

## THE EUROPEAN ENVIRONMENT AGENCY INDICATOR-BASED REPORTING ABOUT 'SALTWATER INTRUSION DUE TO GROUNDWATER OVER-EXPLOITATION'

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### Abstract

"Saltwater intrusion as a result of groundwater over-exploitation is a major concern in many aquifers throughout Europe". This is the key message of a European wide indicator developed by the European Environment Agency (EEA). The EEA aims to support sustainable development and to help achieve significant and measurable improvement in Europe's environment through the provision of timely, targeted, relevant and reliable information to policy making agents and the public. This is done by establishing a seamless environmental information and observation network (EIONET) to assist the Community in its attempts to improve the environment and move towards sustainability, including the EU's efforts to integrate environmental aspects into economic policies. European wide overviews regarding environment problems are key instruments for raising public awareness and for communicating the dimension of a problem to political decision makers. It supports political decision makers in checking the effectiveness of their legal instruments, in prioritising the problem and in allocating resources accordingly. Saltwater intrusion caused by anthropogenic alterations of the groundwater level or groundwater flow directions is of high policy relevance due to the Water Framework Directive (2000/60/EC) which, inter alia, aims to ensure a balance between abstraction and recharge of groundwater quantity and a chemical composition of the groundwater body not exhibiting the effects of saline intrusion, with the aim of achieving good groundwater status by 2015. It is the challenge of the scientific community to investigate on the reasons causing such intrusions, to clearly identify human responsibilities and to elaborate and propose changes and alternatives in water management in order to diminish the anthropogenic share causing saltwater intrusion. In order to support the whole process it is inevitable to diminish communication gaps between the scientific and the policy-making communities representing a huge loss of resources for the Community as a whole.

**Keywords.** European Environment Agency, European Topic Centre on Water, EIONET, European wide overview, Indicator, Water Framework Directive, Saltwater intrusion.

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## Introduction

### *The European Environment Agency (EEA)*

The European Environment Agency (EEA) [[www.eea.eu.int](http://www.eea.eu.int)] is based on Council Regulation (EEC) 1210/1990 (amended by Council Regulation (EC) No 933/1999); it is operational since 1994 and located in Copenhagen.

The EEA aims to support sustainable development and to help achieve significant and measurable improvement in Europe's environment through the provision of timely, targeted, relevant and reliable information to policy making agents and the public. One key instrument in reaching these objectives is the establishment of a seamless environmental information and observation network (EIONET) [[www.eionet.eu.int](http://www.eionet.eu.int)]. By providing the right information and analysis at the right time, the EEA assists the Community in its attempts to improve the environment and move towards sustainability, including the EU's efforts to integrate environmental aspects into economic policies.

The EEA thus builds on the work of existing organisations in their 31 member countries (see Figure 1); it cooperates with them, coordinates the work at European level and seeks to avoid duplication of work in environmental data collection, analysis and reporting. Instead, the EEA brings together, in compatible formats, the best available environmental data from individual countries. This data forms the basis of integrated environmental assessments and knowledge that is disseminated and made accessible, not only to EU bodies and national governments, but also to environmental managers, the business community, academia, NGOs, the media and the general public.

Proper communication and dissemination of EEA products and services is a major challenge, and all the more so as the EEA's reach has been extended to cover most European countries. In recent years, the Agency has published on average 40–50 reports per year, the vast majority in both paper and web versions. Summaries of major reports are usually published in the official languages of all EEA member countries (with the enlargement of the Agency, this comprises no less than 24 languages).

The EEA's web site [[www.eea.eu.int](http://www.eea.eu.int)] is one of the most comprehensive and technically advanced public information services on the environment available on the Internet. It gives access to a wide range of environmental information produced by the Agency and its partners in the EIONET as well as to information from other national and international sources.

The EEA Data Service gives access to aggregated data compiled for the preparation of Agency reports, basic spatial reference data and map-based information packages. Users can manipulate the data and make customised tables and graphs.

The EEA reporting is indicator based and each indicator is accompanied by a fact sheet with detailed information. The full core set of water indicators is available on the EEA website under: [http://themes.eea.eu.int/Specific\\_media/water/indicators](http://themes.eea.eu.int/Specific_media/water/indicators) and the indicator on saltwater intrusion is exemplarily demonstrated below.



**Figure 1.** Member countries of the European Environment Agency

## Saltwater intrusion in Europe - an inventory

The EEA together with the ETC/WTR developed the indicator "Saltwater intrusion", in accordance with European legislation focusing on anthropogenic impacts and responsibilities. It aims to focus on sustainable use of groundwater in mainly coastal areas and whether abstraction and recharge of groundwater quantity are in balance or not.

