Sustainable River Basin Management

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Module - 3 -1

Lecture - 17

Part – 02

Welcome everybody to Sustainable River Basin Management, module three-one, part two. Last time we were talking about how to measure water scarcity and how to assess water scarcity and we started looking into some of the indices, which were developed. I want to continue this in this module and complete in this module.

The next, that I want to show you is the physical and economic water scarcity index. What does it mean? It is including the country's water infrastructure, which means also water infrastructure dealing with desalination of water. It measures water availability. It also includes the recycled water by limiting the measurements of water demand to the consumptive use instead of taking the total withdrawals as other indices have been doing. It also measures the adaptive capacity of a country by assessing the potential for infrastructure development in the water sector and the efficiency in the improvements of the infrastructure. That index was developed by the International Water Management Institute in 2008 and you can get more information from that institute.

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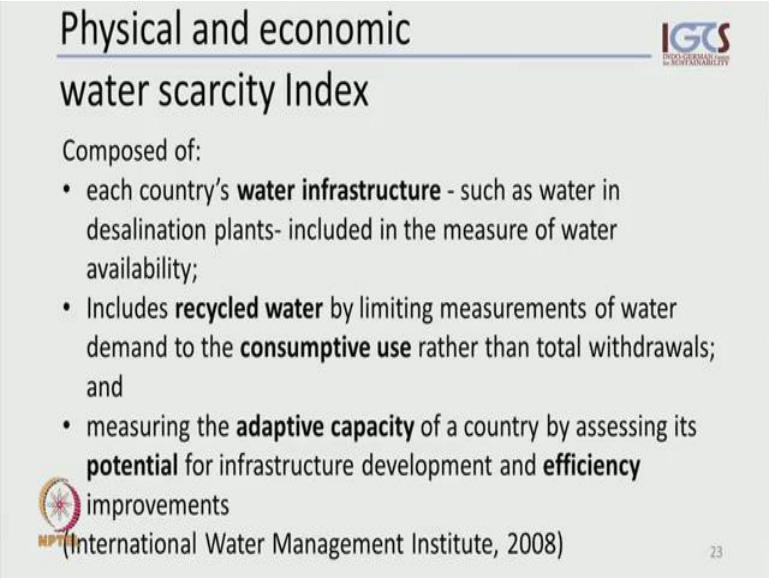

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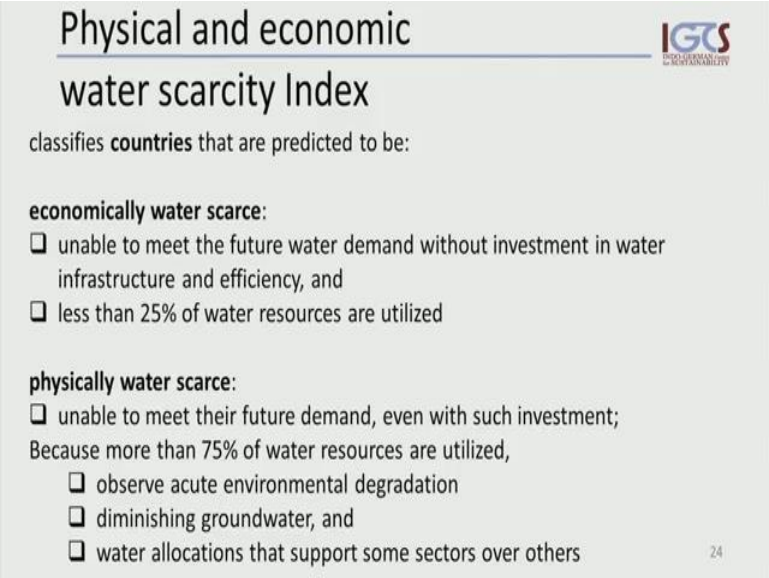

It classifies countries that are predicted to be either in one or the other of the two categories. The first category is called economically water scarce. So, what does it mean? Economically water scarce, it means, that country is unable to meet the future water demand without investment in water infrastructure and without investment in water efficiency and it means, that less than 25 percent of the water resources of that country are utilized. So, this is one of the groups.

