quality model, HEC model, and SMS models which are there. So, if you see how they are applied, stimulate tides, currents, and discharge in the shallow vertically mixed estuaries. So, these models are available, and as you will see dynamic water quality model, stimulates the mass transport of either conservative or non-conservative quality how the entire hydrodynamic model will work.

Then you have HEC-2 compute the water surface profile in the study situation gradually varying flow in both different kinds of channels which are there, and then what kind of circulation saltwater intrusions would happen. So, all these models can undertake that work.

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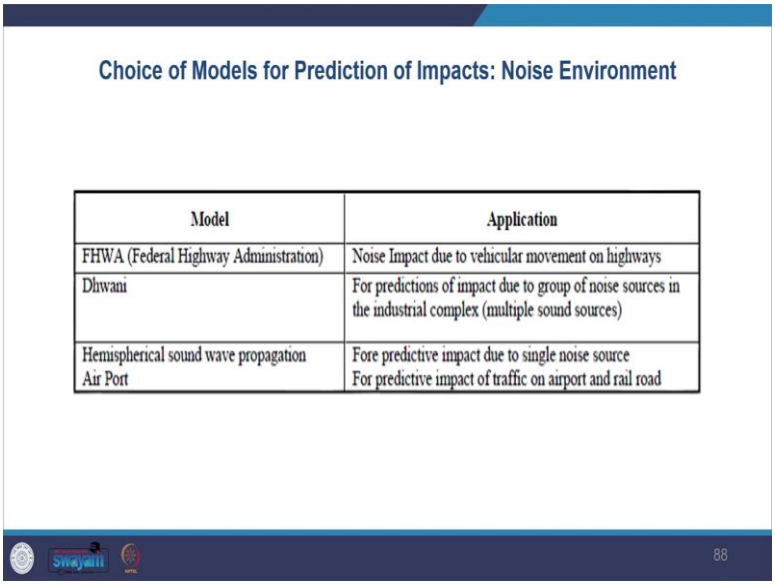

And then, you have models for noise environment impact assessment also within this. So, you can see Federal Highway Administration, FHWA has a model that helps you to noise impact due to vehicular movement, can see, then you also have the Dhwani model and then you also have hemispherical sound wave propagation, AirPort, that is, that model is also there.

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Choice of Models for Prediction of Impacts: Land Environment

Model	Application	Remarks
Digital Analysis Techniques	Provides land use / land cover distribution	
Ranking analysis for soil suitability criteria	Provides suitability criteria for developmental conversation activities	Various parameters viz. depth, texture, slope, erosion status, geomorphology, flooding hazards, GW potential, land use *etc.* are used.

Then you will also find model for land environments. So, you have a digital analysis technique, ranking analysis for soil suitability criteria. So, this can be used.

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Choice of Models for Prediction of Impacts: Biological Environment

Name	Relevance	Applications	Remarks
Aquatic Flora			
Sample plot methods	Density and relative density Density and relative dominance	Average number of individuals species per unit area Relative degree to which a species predominates a community by its sheer numbers, size bulk or biomass	The quadrant sampling technique is applicable in all types of plant communities and for the study of submerged, sessile (attached at the base) or sedentary plants
	Frequency and relative frequency	Plant dispersion over an area or within a community	Commonly accepted plot size: 0.1 m^2- mosses, lichens & other
	importance value		mat-like plants
		Average of relative density, relative dominance and relative frequency	0.1 m^2- herbaceous vegetation including grasses
			10.20 m^2 – for shrubs and saplings up to 3m tall, and
			100 m^2 – for tree communities
Transects & line intercepts methods	Cover	Ratio of total amount of line intercepted by each species and total length of the line intercept given its cover	This methods allows for rapid assessment of vegetation transition zones, and requires minimum time or equipment of establish
	Relative dominance	It is the ratio of total individuals of a species and total individuals of all species	Two or more vegetation strata can be sampled simultaneously

Terrestrial Flora			
Plot-less sampling methods	Mean point plant Mean area per plant	Mean point – plant distance Mean area per plant	Vegetation measurements are determined from points rather than being determined in an area with boundaries
	Density and relative density		Method is used in grass-land and open shrub and tree communities
	Dominance and relative dominance		It allows more rapid and extensive sampling than the plot method
	Importance value		Point quarter method is commonly used in woods and forests.

Fauna			
Species list methods	Animal species list	List of animal communities observed directly	Animal species lists present common and scientific names of the species involved so that the faunal resources of the area are catalogued
Direct Contact Methods	Animal species list	List of animals communities observed directly	This method involves collection, study and release of animals
Count indices methods (Roadside and aerial count methods)	Drive counts Temporal counts	Observation of animals by driving them past trained observers	Count indices provide estimates of animal populations and are obtained from signs, calls or trailside counts or roadside counts
	Call counts	Count of all animals passing a fixed point during some stated interval of time	These estimates, through they do not provide absolute population numbers, Provide an index of the various species in an area
			Such indices allow comparisons through the seasons or between sites or habitats
Removal methods	Population size	Number of species captured	Removal methods are used to obtain population estimates of small mammals, such as, rodents through baited snap traps
Market capture methods	Population size estimate (M)	Number of species originally marked (T) Number of marked animals recaptured (t) and total number of animals captured during census (n) N = nT/t	It involves capturing a portion of the population and at some later date sampling the ratio of marked to total animals caught in the population

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Then you also have biological environments like sample plot methods. So, we have seen these transactive line intercept methods, plotless sampling methods, species list methods, and direct contact methods. So, all these we have seen.

