Environmental Impact Assessment
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Lecture - 36
EIA Methods – Climate and Climate Change – Part II

Welcome to the course, Environmental Impact Assessments. In this session, we will cover part two of methods involved within, methods involved for climate change assessments in the larger embed of methods that we are covering in EIA. In the previous part, we covered definitions and concepts and we also looked at the legislative framework and we looked at certain guidelines and standards available for the domain. Today, we will cover methods for scoping and baseline studies and impact prediction and evaluation.

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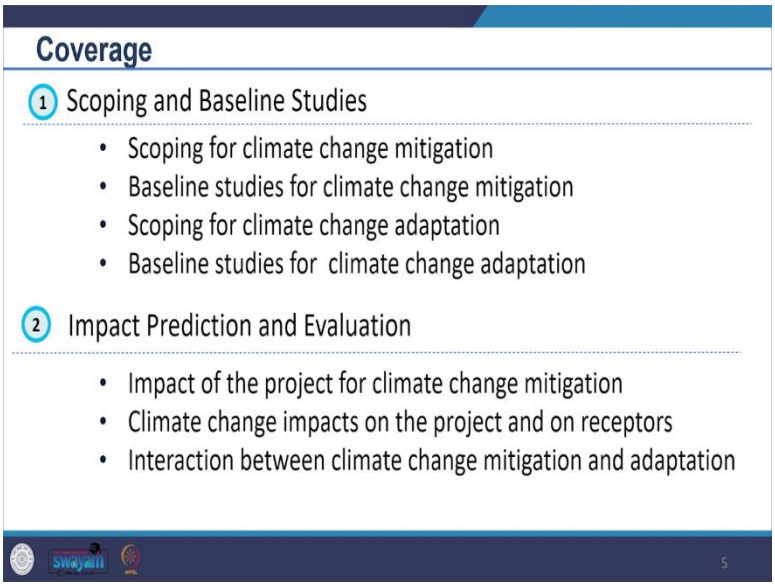

So, accordingly, our coverage will include looking into scoping for climate change mitigation, we will look into baseline studies for climate change mitigation, as well as we look at scoping for climate change adaptation, as well as we will look into baseline studies for climate change adaptation. So, you may recollect that we differentiated between the terms mitigation and adaptation in our previous class, so how for these things we do separately we look at, how do we look at scoping and how do we undertake baseline studies?

We will also look at how we will also look at different methods for impact prediction and evaluation. Within that, we will look at the impact of the project on climate change mitigation, we will look at climate change impacts on the project, and receptors will also look at the interaction between climate change, mitigation, and adaptation. So, you may connect with the previous session about the different terms that we talked about.

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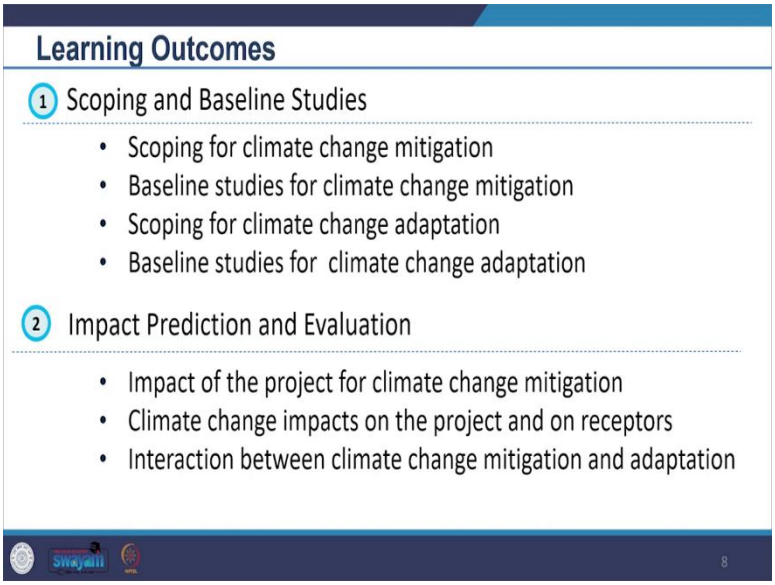

Accordingly, the expected learner-learning outcomes include that after completion of the session, you should be able to list out different methods that are available to you in scoping and baseline studies, about mitigation, adaptation, as well as you should be able to review impact prediction and evaluation methods, you should be able to look into different approach which are adopted for mitigation as well as for adaptation purpose, and at the same time you should be able to look at the impact on the project as well as on the receptors based on these concepts.

For this session, for this section, we are following Chapter 5 of the book Methods of Environmental and Social Impact Assessment by Ricky Therivel and Graham Wood. So, moving forward looking at these coping and baseline studies, most of the available legislation and guidance we see that require climate change to be considered in the early stage of EIA.

So, we see that it is very useful to consider EIA at the scoping stage, right at the beginning, so that the key elements of climate change can be identified and can be also identified through the key, engaging with the key stakeholders and you can also check with the key legislations like what all needs to be studied here.

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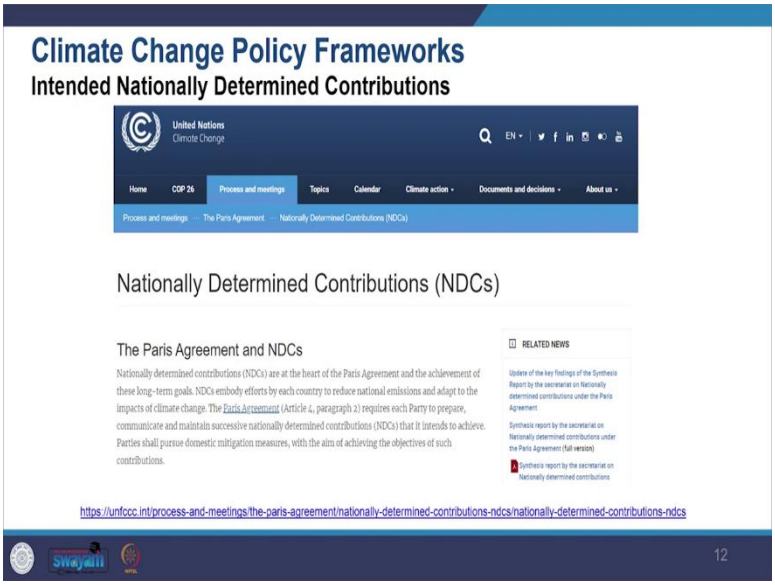

So, examples of climate change policy framework, with what would be your reference would include intended national, nationally determined contributions as per the Paris Agreement. So, what as a nation one has the nation has committed towards this agreement to meet the target, so you need to look at those things and so those will be the binding provision for the country, and within that, the other EIA process would follow.

Scoping in and scoping out will mostly depend on nation to nation based on the legislative provisions that they have. Mostly, it is suggested that climate change should be put in scope for all major infrastructure projects, so minor would not have that kind of impact but it is important to consider the major infrastructure projects as they are likely to contribute towards the greenhouse gases. So, minor infrastructure projects, however, with no significant climate change concern can be kept out from the climate change assessment process.

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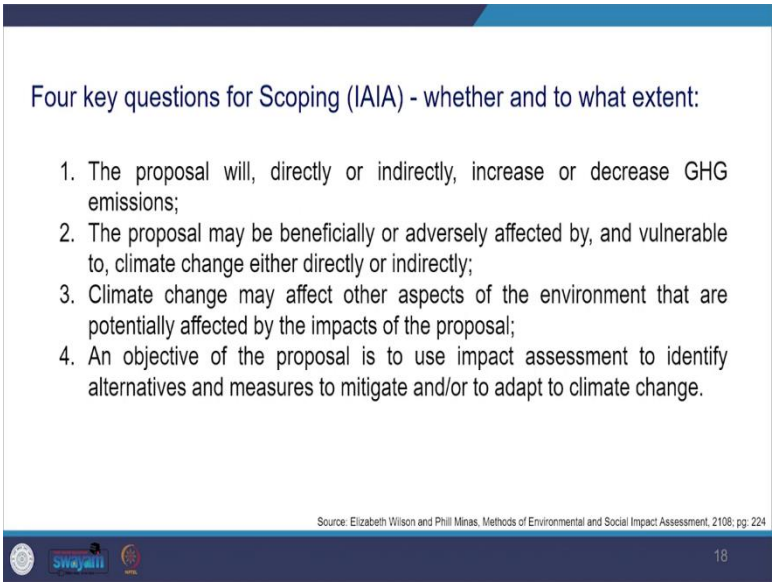

So, we see that according to the IAIA list, there are four key questions when you are doing this scoping stage, reviewing under the scoping stage, you need to ask four key questions, which you should consider to review the need for climate change assessments. So, number one you would ask will the proposal directly or

indirectly increase or decreases greenhouse gas emissions, and if it will to what extent, you should review and check your content on the case within this question.

