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Compilation and Editing

Lorant Czaran
Nickolai Denisov
Claudia Heberlein
Otto Simonett

Graphical Production

Petter Sevaldsen

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GIS Application Case-Studies

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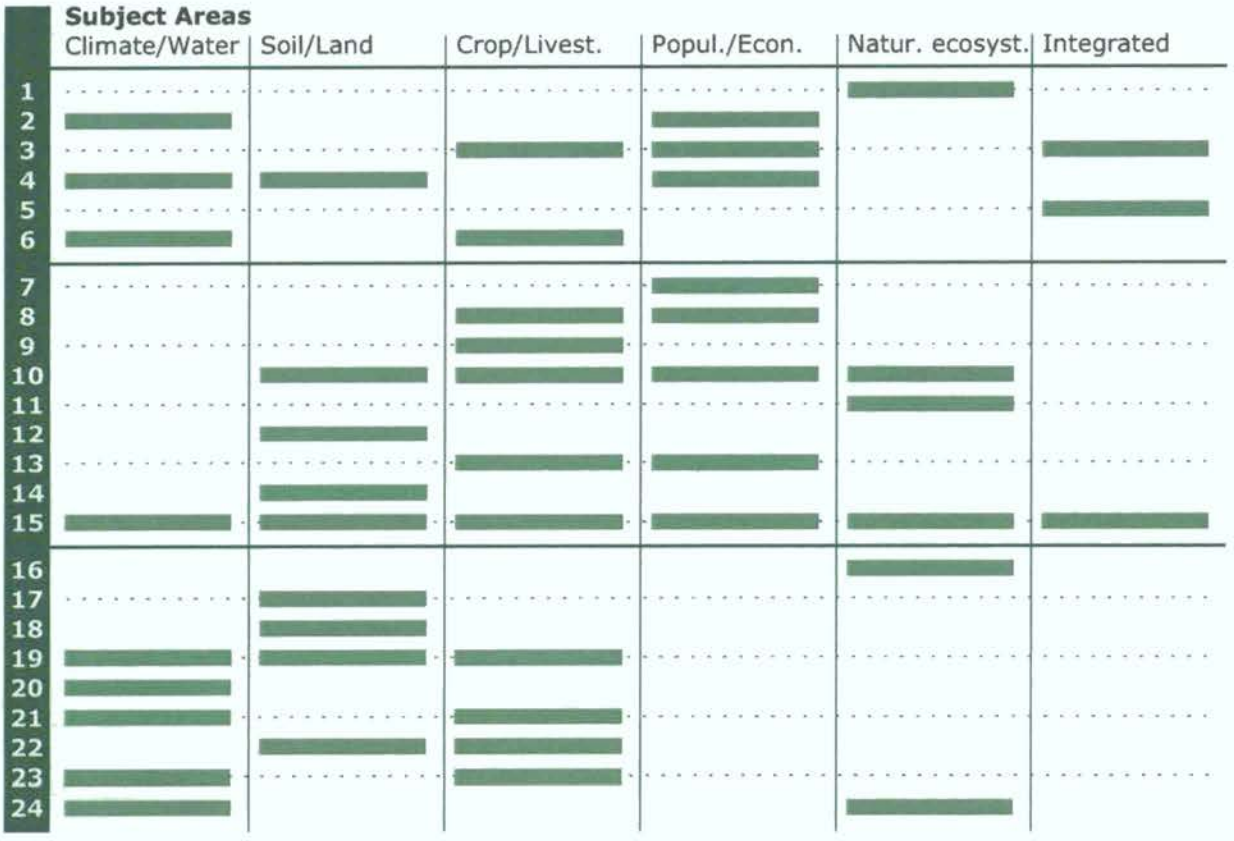
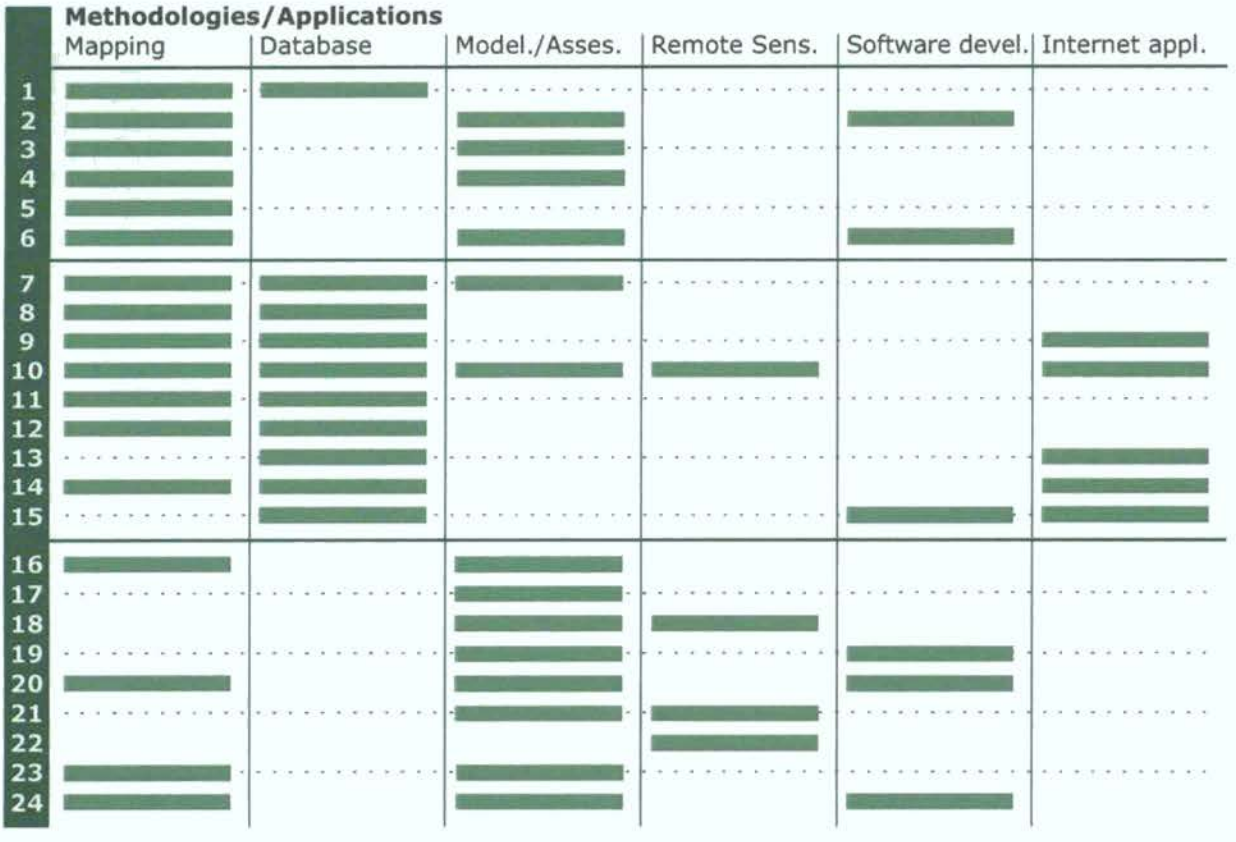
Classification of the Case-Studies





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A Systems Analysis of the World's Forests

Objective

Distribution of information on world forest systems and people-forest relationships, specifically

- extent and location of *different forest types*,
- types that are protected, the effectiveness of that protection,
- relationship between people and forest distribution, the changes in forest cover over time,
- current management practices and their degree of success.

Targeted users are institutions with national, regional and global mandates: Governments, national and international non-governmental organisations (NGOs), donor organisations, development planners and research institutes.

Method

Collection and integration of data and information from existing sources at the two collaborating institutions, in particular:

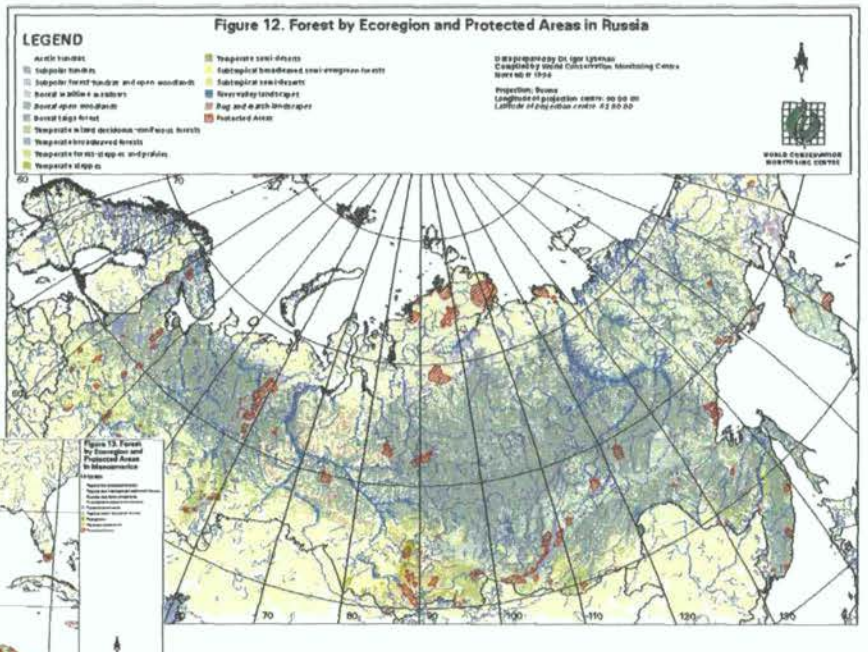
- WCMC *Biodiversity Map* Library (BML),
- analysis of the amount of tropical forest under protection worldwide based on the ecofloristic zones adopted by FAO carried out by WCMC,
- CIFOR studies on the relationship between forests and people in a number of tropical countries.

The forest coverages have been expanded to include all temperate and boreal areas of the globe, so that the coverage is now global.

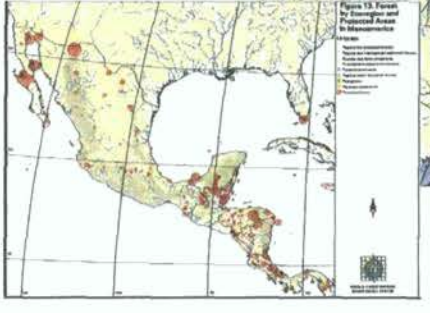
New datasets for forests from national sources have been incorporated into the forest coverages, ensuring that they are as accurate as possible.

Result

Outputs from the project include accurate maps of forests for the world and protected areas information, and periodic reports highlighting the most important features. The forest information is available on the Internet. The GIS forest and protected areas coverages for the tropics have been published on CD-ROM and disseminated widely.



RUSSIA and MESOAMERICA: *Forests by ecoregions and protected areas*



UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Susan Iremonger, World Conservation Monitoring Centre,
219 Huntingdon Road, Cambridge CB3 0DL, United Kingdom
Tel: + 44 1223 277314 Fax: + 44 1223 277136
E-mail: susan.iremonger@wcmc.org.uk http://www.wcmc.org.uk/

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Anamorphic Maps

Objective

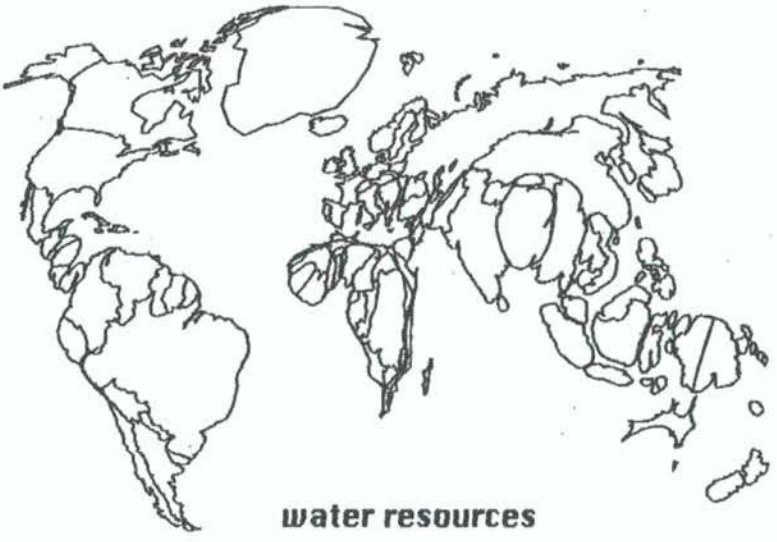
Display of key environment and development indicators in an unusual, however easily readable format.

