The GEO Data Portal

Sub-title: "Using advanced Internet technology to access environmental data"

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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, including the state of natural resources, as well as the societal driving forces and root causes of environmental change and degradation.

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. The GEO project has two components:

➢ A global environmental assessment process that is cross-sectoral, participatory and consultative. It incorporates regional views and builds consensus on priority issues and actions through dialogue among policy makers and scientists at regional and global levels. It also aims to strengthen environmental assessment capacity in the regions through training and 'learning-by-doing'.
➢ GEO outputs, in printed and electronic formats, including the GEO report series. This series presents periodic reviews of the state of the world's environment, and provides guidance for decision-making processes such as the formulation of environmental policies, action planning and resource allocation. Other outputs include regional, sub-regional and national environmental assessments, technical and other background reports, a website, products for young people (GEO for Youth) and a core database ~ the GEO Data Portal.

The GEO Data Portal provides report producers with easy access - via the Internet - to a common and consistent set 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 ever since the start of the GEO project ~ the need for reliable, harmonized data for global and regional level environmental assessment and reporting. As of August 2002, the Portal gives access to some 400 statistical and geographical data sets at national, sub-regional, regional and global levels. State-of-the-art functionality for on-line data visualization and exploration are available for creating graphs, tables and maps.

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The GEO process

The coordinated global network of collaborating centres (CCs) is at the core of the GEO process. These centres have played an increasingly active role in preparing GEO reports. Regional centres are now responsible for nearly all the regional inputs, combining top-down integrated assessment with bottom-up environmental reporting. Other institutions provide specialized expertise on cross-cutting or thematic issues. Working groups provide advice and support to the GEO process, particularly on integrated assessment methodologies and process planning. Other United Nations agencies contribute to the GEO process, mainly by providing substantive data and information on the many environmental and related issues that fall under their individual mandates, and also participate in the review process.

GEO report series

The GEO reports are produced using a regional and participatory approach. Input is solicited from a wide range of sources throughout the world, including the Collaborating Centres (CC) network, United Nations organizations and independent experts. Working together with the GEO Coordinating Team in Nairobi and the regions, the CCs research, write and review major parts of the report. During the preparation of the report, UNEP organizes consultations inviting policy-makers and other stakeholders to review and comment on draft materials. Drafts also undergo extensive peer review. This iterative process is designed to ensure that the contents are scientifically accurate and policy-relevant to users in different parts of the world, and with different environmental information needs.

GEO Data Portal: a sound basis for assessment and reporting

As we have seen, the GEO reporting process is based on sound empirical analysis and the contributions of a global network of partners. It thus requires having readily at hand (that is, via the Internet and off-line) a wide range of statistical and geo-spatial data sets that meet as much as possible the following requirements:
- world-wide coverage, but with data at the regional and national levels;
- harmonised data values, collection units and definitions;
- time series data (data are currently available for every year since 1970 to coincide with the GEO "retrospective" period);
- free and easy access for GEO contributors and broader user community; and
- aggregated statistics for the sub-regional, regional and global levels.

The contents of the GEO Data Portal are therefore guided by these requirements, as well as the background information needs of the GEO process, which are related to:
(i)   societal driving forces (economic development, population);
(ii)   environmental pressures (emissions, pollution);
(iii)   state-of-the-environment (air, land and water); and
(iv)   impacts on natural ecosystems and human health (biodiversity loss, diseases, life expectancy etc.).

Thus, 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.

The GEO Data Portal was initiated to fulfill these purposes in September 2000, with the help of a great number of primary data collecting agencies and other partner organisations. With more than 400 data sets altogether, it has become the standard data reference and access tool for the GEO assessment process, both for UNEP and its reporting partners. All data sets can be displayed, queried and explored on-line through maps, graphs and tables, as well as downloaded for further use if desired, with a few exceptions due to copyright restrictions. As the GEO reporting process is organised along regional lines (mainly continents) and sub-regions, national data sets have been aggregated to those levels. The source data have been obtained from a large number of reliable international sources responsible for given areas or themes, including UN and affiliated inter-governmental organisations.

