Umweltbundesamt

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Reports

R-156

Establishment of Environmental Indicators, Subtopic Water

For the Alpine Region within the Framework of the Alpine Observatory

Wien, 1998

Bundesministerium für Umwelt, Jugend und Familie

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THIS REPORT WAS ELABORATED AS A PROPOSAL TO THE ALPINE OBSERVATORY (JRC – ISPRA) UNDER THE EUROPEAN COMMISSION CONTRACT No. 13158-97-08 F1EI ISP A.

Impressum

Medieninhaber und Herausgeber: Umweltbundesamt, Spittelauer Lände 5, A-1090 Wien

Druck: Riegelnik, 1080 Wien

ISBN 3-85457-478-9

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Acronyms

Cond. = Electric Conductivity
ETC/IW = European Topic Centre on Inland Waters
NUTS = „Nomenclature des Unités Territoriales Statistiques“ (see Tab. 1)
SC-Table: Statistical compendium for the Dobris Assessment (EUROSTAT, 1995)
WMO = World Meteorological Organisation

Fig. I: Proposed Environmental Indicators in the hydrocycle (see following page)

Summary

On behalf of the European Commission (JRC – Ispra) a set of 19 environmental indicators was suggested to monitor the environmental status of water within the framework of the Alpine Observatory. The indicators were grouped according to a Pressure - State - Response (PSR) concept and range from precipitation and water abstraction to waste water treatment. For practical reasons parameters were selected which in most states have already been measured for years in all sorts of water environments and which are comparable to the environmental indicators suggested by the European Environment Agency and the UN Commission on Sustainable Development. Isolated information on the environment may be difficult to evaluate, therefore, it is important to be able to compare the situation and development in various countries with specific Alpine conditions.

Zusammenfassung

Im Auftrag der Europäischen Kommission (JRC – Ispra) wurden 19 potentielle Umweltindikatoren zusammengestellt, um die Umweltsituation des Wassers in einheitlicher Form im Rahmen der Alpenkonvention (Alpenobservatoriums im Europäischen Forschungszentrum Ispra) anzuzeigen. Die potentiellen Indikatoren wurden nach dem „Pressure - State – Response” (PSR, Beeinflussung – Status – Reaktion) Konzept gruppiert und reichen vom Niederschlag und der Wasserentnahme bis zur Abwasserreinigung. Aus pragmatischen Gründen wurden Parameter gewählt, die meist schon seit Jahren in den verschiedensten Umweltbereichen gemessen wurden und weitgehend vergleichbar sind mit den Indikatoren, die von der Europäischen Umweltagentur und der UN – Kommission für nachhaltige Entwicklung bereits vorgeschlagen wurden. Da sich die regionale Umweltsituation durch isolierte und nicht vergleichbare Informationen schwer bewerten läßt, ist es um so wichtiger, die Situation und Entwicklung in verschiedensten Ländern mit deren spezifisch alpinen Bedingungen grenzüberschreitend zu vergleichen.

Introduction

„Environmental Indicators“

Ideally, environmental indicators measure the „integrity“, stability and sustainability of the biological and physical environment and in particular those aspects that, like miners canaries, can warn of impeding rapid changes.

A physician assesses human health by monitoring a patient’s vital signs using a standard set of indicators - blood pressure, cholesterol levels and so forth (BERGER, 1997). In order to assess the „health of the environment“ a profound knowledge and a certain database of parameters measured in the past and present is essential to set up standards of “good health“.

For practical reasons parameters were selected which in most states have already been measured for years in all sorts of water environments. In this context the first proposed concept of an indicator set must be characterised from a scientific perspective as preliminary and „quick and dirty“ (VERBRUGGEN & KUIK, 1991). Specialists working in the different fields related to waters will in a further step make refinements and adjustments for the Alpine environment in order to obtain the most sensitive indicators that reflect how far ecological functions are attacked by environmental pressures.

Isolated assessment is problematic

Isolated information on the environment may be difficult to evaluate. Since it is important to be able to compare the situation and development in various countries indicators were selected which are in a broad sense comparable to the environmental indicators suggested by the EUROPEAN ENVIRONMENT AGENCY (1996) and the UN COMMISSION ON SUSTAINABLE DEVELOPMENT (1996). Some of them had to be adapted to the special conditions prevailing in the Alpine environment.

In this report it was agreed on a general definition of environmental indicators based on the definition given by the State of the Environment in Norway 1997 (BJORKE, 1997):

Environmental indicators

An environmental indicator is meant to indicate the state or development of important aspects of the natural environment, what causes these changes and how society responds to them.

Pressure - State - Response

This report is predominantly based on a cause- and effect chain according to a Pressure - State - Response (PSR) concept.

Pressure: Human activities put pressure on the environment in different ways, e.g. through emissions of SO_2 and NO_x.

State: The pressure is reflected in an altered quality and quantity of the natural resources, e.g. increased acidity in freshwater.

Response: Society responds to limit these alterations or tries to repair damages on the environment. e.g. liming.

Objectives

The goal of this work within the framework of the Alpine Observatory is to establish a set of environmental indicators for the topic water. These indicators should be adequate to analyse the state of the environment and its evolution in a region. Indicators for the major groups nature and nature protection, forest and air will be established separately.

The objective according to the working plan is to develop a specification for each individual indicator according to which necessary data will be provided by the participating countries and statistically processed by the Joint Research Centre (JRC-Ispra). Obtained data will then be evaluated to assess the situation relevant to the topic in the Alpine region.

A further aim is to combine the major groups of environmental indicators and to see them in combination with a set of socio-demographic indicators obtained within the framework of the pilot activity for the Alpine Observatory as well as the set of socio-economic indicators to be elaborated during the current work program.

Final goals

1. Identification of a final list of indicators to be elaborated during the first operational phase of the Alpine Information and Observation System (AIOS) useful to describe the situation related to water availability and water quality in the Alps.
2. Development of a specification of each indicator, which will be the basis for the provision of data by the participating countries.

It will detail the following points:

- *a short definition of the indicator*
- *the probable information source*
- *the geographic level for which the data is to be provided and the geographical area*
- *the time frame*
- *the unit*
- *the statistical formula/method used for the calculation of the indicator*
- *possible intermediate elements needed*

Table 1: Correspondence between NUTS[1] levels and the national administrative units[1] (source: KUKAR, 1997).

	NUTS 1		NUTS 2		NUTS 3		NUTS 4		NUTS 5	
Germany	Länder	16	Regierungsbezirke	38	Kreise	445			Gemeinden	16.176
-A. terr.		1		2		14				283
France	Z.E.A.T.	8	Régions	22	Départments	96			Communes	36.664
-A. terr.		2		2		10				1.750
Italy	Gruppi di regioni	11	Regioni	20	Provincie	103			Communi	8.100
-A. terr,		3		7		21				1.764
Austria	Gruppen von Bundesländern	3	Bundesländer	9	Gruppen von politischen Bezirken	35			Gemeinden	2.351
- A. terr.		3		8		29				1.135
Slovenia		1		1	Statistiène regije	12			Obèine	147
-A. terr.						7				41
Switzerland		1		1	Canton	26				
- A. terr.						15				967
Liechtenstein		1		1		1				11
- A. terr,										11
Monaco		1		1		1				1
- A. terr,										1
Europe 15		77		206		1031				98.433
AT		13		23		98				5.952

[1] NUTS=“ Nomenclature des Unités Territoriales Statistiques“

Indicator No.: 1.1	**Section:** Water
Indicator: Surface Water Abstraction	
Description: This indicator shows the uses and requirements for surface water. Variations in this indicator with regard to areas and time depend on climate, population, economic development and the economic and institutional capacity to manage water resources and demand. • Trends in surface water abstraction (1980-1995) should be illustrated. • Trends (1980 & latest year available) in surface water abstraction by major uses should be presented.	
Type of Indicator: Pressure	
Update of: SC-Table 5.1: Water resources SC-Table 5.2: Inland water abstractions SC-Table 5.3: Water supply by category of final user.	
• **Data Source:** OECD/Eurostat collects information on water abstraction every 2nd year from the OECD countries.	
Short Definition: Water abstractions[1]: refer to annual water withdrawal as taken from (fresh) surface water[2] sources and conveyed to the place of use. If water is returned to a surface water source, abstraction of the same water by downstream users is counted again compiling total withdrawal. Major use categories: 1.1.1 Surface Water Abstraction by Private Consumption 1.1.2 Surface Water Abstraction by Agriculture 1.1.3 Surface Water Abstraction by Industry (excluding cooling water) 1.1.4 Surface Water Abstraction for Cooling Purposes (energy production etc.)	
Comments: OECD remarks, it should be born in mind that definitions may vary considerably. Where available abstractions should be given as percentage of the total surface freshwater resource. This indicator has several important limitations, most of them related to the computation of *available water.* Accurate and complete data are scarce. In addition, seasonal variation in water availability is not reflected.	
Geographical Level: NUTS 2 (Tab. 1) or river basin	**Detailed Geographical Level:** NUTS 2 (Tab. 1)
Time Series: Water abstraction: 1980, 1985, 1990 & 1995	**Unit:** abstraction in million m^3 and abstraction in litre per capita per day
Possible Presentation: Water abstraction: Trend graph Major uses: Bar chart (1980 & early 1990)	**Aggregation Problems:** Problems of aggregating the major uses (percentage per country) to European estimates. Some countries (e. g. Switzerland) may not have statistical data differentiating abstraction according to the categories mentioned above.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Statistical Offices	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

[1]" Water abstractions (or water withdrawal)": water removed from any source, either permanently or temporarily. Mine water and drainage water are included (based on UN-ECE) (OECD 1996)
[2]"surface water" means surface freshwater, estuaries and coastal waters (EUROPEAN UNION, 1997a)

Literature:

EUROPEAN ENVIRONMENT AGENCY (1996)
EUROSTAT (1997)
EUROPEAN UNION (1997a)
OECD (1996)

Examples for data presentation:

Total water abstraction by economic sectors in 5 European countries

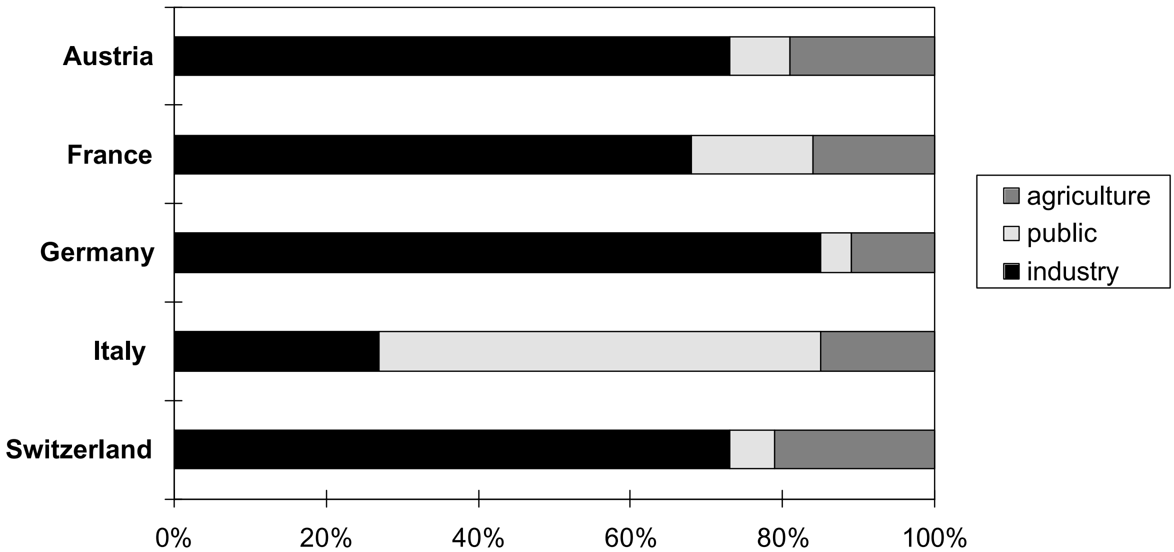


Fig. 1.1.A: Trends in total water abstraction in 5 European countries (source: EUROPEAN ENVIRONMENT AGENCY, 1995; p. 63 modified).