Method

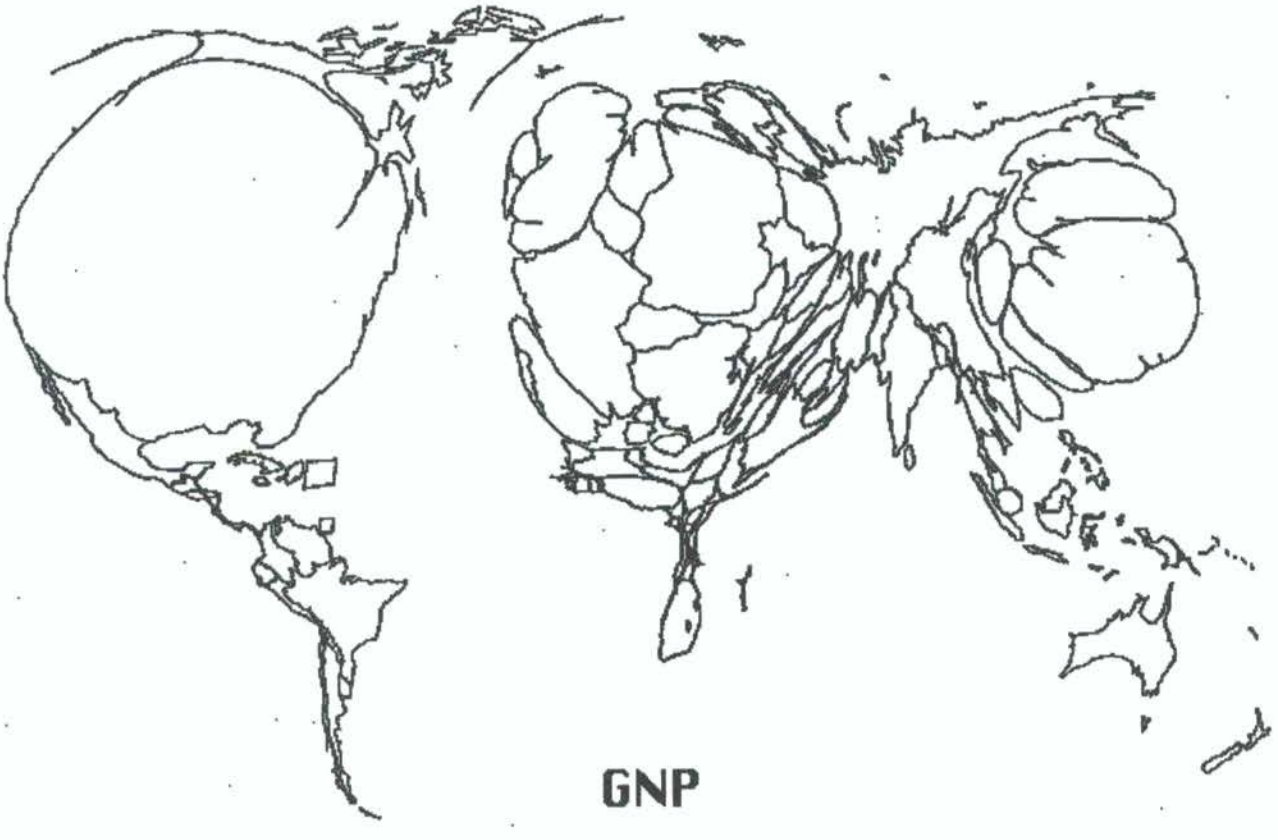
Using a computer program, countries are being distorted according to one index.

Result

Anamorphic maps of the world.



water resources



GNP

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GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Vladimir S. Tikunov, Moscow State University
Moscow 119899 RUSSIA
Phone: + 7 095 939 28 12 Fax: + 7 095 932 88 36
E-mail: tikunov@vst.geogr.msu.su

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Environmental and Sustainability Indicators for Latin America and the Caribbean

Objective

Ensure better access to information on sustainable development by devising relevant indicators for simplifying, quantifying and analysing technical information and communicating it to various groups of users. GIS is a tool for integrating economic, social and environmental indicators in a spatial framework which allows for more powerful analyses than conventional non-spatial methods. This way the cause-effect relationships alluded to in indicator models and frameworks, such as the Pressure-State-Impact-Response model, may be identified and analysed more accurately and realistically.

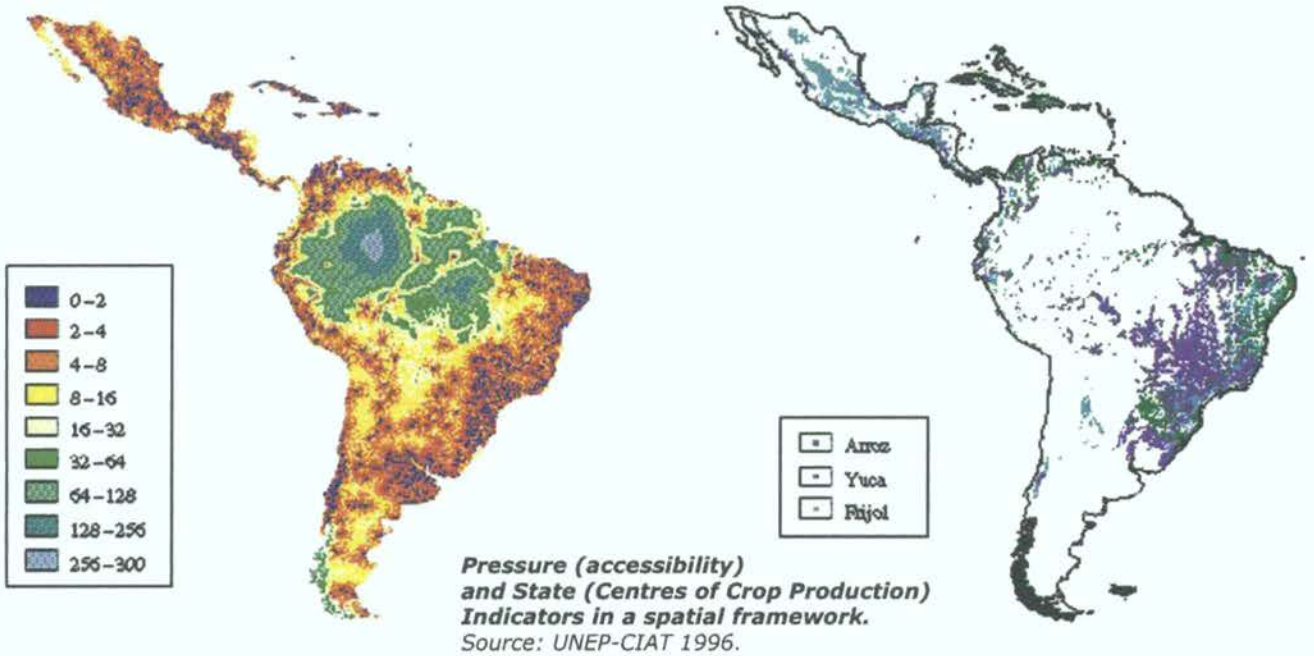
Method

Besides spatial analysis, GIS provide a mean for organising large datasets: the UNEP-CIAT Indicators Project has over 100 indicators stored in its GIS database.

Comprehensive data search and data validation is required to ensure reliable and up-to-date sources. The datasets not yet available in spatial format have to be related to spatial datasets or have a spatial element introduced so that they can be visualised in the GIS. The software has to be customised to enable users with little or no computer experience to get the most from the indicator datasets. Finally, land use models have to be incorporated to allow users to develop 'What if?'-scenarios. This extends the applicability of the product from a visualisation tool to a spatial decision support system.

Result

CD-Rom containing the indicator database and the GIS software to visualise and analyse the indicators.



Pressure (accessibility) and State (Centres of Crop Production) Indicators in a spatial framework.
Source: UNEP-CIAT 1996.

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GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Manuel Winograd (m.winograd@cgnet.com), Andrew Farrow (afarrow@sig.ciat.cgiar.org)
Centro Internacional de Agricultura Tropical (CIAT), A.A. 6713, Cali, Colombia
Phone: + 57 2 445 0000 Fax: + 57 2 445 0073
http://www.ciat.cgiar.org/land/indicators/project.html

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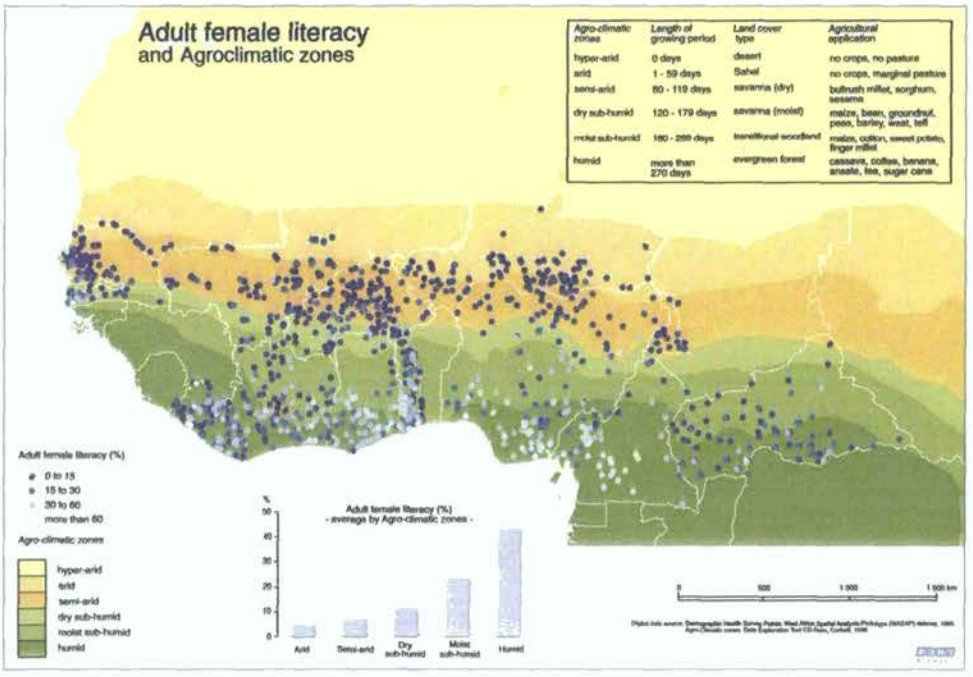
Mapping Poverty in West Africa

Objective

Examine the relationship between the location of rural poor population and land use potential in West Africa based on 'best available' data.



Method

Poverty (in terms of 'human development') was represented with indicator variables used to produce UNDP's Human Development Index (HDI). Actual data came from the Heath and Demographic Survey (HDS). Because none of the HDI indicators were explicitly captured in this survey, surrogate variables collected at 1113 sample rural locations in West Africa were used from the DHS dataset to refer to poverty levels. To detect possible influences of spatial factors on the degree of human development, the data was combined with 4 different approximations of 'marginal land'. Those can be grouped in two categories:

- Biophysical: Agroclimatic Zones and Land Degradation,
- Socio-economic: Population Density and Accessibility.

The first three variables were analysed for all West-African countries, whereas the accessibility data was only available for Burkina Faso and Mali. The accessibility data were partly developed under the project. The GIS and statistical processing included point/polygon overlay analysis using ARC/INFO and Arc/View software. For each HDI sample point, a geographically referenced value was extracted from the thematic layers. Average and standard errors were then calculated for surrogate by thematic variables using MS-Excel spreadsheet.

Result

A set of maps for each indicator of human development (representing an approximation of poverty) and for each thematic background variable, as well as graphs displaying the indicators in correlation with the background data.

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GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Claudia Heberlein, Manon Desforges
UNEP/GRID-Arendal, Longum Park, P.O. Box 1602, Myrene, N-4801, Arendal, NORWAY
Phone: + 47 370 35 650 Fax: + 47 370 35050
E-mail: grid@grida.no

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Natural Agricultural Potential of European Landscapes

Objective

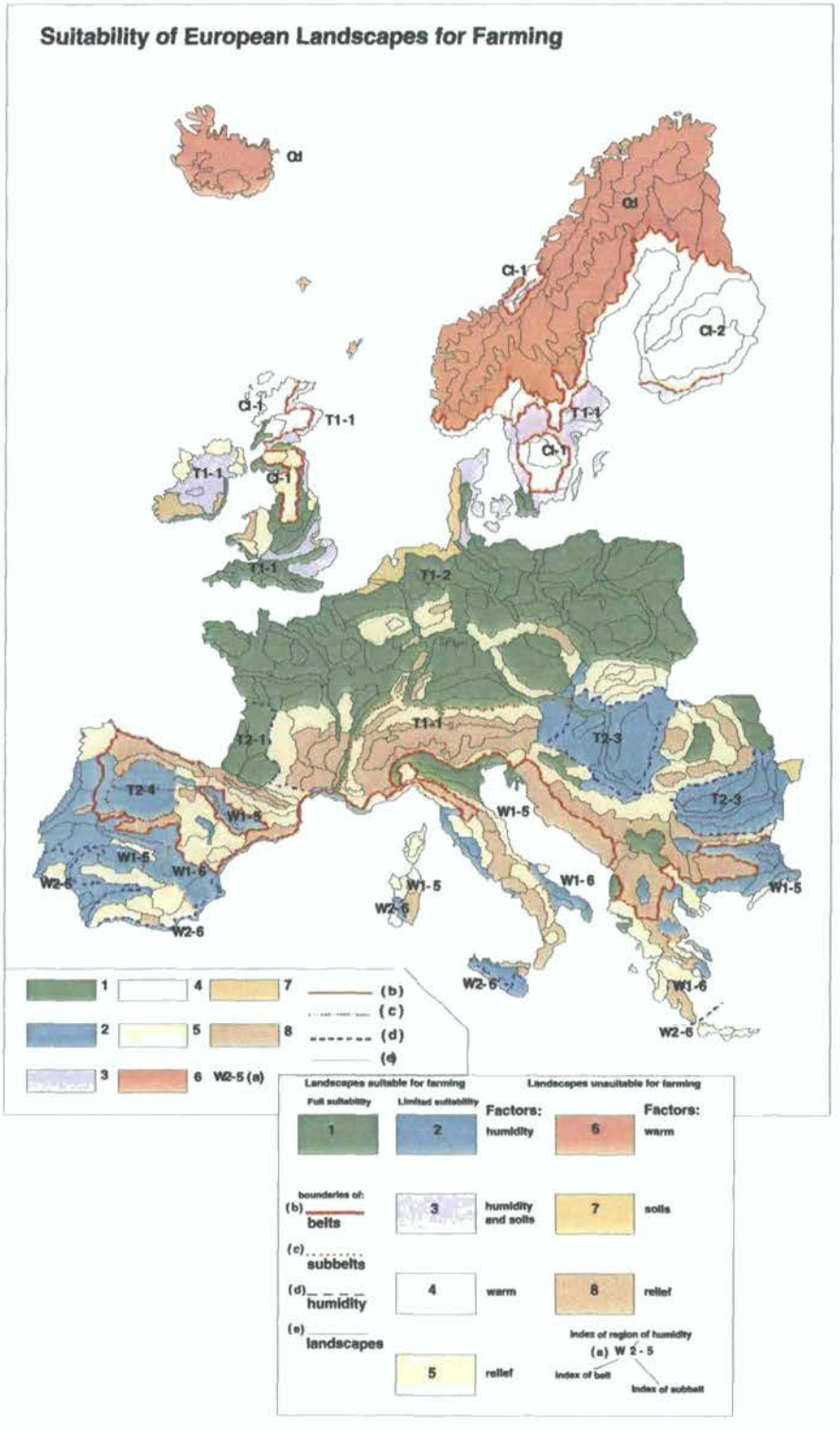
Regionalisation of Europe according to natural agricultural potential of ecological units (landscapes) and evaluation of their suitability for farming.