The Portal has evolved from a map-centered application to a more broadly-based analysis system, with a comprehensive set of functions. Aside from making core data sets available to the GEO user community as the main service, the intention has been to add functionality to strengthen the analytical capacity of the network of GEO CCs and other key partners. The user is offered a wide variety of tools to explore the data though on-line visualisation and querying. The application's technical base now consists of a combination of HTML/JavaScript and PHP, in conjunction with a MySQL database, which holds all the necessary data tables. The documentation and meta-data are stored in an MS-Access database and also made available through MySQL, although there are plans to change this to a 'live' XML link in the near future.

A powerful search tool to query the database and select among the hundreds of variables has been integrated, whereby the user can choose between a simple search interface and a more complex one (see Fig. 1). As the GEO Data Portal aims to meet first the needs of UNEP's GEO 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.

From there the user can access different modules (see Fig. 2):
1. The mapping module ("Draw Map") uses ESRI's MapObjectsIMS product suite. The maps (see Fig. 3) are created dynamically, offering some basic GIS functionality such as *zoom*, *pan* and *identify* (displaying then the name of the country/region with its value). Additional capabilities are the display of graphs and histograms; switching between different selected years; and the display of additional layers.
2. The graphics module ("Draw Graph") 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 (see Fig. 4). 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.
3. The 'raw-data' module ("Show Values") consists of a purely HTML/JavaScript/PHP-coded page and displays the raw data for the selected options (time period, region, variable; see Fig. 5). 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.
4. The download module ("Download Data") 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 formats (plain text, Adobe pdf, Excel, xml, ArcInfo, Ascii, Bil, Tif).

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.

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.

The way forward

The GEO Data Portal was initiated to serve the long-term GEO process with access to a reliable and consistent set of data on the state of the global and regional environment, including information on causes of degradation, impacts on humans and ecosystems and possibly on future perspectives and trends. The Data Portal was used to a limited extent in preparing the third edition of the GEO report, and it is envisioned that future GEO reports will make even fuller use of the Portal. As the contents and functionality of the Data Portal are in many ways generic and comprehensive, it is expected that other assessment programmes inside and outside the UNEP and the UN system will also make use of it, a fact that has already been demonstrated through reactions and queries.

Until now, the Data Portal has focused on readily available data for the retrospective period covered by GEO-3; that is, the last thirty years. Data on environmental impacts are being included insomuch as these exist; they are, however, still very limited. There are several data sets covering issues such as biodiversity, forest loss and human health, but these are not very comprehensive given that solid observation and reporting mechanisms for these topics are not yet in place. Neither are good data available on environment-related national and international policies and their impacts and effectiveness. Tangible information on future scenarios could not yet be included due to the late phase in which the GEO scenarios were developed, and their relatively empirical nature. Some information on other scenarios is included, however, such as the UN World Population projections.

However, following the lines of the overall GEO assessment methodology and process, it is the intention not only to keep the existing data up-to-date and complete, but also to complement these with data on impacts, responses and scenarios when they become available. At the same time, there is a need to work more closely together with the user community and build capacity to optimize the use of such data for assessment and reporting purposes.

The GEO Data Portal can be accessed at <u>http://geodata.grid.unep.ch</u>.

Biographies of the Authors

<u>Ron Witt</u> serves as UNEP/DEWA's Regional Coordinator for Europe in Geneva, Switzerland, having worked for UNEP and its Global Resource Information Database (GRID) network since 1986. His first assignment was as database administrator and project manager for UNEP and GRID in Nairobi, Kenya. Prior to joining UNEP, he worked for the U.S. NASA at the Goddard Space Flight Center as a researcher in remote sensing systems and technology transfer specialist. He holds a master's degree in geography from the University of Utah.

<u>Jaap van Woerden</u> has recently joined UNEP's DEWA~Europe/GRID-Geneva office as coordinator for the data activities related to the Global Environmental Outlook and UN System-wide Earthwatch mechanism, and as such he also serves as deputy to UNEP/DEWA's Regional Coordinator for Europe. Prior to joining UNEP, he worked as International Data Coordinator for the Netherlands' National Institute for Public Health and the Environment (RIVM) and for

UNEP/GRID in Nairobi and Geneva. He holds a master's degree in geography from the University of Utrecht (NL).

