Policy and decision makers' involvement

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Abstract

The deliverable presents a complete overview of past, on-going and future activities of the enviroGRIDS project and partners in the field of policy makers' involvement through the interface of the International Commission for the Protection of the Danube River (ICPDR) and the Commission on the Protection of the Black Sea against Pollution (Black Sea Commission, BSC).

First, a short description of the ICPDR and BSC structure, objectives and expectations from the enviroGRIDS project are explained.

Then, past activities are presented through the description of some important outputs of the project:

- Factsheets in 15 languages
- Data gap analysis on Earth observation in the Black Sea catchment
- Policy briefs on GEOSS, Integrated Water Resource management and scenarios of global changes
- Workshops in several countries on bringing GEOSS into practice
- Publications in Danube Watch, Saving the Black Sea and International Innovations
- Contribution in several ICPDR and BSC meetings and conferences
- Video on the Story of Data on the Environment

On-going activities concern:

- Improvement of the ICPDR and BSC Spatial Data Infrastructures
- Creation of data and metadata web services
- MONERIS and SWAT hydrological modelling
- Creation of global changes scenarios in climate, demography, land use and water resources
- Preparation of the last general assembly in Sofia and the final conference in Batumi

In the last year of the project, enviroGRIDS will strive to finalize the following activities:

- IT support to the ICPDR and BSC Spatial Data Infrastructures
- Encourage new GEO national memberships in Bulgaria and Georgia
- Support know-how of ICPDR in river basin management
- Assess the pollution loads for the needs of the Black Sea Commission
- Prepare an After-life plan for the enviroGRIDS project.

Finally, both commissions draw a few conclusions on their relationships with the enviroGRIDS projects and related domains of the Earth Observation and Spatial Data Infrastructure.

1 Introduction

1.1 WP7 objectives on dissemination and training:

The main objectives of enviroGRIDS (Lehmann et al. 2008) in terms of dissemination and training (Figure 1) can be summarized as follows:

- To involve decision- and policy makers in the Black Sea Catchment and disseminate project results through the Commissions for the Danube (ICPDR) and Black Sea (BSC)
- To build capacity of end-users in the Black Sea catchment for the domains of EnviroGRIDS; thereby contributing to the Global Earth Observation System of Systems by means of workshops, conferences and virtual platforms
- To promote the sustainability of partnerships and enhance local ownership of the data and outcomes.

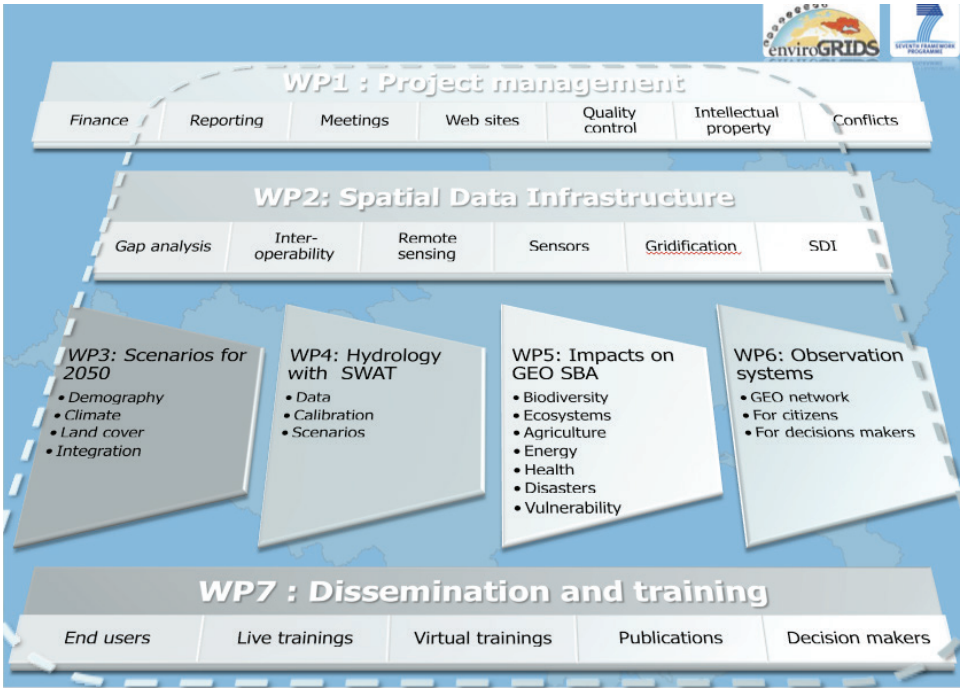

Figure 1 Work packages and tasks structure of the enviroGRIDS project. Lower right: task on Decision makers

1.2 Description of task 7.5 on Decision and policy makers involvement

This task is co-ordinating the dissemination of the research results towards decision makers and policy makers. The two Commissions are in a perfect position to help improving the use of EnviroGRIDS outputs to policy makers through their existing networks of communication. These Commissions have for instance members of environment ministries of all countries in the Black Sea catchment in their different boards.

More particularly the Commission on the Protection of the Black Sea Against Pollution comprises nationally appointed Commissioners to represent the countries in the Commission, and thus ensures representation at the country level. Expert work is carried out mainly through the Advisory Groups and other activities, however for any scientific or other results to disseminate and translate into political or policy decisions they will be reviewed by the Advisory Groups, and then by the Commissioners.

To clarify the ownership of the data as well as to ensure a sustained engagement of the end-users, an after-life plan (post implementation plan) will be setup. This plan will essentially concentrate on the needs of the BSC and ICPDR partners by making sure that they can continue to use the spatial data infrastructure built during the project, as well as the Observation System.

The after-life plan aims 1) to consolidate the build up capacity in the Black Sea Region, 2) to clarify the ownership of the obtained data and outcomes, 3) to consequently transfer project outcomes, data, tools and guidelines, 4) to institutionalize the activities, 5) to ensure the updating of the developed systems and 6) to include lessons learned.

1.3 Document Structure

This report is organized in 6 main chapters and each chapter is divided in sub-chapters:

1. Overview of the objectives of this document
2. Objectives and expectations of the both commissions (BSC and ICPDR)
3. EnviroGRIDS past activities (factsheets, policy briefs, gap analysis, workshops, publications, conferences)
4. Description of ongoing activities of the project
5. EnviroGRIDS future activities and after-life plan
6. Recommendations

1.4 Objectives

This report describes how policy and decision makers have been involved through the activities of the BSC and ICPDR. In particular, enviroGRIDS is supporting both commissions in the fields of:

- Integrated Water Resource Management in connection with the European Water Framework Directive (**Error! Reference source not found.**)
- Earth Observations and spatial data infrastructures in connection with the INSPIRE and GEOSS international initiatives (Figure 2)
- Scenarios development for climate, land cover and demography in connection with various United Nations projects

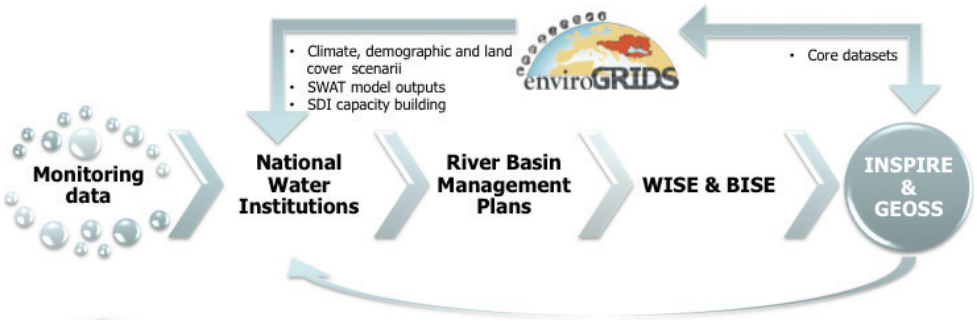

Figure 2 Contributions of enviroGRIDS to the chain of information for Integrated Water Resource Management

2 ICPDR and BSC as an interface to policy and decision makers

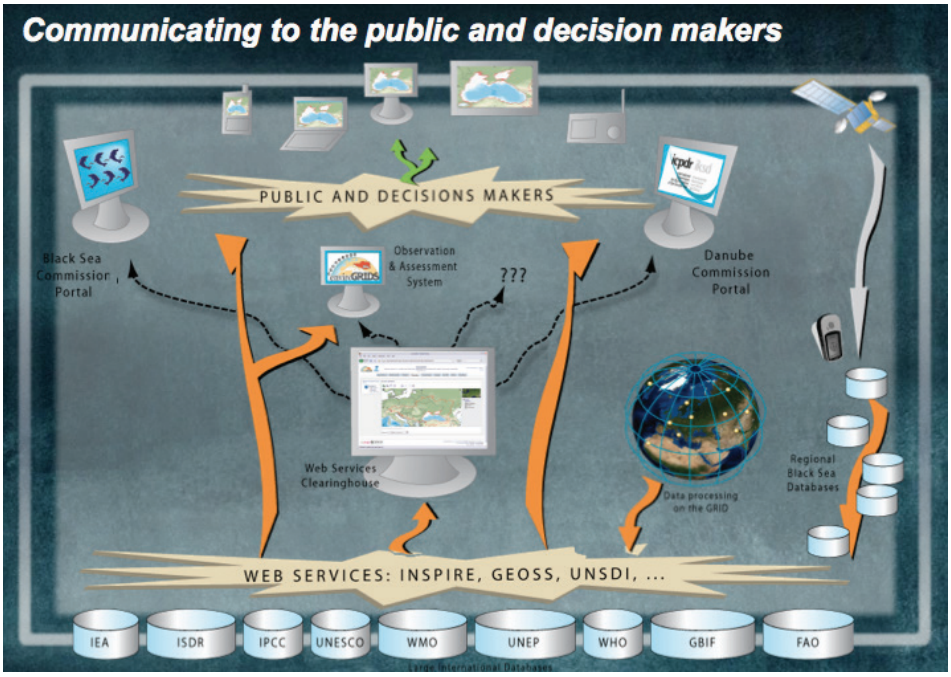

Figure 3 Contributions of enviroGRIDS to the creation of geo web services to feed the BSC and ICPDR web portal for public and decision makers' communication.

2.1 The International Commission for the Protection of the Danube River (ICPDR)

The International Commission for the Protection of the Danube River (ICPDR) works to ensure the sustainable and equitable use of waters and freshwater resources in the Danube River Basin.

The work of the ICPDR is based on the Danube River Protection Convention, the major legal instrument for cooperation and transboundary water management in the Danube River Basin.

The International Commission for the Protection of the Danube River (ICPDR) is a transnational body, which has been established to implement the Danube River Protection Convention. The ICPDR is formally comprised by the Delegations of all Contracting Parties to the Danube River Protection Convention, but has also established a framework for other organizations to join.

In 2000, the ICPDR contracting parties nominated the ICPDR as the platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD: CEC 2000). The work for the successful implementation of the EU WFD is therefore high on the political agenda of the countries of the Danube river basin district.

Since its creation in 1998 the ICPDR has promoted policy agreements and the setting of joint priorities and strategies for improving the state of the Danube and its tributaries.

The goals of the ICPDR are:

- Safeguarding the Danube's Water resources for future generation
- Naturally balanced waters free from excess nutrients
- No more risk from toxic chemicals
- Healthy and sustainable river systems

- Damage-free floods

Organisation and technical expert groups

The different bodies of the ICPDR are:

- Ordinary Meeting Group: taking the political decisions
- **Standing Working Group**: providing political guidance
- Technical Expert Groups: preparing the technical background documents

Technical Expert Groups form the backbone of the operation and the success of the ICPDR. These are formed by national experts from the Contracting Parties and representatives of the observer organisations.

Seven Expert Groups deal with a variety of issues - from policy measures to reduce water pollution to the implementation of the EU Water Framework Directive.

All technical work within the ICPDR is carried out by the Expert Groups. These Expert Groups are essential to the operation of the ICPDR, and rely upon the inputs and contributions of national experts from the Contracting Parties and from the Observers. In 2008, four Expert Groups dealt with technical issues, while three ad-hoc Expert Groups addressed specific questions and support the respective Expert Groups and/or other ICPDR bodies on request.

Expert Group on River Basin Management

The Expert Group on River Basin Management (RBM EG) defined and prepared tasks related to the implementation of the EU Water Framework Directive in the Danube River Basin, the Roof Report 2004 and coordinating the development of the Danube River Basin Management Plan in 2009.

Pressures and Measures Expert Group

The Pressures and Measures Expert Group (PM EG) identifies the causes of pressures and promotes measures to address them. Harmonizing the work of the ICPDR with the EU directives (e.g. UWWT Directive, Nitrates Directive, IPPC Directive) is another issue. The current priority of this Expert Group is to develop the Joint Programme of Measures, which is part of the Danube River Basin Management Plan. This Expert Group also works with pollution prevention and precautionary controls, including inventories of potential accident risk spots and old contaminated sites in areas liable to flooding.

Monitoring and Assessment Expert Group

The Monitoring and Assessment Expert Group (MA EG) is responsible for issues concerning water quality assessment and classification, including the operation of the Trans-National Monitoring Network and Analytical Quality Control. During 2001 and 2007 this expert group also carried out the Joint Danube Surveys.

Flood Protection Expert Group

The Expert Group on Flood Protection (FP EG) has been responsible for developing the Action Programme for Sustainable Flood Protection in the Danube River Basin and is currently overseeing its implementation at the national level.

Accident Prevention and Control Expert Group
The overall objective of the APC EG is to support ICPDR activities to reduce accidental water pollution including safety measures, to limit accidents caused by substances hazardous to water and especially their transboundary effects in the Danube basin and to maintain, operate and as needed further develop the Accident Emergency Warning System (AEWS) in the Danube River Basin ensuring its timely response to the relevant accidents.

Information Management and GIS Expert Group

Under the Information Management and Geographical Information System Expert Group (IM GIS EG)

the a series of maps of the Danube River Basin and the Strategic Plan for a Danube River Basin GIS have been developed. The Expert Group supports all activities related to the operation of the information system.

Public Participation Expert Group

The task of the Public Participation Expert Group (PP EG) is to support and provide input to ICPDR activities regarding communication and participation issues.

Strategic Expert Group

The ad hoc Strategic Expert Group (ad hoc S EG) addresses administrative and legal matters arising from the implementation of the DRPC. The Expert Groups have the possibility to form Task Groups, if specific tasks involving specific experience arise. Task Groups involve experts from the group and/or additional experts. Task Groups have specific mandates and their work is usually time limited.

The **Danube-Black Sea Joint Technical Working Group** co-ordinates the work of the ICPDR and the International Commission for the Protection of the Black Sea, particularly aiming to reduce nutrient inputs into the Black Sea.

During the project, the different bodies of the ICPDR were kept informed and updated with the latest information about the enviroGRIDS project. Thus, the **Information Management and GIS Expert Group** which is the technical group that coordinates the GIS activities and information systems of the ICPDR received information about enviroGRIDS project biannually at the meetings.

On 16 June 2009 at the 8th IMGIS EG Meeting held in Vienna, Austria the group received for the first time information about the enviroGRIDS project and its objectives. On that date were presented information about kick-off meeting from 24 – 29 April 2009 in Geneva and the two work packages with ICPDR involvement. Also the first task (together with the Black Sea Commission), the gap analysis of spatial data infrastructure in the Black Sea catchments was described.

Between 13 and 14 October 2009 the 9th IMGIS EG Meeting was held in Brno, Czech Republic. The group was informed about the current status of the enviroGRIDS project. Also presented and discussed was the first step of the Gap Analysis on Observations Systems in the Black Sea Catchments – the online questionnaire.