Methods

On the basis of the original map "Landscapes of Europe" (1:5 M) each of the 500 types of landscapes identified in Europe was characterised by a number of parameters stored in a database. The database contains information on climatic conditions, soil and land resources for agriculture. Data were processed using Russian GIS software, the outputs are also compatible with more common standards (e.g. Arc/Info). The analyses of data allow for the identification and presentation of landscapes with various suitability for farming.

Result

Digital map "Suitability of European Landscapes for Farming" (1:5 M). The potential users are research and academic institutions and schools, as well as decision-makers.



UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Emma P. Romanova, Department of World Physical Geography and Geoecology
Faculty of Geography, Moscow State University
Tel: + 7 095 939-3842 Fax: + 7 095 932-8836
E-mail: balex@global.geogr.msu.su

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Spatial Characterization Tool

Objective

The Spatial Characterization Tool (SCT) is a GIS application which accesses gridded environmental data, point data, and vector based information (polygons).
It provides a suite of query capabilities aimed toward the characterization of agricultural and agroecological environments. This information might, for example, aid in the identification of the target domain for each experimental site or contribute to the sample stratification of an area. Initially focused on the first order determinant, climate, data in the SCT also include population density, soil available water capacity, and topographic characteristics.

Method

The production of the SCT requires programming, database compilation and documentation using ARC/INFO.

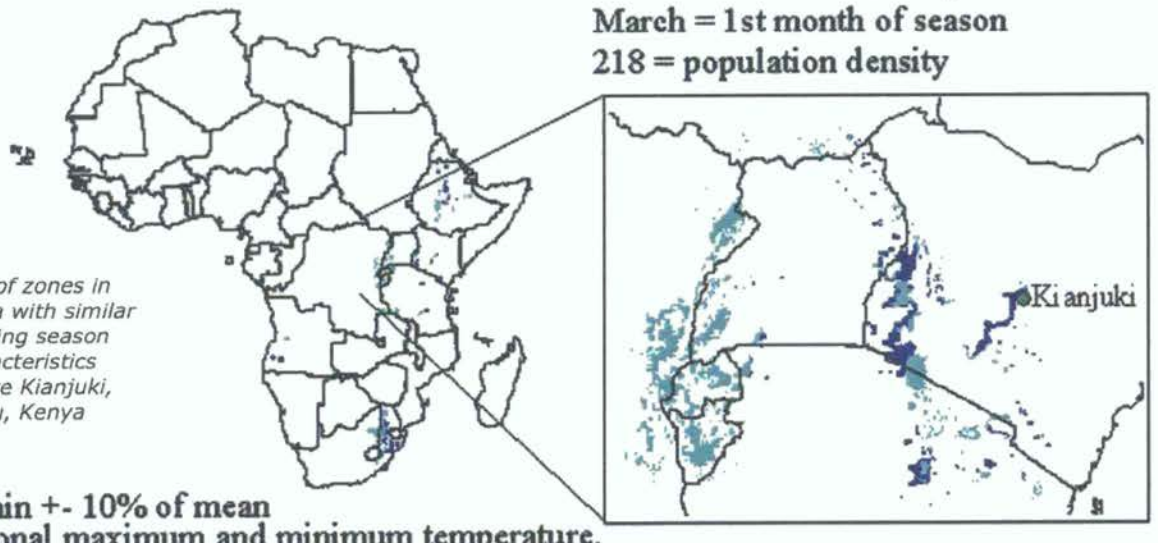
Result

The tool enables the rapid construction of simple "empirical" models of conditions at a site or for a zone, or across a transect.

Kianjuki, Embu, Kenya

-0.33S, 37.6E, 1524 masl

Five month maximized P/PE season:
707 mm total precipitation
692 mm total potential evapotranspiration
25.3 mean maximum temperature
13.1 mean minimum temperature
March = 1st month of season
218 = population density



Map of zones in Africa with similar growing season characteristics as site Kianjuki, Embu, Kenya

Within +- 10% of mean seasonal maximum and minimum temperature.

Within +- 20% of seasonal Precipitation and Potential Evapotranspiration Totals (108,000 km^2, 10.3 million people)

Within +- 30% of seasonal Precipitation and Potential Evapotranspiration Totals (285,000 km^2, 32 million people)

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GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

John D. Corbett, Integrated Information Management Laboratory,
Texas A&M University System, Temple, Texas TX 76502, USA
Phone: + 1 817 770 6600 Fax: 1 817 770 6561
E-mail: corbett@Brcsun0.tamu.edu

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Thematic Mapping and Assessment

Database Development and Dissemination

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Asian Population Database

Objective

Improve global, spatially referenced demographic data holdings. Such databases are useful for a variety of applications including strategic-level agricultural research and applications in the analysis of the human dimensions of global change.

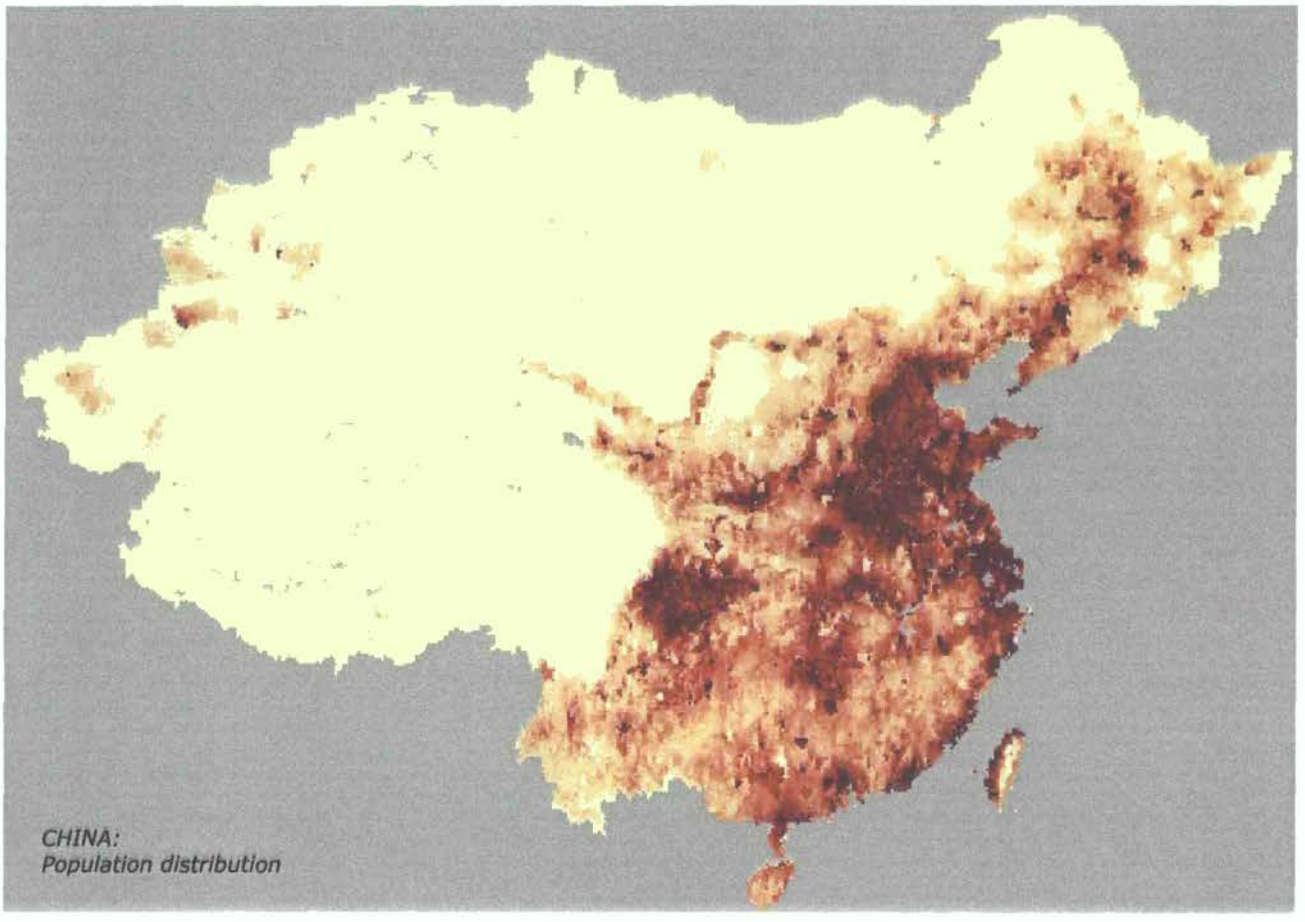
Method

This project has pooled available data sets, many of which had been assembled for the global demography project. All data were checked, international boundaries and coastlines were replaced with a standard template, the attribute database was redesigned, and new, more reliable population estimates for subnational units were produced for all countries.

The project was carried out as a cooperative activity between NCGIA and UNEP (GRID-Geneva and GRID-Arendal) under the UNEP-CGIAR project on GIS in Agricultural Research.

Result

Improved datasets and population distribution maps.



CHINA:
Population distribution

UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Uwe Deichmann, National Centre for Geographic Information and Analysis
University of California, Santa Barbara, CA 93106
E-mail: uwe@ncgia.ucsb.edu
http://www.grida.no/prog/global/cgiar/htmls/data.htm

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Circumpolar Population and Agriculture Database

Objective

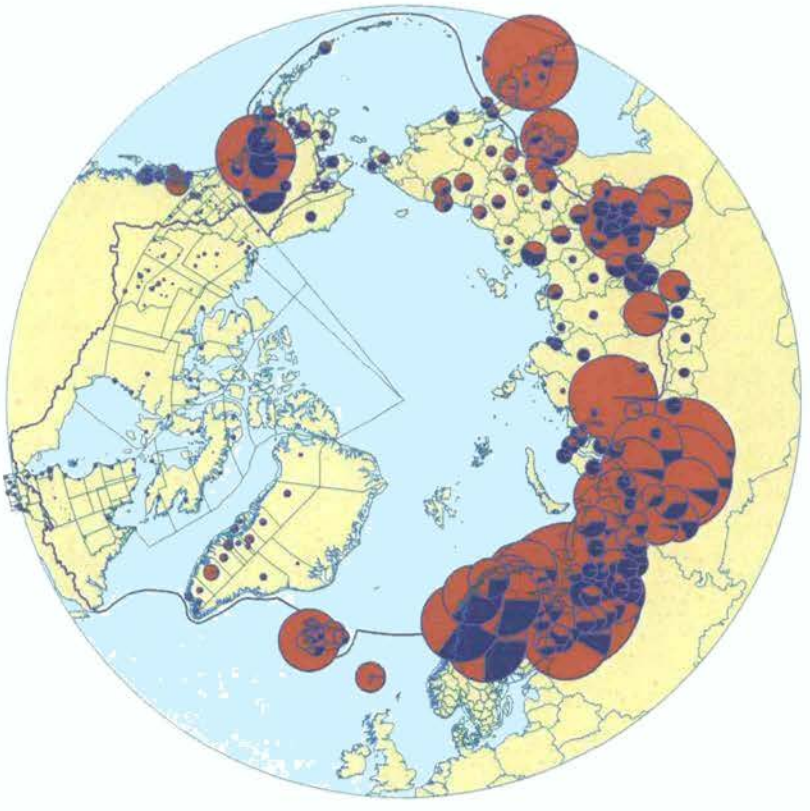
In support of the preparation of the report of the Arctic Monitoring and Assessment Programme (AMAP) on the state of the Arctic Environment, UNEP/GRID-Arendal is compiling a circumpolar database of human population and the output of selected products of agriculture and harvesting. The objective of the data collection was to provide support to modelling the flux of radioactivity from the environment to humans through food consumption. The data base is however also useful as a stand-alone source of population and agricultural statistics for the Arctic region. The work was done in co-operation with the Institute of Terrestrial Ecology (UK), the Norwegian Mapping Authority, the Norwegian Radiation Protection Authority and the AMAP Secretariat.

