Subproject 4: Sustainability Assessment and Governance of Water Resources

Background & Objectives

The sustainable use of water is of greatest importance for the achievement of the Sustainable Development Goals (SDGs). Though, water provision is subject to conflicts worldwide between users, with agriculture as a major driver of discords over water distribution[1-4]. Increased food production through irrigation is often correlated with the loss of ecosystem services such as drinking water provision, regulating services and habitat function[5-8]. In particular wetland services are suffering to a great extent from water overuse by agriculture[5, 9, 10]. These issues are not sufficiently included in risk assessments.

The goal of subproject 4 was to develop an assessment approach that overcomes restrictions of existing sustainability assessments such as missing incorporation of legitimate sustainability standards and disregard of ecological water requirements that impedes area specific results as to impairment of ecosystem functioning and biodiversity[11,12]. Based on legiitimized standards for sustainable water use, within subproject 4 we developed an evaluation tool that aims to support the implementation of international water norms and to increase the transparency and legitimacy of assessment results for water use and distribution.

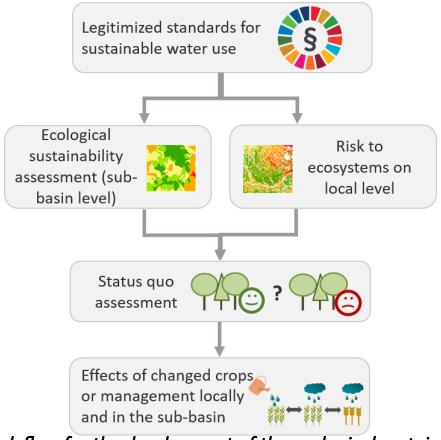

Figure 1: Work flow for the development of the ecological sustainability assessment and the ecological risk assessment within the ViWA project.

Results

The developed Ecological Sustainability Assessment of Water Distribution (ESAW) spatially and quantitatively specifies the sustainability of water use by different water users in a given basin and identifies specific areas where water use of agriculture should be restricted in order to protect ecosystems and their services against impairments by overexploitation. ESAW builds on existing tools (i.e. Water Footprint Sustainability Assessment[13], Water Stress Indicator[11]) and is composed of a combined assessment for sustainable water use on sub-basin level **(a)** and a place-based ecological risk assessment that localises critical areas where agriculture is expected to impair water supply of ecosystems **(b-d)**. The tool works in standard GIS applications and is applicable in basins worldwide.

ESAW was tested in the Danube river basin with high resolution agro-hydrological model data from the project partners (PROMET (LMU); OpenGeoSys (UfZ)) and further freely available data (water use, local biodiversity & wetlands maps).

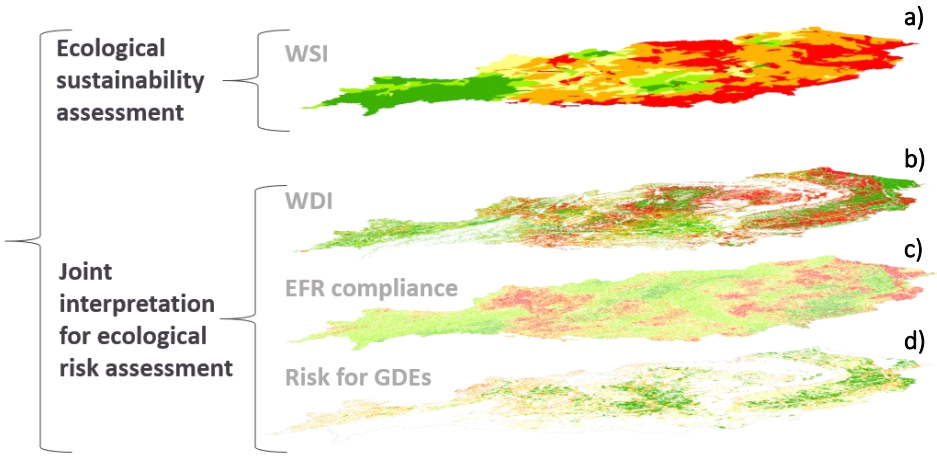

Figure 2: Evaluation of agricultural water use in the Danube basin through the ecological sustainability assessment and the ecological risk assessment.

Application

The results of the developed tool support the allocation of quantitative water rights to different user groups on basin and local level considering sustainability criteria[14]. Moreover, concrete measures for sustainable water management can be quantitatively verified and deduced, such as increase of rainfed agriculture near vulnerable ecosystems or change of certain crops.

The tool can support decision making of authorities from local to national level as well as private enterprises who want to improve the sustainability of their supply chains.

