Sustainable River Basin Management

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Module – 01

Lecture – 04

Part – 04

Hello everybody to Sustainable River Basin Management module 1, part 4.

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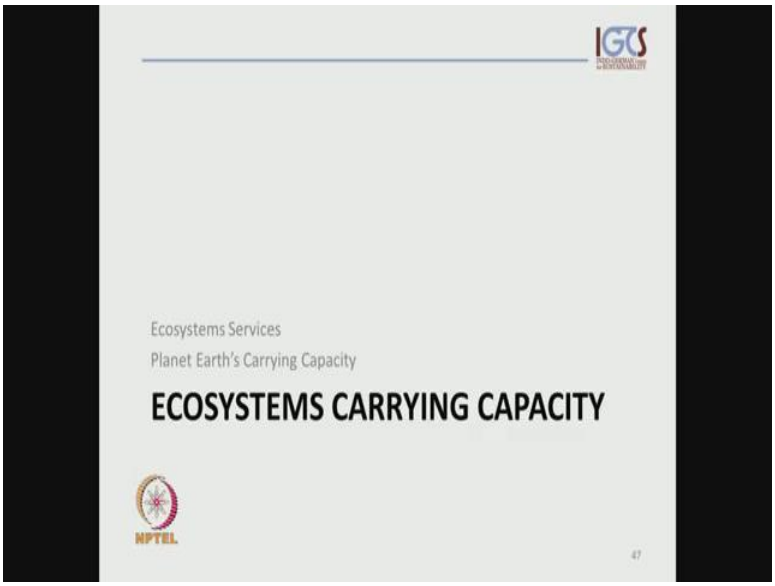

We have been talking about economic growth models and alternatives to our current economic growth models in our last lecture and we will be touching upon the concept of green economics. Now, this was one of the concepts or one of the focus points to changing our current economic models and the second components of it was a ecosystem carrying capacity and we will be specifically talking about ecosystem services and the planetarium carrying capacity.

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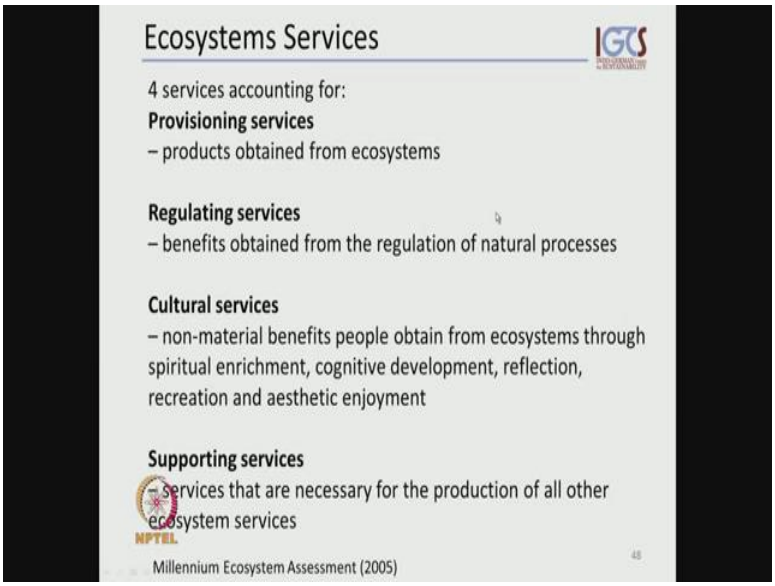

Now, looking at ecosystem services, we essentially can differentiate for major services which we have to account for in wherever we approach in for resource consumption or resource recovery. And this was summarized for the first time in this millennium ecosystem assessment in 2004 and 2005. The ecosystem surfaces recognized was the provisioning service, this means any products obtained from ecosystems, if you apply to this to our reverse, then this would be fresh water availability, water abstraction for irrigation of a drinking water supplies.

The second important ecosystem service that we take from the environment on regulating services. And regulating services we mean any benefits obtained from the regulation of natural processes. So, this essentially means processes of a climate availability of a rain fall, of a water availability, of water cleaning processes, if we apply this to water alone now.

The third important ecosystem service is a cultural services and these are quite important also not eatable or not something that we can sell or we can from an economic point of view account for. Those are benefits to people from a spiritual point of view or from regulating point of view, they are very important, anybody enjoys water fall or a lake or a river side and that is a cultural service.

