Introduction to Environmental Economics
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Lecture – 23
Environmental Performance Index

Hello everyone. So, today we will be discussing one of the metrics for measuring the Environmental Performance. So, that is the Environmental Performance Index and as you understand that in this chapter of sustainability we have discuss the environmental sustainability index. So, there we have try to see that how the how the indices are developed, so as to capture the sustainability take into account the environmental aspects. So, today we will be discussing what is this Environmental performance index as a part of the sustainability.

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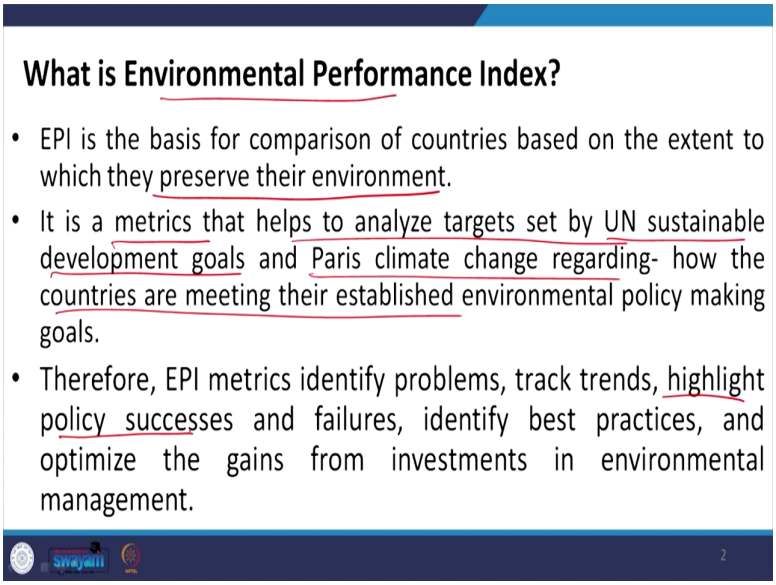

So, again in this environmental performance index as you understand it is an indicator or criteria for measuring the performance of the environment of all the states or countries and how they have been progressing towards achievement of the policy oriented goals to achieve the environmental targets.

So, basically we want to say that in this environmental performance index, we want to measure or it is a kind of method by which we are trying to measure trying to quantify and numerical measure the environmental performance of a countries policies that whatever the policies the country is adapting for achieving the environment targets. And moreover by doing so we can have a comparison that how the countries they are working on towards achieving the targets let forth put forth by different by different policy by different countries on the environmental policy itself.

So, that we can actually say that what is the target for target put forth by the respective policies towards preserving their environment and to what extent they are able to achieve the same. So, first of all if you see this metrics that this ESI environmental sustainability index is also another matrix that captures the environmental states or how the environment is to be preserved and then we are saying that this environmental performance index is also another method or another metrics to capture the performance of the environmental policies put forth by different countries and states.

So, by doing so, by capturing this quantifying this environmental performance based on this policies that the countries they have designed, it helps us to analyze the targets. Targets put forth by the respective countries towards accepting the environmental performances or environmental objectives. So, again this environmental performance index in a broad sense is tries to achieve the or help the UN sustainable development goals and also it is aligned with the Paris climate change.

So, in both on these; in both of these programs, one is your UN sustainable development goals and the second one is the summit that is Paris climate change summit, in both these programs it tries to find that how the countries are meeting their established environmental policy

making goals, how they meeting or whether there is any gap in which way in which aspect of environment they are performing and performing best and in which aspect of the environmental indicators they are actually lagging behind.

So, this is what you can say this environmental performance index it helps us analyzing that how the targets are met and met and even which are the targets that are on met, but that are emphasized, but the UN sustainable development course along with the Paris climate change summits. So, therefore, in universal you can say that EPI helps us in identifying the problems related to the environment and also it tracks the trains that in which the rate at which these indicators that we are following they are performing in the context of the particular environment.

So, it also highlights the policies successes that whether the policy is let say that policies related to conservation of biodiversities or policies related to the sustainable use of water resources. So, how the particular government or particular country they have led forth different public policies to safeguard in this respects and how they have actually achieved in this policies. So, in that way it helps us to analyze the success and failures of the policies as well.

And a by doing so, by because it is giving a major comparisons across the countries of the globs that is why by doing this environmental performance matrix. So, it helps us identifying what is the best practices we are following or which countries are following in order to achieve the environmental performance or which are placed the best one in the contest of environmental performance, so for different indicators and different parameters and different policies are concerned. By doing all this exercise EPI will be helpful in optimizing, the benefits from different kinds of investment we are making in environmental management.

So, because environment is like a umbrella concept, though in which aspect of the environment we need to invest so that we can optimize the same optimize the gains out of this investment. So, in this way you can say this is EPI is one step ahead in comparison to the environmental sustainability index. And why we are saying environmental sustainability index and EPI together? Because if you see the sustainability that we have discussed in the last class

we are finding that this a ESI Environmental Sustainability Index is the previous version of the environmental performance index.

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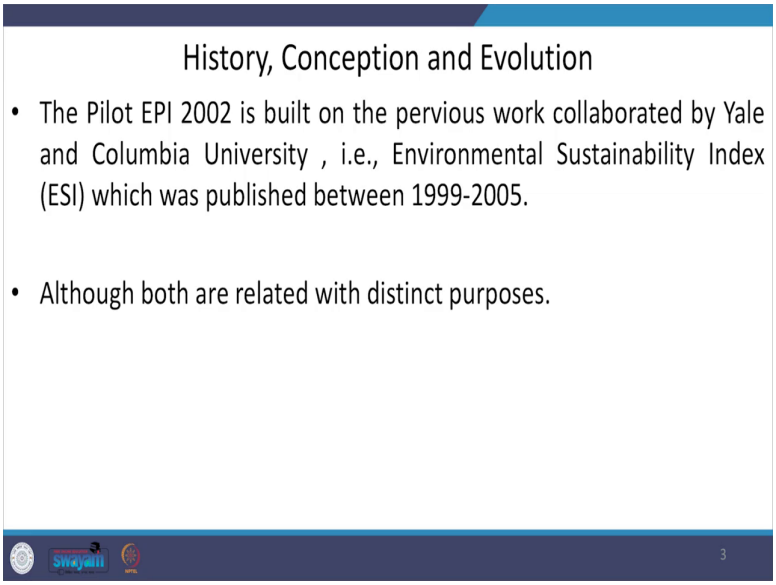

And if you want to find out the history and the very evolutions that how the sustainability indicators are changing from ESI to EPI and then we had some pilot EPI to test the concept that how this performance indicators will be helpful in comparisons in comparing the public policy in ranking the countries, so far this environmental achievements of those countries are concerned. So, that we can actually help in the help the policy makers to have the sustainable kind of environment system. That is why we had two pilots on this environmental performance index. The first one is the pilot environmental performance index in 2002 and the second one is environmental performance index pilot 2006.

But however, the first one this is the pilot EPI 2002 it is actually built on the previous work by the same organizations and collaborators. So, it is hosted by the Yale University and Columbia University and these two universities along with world economic forum they publish this and this environmental sustainability indicators between this time frame 1999 to 2005.

So; however, in 2002 itself, the thought of changing the very scope of their project that is why the targeted for environmental performance index instead of environmental sustainability index. Although both these parameters or both these matrixes, they use some related concept, but they do have very distinct objectives and purposes.

So, what exactly is the difference between ESI and EPI or what are the similarities between these two matrix and why at this point of time in 2002 these collaborators they thought about that instead of working on this ESI concept ESI indicators or ESI index (Refer Time: 09:30) across the countries, we need to actually work on this environmental performance index. So, let us have a look that what is the what is the similarities between these two matrix.

