Water Resources Management and Water Scarcity in the Alps

RECOMMENDATIONS

for Water Resources Managers and Policy-makers

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The role of mountains in providing the indispensible water resources for municipal and industrial water supply, irrigation, hydropower production and other environmental services is well known and unquestioned (e.g. Barnett et al. 2005; EEA 2009; Viviroli 2003, 2007, 2010).

In Europe in particular, the Alps, with their seemingly vast water resources, are of immeasurable importance for the economic and cultural development of not only the Alpine Arc, but also the lowlands and major urban areas far beyond.

Although it may seem that drought events or water scarcity problems in the Alps have only occurred over short periods of time and in small, distinct areas in the past (PSAC 2009), the severe droughts which affected much of Europe in 2003 also had a significant impact on the water resources of the Alpine regions. The creation of the European Drought Centre in 2005 can be seen as one of the results of this experience as well as communications by the Commission to the European Parliament and the European Council (EC 2007) and several regional and local initiatives (e.g. drought committees in France). Efforts have been made not only on a legislative level to deal with the issue of water scarcity and droughts, but also on a scientific level where many studies have been carried out to assess the effects of climate change and its impacts on the water resources of the Alps, resources that are also facing increases in anthropogenic water abstraction.

The work carried out within the "Alp-Water-Scarce" project (1.10.2008 – 31.10.2011) funded by the EU Alpine Space programme has resulted in a set of recommendations which are based on case studies performed in the different Pilot Sites (Hohenwallner et al. 2011). Common to all these recommendations is the need to preserve the water resources of the Alps for future generations, to meet increasing water demand and to cope with climate change-induced stress on those resources. The strong commitment of public bodies to cooperate on regional, national and transalpine levels and a common understanding of the terms "water scarcity" and "drought" are the preconditions for the implementation of long term measures to tackle water scarcity.

Viviroli et al. (2010) conclude that there is a strong need to promote research and exchange of knowledge with practitioners. These recommendations have thus been developed in collaboration with water management experts across the Alps in a trans-disciplinary and participatory approach.

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1. Early Warning of Water Scarcity

The establishment of Early Warning Systems against water scarcity or drought is recommended in several EU regulations and directives (DG Environment 2008; EC 2011).
Within Alp-Water-Scarce, four different Early Warning Systems were developed that address the specific needs of the particular Pilot Sites: In the Arly catchment (France) the Early Warning System aims at long term water reconciliation; in Carinthia (Austria) the Early Warning System is dedicated to ensuring a sustainable drinking water supply; in the Piave catchment (Italy) it is intended help to avoid user conflicts between hydropower generation and agriculture and in Slovenia it contributes to water saving measures for agriculture.

RECOMMENDATIONS
• The terms “drought” and “water scarcity” should be defined taking into account local/regional characteristics. A common understanding of these terms would improve the effectiveness of implementing necessary measures.
• The establishment of Early Warning Systems against water scarcity should be embodied in national/European legislation.
• Operation of Early Warning Systems should be the responsibility of local/regional public authorities.
• The parties responsible for the implementation and operation of Early Warning Systems should be clarified: ✔ Who provides the necessary data? ✔ Who guarantees the quality of the data used? ✔ Who is responsible for maintaining the data? ✔ Who sets necessary measures prior to or in case of water shortage? ✔ Who is responsible for informing other stakeholders and the public?
• Early Warning Systems should be adapted to local/regional needs, ideally including those of the different users.
• Simulation models should be used in order to increase the prediction lead time and reduce uncertainty.
• Long-term partnerships should be established with experts (including public and private consultants).

2. Implementation of short-term crisis management

Forecasting periods of water scarcity or drought with the help of Early Warning Systems necessarily means taking into account existing administrative or governmental regulations that set the required measures to deal with these phenomena. The fast and efficient implementation of actions to prevent the crisis or to mitigate its effects is essential and the cooperation of all parties concerned is crucial. All countries involved in Alp-Water-Scarce (Austria, France, Italy, Slovenia and Switzerland) have established procedures to be taken in case of a crisis. However, the existing measures and frameworks need to be revised in order to deal with the impacts of climate change in some regions of the Alps, which might involve longer and more frequent periods of water shortage.

RECOMMENDATIONS
• Emergency plans should be adapted to deal with longer and more frequent periods of water shortage.
• Available tools should be revised and adapted to establish appropriate measures under changing conditions.
• The short-term crisis management approach should be reoriented towards the implementation of long-term, anticipatory water management.
• A clear and precise information transfer policy should be implemented.
• The necessary administrative structures should be established that support long-term integrated water resources management to avoid periods of water scarcity.

