Sustainable River Basin Management

Dr. Franziska Steinbruch

Department of Civil Engineering

Indian Institute of Technology, Madras

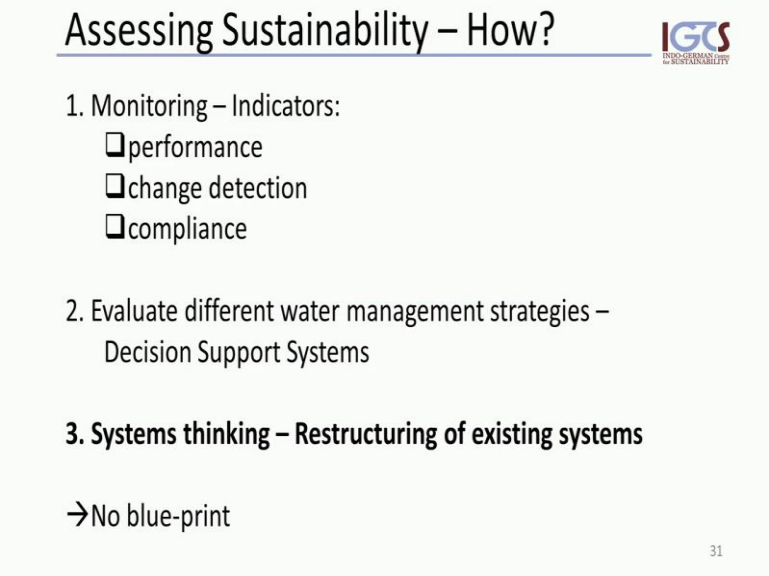
Module – 05

Lecture - 38

Part 3

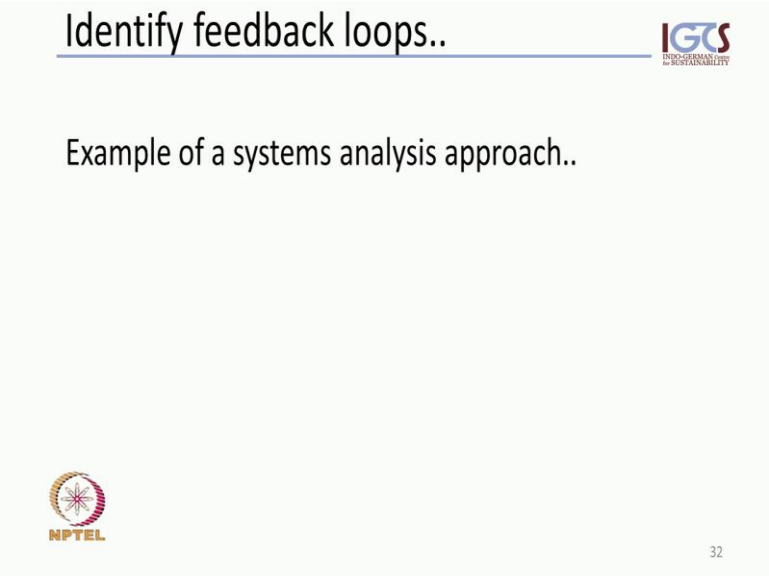
Welcome everybody to sustainable river basin management; module 5, part 3.

(Refer Slide Time: 00:17)



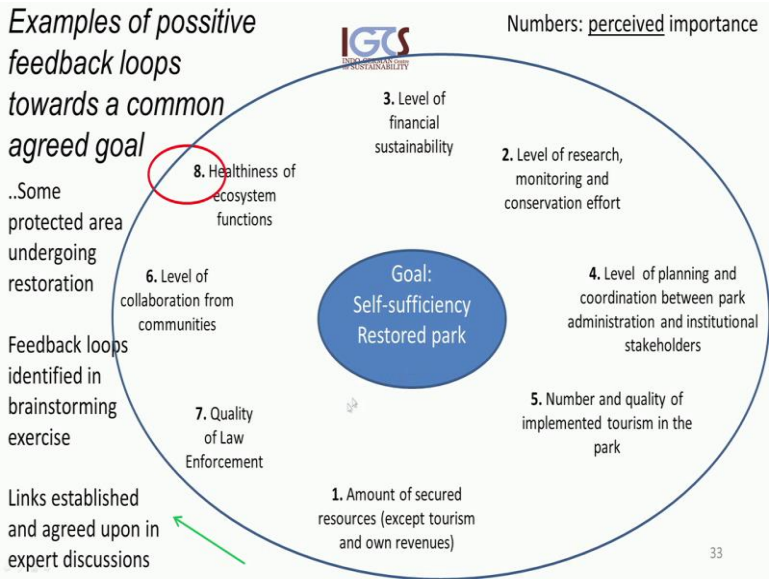
We have been talking about assessing sustainability and looking at ways of doing so, and I have just introduced to you, the basic of systems components and we will be talking about systems thinking right now.

(Refer Slide Time: 00:37)



First of all, I want to look in identifying feedback loops and I want to show you one example of how this could be done. Not always, these feedback loops are immediately, obvious and very often, we may think of what is the driving force or what is the actual feedback loop in a system, where we may later find out that this is not actually, the one that triggers the observed results or the observed impacts, and identify the appropriate feedback loops. We can then efficiently, also trigger changes. So, this is an example that I want to show you here.