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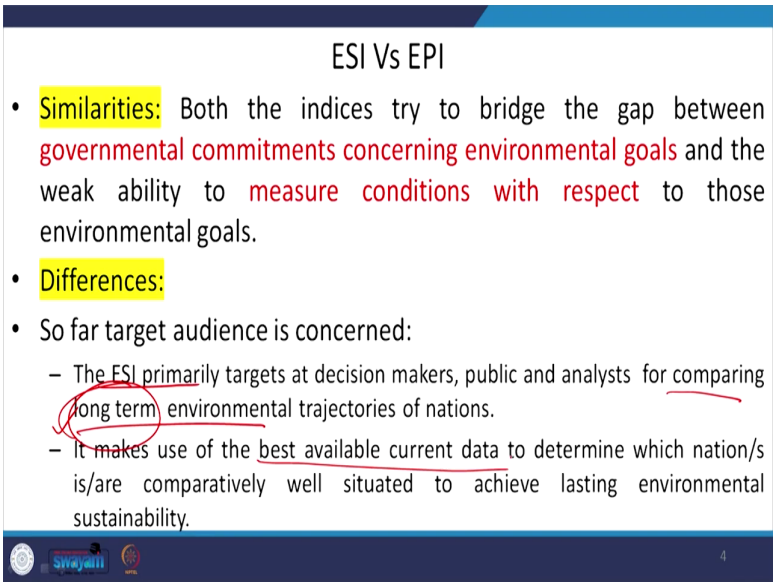

So, for this similarities are concerned, both these indices they are trying to bridge the gap between the ah the governmental commitments concerning the environmental goals that what country is committing or which country is committing on what environmental goals and to what extent their trying step or their taking steps to make is make it a reality. So that means, here one is a targeted one targeted goal and the second one is the actual goal.

So, in order to measure what is the gap, is there any gap between this two one two goals, one is targeted goals and the actual goals and if there is any gap then by this indices it will be easily find out, that how the government commitments on different environmental aspects, whether they are fully performed achieved or it is lagging behind?

So, in this respect both the indices are helpful in finding the gap between the governmental commitments for achieving the environmental goals and what exactly they are doing what kind

of measures they are taking for achieving the same. And so, for the differences between this ESI and EPI is concerned, we can say it depends upon the audience itself, the target audience for both these ESI and EPI are different.

So, what is the difference I can why the or how the audience targeted audience are different, so, for these two matrices? So, if you see the first one that is ESI it primarily targets decision makers or the public officials and analysis, for comparing the long term environmental projections and trajectories of a nations. So, here it is helpful for comparing the long term environmental trajectories.

So, here I am saying I am putting for this highlighting this word long term. So, ESI is helpful for the policy makers for the analysis so that it will be giving a long term perspective on the environmental trajectories or scenarios based on different kinds of variables and sensitivity into account of a particular country or nation.

So, in that case you can say that ESI makes use of the best available data what is available at that point of time to determine which nations or countries they are comparatively doing better in this so far this environmental sustainability is concerned and which countries they are lagging behind. So, what this environmental sustainability target is concerned. So, here again I just wanted want to highlight that ESI is ESI was aligned (Refer Time: 12:48) for the target towards the target of the UN million development goals and in the million development goals one of the target is to sustain the environment or environmental sustainability. Whereas, if you take into account the second indices second index that is the matrix of environmental performance, so, it will be helpful again in national competition, but on the recent efforts to manage the common policy objectives.

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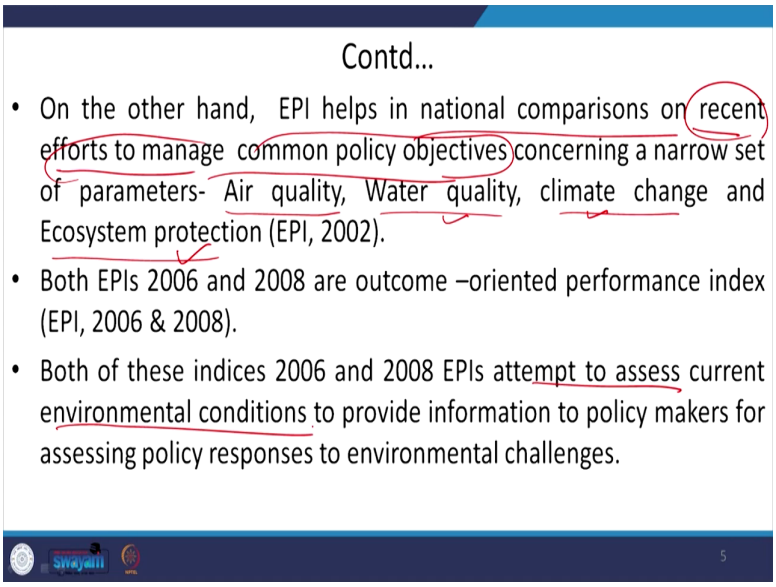

So, in the first case we are targeting the long term comparisons of the so, for the environmental sustainability concept was concerned for a particular country or across the countries, but now in EPI what we are doing, so, EPI is actually helpful in this national comparison. It is also we can also use this data for national comparison, but the thing is that we are emphasizing on the recent efforts to manage the policy objectives.

And for the first pilot that is EPI 2002, we have taken a very narrow set of parameters for doing this exercise that how to compare the these how to have a national comparison, so for the environmental scenarios or parameters are concerned right.

And that is based on the recent efforts not the long term efforts that the country a particular country is taking for achieving the environmental sustainability. So, in that respect in 2002, for the first time we have taken this four parameters in order to understand the environmental

performance across the countries and again as it is understood that for the first time it this kind of exercise was done. So, for most of the countries we are lacking the data or there was a there was a crunch of data on all these parameters because environment again is a very broad concept we need to say and we need to take into account so many wide variety of data for this.

But; however, because of this data shortage, in almost all the countries we have taken a very few countries based on a pilot a survey kind of thing and the project had given emphasis only by take into account this four indicators that the first one is air quality. So, for air qualities like it is a kind of common environmental problem. So, the collaborators they thought of that we can get (Refer Time: 15:33) data or we can have access to these kind of data so that we can have a comparison all over the countries.

And the second one is water quality and the climate change and ecosystem protection. So, however, if you see that these are very limited or a kind of it is giving a kind of very narrow picture, so far this parameters are concerned which can reflect the total environment. And that is why the collaborators they again had another pilot in 2006 that is environmental performance index in 2006 and they actually try to get some new data into account into account so that they try to have a kind of better EPIs, so, for the indicators of environment has concerned in comparison to first pilot.

However, both these 2002 and 2006 sort of pilot because they are just for a testing mode. And the first full pledged environmental performance index is has been made in 2008 and if you compare the pilot one 2006 and 2008 then they are all; so, both this indices they are outcome oriented ah performance index and both these indices they attempt to assess the current environmental conditions not or not giving a prospective like long trajectories or long scenarios of what will happen. So, this is what will happen by take into account the long prospective it was emphasized on emphasized on ESI. However, we do have some challenges in ESI also.

So, the project the collaborators they thought about that instead of actually take into account the long term scenarios we are we are we are having many challenges on the data fronts across

the countries. So, why not focus on the current policies current environmental policies of these countries, so that we can have an access an analysis or an assess to the current environmental conditions by take into account the informations to the what is what is available and this information can be provided to the policy makers for again evaluating the policy responses to the environmental challenges.