Stefan Schwarzer holds a Diploma in Applied Physical Geography form the University of Trier in Germany, and has been chiefly responsible for design and development of the GEO Data Portal. Major areas of his work also include statistics, GIS, website design and programming.
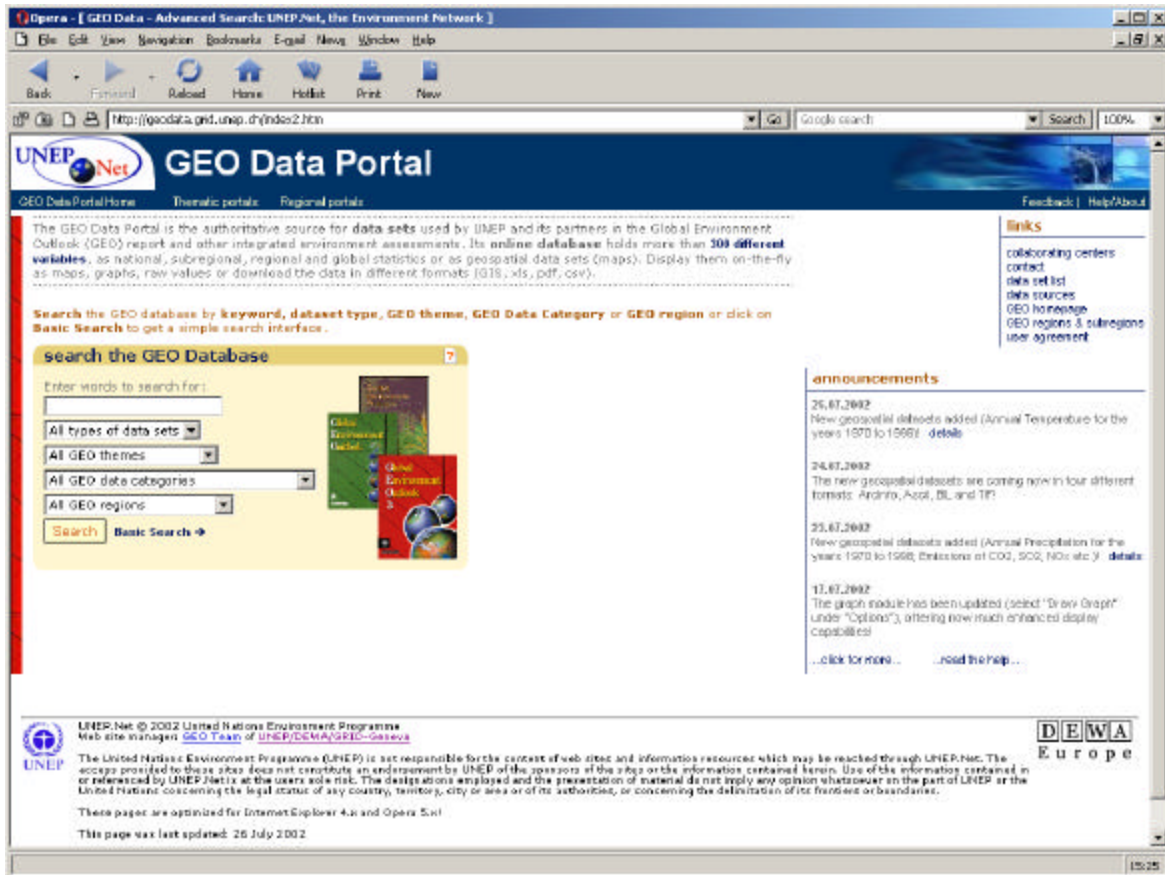