(Refer Slide Time: 01:29)



It is an example of a positive feedback loops, towards a common agreed goal and this was developed in some protected area, which is undergoing restoration. The good part is

that the team was able to agree upon a common goal and that goal was the self sufficiency and the restoration of the park; achieving self sufficiency and restored beautiful park. Very often already, this can go into very different directions, because there may be ambitious individuals, ambitious organizations funding parks and pieces of something, which may fall actually, lead to many sub goals or falling or cracking apart the overall goal that initially, might have been in place.

So, good is in this case, there was a common agreed goal in first place and then, the feedbacks are identified based on the exercise. So, people would part together or individuals were asked and or groups of people met and discussed one and the same thing, and the feedback loops were identified and (refer Time: 03:04) against the various proposed ideas, and (refer Time: 03:12) came together. First item also considered and perceived, is the most important one, was amount of secured resources. In this case, it is excluded resources, obtained from revenue generation.

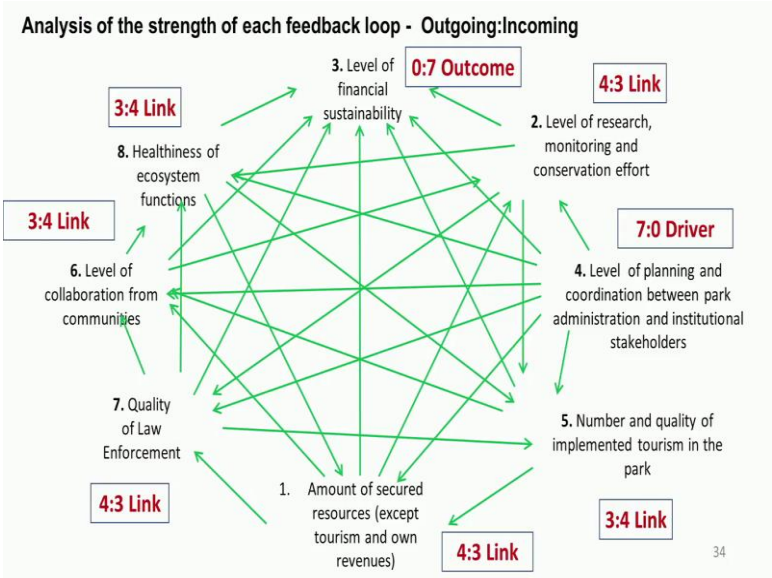
The second perceived, is important was the level of research monitoring and efforts going into conservation. The third level perceived is important, was the level of financial sustainability. The fourth; the level of planning and coordination between the park itself and the institutional stakeholders in the stakeholders of the region. The fifth was the number and quality of implemented tourism in the park.

The sixth; the level of collaboration from the communities, surrounding the protected area. The seventh was the quality of law enforcement, taking place, that aids in the healthiness of the ecosystem functions. Now, we try to limit is to a number below 10, because it becomes more blushed when we increase the number of possible feedback loops. It does not add to the understanding and the simplification of the system. Even in this case, we will see later that a aid is actually, already over the top and not simplifying our systems understanding. We will see it in a second.

Now, the numbers that we have here is perceived importance and again, this very much depends on how strong our lobbies are; how strong individuals are; how convinced each and everybody; how convinced individual departments are of the role and important of their departments and so on. So, this is a perceived importance, which was however, agreed upon through these various discussions or the exercise that took place. Then we established links between those or analyzing those, against our agreed and accepted overall goal. Those were expert discussions, which took quite some time and led us to an

agreement; agreed decision on how each of those individual loops actually, link to each other and help us get to this common goal.

(Refer Slide Time: 06:18)



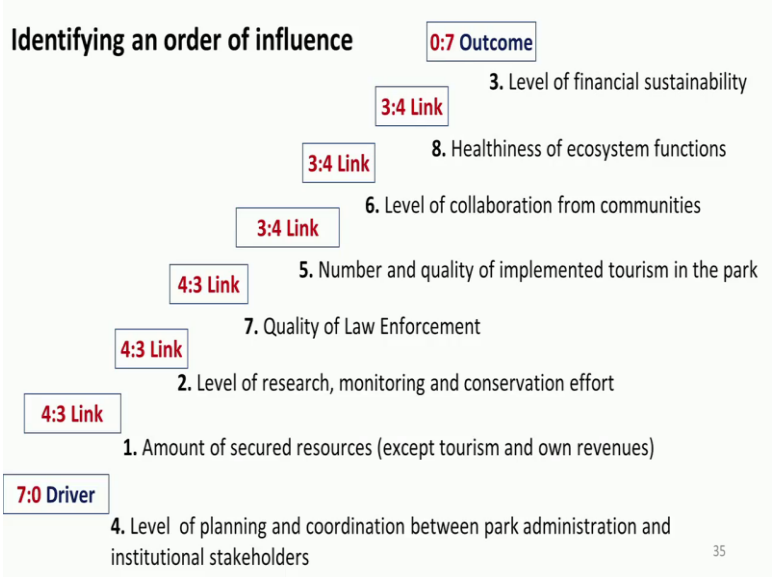
Now, the result of this gives us an analysis of the strength of each of these feedback loops. So, you have an outgoing and an incoming element to that, taking our eight loops and connecting each of these loops to each of the other identified loops. We have, for instance, in the case of the number and quality of implemented tourism in the park, this will impact positive on this one and for that, it will impact positive on the level of collaboration from the communities and for the rest, it will be responded on the receiving end. All of the other actually, serve else as triggering loops to improve the number and quality of implemented tourism in the park.