Trends in total water abstraction in 5 European countries

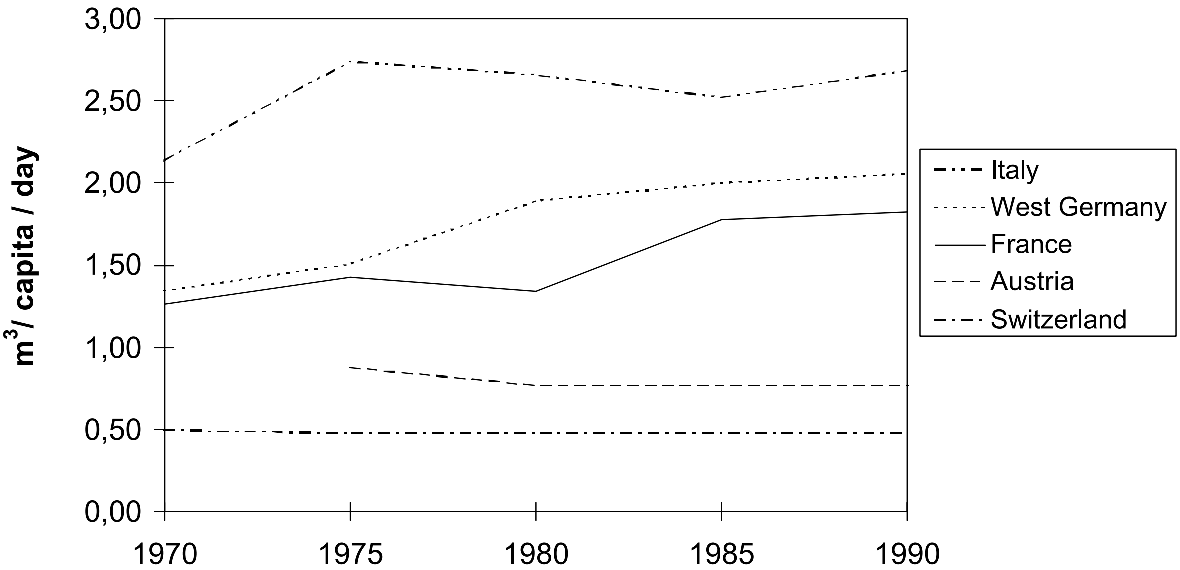


Fig 1.1.B: Total water abstraction (surface and groundwater) by economic sectors in 5 European countries (source: EUROPEAN ENVIRONMENT AGENCY, 1995; p. 64 modified).

Indicator No.: 1.2	**Section:** Water
Indicator: **Groundwater Abstraction**	
Description: This indicator shows uses and requirements of groundwater. Variations in this indicator with regard to areas and time depend on climate, population, economic development and the economic and institutional capacity to manage water resources and demand. • Trends in total groundwater abstraction (1980-1995) should be illustrated. • Trends (1980 & latest year available) in groundwater abstraction by major uses should be presented.	
Type of Indicator: Pressure	
Update of: SC-Table 5.1: Water resources SC-Table 5.2: Inland water abstractions SC-Table 5.3: Water supply by category of final user.	
• **Data Source:** OECD/Eurostat collects information on water abstraction every 2nd year from the OECD countries.	
Short Definition: Water abstractions[1]: refer to annual water withdrawal as taken from groundwater[2] sources and conveyed to the place of use. According to the Eurostat methodology the abstraction of water corresponds to water extracted from any groundwater source on a permanent or temporary basis. Pumped and drained water is included. The quantities of water artificially poured or injected into the aquifer are considered as abstractions irrespective of the water source from which they are taken. Major use categories: 1.2.1 Groundwater Abstraction by Private Consumption 1.2.2 Groundwater Abstraction by Agriculture 1.2.3 Groundwater Abstraction by Industry (excluding cooling water) 1.2.4 Groundwater Abstraction for Cooling Purposes (energy production etc.)	
Comments: OECD remarks, it should be born in mind that definitions may vary considerably. Where available abstractions should be given as percentage of the total groundwater resource. This indicator has several important limitations, most of them related to the computation of *available water.* Accurate and complete data are scarce. Due to technical and scientific problems in order to give sound estimates about the volume of water stored in the groundwater, the water abstracted should be expressed as a percentage of the long-term average of annual groundwater recharge. In addition, seasonal variation in water availability is not reflected.	
Geographical Level: NUTS 2 (Tab. 1) or river basin	**Detailed Geographical Level:** NUTS 2 (Tab. 1)
Time Series: Water abstraction: 1980, 1985, 1990 & 1995	**Unit:** abstraction in million m^3 and abstraction in litre per capita per day.
Possible Presentation: Water abstraction: Trend graph Major uses: Bar chart (1980 & early 1990)	**Aggregation Problems:** Problems of aggregating the major uses (percentage per country) to European estimates. Some countries (e. g. Switzerland) may not have statistical data differentiating abstraction according to the categories mentioned above.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Statistical Offices	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

[1]" Water abstractions (or water withdrawal)": water removed from any source, either permanently or temporarily. Mine water and drainage water are included. Water abstraction from groundwater resources in any given time period are defined as the difference between the total amount of water withdrawn from the aquifer and the total amount charged artificially and injected into aquifers. The amounts of water artificially charged or injected are attributed to abstraction from that water resource from which they were originally withdrawn. (based on UN-ECE) (OECD 1996)
[2]"Groundwater" means all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil (EUROPEAN UNION, 1997a)

Literature:

EUROPEAN ENVIRONMENT AGENCY (1996)
EUROPEAN UNION (1997a)
OECD (1996)

Example for data presentation: See Fig. 1.1.A and Fig. 1.1.B.

Indicator No.: 1.3	**Section:** Water
Indicator: Irrigated Land	
Description: • Trends in the percentage of land irrigated for agricultural purposes will be presented.	
Type of Indicator: Pressure	
Update of: SC - Table 22.5: Total irrigated area and irrigated area as proportion of agricultural land. Source: FAO	
Data Source: FAO's Agriculture Statistics Data Base (http://www.fao.org/WAICENT/Agricul.htm) contains time-series data (starting 1961) for over 210 countries and 1500 items on the production and trade of primary and derived crops and livestock products, agricultural machinery, irrigation, fertiliser, pesticides and insecticides (trade only), land use and population. Data contained in this database may be used freely, provided that the Food and Agriculture Organisation of the United Nations (FAO) is cited as the source. ETC/IW will supplement data from its own network The OECD compendium contains Table 11.2: Irrigated area, 1980-1993 with relevant information.	
Short Definition: Percentage of the total agricultural land irrigated with surface (river or lakes) or groundwater (wells or springs) (FAO, 1997).	
Comments: The focus is on trends. However, an alternative source could be the Corine Land-cover dataset. In some areas (e. g. South Tyrol) irrigation is an important factor. In other areas (e.g. Bavaria) hardly any irrigation exists.	
Geographical Level: NUTS 2 (Tab. 1) or river basin	**Detailed Geographical Level:** NUTS 2 (Tab. 1)
Time Series: 1980-1995 (at present, the FAO database is updated until 1995)	**Unit:** Percentage of irrigated area of the total agricultural area
Possible Presentation: Trend graph: percentage of irrigated area	**Aggregation Problems:** Good statistical data may not be available. In many cases just estimates are available.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Statistical Offices	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

Literature:

EUROPEAN ENVIRONMENT AGENCY (1996)
FAO (1997)

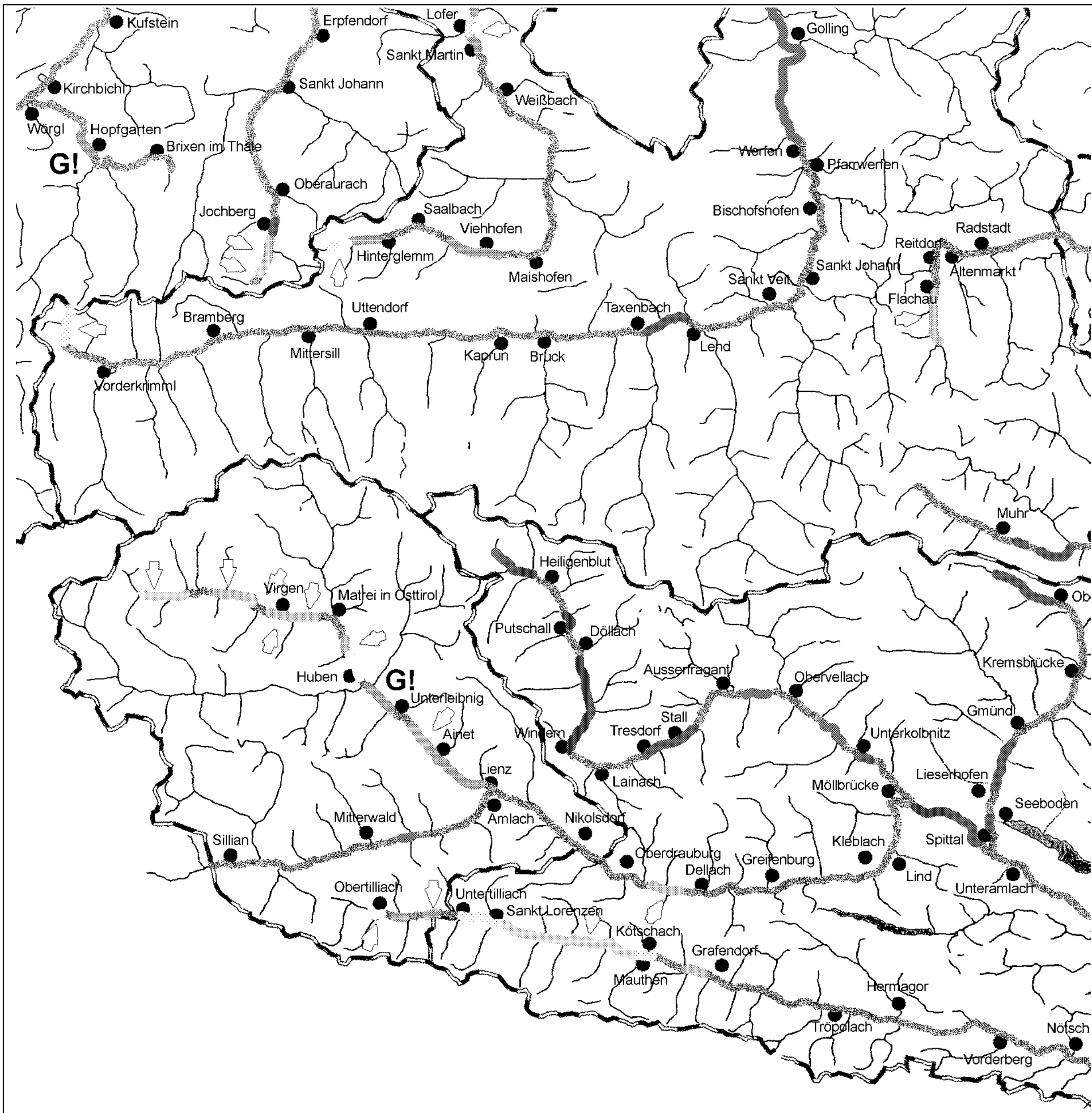
<table>
<tr><td>Indicator No.: 1.4</td><td>Section: Water</td></tr>
<tr><td colspan="2">Indicator: Ecomorphological Structure of Rivers</td></tr>
<tr><td colspan="2">• Description: Identification of river stretches which have remained in a relatively natural state. Evaluation with regard to rivertype-specific morphological and hydrological aspects. ''Natural'' refers to conditions either known to exist or assumed to exist prior to the first systematic channel regulations.</td></tr>
<tr><td colspan="2">Type of Indicator: Pressure</td></tr>
<tr><td colspan="2">Update of: this indicator has to be established</td></tr>
<tr><td colspan="2">Data Source:</td></tr>
<tr><td colspan="2">Short Definition: MUHAR et al. (1996)
Category A
River stretches which conform to rivertype-specific natural conditions in terms of morphology, riverbed dynamics and riparian conditions; with no direct influence on the discharge regime through impoundment, abstraction or hydropower pulse releases.
Category B
River stretches which do not fully conform to rivertype-specific natural conditions in terms of morphology, riverbed dynamics and riparian conditions (e.g. because of centuries of landuse) but which have nevertheless retained their overall character as they were not altered by systematic river engineering or hydropower development.
Potential category A or B
River stretches whose discharge is anthropogenically affected (water abstraction, pulse releases) but whose morphology was altered very little.
Reference
River stretch representing rivertype-specific natural conditions or at least essential elements thereof.
MUHAR et al. (1996)</td></tr>
<tr><td colspan="2">Comments: Due to different evaluation schemes in different countries the information is not fully comparable. For rivers included in the evaluation which do not belong to the categories A or B anthropogenic influences such as water abstraction, damming and pulse release should be marked due to their hydrological and ecological impacts.</td></tr>
<tr><td>Geographical Level: NUTS 2 (Tab. 1) or river basin</td><td>Detailed Geographical Level: NUTS 2 (Tab. 1)</td></tr>
<tr><td>Time Series:</td><td>Unit: Percentage of the single categories of river stretches of all rivers included in the assessment</td></tr>
<tr><td>Possible Presentation: Maps
Trend graph: percentage of categories</td><td>Aggregation Problems: In addition to the different evaluation schemes in most countries only limited data are available at the present stage. Discussion about the Ecological Quality for Surface Water is in progress (EUROPEAN UNION 1996).</td></tr>
<tr><td>Target/Projection/Scenario:</td><td>Intermediate Elements needed:</td></tr>
<tr><td>Data Compilation: National Research Institutes</td><td>Contact:</td></tr>
<tr><td colspan="2">Needed Actions:</td></tr>
</table>

