

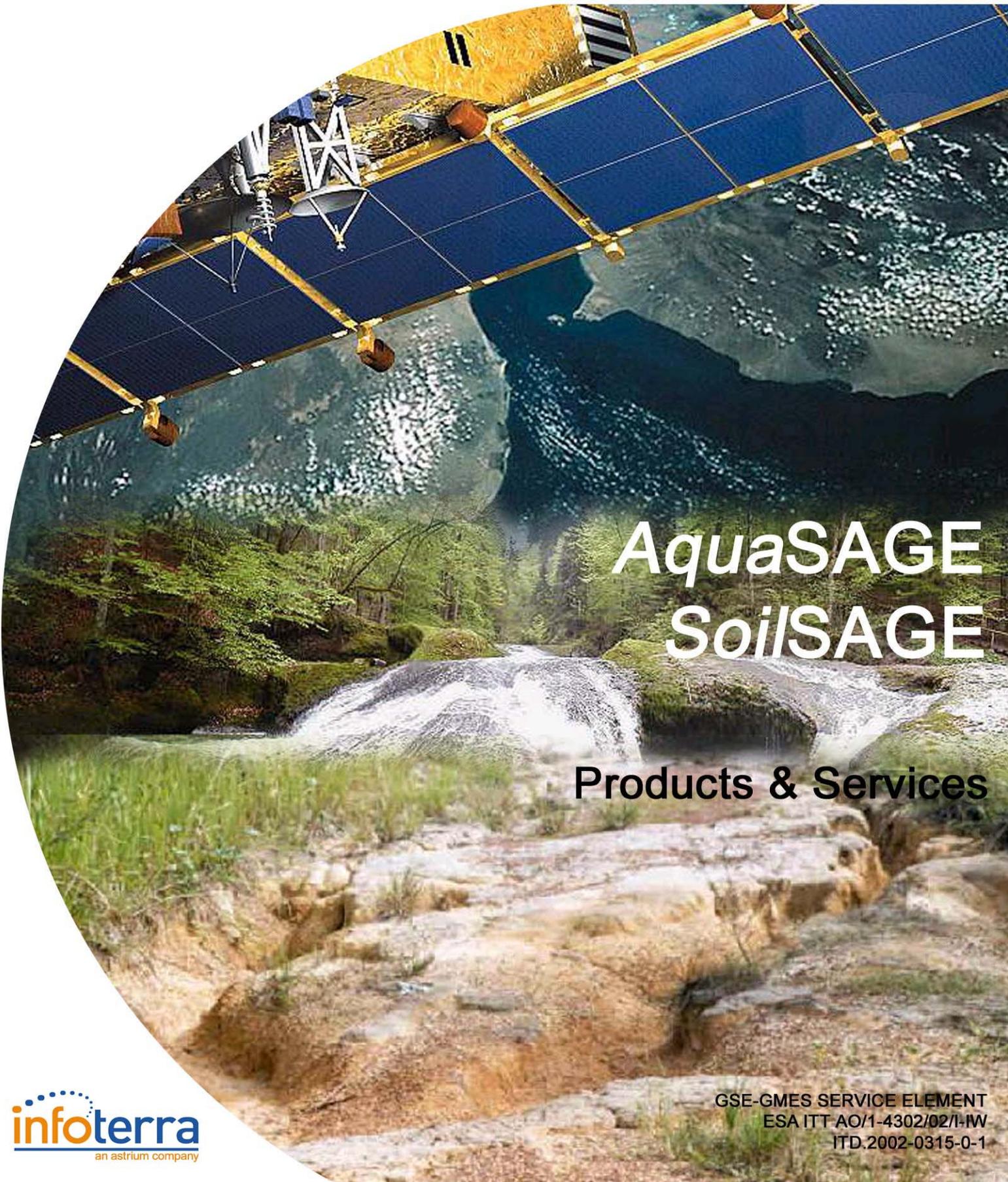


Global  
Monitoring for  
Environment and  
Security



# SAGE

Service for the Provision of Advanced Geo-Information  
on Environmental Pressure and State



## *AquaSAGE* *SoilSAGE*

### Products & Services



GSE-GMES SERVICE ELEMENT  
ESA ITT AO/1-4302/02/1-IW  
ITD.2002-0315-0-1

## END-USERS STATEMENTS:

---

**European Environmental Agency (EEA):** "...these studies face the inherent limitations of CORINE landcover data, due to the adopted scale and nomenclature. The definition at the European level of large-scale digital maps, adapted to the needs of rural management, should be considered" (EEA (2001): Towards agri-environmental indicators; Topic Report No. 6;; p. 129)

**Natur Vards Verket (Swedish Environmental Protection Agency):** "Use of EO data is already part of the Swedish forest monitoring strategy (protected forest areas as well as the forest landscape as a whole). However, more can be done to use these data sets as input to monitoring, modelling and planning in a watershed context, e.g. for the WFD implementation." (LOI)

**Landesanstalt für Wald und Forstwirtschaft (Germany):** "As a service center ... the LAWUF is involved also in the development of procedures for the European Union report system. Here, the principal interest is on the development of standardized, cost effective and regularly repeatable procedures" (LOI)

**Federal Environmental Protection Agency (FEA, Austria):** "FEA requires specific data, information products and services on soil sealing as input to spatial planning at different levels because for instance "the Austrian Rhine Valley will – without the implementation of adequate policies – be totally sealed (in the sense of covered by scattered settlements) at the turn of the century" (LOI)

**Land Vorarlberg (Austria):** "We are highly interested in the development of potential Earth observation based products and services that meet our information demands and are looking forward to a successful co-operation".