In Munich, Germany the 10th IMGIS EG was held between 23 and 24 February 2010. The enviroGRIDS project was presented and the further steps discussed. The IMGIS EG was informed that the Gap analysis will be split into two parts, a draft one until end of April 2010, and the final one at the end of April 2011. The results of the first draft of the Gap analysis will be available at the beginning of May, and will be presented at the General Assembly Meeting that will be held in Tulcea, Romania between 4-7 May. The IMGIS EG was informed that a request was made by a project partner (EAWAG) for GIS data to test SWAT (Soil Water Assessment Tool, see review in Gassman 2005)) on the Danube Basin in the frame of the work package 5 (development of a hydrologic model of the Black Sea Basin). Group members inquired about the relation of SWAT and the similar MONERIS model. It was explained that there has already been a meeting between the developers of both models and they agreed to compare the results for the Danube basin. Germany informed that a comparison between SWAT and MONERIS has been done in Bavaria and agreed to check, if this comparison can be made available to the ICPDR.

On 14-15 September 2010 the 11th IMGIS EG Meeting was held in Timisoara, Romania. The IMGIS EG was informed about the activities in the frame of the enviroGRIDS project, particularly the first draft of the Gap Analysis report, which has been submitted in April 2010.

Within the 12th IMGIS EG Meeting held in Pleven, Bulgaria, the group members were informed about the activities in the frame of the enviroGRIDS project, particularly the second stage of the Gap Analysis report focusing on implementation of INSPIRE and GEOSS in terms of data and services, the forthcoming yearly Project Meeting in April 2011 and the recently launched enviroGRIDS Geoportal.

The 13th IMGIS EG was held in Budapest, Hungary with the participation of Mr. Nicolas Ray. At this occasion the IMGIS EG was pointed to the activities of the enviroGRIDS project aiming at building capacity for a Black Sea Catchment Observation and Assessment System. A short overview on the

project frame was presented as well as a description of the Soil & Water Assessment Tool (SWAT) in particular, giving details on input and output data, as well as parallelization of this software with the help of CERN. The benefits of sharing data via webservices in the frame of GEOSS and the EnviroGRIDS portal were emphasised. The Gap Analysis 2 which deals with the requirements and implementation status of INSPIRE and GEOSS in the Black Sea Catchment countries was presented, too. The presentation gave an overview about existing data and SDI in the region. The benefits of sharing of data were again highlighted. In this context it was also pointed out, that the DanubeGIS development plan (ICPDR 2010a,b) to establish integration of ICPDR databases and use of web services aims in the same direction as enviroGIRDS.

Besides the technical meetings of the IMGIS EG, the enviroGRIDS project was also presented biannually at the high level meetings of the ICPDR**.** These are the **Ordinary Meeting** taking the political decisions and the **Standing Working Group Meeting** that provides political guidance. These meetings bring together the national delegates; the representatives from highest ministerial levels, technical experts, and members of the civil society and of the scientific community.

ICPDR objectives and expectations

The main objectives and expectations of the ICPDR related to the enviroGRIDS project focus on how to improve and increase the capacities on principal tasks, especially regarding data and information management, state of the environment reporting, assessments, water quality studies, early-warning systems and modeling.

The ICPDR uses the DanubeGIS system as an integrated, multi-thematic, harmonised web-based tool for geodata collection providing a basis for analysis and map production and thus supporting reporting and decision-making. The DanubeGIS was launched in 2006 and continuously improved and extended. The ICPDR identified some significant challenges for the system in the nearer future:

- the currently used ArcIMS map server reaches its end of product life,
- the WebGIS client needs to be substantially reworked to improve usability and performance,
- related ICPDR databases (e.g. emission inventories) need to be integrated for analysis and visualisation.

Also the following DanubeGIS needs were identified:

- EU Floods Directive (2007) related reporting, starting with the Preliminary Flood Risk Assessment in 2012
- Integration of PM databases (Emission Inventory, Investment projects, Accident Risk Spots, MONERIS scenarios, agriculture and economics) for analysis and visualization
- Integration of MA databases (TNMN, JDS) was already tested in the current system, but needs to be reworked in the future system
- Sharing (data or) metadata on the geoportal is expected by the enviroGRIDS project
- Adapt style according to the ICPDR website relaunch

If one or more of these issues could be improved within enviroGRIDS project, this will be an important benefit for the ICPDR and Danube countries.

Another objective of the ICPDR is to become one component of Global Earth Observation System of Systems (GEOSS) which is compatible with the new EU Directive on Infrastructure for Spatial Information in the European Union (INSPIRE: CEC 2007). Even if INSPIRE rules only apply to the EU member states, for ICPDR as a coordination platform at the regional level, the INSPIRE rules will be important in the reporting processes.

Another important issue for the ICPDR is the SWAT model (e.g. Dilks 2003). The SWAT model results should be compared with MONERIS model used by the ICPDR Pressures and Measures Expert Group. As BSC will make use of the outputs of the SWAT model and ICPDR is using MONERIS

model, a comparison between the outputs of both models will be essential for both commissions in order to be able to improve the situation in the Black Sea. The ICPDR participated in the Workgroup meeting of the Pressures and Measures Group of the Black Sea and discussed together with BSC about the use of indicators and whether the situation in the Black Sea is improving or not. Huge amounts of money have been invested in actions in the Danube basin in order to reduce the pollution and the results should be able to be seen in the Black Sea.

A series of key objectives and datasets are extremely important for the current and the future work of ICPDR in order to achieve their goals.

The key objectives of the ICPDR include the following:

- Ensure sustainable water management
- Ensure conservation, improvement and rational use of surface waters and ground water
- Control pollution and reduce inputs of nutrients and hazardous substances
- Control floods and ice hazards.

Also there are some data of key interest and where ICPDR is having expectations:

- Nutrient concentrations in the water column - [N, P, Si (total/available)]
- Secchi depth
- Turbidity
- Chlorophyll-a
- Macro-algae (indicative species) presence/absence
- Oxygen content
- Phytoplankton (key groups in numbers, biomass, and average volume of cells)
- Zooplankton (biomass/percentage of key groups, number of Noctiluca)
- Macro-zoobenthos (biomass, percentage of key groups)
- Pollutants – inorganic and organic

Data of potential interest:

- Water level
- Climatic information: temperature, precipitation
- Atmospheric deposition
- Land properties and resources
- Groundwater parameters
- Marine biology parameters

It is evident that not all issues listed could be solved within the enviroGRIDS project, but at least with enviroGRIDS support, ICPDR will use the tools and the new international standards to gather, store, distribute, analyze, visualize and disseminate data, metadata and scientific information.

2.2 The Commission on the Protection of the Black Sea against Pollution (BSC)

BSC mission and objectives

The Commission on the Protection of the Black Sea against Pollution (Black Sea Commission, BSC) was established in 1992 for implementation of the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), its protocols, and the Black Sea-Strategic Action Plan (BS-SAP: BSC PS 2009). The BSC is presently the regional Focal Point in environmental protection,

dealing with monitoring activities, policy and legislation development, state of the environment assessments, decision-making, harmonization in different aspects (standards, methodologies, policies), emergency situations, etc.

The ultimate goal of the Black Sea Commission is to "rehabilitate" the Black Sea, and "to preserve its ecosystem as a valuable natural endowment of the region, whilst ensuring the protection of its marine and coastal living resources as a condition for sustainable development of the Black Sea coastal states, well-being, health and security of their population". [1].

Most of the environmental problems in the Black Sea are of transboundary character, and as such cannot be efficiently regulated by individual states. Besides, many Black Sea resources are shared and in need for a common regional policies. The successful strategy in environmental protection of a sea with transboundary problems lies in the regional approach, uniform understanding of environmental quality objectives and joint efforts to achieve them. The new environmental management approaches: Integrated Coastal Zone Management (ICZM); the Ecosystem Approach; and Integrated River Basin Management (IRBM) became a core of the new Black Sea Strategic Action Plan, based on sound understanding of the priority transboundary environmental problems and consequent formulation of ecosystem quality objectives.

The Ecosystem Quality Objectives in the BS-SAP2009 are addressed to the major environmental problems in the Black Sea region and they are:

- EcoQO 1 Preserve commercial marine living resources through:
  - Sustainable use of commercial fish stocks and other marine living resources.
  - Restore/rehabilitate stocks of commercial marine living resources.
- EcoQO 2 Conservation of Black Sea Biodiversity and Habitats through:
  - Reduce the risk of extinction of threatened species.
  - Conserve coastal and marine habitats and landscapes.
  - Reduce and manage human mediated species introductions
- EcoQO 3 Reduce eutrophication through:
  - Reduce nutrients originating from land-based sources, including atmospheric emissions.
- EcoQO 4. Ensure Good Water Quality for Human Health, Recreational Use and Aquatic Biota through:
  - Reduce pollutants originating from land-based sources, including atmospheric emissions.
  - Reduce pollutants originating from shipping activities and offshore installations

The BS-SAP2009 includes short-, mid- and long-term targets to tackle the sources of possible degradation – municipal, industrial and riverine discharges, overfishing, habitat destruction, ballast waters, illegal discharges from ships and other ship-related threats, climate change, lack of integrated coastal zone management and spatial planning, and others. The intention is to reach 'Good environmental status' of the whole Black Sea and to sustain it as likewise stated in the EC Marine Strategy Framework Directive (MSFD).

The primary geographical scope of the Bucharest Convention is the Black Sea. In addition, the SAP covers pollution sources from coastal area and stipulates Black Sea coastal states to make effort to implement relevant provisions of the SAP at the Black Sea basin (catchment) level.

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1 The Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea 2009, adopted in Sofia, Bulgaria, on 17 April 2009, available at www.blacksea-commission.org/_bssap2009.asp

During the last years the Black Sea Protocol for Combating Pollution from Land Based Sources (LBS Protocol) was in process of revision and in April 2009 the Black Sea coastal states signed this revised legal document. One of the main aspects of the revised LBSA[2] Protocol is the extended geographical scope based on understanding of role of transboundary watercourses that drain into the Black Sea. The Protocol provides the legal ground and presents opportunities to enhance cooperation with States and international bodies concerned with the protection and rehabilitation of the rivers draining into the Black Sea. This is of great importance for the Black Sea into which more than 300 rivers flow and where 80% of the pollution is recognized to come from activities carried out on land, either in coastal areas or further upstream in the proximity of rivers, which then transport the pollution to the sea. The rivers remain the largest source of nutrients loads to the Black Sea (Table 1).

Table 1 Estimates of annual nutrient loads to the Black Sea (tonnes)[3]
(Transboundary Diagnostic Analysis 2008, http://www.blacksea-commission.org/_tda2008.asp)

Nutrient source	DIN	PO_4-P
Direct discharges from municipal waste water treatment plants serving >5000 people	6,120	2,150
Direct discharges from Industrial sources discharging >1000 m^3/day	1180	250
River loads	362545	317799
Atmospheric deposition	203040–431460	

Considering the above, the Black Sea catchment is in area of interest of the BSC with respect to implementation of its mission.

BSC organization and advisory groups

The Black Sea Commission is made up of one representative from each of the Black Sea coastal states, parties to the Bucharest Convention (Bulgaria, Georgia, Romania, Russian Federation, Turkey and Ukraine). The regular meetings of the Black Sea Commission are organized once per year to discuss the ongoing activities, analyze the progress made in protection and rehabilitation of the Black sea and formulate work plan for the next period.

The institutional structure of the BSC includes its Permanent Secretariat (BSC PS), based in Istanbul, six Advisory Groups, which are the main source of expertise, information and support to implementation of the BS SAP, and respective Activity Centers established in the Black Countries. Advisory Groups consist of two representatives from each of the six Black sea countries. Advisory Groups serve not only as specialized technical bodies but also as also as an intermediary between the Commission and the national authorities and other decision makers and stakeholders to promote more harmonious implementation of policy and consequently advance the objectives of the Bucharest Convention and the Black Sea Strategic Action Plan.

Advisory Group on the Environmental Safety Aspects of Shipping (AG ESAS)

The Group coordinates the regional approach to emergency response, particularly the international response to accidents involving the extraction, maritime transport, handling and storage of oil and, where relevant, hazardous chemicals. It also coordinates, on behalf of the Commission, regional aspects of implementation of the MARPOL Convention defined in the BS-SAP. Furthermore, it assists

2 LBSA – Land Based Sources and Activities

3 Annual averages based on data collected in the period 2000-2005

with the elaboration of port-state-control procedures. It is collaborating closely with relevant institutions and governmental bodies, international organizations (such as IMO) and the private sector (shipping, oil and gas industries).

Advisory Group on Pollution Monitoring and Assessment (AG PMA)

The work of this Group is focused on implementation of the Black Sea Regional Monitoring and Assessment Programme – BSIMAP. Specifically, the Group is providing the following services: Quality Assurance/Quality Control services for environmental chemical analysis; coordination of monitoring activities; coordination of regional training exercises; coordination of regional multi-disciplinary expert consultations to develop common environmental objectives and standards for different water uses in the Black Sea.

Advisory Group on Control of Pollution from Land Based Sources (AG LBS)

The Group provides technical support for actions related to the assessment and control of discharges of pollution from land-based sources (direct discharges, river inputs and diffuse sources, including atmospheric deposition). Its activities include gathering of data from National Focal Points regarding discharges and providing reports to BSC; coordination of activities to improve permitting procedures; development/harmonization of pollution discharge models and scenarios in order to assist with the establishment of scientific criteria for setting permit levels/emission standards.

Advisory Group on the Development of Common Methodologies for Integrated Coastal Zone Management (AG ICZM)

The Group facilitates the exchange of information and experience on ensuring sustainable resource use, including recreational use by tourists in the coastal zones of Black Sea countries and coordinates elaboration of methodologies and preparation of Regional Guidelines for Integrated Coastal Zone Management.

Advisory Group on the Conservation of Biological Diversity (AG CBD)

The Group provides coordination and technical support for actions taken to protect biological diversity in the Black Sea according to the provisions of the Odessa Declaration, Black Sea Strategic Action Plan, the UN Convention on Biological Diversity and the Pan-European Strategy on Landscape and Biological Diversity. The Group prepares inventories (checklists) of the biodiversity and regularly updates them, in order to evaluate the trends and recommend remedial actions. The Group coordinates the update of the Black Sea Red Data Book on the endangered species.

Advisory Group on the Environmental Aspects of the Management of Fisheries and other Marine Living Resources (AG FOMLR)

The Advisory Group coordinates activities on gathering the information related to the fish catches, stocks, installed capacity and aquaculture projects; harmonization at the regional level of a legal and institutional framework aimed at sustainable use of living marine resources; improvement of Black Sea fisheries resource assessment based on a regional approach. It will provide the basic source of information for elaboration of management strategies and regional legally binding document on Fisheries.

Advisory Groups of BSC have Focal Points in each Black Sea country, which are responsible for collection of data and information in area of their responsibility and reporting them on an annual basis to the Commission via its Permanent Secretariat.

The Black Sea Integrated Monitoring and Assessment Programme (BSIMAP) is implemented by Black Sea Commission since 2001. The BSIMAP is addressed to the main transboundary environmental problems in the Black Sea region: eutrophication, water pollution and water quality, biodiversity change and decline, habitats destruction. The final version of BSIMAP was adopted in 2006 at 13th Meeting of the Commission. The BSIMAP is based on the national monitoring and assessment programs. It is operational, providing common format reports to the BSC annually. The reported data and information are used for periodical assessment of the State of Environment (SoE) of the Black Sea (annually and every 5 years for changes and trends); Transboundary Diagnostic Analysis (every 5 years) and assessment of SAP implementation (every 5 years).