And then the fourth ecosystem service is, our supporting services and those are services that are necessary for the production of all other ecosystem services and those are reproductive cycles. For instance, those are also the safe cleaning processes, buffering

processes taking place in our environment. Now, notice that under ecosystem services what you mean is, what our environment or ecosystems can do on their own. This does not mean any men made intervention of, let us say a flood control, building a dam or by redirecting water and so on. When we speak about ecosystem services, we mean, the self- contained capacity of our environment to deliver those services.

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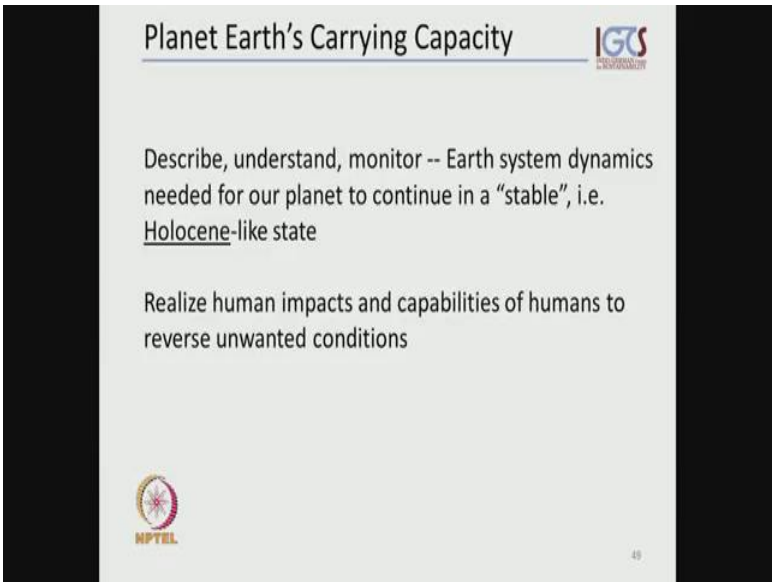

Now, an important additional component of evaluating environmental states are the so called carrying capacity concept and if you zoom to the largest level on our planet, then we have to look at the, planet has carrying capacity. And this is essentially describes helps to understand and helps to monitor those systems dynamics needed to maintain our current climate state. This means to maintain our living conditions which have been favorable throughout the zoological time called Holocene today and has enabled us to developer humans into civilizations. This also means looking at planet carrying capacity that we assumes to realize that we have influence parameters created an influence set shows as an negative impact on the carrying capacity of our planet and that we also believed that we have assumes capability to reverse unwanted conditions. So, this is why this concept was developed in the first place.

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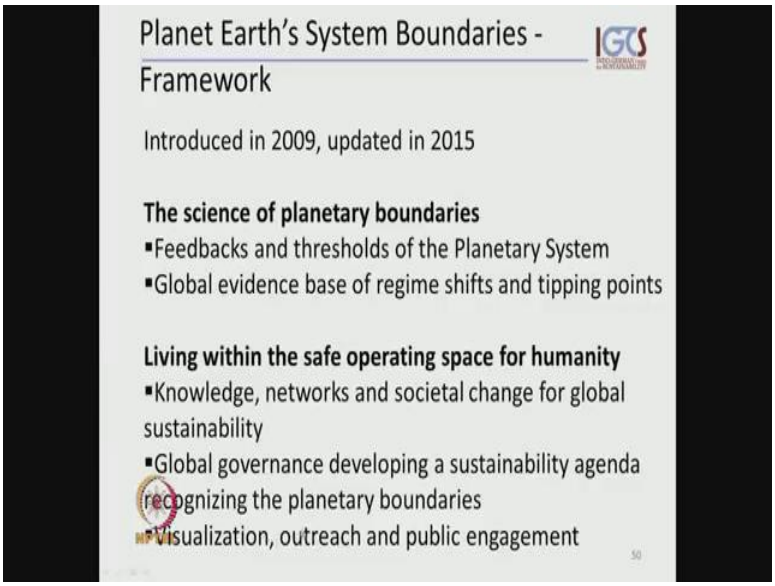

Now, an entire framework of systems boundaries applicable to the largest stage of our earth's planet, planet was developed and introduce in 2009 and we recently updated. Essentially it contains, that framework contains two components, the science of planetary boundaries, which means to understand scientifically, understand feedbacks and thresholds of our planetary system. To collect evidences effects to document to understand shifts and tipping points in the system.