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, F. Trocherie, C. Ottavi, M. Zupan

<u>Literature:</u>

MUHAR et al. (1996)
MUHAR et al. (1998)

EUROPEAN UNION (1996)



Rivers included in the investigation

Stretches placed in category A
River stretches which conform to rivertype-specific natural conditions in terms of morphology, riverbed dynamics and riparian conditions, with no direct influence on the discharge regime through impoundment, water abstraction or hydropower pulse releases.

Stretches placed in category B
River stretches which do not fully conform to rivertype-specific natural conditions in terms of morphology, riverbed dynamics and riparian conditions (e.g. because of centuries of landuse) but which have nevertheless retained their overall character as they were not altered by systematic river engineering or hydropower development.

Potential stretches of category A or B
River stretches whose discharge is anthropogenically affected (water abstraction, pulse releases) but whose morphology was altered very little.

Reference
River stretch representing rivertype-specific natural conditions or at least essential elements thereof.

G! **River stretch of category A or B with water quality > II**

Fig. 1.4: Ecomorphological classification river stretches in the Austrian Alps based on rivertype-specific morphological and hydrological criteria (source: MUHAR et al 1998; map modified).

Indicator No.: 2.1	**Section:** Water
Indicator: Change of Precipitation	
Description: Precipitation is one of the most important meteorological and climatological indicators for our ecosystems and civilisation. In particular this is the case in mountainous regions, where ambient moisture is extracted from the atmosphere by various orographic precipitation mechanisms. • Average daily precipitation at European measurement stations in 1995 compared to one or two reference years (for example 1980 and 1950, all based on climatological 20 years periods; 1971-1990)	
Type of Indicator: State	
Update of: This indicator has not been established for the Alpine area, yet.	
Data Source: National Meteorological Institutions, which are connected through the WMO.	
Short Definition: This indicator is based on an extensive dataset of rain-gauge observations from the operational high-resolution networks of all Alpine countries.	
Comments: No corrections are made of the systematic measurement bias of the rain-gauge measurements. Underestimates may be large in case of strong winds and in winter. In addition, inhomogeneities in station ensembles and time series must be carefully alleviated. Maps and trends of precipitation in the summer and winter half year should be presented separately due to its different implications for vegetation and hydrology.	
Geographical Level: NUTS 3 (Tab. 1) or river basin	**Detailed Geographical Level:** Monitoring site or regular grid (e. g. 25x25 km)
Time Series: 1950, 1980, 1995	**Unit:** Precipitation in mm per day
Possible Presentation: Maps of changing precipitation	**Aggregation Problems:** Spatial analysis of rain-gauge observations onto a regular grid, e.g. the modified version of the SYMAP algorithm (FREI & SCHÄR, 1997a). Use can be made of high station coverage while still providing a coarser resolution analysis for areas with sparser coverage.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Meteorological Institutes	**Contact:** National Meteorological Institutes
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

<u>Literature:</u>

EUROPEAN ENVIRONMENT AGENCY (1996)
FREI (1997)
FREI & SCHÄR (1997a)

Examples for data presentation:

'Mean annual precipitation in the Alps for the period 1971-1990' [mm per day]

Fig. 2.1: Mean annual precipitation in the Alps for the period 1971-1990' The thick line represents the 800 mMSL; FREI (1997):. http://map.ethz.ch/rr_clim/ (9. Oct. 1997); FREI & SCHÄR (1997a)

Indicator No.: 2.2	**Section:** Water
Indicator: Duration and Thickness of Snow Cover	
Description: • Yearly sum of the depth of fresh snow and number of days with snow cover (> 1cm; more than 50% of the area covered) at European measurement stations in 1995 compared to one or two reference years (for example 1980 and 1950, all based on climatological 20 or 30 years periods).	
Type of Indicator: State	
Revised by: This indicator has not been established, yet.	
Data Source: National Meteorological Institutions, which are connected through the WMO	
Short Definition: Annual sum of fresh snow and number of days with snow cover of at least 1 cm	
Comments: There are great difficulties in obtaining certain homogeneous series of snow data.	
Geographical Coverage: NUTS 3 (Tab. 1) or river basin	**Detailed Geographical Level:** Monitoring sites
Time Frame: 1950, 1980, 1995	**Unit:** Thickness in [cm] and duration of snow cover (> 1cm; more than 50% of the area covered) in days
Possible Presentation: Time series with map illustrating the monitoring sites.	**Aggregation Problems:**
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Meteorological Institutes	**Contact:** National Meteorological Institutes
Actions required:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

<u>Literature:</u>

MOHNL (1991)

Indicator No.: 2.3	**Section:** Water
Indicator: **Change of Glaciers**	
Description: Trends in the change of length of glaciers should be illustrated.	
Type of Indicator: State	
Update of:.	
Data Source: World Glacier Monitoring Service (WGMS)/ ETH Zürich	
Short Definition: Annual measurements should be carried out at the glacier monitoring sites. Changes in the length of glaciers should be presented as average of the glaciers of a predefined area (geographical levels as can be seen below).	
Comments: • Changes of length may occur with delay to the climate signal which caused them. • Also glacier mass balances are a good indicator. They illustrate the ratio between mass growth (snowfall etc.) and decrease (melting etc.) of a glacier. Data from monitored glaciers can be extrapolated for monitoring units and higher geographical units. At present mass balances are set up at selected glaciers only.	
Geographical Level: NUTS 3 (Tab. 1)	**Detailed Geographical Level:** Monitoring units
Time Series: 1980, 1985, 1990 &1995	**Unit:** Change of length in m
Possible Presentation: Trend graphs	**Aggregation Problems:**
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National institutions, World Glacier Monitoring Service	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

<u>Literature:</u>

Glacier Mass Balance Bulletin, IAHS (ICSI) - UNEP - UNESCO
PATZELT (1996)
PSFG (1985)

Example for data presentation:

Mean change of length of the glaciers under observation in Austria

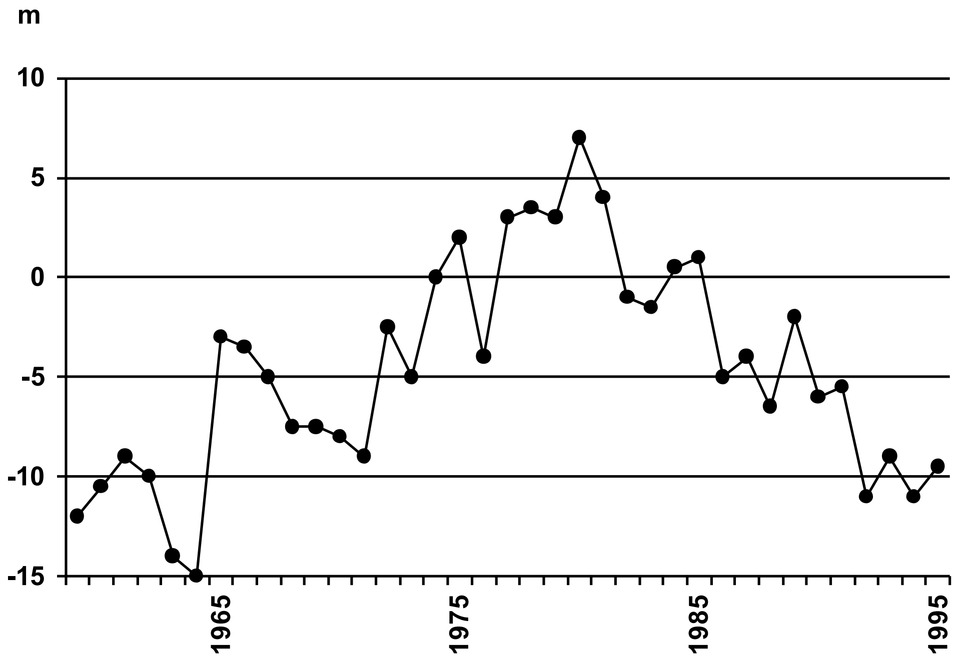


Fig. 2.3: Mean change of length of the glaciers under observation in Austria (source: PATZELT (1996), Fig.2 above modified).

Indicator No.: 2.4	**Section:** Water
Indicator: Frequency of „Heavy Precipitation“	
Description: • Frequency of days for which the daily total exceeds the threshold 20mm. Valid for the 20 years reference 1971-1990. Frequencies determined individually for the time series. Frequency given in % of days.	
Type of Indicator: State	
Update of: This indicator has not been established, yet.	
Data Source: National Meteorological Institutions, which are connected through the WMO	
Short Definition: Frequency of days for which the daily total exceeds the threshold 20 mm. Valid for the 20 years reference 1971-1990. (FREI 1997)	
Comments: Forms a crucial element of erosion.	
Geographical Level: NUTS 3 (Tab. 1) or river basin	**Detailed Geographical Level:** Monitoring site
Time Series:1985-1995	**Unit:** % of days for which the daily total exceeds the threshold 20 mm
Possible Presentation: Maps of changing precipitation	**Aggregation Problems:** Spatial analysis of rain-gauge observations onto a regular grid, e.g. the modified version of the SYMAP algorithm (FREI & SCHÄR, 1997a). Use can be made of high station coverage while still providing a coarser resolution analysis for areas with sparser coverage.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Meteorological Institutes	**Contact:** National Meteorological Institutes
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

<u>Literature:</u>

AUER & BÖHM (1996)
FREI (1997)
FREI & SCHÄR (1997b)

Examples for data presentation:

'Mean annual frequency of days with a daily total precipitation larger than 20 mm in the Alps for the period 1971-1990' [frequency given in % of days]

Fig. 2.4: Mean annual frequency of days with a daily total precipitation larger than 20 mm in the Alps for the period 1971-1990. The thick line represents the 800 mMSL; FREI C. (1997):. http://map.ethz.ch/rr_clim/ (9. Oct. 1997)

