Sustainable River Basin Management

Dr. Franziska Steinbruch

Department of Civil Engineering

Indian Institute of Technology, Madras

Module 3- 2

Lecture - 23

Part 03

Welcome everybody to Sustainable River Basin Management, module three-two, part three. This time I am going to speak to you about the environment.

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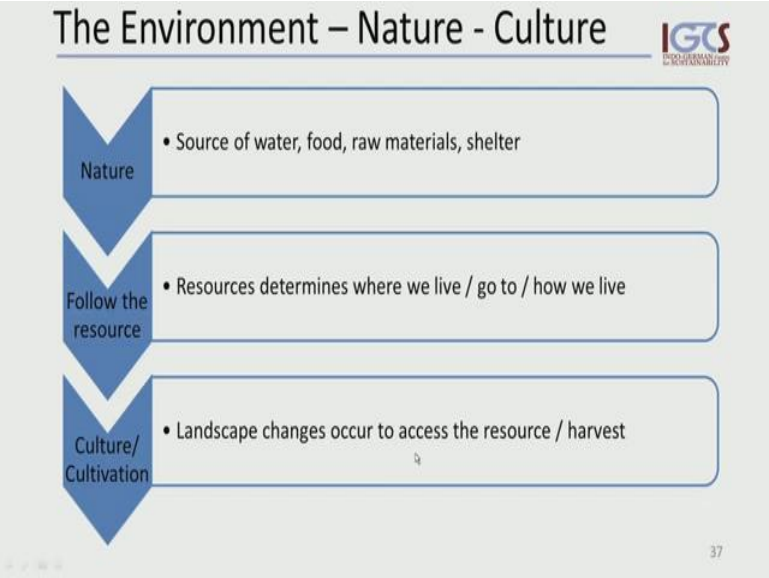

Let us first of all talk about environment in the context of nature versus culture now, and reflect upon this in terms of water, water use. Now, in the first place, we see our nature and the nature with us as part of the nature and we use the nature as a source of water, as a source of food, as a source of raw materials and source of shelter, for instance. So, we use nature as a source to serve us. That is what also the other species are doing, but we also follow the resource.

So, we follow the resource and the resource availability determines where we live and it determines where we go to and how we live and this is even applicable to a very urbanized person disconnected may be from the nature in general and the nature, nature's

flows in general. Even then, the resource availability determines where we go and where we live.

Then, we move up the scale to something what we call culture or cultivation. So, instead of following what nature offers at certain times, at certain locations, we have started to change our environment or we have shaped our landscape to access our resources to harvest it, to easy access it. We may have deforest it, places we have channelized or river system to serve these accesses to the resource water and to harvest what the water offers us.

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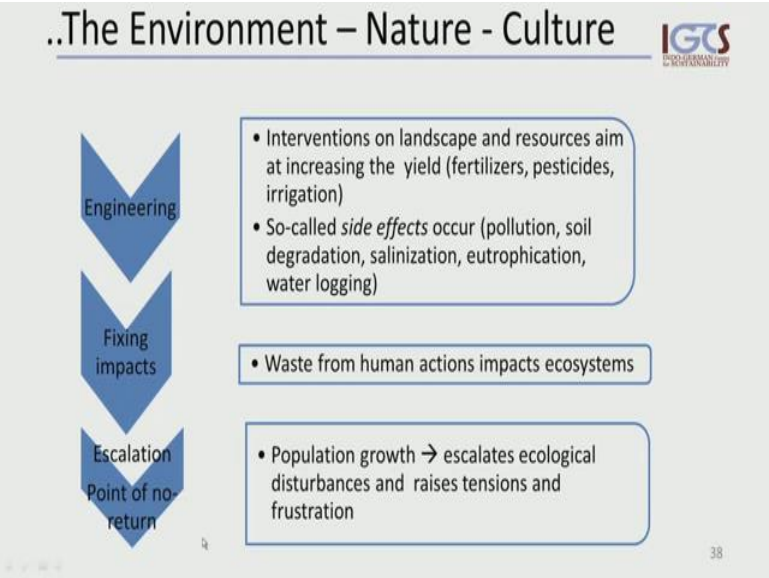

Now, moving on, we actually come, came to the point where we not just cultivate nature, but we also, engineering, engineer our nature. So, and this means, that we have been changing our landscape to improve on yields, to improve the quality of the resources, to improve species, for instance, to serve specific purpose for us. And we have been applying fertilizers or pesticides, we have been irrigating to grow certain resources at the place, that is, ((Refer Time: 03:18)) and to have it available at times in that specific locations, so that we do not have to migrate around to find the resources at different locations, and this comes along with, we could just call side effects, if it would not be as serious as it is. And those so called side effects are pollution, they are also soil degradation, they are salinization, eutrophication, water logging and the list could continue.