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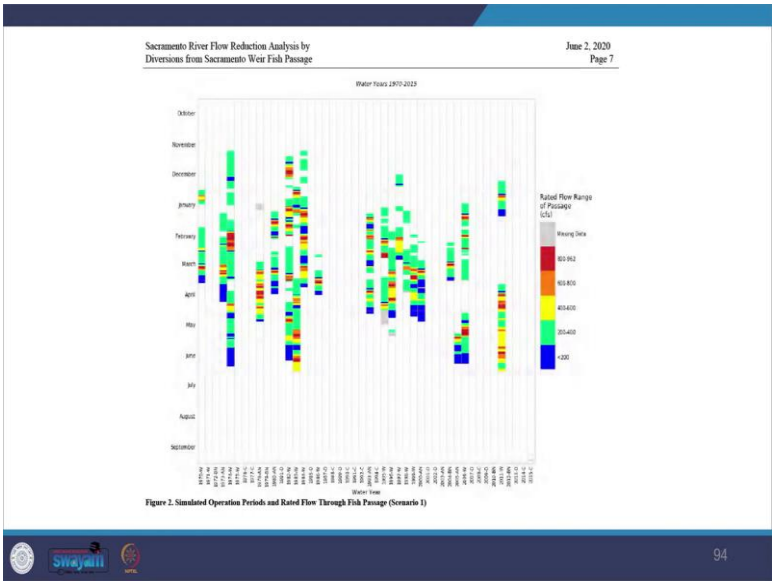

Figure 2. Simulated Operation Periods and Rated Flow Through Fish Passage (Scenario 1)

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So, I am sharing this example also case study with you. So, you have this image you can see, Sacramento River Flow Reduction Analysis which they have done. So, diversion from how what kind of fish passage would be created. So, in the figure, you can see the simulated operation period and rated flow through the fish passage. So, they are working on the different scenarios. Scenario 1, you can see how that like by year wise 1970, 9071, and so on 2015. What kind of change would happen, flow range of passage would happen. So, month-wise also on the left-hand side vertical axis you can see variations.

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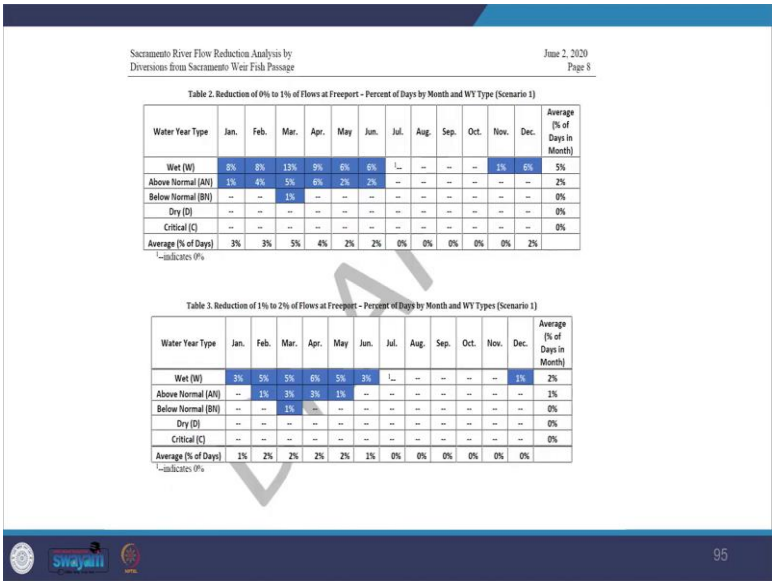

And then again, through this report, you can see how they are working out the flow reduction analysis. So, you can see how within all months Jan, Feb, March, and April what kind of flow reduction would happen in the rate? Above normal, below normal scenario, and then you can see which are the considerable variations as per the scenario. So, these models are used so, you are familiar with those models now.

So, once you identify the impact, you undertake impact assessments. So, now, you need to understand how significant is that impact. So, an impact arises whenever there might be a lot of things happening, but the impact happens when a particular effect interacts with the receptor, and those changes can be positive or that can be negative. So, that is what you check.

And especially in the impact assessment stage for coastal or marine ecological assessment, you look at the nature or the magnitude of what kind of impact is going to happen. What is the nature of the impact? How sensitive is the receiving environment and what understanding do you have to develop? So, while looking at that, you look at these questions, and you remember how we have looked at these questions before also. So, while assessing that, you look at that.