So, when we list this analysis now, from simply drawing these connections and checking each of these connections against each other, we can see that there are two of these perceived feedback loops, which happened to be not feedback loops in themselves. They are actually, one of them is a driver, because it initiates all of these other loops, which keeps all those loops driving, functioning, working and then, we have one which is receiving all of these initiatives. So, all of the loops, whatever the individual loops are doing actually, move or input directly on this level of financial sustainability. So, overall the level of financial sustainability turns out to be not a feedback loop, but an outcome.

Then we have here various other loops, which in itself, are important, but as not a single one, which one would pick and say; this is the one that triggers all the rest. They are very

much nested with each other and depending on each other. So, we could regroup probably, some of them and group them into one or two and end up, having may be less of loops and in that respect, less of interventions and less may be, simplify our hierarchy of the system.

(Refer Slide Time: 09:21)



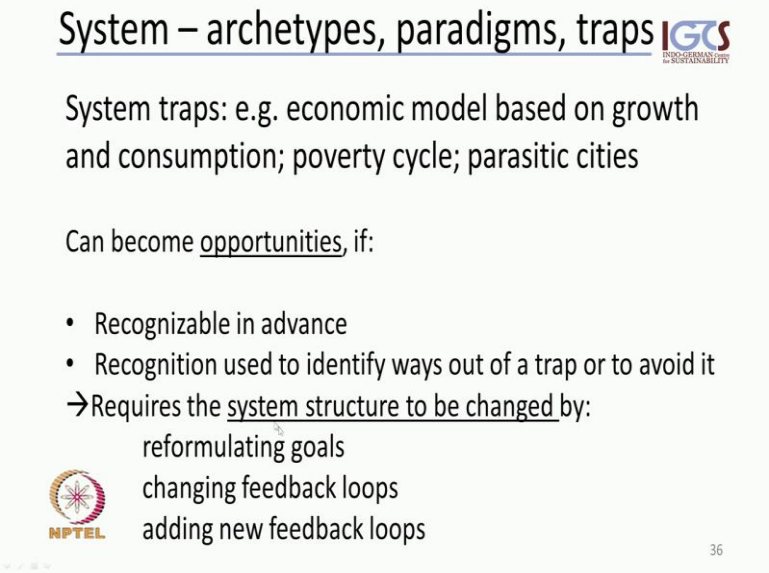
Now, when we place those identified positive feedback loops, putting our driver at the bottom here, as our point of initiation and putting our outcome to the top; this is what we want to achieve over the years, may be, twenty year or five year period, whatever the frame of our intervention is; there are those different links in between or the feedback loops in between, which will take us to the set outcome and now, those can be as the out coming and incoming. We organized the highest out coming or incoming, highest outcome and as it reduces be at them to the next higher level.

The order here as per the perceived importance, as perceived from the expert inputs, as amount of secured resource resources appeared to be the very strong or the strongest and there is then the level of research. Quality of law enforcement would be almost at the same level and could be, may be put under one and the same effort; one feedback mechanism here, and the same for the next level here, on numbered quality of tourism; community helps ecosystem health, which would be essentially, a result of the interventions taking place at that level.

So, you may if we put all of our efforts into this feedback loop here, we would not be able to achieve this, because we will not be needing the driving feedback loops as

identified in the system. If you would put our effort in one of those here, you probably will automatically, reach the other ends, the other levels, without having to put to artificially, move or accelerate these loops here, and still reach the level of financial sustainability is our overall outcome. So, this is very interesting, because as you can imagine, individuals will be very strong and they are points of five(refer Time: 12:17). One or the other thing should receive more priority and as this has been an agreed process and all these individual steps were agreed, the analysis was agreed. This can actually become very useful as an instrument to change the systems approach and prioritize resources in a very efficient way.

(Refer Slide Time: 12:43)