"We require up-to-date information products on soil sealing for the formulation and validation of policy on State and local level" (LOI)

**Institut Francais de l'Environnement (France):** "The shortcomings of the current approach (here the Water Directive 2004 Inventory data supply) are that the available information is not exhaustive and representative. The same comment can be made for its relevance" (LOI)

**UBA, D:** "... it becomes obvious that remote sensing is a useful tool to efficiently generate land use information. However, different tasks require different levels of detail".

"... most remote sensing based surveys have been conducted in the framework of prototype projects without being developed into operational services." (LOI)

## THE SAGE PROJECT: AN INTRODUCTION

*The project team understands the ESA GSE programme as a major effort of all ESA member states, the European community and their respective Member States, the European Commission, and Canada to provide operational information for monitoring and management of the environment and for security in order to fulfil European policies.*

A **GMES Service Element on Environmental Stress** can be achieved by **integrating existing operational services** and enhancing these elements with the results of several years of research and development into novel operational geo-information services. The goal is to overcome current obstacles and drawbacks due to deficiencies in space, ground and service infrastructure, resulting in an immature market for EO based geo-information.

Information on stress (i.e. pressure and state) to the environment as well as **indicators on environmental quality** is required by environmental authorities as the prerequisite for the evaluation of threats, the initiation of mitigation actions and the assessment of progress and improvements towards quality of life and social welfare. Such information can be provided using recent and future Earth Observation (EO) systems and information retrieval technology in the framework of geographical information systems (GIS) already installed throughout Europe. Therefore, in response to the GSE ITT, Infoterra GmbH and its partners are proposing a consolidation action on the establishment of **SAGE** for the benefit of environmental agencies reporting at European, national and regional level. (fig. 1).

