SDI FOR THE SAVA RIVER
WORKSHOP AND RECOMMENDATIONS

EU- LIFE 06 TCY/INT/246: “Protection of Biodiversity of the Sava River Basin Floodplains”
NL-BO Project -10-006-102: “Development of an Ecological Network for Serbia”
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1. Introduction

Background
Croatia, Serbia, Slovenia and Serbia are collaborating on the development of an Ecological Network along the Sava River.
Participating partners are:

- Institute for Nature Conservation of Serbia
- State Institute for Nature Protection (Croatia),
- Institute of the Republic of Slovenia for Nature Conservation
- Faculty if Sciences of the University of Sarajevo
- Agricultural Institute of Banja Luka

The development of the Ecological Network is supported through a Life 3rd countries project coordinated by the IUCN Office in Belgrade. International partners in this project are Wageningen University and Research (Wageningen International and Alterra) and Orbicon (DK). One of the main challenges of the Life project will be to develop a harmonised database structure and procedures in accordance with the EU reporting requirements for Natura 2000 based on the wishes and needs of Croatia, Bosnia-Herzegovina and their Sava River neighbours.

In addition Wageningen International supports capacity development of the Serbian Institute for Nature Conservation in ecological network development and database handling through a separate project funded by the Dutch government (BO-10-006-102). An additional objective of this project is to improve the cooperation of the Institute of Nature Conservation of Serbia with the State Institute for Nature Protection in Croatia in the development of the ecological network along the Sava River by enhancing the capacities of the experts of the Institute in Belgrade. As such the BO project functions as co-funding for the Life 3rd countries project. The involvement of ESRI and Alterra was funded by the BO project while the costs for the participation of the other participants were covered by the Life project.

Within the LIFE project, tasks have been divided between several working groups. The GIS working group supports the other working group by establishing a Spatial Data Infrastructure, combining and sharing geodata sources from all participating countries.

The GIS Working Group (GWG) includes both international IT/GIS experts and experts selected from participating institutions from Croatia and Bosnia-Herzegovina. In order to harmonise the actions carried out by the different project working groups, the GWG also includes an expert from the Biodiversity WG, the Land use WG and the Awareness WG. The members of the GWG are contracted by the IUCN.

A first version of the Sava SDI was realized in 2005, using the FAO GeoNetwork Software and Minnesota MapServer. Although the software was OpenSource and free to use, it proved that the level of knowledge required maintaining the SDI was insufficiently available within the GIS working group.

The workshop, held on 29 May 2007 at the premises of the Institute for Nature Conservation State Institute for Nature Protection in Zagreb (Croatia), was
Objective of the workshop

The main objectives of the workshop were:

1. Improve the capacities of experts from the participating institutes in the Life 3rd countries project in working with the SDI by an introduction in the state of the art knowledge of Spatial Data Infrastructures, organizational developments (INSPIRE), and advances in metadata standards and OGC standards;

2. To discuss options for improving the SDI for the Sava River in order to make the SDI more user friendly and more adapted to the needs of developing an ecological network along the Sava River;

3. Enhance transboundary cooperation and promote the exchange of data needed for the development of an ecological network along the Sava River

Recommendations are laid down in an advice report (as part of this document).

Participants in the workshop

The workshop was attended by technical experts from the organizations involved from Bosnia and Herzegovina, Croatia and Serbia. Experts supporting the Ecological Network design working group also attended.

Purpose of this document

This document gives a brief overview of the workshop. Key components in an SDI are metadata and portals. Metadata describe data and other information resources. Portals are the interface between users and information resources and provide a mechanism for knowledge exchange. A separate chapter is dedicated to the concept and architecture of a portal.

Much of the content of the workshop is based on the experiences of ESRI Nederland and Alterra in the Dutch SDI project ‘Geoloketten’. These experiences can help other organizations in setting up their SDI.

Conclusions and recommendations for future work finish the report. These are summarized in practical way in a ‘working package’.
2. Spatial Data Infrastructures

2.1 Sharing geographical knowledge

SDI’s are all about sharing knowledge: sometimes technology; sometimes methods and how we organize each other, ourselves, our data, what we do. The workshop is focused on sharing spatial data and knowledge in the context of GIS.