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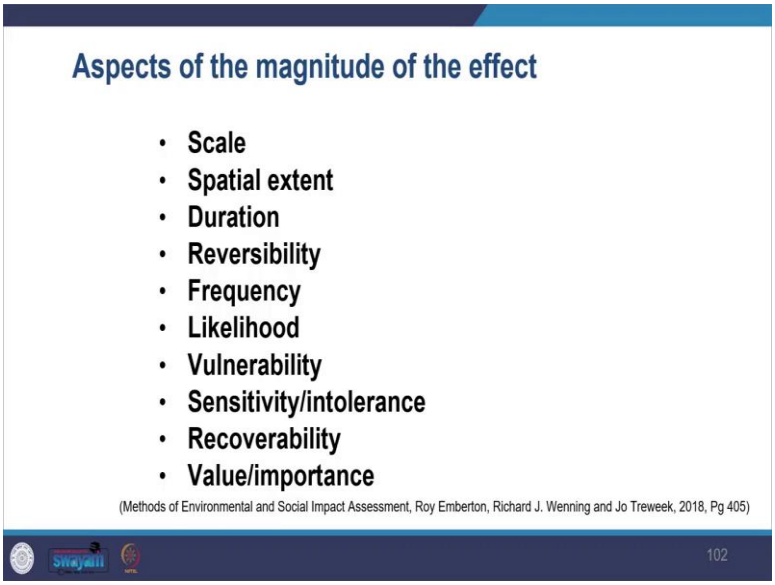

So, what is the scale of change which is happening? And will it how, how much is the change? Then the spatial extent and what kind of duration is there? And whether that is reversible or not. What is the frequency of the change? And what is the likelihood of whatever change you are thinking that might happen? And then looking at the receptor's thing, so, how vulnerable is the receptor, how sensitive or intolerant the receptors are? So, just to quickly revisit, what really sensitivity means, and what recoverability means we have seen all that in our previous session.

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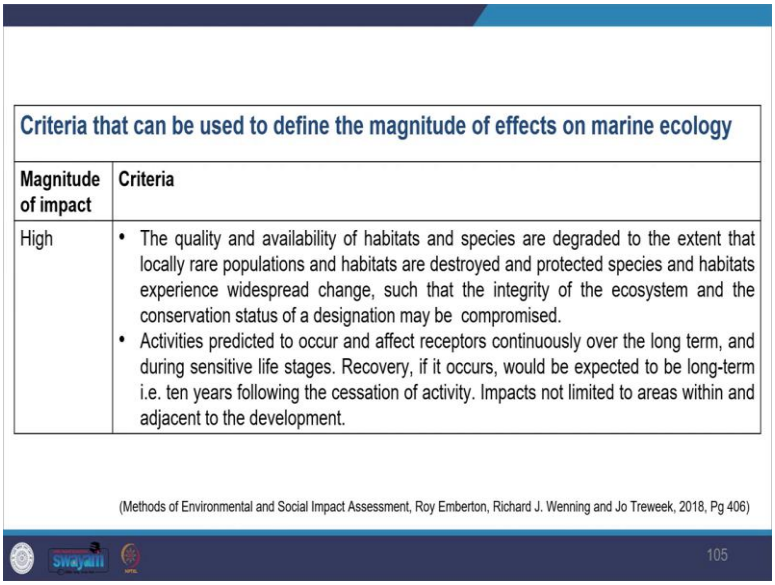

So, you also see that there are a lot of criteria that are used to determine and look at to assess the impact. So, whether they are significant or not. So, like here in the table, you can see whether the magnitude of the impact, whether it is higher or not, you have certain sets of questions. So here you can see, I am just going to talk about one of the parameters.

So, the quality and availability of habitats and species are degraded to the extent that locally rare populations and habitats are destroyed, and protected species and habitats experience widespread change, such that the integrity of the ecosystem and conservation status of the designation may be compromised. So, in such a

situation you consider that to be high. So, it is going to change, the integrity will be disturbed and it will be compromised then the impact would be considered high.

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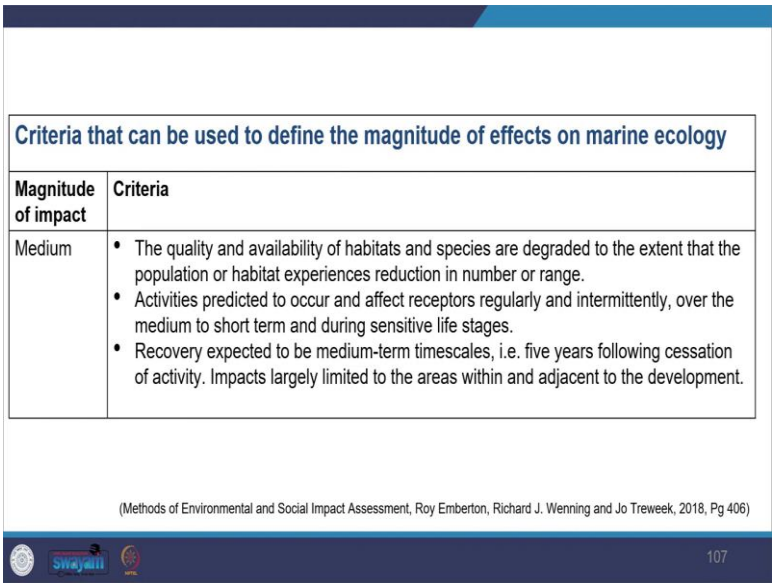