The second of the, second division is called physically water scarce and this means, that country is unable to meets its future demand even if it is able to invest in water infrastructure and this is because more often, more than 75 percent of the water resources have been utilized. The water resources are in acute environmental degradation state, the ground water resource have been diminishing and water allocations are in support of certain and some sectors over others. So, those are the two differentiations, one is economical and the other physical. Physical in the sense of having reached the hydrological, hydrologically available maximum of in a particular country.

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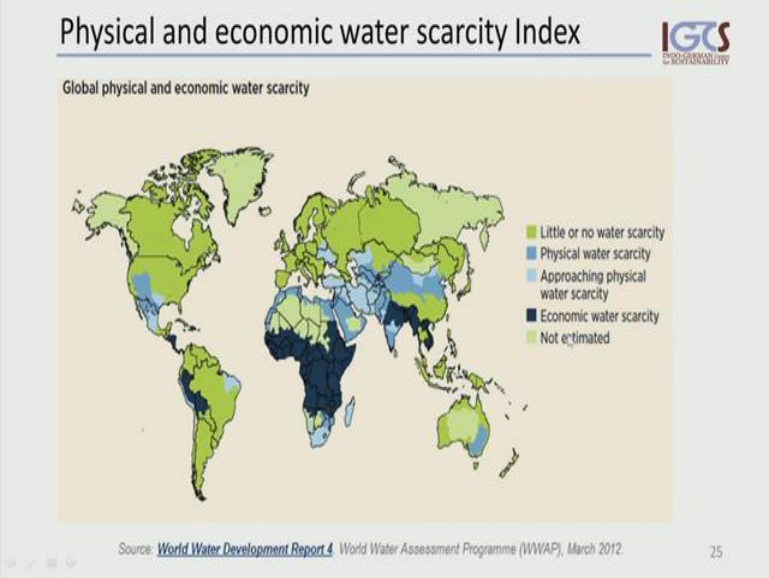

Now, let us look at the recent map of the physical and economic water scarcity index. This was produced in 2012. You can look up maps of 2008 and you may, you see slight changes in that. Now, what you can see here is the green color for little or no water scarcity and there are several regions where this appliers except on the African continent where we have water scarcity in both ways. And we have the blue, the two blue colors here indicating physical water scarcity or approaching physical water scarcity. And what we see is, that major parts here fall under this category. This means, that the water resources have been fully exploited or heavily degraded to a level that even economic inputs or investments in the water infrastructure will not be able to improve on water scarcity.

Then, we have the dark blue here, which gives us the economic water scarcity group and we see that large parts of the African continent are classified as economically water scarce, which means, that it has large potential for water infrastructure investments. This is where probably most of the budgets will be going to in the near future on water development on, in all scales. But you also can see this in this part, here in Asia, where it has potential, where water investments in the water sector still would bring relief to water scarcity and then, there are some parts which are not estimated and cannot be represented here.

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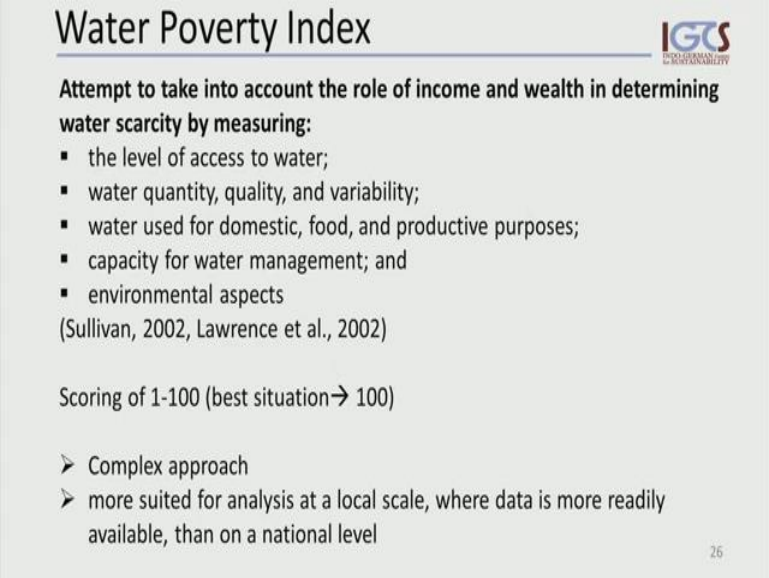