Indicator No.: 2.5	**Section:** Water
Indicator: Precipitation Quality	
Description: • Trends in pH, SO4 and NO3 of precipitation should be illustrated	
Type of Indicator: State	
Update of: No information has been presented in previous reports.	
Data Source: NILU (EMEP-CCC: Co-operative Programme for Monitoring and Evaluation of the long Range Transmission of Air Pollutants in Europe)	
Short Definition: 2.5.1 Physical parameters (Cond., pH) 2.5.2 Major ions (Cl, SO4, Ca, Mg) 2.5.3 Nitrogen (NO3, NO2, NH4) 2.5.4 Phosphorus (total, PO4) 2.5.5 Organic pollution indicators (DOC, TOC) 2.5.6 Pesticides (5 most frequent ones) 2.5.7 Heavy metals (Cd, Pb etc.)	
Comments: The wet only deposition without the important contribution of fog droplets and dry deposition is only a portion of the total deposition. However, as the latter can influence the quality of water considerably, these data should be included where available (BUWAL 1997). State how many pesticides are analysed and which are the 5 most frequent ones.	
Geographical Level: NUTS 3 (Tab. 1) or river basin	**Detailed Geographical Level:** Monitoring site
Time Series: 1980-1995	**Unit:** µS/cm (25°C), pH-units, mg/l, µg/l
Possible Presentation: Trend graphs	**Aggregation Problems:** Analytical data collected by different countries may not be fully comparable because of differing standard procedures. Due to the insufficient density of monitoring sites quality data cannot be extrapolated.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Institutions	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

<u>Literature:</u>

BUWAL (1997)
EUROPEAN ENVIRONMENT AGENCY (1996)

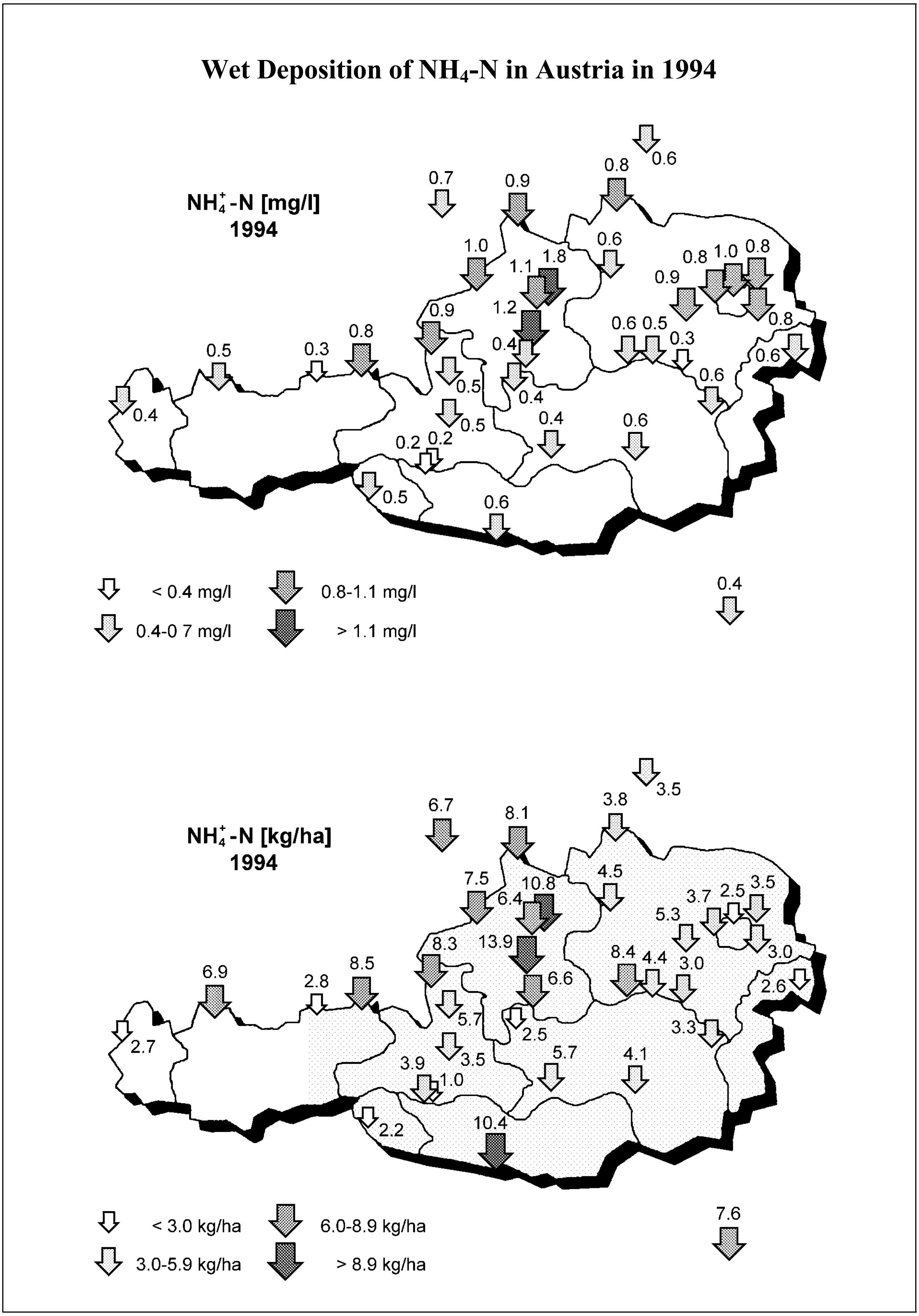


Fig. 2.5: Wet deposition of NH_4-N (mg/l and kg/ha) in Austria in 1994 (source: KALINA & PUXBAUM, 1996; p.12 modified).

Indicator No.: 2.6	**Section:** Water
Indicator: Lake Acidification	
Description: Surface water acidification can be expected in areas where acidic deposition is high and the soil and bed rock in the catchment area is poor in carbonates and other easily weatherable minerals. Small high altitude lakes and streams are generally effected more severely than larger low-land surface waters. Indicates the effects of acidification on the surface waters on an international scale. • Maps presenting an overview of the state of surface acidification in the Alps • Trends in surface water acidification will be described	
Type of Indicator: State	
Update of: EUROPEAN ENVIRONMENT AGENCY (1995) - Map 5.22: Areas of Europe where surface water acidification has been observed.	
Data Source: The Norwegian Institute of Water Research (NIVA, partner in the ETC/IW) is responsible for the international Co-operative Programme Freshwater on assessment and monitoring of acidification of river and lakes (under the convention LRTAP): NIVA will provide the relevant information. (Part of the ETC/IW 96 work programme).	
Short Definition: The essential determinants of the monitoring programme are those that define the degree of acidification or which are directly related to the acidification of water: pH, Cond., Ca, Mg, Cl, SO_4, alkalinity, NO_3 (NIVA, 1996)	
Comments: Determinants that may be useful in interpreting the effects of acidification: T (°C), Na (mg/l), K (mg/l), NH_4 (µg/l), Al (µg/l), Fe (µg/l), Mn (µg/l), P (µgP/l), Si (mg SiO_2/l) (NIVA, 1996). Analysis of sediment cores in order to calculate the lake pH of the past from sediment subfossil flora and the degree of weathering, which is temperature dependent.	
Geographical Level: NUTS 3 (Tab. 1) or river basin	**Detailed Geographical Level:** Monitoring site
Time Series: State around 1995 Trends: 1980-1995	**Unit:** Lakes affected by acidification; trend in acidification indicators pH-units, Cond. (µS/cm), Ca (mg/l), Mg (mg/l), alkalinity (mmol/l), SO_4 (mg/l), NO_3 (µgN/l), Cl (mg/l),
Possible Presentation: Trend graphs	**Aggregation Problems:** In deep Alpine lakes (seasonally not mixed) mean values are misleading and do not supply the necessary information about the dynamic of concentration changes during time and lake depth.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: Scientific Institutions	**Contact:**
Needed Actions:	

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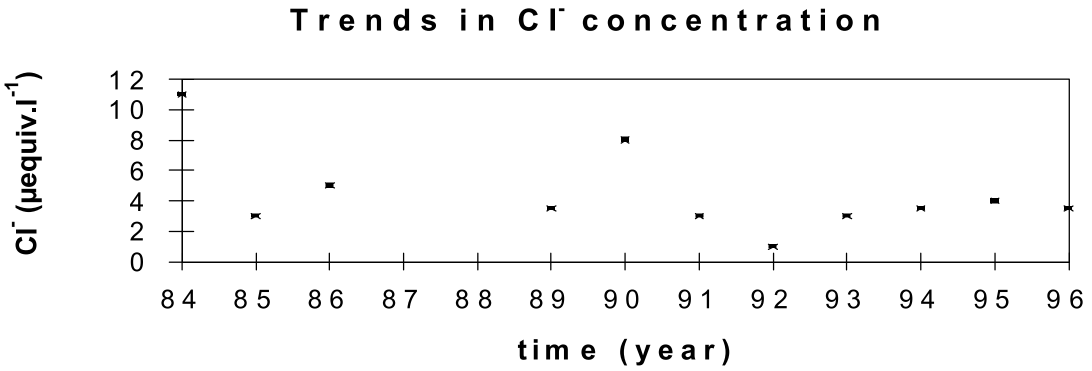
Literature:

EUROPEAN ENVIRONMENT AGENCY (1996)
NIVA (1996)
SOMMARUGA-WÖGRATH et al. (1997)

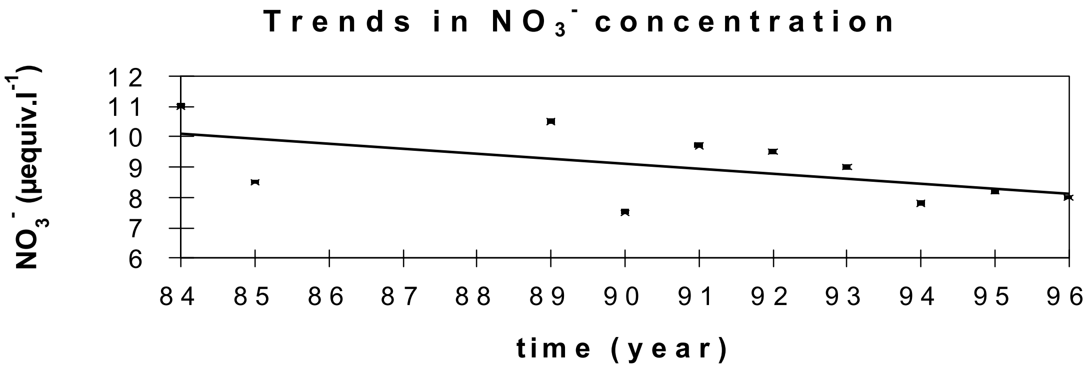
Examples for data presentation:

Changes in ion concentrations in Schwarzsee ob Sölden and annual trends

a)



b)



c)

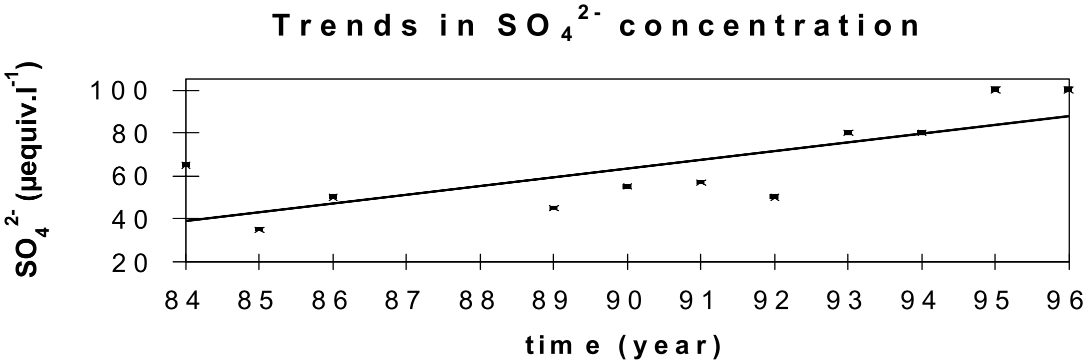


Fig. 2.5: Changes in ion concentrations in Schwarzsee ob Sölden (Tyrol/Austria) from 1984 to 1996 and annual trends (source: SOMMARUGA-WÖGRATH et al. (1997); Fig.3 modified). a) chloride. b) nitrate. c) sulfate.