In addition to the Advisory Groups on implementation of the Black Sea Strategic Action Plan there was established a Joint Ad Hoc Technical Working Group in implementation of the Memorandum of Understanding with ICPDR (also referred to as ***Danube/Black Sea Joint Technical Working Group***). The MoU has the long-term goal to take measures to reduce the loads of nutrients and hazardous substances, discharged from the Black Sea watershed, to such levels necessary to permit the Black Sea ecosystems to recover to conditions similar to those observed in the 1960s.

The expected outcomes of the enviroGRIDS project are in the scope of activities of the AG LBS, AG ICZM, AG PMA. These Advisory Groups as well as the Black Sea Commission were regularly informed about the project progress at their annual meetings.

BSC Expectations

An important feature of the Black Sea is an unusually high river discharge into the relatively small semi-enclosed Sea. The Black Sea drainage basin covers almost a third of Europe; the largest river is Danube flowing through ten European countries. The Black Sea catchment (BSc) includes 23 countries with a total surface of 2,414,691 square kilometers. Seven countries have more than 90 % of their surface included in the catchment. The population for the whole catchment calculated using the global dataset "Landscan" (Budhendra et al., 2002) for the year 2007 is approximately of 183 millions of persons. Due to the large catchment area as compared to its own area, the Black Sea is very vulnerable to pressure from the land based human activities and its health is equally dependent from the coastal and non-coastal states of its basin. Due to the same reason, the Black Sea is vulnerable to climate change in the whole region.

As the enviroGRIDS project is dealing with gathering, analyzing, visualizing and disseminating information on past, present and future states of environment in the Black Sea catchment, its outcomes are important for BSC. Moreover, the Black Sea Commission along with the International Commission for the Protection of the Danube River is considered as the main end-users of the project. The BSC expectations within the project are as follows:

- Assessment of nutrients loads (including drivers) to the Black Sea with the SWAT model;
- Early warning about hazardous events in watershed potentially dangerous for Black Sea ecosystem;
- Assessment of climatic trends and their impact on environment;
- Assessment of environmental vulnerability and risks;
- Providing project products and environmental information to public and decision-makers.

The most important outcome of the project expected to be the result of modelling of the Black Sea watershed with SWAT – Soil and Water Assessment Tool. The SWAT is a river basin scale model developed to quantify the impact of land management practices in large, complex watersheds. It performs simulations that integrate various processes such as hydrology, climate, chemical transport, soil erosion, pesticide dynamics, and agricultural management. In enviroGRIDS, SWAT will not only calculate the hydrology but also estimate the chemical transport in rivers flowing into the Black Sea thus allowing assessing loads of nutrients and other pollutants affecting the state of the Black Sea ecosystem. Moreover, SWAT allows to quantify pressures from different sources (agriculture, urban settlements, forestry and so on), assess their contributions into the total loads; and evaluate response of river basin due to pressure reduction measures. The obtained information can be used for elaboration of appropriate measures on reduction of nutrients and pollution transported to the Black Sea from rivers.

The Management Target 39 of the Black Sea SAP envisages development of "a nutrient modelling tool to enable source apportionment estimates to be made" for all major rivers discharged into the Black Sea. The SWAT model has potential to become such modelling tool serving the needs of the BSC, provided that the model is tested and validated, and that its outputs are accepted by all BSC member states.

It is expected that the hydrological model of the Black Sea catchment can serve for early warning about possible consequences of hazardous events occurred in the watershed and potentially dangerous for the Black Sea ecosystem. Flooding and accidents of anthropogenic origin, such as Red Sludge Spill

accident in Hungary on October 4, 2010, can pollute water in rivers. For BSC it is important to know when the water pollution generated by such events can reach the Black Sea through watercourses, and what will be the concentration of pollutants at the point of inflow into the Black Sea.

The changes in the Black Sea environment are inter-linked with the processes in its catchment including those induced by climate change. The enviroGRIDS project will develop demographic, climatic and land cover change scenarios at the Black Sea Catchment for coming 10-50 years. In the context of the project, it is an input for the assessment of water resources quantity and quality, and the vulnerability to this resource (Baer and Lehmann, 2012). However, the predicted outputs will be useful also for the assessment of changes in the Black Sea environment derived from variations of freshwater inflow.

Of particular interest of BSC is the retrospective analysis of historical data on Black Sea plankton ecosystem to be performed within enviroGRIDS by IBSS in order to investigate relationship between the zooplankton species diversity, species abundance, physical dynamics of water masses, anthropogenic impact and climate change issues and enable researchers to classify plankton ecosystems of the Black Sea on the basis of their spatial-temporal trends.

The demographic, climatic and land cover change scenarios as well as assessment of environmental vulnerability and risks in coastal zone can serve to support decision makers dealing with the Integrated Coastal Zone Management.

Data on the Black Sea marine environment in most are beyond the scope of the enviroGRIDS activities, however, there are several data themes where BSC expects to benefit from the project by accessing through SDI:

- Data produced by hydrological and SWAT models on water flow, nutrients and pollutants loads to the Black Sea;
- Plankton biodiversity data along with supplementary physical and biological parameters, contributed by IBSS;
- Data on biodiversity and habitats in coastal zone provided by enviroGRIDS partners;
- Data on land cover and land use in coastal zone.

It is expected that environmental data and information, scenarios, models outputs, respective services and tools will be available at the Black Sea Catchment Observation System (BSC-OS) web portal and can be used for supporting decision makers. The Permanent Secretariat and subsidiary bodies of BSC will get possibility to use the tools and the new international standards to gather, store, distribute, analyze, visualize and disseminate Black Sea environmental data, metadata and scientific information.

3 Past activities

3.1 Factsheets translated in several languages

In order to best introduce the project to all policy and decision makers in the Black Sea region, the enviroGRIDS partners have translated the original factsheet in 15 languages (**Error! Reference source not found.**).

Figure 4 enviroGRIDS factsheet translated in 15 languages, here in Georgian.

3.2 Data gap analysis

The enviroGRIDS project aims to gather, store, distribute, analyze, visualize and disseminate crucial information on the environment of the Black Sea catchment in order to increase the capacity of decision-makers and other interested stakeholders to use it for development of most relevant management options. It will build a state of the art Grid-enabled Spatial Data Infrastructure (G-SDI, e.g. Giuliani 2011a) that will become a component of the Global Earth Observation System of Systems (GEOSS, e.g. Giuliani 2011b) targeting the needs of the Commission on the Protection of the Black Sea Against Pollution (short name: Black Sea Commission or BSC) and the International Commission for the Protection of the Danube River (ICPDR).

The aim of the gap analysis was to identify the list of existing datasets and observation systems within the Black Sea catchment and to assess their level of compatibility with the INSPIRE and GEO standards of interoperability. The gap analysis allowed identifying areas where further efforts are needed to reinforce existing observation systems in this region.

The gap analysis was undertaken by BSC PS and ICPDR with contribution of all project partners. Generalized requirements to the data and observation systems have been formulated on the base of end-user needs (primarily BSC, ICPDR) as well as the project requirements.

An online Questionnaire for gap analysis has been developed in order to get information from project partners, to the best of their knowledge, about available datasets and observation systems at different scales, from local and national to regional and global. In total, information about 162 datasets and 30 observations systems covering the Black Sea catchment has been received. This information was supplemented with an extensive Internet research. All collected information was analyzed in order to produce cross-tables showing the availability of identified datasets and observation systems for the end-user needs and for GEO Societal Benefit Areas (SBA).

The analysis of the identified datasets and observation systems against the project requirements revealed spatial and temporal gaps in data coverage, gaps in observation systems, problems with data accessibility, compatibility and interoperability. Some recommendations to the enviroGRIDS project

on filling the identified gaps have been elaborated, including proposals on involving new partners and collaboration with related projects.

The first phase of the gap analysis focused on identification of available data and respective observation systems for the Black Sea catchment region and their initial analysis against project and end-user needs. BSC PS and ICPDR performed the work with contribution of the project partners.

The large amount of datasets relevant to the project and end-users data needs have been identified at different scales from national to regional, European and global. At the same time, it was found that access to data in many cases is limited or restricted, particularly at national level, so the data accessibility appears to be the main problem preventing effective data usage.

The Gap analysis revealed large spatial and temporal gaps in data coverage. With respect to the data and observation systems needs of the main end-users, the gap analysis found out the following:

BSC:

- There are significant gaps in availability of marine environment data from water column, sediments and biota resulted from gaps in corresponding observation / monitoring systems. It is unlikely that these gaps can be covered within the enviroGRIDS project, since the project is focused mainly on the catchment area rather than on the Black Sea water body.
- There are gaps in data on pollution loads to the Black Sea from land-based sources, including rivers.
- Observation system to monitor pollutants deposition from atmosphere is missing.

ICPDR:

- Most of required data are available at the regional (Danube) or European scales,
- There are gaps on availability of data on pollutants deposition from atmosphere.

SWAT:

- Some of required data (DEM, land cover, soil, population) are available at regional to global scales, however,
- Data from climate and river station are rather scarce and have to be complemented with national data;
- Access to the data on pollution discharges and water quality, particularly in non-EU countries, is limited or restricted;
- The spatial resolution of crop yield data from open sources of global scale may be not satisfactory, while access to more detailed national agriculture data is limited or restricted.

The analysis of available datasets revealed the problem of data compatibility at different scales. For example, global and European datasets for land cover are not compatible in terms of land cover categories. Similar problems exist between datasets of country scale and other scales. Resolving this problem may require significant efforts, particularly when it is necessary to combine in one application data from different scales.

Combining data from different scales is directly linked to the issue of compliance of datasets and observation systems to INSPIRE and GEO interoperability standards. The fact, that most of reported national datasets are not accessible through the Internet and do not have relevant metadata available, points to absence of such compliance. The enviroGRIDS project has to facilitate bringing project partners' data to the interoperability standards.

In the framework of the gap analysis project partners were also asked whether they were using grid technologies (Giuliani et al. 2011a, Gorgan et al. 2011). So far, only four partners – UTC, CSR4, UAB and UNIGE – were using these technologies at the time of report preparation, which means both that application of grid technologies is underdeveloped in the Black Sea catchment region and that this technology is still relatively recent and not much developed for geosciences in general.

In conclusion, the aim of the enviroGRIDS project to build capacity on Earth Observation Systems through improved data collection, management, storage, analyses and dissemination is more than ever a necessity in the Black Sea catchment.

The main recommendations from the Gap Analysis Report are:

- To open exchange of data, metadata, and products
- Shared data, metadata, and products shall be made available with minimum time delay and at minimum cost
- Sharing data, metadata, and products free of charge or at no more than cost of reproduction will encourage research and education
- Use enviroGRIDS URM geoportal for registering project partner's informational (OGC web) services, data and/or metadata and thus bring them into GEOSS

3.3 Policy briefs

Four policy briefs have been scheduled by the enviroGRIDS project, once every year (Figure 5), and they were also translated in several languages.

Figure 5 enviroGRIDS policy briefs on:
1) GEOSS, 2) IWRM, 3) Global change scenarios, 4) GEO Societal Benefit Areas

3.4 Workshops on Bringing GEOSS into practice

"Bringing GEOSS services into practice" aims at teaching participants how to install, configure and deploy a set of open source software to publish and share data and metadata through the Global Earth Observation System of Systems (GEOSS) using OGC web services & ISO standards (Figure 6).

GEOSS has been created as an international voluntary effort that connects geospatial and Earth Observation and information infrastructures, acting as a gateway between producers of environmental data and end users. The aim of GEOSS is to enhance the relevance of Earth observations and to offer public access to comprehensive, near-real time data, information and analyses of the environment (Giuliani et al. 2011b)).

This workshop is held within the framework of the enviroGRIDS project that addresses the environmental problems surrounding the Black Sea Catchment. This area is known as one of ecologically unsustainable development, where inadequate resource management has led to severe

environmental, social and economic problems. EnviroGRIDS aims at improving this by building capacities for sharing and exchanging environmental data through GEOSS.

The workshop covers interoperability, hands-on experience with web portals, information access, open source software and data sharing through web services and the GEOSS registries.

Figure 6 enviroGRIDS workshops on Bringing GEOSS into practice

3.5 Publications in Danube Watch, International Innovations and "Saving the Black Sea" Newsletter

A series of articles related to the enviroGRIDS project were published in the ICPDR's Danube Watch magazine and the "International Innovations" magazine.

The first article, "Looking into the future of the Black Sea". Danube Watch, 2/2009 (http://www.icpdr.org/icpdr-pages/dw0902_p_12.htm, available also at: http://www.envirogrids.net/spip.php?article104) gives an overview and information about what the enviroGRIDS project is.

The second article, "Filling the gap between science and policy" (available also at: http://www.icpdr.org/icpdr-pages/dw1103_p_13.htm) is about data and sharing data in the Black Sea catchment.

The third one was published in "International Innovation" magazine, and contains interviews with Anthony Lehmann (UNIGE), Philip Weller (ICPDR) and Ahmet Kideys (BSC PS) (Figure 7) (http://www.envirogrids.net/index.php?option=com_jdownloads&Itemid=13&view=finish&cid=53&catid=6).

Figure 7 enviroGRIDS publication in International Innovation

Two articles were published in "Saving the Black Sea" – the Official Newsletter of the Commission on the Protection of the Black Sea Against Pollution:

- "EnviroGRIDS at Black Sea Catchment: A new way to observe our planet" in Issue No 12 (http://www.blacksea-commission.org/_publ-Newsletter12.asp), and
- "THE ENVIROGRIDS PROJECT: Building Capacity For A Black Sea Catchment Observation and Assessment System Supporting Sustainable Development" in Issue No 13 (http://www.blacksea-commission.org/_publ-Newsletter13.asp).

3.6 Presenting the project at the events organized by the Black Sea Commission

The enviroGRIDS project was presented to experts, decision makers and stakeholders at the following events organized by the Black Sea Commission:

14th meeting of AG LBS held in Istanbul Turkey on October 15-16, 2009. Participants were introduced with the enviroGRIDS project. Special attention was paid to data needs for assessment of pollution loads from rivers with the help of SWAT model. Participants were kindly requested to provide information regarding existing observation systems in their countries to monitor hydrology, nutrients in rivers, atmospheric deposition; available data on land use, soils, livestock etc. The obtained information later was incorporated in the Gap Analysis report.

12th meeting of AG ICZM held in Istanbul, Turkey on November 23-24, 2009. Participants were introduced with the enviroGRIDS project and provided with the overview of the SWAT model followed by discussion on applications of different models (MONERIS, INCA) for watershed modelling and IRBM. AG members were requested to provide information regarding observations systems and data availability in their countries further used for Gap Analysis.

International Black Sea Day Celebration, Samsun, October 31, 2009. Participants (members of the BSC, representatives of Ministries of Environment, BSEC, UNDP... and other stakeholders) were introduced with the enviroGRIDS project and its expected outcomes.

22nd Regular Meeting of the Black Sea Commission held in Istanbul Turkey on January 19-21, 2010. Participants of the meeting comprising of the members of the BSC, observers (ICPDR, EEA, EC DG

Environment, UNDP...) and other stakeholders were introduced with the enviroGRIDS project and its expected outcomes.

