Sustainable River Basin Management

Dr. Franziska Steinbruch

Department of Civil Engineering

Indian Institute of Technology, Madras

Module – 4 – 1

Lecture - 26

Part 1

Welcome everybody to sustainable river basin management module 4- 1, part 1. Let us first reflect upon what we have been doing so far. We have completed module 1, 2 and 3 and we are now moving into module 4, dealing with sustainability in river basin management; cover two weeks we start today this week one.

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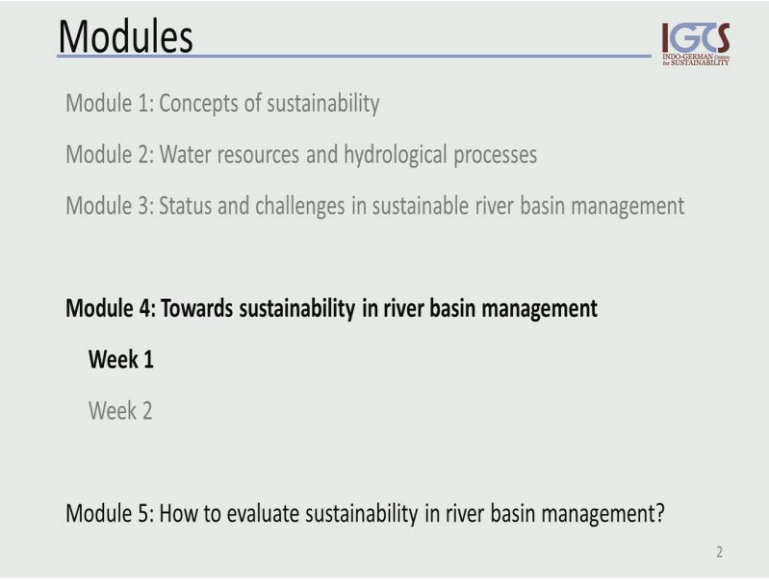

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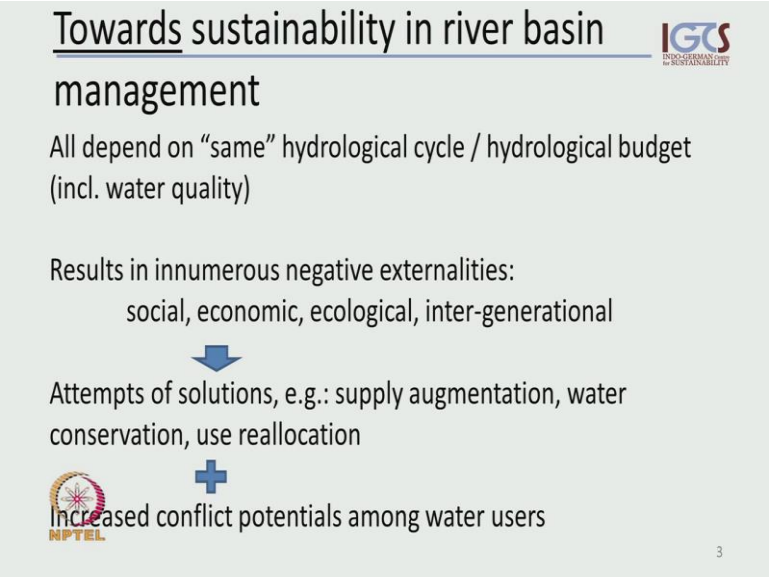

Let us, first thing about our topic towards sustainability in river basin management, which indicates that I will present you a number of tools and recommendations and guidelines, but there is no such final recipe for appropriate sustainability management as yet for, which I can present to you. Now, let us, if you can remember that all depend on one and the same hydrological cycle. All depend on one and the same hydrological budget including water quality, and these results in innumerous negative externalities such as social, economic, ecological, but also inter generational externalities. There are a number of attempts of solutions; again, there is no such solution that I can present you is the best working everywhere. That is why attempts such as supply augmentation, artificial recharge, water conservation, use reallocation and many others, and this leads us to an increased conflict potential among the water users, which also we will be looking into in detail right now.