This brings us to the next level along this scale, from engineering to trying to fix the impacts to replace damages, to recreate something in a different location, may be to try to restore environments. So, this is to result from the facts, that whatever we do in terms of resource use there will be waste produce, which will impact the ecosystems. And then, we come to a point where all those escalate, where we reach points of no return or have crossed points of no return and this, basically due to population growth, which escalated ecological disturbances and also alongside raised tensions and frustrations in terms of access and allocation to water resources. So, this is the chain that we have been following. And the question is how could we counterbalance this in the future?

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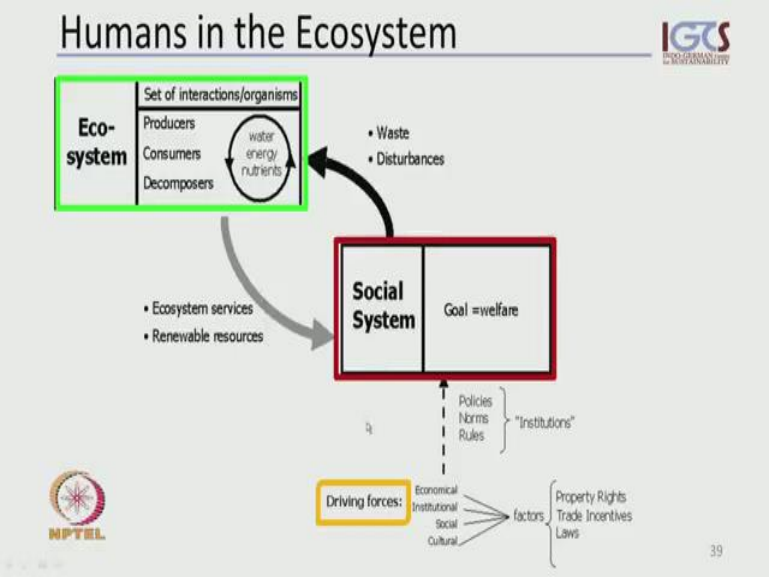

Now, let us look into humans in our ecosystem and we can look at this in as one system or in as boxes of subsystems. One of these subsystems would be the ecosystems. So, there are a set of interactions taking place between various organisms. We have looked into the bio-geo chemical cycle earlier that produces consumers, the decomposers, which move along a circle, which does not go in diameter, which is determined by water availability, water quality, the energy availability and nutrient availability.

Then, we have a second subsystem, which we could call a social system or the human system. This is where we appear in a way outside this circle because as such, we would be actually part of the consumers list in the ecosystem, but we have created our own subsystem and we have just called it here our social system. And the goal of our social

system is welfare, well-being, good living and so on. And this is being driven by a set of forces, which are economical, institutional, social and cultural driving forces, and the factors to this are property rights, for instance, trade incentives, subsidies, laws and so on. And this is back feeding into our social systems, it is driving our social systems. And there are institutions set up to provide policies, to provide norms and standards and to rule those social systems. And there is a link between those. Remember, that we have simply moved ourselves, disconnected ourselves as human systems from, from the subset of ecosystems, but as a link between those two, which is a back flow from the social system in terms of waste and disturbances. And there is a flow coming an input flow from the ecosystem towards this into this social system subset, which are ecosystem services and renewable resources.

Now, remember, that we can measure all these and we measure this in terms of TDP, for instance, or human health or human development index and so on. There are many indicators, which rate and rank our well, our functioning of the social system, but and most of them are monetary, whereas this is a service, that quietly takes place as, and is a crucial input to the functioning of and existence of our social system.