Regarding the present assessment, groundwater over-exploitation is defined as groundwater abstraction exceeding recharge and leading to a lowering of the groundwater table or to a reversing of groundwater flow directions. The rapid expansion in groundwater abstraction over the past 30 to 40 years has supported new agricultural and socioeconomic development in regions where alternative surface water resources are insufficient, uncertain or too costly (EEA, 2000). Over-abstraction leads to groundwater depletion, loss of habitats and deteriorating water quality. It is a significant problem in many European countries. One of its impacts is the intrusion of saltwater into aquifers.

Once saltwater intrudes into a groundwater body its recovery is nearly impossible even in the longer term. Hence freshwater demand has to be met by abstractions from other groundwater or surface water bodies, often over long distances, transferring and increasing the water stress to distant areas. Alternatively in many regions the freshwater demand is met by a desalination of saltwater. Common to both solutions is that they are very costly.

### Assessment

The investigations showed that saltwater intrusion as a result of groundwater over-exploitation is a major concern in many aquifers throughout Europe.

In ten of twelve countries where over-exploitation was reported to exist, saltwater intrusion is the consequence (see Figure 2). Large areas of the Mediterranean coastline in Italy, Spain and Turkey have been reported to be affected by saltwater intrusion. More than 100 areas (in 10 countries) have been reported to be affected by marine saltwater intrusion. In 16 areas (in 3 countries) saltwater intrusion is



Data Source: European Environment Agency (2003)

Graphics: umweltbundesamt<sup>®</sup>

**Figure 2.** Groundwater over-exploitation and saltwater intrusion in Europe (EEA, 2003)

caused by the rise of highly mineralised water from deeper aquifers. In ten countries groundwater over-exploitation is reported not to occur.

The main cause of saltwater intrusion in aquifers is groundwater over-abstraction for meeting the demands for public water supply and irrigation.

### ***Policy relevance and policy context***

The indicator is taking regard of the European Environment policy in the form of the 6<sup>th</sup> Environmental Action Programme (Decision 1600/2002/EC) and the Water Framework Directive (Directive 2000/60/EC) and aims to support the evaluation of the progress of their implementation and their functioning.

The 6<sup>th</sup> Environmental Action Programme aims to ensure that the rates of abstraction from our water resources are sustainable over the long term and to promote sustainable water use based on a long-term protection of available water resources

The Water Framework Directive aims to ensure a balance between abstraction and recharge of groundwater quantity and a chemical composition of the groundwater body not exhibiting the effects of saline intrusion, with the aim of achieving good groundwater status by 2015. Furthermore, for achieving good quantitative status of a groundwater body "alterations to flow direction resulting from level changes may occur temporarily, or continuously in a spatially limited area, but such reversals do not cause saltwater or other intrusion, and do not indicate a sustained and clearly identified anthropogenically induced trend in flow direction likely to result in such intrusions" (Directive 2000/60/EC).

### ***Science context***

The policy-making community is dependent on the scientific community, which is invoked to investigate the reasons causing saltwater intrusions and to clearly identify human responsibilities in this respect. A clear identification and allocation of the underlying reasons, the elaboration of proposals and alternatives in order to reduce anthropogenic impacts as well as an outlook on future scenarios of the consequences are extremely helpful for the policy-making community to adopt water management practices and legislation in order to diminish anthropogenically induced saltwater intrusion.

Vice versa, the scientific community is dependent on such inventories and overviews for allocating their efforts and resources most efficiently on the most important issues to be investigated and solved.

In order to support this process it is inevitable to diminish communication gaps representing a huge loss of resources for the Community as a whole. The production of "policy-maker's friendly" summaries of research projects, requiring a "translation" of scientific results in information directly usable for legislative purposes, would greatly facilitate result's usability.

## **Outlook**

In order to improve the completeness and persuasive power of the available overview, the EEA member countries will have to be motivated to validate the available information and to complete the European coverage.

## **Data collection**

### ***The European Environment Information and Observation Network (EIONET)***

The EEA's work is based on the input of the EIONET, an extensive information network of over 300 environmental agencies and other bodies in the public and private sectors in 31 member countries (see Figure 1) through which the EEA collects, analyses and distributes data and information.

