Sustainable River Basin Management

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Module – 4 – 2

Lecture - 31

Part 1

Welcome everybody to sustainable river basin management; module 4- 2, part 1.

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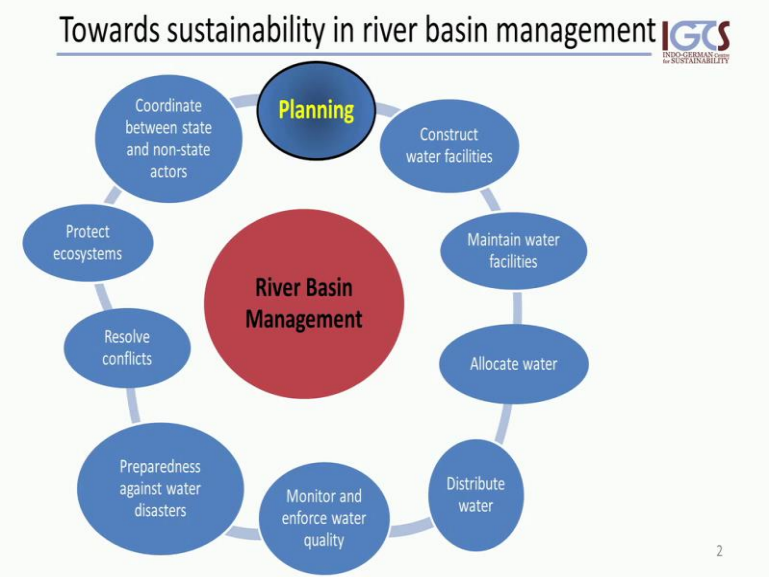

Remember that we are still in our module, towards sustainability in river basin management and we are starting now, our second week. I want to now, focus on planning in river basin management functions.

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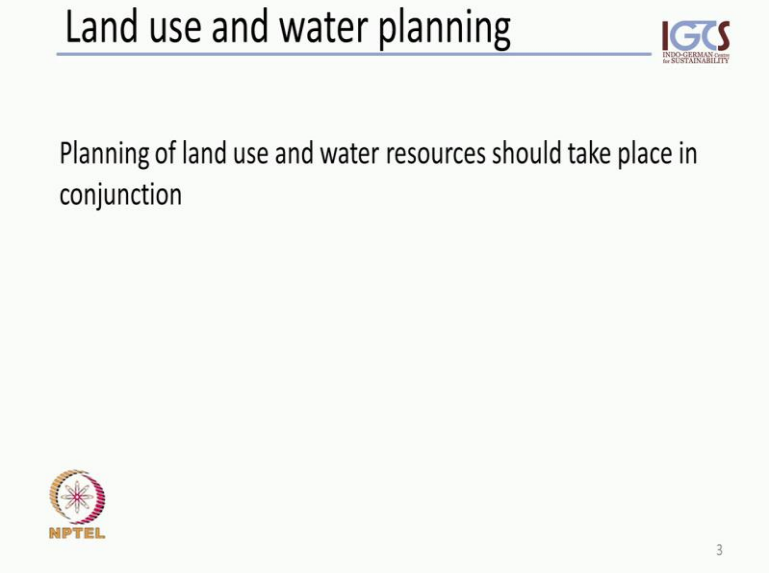

Now, we will be talking about land use and water planning, because planning of both of the resources, land use and water resources should take place in conjunction.

