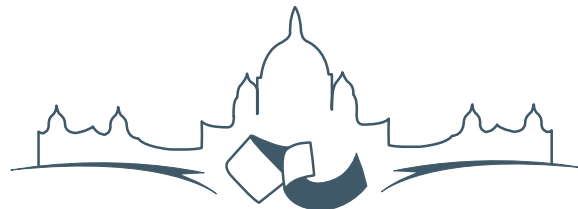

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A Spatial Database to Integrate Information of the Rondonia Natural Resource Management Project

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Keywords: *Spatial Database, ZSEE-RO, PLANAFLORO, Data Integration*

Abstract

This paper presents the construction of a spatial database for the integration information from Social-Economic Ecological Zoning of Rondonia State (ZSEE/RO). The project's objective consists of modeling a new database for ZSEE/RO, making it possible to access the data and information for use in varied projects. So all the evaluation was performed based on the quantity of ZSEE-RO data and information. File conversions were carried out, aimed at making the files accessible in standard formats. Later the consistency of converted data was verified, to insure quality control at different scales. Some applications had to be reconfigured and installed which were developed exclusively for the ZSEE/RO. The main results so far relate to the recognition of ZSEE/RO data quantity and establishment of the necessary requirements for accessing the original data. Diverse files have been converted to universal formats. Moreover, the problems with regard to the data quality which have been detected include non geocoded data, inconsistencies at different scales, and inconsistency in printed matter versus stored digital files.

Introduction

This article covers spatial database construction for the integration of Social-Economic Ecological Zoning of Rondonia State (ZSEE/RO), which is being developed in partnership with Secretariat of Planning and General Coordination of the State of Rondonia. The ZSEE/RO is originally the Rondonia Natural Resource Management - PLANAFLORO.

The general objective of the project consists of modeling a new database of the ZSEE/RO, mak-

ing it possible for various project to access the data. Specifically, it is intended with the elaboration of this work: to evaluate the content of diverse source databases for ZSEE/RO, to shape and construct a spatial database for storage of data and information, and to convert the data to a new internet based format.

The PlanaFloro Project

Through the State Decree No. 3782 of 14 June of 1988 the Social-Economic Ecological Zoning of Rondonia State - ZSEE/RO - was established, dividing the State into zones of ambient protection and zones for farming and agroforestry activities (4). Rondonia was the first Brazilian state to have policies of preservation of nature with the Rondonia Natural Resource Management Project - PLANAFLORO, directed to the question and of granting land for the aboriginal peoples, executed between 1992 and 1999 growing into the Social-Economic Ecological Zoning of Rondonia state.

As one of the components of PLANAFLORO the second approach of the ZSEE/RO supported a field survey at 1:250,000 scale, elaborating diverse fields of the knowledge such as: vegetation, geology, pedology, geomorphology, fauna, land use and occupation etc. The partnership responsible for execution of this mission consisted of distinct teams, one for each area of the knowledge. Consequently, The thematic data had been stored using different solutions in accordance with the necessities of the diverse teams. Its implementation was an ArcINFO geographic database, however it was very poor in attributes (Dall'Igna, 2005). The completed thematic studies became the basis for diagnosis of the State of Rondônia and, using its results, Approach of Ecological the Partner-Economic Zoning of the State was elaborated.

Initial Procedures

To define the work methodology the great volume of data concerning the ZSEE/RO was taken into

account, Original data were available in heterogeneous formats, many of them unknown to the technician of the state agencies and potential researchers. Technological obsolescence was also considered, even though PLANAFLORO was initiated in 1992. Thus the project proceeded to evaluate and collect data and information for ZSEE-RO, composing archives in digital media, customizing software for PLANAFLORO and producing printed material as maps, letters and reports. The principal files formats found included:

- ADF: ArcINFO 7.x Coverage files. In this format were themes covered by ZSEE, vector and descriptive data, airport points, curve-level, law protected areas, etc.
- LAN: Raster files. Landsat satellite images, with a 30 meters resolution, covering the entire state of Rondonia.
- GRA: Plot files. Maps generated by ZSEE for printing.
- RTL: Plot files. All themes covered by ZSEE as hydrology, geology, hydrogeology, geomorphology, vegetation, among others, and all maps prepared in scales ranging from 1:250.000 to 1:1.000.000

In addition to the formats listed above reports, pictures and spreadsheets in .DOC .XLS .TIFF .JPG and .EPS were identified.

