



## **Vulnerability of Water Resources under Climate and Land Use Change: Evaluation of Present and Future Threats for Austria**

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Climate and Land Use Change can have severe impacts on natural water resources needed for domestic, agricultural and industrial water use. In order to develop adaptation strategies, it is necessary to assess the present and future vulnerability of the water resources on the basis of water quantity, water quality and adaptive capacity indicators. Therefore a methodological framework was developed within the CC-Ware project and a detailed assessment was performed for Austria.

The Water Exploitation Index (WEI) is introduced as a quantitative indicator. It is defined as the ratio between the water demand and the water availability. Water availability is assessed by a high resolution grid-based water balance model, utilizing the meteorological information from bias corrected regional climate models. The demand term can be divided into domestic, agricultural and industrial water demand and is assessed on the water supply association level.

The Integrated Groundwater Pollution Load Index (GWPLI) represents an indicator for areas at risk regarding water quality, considering agricultural loads (nitrate pollution loads), potential erosion and potential risks from landfills. Except for the landfills, the information for the current situation is based on the CORINE Landcover data. Future changes were predicted utilizing the PRELUDE land use scenarios.

Since vulnerability is also dependent on the adaptive capacity of a system, the Adaptive Capacity Index is introduced. The Adaptive Capacity Index thereby combines the Ecosystem Service Index (ESSI), which represents three water related ecosystem services (Water Provision, Water Quantity Regulation and Water Quality Regulation) and the regional economic capacity expressed by the gross value added. On the basis of these indices, the Overall Vulnerability of the water resources can be determined for the present and the future.

For Austria the different indices were elaborated. Maps indicating areas of different levels of vulnerability were developed. A comparison with existing data (River Basin Management Plan and Groundwater Chemistry Regulation) shows a good agreement between the elaborated maps and observations for the present state.

The Overall Vulnerability is very low and low for most parts of Austria, especially in the forested alpine region. Bigger cities like Vienna, Graz and Linz show medium vulnerabilities, due to the high water demand and low ecosystem services. Only in the north-eastern and south-eastern part of the country some water supply associations with high and very high overall vulnerability exist. Groundwater recharge is quite small in these regions and the water quality is limited due to intense agriculture and possible threats through landfills.

The developed framework allows an evaluation of water quantity and quality vulnerabilities for large scales for the present and the future. Including ecosystem services and gross value added an overall vulnerability can be determined.