



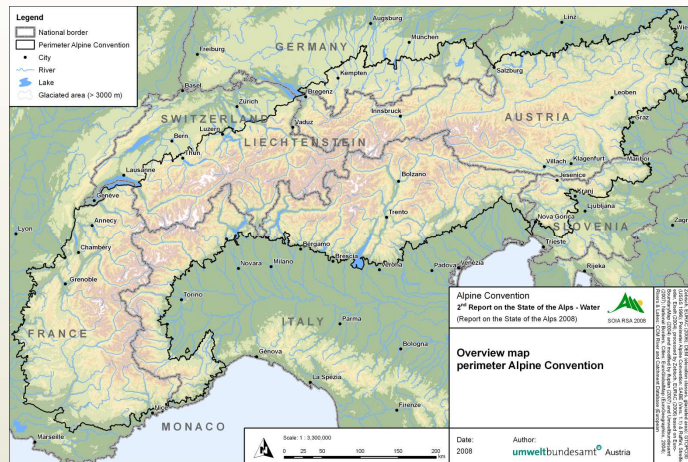
WATER IN THE ALPS: the main challenges for sustainable management

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Water Platform of the Alpine Convention



The Alpine Convention

The Alpine Convention is a multilateral framework treaty signed in 1991 by the 8 states of the Alpine arc (AT, CH, DE, FR, IT, SL, MO, LI) as well as the EU.



Objectives and themes of the Alpine Convention

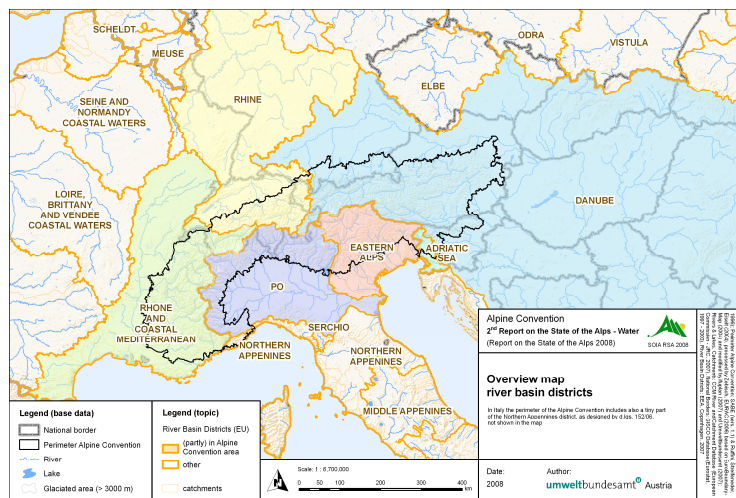
Its main objectives are the sustainable development of the Alpine territory and the safeguarding of the interests of the people living within it.

The Framework Convention has been equipped with a large number of thematic Protocols over the years:

- **Energy** development
- **Tourism**
- **Transport**
- Spatial planning and sustainable development
- Nature conservation and landscape protection
- Soil protection
- Mountain farming

www.alpconv.org

The Alps: water tower of Europe





The Alpine Convention and Water Policy

- Water is listed among the twelve themes in relation to which the Contracting Parties are supposed to [take measures and coordinate their policies](#) (Article 2 of the Framework Convention).
- The Alpine Convention aims at [preserving and re-establishing healthy water systems](#) keeping waters clean and protecting the natural environment.
- This is why aspects of water protection are to be found in all the protocols, despite [a specific protocol on water is not in place](#).
- In the [Multi-annual Working Programme](#) of the Alpine Conference and the [Climate Action Plan](#), [water resources are one of the most important priorities](#).
- The Alpine Conference at Alpbach in November 2006 chose water as the topic for the [Second Report on the State of the Alps](#).
- [Continuous dialogue](#) with science and large public in Innsbruck (2006), Munich (2008), Venice (2010), Munich (2012) and Trento (2014).



Water related elements in the *Energy Protocol*

As a general objective, the production, distribution and use of energy must be made compatible through the adoption of **framework conditions and adequate measures, to the Alpine region's specific tolerance limits**.