GIS is providing a medium for understanding, modeling the physical and cultural knowledge of our world, breaking it down into components and subsistence, providing us systematic knowledge and integrative framework, analytic methods, intuitive visualization, responding to both the cognitive and the intuitive side of what we understand. This is creating order and meaning for us of the planet. It’s helping us to define the interconnections and interdependencies and providing a broad understanding of nature and human ecology.

The Web, the new platform for GIS, is becoming geographically enabled—many services, lots of new communities and users. Today, we see the Web with lots of servers that do mapping and visualization. In the future, the Web will evolve to be a kind of distributed, collaborative environment with many authors—you—many publishers with interconnections, interoperable, integrative and dynamic, and this will, indeed, change the way we do things and the way we collaborate.

Individual systems, your systems, the communities that you operate in will use each other’s services, breaking down the earth into components, you see, and dynamically integrating it, distributing its management. This will require a geographic framework. Geography gives us that home. It will give us more collaboration, but it requires conscious collaboration thinking, sharing content freely, interoperability, and enabling technology.

2.2 The evolution of SDI’s

SDI’s are not new. Sharing data date’s back to the late eighties.

Technology behind SDI’s has evolved with the general evolution of the IT industry, with geo-enabled web services (SOAP-based) is the latest paradigm.

The concept of an SDI builds on generic ICT concepts, developed by the W3C and adopted by the geospatial community to build distributed GIS infrastructures.

A few notions are key to this concept of distributed GIS.

1. Users do not have to know where services are located.
2. Everyone can ‘participate’ both as users and as service providers. It is important that it not enforces but enables participation.
3. A portal discloses the available resources to larger numbers of users. The portal is not one big geodatabase. It accesses distributed databases and (data) resources.
A GIS portal is one of three critical components of an SDI - it is the gateway to the GIS network or SDI. The other components are GIS nodes where users compile and publish GIS information sets and GIS users who search for and find, then connect to and use published GIS data and services.

In this model, the Portal provides a single access point to geospatial resources; it is the gateway to the spatial data infrastructure.

Value Propositions of an SDI

A spatial data infrastructure has important benefits to the participating organizations.

1. **Collaboration** - Publish, share, and disseminate data and GIS Web services across the enterprise
2. **Searching** - Discover, connect to, and utilize GIS data and Web services
3. **Awareness** - Organize geospatial resources in one place for the enterprise
4. **Categorization** - Catalog GIS data and web services within the context needed

SDI's support and facilitate faster discovery of data resources, direct access and use, improvement of data quality and coverage and options for collaboration for new data collection.
3. Standards

3.1 Interoperability

GIS technology is evolving beyond the traditional GIS community and becoming an integral part of the information infrastructure in many organizations. The unique integration capabilities of a GIS allow disparate data sets to be brought together ("integrated") to create a complete picture of a situation. GIS technology illustrates relationships, connections, and patterns that are not necessarily obvious in any one data set, enabling organizations to make better decisions based on all relevant factors. Organizations are able to share, coordinate, and communicate key concepts among departments within an organization or among separate organizations using GIS as the central spatial data infrastructure. GIS technology is also being used to share crucial information across organizational boundaries via the Internet and with the emergence of Web services.

To fully realize the capability and benefits of geographic information and GIS technology, spatial data needs to be shared and systems need to be interoperable. Open GIS technology provides the framework for a shared spatial data infrastructure and a distributed architecture.

3.2 Open GIS

An open GIS system allows for the sharing of geographic data, cooperation of different GIS technologies, and integration with other non-GIS applications. It is capable of operating on different platforms and databases and can scale to support a wide range of implementation scenarios from the individual consultant or mobile worker using GIS on a workstation or handheld device to enterprise implementations that support hundreds of users working across multiple regions and departments. An open GIS also exposes objects that allow for the customization and extension of functional capabilities using industry-standard development tools.

A state chief information officer, for example, would expect an enterprise GIS solution to provide a spatial data warehouse supporting shared spatial data and services across multiple agencies such as transportation, environmental protection, natural resources, state police, and information technology (IT). Each agency might also have a local database to update and maintain the framework data for which the agency is responsible and provide an e-government portal for public access. Today's "always on" availability requirements and the growing security considerations also dictate that any GIS solution operates in clustered, high-availability environments and be easily replicated to remote backup server locations.