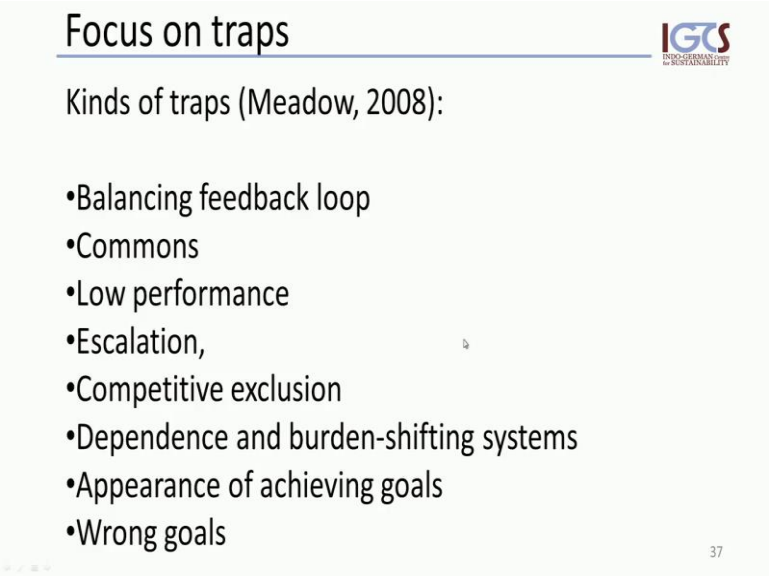


Now, let us look into various systems archetypes or we can also call them paradigms or system traps, as the one of the driving mechanisms of physical system feedback loops. So, such system traps could be for example, our current economic model that is based on growth and consumption. It does discuss this. The system trap could also be the poverty cycle and the measures that we take to overcome that poverty cycle. The system trap is also our current city or urban model, the parasitic cities as we discussed in earlier. Now, we should not lose hope, because such system traps can be opportunities if they are recognizable in advance; that is a condition. If they are, if the recognition is being possible, then it should be used to identify ways out of the trap or ways to avoid it.

So, two steps; understand that first; recognize that next is to be able to take interventions and implement them and it in many case, requires the system structure to be changed and this may be quite painful in some cases. So, this means the goals have to be

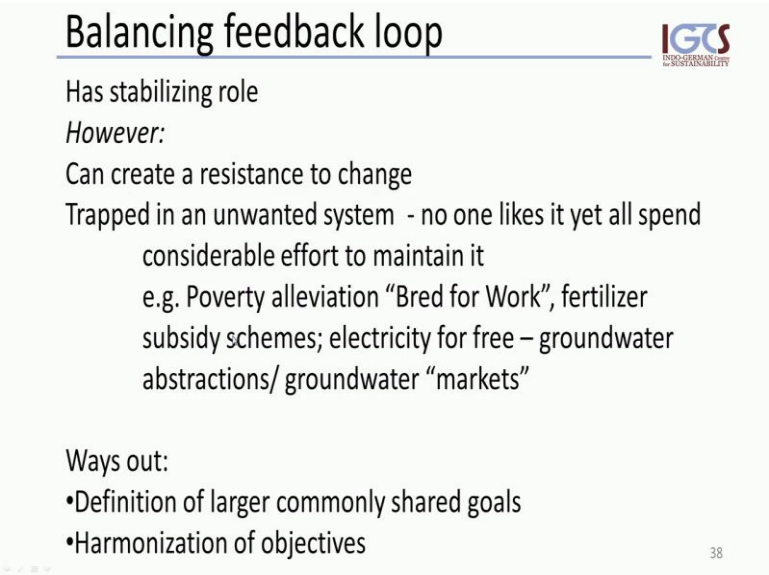
reformulated; the feedback loops have to be changed overall and we may have to add new feedback loops.

(Refer Slide Time: 14:34)



Now, let us focus on these system traps right now, and I am following the examples given by this author here. The kinds of feedback or the kinds of traps that we have; our balancing feedback loops, the commons, the low performance, escalation, the competitive exclusion, the dependence and burden shifting systems, the appearance of achieving goals and wrong goals, and we will be discussing them right now.

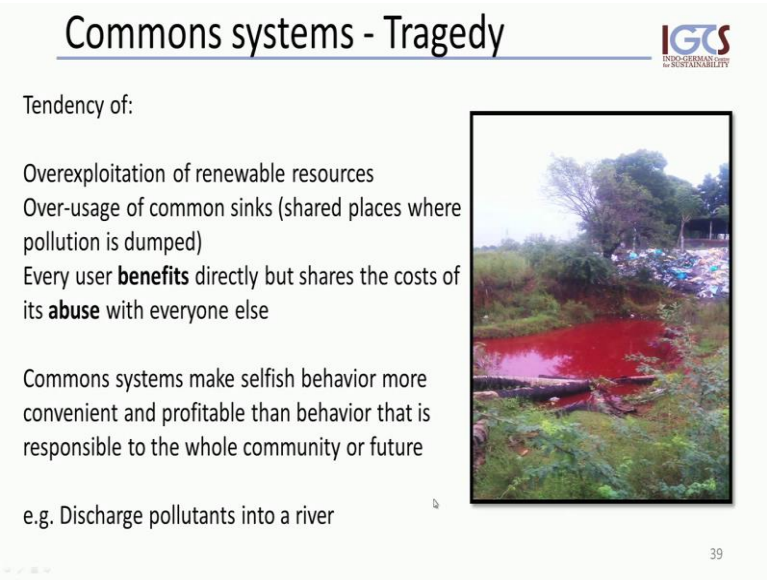
(Refer Slide Time: 15:11)



Let us start with the balancing feedback loop. It has a stabilizing role as the term suggests, it is a balancing mechanism; however, it can create resistance to change. Very often, we see that we are trapped in an unwanted system; actually, no one likes it, but everybody will spend considerable time and effort to maintain that actually, unwanted system. Examples are very abundant. Just look into the poverty alleviation schemes; for instance, bread for work, where you put people to work to get food, which will not have tend to move out of the poverty situation, because they spend all the time just to get some food for today.

