

Abstract

This study aimed to analyze the current land use of the Alto do Rio Pardo - Botucatu (SP), through data collected on bands 3, 4 and 5 from Landsat 5 "Thematic Mapper" sensor. The image date is June 8 1997, corresponding to orbit 220, point 76, quadrant A. The image was used in colorful compositions, scale 1:50.000 and digital format. It was done a visual interpretation on a photographic paper image and a field check. To confirm the land use, each band from Landsat image was examined. According to the results obtained in the research the conclusions are: a) the data collected by the "Thematic Mapper" of Landsat have valuable information for different targets of land occupation, therefore very useful in mapping studies of current land usage; b) The results of visual analysis on the data from Landsat, presented that the type of pasture plant were the most significant occupying 69.70% of the area; c) Through visual analysis of data from Landsat it was possible to verify that there is environmental preservation only in areas of forest gallery. occurrences

Key words: Satellite image; visual analysis; vegetation cover.

Introduction

The decrease of natural resources imposes the need for an inventory and rational planning of its maintenance. The use of land without a proper planning, makes it poor, causing low productivity of crops.

The lifting of the current usage of land, necessary for planning purposes, can be obtained from the use of multispectral data, provided by remote sensing satellite and technical interpretation (PEREIRA et al., 1989).

With the increasing demand of natural resources, the periodic survey of the land use in a specific region has become an aspect of fundamental interest to understand the patterns of organizing space. Whatever the spatial organization of land use in a specific period, is rarely permanent, because the soil is always transformed by human action. In this context, the information about land occupation, periodically collected by sensors placed in orbit satellites, combined with geoprocessing techniques have proven as an efficient tool to assist in the

Visual analysis applied in the land use espacialization

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characterization of landscape elements, in studies for the identification and mapping of natural resources. With this, many traditional methods for removal of land use can be improved or even new methods may arise due to the availability of information on the environment.

According to Vettorazzi (1992) the products obtained from orbital imagery sensors may be presented in the form of data stored on tapes suitable for analysis by computers (digital analysis), or in the form of photographic images on transparencies or copies of paper, used for visual interpretation (visual analysis).

The visual interpretation is based on the process of image analysis through the detection, identification and classification of targets of interest contained in the images. In the image analysis is fundamental the perception of features through fundamental characteristics called elements of analysis, which are: color, tone, texture, size, shape, pattern, shadows, height, location of targets and aspects (context).

According to Sano et al.(1990), the visual image interpretation follow these stages of work: acquisition of images, make cartographic basis, visual interpretation and area calculation

Santos et al. (1993), commented that the use of satellite imagery as based mapping is very promising because of its low cost, easy purchase, frequency and can provide important information about changes in land use .

This study aimed to complete the land use map of Alto Rio Pardo - Botucatu (SP), through visual analysis, using information from soil occupations collected by the orbital sensor "Thematic Mapper" of Landsat 5.

Material and methods

The study covers the head of Rio Pardo, located in the city of Pardinho, District of Botucatu, in the Central West of the State of Sao Paulo, being situated between the geographical coordinates: 22° 26' 08 "W 22° 20' 28" to 48° 06' 39 "S latitude and 48° 58 '32 "to 23 ° longitude Gr, with an area of 5,338 ha.

The data used in this work was collected by the "Thematic Mapper" sensor from Landsat-5, both in photography, colored composition of bands TM3, TM4 and TM5 in 1:50.000 scale, as in digital format, referring to orbit 220, point 76 , quadrant A, date of passage of June 08, 1997.

The data processing was performed in a microcomputer Pentium, 200 Hz, 2.1 GB HD, 64 MB of RAM, with output of ink jet printer for HP Deskjet 692 C, and a table scanner SUMMERGRAPHICS SUMMAGRID IV, size A0 .

The map of current land usage of the study area was obtained by visual interpretation of the TM Landsat image on paper, scale 1:50.000, with support from field. The study area and cover plants have been defined and modeled on polyester film according to the spectral value of each soil occupation and then scanned through the module Tosca from IDRISI GIS software. Some criteria used to identify the land occupations, was cited by Vettorazzi (1992).

To confirm the land-use map done by visual analysis, it were done visits to the field with the Landsat image on paper and a topographic map.

After confirming the areas in the field, the visual analysis map was corrected on paper, and then georeferenced, scanned and edited in Geographic Information System IDRISI.