So, this is the in brief this is basic objective that why the collaborators they thought about developing another index that is EPI, although they were working earlier on the environmental sustainability index.

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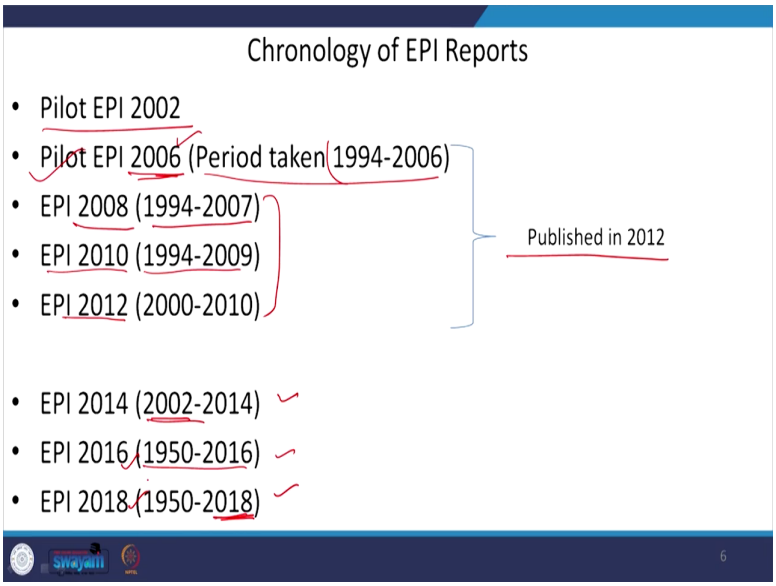

And now let us understand what is the a chronology or evolution of this environmental performance index because we are saying it started with a from a pilot project 2002 and right now in the latest report on the environmental performance index in 2018 and more or less on

every 2 years bases, this organizations Yale University and Columbia University along with the world economic forum they publish the data set and sharing.

So, it is in a public can access or public sharing database. So, that the policy makers if they want to know that what exactly they or how far they are performing in achieving the environmental sustainability they can do. And let us understand this chronology of the environmental performance index since 2002.

So, this is the initial one that EPI 2002 then again we had another pilot on EPI 2006 and during this period they have taken this time frame 1994 to 2006. So, around 10 years time 10 years data and performance 10 years situations 10 years data on different indicators of the environment, they have taken into account in order to find this environmental performance index. And then in the after this 2006 pilot, so, they thought about a full pledged environmental performance index that is 2008.

So, they have taken into account the data for 94 to 2007. So, likewise a likewise after 2 years in 2010, they have again published the environmental performance index reports and it covered a period of data period of 1994 2009. And again in 2012, they had published another report so that cover the data, environmental (Refer Time: 20:17) and environmental data from 2000 to 2010.

So, the thing is that we need to highlight that all these. So, all these four starting from the pilot EPI 2006 to the environmental performance index 2012, it was published in 2012 itself. So, although EPI pilot was undertaken 2006, but final report on this on this EPI it was published in 2012 along with the 2012 EPI index.

So, in 2012 we had 4 EPI reports starting from 2006 to 2012 and thereby we had the dataset on environment different parameters on environment starting from 94 to 2010. And in recent years after that these organization they are regularly they are regularly publishing the EPI reports and EPI database to the public itself. So, EPI 2014 EPI 2016 and 2018, and they are covering the environmental data from 2002 to 2008; so, 18.

And to be precise if you want to have a long term performance of a particular state particular country and their policies, so for this environmental sustainability is concerned. So, 2016 and 18 are giving the better future for comparison because they are trying to have a broader framework of time since 1950s to 2016 and 2018 respectively in these two latest reports.

And again, we need to think about if these are these chronologies or you can say the evolutions even because 2002 pilots is different from the EPI 2016 and 18. Then what exactly would be the objectives or what are exactly the objectives of these EPI s and its reports?

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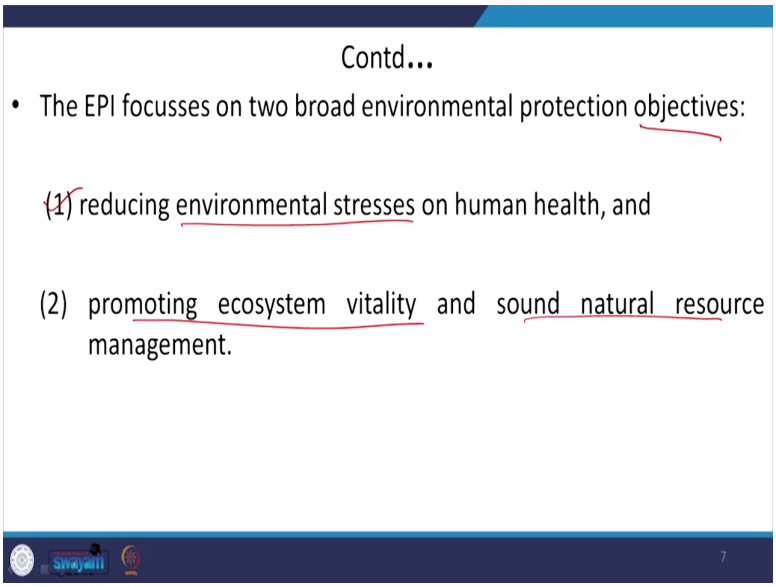

So, the first things first objectives of EPI it focused on the reducing environmental stresses on human health. This is the first objectives. And the second one is promoting ecosystem vitality and the sound natural resource management.

So, these are the two placed two important objectives put forth by EPI; Environmental Performance Index that how to reduce this environmental stresses on the human health so, that the human health can be improved and the stresses on the environmental environment can also be reduced and the second to increase the environmental vitalities and how to safeguard how to manage the natural resources itself.

So, if these are the objectives then we need to actually prove that whether a particular country or particular state is taking enough steps to safeguard to achieve this two objectives based on their policies itself. So, for proving this two objectives, so, the methodology they have taken into account it deferred since 2002 to the latest time 2018.

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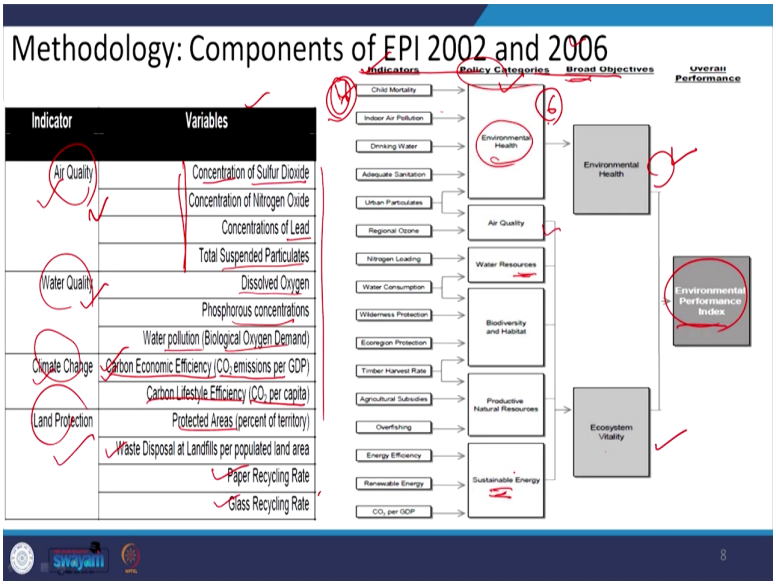

So, what exactly was there a methodology? So, let us have loop from the pilot one to the recent environmental performance indicators or indices their indicators and the methodology

they followed. So, this is we are now talking about two methodology components of the environmental performance index 2002 and as well as 2006. So, these are the two pilots one. So, initially when we thought of the first pilot in order to measure this in order to have this metrics quantify these performance environmental performance.