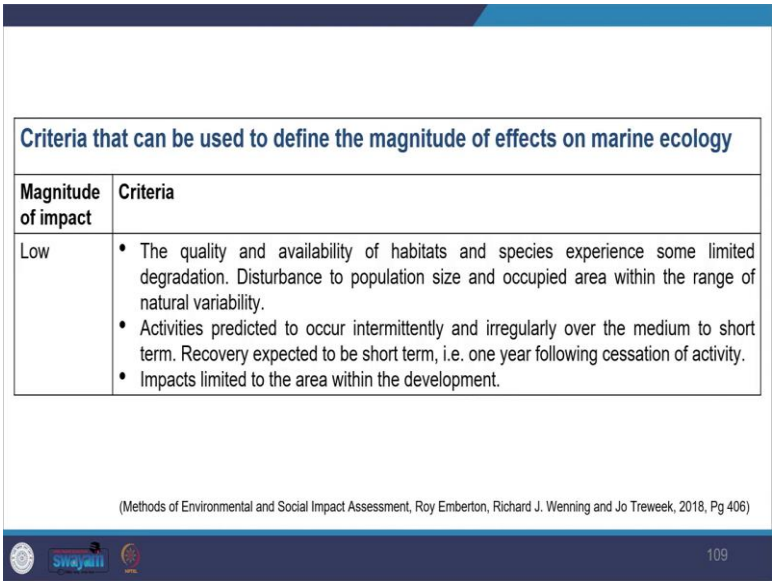

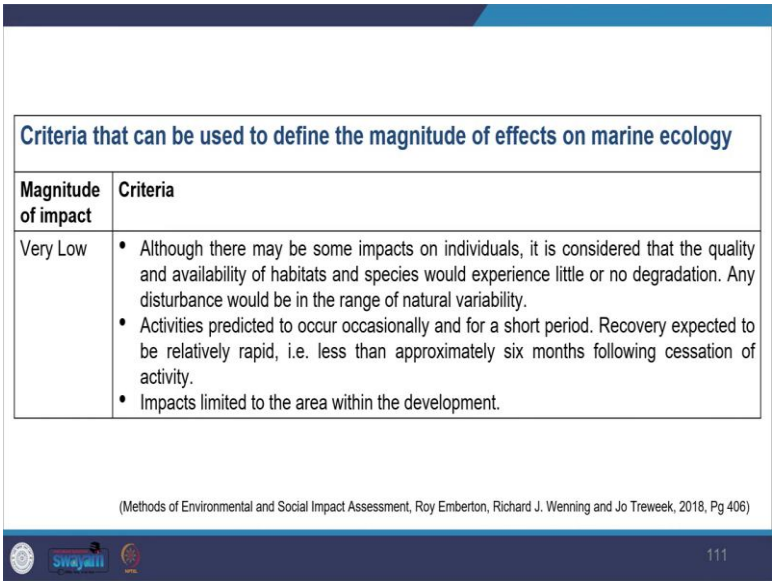

So, likewise, you would look at where integrity is not much compromised, it would be considered a medium. And where it is, where it is recoverable then it would be low, and then a certain extent very low.

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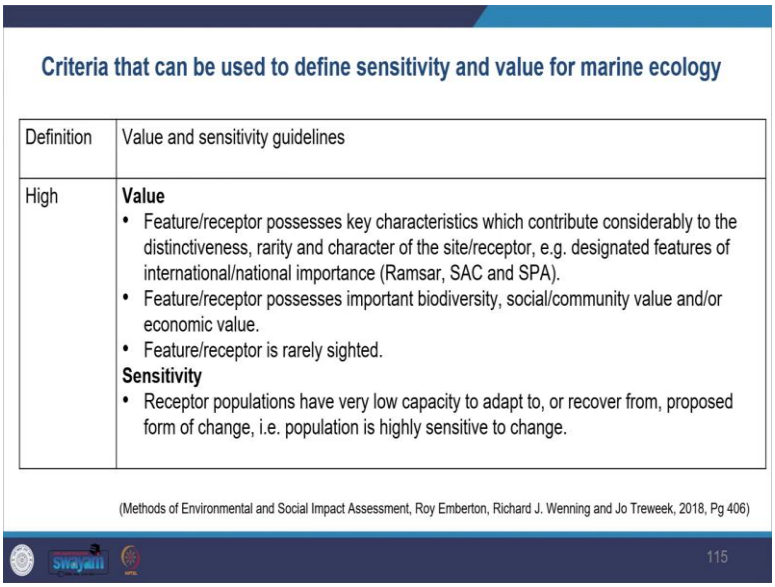

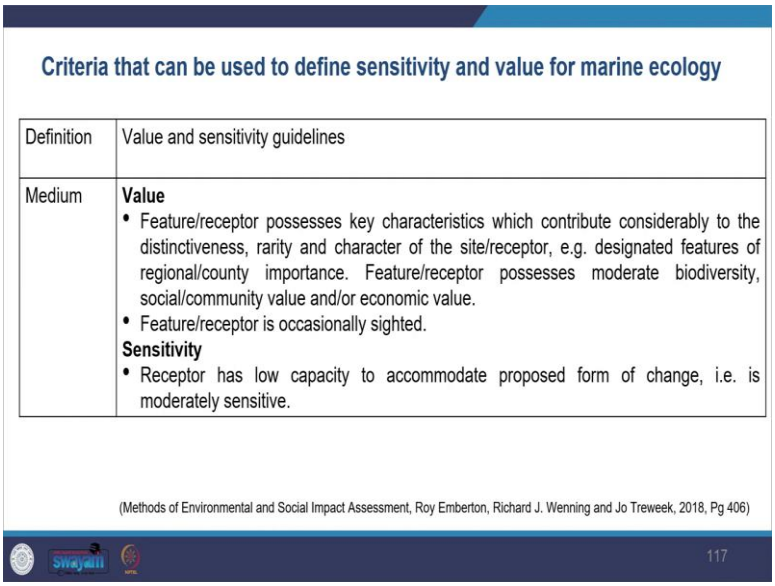

So, you see that you look at those questions, and same way you have another example where you look at the sensitivity of the receptor. So, you also see what when do you see, see that is the, there is high sensitivity? So, if you look at receptors, what is the key characteristic of that receptor? Are they distinctive or not? And are they like specially protected areas or protected species?

