

The role of communication technology and multi-media in the development of land and water information systems

CONTEXT AND JUSTIFICATION

Land and water resources information systems deal with dynamics and changing realities. Land use changes constantly in time and space. The degradation processes or restoration of natural resources also suffer variations according to the type of agro-ecosystem considered. An information system in soil and water should be able to consider the diversity of existing agro-ecological, technical and socio-economic processes, at the regional and national level.

For more than 50 years, FAO has been collecting data and information on the two most important resources for agriculture: land and water. A series of large databases and comprehensive information systems on natural resources were developed; the use of advanced information technologies was promoted concurrently (computers, remote sensing, models, expert systems); and international standards, classifications and methods as well as programmes and networks were established in order to facilitate cooperation in collecting and sharing information on LWR. The 1996 World Food Summit gave the opportunity to access the accumulated knowledge and experience and evaluate future prospects for sustainable agricultural development and long-term food security. On this occasion, several problems emerged when attempting to produce reports on the state of land and water resources (LWR) for food and agriculture and related perspective studies at national, regional and global levels:

- i. the data and information coverage of FAO member countries is uneven: important gaps remain to be filled subject-wise and area-wise;
- ii. when data and information are available, the diversity of their formats, modes and dates of collection, and degree of detail makes their compilation and interpretation across sectors and across countries particularly difficult, especially as regards the use of data and information on land together with those on water resources for diverse purposes, such as irrigation development or food security assessments.

How can a system be created that will allow permanent access to existing information? The development of recent technologies of electronic communication and of multi-media is allowing the creation of structures where these activities can be made on a remote and varied way. This paper summarizes the role that communication technology and multi-media can play in the development of land and water information systems.

The results are based on experiences of the non-governmental organization ECOFORCE - Research and Development (<http://www.ecof.org.br>) and of EMBRAPA's Environmental Monitoring Center (<http://www.nma.embrapa.br>). In particular, this paper presents concepts developed on the creation of a hypertext prototype in four languages about "The state of the world land and water resources" for the Land and Water Development Division (AGL) of FAO.

Conceived as a cooperative work, this hypertext tries first to value the documentation and the accumulated experience of FAO. It establishes links with databases already existing, at FAO and at other institutions with which FAO cooperates. Special attention was paid to the technological feasibility of the project due to differences in communication resources among the possible participating countries.

OBJECTIVES AND GOALS

The main objective of the communication technology and multi-media in the development of land and water information systems is to provide a framework between users and information providers, allowing constant actualization and with remote access.

A secondary objective is the need to value pre-existing competence in different countries and a more intensive use of data which are not being used sufficiently in different organizational conditions. The comparison between countries at the same level of development and the diffusion of positive experiences, so that they can be reproduced, also fits in the category of secondary objectives.

The target public of this system is those responsible for the planning of land and water use, the formulation of land and water policies and the technicians involved in their application and development. It also focuses, in a diffuse way, on all those interested in obtaining structured information about land use and its consequences on soil and water resources worldwide.

METHODOLOGICAL ASPECTS

The project's methodological strategy was divided into three main parts:

- i. data acquisition with the active participation of national organizations under FAO/AGL coordination;
- ii. data processing to provide a homogeneous and hierarchical database (thematic and geographic);
- iii. presentation of results using Internet software to make the numerical and cartographic data available (www, ftp).

Finally, a hypertext structure was built with remote interaction with FAO-Rome and the participating institutions in Brazil through a common site on the Internet. A prototype document was prepared using the hypertext structure, in which examples of texts, maps and images were changed electronically.

MAIN TECHNICAL TOOLS

The main technical tools of this project were the hypertext, the use of satellite data and the Internet.

Hypertext: the use of hypertext allows multiple readings and combinations of available information, according to the reader's interest. Among the possible available reading routes the following are highlighted: geographic route, agro-ecological system route, thematic route and institutional route.

Satellite Data: the use of meteorological and environmental satellite imagery has opened many possibilities for the detection and monitoring of water and land resources and of the changes on the planet surface caused by human activities. Therefore, the intention of including satellite data in the document is not only as illustrations of state of the world resources, but as an important complement of all information with a new way of looking - at the same time wider and more accurate - at men's impact on Earth.