So, we had only taken this report had only taken this four indicators; air quality, water quality, climate change and land protections. So, how these what are the states of what is the status of air quality, what is the status of water quality climate change and land protection? It must be measured through different variables. So, what are the variables they have taken for? For measuring the status of air quality at that point of time in 2002 and they have take into account the variables like sulfur dioxide concentration, nitrogen dioxide concentration and the concentration of lead as well as the total suspended particles.

So, these are the four variables they have taken into account in order to reflect that how best or worst is the air quality of a particular country or a nation. And likewise for the water quality in order to judge the whether the water quality is good bad or what is the status, they have take into account the parameters or variables like the dissolved oxygen in the water itself, then phosphorus concentration water pollution take into account the BOD; that is Biological Oxygen Demand.

So, what are the what is the amount of all these variables in water itself that actually tells us the quality of the water. And again for finding out the status of climate change this report has taken into account, two parameters that is the first one is the carbon dioxide emissions for GDP. So that means, for if the country GDP is increasing by let say 1 percent. So, what would be the amount of carbon dioxide that is generated for increasing this GDP?

So, it measures the carbon economic efficiency, the how to actually increase the GDP by minimizing the carbon dioxide emissions. So, that is what that will be determine the state the status or the state of the climate change that a particular country is having. Along with this in order to measure this climate change they are also taking into account the carbon dioxide per

capita; that means, per head carbon dioxides by taking into account the carbon lifestyle efficiency.

So, again it will be actually talking implying how to have low carbon in the in the congestion itself or in maintaining the lifestyle itself. And so, for the land protection is concerned, it has taken into account the protected areas in terms of sanctuaries, national park and other kind of protected areas that is defined by international union for conservation of nation; IUCN.

And again it also talks about the waste disposal at landfills per populated land area paper recycling rate and the glass recycling rate, but as you understand that this is the variables that we are taking we that was taken into account in the EPI 2002, it was giving a very narrow picture of these indicators air quality water quality and climate change or the land protections.

But we need to actually the limitations of this report is that all these data that can actually give the true sense of air quality, water quality, climate change or land protection it they are lacking for almost all this countries and very few countries they can produce this data that this is the data on this. So, because of this they have try to use this narrow framework for finding the environmental performance index.

But; however, again as we discussed that they have taken to account two pilots. The first one is 2002, taking into account this crunch of this very limited number of variables. So, in 2006 they try to increase these number of variables in order to have a better framework of the environmental performance index which can give us a robust sense of robust matrix of for the environmental sustainability.

So, earlier they had taken into account four indicators and these are the variable that we have we are; so, these are the variables that we have taken into account. But; however, in 2006 they expanded this number of variables, so, from these two 16 indicators. So, these are the indicators and they have take into account 6 policy categories here. So, earlier they had taken into account these are the indicators and these are the variables, but here in 2006 they have

taken into account this 6 policy categories starting from the environmental health which can actually talk about the air pollution and water case.

So, here we had done this. And again, we had also taken into account in 2006 report we can also find out the water resources and sustainable energy. So, here in this case 2002 case, for sustainable energy we are talking about this only the CO2 emission per capita and CO2 per capita in terms of the climate change.

So, here; obviously, in 2006, so, we are finding a better measure because we are trying to capture more variables to explain the policy categories and that is why our indicators also got increased 2, 16 indicators. So, now, in 2006 we do have 6 policy categories and 16 indicators in order to express or in order to measure the environmental performance index. So, here it broadly for the first time 2006, it subdivided these environmental performance index in 2 categories. The first one is emphasizing on the environmental health itself and the second one is on the ecosystem vitality.

And again in the environmental health, it has taken to account the child mortality, then in the environmental health aspect itself and in ecosystem vitality it has taken into account the air quality all these test 5 policy indicators in order to capture the status of ecosystem vitality. So, that is how we can say that this 2006 pilot is giving a better future for the environmental performance index so for the variables and the parameters are concerned.

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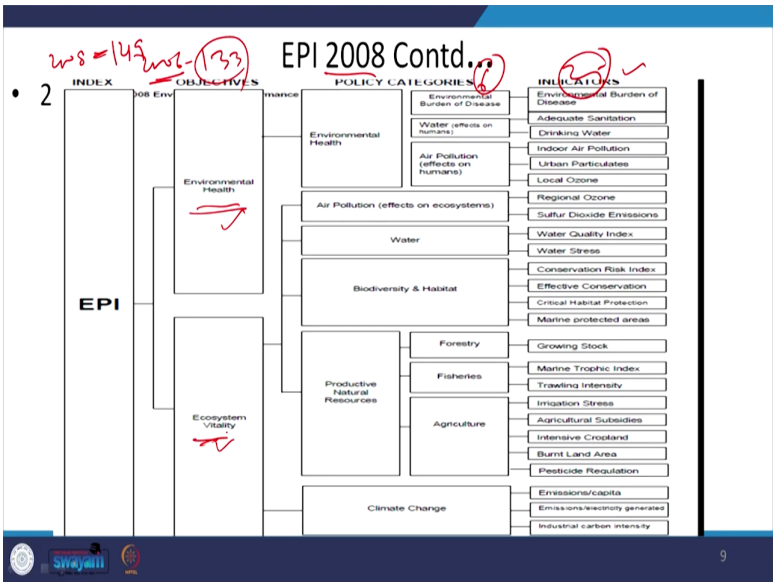

And again for the first time we are saying that these are the pilots, from the pilots we are these the projects. We are trying to have a full pledged data completion of data and the matrix of data, so for the environmental was concerned. So, that is why they have they had increased the parameters for environmental performance index.

So, this time in 2008 they had take into account 6 categories of the policy, so, for the policies are concerned, policy categories along with 25 indicators. So, this is 25 indicators and 6 categories and again in 2006 if you see, so, the EPI was covering a the a is it was stating the case of ah 133 countries. So, it was having the data set on 133 countries on all these parameters and in 2008 this number has increased to 149.

So, in 2008, so, the number of countries that we are talking about your ranking is 149. And here it is 25 indicators are taken into account and 6 policy indicator policy categories are

taken into account. Again the very objectives are remaining the same as the pilot 2006. So, here we also taken into account the environmental health as well as ecosystem vitality.

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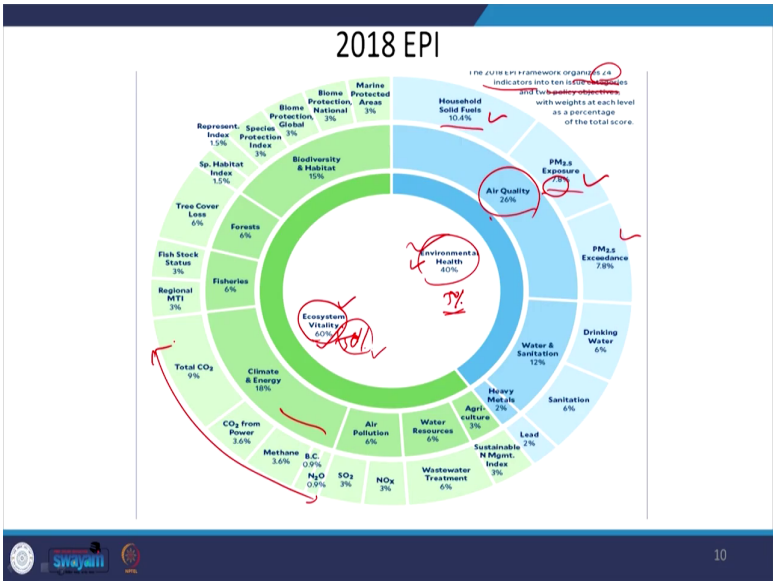

And again we are we let us talk about the latest one that since 2008 to 2018. So, what is the change because it must be it must have gone through a kind of evolutions, so, for the data policies and parameters and concerned. So, in 2018, so, we do have 24 indicators expressing this 10 issues categories.

