Sustainable River Basin Management

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Module 3-1

Lecture - 18

Part – 03

Welcome everybody to Sustainable River Basin Management, module three and part three. This time I want to talk to you about urbanization and demography as part of the challengers of the water sector.

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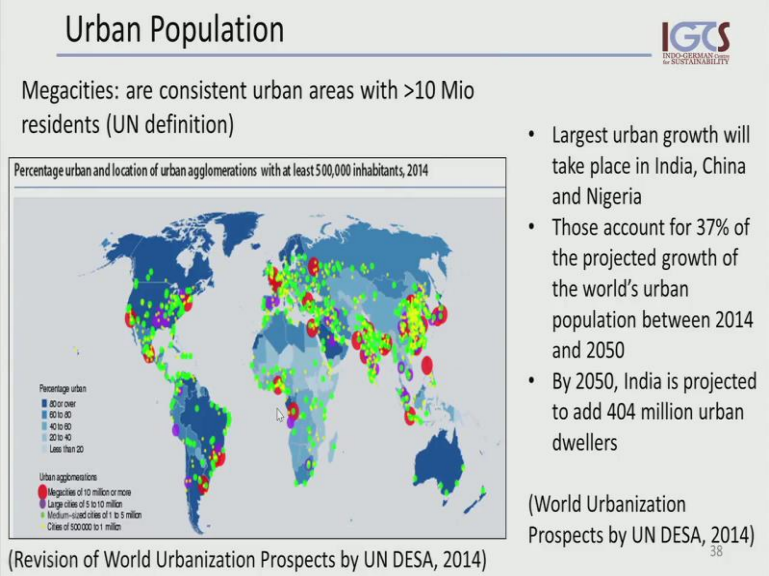

Let us first look into urban population, urbanization. There is a new term, that you increasingly hear, which is the term megacities. And, what is considered as a megacity by UN definition is a consistent connected urban area, where we have more than 10 million residents living. The largest urban growth is projected to take place in India, China and Nigeria in the next years. Those three countries will account for about 37 percent of the projected growth of the global urban population between 2014 and the year 2050. And by the year 2050, it is projected, that India, it is alone at about 404 million urban dwellers to the statistics. Now, those are years, which many of us will see, reach. This is part of our lifetime now. It is not part of future generations and in that context we also should see the next discussions.

The map here shows, which comes from the revision of world urbanization prospects produced by UN DESA in 2014 and this shows us the percentage of urban agglomerations was at least half a million inhabitants in the year 2014. So, it is a reason, it is an up to date image of our current situation and what we can see is, that we have major concentrations of urban agglomerations in this region.

Also, India is one of the major concentration points and Europe. And then, we have a few hot spots, so to say, some of the continents like, Latin America and Africa, which will play a major role in economic growth also in the environmental impacts and the water needs and demands accordingly.

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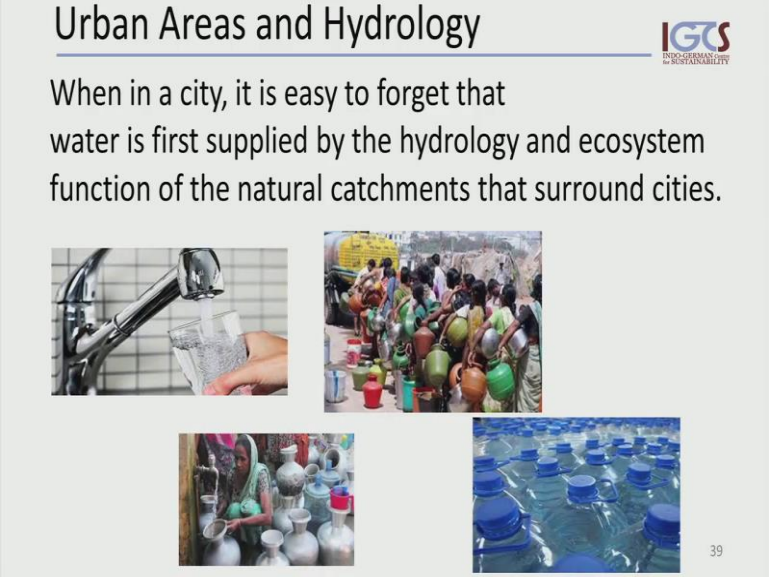

Now, let us reflect on urban areas and the hydrology. This is what interests us. So, what we most know living in cities is that we get water when we open our taps or we get water when we go to our community tap or to our kiosks or when we are delivered water through lorries, tanker system, which comes every other day. We get water or we may get water in a can system or in bottled system.