Another very predominant example are the fertilizer subsidy schemes or the electricity for free schemes, the subsidy schemes, which provide ground water or facilitate ground water abstractions, but on the other hand create a ground water markets and at some point, it was positive, but and very useful, but then it gets to a point, where it becomes an established system, which as so many external beneficiaries that it is very difficult to move from away from it. So, the ways out of this would be definition of larger commonly shared goals and it would also have to harmonize the objectives; to focus back and see why are those initially, was interfused; what was the initial idea of it and see whether, this can be achieved through different mechanisms if the subsidy would be slashed back or applied in a different way if the overall objectives could still be met.

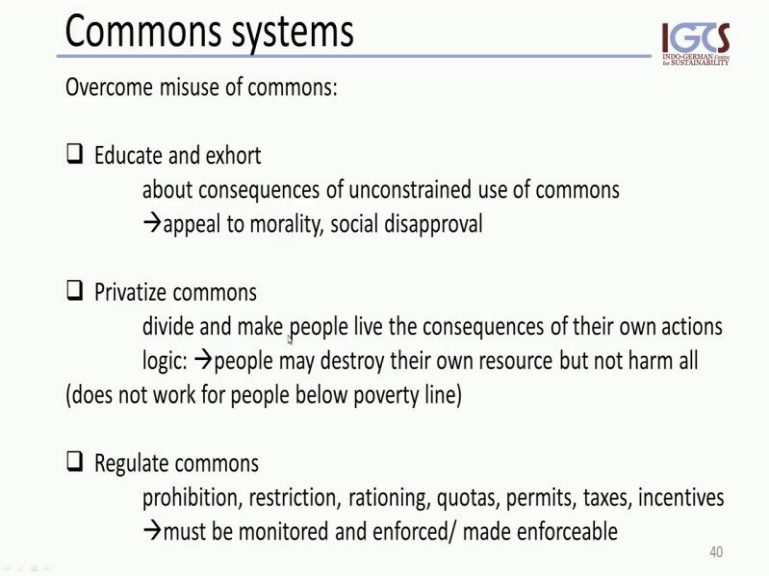
(Refer Slide Time: 17:38)



The next of these traps are the commons systems and we also, often hear the term the tragedy of the commons. What is meant by this is an example of a lake here, which has changed color, because somebody done something here; it is in a public space. So, we

see a tendency of over exploitation of renewable resources, the over usage of common sinks, just like this example, is a shared place, where pollution is dumped and very often, we see the tendency that every user benefits directly, but shares the costs of its abuse with everyone else. So, the commons systems, in a way make selfish behavior, more convenient. It can be hidden and it is profitable, rather than a behavior that is more responsible or more lasting for the whole community or the future. An example is the discharges of pollutants into rivers.

(Refer Slide Time: 19:03)



How can we overcome such misuse of our commons? We can educate and exhort people; those would be about the consequences of unconstrained use of commons. This is presenting facts or presenting values and trying to send the message across to people and make people change. It appeals to morality and social disapproval. There may be, so the social disapproval system of social monitoring, where people watch out for what the other people are doing; what the neighbors doing, and in that way, a community in itself, or the society in itself, could take care of the commons. It is a way; it has been very established in traditional societies; this social monitoring of the commons and something that has been lost or forgotten in our today's societies.

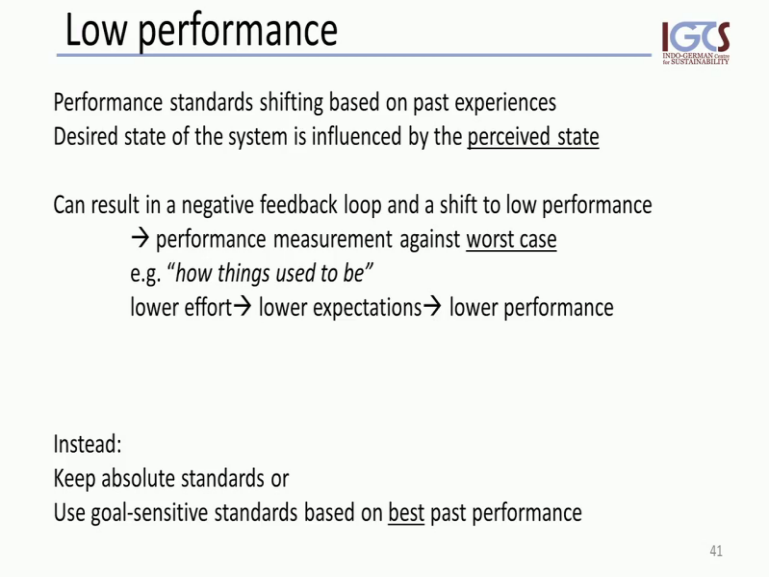
Another way of overcoming misuse of commons is to privatize commons; that is another approach very much in our today's economic and social fields; a solution to divide and make people, live the consequences of their own actions. It is not solving the issue as such, but it builds on the view that if you destroy something, if you polluted, at the end you will be suffering from it, which or ever in the case of the commons very often, is not

possible, because the impact may take place. The negative impact will take place in one location and that will be suffered, very distance often from that impact location, but the logic in this is that people may destroy their own resources and in the same way, not harm all the others, other people.