Second, will, you should ask will the proposal be beneficial or will adversely affect and will vulnerable, will be vulnerable to climate change either directly or indirectly if whatever you are proposing will be beneficial or it will be negative, and will that particular proposal also be vulnerable to climate change and it can be vulnerable or the impacts can be one directly or indirectly influencing your project, and to what extent the influence is.

Likewise, you would be asking questions like will climate change affect other aspects of the environment that are potentially affected by the impacts of the proposal and to what extent Then you would look at the objectives of the proposal, whether impact assessment for identifying the alternatives and what measures you would be adopting to mitigate and to adapt for the climate change purpose, so you need to have those objectives in place.

Further, we see that in the scoping phase, it is very important to consider many of the existing guidelines. So, you should look at existing guidelines in the state general and broader consideration should be taken such as you need to look at the greenhouse gas emissions, so you would be looking at those figures but it is important for you to also look at the carbon sinks, so you will have a totally complete picture of the scenario. So, at the beginning, at the scoping stage, you should look at both the emissions as well as the sink.

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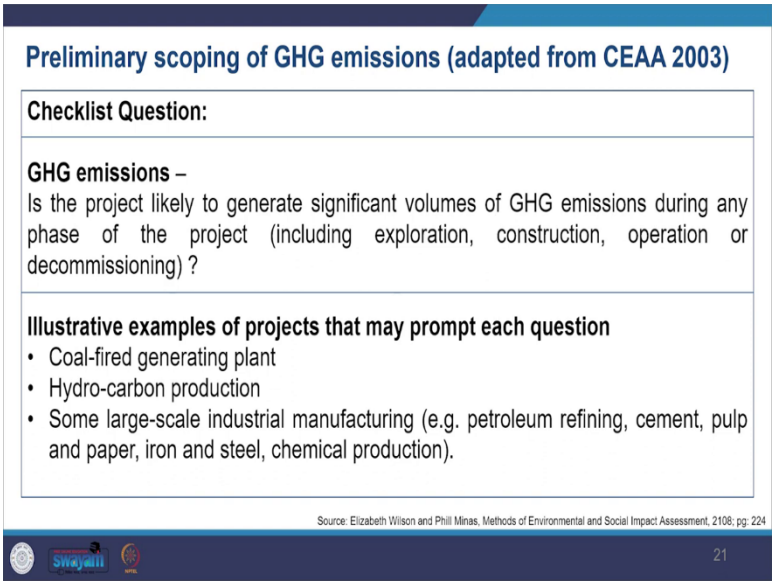

In the table, you can see the checklist as per the guidelines issued by the Canadian Environmental Assessment Act of the potential questions that would help you during the scoping stage. So, we see another set of questions that can help you to identify all these areas for further detailed study.

So, questions such as is the project likely to generate a significant volume of greenhouse gases, and emissions would arise during any phase of the project. So, the phase could be the exploration phase,

construction phase, operation phase, or discrimination of the face of the project. So, you need to review all those things whether there will be what level of emissions would happen.

It can be both, the emissions could be bought short-term as well as long-term type, and examples of this type of project include coal fire generating plants, hydrocarbon production large large-scale industrial manufacturing, like petroleum refining, cement, and so on. So, you see those things here, you can look at the table here.

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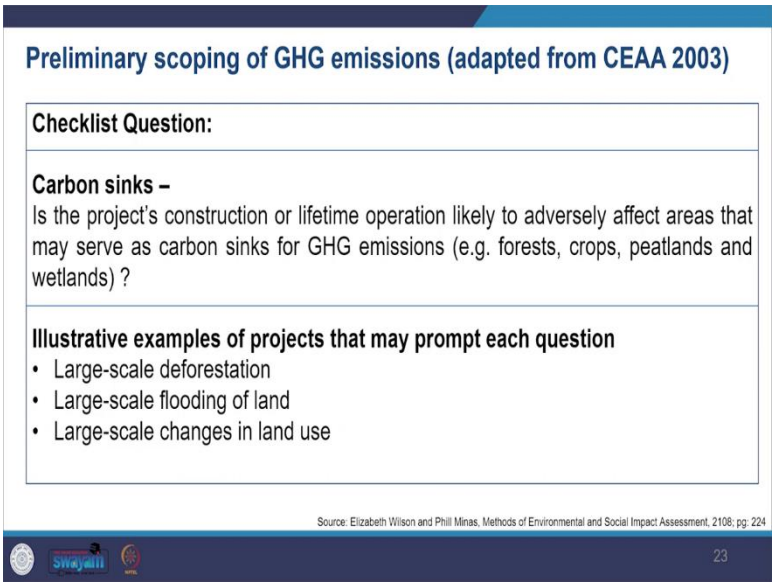

You should also look into whether the project's construction or its lifetime operation will negatively impact the areas that act as carbon sinks for greenhouse gas emissions, so you have to be cautious about whether are you disturbing the sinks as well. For example, you might be causing deforestation and then you might be also interfering with the peatland or the wetlands.

So, the related project activities could be deforestation, flooding of the land, or large-scale changes in land use, so this kind of activity can also happen, so you need to review all those things. Further, for baseline study for climate change mitigation, in many contexts, it is easy to undertake baseline studies, so baseline studies are very intensive with data, in many of the contexts it is simpler to undertake baseline study.

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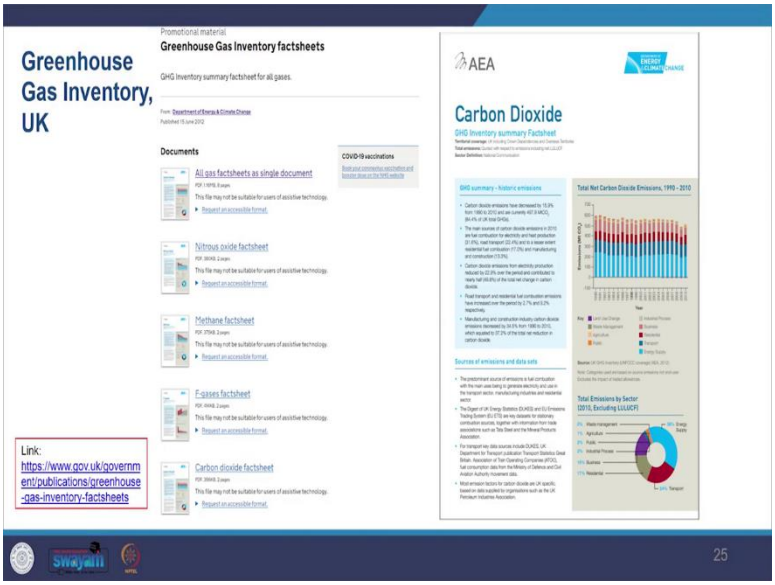

Particularly, we see the UK for example maintain a greenhouse gas inventory that contains all the UK's official reported greenhouse gases, so one can straight away take the data from there as a baseline study and these data are maintained by the local authority. You may see here the snip of the inventory from the UK government website, you may note how they maintain sector-wise inventory here, so you will have a look at this.

So, how many details you would provide in the baseline study would also vary from project to project, so you might be providing the levels of emissions and what like, from what source, how it is coming, how much it is coming, so it that particular detail will depend upon project to project, like what is the concern and how much data is available to you.

So, you can also provide historical data, you can provide current data as well as future projected data. So, in that you can provide the conditions, what are the current conditions and you can also look at the trends in your baseline assessment while you are doing this and how you are presenting your data.

So, you need to determine how the baseline environment will change. Detailed quantification of greenhouse gas emissions may not be necessary and will depend on the project in hand, so you don't need to take all the, undertake all the quantification of the emissions.