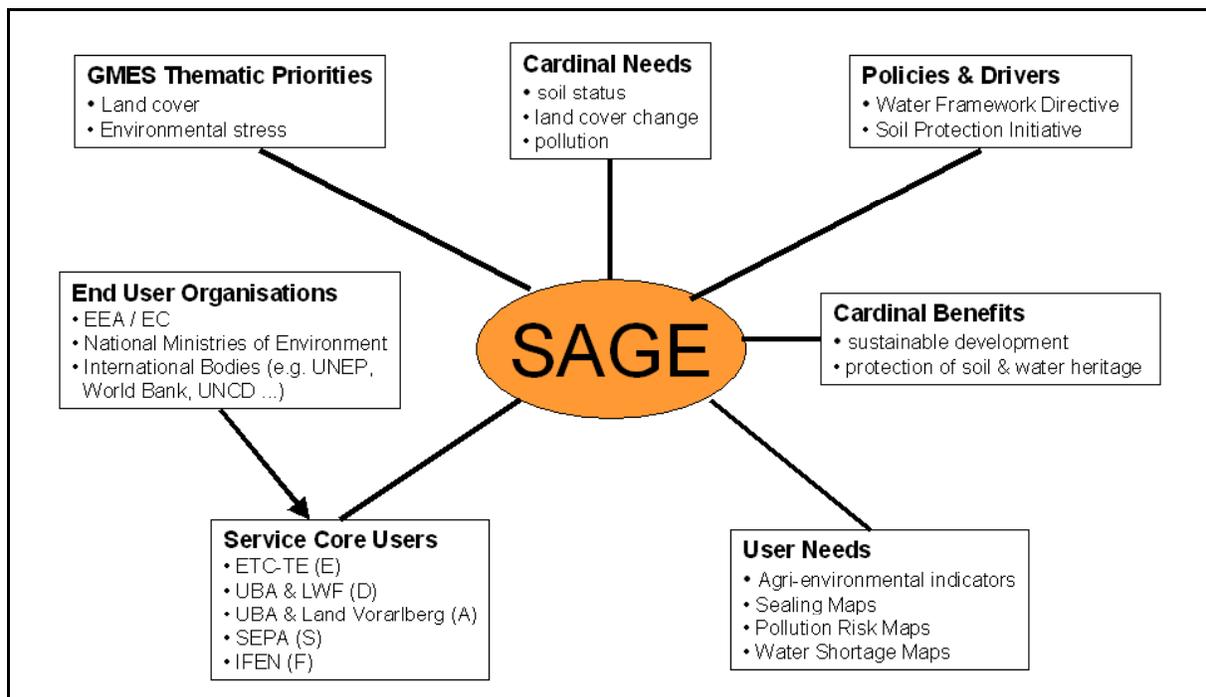


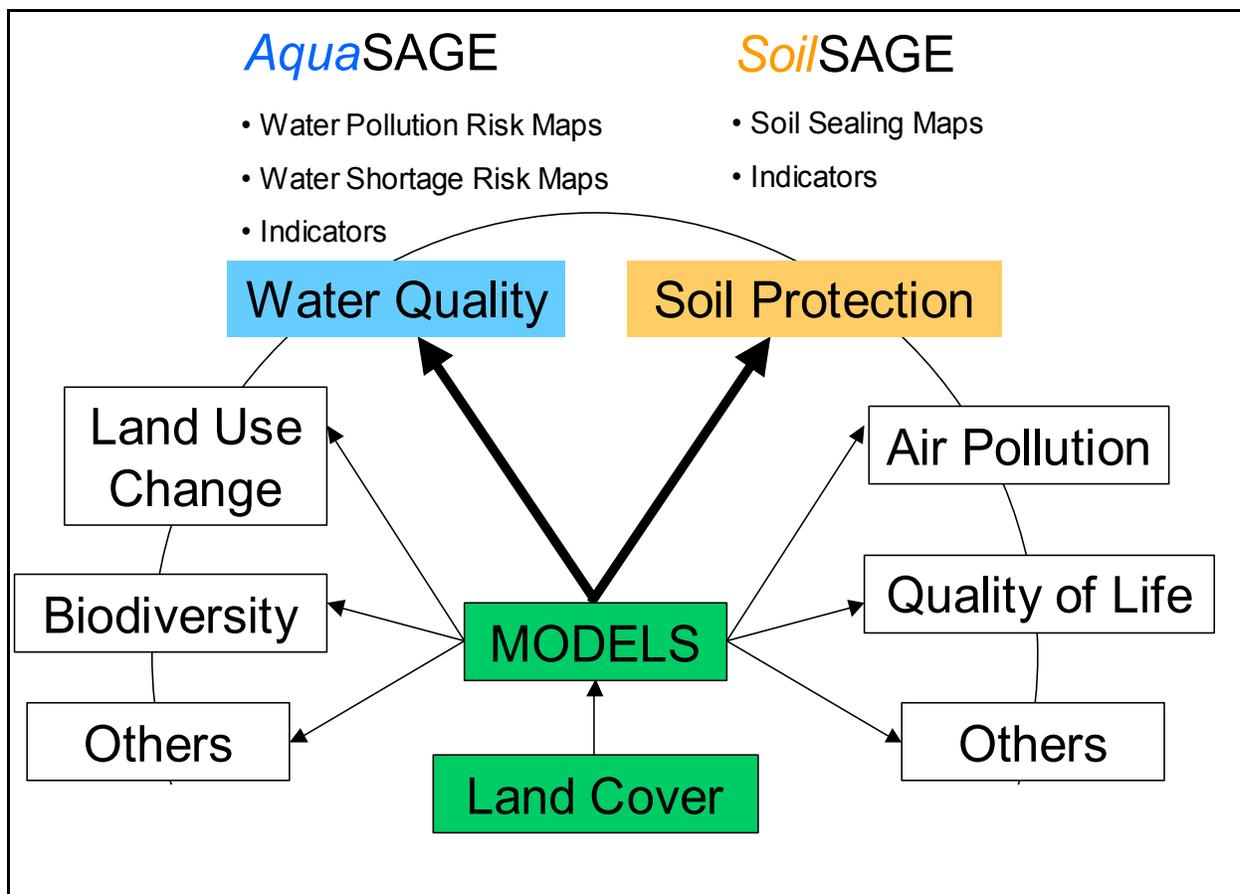
Figure 1: SAGE, the answer to GMES requirements on environmental pressure and state.

## THE SAGE IGNITION: RELEVANT EUROPEAN POLICIES

*The proposed project aims at the GMES priority themes “Environmental Stress” and “Land Cover”. The pre-cursor services address the European Water Framework Directive (WFD) and the Soil Protection Initiative (SPI).*

It is recognised, that in the long term economic growth, social cohesion and environmental protection must go hand in hand as a result of the development of an EU sustainable development strategy. This requires that economic growth supports social progress and respects the environment, decoupling environmental

degradation and resource consumption. However, in order to monitor and improve environmental conditions, the **cardinal needs** of planners and decision makers on available, reliable, and affordable information delivered in time on environmental pressure and stress have to be served. As it is out of scope for a limited project to deal with all aspects addressed by both priority themes, emphasis will be set on the provision of **environmental information on European water and soil conditions** (Figure 2).