It does not work for people below the poverty line, where people have no access to alternatives, where people have actually, a very short life expectancy and people cannot really think beyond tomorrow or beyond today. Such mechanisms would not be working and the major impacts right now, we see on pollution, land degradation is often, driven by livelihood restrictions as a result of the poverty situation of these people.

So, it is a possible option, but it is not one of the very successful ones if first of all, because of the characters of the commons and second, because it does not really include and work for a major part of the people in our societies. Then the third of these possibilities is to regulate commons and this means that may request prohibitions, restrictions, the rationing. You may have quotas, permits, taxes, incentives, but the back side on this is that this must be monitored and must be enforced; otherwise, it does not make sense to have regulations and it must be made enforceable also.

(Refer Slide Time: 23:23)

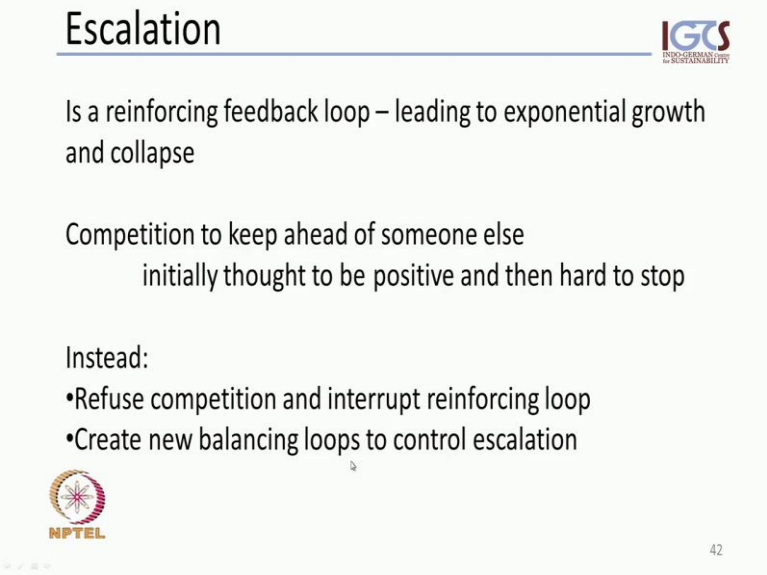


Now, the next on these traps that I want to discuss here, is the low performance trap. This means that we have a performance standard or performing standards, shifting based on past experiences. We take off with one standard and is being gained experiences, as people come and go, and knowledge comes and goes, and our performance standards

may shift and change the way it is. So, the desired state of a system is influenced by the perceived state. This is very important that this is not independent from each other. We are defining our performance standards and we also, define how we perceive the current state of our system.

It can result in negative feedback loops and a shift to low performance when performance is measured against worst cases. Just a phrase that I had this (refer Time: 24:36) that people say "how things used to be" or how life is if we cannot touch upon what life is, because some elderly person knows and should know that we as, you as younger, as a professional, you know that things can be changed, but you are stop the in your in your implementation, because it is an established frame and that is untouchable. So, this leads to a low effort, low expectation and low performance scheme. We see this in many countries, many societies, that this cannot take entire systems down and keep them at a very low level. Now, what can be done instead is to keep absolute standards or to use goal sensitive standards, based on a best past performance.

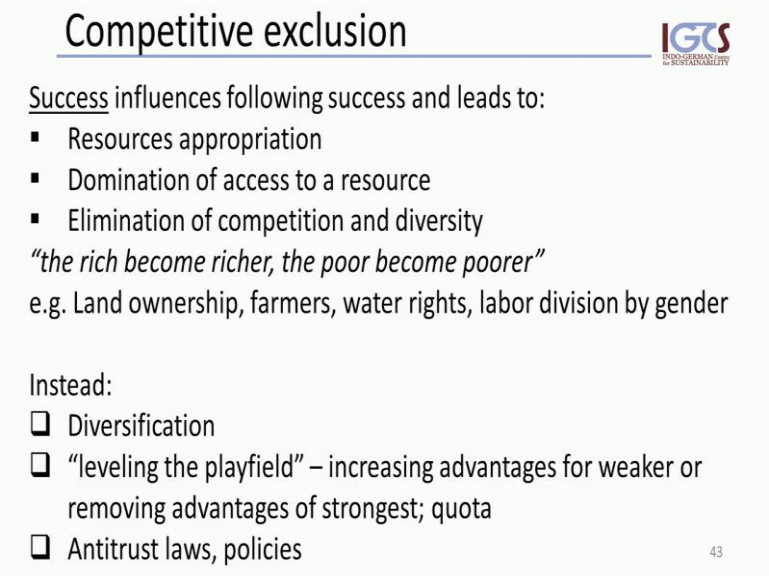
(Refer Slide Time: 25:45)



Yet another trap that I want to discuss here is the so called escalation. It is a reinforcing feedback loop, which leads to exponential growth and eventually, to collapse and we have discussed this previously, on population growth, on our economic growth models, our relationship of source and sink in our resources use; this is called escalation. We often see this as a positive exercise in the beginning, because we use competition to keep ahead of someone else. We measure ourselves and put ourselves into such a frame. It is, very often, there are incentives given to this kind of competition.