And it as a second component, the living within the safe operating space for humanity, means that to undertake the information collected from here. The understanding that, we have came from monitoring our planetary systems boundaries and define a safe operating space. So, this means there will be to find a range of acceptable conditions, where humanity can live in under good living conditions.

So, this means that knowledge has to be generated, it has to be managed, networks are required and that at large social changes have to take place in cooperating sustainability concepts into the society but, also into governance structures in countries or for regions or for the entire globe. And this has to take place by engaging people by visualizing, outreaching and public awareness and media.

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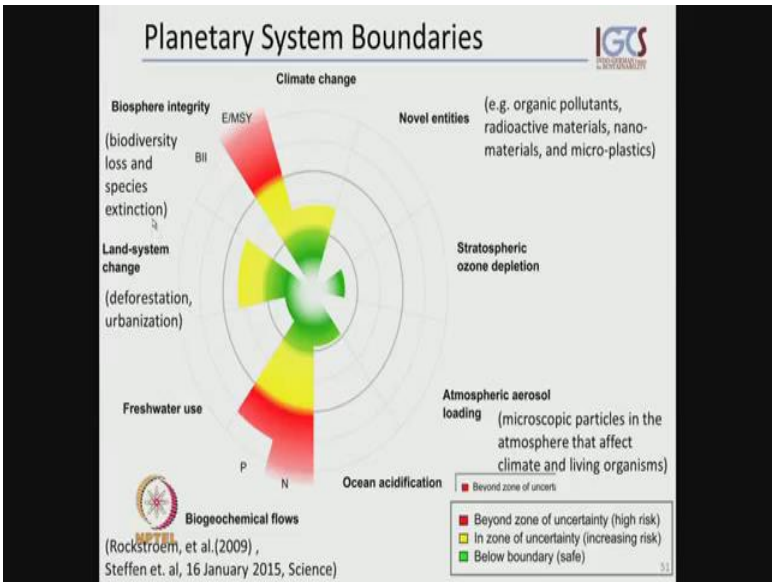

Now, let us look at planetary system boundaries, what orders and they are two essential applications which you should read seriously, very comprehensive also updates are coming up regularly on this. Because, that is a science ongoing effect finding, ongoing research and ongoing expansion of monitoring networks across the globe. There are nine so called planetary system boundaries this what we call biosphere integrity, climate changes as a system boundary, novel entities as a system boundary, stratospheric ozone depletion, atmospheric aerosol loading, ocean acidification, biochemical flows, freshwater use and land system changes.

You see a circle shaded with different colors and the green color here indicates that the monitoring indicator is in safe boundaries. The yellow here shows that there is an increasing risk that are very large and certainty about the indicator, the range and the tipping point of the indicator and the red indicates that we are already in a higher risk or beyond the zone of uncertainty.

So, what we can see here is that there are also first of all they are two of the planetary system boundaries by far (refer time: 11:17) already, which is the case of the biosphere integrity, which includes biological diversity, species numbers the extinction of biological specious, this boundary has been cost by far already. And another bases is seals our corresponding, we can observe for nutrients very important phosphorous we touched upon this already and nitrogen in cost and for the case of freshwater use and atmosphere here.

So, loading belief that this at least indicated that has been used right now in safe boundary conditions. Now, the atoms are also in boundaries which we are not defined yet and let us try to look at those the novel entity is a way, not a very distinguish term. What is behind it? Behind it is organic pollutants, radioactive materials, nano particles and it is micro plastics, this means those are all a components with which we are created by human activity and these are artificial components, which would otherwise not occur in the environment; otherwise, not occur in the Biomet in such level of concentration.

So, for now those have become such higher level of concern right now, say if move from being micro pollutants to actual becoming the abundant in our systems, especially in water. And we do not have a policies in place yet in all our (refer time: 13.18) are indicators that would give us mean of measuring our situation and setting us limits and boundaries, so that... So, there is a research factor which is and a lot of activities and research are going right now.

And the same applies to atmosphere also way we have a referring to microscopic particles in the atmosphere, which affect climate and living organism. The other similar to the compounds produced from human intervention which would otherwise not a approved in the environment. Land system changes are taking place and one of the examples of this deforestation, but in many other parts of the world we also see a fast encroachment taking place. So, this is a factor and this not an indicator which may not appear very suitable.

