LAND USE AND LAND COVER MAPPING IN PARAIBA-CNPQ PROJECT* THE APPLICATION OF REMOTE SENSING TECHNOLOGY.

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ABSTRACT:

The present investigation provides an overview of methodology and results of land use/land cover interpretation through visual and digital interpretation, carried out as part of the multitemporal and multisources project of the CNPQ for the Litoral zone of the state of Paraiba. The results of visual interpretation, computer classification (unsupervised and supervised), map preparation, limitations, utilities and implementation for the development of the region are discussed in this project.

The digital image processing systems resulted in the maps of land use/land cover classification for a part of the coastal regions of the Paraiba state of NE Brazil. The major land use/land cover classes derived, using the SPOT data and ERDAS systems are: water, cultivated lands; urban; pasture lands; forest lands; swampy lands, poor drained lands, barren land, and alluvial lands which were further subdivided into several subunits in accordance with their limitations, gray values, and utility.

INTRODUCTION

Now-a-days the combined impact between population growth and demands of food is putting a pressure on Northeast Brazilian environment, which are the main reasons in changing land use patterns of the region. Land use/land cover mapping is an integral part of any regional and local planning projects in order to develop procedures for land use mapping, monitoring and land allocation.

Remote Sensing and Earth Resources Information Systems are being used very frequently for mapping and analysis of natural resources for regional planning of coastal regions. Remote Sensing provides one or a few of the many data required for such systems for evaluation of various types of land capabilities, such as land capabilities for urban land use, agricultural use, land use/land cover and for forest use.

The coastal zone of northeastern Brazil comprises of nine states, such as, Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas, Sergipe, and Bahia. It has various physiographical relief and geomorphological forms, such as alluvial plains, flood plains, low lands, cultivated and uncultivated fields, hills, inselbergs, rock ridges, rocky land, eroded lands, swampy and poor drained lands.

Land use is one of the major factors affecting Global environmental conditions. The iterative cyclical practice of land cleaning, cultivation abondonment, and reclening, combined with a lack of economic incentives to promote fertility maintenance, has been responsible for increasing

lack of economic incentives to promote fertility maintenance, has been responsible for increasing severe environmental degradation. Remote sensing methods are fundamental and essential to land cover and mapping, in which landscapes are stratified into enumeration units.

The present study is being executed over a physiographic region" Litoral Paraibano" in order to know the realistic assessment of the extent to which SPOT data can be used for the survey of the study area, and to provide the basic information about the nature of digital multispectral remote sensing data and how they can be used in different

applications.

Considering the needs for planning and managing the land for regional planning in the Coastal parts of the state of Paraiba to derive Optical and Digital land use and land cover information using processing and GIS procedures and the latest classification systems and Image Processing systems ERDAS 7.5 and ERDAS Imagine Ver. 8.1

MATERIALS AND METHODS

Study Area:

The present investigation was conducted for a Coastal Region "LITORAL PARAIBANO" of the Paraiban State of NE brazil. The surface area represents nearly levelled to undulating topography. It covers 17 municipalities and an area of 431,600 Ha. The municipalities of the region are: Alhandra, Baia da Traição, Bayeux, Caaporn, Cabedelo, Conde, Cruz do Espírito Santo, Itaporroca, Jacarau, Jono Pessoa, Lucena, Mamanguape, Mataraca, Pedras de Fogo, Pitimbu, Rio Tinto and Santa Rita.

Equipments:

Hardware:

-Micro-Computer, PC/486AT with all the accessories
-SVGA Color Monitor
-Image Processing Board (Number Nine)
-RGB 20" Monitor
-Digitizing Table
-Color Printer

Softwares:

-ERDAS 7.5 and ERDAS Imagine Ver. 8.1

Field Materials:

For visual as well as digital interpretation, the field work was very necessary. The following survey materials was used for detailed field survey and checking the mapping units.

-Abney level
-Color Chart
-Hammer

-Binocular
-Camera
-Augers etc.

Topographical and other materials:

-Topographic Maps received from SUDENE
-Soil Maps
-Geological Map
-Climatic map
-Technical reports.
-SPOT images (B/W Color Composites and CCT Tapes).