<table>
<tr><td>Indicator No.: 2.7</td><td>Section: Water</td></tr>
<tr><td colspan="2">Indicator: Lake Water Quality - Eutrophication Indicators</td></tr>
<tr><td colspan="2">Description: Human settlements and associated clearance of forests, agricultural development and urbanisation greatly accelerate the runoff of materials and nutrients into rivers and lakes (reservoirs): “cultural eutrophication“.
• The state of lake eutrophication in various regions of Europe should be illustrated (dot map and pie-chart map)
• Trends (1980-1995) in phosphorus concentration in lakes should be presented.</td></tr>
<tr><td colspan="2">Type of Indicator: State</td></tr>
<tr><td colspan="2">Update of: EUROPEAN ENVIRONMENT AGENCY (1995) - Map 5.19: Frequency distribution of summer mean phosphorus concentration in European lakes by country, 1988-91.
EUROPEAN ENVIRONMENT AGENCY (1995- Map 5.20: Summer mean phosphorus concentrations in large European lakes and reservoirs, 1988-91</td></tr>
<tr><td colspan="2">Data Source: Depending on the proposed indicators (ETC/IW) it will be necessary to collect data from the individual countries.</td></tr>
<tr><td colspan="2">Short Definition:
Total phosphorus; chlorophyll a; water transparency</td></tr>
<tr><td colspan="2">Comments: Although phosphorus tends to be the nutrient that most limits plant growth in lakes and reservoirs, increased nitrogen levels can also lead to higher biological production.</td></tr>
<tr><td>Geographical Level: NUTS 2 (Tab. 1) or river basin</td><td>Detailed Geographical Level: Monitored lake</td></tr>
<tr><td>Time Series: State: around 1995
Trend: the period around 1980 compared with the period around 1995</td><td>Unit: Average total P (mg/l), PO4 (mg/l), chlorophyll a, Secchi disk transparency (m), and total nitrogen concentration (mgN/l).</td></tr>
<tr><td>Possible Presentation:
State: maps
Trend: diagrams</td><td>Aggregation Problems:</td></tr>
<tr><td>Target/Projection/Scenario:</td><td>Intermediate Elements needed:</td></tr>
<tr><td>Data Compilation: National Limnological Institutes</td><td>Contact:</td></tr>
<tr><td colspan="2">Needed Actions:</td></tr>
</table>

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

Literature:

EUROPEAN ENVIRONMENT AGENCY (1995)
EUROPEAN ENVIRONMENT AGENCY (1996)

Indicator No.: 2.8	**Section:** Water
Indicator: Microbiological Quality of Bathing Waters	
Description: In order to protect the environment and public health, it is necessary to reduce the pollution of bathing water and to protect such water against further deterioration[1].	
Type of Indicator: State	
Update of:	
Data Source:	
Short Definition: Percentage of fortnightly collected surface water samples exceeding guide and mandatory values for bathing water quality (Council Directive 76/160/EEC) for total and faecal coliforms during the "bathing season" [2]. Orange: bathing water with insufficient sampling (fortnightly during bathing season), but where samples are in conformity with the parametric values (too few samples). Red: - bathing water with insufficient sampling and where the samples taken are not in conformity with the parametric values (non compliance); - bathing water with sufficient sampling and where the samples taken are not in conformity with the parametric values (non compliance). Green: bathing water where 95% of the samples taken are in conformity with the mandatory values (Council Directive 76/160/EEC); 1 out of 20 samples may fail (compliance). Blue: bathing water in compliance with the mandatory values and on top of that if 80% of the samples are also in conformity with the stricter guide values for total and faecal coliforms (Council Directive 76/160/EEC); 2 out of 10 samples may fail. (EUROPEAN UNION, 1997b)	
Comments: The concentration of faecal streptococci is analysed in most bathing waters as well.	
Geographical Level: NUTS 3 (Tab. 1) or river basin	**Detailed Geographical Level:** Monitored bathing area of a river or lake
Time Series: State: around 1995 Trend: the period around 1980 compared with the period around 1995	**Unit:** Percentage of water samples exceeding guide (500 total coliforms and 100 faecial coliforms/100 ml) or mandatory values (10 000 total coliforms and 2000 faecal coliforms/100 ml) (COMMISSION OF THE EUROPEAN COMMUNITIES (1992b): Council directive 76/160/EEC)
Possible Presentation: State: maps Trend: diagrams	**Aggregation Problems:** In countries not belonging to the European Union monitoring of the microbiological quality is different.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation:	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, F. Trocherie, C. Ottavi, M. Zupan

[1]Identification of bathing areas: All running or still freshwaters or parts thereof and sea water, in which:
•bathing is explicitly authorised by the competent authorities,
•bathing is not prohibited and is traditionally practised by a large number of bathers.
[2]Determination of the bathing season:
The bathing season is the period during which a large number of bathers can be expected in the light of local custom, and any local rules that may exist concerning bathing and weather conditions. This can be done locally, regionally or nationally. (EUROPEAN UNION, 1997b)

Literature:

COMMISSION OF THE EUROPEAN COMMUNITIES (1992b)
EUROPEAN COMMISSION (1994)

EUROPEAN UNION (1997b)

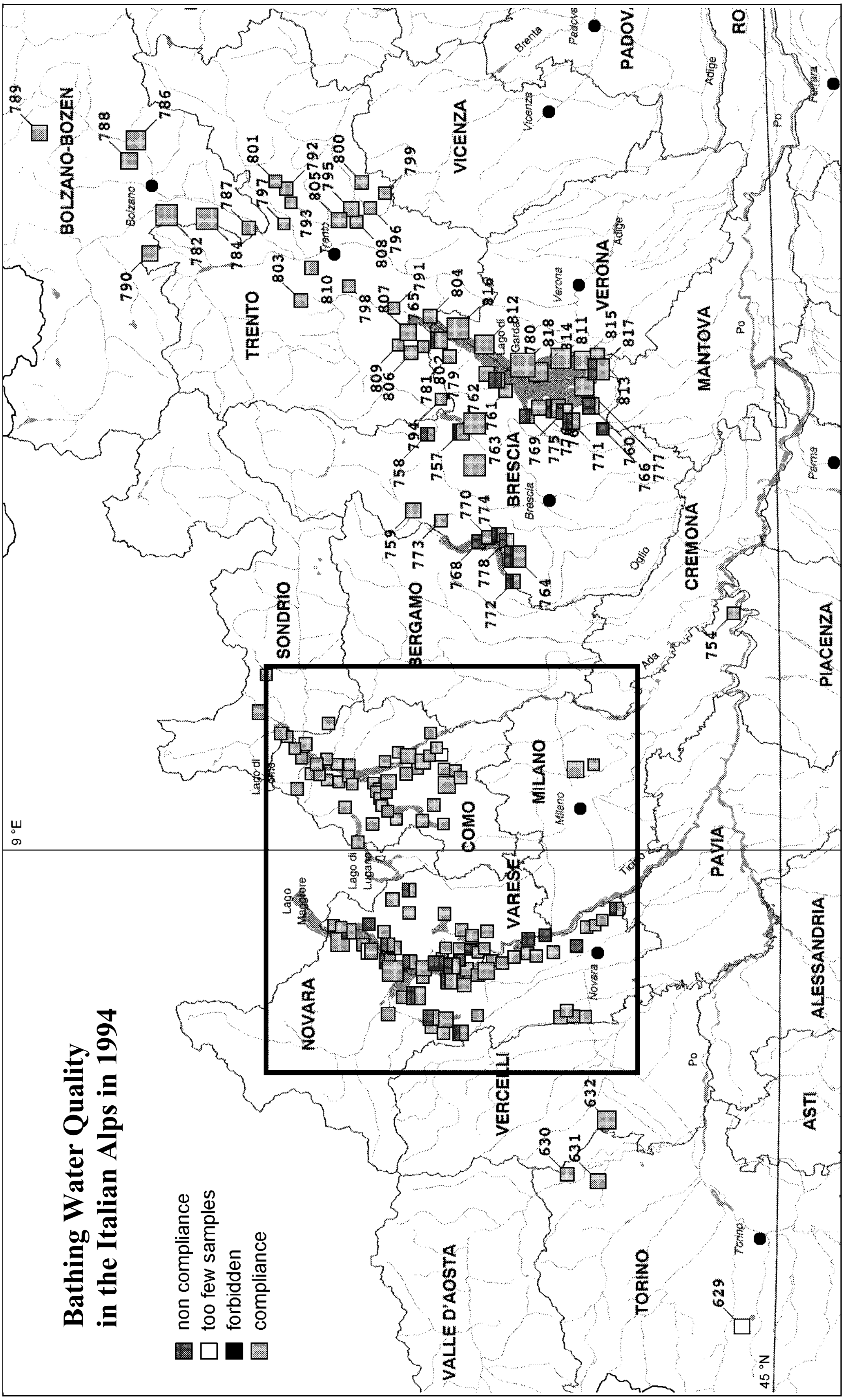


Fig. 2.8: Microbiological quality of bathing waters in the Italian Alps in 1994 (source: EUROPEAN COMMISSION, Bathing Water Quality 1994, Nr. 10, Italy (North), map modified).

Indicator No.: 2.9	**Section:** Water
Indicator: Biological Assessment of River Quality	
Description: Many countries classify the quality of their rivers (good, fair, poor and bad) either based on macro-invertebrate surveys or on the species based approach of the Saprobic System. These classification systems are not directly comparable, however, at the moment the results from these classifications are the most comprehensive overview of river quality. EUROPEAN ENVIRONMENT AGENCY (1996)	
Type of Indicator: State	
Update of: EUROPEAN ENVIRONMENT AGENCY (1995) - Table 5.13: Quality of European river reaches	
Data Source: National river reports and the ETC/IW network	
Short Definition: The definitions used in EUROPEAN ENVIRONMENT AGENCY (1995; Box 5H) may be used for harmonising the various classification systems. • *Good quality:* river stretches with nutrient-poor water, low levels of organic matter; saturated with dissolved oxygen; rich invertebrate fauna; suitable spawning ground for salmonid fish. • *Fair quality:* river stretches with moderate organic pollution and nutrient content; good oxygen conditions; rich flora and fauna; large fish population. • *Poor quality:* river stretches with heavy organic pollution; oxygen concentration usually low; sediment locally anaerobic; occasional blooming of organisms insensitive to oxygen depletion; small or absent fish population; periodic fish kill. • *Bad quality:* river stretches with excessive organic pollution; prolonged periods of very low oxygen concentration or total deoxygenation; anaerobic sediment, severe toxic input; devoid of fish.	
Comments: A comprehensive evaluation of the biological quality of the surface water is suggested where the Saprobic Index and macro-invertebrate surveys are just components (ÖNORM M6232).	
Geographical Level: NUTS 3 (Tab. 1) or river basin	**Detailed Geographical Level:** Monitored river site
Time Series: Classification around 1980 and in the latest available classification (1990-95)	**Unit:** Percentage of river length with a certain quality
Possible Presentation: State: maps Trend: diagrams	**Aggregation Problems:** The information is not fully comparable in different countries. The above suggested classification scheme seems to be not fully adequate for Alpine areas as in many regions all Alpine rivers will be in the category of „good quality“.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: ETC/IW and national Environmental Institutes	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, F. Trocherie, C. Ottavi, M. Zupan