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In the example here, you can see one of the cases from the US you can see or I have taken up this EIA statement from the California report. So, here you can see they have given very detailed air quality and greenhouse gas emissions and how it is impacting the environment, they are looking at the air quality. In the table here, you can see the ambient air quality standards and the measured criteria pollutant concentrations that have been given here. So, this link also has provided, access to this has been also provided to you.

So, every country has committed to a reduction in greenhouse gas emissions, but there is a considerable difference in the commitment and actuals, we see that every country has committed to it but how much is the commitment, and how much they can do it on ground there is a huge difference between that, so you may note the global targets which we talked in our previous class as well is to hold the global average temperature to well below 2 degree centigrade above pre-industrial level. So, that is the target, and how we align our EIA process and project to project would depend on that. So, you should refer to the nationally determined contribution for reference while undertaking baseline studies.

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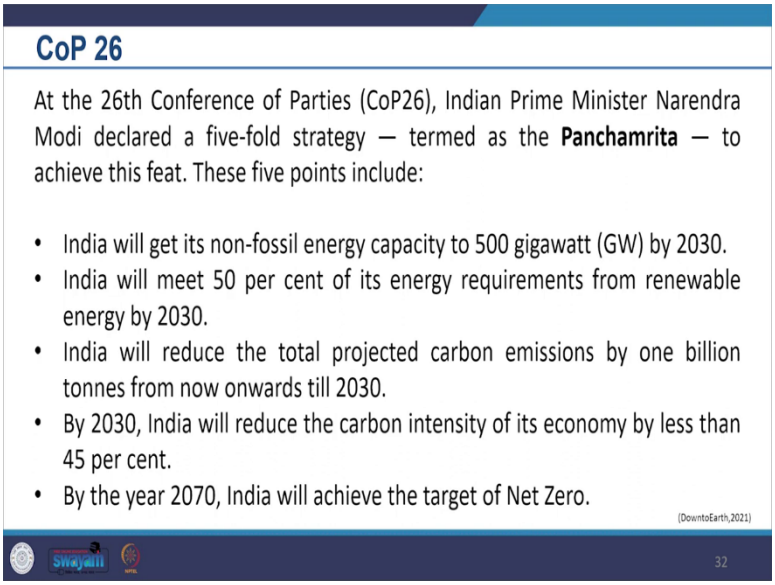

So, you may have observed the commitment of our Prime Minister at the 26 conference of parties CoP 26, where the PM gave a fivefold strategy termed Panchamrita - to achieve the emission goals which include like, use of non-fossil energy capacity, then you also see that to meet 50 percent of its energy requirement from the renewable energy sources, as well as to reduce the total projected carbon emissions by one billion tons from now onwards till 2030 and by 2030 India will reduce the carbon intensity of its economy by less than 45 percent. So, that is what we are committing. By the year 2070, India will achieve the target of net zero, so you would look at such kind of commitment to evaluate our position.

Now, looking at the scope for climate change adaptation, so we looked at the mitigation parts, and now we are going to look at the climate change adaptation. So, the authors suggest that climate change adaptation has yet very much been neglected in the environmental assessment process, so this is not very well established and the probable explanation for this. Neglect is that there is a lack of equal international emphasis on adaptation, so there is a lot of emphasis on the mitigation path but relatively there is less emphasis on adaptation part.

So, also, we see that the impact of climate change on development is experienced, so the impact is more realized at the local level therefore it depends a lot on the local government to handle it, and since, locally, there is a lot of variation about how each region experiences it.

So, there is a lot of variation in how the impact is happening and how those impacts can be addressed, so that is why there is a lack of emphasis on the adaptation part. Plus it is said to be there is a lot of uncertainty in the projection for the future. So, now looking at the project's lifetime and the climate change, once we look at this adaptation we also look at the project lifetime, and when we look at the climate change, what project lifetime we should consider while assessing this? So, you may know that most major infrastructure projects are likely to have a lifetime of around 60 to 100 years.

So, most of the major projects have this lifetime and some of the major infrastructure projects could have an even bigger lifetime, like a lifetime from the operational to the decommissioning phase. So, the example could be the nuclear power station could be 160 plus years, so the life span and project life span would vary for climate change, you need to take a larger lifespan period for your estimations. It is suggested that a full lifetime may be considered during the study.

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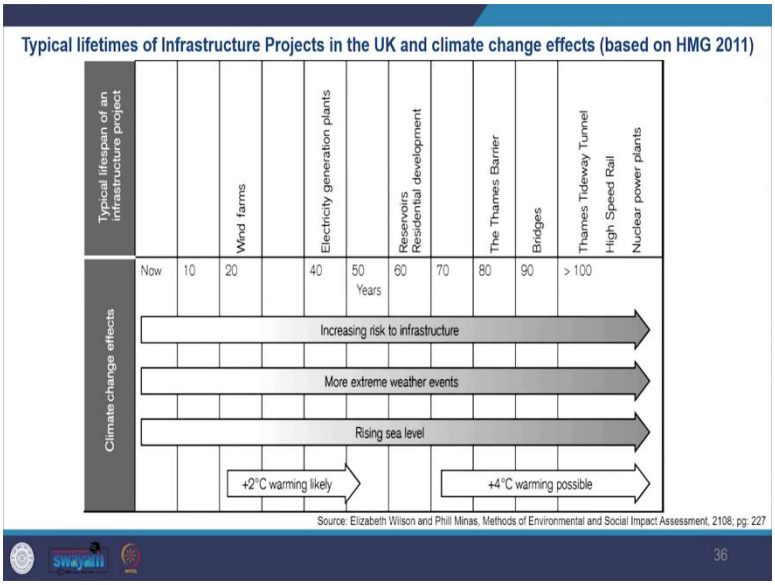

In the figure, you can see the typical lifetime of infrastructure alongside climate change time skills projects based on the projects in the UK. So, you can see here what is the range of time, and lifetime it has and how what kind of climate change impact it would have. You should consider the impacts on the project and or adaptation capacity of recovery receiving environments, you should consider the impacts on project and or adaptation capacity of the receiving environment.

So, we have been seeing in all our domains that one needs to also look into this aspect and how what is the sensitivity of the receiving environment, so you need to look at, in such cases also you need to look at the adaptation of the receiving environment and also look at the impact on the project by the climate changes and you should look at all the stages of the project for assessment, so all the stages you are now familiar with all the stages here.

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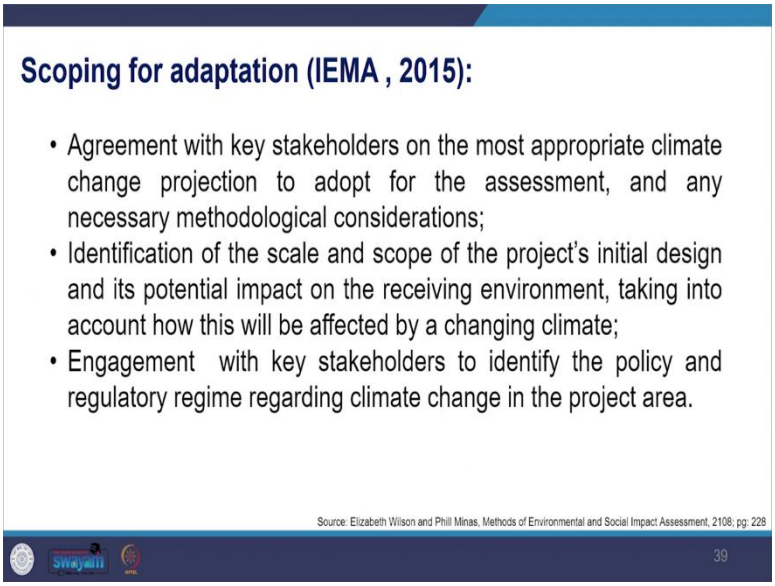

So, as for the suggestion from IEMA, the scoping of adaptation should involve, you should come to an agreement with key stakeholders on the most appropriate climate change projection. So, to adopt the assessment and any necessary methodological consideration to be taken, it has to be a participatory approach

and you need to look at the key stakeholders and you should come to an agreement like what all projections, you would consider here.

