

## **ENVIRONMENTAL ATLAS OF THE CORUMBATAI WATERSHED**

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### **ABSTRACT**

The Corumbatai watershed (1.710 km<sup>2</sup>) in the State of São Paulo – Brazil, is a very well studied site due to one of the branches of the São Paulo State University – UNESP, where most of the courses are related with environmental sciences. However all data are in the analogic format and are scattered in different libraries and departments, which means that they are not so usefull as they could be, not only for the University, but mainly for the society as a whole. The project followed four steps: 1 – Data Identification and Collection, 2 – Data Completion, 3 – Data Preparation and 4 – Data Input/Multimedia Programming. The Environmental Atlas is structured as follows: PRESENTATION; LOCALIZATION; ABIOTIC ENVIRONMENT: Geology, Geomorphology, Pedology, Climatology, Hidrology; BIOTIC ENVIRONMENT: Natural Vegetation; Forestry and crops; Fauna; SOCIO-ECONOMY; PHOTOGRAPHIC COLLECTION; WORKING TEAM. All information was integrated through the multimedia software named FLASH 5 (Macromedia). The final product is available in the IGCE-UNESP's website [www.rc.unesp.br/igce/ceapla/atlas](http://www.rc.unesp.br/igce/ceapla/atlas).

### **INTRODUCTION**

Since the very beginning it was much more easier to learn and understand through the use of texts associate with images. According OLSON (1997) the multimedia of the 70's was a sound track synchronized with one or more slide projector. Today, the components of the multimedia technology include appropriate hardware and software and specific programming techniques, allowing the combination of text, videos, sound and images (BILL, 1994).

The multimedia represents the utilization of the technology to develop products and data integration from different sources, using computer techniques (EARNSHAW & VINCE, 1995). One of the more important product of this new technology is the Eletronic or Digital Atlas which is an organized and systematized set of maps and qualitative/quantitative information about one or several subjects, representing a piece of the physical space or the natural environment.

The use of digital atlas has been growing in the last years mainly due to the use of the multimedia technology which means more interactivity between the user and the database. There is no doubt that the most important applications is in the educational field, specially when related with the environment (SCHNEIDER, 1998).

The first step to produce an atlas in the development of a geographic database with all necessary linkages among the different parts of the data set allowing the manipulation and data retrieval (PEREIRA, 1999).

Electronic or Digital Atlases are not considered GIS, since in the GIS the main objectives are the spatial analysis and the selective retrieval. In the Digital Atlas the objective is only cartographic. There are now three types of atlases: a) Visualization Atlas: Minimum interaction with the user, except the multimedia possibilities; b) Atlas which is possible to draw new maps, using the existing data; c) Analytical Atlas, where the functionality is greater, allowing comparisons, overlapping, evaluation etc. (SIEKIERKA, 1996).

The main objective of this project was the development of an Environmental Digital Atlas of an important watershed in the State of São Paulo – Brasil using the multimedia technology and to be released at the IGCE-UNESP website.

## **MATERIAL AND METHODS**

### Study Area

The Corumbatai watershed (Figure 1) is an example of hidrographic basin developed during the Cenozoic. The topography is moderate undulated and the size of the basin is about 1710 km<sup>2</sup>. The altitude on the springs of the Corumbatai river is near 1058 m and at the discharge near 470 m.

The first settlements are of the beginning of the XIX century (Corumbatai, 1921; Rio Claro, 1827) and since then the economy is based on the agriculture and dairy cattle. More recently there is an encrease in the level of industrialization, mainly in Rio Claro and vicinities. The following cities are located in the basin: Rio Claro, Santa Gertrudes, Corumbatai, Analandia, Itirapina, Ipeúna and Charqueada.

According the Koppen classification, the climate is Cwa, subtropical, dry in the winter and rainy in the summer. The average temperature in the warmest month (January) is higher than 22°C and in the coldest month (July) is higher than 17°C. The precipitation in the watershed varies from 1531 mm/year in Ipeúna to 1393 mm/year in Rio Claro.

According OLIVEIRA et al (1981), OLIVEIRA & PRADO (1984) and OLIVEIRA & PRADO (1989) the most important soils on the watershed are: Argissolos Vermelho - Amarelos (Typic Palendult), Latossolos Vermelho - Amarelos (Quartzipsammentic Haplorthox), Litólico (Typic Udorthent), Latossolos Vermelhos (Typic Eutrorthox) and Neossolos Quartzarênicos (Orthoxic Quartzipsamment).