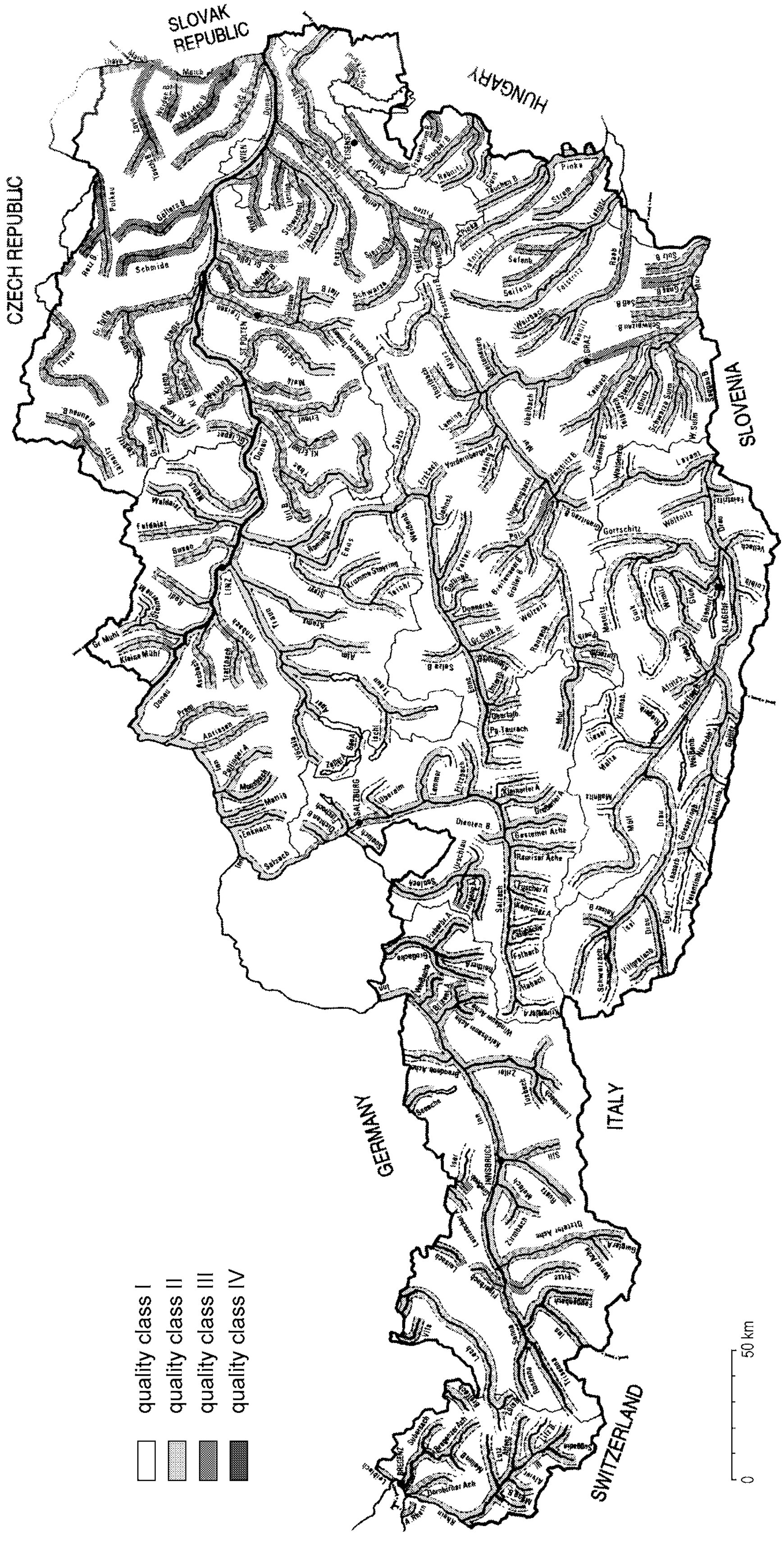
Literature:

BUNDESMINISTERIUM FÜR LAND- UND FORSTWIRTSCHAFT (1995)
EUROPEAN ENVIRONMENT AGENCY (1995)
EUROPEAN ENVIRONMENT AGENCY (1996)
ÖNORM M 6232 (1997)

Fig. 2.9.:

Biological Water Quality Map of Running Waters in Austria 1993/94

issued by the Federal Ministry for Agriculture and Foresty, Federal Water Management Register



Graphics: R. Wegl, Federal Agency of Water Management – Institute of Water Quality

Indicator No.: 2.10	**Section:** Water
Indicator: Chemical Assessment of River Quality	
Description: Nutrients and organic micropollutants are a considerable threat to the chemical quality of river waters and originate primarily from industry, urbanisation and agriculture.	
Type of Indicator: State	
Update of: EUROPEAN ENVIRONMENT AGENCY (1995) - Map 5.13: Frequency distribution of annual mean concentration of organic matter in European rivers by country, 1988-91. EUROPEAN ENVIRONMENT AGENCY (1995) - Map 5.14: Annual mean concentration of organic matter at specific stations in European rivers, 1988-91. Statistical Compendium Table 5.11: Frequency distribution of annual mean concentration of organic matter in European rivers. EUROPEAN ENVIRONMENT AGENCY (1995) - Map 5.15: Frequency distribution of annual mean phosphorus concentration in European rivers by country, 1988-91. EUROPEAN ENVIRONMENT AGENCY (1995) - Map 5.16: Annual mean phosphorus concentrations at specific stations in European rivers, 1988-91 Statistical Compendium Table 5.13: Frequency distribution of annual mean phosphorus concentration in European rivers. EUROPEAN ENVIRONMENT AGENCY (1995) - Map 5.17: Frequency distribution of annual mean nitrate concentration in European rivers by country, 1988-91. EUROPEAN ENVIRONMENT AGENCY (1995) - Map 5.18: Annual mean nitrate concentrations at specific stations in European rivers, 1988-91 Statistical Compendium Table 5.12: Frequency distribution of annual mean nitrate concentration in European rivers.	
Data Source:	
Short Definition: 2.10.1 Physical parameters (Cond., pH) 2.10.2 Major ions (Cl, SO4, Ca, Mg) 2.10.3 Nitrogen (NO3, NO2, NH4) 2.10.4 Phosphorus (total, PO4)	2.10.5 Organic pollution indicators (BOD, DOC, TOC) 2.10.6 Pesticides (5 most frequent ones) 2.10.7 Heavy metals (Cd, Pb etc.) in sediments, suspended matter or aquatic mosses.
Comments: A considerable portion of nutriens and organic micropollutants is transported in suspended matter and finally trapped in sediments. Therefore the nutrients and micropollutants should be analysed in suspended matter or sediments as well.	
Geographical Level: NUTS 2 (Tab. 1) or river basin	**Detailed Geographical Level:** Monitoring site
Time Series: State: around 1995 Trend: the period around 1980 compared with the period around 1995	**Unit:** µS/cm (25°C), pH-units, mg/l, µg/l
Possible Presentation: State: dot maps and pie-chart maps Trend: diagrams	**Aggregation Problems:** Analytical data collected by different countries may not be fully comparable, because of differing standard procedures. Due to the insufficient density of monitoring sites quality data cannot be extrapolated. Not all of the suggested parameters are monitored in the national monitoring programs.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Water Authorities	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

Literature:

EUROPEAN ENVIRONMENT AGENCY (1996)

EUROSTAT (1995)
CHOVANEC (1996)

Fig. 2.10: Mean and maximum values of ammonium at Austria's river monitoring sites.
Ammonium limit value for mountain waters: <= 0,3 mg/l; ammonium limit value for lowland waters: <=0,5 mg/l.
(source: DEUTSCH 1997; map modified).

Indicator No.: 2.11	**Section:** Water
Indicator: Groundwater Quality	
Description: The indicators should provide an overview of the state of nitrate pollution of groundwater. For example: • the percentage of wells affected by high nitrate levels per country could be used to present the state. • the trend 1980-1995 in nitrate levels for different European regions should also be illustrated. • the percentage of wells affected by pesticide pollution per country could be used to present the state. • the trend 198?-1995 in pesticide pollution for selected European regions should also be illustrated. The assessment should preferably be based on actual data instead of model calculations.	
Type of Indicator: State	
Update of:	
Data Source:	
Short Definition: 2.11.1 Physical parameters (Cond., pH) 2.11.2 Major ions (Cl, SO4, Ca, Mg) 2.11.3 Nitrogen (NO3, NO2, NH4) 2.11.4 Phosphorus (total, PO4) 2.11.5 Organic pollution indicators (DOC, TOC) 2.11.6 Pesticides (5 most frequent ones) 2.11.7 Heavy metals (Cd, Pb etc.)	
Comments: Sampling sites should be categorised in drinking water wells, monitoring wells, industrial water wells, other wells to allow a better interpretation of the data.	
Geographical Level: NUTS 2 (Tab. 1) or river basin	**Detailed Geographical Level:** NUTS 3 or groundwater aquifer
Time Series: State: latest year available Trend: should be presented for the period 1980-1995	**Unit:** µS/cm (25°C), pH-units, mg/l, µg/l
Possible Presentation: State: maps Trend: diagrams	**Aggregation Problems:** Analytical data collected by different countries may not be fully comparable, because of differing standard procedures. Due to the insufficient density of monitoring sites quality data cannot be extrapolated.
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: ETC/IW and national Environmental Institutes	**Contact:**
Needed Actions:	

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Literature:

EUROPEAN ENVIRONMENT AGENCY (1996)
BAYERISCHES STAATSMINISTERIUM FÜR LANDESENTWICKLUNG UND UMWELTFRAGEN, (1994)

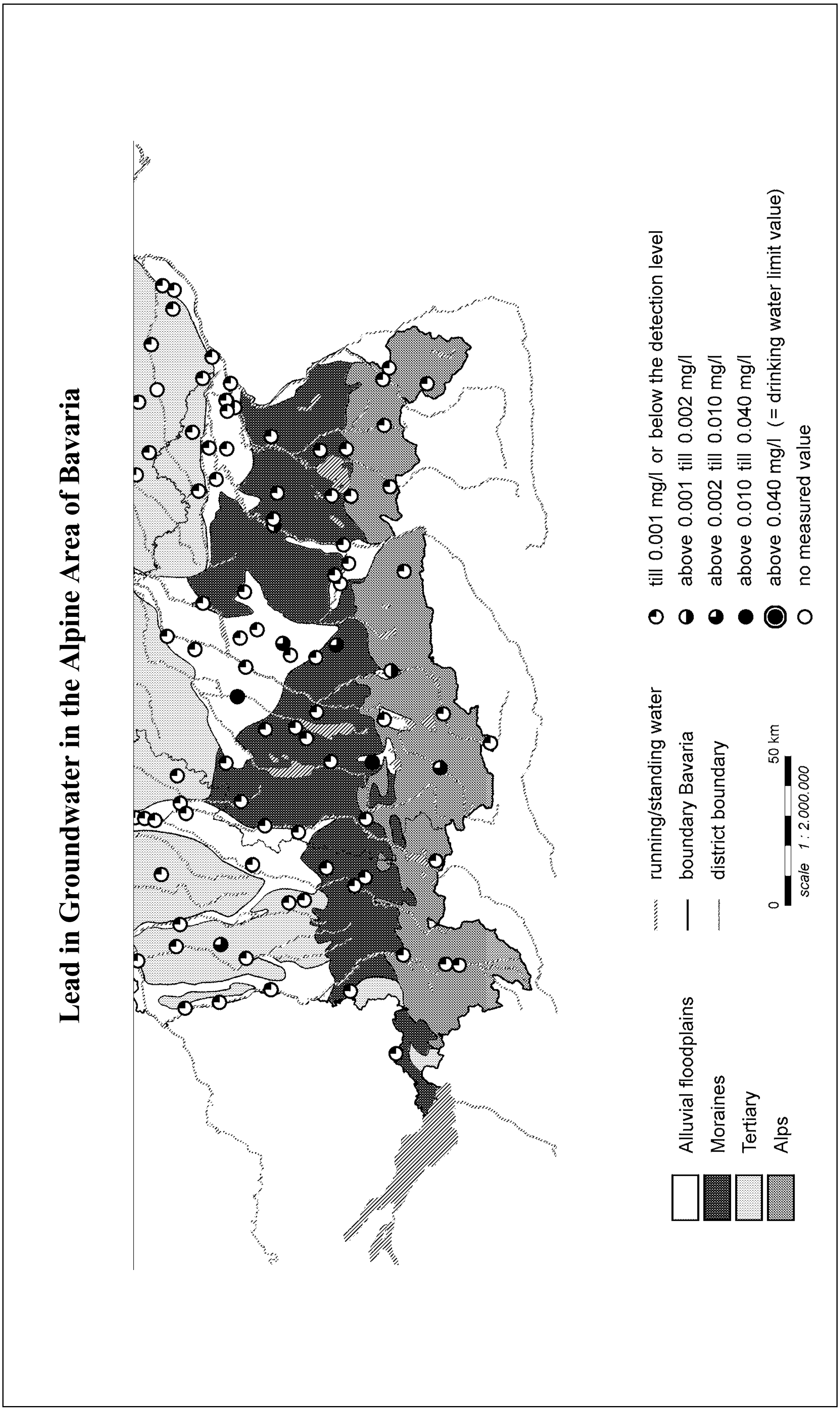

Fig. 2.11: Lead in groundwater in the alpine area of Bavaria (source: BAYERISCHES STAATSMINISTERIUM FÜR LANDESENTWICKLUNG UND UMWELTFRAGEN, 1994; map 9 modified).

