

***Title: Setting up integrated GIS for the Walloon Region (Belgium)***

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***Abstract:***

The Ministry of the Walloon Region is responsible for many geographical data, among which datasets of physical environment (geology, pedology, hydrology, etc.) dominate. In particular, the soil map is especially interesting because of its exhaustiveness, quality and precision. This dataset had been used early on in GIS applications (Decision-making Geo-Environmental Tool, Rural Areas Observatory) to provide help in solving point source pollution, protecting aquifers and soils, managing manure and sludge, etc.

Geographical Reference databases including these datasets and various others (land use planning map, orthophotos, etc.) were published on Intranet making up a distributed GIS.

This infrastructure supports the administration's missions: environmental permits, Common Agricultural Policy, rural development, Natura 2000, management of buildings and roads, etc.

Meanwhile, this infrastructure is gradually becoming available through Internet (geological map, topographical features, etc.) to form a geoportal (meeting interoperability requirements) for decision makers, citizens, scientists, engineering and consultancy companies, associations, etc.

***Background:***

Like elsewhere throughout the world, Geographic Information Systems (GIS) are playing an increasingly important role in decision making in the Walloon region in Belgium.

The Ministry of the Walloon Region is composed of several Departments responsible for various territorial issues: the environment and natural resources, agriculture, planning, etc. Several divisions within these Departments use GIS and some are even doted with a unit responsible for coordination and assistance for users.

This article describes a Spatial Data Infrastructure (SDI) based on data interoperability that was developed by the DGRNE (Department of Natural Resources and Environment). In addition, some of the thematic data available is presented and some applications are illustrated. The perspectives show that development of a Regional SDI (RSDI) could benefit from European initiatives and directives encouraging the publishing of geographical data on the Internet.

## ***Infrastructure of the DGRNE:***

The Departments of the Walloon Region, and the Department of Natural Resources and Environment in particular, use 2 pieces of GIS software from the ESRI and STAR families.

To meet increasing user demand, the DGRNE infrastructure is based on the "Reference Geographical Database"<sup>1</sup> as the only source of geographical data concerning the environment and natural resources. It was originally designed to be accessible to all users and, thus, to also be open and compatible with their initial choice of GIS software.

The centralized infrastructure was built on a three-tier architecture based since 2000 on Oracle and ArcSDE. This architecture made it possible to make environmental geographical data available for visualization and partial or complete download and to perform geoprocessing using the GIS from the ESRI family. These functions and accessibility of data have been and are still available on the Intranet of the Walloon Regional Administration that includes decentralized offices throughout the territory. To make access to the information easier and faster for the end-users, a generic application based on ArcIMS was made available to administrative employees in 2001. This application, called OGEAD (Decision-making Geo-Environmental Tool, in French: *Outil Géo-Environnemental d'Aide à la Décision*) for the Intranet, is described later in this text. Finally, starting in 2002, the data were progressively stored in Oracle Spatial, thereby ensuring interoperability of data storage and access for STAR users as well as possibly for other GIS software publishers (cf. Capoen *et al.* [2003] for a comparison of the ESRI, STAR, Oracle and OGC geometries).

The "Geographical Reference Database" is currently in Oracle 9i. The bridge with ESRI products is made possible using the ArcSDE 9.0 middleware. The functions for viewers, users and doers remain available. The Intranet applications are mainly based on ArcIMS 9.0. The other ESRI clients are ArcGIS 9.0 and ArcExplorer 9.0. The functional and operational infrastructure is shown in Figure 1.

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<sup>1</sup> This term means that Database contains source data for the environment and not necessarily only reference data such as reference topographical data.

*Figure 1: Functional infrastructure in the DGRNE (adapted from Hecq et al. [2003], updated in June 2005)*

The system is managed by a university team with technical and scientific expertise in the areas of GIS and the themes presented. Their goal is to efficiently meet internal and external needs and the team is close to users and producers of the geographical data.

