

# Development of GIS database and interface for IM network

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## Abstract

*Development of assessment and monitoring techniques at integrated monitoring sites in Europe* is a project financed by EU's LIFE foundations. The project is based on intensively monitored reference sites of the UN/ECE International Cooperative Programme on Integrated Monitoring. The IM network presently covers 21 mostly European countries and the database containing the measurement data includes data from 61 sites.

One aim of the project was to improve the availability and use of GIS data from the IM network. The implementation of the project included the development of a GIS database covering all the IM sites and an interface for this database. The GIS work was done in Finnish Environment Institute (FEI).

Both the already existing GIS data and new data received from the participating institutes were processed and included in a common database. The user interface was built to facilitate the use of digital data. The GIS database will improve the transfer of vegetation, soil and other site information to various modelling and assessments groups as well as the use of IM data at the IM Programme Centre. A modelling group can for example select suitable IM sites for a modelling projects, use GIS data in modelling, analyse and visualize GIS data using this interface.

## I GIS database

There were very few GIS data from the IM sites available at the Finnish Environment Institute (FEI) before the project started. Most of the digital data were from Finland. There were, however, many paper maps

which had a very heterogeneous quality. Some maps did not have any coordinate system or even scale bar. The digital data were not organized in any database, all the data available for one country were stored separately. An accurate and well-organized database was needed to

improve the use of this data. The ARC/INFO GIS software was selected as main tool for building the database.

In the beginning of the project a questionnaire was sent to all the participating institutes to make a survey of the available GIS data and paper maps. The most interesting themes for the database were area boundaries, soil, vegetation, catchment borders, elevation, permanent plots and aerial photos. After the availability and status of the data from each country was obtained, the institutes were asked to forward the existing data and maps together with information about map projection and coordinate system to FEI. The digital data were transferred from National Focal Points to FEI via FTP or using e-mail. All the themes mentioned above were received from only one site and from some sites no data were received. Additional themes like lakes, streams, land use, surface deposits, geology, tree specification, development classes of trees, base map, monitoring stations, circular plot and monitoring trees were also received from a few of the sites. The total number of the layers presently included in the database is 326.

Various tasks had to be carried out depending on the individual map/data, before a map layer could be stored into the database. Paper maps with good quality were digitized by a consultant. Some ASCII and Excel files were manipulated to get new map layers. The map layers which were in other GIS/CAD formats had to be converted into ARC/INFO format. Some coordination transformations

were made in order to have all the themes of one IM site in the same coordinate system. In the database most of the map layers are stored in the national coordinate system of the country, where the monitoring area is situated. Original maps of some IM sites did not include any coordinate points and for that reason a new coordinate system has been created for these sites. Different themes of the same site were made compatible so that for example lake boundaries are same in every theme. That required so called "rubber-sheeting" and replacements of some map features by corresponding features of the other layer. The map layers and layer attribute items (columns, fields) were named according specific naming conventions so, that they are suitable for the database and that the names are as clear as possible. The database is organized so that, if new sets will become available, they can be easily appended into the database and be used by the interface.

Because the software for the database is ARC/INFO, all the GIS data are in ARC/INFO format. Most of the data are in vector format (ARC/INFO coverage) and some data are in raster format (ARC/INFO grid). Also some images (TIFF, BIL format) and dBASE files having information about sites are included into the database. The quality of the GIS data is quite heterogenous, but yet the data are the best data available. A file containing a description of the layers has also been created. The description includes the source of the data, original scale, map projection and coordinate system when this information has been available.

## 2 GIS interface

An easy-to-use interface for GIS database was developed side by side with building the database. The idea is that the interface has necessary functions to ease the use of the GIS data without having any unnecessary and confusing functions. The software for the interface was originally chosen to be ArcView2. The work started with ArcView2, but as a new version ArcView3 was released at the end of 1996, the interface was completed using ArcView3. The interface has all the functions of the basic ArcView3 and additional functions to facilitate the use of GIS data from IM sites. The additional functions were made by programming scripts with ArcView's own Avenue language. The interface is so called 'ArcView extension'.

When the user starts the interface, he gets a view, which contains all the IM sites with their codes as labels and the borders of the European countries. The user can get the basic information from a selected IM site by clicking on it. To get a closer view from a specific site the user can select it by clicking on it or giving its name or code. A new view is created and all the themes (map layers) of the site are collected from the database for the view. The different themes of the site are drawn to view using menu choices. Colouring of the

theme is based on one attribute item, which classifies the features (point, line, polygon) of the theme (for example: soil class). The user can obtain information related to a selected feature by clicking on it.

The user can easily print maps and make image files to be used in an other software. Some GIS analyses like intersections of themes can be made. The user can for example make a new theme by intersecting soil and vegetation themes. Intersecting themes function helps also, when the user wants to have a layout, where for example the soil polygons inside the watershed are shown, but not those outside the watershed. The user can also easily make an Excel file from a theme's attribute table, so that the file contains the selected records (features) and fields.

In the future the relational IM database containing the measurement data and the GIS database could be joined and the GIS interface used for data handling. So far this has not been possible, due to a lack of a compatible driver.

Use of the GIS interface requires an ArcView licence. The data in the GIS database can as well be used directly in ARC/INFO. The data in the GIS database can also be converted into other GIS formats. So, if the user has neither ArcView nor ARC/INFO, but he has some other GIS software, he can still benefit from these GIS data.