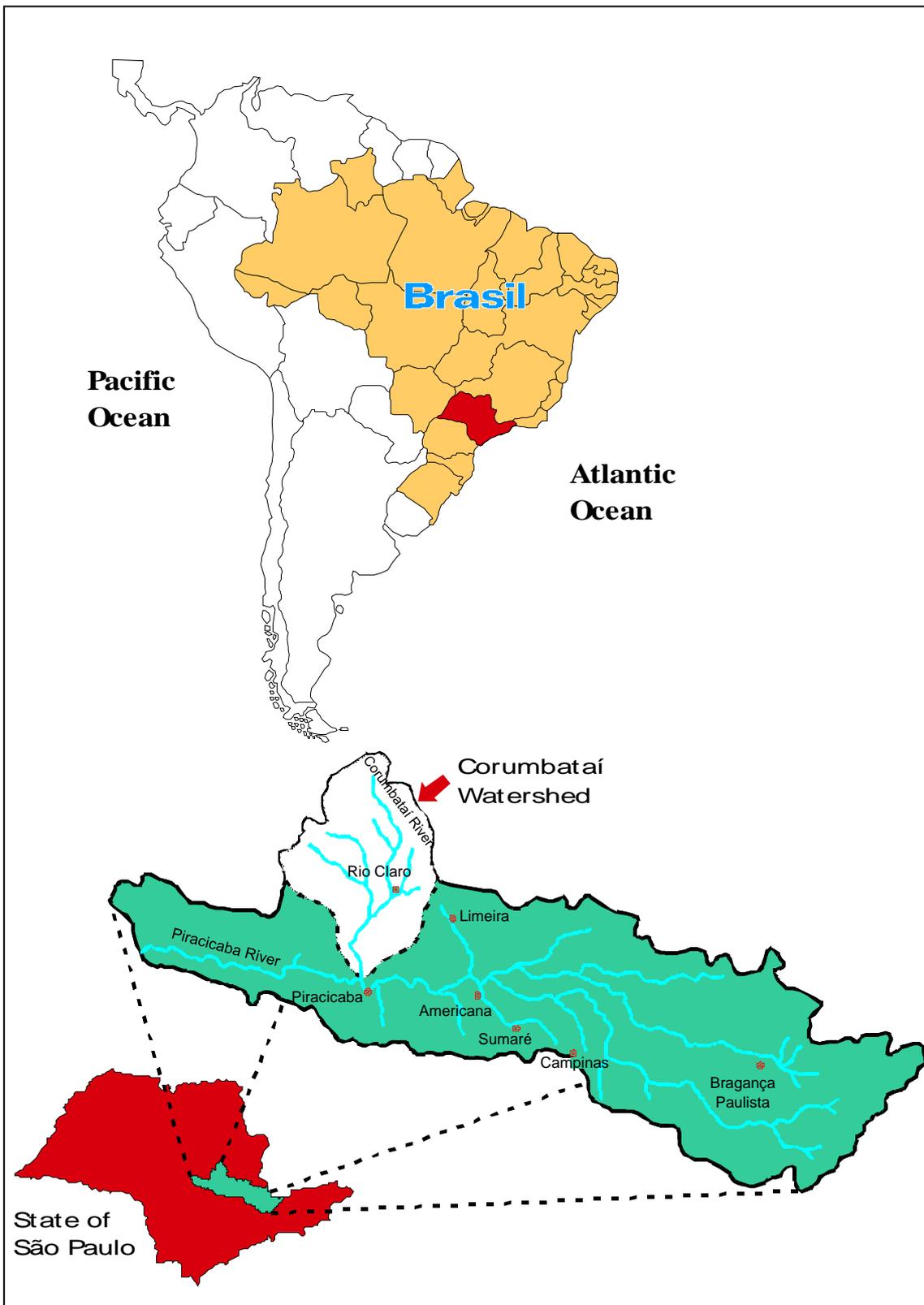


Figure 1 – Localization of the Corumbataí Watershed.

### Data Set

The project followed four steps: 1 – Data identification and collection; 2 – Data completion; 3 – Data preparation and 4 – Data input/multimedia programming. The atlas content is shown on Table 1.