Internet: the use of network electronic communication (Internet) allows multiple connections and remote access to available information, in many databases, especially those from FAO. These links are shown all over the document. The source of the Brazilian region's data was the project "Ecological-Economical Geo-codified Information System for the Cartographic Monitoring of Agriculture", by EMBRAPA's Environmental Monitoring Center, available on the Internet. The source of the agro-ecological systems data is the project "Brazilian Ecosystems", by the non-governmental organization ECOFORCE - Research and Development.

MAIN RESULTS

The elaborated prototype will be soon available from FAO. The elaborated system is divided into two main starting menus: theme and geographic regions. The themes are food security, water resources, land resources and biodiversity and biotechnology. The world regions are Africa, Asia, Latin America and Caribbean, Middle East, North America, Europe and Oceania. A relatively homogeneous structure was proposed for each theme.

On the food security theme, the system will provide information about availability of land resources at global and regional levels. The main points proposed are:

- map of low-income food-deficit countries;
- regional and national challenges;
- natural disasters and food emergencies;
- map of most sensitive regions (drought, floods, land slides, wild fires, hurricanes);
- viewpoints;
- women and food security (example);
- action plans for food security.

On the water resources theme, the system will provide information about availability of land resources at global and regional levels. The main points proposed are:

- map of water resources of the world;

- water consumption (per caput, by country, by sector);
- the use of water resources;
- sound use of water resources and wastewater use examples;
- water resources management possibilities and constraints for food production and food security;
- irrigation development;
- water conservation options for agriculture;
- irrigation potential in Africa, Asia, Latin America, Europe, Middle East, North America, Oceania;
- environmental impacts of water resources development and use;
- existing global and regional databases.

On the land resources theme, the system will provide information about availability of land resources at global and regional levels. The main points proposed are:

- map of soil resources of the world;
- conflicts related to land resources;
- land cover and present land allocation for agriculture, livestock, forestry and aquaculture;
- potential production of the world;
- present production zones, based on land classification;
- hot spots/bright spots;
- environmental impacts of inadequate land use:
 - ◊ land degradation;
 - ◊ desertification;
 - ◊ land pollution;
 - ◊ loss of biological diversity;
 - ◊ soil losses;
- data and economic costs;
- existing global and regional data bases.

On the biodiversity and biotechnology theme, the system will provide information about availability of land resources at global and regional levels. The main points proposed are:

- land cover, land use and biodiversity;
- risks of monoculture and biodiversity loss: hot spots;
- biotechnology and intensification;
- map of genetic megacentres of the world;
- ECOCROP 1 & 2;
- existing global and regional databases.

On the regional topic, the system will provide information about availability of land resources at global, regional and national levels. All the countries were included in each region. Each country can follow its own route of available information, according to its own characteristics, but always according to a basic structure proposed by FAO.

The Brazilian case was treated with greater detail, to exemplify a wide range of conditions and to serve as an example, not a model, for other countries.

On the regional level, for the agro-ecological systems, the main points proposed are:

- definition of agro-ecological zoning of FAO;
- main methods and applications;
- compatibility with other zoning, adaptation with socio-economic contexts;
- main land conservation technologies (WOCAT database);
- FAO food security strategy paper.

CONCLUSIONS

The experience developed during this work with FAO shows that the role of communication technology and multi-media in the development of land and water information systems could be:

- to help create a multilingual framework;
- to assure remote access to data and information;
- to assure free access to all databases or meta databases;
- to make possible the remote updating and the cooperative construction of the system;
- to reduce costs and make feasible the progressive creation of the framework;
- to make information available in a cooperative way;
- to establish and adjust spatial and thematic hierarchies for the availability of text, numerical and cartographic information;
- to establish links between geo-coded databases and orbital imagery, giving access to data by ftp, www or other means;
- to give an actualized and hierarchized vision of the soil and water resources for planners and policy-makers;
- to facilitate the implementation of sustainable policies for the wise use of soil and water resources through:
 - ◊ thematic maps;
 - ◊ orbital imagery;
 - ◊ opinion texts;
 - ◊ decisive process analyses;
 - ◊ electronic discussion lists;
 - ◊ other fora results;
- to allow access to different data and different routes of data acquisition (geographical and thematic), according to the user's interest (hypertext);
- to allow the comparison between different countries' data or between one country's data and the world's;
- to allow the diffusion of positive experiences, as a model to other countries with the same development level;
- to detect and to identify the deficiencies in structure and functioning of the system;
- to keep a window of actualized information on the theme, for the general public opinion.