So, what is the value of it, and how sensitive are those receptors, can they adapt to the change or not so, if not, then their value would be high. So, likewise, you have a certain medium, where you will say the impact is medium when the value is relatively low, and then the sensitivity can accommodate the changes.

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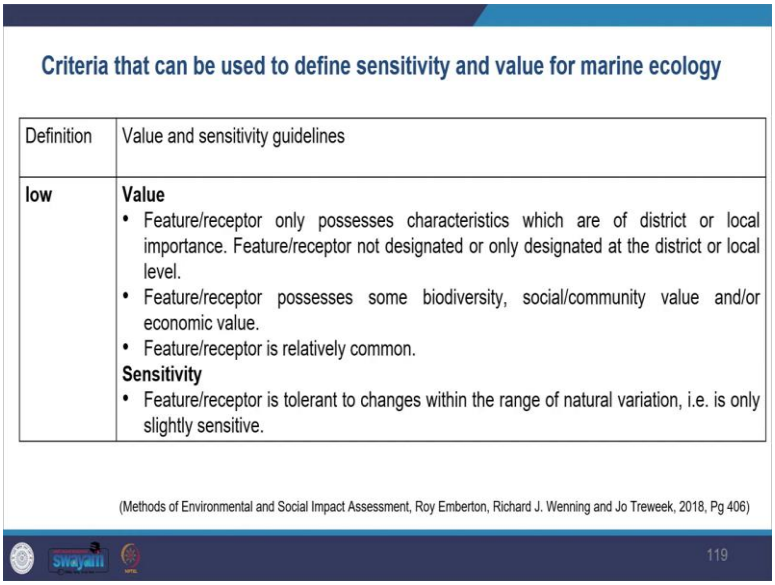

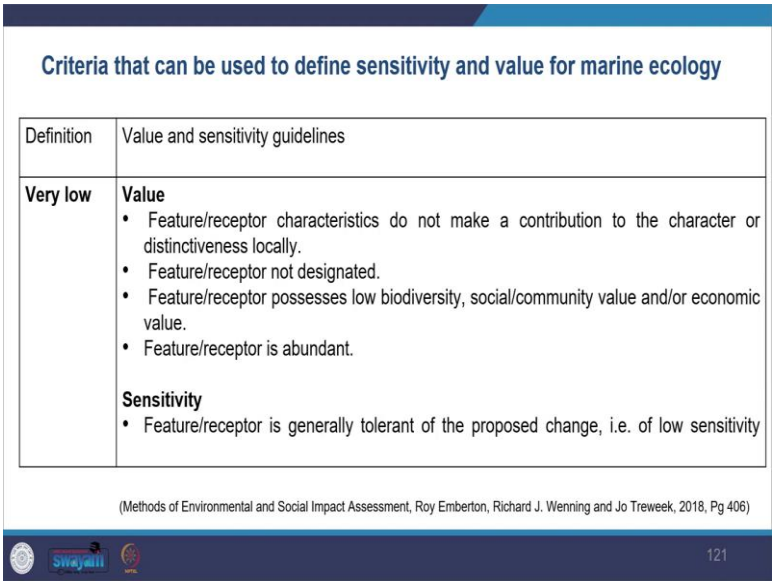

So, likewise, you will see the impact is low, when the value is of local importance, and not designated anything, and then sensitivity wise also they can tolerate and they can adapt to the changes given. Similarly, very low, so that is how you would have parameters to evaluate all the significance.

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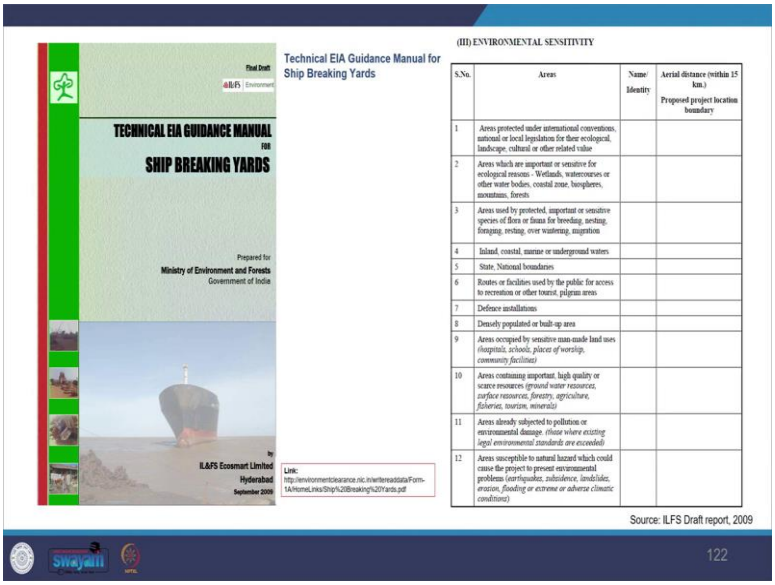

So, here as per the manual, you can see how they are looking at the environmental sensitivity again taken from the shipbreaking yard examples, so you would look at certain parameters given here in the Indian scenario. So, you have areas protected under international convention. So, you would consider it to be more sensitive, and so on. So, areas that are important or sensitive areas used by protected important or sensitive species, inland coastal marine or underground water, and overall things have to be taken care of. So, this sensitivity is also given.