Further, you should identify the scale and scope of the project's initial design and its potential impact, what is been put in the initial design, and what kind of impact it might have on the receiving environment. You need to consider how it is, how it is going to be affected, and how it will be affected by the changing climate.

Further, you should engage with the key stakeholders to identify the policy and regulatory regime like within what policy framework you are working so that understanding has to be developed here. So, these things are the suggestions made while you are doing scoping for the adaptation purpose.

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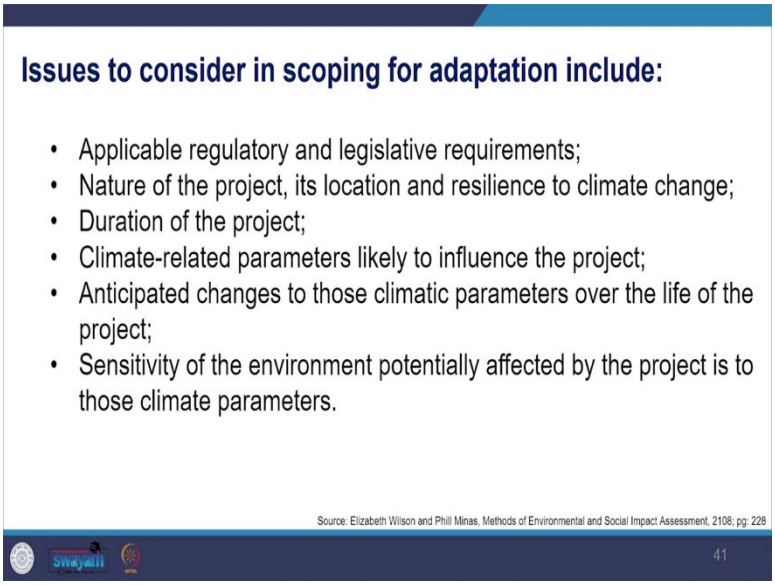

Further, you should consider certain issues for adaptation such as you should look at the applicable regulatory and legislative requirements of the nation's state and the project, so you should look at these things. Further, you should review the nature of the project, what kind of project you are dealing with its location, and resilience to climate change, as you saw that the project life span also varies, the activities also vary and the kind of impact it might have or the risk it might have also varies.

So, you need to look at the nature of the project, you should look at the duration of the project, what was the duration of the project you should review the climate-related parameters likely to influence the project. So, we will be also looking at the climate-related parameters here. You should anticipate changes to those climatic parameters over the life of the project, so you have already seen what lifespan we take for the project.

You should review how sensitive the environment potentially affected by the project is to those climatic parameters, so when you stimulate those climatic parameters, you should see how sensitive your project is to those parameters. So, that it gives you an idea in cases of accidents or different extreme events how your

project would behave. So, you have to review the possible changes in the period of 50 or 100 years into the future.

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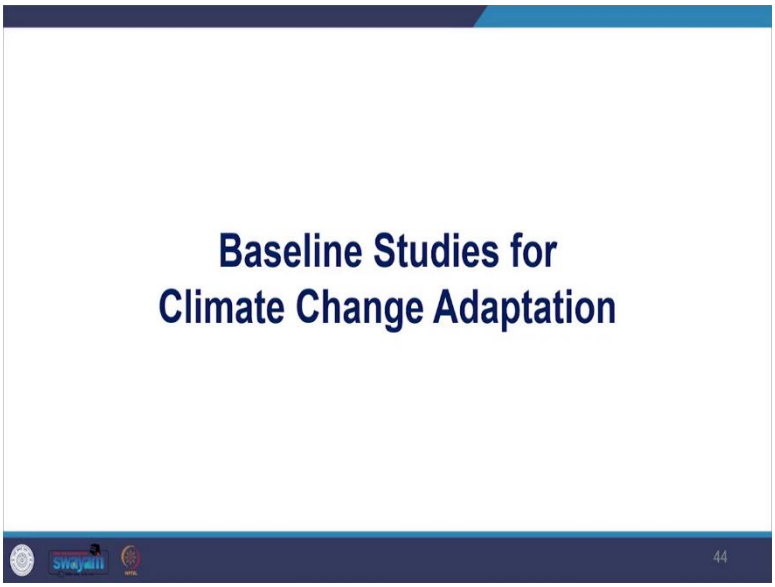

Now, looking at the baseline study for climate change adaptation. So, now moving on we see how you undertake baseline study for understanding, and assessing climate change adaptation. So, within the climate change adaptation under the provision of UNFCCC, climate change models have been downscaled, so we see that the scientific community has downscaled the model from the global to the regional, to the national areas. Which range of climate change scenarios can be generated by manipulating key parameters and it can be done for the periods to 2080s, so those things are available.

It has been done for developing, so they have categorized done for the developing and the least developed countries. So, at the scoping stage, it is suggested to agree with these stakeholders on which scenario you would like to align your assessment with. So, which period, what kind of parameters, or what kind of scenarios? For modeling scenarios, you may take minimum emissions, so as for the project depending upon the project you can take minimum emission scenarios or for the bigger project you can take high emission scenarios as per the nature of the project, so you may also find adaptation measures.

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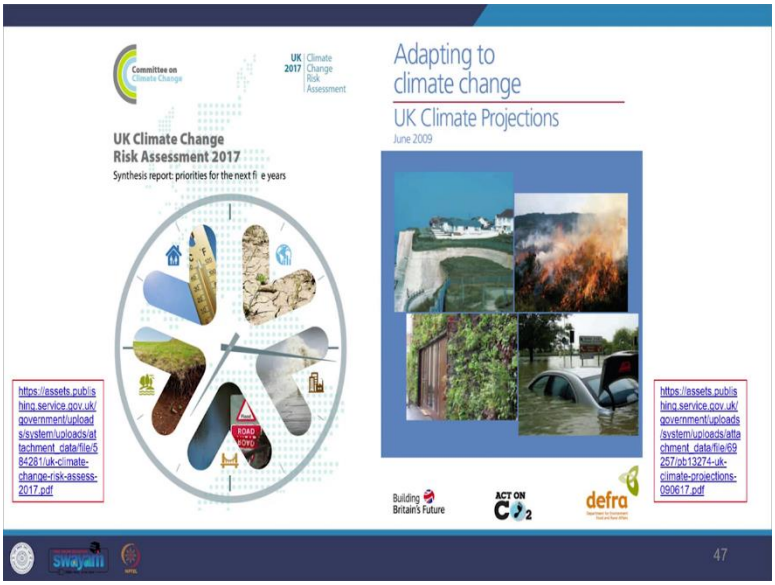

So, this is like you can look at different scenarios and see what kind of impact adaptability is suitable. So, you also have guidelines that give you what adaptation measures look like for climate change risk assessments, and there or you can also refer to UK climate change projections, which also gives you information on the projection aspect. Further, we see for the purpose of baseline studies for climate change adaptation you would be required to identify certain conditions.

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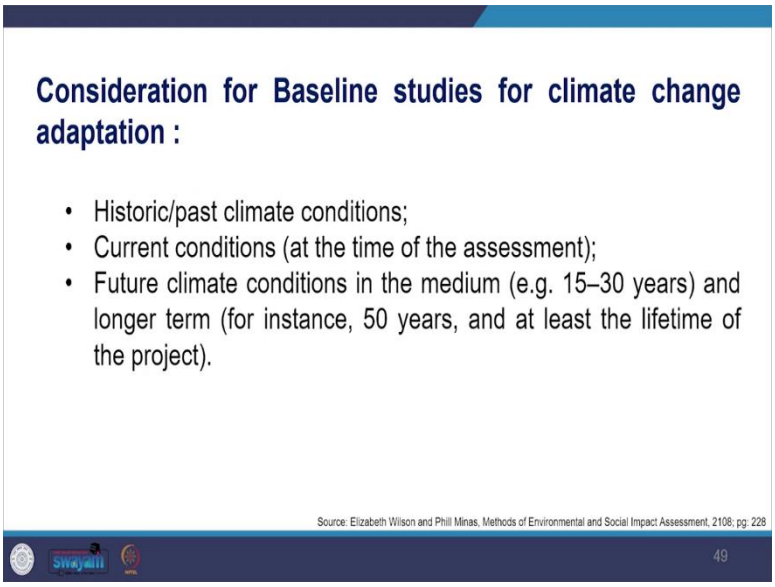

For example, you need to look at the historical past climatic conditions, you might have to look at the current conditions, then the future climate conditions with like 15 to 30 years time period, a longer period for 50 years to 100 years beyond the lifetime of the project. And then your future climatic conditions can be identified through available climate change projections, so you also have climate change projection, so you can also refer to that.