It is important to recognize that standards must support working GIS systems and be practical to implement. They must support users' requirements for interoperability.
In order to be successful, GIS interoperability is also heavily influenced by, and must fit within, the broader computing industry standards efforts. Technology, such as operating systems, commodity hardware, DBMS, and the Internet, certainly influences interoperability work of the GIS industry. For example, consider the recent development of Web services standards and their potential influence on GIS.

### 3.3 Web services

Web services are a new framework of technology and standards for computing. Web services will provide the means to connect a network of distributed computing nodes, which includes a range of devices such as servers, workstations, desktop clients, and lightweight “pervasive” clients (e.g., phones, PDAs), in a loosely coupled fashion. Web services standards are the first attempt at building a foundation through which computers and devices interact to form a greater computing whole, accessed from any other device on the network. It is also important to recognize that Web services are not just for the Internet; they are the next evolution in distributed computing.

A services architecture supports the integration of information and functionality maintained in a distributed network via a registry. This architecture is appealing to organizations, such as local governments, that have entities or departments that independently collect and manage spatial data (e.g., roads, pipes, surveys, land records, administrative boundaries). At the same time, many of the functions of a local government require these data sets to be integrated. The use of Web services (a connecting technology) coupled with GIS (an integrating technology) can efficiently support this need. The result is that the various layers of information can be dynamically queried and integrated, while at the same time the custodians of the data can maintain this information in a distributed computing environment.

### 3.4 Standards for SDI

In the context of SDI’s, support for Open Standards (OGC, ISO) is very important.

*Metadata following the ISO 19115 standard, data services following W*S.*

Based on the same standard technology, there are several examples of operational SDI portals. The most well-known portal is the US Geospatial One-Stop (GOS). Other examples are GeoNorge (Norway), Portale Geographico Nationale (Italy) and the INSPIRE portal.

Another interesting example is the Conservation Portal (www.conservationmaps.org)
4. **Metadata**

4.1 **Why metadata**

Metadata is data about data and is indispensable in the context of Sava SDI and portals in general. It describes the content of data and helps users in finding the right data for their needs.

The major purposes of metadata are:

- Organize and maintain an organization's internal investment in spatial data;
- Provide information about data holdings to data catalogues and clearing houses;
- Provide information to process and interpret data received through a transfer from an external source.

4.2 **Metadata standards**

What do users and organizations need to know about datasets?

A metadata standard provides a common set of terminology and definitions for documentation of geospatial data. By following an international standard, metadata can be easily exchanged across borders. Metadata for geodata is described conform the ISO19115/19139 standard. It contains data elements for the following topics:

- Identification Information
- Data Quality
- Spatial data organization, spatial reference
- Entity and attribute information
- Distribution information

4.3 **Metadata completeness and metadata use**

Figure 1 shows the relationship between the level of detail and completeness of the metadata in relation to the level of GIS expertise of the GIS Portal user. The general public is likely to need only those pieces of information that allow them to find the data they need. In addition to being able to find the data, the GIS expert will most likely want a lot more detail in order to use the data in applications, analyses, and to integrate it with other data sets.

Another relationship is for the publisher: less metadata means less effort, which accommodates small organizations that don’t have resources to compile full metadata records.
4.4 Metadata standards in Europe

ISO Metadata standards

ISO is the International Organisation for Standardisation. Their purpose is to provide standards which are adopted globally. Their procedure is very strict and the quality of the standards is excellent, because of the input by many specialists.

ISO does also provide some metadata standards. ISO 19115 is the ISO standard about metadata for data. This standard is a very mature standard. The other metadata standards often refer to this standard.

ISO 19119 is the ISO standard about metadata for services. Because of the quick change of use of services and the slow procedures in ISO, this standard lacks to adopt new features. On the other hand, this standard does contain the semantics how to deal with the most import issues.

ISO 19139 is a technical standard with the purpose to have a syntactical validation of a xml file according to ISO 19115. Not all semantics can be checked with this standard, but when the metadata file is represented as XML file, the structure and contents are correct. This doesn’t mean the catalogue service can understand the file.