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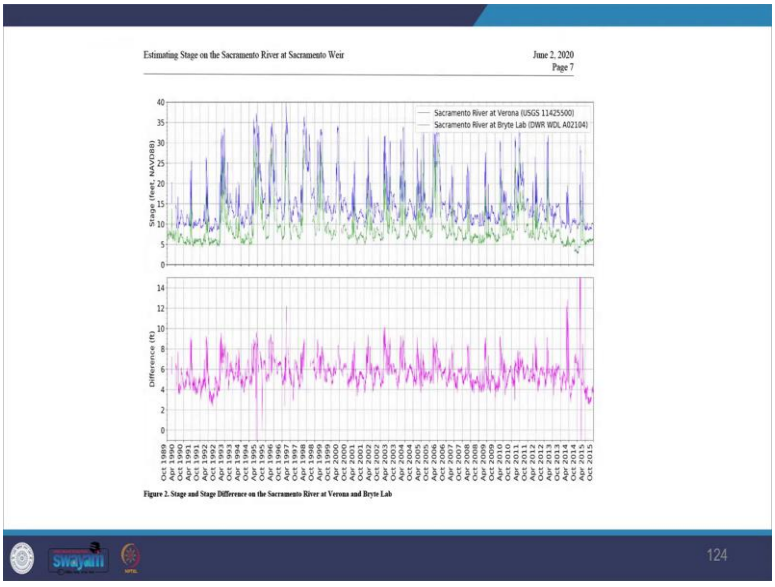

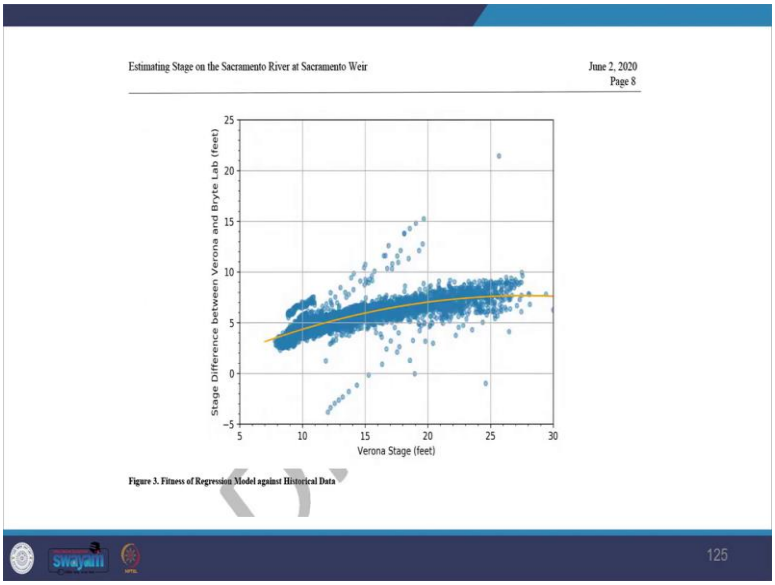

And then you would also use the current and historical data to understand this. So, I have taken this snip from the case example of the Sacramento River. So here you can see how they are putting their data to understand the historical perspective. Here also again, you can see the historical data on how the changes are happening.

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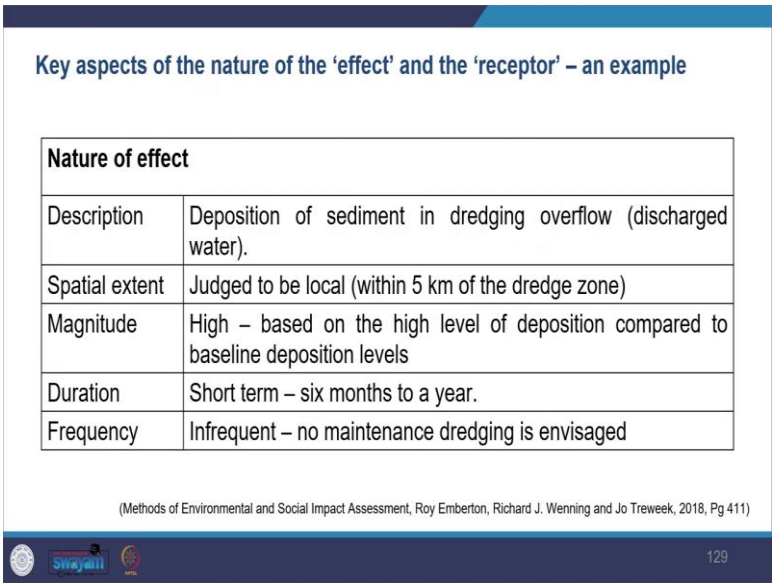

Key aspects of the nature of the 'effect' and the 'receptor' – an example

Nature of receptor	
Description	Herring spawning ground (evidence based)
Is the receptor vulnerable to the effect?	Yes – spatial analysis using GIS indicates that the deposition footprint and the herring spawning ground overlap.
Sensitivity (intolerance) of receptor to the effect	High – the predicted depth of deposition is higher than smothering values that would have adverse effects on herring spawning. It is predicted that the deposition will change the substrate composition to a degree that makes the ground unsuitable for herring spawning.
Recoverability of receptor to the effect	High – the receptor has a rapid recovery rate. The impact would be temporary, as following the cessation of dredging (and deposition), excess sediment would be removed by natural processes and depths of sediment would return to baseline levels within five years. Therefore, the ground would once again be suitable for herring spawning.
Value (importance) of the receptor	High – it is the only known spawning ground for this species within the wider study area and the respawning aggregation of herring in this area represents an important component of the local commercial fishery (i.e. it has economic value).