However, it is also important to identify the possibility of extreme weather events, so you need to look at extreme weather events like extreme rainfall, prolonged periods of drought, floods, and so on. So, you need to look at those scenarios also you would be required to study the climatic factors that affect adaptation.

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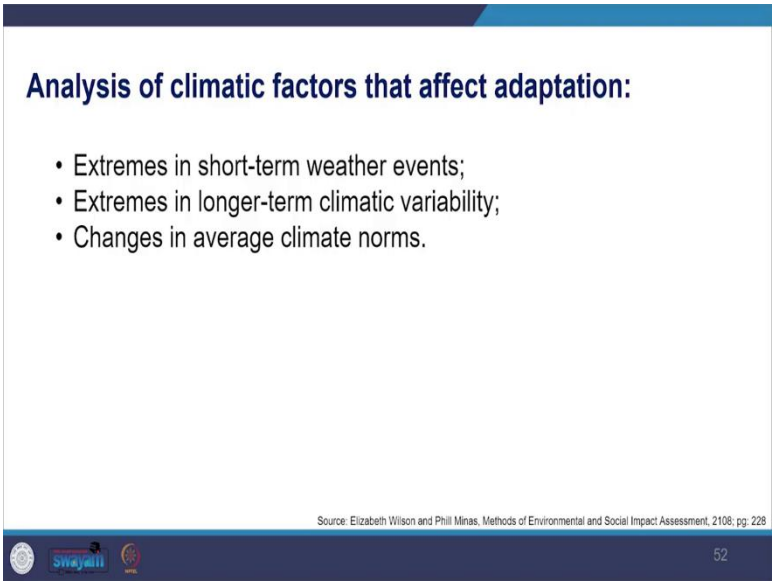

For example, extremes in short-term weather events, such as you can have heat waves, extreme flooding freezing conditions, and so on. And then, you also need to look into extremes in longer-term climatic variability including precipitation over one or more seasons, so when there is heavy rain not only one season but more than one season and then there is a regular increase in temperature, all those things you need to take care of.

Further, we see changes in average climatic, and climate norms, resulting in sea level rise, increasing, increases in freezing and thawing average ambient temperature and all those have to be taken care of. So, for certain specific long-lasting projects like road projects, or pipeline projects, it is advisable to use scenarios.

So, when you are using scenarios the period suggested is 30 years 50 years, or 70 years and you can also try a 100-year timeline, so when you are projecting the climatic scenario, you can try these timelines, and especially for the long-lasting projects you should do this.

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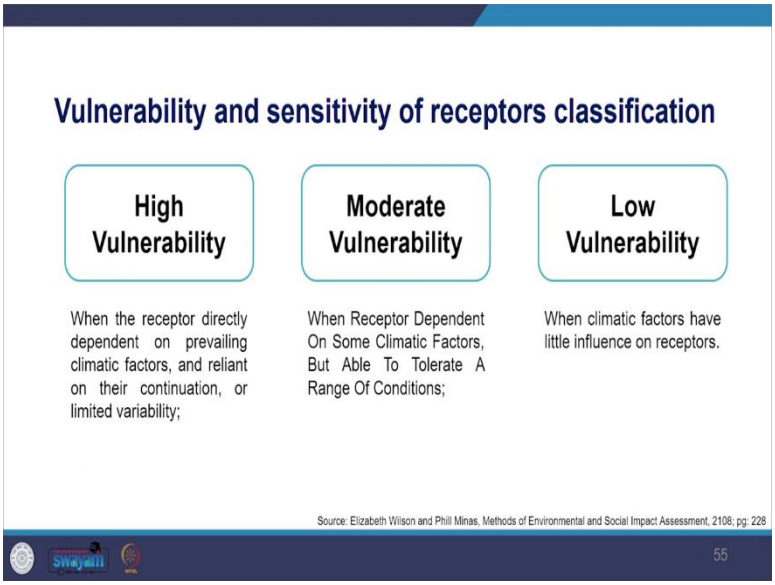

So, you have to also review the vulnerability and sensitivity of the receptor. So, in this process, you would be required to review vulnerability and sensitivity, the sensitivity of the receptors in the community, or the physical features that are on the receiving side, so you need to look at how vulnerable that is, how sensitive that is till the existing or prevailing climatic conditions. Based on that, you can classify your assessment into high, highly vulnerable, moderate vulnerable, and low vulnerable.

So, high vulnerability would indicate the receptors are directly dependent on prevailing climatic factors, so they are dependent on that. And any kind of variations on that would be, like then it would be considered limited variability. Then you look at the moderate vulnerability when receptors depend on some climatic factors, so they are not completely dependent on that but they will be able to tolerate a range of conditions changes in the conditions that happen. Then you look at low vulnerability when climatic factors have little influence on the receptors, so maybe it is like they could adapt to the changes that happen here.

So, you can also develop a matrix for this purpose to indicate the sensitive receptors and the physical location of the project dimension. So, you can have topography, hydrology, soil condition habitats, and communities, you can show how the baseline for these dimensions will change due to climate change, so you can show that.

So, the matrix method can also be used to indicate these things, you should also consider the possibility of reaching a tipping point, so a tipping point is somewhere from where you cannot come back, so, it is very important that you also review the tipping point, a critical turning point or a bottom line, so that consideration should also be given.

To review that you would require expert judgment, so an expert judgment system would be required to make such decisions or to identify those tipping points. So this would, so this was about scoping and baseline studies for climate change assessment, so we saw all these things here.

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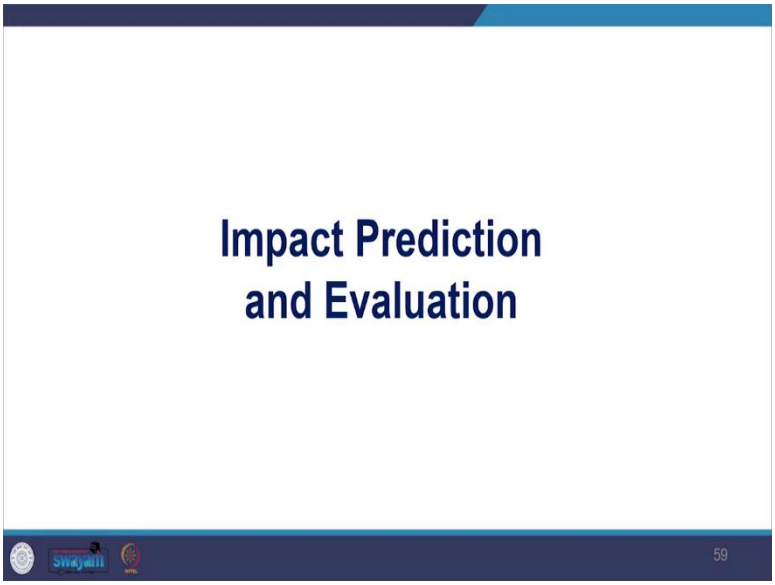

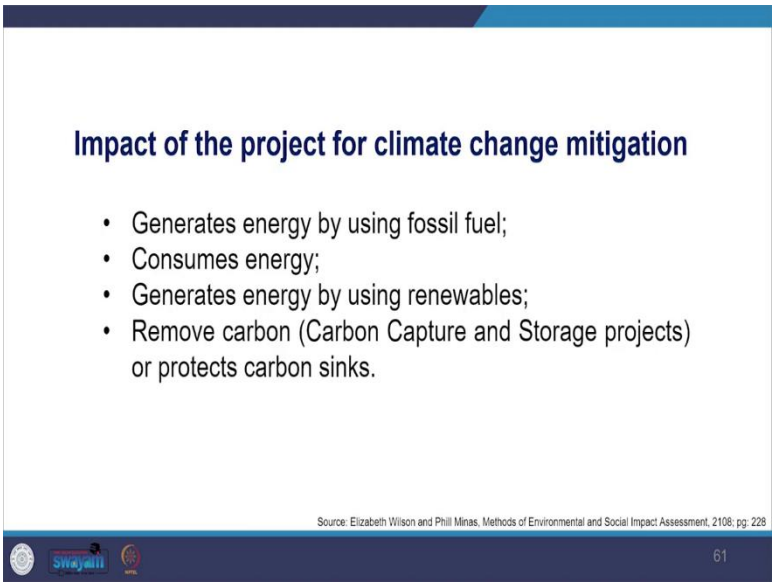

So, now moving forward we will look at the methods for impact prediction and evaluation, so now we will look at that aspect here. So, let us first look at the impact of the project on climate change mitigation. You may reflect as per our commitment to CoP 26 also that project impacts on climate will depend on the degree to which the project generates energy by using fossil fuel, then what is the consumption of energy, how much renewable energy the project is using, and how much it the project removes carbon, and how much it protects the carbon sink, so all this in totality not only looking at the emissions but also looking at the carbon sinks and then all the energy consumption, so all those have to be taken care of here.