The developments of this Department are part of the future RSDI designed to federate the initiatives of the various Departments and serve as a role model for the infrastructures of other Departments.

***Data:***

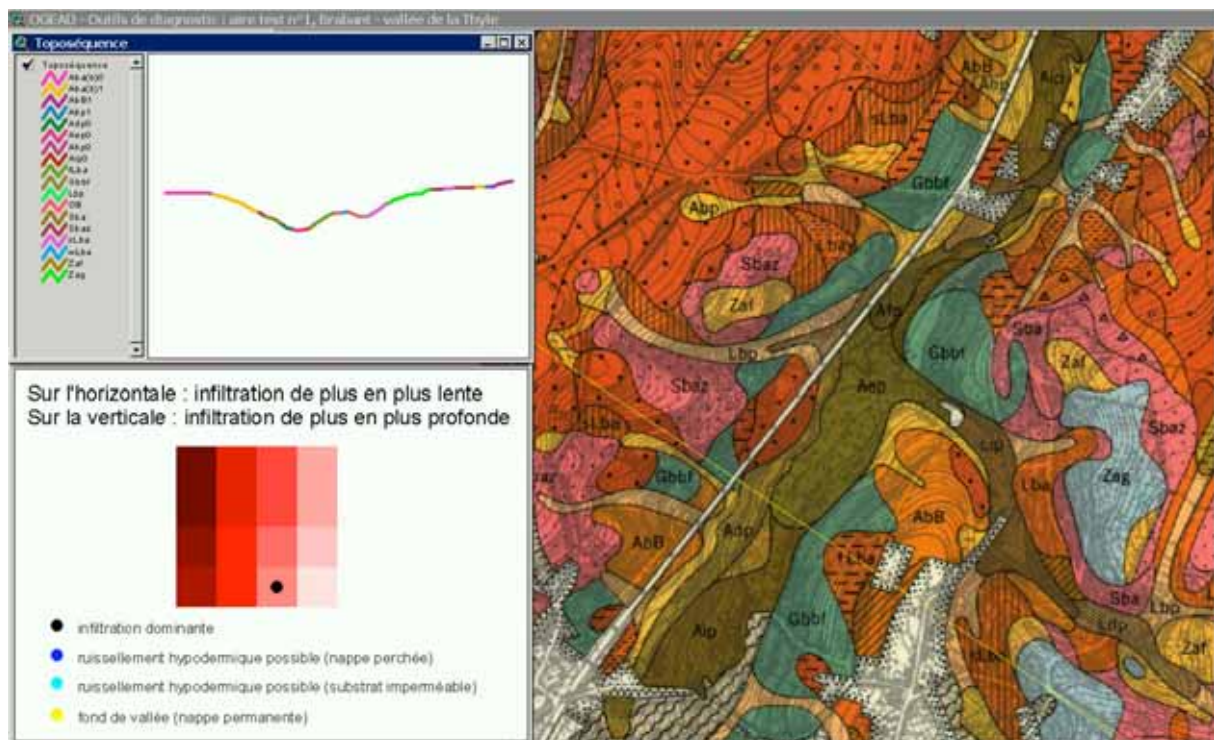
Within these Departments, the themes cover the main subjects of interest related to the environment, agriculture and city and regional planning. These include the following:

- Geology
- Soil
- Water catchments, hydrography, etc.

- Groundwater bodies, wells, protection areas, etc.
- Bio-ecological regions/data, habitats and biotopes, nature conservation areas
- Natural risk vulnerability zones
- Technological risk vulnerability zones
- Local contaminated areas
- Green urban areas
- Cultural heritage
- Land use planning maps

The data are derived from throughout the territory and mostly concern the local scale (on the order of 1/10000).