(Methods of Environmental and Social Impact Assessment, Roy Emberton, Richard J. Wenning and Jo Treweek, 2018, Pg 411)

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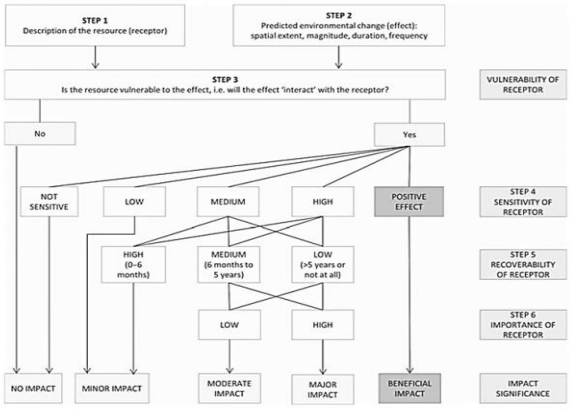
Potential decision framework for assigning significance to impacts on marine ecology, fish and shellfish, and archaeology (modified from Posford Haskoning 2004)



(Methods of Environmental and Social Impact Assessment, Roy Emberton, Richard J. Wenning and Jo Treweek, 2018, Pg 412)

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So, there is another example, you can see how you can look at the impact that happens on the receptor. So, you look at the different magnitudes you describe the nature of the receptor and look at the magnitude and then you also find a framework which is there to check this. So, you can see this decision-making framework, how do you decide whether it is important or not important, so, one of the frameworks has been given here. So, even that can be referred to here.

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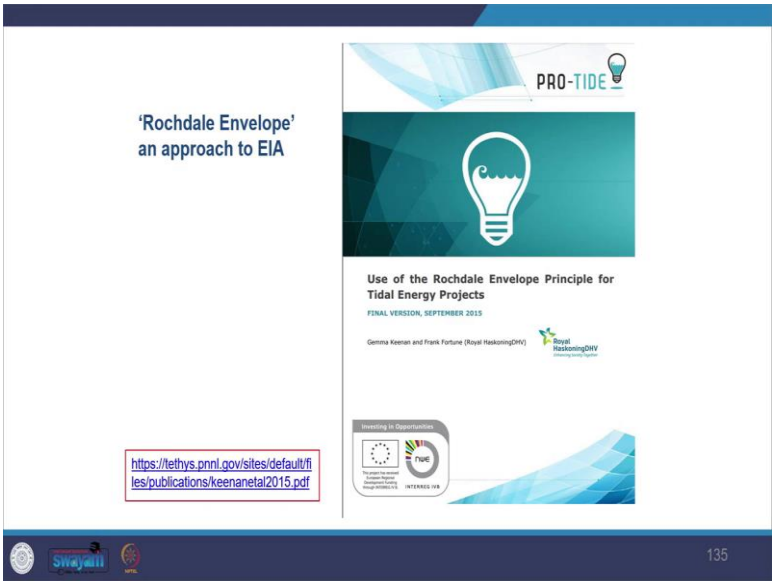

Then there is another framework approach which is given, which is like Rochdale Envelope, which is also very much used in the environmental impact assessments. So, that can also be used here. So, the link to this document I have provided this for you. So, that is what we saw about the coastal area, what are the different impacts? And then what kind of models are used? And then what kind of questions do you ask to see the impact, magnitude significance, and sensitivity of the receptor?

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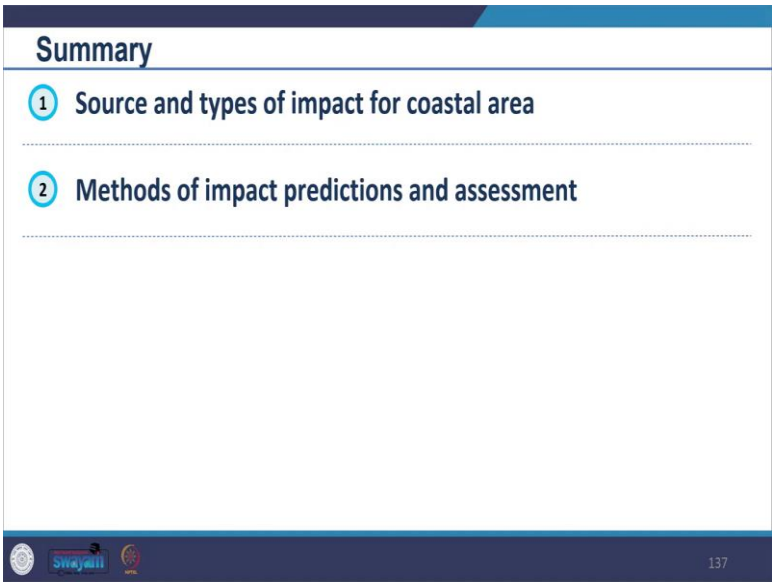

So, what did we cover today, we covered the sources and types of impacts for coastal areas. Then we looked at the methods for impact predictions and assessment. So, that was the coverage for today.