The Contracting Parties may, in the framework of their national legislation, examine how they can make end-consumers of Alpine resources pay **market-related prices**, and the extent to which the **local population can be fairly compensated for services** supplied in the general interest.



Water related elements in the *Tourism Protocol*

The protocol on “Tourism” requires measures leading to a sustainable tourism, which preserves the natural environment.

Guidelines, development plans, sectorial plans have to be adopted at the appropriate territorial level in order to enable to assess the impact of tourism development on, inter alia, **water**. This extends also to ski slopes developments.

In particular, **the production of artificial snow** may be authorized only if the location’s hydrological, climatic and ecological conditions allow.



Water related elements in the *Action Plan* “*Climate Change*”

1 – reduce water consumption:

...

2 – improve the use of water:

- a. rationalize the use of water resources, unevenly distributed throughout the year
- b. favor collaborative management between the various uses for water
- c. identify water catchment areas for various uses (in particular for snow-making equipment)

3 – reduce the impact of hydro-electric plants on the environment :

- a. improve the efficiency of existing artificial lakes and electricity plants
- b. decide on common guidelines for the construction of small power stations



Water – key asset of the Alpine Perimeter

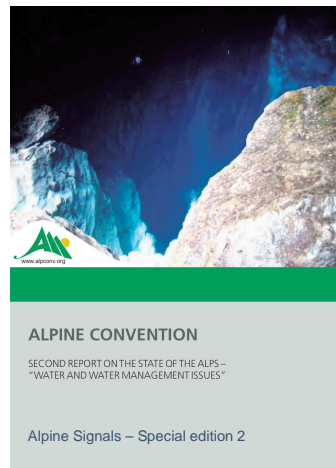
5 International Conferences devoted to Water

- **Innsbruck 2006** – Do we need a water protocol ?
Water as the topic for the *II Report on the State of the Alps*
- **Munich 2008** – Presented the *II Report on the State of the Alps*:
no protocol - need for follow up on hydropower
=> platform „Water Management in the Alps“
- **Venice 2010** – Presented the results of the *Water Platform*:
Common guidelines for the use of small hydropower
- **Munich 2012** – Presented the results of the *Water Platform*:
focus on *hydropeaking* and *sediment transport*
- **Trento 2014** – Adapting mountain river basins to *climate change*



RSA II - Second Report on the State of the Alps

- ❖ Work on report started 2007; draft report was delivered begin September 2008; adopted by ministerial conference in Evian, March 2008
- ❖ Drafted by the Permanent Secretariat of the Alpine Convention in conjunction with an ad-hoc expert group