IMAGE ANALYSIS:

This research work was conducted by visual and digital analysis. The outlines and flow charts of both types of interpretations are shown as follows:

Visual Interpretation:

Visual interpretation is divided into three phases: preinterpretation, field survey and post/interpretation. All the steps taken in this interpretation are shown in the following flow scheme:

1.Pre-Interpretation:

-Acquisition of Images
-Map-Base Preparation
-Specific Identification
-Preparation of Identification Key
-Optical Interpretation
-Systematic Interpretation
-Selection of the Sample Strips

2. Field Survey:

-Detailed Survey in sample strips
-Adjusted Interpretation
-Selective Verification
-Extrapolation

3. Post-Interpretation:

-Finalization of the maps and legends
-Confection of final maps and legends
-To establish Classification Criteria
-Recommendation for Detailed Planning

Digital Interpretation:

The main objective of this research through remote sensing is to apply the Image Processing and Pattern Recognition Technologies in order to drive a Land Use/Land Cover Map. The Principal activities used in this interpretation are divided into the following steps:

-Statement of the problems of the project area
-DATA acquisition from DLR/INPE Brazil
-Image Processing used: ERDAS Software, Ver. 7.5
-Preprocessing:
  Statistics,
  Geometric Correction,
  Elements Consideration
-Display and Enhancement to assess image quality
-Thematic information extraction:
  - Field work
  - Training sites
  - Unsupervised
  - Classification
  - Supervised Classification
  - Accuracy Assessment
-Detect and solve the problems
-Accept the interpretation, if the accuracy is more than 85%
-Reject the interpretation if the accuracy is very low, and try again the whole system with more field information.

RESULTS

The results obtained in this research are divided into two parts:

1. Results received through Visual Interpretation,

2. Results obtained by Digital Analysis.

Because of limited space, the results of visual and digital interpretation are given here in a tabular form (Table 1 & 2 and figure 1 & 2).

Table: 1 Land Use/Land Cover Classification (Modified System of Anderson et all, 1976)

Items	Mapping Units
-Agriculture/ Cultivated Land	CL1, CL11 CL2, CL3, CL4, CL5,
-Range/Pasture Land	P1, P2
-Forest Land	FO, FO1, FO2, FO3
-Swampy Land	S1
-Poor Drained Land	D
-Barren Land	CL6
-Alluvial Land	Ae1

For detailed description of each mapping unit, see the TR of CNPQ, project no*530507/93-5 (NV)

Table. 2: Land Use/Land Cover Classification (Digital Interpretation-MAXCLAS)

NO.	Description
1.	Beach Sand/Sandy Areas
2.	Eroded Barren Land
3.	Poor Drained Wet Land
4.	Marshy Shrubs Land
5.	Dense Forest
6.	Eroded Barren with Pasture
7.	Cultivated/Pasture
8.	Cultivated Land
9.	Moderately Dense Forest
10.	Slight Dense Forest and Pasture
11.	Barren Urban Land and Pasture
12.	Cultivated/forest
13.	Cultivated/Pasture/Forest
14.	Moderately Polluted Ocean Water
15.	Severely Polluted Water of Paraiba River
16.	Moderately to Severely Polluted Ocean Water
17.	Slight to Moderately Polluted Ocean Water
18.	Slightly Polluted Ocean Water
19.	Clean and / or Shallow Ocean Water

CONCLUSION

The SPOT Photographs are found more reliable for Land Use/Land Cover Mapping and could be used effectively for the Land Use and Land Cover Classification over the LITORAL region. This is possible by visual as well as digital analysis at an affordable cost using a PC-based Software-ERDAS Ver. 7.5. The orbital images proved to be an extremely useful source of data for the purpose of detailed regional/local planning process.