Now, let us, we have been looking into the water aspects from a hydrological component, of a hydrological point of view from a country's capability to manage its water resources. But it still lacks one of the components, which are quite important ((Refer Time: 06:54)) one to be comprehensive when we also talk about the sustainability and for that reason the so called water poverty index was developed. And this is an attempt to take in to account the whole of income and wealth when we assess water scarcity.

So, it includes the level of access to water. It includes water quantity, quality and also the water variability. It includes the components of water use for domestic purposes, for food and for productive purposes. It includes also the capacity for water management and also includes environmental aspects. So, this is ((Refer Time: 07:51)) to be entirely comprehensive along the sustainability scale and this is, that index is expressed as a

score ranging from 1 to 100, where 100 means the highest, the best situation. There are major restrictions to this water poverty index. It is a very complex approach and it is most suited for analysis at a local scale, where data maybe more easily available or can be collected specifically for this purpose rather than on a national level.

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COMPONENT	SUBINDEX	INDICATOR	unit
Resources		internal water resources	km³/cap/year
		external water resources	km³/cap/year
Access		access to safe water	%
		access to sanitation	%
		access to irrigation	--
Capacity		GDP per capita	US$
		under-5 mortality rate	per 1000 live births
		UNDP education index	--
		Gini coefficient	--
Use		domestic water use	l/cap/day
		industrial water use (as: proportion of GDP derived from industry/ proportion of water used by industry)	--
		agricultural water use (as: proportion of GDP derived from agriculture/ proportion of water used by agriculture)	--
Environment	water quality	dissolved oxygen concentration	mg/l
		phosphorus concentration	mg/l
		suspended solids	mg/l
		electrical conductivity	mS/cm
	water stress	fertiliser consumption	100 g
		pesticide use	kg
		industrial organic pollutants	metric tons/ km³
		% of countries territory under severe water stress (according to ESI-definition)	%
	regulation and management capacity	environmental regulatory stringency	--
		environmental regulatory innovation	--
		land under protected status	%
		number of sectoral EIA guidelines	--
	informational capacity	availability of sustainable development information at the national level, environmental strategies and action plans	--
		% of ESI variables missing from public global data sets	%
	biodiversity	% of threatened mammals	%
		% of threatened birds	%

Example Matrix

But I want to show you the inputs, an example matrix for this water poverty index. This shows us the components here such as the resources access capacity, use environment, those which I mentioned before. And then, we have sub indexes, water quality, water stress and so on, information capacity and so on. And then, we have indicators for each of these major components, which are the actual data, which have to be grouped accordingly and then transformed into an index to form the water poverty index.

So, we see, that this is where it becomes very challenging to bring all this data together and to bring the data together in a way that you can compare one region with another region. If you are not able to collect all of the data for all of the areas that you want to compare, I can sit at a, that may be difficult.

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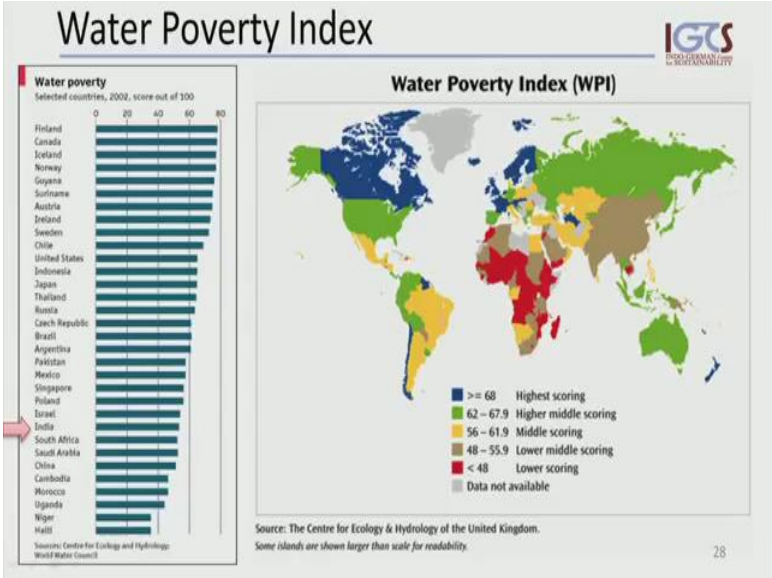