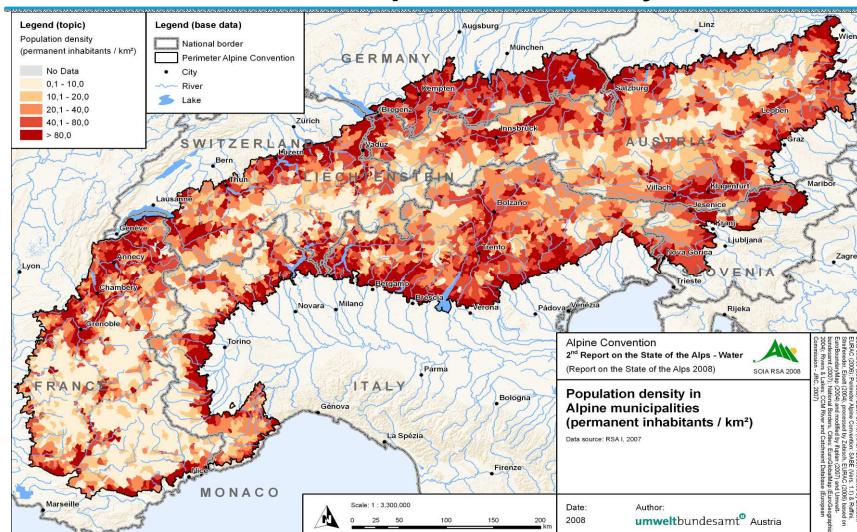


RSA II - Content of the Report

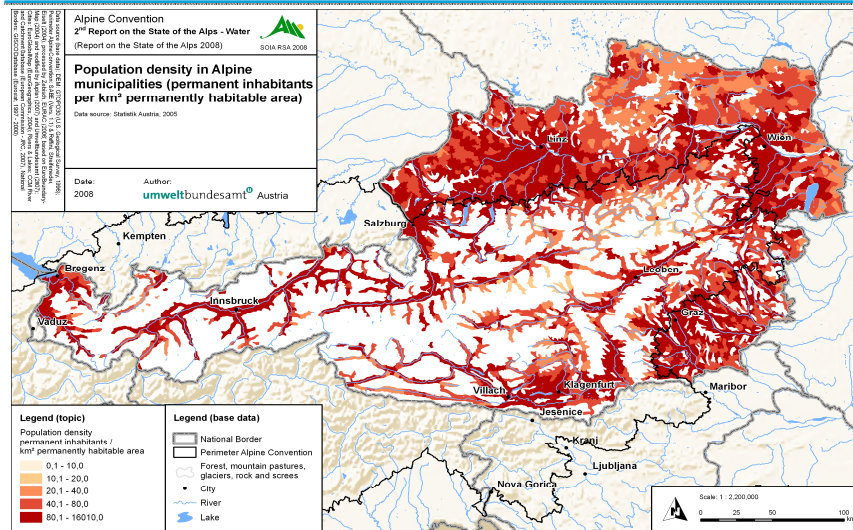
- ✦ **Broad range of issues has been covered** (also based on feedback from observer organisations)
 - Water quality (point and diffuse sources of pollution) and water quantity aspects (droughts and water scarcity, snow guns, ...)
 - Hydro-Morphology (residual water, hydro-peaking, connectivity..)
 - Appraisal of the status of Alpine waters
 - Assessment of legal framework (Protocols, EU legislation, bi- and multilateral agreements)
 - Major Water Management Issues and Main Challenges for the Future

- ✦ **Findings are supported by maps** (e.g. population density; nitrates, hydropower, reservoirs and lakes, ...)

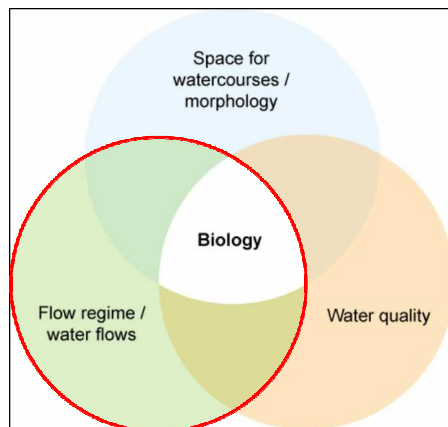
RSA II - Population Density



RSA II - Population Density Austria



Pressure and Impacts



water quantity
(flow regime) constitutes one of the influencing factors determining the **ecological status** of the alpine rivers

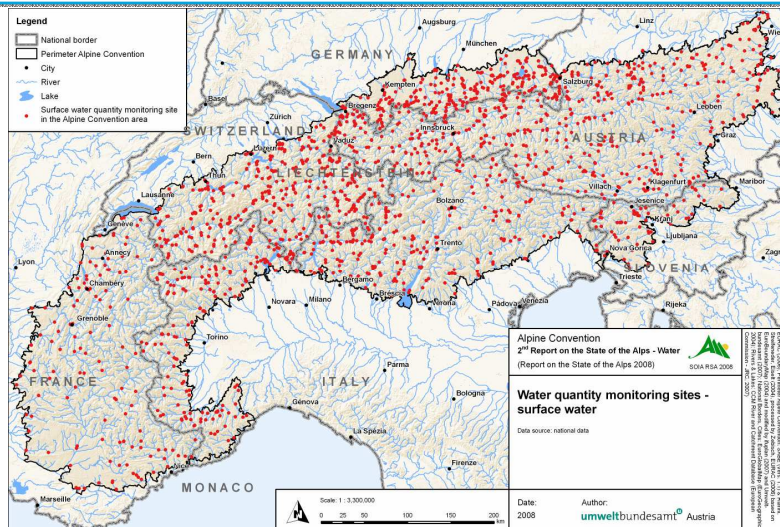
Water quantity monitoring system

Having a set of reliable long-term monitoring data for water quantity is a central necessity for projects, programmes and management questions in the field of key water management issues.

