Submitted Abstract

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Abstract

The Alps play a crucial role in sustaining the socio-economic wellbeing of the people living in lowland regions. In particular, a wide range of sectors rely on water, amongst them energy production, agriculture, industry, tourism and ecosystems. Water, Energy, Food, and Ecosystems are inextricably linked within a complex system: the WEFE nexus. As water is a resource shared across sectors, its upstream-downstream exploitation often leads to disputes and tensions connected to its management and governance.
An example of a complex WEFE system is the Adige River basin, with the river flowing from the Italian Alps through six provinces, characterized by a complex governance and fragmented water management responsibilities. Throughout the basin, economic sectors historically developed in conditions of abundant water resources with tensions arising in case of decreased water availability especially in the context of climatic and socio-economic future scenarios.

Although sectoral data and models to improve water management are widely available, a siloed perspective still confines and hampers the implementation of an integrated model able to address the complex cross-sector and geographic WEFE interrelations. Mainstream nexus frameworks focus mainly on the water, energy and food sectors, while the role of ecosystems is usually overlooked. Moreover, existing studies on the Adige basin only consider dual interactions instead of addressing the full complex system. This challenge is reflected also in policies which are designed without comprehensively considering sectoral synergies and their impact on the whole WEFE nexus.

In this context, this study aims at adopting a WEFE Nexus approach, applying an interdisciplinary methodological framework, developed within the H2020 project Nexogenesis, launched in September 2021 and ending in 2025. To comprehend and tackle the WEFE nexus as a whole, the implemented approach integrates i) participatory processes, to analyse the institutional and political context, as well as to map current and future interconnections between sectors, involving local stakeholders; ii) modelling activities, aimed at spatially-temporally and quantitively assessing resource flows across sectors, improving available hydrological models, incorporating long-term climate projections and sectoral water demand. This allows to pinpoint unbalanced supply-demand conditions as well as challenges and conflicts which may arise in the future.

Finally, further activities within the Nexogenesis project will exploit the potential of artificial intelligence tools aimed at providing a better understanding of the impact of policies on the WEFE nexus, to facilitate coherent water-related policies and to achieve resource use efficiency, leverage synergies, and promote sectoral cooperation.