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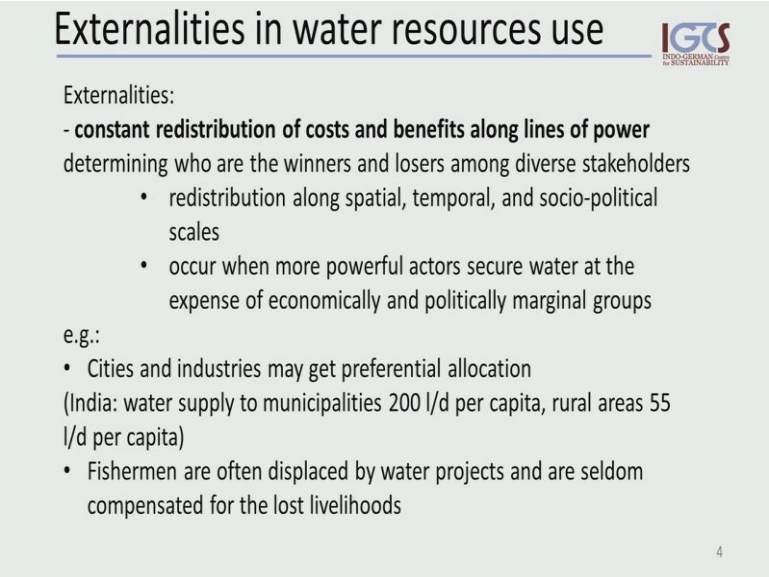

Let us talk about the externalities in water resources use. What is meant by this term? Its meaning the constant redistribution of costs and benefits along lines of power, determining who are the winners and losers, among diverse stakeholders. It means also redistribution along spatial, temporal and socio-political scales. So, it is a readers' distribution of costs and benefits. Those occur when more powerful actors secure water at the expense of economically and politically marginal groups. This, just as an example the cities and industries may get a preferential allocation of water. An example here, in the case of India, water supply to municipalities is set to a minimum of 200 liters per day per capita, whereas in rural areas, it is 55 liters per day per capita and one can put question that differentiation, or the case of fishermen, which are often displaced as a result of water projects, construction of dams for instance, and are way aside in compensated for the loss of their livelihoods.

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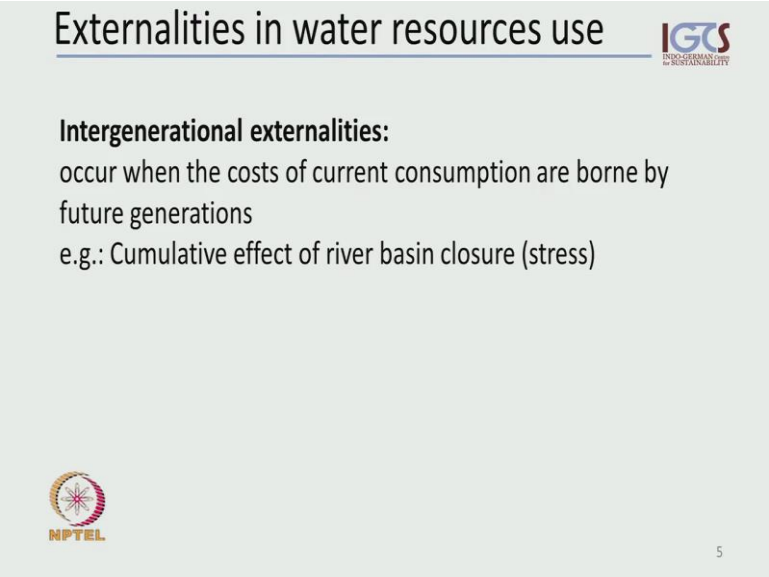

Let us try to understand these inter generational externalities. Those occur when the cost of current consumption are borne by the future generations, and just remember of the cumulative effect of river basin closure or river basin stress, as it accumulates, it will be postponing the need for solutions and they postpone problems on to our coming own children, coming generations.