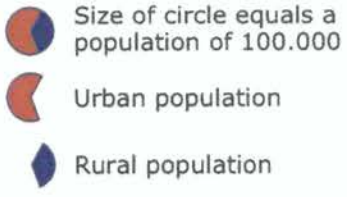
Method

The database covers the northern parts of the Arctic countries and, wherever possible, are represented by the 1st-/2nd-level sub-national units. The sources of data have been national and regional statistical offices and survey bureau, agriculture, forestry, wildlife and environment management authorities, research institutions, and such international sources as FAO and UNEP itself. The collected data covered such themes as total, urban/rural, indigenous/non-indigenous population, and the output (or other measures) of livestock, meat, milk, potato, berries, mushrooms, fish, reindeer. Estimation techniques were used to fill gaps in some of the data sets, e.g. regarding urban/rural population split and the calculation of agricultural output from crop area and livestock counts.

Result

The database exists as a collection of spatial and statistical data sources, including circumpolar coverages of selected themes.





UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

David Henry, Nickolai Denisov
UNEP/GRID-Arendal, Longum Park, P.O. Box 1602, Myrene, Arendal, N-4801, NORWAY
Tel: + 47 370 35650 Fax: + 47 370 35050
E-mail: grid@grida.no http://www.grida.no/prog/polar/index.htm

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Electronic Atlas of Rice Areas by Type of Culture: South, Southeast and East Asia

Objective

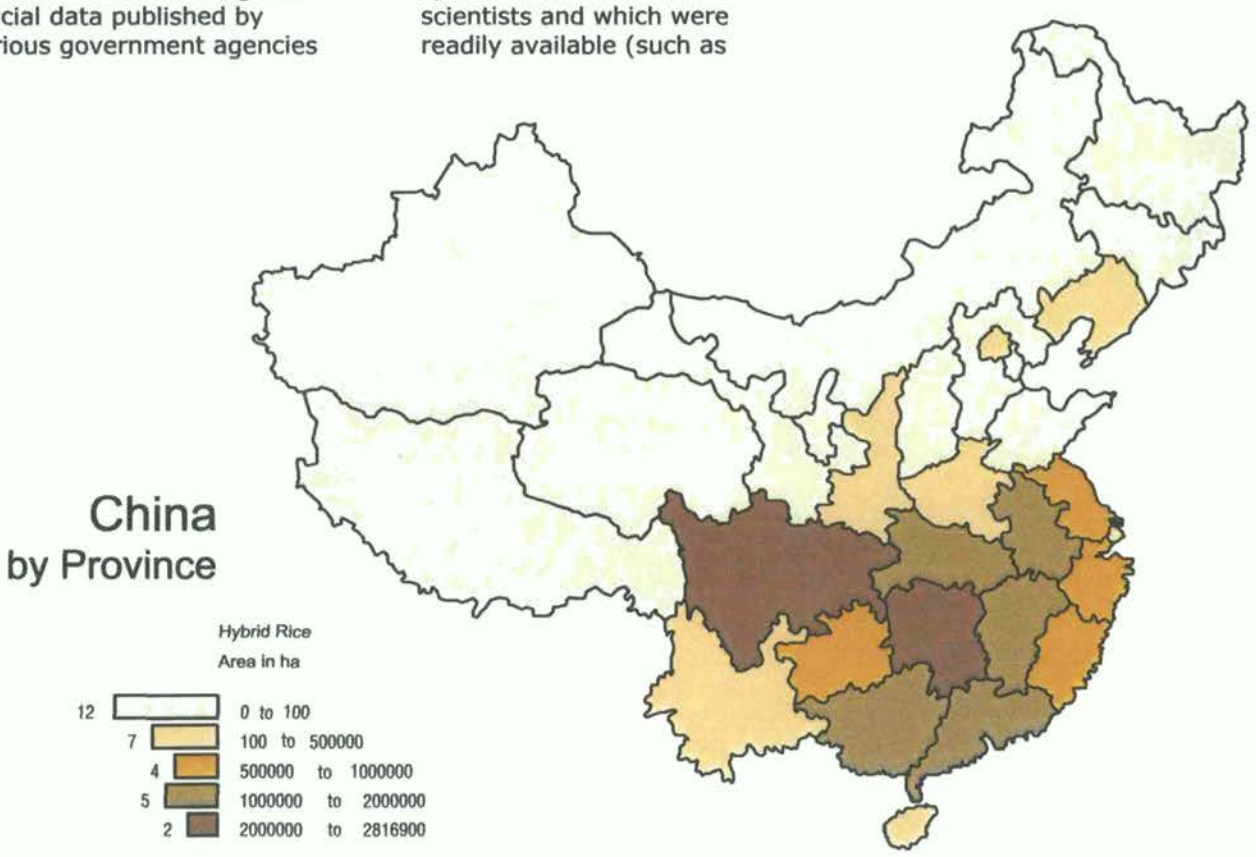
- To make available a geographically-referenced data set on rice areas reported by type of culture at sub-national level that can be accessed and used by rice researchers as reference information.
- To link the data to GIS maps so that they can be accessed, viewed and analyzed electronically.

Method

A revised and updated data base was developed largely on the basis of a wide range of official data published by various government agencies and from consultation with NARS-IRRI field research teams. The breakdown of rice area by type of culture is often not explicitly reported, so accessory information such as topography maps, reports on extent of irrigation and local knowledge were employed to provide the best estimates.

Result

The basic data (in tabular form) which serve as the attribute data for the GIS maps.
Other data thought to be of special interest to IRRI scientists and which were readily available (such as demographic and rice production data) have been included as well as base maps for all countries and a series of bar graphs that depict changes in rice areas by type of culture for 16 countries. The report is offered electronically and in conjunction with the ArcView GIS package. In the near future, the data sets will be available for IRRI outreach staff and interested users outside of IRRI through the Internet home page.



UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

For the published report: Mr. R.D. Huggan, Head Communication and Publication Services
For the GIS data base: Dr. Kam Suan Pheng, GIS Specialist GIS/IP Lab., irrigis@cgnet.com
International Rice Research Institute (IRRI), P.O. Box 933, 1099 Manila, Philippines
Phone: + 632 845-0563, 845-0569, 845-0570 Fax: + 632 891-1292, 817-8470

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On-line Baltic Sea Drainage Basin GIS

Objective

The on-line Baltic Sea drainage basin GIS, map and statistical database is an outcome of the Baltic Drainage Basin Project (BDBP). The database is provided to the general public to improve the general knowledge about the Baltic Sea region and to stimulate research and the use of geo-referenced data for improved description, assessment, analysis and management of environmental issues.

Method

The following GIS layers are included into the data-base:

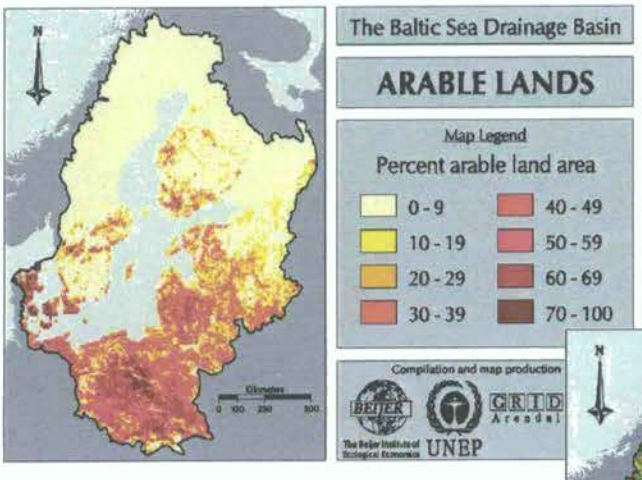
- Land and ocean (coastline),
- Sub-watershed drainage basins,
- Administrative units,
- Population density,
- Arable lands and pasture lands,
- Land cover,
- Wetland distribution.

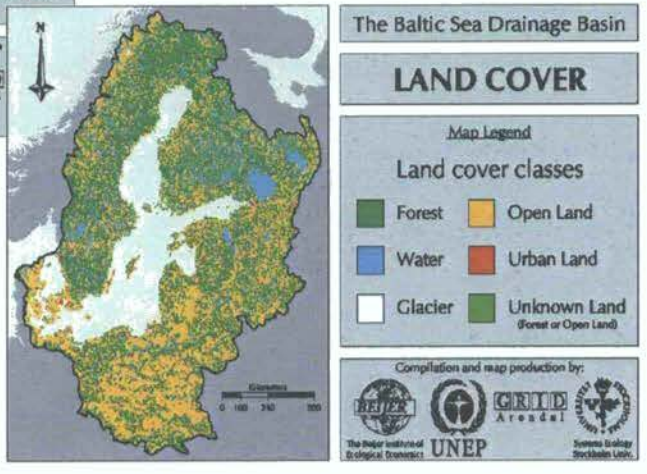
The physical and political/ administrative boundary and land cover layers were created using existing ana-logue and digital spatial data sources, such as the DCW, the ESA's Remote Sensing Forest Map of Europe, the EUROSTAT GISCO map of EC NUTS regions, and regional (Baltic, Scandinavian) and national sources. The population density, arable and pasture land, and wetland layers were derived using a combination of spatial and statistical data sources, by spreading statistical data according to the spatial distribution of other related features. The spatial resolution of the layers varies between 1 km^2 and 2500 km^2.

Data pre-processing (extracting, digitising, projecting, editing, coding, creating topology) was mainly done using ARC/INFO v.3.4D Plus. The layers were then rasterised and imported into IDRISI v.4.1 for final work.

Result

The database layers are available on-line in a GIS format (Arc/Info and IDRISI) together with the corresponding maps, statistical data, and documentation.





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UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Sindre Langaas, UNEP/GRID-Arendal, c/o Department of Systems Ecology
Stockholm University, S-106 91 Stockholm, Sweden
Tel: + 46 8 16 17 37 Fax: + 46 8 15 84 17
E-mail: sindre.langaas@grida.no http://www.grida.no/prog/norbal/baltic/welcome.htm

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ReefBase: Toward Informed Management of Coral Reefs and Their Resources

Objective

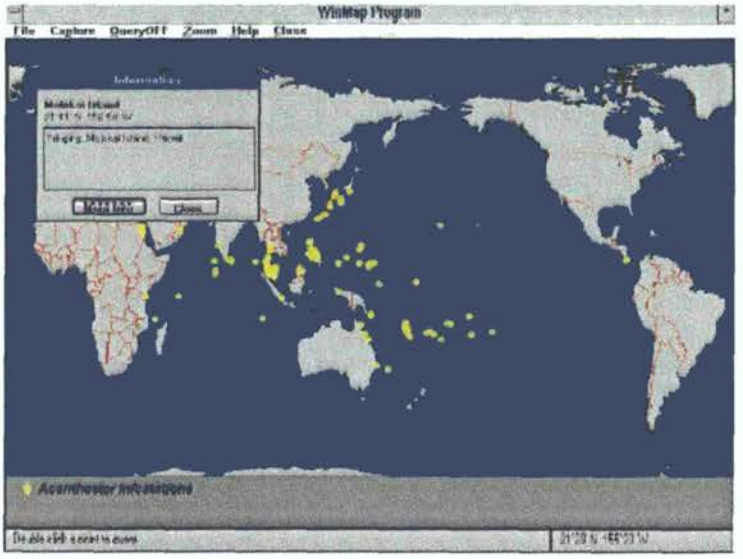
ReefBase is a user friendly database on coral reefs and their resources. ReefBase aims to make reef information available to a wide range of audiences to promote awareness and support the management of coral reef systems.

Methods

The information in ReefBase is gathered from the published literature as well as conference proceedings, technical reports, news articles, theses and manuscripts contributed by institutions and other research groups involved in the study of coral reefs.
Two mapping systems, WinMap and ReefMap are also a part of ReefBase. ReefMap displays standard maps of major reef systems prepared by the World Conservation Monitoring Centre (WCMC). These maps show land and sea areas, bathymetry, coral reefs and mangrove forests. Fully referenced maps enable users to assess the quality and reliability of source information. WinMap, a low level geographic access system developed for Reef-Base, provides the geographic display of data in ReefBase.

Result

Like an electronic encyclopedia, ReefBase presents coral reef information in a relational database designed to accommodate a wide spectrum of coral reef references. The reef is the basic unit, and the coverage is necessarily very broad.