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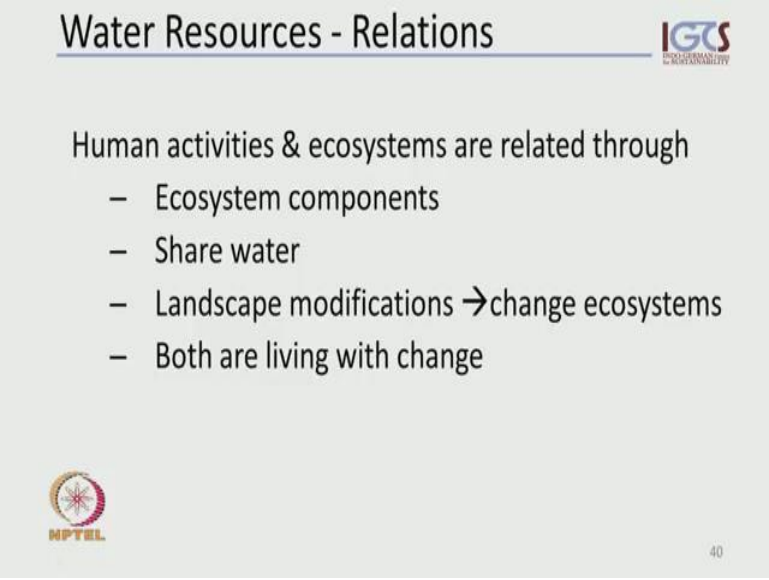

Now, let us zoom into the water resources relations. Human activities and ecosystems are related and they are related through the ecosystems components. They are related through sharing water as a resource and they are related to each other through landscape

modifications, that means, changes in ecosystems and both of these, the human and the environment are driven by changes. They are subject to permanent changes, ongoing changes, and are adjusted to it.

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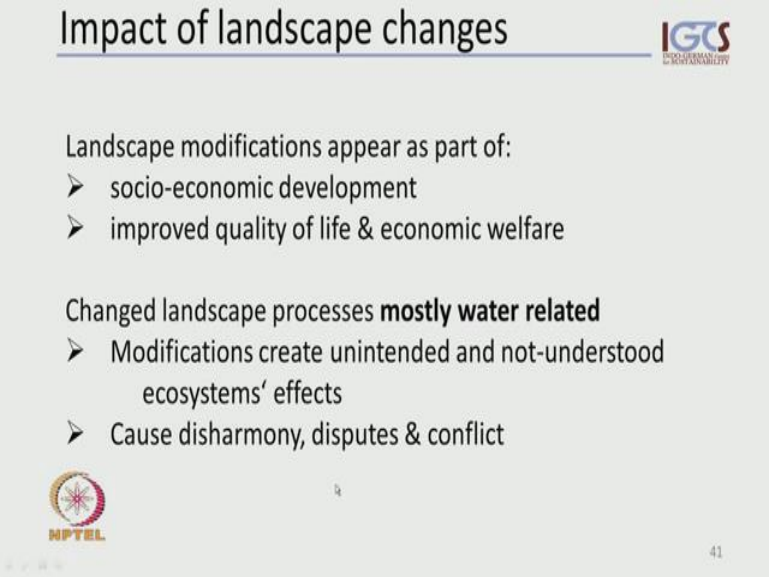

Now, the impact of landscape changes that we impose by cultivating or engineering our environment, those landscape modification appear as part of socio-economic development. They are justified as being necessary and important for our social, social and economic development and they are justified because they improve quality of life and economic welfare.

But on the other hand, those changes in landscapes processes are mostly water related and in many cases, those modifications create unintended and in very many cases also, completely ununderstood, not understood ecosystems effects. So, and of all these causes disharmony in environmental aspects between human societies, but also disputes and open conflicts.

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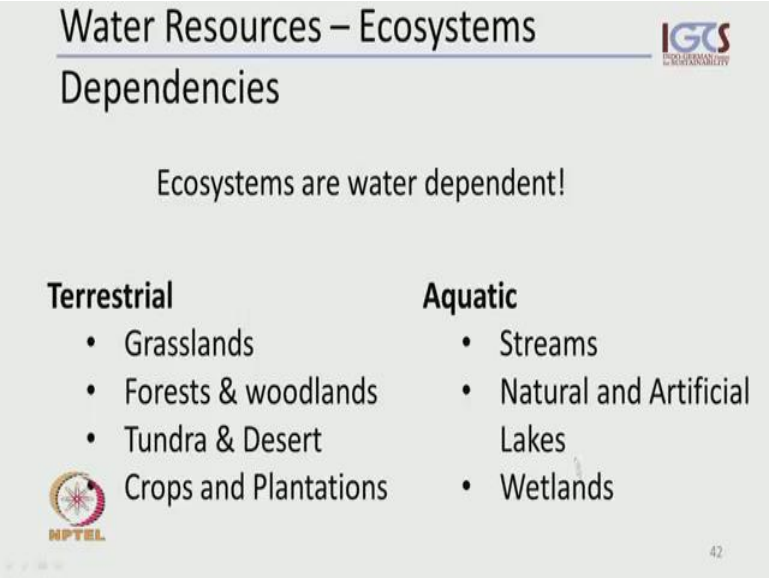

Now, let us look into the water resources and ecosystems' dependencies a little bit more because this is crucial to understand. And the first of all is, ecosystems are all water dependent. There is not a single ecosystem, which would be outside this and our major fields are terrestrial. And let us remember of the grasslands units, the forest and woodlands, the tundra, the deserts and crops and plantations, they all depend on water. And our aquatic system in itself, the term already includes the water dependency. Think of our streams, the natural and artificial lakes and the wetlands.