INSPIRE and metadata

INSPIRE is a program of the EU to stimulate the creation of a European Geospatial Information Infrastructure. A separate Drafting Team “Metadata” has provided a document with implementation rules, which should be followed by the European Countries. These Implementing Rules are mainly semantically. Remarkable is the preferred catalogue specification by INSPIRE. This is the OGC CS-W profile.
5. INSPIRE

5.1 The INSPIRE initiative

The general situation on spatial information in Europe is one of fragmentation of datasets and sources, gaps in availability, lack of harmonization between datasets at different geographical scales and duplication of information collection. These problems make it difficult to identify access and use data that is available.

Fortunately, awareness is growing at national and at EU level about the need for quality geo-referenced information to support understanding of the complexity and interactions between human activities and environmental pressures and impacts. The INSPIRE initiative is therefore timely and relevant but also a major challenge given the general situation outlined above and the many stakeholder interests to be addressed.

INSPIRE is complementary to related policy initiatives, such as the Commission proposal for a Directive on the re-use and commercial exploitation of Public Sector Information.

5.2 The INSPIRE concept

INSPIRE is ambitious. The initiative intends to trigger the creation of a European spatial information infrastructure that delivers to the users integrated spatial information services. These services should allow the users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an inter-operable way for a variety of uses. The target users of INSPIRE include policy-makers, planners and managers at European, national and local level and the citizens and their organizations. Possible services are the visualization of information layers, overlay of information from different sources, spatial and temporal analysis, etc.
6. GIS Portals and SDI

6.1 GIS Portals
GIS portals provide the framework for collaborative geospatial user communities and facilitate the discovery, sharing and delivery of GIS content and services. GIS portals in general organize content and services such as directories, search tools, exploration tools and data. They provide the capabilities to query metadata records for relevant data and services and link directly to the online sites that host content services. The content can be visualized as maps.

A GIS portal supports collaboration, searching and categorization of data sources. Collaboration means that people can publish, share and disseminate data and GIS Web services across the enterprise and between organizations. Search tools help users discovering GIS data and Web services for a geographic area in the desired context, whether the search is defined spatially or thematically. Metadata stored in the portal catalog contains the knowledge required to connect and utilized distributed geospatial databases and applications. By categorization, resources can be easily and more directly delivered to users within the context needed.

6.2 Why are portals important
The importance of GIS portals lies in the fact that they facilitate people and organizations to collaborate by sharing their data. What are these users looking for? Users need a mechanism to quickly find the most useful data for a given purpose. So metadata in a GIS Portal is not limited to data or services. In essence, when talking about portals, we are not just talking about GIS data. Metadata is NOT just for GIS Data. Metadata is for applications and geospatial resources too. And: metadata can be about other then spatial data.

A metadata portal contains metadata for:
- Data for Use in GIS Software
- GIS Services - Mapping, Geoprocessing
- Live data & download data
- Geospatial Applications

It can also contain information about planned data acquisitions, project background and ongoing research projects and information about events, activities and other useful information for a user community.

6.3 The portal concept
The concept of a portal is a generic ICT concept, developed by W3C. It has been adopted by the geospatial community a couple of years ago to build distributed GIS infrastructures.
Figure 2; GIS Portal Concept

Users do not have to know where services are located. Everyone can ‘participate’ both as users and as service providers. It is important that it not enforce but enables participation. The portal opens resources to larger numbers of users. The portal is not one big geodatabase. It discloses distributed databases and (data) resources.

The concept of a portal is like eBay. On one side, there is a group of providers. (I’m providing something – a book, a bike). But for consumer to buy, they want to know the description (age, color, etc.) of goods for sale. This description is metadata. The portal is the “eBay”.

The same goes for GIS. On one side, you have services, data, etc. The Portal is the location where providers can publish and users can search the catalog to find what they need. Data itself is NOT in the portal. Once found “data” in the portal, a user must contact the original source to actually obtain it. It doesn’t matter where actual data resides.

6.4 Portals and SDI

Portals are the heart of Spatial Data Infrastructures, like Sava SDI. In this context, support for Open Standards (OGC) is very important. The portal must support harvesting metadata following multiple protocols and data download from remote services (W*S).

Based on the same standard technology, there are several examples of operational SDI portals. The most well-known portal is the US Geospatial One-Stop (GOS). Other examples are GeoNorge (Norway), Portale Geographico Nationale (Italy) and the INSPIRE portal.

Another interesting example is the Conservation Portal (www.conservationmaps.org).
7. Portal functionality

7.1 User perspective

This chapter contains a functional description of a GIS portal in general. This generic description should also match the (functional) requirements of the Sava SDI project.