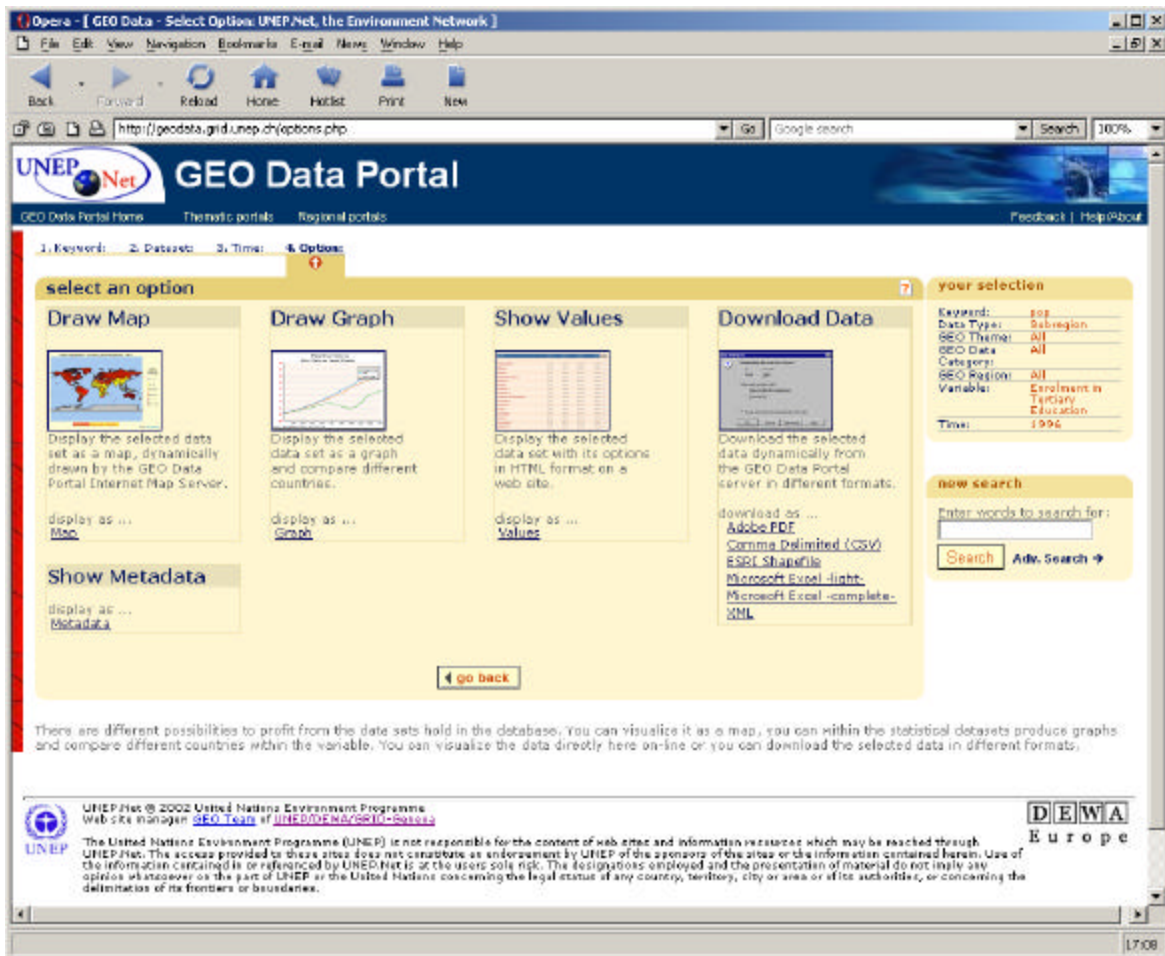**Fig. 1: The GEO Data Portal offers a simple keyword search, as well as more advanced search mechanisms for experienced users.**