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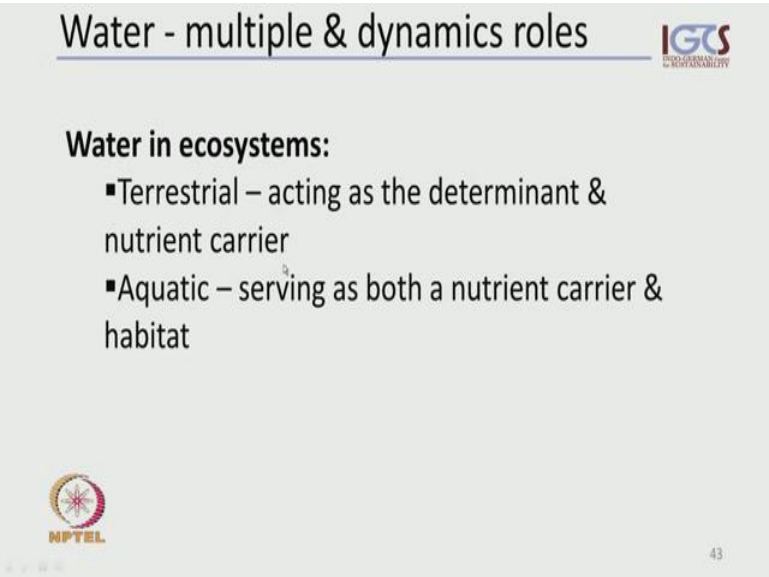

Now, let us look into the ecosystems and the water in relevance or water in those ecosystems. In terrestrial systems, water acts as the determinant and it also acts as a nutrient carrier. That means, this water scarcity, certain vegetation types will not be able to survive. So, we may end up having a desert, for instance, or have forest where we have less water available and we may end up with a flood plain or a grassland pattern where we have more water available throughout the year. So, water is determining what type of ecosystem we have and the transitions taking place between those ecosystems are determined by among other aspects, like temperature and solar radiation as on the slopes by water mainly. And in the aquatic ecosystem, water is both, its habitat and it is also a nutrient carrier.

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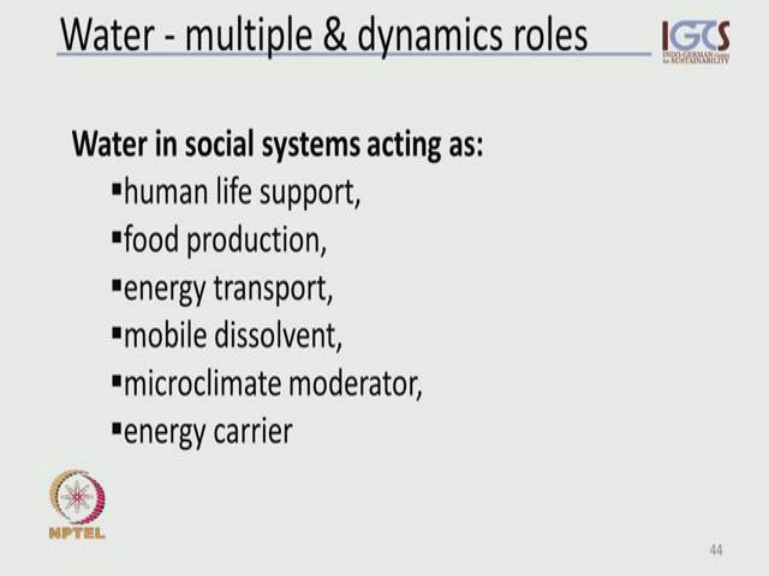

Now, this is on the environmental side, let us look into where water is important in our social systems. It acts as a human life support. We need water as drinking water, it is a life support. It is a, it helps us in food production, in energy transport. It is also a mobile dissolvent, it is a micro climate moderator, it is an energy carrier. All of those are important just for social systems.