You may use a carbon calculator such as the one which we had discussed developed by the Scottish government for the purpose, so one can use that also carbon calculator. For evaluation, we see that climate change has a cumulative effect. So, climate change is the complexity involved because we had discussed this before it is a cumulative effect. So, for that purpose, individual projects cause, this limited impact of individual projects.

However, they together make a huge difference. So, one needs to look at the cumulative effect and for that purpose, one can remove the smaller projects but can consider larger projects and there are set guidelines for those where one could refer to the emission guidelines. So, Scott's plan provides guidelines to estimate greenhouse gases for various natures of the projects, so that one can refer to those guidelines as well to see that and, in our context, we refer to the air quality guidelines as provided by CPCB.

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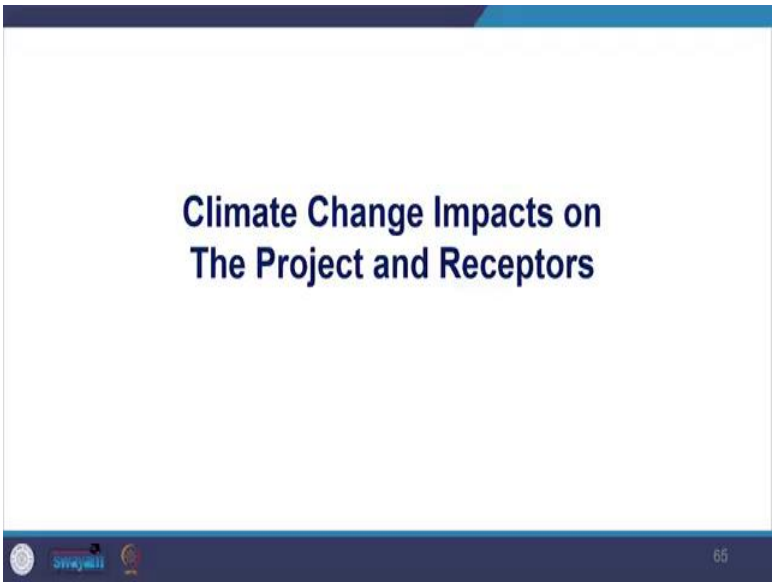

Moving forward, now looking at the climate change impact on the project and the receptors. So, now we are looking at what kind of impact it will have on the project as well as on the receptors. Climate change will influence our environment and will be risky for the proposed development itself, so it is just not the receptor but it can be risky for the proposed development also.

So, the risk may be more for the vulnerable people and the community, so you need to identify them, so the risk must be much greater for the vulnerable community people. So, those need to be identified. Therefore, you should review the sensitivity of these receptors under various stages of the project and also review the impact of the project there might be an interaction between the project and the climate change and also the other socio-economic factors, so you may also consider that.

So, as we had talked about adaptation, mitigation, and also the interaction between that plus whenever we are considering the vulnerable community then you also need to look at the actual climate change and then the socio-economic factors that might be influencing or increasing the vulnerability of the people.

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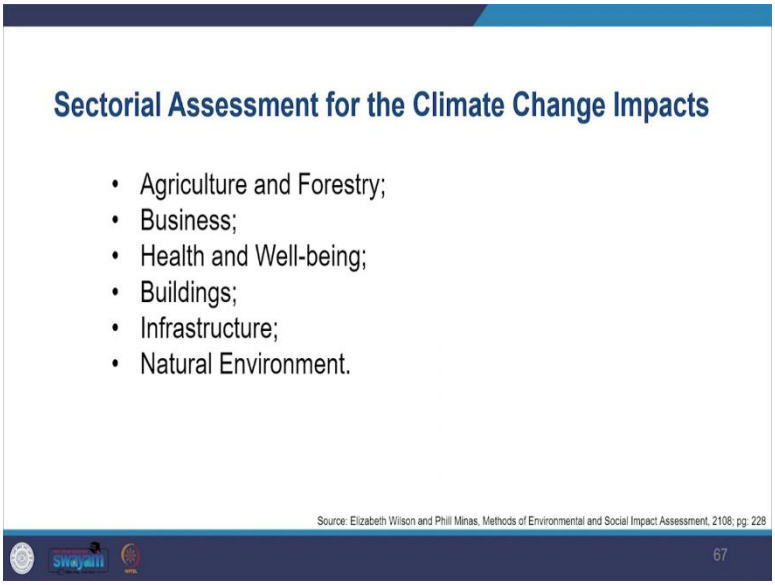

So, there are many sectoral assessments available for the purpose, you may find that the UK climate change risk assessment, is based which is which provides guidelines on agriculture and forestry. It provides for business, it provides on health and well-being, buildings and infrastructure, and the natural environment. So, all these sectoral assessments are available for reference.

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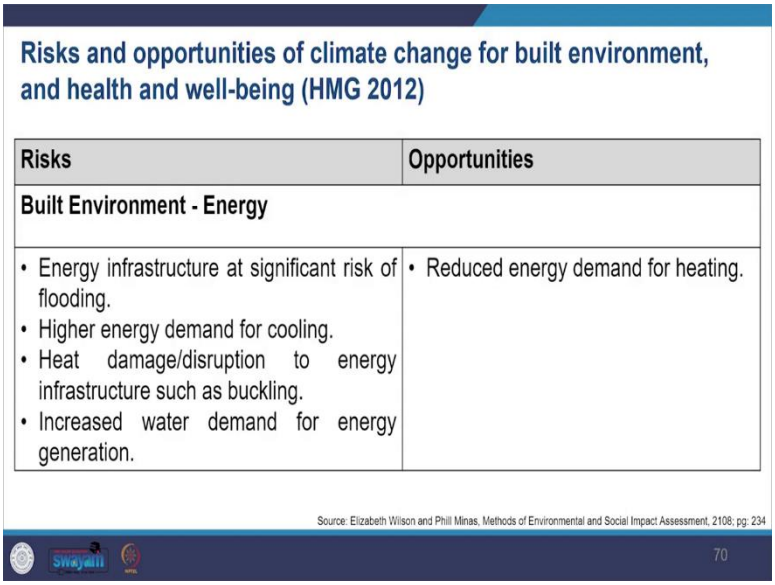

In the table here, you can see the assessment for building infrastructure and health, you can see here. On the left-hand side, you can see the risk involved in the built environment, and on the right-hand side, you can see the opportunities. For example, you can see energy infrastructure at significant risk of flooding as a potential risk and reduced demand for energy for cooling as opportunities. So, you can see here, how what kind of risk and what kind of opportunities are there with all the kinds of projects here.