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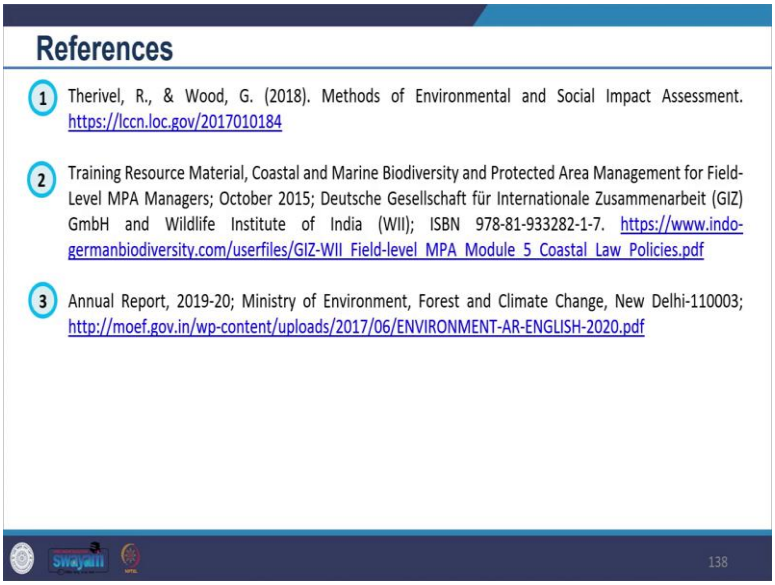

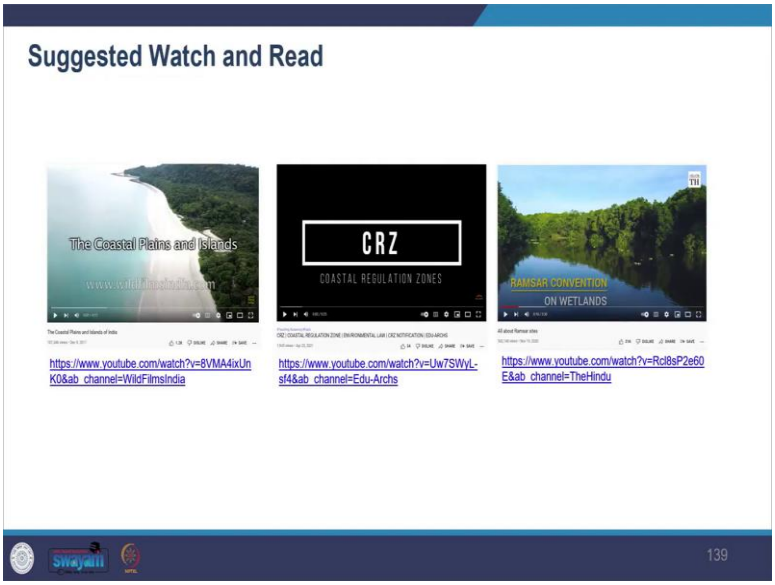

And this was the key reference, the book Therivel and Wood's book, which is that textbook and then now there are suggested readings and watch, like all the phenomenon and cases which we could not discuss all of them but then they have been given here so that you can look at those videos separately if you are interested.

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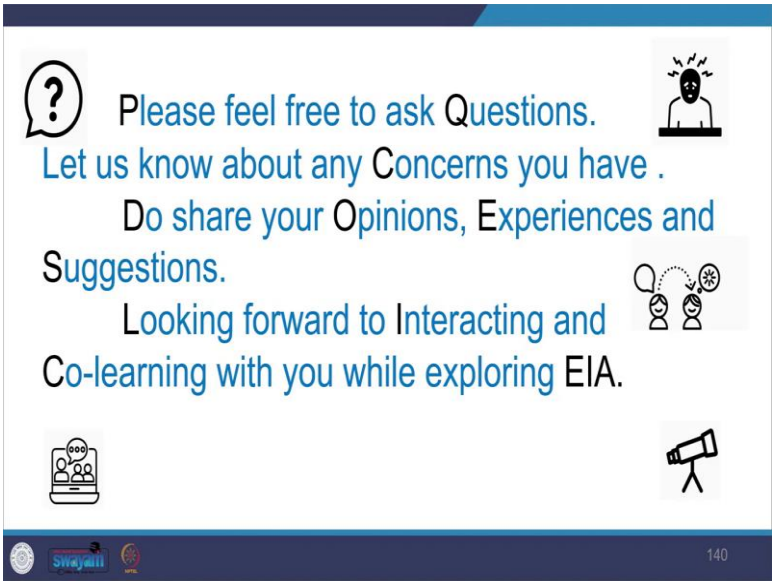

So, we will wind up there, so please feel free to ask questions. Let us know about any concerns you have. Do share your opinions, experiences, and suggestions, looking forward to interacting and co-learning with you while exploring EIA. Thank you.