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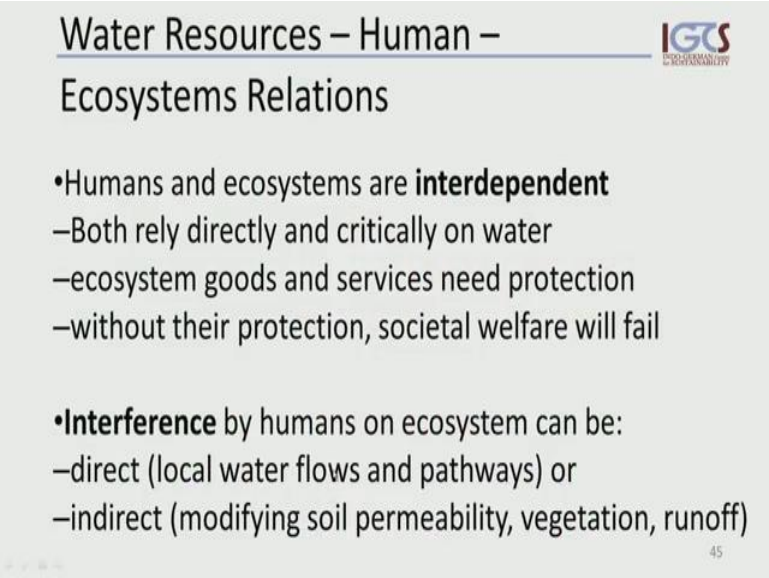

We can state without hesitating, that humans and ecosystems are interdependent. Both rely directly and critically on water and ecosystem goods and services for that reason need protection. It also implies, that without protecting ecosystems goods and services, our social welfare will completely fail, our societies will fail.

So, the interference of by humans on ecosystems takes place either directly, by changing local water flows, by changing pathways or for instance, or it could take place in an indirect way by, for instance, modifying soil permeability, for instance, through urbanization or by changing vegetation or by changing run off and creating flesh floods.

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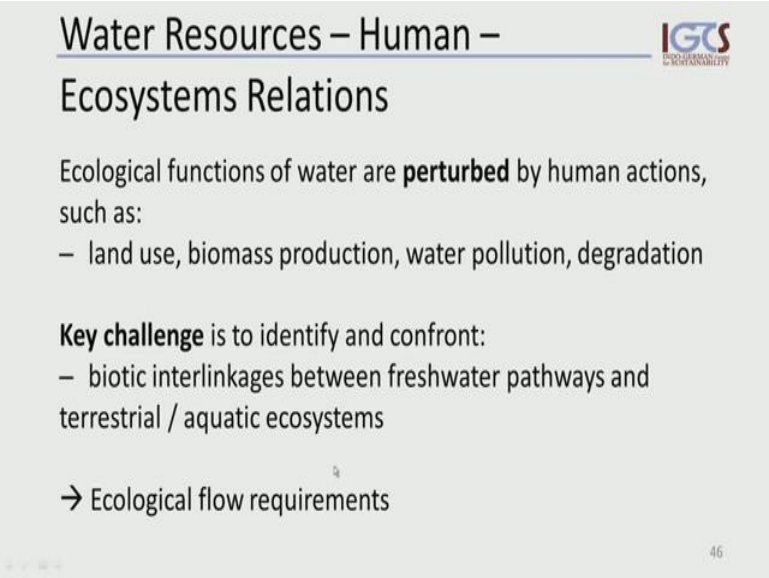

Overall, all of these ecological functions of water influence and perturbed by human actions such as land use, that you employ the biomass production, that we encourage by using certain fertilizers, the water pollution, the degradation and so on. So, the key challenges to this are to identify those and to influence and try to confront the biotic interlinkages between fresh water pathways from the terrestrial to the aquatic ecosystems. And how we do that? We use a framework that we call ecological flow requirements which has been incorporated into environmental impact assessments, also into planning of infrastructure projects in river basins.