*Figure 2: Starting from basic geo-information on landcover in its initial stage, the SAGE portfolio focuses on supportive actions for the implementation of WFD and SPI.*

## THE SAGE USERS

SAGE addresses directly the requirements of core users dealing with implementation of the WFD and SPI, and representing different environmental conditions (boreal, central European, Alpine, Mediterranean), different information levels (European, regional, national, local), and different **end user-organisations** (European Commission – European Environmental Agency, Ministries of Environment from member states and local end user groups; e.g. federal state ministries or regional water / soil authorities).

This structure has significantly influenced the composition of the study team. Figure 3 shows the user-segment to be served in the study, mapped on the hierarchical structure of the legal frameworks and their implementation.

A global user-base cannot be addressed within this project, yet. But a further roll-out is foreseen in the strategic plan.

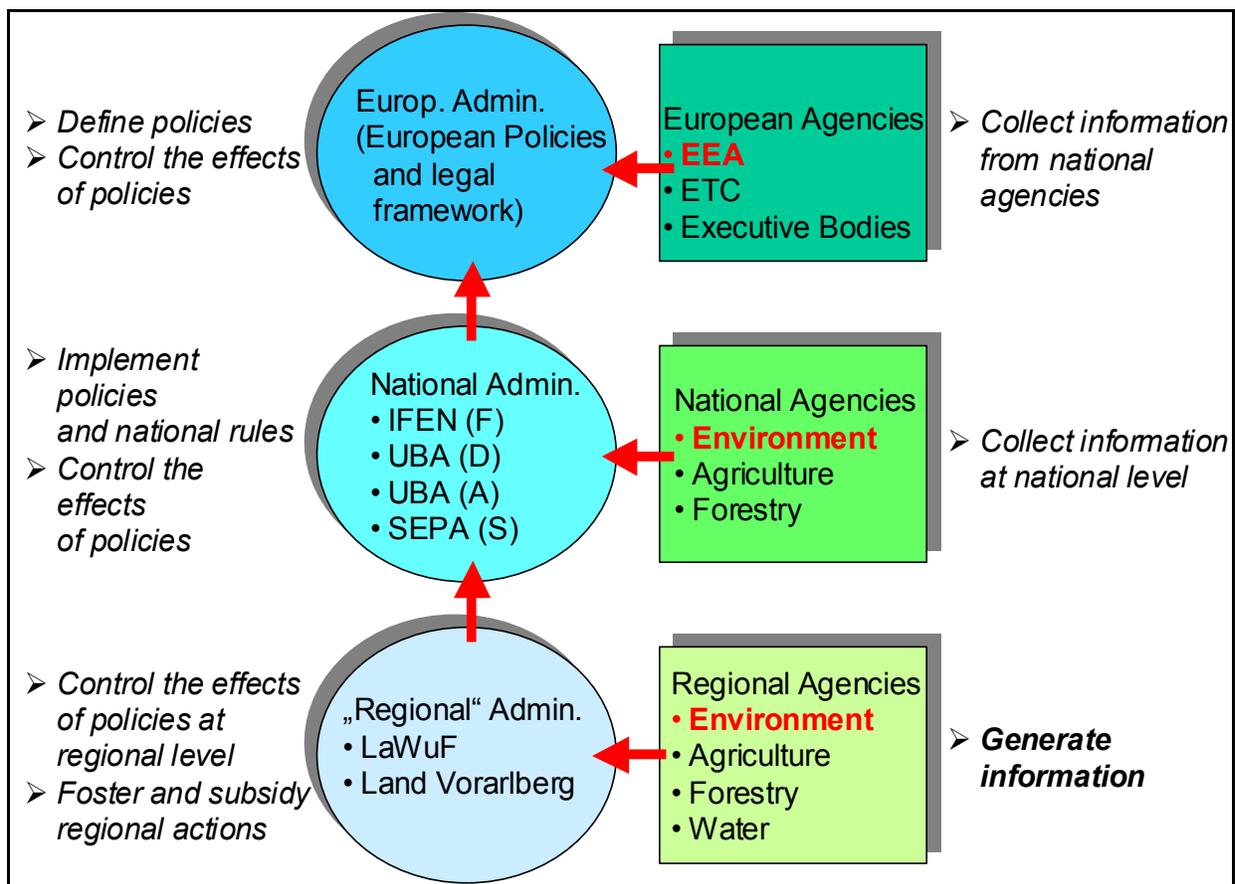


Figure 3: The SAGE User Segment

## THE SAGE CORE USERS AND THEIR NEEDS

According to the consultations with the core users during the preparation phase of GMES (e.g. in the national GMES working groups) resp. during the preparation of this proposal, the following **major demands** have been identified:

- *Efficient implementation of monitoring and reporting mechanism for WFD and SPI;*
- *New directives require reporting on a river basin unit, not on administrative units;*
- *In-situ point measurements lack spatial context resulting in limited quality of model results,*

- *therefore new spatially based monitoring systems need to be implemented.*

Due to their high interest in SAGE, the core users will actively participate in the project. Of special importance is the involvement of the ETC-TE as a European co-ordinator of the core user group.