So, earlier what we had taken into account 6 issue categories or 6 policy categories and we had take into account 16 indicators in 2006. So, now, we had taken into account for 2008 18 EPI you have taken into account 24 indicators, but 10 policy categories areas. And we had also given emphasis that what is the weightage or what kind of importance or weightage we need to emphasize ore you need to give for both of our objectives.

So, our first objective as you know from 2006 pilot and the first 2008 EPI s that where finding the objectives or environmental health how to capture environmental health and the second one is ecosystem vitality. So, but in 2010 EPI s if you actually focus on, I am not discuss in detail that how we are progressing or how we are changing the indicators and parameters in order to test in order to find that what kind of results we are we are finding.

In 2010, so, for this two objectives are concerned we are they had given different weightage that is equal weightage for 50 50 percent. So, in 2008 EPI, they had take into account they had equally given weightage to the environmental health 50 percent weightage were given and for ecosystem vitality also 50 percent weightage here given. But however, in 2016 as well as 2018, this weightage has been changed to 40 percent they had given 40 percent importance. So, weightage was given to environmental health and for ecosystem vitality they had given 60 percents weightage.

And again these are this these are the different indicators that talks about or that actually speaks about the issue categories or policy categories like air qualities we had taken into account house household soil fuels as well as particle matter 2.5 exposures. So, these are the weightage that we had take into 7.8 percent we have given the weightage for catering the PM 2.5 and for household solid fuels we have given the weigthtage 10.4.

So, this is a for all the rest of rest of the policy indicators these are the these are this indicators that we had taken into account and these are the respective weightage that we have provided.

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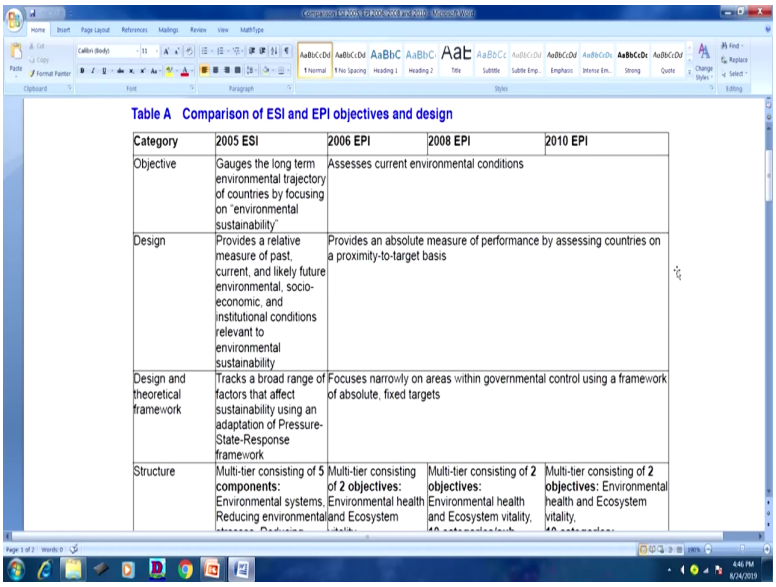

Table A Comparison of ESI and EPI objectives and design

Category	2005 ESI	2006 EPI	2008 EPI	2010 EPI
Objective	Gauges the long term environmental trajectory of countries by focusing on "environmental sustainability"	Assesses current environmental conditions		
Design	Provides a relative measure of past, current, and likely future environmental, socio-economic, and institutional conditions relevant to environmental sustainability	Provides an absolute measure of performance by assessing countries on a proximity-to-target basis		
Design and theoretical framework	Tracks a broad range of factors that affect sustainability using an adaptation of Pressure-State-Response framework	Focuses narrowly on areas within governmental control using a framework of absolute, fixed targets		
Structure	Multi-tier consisting of 5 **components:** Environmental systems, Reducing environmental	Multi-tier consisting of **2 objectives:** Environmental health and Ecosystem	Multi-tier consisting of **2 objectives:** Environmental health and Ecosystem vitality,	Multi-tier consisting of **2 objectives:** Environmental health and Ecosystem vitality,

So, now let us understand to have we can have a comparison among this indices that is ESI and EPI. So, we have taken into account 2.2 2005 environmental sustainable indices index; as well as the 2006 environmental performance index, 2008 environmental performance index and 2010 environmental performance index. And let us have a comparison so, for the objectives of these indices are concerned. So, for the first one that is 2005 environmental sustainable index, we emphasized on the long term environmental trajectories in order to have a broad idea broad data on the environmental sustainability.

But in case of a environmental performance index, we try the reports they try to evaluate or have the data on the current environmental conditions. So, this is how in the objectives itself we do have different thing. And so, for the designs of this two indices are concerned then again we do have some differences.

For the first one in making this environmental sustainability index. So, it takes into account the kind of sceneries for the environment take into account, the past scenarios currents scenarios and the future one.

So, what would be the projected one. So, what the environmental social socioeconomic and institutional conditions are concerned, so, it will be giving a board framework for the environmental sustainability. But whereas, so, far this environmental performance index is concerned as we understand that it is giving emphasis on the current environmental conditions only not the past and future.

So, it gives very absolute measure of a performance by evaluating the countries on proximity to target basis, what is the proximity and what is the target on a particular or current data or the current environmental conditions not the very fast conditions and not the projected future conditions.

So, that is why we are saying it is this indicator evaluates the contest based on the proximity to the target basis. And again so, for the theoretical framework is concerned these two indices they are giving they are having different things. So, the for the first one that is environmental sustainability index, so, they so, this report this index uses the adoption of pressure state response framework.

So, this pressure state response framework is a kind of framework which we generally used for finding the factors which can which are affecting the sustainability itself. So, but in case of this environmental performance indicators of 6 8 and 2010, it actually narrowly focuses on some definite government controlled areas. So, that is why they this these reports they are using a framework of very absolute and fixed targets just like in 2006 as we as we are finding from the report it has given a emphasis on the 4; 4 broad aspects of the government controlled frameworks. And again, so, far the structure of this indices are concerned.