Fig. 2: After selecting variable and a time period, the user has different options for display, analysis and download.
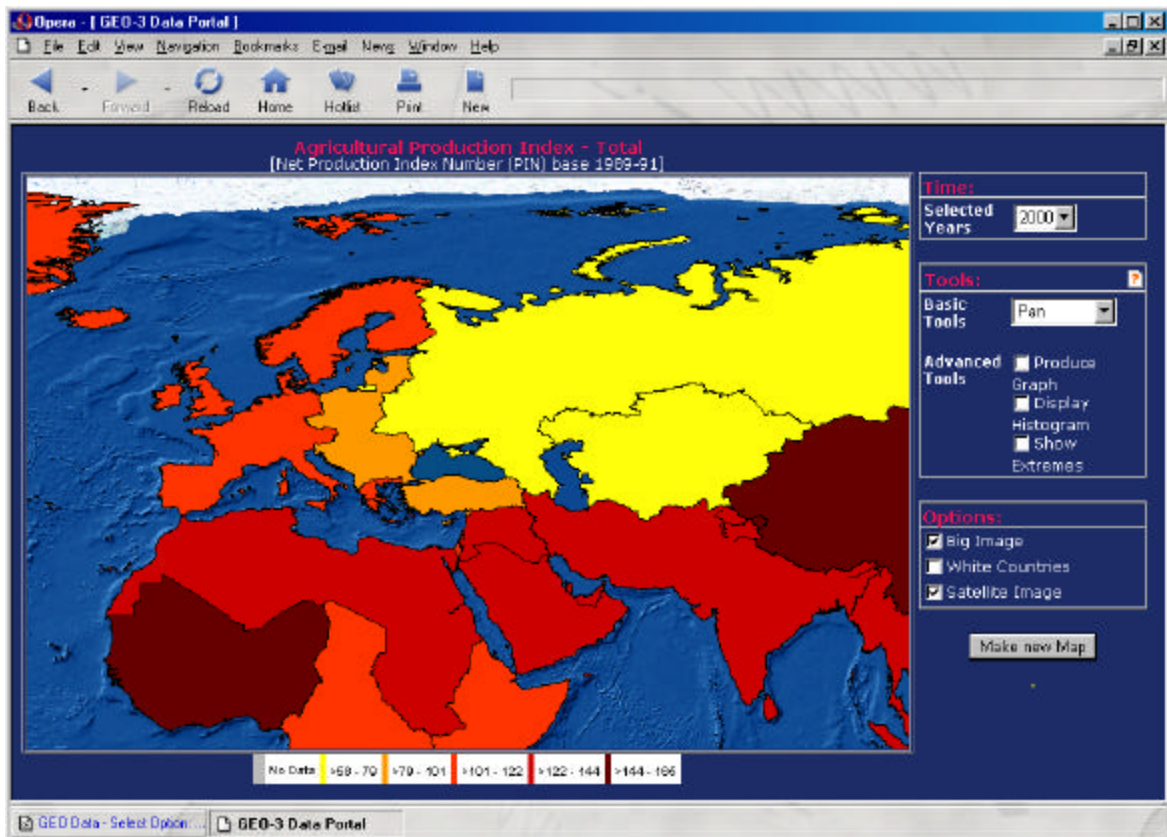
Fig. 3: The mapping module displays the selected data set "on-the-fly" and offers some additional navigation and analysis capabilities.
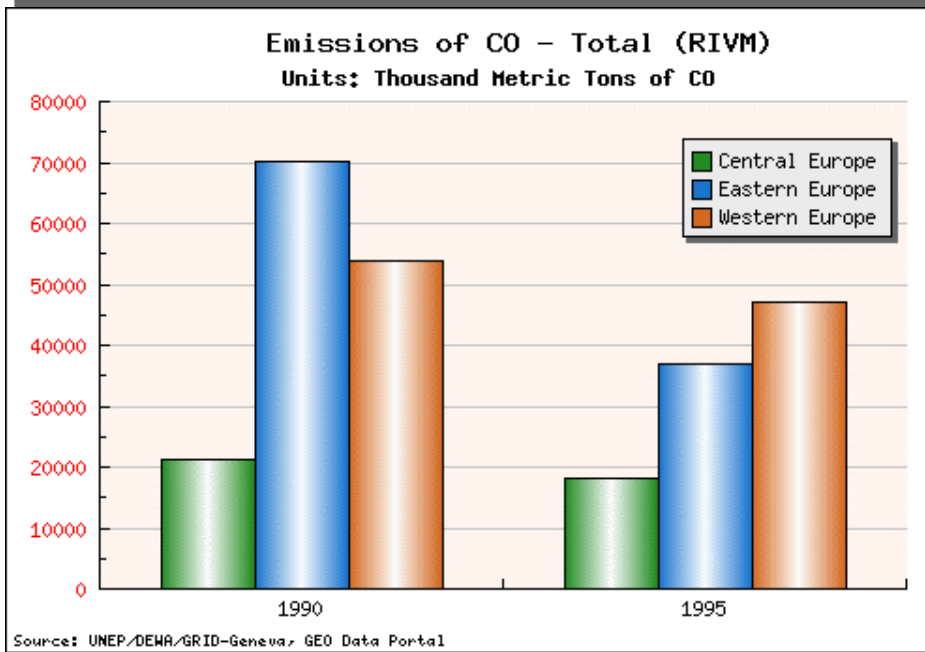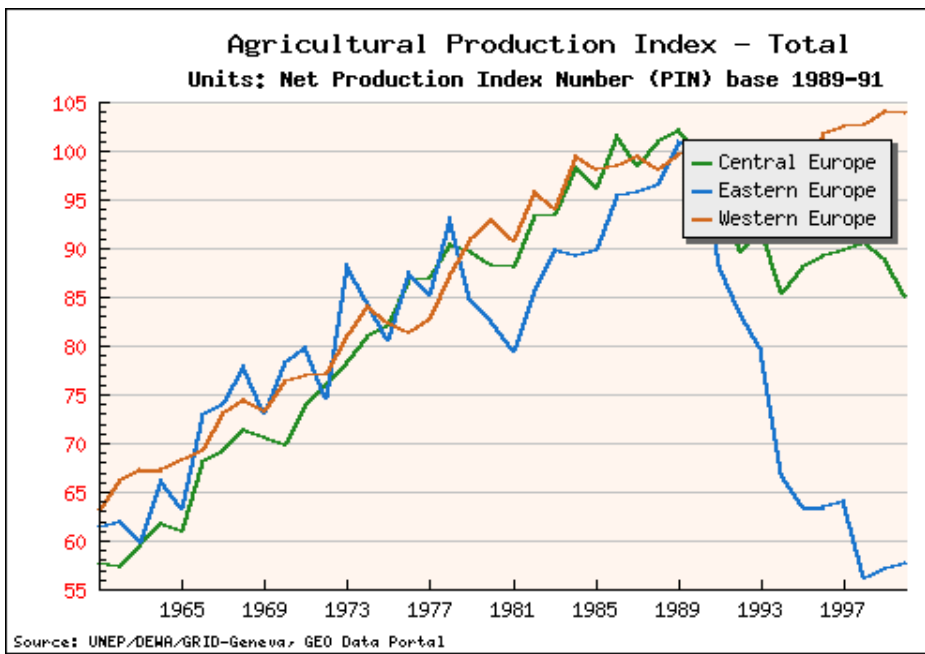
Fig. 4: Different possibilities to display graphs enable the user to visualize and analyze trends and differences between countries or regions.

Urban Population - Percent of Total Population [Units: Percent]					
Subregions	1970	1980	1990	2000	Graph
Australia + New Zealand	84.4	85.4	85	84.9	☑
Arctic	73.4	76	79.4	82	☑
South America	59.9	68	74.5	79.8	☑
Western Europe	73.3	75.9	77.5	79.5	☑
North America	73.8	73.9	75.3	77.2	☑
Eastern Europe	58.6	65.8	70.4	73.4	☑
Mashriq	53.6	61.3	66.5	71.4	☑
Meso America	53.8	60.1	65.3	67.3	☑
Central Europe	45	52.4	59.8	66.3	☑
Caribbean	47.4	54.1	59.2	63	☑
Arabian Peninsula	33.3	48.8	60.1	62.4	☑
Northern Africa	36.3	40.3	45.2	50.5	☑
Central Asia	42.9	45.2	44.9	41.8	☑
Western Africa	19.6	25.7	32.4	39.9	☑
Southern Africa	23.3	27.8	32.2	39.1	☑

Fig. 5: The "Show Values" module enables the user to see the raw data and access different sorting and display capabilities.