15th meeting of AG LBS held in Istanbul Turkey on October 5-6, 2010. Participants were informed about progress of the enviroGRIDS project and results of Gap Analysis on data availability in the Black Sea catchment area for application in models such as SWAT and MONERIS to assess the shares of point and diffuse sources in the nutrient loads stemming to the Black Sea. Geoportal of the project: http://www.envirogrids.cz was presented.

International Black Sea Day Celebration activities, Trabzon, October 31 – November 2, 2010 were held in the Karadeniz Technical University (KTÜ) campus, jointly organized by the Turkish Ministry of Environment and Forestry and the Black Sea Commission. The important part of the activities were eight panels attended by over 400 interested experts, decision makers, representatives of private sector, NGO and other stakeholders:

- Panel 1: Pollution from shipping in the Black Sea-Monitoring, impacts and measures
- Panel 2: MONINFO Project: Monitoring and Information Systems for Reducing Oil Pollution in the Black Sea
- Panel 3:State of the Environment of the Black Sea and Information Support
- Panel 4: Land-based Sources of Pollution - Implemented Activities
- Panel 5: Challenges in Sustainable Fisheries and Biodiversity
- Panel 6: Integrated Coastal Zone Management (ICZM) Activities and Marine Protected Areas
- Panel 7: Cooperation among International Organizations on the Black Sea environment
- Panel 8: Examples of NGO and Private Company Activities Related to the Black Sea

The presentation "EnviroGRIDS project: Building Capacity for a Black Sea Catchment Observation and Assessment System supporting Sustainable Development" was given by the project coordinator Anthony Lehmann in Panel 4.

23rd Regular Meeting of the Black Sea Commission held in Istanbul Turkey on January 25-26, 2011. Participants of the meeting comprising of the members of the BSC, observers (ICPDR, EEA, EC DG Environment, UNDP...) and other stakeholders were informed about progress of the enviroGRIDS project.

24th Extraordinary Meeting of the Black Sea Commission held in Istanbul Turkey on April 28, 2011. Members of the BSC were informed about progress of the enviroGRIDS project.

Expert workshop "Assessment of eutrophication and nutrient pollution in the Black Sea and experiences from the Baltic Sea" held in Istanbul, Turkey on 6-7 September 2011 with participation of members of Advisory Groups on Pollution Monitoring and Assessment and Land Bases Sources of Pollution and experts from Black and Baltic Sea regions. The workshop focused on creating a dialogue between the experts of the Black Sea and Baltic Sea regions on methods used for region-wide assessments of eutrophication status, including development of indicators with state targets. Other important topics were monitoring and assessment of nutrient loads from land-based sources using regionally harmonized methods and introduction to the Black Sea experts of the HELCOM Baltic Sea Action Plan nutrient reduction scheme. The workshop was organized in framework of the Baltic2Black project having one of tasks the development of implementation plan on setting up a modelling tool, linking background pollutants triggering eutrophication in the Black Sea with requirements, set by the Black Sea Commission, for reducing input of nutrients, including riverine loads. In order to get experts advice regarding possible solutions the different approaches on assessment of nutrient loads from watershed were proposed to the attention of experts including those developed within the enviroGRIDS project and provided by project manager A. Lehmann in presentation "Catchment modeling for estimating nutrient loads to the Black Sea".

27th Regular Meeting of the Black Sea Commission held in Istanbul Turkey on November 22-23, 2011. Participants of the meeting comprising of the members of the BSC, observers and other stakeholders

were informed about achievements of the enviroGRIDS project and expectations regarding future usage of the project outcomes.

3.7 Participation in Black Sea Commission conferences

The joint 3rd Bi-annual Black Sea Scientific Conference of the Black Sea Commission & Final UP-GRADE BS-SCENE Project Conference was organized by Black sea Commission and UP-GRADE BS-SCENE Project in Odessa, Ukraine on 1 - 4 November 2011 (http://www.blacksea-commission.org/_3BSCConf.asp) and took place back to back with the International Black Sea Day activities held on October 31. More than 200 scientists from Black Sea countries attended the Conference.

The objectives of the Conference were as follows:

- Update the knowledge on the Black Sea, following the model DPSIRR, finding the gaps in data/information/perception of the Black Sea ecosystem evolution - past, present and future.
- Overview technologies and decision-support tools available for the Black Sea region, give recommendations for further developments.
- Revisit environment priorities, develop an outlook for advancing the Black Sea protection through an ecosystem-based management of living and non-living resources.
- Continue the integration of science in decision-making in the field of environment protection.

The Conference consisted of 6 Sessions:

- Session 1: Pollution: focus on oil pollution, oil spills and eutrophication;
- Session 2: Data-management and Data Information Systems, Decision-support tools and Data Products, Accessibility and use of data;
- Session 3: Industry versus environment;
- Session 4: Integrated Coastal Zone Management;
- Session 5: Climate change;
- Session 6: Common understanding of Black Sea Good Environmental Status;

The Conference provided excellent opportunity to present enviroGRIDS project and it outcomes to the Black Sea Scientific community. The oral presentation of the project was included into the program of the 2nd Session. Titled "Sharing and processing information through the Global Earth Observation System of Systems (GEOSS): an example with the Black Sea catchment" the presentations was prepared by the project coordinator Anthony Lehman in a new attractive style and aroused great interest. Providing an overview of all project activities, the presentation was focused on introducing innovative data sharing and processing technologies (GEOSS, SDI and GRIDS) and decision support systems addressed needs of project end users - BSC and ICPDR.

3.8 Video on the Story on Data for Environment

A movie called 'The Story of Data on the Environment' was prepared. The purpose of this animation is to convince the public and decision makers about the need for improved data sharing on the environment. The movie can also be considered as a capacity building product that is trying to explain in simple words the basic concepts behind Spatial Data Infrastructures (Figure 8).

The video can be found at the following links:

- Long: http://www.youtube.com/envirogrids#p/u/1/9SKOwQDFhYI
- Short: http://www.youtube.com/envirogrids#p/u/2/-ZrZaLtMAm4

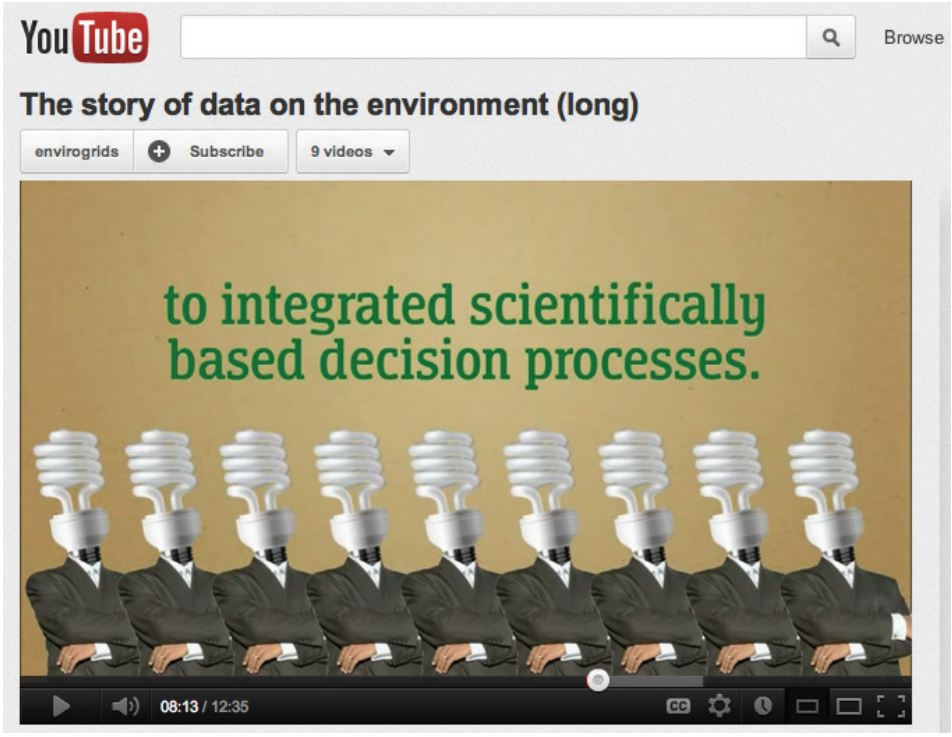

Figure 8 enviroGRIDS Story of Data on the Environment

A direct link from the enviroGRIDS website (http://www.envirogrids.net) is also available.

The video has been featured at the GEOVIII plenary session in Istanbul (http://www.earthobservations.org/geo8.shtml) in November 2011, as well as at other events. The consortium will continue to use it as capacity building material in the forthcoming events of the project.

Later this year, EuroNEWS is planning a shooting about the EnviroGRIDS project as part of their FUTURIS series. The documentary will be between 8 and 10 minutes long, and it will be broadcast to 130 countries in ten languages (English, German, French, Italian, Russian, Spanish, Portuguese, Arabic, Turkish and Persian). This FUTURIS documentary will be considered as the second main multimedia material item for the public.

4 Ongoing activities

4.1 Improvement in ICPDR and BSC Spatial Data Infrastructures (SDI)

Improvements of the ICPDR SDI

The system development of the ICPDR DanubeGIS started in the year 2005. The first prototype was provided in 2006, the launch of the system was in 2007. In the following years continuous improvements and further features have been added to the DanubeGIS expert and public systems.

The main challenges for the nearer future are:

- the replacement of the ESRI ArcIMS MapServer, which is producing the maps and has reached the end of its life cycle (options: ArcGIS Server – closed source, Geoserver – open source);
- the update of the WebGIS client to improve the look-and-feel, the performance and the data visualization (combination of map layers on the fly according to user needs; state of the art, interactive web viewer; integration of external data sources);
- the integration of ICPDR databases – both for data visualization and data analysis.

The implementation of an integrated geospatical database backend (based on PostgreSQL/PostGIS) is an essential step in the development of the DanubeGIS to improve the process of data validation, map drafting and analysis and to facilitate the integration of other ICPDR databases.

Mid-term developments might address the restructuring of the data model and the data upload process. Thus further steps will be the evaluation of the current data management as regards the data transfer (submission of GIS datasets including a large number of attributes or separation of GIS data features from attribute data (e.g. WISE reporting)), the data storage (data repository and database backend) and the management of data updates (data life cycle management, GIS reference layers).

All these adaptations and further development steps have to be done allowing compliance with other systems.

The envisaged future system should thus ease data preparation of countries and data submission, allow straightforward and interactive data visualization in the public and expert web viewer, ease data management and data analysis by using a database backend and enable the integration of various ICPDR databases.

Due to the limited financial resources, the further development of the DanubeGIS system will be done step by step taking into account interdependent issues keeping operational a working system for data collection and map production tasks of the ICPDR in the near future.

Summing up, the proposed next steps are:

- Refine the shape files data repository to distinguish background, reference and reporting data
- Implementation of a PostgreSQL/PostGIS database backend
- Migration from ArcIMS towards GeoServer
- Replacement of the server hardware with a virtual server
- Upgrade of the web framework and improvement of the usability
- Upgrade of the WebGIS client to a state of the art user interface based on OpenLayers
- Extension and review of templates related to the upcoming data collection needs
- Implementation of a first set of reference layers for the DRB

The proposed mid-term developments are:

- Review of the meta-data editor
- Upgrade of data validation (incl. spatial checks) during the upload process
- Enlargement of download options (bulk download)
- Integration of further ICPDR databases
- Further enhance data visualization and integrated query possibilities
- Further implementation of the concept of reference data (GIS reference layers)
- Investigate options and implement a common DRBD background map
- Adapt public DanubeGIS to the new ICPDR website style

The enviroGIRDS project provided presentations and workshops on readily available open source tools based on open standards that could be used as a basis in these development steps. The first tool to be considered, is the OpenGeo suite, a web-based mapping system which comprises the PostGIS database, GeoServer, a tile cache and a WebGIS user interface based on OpenLayers called GeoExplorer. The other tool is GeoNetwork that can be used for the management and publication of metadata.

Within enviroGRIDS this system could be further developed, as the project will facilitate the necessary platform. An interesting challenge for ICPDR and the Danube countries is to use and benefit from the Grid enabled Spatial Data Infrastructure (GSDI) developed by enviroGRIDS, which will become one component in the Global Earth Observation System of Systems (GEOSS) and will be compatible with the new EU directive on Infrastructure for Spatial Information in the European Union (INSPIRE).
Using SDI is the goal of ICPDR too, as SDI objective is to maximize the reuse of geospatial data and information avoiding the duplication efforts and expenses and thus enabling users to save resources, time and effort when trying to acquire or maintain datasets.

Improvement in BSC SDI

By the beginning of the project (April 2009) BSC PS did not possess web services for sharing spatial data and metadata. The only operational tool at that time was the Black Sea Information System (BSIS) developed in 2002-2005 in framework of the GEF BSERP project and existing in desktop and web versions. The desktop version possessed some GIS functionality, while web version allowed only preview of selected data. The main databases of the BSIS were organized according to the thematic division of the BSC Advisory Groups and included the followings databases:

- Pollution monitoring and assessment database;
- Biodiversity Conservation database;
- Fisheries and Aquaculture database;
- Integrated Coastal Zone Management database;
- Land-based pollution sources database;
- Environmental aspects of shipping database;

The BSIS was designed to serve the informational needs of the BSC and its Programmes, particularly BSIMAP. The data from the BSIMAP reports were expected to be loaded into BSIS continuously. However, the latest data loaded in the database were dated by 2004 - upon the end of the BSERP project the information in the system was not updated. There were several reasons for this, most critical of which was the lack if interoperability, i.e. the data loading subsystem was able to work only with the old BSC data reporting formats not used anymore. The web version of the BSIS was accessible online up to September 2010 when the 8-years old server crashed and could not be recovered.

The GIS data available at BSC PS at the beginning of project were developed in the mid of 2000s and consisted of two sets: 1) GIS layers obtained jointly with ArcMap software (political boundaries, settlements, roads, railroads, river network, water bodies, elevations etc) and not available for sharing due to the license agreement; 2) GIS layers created to support the Transboundary Diagnostic Analysis 2008 (protected areas, exclusive economic zones, monitoring stations, Hot Spots, contaminants, etc) available for sharing but rather outdated.

The enviroGRIDS project provided a good opportunity to upgrade the BSC information system by introducing innovative approaches for data sharing and visualization. The task became more urgent after failure in September 2010 of the server hosting the Black Sea Information System with no possibility to recover. The BSC PS took decision to redevelop the Black Sea Information System as a set of independent interoperable thematic components to be composed at the dedicated web portal with GIS functionality and with possibility to share spatially explicit data using innovative tools. The works began in the first half of 2011 by setting up the GeoServer, introduced by enviroGRIDS, updating available and developing new GIS layers. At the same period, the development of the Regional Database on Pollution (RDB-P) as well as development of a prototype of information system for monitoring of oil pollution in the Black Sea (MONINFO) started. The same technology - GeoServer – was used to develop the test version of Geoportal of MONINFO (Figure 9).