Now, let us look into examples of the water poverty index. It has been calculated at country level and this shows us a list of the water poverty index in 2002 for some countries and we find India here on the scale. And we have the same information put into a map, which you may find easier, readable where we have the highest scoring classification here, highest scoring, so to say, from above, about 68 and we have the lowest going below 48 percent, 48 points, tech points here.

What is interesting here is that there are a very few countries regions, which are scoring quite high and they are many parts even in Europe or, where we, including in Europe where the scoring is only in the middle ranges here or middle to high ranges. And then, we have many regions where this scoring is very low or low to a middle. But there are parts where we would think, that the range may be, may be different because may be, the economical power potentials are lower in some of these regions, which still looking, putting it into a water poverty scale analysis actually score quite well.

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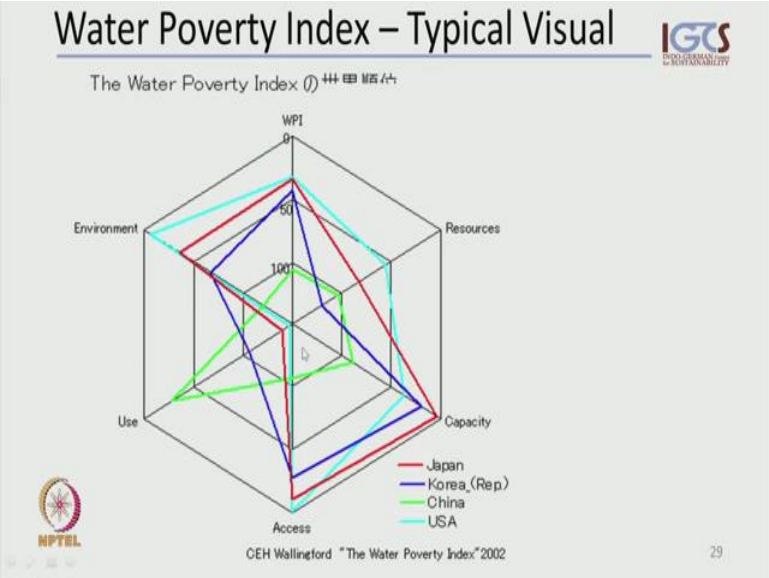

Now, more typical way of visualizing the water poverty index, which also is more helpful from a decision taking point of view is the spider diagram and this is an example showing, bringing together some other countries: Japan, Korea, China, USA. And we have here on each of these accesses, one of the components of which make up the water poverty index and then, the different lines here correspond to the countries, which I have just mentioned.

Then, we can see where are the strengths and the weaknesses are in the water sector in each of the countries. We can do this for catchments and compare catchments with each other. We can take this also as a monitoring criteria when as a baseline to start with or start from. And after some years of interventions we could develop or calculate our water poverty index again and see, whether we have achieved changes for ((Refer Time: 13:12)) capacity or access or in environment, whatever the most needed sector is in terms of, to improve on water, water scarcity in a particular area. So, this is very useful for planning, very useful for monitoring and for setting priorities in improving the water situation in a particular area.