The soil map merits further attention. The original document, the Soil Map of Belgium, was drawn up between 1949 and 1991 at a highly detailed scale: 1/5000 and published at 1/20000. The base unit is the soil series. The parameters described (texture, natural drainage, soil development, stoniness, etc.) made the map easy to include in thematic applications. Several studies mainly conducted by researchers since the late 1980s illustrated the utility of this digitized document (cf. an example in Figure 2). Recently, the Digital Soil Mapping Project of Wallonia completed the digitizing of this document in which the digital data is of homogenous high quality throughout the Walloon region. This information will soon be available on the infrastructure of the Department of Agriculture.



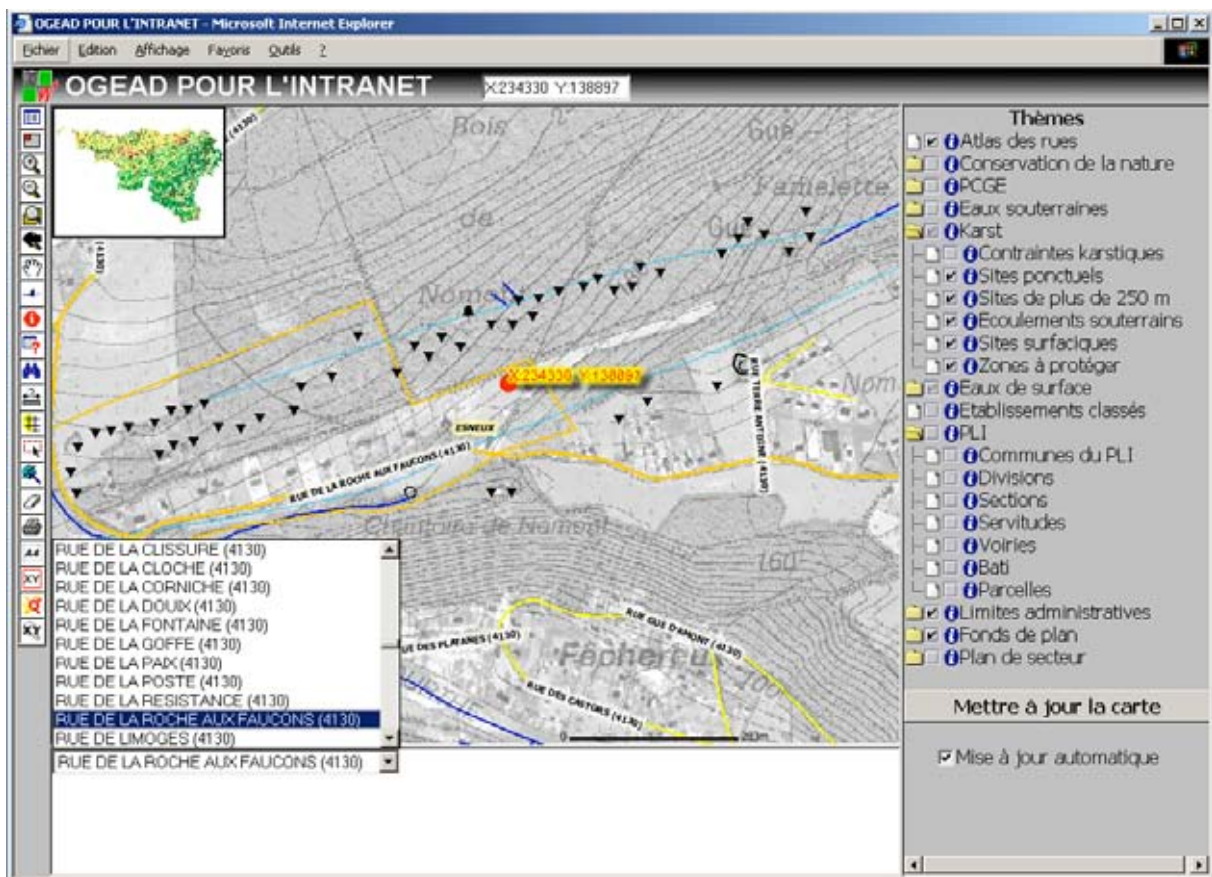
**Figure 2: “Diagnostic Tools” Application (1999) – Developments in ArcView 3.2** Soil map (example of a map published, right). Document read automatically in the form of a toposequence from isohypses and from the scanned soil map (top, left). Interpretation of infiltration in a soil unit based on the cartographic parameters and analytical data (bottom, left) (taken from Engels et al. [2004]).