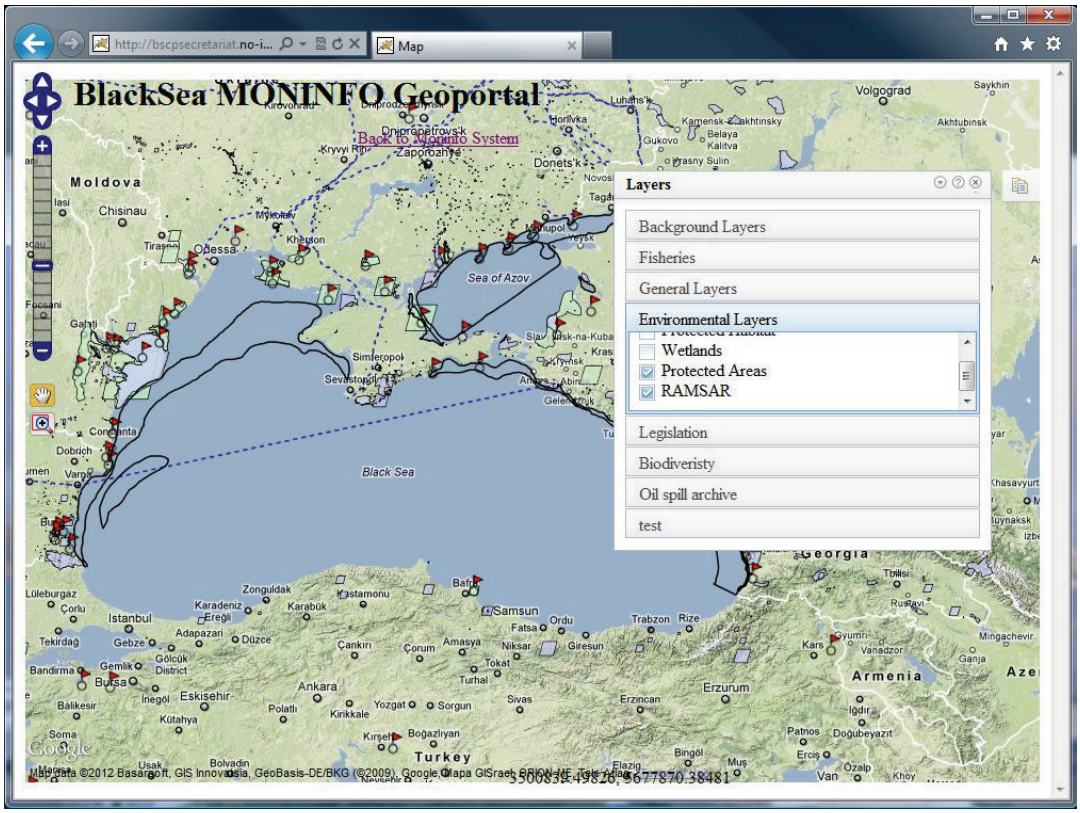

Figure 9 MONINFO Geoportal based on GeoServer

The works on development of the RDB-P are ongoing. Upon availability of resources the thematic databases of other BSC Advisory Groups will be developed and respective data and metadata become available for visualisation and sharing.

4.2 Creation of data and metadata web services

ICPDR Web services

The 12th IMGIS EG Meeting stressed the importance and needs of reference dataset for ICPDR's DanubeGIS at least from two main points of view:

- Map production
- WebGIS

Currently, both map production and WebGIS are based on national datasets uploaded into DanubeGIS. For certain general datasets, which are used in many maps and referenced by other datasets, it would be useful and more efficient to have merged datasets covering the whole DRB.

The concept of reference data was not realized in the DanubeGIS so far due to the fact that the main exercise of data collection was the implementation of the EU Water Framework Directive. To simplify the manifold use of geographic data, the development of reference datasets is an important goal of the DanubeGIS and for enviroGIRDS too.

Thus this is a step-wise process because of limited resources and to gain experience with the implementation of the further needs of the ICPDR Secretariat. Moreover compatibility with WISE and INSPIRE have to be kept.

Considering the suggestion from the 12th IMGIS EG Meeting, in the first step the following reference datasets could be produced:

- DRBD (Danube River Basin District)
- Rivers and canals
- Lakes
- Transitional and coastal waters
- Transboundary groundwater bodies
- Cities

Within enviroGRIDS, the ICPDR will share metadata and data that are available on the basin-wide level in GEOSS – These are the reference datasets that currently are under development. Sharing of national datasets in GEOSS and implementation of INSPIRE is a task of the countries.

The production of reference datasets will consider the handling restrictions on the dataset provided by Danube countries. There are 7 types of restrictions of the datasets defined by ISO19115:

- Unclassified
- Restricted
- Confidential
- Secret
- Top Secret
- Not relevant
- Not available

Error! Reference source not found. below show in details the type of restriction, code, definition and usage of the ICPDR dataset.

Table 2 Type of restrictions, codes, definitions and usages of the dataset

name	code	definition	ICPDR-related meaning
unclassified	1	available for general disclosure	available for public users (free for use according to EULA)
restricted	2	not for general disclosure	available for use by ICPDR delegations, EG/TG members and guests, Observers, Secretariat
confidential	3	available for someone who can be entrusted with information	available for use in ICPDR-related projects after signing of a usage agreement
secret	4	kept or meant to be kept private, unknown, or hidden from all but a select group of people	available for tasks of the Secretariat and IM&GIS EG
topSecret	5	of the highest secrecy	available for harmonization tasks of the IM&GIS EG
not relevant	0		datasets which are by nature or obviously not relevant for a country (e.g. CWBody is not relevant for all inland countries; City_a is not relevant, if there are only cities with less than 1 Mio inhabitants, etc.)
not available	6		datasets which could be relevant, but no data is available (no data has been uploaded).

There is still limited knowledge about the benefits of data, metadata sharing and OGC standards in particular and the different restrictions on data distribution in the Danube countries make it currently still difficult to apply OGC standards compliant data sharing on a basin-wide level. The ICPDR, in the frame of the further development of the DanubeGIS, is discussing these issues and the current efforts in the development of reference datasets for the Danube River Basin will result in key milestones towards sharing basin-wide metadata and data sets on the basin-wide level.

Currently the ICPDR is using the DRB GIS Metadata profile, which is identical to the WISE metadata profile. It comprises the metadata elements required by Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata3) for services, spatial datasets and spatial dataset series (sections 1 to 10) and the additional elements specified for WISE (section 11). Thus the WISE metadata profile is an extension of INSPIRE. This tool is still under development and is having limited usage in the Danube countries.

Within enviroGRIDS project, the needs of the reference dataset, limited now to map production and WebGIS, could be extended to web services and using of metadata.

BSC PS Web services

BSC PS has set up GeoServer (V 2.1.0 at http://bscpsecretariat.no-ip.org:8080/geoserver/web/) as components of the Black Sea Information System, which is being developed. The GeoServer is the reference implementation of the OGC Web Feature Service (WFS) and Web Coverage Service (WCS)

standards and Web Map Service (WMS). The GeoServers host following environmental layers under Workspace "BSC":

- Black Sea Coastline
- Black Sea Bathymetry
- Elevations
- Black Sea Integrated Monitoring Program (BSIMAP) Monitoring Institutions
- BSIMAP monitoring stations
- Protected areas in Black Sea and Sea of Azov regions
- Exclusive Economic Zone
- Environment Sensitivity Index
- Fish spawning areas
- Hot Spots
- Marine Protected Areas and Coastal Protected Areas, which include marine part
- Natural habitats (Ukrainian part)
- Offshore installations (Ukrainian part)
- Phyllophora fields (marine algae)
- Pipelines (Ukraine and provisional route of South Stream)
- Nationally designated areas for protection
- Protected areas
- Recreation areas (Ukrainian part)
- Sampling sites

Additionally, under MONINFO Workspace GeoServer hosts the Black Sea bottom topography and numerous layers related to fishery: catches, spawning areas. The WMS services of BSC PS are part of SDI being developed within the enviroGRIDS project and are registered into GEOSS.

4.3 Comparison between Moneris and SWAT modelling approach

The MONERIS approach

MONERIS - MOdelling Nutrient Emissions in RIver Systems

MONERIS is a nutrient emission model to be used for regional, national and international studies of water quality in catchment areas. It was developed at IGB-Berlin, to address three goals:

- Identification of the sources and pathways of nutrient emissions at the analytical unit (smallest calculation unit) level
- Analysis of the transport and the retention of nutrients in river systems
- Provision of a framework for examining management alternatives (scenarios)

In order to reach "an acceptable chemical state of water condition" by 2015 as required by the Water Framework Directive (WFD, European Parliament and Council of the European Union 2000) there must be catchment-based approaches for recording the present state of load, and for the development of guidelines.

The MONERIS model calculates the emissions of nitrogen and phosphorus to the surface water, by different pathways as well as the instream retention in the surface water network. Through MONERIS

the nutrient loads within the Danube river network has been calculated for today and a scenario has been developed for 2015.

Nutrient emissions of point and diffuse sources into surface waters are evaluated in the model. Point data (e.g. waste water treatment plants), areal information (e.g. soil data), and administrative information (like statistical data for districts), are integrated. The application of geographic information systems (GIS) is essential. Modelling scenarios allows calculation of the efficiency of management measures for reaching prescribed water quality standards (such as target concentrations of surface water quality). The MONERIS approach provides an assignment of the measures applied to the analytical units. In the model, suitable measures are pre-defined which can be implemented by the user, either as single or combined measures. The measures can be based on analytical units or cover larger areas. Therewith, the resulting effect of measures on loads in the catchment can be tested. By integrating numerous of possible components into the system, complex analysis of effects of measures can be obtained in a short time.

The Institute of Freshwater Ecology and Inland Fisheries of Leibniz, Germany, is compiling a harmonised inventory for point and diffuse sources of pollution. The model MONERIS (MOdelling Nutrient Emissions in RIver Systems) has been developed and applied in the Danube River Basin to estimate nutrient emissions into surface waters from point and various diffuse sources.

While point source emissions from wastewater treatment plants and industrial sources are discharged directly into the rivers, the diffuse source emissions that end up in surface waters have many different pathways (point sources: waste water treatment plants and industry; diffuse sources: overland flow, ground water flow, tile drainage, erosion, urban systems and atmospheric deposition).

About half of the nutrients discharged into the river are from agricultural sources, a quarter from industrial sources, and a similar proportion from settlements. The main pollution sources in addition to industrial and municipal wastewater include chemical fertilisers and manure from intensive farming operations, petrochemical processing plants, iron and metal processing plants, timber, paper and pulp plants, and municipal solid waste disposal sites.

The application of the MONERIS (MOdelling Nutrient Emissions into RIver Systems) approach was successfully for the modeling of the nutrient inputs within the Danube River Basin. MONERIS is a semi-static emission model for point and diffuse sources of nutrients can also be adapted in order to deal also with heavy metals and some priority substances (e.g. Lindane).

Conceptually, MONERIS calculates the emissions into surface waters via several independent pathways for separate catchments, which are topologically linked in a tree-like structure (see figure below). Input data are taken from various sources (e.g. statistical yearbooks, emission inventories, digital maps etc). Those data were preprocessed to give specific values for every catchment.

The emission of substances from diffuse sources cannot be easily measured. The emissions estimation of diffuse source pollution for large river catchments such as the Danube is only possible by mathematical modelling. In the framework of the DBA and DRBM Plan, nutrient emissions into the river system through individual pathways were calculated/estimated using MONERIS (MOdelling Nutrient Emissions in RIver Systems) model. MONERIS considers point source emissions and combines them with emissions resulting from different diffuse source pathways (Figure 10). Furthermore, MONERIS integrates various statistical information for different administrative levels, land use, hydrological, soil and hydrogeological data and works for Geographical Information System (GIS) illustration.

Error! Reference source not found. 10 gives an overview of the main pathways and processes in MONERIS. There are seven pathways for nutrient emission into surface waters:

- Point sources (from municipal waste water treatment plants and direct industrial discharge)
- Atmospheric deposition on water surface areas
- Groundwater
- Tile drainages
- Urban areas (sealed)

- Erosion
- Overland flow (dissolved nutrients)

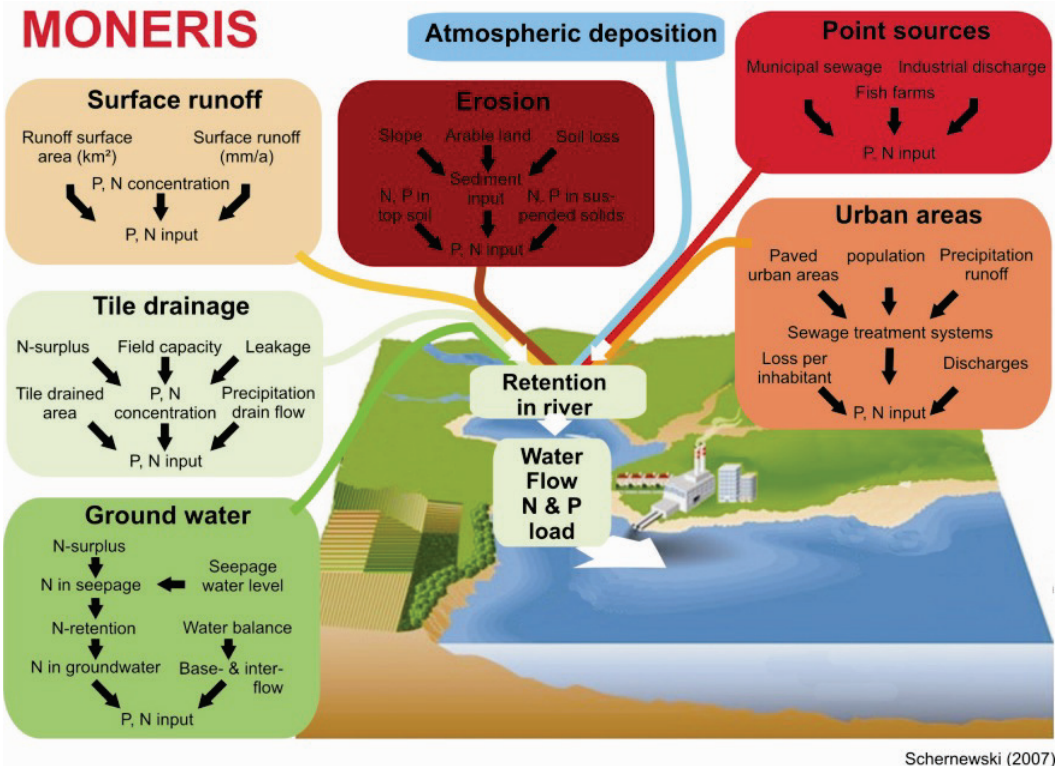

Figure 10 Schematic picture of main processes in relation to sources and pathways of nutrient inputs, including retention, into surface waters (MONERIS model).

Whereas point emissions from waste water treatment plants and industrial sources are directly discharged into the rivers, diffuse emissions into surface waters come from different pathways, represented by separate flow components. The direct and diffuse components must be separated, since the underlying processes and the nutrient concentrations are different. The model facilitates beneath the calculations of emissions into surface waters, calculations of nutrient retention in surface waters, and allows a comparison between the calculated and the observed loads.

Initially a database is created, the complexity of which depends on the questions to be answered and the minimum standards required for the related dataset. The pre-processing procedure comprises acquisition and preparation of data, and its quality assurance. Established protocols for this are available, although they are not compulsory, and individual users may choose to develop and use their own pre-processing procedures. Pre-processed data is stored in three tables in the MONERIS database in Access, depending on the spatial and temporal characteristics:

- Basic information, study area-specific and treated as temporally constant data,
- Periodical data, used for study area-specific time sequences, and
- Country data, which is used for country-specific time sequences.

Other databases include the Meta information, and the user defined settings, for the scenarios. They regulate the further use of input data for every analytical unit of the values in the database. Every analytical unit is assigned to corresponding information, including a country code obtained from the country code data table, which includes basic data of the respective country, e.g. special factors for

phosphate in detergents. Based on the analytical units, the area topology defines the hydrological connections of the analytical units. This hydrological connection is the basis for the creation of the runoff equation to calculate the total runoff.