Then it becomes very difficult to step out and to stop this. There are possibilities, but very difficult in a group situation or in a society as a whole. We can refuse competition. We could interrupt this reinforcing loop and we could create new balancing loops to control escalation. This is a mechanism which may help some of this, but it may only act in some of the cases; new complexity like just adding a new balancing loop, which may after all, still diverse into the call-ups into the final escalation. So, this is very difficult and tricky, but it also it is possible.

(Refer Slide Time: 27:46)



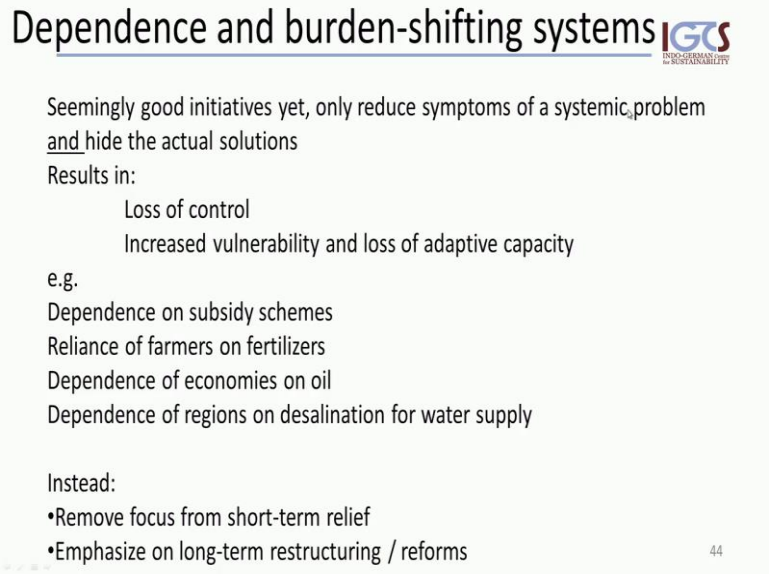
Then another loop, another trap that I mentioned also previously, on water when we talked about water scarcity and water rights; that is called competitive exclusion. It actually departs from that viewed at success, influences following success. That success can be borne by professional intervention by learning, but very often, that success is built in to sort of a cultural heritage, which give an advantageous position, then adapt to following success. This leads to resources appropriation, which is the range of it. It leads to a domination of access to resources and it leads to the elimination of competition and finally, also the elimination of diversity.

We know that sayings that the rich become richer; the poor become poorer, and this essentially, expresses this that process. You may have examples like the land ownership. Land ownership again, is attached to resources. Land ownership sometimes is linked to the right to vote or right to access to certain services or public influence and influential positions, the farmers as one, like group of people, affected by this as an example. The water rights system I mentioned before or also mentioned before, the labor division

based on gender. Those are few examples, but you can find many more of those as well. So, what can be done and sometimes, this also be done by state regulations.

We could have a diversification. We can aim at that individually. Our institutional frameworks can help us increase diversification. There could be mechanisms that lead to what we call, a leveling of the playfield. We are resetting the clock here and increase the advantages for weaker or removing advantages of the strongest mechanism that sometimes has been used, but may not be successful in our quota systems. We see in some countries are also, antitrust laws or policies or regulations, that aim at exactly avoiding accumulation of such successes and avoid this domination of processes.

(Refer Slide Time: 31:06)

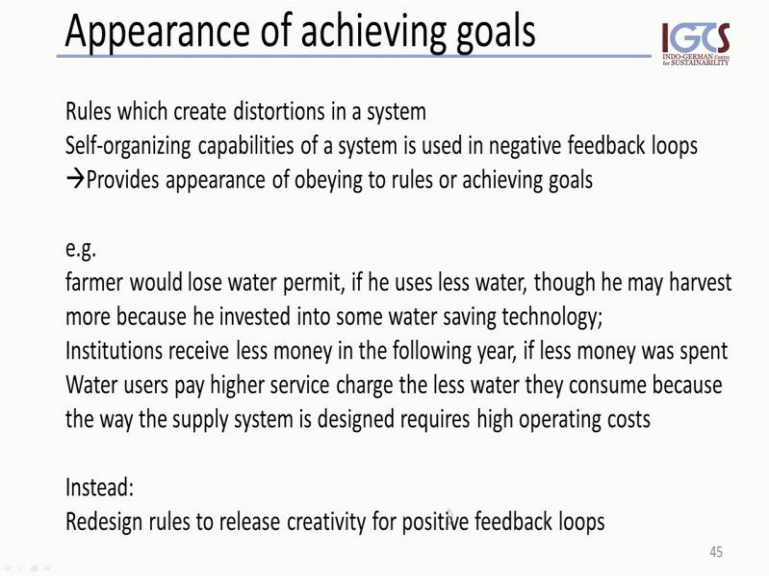


Now, another trap I want to mention here, is the dependence and burden shifting system. This is seemingly, a good initiative in such; however, it actually only reduces the symptoms of a systemic problem. It hides the actual solutions. What happens is that we, this goes along with a loss of control. It goes along with an increased vulnerability and the loss of the adaptive capacity.