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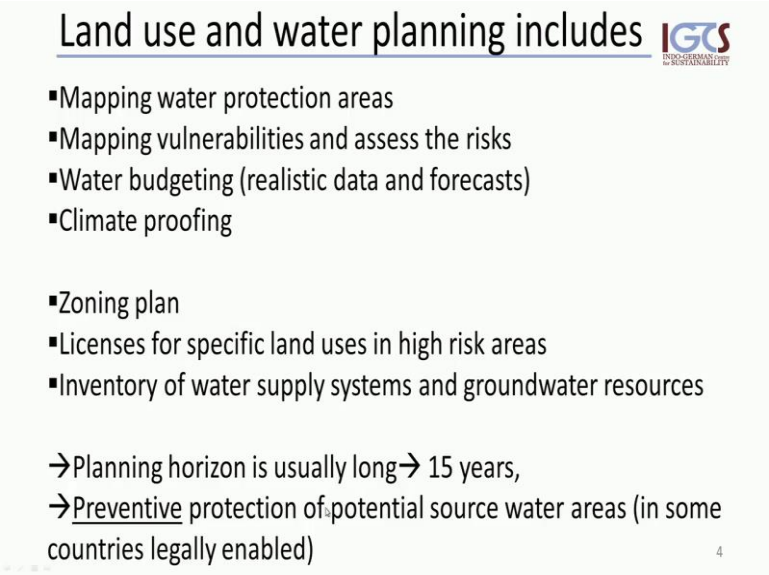

Water land use and water planning includes the mapping of protection areas, water protection areas that we will be talking about next time. Mapping of vulnerabilities and the assessment of risks; that is what we will be discussing right now. The water budgeting and this should be based on realistic data and realistic forecasts, and climate proofing. Land use and water planning should also, include zoning plan, based on these

mapping exercises here, and budgeting. The outcome should be a zoning plan and there should be license scheme, based on these inputs here, for specific land uses and what these are identified as high risk areas. Then we need an inventory of water supply systems and ground water resources.

Now, what we should keep in mind when we conduct this land use and water planning as such, the planning horizon is usually, quite long. We talk about 10 to 15 years in usual planning scenarios. We also need to keep in mind that we are not only talking about what just today, and keeping in mind, the long term the exercise will take some time to actually, come to a point, where it can be implemented, but you also need to keep in mind that we after exercise preventive measures also, in terms of the protection of potential source water areas when we speak about water planning. In some of the countries, this is legally enabled that areas (refer Time: 02:45) forecast of water budgeting; certain areas can be preventively, put under protection of potential source water areas.

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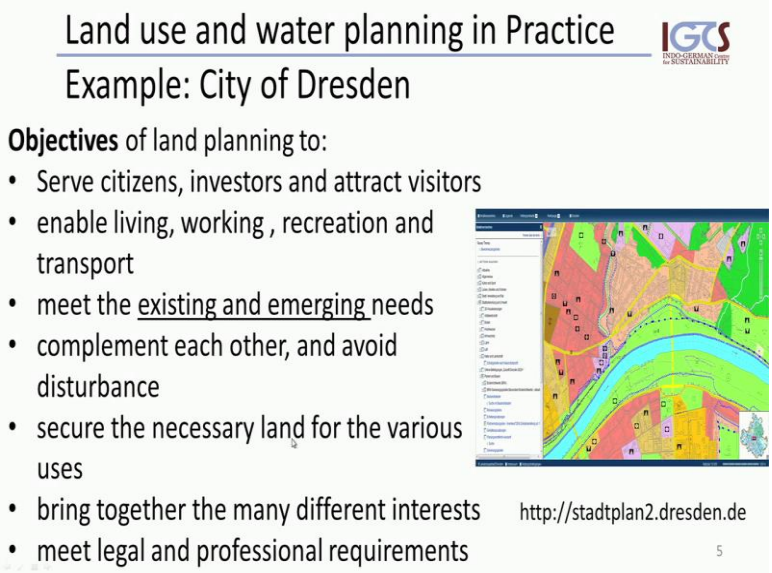

Now, let us look into an example, because we can talk about this very long and surely, and you may have a lot of examples in your own mind or how this has not taken anybody into any solution or any conversion of this type of problems in your region, but there are examples of how this is working and functioning. I want to show you one case specifically, which is the city of Dresden in Germany, and you can open this web page

and surf around yourself and obtain more information. So, I have an information system well, that was built around the land use and water planning in this case. They also departed from defining the objectives of the land planning. This is quite comprehensive and it could be a good example for other areas as well.