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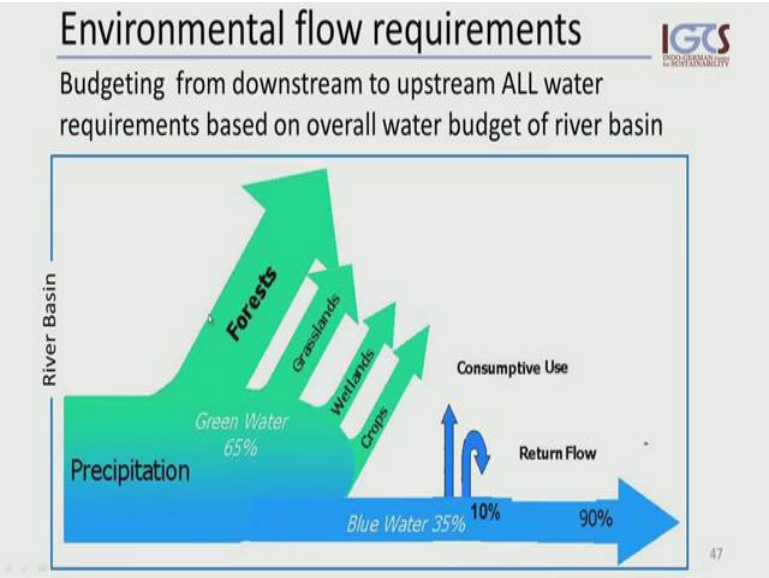

How this environmental, flow requirement is determined? We briefly touch up on this. This shows us a case where we have the box, the blue box indicating river basin. It could also be a different scale. We could look into water shed, for instance, or a command area and what we account for is the surface run-off and the groundwater run-off including the return flows and consumptive usages. Remember, we call this component the blue water component of departing from the input in terms of precipitation into the river basin and the different water usages, consumptive usages by different ecosystems occurring in this river basin, which would be budgeted in terms of green water use.

Now, by moving from a downstream approach, the overall budget available, the overall knowledge of what type of ecosystems we have, let it be human induced crops or urban areas, let it be natural systems, all accounted for, there should still be a percentage of water reaching the estuary, reaching the ocean. Although many in water scarce parts would argue here, that each drop reaching the ocean is the lost drop of water, but you remember, that our estuaries are highly productive in terms of biomass. So, for the survival of this part of the stream, the estuarial, it is just important, that water reaches that part and maintains it.

So, moving from downstream water availability, water needs assessment through these various segments of the stream, the river basin to the upstream. We can account and allocate amounts of water and water qualities to these specific compartments of the ecosystems. Now, and this enables the inclusion and allocation of water to all of the water users including the environment. In many cases we only budget for the crops and urban areas are settlement areas. We are not accounting for what our forest or grasslands or wetlands need in terms of water; that is what we try to overcome by calculating environmental flow requirements.

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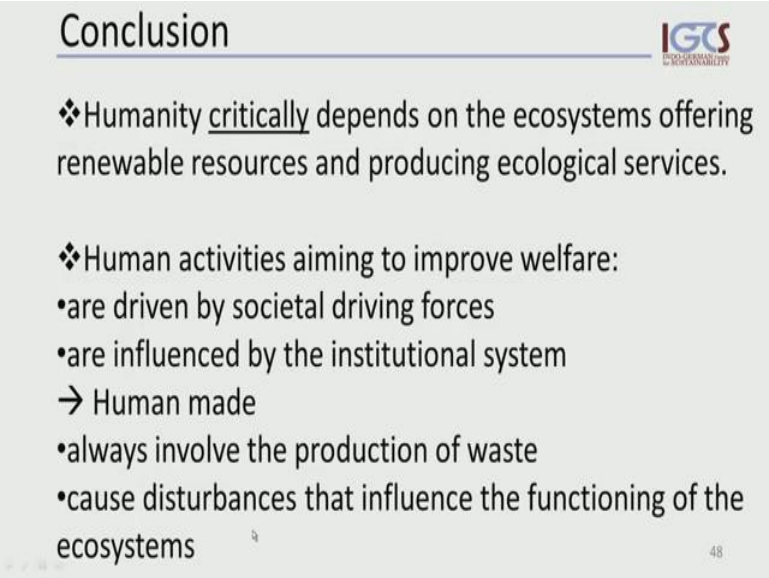

With this we want to move to conclusion. What we have been showing here is that humanity critically depends on the ecosystems, which offer renewable resources and produce ecological services.

So, there is two ((Refer Time: 19:50)), two products. We as people, as societies depend on the resource and the services and while human activities aim to improve welfare, those are driven by our social forces and they are influenced by our institutional system. Those are manmade, they are human made and as such also can be shaped and we should be able to influence them to better integrate with environmental issues and integrate with human issues. Whatever we do we always produce waste and where we reduce the waste, it is relationship to our environment, which has to change. We have talked about this earlier and this, both of these interferences cause substantial disturbances and influence the functioning of the ecosystems.

So, this is something, no matter how well we are doing on this site here as where we always have an impact on the function of our ecosystems in a positive or in a negative way. With this I want to leave you and see you next time again for module three.