Conversions of archives has been carried out, aiming to become accessible and standardized, converting them from proprietary files which need specific software, into universally accessible files for diverse technologies. The files that were in .ADF vectorial format were converted to the ESRI Shapefile format. The satellite images .LAN format were converted to GeoTiff and the plot files .RTL and .GRA were converted to .PDF format. The reports and pictures originally in .DOC, .TIF, .JPG and .EPS were also converted to the .PDF. All spreadsheets, database and some TXT format files were uploaded to tables on PostgreSQL. Some applications adopted and developed exclusively for the ZSEE/RO, have been reconfigured and installed. In the future, its functions will be tested to determine if they will be used, substituted or brought up to date.

Also TerraView, ArcView, ArcInfo and IDRISI are software being used. The geographic database of the ZSEE/RO was structured with ArcInfo, extensions were developed for ArcView for use in visualizations and consultations. The pedology team used IDRISI in its analyses giving the possibility of working with the data of SIGTERON as well as with the ArcInfo

and ArcView.

TerraView was chosen as an alternative, being free software capable of importing shapefiles and images in GeoTIFF format, and universal formats for vector and raster files respectively. The permission for its redistribution and/or modifications is under the terms of the GNU General Public License (GPL), as published by the Free Foundation Software. TerraView is an application based on the geo library TerraLib. It manipulates vector and raster data, both stored in relational or geo-relational DBMS on the market such as ACCESS, PostgreSQL, MySQL and Oracle (7). Figure 1 demonstrates the TerraView interface.

Later the consistency of the converted data was verified, with the intention to check the quality of the information at different scales. The procedures for checking consistency of data involved georeferencing available data points, the overlap of raster files among themselves, and the verification of the geocoded data, with the links between the geometry of objects and their descriptive attribute.

ZSEE/RO Spatial Database

An infrastructure for storage and distribution of spatial data was implemented, based on free software: PostgreSQL (5), with the PostGIS extension (6), the web map servers MapServer and GeoServer (2) as well as the catalog server GeoNetwork (3).

Vector layers were converted and stored into a PostgreSQL database through the functionality provided by the spatial extension PostGIS. The descriptive data of spatial objects, contained in heterogeneous format files, such as database files in format .DBF and electronic spread sheets, were converted for PostgreSQL tables and properly linked with its geometric representation. The vector data stored included information on various topics covered by the project ZSEE/RO: geology, soils, land use and occupation, socio-economics, transmission lines, flora, fauna, climatology, and so on. Furthermore, the data refer to basically raster images from the Landsat satellite with a resolution of 30 meters and cover the entire state of Rondonia. Furthermore, descriptive data of spatial objects, contained in heterogeneous format files, such as database files in format .DBF and electronic spread sheets, are being converted to PostgreSQL tables and properly linked with the layer's geometry.

All the thematic documentation of the ZSEE/RO was organized and stored in the GeoNetwork Open-