So, this is what we know from an urban area depending on the situation, depending on some other factors. But, what we easily forget is that water is primarily supplied by the hydrology and the ecosystem's function of natural catchment that surrounds the cities. And this is what we need to emphasize and that is why, we are talking about urbanization also, when we generally talk about the sustainable river basin management. So, those cities are occurring, our residing within such catchments and as such cannot be managed

out of site of the functioning of the hydrological processes in these catchments.

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Now, urban growth has been a quite challenge on its own in terms of planning, planning of infrastructure. A typical situation is shown here. This is the picture of Mumbai, where we have an urban sender, which was probably planned some time, some years ago and then, build up and probably most of these buildings are probably connected to the urban service, utilities, such as water, such as may be warm waters, heating systems connected to proper sewage systems as planned here, may be in the 1940s and so on.

And then, we have a major part, which is been going completely out of, outside this planned scheme very often. This is just an example here, where small houses, may be quarters pop up, which then successively change into proper houses or even proper constructions, high rise buildings in an organic way and are not connected to utilities, are only connected through few main, main lines, mains, the roads, that may have been driven through these organically growing settlements and the rest of it is doing, helping yourself, service systems and may be community based solutions. So, very often this is what we see not just in the so called developing countries, but even in developed countries. This is sometimes happening in a very same way.

We have situations very often, that an urban sender, that was planned as mentioned here already, simply swallows villages. Rural areas, that increase the area of the urban, urbanized locations, expands, it grows and takes, builds in old villages. So, in many cases we have cities, which consist of many villages of old course, which eventually

have gone into one organic area, which we called today a city, mega city, or a large city. This is an example from Korea.

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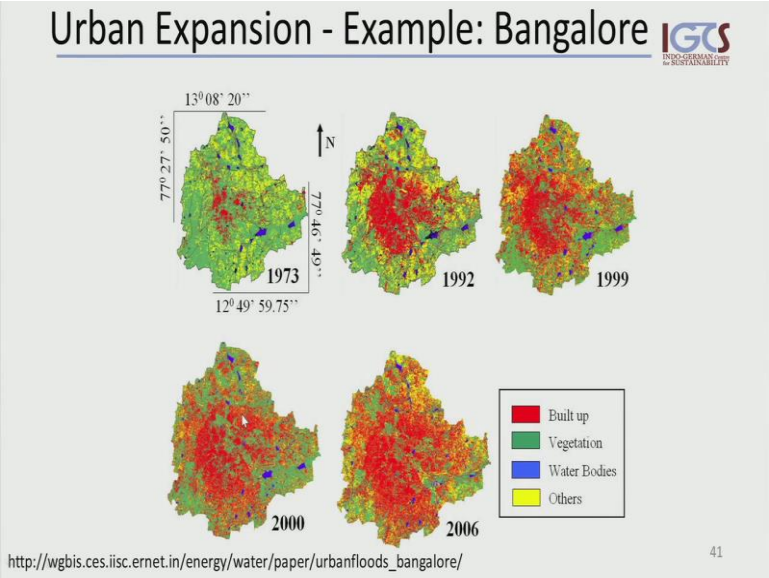

Now, another example that shows us how this urban expansion is taking place at a very rapid pace is here from Bangalore in India. We have a land use, change map here using satellite images, you can get more detail and also the data from the site here. The red color show us built up areas, those are the so called the urbanized areas. We have the green color here, which indicates vegetation, can be agriculture, could be forest. We have blue, which shows us water bodies.

Then, we have some other, others, which could be industrial zones or degraded land in some other categories here. Now, what we see is, that this began in the 1973 as a very small spot, several urban areas here, many small villages. And then, out of a sudden it exploded to this level that we see in the 1992, where this has become a large connected area with some lines already going in to the neighborhood, which at this point are either degraded and may be land under constructions or still green areas, which may be agricultural fields.

We have the blue the water bodies, which, were have, now in the past were sitting far apart from the urban centers has, now become the fringes or the outskirts of the peri-urban areas of this growing city. And this pattern continues, swallowing the rural areas and incorporating the water bodies into the city boundaries of the example of Bangalore. So, we can see similar patterns in most of these urban aggregations and we can also use

this in a way to predict what growth pattern is.