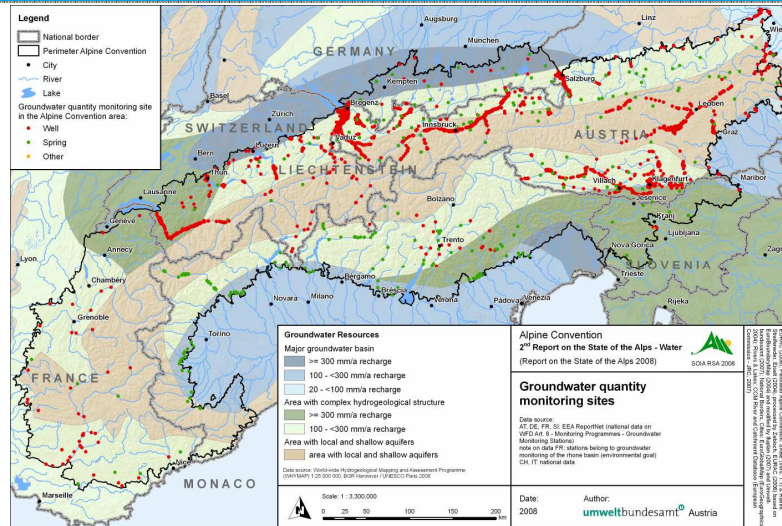
A comprehensive monitoring network, including gauging stations for measurements of precipitation, snow depths, water levels of lakes and groundwater as well as the discharge of rivers, is in place within the alpine perimeter.

The alpine monitoring network, which was recently rearranged and modernised with the implementation of the EU Water Framework Directive for EU Member States but also in Switzerland, is considered to be prepared for future challenges with the provision of continuous and area-wide data series on alpine waters.

Surface water quantity monitoring sites



Groundwater quantity monitoring sites



Alteration of the flow regime

The most prominent phenomena regarding alterations of the flow regime in alpine regions are on one hand **too less residual water** and hence not achieving minimum standards for the *ecological flow* in river stretches, and on the other hand **hydro-peaking** caused by a sudden discharge of water.

The two elements are linked to the abstraction and successional discharge of water back into rivers, **causing anthropogenic alterations of the natural flow regime**.

The term **“ecological flow”** refers to the water remaining in watercourses downstream of water abstraction sites necessary to preserve the various functions served by rivers and streams (e.g. providing habitats for plants and wildlife, forming a landscape element, feeding aquifers or breaking down and diluting pollutants).

Residual water



Sufficient ecological flow is a fundamental element to fulfil the requirements regarding qualitative and quantitative maintenance of the diversity of species and their habitats.

A significant share of alpine river stretches is not in the good ecological status due to not meeting ecological flow requirements.

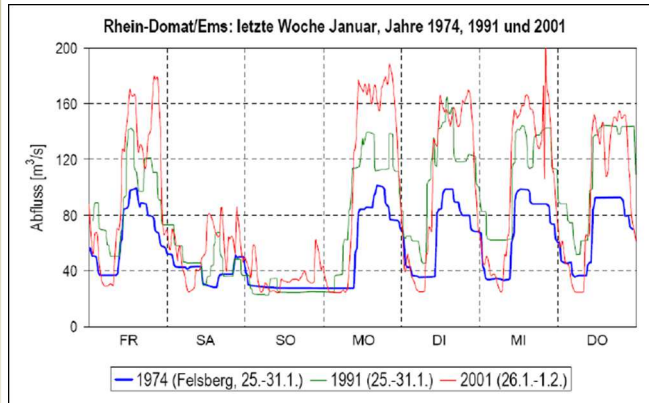
River Massa after the dam "Gebidem" in the Wallis, Switzerland

Hydro-Peaking

Hydro-peaking impacts aquatic ecosystems in various ways: **water levels**, **flow velocity** and **watercourse width** are all altered by these man made events. Hydro-peaking occurs mostly at middle size alpine river systems.