## Applications

### Example of OGEAD for the Intranet

OGEAD for the Intranet (cf. Figure 3), available on the infrastructure of the Department of Natural Resources and Environment, provides easy access to most information described above. The application is a customized version of the ArcIMS HTML viewer that includes original functions: street scale, access to metadata, insertion of a point and its coordinates, etc.

This application is employed by over 1200 users. The uses are mainly for rapid visualization to provide data for forms for environmental permits, Natura 2000 (EC directive on nature conservation), the definition of protection areas, studies of quarry perimeters, urban planning permits, sewage management, etc.



**Figure 3: OGEAD for the Intranet**

*This WebGIS application of the DGRNE provides administrative officials in the Walloon Regional Administration with access to more than 60 themes concerning the environment and natural resources. The screen shot shows the "search by street" function as well as the insertion of a point and its coordinates.*

Other WebGIS applications are regularly added to the management and data access infrastructure. These applications publish data using unique symbology and the functions are partially shared between applications when technically possible. For this reason and to provide greater coherence, the WebGIS applications will be

migrated to a centralized application based on a JAVA Struts architecture using the ESRI JAVA Connector.

### **Another example of application for Intranet**

In this same line, other Departments offer similar applications on the Walloon Intranet. One example is the "Rural Areas Observatory" application of the Department of Agriculture.

### ***Perspectives and opportunities***

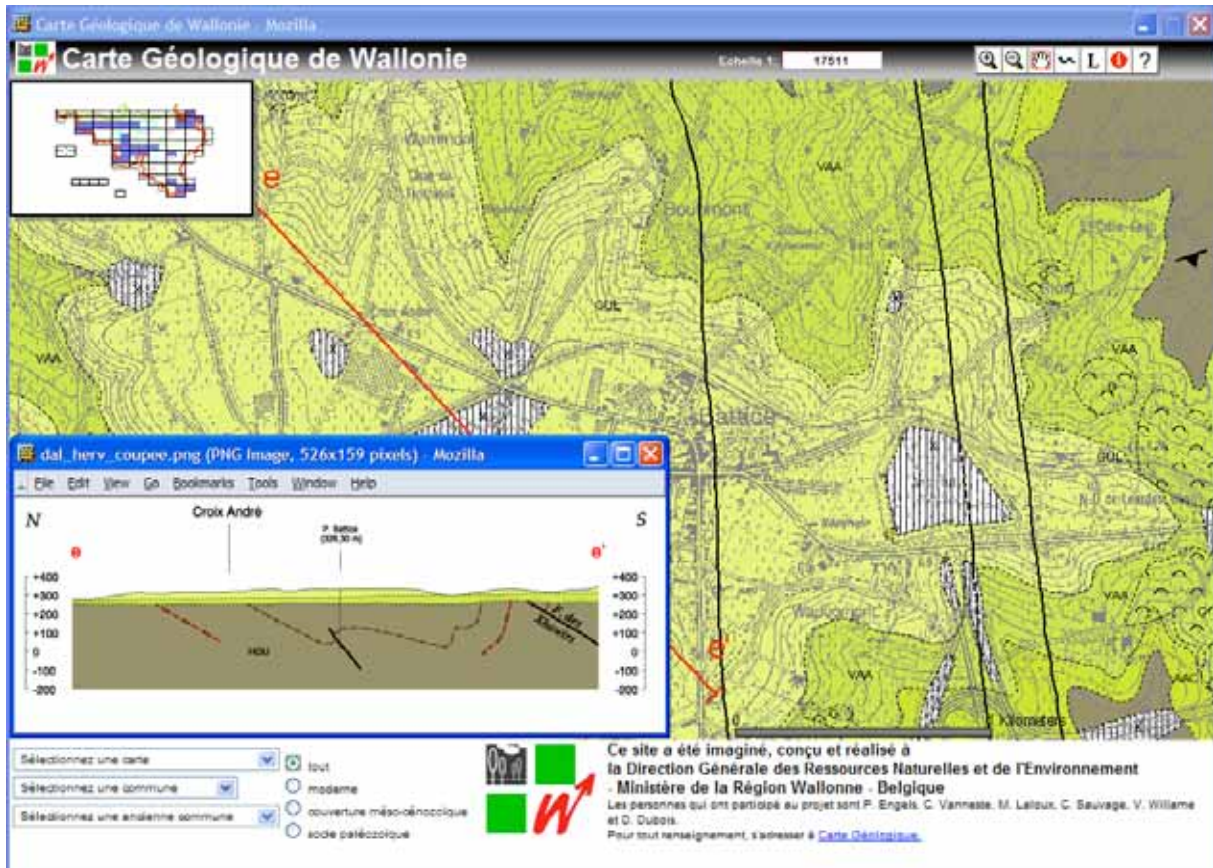
As illustrated above, a distributed GIS is being gradually implemented in the Walloon Regional Administration. The initiatives described above are, of course, not the only ones underway. For example, the Ministry of Equipment and Transportation has created a topographic database at the scale of 1/1000 called PICC. The Department of Local Authorities has also acquired a set of orthophotos at the scale of 1/10000.