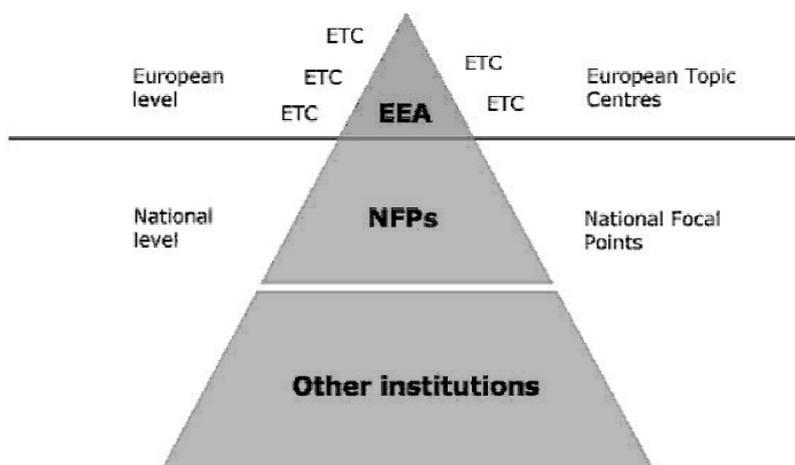
The EIONET [[www.eionet.eu.int](http://www.eionet.eu.int)] comprises several key elements:

- National Focal Points (NFPs), whose role is to coordinate their national EIONET organisations and to assist in the preparation, implementation and follow-up of the EEA work programme and the development of the EIONET. Typically, national environment ministries or agencies act as NFPs. NFPs are also active in disseminating information within EIONET and many NFPs produce reports on their activities, distribute newsletters and offer free access to their national databases.
- European Topic Centres (ETCs). These are centres of thematic expertise contracted by the EEA to carry out relevant parts of its work programme, including preparation of reports. Each ETC is a consortium of specialist partner organisations from the environmental research and information community which pools resources in its particular area of expertise. The importance of the ETCs is illustrated by the fact that 50 % of the Agency's operational budget is spent on work they undertake for the EEA. There are currently five ETCs, covering: water, air and climate change, nature protection and biodiversity, waste and material flows and terrestrial environment.
- National Reference Centres (NRCs). These are established at national level in specific areas of environmental activity, usually corresponding to the ETC areas. They play a role in technical coordination on these topics and work with the relevant ETCs, either directly or through the NFPs.

The EEA supports and is working towards simplified and streamlined production and reporting of environmental information. It is also promoting and encouraging the development of a European environment information system (EEIS) that would be shared with other EU bodies, international organisations and third countries. The EIONET would form a key part of this.

### ***The European Topic Centre on Water (ETC/WTR)***

The European Topic Centre on Water (ETC/WTR) [<http://water.eionet.eu.int>] is an international consortium of 12 European organisations led by the Water Research Centre (WRC) brought together to support the EEA in its mission to deliver timely, targeted, relevant and reliable information to policy-makers and the public for the development and implementation of sound environmental policies in the European Union and other EEA member countries.



**Figure 3.** The European Environment Information and Observation Network (EIONET)

Eurowaternet is the process by which the EEA obtains information on water resources in Europe, including rivers, lakes, groundwater, transitional, coastal and marine waters, emissions to water and water quantity. Data are, primarily used by the ETC/WTR to compile indicator fact sheets upon which EEA assessment reports are based.

Eurowaternet is based on monitoring networks that already exist in the EEA member countries and makes no additional demands for new data gathering. Eurowaternet is a statistically designed, stratified system, which, if implemented by countries in line with the guidance documents that are available, will give rise to data that are comparable, with known statistical power and precision. Eurowaternet has been implemented by many of the EEA member countries. The onus of quality control and assurance lies with the member country.

Waterbase is the EEA's database on the status, quality and quantity of Europe's water resources, accessible through the EEA Data Service's web site, through which the user can analyse, view and download data on Europe's water resources. Waterbase has been updated with 2002 data collected through the last Eurowaternet update. Waterbase is maintained by the European Topic Centre on Water in conjunction with the EEA's Data Service [<http://dataservice.eea.eu.int/dataservice/>]

Waterbase is based on an annual data flow with defined data sets. With regard to groundwater quality the data are requested at groundwater body level and comprise the nitrogen compounds nitrate, nitrite, ammonium and the supporting determinant dissolved oxygen and information on priority substances. Furthermore, information on saltwater intrusion as a result of groundwater over-exploitation is requested.

## Conclusion - Benefits

European wide overviews regarding environment problems are key instruments for raising public awareness and for communicating the dimension of a problem to political decision makers. It supports political decision makers in checking the effectiveness of their legal instruments in prioritising the problem and in allocating resources accordingly.

The EEA supports this process by providing the right information at the right time. This mission was demonstrated by a European wide overview of saltwater intrusion due to groundwater over-exploitation.

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