<table>
<tr><td>Indicator No.: 2.12</td><td>Section: Water</td></tr>
<tr><td colspan="2">Indicator: Large Spring Water Quality</td></tr>
<tr><td colspan="2">Description:
• Large springs with considerable recharge areas and rapid response to precipitation events (in many cases karst springs) should act as indicators for springs used as drinking water source in the region.
• Large springs can be used as indicators of regional changes and of filtering mechanisms exhausted by long range transport of pollutants. (KRALIK, 1997)</td></tr>
<tr><td colspan="2">Type of Indicator: State</td></tr>
<tr><td colspan="2">Update of: no information has been presented in previous reports</td></tr>
<tr><td colspan="2">Data Source: National environmental monitoring programs</td></tr>
<tr><td colspan="2">Short Definition:
2.12.1 Physical parameters (Cond., pH)
2.12.2 Major ions (Cl, SO4, Ca, Mg)
2.12.3 Nitrogen (NO3, NO2, NH4)
2.12.4 Phosphorus (total, PO4)
2.12.5 Organic pollution indicators (DOC)
2.12.6 Pesticides (5 most frequent ones)
2.12.7 Heavy metals (Cd, Pb etc.)</td></tr>
<tr><td colspan="2">Comments:.</td></tr>
<tr><td>Geographical Level: NUTS 2 (Tab. 1) or river basin</td><td>Detailed Geographical Level: Monitored spring</td></tr>
<tr><td>Time Series: 1980-1995</td><td>Unit: µS/cm (25°C), pH-units, mg/l, µg/l</td></tr>
<tr><td>Possible Presentation: Maps and trend graphs</td><td>Aggregation Problems: Analytical data collected by different countries may not be fully comparable, because of differing standard procedures. Due to the insufficient density of monitoring sites quality data cannot be extrapolated.</td></tr>
<tr><td>Target/Projection/Scenario:</td><td>Intermediate Elements needed:</td></tr>
<tr><td>Data Compilation: National Institutes</td><td>Contact:</td></tr>
<tr><td colspan="2">Needed Actions:</td></tr>
</table>

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

Literature:

KRALIK (1997)

Indicator No.: 3.1	**Section:** Water
Indicator: Density of Hydrological Networks	
Description: • Density of hydrological networks is defined as the average area served by one hydrological station. It is derived by dividing the area of the territory by the number of hydrological stations operated within the territory.	
Type of Indicator: Response	
Update of:	
Data Source: National Statistical Institutes	
Short Definition: Density of hydrological networks is defined as the average area served by one hydrological station (Staff gauge, level recorder etc.). It is derived by dividing the area of the territory by the number of hydrological stations operated within the territory.	
Comments: Adequate hydrological networks to provide data on freshwater are important to support sustainable development. Hydrological observations of appropriate spatial and temporal coverage provide information to decision makers to facilitate preventative action. In some areas, however, a simple presentation of the hydrological stations in maps may be more meaningful than the number of hydrological stations per square kilometres in a high Alpine area with glaciers and a nearly permanent snowcover. This would be misleading in an international comparison.	
Geographical Level: NUTS 2 (Tab. 1) or river basin	**Detailed Geographical Level:** NUTS 3 (Tab. 1)
Time Series: Density of hydrological networks: 1980, 1985, 1990 & 1995	**Unit:** Area in km^2 per station
Possible Presentation: Trend graph Bar chart (1980 & early 1990)	**Aggregation Problems:**
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Institutions	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, F. Trocherie, C. Ottavi, M. Zupan

Literature:

HYDROGRAPHISCHES ZENTRALBÜRO (1997)
UN COMISSION ON SUSTAINABLE DEVELOPMENT (1996)

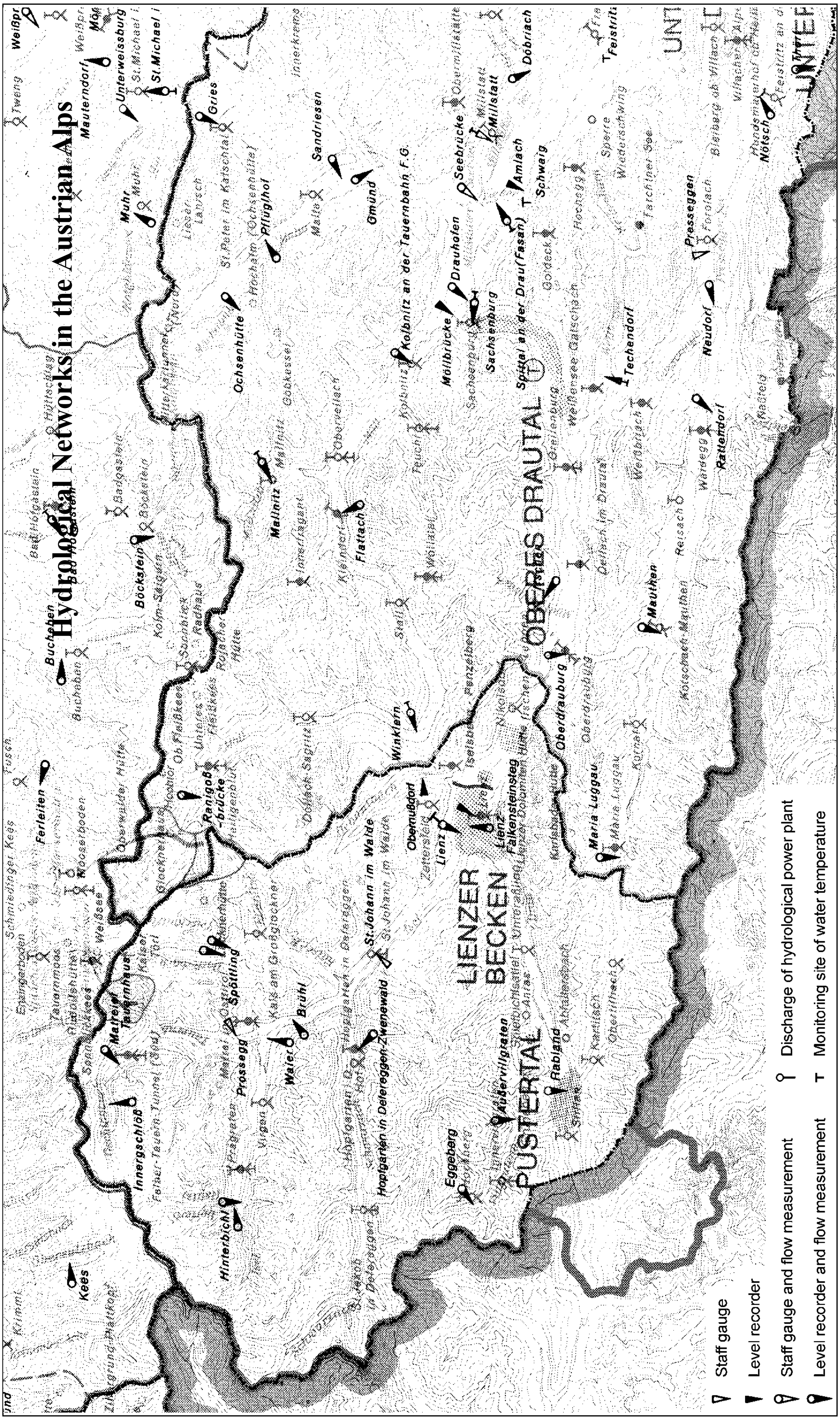

Fig. 3.1: Hydrological networks in the Austrian Alps, extension as of 1994 and 1995 (source: HYDROGRAPHISCHES ZENTRALBÜRO, 1997; map modified).

Indicator No.: 3.2	**Section:** Water
Indicator: Water Protection Zones (Inner - Outer)	
Description: • Trends in the percentage of land identified as water protection zones (inner and outer) will be presented.	
Type of Indicator: Response	
Update of:	
Data Source: National Water Administration	
Short Definition: Percentage of protected area (Inner- , Outer Protection Zones and Prevention Zones excluding well head protection areas; Tab. 2) of the total area. Included are all larger areas used as groundwater source and/or water resource protected by law. Excluded are small spring or well head protection zones.	
Comments: The extension of protection areas also depends on population density, the industrial and agricultural use of the catchment area.	
Geographical Level: NUTS 2 (Tab. 1) or river basin.	**Detailed Geographical Level:** NUTS 3 (Tab. 1)
Time Series: 1980-1995 (at present)	**Unit:** Per cent protected area of total area
Possible Presentation: Maps: Trend graph: per cent protected area	**Aggregation Problems:** It should be borne in mind that administrative definitions of Inner- , Outer Protection Zones and Prevention Zones may vary considerably from region to region (Tab. 2).
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation:t National Water Administration	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

<u>Literature:</u>

EUROPEAN COMMISSION (1995)

Table 2: Source protection: Comparison of general regulations with special comments on karst areas (source: EROPEAN COMMISSION(1995); p. 407 modified).