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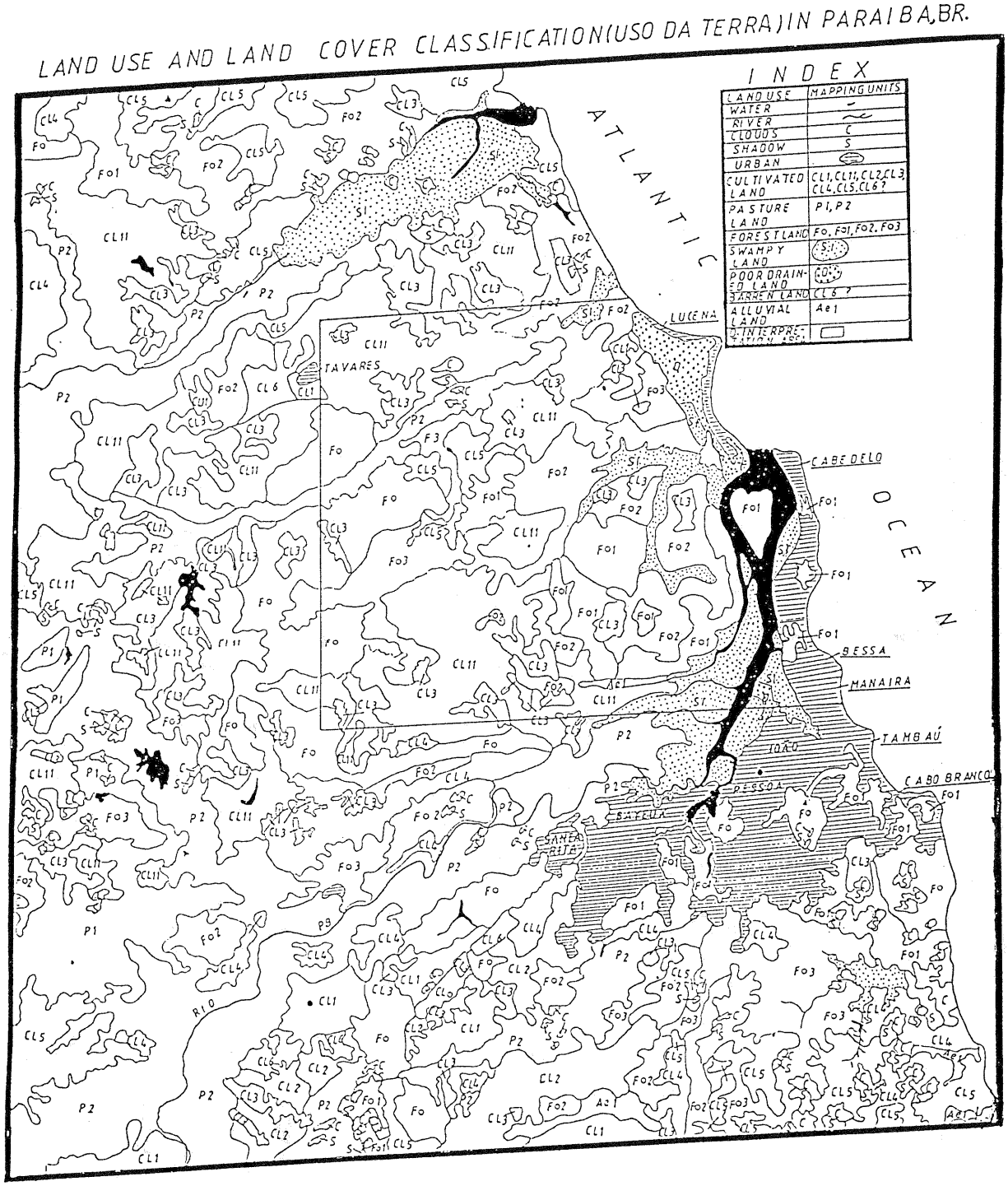
LAND USE AND LAND COVER CLASSIFICATION(USO DA TERRA)IN PARAIBA,BR.
INDEX
LAND USE
MAPPING UNITS
WATER
RIVER
CLOUDS
SHADOW
URBAN
CULTIVATED LAND
CL1,CL11,CL2,CL3,CL4,CL5,CL6?
PASTURE LAND
P1,P2
FOREST LAND
Fo, Fo1, Fo2, Fo3
SWAMPY LAND
POOR DRAINED LAND
BARREN LAND
CL6 ?
ALLUVIAL LAND
Ae1
ATLANTIC
OCEAN
LUCENA
TAVARES
CABEDELO
BESSA
MANAIRA
TAMBAÚ
CABO BRANCO
JOÃO PESSOA
SANTA RITA
BAYEUX
RIO