So, the objectives are to service deserved citizens, investors and attract visitors. This is applicable to many other cities as well. They have to serve their own people, residence They also want to have and they want to service those to come. The second is to enable living working recreation and transport. This again, is all the different dimensions of good quality life of what brings people together, and what makes people move to a specific region and settle there. It also should meet the existing and urgent needs and should complement each other and avoid disturbance. So, this is quite interesting again. It is not just looking into what people today, demand and what industries or some specific sectors want to see happening today, but there should also be a wise view into the future.

Some of the sayings can should be predicted or before seeing and space for such emerging needs, should be built in facilities, land or whatever is required to make space for these emerging needs, should be built into the planning at this point, which is not always easy to see what the direction will be, as we have seen in one of the previous lectures on the water distribution systems and the investments made in Germany specifically, and then, how migration patterns have actually, negatively impacted on these large scale investments. So, it is not always to predict the right things many years before, but we have to build it in.

We should secure the necessary land for the various uses. We should also bring together, many different interests and it should meet legal and professional requirements. Not all may see this as important to bring together, many different interests. Sometimes, we may just focus on favoring certain industries for instance, which bring along certain people, certain interest together. We could think of IT. The IT sector may dominate a certain region or certain urban areas and then, or we could have only automobile industries, dominating the entire land use and water use in a specific region, or we could look into the rectification, which is in this case, what the objective of the planning exercises.

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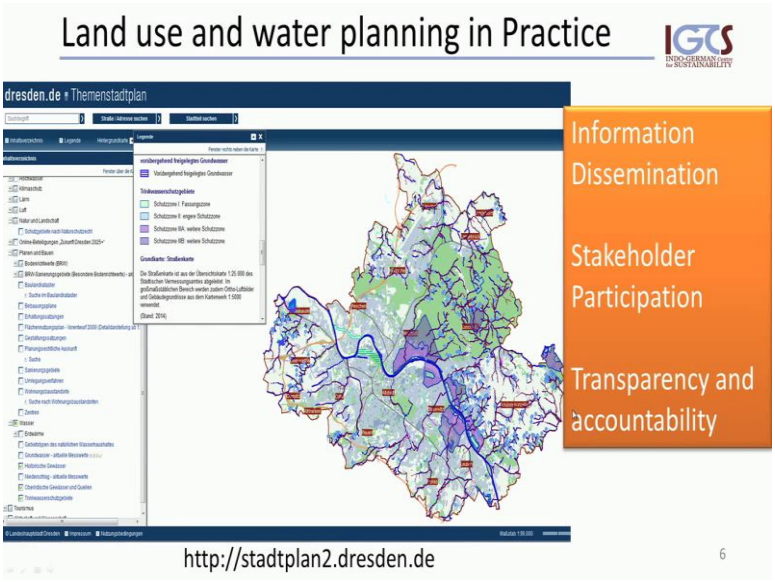

Now, how does it look in practice? Now, we have all the information, compiled in a database, which is accessible to the public. Anybody can go there and obtain information, can visualize the different components of the plan. This goes from geographical elements, physical to land use, including emission, including disaster, including different industries, different water requirements; all these are here and providing additional information once we click on any of these fields here. We can zoom in to a very detailed level, to a level, where we can see individual houses; each individual house and we can obtain individual precise information by clicking on any of these features here. Now, this brings us to the point that information dissemination is very important when we conduct this planning exercise.

One thing is to have good plans or several volumes of plans somewhere in shelves or somewhere in an expert group, which then will not be moving ahead to any implementation stage, or we may put efforts into some form of information dissemination, and this could be one, where people can, anybody can make use to a level of scale that is useful for the individual, the household or for planning a new business to think about, where you would open new branches for instance; all these could be an information system, providing you those details.