The work has been supported by the European Commission and the Netherlands Government

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GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

ReefBase International Centre for Living Aquatic Resources Management
MCPO Box 2631, 0718 Makati City, Metro Manila, Philippines Fax: + 632 8 163 183
E-mail: ReefBase@cgnet.com http://www.cgiar.org/iclarm/resprog/reefbase.html
http://www.wcmc.org.uk/data/database/reefbase.html

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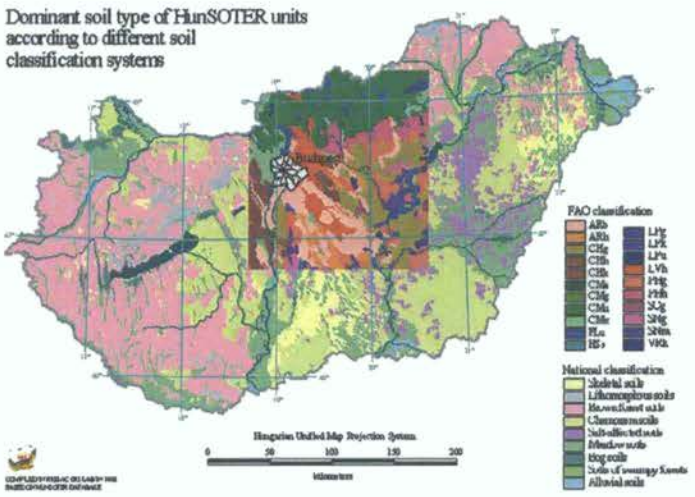
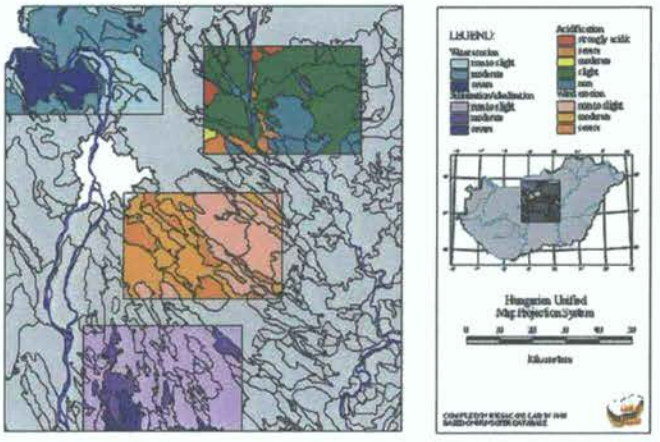
Soil and Terrain Database for Sustainable Agriculture and Environmental Protection in Hungary (HunSOTER)

Objective

To provide necessary data for improved mapping, modelling and monitoring of changes of world soil and terrain resources, UNEP's Soil and Terrain Digital Database project (SOTER) has been implemented. For Hungary in particular this implied the development of a Hungarian Soils and Terrain Digital Database following the international SOTER methodology and tools.



VULNERABILITY OF SOILS
TO VARIOUS SOIL DEGRADATION PROCESSES



Methods

HunSOTER data are stored in a relational database management system.
The database was organized with PC ARC/INFO, maps were generally compiled together with topographical background by ArcView.
The Hungarian version of SOTER has been built up with various modifications to fit the methodology to Hungary. The most significant deviation is the larger scale of HunSOTER, namely 1:500,000 versus the ordinary 1:1,000,000.
Methodological and technical support was given by International Soil Reference and Information Centre (ISRIC) Wageningen/The Netherlands.

Result

Orderly arrangement of natural resource data through the creation of a database containing attributes on physiography, soils, vegetation, land use and climate. This database is linked to a base map.
Case studies demonstrate the applicability of HunSOTER for the evaluation of the vulnerability of land and the suspectibility of soils to degradation.
Based on the experiences gained during the development of HunSOTER database, a modern and up-to-date GIS Lab was established at RISSAC and is prepared to become a SOTER training centre in the region.

UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

László Pásztor, József Szabó, György Várallyay
RISSAC GIS Lab, H-1022 Budapest, Herman O. 15.
Phone: 361-156-4644/13 Fax: 361-155-8839
E-mail: h2295pas@ella.hu

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FAO Statistical Database Dissemination System

Objective

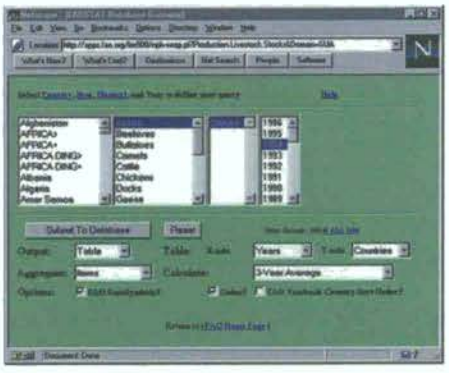
Disseminate FAO statistical data world-wide.

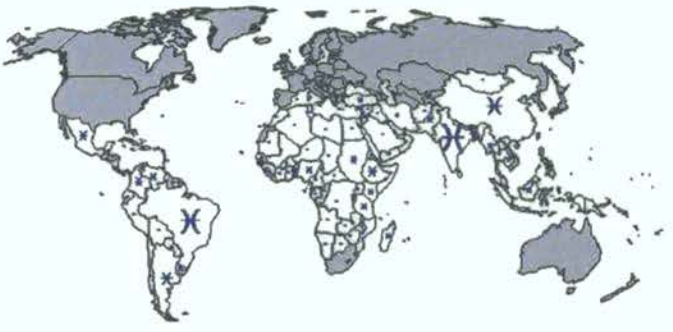
Method

The dissemination system was built on top of the core FAO-STAT Statistical Database System of agricultural statistics on the country, regional, and global levels. The dissemination system development included the elaboration of the Internet interface to the FAOSTAT application code and the Database. Special features were added, including specific statistics logging, subscription and FTP service, multi-lingual support, and maintenance features.

Result

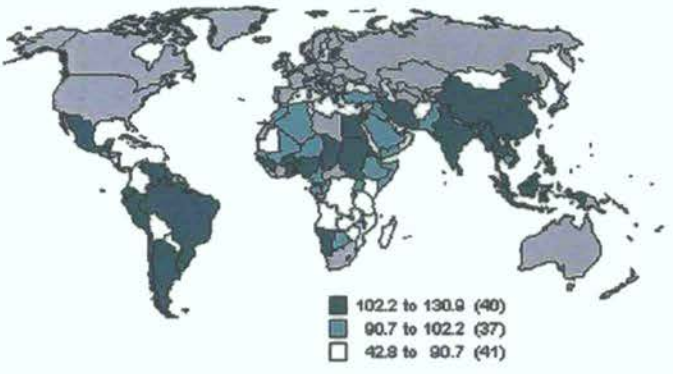
Since its inauguration in mid-1995, the system has by end 1996 processed over 220,000 external database queries and 35,000 internal (FAO) queries.





Cattle in Developing Countries - 1994.
Symbol size corresponds to cattle number

The map of agricultural statistics for developing countries shown have been generated at UNEP/GRID-Arendal by downloading data from FAOSTAT in a CSV format and using a mapping tool of Microsoft Excel 7.



Agricultural production (net per capita), PIN value. base 1989 - 1991.

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GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Kurt Vertucci, Technical Systems Branch of the Computer Service Division
The Food and Agriculture Organization of the United Nations
Phone: + 39 6 5225 5548 Fax: + 39 6 5225 6204
E-Mail: Kurt.Vertucci@fao.org http://www.fao.org/

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Land Quality Indicators Information System

Objective

The development of a global information system related to land will involve:

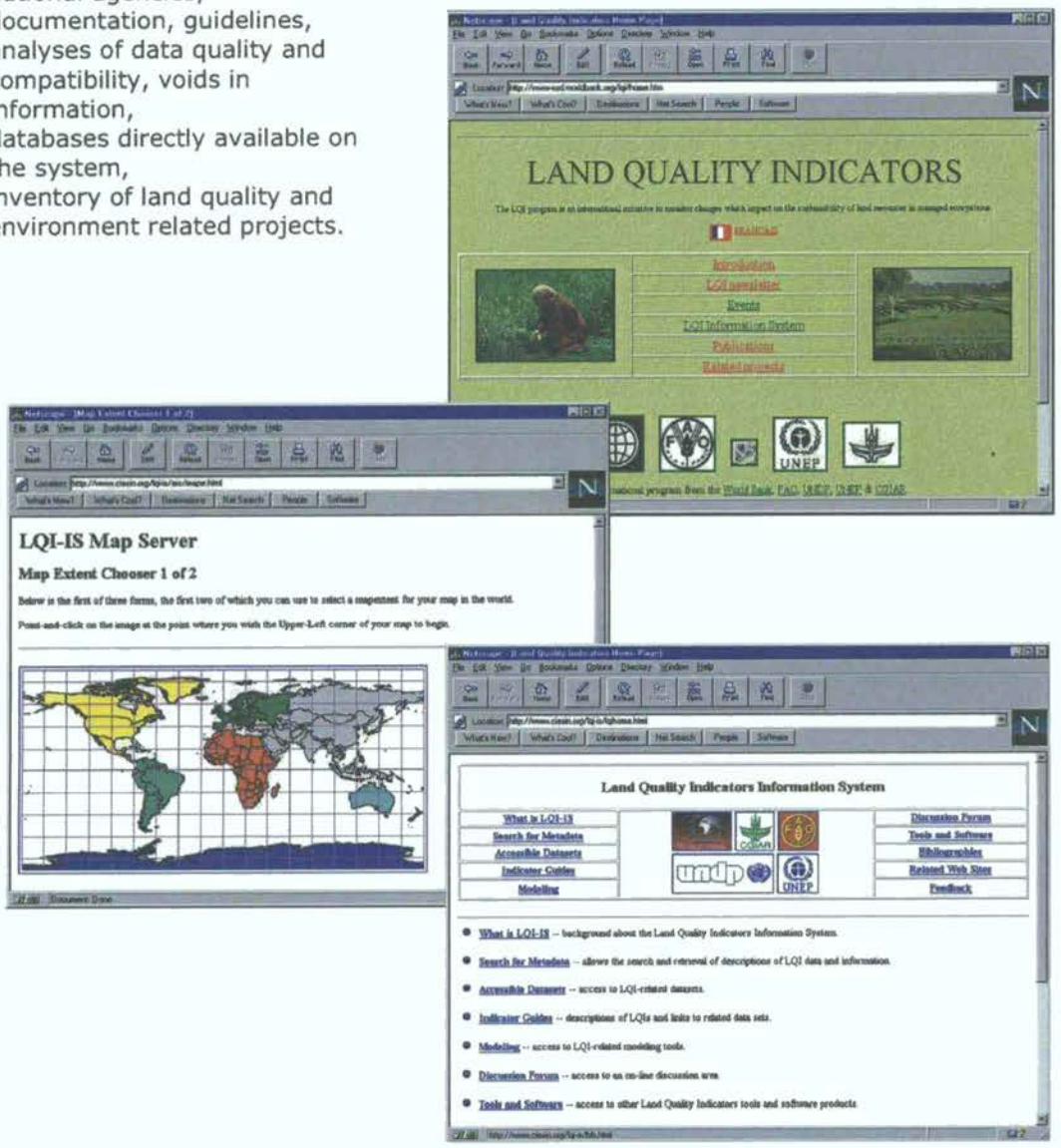
- the development of a meta-data catalogue on land-related data currently being stored by various international and national agencies,
- documentation, guidelines, analyses of data quality and compatibility, voids in information,
- databases directly available on the system,
- inventory of land quality and environment related projects.

Method

For the implementation of the first version, about six months of work were spent. ARC/INFO was used for the mapping component of the project.

Result

Comprehensive collection of mostly geo-referenced land information accessible on WWW for users such as task managers and policy makers at national and sub-natioal levels.



UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Alexandre Borde, The World Bank, 1818 h Street, NW, Washington DC, 20433, USA
Phone: 202 473 0898 Fax: 202 522 3306
Email. Aborde@worldbank.org
http://www-esd.worldbank.org/lqi/home.htm

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The UNEP Meta-data Directory

Objective

Meta-data are the "overview" or an informational abstract that describes (and points to) a particular data-set, report, map or institute. Meta-data assist users by providing access to institutes and/or data. The UNEP Meta-data Directory serves as a library card catalogue of environmental information. The software has been designed to manage both UNEP/GRID's internal meta-data and the assets of those organisations willing to co-operate with UNEP.

Methods

In UNEP/GRID's discussions and consultations on this subject it has been determined that, given the multitude of hardware and software meta-data solutions, the most important aspect of the meta-data directory is its structure. Therefore, it has been decided to use a harmonised and easy-to-use structure accessible by the widest possible user audience. The PC-based tool is designed to allow simple data entry (there are only ten mandatory fields for an institution entry or a data-set entry), uncomplicated data queries and easy data exchange between any organisations that use a basic international meta-data standard, such as the "Directory Interchange Format" (DIF) of NASA and the Committee of Earth Observing Satellites (CEOS).

Result

The Directory contains "card entries" (or meta-data descriptions) of institutes and data sets. Similar to a library card catalogue, the meta-data directory will allow users to search for environmental information by institute name or data-set (title), contact person (author), theme, keyword and location (subject), as well as other criteria. The tool is currently being used for documenting the spatial data holdings of the CGIAR centres.

UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

James McKenna, UNEP, P.O. Box 30552, Nairobi, Kenya
Phone: + 254 2 623899 Fax: + 254 2 624315
E-mail: mckennaj@unep.org
http://www.grid.unep.no/

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Modeling and Remote Sensing

GIS awareness package
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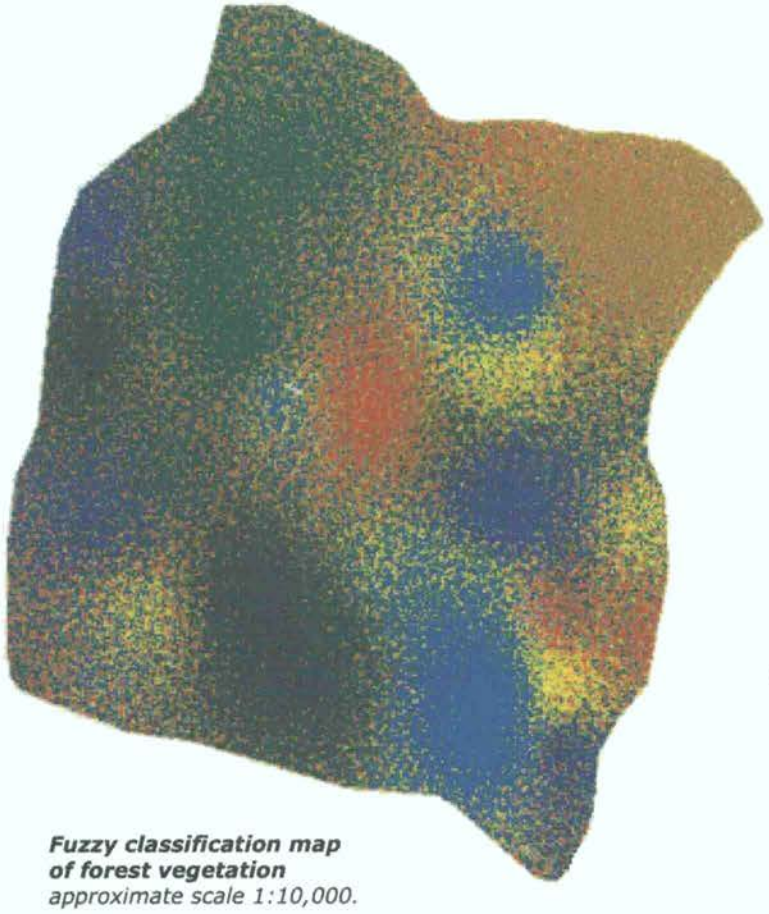
Fuzzy Classification for Mapping Forest Vegetation

Objective

Many spatial phenomena can not be represented properly with conventional deterministic classification techniques. Instead, the elaboration of a fuzzy set approach with regards to mapping can be of particular advantage for representing complex spatial systems. The method can generally be used for mapping any multidimensional spatial data.

Method

Source data on percent vegetative cover of 78 forest species were collected at 57 sampling sites in a nature reserve in Western Flevoland, The Netherlands. Non-hierarchical fuzzy cluster analysis was used for classification, so that each site was finally characterised by a set of membership values, each corresponding to a particular class. Between the sampling locations member-ship values were interpolated by conventional kriging and adjusted to ensure that the sum of values for each location always equaled to one. The resulting fuzzy map consists of cells each containing 100 randomly distributed coloured pixels. The total number of pixels of a certain colour in a cell corresponds to the membership value of this cell with respect to a class represented by this colour. The method is implemented as a stand-alone software operating under MS-DOS and was developed during the author's stay at Winland Staring Center, Wageningen, The Netherlands.

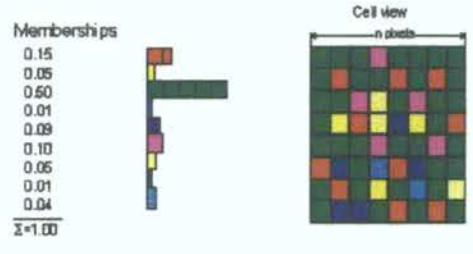


Fuzzy classification map of forest vegetation
approximate scale 1:10,000.

Result

A map of forest vegetation classification based on a fuzzy mapping algorithm: nature reserve in Western Flevoland (The Netherlands).

fig 3. **Representation of grid cell in fuzzy mapping algorithm.**



UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Victor B. Wagner, V.V. Dokuchaev Soil Institute, Russian Academy of Agriculture
Pyzhevsky lane 7 , Moscow, 109017 Russia
Phone: + 7 095 230 80 61 Fax: + 7 095 230 80 42
E-mail: vitus@agropc.msk.su

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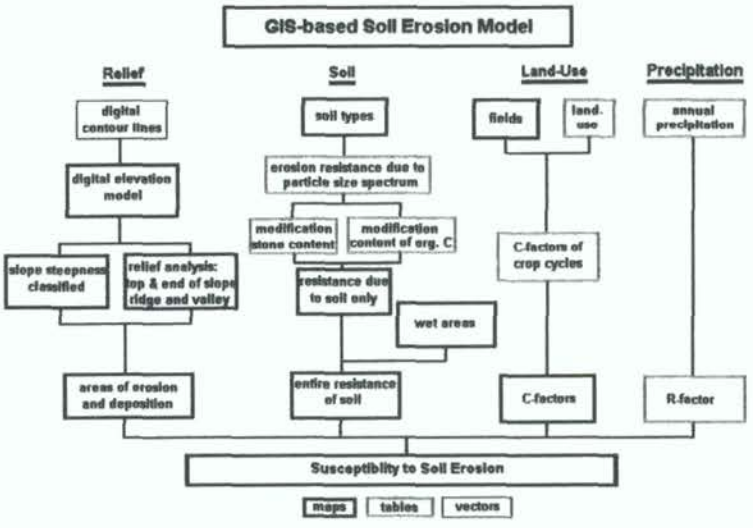
GIS-Based Soil Erosion Model

Objective

Use GIS methods to assess the soil erosion risk.

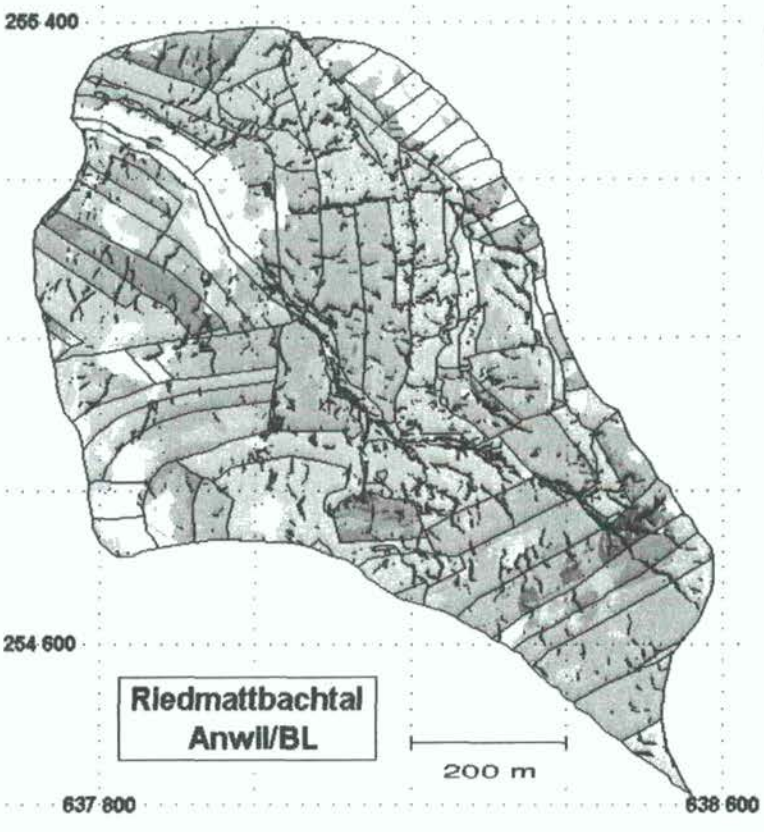
Method

Use of model to derive map showing "Suspectibility to soil erosion". Officially available governmental GIS data at a scale of 1:25.000 are being used in the model.



Result

Soil erosion potential map.



GIS-based Soil Erosion Model
Approach of Model: BA LVL / USLE
Relief-Analysis from "DHM5"

Susceptibility to Soil Erosion

- soil loss class 0, no susceptibility, meadow, shrubs, forest
- soil loss class 1, extremely low sus.
- soil loss class 2, very low suscept.
- soil loss class 3, low susceptibility
- soil loss class 4, moderate suscept.
- soil loss class 5, heigh susceptibility
- valley line, path of overland flow, soil loss class 6, very heigh suscept. on fields with crop cycle
- area of deposition
- limit of field

UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Dietrich Dräyer, Geographisches Institut, Universität Basel
Spalenring 145, CH-4055 Basel
Phone: + 41 61 272 66 32 Fax: + 41 61 272 69 23
http://www.gib.unibas.ch/www/physio/crew/draeyer.htm

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Modeling of Spatial and Temporal Changes in Soil-Water Erosion

Objective

Develop a methodology for dynamic modelling of soil-water erosion within a GIS environment.

Method

A dynamic approach in physically-based soil water erosion modelling within a GIS (GRASS) environment was used.
The application of the unit stream power theory and physical fields theory in water erosion modelling is presented.
Dynamics of the phenomenon are studied in both the short and long-term.
Two visually interpreted aerial photographs of different contrast time horizons (years 1955 and 1990 - Fig. 1) were selected to derive the model input parameter - Manning's surface roughness coefficient.
The method is tested on a small basin selected in Myjava hillyland.

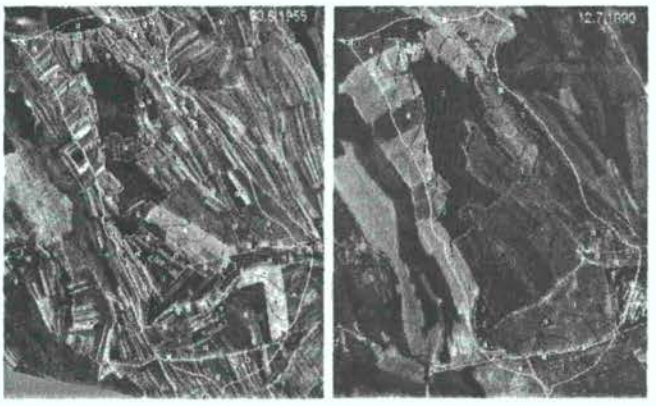

Fig.1

Result

Results of the modeling document highlight the influence of two of the most important factors - relief and land cover/land use. These two factors control spatial and temporal changes in erosion and deposition pattern in both the short-term (at the level of erosion event - Fig. 2) and the long-term (Fig. 3).
The work is targeted mainly at researchers working with soil-water erosion problems.
Future work will verify obtained results by terrain mapping.

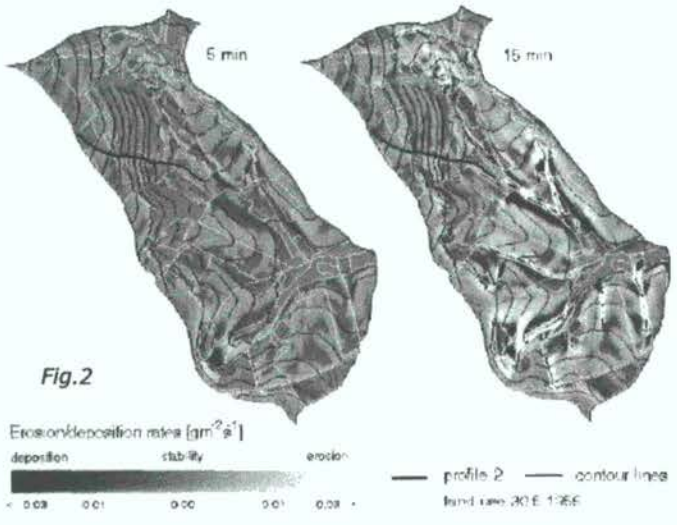

Fig.2

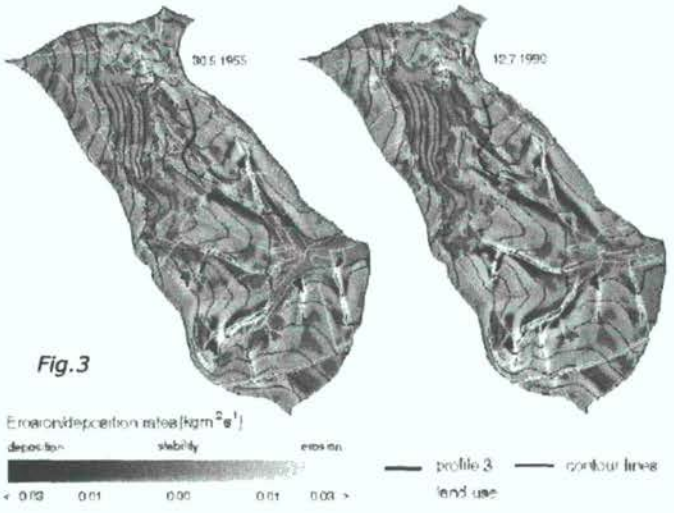

Fig.3

UNEP
GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:
Jaroslav Hofierka, Mestsky urad, Radnicne nam. 16, Bardejov, Slovakia
E-mail: hofierka@netlab.sk
Marcel Suri, Institute of Geography, Slovak Academy of Sciences, Bratislava, Slovakia
E-mail:suri@savba.sk

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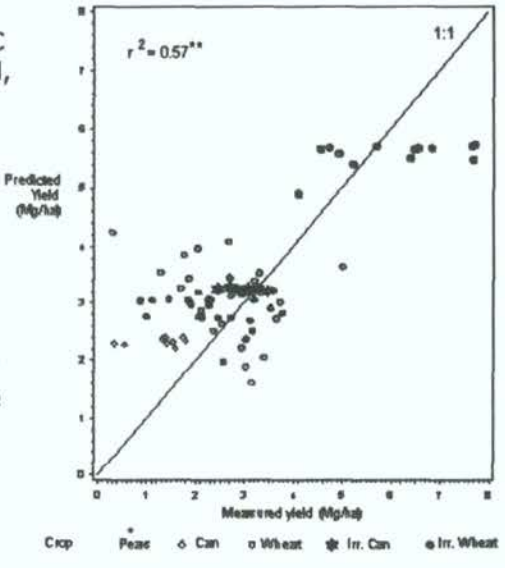
Precision Farming - The EPIC Model

Objective

The Environmental Policy Integrated Climate (EPIC) Model is a soil/crop model composed of several simulation components for weather, hydrology, nutrient cycling, pesticide fate, tillage, crop growth, soil erosion, crop and soil management and economics. The objective of this study was to evaluate the EPIC model on a variable landscape site specific management basis and to develop a computer-based tool that would integrate the EPIC model with the GRASS-GIS.