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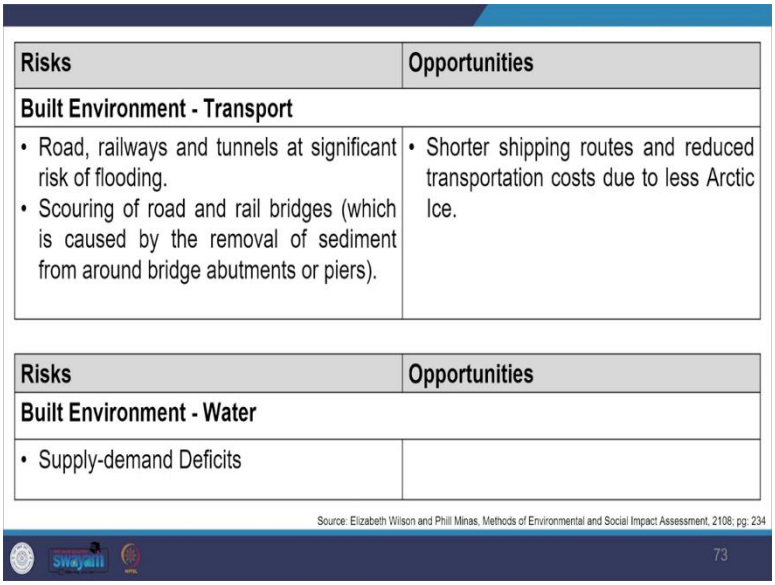

So, likewise, you may review transportation projects and water projects, so what kind of risks are there and what kind of opportunities are there.

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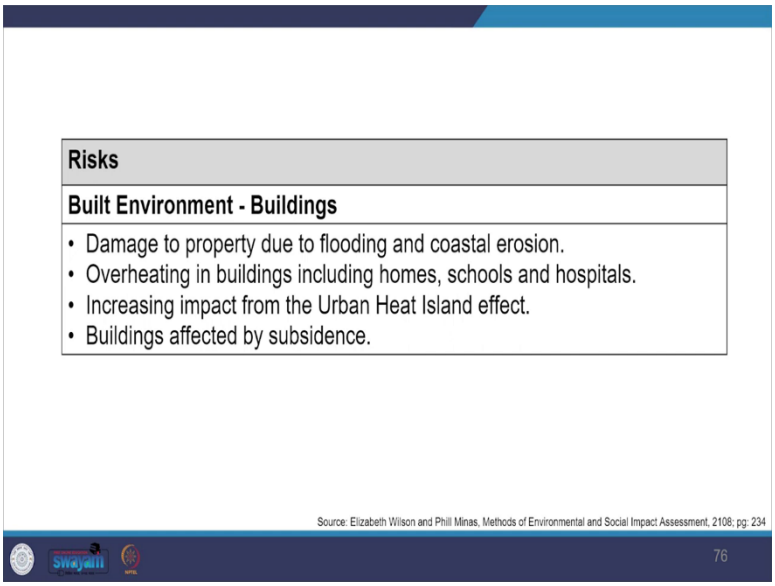

Likewise, you can see the risk for the building projects, so there can be damage to the property due to flooding and coastal erosion. Then you can have overheating in buildings including homes, schools hospitals and so on.

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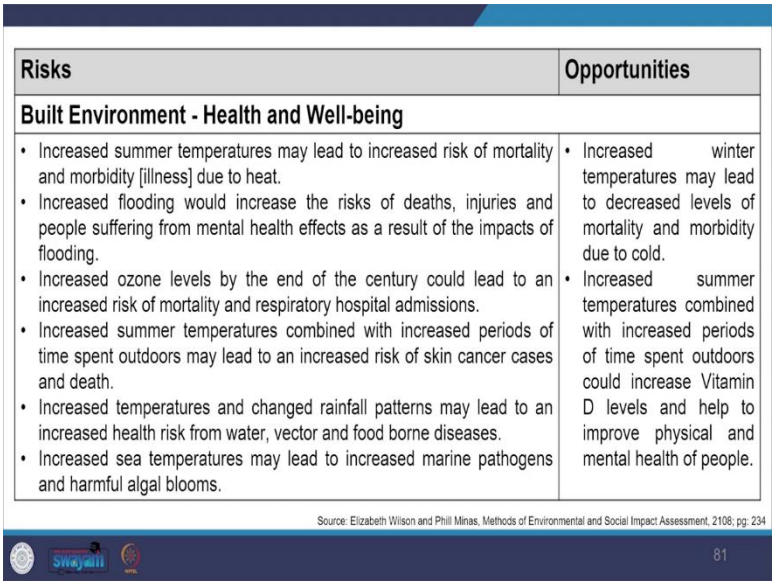

Likewise, you can see the risks to health and well-being and the opportunities, you can see how there can be increased summer temperature may lead to increased risk of mortality and morbidity, so there can be more deaths because of this, people can be, many more people might get sick and unhealthy. So, that is the risk and then, but the opportunities increased winter temperature may lead to decreased levels of mortality and morbidity due to cold, so fewer people might die because of the wind and cold weather, there is both a component to that.

So, for vulnerability assessment, how do we take the vulnerability assessment, you should review critical interdependencies. So, you need to see how interdependency is there between one factor the another, so the socio-economic and then all the climate change aspects, so how they are interdependent. So, you need to identify those critical interdependencies and you may note that one failure, if you identify those interdependence, you may know that one failure might lead to several other failures.

So, for example, a flooded power station leads to power cuts and when there are power cuts, there might be a lack of communication and many other services might get stopped, so you have to look at the interdependency between things.

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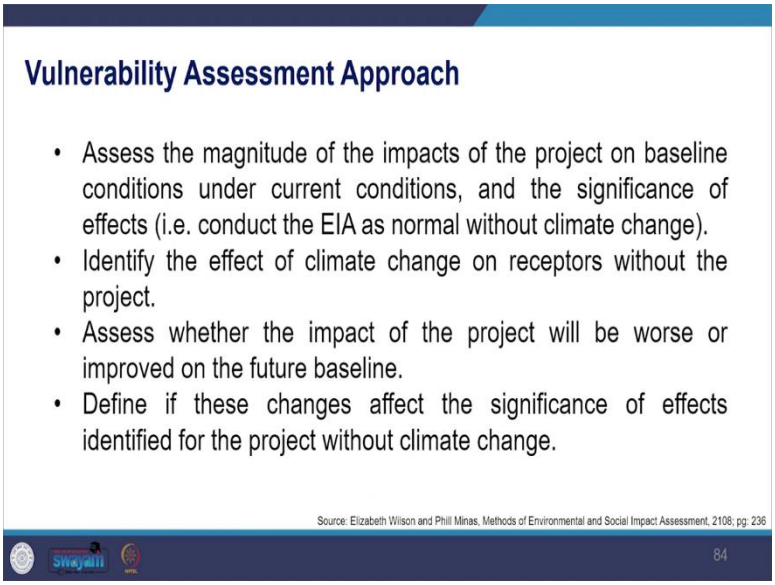

You would be looking at the impact, on now when you review the impact, you might be on while looking at that, you might be looking at the magnitude of the impact. So, how big is the impact on the baseline conditions, under the current conditions and what is the significance of the effect? Further, you would also see the effect of climate change on the receptors without the project, so you would be looking at what kind of effect the climate change has on the receptors without the project.

Then you would look at the impact of the project, whether it is positive or negative on the baseline scenario, so what will happen with the project, what kind of changes will happen and you need to define these changes if they are significant, so that would be your while you undertake that this would that would be our responsibility to clearly state that.

You should also consider the susceptibility or resilience of the receptor to climate change, so you may identify high-value receptors. So, high-value receptors are those that have very little resonance to the changes in the climatic conditions, so if something is not able to change to whatever change would happen not able to adapt to or is not resilience, then you need to identify those, and those priority areas have to be clearly stated.

You need to review the uncertainty of the combined effect, so if there is a combined effect, you need to bring that up as well you may see the examples here for reference. Further, you need to review the interaction between climate change and mitigation and adaptation, so this is the third component where you need to look at the interaction between them. You need to consider possible trade-offs, so you need to see between the mitigation and adaptation how things can be exchanged and how they interact with each other, you can look at the CEC guidelines.