Important here also, is that this planning includes, should include stakeholder participation. Also, this is possible here on almost any of these functions, fields that you

can open here, is a feedback, or we trust for more information function built in. This means you can, as some, anybody was interested, send a message out and contact somebody and obtain additional feedback, or ask for a meeting and get a detailed technical response to that. This brings some level of transparency and also some level of accountability to the forefront.

Once we know what the plan is here, we can also influence what we want to have happening in certain area, and we do not want and also we can visualize at an early stage and avoid certain speculation, taking place and misuse of our knowledge for land use and water planning. Also, from the accountability part, we can actually follow up on what has been promised to happen, in terms of improvements for instance, in the city and what has not been realized and it is not implemented to the date promised.

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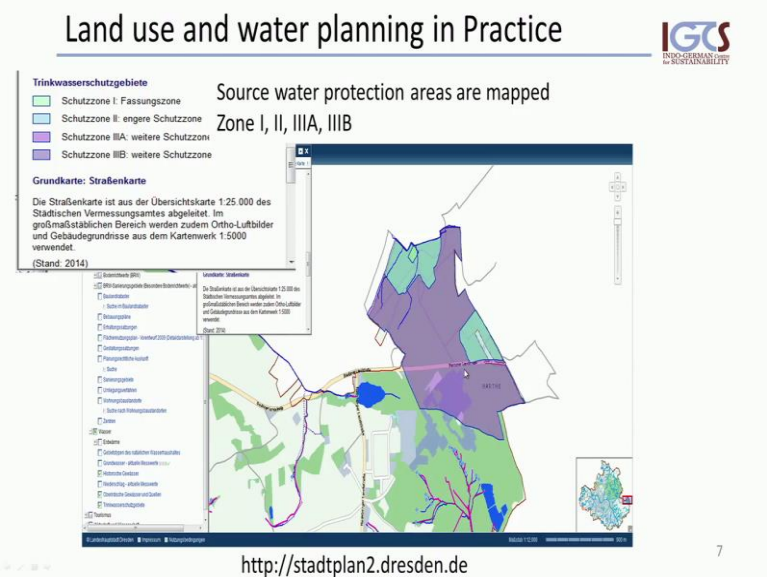

Now, when we zoom into this, we can get to a very detailed level and essentially, wanted to look into water specifically, and just picking or picked here, the details on dealing with water protection. We have here, even in a in an urban area, zoomed in now, to this corner here, of the urban area; all this is part of the city. The source water protection zones; this means that in any urban boundaries, we have also water protection taking place or something, that is very much possible to set land beside and restrictive land use to take place in the favor of protecting water for drinking water supplies. Now here, just to translate what is going on; source water protection areas are specifically, mapped and

there are three different types of zoning categories, which all appear in the city boundaries in this case to demonstrate this.

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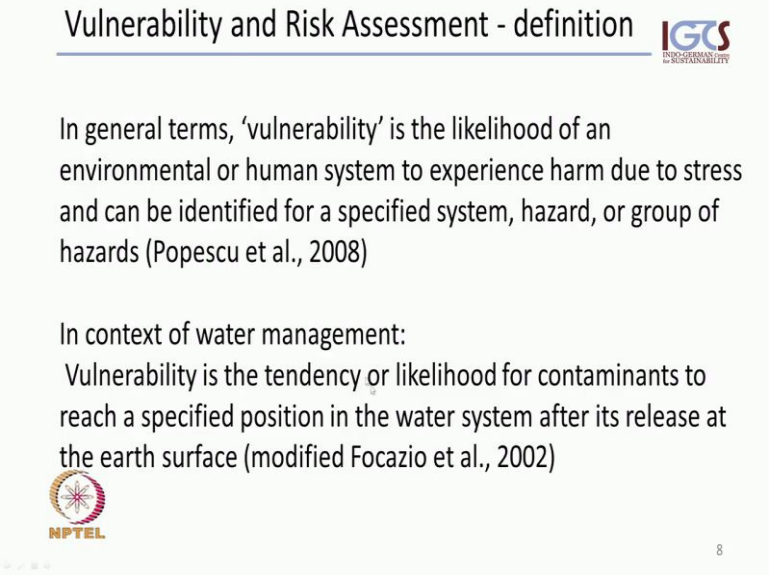

