Water Management Strategies against Water Scarcity in the Alps: The Project Alp-Water-Scarce

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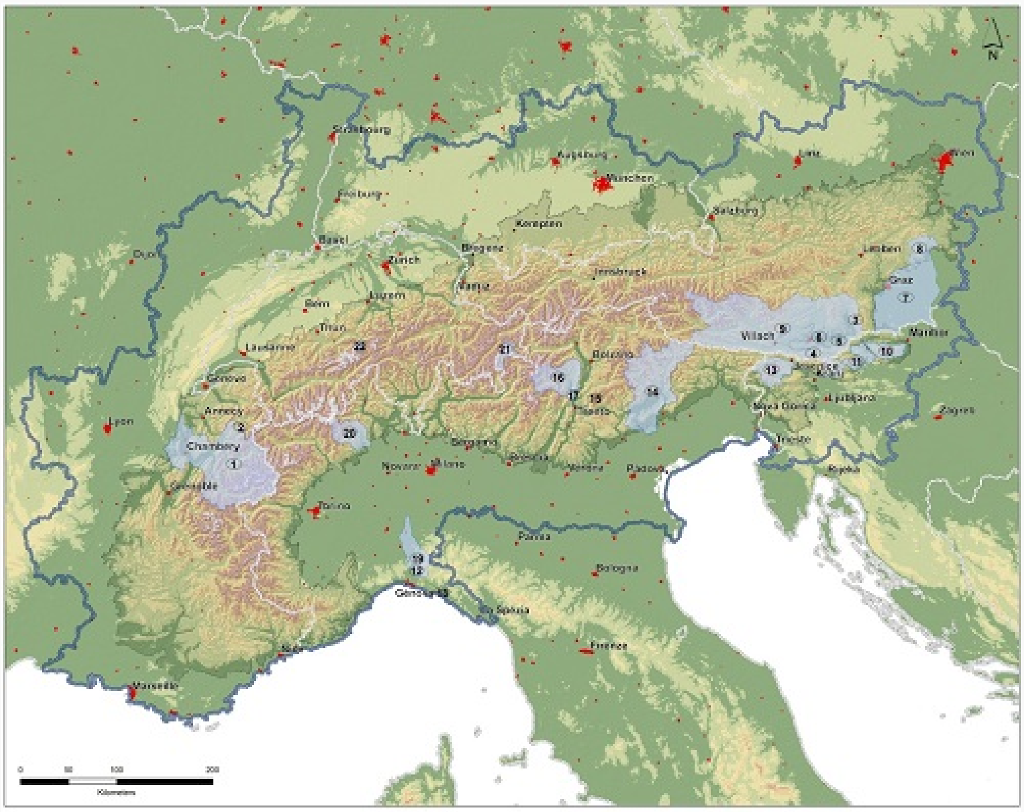
Abstract

In the recently finished Alpine Space project, Alp-Water-Scarce authorities, universities and research institutes from five countries collaborated to develop a Water Scarcity Early Warning System. The system composes an improved and consistent understanding of the spatial-temporal availability of water and the water consumption by society. Using 22 pilot sites, the socio-economic and cultural aspects of water use in agriculture, industry, tourism and domestic purposes are considered for the development of regional adaptation strategies. The findings in the pilot sites developed by the 16 consortium partners are put together in a GeoPortal, while recommendations on adaptation and mitigation strategies are placed in the final reports on the Alp-Water-Scarce website.



The Alp-Water-Scarce Pilot Sites: 1 Savoy (FR), 2 Arly River Basin (FR), 3 Koralpe (AT), 4 Karawanken/Karavanke (AT/SI), 5 Jauntal (AT), 6 Lower Gurktal (AT), 7 Steirisches Becken (AT), 8 Steirisches Randgebirge – Wechsel (AT), 9 Entire Land Kärnten (AT), 10 Pohorje with Dravsko polje (SI), 11 Ptujsko polje (SI), 12 Scrivia River Basin (Alessandria) (IT), 13 Julian Alps (SI), 14 Piave River (IT), 15 Fresina (IT), 16 Noce (IT), 17 Adige (IT), 18 Entella River Basin (IT), 19 Scrivia River Basin (Genova) (IT), 20 Sesia River Basin (IT), 21 Spöl River (CH), 22 Sandey River (CH).

Drivers and impacts of water scarcity

The Alps are regarded as the water towers of Europe (Viviroli and Weingartner 2004, European Environment Agency 2009a, Beniston 2010). They are the origin of the three large central European river systems Rhône, Rhine, and Po, which provide freshwater to downstream countries in the lowlands and urban areas far beyond the

Alps. However, in the last decades, alpine hydro-climate driven changes have been demonstrated using long-term records on temperature, precipitation, river discharge, and glacier mass balances (Berger et al. 2004, Farinotti et al. 2009, Paul et al. 2007, European Environment Agency 2009b, Dg Environment 2007, Dg Environment 2006, Schröter et al. 2005, Beniston 2010). In the Alps, regional water balances are stressed by an imbalance between the distribution of naturally available water and the anthropogenic water demand. The impacts are caused by a trend of increasing temperatures and a changing precipitation pattern (Auer et al. 2005, Auer et al. 2007, Moberg et al. 2006, Schär et al. 2004, Seneviratne et al. 2006). Droughts and floods are forecasted to become more frequent (Schwarzl 1991, Calanca 2007, Van Vliet and Zwolsman 2008, Schmidli and Frei 2005, Moberg and Jones 2005, Frei et al. 2006, Briffa et al. 2009). All these factors intensify the trend of certain regions being prone to water scarcity at certain times. Due to the growing request for freshwater, water resources most likely will decline in the future. This may affect regional water competitions in future, when water will be available at different times and in different quantities than it is today (Beniston 2010). Thus, to handle the long term, but also short term, water scarcity situations, water scarcity risk mitigation strategies have been developed by the Alp-Water-Scarce partners.