But, what so many takes place is large way of urbanization which effects that rent use in almost irreversible way. Biodiversity we have mentioned already in the loss of species and the extinction of species.

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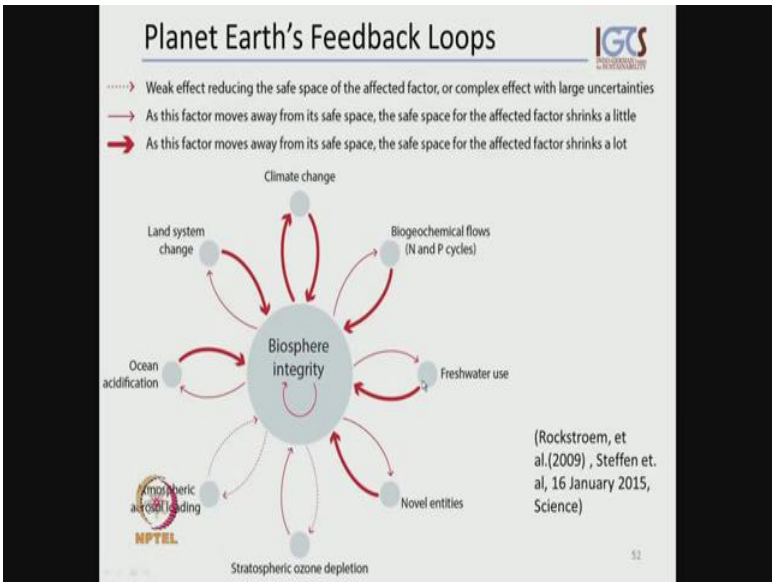

Now, when we speak about planet earth as a system, then what matter is, how can we influence those parameters? How can we change those boundaries? And for that purpose we have to understand feedback loops and moving our biosphere integrity to the center of interest. We can loop all the other monitoring components, connecting to our biosphere through feedback loops and highlight them in different phase and what we can see is that climate change is one of the major impacting factors.

On biosphere integrity and we can also looping back, feedback loop directly feeding back to climate changes as well. So, this is a very crucial relationship which serves to assigning loop, which is very difficult in that stage it was a true change. If you look at freshwater use for instance, lack of fresh water or the lack of or a pollution of freshwater is a very influential feedback loop on to biosphere integrity, better you can also feeds back to freshwater use in itself.

So, by understanding those relationships we can create mechanisms to inter (refer time: 17:09) or influence these feedback loops and we will be talking about this at a later stage. How, what can we do, how can we influence and change self-reinforcing feedback loop in a wanted way.

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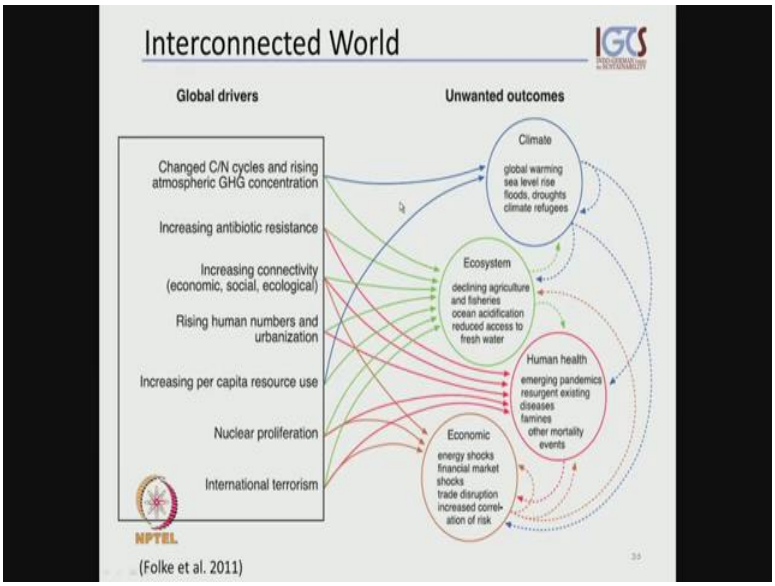

Now, having understood our boundary conditions we also need to realize that we are in a interconnected world and this was part of our sustainability definitions already. And looking at this figure here, we can see that we could list the number of global drivers and this list may not be comprehensive. It ranges from Newton cycles which influence our green house gas concentration to such social aspects like international terrorism.