Now, let us move into the second point of land planning that I mentioned, which are the vulnerability and risk assessment. Let us start with the definitions. The general term vulnerability is the likelihood of an environmental or human system to experience harm, due to stress and can be identified by specified system hazard or a group of hazards; that is a very generic definition of vulnerability. Now, in the context of water management, we mean vulnerability is the tendency or likelihood for contaminants to reach a specified position in the water system, after its release at the earth surface. This is applicable to the surface systems, but also to ground water systems, and this is what we identify and assess by these vulnerability assessments.

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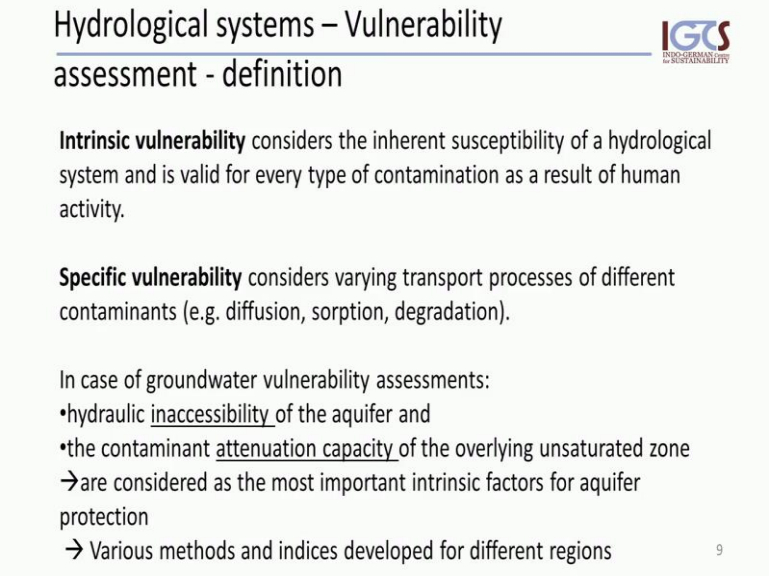

Now, hydrological systems are very special and for that reason, we also differentiate vulnerability in a slightly, more specialized way. First is we use the term intrinsic vulnerability, which considers the inherent susceptibility of hydrological systems, and is valid for every type of contamination as a result of human activity. Then we differentiate specific vulnerability, which considers varying transport process of different contaminants. So, one is looking at the contamination of susceptibility as such. The other one is looking at the processes, which lead to the mobility or the impact of the contaminants by diffusion, sorption or degradation processes.

Now, in the case of ground water vulnerability assessments, we assess the hydraulic inaccessibility of the aquifer and the contaminant attenuation capacity of the overlying unsaturated zone. Those are the two factors, which we never write down, characterize or vulnerability, and are the most important intrinsic factors of finding options to protect our ground water resources. There are many different methods of describing those vulnerability, and there are also different indices, which were developed for different regions, different geographical regions, but also different geological regions or for different hydrological systems. For that reason, it will be hard to demonstrate you what generally, is the method to take. I just want to show you steps to conduct a vulnerability assessment.