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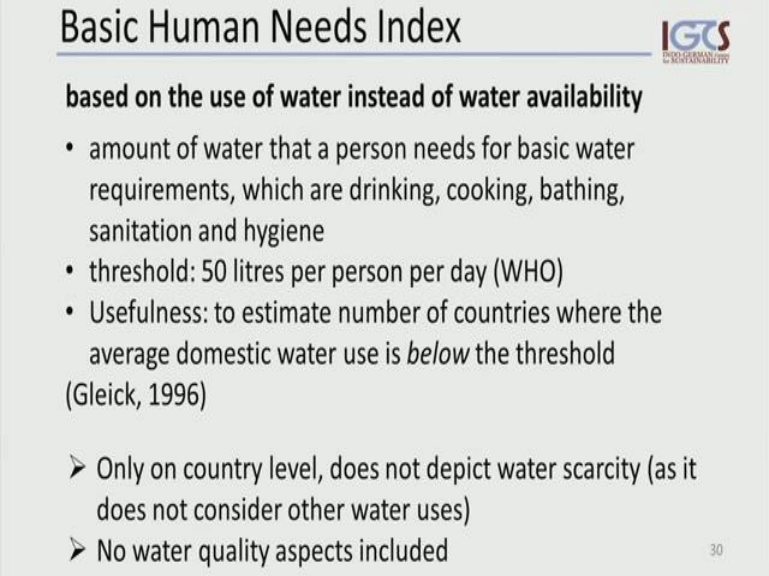

Now, the last of these indicators or indices, which I wanted to present to you is the basic human needs index that is based on the use of water instead of water availability. I can make water available in a constraint way and then, all you have available is what you, what you can use because I have been restricting it or someone has been restricting it, or you can make water abundant and then it is a, it is not constraint by its availability, but the way I am consuming it or the techniques, the way I perceive how water should be used.

So, to differentiate between those two, the constraint water use and the abundant and available water use, under abundant or water available situations, that basic human needs index becomes important. It is the amount of water, that a person needs for basic water requirements and what you mean by basic water requirements is drinking, cooking, bathing, sanitation and hygiene. And there is a threshold that was defined by the WHO the World Health Organization, which is said by to be about 50 liters per person per day.

Some countries have set their own thresholds, but this is a generally agreed basic threshold used at global scale and this is useful to estimate number of countries, where the average domestic water use is below that threshold. This is to point to situations, which need attention and need improvement. It is being used at country level usually and for that reason it does not depict water scarcity as such because it is not looking into the

industrial usages or the agricultural usages or whatever the other water utilizations are in a particular country and it also does not depict water quality aspects.

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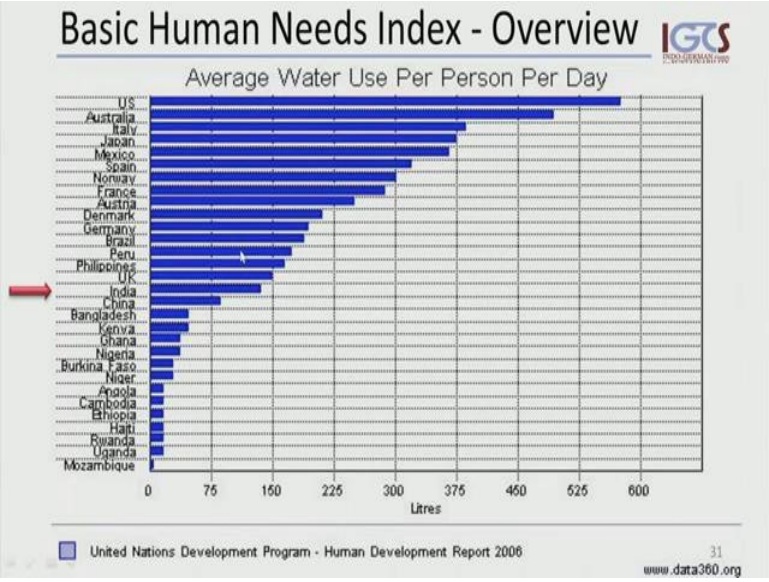

Now, the basic human needs index applied to countries, this is from the human development report 2006. You could go to this database and access more information for your own research on this matter, just have a look at where India is positioning in this report at, about just above 75, 80 liters per person per day. So, compared to what globally a person has been using is, India is in the lower ranks here.