All core users have expressed their commitment in respective LOIs and/or through signing consultancy contracts attached to this proposal. In Table 1, the most prominent statements are listed, emphasising the end user's commitments.



Figure 3: The SAGE Core User Group

## NEW EO-BASED SERVICES: THE SAGE PORTFOLIO

To serve the needs of many different end user-segments **SAGE reflects:**

- **hot spot mapping** or sampling approaches on local / regional level
- **complete coverage** in significantly reduced scales on international level
- **different end user infrastructures;** e.g. an agency which has an information service already installed and which likes to improve their service will request only for better landcover information, while other customers may ask for a complete service on agri-environmental risk maps or indicators for planning, control and response actions. SAGE pre-cursor services comprise
- **AquaSAGE with Water Quality, Water Shortage and Indicators (pressure & state indicators)**

- **SoilSAGE with pressure and state indicators.**

SAGE will start with the generation of intermediate LC/LU products. In a second step they will be combined with other data by GIS models towards final products directly suiting the end user needs. Implementing this approach into a production environment the production chain has to be based on a GIS embedded product level hierarchy. The thematic content required for SAGE's advanced geo-information services (model for pressure, risk and indicators) will comprise layers from external sources rapidly changing layers (e.g. agriculture) based on EO. On European level such an approach requires a high rate of harmonisation of formats, thematic class definitions and modelling methods in order to achieve a seamless data transfer between different hierarchy levels, agencies and nations.

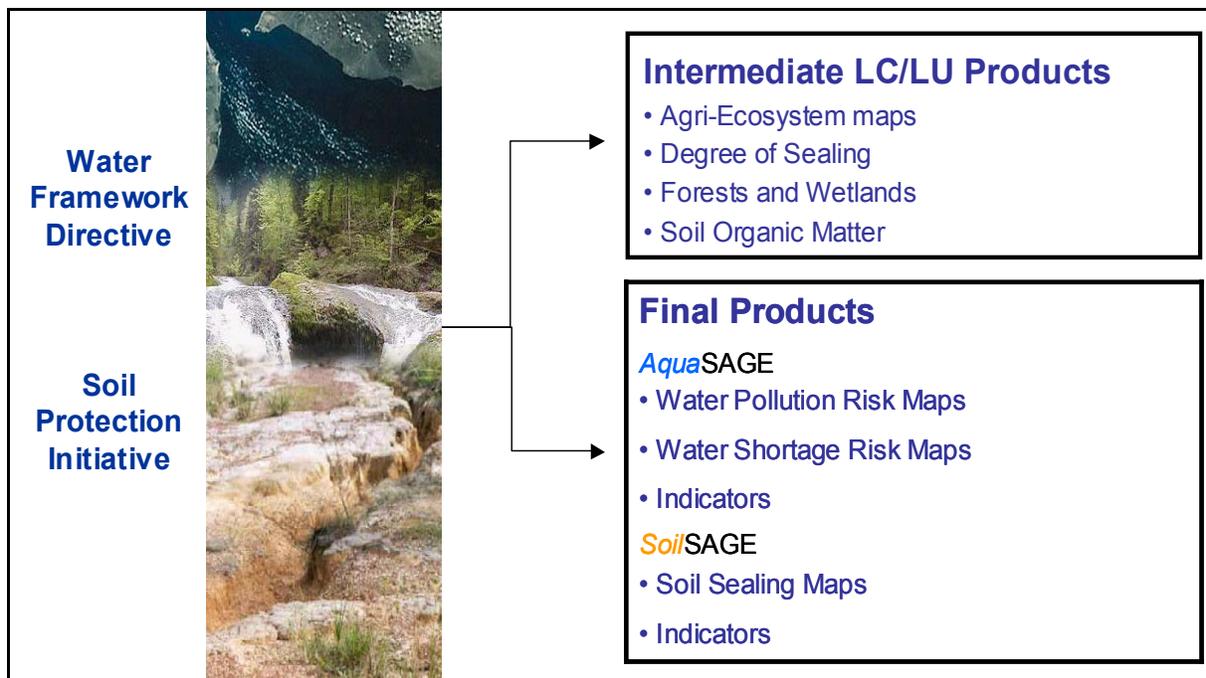


Figure 4: The SAGE Product Portfolio, based upon the requirements of WFD and SPI

## SAGE PORTFOLIO GROWTH POTENTIAL

---

At the current stage, no end users from additional states have been included. However, the test sites selected already cover many environmental issues directly relevant for them. Via the ETC-TE, the dissemination of results to Candidate Countries is assured. In addition, the close relationship of Austrian and German team members (from both service providers and end users) to eastern European countries will

contribute to that issue as well. The global perspective of SAGE is assured, because the service is able to easily up-scale environmental indicators following international agreements and definitions, and because global consultants such as e.g. the Gerling Sustainable Development Partners (GSDP) can be approached within the user federation work packages.