And those global drivers may add to this list on our own, create unwanted outcomes and those unwanted outcomes influence our climate, they influence our ecosystems, they influence our human health and they influence economics or economic systems. So, what we can see here is that most of these global drivers have a way direct influence on our ecosystems and most of our global driver also have a very direct impact on our human health's. Few of them, have an impact on economic growth, economic financial market stocks and so on. And way few of those have an impact and climate change yet, all of the ecosystem, human health's and economics are directly influenced by climate change in way of floods, droughts, larger climatic events which interrupt economies, interrupt ecosystems services and killer diseases and kill people. So, what you can see is that we can work on some of these drivers and try to influence some of these drivers and still we may not be able to a oversee what the unwanted outcomes will be versus the wanted outcomes.

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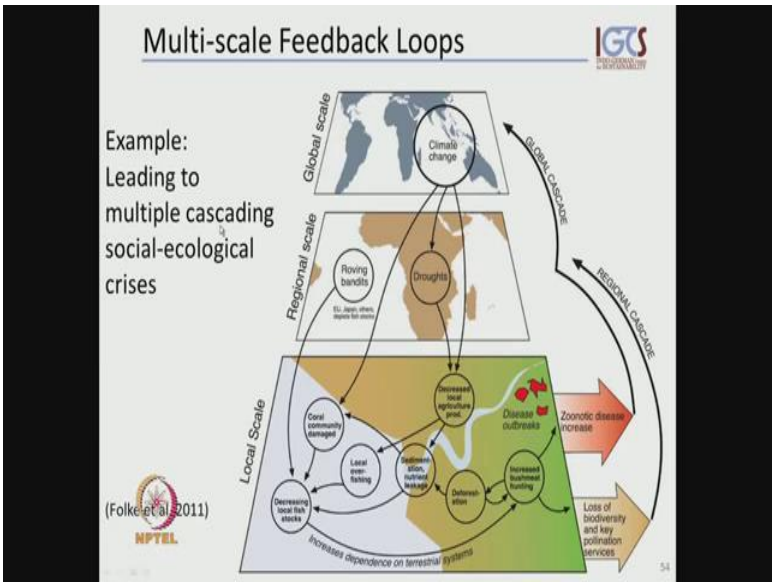

To the interconnected aspects, interconnection of sustainability there is a multi-scale facet to it and multi scale from a geographical range as well as from temple range. And I want to show you, here an example of this multi-scale feedback loop, we have here an example of global climate change affecting the planet at a global scale. Now, we can ignore this at one location and ignore at in one continent, yet it is a reality that is measurable.

And this climate change can result in for example, droughts on one continent, there might be a flood on another continent. So, it affects, what happens at regional scale and this can take a number of actions and responses at the local scale. So, for instance if we take the example that climate change, increases the number of droughts events, the duration of droughts, then this has a direct impact on agriculture production.

So, the entire agriculture production may decrease or decline and people will be forced to look for alternatives. So, they move into a fishing for instance and fishing is directly influenced by a climate change again, where fish stocks have been decreasing, wiped out simply due to climate change, due to ocean farming for instance. Yet an entire population here would be depending on this fishery in the same.

And alternatively they may shift to subsistence production, subsistence life reverts and push meet, hunting made wild life based lively hoods may increase, which again has an impact on bio-diversity and deforestation. As a side result of droughts to do climate change we may also have higher number of diseases taking place, which may weaken the

human population or may extinct, wipeout other species which are important to the survival of human populations.

So, this is to show that something that maybe like far away from one, ourselves has a way for reaching impact on continents, on decision taking and responses at local scales and for local societies and local economist. So, this can just like in this demonstrate case here lead to a cascading prices effect and this is what we also observing in many cases when we look across continents.

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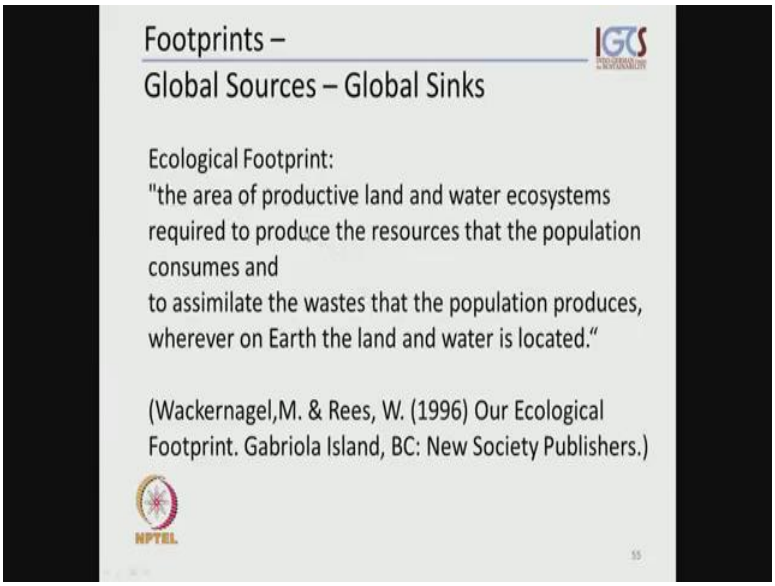