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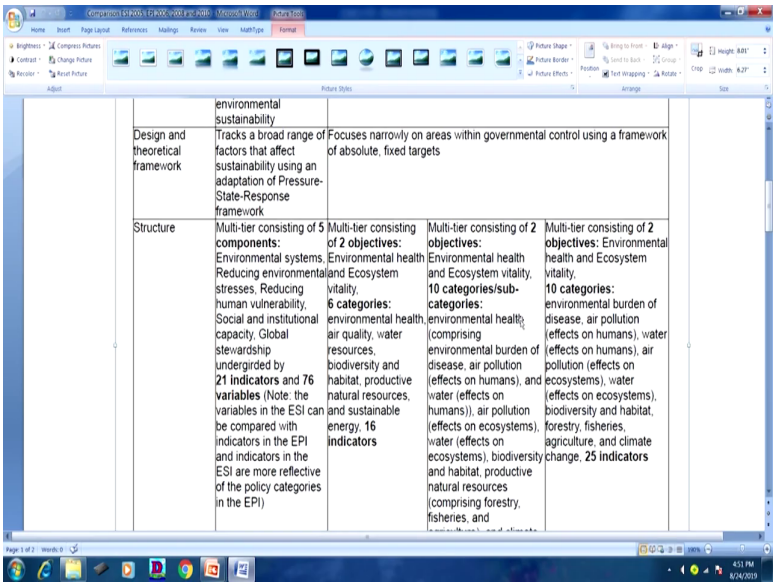

	environmental sustainability			
Design and theoretical framework	Tracks a broad range of factors that affect sustainability using an adaptation of Pressure-State-Response framework	Focuses narrowly on areas within governmental control using a framework of absolute, fixed targets		
Structure	Multi-tier consisting of 5 **components:** Environmental systems, Reducing environmental stresses, Reducing human vulnerability, Social and institutional capacity, Global stewardship undergirded by **21 indicators** and 76 **variables** (Note: the variables in the ESI can be compared with indicators in the EPI and indicators in the ESI are more reflective of the policy categories in the EPI)	Multi-tier consisting of 2 **objectives:** Environmental health and Ecosystem vitality, **6 categories:** environmental health, air quality, water resources, biodiversity and habitat, productive natural resources, and sustainable energy, **16 indicators**	Multi-tier consisting of 2 **objectives:** Environmental health and Ecosystem vitality, **10 categories/sub-categories:** environmental health (comprising environmental burden of disease, air pollution (effects on humans), and water (effects on humans)), air pollution (effects on ecosystems), water (effects on ecosystems), biodiversity and habitat, productive natural resources (comprising forestry, fisheries, and	Multi-tier consisting of 2 **objectives:** Environmental health and Ecosystem vitality, **10 categories:** environmental burden of disease, air pollution (effects on humans), water (effects on humans), air pollution (effects on ecosystems), water (effects on ecosystems), biodiversity and habitat, forestry, fisheries, agriculture, and climate change, **25 indicators**

In 2005 ESI, it has taken into account 5 components environmental systems reducing environmental stresses, reducing environmental vulnerability, social institutional capacity and global stewardship that is why we have taken into account 21 indicators and 17 76 variables. And this is how we can say the very structure of the ESI and EPI are also different. While we are talking about the EPI 6, 8 and 2010 then we are having that the objectives are different here we are we have only two objectives that now we highlighted.

The first one is the environmental health to capture the status of environmental health and the second one is what is the status of ecosystems and these objectives are same for these (Refer Time: 40:33) and the EPI s; whereas, for the first EPI it has taken into account 6 categories of variables giving starting from environmental health air quality water resources biodiversity productive natural resources and sustainable energy.

And for the 6 policy categories it has taken into account 16 indicators, whereas, for this 2008 EPI it has taken into account 10 categories and sub categories that we have already discussed in our frameworks and for 2010 again we had taken into account 10 categories. A policy variables taken into account the burden of environmental burden of disease till the status of natural resources and it has taken into account 25 indicators.

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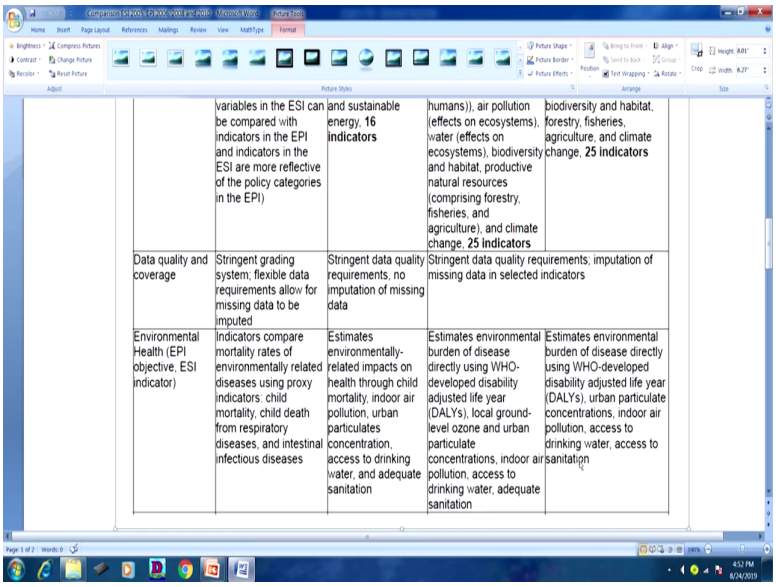

	variables in the ESI can be compared with indicators in the EPI and indicators in the ESI are more reflective of the policy categories in the EPI)	and sustainable energy, **16 indicators**	humans)), air pollution (effects on ecosystems), water (effects on ecosystems), biodiversity and habitat, productive natural resources (comprising forestry, fisheries, and agriculture), and climate change, **25 indicators**	biodiversity and habitat, forestry, fisheries, agriculture, and climate change, **25 indicators**
Data quality and coverage	Stringent grading system; flexible data requirements allow for missing data to be imputed	Stringent data quality requirements, no imputation of missing data	Stringent data quality requirements; imputation of missing data in selected indicators	
Environmental Health (EPI objective, ESI indicator)	Indicators compare mortality rates of environmentally related diseases using proxy indicators: child mortality, child death from respiratory diseases, and intestinal infectious diseases	Estimates environmentally-related impacts on health through child mortality, indoor air pollution, urban particulates concentration, access to drinking water, and adequate sanitation	Estimates environmental burden of disease directly using WHO-developed disability adjusted life year (DALYs), local ground-level ozone and urban particulate concentrations, indoor air pollution, access to drinking water, adequate sanitation	Estimates environmental burden of disease directly using WHO-developed disability adjusted life year (DALYs), urban particulate concentrations, indoor air pollution, access to drinking water, access to sanitation

And again this, so, for the data quality and coverage is concerned then it is also different these indices they follow different data quality and different scope of the data as well as. And so, for the environmental health objectives are concerned, the indicators like the EPI and ESI they are also giving different approaches altogether.

So, for example, in EPI that we have take into account DALYs framework, that is one of the indicator developed by world health organization that talks about the disability adjusted life

years which is named as DALYs that takes into account the local ground level ozone the urban particulate concentration and the indoor air pollution as well as access to drinking water and so on so forth. And if you are talking about the environmental sustainability index, so, it is giving emphasis on the environmentally related diseases. So, these are the process indicators it is taking into account for the mortality rates.

So, for this indicators, it has taken into account the child motilities child death from different kinds of diseases like you respiratory diseases or intestinal infected infectious diseases. But however, in this EPIs the complete indicator and complete framework is different and again it is being assisted by the framework developed by World Health Organization DALYs framework that is disability adjusted life year.

So, one thing that must be highlighted here that in case of environmental sustainability index, it also talks about the that how the environmental status is impacting the human health. And into the in the environmental performance index as well, it is also talking about the impact of environmental status on the human health, but also it talked about the another thing that on the not only on the mortality rate. But also how these human welfare is being sacrificed or is being lost because of these environmental status, that is also taken into account. That is why by taking this DALY framework, it is actually capturing these two things: one is the estimates of environmental burden of disease as well as the mortality.