Examples of those in our context of the water resources management are the dependency on the subsidy schemes or the reliance of farmers on the fertilizers; the dependency of our current economy on oil; the dependency of region on desalination for water supply. The ways out of this are to remove the focus of interventions from short term relief to long term interventions with an emphasis on long term restructuring or long term reforms. This is very hard to achieve very often, but it is the only way out of something,

that is only trying to firefight the situation without actually, going into the fundamental problems of the system.

(Refer Slide Time: 32:51)

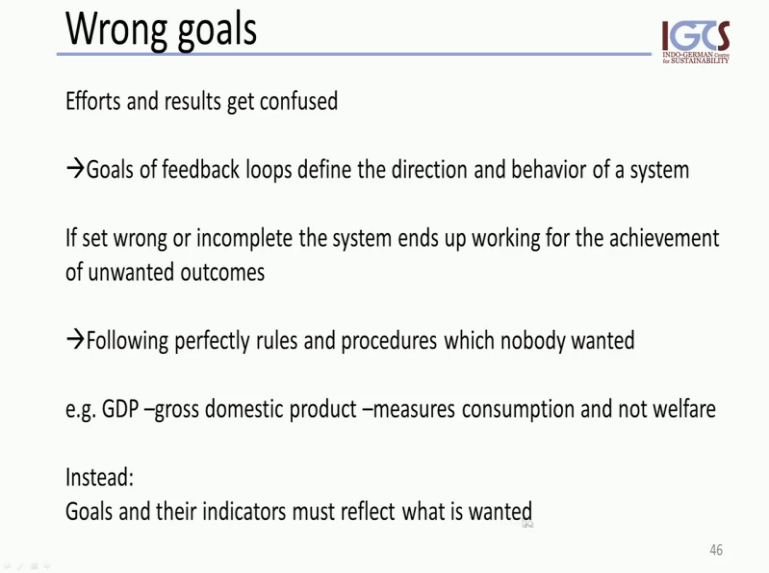


Then a trap that I want to discuss here is the appearance of achieving goals so called. This is our set of rules, which are developed and create distortions in the system. The self organizing capabilities of a system is used in a negative feedback loop. So, this means that it provides appearance of obeying to rules or it seems that we do everything to achieve the goals, but in reality, we use or abuse our systems' capabilities, our self organizing capabilities to divert our stints in negative feedback loops. So, examples of these are for instance, the farmers who would lose their water permit if he or she uses a less water, though that person may have harvested much more, because that person has invested into some water saving technologies. So, it is back filing, because the person may not need so much of water anymore, or it may not need water at all, because it uses a different farming methodology and still, contributes to the society, contributes to the economy in a positive way.

But this does not matter, because it is not measured for and it is not part of the established systems scheme. Another example which may be sounding very familiar to you is that institutions receive less money in the following year if they have spent less money in the previous year. So, this might be interpreted as (Refer Time: 35:12) management capacity to use money, to spend money, but on the other hand, if money was spent wisely or efficiently, and all the goals or targets were achieved by using less money.

It is a punishment for that very institution to receive less money, because they could use that same amount of money to achieve more in the following year by using the same efficient wise application of their funds. Another example are water users may pay for, will pay a very high service charge, although they consume less water; just because the water supply system is designed in such a way that it requires a high operating cost; that is again one of the examples. What can be done is that it requires the redesign of the rules, which would allow the system to release its creativity to or its self organizing capabilities to achieve positive feedback loops. So, all these initiatives here actually, positive feedback loops, which need to be. There should be space given possibility to explore those and make them available in a positive, towards a positive outcome of the entire system.

(Refer Slide Time: 36:56)



Then finally, I want to bring up the trap that is called wrong goals. This is an effort that is, we call this one those when you have mixing a confusion between effort and results. We see this set goals of feedback loops, define the direction or the behavior of the system. We have seen this in our example at the beginning. If those goals are defined wrong or set wrong or incomplete, then the system will end up with working towards achieving an unwanted outcome. So, if we define our systems, the goals wrongly, or incompletely, if we define our loops wrong, then the achievement will be responding to what we set ourselves, but it may actually, lead to a completely unwanted outcome.

So, this, the result of this could be that will follow all of ourselves, follow perfectly the rules and procedures, which nobody intended and nobody wanted initially. Examples are

our safety discussions of how much control do we need in a society to achieve, to reduce crime rate for instance. We can overdo in a way and not achieve anything or we could. Another example would be the gross domestic product, which I brought up earlier, which was setup to measure consumption or income generation in the first place at country level; however, latter was actually used to assess well being.

So, it is mixing up two different things; either we continue measuring our economic flows and by that, for that, you can use our GDP or you have to define a different indicator if we actually, intend to measure the prosperity or the wealth of our humans in this system. Now, what this means that we have to overcome such wrong goals as to; we have to redefine our goals and also redefine the indicators in such a way that they reflect what we actually, intend to measure and what we intend to achieve; what we want from our system. With this, I want to stop the discussion on assessing sustainability in river basins and the various instruments that we have it hand for that. I will see you next time again.