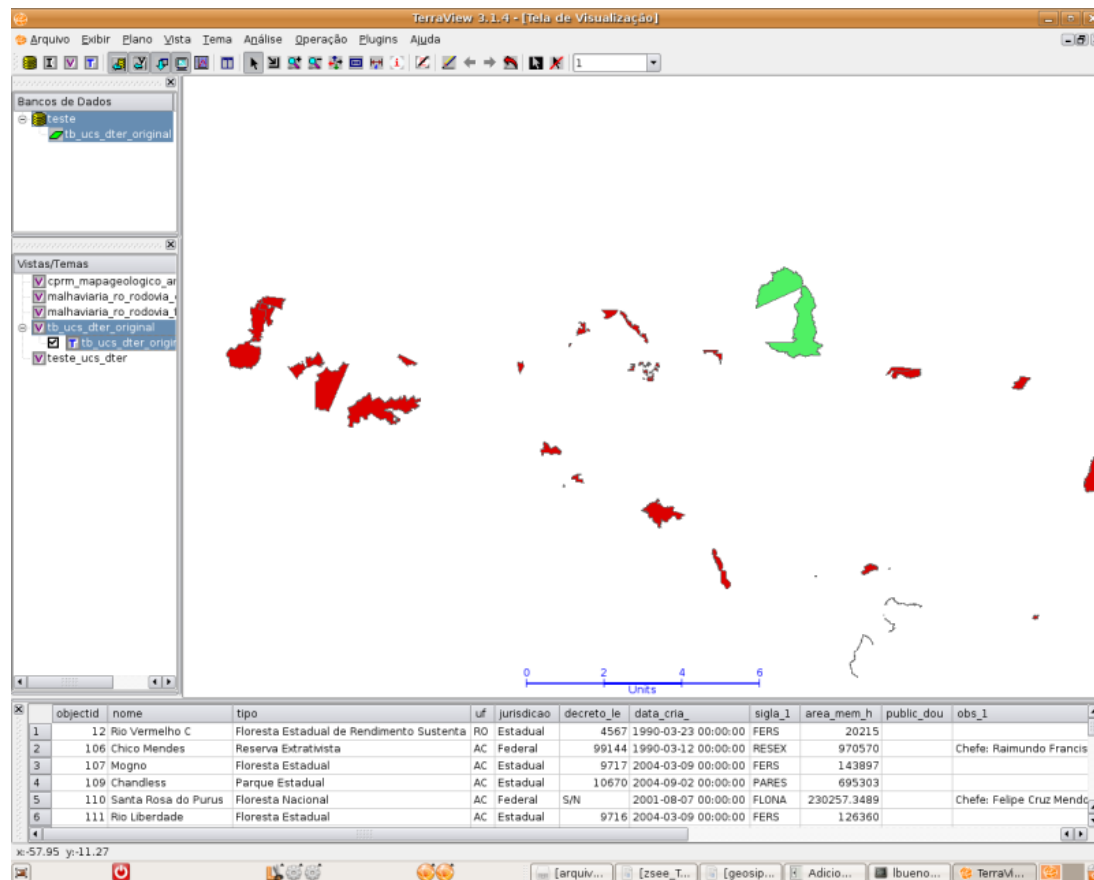


Figure 1: The Terraview interface

source. The functionality of a literal search in GeoNetwork allows easy access to a great amount of information. For each subject encompassed by ZSEE/RO, a corresponding metadata was created, where all the documentation related with the subject is posted through the resources of distribution of the GeoNetwork.

The visualization tool for spatial data chosen was I3Geo. I3Geo (Integrated Interface for Internet of Geoprocessing tools) is an application developed for access and analysis of geographic data. Based on free software, especially MapServer, it uses as its platform standard internet browsers, Internet Explorer and Firefox. I3Geo is licensed under GPL and can be used and incorporated by any interested institution with no costs. Adopting international standards of interoperability, I3Geo incorporates functions that facilitate the remote access of data, allowing for the establishment of cooperative networks. Operations that normally are found only in programs for personal computers, which operate in local installations, are available in I3Geo, such as generation of graphs,

tabular data analysis, spatial operations, etc. (8).

Results

The main result achieved so far is the recognition of the content of ZSEE/RO and establishment of the necessary requirements for the access to the original data. In addition, many files have been converted to universal formats, totaling more than 500 (five hundred) converted files, and stored in the spatial database and available for consultants. Moreover, problems with regard to quality of the data have been detected, such as non-geocoded data, inconsistency of the data in different scales, and inconsistency of the available data in printed maps in rela-

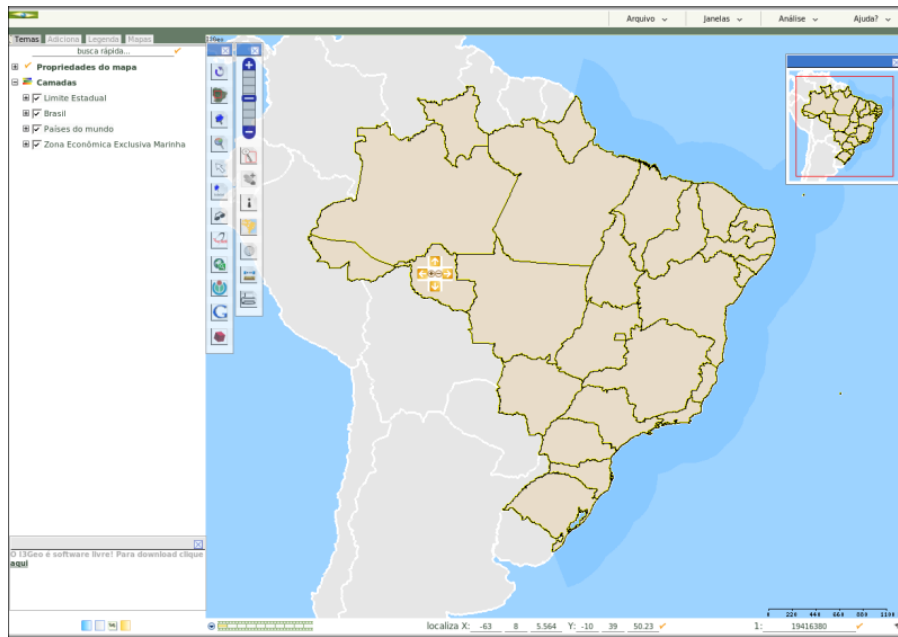


Figure 2: The I3Geo interface

tion to the stored ones in digital files.

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