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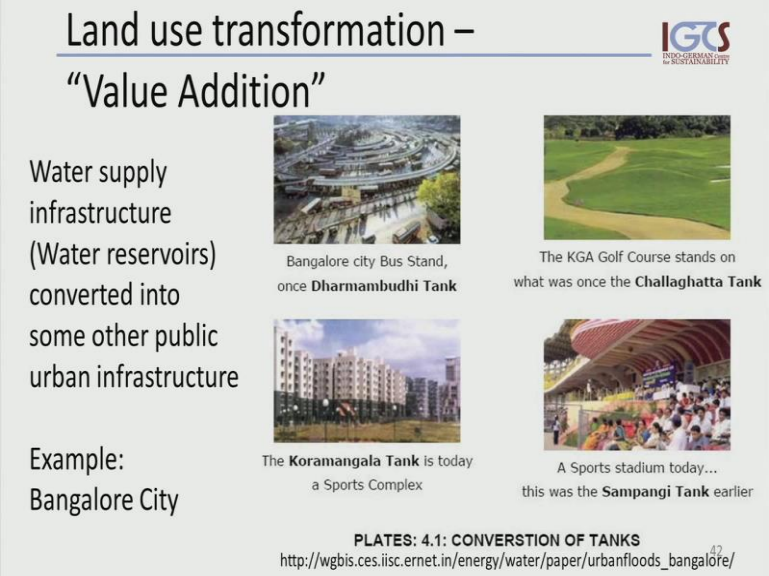

Now, let us look into water. This is, what is our subject and one critical topic to this is the land use transformation, which very often goes another category of value addition. This is when water supplying for structure water reservoirs lakes are knowingly converted into some other public urban infrastructure. So, where water has been categorized as something that does not serve any purpose and is rather ((Refer Time: 11:28)), polluted water system, a mosquito breeding count and for that reason there could be the value addition, be implemented by constructing something else on top of this.

Again, from the example in that same website that I mentioned before, of Bangalore, we see, that for instance, these major tanks, tanks are lakes, manmade lakes for the purpose of rainwater harvesting or for purpose of groundwater recharge in the pass were now transformed into infrastructures, which serve an important purpose, but whether this is a better purpose than for water supply is the question, that I want to leave this to you. In this case, it has become city bus stand or a golf course or a sports complex, a sports stadium. So, all of those are important infrastructures in an urban environment. However, this is on, at the expense of water, water infrastructures, which could have, could believe water scarcity situations and water availability in urban areas. So, we need to keep this is mind in our sustainability assessments and how we recommend, when we are in the position, how urban development should take place taking into account water resources.

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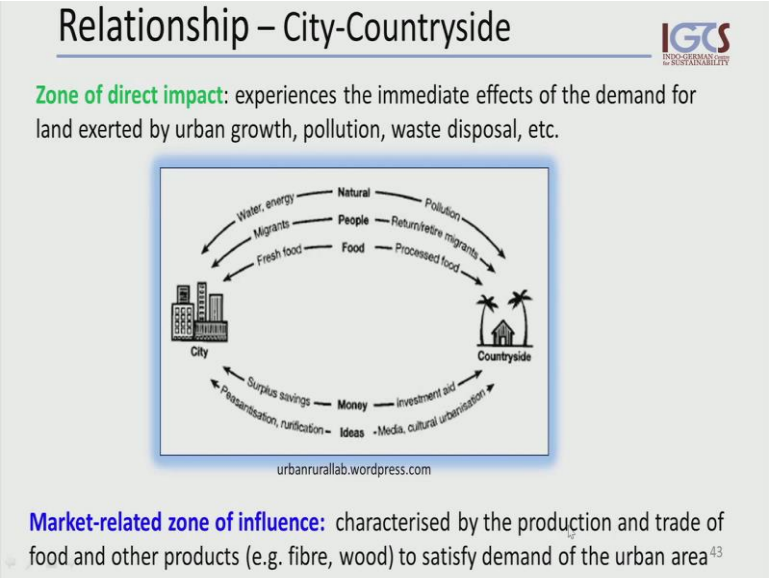

Now, let us look into the relationship of the cities and the rural areas or the countryside. You should look at this picture, which shows the swallowing of this, of villages and also how cities just organically go into these rural areas. This picture here shows us the city here and the countryside here, how typically both contrast quite a bit. And then, we have, so this side, the natural components, the people the food on one chain, which shows one directional flow from the rural areas to the city and we also see the one directional flow of the garbage, the waste pollution migrants, retired people moving back into the countryside.