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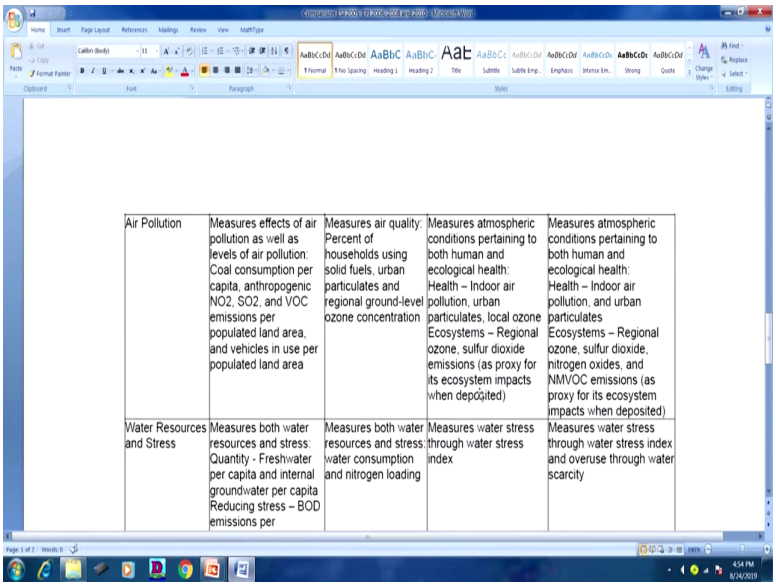

Air Pollution	Measures effects of air pollution as well as levels of air pollution: Coal consumption per capita, anthropogenic NO2, SO2, and VOC emissions per populated land area, and vehicles in use per populated land area	Measures air quality: Percent of households using solid fuels, urban particulates and regional ground-level ozone concentration	Measures atmospheric conditions pertaining to both human and ecological health: Health – Indoor air pollution, urban particulates, local ozone Ecosystems – Regional ozone, sulfur dioxide emissions (as proxy for its ecosystem impacts when deposited)	Measures atmospheric conditions pertaining to both human and ecological health: Health – Indoor air pollution, and urban particulates Ecosystems – Regional ozone, sulfur dioxide, nitrogen oxides, and NMVOC emissions (as proxy for its ecosystem impacts when deposited)
Water Resources and Stress	Measures both water resources and stress: Quantity - Freshwater per capita and internal groundwater per capita Reducing stress – BOD emissions per	Measures both water resources and stress: water consumption and nitrogen loading	Measures water stress through water stress index	Measures water stress through water stress index and overuse through water scarcity

And again, we have taken into account some of the parameters or policy focused areas like your air pollution and water pollutions level and as for the availability of data the ESI and EPI they are measuring different things. So, just like to for example, to state in 2005 ESI for measuring this air pollution or air quality starters it has taken into account, the levels of CO2 consumption per capita anthropogenic, NO2, SO2, and VOC emissions per populated land area.

Whereas, for measuring the same air quality in the EPI report it has taken into account the percentage of household using solid fuels or urban particles or and also the regional ground level ozone concentration. So, in that way you can actually find that how the very structure and very framework very variables in the policy variable seven they have taken different or they are different, so, what this two indicators are concerned. And again we can also find out the case of the water resources.

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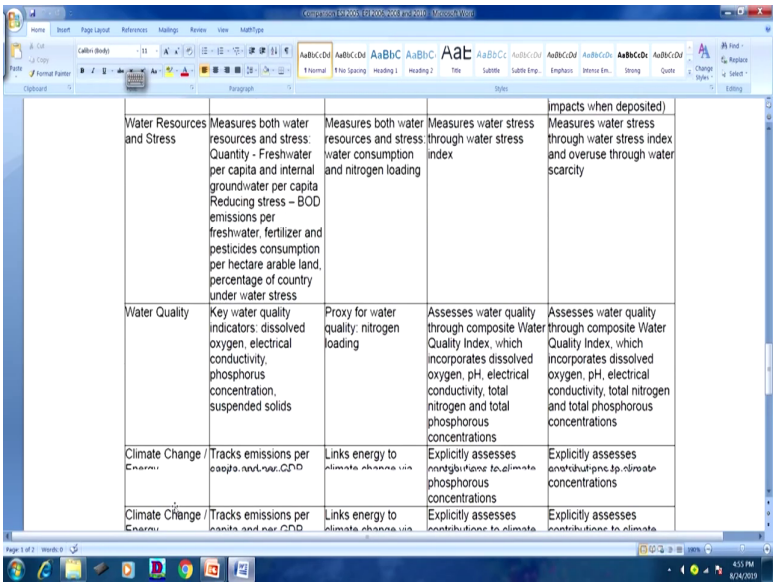

				impacts when deposited)
Water Resources and Stress	Measures both water resources and stress: Quantity - Freshwater per capita and internal groundwater per capita Reducing stress – BOD emissions per freshwater, fertilizer and pesticides consumption per hectare arable land, percentage of country under water stress	Measures both water resources and stress: water consumption and nitrogen loading	Measures water stress through water stress index	Measures water stress through water stress index and overuse through water scarcity
Water Quality	Key water quality indicators: dissolved oxygen, electrical conductivity, phosphorus concentration, suspended solids	Proxy for water quality: nitrogen loading	Assesses water quality through composite Water Quality Index, which incorporates dissolved oxygen, pH, electrical conductivity, total nitrogen and total phosphorous concentrations	Assesses water quality through composite Water Quality Index, which incorporates dissolved oxygen, pH, electrical conductivity, total nitrogen and total phosphorous concentrations
Climate Change / Energy	Tracks emissions per capita and per GDP	Links energy to climate change via	Explicitly assesses contributions to climate phosphorous concentrations	Explicitly assesses contributions to climate concentrations
Climate Change / Energy	Tracks emissions per capita and per GDP	Links energy to climate change via	Explicitly assesses contributions to climate	Explicitly assesses contributions to climate

These are the policy variables and how both the indices their emphasis is different and water quality also and the climate change and energy also.

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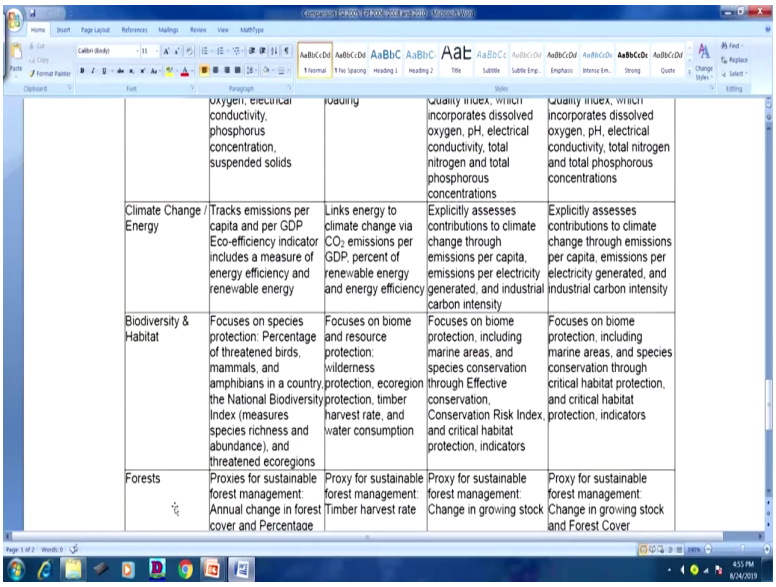

	oxygen, electrical conductivity, phosphorus concentration, suspended solids	loading	Quality Index, which incorporates dissolved oxygen, pH, electrical conductivity, total nitrogen and total phosphorous concentrations	Quality Index, which incorporates dissolved oxygen, pH, electrical conductivity, total nitrogen and total phosphorous concentrations
Climate Change / Energy	Tracks emissions per capita and per GDP Eco-efficiency indicator includes a measure of energy efficiency and renewable energy	Links energy to climate change via CO_2 emissions per GDP, percent of renewable energy and energy efficiency	Explicitly assesses contributions to climate change through emissions per capita, emissions per electricity generated, and industrial carbon intensity	Explicitly assesses contributions to climate change through emissions per capita, emissions per electricity generated, and industrial carbon intensity
Biodiversity & Habitat	Focuses on species protection: Percentage of threatened birds, mammals, and amphibians in a country, the National Biodiversity Index (measures species richness and abundance), and threatened ecoregions	Focuses on biome and resource protection: wilderness protection, ecoregion protection, timber harvest rate, and water consumption	Focuses on biome protection, including marine areas, and species conservation through Effective conservation, Conservation Risk Index, and critical habitat protection, indicators	Focuses on biome protection, including marine areas, and species conservation through critical habitat protection, and critical habitat protection, indicators
Forests	Proxies for sustainable forest management: Annual change in forest cover and Percentage	Proxy for sustainable forest management: Timber harvest rate	Proxy for sustainable forest management: Change in growing stock	Proxy for sustainable forest management: Change in growing stock and Forest Cover