## IMPROVED SUSTAINABILITY: THE BENEFITS OF SAGE

---

*The key goal is the support of the responsible authorities by sustainable management of their water basins and their soils. A better understanding and the early detection of potential risks and sources of environmental degradation will contribute towards a reduction of costs for mitigation, maintenance and sustainable management of the environment as well. In addition, SAGE will be an important step towards a harmonized reporting scheme for the European Union as a whole.*

- a) For both policies the user's needs of topical and reliable geo-information about pressure and state **over large areas and crossing borders** (e.g. the huge catchments of rivers Rhine, Danube or Elbe) are increasing, but currently no operational geo-information service, serving these needs by **offering an end-to-end information service**, exists.
- b) SAGE addresses an emerging market, where legal frameworks and time-frames are already defined or on their way. The technical implementation is still under discussion, which offers a **unique chance to introduce spatial information with substantial EO contribution to a broad end user segment**.

**The implementation of the new European policies (WFD & SPI) are a challenge to most legal bodies in charge.** For example, the demand for water basin management plans addressed by the WFD, and reporting schemes on GIS basis requested from the EC, will impose a **real paradigm change**: instead of statistical data from sampling and point measurements (today's standard approaches), spatial information on is increasingly required on national and local scales. In addition, the European Commission put strong efforts on harmonised reporting from the member states, which requires harmonisation of thematic content and data formats in order to make reports comparable on European level. Here, EO based geo-information data provided by SAGE will contribute significantly.

- c) SAGE's features and potential benefits will be demonstrated by a **team of well-established and experienced service providers**. It relies completely on existing precursor services, e.g. landcover mapping and monitoring, hydrological models and environmental pressure and state indicators. Thus - under the pre-condition that appropriate EO data are available – **SAGE can be assumed to be semi-operational**.

## THE SAGE DEFINITION APPROACH

---

The salient features to achieve SAGE's objectives have already been identified by ESA and are recognised by the study team. They constitute the GSE's objectives and milestones:

- The involvement of end users for **"closing the loop"** between the operational results obtained from the present generation of EO satellites and the definition of future systems.
- The **demonstration** of EO based information precursor services which are based on proven technology and which are capable to deliver in time reliable and affordable information.

- The identification of **cross-cutting issues** of a GSE core service basis, addressing for instance a harmonised production chain for landcover / land use (LC/LU) information as "intermediate" products.

The technical realisation of SAGE is based on an open concept for both the infrastructure (space, ground and services) and the partner network. As an overall principle, the design first of all reflects the user needs translated into SAGE's product portfolio.

## OPEN SERVICE PARTNERSHIP: THE SAGE ORGANISATION SCHEME

---

*The consortium members are not committed by any exclusivity agreement. The partnership is open in principle. Both, the organisation scheme envisaged for further operational services and the product design principles and production definition along the value chain with open interfaces enable the integration of new partners:*

- The **product design** builds on late customising to exploit product development and production synergies for the upstream steps of the value chain (data acquisition, data processing, common intermediate products). Downstream customising is necessary to **answer the different needs of geo-biophysical zones and national requirements**. The latter adaptation is necessary as the current European directives build on the principle of subsidiarity and pass on the legal mandate for monitoring and information collection to national entities.

A general harmonisation of the reporting schemes and models used has not been agreed between all member states, yet.

- The production chain relies on a **common architecture for the key production steps**; it is designed in a modular way with open interfaces to enable different entities to collaborate.
- The **service partnership** does foresee an **evolution** from single companies working on individual projects to a network of partners serving national / regional end-customers (representing the current de facto status in Europe) to a structured consortium with partners providing centralised core services and de-centralised customising to local requirements. This layout keeps open windows of opportunity for specialised service providers focussing on certain aspects of the production chain and local service and/or distribution partners.

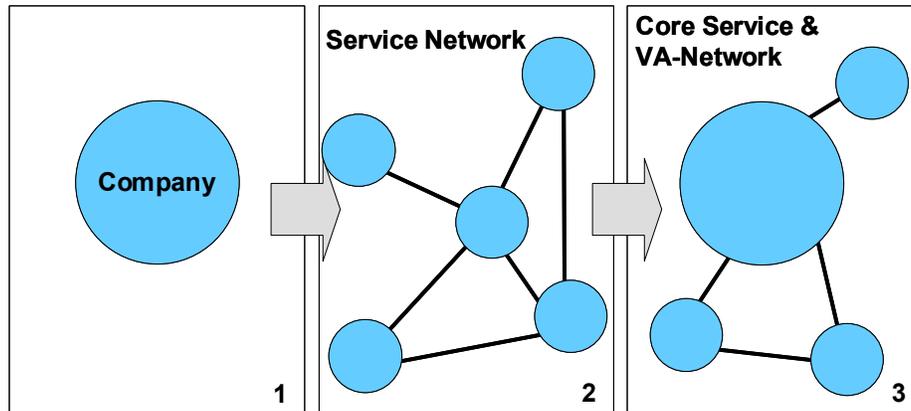


Figure 3: The Sage Vision: Development of Core Services within VA-Networks

### BOTTLENECKS TO OVERCOME: SAGE CHALLENGES

- **Reliability of service** to be achieved on all levels of the infrastructures involved, especially through reliable and timely data acquisition, product generation, and dissemination.
- **Harmonisation of European reporting mechanism** for SPI and WFD w.r.t. to content standards to enable efficient mapping approaches and data exchange.
- **Acceptance of technical standards** allowing for EO-based geo-information procurement for WFD and SPI.
- **Implementation of budgets dedicated to WFD and SPI monitoring and reporting services** (expected until 2004 for WFD within the given time schedule of the directive).