The SWAT approach

One of the main aims of the enviroGRIDS project is to assess past, present and future water resources in the Black Sea catchment (e.g. Rouholahnejad et al. 2012). The Soil and Water Assessment Tool (SWAT) performs simulations that integrate various processes such as hydrology, climate, chemical transport, soil erosion, pesticide dynamics and agricultural management. SWAT is recognized by the U.S. Environmental Protection Agency (EPA) and has been incorporated into the EPA's BASINS (Better Assessment Science Integrating Point and Non-point Sources). For its simulation, SWAT requires data on elevation, soil, land cover and climate for model setup and river discharges, river water quality and crop yield (as available) for calibration and uncertainty analysis (Figure 11). Most of this data exists and can be obtained with some difficulties from national authorities, or from the Internet.

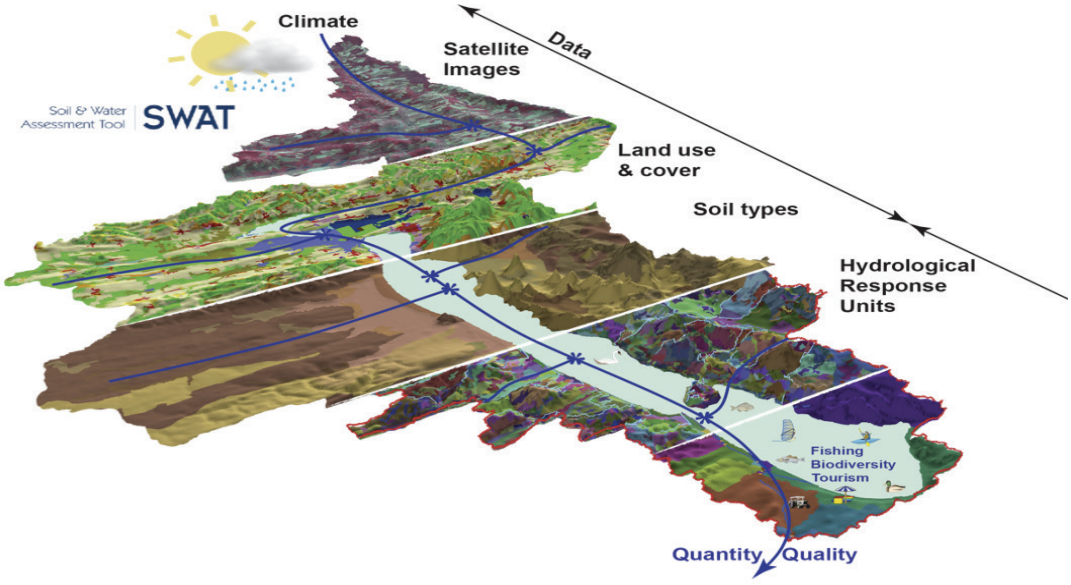

Figure 11 SWAT translates input data (climate, elevation, soil, land cover) into water quality and quantity outputs
(here with an example from Lake Balaton catchment in Hungary)

SWAT accounts for variable soil and land cover conditions by subdividing the simulated catchment into sub-areas. The model uses a daily time step and can perform continuous simulation of water quality and quantity for a 1 to 100 year period (Figure 12).

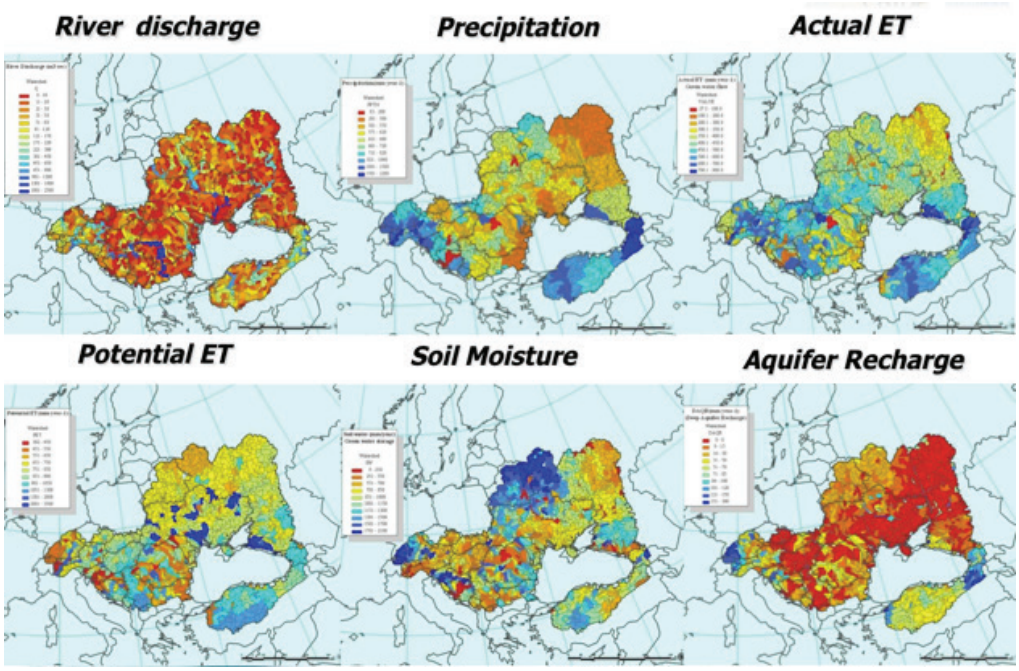

Figure 12 SWAT outputs in the Black Sea catchment

4.4 Creation of Socio-Economic scenarios for the Black Sea catchment

IPCC Special Report on Emission Scenarios

As climatic change is becoming a worldwide concern that will affect many areas of human activities, the last report of the Intergovernmental Panel on Climate Change (IPCC 2007a,b,c) predicts important changes in the coming decades that will not only modify climate patterns in terms of temperature and rainfall, but will also drastically change freshwater resources qualitatively and quantitatively, leading to more floods or droughts in different regions, lower drinking water quality, increased risk of water-borne diseases, or irrigation problems.

These changes may trigger socio-economic crises across the globe that need to be addressed well in advance of the events in order to reduce the associated risks. Next to the climate change there are also other changes land use and demography that can be predicted over the next decades.

What will be the impact of the global climate and demography changes in agriculture, grassland and forest? What will be the effects from continuous population decline in Eastern Europe? What will be the impact of urban sprawl in Western Europe?

This policy brief presents an overview of different possible scenarios for the territory of the Black Sea catchment.

¨Rather than relying on predictions, scenarios enable a creative and flexible approach to preparing for an uncertain future¨ Mahmoud et al, 2009

The main sources of inspiration come from the IPCC, Global Scenarios Group and Global Environment Outlook scenarios. These global scenarios use either country or broader-region calculations of future changes, like for instance plausible changes for Western Europe, Eastern Europe and the Middle East. Storylines per group of countries were developed following the IPCC approach and using existing predictions of future GDP and population density numbers.

The IPCC-SRES overall scenarios emphasise future plausible changes along two axes (Figure 13):

1. Economy: unrestrained development versus environmentally restrained development;
2. Cooperation: globally concerted developments versus local solutions;

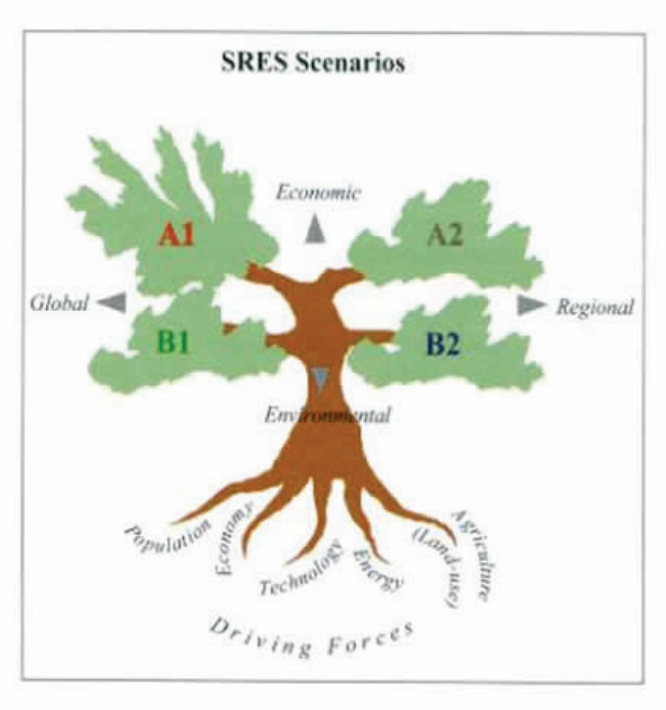

Figure 13 Characteristics of the four main scenario families of the IPCC Special Report on Emission Scenarios (Nakićenović et al., 2000)

Consequently, four scenarios are commonly cited:

- **A1**: Environmentally unrestrained and globally concerted strong economic growth;
- **A2**: Environmentally unrestrained but locally and regionally driven economies;
- **B1**: Far-reaching environmental considerations on global level with adapted economic and technological developments;
- **B2**: Locally and regionally driven developments strongly respecting environmental constraints.

Scenarios investigated within enviroGRIDS

The enviroGRIDS scenarios hold a number of plausible alternative storylines that are based on a coherent set of assumptions on future demography, climate and land use. The main ambition of these scenarios is to stimulate the discussion among policy makers on global changes and on their consecutive environmental and socio-economic impacts. The enviroGRIDS scenarios are based on the Intergovernmental Panel on Climate Change – Special Report on Emission Scenarios (IPCC - SRES) (Figure 14)

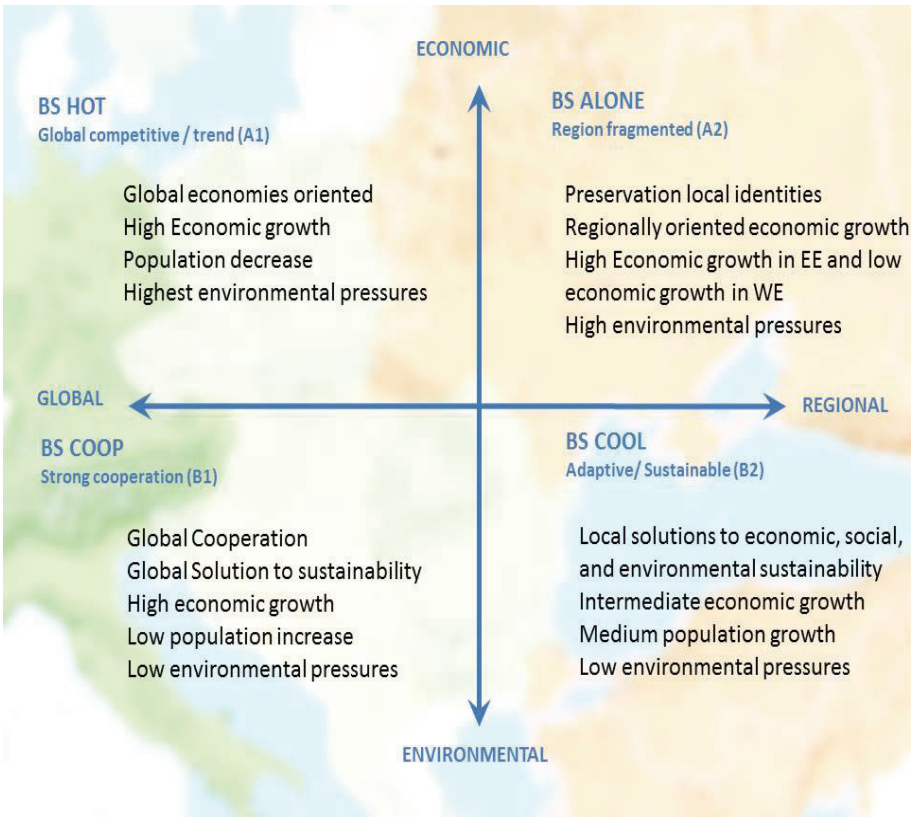

Figure 14 enviroGRIDS scenarios – BS HOT, BS COOP, BS ALONE and BS COOL

BS HOT – In this scenario the highest economic growth is assumed, free-market policies, very large increase in greenhouse gas emissions, and consequently global climate change. This also implies very high environmental pressures in the areas of the Black Sea catchment, which could be partially alleviated by rapidly emerging technological developments. In general, agricultural areas will decline in the Black Sea catchment due to strong urbanization. Abandoned land tends to turn into urban areas or natural vegetation and forest. Forest areas will increase in all countries initially, but afterwards will decrease in Western countries and increase in Eastern countries. Urbanization rates will increase due to population movement from rural to urban areas and consequently there will be an expansion of built-up areas. Urban areas are expected to increase in highly populated regions as a result of high rates of economic development and population growth. As a result of urban population growth, high economic growth leads to a larger use of space per person and consequently growth in the industry and services sectors. Meanwhile, in sparsely populated areas, natural areas associated with agricultural abandonment are expected to increase.

BS ALONE – The BS ALONE scenario is characterized by lower levels of trade and regionally oriented economic growth. In the Eastern countries high economic growth is expected to slow down while the population continues to shrink. In the Western countries economic growth will be lower and population will grow. In general, this scenario shows the highest increase in agricultural areas over the whole Black Sea catchment, due to strong regional policies and production incentives. In this scenario there is a strong competition between agriculture and urban areas. Deforestation is highly apparent in this scenario, especially in Western European countries. Nature conservation continues only within existing protected areas. The increase of urban areas is mostly due to the increase in prosperity; these new urban areas will therefore include both sprawl around existing urban areas and an increase in urban areas in touristic regions.

BS COOP – In the BS COOP scenario economic growth will be high with low population growth. Some regions are expected to lose population, mainly during the first period (2000-2025), and

afterwards the population will remain stable. Economic growth rates are certainly lower than in BS HOT, but with less pronounced differences between countries. Lower growth is also foreseen during the second period (2025-2050). The emphasis is on globalization of both economic and environmental concerns. In the BS COOP scenario, strong emphasis is placed on the implementation of global environmental policies in order to cut the rise in greenhouse gases and decrease the effects of climate change. Afforestation is strongly supported and consequently agricultural areas tend to decline, mainly in less suitable areas. Abandoned lands are expected to be converted to natural protected areas. Urban areas are expected to increase; however, this increment will be very compact (no change in size) due to the strictness of spatial policies, in particular in the Western countries. In the Eastern countries the planning policies are less strict and the urban areas experience stronger growth; however, this growth is lower than in the BS HOT (global economic) scenario.

BS COOL – This combines intermediate economic growth with medium population growth. Generally this scenario displays the most heterogeneous patterns of development in the BSC countries. In this scenario no major changes in land use are expected to happen. Urbanization is very low and consequently agricultural and forest areas are not expected to change. In this scenario the most important change to emphasize is the conversion from cropland to grassland, especially in the Western countries.

Based on these scenarios, enviroGRIDS is trying to set the scene in the Black Sea catchment by bringing spatially explicit and quantitative answers to the following questions.

4.5 Preparation of General Assembly in Sofia with ICPDR

General assembly meetings are held once a year and will be aimed an overview of project progress.

The 4th enviroGRIDS General Assembly Meeting 2012 will be hosted by our Bulgarian partners BSREC and NIMH, and will be held in Sofia, Bulgaria, from 19-20 April 2012.

ICPDR invited for this meeting the Bulgarian members of the ICPDR Expert Groups, especially those from IMGIS EG. The Bulgarian GIS experts were encouraged to attend to the workshops, which will be held in the first day of the meeting.