Hydro-Peaking



Weekly hydrographs in January for three distinct years at a gauging station on the Alpenrhein, depicting the typical pattern caused by hydro-peaking

Droughts and Water Scarcity

WATER SCARCITY :

a temporary decrease in water availability due to rainfall deficiency.



DROUGHT :

situation of long-term water imbalance, where water demand exceeds the level of water resources available.



Water scarcity is a human driven phenomenon.



Drought should refer to significant decreases in average levels of natural water availability.

Droughts and Water Scarcity

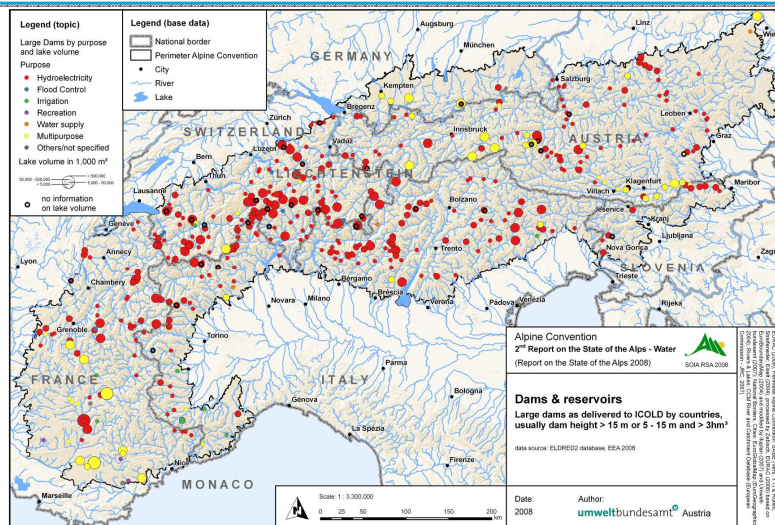
Droughts and water scarcity are problems with relevant socio-economic and environmental impacts in Europe.

Within the Alpine Convention area droughts and water scarcity **are not perceived as a major issue** due to the relatively high precipitation of the whole area, the snow cap and the glaciers contribution. In the past years (2003, 2004, 2007) they were occasionally experienced at locally.

The **economic consequences** of droughts are limited in their extent if only the Alpine area is considered, but they **assume entirely different proportions if the river basin is considered as a whole**.

Water stored in the Alpine reservoirs, and its management, play a considerable part in preventing or mitigating drought effects downstream (**Alps are the water tower of Europe**).

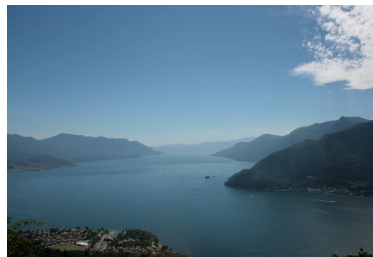
Reservoirs and Regulated Lakes





Reservoirs and Regulated Lakes

- are highly prominent and remarkable landscape elements;
- represent significant water storage and balancing elements providing water in periods when the natural flow conditions would not meet the anthropogenic water demand;
- at a shorter time scale have an function for flood retention;
- secure minimum discharge level for downstream rivers during dry periods (light of climate change);
- can be an important element for leisure and recreational activities.



Highlight - water quantity

Too little **residual flow** downstream of abstraction sites together with **hydro-peaking** is recognized as **a major challenge** for water management in order to achieve the objectives of the legal framework in place (EU WFD and also Swiss legal system).

Permissions for **new facilities** are already taking into account the need for also realizing environmental objectives, but additional measures are required for reducing the negative impacts of **existing facilities** on the freshwater ecology.

Innovative solutions, mitigating adverse ecologic effects of reservoirs (sufficient residual flow, artificial flooding, attenuating basins against hydro-peaking, definition of ecological less valuable areas with stronger exploitation and determination of ecologically very valuable areas without exploitation etc.) are suggested.