### BRINGING EUROPE TOGETHER: THE SAGE TEAM

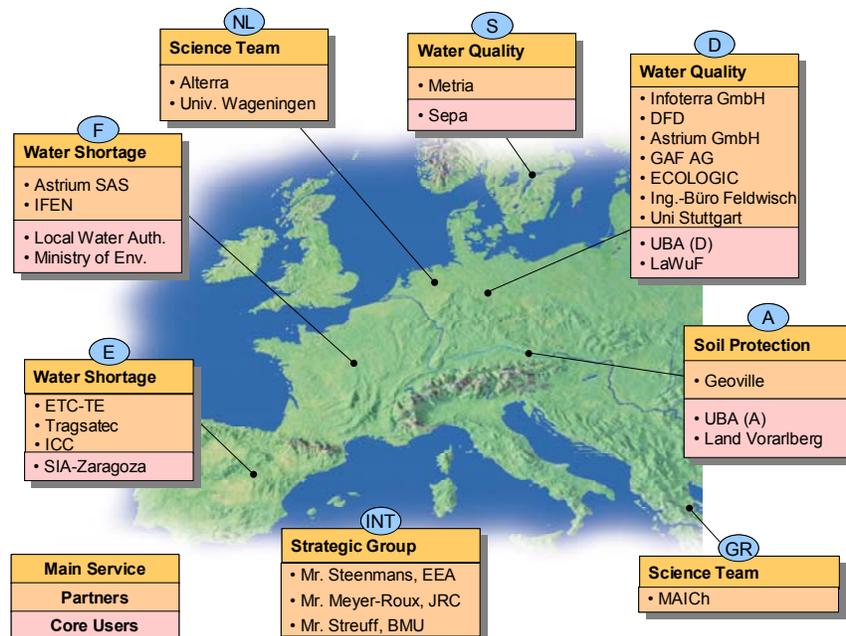


Figure 5: Overview of the SAGE team organisation and the partners

### Core User Group

#### **ETC Terrestrial Environment**

Torre C5-S, 4th floor,  
E-08193 Bellaterra (Barcelona), Spain  
P: +34935813549  
F: +34935813545

#### **Institut Francais de l'Environnement**

Department des Milieux et des  
Territoires  
61, bd Alexandre Martin  
45058 Orléans Cedex 1, France  
P: +33 (0) 238797878  
F: +33 (0) 238797870

#### **Landesanstalt für Wald u. Forstwirtschaft**

Jägerstr. 1  
99867 Gotha, Germany  
P: +49 03621-225 331  
F: +49 03621-225 222

#### **Swedish Environmental Protection Agency**

Blekholmsterrassen 36  
S-106 48 Stockholm, Sweden  
P: +46 8 698 1000  
F: +46 8 202925

#### **Federal Environment Agency Austria**

Spittolauer Laende 5  
1090 Vienna, Austria  
P: +43 131 3040  
F: +43 131 3045400

#### **Umweltbundesamt**

Bismarckplatz 1  
Postfach 33 00 22  
14191 Berlin  
Germany  
P: +493089032751  
F: +493089032907

#### **Amt der Vorarlberger Landesregierung**

Abt. VIIa/VoGIS, Landhaus  
6901 Bregenz, Austria  
P: +43 05574 5110  
F: +43 05574 51180

### System Developers

#### **Astrium GmbH**

88039 Friedrichshafen, Germany  
P: +49754583471  
F: +49754584105

#### **DLR Oberpfaffenhofen**

82234 Wessling, Germany  
P: +49 (08153) 282658  
F: +49 (08153) 281448

### Service Providers

#### **Astrium SAS**

Ground Systems, Applications &  
Services Directorate  
31, avenue des Cosmonautes  
31402 Toulouse Cedex 4, France  
P: +33 (0) 562 19 64 23  
F: +33 (0) 562 19 97 81

#### **GAF AG**

Arnulfstr. 197  
80634 Muenchen, Germany  
P: +49 (0)89 121528-60  
F: +49 (0)89 121528-79

#### **Geoville Informationssysteme und Datenverarbeitung GmbH**

Museumstraße 9-11  
A-6020 Innsbruck, Austria  
P: +43 (512) 56 202 10  
F: +43 (512) 56 202 122