But again, what a human need is has been defined by what I have saying, I have been saying before, cooking, drinking and so on, and this personal average water use here certainly accounts for many other uses of that person on a day and not just for the basic needs. So, again this may be looked at it from a critical development point of view, but also could be looked at from a different angle, from an efficiency point of view in what actually is basic need, what should be provided and has to be provided and what is above, outside the basic needs and accounted for here in this case.

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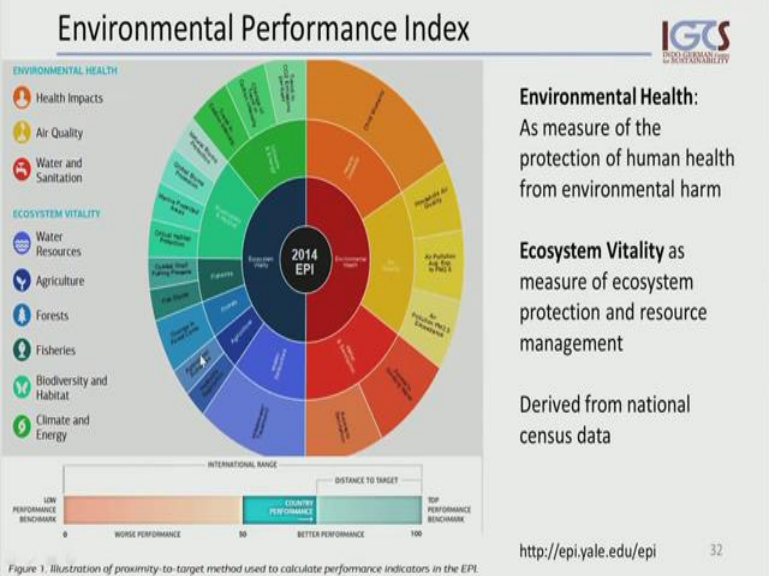

Now, stepping out of this water scarcity as such and taking this into broader perspective of environmental performance or environmental sustainability, there has been an attempt to develop such indices to measure all these dimensions from not only the water availability perspective. And one of the examples I want to present to you here is, well, the so called environmental performance index, which was develop jointly and was presented as a, as a tool box on this university's web page.

It basically divides our environmental components into two parts. One, the environmental health's, which measures the protection of human health from environmental harm. This is one way; this is the human centered perspective. And it combines this with the ecosystem vitality, which is the measure of an ecosystem, protection and resources management. So, this is the functioning of an ecosystem and how well it is being managed and the data, which are taken into this index are usually derived from national census data. So, there is a trial to only use such data, which are usually been collected by the country's census or the authorities responsible for census data collection.

Now, this environmental performance index is the scale like this. We have 0 to 100 score or percentage. The lowest 0 is the lowest benchmark and 100 is the top benchmark and then, this is been stretched along the international range. So, this means, that the scale is being, is changing depending on how the international range is. If we over to better than

this moves, that range will move up or if we over to worse, then that whole, the top benchmark will be shifting towards the lower levels. And then, we have a differentiation between worse performance and better performance of countries.

Now, this is now put into ((Refer Time: 21:16)). The way this is been presented, we have other ecosystem vitality on one side here, this color part half, and this one, the environmental health and this is and subdivided into categories and for which each of those sub categories, indicators or data are collected and then taken into this index.

So, for instance, the health impacts air quality, water and sanitation on one side, which will correspond to the environmental health. And to ecosystem vitality, we have climate and energy, we have biodiversity and habitat, we have fishery, we have forests agriculture, the water resources. And then, we have those different components for each country should have some data available, which could enable us to convert into an index and compare one with the other.