Actions done

With certain regions being water stressed at a certain time period, the Alp-Water-Scarce consortium worked in 22 different pilot sites in the central- and pre-alpine areas in order to explore certain management strategies against water scarcity. The “short guideline based on the results of Alp-Water-Scarce” (Saulnier et al. 2011) shows the different monitoring and modelling strategies and their synergies invented across the Alps. Different required and recommended hydro-climate measurements are discussed and the diverse datasets used in the pilot sites are outlined. The monitoring and modelling approaches of the natural water balance and its anthropogenic impacts are reviewed and discussed. The advantages and disadvantages of 10 hydrological models and their use in the pilot sites are outlined and recommendations for stakeholders and practitioners are proposed.

As a result of the three-year-project actions, a summary on “Recommendations for Water Resources Managers and Policy-makers” has been formulated by Hohenwallner et al. 2011a. They outlined different Water Scarcity Early Warning Systems tailor made for certain regional demands and needs to observe and detect crisis situations and promoting consolidation to avoid user conflicts on water resources.

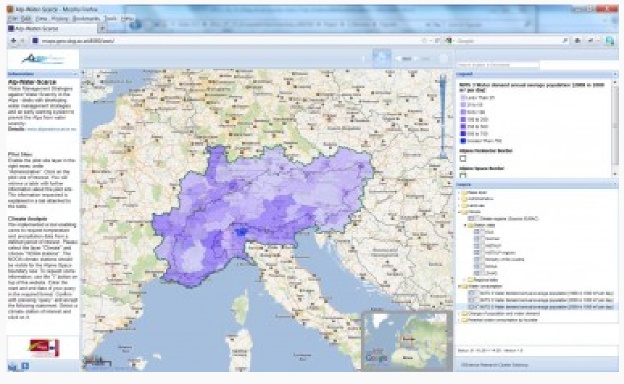
A more thorough overview of the project outcomes and recommendations is given in Hohenwallner et al. 2011b. Here, the different pilot sites are visualized and the main challenges from society (drinking water supply), agriculture (irrigation), hydropower generation, and tourism are described. As a table summary, water scarcity concerns and their importance for drinking water supply, agriculture, hydropower generation, tourism, tunnel construction, and thermalism are described. Another table outlines the sources of drinking water and their importance for deep aquifers, springs, surface water or large rivers, surface waters or small torrents, shallow groundwater, and artificial lakes.

To transfer the results, findings and experiences gained from the pilot sites a WebGIS platform has been developed. Both tables mentioned above are also available in the WebGIS promoting the pilot site results on a map interface. This open source based prototype geoportal is following the principles of a Service Orientated Architecture (SOA) and the concept of a Spatial Data Infrastructure (SDI). A HTML-website embedding several JavaScript libraries for the spatial components and functionalities as well as layout, serves as the basis for the geoportal. Besides the two tables, additional information is linked through PDFs. These PDFs include detailed pilot site descriptions and further non-georeferenced maps for local planning. The user interface of the WebGIS is subdivided into three vertical frames: The left frame contains the overall project information with a short description, the project logo, contact information, and the funding organization; The right frame is vertically split in a search option, legend of presented layers, available layers or datasets, and the status and copyright area. The center frame shows the map containing baseline datasets. This platform has started collecting climate change and hydrology related datasets across the Alps including special case study examples at regional or even local levels. Recently, the modelling results from drinking water consumption from the local population and tourists were updated.

Conclusion and outlook

Common to all the Alp-Water-Scarce findings and recommendations are the valuable transdisciplinary collaboration of partners coming from very different working environments including regional planning, Geoinformatics, federal, state and national governments, hydrologists, agricultural sciences, biology, nature protection agencies, and others. Looking at the water resources from a holistic and participatory view helped a lot in approaching the expected forthcoming spatial-temporal related water scarcity challenges to preserve the water resources of the Alps for future generations. The commitment of national and regional authorities, universities and research institutes working together with business companies are the preconditions for the implementation of long-term measures to cope with short-term effects.

Water scarcity is a worldwide challenge. This is demonstrated by the FP7 project GLOWASIS. Compared to Alp-Water-Scarce, this project approaches a different spatial and temporal scale and scope of analysis. However, in the future, it would be beneficial to combine endeavors of both projects to draw conclusions from the global to the local scale, and annual to weekly time scales. This would enhance freshwater management approaches such as those proposed by the SMART project which is funded by the Ministry of Science and Innovation, New Zealand.



A screenshot of the Alp-Water-Scarce website

Alpine climate change is not only affecting natural water resource availability but is also impacting tourism, forests, surface water bodies, and others. In the soon-to-be-launched Alpine Space project “Capitalising Climate Change Knowledge for Adaptation in the Alpine Space,” the portal developed in the Alp-Water-Scarce project will be further advanced and populated with additional and updated information on climate change findings to be used in adaptation and mitigation strategies.

Author

Hermann Klug‘s research expertise focuses on the development of holistic landscape planning approaches using GIS and Remote Sensing for integrated water resources and landscape management. Involved in several transdisciplinary projects, Klug is working at the interface of the climatology, pedology and hydrology with a special focus on harmonization processes of environmental datasets and setting up of Spatial Data Infrastructures and WebPortal services.

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