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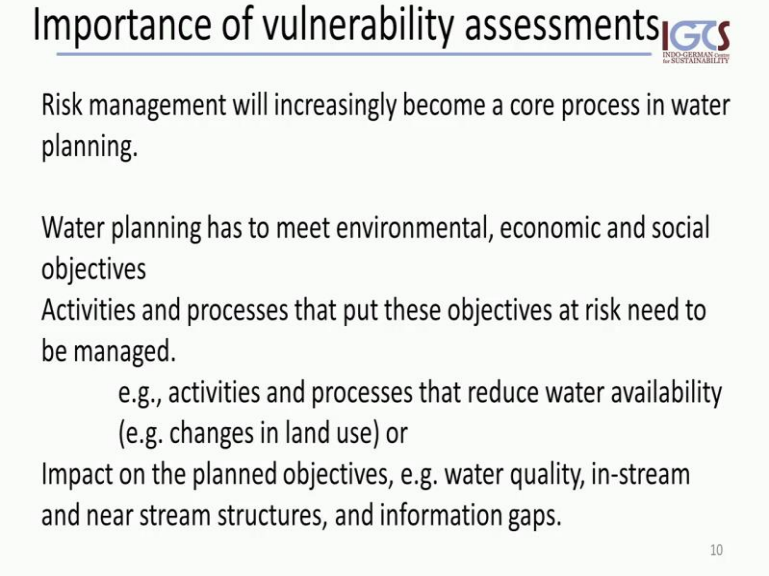

The importance of the vulnerability assessment is that in general, risk management will increasingly, become a core process in water planning. You remember that water projects fetch major budgets, so major capital investments, which takes place for the implementation of these projects and this simply, requires good risk management from all of the dimensions. The water planning has to meet environmental, economic and social objectives. The activities and processes that put the objectives of such projects at risks need to be managed. This is a preventive way of dealing with vulnerability.

Such activities and processes could be for instance, influencing water availability, reducing water availability, for instance land use change, plantations, some mono cultures, some urbanization; whatever the change in land uses, wetland removal; have an impact on our water planning, and have to be assessed before hand, and the impact on these planned objectives for instance, in terms of water quality or instream and near stream structure information gaps, has to be understood and dealt with specifically, in the form of preventive measures in our assessment analysis.

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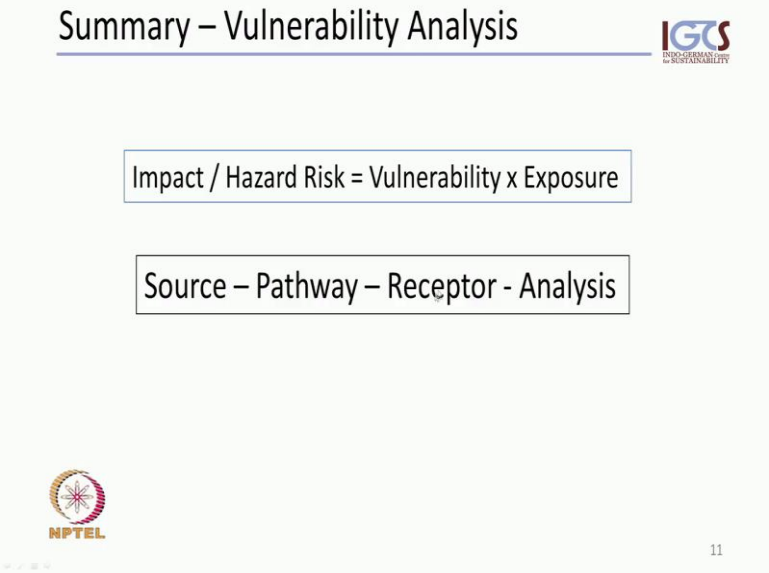

Now, let us look into the generic vulnerability analysis summary. How this is in a generic, will be done to compose indicators of the hazard risk or the vulnerability of certain system? What we usually, say is that the impact or the hazard risk is a factor of vulnerability and exposure; it is a function of vulnerability and exposure. Vulnerability and exposure could be part into a simple relationship and this can be expressed in a form of indicators or factors. This takes us to a source pathway receptor analysis, which is heading us to then, take a decision of where we can influence and change individual components to a wanted outcome.