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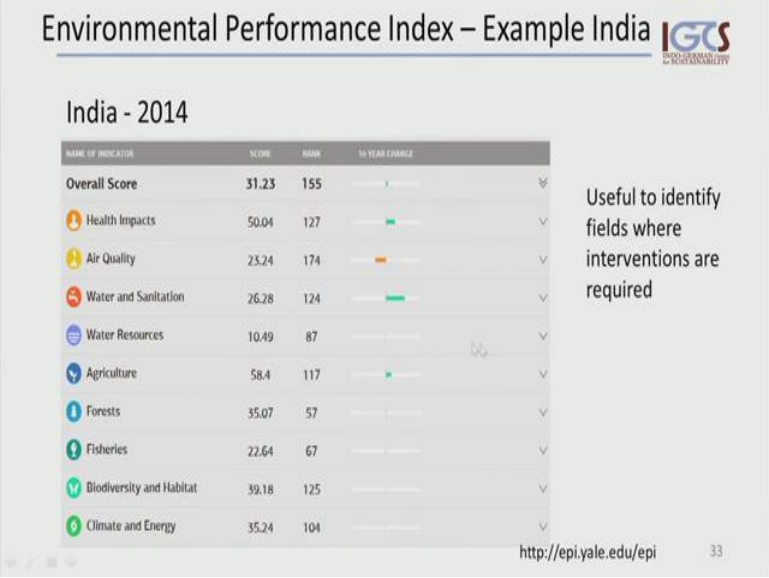

Now, let us look into just two examples. This is the case of India in the year 2014, last year, and we have here the sub categories, which I just write out here on your part. I just cut a table and we have here the overall score of India, scoring about 31 percent points. And if we go back, it would perform somewhere here along the scale. And we also can see in this table, the long term changes, the change compared to 10 years ago. And we can see, that for instance, in the case of air quality the situation has deteriorated, whereas

in the part of water and sanitation a lot has happened. The changes are along the positive scale, the same to agriculture and the same to health impacts where we will see positive changes.

Now, this is very useful, as was the case of the water poverty index in a spider diagram. It is quite useful to identify individual fields where interventions are required, where changes are necessary and where changes can made visible also where we can monitor the changes to the better or monitor the changes to the worse in both directions.

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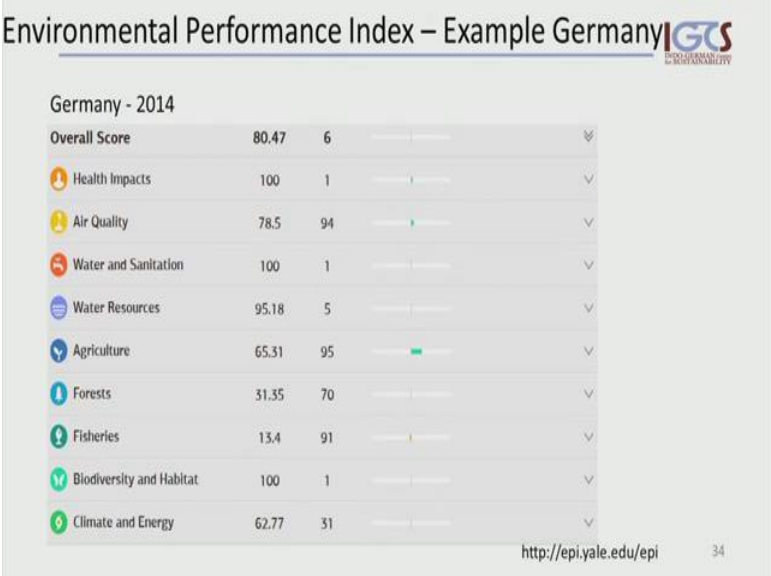

Now, just to provide a contrast I have picked another country as an example, Germany, also in the year of 2014. And what you can see here is, that the overall score is high about 80 percent here and, but what you also see is that only a few changes have taken place, where the situation has become, has decreased is in fishery, for instance. The situation has improved is in agriculture and a lot has been, was done in the agriculture field. So, subsidy schemes where less of pollution is taking place, for instance. But, we also see improvements in air quality and also in health impacts. So, this is a good way or useful way to, for decision taking, also for long term comparison.

So, on this I want to stop and moving to a new subject next time I see you again.