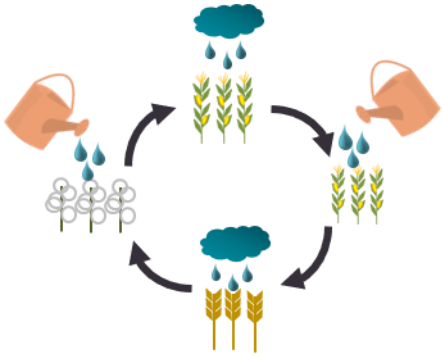

Figure 3: Deduction of spatially specific measures for sustainable water use based on the assessment results.

iup Institut für Umweltplanung
Leibniz Universität Hannover

Standards for sustainable water use

Norms for sustainable use of water resources[15] and evidence-based decision-making should set a globally, equal basis for sound management and policy action[16-18]. Therefore, sustainability assessments aiming to support decision-making are needed that are based on transparent, legitimized evaluation standards for acceptability of the results[19-21]. International norms are increasingly including legal standards for sustainable water use and distribution that are inclusive to the environment as legitimised water user. These global norms, namely UN Conventions, the SDGs and further agreements have been operationalized into a set of legitimised and spatially applicable criteria for assessing sustainable water use and distribution on basin level[18]. The underlying standards represent the minimum international requirements of sustainable water use.

Water availability
- Use renewable water
- Consider alternative water sources (technical adaptation)

Human Right to water
- Give priority to domestic water supply
- Consider water for food production

Water for ecosystems and their functions
- Preserve water for ecosystem functioning (incl. Environmental flow requirements)
- Respect balance of recharging aquifers
- Limit drawdown of fossil aquifers

Water for preservation of biodiversity
- Protect wetlands and biodiversity hot spots
- Consider special water requirements of wetlands

Transboundary water allocation
- Establish equitable and reasonable water allocation
- Stay within limits of a countries aquifer recharge

Figure 4: International standards for sustainable water use compilded from UN Conventions , SDGs and further international agreements.

Governance Analysis

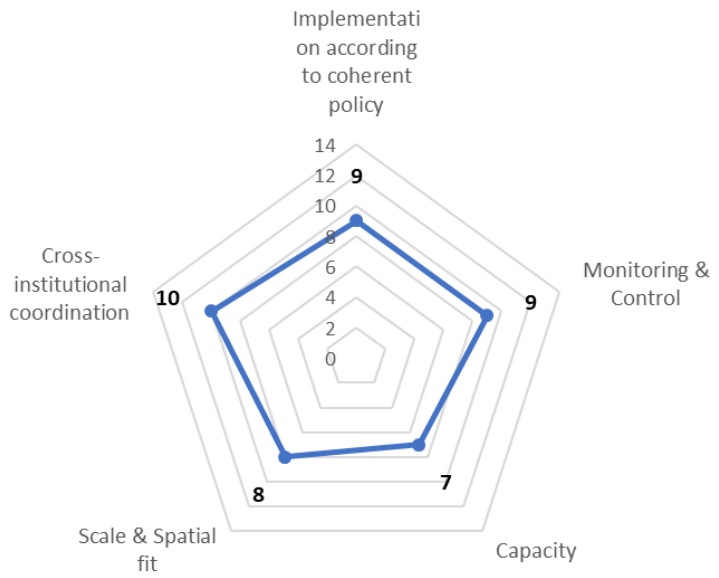

Figure 5: Total scores for the institutional governance analysis in Israel.

The governance of water resources can improve the spatial and temporal availability of water resources for anthropogenic use. Though, weak governance systems may not impede water crisis or are even reason for the overuse of renewable water resources[22] with severe consequences for ecosystems and the long-term water supply for anthropogenic water use. A governance analysis was carried out that examined three systems of spatial water governance (Israel, Germany, Bulgaria) in order to identify potentials and obstacles for sustainable water use. A set of criteria for good water Governance was identified[22,23] and discussed with stakeholders from the case study regions during workshops or expert interviews. Together with a literature based "mapping" of the institutional water systems, this information was used to classify and compare the different systems. The focus of the analysis was the specification of international standards for sustainable water use through structures, legislation and instruments and their implementation in responsible authorities from national to local level.

Prof. Dr. Christina von Haaren
Project lead ViWA subproject 4
haaren@umwelt.uni-hannover.de

Anna Schlattmann, M.Sc.

- Design ecologial sustainability assessment, support implementation in GIS
- Design governance analysis and implementation in Israel and Germany

schlattmann@umwelt.uni-hannover.de

Felix Neuendorf, M.Sc.
- Design ecological sustainability assessment and implementation in GIS

neuendorf@umwelt.uni-hannover.de

Dr.-Ing. Kremena Burkhard

- Support ecological sustainability assessment
- Implementation governance analysis in Bulgaria

burkhard@umwelt.uni-hannover.de

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References: 1 Falkenmark & Rockström 2006; 2 MEA 2005; 3 UN 2018; 4 Eamus et al. 2016; 5 Grizzetti et al. 2016; 6 Poff et al. 1997; 7 Molden 2007; 8 Foley et al. 2015; 9 Russi et al. 2013; 10 UN Water 2020; 11 Smakthin et al. 2004; 12 Vanham et al. 2018; 13 Hoekstra et al. 2011; 14 Von Haaren et al. 2019; 15 Schlattmann et al., submitted; 16 Molden 2007; 17 Opdam & Vos 2002; 18 Von Haaren et al. 2008; 19 Oudenhoven et al. 2018; 20 Heink & Kowarik 2010; 21 Hagan & Whitman 2006; 22 OECD 2015; 23 Mostert 2018