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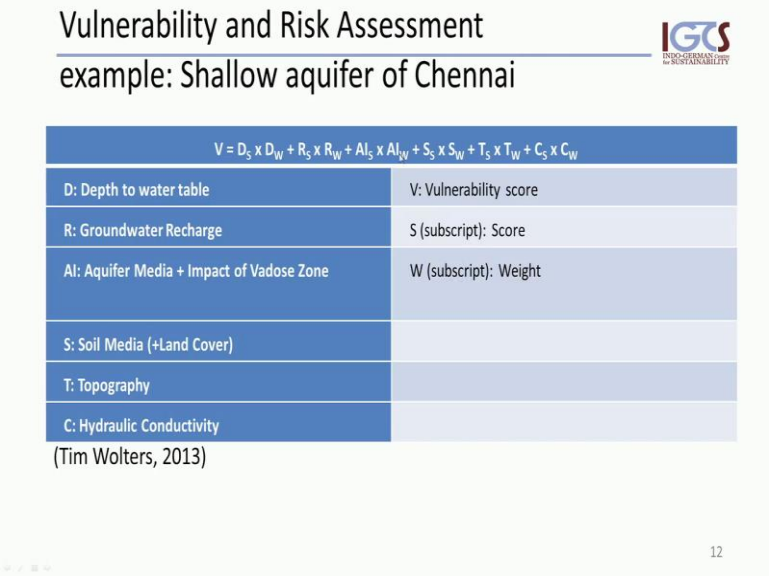

Now, let us move into an example of such vulnerability and risk assessment. This is dealing with one of the aquifer systems of the city of Chennai in India; one of the shallow aquifers. This was published in a study in 2013, and this is showing us here, that how vulnerability was determined. What are the input parameters to come up with the vulnerability score? Now, we have here, depth to water table; ground water recharge; the aquifer media or the aquifer formation; the impact of the Vadose zone; the soil media; the land cover; the topography; the hydraulic conductivity; brought together here, and brought together also, in a weighted individual index.

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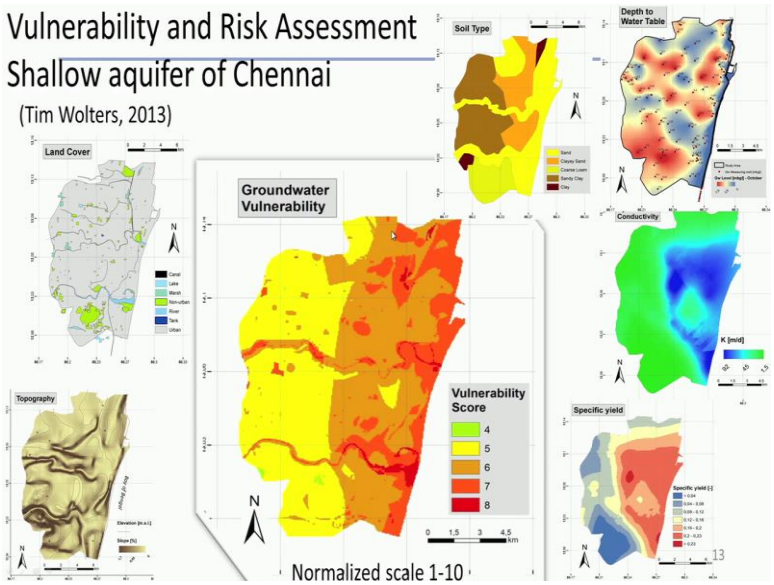

Now, the good part here is that you can use geographical information systems, GIS facilities to calculate and reclassify the individual input components to be able to calculate an index from that. So, we have here, for instance, the case of the land cover information; we have topography here; we have soil types; we have the depth to water table here; we have conductivity here and we have specific years. If we have more information, more data; we could compile additional parameters here, or if one would be less reliable, we could eliminate one of these parameters here, and still come up with a vulnerability index.