Then, we have on the other side stream flow taking place between those two compartments in terms of virtual flow of money and ideas, which again are very much one directional from the countryside to a city. And in terms of aid, investment aid and in terms of new ideas of media or cultural or urbanization of the countryside, which is often going along with a loss of tradition and the loss of social structures in rural areas in from the cities again back into the countryside.

Now, we can also see this as in two other ways as ((Refer Time: 15:12)) of direct impact, which means, experience is the immediate effect of the urban rural interface in terms of pollution, waste disposal and in terms of a market related zone of influence, which is more in terms of trade, food production, demand oriented. So, those are, those are the typical relationships that we see nowadays. Now, let us just reflect on the water, land and living resources, how this progresses, so and in which stage a certain area might be when we start looking in a certain catchment, which is urbanized.

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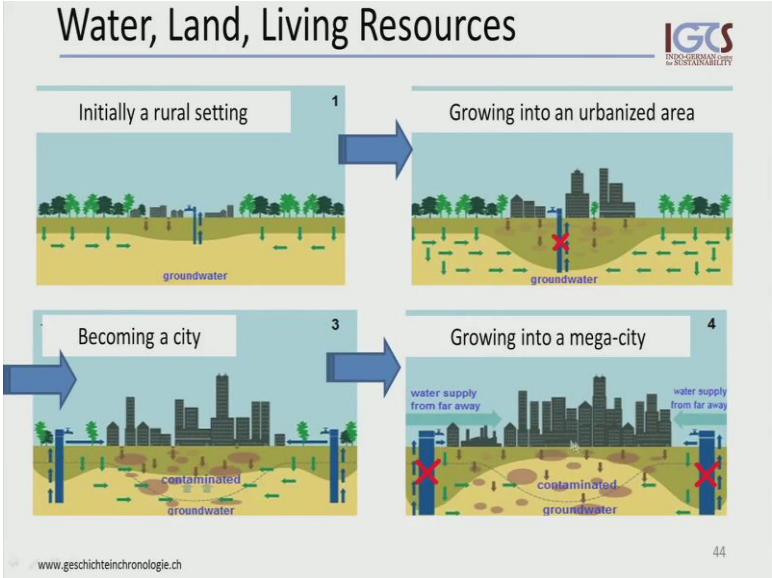

So, initial state we would say is the rural setting where we have a ground water table, we have recharge taking place immediately in the vicinity of, where we are also extracting water from a shallow region or from a surface water body. And we have a few settlements here and most of this has been agriculture or for say, and this setting changes into a going urbanized area.

This also means, that water demand is increasing and with the usages taking place, services are activities taking place in this urbanized area, contamination is taking place, still recharge is taking place at a, at a lower pace, but not of good quality water, but of contaminated water and our ground water may not be available anymore because of that contamination. It may also not be available anymore, because we have been abstracting so much to satisfy our needs and the water table may have topped quite substantially. That is the second stage.

In this third stage, that we usually see is, that this has, is transforming into a city. There is almost no natural recharge taking place any more as recharge taking place from storm water drainage, from sewage systems into this underground, underneath the urban buildings, urban infrastructure. This ground water aquifer systems had to be abundant because the water table is too deep by now or the water has been too contaminated by now. And we have to had to set up our water abstraction systems on the fringes outside in the rural areas outside the city boundaries and have to, had to create our pipes systems, which may be several kilometers, several hundreds of kilometers away distant from our city. And then, this goes on like this and may be flexible enough to accommodate more

buildings along these distances here. But eventually, also these areas will be converted into urban spaces, into parts of the city and that same problems will have reached here.

Then, we either stage where we, probably we can call this a megacity and where the long distance water supply is not working anymore. It is not economic or simply not existing, not available because more such going urban centers are, exist in our catchment. So, there may be not, no distance from, where we can take the water to supply just one megacity from. So, and this takes us to the real crisis management we can also observe in many of these large urban agglomerates. What is obvious here is already, that this is not easily be transformed or built back into an earlier situation. This is relatively impossible. But, some of the sinks, some sinks can happen and this is, what we need to investigate, move on.