We have chosen to take the perspective of different users / user groups to describe the functions of the portal.

7.2 Portal functionality and users

Five categories of users can be distinguished, with the following tasks.

- **Anonymous User**
  - Search catalog, view results and view maps
- **Registered User**
  - Save searches and save maps
- **Publisher**
  - Create metadata, upload metadata, update and delete metadata, download metadata
- **Steward**
  - Manage content of assigned channels
- **GIS Portal Administrator**
  - Approve metadata, update user accounts to publisher status, batch load metadata

The functions are explained in more detail in following section.

**Anonymous user**

The anonymous generally is looking for appropriate data resources. Therefore he needs to be able to:

- View / browse channels
- Search metadata
- View (explore) metadata
- View maps (explore data)
- Download data
- Become registered user

All users have access to a simple map viewer to explore potentially appropriate datasets. This map viewer displays multiple live map services, such as Open Gis™
WMS, WFS and WCS. It handles multi-threaded requests. The resulting images are merged server-side, a single image is streamed to the browser.

Figure 3; Map viewer

Registered user functions
A registered user has all the functions of an anonymous user at his disposal and some extra privileges.

Registered users can:
- Manage Profile
- Change Password
- Save Maps
- Save Searches

Publisher user functions
A user with publisher authorization is able to publish metadata documents and other content to the portal.

- Create metadata. To create metadata, the portal has an online form. Publishers select the appropriate standard, select the content type and fill in the form. For W*S services, the Capabilities information must be provided.
- Upload metadata. This function is to upload metadata documents created by a metadata editor (e.g. ArcCatalog).
- Manage my repositories
- Manage my metadata
- Manage metadata access
Steward functions

To streamline the content of the (catalog on the) portal, GIS portal toolkit supports the concept of ‘channels’. On a channel, metadata of resources about certain domains, topics, projects, regions or other interests can be grouped together. Channels are managed by so-called stewards.

Steward functions are:

- Manage channels
- Create sub-channels

Both registered users and publishers can be channel stewards.

Administrator functions

Finally, the portal is administered by the administrator. An administrator has all functions of the other roles and can:

- Manage metadata
- Manage users
- Manage groups
- Batch upload
- Manage repositories

Figure 4; Administrator functions
7.3 Workflow

The general workflow is schematized in Figure 5.

Figure 5; Metadata workflow

7.4 Administration of the portal and channels

This section gives some additional directions with respect to portal administration.

Administrator tasks

Some remarks with respect to the task of the administrator.

The portal can work with ‘groups’. Groups are collections of users, created by the administrator (per request from publisher?). The group’s access to metadata is defined by publishers. Why use groups? This is to manage access to “secure” metadata records, by setting access to metadata at the collection level. Your collection is either “public” or “private”.

An important metadata management task of the administrator is to review and approve metadata. To ‘review and Approve’ the administrator can search by title, folder, owner, status, docUUID, date range and change document state.
Batch Publishing allows the administrator to load many records at one time.

Channels

Channels provide quick access to key resources, like ‘Live Data and Maps’, websites, documentation, maps and other. It is the mechanism to implement the “2 clicks to content” principle.

Types of Channels can be:

- Data Categories. Typically ISO data category driven. Examples: Elevation, Biology, Conservation
- Applications, with focus on a specific topic. Examples: Threatened and Endangered species and application type like GIS modeling.
- Events. Typically used to focus on “important and current events”, examples: Disasters, weather
8. Portal architecture

8.1 Portal functional architecture

The generic portal architecture consists of five components around a metadata catalog in the centre of the architecture.

Figure 6; Portal Architecture

GIS Portal Site Starter
This is a customizable, integrated set of web pages, ready to be customized for setting up a GIS Portal for your organization. The site starter provides generic capabilities for the workflows needed to support an SDI:

- Search and Discover metadata about GIS data and services
- Channel pages for organizing thematic content
- Online Mapping
- User login and profile
- Save maps and searches
- Metadata management for publishers and administrators
- Register metadata repositories for harvesting
GIS Portal Catalog Service

The Catalog Service is a web service component for handling metadata discovery, publishing, and validation. It is the engine of the portal. The GIS Portal supports public and private metadata collections. The ISO 19115 metadata standard is supported by default. Users interact with the catalog service using the GIS Portal site starter.