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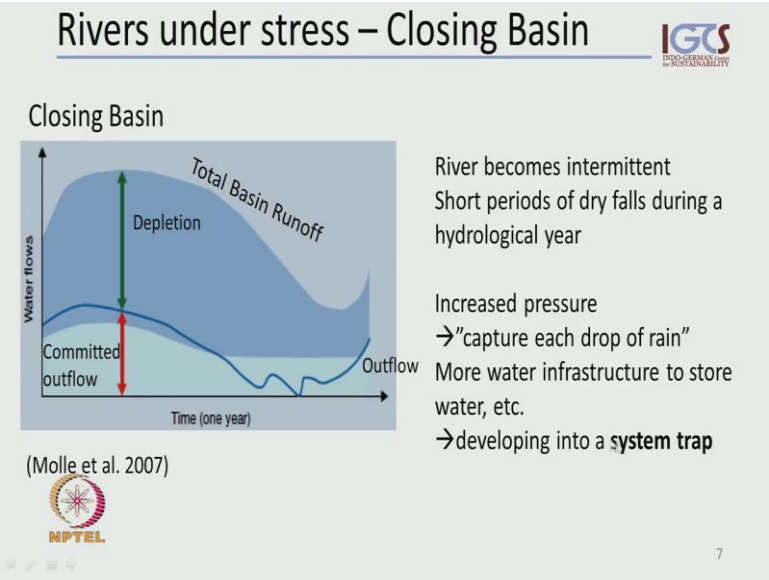

Now, I (Refer Time: 04:20) the term closed river basin already, or stress river basin several times, and I think it is appropriate now to define this a little bit better to understand what are our installation options for towards sustainability in river basin

management. Let us look into the open basin first and rivers under stress. We can say that river basin development is following a characteristic pathway from an open to a closed stressed basins. It is almost predictable to any river basin, anywhere on our globe. What is an open basin? This shows us a typical hydro curve, the time state here of one hydrological year and then, we have discharge here, water flow here, risk for that we have the dark blue, the total basin run off which includes ground water flows as well and then, we have what is the surface water outflow from the basin, the blue line, and we have the lighter blue line here, which lighter blue volume area covered here.

It corresponds to a discharge right volume, committed outflow, the amount of water that is being allocated to certain water users. What you can see in this case is that we have still, certain amount of water that is not committed, that committed to any of our human water utilizations, which would be for instance, available for aquatic systems. There is some water still reaching the sea or the ocean. Now, this river basin development is a gradual process; it is taking time; it is occurring along generations of people working on this river basin development. The changes in water availability are first hardly noticed by the local residents, thereby somebody coming occasionally, to this region may will see and recognize that changes are indeed taking place. So, it is a gradual process and for that reason, many may not pay too much attention to the changes taking place already.

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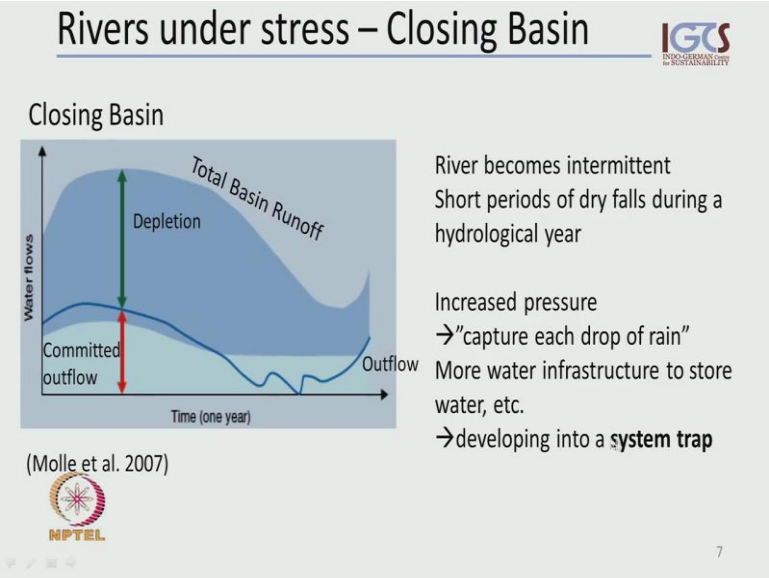

Now, when we look into a closing basin, which is the next step on this, we again have a hydrograph here, which shows us the dark blue, including the light blue as our total basin and of the blue line, our outflow. What you can see here is under committed flow as the

light bluish area here again, and what we can see is that our surface water outflow is taking zero line here. So, there is no discharge taking place in some, during some periods of the year and in some periods, it is coming close to falling, completely trying and we can see that our committed allocated water amounts cannot be provided.