Table 1 – Data content of the Environmental Atlas

PRESENTATION	<ul style="list-style-type: none"><li>• Map of the drainage network + Text</li><li>• Outflow (Text) and link to <a href="http://www.sigrb.sp.gov.br">www.sigrb.sp.gov.br</a> (State Government)</li></ul>
STUDY AREA	
<ul style="list-style-type: none"><li>• Map of Brazil in South America</li><li>• Map of the watershed in the state of São Paulo – Brazil + Text</li><li>• Detailed map of the watershed + Text</li></ul>	<ul style="list-style-type: none"><li>• Water quality (Text)</li><li>• Critical analysis (Text) + graphs</li><li>• Bibliography</li></ul>
ABIOTIC ENVIRONMENT	BIOTIC ENVIRONMENT
Geology	Flora
<ul style="list-style-type: none"><li>• Map of Geology + Text</li><li>• Map of Mineral resources</li><li>• Bibliography</li></ul>	<ul style="list-style-type: none"><li>• Map of natural vegetation + Text</li><li>• Photographs of the main trees and shrubs + Text</li><li>• Map of Crops, forestry and pasture + Text</li><li>• Bibliography</li></ul>
Geomorphology	Fauna
<ul style="list-style-type: none"><li>• Map of Relief (DEM) + Text</li><li>• Map of Classes of slope + Text</li><li>• Map of Slope exposition + Text</li><li>• Map of Hipsometry + Text</li><li>• Bibliography</li></ul>	<ul style="list-style-type: none"><li>• Photographs of wasps and bees + Text</li><li>• Photographs of mastofauna, fishes and amphibians + Text</li><li>• Bibliography</li></ul>
Pedology	SOCIO-ECONOMIC ENVIRONMENT
<ul style="list-style-type: none"><li>• Map of Soils + Text</li><li>• Map of Erosional Risk + Text</li><li>• Map of Land suitability + Text</li><li>• Maximum utilization potential + Text</li><li>• Bibliography</li></ul>	<ul style="list-style-type: none"><li>• History and economic development (Text)</li><li>• Link to <a href="http://www.investimentos.sp.gov.br">www.investimentos.sp.gov.br</a> (State Government)</li><li>• Bibliography</li></ul>
Climatology	PHOTOGRAPHIC COLLECTION
<ul style="list-style-type: none"><li>• Temperature (Text) + graphs and tables</li><li>• Rain (Text) + graphs</li><li>• Available water in the soil (Text) + graphs</li><li>• Bibliography</li></ul>	WORKING TEAM
Hidrology	<ul style="list-style-type: none"><li>• Content</li><li>• Development</li><li>• Support</li></ul>

### Data Completion

When necessary, the information was up-to-dated. For example, a new map of land use was prepared using satellite images.

### Data Preparation

In this step the maps were uniformized, mainly in terms of scale/fragmentation, datum, legend and cartographic control.

### Data Input

Most maps were firstly rasterized in an A0 scanner (Summagraphics, model LDS 5000) and then vectorized using the software CAD Overlay R14 and AutoCAD MAP 3.0.

Some maps were digitized using an A0 digitizing table (Digigraf Velásquez). At the end all maps were georeferenced and the data prepared in the dxf format file.

The photographs of animals and plants were scanned in a A4 scanner, HP ScanJet 6300C.

Two computers, IBM compatible, were used each with the following configuration: Pentium III, 800 Mhz, HD 20 GB, 256 MB DIMM.

### Multimedia Programming

A benchmarking was performed among three softwares; Authorware, Director and Flash all of them developed by Macromedia. However in a later decision the team decided to developed the Atlas directly to be presented in the Web and this characteristic was fundamental to choose the Flash 5.

The Flash 5 fuses the precision and flexibility of vector graphics with bitmaps, audio, animation, to create Web experiences. The Flash is also friendly, easily integrating with existing Web production workflow, providing powerfull development tools for creating advanced Web sites and applications. (MACROMEDIA, 2000). Using the Flash 5 is possible the creation and visualization of fast Web pages with good design and full screen navigation interfaces highly compacted as well as, technical ilustrations, long animations and other effects [HREF1].

### Overview of specific features

#### 1. Approachable

- New user interface; Macromedia User Interface; Macromedia Free Hand import; Macromedia Generator-Developer Edition support; Improved documentation and learning aids; Intuitive Timeline; Asset management – Public command

#### 2. Creative

- Bezier pen tools; Shared Symbol Libraries; Intuitive drawing tools – vector effects; Bitmap support; Advanced buttons & menus; MP3 streaming audio – Precise layout control

#### 3. Standard

- Movie Explorer; Macromedia Flash Player; Web-native printing; QuickTime and Real Player support; Action Script development tools; Smart Clips; XML transfer and HTML text support; Flash based forms – Bandwidth profiling

## RESULTS AN DISCUSSION

As cited before, maps, graphs and tables were prepared using AutoCAD MAP, CAD Overlay, Corel Draw and PhotoShop.

