

“Synergies and trade-offs of climate change mitigation measures involving water management”

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How can we manage water for climate mitigation?

- the first option which comes probably to our minds is to use water power as renewable energy source. That is certainly correct and necessary to implement the energy change. But for that we have to intervene into the natural behavior of waters and ecosystems and we should also question: Does this have counterproductive effects and how relevant are they? Here the nexus water and energy has to be further investigated to reach SDGs 6, 7 and 13 (climate mitigation) knowing their trade-offs
- But water is not only surface water. We have to look to the whole water cycle and its essential water variables to understand better how water can or is contributing to climate mitigation. E.g. if we look to groundwater and soil moisture we know that this are essential variables for food and agriculture. And we all know that water is essential for plants and soils and their capabilities for carbon uptake.
- With regard to these aspects we have to have a wider look, not into visible surface waters only. Water management should mean much more than being a synonym for interventions in the river beds and providing drinking water and energy. We do not do any good in trapping ourselves discussing exclusively the environmental impacts of river interventions, even if this is an important and unavoidable step towards sustainable water management.
- We should do a step forward towards understanding “water management” as an important factor of “landscape management”. The establishment of the concept “Integrated Water Resource Management” went already in this direction, but has been only poorly applied in the field and with very different methodologies.
- So my point is that we have to account for the benefits of nature conservation and nature-based solutions for water provision, purification and avoidance of risks (for example flood events). Recent studies and reports, for example the World Water Development Report 2018, demonstrate and highlight the potentials and benefits of working with nature instead of working against nature. This COP24-day has the

theme „From Science into practice“ and I it is time to consider for education and capacity building that we have already world-wide real case studies in the field of waterborne infrastructure how the philosophy „Working with Nature“ is implemented by national programmes like Engineering with Nature (USA) or Building with Nature (NLD) with a holistic view on ecosystems and their services.

- This should not decrease the importance of better understanding the water-soil-food-energy nexus and the benefits for climate mitigation.
 - E.g.: healthy and well managed soils are more productive, better retain irrigation water AND sequester carbon;
 - well-managed forest and reforested areas have an added value for recreation, help naturally to filter precipitation water AND sequester carbon;
 - renatured wetlands are an habitat for biodiversity, help avoid flood events AND sequester carbon.
- What I am trying to say is that climate mitigation can be a co-benefit of managing landscapes towards sustainably and taking into account the ecosystem services provided by landscapes in the water domain.

What are the challenges that you see for managing landscapes for climate mitigation and water provision?

- There is definitively, and that is true in developed AND developing countries, a fragmentation of the responsibilities and competences. The issues regarding natural ecosystems, water and agriculture are dealt with in different ministries and agencies.
- With Federal and Federal state agencies and institutes we often have a mix of different national and regional responsibilities. Communication and coordination is thus a challenge. And integration very difficult. Mechanisms for information and coordinated response are needed. (Give the example of Wasserkreis in Germany including very different ministries, etc.).
- Against this background you can imagine how important it is to get the essential water data for transboundary or even global use to come to scientific accepted methods and products. As I am responsible for an International Centre for Water Resources hosting also global water centres I see these problems in the daily work. To get better here it needs real good country case studies showing how the status and outlook of water resources and quality are and will be and how they contribute to human welfare, climate mitigation and adaptation. The users and decision-makers should become the demander of good applied, practice-oriented information. Therefore the user and decision-makers have to be involved from the beginning in

developing new methods and products, which demands for new ways of interaction and communication.

- Another aspect: Disciplinary research has also been an obstacle. In former times, hydrologists were not concerned with agronomists or biologists. That has changed a lot, for example with the development of the concept “water-food-energy nexus”. And even so, some projects and communities are still working parallel to each other and not with each other. Requirements in funding calls are only partially successful against this.
- The debate of “land-sharing versus land sparing”, showed that sometimes there is no right and wrong, but rather a political decision to be taken. Do we want to use smaller areas intensively for agriculture and thus have larger natural areas? Or do we want to have larger agricultural areas used extensively and less large natural areas? Both have pros and cons, both for sustainability and climate mitigation.
- Finally, analyzing and projecting the interlinkages in complex systems is a challenge, both in research, administration and politics. Simple tools showing the results of complex system behavior need to be developed and put at the service of decision makers for them to evaluate synergies and trade-offs of interventions.