

GEO Data Portal and UNEP.Net: UNEP's new platform for environmental data access & web interoperability

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Abstract

The Global Environment Outlook (GEO) Data Portal was initiated in October 2000 to provide a comprehensive, reliable and timely supply of data for the preparation of UNEP's GEO reports. Since then, it has matured into a unique data and information application which responds to the needs of the global environmental community for easy access to systematic and well-documented data on the environment. In addition to the possibility to download the statistical and geo-spatial data sets in various formats, it offers a wide variety of analysis and display options – such as drawing maps, graphs and tables in real time. Furthermore it provides access to its content and functionality from remote sites, thus rendering the Portal a web-interoperable platform.

1. Introduction

The UNEP Global Environment Outlook (GEO) project was initiated in response to the environmental reporting requirements of Agenda 21 and to a UNEP Governing Council decision of May 1995 which requested the production of a comprehensive global state of the environment report. A major component of this project is the GEO report (UNEP 2003), a global environmental assessment report based on a cross-sectoral, participatory and consultative process, including a wide range of policy makers and scientists on regional and sub-regional levels.

The GEO reporting process is based on sound empirical analysis and the contributions of a global network of partners. It requires having readily at hand a wide range of statistical and geo-spatial data sets that meet as much as possible the following requirements (UNEP/RIVM 1999):

- world-wide coverage, but with data at the regional and national levels;
- harmonised data values, collection units and definitions;
- use of internationally recognised sources;

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- time series data;
- free and easy access for UNEP and GEO contributors and broader user communities;
- aggregated statistics for the sub-regional, regional and global levels.

The GEO Data Portal development started in August 2000 to provide UNEP's report producers with easy access via the Internet to such a common and consistent collection of data sets from primary sources (UN and others), while covering a broad range of environmental and socio-economic themes. The Portal addresses one of the major concerns expressed since the start of the Global Environment Outlook project ~ the need for reliable, harmonized data for global and regional level environmental assessment and reporting. As of August 2004, the Portal gives access to over 450 statistical and geospatial data sets at national, sub-regional, regional and global levels, and to the extent possible, for the years from 1970 until now. State-of-the-art functionality for on-line data visualization and exploration is available for creating graphs, tables and maps, while ample documentation and other meta-data are provided.

The Data Portal hosts data sets such as: population size and growth, educational enrolment, GDP per capita, carbon dioxide and other greenhouse gas emissions, fish catch, forest cover and deforestation rate, land cover, natural disasters, protected areas and many more variables.

2. The GEO Data Portal functions

A relatively simple interface and a guided, step-by-step approach has been selected to enable easy, fast and flexible access to the data. A light application, for easy access in developing countries, based on OpenSource products, such as Linux, PHP, MySQL and Minnesota MapServer has been developed, that aside from diverse searching possibilities offers some basic GIS and Excel-style graphing capabilities.

2.1 Search

A simple keyword search tool on the home page – supported by solid and well-structured meta-data in the background – allows the user to query the database and to select among the hundreds of variables. A more complex search interface is also available to give advanced users a more sophisticated access to the Portal's resources. As the GEO Data Portal aims to meet first the needs of UNEP and its GEO Collaborating Centers (CCs), the search criteria have been adjusted to their requirements. Thus the user can query very specific, pre-defined themes and categories, or define their own specific region. After selecting the time period, the user can access five different modules:

2.2 Map module

The map module is a spatially-enabled Internet application (“Internet Map Server”), which uses the OpenSource Minnesota MapServer development environment. The maps are created dynamically, offering some basic GIS functionality such as *zoom*, *pan*, *identify* and *query*. Additional capabilities within this module are the display of graphs and histograms; switching between different selected years; the display of additional layers; the change of symbology – size of labels, color of items, etc.

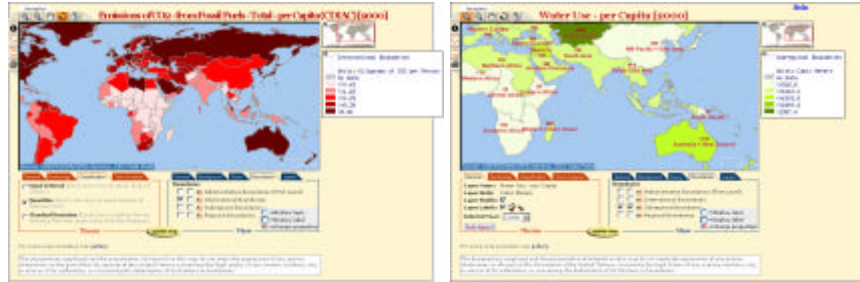


Figure 1

The map module offers some basic GIS capabilities

2.3 Graph module

The graph module works with an additional PHP module (“JpGraph”) and is connected with the MySQL database. It draws “on-the-fly” simple line, accumulated line and bar charts. The user can select several countries or regions at a time to enable a comparison between them, or explore the evolution (trend) of a variable over a given time period for a specific country or region.