Methods

A research project was initiated using EPIC to study the development of optimal agronomic management on a site-specific basis. Crop yields were monitored during 1994 and 1995 at four sites in Alberta using a high-precision 3-D Differential GPS. The EPIC model was used on a sub-field, site-specific basis using soil profile information for various landscape transects, agronomic management and daily climatic data. The crop growth routines of this model were compared against two years of yield maps obtained from each field. The GISSMO interface provided an effective means of managing the various data layers for a field to utilize the EPIC model for each unique landscape-management polygon.

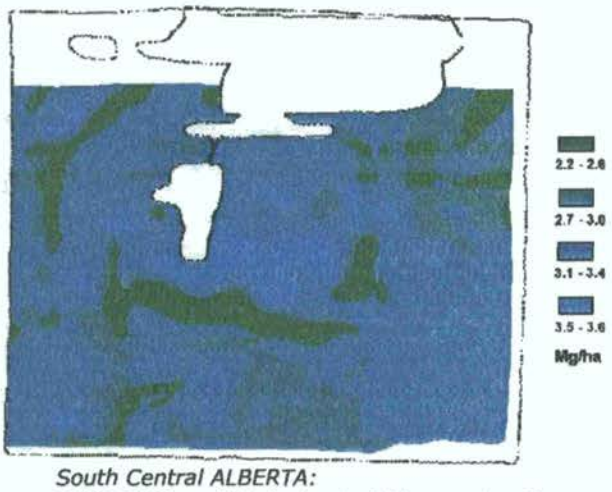


Relation between predicted and measured grain yield, using EPIC for all crops, fertilizer rates, etc.

Result

This study showed that the EPIC model can function as a good predictor of crop yields in Alberta using Canadian crop parameters, local station weather data, and site-specific soil investigations.

The potential benefit of using an integrated model is that other features of the model can then be used with little additional effort which may be very appealing for wide spread use in the agriculture industry. Models for nitrate and pesticide leaching, erosion and tillage are more likely to be used if they come as part of an agronomic model that can be used for prescription mapping and risk assessment. A reliable model could also be used to test various management practices, climatic conditions and soil conditions on crop yields and soil conservation. Considerable work is still needed but the potential use of a model for site-specific farming is to provide a very powerful tool for farmers and researchers.



South Central ALBERTA:
1995 EPIC predicted wheat yield map at a site.

UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Tom Goddard, Len Kryzanowski, Karen Cannon, Alberta Agriculture, Food and Rural Development
#206, 7000 - 113 St. Edmonton, AB Canada T6H 5T6
Phone: + 403 422 6530 or + 403 427 6361 Fax: + 403 422 0474 or + 403 427 1439
goddard@gpu.srv.ualberta.ca, Len. Kryzanowski@mailer.agric.gov.ab.ca, cannon@agric.gov.ab.ca

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Water Management in Kirindi Oya Irrigation and Settlement Project. Kirindi Oya Geographic Information System (KOGIS)

Objective

Water management in Kirindi Oya irrigation project involves three salient features.
In that context the goals of water management are :

- properly harvest rainfall,
- manage water issues to avoid losses and
- control water quality within the area.

The target is to end the season with saving maximum capacity of storage to supply the whole area for Yala cultivation. The implementation of an information system is the primary step in improving irrigation management.

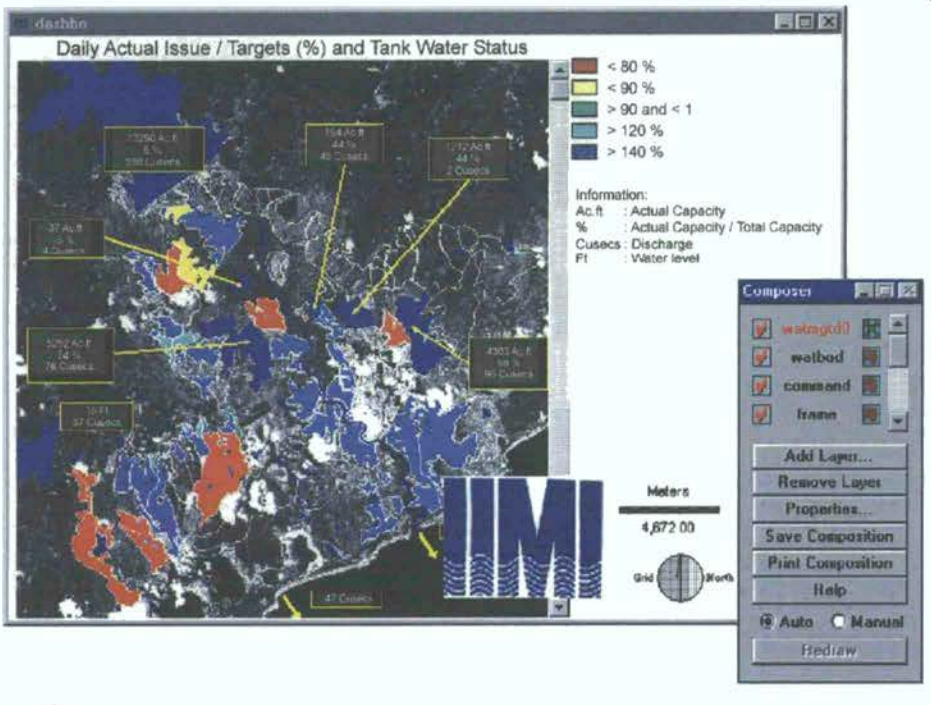
Method

The use of GIS in addressing water deliveries scheduling, allocation and operation is based on the following GIS capacities:

- display of spatially distributed variables,
- handling of spatial relationships (command areas, watershed and drainage contribution),
- connection with other models and data bases (hydraulic, hydrologic).

Result

A dashboard addressing the quantitative aspect of water management:
The dashboard is installed in the manager's office and displays real-time data that are currently collected throughout the watershed, showing the water status and the flows and physical characteristics of the area (soil map, water bodies, drainage, rainfall station, etc).
Planned improvement will include building macro-procedures and linking to specific models to develop a decision support platform (e.g. with the goal to maintain salinity at a reasonable level by mixing water from different sources).



UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Daniel Renault, International Irrigation Management Institute, ITIS Unit,
P.O. Box 2075, Colombo, SRI LANKA
Phone: + 94 1 867404 Fax: + 94 1 866854
E-mail: D.Renault@cgnet.com http://www.cgiar.org/iimi/

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Early Determination and Monitoring of Droughts in Kazakhstan

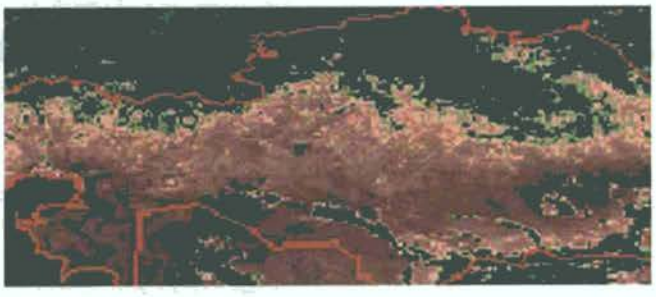
Objective

Develop methodology for thorough monitoring of the crop environment and conditions and estimation of wheat production over a large area which allows for the detection and monitoring of drought expansion, duration and impact.

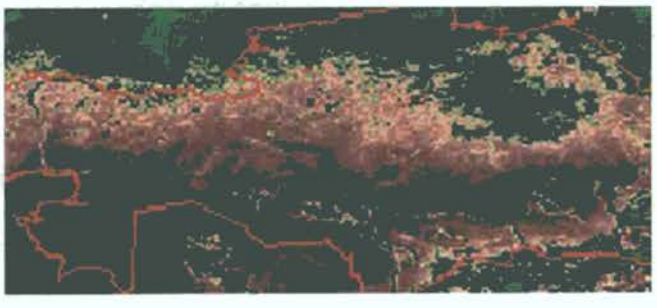
Method

A Vegetation Temporal Index (VTI) which is a dynamic modification of the Normalised Difference Vegetation Index (NDVI) has been developed at the ISR to serve as a base indicator for the early identification of adverse weather conditions and the estimation of their impact on future yield. The method involves an integrated evaluation of spring temperature and moisture conditions (March-May) on the basis of AVHRR/ NOAA NDVI data. The verification of results for 1991, 1992, 1995 and 1996 years have shown a good correlation between VTI values and drought locations. Real-time monitoring was carried out using data obtained from NOAA/AVHRR through the reception of D-Band digital signals from a NOAA-HRPT polar-orbiting satellite. Data are processed using ER Mapper, ARC/INFO and SCANOR software operated on Telonics and SUN workstations. Four ISR staff members are involved in the project.

1991:
Strong drought



1992:
Good conditions



1996:
Latest data

Kazakhstan:
Time series of vegetation index values during the week August 6-12

Result

Time series of vegetation index values for the territory of Kazakhstan.

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GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Edige Zakarin, Lev Spivak, Space Research Institute (SRI),
National Academy of Sciences of the Republic of Kazakhstan,
Shevchenko st. 15, 480021 Almaty, Kazakhstan Phone: + 7 3272 61 58 53 Fax: + 7 3272 49 43 55
E-mail: zak@kaziki.alma-ata.su, iki@app.academ.alma-ata.su http://smis.iki.rssi.ru/inform/sri-kaz.htm

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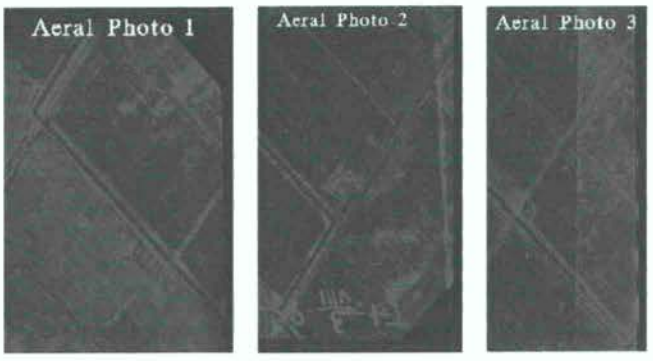
Use of Aerial Photography for Mapping the Salinisation of Agricultural Soils in Uzbekistan

Objective

Identification of the growth conditions of cotton and alfalfa using readily available panchromatic materials of aerial photography, aiming at increased accuracy of salinisation surveying and cost reduction. The approach also allows for quantitative (e.g. cost-related) estimates to be consistently applied to large areas.

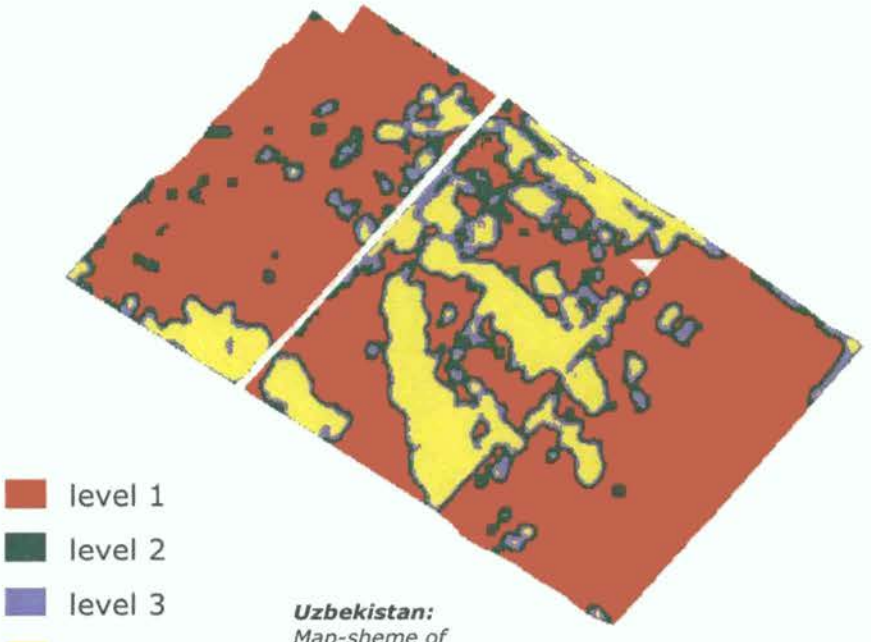


Method

Field work has been carried out for 10 years in the irrigation zone of Golodnaya and Yizagskaya steppes in Uzbekistan, including the old irrigated lands. Field mapping of salt salinisation in key areas was conducted. This was used for the identification of salinisation patterns in the entire area using inexpensive panchromatic aerial photos. A time-series of maps beginning in 1960 was compiled.