#### **Infoterra GmbH**

88039 Friedrichshafen, Germany  
P: +49 (0) 7545 8 9969  
F: +49 (0) 7545 8 1337

#### **National Land Survey, Metria Miljöanalys**

P.O. Box 355  
SE-101 27 Stockholm, Sweden  
P: +46 (8) 579 972 74  
F: +46 (8) 579 972 80

#### **TRAGSATEC**

Dpto. Teledetección  
C/ Conde de Peñalver 84, 2 C  
28006 Madrid, Spain  
T: +34 91 396 90 61

### Strategic Group:

#### **JRC – IES**

Jean Meyer-Roux  
I-21020 Ispra, Italy  
P: +390333789514  
F: +390332785230

#### **EEA**

Chris Steenmans  
Kongens Nytorv 6  
1050 Copenhagen K, Denmark  
P: +4533367116  
F: +4533367151

#### **Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit**

Dr. Hartmut Streuff  
Heinrich-von-Stephan-Strasse 1  
53175 Bonn, Germany  
P: +49 (0)1888 3052180  
F: +49 (0)1888 3053972

### Research Partners

#### **ALTERRA**

P.O. Box 47  
6700 AA Waageningen, Netherlands  
P: +31 (0) 317 47 4509  
F: +31 (0) 317 41 9000

#### **ARC Seibersdorf Research**

Space Applications Division  
2444 Seibersdorf, Austria  
P: +43 0 50550 2020  
F: +43 0 50550 2010

#### **Vienna University of Technology**

Institute of Photogrammetry and  
Remote Sensing  
Gusshausstrasse 27-29  
1040 Vienna, Austria  
P: +43 1 58801 12225  
F: +43 1 58801 12299

#### **Mediterranean Agronomic Institute of Chania**

Alsyllion Agrokepion, (P.O. Box 85)  
73100 Chania, Crete-Greece  
P: +30 (28210) –81151  
F: +30 (28210) –811 580

#### **Swedish University of Agricultural Science**

Dept. of Environmental Assessment  
PO Box 7050  
75007 Uppsala, Sweden

#### **Institut für Landwirtschaftliche Betriebslehre (410A)**

Universität Hohenheim  
Schloss Osthof Süd  
D - 70593 Stuttgart, Germany  
T: +49 (0)711 459 2543  
F: +49 (0)711 459 2555

### Consultants

#### **ECOLOGIC**

Pfalzburger Strasse 43/44  
10717 Berlin, Germany  
P: +49 (0) 30 86880105  
F: + 49 (0) 30 86880 100

#### **ECORYS Transport – NEI**

P.O. BOX 4175  
3006 AD Rotterdam, The Netherlands  
P: +31 (10) 4538606  
F: +31 (10) 4523680

#### **Ingenieurbüro Dr. Feldwisch**

Hindenburgplatz 1  
51429 Bergisch Gladbach  
P: +49 02204-4228-50  
F: +49 02204-4228-51

# The SAGE Team

## Core Users

ETC Terrestrial Environment  
(ETC-TE, Int.)

Institut Francais de  
l'Environment (IFEN, F)

Landesanstalt für Wald u.  
Forstwirtschaft (LaWuF, D)

Swedish Environmental  
Protection Agency (SEPA, S)

Federal Environment Agency  
Austria (FEA, A)

Umweltbundesamt (UBA, D)

Amt der Vorarlberger  
Landesregierung (A)

## Service Providers

Infoterra GmbH (D)

Astrium SAS (F)

GAF AG (D)

Geoville Informationssysteme  
und Datenverarbeitung GmbH  
(A)

National Land Survey, Metria  
Miljöanalys (S)

TRAGSATEC (E)

## System Developers

Astrium GmbH

Deutsches Zentrum für Luft-  
und Raumfahrt (DLR, D)

## Consultants

ECOLOGIC (D)

ECORYS Transport - NEI (NL)

Ingenieurbüro Dr. Feldwisch (D)



For further Information please contact:

**Infoterra GmbH**  
**Mareike Doepke**  
Management Training & Promotion  
An der Bundesstrasse 31  
88090 Immenstaad/Bodensee  
Deutschland/Germany  
T. +49 (0) 7545 8 9969  
F. +49 (0) 7545 8 1337  
E. [Mareike.Doepke@infoterra-global.com](mailto:Mareike.Doepke@infoterra-global.com)  
[www.infoterra-global.com](http://www.infoterra-global.com)

Project funded by European Space Agency  
ESRIN/Contract No. 17064/03/I-LG  
**European Space Agency (ESA)**  
**Earth Observation Programme**  
**Application Department- ESRIN**  
**Frank Martin Seifert**  
Via Galileo Galilei  
00044 Frascati (RM)  
Italy  
T. +39 (06) 94180560  
F. +39 (06) 94180552  
E. [frank.martin.seifert@esa.int](mailto:frank.martin.seifert@esa.int)  
[www.esa.int](http://www.esa.int)