The chairman of the IMGIS EG was also invited and will give a presentation about Standardization of geographic information as a key tool for interoperability in grid computing"(included the activity of IMGIS EG of ICPDR: river network harmonization, metadata editor, key idea of river network coding)

Participation from the highest Bulgarian ministerial levels is expected, like Bulgarian Head of Delegation.

Also the Executive Secretary of the ICPDR will be present and will give a presentation about ICPDR and WFD in the context of enviroGRIDS.

4.6 Preparation of Final Conference in Batumi with BSC

The final project conference will be organized in October 2012 jointly with BSC in order to gather scientists and policy makers to help filling the gap between science and decision-making. The conference will be organized back to back to the International Black Sea Day event and will give possibility for wider promoting of the BSC efforts in protection of the Black Sea environment and achievements and outcomes of the EnviroGRIDS project.

The International Black Sea Day is celebrated on October 31. This is the day of signing the Black Sea Strategic Action Plan on 31 October 1996 by six Black Sea countries – parties to the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), namely Bulgaria, Georgia, Romania, the Russian Federation, Turkey and Ukraine. The main objective of the Black Sea Day is to promote the urgent need for greater regional cooperation against the threats facing the Black Sea, and raise public awareness of these threats, ranging from pollution and poorly regulated fishery to unsustainable coastal development. The Black Sea day activities are organized in all Black Sea countries, while the major regional event is organized every year in other country in one of large coastal cities, e.g. in Trabzon, Turkey in 2010, in Odessa, Ukraine in 2011. The regional International

Black Sea Day event is attended by BSC Commissioners, representatives of different regional organizations, national government agencies and coastal municipalities, NGOs, and scientists.

The regional International Black Sea Day event 2012 will be organized in the coastal city of Batumi in Georgia. The tentative agenda for the activities to be organized jointly by enviroGRIDS project and BSC is provided in Table 3.

Table 3 Tentative Agenda of the joint event to be organized by enviroGRIDS project and BSC

Wednesday, 30 Oct., 2012 (enviroGRIDS workshops, only for project partners)		
9:00 – 13:00 14:00 – 17:00	Workshops: Bringing data into enviroGRIDS, INPSIRE and GEOSS	

Thursday, 31 Oct., 2012 (Black Sea Day)		
Time	*Subject*	*Speaker*
9:00 – 9:05	Opening, schedule of the day	Organizers
9:05 – 9:45	Welcome • Representative of the Ministry of Environment of Georgia • Representative of City Administration • BSC PS • Statements from representatives of MoE of Black Sea countries	
9:45 - 10:15	Black Sea Medals Awards	
10:15 – 10:35	BSC Achievements	BSC PS
10:35 – 10:45	EC DG Environment	???
10:45 – 10:55	Global Earth Observation System of Systems	GEO
10:55 – 11:10	enviroGRIDS achievements	A. Lehmann
11:10 – 11:40	Coffee break (posters)	
11:40 – 11:50	European contributions to GEOSS	DG research
11:50-11:00	Climate changes in the Black Sea catchment	UNIGE
11:50 – 12:00	ICPDR Spatial Data Infrastructure	ICPDR
12:00 – 12:10	BSC and Earth Observations	BSC
12:10 – 12:20	enviroGRIDS SDI	UNIGE
12:20 – 12:30	SWAT for Black Sea Catchment	EAWAG
12:50 – 13:00	The Black Sea catchment in	UMA

	2050?	
13:00 – 13:10	enviroGRIDS Observation System	UTC
13:10 – 13:20	Open Geospatial Consortium	OGC
13:20 – 13:30	Eyes on Earth	EEA
13:30 – 14:30	Lunch buffet	
14:30 – 15:30	Earth Observations in Black Sea countries	TUBITAK, ScanEx,…
15:30 -16:00	Presentations from experts from Black Sea countries	Local experts
16:00 – 16:30	Coffee break (posters)	
16:30 – 16:40	Euronews movie	
16:40 – 17:15	Panel discussion	
17:15 – 18:00	Concert dedicated to BSD	
19:00 – 23:00	Black Sea Day Dinner	

Friday, 1 Nov., 2012		
9:00 - 10:30	Presentations from WP2: SDI	WP2 partners
10:30 - 11:00	Coffee break	
11:00 - 12:00	Presentations from WP3: Scenarios	WP3 partners
12:00 - 13:00	Presentations from WP 4: SWAT	WP4 partners
12:30 - 14:00	Lunch buffet	
14:00 - 15:30	Presentations from WP5: SBAs	WP5 partners
15:30 - 16:00	Coffee break	
16:00 - 17:00	Presentations from WP6	WP6 partners
17:00 - 17:30	Conference wrap-up and next steps	Anthony Lehmann
19:00 – 23:00	Wine tasting & dinner	

Saturday, 2 Nov., 2012		
9:00 – 15:00	Excursion	

5 Future activities

5.1 IT support for ICPDR and BSC SDI

As was already mentioned in this document, the one main issue for the ICPDR is to improve the current DanubeGIS system. There are certain issues, which should be improve and also then to decide the best possible solution available in terms of cost and personal too.

The current DanubeGIS issues are shortly described below.

Data collection format

Currently, data for the DanubeGIS is collected in ESRI shapefiles (incl. dBase tables). This format was chosen because it is the de-facto standard for geodata and no other format has yet reached a comparably wide support by related tools. However, it comes with some problems and limitations, e.g. shapefiles can not be easily edited by other than GIS experts, the dBase format is problematic with different character encodings, limits field names to 8 characters and does not support empty numeric values.

Compliance & interoperability with other systems and data specifications

The compliance and interoperability with several other systems and data specifications is difficult as they go in different directions.

WISE and DanubeGIS have considerable overlaps in the data collected, and these should be "translatable", but DanubeGIS has specifics due to the Danube basin-wide perspective of the ICPDR. As discussed in relation to the data format, WISE has now a rather complex data collection approach involving shapefiles, data input tool in MS Access and XML files – following this directly would impose an unreasonable development effort, as data structures would have to be maintained both in an data input tool and on the database server side.

The INSPIRE Directive has to be implemented by countries and therefore could affect their data structures, e.g. river segments, where it requires that there is only one segment between two confluences – in contrast, the current data is in most cases much more segmented. Following the INSPIRE approach could lead to a split of geometries of river segments and water bodies which would make substantial changes of templates necessary.

Data storage (repository)

The implementation of a database backend is a basis for further improvement of the tools for data validation, analysis and integration of other databases.

The complete replacement of the file repository by a database repository however, is not feasible, as data structures for all template versions would be needed which results in a too complex system.

The need for keeping all uploads – even those which are corrected because of mistakes or completed with additional data in the same reporting period – was questioned, as only the latest uploads for a report are relevant for further use. The mutual understanding was then that the Download Tool should make it easier to access the latest datasets (see below), but keep all files in the background as a proof of submission and backup.

Character encoding of datasets

Character encodings are currently not handled properly and result in wrong display of special characters, e.g. in the names of rivers and any other objects.

This issue has to be addressed taking into account the limitations of shapefiles. Therefore, the preferred solution would be a server-side transformation of uploaded datasets to the UTF-8 character set encoding, which covers all used languages and would eliminate further problems with display.

Data validation

Currently, the Upload Tool of the DanubeGIS checks datasets for compliance with the template structure. A separate Review Tool was developed to add additional checks more related to the content which are not possible during the upload as they check e.g. consistency between different fields (e.g. catchment size and reporting level), uniqueness of IDs over separated files (e.g. FIProjects), referential integrity between datasets (e.g. river segments and water bodies), availability of optional or conditionally mandatory data (e.g. chemical status for EU members), availability of newly introduced fields. The current deficiency is the manual intervention needed to transfer and import the files into the Review Tool.

Data update management

In the Report "Concept on Data Update for the ICPDR DanubeGIS" it is proposed to identify and store datasets belonging to certain reports and recommendations on the use of attributes and meta data elements for updates are given. The consequences for the data repository were already dealt with under the item Data storage (repository).

Reference datasets

Currently, map production and WebGIS are all based on national datasets. For certain general datasets which are used in many maps and referenced by other datasets, it would be useful and more efficient to have merged datasets covering the whole DRB.

The suggestion is to produce centrally merged, generalised and harmonised datasets with limited attributes on the roof level and define intended usage cases, e.g. that they can only be used for DRB overview maps with a scale up to 1 : 1,000,000.

The following reference datasets could be produced in a first step for the roof level:

- DRBD
- Rivers and canals
- Lakes
- Transitional and coastal waters
- Transboundary groundwater bodies
- Cities

Data access rules

Currently, the DanubeGIS provides for setting up simple access rules for datasets, i.e. an "Expert" user can download all datasets of the neighbouring countries (for harmonisation purposes).

An advanced system could provide a more flexible approach using metadata: the data providers would provide information on restrictions of data use in the metadata. There are agreed rules, which give user groups certain access levels, e.g. "public" users to "freely available" datasets, "IMGIS EG members" to "restricted" datasets. Although this concept might still be useful at some point when the metadata is available, it will probably still result in availability of only part of the data to certain users.

Data download

The desired improvements for bulk download in the Download Tool were discussed. There should be options to download:

- all latest datasets per country (either for a selection of templates or all templates);
- all latest datasets of all countries per dataset/template for a specified template version and
- all latest datasets of all countries per dataset/template for a specified date (by default the current date).

The dataset files should be in a flat ZIP archive and filenames should include the country code and the template version.

Data integration

Integration of DanubeGIS datasets with various other ICPDR datasets (emission inventory, etc.) is highly desired for better analysis and visualisation options.

It was discussed which is the best approach: centralisation of all databases into one system would be a high effort and probably result in a complex system with not too much added value. A data warehouse concept on the other hand, would leave the specific databases in place and build up a separated database with structures specialised for reporting. The concept seems to be ideal in terms of scalability and reporting options, however the effort has to be evaluated to find out if it is feasible for the short to mid term perspective.

It is proposed that the planned reporting database for the DanubeGIS could be supplemented with relevant reporting data (automatically extracted) from other specialised databases, leaving the different systems in place and using the reporting database for analysis and visualisation as a first step in the direction of implementing a data warehouse.

Data analysis and reporting

The existing Review Tool seems to be sufficient for data analysis and reporting in the short term. If more complex needs emerge, more specialised tools could be introduced in parallel.

Map Server software

ArcGIS server and Geoserver were discussed as possible options for the map server. ArcGIS Workgroup Edition was not considered, as it limits the database integration. Related to the needs of the ICPDR, there seems to be no major differences except the following:

A map produced with ArcGIS desktop can be easily published to ArcGIS server, because the same style definition is used (MXD file). Publishing the same map to Geoserver requires conversion of the styles to a SLD file (Styled Layer Descriptor is an XML schema specified by OGC for describing the appearance of map layers). There are some manual steps necessary, but the outcome will be similar.

The license for ArcGIS Enterprise Edition is about €16.000,- and annual upgrade and maintenance license costs are approx. €5.000,-. There are no license costs for Geoserver.

Geoserver supports more formats and is easier to extend and customise. This makes Geoserver more adaptable to future changes in the needs of the ICPDR.

Based on this comparison, the proposal is to use Geoserver as map server for the future DanubeGIS as the additional effort for publishing maps with Geoserver is not likely to outweigh the license costs of ArcGIS server.

Database server software

The currently used MySQL database server software has only limited capabilities in supporting geodata types.

The database server tightly integrates with the map server and therefore the most obvious choice is the PostgreSQL database with the PostGIS extension which integrates with Geoserver out of the box.

The proposal is therefore to use PostgreSQL/PostGIS as database backend for the DanubeGIS. This database will include the meta information of the file repository and the proposed reporting database and be used by the Review Tool and the Geoserver.

WebGIS Client software

The choice of WebGIS client software (ArcGIS, OpenLayers, Umweltbundesamt client) was discussed independently from the map server choice although these components are very much dependent on each other. The following needs for the WebGIS client seem to be possible with any of the choices:

- Common background map as tiled service. As a first step, a publicly available map (e.g. Google maps) could be used until later a custom ICPDR map based on reference layers is implemented.
- Provide a user interface to interactively add and combine different layers (map themes) with data from various sources (DanubeGIS file repository, reporting database, external services)
- Provide access to attributes in readable form (long titles and meanings, instead of field names and codes), also access to related attributes (segment – waterbody)
- Increased usability and speed (Ajax)
- Allow different access to public and expert users: public users can only see final published report data and expert users can additionally see the latest data
- As there is no substantial advantage of ArcGIS client, the client had no influence on the proposal which map server should be used. Following the proposal for Geoserver, OpenLayers is proposed as the most obvious choice for the WebGIS client software.

5.2 State of GEO memberships in Black Sea countries (more details in deliverable D.6.8)

Bulgaria

During the last year and a half, the efforts regarding membership of Bulgaria in GEO and establishment of National GEO Committee include collection of recent GEO-information materials and completion of list of experts/institutions with activities related to the GEO Societal Benefits Areas. Following the GEO-membership step-by-step guide developed by NIMH-BAS for the Deliverable 6.2 of enviroGRIDS, the following steps were undertaken:

- The 10 Years GEO Implementation Plan was translated into Bulgarian
- A proposal expressing our interest in GEO membership was prepared and submitted to the Bulgarian Ministry of Foreign Affairs. Their answer was positive and we received instructions how to proceed further with the procedure.
- An information seminar was organized and held in NIMH.

Georgia

The situation in Georgia regarding the procedure of becoming a GEO member and establishing a national GEO committee has not changed significantly since 2010, when first answering the Questionnaire on GEO membership.

Georgia is still not a GEO member but the International Department of the National Environmental Agency (NEA) of Georgia, the NEA of Ministry of Environment Protection of Georgia, through its Hydrometeorology Department, would be willing to proceed with necessary organizational steps to join GEO and establish national committee. The enviroGRIDS partners from Geoinformation Systems and Remote Sensing Consulting Centre (GeoGraphic), Georgia are committed to assist NEA in preparing necessary technical communication, documentation and other organizational matters.

Romania

Romania is a member of GEO but they have no official National GEO Committee established. There is a number of not official members. According to the Romanian enviroGRIDS partners, the

meteorological and hydrological information forms the main type of data and products which are available (open access) in their country.

Geospatial, Internet-based and warning services, related to EO could be provided**.** Concerning the GEO' "Societal Benefit Areas", Romania declares most interest and readiness to participate actively in the areas of disasters, climate, water and weather.

Turkey

Turkey is a member of GEO since 2008 and TUBITAK is the national representative agency for GEO activities in the country.

Turkey is a country with a rapid rate of change in many aspects: its urbanization process is not sufficiently controlled, it has large development projects (highways, dams, irrigation, housing, infrastructure etc.), it undergoes changing agricultural practices, causing environmental problems with soil erosion and deforestations. Moreover, natural hazards such as landslides, flooding, earthquakes, and uncontrolled developments cause higher risks and in the likely case of disaster event higher damages. All these impose coordinated efforts to observe and, when possible, predict natural hazards.

Turkey sees space as a matter of strategic importance and national pride, and space technology is identified as a priority area for the country. Turkey has a growing space related activity in several government agencies, universities, research centers and institutions and private sector. Individual scientists and groups carry out research in space science, space technology and applications in several universities and research centers.