Result

Map of soil salinisation levels in Golodnaya and Yizagskaya steppes, Uzbekistan



Uzbekistan:
Map-sheme of soil salinization

UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Dmitrii Ruchovich, V.V. Dokuchaev Soil Institute, Russian Academy of Agriculture,
Pyzhevsky lane 7, Moscow, 109017 Russia
Phone: + 7 095 231 07 77, 230 80 42 Fax: + 7 095 230 80 42, 231 50 37
E-mail: ruh@agropc.msk.su.

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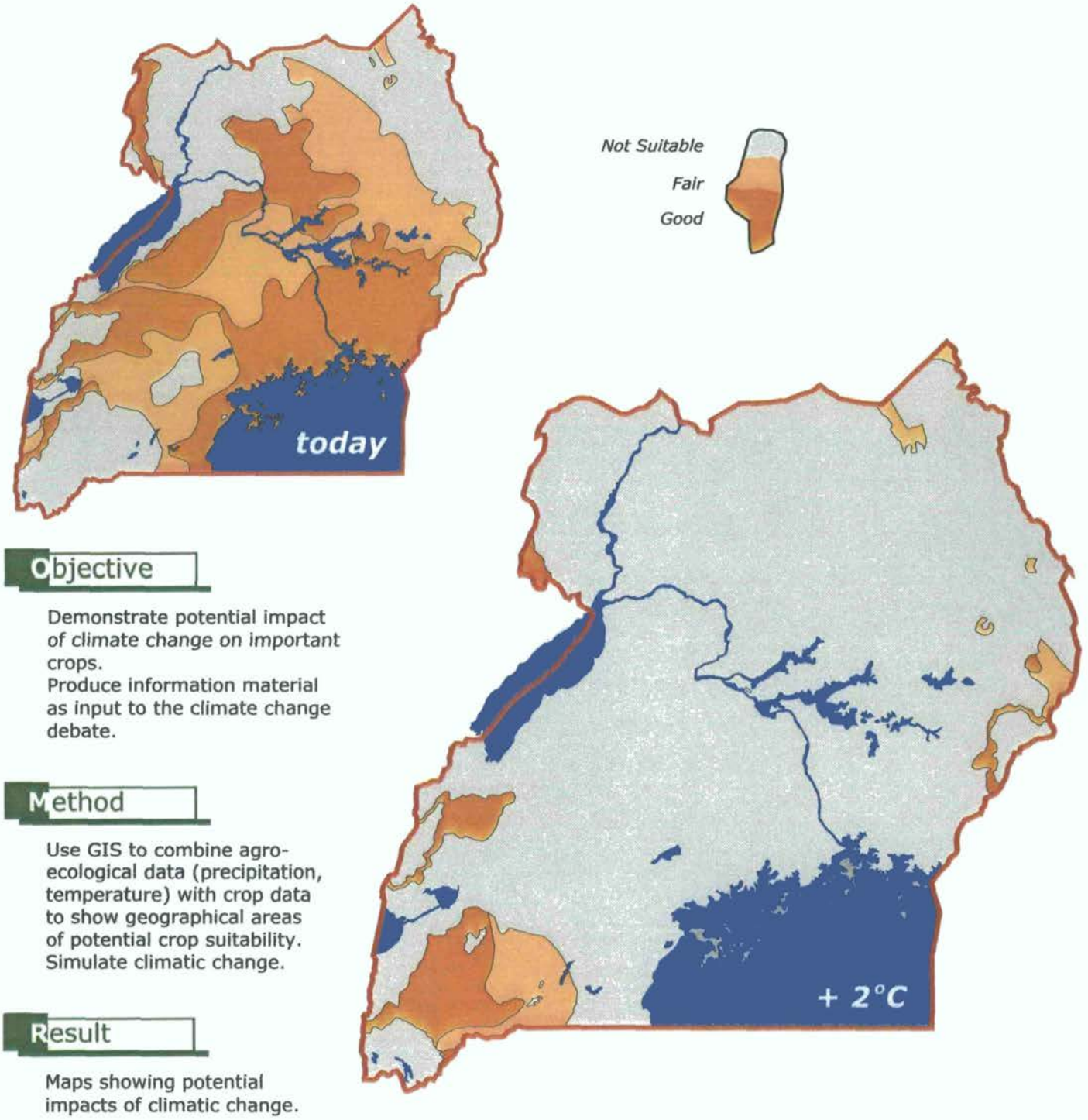
Potential Impact of Climate Change on Crop Suitability: Robusta Coffee in Uganda



Objective

Demonstrate potential impact of climate change on important crops.
Produce information material as input to the climate change debate.

Method

Use GIS to combine agro-ecological data (precipitation, temperature) with crop data to show geographical areas of potential crop suitability.
Simulate climatic change.

Result

Maps showing potential impacts of climatic change.

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GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Otto Simonett, UNEP/GRID-Arendal
P.O.Box 1602 Myrene, N-4801 Arendal, NORWAY
Phone: + 47 370 35650 Fax: + 47 370 35050
email: simonett@grida.no

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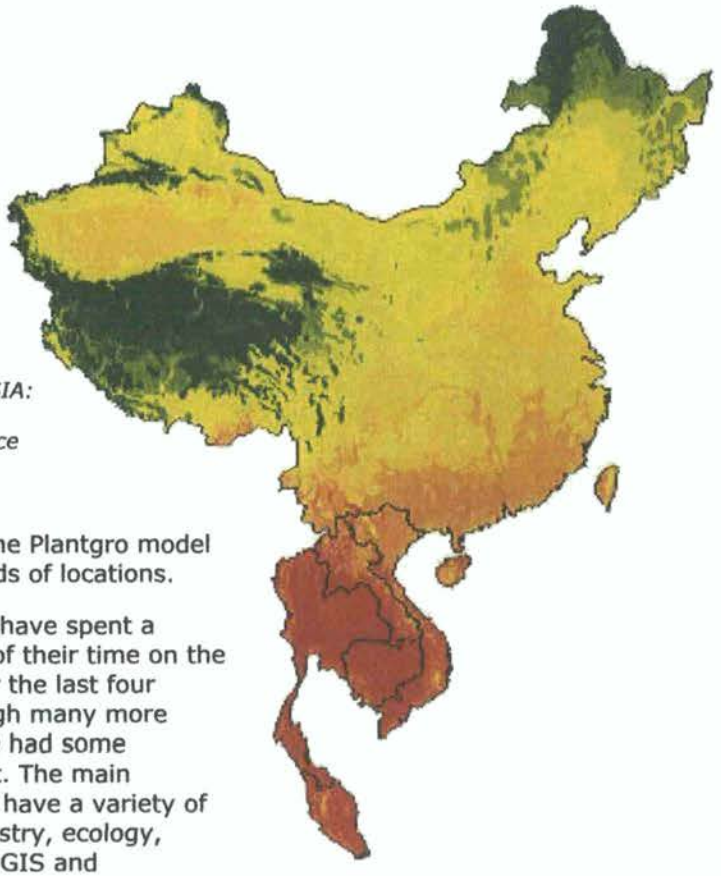
Where will it grow?
How well will it grow?

Objective

Develop generic methods for predicting where and how well particular plants will grow in different environments.
Produce PC-based tools, which can be easily used by individuals and small organisations as well as large national and international organisations.



CHINA and Southeast ASIA: Interpolated climate surface

Methods

Four basic techniques are applied:

- Interpolation relationships are developed to enable mean monthly climatic conditions to be reliably estimated for any location within the study area.
- "Climatic mapping programs" containing data for thousands of locations are developed to enable regions satisfying the requirements of particular species to be easily identified.
- The Plantgro program is used to evaluate the relative suitability of individual sites for particular species using soil as well as climatic information.
- "Simulation mapping programs" are developed which can run a simplified version of the Plantgro model for thousands of locations.

Five people have spent a major part of their time on the project over the last four years, though many more people have had some involvement. The main researchers have a variety of skills in forestry, ecology, agriculture, GIS and computation.

CHINA: Climatic suitability of Acacia mearnsii

Results

Products from the research are being used by individuals and organisations in many countries around the world.
In addition to their use in forestry, some of the programs and databases are being used to assist the selection of grass species, to analyse native bird distributions and to predict the risk of insect pests.

Results of the project have been summarised in a four page colour research note and in a 125 page proceedings volume entitled "Matching Trees and Sites".
Eight training courses in the use of the methods have been given in six countries in the last three years.

The work has been supported by ACIAR and AusAID

UNEP

GRID-Arendal,
P.O.Box 1602 Myrene,
N-4801 Arendal,
NORWAY
e-mail grid@grida.no

Contact:

Trevor H. Booth, CSIRO Forestry and Forest Products
PO Box 4008, Canberra, ACT 2600, Australia
Fax: + 616 281 8312
E-mail: trevor.booth@cbr.for.csiro.au

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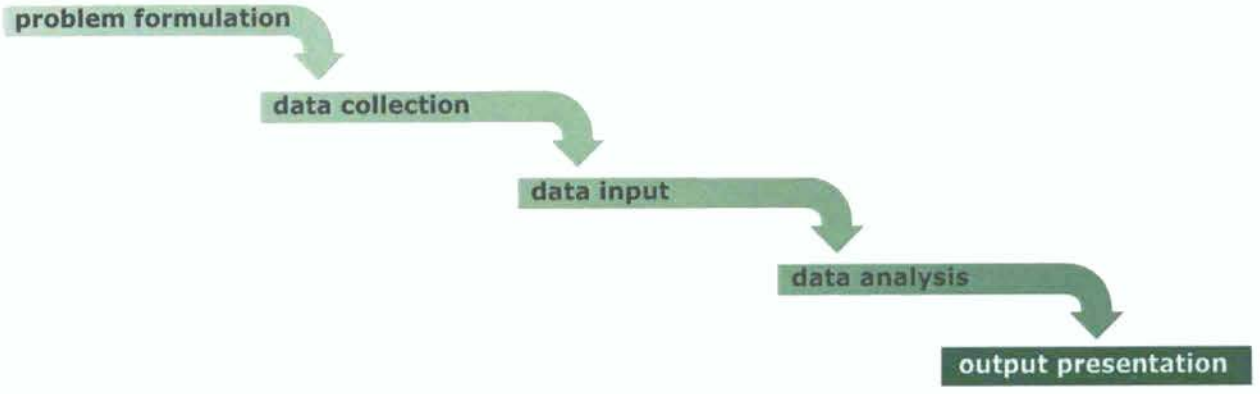
A GIS Application Project: Objectives, Steps, Benefits

The most common objectives of GIS applications:

- integration of data from different sources
- visualisation of spatial data and information
- development, analysis, and presentation of scenarios

Steps of a GIS application project:



Benefits of using GIS:

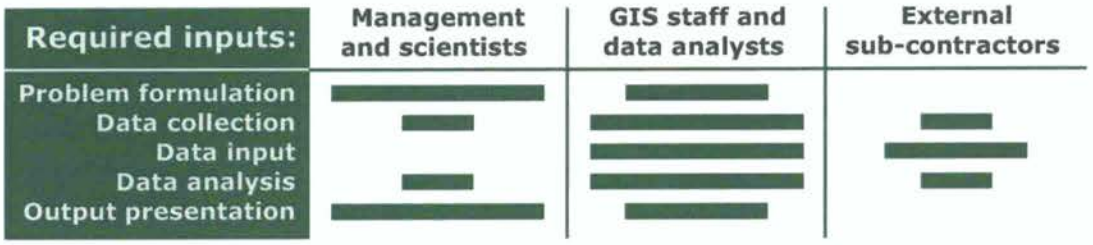
- research planning (diagnostics/definition of site-specific priorities)
- targeting the products of research
- assessing the impact of research and development
- support to strategic (pure) research

Benefits of establishing partnership among institutions applying GIS:

- sharing of data catalogues and data-bases
- sharing and building of institutional capacities
- cooperative development of methodology
- avoidance of the duplication of efforts

GIS awareness package
IN AGRICULTURAL RESEARCH

A GIS Application Project: Inputs, Resource Needs



The width of a bar corresponds to the degree of the relative involvement of a particular group into the project at a given stage

Resource needs:	Hardware	Software
Data collection	Internet connection desirable	Data catalogues
Data input	PC/workstation, digitising board, scanner ($3,000-25,000)	Vector GIS for paper maps, raster GIS for space images, database software ($2,000-20,000)
Data analysis	PC/workstation ($2,000-15,000)	Same as above, + statistical add-ons
Output presentation	Same as above, + colour plotter ($500-5,000)	Same as above, + professional mapping/graphic software desirable ($1,000-3,000)

- A clear problem formulation and definition of the outputs are important: management has to actively guide the technical staff, otherwise resource use may become excessive
- Inexperienced managers tend to grossly underestimate resource requirements for data collection, input and analysis (often relying on over-optimistic estimates by the technical staff)
- Too little resources are often allocated for the user-friendly presentation of outputs
- Trained staff is assumed to be available; additional time/labour investments are normally required to start up an operational GIS unit before production can begin