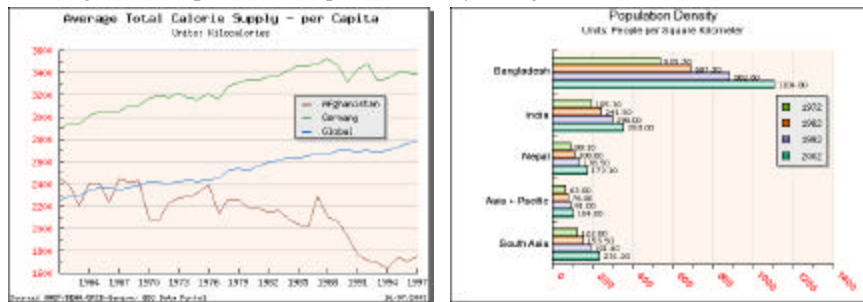


Figure 2
Graph display possibilities within the Graph module

2.4 Table module

The 'raw -data' module consists of a purely HTML/JavaScript/PHP-coded page and displays the raw data for the selected options (time period, region, variable). It offers diverse sorting capabilities, shows extreme values by displaying the range of minimum and maximum values, and enables the display of histograms to highlight the absolute distribution of values.

	1970	1975	1980	1985	1990	1995	2000
Global value	85.00	92.00	73.00	90.00	101.00	109.00	129.00
Afghanistan	103.00	120.00	124.00	102.00	100.00	111.00	125.00
Algeria	88.00	70.00	80.00	89.00	102.00	114.00	124.00
Algeria	64.00	74.00	78.00	60.00	59.00	123.00	125.00
Arabic World	146.78	126.90	118.08	104.80	108.60	94.28	96.90
Armenia	-	-	-	-	-	-	-
Bangladesh	117.78	120.80	98.08	95.90	97.00	111.08	140.90
Benin	-	-	-	-	-	-	-
Bhutan and Maldives	78.48	80.20	88.08	108.70	108.70	94.28	96.60
Burkina Faso	78.28	76.80	87.12	97.60	104.00	114.48	120.80

Figure 3

Table module with different options like sorting, displaying extremes and graphs

2.5 Download module

The download module is a partly "on-the-fly", partly pre-programmed download manager. Depending on the type of data set selected by the user (statistical or geo-spatial), one can choose between various, widely-used formats (CSV, PDF, XLS, XML, ArcInfo, ASCII, BIL, TIF, etc.).

2.6 Metadata module

Extensive meta-data documentation has been included for all data sets, following the meta-data standards of UNEP.Net, which is UNEP's wider environmental information network/system. It follows mainly the FGDC standard and will soon be adapted to ISO 19115. In addition to free-text background documentation - usually

derived from the data source - extensive information is given on the origin of the data, the way the data were processed, missing values, measurement units and so forth.

3. First steps towards interoperability

Interoperability seems to be the current buzz-word in the GIS & Internet field. Software finds its way to the clients with built-in interoperability features; applications are developed which provide maps to other map services, or request maps from others.

Given the unique place the GEO Data Portal is holding as a comprehensive and harmonised database within UNEP, there was a need to open access to the map-, graph- and table-services for partner organizations to the extent possible. This development was even more of interest because, at the same time, UNEP initiated a wider environmental information system – UNEP.Net. This network gives access to selected, authoritative information (sources, documents, graphics etc.), related to the environment, based on themes and regions. The UNEP.Net system offered a good possibility to use the resources and technology of the GEO Data Portal for enriching its content in an efficient and effective way.

3.1 Passing parameters

For (digital) map services, a standard for remote access has been developed in recent years and published by the Open GIS Consortium (OGC). The Web Map Service (WMS) parameters used for launching a query to a distant map service have been defined as part of this. A standard OGC URL would include the following (and potentially additional) parameters (Open GIS Consortium Inc., Web Map Service Implementation Specification 2002):

URL of the map service	http://a-map-co.com/mapserver.cgi?
Indication which service operations being invoked	REQUEST=GetMap&
Projection	SRS=EPSG:4326&
Bounding box	BBOX=-97.105,24.913,78.794,36.358&
Size of the image	WIDTH=560&HEIGHT=350&
Name of the cartographic layer	LAYERS=AVHRR-09-27&
Color for the background	BGCOLOR=0xFFFFFF&
Format of the retrieved image	FORMAT=image/png&