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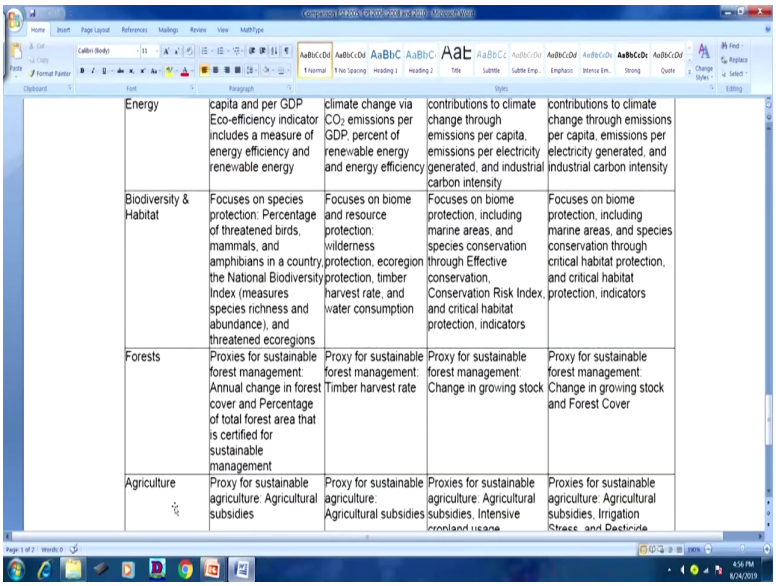

Energy	capita and per GDP Eco-efficiency indicator includes a measure of energy efficiency and renewable energy	climate change via CO_2 emissions per GDP, percent of renewable energy and energy efficiency	contributions to climate change through emissions per capita, emissions per electricity generated, and industrial carbon intensity	contributions to climate change through emissions per capita, emissions per electricity generated, and industrial carbon intensity
Biodiversity & Habitat	Focuses on species protection: Percentage of threatened birds, mammals, and amphibians in a country, the National Biodiversity Index (measures species richness and abundance), and threatened ecoregions	Focuses on biome and resource protection: wilderness protection, ecoregion protection, timber harvest rate, and water consumption	Focuses on biome protection, including marine areas, and species conservation through Effective conservation, Conservation Risk Index, and critical habitat protection, indicators	Focuses on biome protection, including marine areas, and species conservation through critical habitat protection, and critical habitat protection, indicators
Forests	Proxies for sustainable forest management: Annual change in forest cover and Percentage of total forest area that is certified for sustainable management	Proxy for sustainable forest management: Timber harvest rate	Proxy for sustainable forest management: Change in growing stock	Proxy for sustainable forest management: Change in growing stock and Forest Cover
Agriculture	Proxy for sustainable agriculture: Agricultural subsidies	Proxy for sustainable agriculture: Agricultural subsidies	Proxies for sustainable agriculture: Agricultural subsidies, Intensive cropland usage	Proxies for sustainable agriculture: Agricultural subsidies, Irrigation Stress, and Pesticide

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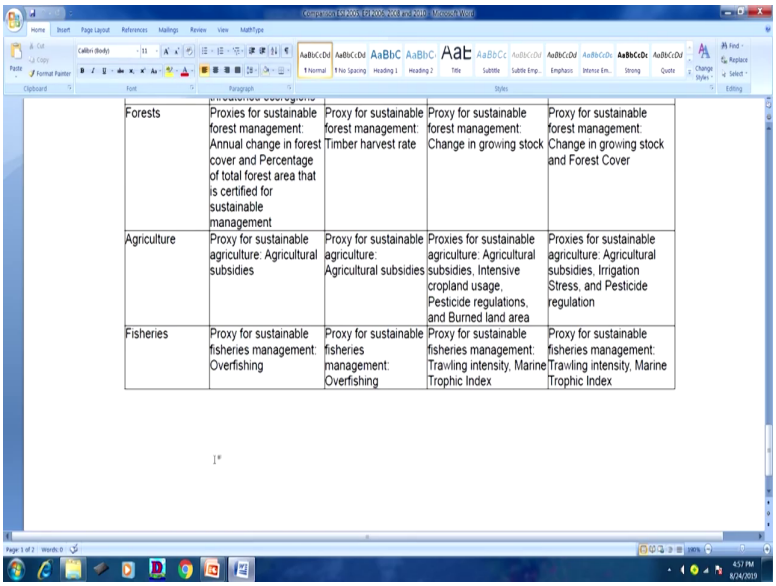

Forests	Proxies for sustainable forest management: Annual change in forest cover and Percentage of total forest area that is certified for sustainable management	Proxy for sustainable forest management: Timber harvest rate	Proxy for sustainable forest management: Change in growing stock	Proxy for sustainable forest management: Change in growing stock and Forest Cover
Agriculture	Proxy for sustainable agriculture: Agricultural subsidies	Proxy for sustainable agriculture: Agricultural subsidies	Proxies for sustainable agriculture: Agricultural subsidies, Intensive cropland usage, Pesticide regulations, and Burned land area	Proxies for sustainable agriculture: Agricultural subsidies, Irrigation Stress, and Pesticide regulation
Fisheries	Proxy for sustainable fisheries management: Overfishing	Proxy for sustainable fisheries management: Overfishing	Proxy for sustainable fisheries management: Trawling intensity, Marine Trophic Index	Proxy for sustainable fisheries management: Trawling intensity, Marine Trophic Index

So, in the broad thing that I, just want to highlight is that we are comparing here both the indices that is environmental sustainability indicator or index and the environmental performance index because we cannot use these two data sources simultaneously because of the very structure of the data the very variables of the data.

And again when we are we have gone through the evolutions of the environmental performance index itself and their reports, from 2002 to 2018 again they are not comparable because in all these years the kind of forecast the kind of objectives the kind of structure the kind of parameters or indicators and then the kind of policy variables they had taken into account since 2002 to 2018, they are different.

So, that is why we cannot actually compare that how the particular country a particular country is performing on the environmental indicators. So, it is a wrong way to interpret like that, but rather we can say that how the country is serving a rank. So, in that way it will be

giving us a better picture of comparison instead of taking the scores of this environmental performance in index for a particular country.

And that is how we can say that these are the altogether different indicators and even they even across this environmental performance indicators they are not comparable. And if you have to anyway compare or analyze something's then we need to actually go behind what kind of methodology they had taken into account in each of the reports the organization they while developing this EPI index.

So, in the next lecture we will be talking about another matrix another indicator of environmental sustainability that is and that is ecological footprint, so, which has been developed by the which is generally popularized by this ecological footprint networks.

Thank you.