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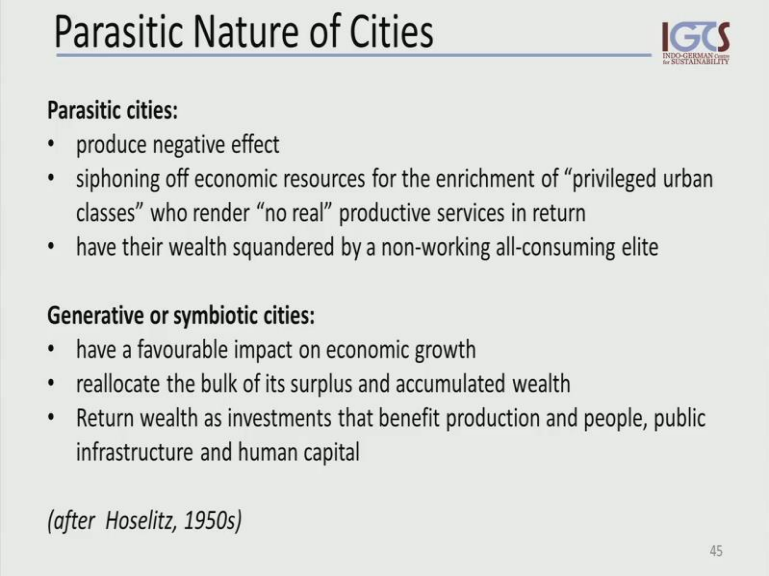

Now, let us talk more about concepts to see where we can start changing something. One of the concepts, that comes from the 1950s and has developed from there, I just give this as a reference. You can take more recent literature on this, but it comes down to a concept of a parasitic nature of cities and you need to know what the parasite is, but what we mean by the parasitic city is that it produces negative effect. It is siphoning off economic resources for the enrichment of, so called, privileged urban classes who do not render real productive service in return from using those resources. And those parasitic cities, they are well squandered by non-working, all consuming elite.

So, we have cities, which ((Refer Time: 21:19)) resources from their neighborhood, from

the rural areas, which have to be fed by the farmers because food and so on, the primary sources of our food is not produced in the cities. So, those people, all may contribute in terms of employment to some services into the economy, but in itself they are not producing their food or also not contributing to solving the waste removal issues.

The other extreme of this parasitic, obviously, are very extreme, but the other extreme on the positive access of this concept would be a generative or symbiotic city. Also, this comes from, as the term parasitic, symbiotic also comes from the biology background and in this case, it is to say, that there is a favorable impact on economic course generated by such a city. Such a city would reallocate the ((Refer Time: 22:39)) of its surplus and accumulated wealth. It would also return wealth as in the form of investments, which would benefit the production and would benefit people, would benefit public infrastructures and human capital. So those are two extremes and we can see such extreme cities, but we can also see a lot of many transitions and this is where we have to work on.

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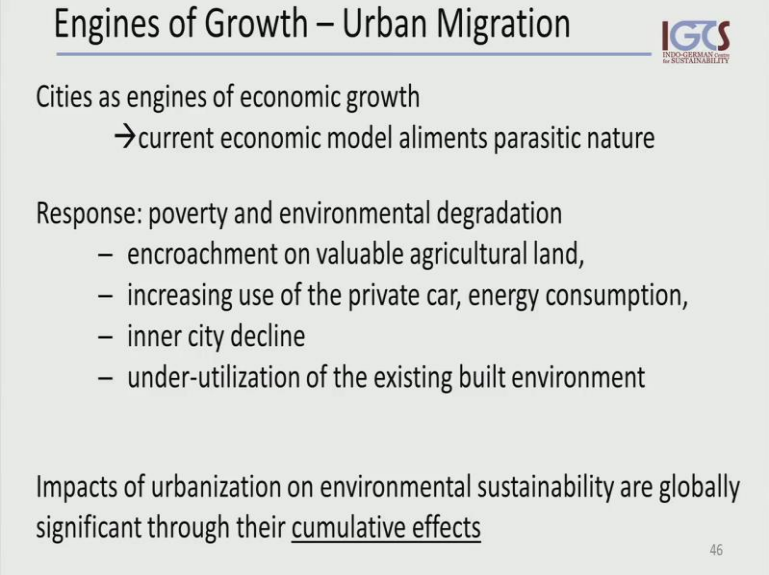

Now, what is also a concept, very often used especially in developing countries, is to see urban centers, urban, urbanized areas, so called engines of growth, which for that reason are like magnets, like very highly attractive regions for and generate urban migration. But by its very nature of our economic goals and our current economic models, such cities of economic growth are parasitic in nature, as we have just described in the extreme form.