This is what is done for this specific case. By calculating the vulnerability score, we have a range here from four green, should say, less vulnerable to red, dark red; vulnerability

score of eight, would be highly vulnerable and then, we have here, what the geographical extend, the spatial extend, would be of this vulnerability component. So, what we could see here is that the beach line here, should know like this is the Bengal here; this is so to say the beach line here; this is coming out as a highly vulnerable area. Then we have here, a few rivers or drainages, drainage line coming in, which also scored fairly high in terms of vulnerability. So, this is something that is a feedback into our land planning, into our land and water planning exercise, which can be in this way, put on to some (refer Time: 22:49) or some methodology, which enables cost comparison with other regions and with other adjacent areas of the area of interest.

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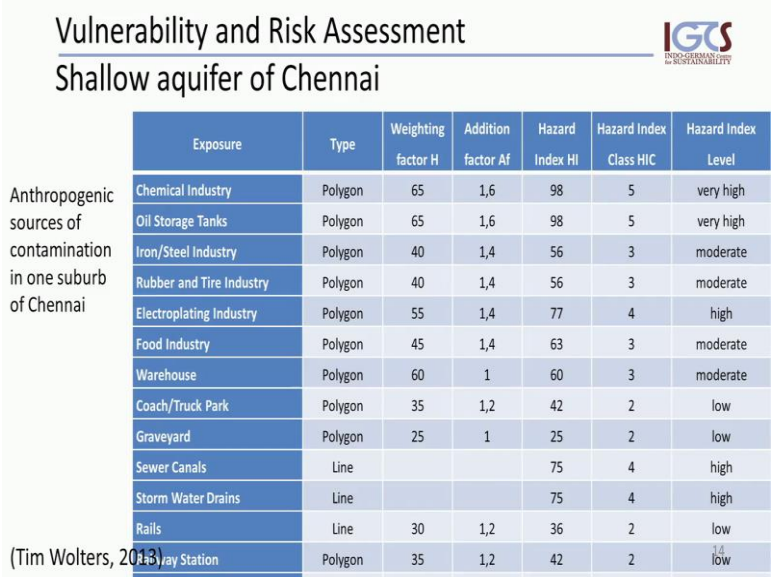

Exposure	Type	Weighting factor H	Addition factor Af	Hazard Index HI	Hazard Index Class HIC	Hazard Index Level
Chemical Industry	Polygon	65	1,6	98	5	very high
Oil Storage Tanks	Polygon	65	1,6	98	5	very high
Iron/Steel Industry	Polygon	40	1,4	56	3	moderate
Rubber and Tire Industry	Polygon	40	1,4	56	3	moderate
Electroplating Industry	Polygon	55	1,4	77	4	high
Food Industry	Polygon	45	1,4	63	3	moderate
Warehouse	Polygon	60	1	60	3	moderate
Coach/Truck Park	Polygon	35	1,2	42	2	low
Graveyard	Polygon	25	1	25	2	low
Sewer Canals	Line			75	4	high
Storm Water Drains	Line			75	4	high
Rails	Line	30	1,2	36	2	low
Railway Station	Polygon	35	1,2	42	2	low

So, this is very powerful, very useful. In this case, we can also, besides to the vulnerability, the natural vulnerability, we have our exposure component, which are all of these human induced sources of contamination. This form was compiled for just one suburb; not for the entire area that we have seen here in this map, but those can be included and build into the risk index, such as in the chemical industry, oil storage tanks, rubber and tyre industries and so on. We can see where the location is. We can give each of those certain weight. We can calculate a hazard index from that and determine a hazard index level to that.

Now, where do we take our weight from in this specific case? This would require some expert inputs; some community or group or focused group discussions, where some local

knowledge, expert knowledge is being built into how relevant, how apparent, some of these exposures are, and in what terms, they can become risk to the water resources. Now, this is just an example and any other location could be dealt with in a similar form; however, similar only. Now, you should take this home and revise this specifically, in about risk and vulnerability assessments in your region, and see how specifically, which type of data were incorporated into these assessments, and how these indicators were computed; whether any expert consultations conducted; do stakeholder consultations take place, and what the usefulness and what you think, the usefulness of the outputs are from your point of view.

Thank you for your attention and I will see you next time again.