Water is not sufficient to be made available to those who have received right or permission, to receive that amount of water. It could affect farmers for instance; who cannot irrigate their fields during this period; could not produce or even may force some factories to close down for that period of time when not enough water is available. So, that increase pressure needs to a way, for an approach of time to capture each drop of rain perception that each drop of rain that reaches the ocean. Still, here may be a last drop to those parts of the basin, which those parts of the months, which underserved by water. The result will be there is more water infrastructure to store water may be built; Investments will go into this and we are moving into this system trap. We come back to the system traps and how we can overcome then at a later point again.

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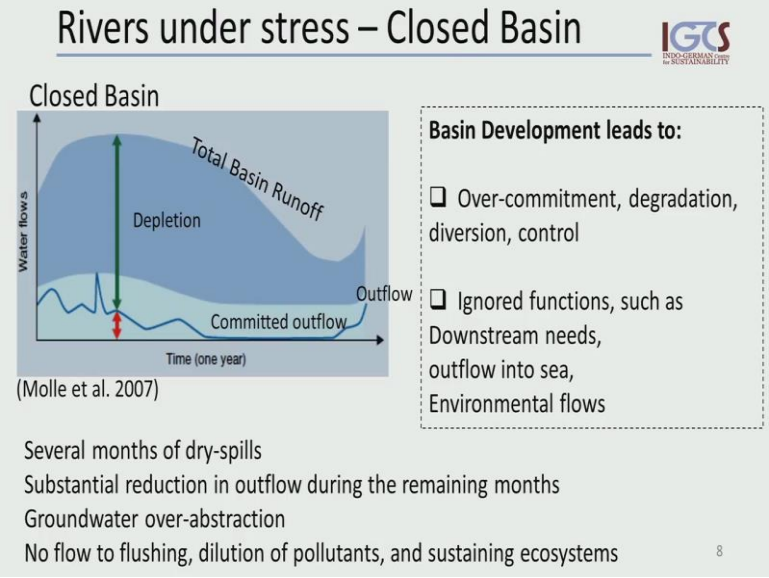

So, but this is a typical pathway, leading to a trap. Now, looking into the final stage of this, the closed river basin or stressed basin, which again shows us here, our total basin runoff and our committed portion here, and our blue line shows us our surface outflows. Now, the surface outflow line, our hydro curve is now, substantially changed. First of all, we can observe these are peaks now, which indicate fresh flood events. This is to do some changes in land use, somewhere in the river basin, leading to a faster surface water runoff and leading to flood events; local flush flood events.

On the other hand, we have substantial low annual, mean annual outflow from surface outflow from our river basin, although the overall total basin runoff. The physical conditions of rainfall have not changed and we also, see that we have now several months, close to half a year of thrice spell, occurring in this river, where the committed outflow cannot be guaranteed, where there can be no supply or no allocation take place and for the rest of the year, where we still have some surface outflow taking place. This is not sufficient to half of what the committed amount would require to be satisfied. So, there are several months as a substantial reduction outflow. This also indicates that a substantial ground water over abstraction and there is no amount of water left to flush or to dilute our pollutants, to remove our pollutants into sustained ecosystem, which is also depending on the flow of the river.

Now, what we can summarize from this system; basin development needs to an over commitment, the degradation of rivers, the diversion and total control of the flow at higher level; that means, the total control of the flows. It essentially ignores functions such as downstream needs; what is not available committed in one stretch and over used in one stretch; then affects all of the downstream users. It also does not include aspects of outflow into the sea, which is essential, just from the point of view of reducing water pollution and ignore this also, anything like environmental flows. Now, this seems to be a trap, out of which, very few were able to lift up and overcome those such situations.