Highlight - water quantity

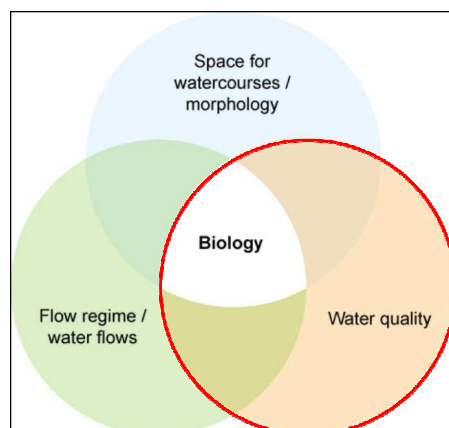
A **step-by-step approach** is considered as an appropriate procedure for necessary investments in the modernisation of facilities.

Procedures focusing on **weighing of interests** are indispensable and should strive for optimized trade-offs, where both economic and ecologic concerns are considered;

To respect lakes role of providing water for the downstream area during dry periods it is important to note that the potential of regulating and topping up runoff for the downstream area is limited due to restricted lake storage capacities and the interests of parties at the shores of the lakes themselves. Thus, expectations from **downstream areas** should be aware of this and regard upstream lakes only as an attenuating factor for satisfying their demands but **strive for solutions at the demand side**.



Pressure and Impacts



water quality constitutes one of the influencing factors determining the **ecological status** of the alpine rivers

Water quality monitoring system

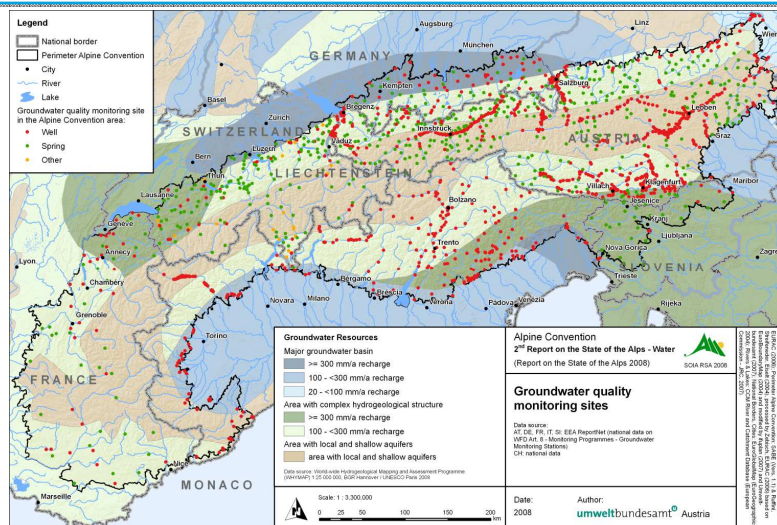
Networks for monitoring water quality is in place all over the Alpine Perimeter; however some countries see some need for improvements (Fr: “inadequate to manage local uses”; It: “more financial resources needed”).

Particular challenge is coverage with sites in higher altitudes (> 1000 m) due to limited accessibility and elevated costs; however it has also to be acknowledged that pressures and impacts are less in higher altitudes.

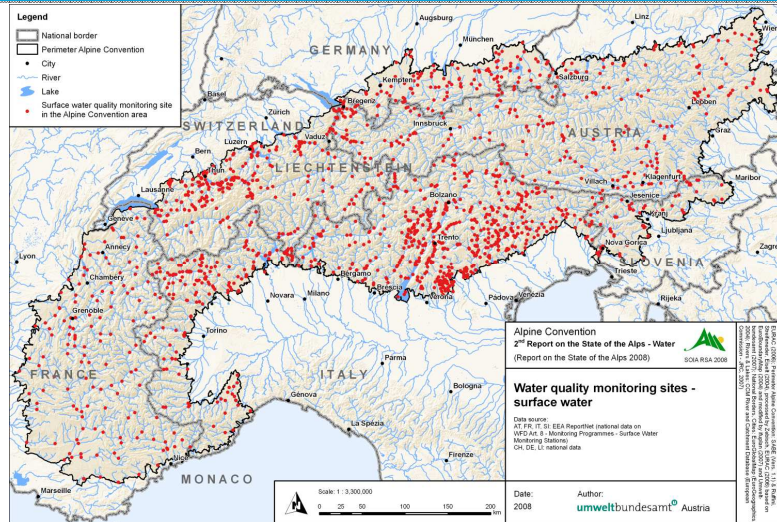
Room for improvement addressed by some countries would justify more thorough assessment of monitoring of water quality in place during second WFD implementation cycle.