Results and discussion

The experimental data are fundamental to the development and studies in the scientific field, particularly in land-use planning through satellite imagery, for being the possessor of a rich and important potential for data measurable aspects of the land surface.

The identification, quantification and the land mapping occupations through visual analysis

of satellite images are of fundamental importance for the professionals who depend on a survey for a deeper analysis of targets, due to inability to be done in the field. The figure 1 that shows the map of occupations of soil occurring in the area of Alto Rio Pardo - Botucatu (SP), obtained from the Landsat image in 1997, revealed the existence of 7 land uses, which are: Water, Natural Forest, Grassland Clears, Wetlands, Culture, Dirty

The occupations of land (Table 1 and Figure 2) allowed to verify through visual interpretation of satellite images and then in the field that almost 70% of the study area was covered with grass, that is, with 55.79% (2975.13 hectares) of clean pasture and 13.91% (741.65 hectares) of dirty pasture, showing the region ability for livestock .

The forests, other vegetation cover present in this area and very important in terms of environmental preservation occurred in 16.20% (863.45 ha). According to the Forest Code, the minimum forest reserve should be 20%. Thus, there is a forest deficiency in order of 3.80% for environmental rehabilitation and improvement of renewable natural resources in the study area, to improve the quality of life of human beings.

The forests occurring in the study area (Figure 1) are in their vast majority represented by gallery forests. This allows infer that there were no human intervention in these places because of the protection given by the Forest Law in force, as the Forest Code defines these areas located on the banks of water courses, rivers and springs around as areas for permanent preservation. The same code states that places of high slope are protected areas, according to Barros (1988) and Campos (1993), the topography is also a limiting factor to the land occupation, because the high slope prevent the mechanization.

Barros (1988), also noted that the areas of forests are in sharp relief of difficult access, where it is practically impossible the use of farm machinery, which contributes to the maintenance of forest cover in these areas.

The occupation by crops, wetland, city and water occurred in smaller percentage in the total area, respectively, comprising 9.44% (593.45 ha), 1.93% (102.65 ha), 2.12% (113. 17 ha) and 0.61% (32.54 ha).

Table 1. Percentages for the occupations of land, obtained through visual analysis of the Landsat satellite image, Alto Rio Pardo - Botucatu, SP.

Land use	Total Area	
	ha	%
Wetland	102.65	1.93
Water	32.54	0.61
Natural Forest	863.45	16.20
Culture	503.45	9.44
Dirty Grassland	2975.1	55.79
Clear Grassland	741.65	13.91
City	113.17	2.12
Total	5331.97	100.00

Figure 1. Map visual analysis of the Alto Rio Pardo - Botucatu, SP, referring to a satellite image of Landsat

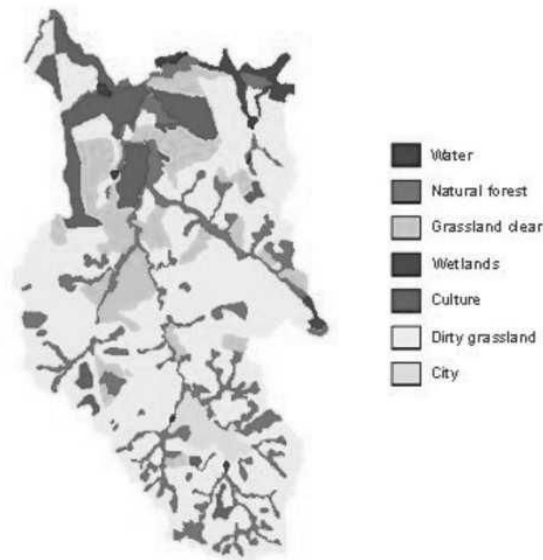
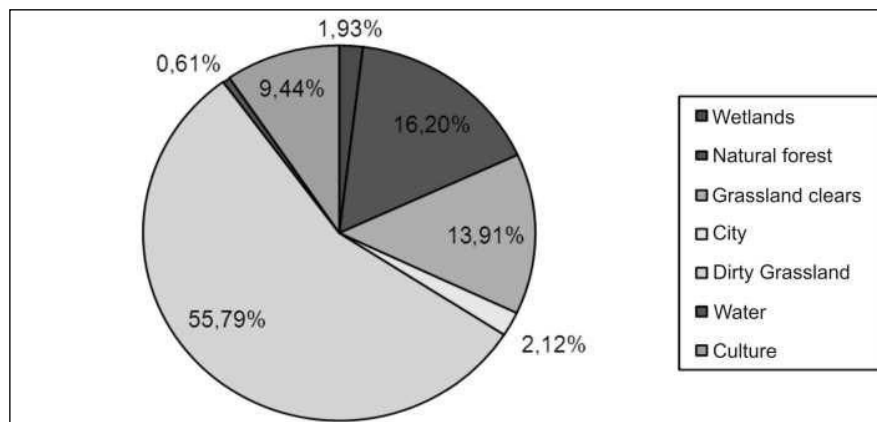