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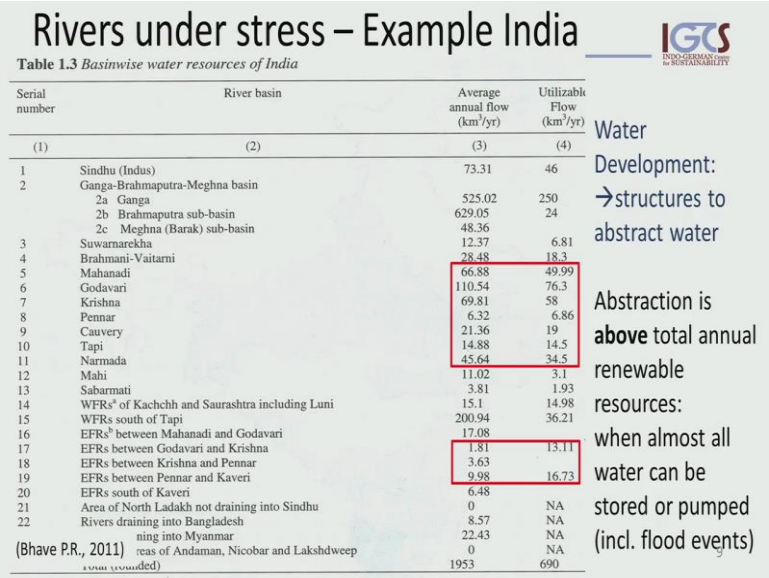

Major river systems, known systems are under such stress conditions. Let us just look into the example of India, and what shows us river system under severe stresses as when the water abstraction is above the total annual renewable resources. This is the case when almost all water can be stored or pumped in it somewhere, including flood events. This is a table from this publication here, which shows us the river basins of India and which shows us here, a column of the average annual flow and on the other column, the utilizable flow annually. Now, what we can see here is just picking few cases here that several of these rivers are, I would almost say most of these rivers are over committed. There is much more infrastructure in place to store water than actually, water is available. In some of the cases it is very extreme here like in those two cases here. Now, what this means also is that water development essentially, is being set equal to setting up structures to abstract water. Only in recent years now, the regeneration, restoration, reactivating of ecological functions have become thoughts and trials are going on; we heard by it; will have been incorporated into water development as well.

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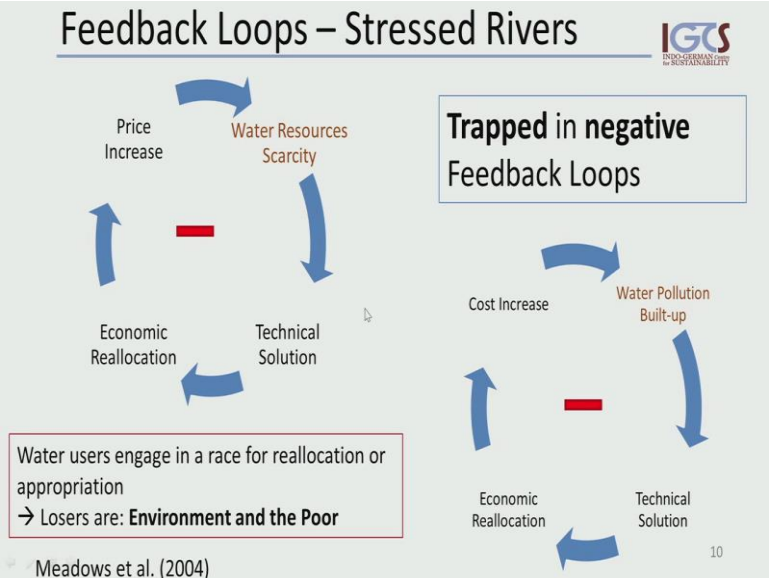

Now, let us look into these feedback loops in stressed rivers and we can look at this from two angles. One angle is that the increase the water resources scarcity and what we do on our side is that we try to find better technical solutions to really, to ease this water resource scarcity. We allocate or reallocate economic resources for that and this comes along with a price, which usually, needs to be increase the costs, increase in the price, which still sharpen the increase, keep on increasing the water resource scarcity, and this cycle goes on and on, and may spin fast and fast and will not take us out of the actual problem of not having enough water, available at all. The other obstacle here is not water quantity, but water quality where we see, because of the water scarcity on this side, we see that water pollution is building up, and again, our way of dealing with this is finding new technical solutions, allocating finances, economic instruments, which usually lead to an increase in costs, increase in costs also in terms of additional resources like electricity.