Coverage of Alpine Perimeter see subsequent slides

Groundwater quality monitoring sites

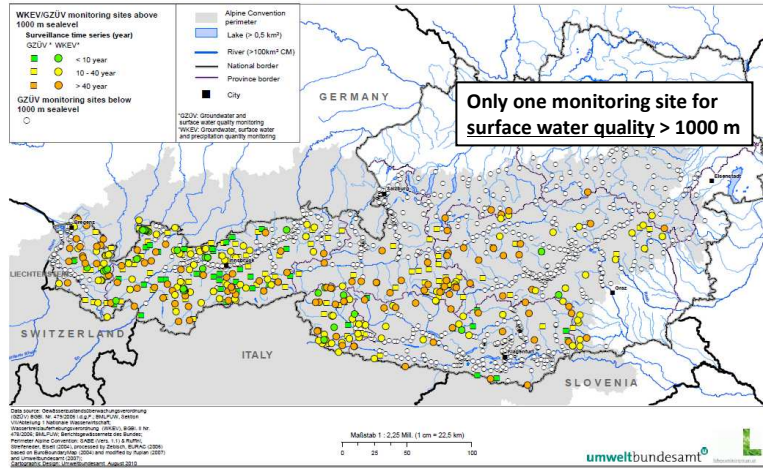


Surface water quality monitoring sites



Monitoring in higher altitudes

Austrian quality and quantity monitoring sites within the Alpine Convention perimeter





Highlight - water quality

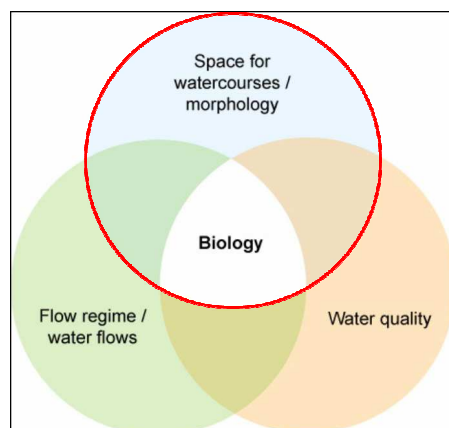
Point-source pollutions: point sources of pollution linked either to local communities or to industrial sites have given rise to important investments in [sewage collection and treatment](#) as required by legislation, in particular the European directives. It is worth mentioning the relative importance of [individual sewage treatment](#) in the Alps, which concerns around 20% of the population.

Diffuse sources of pollution: although the Alps are very sensitive to diffuse pollution, they do not seem to be frequently affected by this type of pollution. The [extensive](#) nature of agriculture explains this situation in part.

Current level of quality of surface water and groundwater: despite their intrinsic sensitivity, [alpine water resources are still in excellent condition](#) in general.



Pressure and Impacts



Hydro-morphology constitutes the most important influencing factors determining the **ecological status** of the alpine rivers.



River morphology

- In the whole Alpine area rivers have been extensively modified during the last 150 years due to **flood protection purposes** and **hydroelectric power generation**.
- Natural watercourses sustained impairment by **longitudinal** and **transverse** construction works even at higher altitudes.
- The **continuity** for fish and other aquatic organisms is strongly compromised today.
- The **reduced transport of sediments** trapped in weirs encourages the erosion of the river bed downstream.