So, the result and the response to model engine of growth is poverty and environmental degradation. It leads to the encroachment of valuable agricultural land. Many of the countries do not have enough agricultural land left to be able to produce enough food for its population. It is increasing the use of facilitating or inviting the increase of private cars, increase in energy consumptions. It often also leads to the deterioration of the core city centers, the decline of the cities because more sole life takes in the fringes. It is more dynamic and may be better served.

In many cases, their might be no way out to take the garbage out of the core city center, for instance. The service lines may not reach the city centers to accommodate the changes or the amount of people and goods that have to move in an out of the inner parts of the city, which leads to the decline. And we may have as a response, the underutilization of the existing built and environment. So, the result is, that the city expands, go into these agricultural areas, whereas the housing density could have been improved or increased without compromising on the quality of the urban service provision.

Now, what is important to keep in mind is, that the impacts of urbanization on environmental sustainability are of global significance and this is because of what we call accumulating cumulative effect. So, all of the small effects, that appears small in itself, each pollution, each part of addition of cars or new garbage sites, change in lifestyles accumulate to a level where it becomes reversible and has its global impact.

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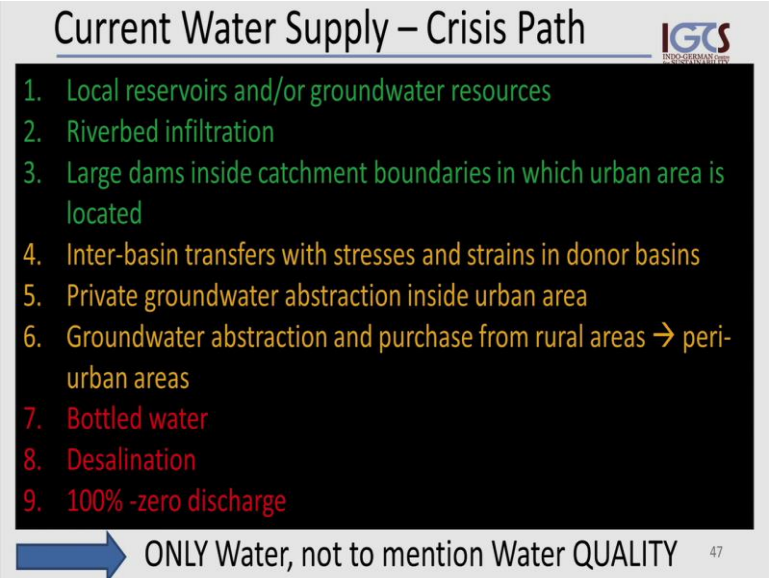

How do we usually start with water supply? We can get water from a local reservoir, could be a dam, a lake. We can get water from our groundwater resources. We could go on, go for riverbed infiltration or we could go for large dams, which could be built inside or catchment boundaries, in which for instance, an urban area or a water demand area is located. This all would be our usual starting points and our normal water supply, water demand conditions.

Now, it becomes critical when we get to a point where we have to opt for the inter basin transfers, where we take water from a donor basin into the receiving basin and by doing so we increase the stress in the donor basin. It becomes increasingly critical, when we have to move on to private ground water abstraction, for instance, inside urban areas as a do it yourself solution. And it becomes increasingly difficult when we have to opt for ground water abstraction and purchases from the peri-urban or rural areas to supply a demand area.

On the last end of this scale, from excellent conditions to very difficult or crisis conditions appear our bottled or canned water and desalination water and our 100 percent zero discharge approaches. Now, this has been only looking into water supply in terms of quantities, what is being left out here and this part is the water quality component which puts an additional stress and conditions on to our water supply options.