Figure-1

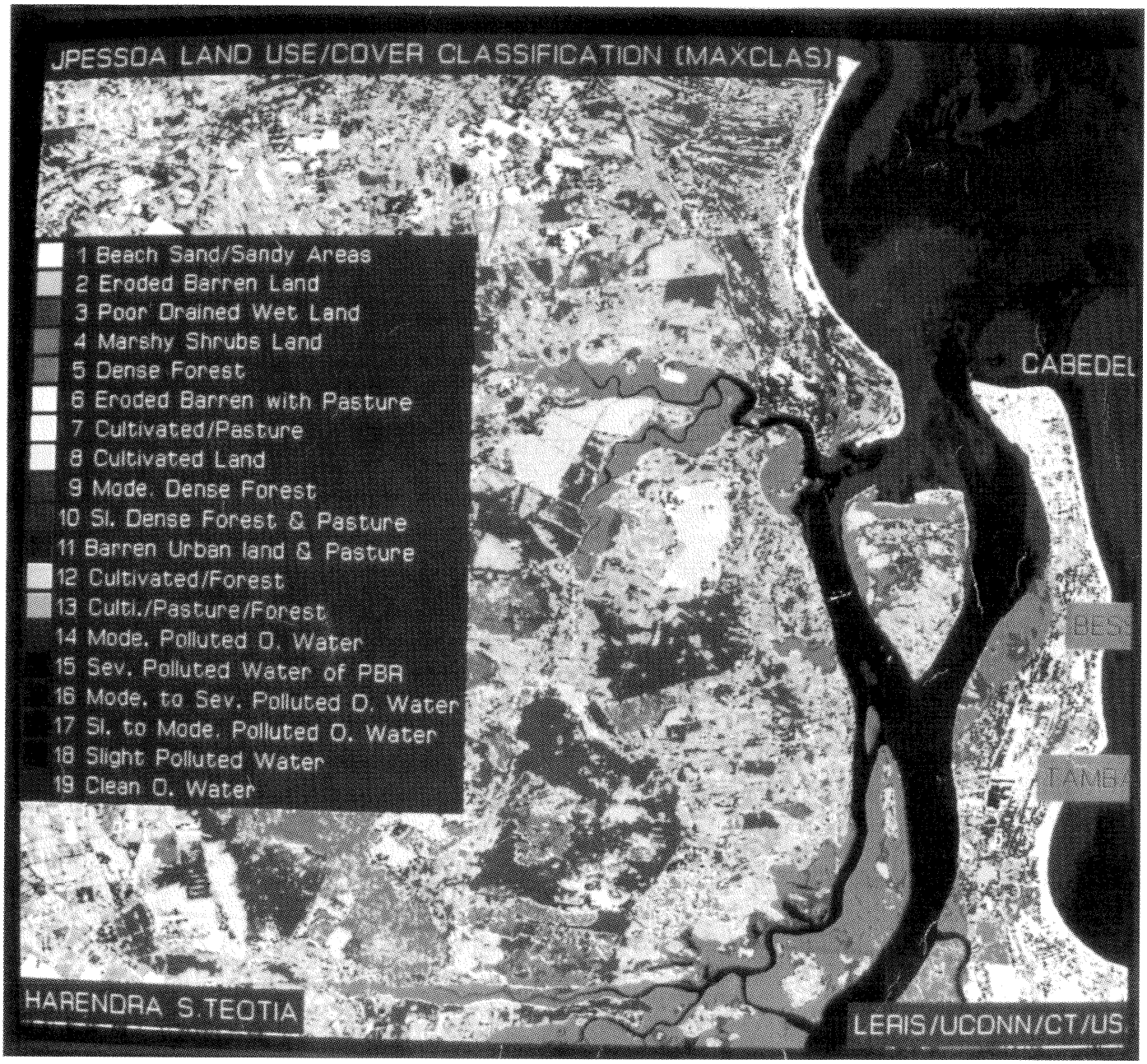
JPESSOA LAND USE/COVER CLASSIFICATION (MAXCLAS)
1 Beach Sand/Sandy Areas
2 Eroded Barren Land
3 Poor Drained Wet Land
4 Marshy Shrubs Land
5 Dense Forest
6 Eroded Barren with Pasture
7 Cultivated/Pasture
8 Cultivated Land
9 Mode. Dense Forest
10 Sl. Dense Forest & Pasture
11 Barren Urban land & Pasture
12 Cultivated/Forest
13 Culti./Pasture/Forest
14 Mode. Polluted O. Water
15 Sev. Polluted Water of PBR
16 Mode. to Sev. Polluted O. Water
17 Sl. to Mode. Polluted O. Water
18 Slight Polluted Water
19 Clean O. Water
CABEDEL
HARENDRA S.TEOTIA
LERIS/UCONN/CT/US

Figure-2