COUNTRY	SPRING/ WELL HEAD PROTECTION AREAS	INNER PROTECTION ZONE(S)	OUTER PROTECTION ZONES	CATCHMENT AREA
Austria	''Inner Protection Zone''	''Outer Protection Zone''	Prevention Zone I recharge area	Prevention Zone II monitoring area
France	Well head dependent on size of wellfield, also around swallow holes etc.	Inner Protection - commonly 50 days		Outer Protecti-on (optional)
Germany	I: 10-20 m radius	II: 50 day travel time	IIIA: 2 km radius	IIIB
Italy	Each regional government responsible for own legislation			
Slovenia	4 protection areas - generally defined for ''larger'' sources			
Switzerland	S1: well/ spring head and sink holes (5-20 m)	S2: 10 days, >100 m - in karst include the contributing region not covered by sufficient impervious material - if necessary, S3 can substitute S2	S3: (at least as large as S2)	Currently under discussion: Delimination of the sector from which approx. 90 % of the abstraction comes from

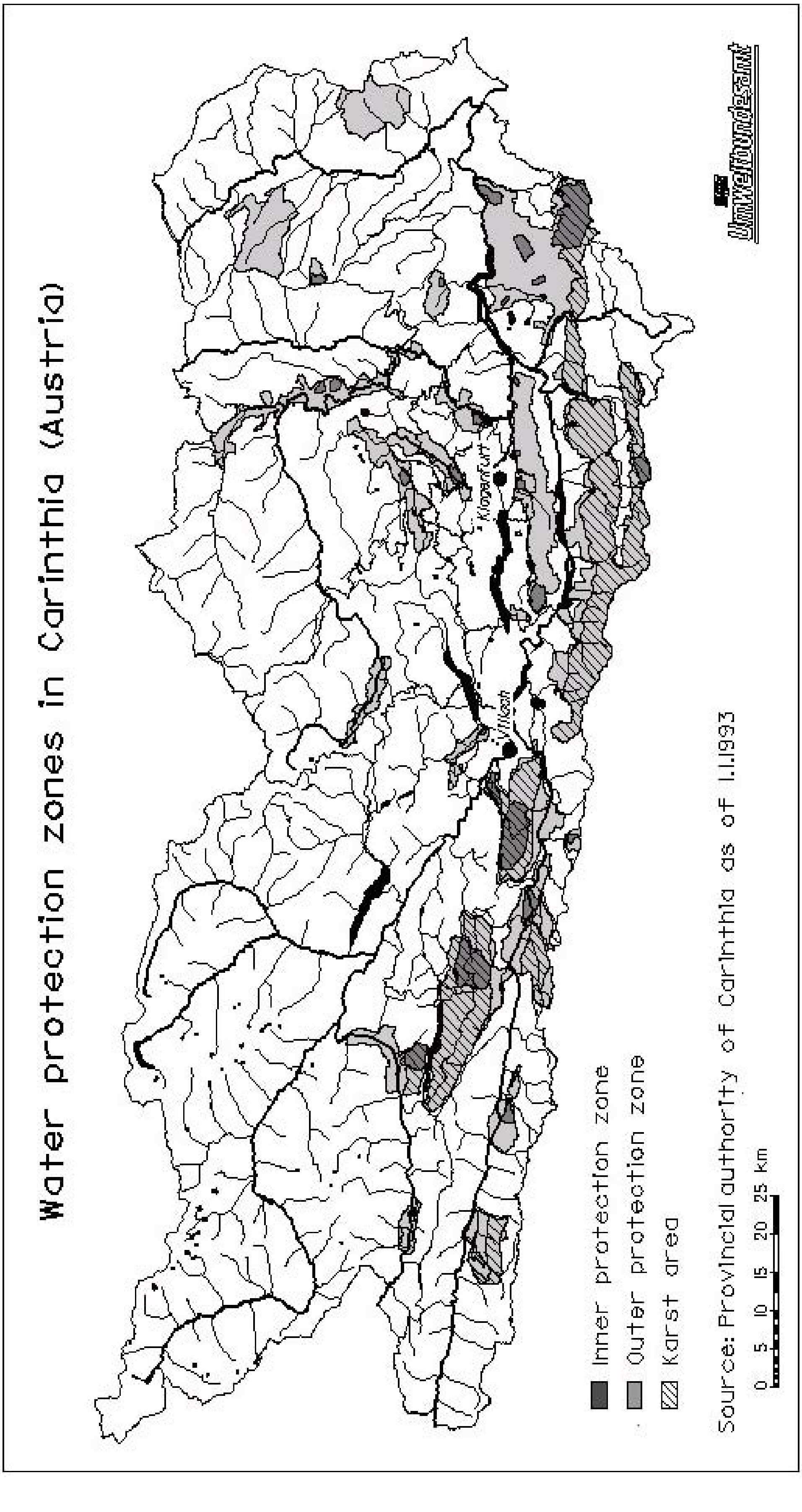

Fig. 3.2: Area of water protection and prevention zones in Carinthia (Austria). The area covered is about 15% of the total area of the province

(source: LANDESGESETZBLATT KÄRNTEN (1992))

Indicator No.: 3.3	**Section:** Water
Indicator: Population Served by Waste Water Treatment Plants	
Description: This indicator assesses the potential level of pollution from domestic and industrial/commercial point sources entering the aquatic environment. • Trend in total population served by waste water treatment plants (1980, 1985, 1990, 1995) should be illustrated • Trends (1980, 1990 & and latest year available) in population served by different types of waste water treatment plants (primary, secondary, tertiary treatment) should be presented.	
Type of Indicator: State	
Update of: EUROPEAN ENVIRONMENT AGENCY (1995): - Map 14.6: Population served by waste water treatment plants. Source: OECD 93	
Data Source: OECD/Eurostat collects information on waste water treatment every second year from the OECD countries. For OECD countries information for the following OECD tables should be used: • Table 3.1A: Population connected to sewerage; • Table 3.1B: Population served by waste water treatment plants, 1980, 1985, 1990, 1993	
Short Definition: The treatment of wastewater can be defined as the collection of wastewater from residential settlements, commercial, industrial or public premises and its conveyance to a location where it receives appropriate treatment allowing the receiving waters to meet the relevant quality objectives. 3.4.1 Primary treatment: Treatment of waste water by a physical and/or chemical process involving settlement of suspended solids, or other processes in which BOD5 of the incoming water is reduced by at least 20% before discharge and the total suspended solids of the incoming water are reduced by at least 50%. 3.4.2 Secondary treatment: Treatment of waste water by a process generally involving biological treatment with a secondary settlement. 3.4.3 Tertiary and advanced treatment: Treatment of waste water by a process generally involving biological and/or chemical treatment in which the total phosphorus and/or nitrogen content are markedly reduced. (COMMISSION OF THE EUROPEAN COMMUNITIES, 1992c: Council directive 91/271/EEC)	
Comments: The concentration of tourism (particularly in winter) in small communities during the peak season causes an overloading of waste water treatment plants (maximum capacities) and high ammonium concentrations in the receiving streams. The percentage of seasonally overloaded waste water treatment plants would be a valuable additional information.	
Geographical Level: NUTS 3 (Tab. 1) or river basin	**Detailed Geographical Level:** NUTS 3 (Tab. 1)
Time Series: State: latest year available Trend: should be presented for the period 1980-1995	**Unit:** 1) The percentage of population provided with a collecting system and served by waste water treatment plants (percentage by type of treatment) 2) maximum capacity of waste water treatment plants (population equivalents: 1p.e.=60g BOD5)
Possible Presentation: State: maps Trend: diagrams	**Aggregation Problems:**
Target/Projection/Scenario:	**Intermediate Elements needed:**
Data Compilation: National Statistical Offices	**Contact:**
Needed Actions:	

compiled by: M. Kralik with the assistance of B. Brunner, A. Göttle, A. Jakob, P. Liechti, F. Trocherie, C. Ottavi, M. Zupan

Literature:

BUNDESMINISTERIUM FÜR LAND- UND FORSTWIRTSCHAFT (1993)
BUNDESMINISTERIUM FÜR LAND- UND FORSTWIRTSCHAFT (1996)
COMMISSION OF THE EUROPEAN COMMUNITIES (1992c)

EUROPEAN ENVIRONMENT AGENCY (1996)
UN COMISSION ON SUSTAINABLE DEVELOPMENT (1996)

Examples for data presentation:

Percentage of population served by waste water treatment plants

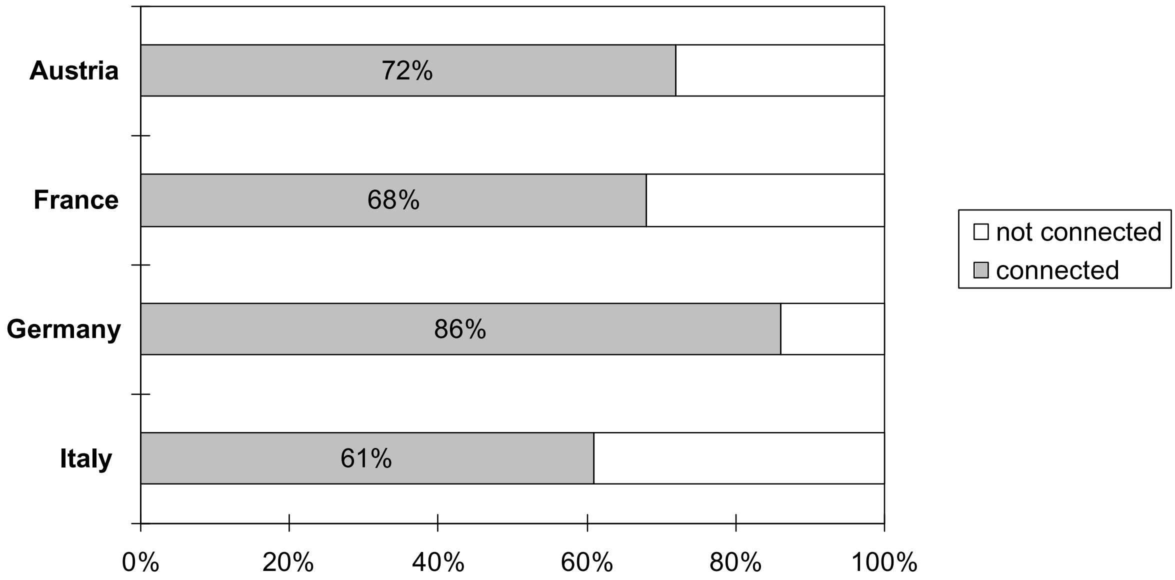

Fig. 3.4.A: Percentage of population served by waste water treatment plants (source: BUNDESMINISTERIUM FÜR LAND- UND FORSTWIRTSCHAFT(1996); p. 96 modified).

Percentage of population connected to centralised water supply, canalisation and waste water treatment; development 1850-2050

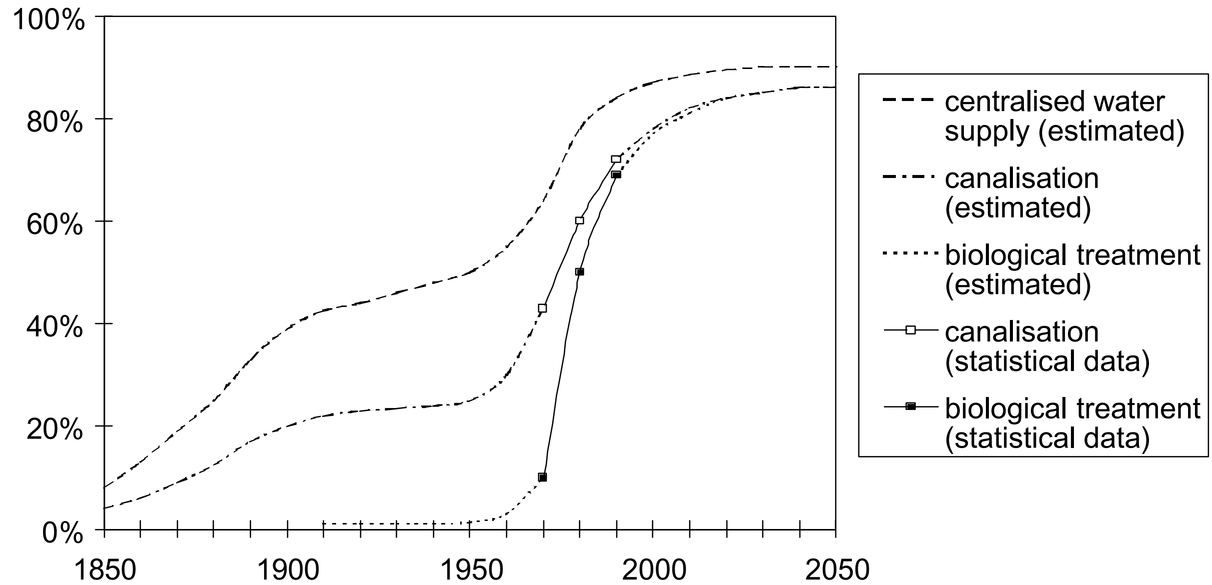

Fig. 3.4.B: Centralised water supply, canalisation and waste yy treatment versus time in Austria (source: BUNDESMINISTERIUM FÜR LAND- UND FORSTWIRTSCHAFT(1993); Abb.2.1 modified).

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Acknowledgement: We thank I. Auer, P. Bockmühl, A. Chovanec, C. Frei, J. Grath, H. Mohnl, V. Koller-Kreimel, S. Muhar, K. Nicolussi and K. Schwaiger for helpful discussions.