Again we are not solving our water pollution problem. We are just adding to it, building it up, concentrating it higher and higher and again, try to find technical solutions to that. So, what is the response to this? What do users engage in a race for the allocation or appropriation? The losers to this circle, those both circles are the environment and those who cannot afford; the poor in general. So, this is not meaning industries or governments on its own, water users also mean individuals like myself or you, listening to this course. Now, in this both of them are very negative feedback loops and also traps. So, we can get out these traps; we are reinforcing instead those negative feedback loops. So, the job, the

task of our generation is to change this into plus, into a positive feedback loop, where we can move ourselves out of the trap and change the scenario

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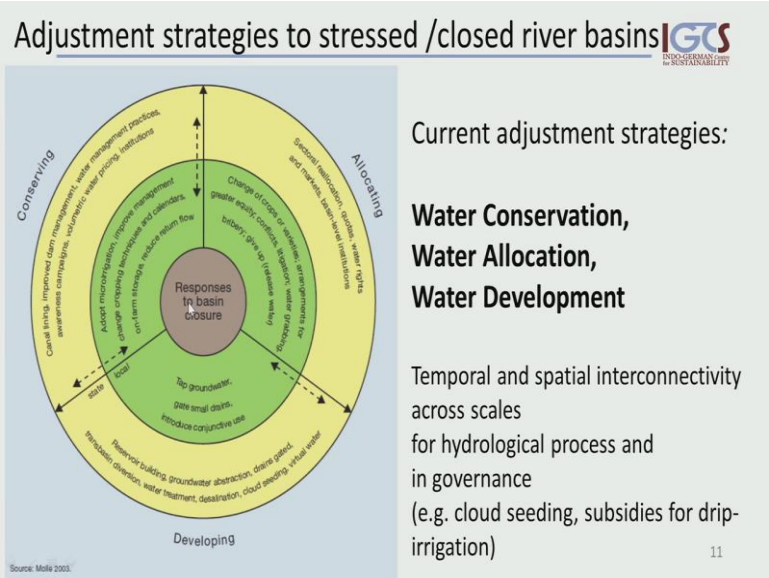

Now, what are our current adjustment strategies to stressed and closed river basins? Our current adjustment strategies are three only; water conservation, water allocation and water development and I found this fairly, comprehensive and useful picture, which compiles obviously, all these details. We have conserving adjustment here. We have allocation here and we have developing here and the center of this, which is responsible to base basin closure to basin stress, and we have several levels, which can be institutional or policy oriented, government oriented and we have the green cycle, which looks into the crop changes in, looking into tapping ground water or into improving on irrigation or improving in water supply technologies so, in the ways parts of allocation, development, the developing and conservation. Now obviously, this is not; this has to be going across temporal and spatial inter connectivity and across those two scales of the hydrological processes and the governance policy oriented decisions that can be made in those three fields. For example, the cloud seeding may be seen as resolution to water scarcity.

We can artificially initiate precipitation rainfall events, localized to increase our water availability, but this again, review water like in when some other parts of, may be the same river basin, of the neighboring country or we may find a sub; we may introduce subsidies for drip irrigation, which then may not be, the technology may not be applicable in the environment, in the actual environment, water quality related to this or

the level of education of people, knowing how to develop such technology, may not be available. So, this goes across the various levels here and scales, and for that reason, one may trigger a reaction or response, somewhere else on the other side here, where we may even not have expected it when we implemented some measures to the best of our knowledge.

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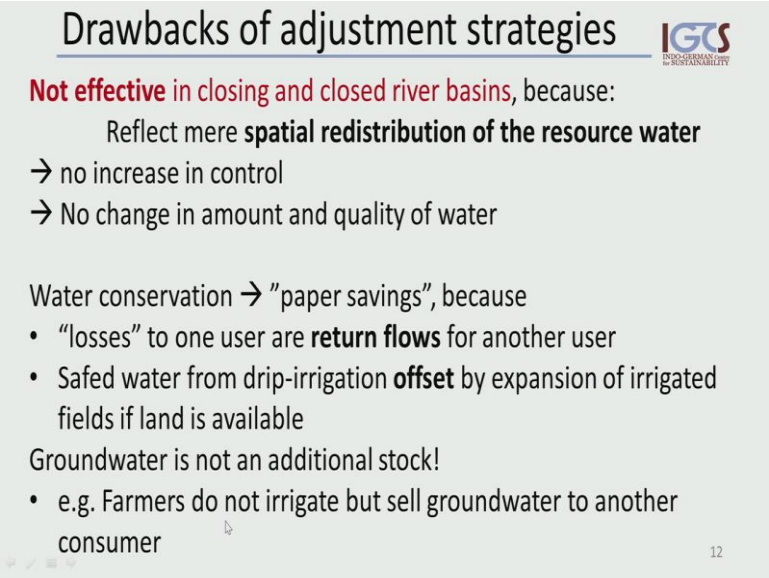