Figure 2. Areas in percentage of total land occupation, obtained through visual analysis of the Landsat satellite image, Alto do Rio Pardo - Botucatu, SP.



Conclusions

The results obtained with the methodology used in the study of the Alto Rio Pardo - Botucatu, SP, have concluded through visual analysis that pasture type were the most significant, because

occupy, 69.70% of the area; that the visual analysis, presented through the large area covered by forest gallery, that environmental preservation has occurred and the land occupation found were: natural forest, culture, clean and dirty pastures, wetland, city and water.

References

- BARROS, Z.X. de. **Caracterização de bacias hidrográficas no mapeamento de solos mediante o uso de análise multivariada**. 113p. Tese (Doutorado em Energia na Agricultura) - Faculdade de Ciências Agrônomicas, Universidade Estadual Paulista- UNESP, Botucatu. 1988.
- CAMPOS, S. **Fotointerpretação da ocupação do solo e suas influências sobre a rede de drenagem da bacia do rio Capivara** - Botucatu, SP, no período de 1962 a 1977. 164p. Tese (Doutorado em Energia na Agricultura) - Faculdade de Ciências Agrônomicas, Universidade Estadual Paulista- UNESP, Botucatu. 1993.
- INSTITUTO DE PESQUISAS TECNOLÓGICAS DO ESTADO DE SÃO PAULO. Mapa geomorfológico do Estado de São Paulo. São Paulo, v.2, 1981. Mapa (Escala 1 : 500.000)
- PEREIRA, M. N., KURKDJIAN, M. L. N. O de, FORESTI, C. **Cobertura e uso da terra através de Sensoriamento Remoto**. São José dos Campos, Instituto de Pesquisas Espaciais. 1989.118p.
- SANO, E.E., WATTIN, O.S., FUNAK, R.S., MEDEIROS, J.S., DIAS, R.W.O. Mapeamento em semidetalhado (1:10000) da cobertura vegetal e do uso da terra na micro região de Tomé-Açu e alguns municípios das micro regiões do baixo Tocantins e Guajarina, Estado do Pará, através das imagens do TM-Landsat-5. In: SIMPÓSIO BRASILEIRO DE SENSORIAMENTO REMOTO, 7, **Anais...** Manaus, 1990.
- SANTOS, M.L.M., MATTOS, M.M., PIRES, I.O., BROWN, I.F., ASSIS, W.S. Utilização de imagens de satélite no mapeamento preliminar do uso da terra e na capacitação de agricultores do médio Rio Capim-Paragominas-PA. In: SIMPÓSIO BRASILEIRO DE SENSORIAMENTO REMOTO, 7, **Anais...** São José dos Campos, 1993. .
- SIMÕES, L.B. **Avaliação das áreas de preservação permanente da bacia do Ribeirão Lavapés, Botucatu, SP, através de Sistemas de Informações Geográficas (SIG-IDRISI)**. 145p. Dissertação (Mestrado em Energia na Agricultura) - Faculdade de Ciências Agrônomicas, Universidade Estadual Paulista- UNESP, Botucatu. 1996.
- VALÉRIO FILHO, M. **Curso de treinamento: Introdução às técnicas de sensoriamento remoto e aplicações. Elementos da interpretação de dados de sensoriamento**. Instituto de Pesquisas Espaciais. 1980. cap. 4. p.1-15. 318p.
- VETTORAZZI, C.A. **Sensoriamento remoto orbital**. Piracicaba: Departamento de Engenharia Rural, ESALQ, USP, 1992. 134p. (Didática, 2).