A supra-departmental organization is progressively taking form. The metadata (ISO 19915) are partially described. The development of a catalogue of services is also being discussed (inventory of services and description of those already provided in accordance with ISO 19119). A specific infrastructure also publishes these reference data (PICC and orthophotos) on the Intranet and Extranet as proprietary services as well as WMS services.

The implementation of such an RSDI is not only dependent on technical factors and scientific initiatives but also on organizational factors.

Nevertheless, various European initiatives and, in particular, several directives have helped to accelerate the development of existing infrastructures and have encouraged, notably, making this information available to the public.

The Århus convention (UNECE Convention, 1998) entered into force in the Walloon Region on April 21<sup>st</sup>, 2003. This text requires member states to make environmental data available to citizens. The existing data, services and applications in the Walloon Regional Administration have progressively been made available on the Internet: geological map (cf. Figure 4), conservation of nature, etc.



**Figure 4: "Geological Map of Wallonia" Application**

<http://environnement.wallonie.be/cartosig/cartegeologique>

*This application not only allows the visualization of cartographic documents but also provides access to all useful information to aid in the comprehension of such documents, such as a geological profile here.*

In accordance with the spirit of this convention, other geographical environmental data will soon be available on the Internet. The experience gained (management, publishing, description, etc. of the geographical information) within the Regional Administration and among environmental experts will help the local authorities in their work and will contribute to the implementation of the European PSI (re-use of Public Sector Information) and INSPIRE (Infrastructure for Spatial Information in Europe) directives.

In addition, sector-oriented European directives such as the Water Framework Directive, the draft Soil Directive or the regulation concerning ecoconditionality underscore the benefits of distributed GIS in the RSDI. Due to the agroenvironmental measures it imposes, the concept of ecoconditionality, for example, should promote cooperation between the Department of Agriculture and the Department of Natural Resources and Environment.

## ***Acknowledgments***

The authors thank the cartographic and GIS teams based in the Walloon Region and working towards setting up of SDI, in particular the teams (Natural Resources and Environment Department – UCL-ULg-ULB-FPMs-SGB) which take part in the application of the "Geological Map of Wallonia" and the team (Department of Agriculture – FUSAGx) that is responsible for the Digital Soil Mapping Project of Wallonia.

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