Flood protection works

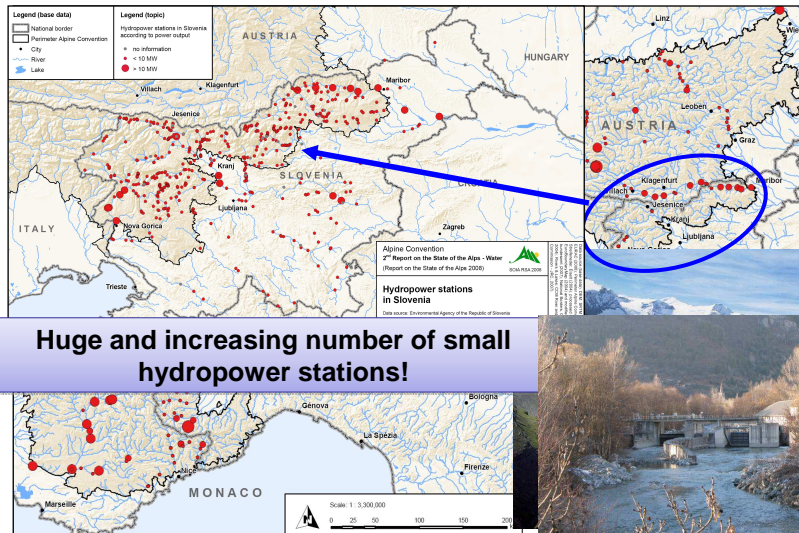


The old Flaz after renaturation



The Alpenrhein at a downstream section

Hydropower Generation



Highlight - hydromorphology

According to **Water Framework Directive**, the important role of river morphology and continuity as an **outstanding factor for the overall ecological status** has been widely recognised.

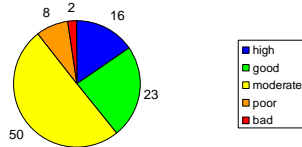
Flood protection measures are coupled, wherever this is possible, with river expansion, the **re-establishment of the continuity of water bodies** and the improvement of protective structures.

One objective, among others, is to grant to the Alpine rivers again **more space** and **more bed load dynamics** to enable river-morphological exchange processes.

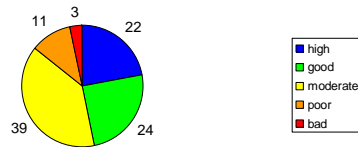
Ecological Status

➤ Status of waters in the Alpine Perimeter is better than outside

ecological status of rivers in terms of overall length [27.715 km] in entire Austria [%]



ecological status of rivers in terms of overall length [19.094 km] in the Austrian alpine perimeter [%]



➤ Main impacts on status due to flood protection and hydropower

Ecological status of surface waters

| Country | River length [km or wb] | High Status [%] | Good Status [%] | Worse than Good status [%] |
|-------------|-------------------------|-----------------|-----------------|----------------------------|
| Austria | 19.094 km | 22 | 24 | 54 |
| France | 12.500 km | 12 | 59 | 29 |
| Germany | 150 water bodies | 1 | 57 | 42 |
| Italy | 557 water bodies | 3 | 74 | 23 |
| Switzerland | not applicable | not applicable | not applicable | not applicable |

Share of water bodies **not in good status** seems to be higher in northern part of the Alps

Heavily modified water bodies (rivers)

| Country | HM wb [%] |
|-------------|----------------|
| Austria | 10 |
| France | 20 |
| Germany | 13 |
| Italy | 6 |
| Switzerland | not applicable |

Share of water bodies designated as **heavily modified** water bodies is quite moderate

Consequences of Climate Change



“Pasterze” with Großglockner (Austria) in 1900 and 2000



Adaptation to Climate Change

Changes forecasted:

- ✧ Further increase of risk due to natural hazards
- ✧ Increased occurrence of water scarcity and droughts
- ✧ Enhanced demand for water and energy; in summer as well as in winter
- ✧ Changes in overall water regime and availability of water due to reduced discharges from glaciers and snow cover with consequences on water supply, hydro power generation....



Main challenges

- ✧ **Issues with varying relevance according to local and regional conditions** (e.g. water quality, local water availability, artificial snow production) and
- ✧ **Major Water Management Issues**
 - Integrated Risk Management / Natural Hazards
 - Adaptation to Climate Change
 - Hydro-Morphological Alterations
 - Hydropower Generation
 - New projects: Increasing pressure in all countries for further exploitation of remaining potential
 - Installations in place: Mitigation of impacts



Way forward

By way of conclusion the following can be recommended

- ✧ To ensure the **proper implementation** and reinforce implementation means of **existing legislation**
- ✧ To follow up the implementation of the **EU WFD** with the focus on **hydromorphology**
- ✧ To assess developments in the **hydro power sector**
- ✧ To quantify in more detail effects of **climate change**
- ✧ Enhance **cooperation** with the scientific community



Thank you!