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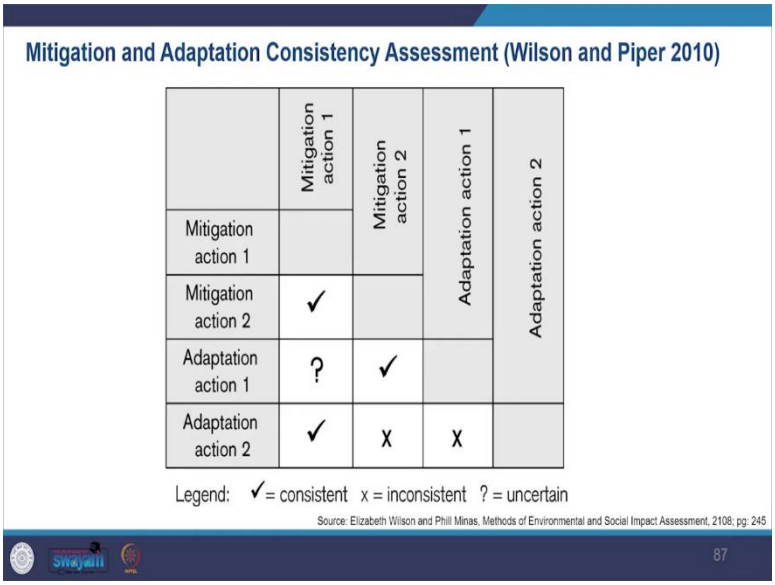

You can also see simple myelitis charts. So, these charts can also be used to capture these things to ensure that we have been able to address climate change and that it is covered or not, so that you can see, so you can make such kind of charts here.

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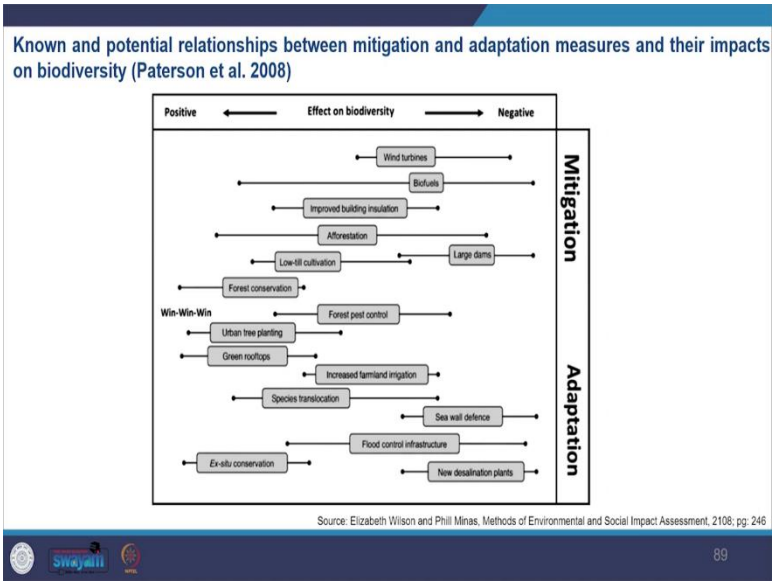

Likewise, you can also have interaction, indicating the interaction of mitigation and adaptation measures. The example we can see here is which shows the measure for biodiversity and you can see the positive to negative impact and also in win-win situations how these things are interacting from negative to positive and how one can with the trade-offs and other things can look at the win-win situation, so you can look at this graph here.

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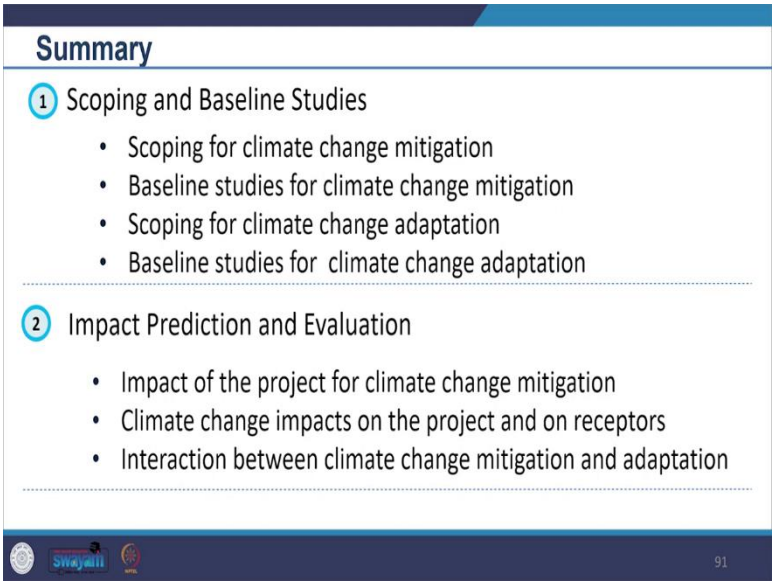

So, that is what we covered today. So, summarizing will see that we looked at what approach we adopt for scoping and baseline studies within that, we looked at what we do within mitigation purposes while undertaking scoping, what we do for baseline study, as well as we saw what we do within adaptation while undertaking scoping process and likewise within the baseline study.

We further saw within the impact prediction and evaluation how we look at the climate change mitigation aspect. How do we undertake projects like climate change impact on the project and receptors? Further, how do we evaluate the interaction between climate change, mitigation, and adaptation we saw some very simple tools to represent those things.

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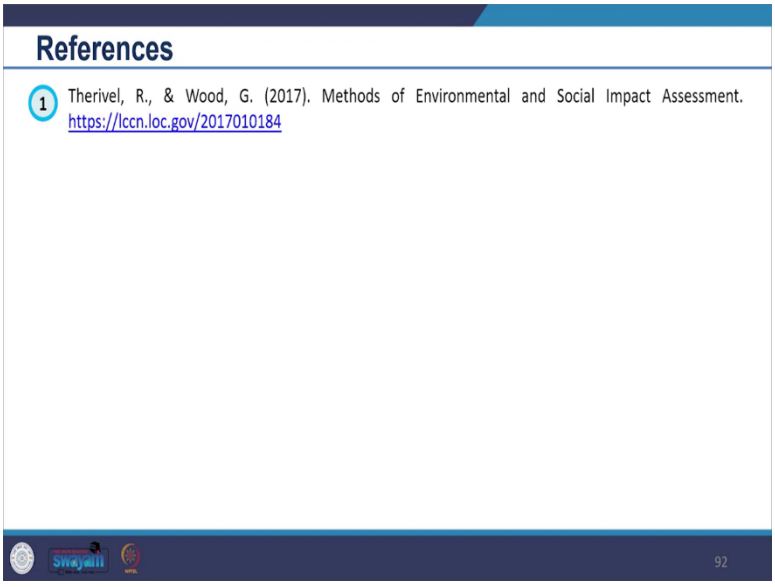

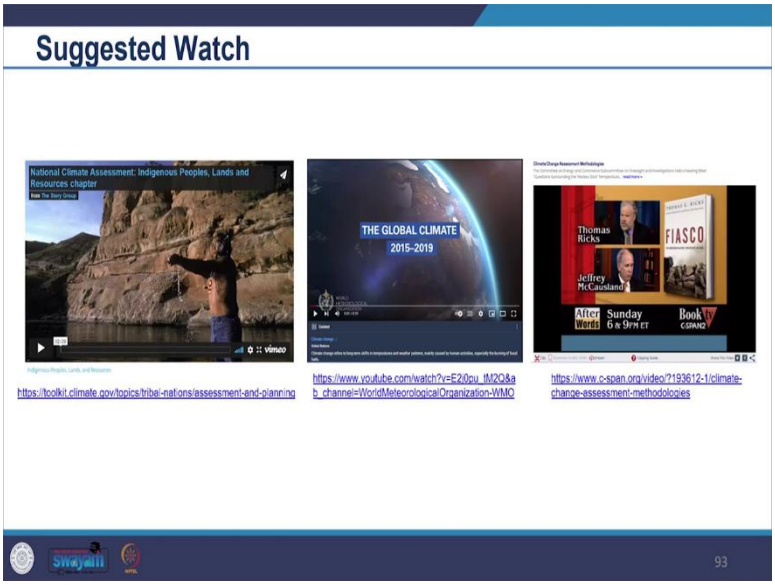

So, that is all for today, these were the references used. So, these are certainly suggested to watch and read for you to identify more and more of the areas and similar studies here. Please feel free to ask questions, let us know about any concerns you have, do share your opinions experiences, and suggestions. Looking forward to interacting and co-learning with you while exploring the subject of EIA. Thank you.