Now, how can we describe our environmental impacts and for that we use a term that is called foot prints and which essentially marks the relationship between global sources and global sinks in our current economic model. It essentially looks at the case of ecological foot print which is the most widest expression of foot print, is the area of productive land and water ecosystems required to produce resource that is required for consumption. And the required land to assimilate the waste that has been produced from the consumption, from the production of these produces, this can be anywhere this sources and sinks may not be connected and this is what I want to show you here.

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If we take a look at the entire globe and the country division here, then we have our color code from the dark point to the green, the foot print which is one and half times larger then the bio capacity and cleaner on the other side, the bio capacity is larger than the one and half times larger than the foot print. Now, what we can see here a number of countries, where the bio capacity is very high, very large and then we have a number of countries here where the foot print is extremely high by far larger than the bio capacity, how can those countries function?

So, now, this shows us that the source and sink relationship between countries. There are countries, which have a way high, foot print which essentially stock the resources from those countries which are sources, which are source countries those are sinks. And then we have countries which... So, far as export of resources to deliver and to those which have a very high foot print, interesting is that we have an extremely high ecological foot print in the middle east countries, you look at those countries as special which I am pointing out here. Those are extremely dry countries or wet countries, this is how a dessert is quite surprising.

If you just look at a map how large the foot print is and this is possible, because the resources are imported. What has been imported, what has been (refer time 27:54) economies which are swerved by the other economies which able to deliver sources to these countries.

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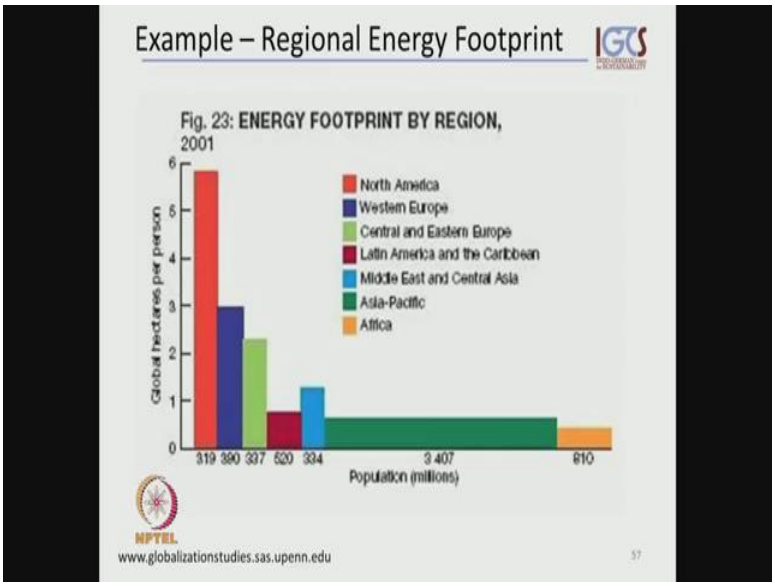

Now, we can take another example set of looking at the ecological foot print and we can just look at the energy foot print here, we have population in millions and here we have the global hectares per person. So, it is converted energy foot print converted into a hectares to make it comparable. What you can see is such for North America we have relatively small number of people forming or causing fairly high energy foot print versus for instance Asia specific region, where we have a very high population number forming exactly the same size of energy foot print by region.

So, we have a one side a low population and on the other side a large population and by summing this up we end up having exactly the same energy foot print in those two regions. So, whatever efforts made to improve and foot prints maybe an energy foot print of water foot print or an ecological footprint, our population numbers can set back all of these positive efforts made.

So, we stop here and next time we will be speaking about the (refer time 30:08) and industrial revolution.