However, the existing standard is not very flexible. Already the GEO Data Portal's "map-service" would require additional parameters, such as the year to be displayed and eventually style (e.g. size and color) of additional layers. Additionally, it is clear that these parameters cannot be extended to a "graph" and a "table-service". Ideally, there would be a generic and consistent list that could be used for any "service", be it a database-, a map-, an image-, a graph or other service. But at the same time, any service will have its own specific needs and structure. The GEO Data Portal's graph service, for instance, uses the following parameters:

URL of the graph service	http://geodata.grid.unep.ch/graphexe.php?
ID of the variable to be used	selectedID=123&
Selected country or countries as ISO-2 or -3 code	selectedCountries=AF&
Selected graph style (bar, line...)	selectedStyle=line&
The years to be displayed	selectedYears=2002,2001,2000,1999,1998
Global average display	global=1
Size of the image	width=500&height=400
Position of the legend	posLegendX=0.9&posLegendY=0.6
Axis definition	selectedXAxis=years

The graph in Figure 4 shows how content and functionality of the GEO Data Portal are being utilised as part of UNEP.Net's Country Profiles. The user can select a country and the full range of data sets by distinct categories. (The list of available data sets is generated on-the-fly by sending a query from the UNEP.Net server to the MySQL database of the GEO Data Portal and listing the variables in distinct thematic categories, such as Air & Climate, Freshwater, Land etc.) A UNEP.Net page is then loaded with a normal HTML image tag that is linked to the GEO Data Portal with the above parameters.



Figure 4
Example of a graph derived from the GEO Data Portal but displayed on a different site (UNEP.Net)

Another example is a direct, interactive link to the graph-module from regional UNEP.Net portals, such as the European one. A graphic beside the variable's title indicates the possibility to display a graph – produced on-the-fly - in full resolution. If data have been changed or updated in the GEO Data Portal, this will be reflected automatically in these graphics as well.

Another effort has been made to enable not only direct remote queries of the MySQL database, but also to display, as in the Portal itself, a table with the data. The problem with direct queries in the database is that: a) the remote service has to run some programming language like PHP or ASP in order to access the database and launch a query; b) the security issues have to be solved on both sides; and c) the distant programmer has to know the structure of the database and its tables.

To avoid this additional workload, a small PHP-script has been developed. This is accessible via HTTP from any HTML-page and transmits the necessary parameters to the database, runs a template that constructs an HTML table and fills it with the values from the query. The code is then sent back as a Javascript variable, which in turn is displayed on the user's web page.

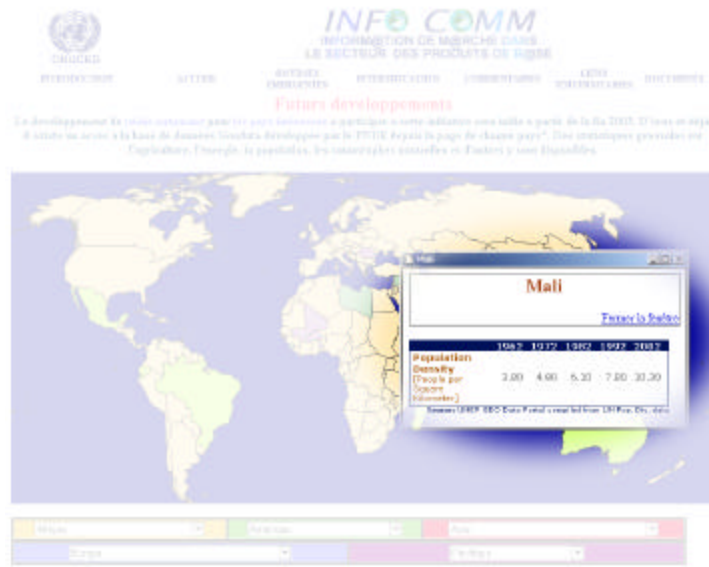


Figure 5
Table display from the GEO Data Portal in remote web sites

4. Conclusions

Over the years, the GEO Data Portal has matured into a solid, comprehensive core database and widely-used tool in support of the GEO assessment process and in other parts of UNEP, the UN and elsewhere (Universities, NGOs etc.). Increased and if possible standardised interoperability is required to improve access, use and flexibility by others. Future developments will investigate the use of XML, XHTML, WDDX, SLD etc., offering the possibility of more “standardised” settings of the parameters, of receiving the “real” values for the table output (instead of a complete HTML file) and of applying different stylesheets.

Bibliography

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