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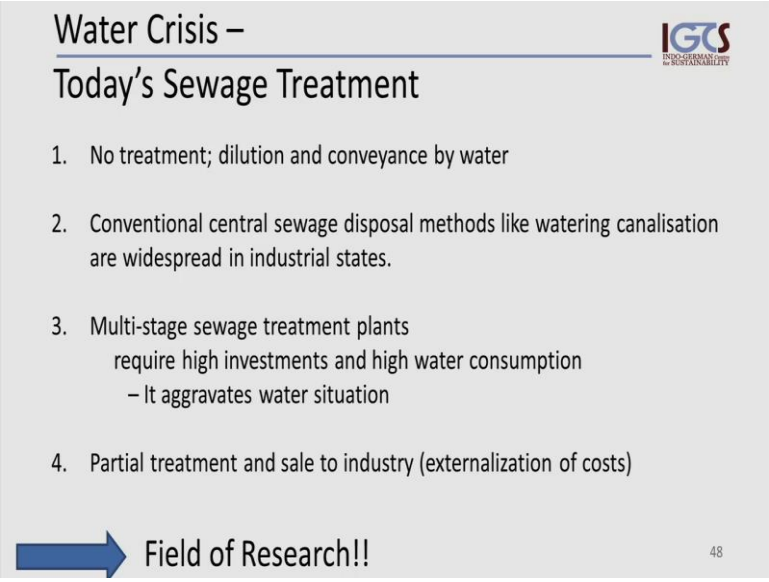

Now, let us look into the other side of the water cycle, from our water supply to our waste water management to our today's sewage water treatment solutions, which I am

also calling on a crisis path. You see, that we either do not have treatment at all. We may have water again as a medium to dilute, our sewage to levels, that may be released into environment or we are using water to move, to convey our sewage from one location to another location to release it and treat it into our environment. That is obviously, not the best solution, but it is, in many areas, in many rural areas especially, the only solution right now.

The second is conventional central sewage disposal method like the watering canalization, which is very widely used in industrial countries, industrial states. It is also not an excellent solution to our water sewage treatment necessities. And the third is the multi-stage sewage treatment plant, which in itself has very high requirements on water. It consumes a lot of water to operate and it requires high investments and technological solutions. So, in itself they add to the water crisis situation.

Then, we have partial treatment which and we usually cut it to a, the sale to a, in industry, which means, we treat water to a level where it is useful or becomes useful again to certain industries, for instance construction or agriculture usages. This is not really a solution again because it externalizes costs, transfers the need of treating water again to some other user and industry in this case.

Now, as I cannot, I am not able to show you here the best way, it is obviously a field of research and when you are searching for your professional priorities, you may as you consider one of these as your field of future research.

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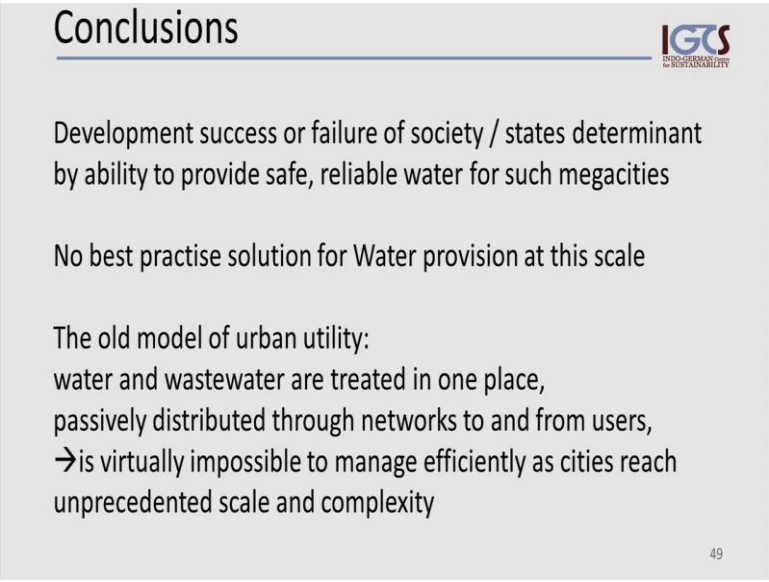

Now, let us come to the conclusions. The development successes or failures of societies and also for the states determined by the ability to provide safe reliable water and this is especially for megacities. There is no best practice solution for water provision especially at those scales of the urban, large urban clusters. There is a lot happening right now in terms of smart city concepts or smart kit solutions. But, there is no such solution at hand right now.

A lot of this will be happening in the Asian region that is because large urban agglomerates are located there. And what we can summarize is, that our old model of urban utility in terms of water and waste water treatment in one location and moving water passively through an established network to the user from the user is impossible. It is impossible to manage efficiently in such large cities at such an unprecedented scale and the complexity of the users, the water pollution, types of pollution, pollution levels. So, at this point I want to stop this module and I see you next time again.