Map Viewer

An integrated Map Viewer allows users to view multiple Live Data and Map services in one map. The map viewer can connect to OGC WMS, WFS and WCS services. Users can share their maps with others, save their maps to their login account, or save the maps as an OGC Web Map Context (WMC) file on their local computer for reuse.

Harvesting Tool

A desktop application that allows the metadata publishers to register metadata collections for scheduled harvesting into the GIS Portal metadata catalog. The Harvesting Tool can harvest from several protocols (OAI, CS-W repositories, and web accessible folders).

Channel Editor

This is a desktop application for stewards of thematic channels to select and organize their online content. Channels provide fast access to key information resources.

Portal Toolbar for ArcMap

This tool provides interoperability between the GIS desktop (ArcGIS) and the GIS Portal. When added to ArcMap, this toolbar allows users to search a GIS Portal for Live Data and Map services and add selected services to a map. The toolbar can also open WMC files created by a GIS Portal Map Viewer.

8.2 Harvesting metadata

Harvesting is the process by which documents describing resources are collected from the participating organization and copies of them are stored and indexed in a central location. OAI defines harvesting as “A means of collecting metadata from repositories”.

The harvesting tool in the GIS portal toolkit is a desktop application that allows harvesting metadata from other repositories and publishing metadata to your GIS Portal.

It is an administrative tool that can operate in desktop mode and from a command line. To support multi organizations (read as: multi-vendor) environments, the harvester can harvest different protocols, metadata services and profiles.
8.3 Map Viewer

A map viewer displays multiple live image services. As the resulting images are merged server-side, a single image is streamed to the browser. So, users do not need any plug-in or client side component to work with the map viewer.

The list of default map servers can be updated by the portal administrator.

8.4 Example: Conservation GeoPortal

There's a vast and growing amount of information available to support conservation analysis and decision making and education. However, it's scattered across thousands of organizations and individuals. The Conservation Commons is established as a set of principles under which organizations openly share data and knowledge while respecting the important rights and responsibilities that go along with data sharing. Also GIS and Web technologies have helped to solve some of the data access and availability problems.

The Conservation GeoPortal provides a single place where anyone can discover and evaluate conservation-related data and maps; and data providers can publish descriptions and links to their maps and data. So, it really makes it easy for users to find data to incorporate into their projects, and for the data publishers to manage the access and currency of the information they're sharing. The viewers that are being developed allow us to create conservation atlases that help us communicate conservation issues, and opportunities to the public, and to decision-makers, which is an essential part of our mission.

Figure 7; Conservation GeoPortal
9. Directions and advice

9.1 Discussion

Some notes and remarkable elements form the discussions are summarized here.

1. The portal should support:
   a) Data and GIS services
   b) Background information on the LIFE Sava project
   c) Links to participants and project partners

2. Content should be relevant to the users. This implies a good balance between demand and supply driven services.

3. The portal should be easy to use: ‘a couple of clicks to data’.

4. For the design of Ecological Networks and for the work in the field of analyzing biodiversity, advanced analytical GIS functionality is required. This goes beyond the GIS functions of a typical SDI portal viewer. Ecologists use professional (desktop) GIS packages and should be able to connect to the data(services) in the SDI.

5. Data collected for ecological networks should comply with Natura2000 regulations. This data is managed and structured in accordance with domain specific data models.

6. A pilot that is carried out in the frame of the National Ecological Network project (www.cro-nen.hr) was discussed. This prototype is an implementation of TimeMap (www.timemap.net). This is an interesting tool, but as it is not build on open standards, it does not fit well in the general concept of an SDI.

9.2 Advice

Tips

- Be pragmatic - take an evolutionary approach, most of the successful SDI’s have a basic level of ‘implementation by design’ and show a substantial amount of autonomous growth;
- Be thoughtful with paperwork. Do not specify too much into too much detail in advance on paper;
- Initially, provide a framework that meets the basic functional requirements;
- Do not wait until the next:
  - Release
Fundamental choice

Our main conclusion from the discussions is that a fundamental choice has to be made whether to build a true distributed SDI or to start with a ‘consolidated’ model. This consolidated model implements the concepts of a spatial data warehouse. Data from separate sources (often in different formats) is brought together in a central data repository. This data can be a copy of the original dataset but it can also be a subset, aggregation or snapshot in time.