All subset of data were linked using the Flash 5, integrating maps, texts, photographs and tables. When necessary, links with others sites were inserted allowing the user to access stronger database. The Main menu and an example of map are shown on Figures 2 and 3.



Figure 2 – Main menu

The Flash 5 vector technology produces very small files even when executed in full screen, allowing the visualization of maps on regular size or enlarged, without loss of resolution. That is the reason because was possible to introduce the zoom possibility in the Atlas.

The maps in the dxf format are graphically prepared to be seen by the multimedia software and to do this the Corel Draw 9.0, Idrisi 2.0, Surfer 6 and Photoshop 5.5 were used.

The final product was released in the site [www.rc.unesp.br/igce/ceapla/atlas](http://www.rc.unesp.br/igce/ceapla/atlas)

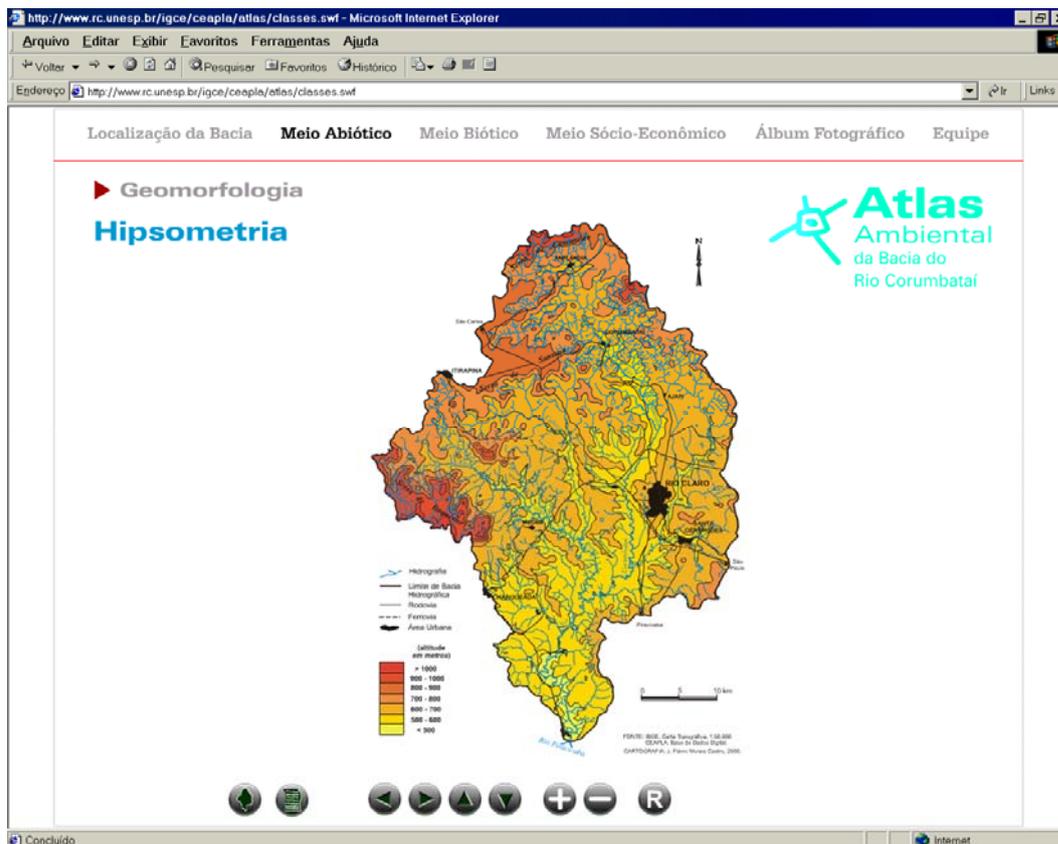


Figure 3 – Hipsometry of the watershed

## CONCLUSION

- The utilization of different software packages were easier than thought, showing high compatibility.
- The Flash 5 is a friendly and powerfull multimedia software and the Atlas can be considered a good product from the user's point of view.
- All maps are available for download in the dxf format.
- Together with maps, tables, graphs and explaining texts are available for the users.
- The content and the format of the Atlas are not fixed, or in another words, "the work never ends". The team is still working, processing new data and trying to improve it.

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[HREF1] [www.macromedia.com/](http://www.macromedia.com/)