Turkey is an active GEO member in the Black Sea Catchment region. The country, through its National GEO committee, initiates and participates in activities related to all nine GEO SBAs. Turkey hosted several very important GEO meetings, namely:

- 4th Architecture and Data Committee meeting (Sep 2010, Ankara)
- 2nd GEOSS Interoperability Workshop (Aug, 2010, Ankara)
- 13th Science & Technology Committee Meeting, (Mar 2010, Ankara)
- 3rd GEO European Projects Workshop (Oct, 2009, İstanbul)
- QA4EO workshop on Facilitating Implementation (Sep 2009, Antalya)

The Scientific and Research Council of Turkey (TUBITAK) hosted the GEO-VIII Plenary in Istanbul on 16 and 17 November 2011 where the new GEO 2012-2015 Work Plan was accepted.

Ukraine

Ukraine is an official member of GEO. There is an official representative of Ukraine in the GEO Committee and that is the Director of Space Research Institute of National Academy of Sciences of Ukraine (NASU) and National Space Agency of Ukraine (NSAU).

National Ukrainian GEO Committee does not exist by now. Ukrainian representatives from various scientific and government organizations and agencies are involved in GEO thematic groups. The work on topics related to the GEO themes is in progress.

At present in Ukraine there is no single government authority, responsible for Earth observations, in particular, remote observations and control of Ukrainian territory. The Ministry of Environment and Natural Resources protection, the Ministry of Emergency situations and the State Space agency of Ukraine are separately responsible for certain functions. However, certain control functions, requiring application of remote sensing data are laid on other state agencies and state inspections.

At present, with regard to the current situation in the country, we do not see any definite way to join the efforts of separate governmental authorities in the framework of enviroGRIDS project and establish Ukrainian National GEO Committee.

Establishment of a National GEO committee has to be a political decision, made at a supreme governmental level. It is impossible to establish GEO solely in the frames of a scientific-technical cooperation project.

The Ukrainian enviroGRIDS partners expressed their readiness, if their understanding of the current situation with National GEO Committees is incorrect, to get clarifications and supporting materials in this regard. They would be grateful to receive from other project partners any materials, which describe the process of establishment of National GEO Committees.

Ukrainian enviroGRIDS partners further intend to continue their activities on popularization of project results in Ukraine, in particular, they will continue to inform interested public authorities and organizations on possibilities of GEOSS and on the enviroGRIDS project. Such activity is necessary to increase motivation of central governmental authorities for building closer ties with GEO."

5.3 Extend ICPDR know-how in the BSC catchment

One of the best solution to extend ICPDR know-how in the BSC catchment is the enviroGRIDS training workshop series "Bringing GEOSS Services into Practice" which teach how to install, configure and deploy a set of open source software to publish and share spatial data and metadata through the Global Earth Observation System of Systems (GEOSS) using OGC web services & ISO standards.

For both ICPDR and the Danube countries will be a great benefit as the training workshop cover interoperability, hands-on experience with web portals, information access, open source software and spatial data sharing through web services and the GEOSS registries.

This should then allow the ICPDR to also extend its best practice in Integrated Water Resource Management in the entire Black Sea catchment.

5.4 Starts assessing pollution loads in the Black Sea as in the Baltic Sea

The Black Sea SAP stipulates the elaboration of cost-effective measures on reduction of pollution from diffuse sources. It requires not only knowledge of pollutant loads though rivers and atmosphere but also knowledge on origins of these pollutants and their relative contribution into the total loads. Such knowledge can be obtained with the help of modelling.

In the framework of the EC Baltic2Black project BSC PS is undertaking initial steps on introducing in the Black Sea a modelling tool, linking background pollutants triggering in the Black Sea with requirements, set by the Black Sea Commission, for reducing input of nutrients, including riverine loads. It will be developed taking into account the HELCOM experience in application of the modelling work carried out by the Baltic Nest Institute (BNI) (Savchuk 2012). The HELCOM-BNI cooperation is a good example of how modelling can be useful to regional intergovernmental nutrient control policy. A decision-support system – Baltic Nest – has been used as a tool for developing and testing ecologically meaningful and cost-effective environmental objective-based strategies to reduce eutrophication in the Baltic.

The implementation plan will describe a set of necessary models to be established for the wide Black Sea region (including watershed) coupled in a tool, linkages between models and data sources, requirements to monitoring, data flows to be organized, decision-support tools to be developed, funding requirements, expected results to be delivered to decision makers and public. A watershed model allowing quantifying the nutrients loads to the Black Sea and identifying respective drivers will be an integral part of the plan.

Several different models have been already used in the Black Sea region to make assessment of river loads. These are, for example:

- MONERIS (MOdelling Nutrient Emissions in RIver Systems) for Danube catchment;
- INCA (Integrated Catchment) for Yesilirmak river, Turkey;

The SWAT model, which is being developed in framework of the EnviroGRIDS project is the only one, which will be applied to the whole Black Sea catchment. It is important that SWAT in

enviroGRIDS will try to utilize all available environmental data in the region delivered through the SDI also being generated by the project.

It is expected that model results will be presented and discussed at the meetings of BSC Advisory Groups in September-October 2012. It is important to make validation of the obtained results against observation data on pollution loads to the Black Sea from major rivers reported to BSC, estimate uncertainty and make comparison with results of other models. In case of success, the Advisory Groups can recommend BSC to approve model as a tool to support decision-makers dealing with elaboration of measures on reduction of pollution loads to the Black Sea.

5.5 Prepare an after-life plan for enviroGRIDS

To clarify the ownership of the data as well as to ensure a sustained engagement of the end-users, an after-life plan (post implementation plan) will be setup. This plan will essentially concentrate on the needs of the BSC and ICPDR partners by making sure that they can continue to use the spatial data infrastructure built during the project, as well as the Observation System.

The after-life plan aims at:

1) Consolidating the build up capacity in the Black Sea Region;
2) Clarifying the ownership of the obtained data and outcomes;
3) Transferring project outcomes, data, tools and guidelines;
4) Institutionalizing the activities;
5) Ensuring the updating of the developed systems; and
6) Telling about the lessons learned.

6 Conclusions

6.1 International Commission for the Protection of the Danube River

The ICPDR (International Commission for the Protection of the Danube River) is an international organization consisting of 14 cooperating states and the European Union. Since its establishment in 1998, it has grown into one of the largest and most active international bodies engaged in river basin management in Europe. Its activities relate not only to the Danube, but also the tributaries and ground water resources of the entire Danube River Basin.

The ultimate goal of the ICPDR is to implement the Danube River Protection Convention by promoting and coordinating sustainable and equitable water management, including conservation, and rational use of waters for the benefit of the Danube River Basin countries and their people. The ICPDR pursues its mission by making recommendations for the improvement of water quality, developing mechanisms for flood and accident control, agreeing on standards for emissions and by assuring that these measures are reflected in the Contracting Parties national legislations and are applied in their policies.

The ICPDR actively organizes and prepares information for the countries on issues related to water quality and quantity in the Danube river basin and is the coordinating platform for the development of the Danube River Basin Management Plan (ICPDR 2009) as required by the EU Water Framework Directive (CEC 2000). To carry out this coordination role the ICPDR has organized GIS information systems and data collection on water management from the Danube countries and produces numerous reports and documents for technical and public audiences.

Within enviroGRIDS project ICPDR together with BSC were involved to perform and supervise the gap analysis report in terms of data and observation systems into the Black Sea Catchment. The recommendations derived from the gap analysis should aim at complementing the existing geographical information systems of the ICPDR to exchange data in various format and projections within the Black Sea Catchment and use a combination of open source (Postgres SQL, PostGIS,

MapServer) and commercial software (ArcGIS server, FME) to complement the existing database used by ICPDR.

As a platform at regional level, ICPDR is coordinating the mechanism of the Danube countries in improving water management and ensuring coordination and cooperation in addressing negative pressures on water resources. The tools developed under the enviroGRIDS project can be helpful for ICPDR and we have to benefit on how these tools might be able to meet some of our needs.

The activities and outputs of the enviroGRIDS project have been brought into and discussed in the meetings of the ICPDR Expert Groups (IMGIS Expert Group) and also at high-level meetings (Ordinary Meeting Group, Standing Working Group) and will further influence their activities. Particularly worth mentioning in this context are the use of open-source standards compliant software to publish data and metadata as shown in the enviroGRIDS project and taken into consideration in the future development of the DanubeGIS.

Also another objective of the ICPDR is to become one component of Global Earth Observation System of Systems (GEOSS) which is compatible with the new EU directive on Infrastructure for Spatial Information in the European Union (INSPIRE), even if INSPIRE rules are applied strictly to the countries. For ICPDR, as coordination platform at the regional level, it will be important to support the Danube countries in the reporting process to INSPIRE.

An important issue for ICPDR is the SWAT model. The SWAT results should be compared with MONERIS model used by the ICPDR Pressures and Measures Expert Group. As BSC will use SWAT model and ICPDR is using MONERIS model, a comparison between the outputs of both models will be extremely useful for both commissions in order to improve the situation in the Black Sea.

The infrastructure created within enviroGRIDS project should increase the capacities and improve the ICPDR's every day work, especially regarding data and information management, state of the environment reporting, assessments, water quality studies, early-warning systems and modeling. Access different data sources and metadata from partners and/or data providers within the Black Sea catchment it is a important benefit for the ICPDR.

Data exchange is another issue of the ICPDR as the owners of the ICPDR datasets are the Danube countries; this process of sharing is difficult. Helping and improving the mentality of sharing data it is an important benefit to achieve. Training workshop series "Bringing GEOSS Services into Practice" could be an first step in order to teach and change the mentality of the data holders, as the workshop cultivate hands-on experience with web portals, information access, open source software and spatial data sharing through web services and the GEOSS registries. This means also to build capacities in the Black Sea region especially regarding data sharing and related technologies (web services, metadata catalogues).

6.2 Commission on the Protection of the Black Sea against Pollution

The Commission on the Protection of the Black Sea against Pollution (Black Sea Commission, BSC) is the international body established for implementation of the Bucharest Convention, its protocols, and the Black Sea-Strategic Action Plan. The BSC is the platform for regional cooperation in protection of the Black Sea environment, coordinating activities in fields of pollution monitoring and assessment, controlling pollution from land bases sources, conservation of biodiversity, sustainable use of marine living, integrated coastal zone management and environmental aspects of shipping, including respective policy and legislation development, harmonization in standards and methodologies, and decision-making.

The Black Sea Integrated Monitoring and Assessment Programme (BSIMAP) implemented by the Black Sea Commission is addressing the main transboundary environmental problems in the Black Sea region (TDA 2008). Its main objective is to provide data for periodical assessment of the state of environment thus allowing to estimate the effectiveness of protection measures applied by Black Sea coastal states. For the BS-SAP water quality objectives to be achieved the measures have to be taken at the river basins discharging the Black Sea.

The two international institutional structures, the BSC and the ICPDR, coordinate the cooperation among the Black Sea basin states. The cooperation of these two main bodies was officially established

through a MOU between BSC and ICPDR Secretariats signed in 1997. The long-term goal in the wider Black Sea Basin is to take measures to reduce the loads of nutrients and hazardous substances discharged to such levels necessary to permit Black Sea ecosystems to recover to conditions similar to those observed in the 1960s.

In framework of the enviroGRIDS project, the BSC PS jointly with ICPDR was involved in performing and supervising the preparation of the Gap Analysis report and current report on Policy and decision makers' involvement, also taking part in development of SDI, communication to decision makers and in dissemination activities.

The objectives, activities and achievements of the enviroGRIDS project have been presented to experts and discussed at the annual meetings of the BSC Advisory Groups (AG LBS, AG PMA and AG ICZM) and brought to the attention of decision makers and stakeholders at the regular meetings of the Black Sea Commission, International Black Sea Day Celebration activities, 2nd Istanbul International Water Forum. The enviroGRIDS project also was presented to the Black Sea Scientific community at the joint 3rd Bi-annual Black Sea Scientific Conference of the Black Sea Commission & Final UP-GRADE BS-SCENE Project Conference held in Odessa, Ukraine in November 2011. The advantageous opportunity to communicate project outcomes directly to BSC policy and decision makers will be the Final Project Conference combined with the International Black Sea Day activities to be organized jointly with BSC in Batumi, Georgia in October 2012.

The BSC objectives to reduce eutrophication and ensure good water quality are to be achieved through the reduction of nutrients and pollutants originated from land based sources including those discharged to the Black Sea from rivers. The enviroGRIDS SWAT model is expected to produce outputs on water quality inflowing into the Black Sea, allowing to assess the contributions of different sources (agriculture, urban, etc) and to evaluate response of river basin due to pressure reduction measures. The obtained information can be used for elaboration of appropriate measures on reduction of nutrients and pollution transported to the Black Sea from rivers.

The SWAT model has the potential to become the modelling tool serving the needs of the BSC PS provided that model is tested and validated and that all countries accept outputs. Considering, that the SWAT model is the only model covering whole Black Sea catchment, it is important to make comparison of its results with the results of MONERIS used by ICPRD in order to achieve comparability of assessment through the region. The recommendations on developing/improving of the existing river monitoring network could be another important outcome of that modelling effort.

The tendencies in demographic, climatic and land cover changes in coastal zone are important for development of regional and national programs for Integrated Coastal Zone Management, therefore the enviroGRIDS scenarios as well as assessment of environmental vulnerability and risks in coastal zone can serve to support decision makers dealing with these issues.

Open environmental data sharing and exchange is crucial for elaboration of scientifically based measures on protection and rehabilitation of the environment in Black Sea region. The BSC will benefit from the innovative technologies of data sharing and exchange being introduced by the project. The BSC website is undergoing process of switching to new technologies of sharing spatial data with the help of web services thus becoming a component to GEOSS. On the other hand, the data from the Black Sea Catchment Observation System will be available to respective scientists and decision makers timely and in full through the enviroGRIDS SDI web services. The core data sets of hydrological and SWAT model will be loaded into the enviroGRIDS data portal and shared through web services registered in GEOSS thus ensuring the efficient usage of models for evaluation of effectiveness of the measures for pollution reducing.

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Abbreviations and Acronyms

- AOS Atmosphere-Ocean System
- ATEAM Advanced Terrestrial Ecosystem Analysis and Modelling
- BSB Black Sea Basin
- BSC Black Sea Commission for the Protection of the Black Sea against Pollution
- CA Cellular Automata
- DDNI Danube Delta' National Institute
- DEM Digital Elevation Model
- ICPDR International Commission for the Protection of the Danube River
- EIS Energy-Industry System
- ESA European Space Agency
- ESRIN European Space Research Institute
- GDP Gross Domestic Product
- GHG Greenhouse Gases
- IMAGE Integrated Model to Assess the Global Environment
- IPCC-SRES Scenarios Intergovernmental Panel on Climate Change - Special Report Emission
- MCK Map Comparison Kit
- MODIS Moderate Resolution Imaging Spectroradiometer
- NUTS Nomenclature of Units for Territorial Statistics
- OECD Organization for Economic Co-operation and Development
- PRELUDE PRospective Environmental analysis of Land Use Development in Europe
- RCM Random Constraint Match
- REF EE Easter countries undergoing Economic Reform
- RIKS Research Institute for Knowledge Systems
- RIVM National Institute for Public Health and the Environment
- SAP Strategic Action Plan
- SRES Special Report Emission Scenarios
- TES Terrestrial–Environmental System
- UMA University of Malaga
- UNEP-GRID United Nations Environment Programme DEWA/GRID-Europe
- UNIGE University of Geneva
- USS User Support Unit
- WFA World Fire Atlas

More acronyms at:

http://www.envirogrids.net/index.php?option=com_content&view=article&id=74:list-of-acronyms&catid=52:list-of-acronyms&Itemid=86