From the data warehouse, the data is published as web services to the portal and user applications.

Figure 8; Conceptual model data warehouse

Architecture

An initial design of the system architecture has been drafted during the workshop. This should be worked out into more detail and into a technical architecture.
In the Sava SDI there will be one central repository for all geo datasets needed for the establishment of the Sava Ecological Network. This repository will be a read-only replicated geodatabase fed by the decentralized read-write geodatabases located in Zagreb, Belgrade, Sarajevo and Lubljana. The purpose of the central geodatabase will be the consolidation and sharing of (harmonized) geo datasets for the whole Sava river basin. All editing and maintenance activities will remain the sole responsibility of the decentralized geodatabases.

The use of a common data model for all thematic geo datasets (such as the model used for the Birds and Habitats Directives) will ensure easy harmonization. For Land Use data, such a common data model has yet to be developed, but can probably be based on the CORINE data model. Likewise for tourist information such a data model has yet to be developed.

### 9.3 GeoPortal Network International

The Dutch GeoPortal Network R&D project - part of the Dutch ‘Space for geo-information’ program aims at developing a network of GeoPortals that will allow easy sharing of geodata for all users. Within the GeoPortal Network, several thematic portals have been developed in the Netherlands, and a lot of experience in operating these portals has been obtained in the past few years. The Portals are relatively easy to setup, but most importantly, easy to maintain for day to day use.

Geoloketten uses ESRI GIS Portal Toolkit to build portals. GPT complies with the relevant open standards.
In the context of ‘Space for geo-information’ ESRI makes this toolkit and the necessary base software available at no costs for the duration of the program (till mid 2009).

The GeoPortal Network Project has offered support to the GIS working group to setup a portal for Sava SDI and train personnel in the use of the software. Through the software grant from ESRI within ‘Space for Geo-Information’, software will be available for free for the next two years. As most participating organizations are already using or in the process of acquiring ESRI software, continued use after those two years will be easily guaranteed.

This proposal will be referred to as ‘GeoPortal Network International’.

9.4 Project activities

Project startup
1. Installation and configuration of the Central Portal in Zagreb

ArcIMS, ArcSDE and Oracle XE/SQLServer Express and GeoPortal Toolkit software will be installed on the SavaSDI server. On a client machine, ArcGIS Desktop Software (ArcEditor) will be installed for maintenance of the geodatabase and replication of the decentralized datasets. ArcGIS Desktop Software (ArcView) will be installed in Belgrade, Ljubljana and Sarajevo for the maintenance of the decentralized geodatabases.

2. Configuration of reference web mapping services

ArcIMS will be used to setup several reference web mapping services at a European scale (infrastructure, topography, landuse, water, etc) from freely available geodatasets.

3. Training

On the job training for the SavaSDI maintainer in Zagreb includes configuring new ArcIMS services, Channel Maintenance, Backup procedures, Metadata uploads, Geodatabase replication. Training of the database managers of the decentralized servers at their own locations is not part of this activity.

4. Support for the GIS Working Group

A GIS expert will support the activities of the GIS working group during the quarterly meetings of this group.

Support of other Working Groups

After project startup the GIS working group will support the other Life working groups (Biodiversity Working Group, Land Use Working Group) by developing and providing common data models that support data collection and management activities by those working groups. The GIS working group will also decide on and provide reference datasets for the whole Sava River basin as web mapping services served from the main SavaSDI web mapping server.
Costs

All ESRI software (ArcSDE, ArcIMS, ArcGIS Desktop (1 ArcEditor plus 3 Arcview licenses) will be provided for free by ESRI NL for a period of two years as part of the Dutch Space for Geo-Information Programme.

Free versions of the RDBMS software from Oracle (Oracle XE) or Microsoft (SQLServer Express) will be used.

Man hours for the WUR expert who will carry out activities as mentioned under 9.4.1 - 9.4.3 will be financed from the GeoPortal Network project. Travel and housing expenses will have to be financed from a different source.

Personnel costs, travel and housing expenses for activity 9.4.4 will be financed from the Wageningen International BO project.

Planning

Activities 9.4.1 through 9.4.3 will be carried out in the second half of September.