Now, what are the large drawbacks of these adjustment strategies? They actually sound good, but they will not take us to resolution. This is because they are not effective in closing or closed river basins, because we simply redistribute spatially, our resource water. We are not increasing the control. We cannot increase control over where water is and in which condition we and what time we receive our water and have it available and it does not have any influence on changing amounts and quality of water. So, those are the major drawbacks, which after taking a close look actually, put water conservation into something that we can call a paper savings exercise, because if the loses to one user are return flows for another user. So, what one farmer is saving and doing well in terms of water conservation; the neighboring farmer by pumping more, abstracting more water, applying more water on his or her fields, increasing evaporation may benefit from the loss on one side.

So, it is on one hand side from a hydrological perspective, not conserving any water at all. We are not having over and more water available and it, from a government or a governance perspective very often also, is not supporting water conservation, because as this farmer may take less water to reduce losses on his side. He may be financed by only

getting lower amount of water, allocated next time when water allocations are made. So, this is very often back filing and indeed, simply a paper saving. Another example is that we may save water by introducing a water saving technology, for instance, drip irrigation and at the same time, we expand our irrigated fields if the land for such expansions is available and all the effects of water conservation are immediately offset by this. We may not be doing it this in our own territory, but then it may be happening in the downstream country, at a downstream district or in a station on that same river basin.

Remember, what I have repeatedly said that ground water is not an additional stock, although one can read this very often in even in the scientific literature as part of the adjustment strategies to work in this ground water, but it is not an additional stock; we know that. So, which means that farmers do not irrigate, use the water to irrigate their fields, but sell the ground water to another consumer; still, use one and the same source or stock of water and do the same damage.

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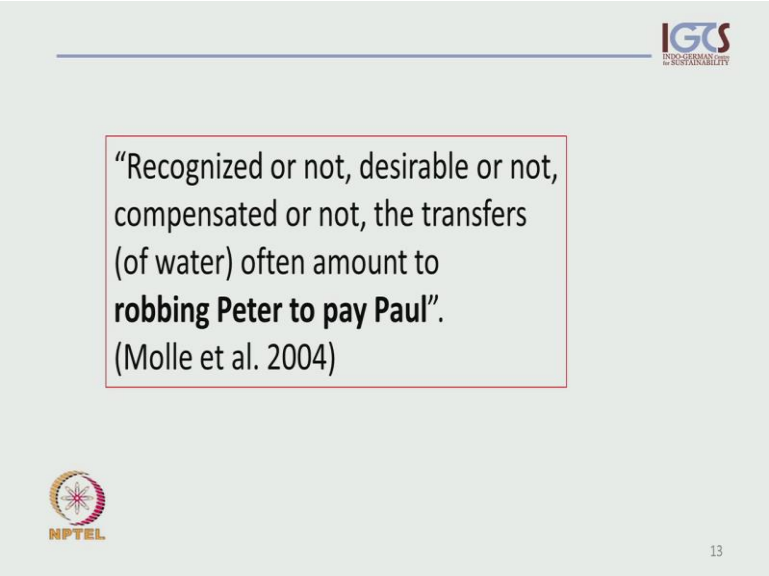

Now, this takes us to a phrase that was coined by this group of researchers, and which brings it down to this essence of it. That is why I am quoting it here. It recognize or not desirable or not compensated or not the transfers of water often amount to robbing peter to pay parker. So, within one and the same river basin or if we are not talking about the river basin that our global water cycle; it is if you are saving on one side, we are only taking away from the other end of it. What we release on this we will be adding as a punishment through, because we are polluting to the other end of it. So, keep this in mind and you may want to read more about this in the literature. You should find river basins

which are under stress conditions; for example, in Asia and find out what is going on about the situations.

I will see you next time for the next class.