3. Securing future water demand

The main aim of sustainable water management is the protection of water resources for the future. Amongst others, the following two questions must be taken into account:

1. How will water resources evolve in the future considering the impacts of climate change?
2. How will water resource demand evolve in the future?

An estimation of both variables enables water managers to take necessary measures to meet water demand whilst preserving the resource.

RECOMMENDATIONS
• Data sharing and integration should be promoted (across different sectors, regions, etc.)
• Actual water demands should be monitored and a reanalysis of past water demands made (including information on demand seasonality, socio-economic data, etc.).
• The development of future scenarios of the evolution of water resources taking into account the impacts of climate change should be considered.
• Future changes in the water demand of the most important water users should be estimated.
• Measures to adapt water management strategies should be implemented to take into account changing scenarios of water availability (e.g. developing long-term structural changes for water saving in agriculture).
• The planning of artificial recharge installations under favorable hydrogeological conditions should be considered.

4. Promoting consolidation to avoid resource user conflicts

An increase in the duration of periods of water scarcity will intensify cross-sectoral water competition in the Alps. Increased demand for agricultural irrigation could reduce water availability for other sectors such as drinking water, energy production etc. and vice versa (Moser et al. 2011). Increased water demands for tourism in summer will compete with agriculture and demands for hydropower generation (EEA 2009). Decreasing water resources for hydropower generation may conflict with increasing demand for electricity for indoor cooling in summer (Prettenthaler et al. 2007). Furthermore, these pressures and the resulting ecological stress on aquatic ecosystems (“optimal ecological discharge”) must be taken into account.

RECOMMENDATIONS
• Integrated planning for the sustainable use of water resources should be a priority.
• The value of ecosystem services should be recognised in determining the balance between economy and ecology.

• The multifunctional use of existing water storage capacities should be promoted.
• The interconnection mechanisms of existing networks should be improved to increase the resilience of available water resources.
• The evolution of water resources should be observed (monitoring and modelling).
• Measures should be implemented that are adapted to regional/ sectoral needs. These measures could be technical solutions, the temporary favouring of one sector over another or the adaptation of practices (e.g. agricultural land use and livestock) to a lower level of water supply. All measures need strong and clear political support.
• A clear set of regulations and cooperation agreements is necessary (regionally modified if needed).
• The efficiency of water usage by the different sectors should be increased (e.g. drip irrigation for agriculture, increasing the storage capacity of existing dams, reducing unnecessary losses).

5. Technical solutions

In the previous chapters suggestions on mitigating periods of water scarcity were given. Most of these measures can be supported by technical solutions such as: increasing the efficiency of the supply network (minimize water losses); optimizing irrigation techniques; restoring floodplain ecosystems for improving water yield; increasing infiltration capacity by increasing the complexity of surface water networks; increasing the efficiency of water use for industrial production; infiltration instead of deviation of surface water or artificial groundwater recharge.

RECOMMENDATIONS
• The storage capacity of dams and drinking water reservoirs should be increased where compatible with ecological aspects.
• The efficiency of existing infrastructure should be enhanced
• Water saving technologies should be prioritized (e.g. drip irrigation for agriculture, reduction of leaks and line losses).

• Plant maintenance and line flushing should be adapted to changing conditions.
• Water treatment (drinking water supply) should be adapted to expected changes in water quality.
• Opportunities for water re-use should be considered and optimized.
• Water supply networks should be extended.

6. Interregional and trans-boundary co-operation to secure water resources

The pressure due to water scarcity on trans-boundary water resources can lead to potential conflicts between users and nation-states sharing the same springs or groundwater basins. Within Europe, agreements for such trans-boundary water management exist for the main river basins of the Danube, the Elbe, the Meuse, the Mosel, the Oder and the Rhine. These agreements clearly also have an impact on the Alps since they are the point of origin of some of these river systems. Apart from these agreements, other initiatives exist that aim at sharing common (trans-boundary or interregional) water resources.

RECOMMENDATIONS
• National legislative hurdles for trans-boundary cooperation should be evaluated and reduced.
• Co-operation activities between countries and within river basins should be intensified.
• Official cooperation agreements for smaller catchments should be established.
• The implementation of trans-boundary water protection zones should be considered.
• Trans-boundary co-operation to perform common studies on the development of water resources should be encouraged.
• Data exchange should be facilitated.
• Planning activities at the river basin scale should be promoted.

Conclusion

The Alp-Water-Scarce consortium concludes that an “Alpine Water Management Committee” consisting of water managers, researchers and representatives of relevant sectors should be established in order to further develop the tools implemented within the Alp-Water-Scarce project to avoid and overcome periods of water scarcity and to target a long-term integrated water resources management strategy in the Alps.

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